

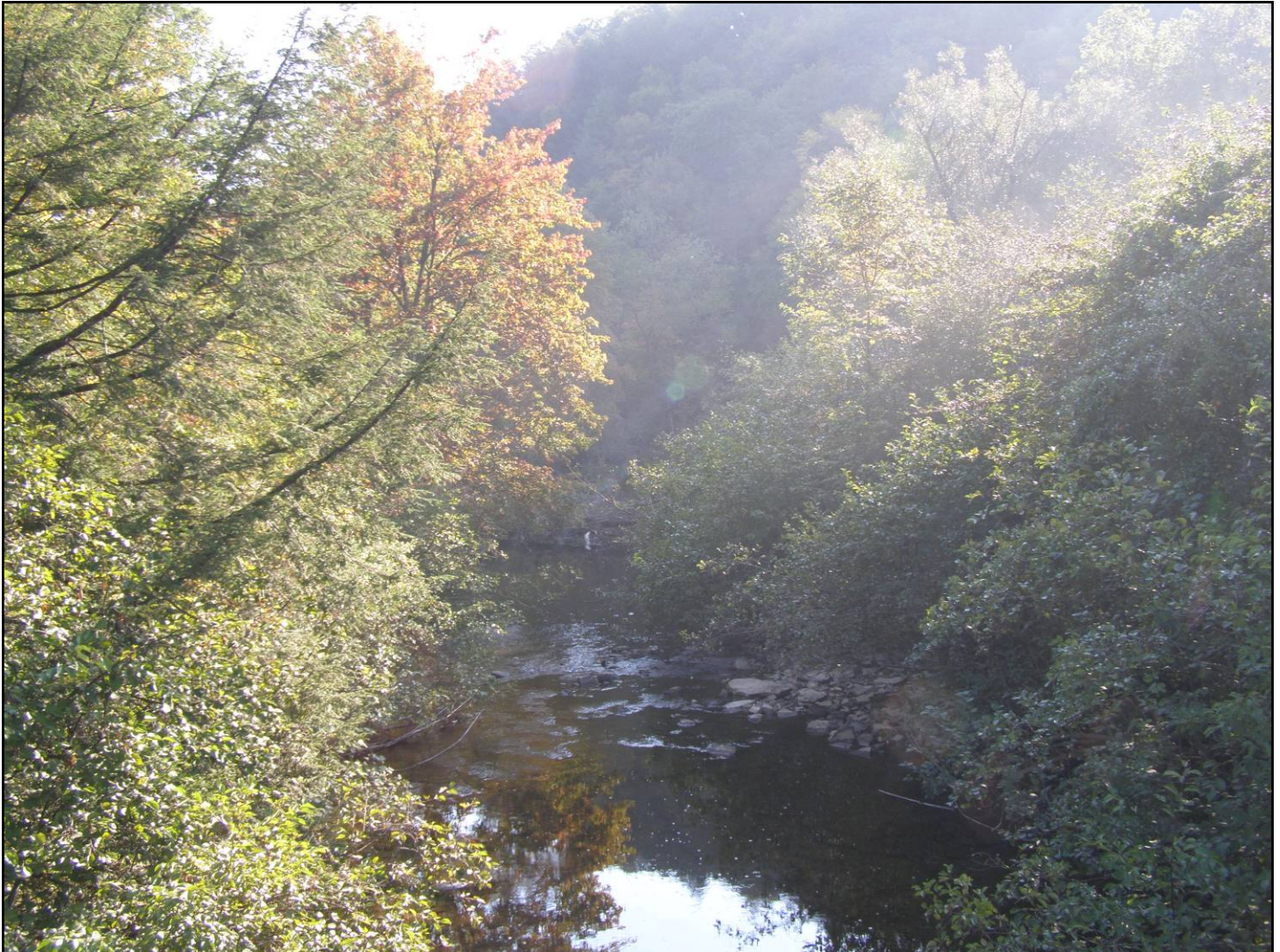
# Brokenstraw Creek Watershed Conservation Plan



Draft October 2011



For more information about the Brokenstraw Creek Watershed Conservation Plan,  
contact Western Pennsylvania Conservancy's Allegheny Regional Office



Western Pennsylvania  
Conservancy



water, land, life.

Western Pennsylvania Conservancy  
Allegheny Regional Office  
159 Main Street  
Ridgway, PA 15853  
(814) 776-1114  
[www.waterlandlife.org](http://www.waterlandlife.org)



Foundation for Pennsylvania Watersheds



**pennsylvania**  
DEPARTMENT OF CONSERVATION  
AND NATURAL RESOURCES

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The Pennsylvania Rivers Conservation Program

# Brokenstraw Creek Watershed Conservation Plan

*Draft October 2011*

Prepared for:

Brokenstraw Watershed Council

Prepared by:

Western Pennsylvania Conservancy



Western Pennsylvania Conservancy  
Allegheny Regional Office  
159 Main Street  
Ridgway, PA 15853



Foundation for Pennsylvania Watersheds

This project financed in part by a grant from the Community Conservation Partnerships Program Environmental Stewardship Fund, under the administration of the Department of Conservation and Natural Resources, Bureau of Recreation and Conservation and by a grant from the Foundation for Pennsylvania Watersheds.

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## ACKNOWLEDGEMENTS

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A sincere acknowledgement and thank-you goes out to all the organizations, agencies, and individuals who dedicated their time and resources to make this project a success. Our apologies to anyone inadvertently omitted.

### Brokenstraw Creek Watershed Conservation Plan Steering Committee

Diane Carson  
Rich Constantino  
Mat Elwell  
Dan Glotz  
Jean Gomory

John Jablonsky  
Joyce McChesney  
Kim McCullough  
L. Christian Moseback  
Brian Pilarcik

Karen Prather  
Jake Welsch  
Heather Wilcox  
Dave Wilson

### Brokenstraw Creek Watershed Conservation Plan Advisory Committees

Lainard Bush  
Tracey Christensen  
Gary Fleeger  
Dorothy Hvozda

Bill Kibler  
J. Lynne Myers  
Kevin Peterson  
Paul Pirozzola

Thomas Savko  
Cecil Steller  
Paul Stroup  
Farley Wright

### Brokenstraw Creek Watershed Conservation Plan Key Individual Interviewees

Wallace Billingham  
Lainard Bush  
Jim Hart  
Shayne Hoachlander  
Rich Hutley

Dorothy Hvozda  
Robert Lindsay  
Harvey Oonk  
Paul Orner  
Michael Pasterik

Suzanne Rhebergen  
Tom Savko  
Craig Weston

### Other Organizations and Individuals

Brokenstraw Watershed Council  
Chautauqua County Planning and  
Economic Development  
Chautauqua Watershed Conservancy  
Corry School District  
Crawford County Planning  
Crawford County Conservation District  
Erie County Planning  
Erie County Conservation District  
Lainard Bush

Panama School District  
Penn State Cooperative Extension  
Pennsylvania Department of Conservation  
and Natural Resources  
Pennsylvania Department of Environmental  
Protection  
Revitalization of Youngsville  
Youngsville School District  
Warren County Planning  
Warren County Conservation District



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## ACRONYMS

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ACB	Alliance for the Chesapeake Bay
AFO	Animal Feeding Operation
AMD	Abandoned Mine Drainage
APHIS	Animal and Plant Health Inspection Service
ASA	Agricultural Security Areas
ATA	Area Transit Authority
ATV	All Terrain Vehicles
BAMR	Bureau of Abandoned Mine Reclamation
BAT	Brownfield Action Team
BDA	Biological Diversity Area
BMP	Best Management Practices
CAFO	Concentrated Animal Feeding Operation
CCC	Civilian Conservation Corp
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CNHI	County Natural Heritage Inventory
CREP	Conservation Reserve Enhancement Program
CSO	Combined Sewage Overflow
CWA	Clean Water Act
CWF	Cold Water Fishery
DA	Dedicated Areas
DCNR	Department of Conservation and Natural Resources
DEP	Department of Environmental Protection
DMAP	Deer Management Assistance Program
DSA	Driving Surface Aggregate
EAB	Emerald Ash Borer
EPA	Environmental Protection Agency
ESM	Environmentally Sensitive Maintenance
EV	Exceptional Value
FEMA	Federal Emergency Management Agency
GPS	Global Positioning System
H+	Hydrogen Ion
HQ	High Quality
HU	Hydrologic Unit
IBA	Important Bird Area
IMA	Important Mammal Area
IMAP	Important Mammal Area
IPM	Integrated Pest Management
LCA	Landscape Conservation Area
LHP	Landslide Hazard Program
LHR	Lumber Heritage Region

MSWLF	Municipal Solid Waste Landfills
NASS	National Agricultural Statistic Service
NFIP	National Flood Insurance Program
NISIC	National Invasive Species Information Center
NOMA	Nutrient and Odor Management Act
NO <sub>x</sub>	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Pollutant List
NRCS	Natural Resource Conservation Service
OH-	Hydroxide Ions
PASDA	Pennsylvania Spatial Data Access
PDA	Pennsylvania Department of Agriculture
PDE	Pennsylvania Department of Education
PFBC	Pennsylvania Fish and Boat Commission
PGC	Pennsylvania Game Commission
PM	Particulate Matter
PNHP	Pennsylvania Natural Heritage Program
PNMP	Pennsylvania Nutrient Management Program
POWR	Pennsylvania Organization for Watersheds and Rivers
QDM	Quality Deer Management
RCRA	Resource Conservation Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SFHA	Special Flood Hazard Areas
SGL	State Game Lands
SMCRA	Surface Mine Conservation Recovery Act
SRBC	Susquehanna River Basin Commission
SSO	Sanitary Sewer Overview
TMDL	Total Maximum Daily Loads
TSF	Trout Stocked Fishery
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WNS	White Nose Syndrome
WPC	Western Pennsylvania Conservancy
WWF	Warm Water Fishery

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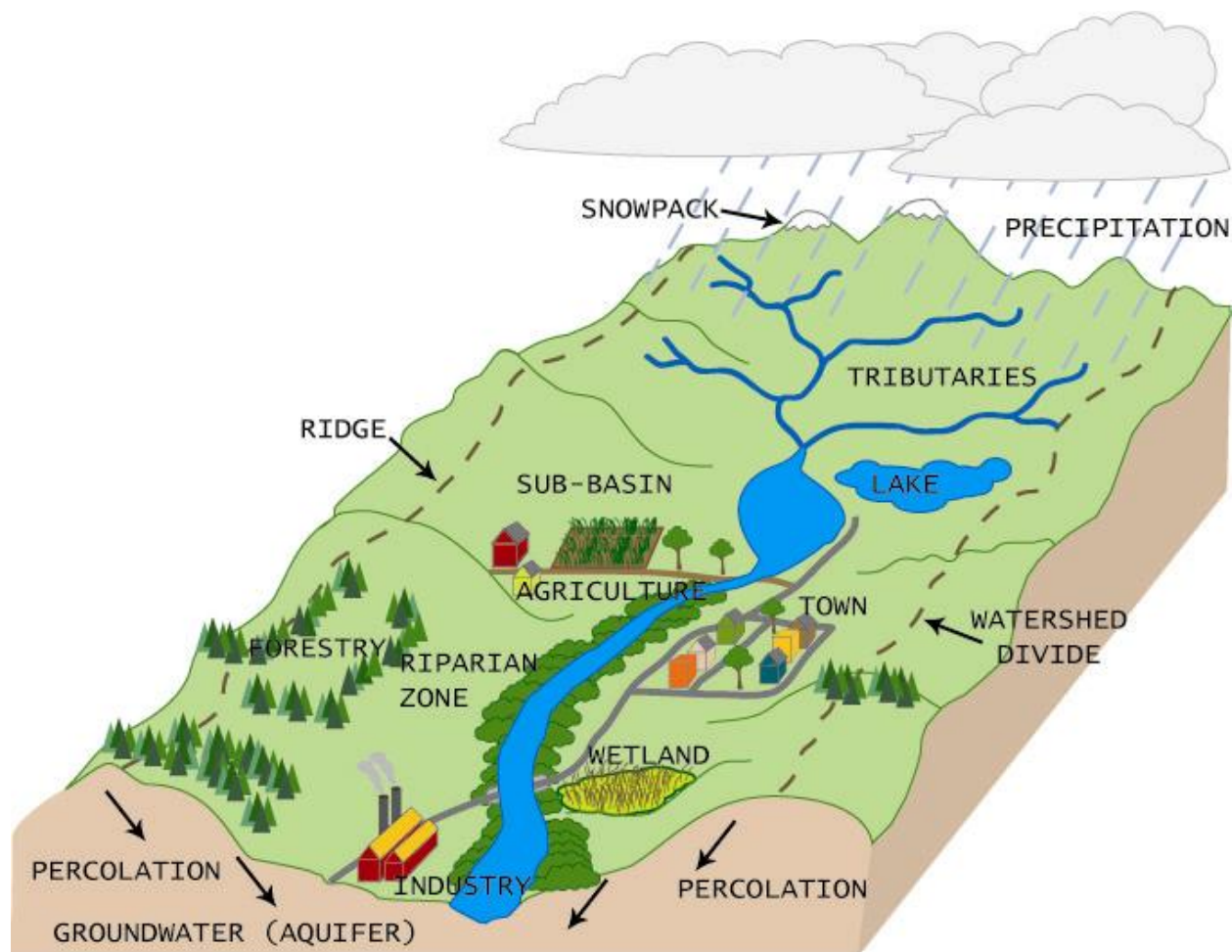
## WATERSHED DEFINITION

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A watershed is an area of land that drains to a common waterway, such as a stream, lake, wetland, aquifer, or ocean. Each waterbody has its own watershed; some are small, such as Brokenstraw Creek, and others are larger, such as Allegheny River. The highest elevation surrounding a waterbody defines its watershed boundary. A drop of water falling outside the boundary will drain to another watershed.

Land uses and human influences can impact the quality of the watershed. Everyone lives in a watershed and “we all live downstream.” Local impacts on the waterbody affect the quality of the watershed downstream, just as impacts upstream affect the local quality of the watershed.



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## EXECUTIVE SUMMARY

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The Brokenstraw Creek Watershed Conservation Plan is a comprehensive study that compiles broad-based data about recreational, historical, socio-economic, and natural resources throughout the region. The plan involves a strong community participation element through the identification of local needs and concerns.

This document is non-regulatory, and serves as a reference and educational tool promoting the conservation of natural resources, monitoring and improvement of water quality, and advocating sound community-planning practices. Recommendations identified in this plan are not enforceable by any agency. Implementation of this plan is the responsibility of the entire watershed community, and depends upon cooperation and collaboration among many different organizations.



*An overview of the Brokenstraw Creek watershed*

Pennsylvania Rivers Conservation Program aids groups in accomplishing local initiatives through planning, implementation, acquisition, and development activities. As part of the program, Pennsylvania Department of Conservation and Natural Resources (DCNR) established the Pennsylvania Rivers Registry to validate the completion of approved watershed conservation plans. The registry serves to promote public awareness of completed plans, while fostering support for future projects that will enhance the overall quality of the watershed.

The Brokenstraw Creek Watershed Conservation Plan was conducted to document current conditions that identify initiatives to improve the livability and attractiveness of the region. Through public perception of current conditions and future expectations, the plan engages community involvement to develop a future vision for the watershed and create a prioritized list of recommendations to achieve this vision.

### Project Background

In 2007, Western Pennsylvania Conservancy (WPC) received funding from the DCNR Bureau of Recreation and Conservation and the Foundation for Pennsylvania Watersheds to prepare a watershed conservation plan for the Brokenstraw Creek watershed.



*Watershed tour highlighted the benefits of using warm season grasses*

Planning efforts began in 2008 with the formation of the steering committee, development of outreach materials, and data collection. Kickoff public meetings were held in conjunction with a watershed tour in September 2008.

Public outreach activities continued into 2009. Two community meetings—a municipal officials meeting and an advisory committee meeting—were held in February 2009. Municipal officials gathered for an update of the plan's progress and to discuss issues facing their communities. Advisory committee members provided in-depth information



about local resources during a focus group meeting. In addition, interested area residents were interviewed for their knowledge and insight for the future of the watershed.

In 2011, the final touches of the Brokenstraw Creek Watershed Conservation Plan were conducted, including the prioritization of management recommendations, public review of the draft plan, and completion of the final Brokenstraw Creek Watershed Conservation Plan.

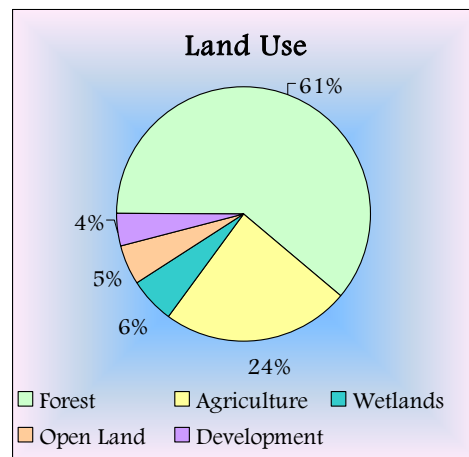
## Chapter Summaries

### Project Area Characteristics

- A major tributary to the Allegheny River, Brokenstraw Creek flows 37 miles from its headwaters in Chautauqua County, New York to the Allegheny National Forest – Buckaloons Recreation Area in Warren County, Pennsylvania.
- Located within Crawford, Erie, and Warren counties in Pennsylvania and Chautauqua County, New York, the project area includes 327 square miles in 15 municipalities and six towns.
- Consistent with Pennsylvania, New York, and the U.S., manufacturing, retail trade, and health care industries are the primary workforce industries within the watershed.
- In 2000, the population of the watershed was 27,256 residents. This was an increase of 2.5 percent from 1980.

### Land Resources

- Agriculture played a significant role in the development of the region and continues to play an important role in the watershed's economy. Dairy products are the top commodity produced in the watershed.
- Forestland dominates land cover within the project area.
- Geology influences attributes of a watershed. Glaciations had a profound impact on the topography and hydrology of the region.



*Spring Creek*

### Water Resources

- Overall, this watershed has good water quality with a high diversity of species. Brokenstraw Creek is known for its excellent angling opportunities.
- Spring Creek and Blue Eye Run are the only streams designated as High Quality Coldwater Fishery (HQ-CWF) waterways.
- Erosion and sedimentation, acid deposition, nutrients, chemicals, and organic matter are sources of impairment of area waterways.

### **Biological Resources**

- Six percent of the watershed is covered by wetlands, most of which are woody wetlands, usually swamps.
- The entire Brokenstraw watershed and the Spring Creek subwatershed, in particular, support some of the most outstanding glacial wetlands in Pennsylvania and southern New York. Several glacial fens supporting endangered and threatened plants and outstanding invertebrate diversity are widely scattered throughout the region.



*Tamarack Swamp*

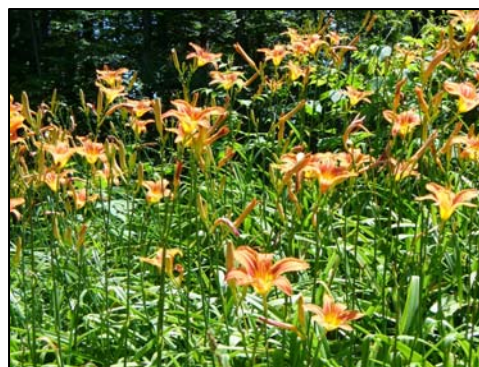
- There are 150 species of concern, 10 natural community types of concern, and two geologic features of concern. The species of concern include 75 plant species, 31 invertebrates, 13 birds, 13 mammals, six reptiles, and two amphibians.

### **Cultural Resources**

- Brokenstraw Creek got its name from Cushmanadauga—a Native American word meaning broken grass—based on the annual crop of tall prairie grass or wild oats that once grew in the region surrounding the Buckaloons Recreation Area.
- Popular recreational activities include fishing, hunting, trapping, wildlife watching, camping, hiking, bicycling, snowmobiling, ATV riding, canoeing, and kayaking.
- Recreational facilities include two New York state forests, two New York wildlife management units, nine community or regional parks, six Pennsylvania state game lands, five golf courses, and four trails.

### **Issues and Concerns**

- Visioning and goal identification is a fundamental element of watershed conservation planning. In order to obtain these visions and goals, local residents and visitors were contacted using a variety of methods, including traveling displays, public meeting workshops, student workshops, public meeting surveys, personal communication, community events, key individual interviews, and a project website.
- The top four issues brought up during the public meetings include:
  - Environmental educational programs for Kindergarten through adult
  - Improve enforcement of existing regulations
  - Invasive species control and eradication
  - Increase installation of agricultural best management practices



*Day lilies are one of many invasive species within the project area*

- The top four issues brought up by survey participants include:
  - Prevent illegal dumping and clean up existing dump sites
  - Improve water quality
  - Reduce erosion and sedimentation
  - Managing waste sites and hazardous spills

### **Management Recommendations**

- Management recommendations are non-regulatory suggestions to maintain or improve the conditions that affect many aspects of life within the region. These recommendations are best used as a guide to conserving, restoring, or improving important watershed characteristics. They were compiled from municipal and public surveys, public meeting workshops, and key individual interview comments.
- No limitation to the number or types of issues, actions, approaches, partners or funding opportunities should be assumed, due to ever changing circumstances. Creativity in implementing the identified recommendations or developing additional suggestions is highly encouraged.

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**Table ES-1. Management Recommendation Goals**

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#### **Project Area Characteristics**

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- Proactively plan for future development.
- Carefully plan development to ensure economic enhancement, while preserving community character, without adversely affecting quality of life.
- Enhance marketability to prospective businesses, and establish economic stability to maintain a balanced workforce.
- Encourage economic growth with minimal impacts to the environment.
- Increase communications and cooperation among municipalities and counties within the region to promote sharing of services and improve conditions collectively affecting the watersheds.
- Identify impacts of acid precipitation to minimize and remediate these impacts.
- Enhance transportation infrastructure.
- Enhance financial support and services to prepare emergency response providers.
- Educate stakeholders how land-use planning can be effective.
- Educate stakeholders about benefits of watershed protection and the use of best management practices.
- Support community libraries and expand service opportunities.

#### **Land Resources**

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- Explore opportunities to generate alternative energy.
- Reduce impacts caused by dirt and gravel roadways.
- Establish cooperation between surface and subsurface rights landowners and develop protection rights for surface landowners in order to protect their property.
- Preserve agricultural lands and culture for future generations.
- Establish or enhance incentives for land protection and conservation practice implementation.
- Identify, inventory, and clean up illegal dumpsites; and prosecute violators using illegal dumpsites.
- Work with agricultural producers to install best management practices to reduce impacts on herds and area waterways.
- Minimize impacts caused by exploration, production, retirement, and abandonment of wells.
- Reclaim abandoned wells, mines, and quarries.

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**Table ES-1. Management Recommendation Goals (continued)**

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**Land Resources (continued)**

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- Protect ecologically significant lands.
- Increase awareness about practices to assist agricultural and forest landowner in managing their lands effectively.
- Increase awareness about the impacts from litter, illegal dumps, and abandoned vehicles.

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**Water Resources**

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- Protect area waterways, while increasing wildlife habitat opportunities.
- Increase awareness about the benefits of riparian corridors.
- Further investigate wetlands and their functions and protect these resources.
- Educate stakeholders about the value and importance of wetlands.
- Reduce the amount of erosion and sedimentation entering waterways.
- Monitor water quantity to ensure demand does not exceed water supply.
- Monitor the use of brine water as a treatment on dirt and gravel roads.
- Minimize potential flooding damages by taking a proactive approach to managing floodplains.
- Encourage non-structural approaches to floodplain management.
- Minimize impacts from stormwater through planning.
- Establish, maintain, or upgrade sewage treatment facilities.
- Establish, maintain, or upgrade water treatment facilities.
- Investigate the need and effectiveness of establishing a water quality trading program within the Brokenstraw Creek watershed.
- Develop a monitoring plan for the watershed or completed project areas, integrating quality assurance/quality control standards into the plan.
- Establish and implement conservation practices to reduce water consumption.
- Conduct an assessment of natural and man-made impoundments, and implement recommendations to enhance their ecosystems.
- Protect and evaluate waterways that are designated or eligible for classification as high quality or exceptional value.
- Reduce water quality impacts by properly disposing of un-needed medication.
- Provide educational programs educating residents about impacts and pollution sources.

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**Biological Resources**

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- Reduce impacts caused by invasive and nuisance species.
- Develop, adopt, and implement management plans to protect forest and wildlife resources.
- Implement best management practices to protect forest resources.
- Identify Important Bird and Mammal Areas
- Identify and protect biologically diverse areas.
- Enhance aquatic habitats.
- Protect rare, threatened, and endangered species and their habitats.
- Identify and protect important habitats for plant and animal species.
- Implement strategies to conserve rare and unique plant and animal communities.
- Increase the use of native plants in landscaping and remediation projects.
- Implement wildlife management practices to protect biodiversity.



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**Table ES-1. Management Recommendation Goals (continued)**

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**Cultural Resources**

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- Increase awareness of recreational resources through marketing and outreach.
- Enhance recreational opportunities for sportsmen and outdoor enthusiasts.
- Increase recreational opportunities for area youth by establishing programs and encouraging outdoor recreational activities and opportunities.
- Improve recreational facilities and ensure availability and access to them.
- Establish, expand, and improve area trails.
- Link recreational facilities to each other.
- Encourage environmentally sound practices when operating recreational vehicles, and enforce existing laws to minimize intrusion on private lands.
- Expand awareness, appreciation, and support for the arts.
- Highlight and preserve local history within the region.
- Promote appreciation for the local history.
- Promote community involvement in conservation and educational initiatives.
- Establish ongoing environmental education programs and displays.
- Educate recreation users about proper and safe practices.

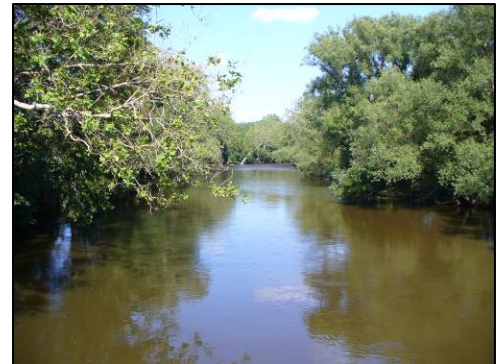
## CHAPTER 1. PROJECT AREA CHARACTERISTICS

This section provides an overview of the project area, its location, watershed sub-basins, topography, municipalities, air quality, land-use regulations, and socio-economic factors.

### Project Area

#### Location and Size

Brokenstraw Creek is a major tributary to the Allegheny River. The headwaters of Brokenstraw Creek begin in Chautauqua County, New York, flowing 37 miles to its mouth on the Allegheny River within the Buckaloons Recreation Area of the Allegheny National Forest. The watershed encompasses four counties within two states, 15 municipalities in Pennsylvania, and six towns in New York (Table 1-1 and Figure 1-1). It drains 327 square miles before joining the Allegheny River near Irvine, PA



*Brokenstraw Creek flows through Youngsville before joining the Allegheny River near Irvine, PA*

**Table 1-1. Watershed Municipalities**

Municipality	Square Miles	Percent of Watershed	Municipality	Square Miles	Percent of Watershed
<b>Chautauqua County, NY</b>			<b>Warren County, PA</b>		
Town of Busti	2.019	0.60%	Bear Lake Borough	0.684	0.20%
Town of Clymer	29.875	8.85%	Brokenstraw Township	26.831	7.95%
Town of French Creek	3.112	0.92%	Columbus Township	40.577	12.03%
Town of Harmony	35.376	10.48%	Conewango Township	3.559	1.05%
Town of North Harmony	1.226	0.36%	Deerfield Township	1.54	0.46%
Town of Sherman	0.884	0.26%	Eldred Township	4.593	1.36%
<b>Crawford County, PA</b>			Freehold Township	34.89	10.34%
Sparta Township	6.618	1.96%	Pittsfield Township	55.111	16.33%
<b>Erie County, PA</b>			Spring Creek Township	48.65	14.42%
City of Corry	5.348	1.58%	Sugar Grove Township	12.797	3.79%
Concord Township	4.815	1.43%	Youngsville Borough	1.342	0.40%
Wayne Township	17.568	5.21%			

The watershed is located within two marketing regions, the Pennsylvania Wilds Region and the Pennsylvania’s Great Lakes Region. Pennsylvania Wilds is the name given to a 12-county region in north-central Pennsylvania, as a marketing initiative for outdoor recreation. The region offers 2.1 million acres of public land, 27 state parks, and hundreds of miles of trails and waterways. The goal of the initiative is to encourage growth of tourism and tourism-related businesses that enhance a visitor’s experience, while protecting the natural resources that make this region unique. Pennsylvania’s Great

Lakes Region is the name given to the four northwestern Pennsylvania counties, Erie, Crawford, Mercer, and Venango counties.

Lumber Heritage Region of Pennsylvania (LHR) encompasses a portion of the watershed. The LHR is a 15-county region, including Warren County, designated in 2001 as 1 of 12 heritage areas in Pennsylvania to highlight and interpret the rich cultural, historical, natural, and recreational resources of Pennsylvania forests.

### **Climate**

The climate follows that of a modified continental climatic regime with hot, dry summers and long, cold winters. Sunshine and humidity combine for three months—June, July, and August—of warm temperatures. The temperature averages 68 degrees Fahrenheit, but typically stays between 50–80 degrees. Historically, the record high temperature of 101 degrees Fahrenheit occurred in 1936. Winter lasts from November to March, with the most severe conditions occurring from December to February. During the winter months, the average temperature is 32 degrees Fahrenheit, with January averaging a temperature of 12.3 degrees Fahrenheit. The record low temperature of negative 34 degrees Fahrenheit occurred in 1979 (Penn State Climatologist, 1994; Weather Channel, 2008).

The growing season—period between the last 32-degree temperature day of spring and the first 32-degree temperature day of fall—averages 148 days. The growing season has ranged from 90 days in 1918 to 189 days in 1946. Rainfall during the growing season accounts for 47 percent of the annual precipitation (Penn State Climatologist, 1994).

Precipitation occurs throughout the year, with 40 to 45 inches per year expected. The area usually receives between 28 and 58 actual inches per year. Excluding January and February, monthly precipitation averages 3 to 5 inches. Summer rainfall occurs as short periods of showers and thunderstorms. The typical snow season occurs from November to April, with total snowfall accumulations that range between 37 inches (during the winter of 1918–1919) and 120 inches (1910–1911). The average annual snowfall is between 55 and 85 inches (Penn State Climatologist, 1994).

### **Topography**

Ancient glaciers, which carved out lakes and valleys, had a profound effect on the topography of some areas within this region. Complex systems, glaciers are dependent upon the climate to dictate whether they grow or shrink. A glacier forms when the temperature is low enough to allow the snowfall to accumulate and transform into ice. It then begins to flow outwards and downwards under the pressure of its own weight.



*An overview of the Brokenstraw Creek valley*

As they move, glaciers erode part of their structure. The eroded materials, known as glacial deposits or till, are deposited along the path, forming features characteristic of glaciated areas. A variety of glacial deposits exist within the project area; they are described in further detail in Table 1-2.

The project area is located within the Northwestern Glaciated Plateau and High Plateau sections of the Appalachian Plateaus Geomorphic Province. A geomorphic or physiographic province is a landform area delineated by similar terrain, shaped by a common geologic history (Radford University, 2005).

**Table 1-2. Types of Glacial Deposits**

<b>Deposit Type</b>	<b>Description</b>
Drumlins	Clusters of elongated hills of un-stratified mixtures of clay, silt, sand, gravel, and boulders
Eskers	A sinuous ridge of sediment, such as gravel or sand, that is deposited by streams that cut channels under or through the glacier's ice
Kames	Mounds of sand and gravel deposited in low areas on or beside a melting glacier
Kettles	Depressions where ice blocks melted
Moraines	Sediments of mud, sand, gravel, and boulders that deposit in long mounds
<i>Ground Moraine</i>	<i>Till-covered areas with irregular topography and no ridges, often forming gently rolling hills or plains</i>
<i>Lateral Moraine</i>	<i>Till along sides of a valley where a glacier reached in its advance</i>
<i>Medial Moraine</i>	<i>Accumulation of debris marking where two glaciers merged</i>
<i>Recessional Moraine</i>	<i>Till marking a temporary halt in the general retreat of a glacier</i>
<i>Terminal or End Moraine</i>	<i>Till accumulated as a pile of debris at the front edge of a glacier</i>
Outwash Plains	Gentle slopes in front of a glacier where eroded materials, transported by water, were deposited

(Source: *Glacier, 2004; Sevon, Fleeger, & Shepps, 1994; Wikimedia Foundation, Inc., 2008*)

### **Major Tributaries**

Brokenstraw Creek is designated as a Cold Water Fishery (CWF). There are 11 named tributaries directly entering Brokenstraw Creek, two of which are considered major tributaries—Little Brokenstraw Creek and Spring Creek. More information about the named streams and major tributaries is available in the Water Resources chapter.

### **Air Quality**

Each year, nearly 200 million tons of toxic emissions pollute the air in the U.S., making air pollution the nation's largest environmental risk (Pennsylvania Department of Environmental Protection (PA DEP), 2003). Any substance in the air that causes damage to life, ecosystems, or property, is an air pollutant. Natural and synthetic processes can lead to air pollution. Over 90 percent of the pollutants originate from industry, power plants, vehicles, and other human influences. In 1970, the Clean Air Act was passed. Amended in 1977 and again in 1990, the act set a national goal to have clean and healthy air for everyone.

Airborne pollutants can travel very long distances. They fall to the ground in raindrops, fog, dew, dust, or simply due to gravity. Identifying sources of airborne pollutants to a body of water is complicated. Pollutants enter waterways through direct deposition (directly into waterways) or through indirect deposition (being washed into waterbodies as runoff). Researchers developed the concept of airsheds to assist in the study of atmospheric deposition, which is the process during which airborne pollutants fall to the ground (U.S. Environmental Protection Agency (EPA), 2003).

Airsheds are geographic areas responsible for emitting 75 percent of the air pollution that reaches a body of water. Different pollutants have different airsheds because of the varied behaviors that occur in the atmosphere. Airsheds are determined using mathematical models of atmospheric deposition, as opposed to watersheds, which utilize physical features of the landscape (EPA, 2003).



### **Atmospheric Deposition**

There are two types of atmospheric deposition: dry and wet. Dry deposition refers to gases and particles that fall to the earth, depositing on buildings, cars, homes, and trees, where they are then washed away during storm events in runoff.

Rain, fog, and snow are examples of wet deposition. One type of wet deposition is acid precipitation, which occurs when nitrogen oxides and sulfur dioxide react in the atmosphere with water, oxygen, and other chemicals to form various acidic compounds.

Atmospheric deposition can affect the water quality of lakes and streams; terrestrial and aquatic wildlife; forests; human health; visibility; and the materials with which automobiles, statues, and buildings are constructed. More information about the effects of acid precipitation is located within the Water Resources chapter.

### **Critical Pollutants**

Six nationally identified critical pollutants that affect air quality are carbon monoxide, lead, nitrogen oxides, ozone, particular matter, and sulfur dioxide.

#### *Carbon Monoxide*

Carbon monoxide is a poisonous compound that results from the incomplete consumption of fuels, such as motor vehicle exhaust, industrial processes, and wood stoves. It can impair vision, alertness, and other mental and physical functions when inhaled. Individuals with cardiovascular disease are at the highest risk, but carbon monoxide can also affect healthy individuals. Carbon monoxide poisoning can be fatal when high levels are present because it replaces the oxygen in blood and inhibits the delivery of oxygen to body tissues (PA DEP<sup>2</sup>).

The majority of the counties in the watershed are among the dirtiest in the U.S. for carbon monoxide. Crawford County is the cleanest with a rank in the 70<sup>th</sup> percentile. A percentile is a descriptive statistic that indicates the percent of a distribution; a rank in the 70<sup>th</sup> percentile means Crawford County's carbon monoxide contamination is greater than or equal to 70 percent of the counties in the U.S. Chautauqua and Warren counties are in the 80<sup>th</sup> percentile and Erie County in the 90<sup>th</sup> percentile (Green Media Toolshed, 2005).

#### *Lead*

The use of leaded fuel, and industrial processes such as battery manufacturing and lead smelting emit lead particles into the atmosphere. The metal development process is a major source of lead emissions. Ingested or inhaled, lead poisoning reduces mental abilities; damages blood, nerves, and organs; and raises blood pressure. Lead is highly toxic and accumulates in the body; even small doses are harmful (PA DEP<sup>2</sup>).

#### *Nitrogen Oxides*

Fossil fuels burned at temperatures that exceed 1,200 degrees Fahrenheit produce Nitrogen oxides (NO<sub>x</sub>). Automobiles, trucks, buses, airplanes, industries, and power plants emit NO<sub>x</sub> into the atmosphere. They contribute to the deposition of nitrogen in soil and water through acid precipitation, and play a major role in the formation of ground-level ozone. Human health is impacted when NO<sub>x</sub> enter the lungs, making breathing difficult (PA DEP<sup>2</sup>).

The majority of the watershed counties are among the dirtiest in the U.S. for NO<sub>x</sub>. Warren County is the cleanest, ranking in the 60<sup>th</sup> percentile. Erie County ranks among the dirtiest in the 90<sup>th</sup> percentile, while Chautauqua and Crawford counties rank in the 80<sup>th</sup> percentile (Green Media Toolshed, 2005).

### Ozone

Ozone is a colorless, odorless gas that forms in the atmosphere. Dependant upon where it is located in the atmosphere, it can be beneficial or harmful. When located in the upper atmospheric layer, it makes up the ozone layer, filtering the sun's harmful ultraviolet rays. When located in the lowest atmosphere, it is ground-level ozone. Ground-level ozone is a secondary pollutant—a pollutant formed in the atmosphere instead of emitted from a specific source. It forms when  $\text{NO}_x$  combines and reacts with volatile organic compounds in the presence of sunlight and warm temperatures (PA DEP<sup>2</sup>). Ozone, and pollutants that cause it, travel hundreds of miles away from their sources.

When inhaled, ozone reacts with tissues in our lungs, making it difficult to breathe. People with asthma and lung diseases are most seriously impacted, but even healthy individuals are at risk with prolonged exposure.

### Particular Matter

Particulates are tiny drops of liquid or small particles of dust, metal, or other materials that float in the air. Particular matter is a mixture of these particulates. Four different types and sizes exist. Particles travel into the lungs and become trapped; they cause respiratory ailments, and may carry chemicals that can cause cancer and produce greater health problems (PA DEP<sup>2</sup>).

**Total suspended particulates** vary in size up to 45 micrometers in diameter. They can remain suspended in the air for a few seconds, or up to several months (PA DEP<sup>2</sup>). Neither federal nor state air quality standards exist for total suspended particulates.

**Particular matter 10 (PM<sub>10</sub>)** is solid matter or liquid droplets from smoke, dust, fly ash, or condensed vapors that are suspended in air for long periods. They are less than 10 micrometers in diameter. Warren County ranked in the 10<sup>th</sup> percentile, among the cleanest counties in the U.S., for PM<sub>10</sub>. Crawford County ranked in the 50<sup>th</sup> percentile, while Chautauqua County ranked in the 60<sup>th</sup> percentile and Erie in the 70<sup>th</sup> percentile.

**Particular matter 2.5 (PM<sub>2.5</sub>)** is fine particles with diameters less than 2.5 micrometers. They can accumulate in the respiratory system and are associated with numerous adverse health effects, especially among children, the elderly, and individuals with asthma or cardiopulmonary disease (PA DEP<sup>2</sup>). The majority of watershed counties rank among the dirtiest for PM<sub>2.5</sub>. Erie County is ranked in the 80<sup>th</sup> percentile, while Chautauqua is in the 70<sup>th</sup>, and Crawford in the 60<sup>th</sup> percentile. Warren County is the only county in the watershed ranked among the cleanest for PM<sub>2.5</sub> in the U.S., being in the 20<sup>th</sup> percentile (Green Media Toolshed, 2005).

Classified together as one critical pollutant are **sulfates and nitrates**. Sulfates are one of the key components in the formation of acid precipitation. Studies to determine the impact of nitrates in the formation of acid precipitation are ongoing. Both sulfates and nitrates have a role in reduced visibility.

### Sulfur Dioxide

Emitted into the atmosphere from burnt coal or oils that contain sulfur, sulfur dioxide damages trees, plants, and agricultural crops. It can accelerate the corrosion of materials, such as iron-containing metals, and materials with which monuments and buildings are constructed (PA DEP<sup>2</sup>). Sulfur dioxide is the main component of acid precipitation; it joins with water vapor in the atmosphere to form sulfuric acid. Children, the elderly, and individuals with asthma, chronic lung disease, and cardiovascular disease are more susceptible to sulfur dioxide's negative health effects.

Sulfur dioxide pollution varies among the counties, but all are among the dirtier counties in the U.S. for this type of air pollution. Chautauqua and Erie counties rank in the 90<sup>th</sup> percentile, while Warren

County ranks in the 80<sup>th</sup> and Crawford County ranks in the 60<sup>th</sup> percentile (Green Medial Toolshed, 2005).

### **Mercury**

Although not identified as a national critical pollutant, mercury is important. Mercury occurs naturally in air, water, and soil. Many rocks, including coal, release mercury into the atmosphere when burned. An estimated half of all mercury deposited within the U.S. comes from sources within the U.S. (EPA, 2005). Approximately 40 percent of the domestic mercury is released from coal burning power plants. Of the mercury emissions from these plants, only one-third is deposited in the U.S.

Mercury emitted into the atmosphere eventually settles into water or onto land, where it is carried to water by runoff. Once deposited, certain microorganisms can change it into methylmercury, a highly toxic form of the pollutant that accumulates in fish, shellfish, and animals that eat fish (EPA, 2005). Some species of fish and shellfish amass more methylmercury than others; the level of methylmercury varies dependant upon what they eat, how long they live, and each organisms' level within the food chain.

Humans are exposed to methylmercury primarily through the consumption of fish and shellfish. At high levels, mercury exposure can harm the brain, heart, kidneys, lungs, and immune system (EPA, 2005). In unborn babies, newborns, and young children, high levels of methylmercury can affect the development of the nervous systems and impair learning.

EPA, U.S. Food and Drug Administration, and individual states work together to establish local fish advisories. These advisories suggest how often women who may become pregnant, pregnant women, nursing mothers, and young children should eat certain types of fish. Advisories for men, women, and children of all ages are issued when appropriate. Pennsylvania advisories are updated annually on the PA DEP's website (keyword: fish advisories).

The commonwealth of Pennsylvania advises that citizens limit their consumption of recreationally-caught sport fish from Pennsylvania waterways to no more than one half-pound meal per week. More proactive advice is available for fish caught within Brokenstraw Creek from the confluence of Little Brokenstraw to the mouth. It is recommended that consumption of recreationally-caught golden redhorse is limited to two meals per month, because of mercury accumulation in the species. However, golden redhorse is rarely sought by anglers (PA DEP, 2008c).

The State of New York recommends that individuals limit the meals of recreationally-caught fish to one half-pound meal per week. New York also recommends that women of child bearing age, children, and infants do not consume any fish caught in waterways in which an advisory exists, even if the advisory is not for the caught species. However, within the Brokenstraw Creek watershed there are no specific advisories identified (New York Department of Health, 2008).

### **Impacts of Air Pollution**

Air pollution not only affects the quality of the air, but the economy, health, and the environment as well. It contributes to land and water pollution, and alters the chemical makeup of streams and soils. It can lead to impairment or destruction of habitats (through the loss of trees, plants, and animals), decreased property values and incomes, and increased medical expenses, as well as employee absenteeism (Kling & Wuebbles, 2003).

## Socioeconomic Profile

### Land-Use Planning and Regulation

Land-use plans and regulations protect communities from unwanted development and land uses. The Pennsylvania Municipalities Planning Code grants municipalities land-use regulation control powers, such as comprehensive plans, zoning, subdivision regulations, and land-use ordinances. Unwanted or uncontrolled land uses may result when these protective measures are not utilized. Land-use controls utilized by municipalities are identified in Table 1-3.

#### Comprehensive Plans

Comprehensive plans serve as a guide for public and private decisions to ensure appropriate development activities. Many municipalities and counties recognize that without formal plans they may be vulnerable to undesirable land uses through uncontrolled industrial, commercial, or residential development. Although often used to guide municipal actions, comprehensive plans have no regulatory authority, unless implemented through the development of ordinances and other municipal regulations.

Within the Brokenstraw Creek watershed, 33 percent of the municipalities have a municipal comprehensive plan. Municipalities within Crawford and Erie counties have individual municipal comprehensive plans, as does Columbus Township, Warren County, and the New York towns of Harmony and North Harmony.

**Table 1-3. Land-Use Regulations**

<b>Municipality</b>	<b>Comprehensive Plan</b>	<b>Zoning</b>	<b>Subdivision</b>	<b>Floodplain Ordinance</b>
<b>Chautauqua County, NY</b>				
Town of Busti	NO	YES	YES	YES
Town of Clymer	NO	YES	NO	YES
Town of French Creek	NO	NO	NO	YES
Town of Harmony	YES	YES	NO	NO
Town of North Harmony	YES	YES	NO	YES
Town of Sherman	NO	NO	NO	n/a
<b>Crawford County, PA</b>				
Sparta Township	YES	NO	NO	YES
<b>Erie County, PA</b>				
City of Corry	2002	NO	YES	YES
Concord Township	YES	YES	County	YES
Wayne Township	YES	YES	County	YES
<b>Warren County, PA</b>				
Bear Lake Borough	YES	YES	YES	YES
Brokenstraw Township	NO	NO	County	NO
Brokenshaw Township	NO	NO	County	YES
Columbus Township	YES	County	County	County
Conewango Township	NO	County	County	County
Deerfield Township	NO	NO	County	YES
Eldred Township	NO	County	County	County
Freehold Township	NO	NO	County	YES
Pittsfield Township	NO	NO	County	YES
Spring Creek Township	NO	Pending	County	YES
Sugar Grove Township	NO	NO	County	YES
Youngsville Borough	NO	YES	YES	YES

*(Note: County indicates that the municipality is utilizing the county's plan or ordinance)*

*(Source: Crawford County Planning Commission, 2000; Federal Emergency Management Agency, 2007; Pennsylvania Governors Center for Local Government Services)*

### Subdivision Regulations

Subdivision regulations limit the number of times that a parcel can be divided into two or more smaller parcels, and are therefore an important tool in controlling sprawl. Subdivision regulations can ensure that new developments do not overburden local roads, facilities, and services; integrate infrastructure with present and planned facilities; and provide adequate provisions for stormwater management, erosion control, water supply, wastewater, and traffic access. Municipalities and counties without subdivision regulations should establish them to assist in growth management.

Erie and Warren counties have countywide subdivision ordinances, while two municipalities—the City of Corry and Youngsville Borough—have individual municipal subdivision ordinances. Crawford County and Sparta Township do not utilize subdivision regulations. The Town of Busti is the only town within the New York portion of the watershed that utilizes subdivision ordinances.

### Zoning and Land-Use Ordinances

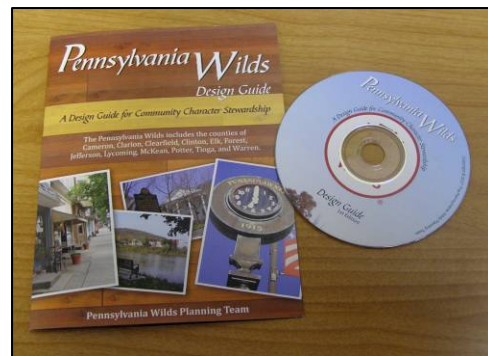
Zoning is a legal mechanism by which government bodies, in order to protect public health, safety, morals, and general welfare, can limit the type of use of land and/or designate development restrictions through land-use ordinances. Ordinances divide all land within a municipality into districts and create regulations that apply to the municipality as a whole, as well as individual districts.

Within the project area, 55 percent of the municipalities utilize land-use ordinances. Three municipalities utilize county-developed ordinances, while eight municipalities developed individual ordinances.

### Pennsylvania Wilds Design Guide

Introduced in 2007, the Pennsylvania Wilds design guide is a non-regulatory tool to help municipalities guide development patterns to fit into their community's aesthetics. The Pennsylvania Wilds Planning Team encourages public agencies, property owners, investors, developers, design professionals, community organizations, and others to utilize the guide when designing and approving development permits. The guide provides recommended suggestions for specific design, placement, and signage. The guide is available at the Lumber Heritage Region office in Emporium. Benefits of using the design guide include (The Pennsylvania Wilds Planning Team, 2007):

- Strengthening the community and regional identity
- Increasing public awareness of design issues and options
- Resulting in well-designed projects
- Avoiding development patterns that look foreign to the region
- Enhancing property values
- Protecting investments in the region's tourism industry



### Conservation by Design

Conservation by Design is an approach used to conserve open spaces, greenways, and natural resources while addressing development issues. Conservation by Design utilizes local zoning and subdivision ordinances to aid conservation. When Conservation by Design strategies are used, development is designed to decrease the amount of buildable space on each individual parcel and increase the amount of community open space.



Conservation by Design is a formalized four-step process:

Step 1 – Identification of land for permanent protection within the development site. These lands become the community open space that is owned by the landowner association and residents within the development. This area can include natural features, such as floodplains, steep slopes, historical sites, farmland, etc.

Step 2 – Locate sites of homes to maximize open space views.

Step 3 – Identification of potential locations of roads and trails; this is the reverse of the conventional development that identifies roads first.

Step 4 – Determine the boundaries of the lots.

Conservation by Design provides an alternative to the typical residential development of cul-de-sacs, manicured lawns, and boxy communities. It provides shared community space and vistas for all residents to enjoy. More information about Conservation by Design is available on the Natural Lands Trust website: [www.natlands.org](http://www.natlands.org).

### Smart Growth

When new developments are being proposed, municipalities and counties should consider cooperative land-use strategies to improve their quality of life. They also should consider Smart Growth practices when addressing development issues. Some strategies to consider are:

- Mixing land use
- Taking advantage of compact building designs
- Creating a range of housing opportunities and choices
- Creating walkable neighborhoods
- Fostering distinctive, attractive communities with a strong sense of place
- Preserving open space, farmland, natural beauty, and critical environmental areas
- Strengthening and directing development toward existing communities
- Making development decisions predictable, fair, and cost-effective
- Encouraging community and stakeholder collaboration in development decisions

Implementation of Smart Growth practices provides for a balanced, well-rounded community. Smart Growth invests time, attention, and resources in order to restore a sense of community and vitality to central cities and older suburbs. Smart Growth is town-centered, transit and pedestrian oriented, and has a greater mix of housing, commercial, and retail uses. It also preserves open space and many other environmental amenities (Sustainable Community Network).

### Demographics and Population Patterns

Since 1980, the watershed population has remained stable, with minor increases. The population of the watershed was calculated with census block group data from 1980, 1990, and 2000 (Table 1-4). Figures 1-4 and 1-5 illustrate population and population change.

Among the watershed municipalities in 2000, the Town of Busti had the largest population with 7,760 residents. However, only two square miles of the town are located within the project area. Bear Lake Borough is the smallest municipality in size and population, with 193 residents within 0.7 square miles. Youngsville Borough is the most densely populated municipality with approximately 1,379 people per square mile.

**Table 1-4. Population and Population Change**

	Population 1980	Population 1990	Population 2000	Percent Change 1980- 1990	Percent Change 1990- 2000	Percent Change 1980- 2000
Population	26,557	26,814	27,256	1.0%	1.6%	2.6%
Female	13,491	13,702	13,849	1.5%	1.1%	2.6%
Male	13,066	13,112	13,407	0.4%	2.2%	2.5%

(Source: Free Demographics, 2005)

The ratio of males to females is approximately one to one, with females holding a slight edge. Table 1-5 displays the comparison of population by sex and age. Six categories are identified— preschool-aged, school-aged, college-aged, post collegiate-aged, midlife-aged, and retirement-aged.

**Table 1-5. Population by Sex and Age**

Age	Male	Female	Total
Under 5 years	966	909	1,875
5 to 17	2,998	2,868	5,866
18 to 24	1,059	997	2,056
25 to 39	2,494	2,518	5,012
40 to 61	3,855	3,919	7,774
≥62	2,035	2,644	4,679
Total:	13,407	13,849	27,256

(Source: Free Demographics, 2005)

There are only a few population centers within the Brokenstraw Creek watershed— Bear Lake, Clymer, Corry, Panama, and Youngsville. Overall, the population within these centers has decreased, while the overall watershed population has increased. Table 1-6 displays the population for each municipality located within the Brokenstraw Creek watershed.

**Bear Lake** is located along the Pennsylvania-New York border. The borough occupies 0.70 square miles, of which no streams flow through. In 2000, there were 193 people residing in the borough.

**Clymer** is located in southwestern New York and occupies approximately 38 square miles. Named for George Clymer, one of the signers of the Declaration of Independence, the settlement of the town began in 1820, and was officially established in 1829. Between 2000 and 2006, the population decreased by less than one percent. In 2006, 1,490 people resided in Clymer.



A view of downtown Corry, Pa.

**Corry** is located on the western edge of Brokenstraw Creek in Erie County. Between 2000 and 2006, the population in the city decreased by 2.9 percent. In 2006, 6,496 people resided in the city. A portion of the population is located within the project area; while the remaining are part of the French Creek watershed.

**Panama** is named for a large rock formation located south of the village. Incorporated as a village in 1861, it occupies 2.2 square miles. Between 2000 and 2006, the village experienced a six percent population change when the population decreased by 28 residents.

**Youngsville**, incorporated in 1849, was named after Matthew Young, a teacher. From 2000 to 2006, the population within the borough decreased by 7.5 percent to an estimated population of 1,706 residents per 1.33 square miles.

**Table 1-6. Municipal Populations**

Municipality	Population			Size (square miles)	Population per square mile	Percent Area in Project Area
	Urban	Rural	Total			
<b>Chautauqua County</b>						
Town of Busti	4,261	3,499	7,760	47.77	162.45	4%
Town of Clymer	0	1,501	1,501	36.06	41.62	83%
Town of French Creek	0	935	935	36.21	25.82	9%
Town of Harmony	0	2,339	2,339	45.51	51.4	78%
Town of North Harmony	272	2,249	2,521	42.19	59.76	3%
Town of Sherman	0	1,553	1,553	36.3	42.78	2%
Village of Panama	0	491	491	2.17	226.44	100%
<b>Crawford County</b>						
Sparta Township	0	1,740	1,740	41.95	41.48	16%
<b>Erie County</b>						
City of Corry	6,660	174	6,834	6.1	1,120.46	88%
Concord Township	60	1,301	1,361	33.02	41.21	15%
Wayne Township	57	1,709	1,766	38.29	46.12	46%
<b>Warren County</b>						
Bear Lake Borough	0	193	193	0.7	277.12	100%
Brokenstraw Township	814	1,254	2,068	38.62	53.54	70%
Columbus Township	381	1,360	1,741	40.62	42.87	100%
Conewango Township	1,977	1,938	3,915	29.97	130.63	12%
Deerfield Township	0	333	333	42.91	7.76	4%
Eldred Township	0	709	709	36.41	19.62	13%
Freehold Township	0	1,402	1,402	35.58	39.4	98%
Pittsfield Township	209	1,310	1,519	55.63	27.31	99%
Spring Creek Township	0	872	872	48.74	17.89	100%
Sugar Grove Township	0	1,870	1,870	35.51	52.67	36%
Youngsville Borough	0	1,834	1,834	1.33	1,380.33	100%

### **Infrastructure**

Infrastructure is a set of interconnected structural elements that provides the framework for an entire system. Although the term has diverse meanings, typically it refers to municipal infrastructure, such as roadways, public transportation, airports, sewage, and public water supply. The existence of infrastructure

is important to the development and redevelopment of communities. Sanitary sewer systems and public water supplies usually determine how much development a given area can support and where it will be located. A lack of clean water and proper sewage treatment and disposal can hinder development and economic conditions. Preparation for infrastructure, development, and redevelopment is crucial to the future of the area.

Within the watershed, four growth areas are identified in County Comprehensive Plans—Columbus, Corry, Sugar Grove, and Youngsville/Brokenstraw/Pittsfield. These areas are identified for future development activities, both commercial and residential. Expansion of infrastructure, particularly water and sewage, into these areas is warranted. Through the designation of growth areas, counties focus development activities into areas able to support them.

#### Sanitary Sewer Systems

Septic or sewage systems treat wastewater. Septic systems are individual sewage systems that treat waste on-site. In North America, approximately 25 percent of the population relies on septic tanks, typically in small towns and rural areas (Septic Tanks, 2007).

Given the general characteristics of the region's soils, there are severe limitations for establishing on-lot sewage systems. These systems cannot support intense development. Therefore, sewage collection systems are situated in the populated areas, and in the growth areas around these population centers. Areas not serviced by public sewage collection and unable to support on-lot systems remain undeveloped (Sparta Township Comprehensive Plan, 1997; Warren County Planning and Zoning Commission, 2005).

Sewage systems collect wastewater and transport it for treatment at off-site locations. There are three types of sewer systems: storm, sanitary, and combined. Stormwater systems carry water from storm events as runoff through pipes and ditches to where it enters the stream. Sanitary systems carry raw sewage from homes and businesses to wastewater treatment facilities. Combined systems carry a combination of raw sewage and stormwater runoff to wastewater treatment facilities. Combined systems often cannot effectively treat all of the water that reaches the sanitation plant during rainstorm events.

When sanitation systems malfunction, causing raw sewage to enter nearby streams, it is called a sanitary sewage overflow (SSO). When the flow exceeds the capacity of the sanitary system, and allows untreated wastewater to enter area streams, it is referred to as a combined sewer overflow (CSO). CSOs occur during heavy storm events. The overflow from SSOs and CSOs flush human and industrial waste, oil, toxic materials, pesticides, and litter into streams.

There are six sanitary sewer authorities within the project area. Table 1-7 identifies the public sewage systems. Two of the authorities—Wayne Township Sewer Collection System and Columbus Township General Authority—utilize the services of the wastewater treatment plant in Corry, PA for treatment of their collected wastewater.

Brokenstraw Valley Area Authority provides services to Brokenstraw, Pittsfield, and Pleasant townships. Treatment of wastewater occurs at their plant along the Allegheny River in Pleasant Township. Expansion projects for the Brokenstraw/Youngsville growth area are planned, as identified in the Warren County Comprehensive Plan. With the expansion, services along Route 6 West and Darvey Hill Road will increase loads at the Brokenstraw Valley Area Authority's plant.

The Youngsville Wastewater Treatment Plant, which services Youngsville Borough, will accept a load increase as its lines expand along Matthews Run Road and Indian Camp Run Road.

The Sugar Grove Area Sewer Authority provides services to Sugar Grove Borough and portions of Sugar Grove Township. It is anticipated that this new plant will experience increased use, as it provides services to the Sugar Grove growth area identified in the Warren County Comprehensive Plan.

**Table 1-7. Public Sewage Systems**

Facility	Communities Served
Wayne Township Sewage Collection Service	Portions of Wayne Township
Columbus Township General Authority	Portions of Columbus Township
Corry Wastewater Treatment Plant	City of Corry, and portions of Columbus, Concord, and Wayne townships
Brokenstraw Valley Area Authority	Brokenstraw and Pittsfield townships
Youngsville Wastewater Treatment Plant	Youngsville Borough
Sugar Grove Area Sewer Authority	Portions of Sugar Grove Township

*(Source: Graney, Grossman, Colosimo, and Associates, Inc. and Erie County Department of Planning, 2003; Sparta Township Comprehensive Plan, 1997; Warren County Planning and Zoning Commission, 2005)*

Public Water Supply

Access to clean water is very important. In Pennsylvania, 89 percent of the population obtains their drinking water from a public water supplier (PA DEP<sup>1</sup>). Two public water suppliers provide drinking water to area residents (Table 1-8). Rural residents are less likely to have public water and rely on springs and wells for their daily needs.

**Table 1-8. Public Water Systems**

Facility	Capacity (avg. daily flow)	Source	Communities Served
City of Corry Water System	1,397,387 gal/day	Groundwater and wells	City of Corry and portions of Concord, Wayne, and Columbus townships
Youngsville Water System	NA	Wells	Youngsville Borough

*(Source: Graney, Grossman, Colosimo, and Associates, Inc. and Erie County Department of Planning, 2003; Sparta Township Comprehensive Plan, 1997; Warren County Planning and Zoning Commission, 2005)*

The City of Corry’s water system supplies 85 percent of the City of Corry, and extends into portions of Concord, Wayne, and Columbus townships. An assemblage of groundwater and well water is stored in a concrete reservoir inside a metal frame building on the south side of Corry.

The Youngsville water system supplies approximately 800 users. Historically, capacity has exceeded the demand. Deteriorating pipes and dead-ends have lead to constant efforts to repair and expand services along Route 6. Expansion into the Pittsfield area is needed, but consideration eastward towards the village of Irvine should not be overlooked.

**Transportation and Safety**

Transportation and safety throughout the region are extremely important. Vehicle transportation is the most popular form of transportation. Emergency services are essential to the area, its residents, and visitors.

Being a rural area, infrastructure capabilities are limited. The establishment of dry hydrants throughout the region is an important safety feature. Dry hydrants are non-pressurized pipe systems installed on ponds, lakes, or streams. They provide rural fire companies with access to water in order to respond to fires. The establishment of dry hydrants increases the capabilities of rural fire departments to save lives and decrease property damages caused by fires. The hydrants save money, reduce operating cost, utilize freshwater as opposed to treated water, and may decrease insurance premiums (Northeast Missouri Resource Conservation and Development).

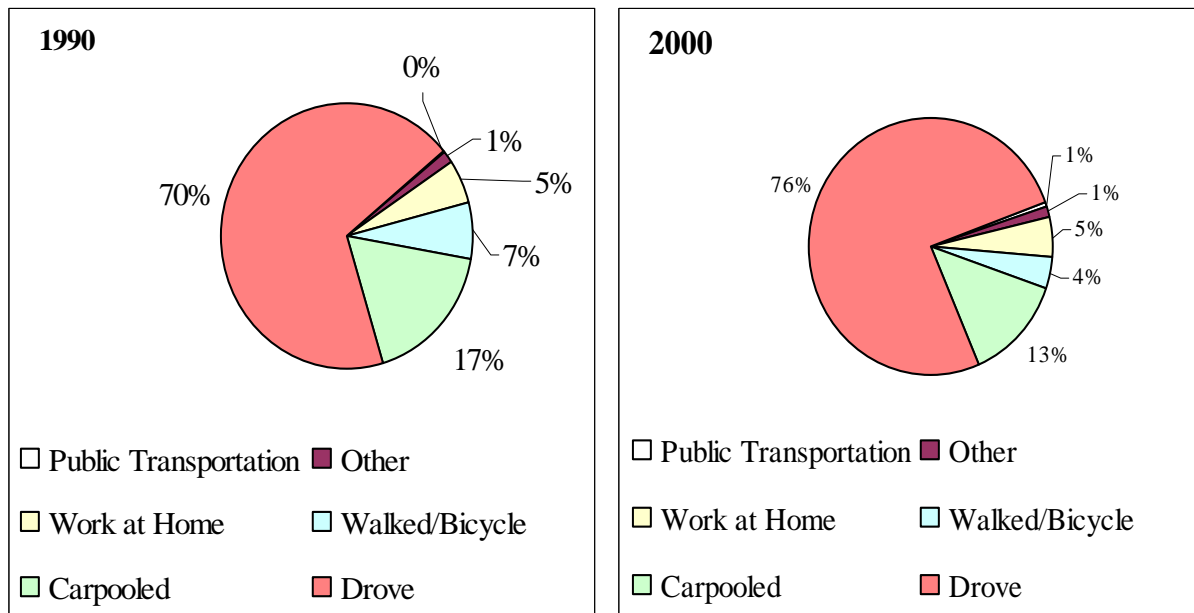


*Dry hydrants provide water for use during emergencies in areas where no public water system is available*

Methods of Transportation

The most popular method of transportation used by residents is the automobile. Within the project area, 76 percent of the employed population drives to work. Approximately 13 percent carpool, and five percent of the people work at home. Between 1990 and 2000, there has been a slight decrease of people who walk or use carpools, and a slight increase in those that drive. Figure 1-9 compares transportation methods used in 1990 to those used in 2000.

**Figure 1-9. Methods of Transportation**



(Source: Free Demographics, 2005; U.S. Census Bureau, 1990)

**Roadways** that traverse the region are categorized as primary, secondary, tertiary, unnamed township, state, and local roads. Primary routes are major highways having four lanes. Secondary routes are two-lane routes that link communities to one another, while tertiary routes are two-lane routes within communities.



U.S. Route 6 is one of 11 State Heritage Areas in Pennsylvania. Designated on January 13, 2005, the route travels 400 miles through 11 counties in northern Pennsylvania. Route 6 was one of the first transcontinental highways in the U.S. Efforts to preserve, enhance, and promote the transportation heritage, along with the enhancement of the small rural communities along the highway are needed.



*There are many dirt and gravel roadways in the project area that can increase sediment into waterways if not managed properly*

In Pennsylvania, four state routes traverse the watershed; Routes 27, 426, 957, and 958. Route 27 enters the watershed from the south, near Torpedo, PA and follows a northeast course into Youngsville. From there, it continues up Matthews Run until it exits the watershed, near Swede Hollow Road. Route 426 begins in Garland, when it splits from Route 27. Traveling in a northwestern direction through the City of Corry, PA, it continues along Hare Creek and into State Game Lands 154, near the Pennsylvania-New York border. Route 957 travels east across the watershed from Columbus, PA, through Lottsville, and exists short of Sugar Grove, PA. Route 958 travels north from its starting point along Route 6 in Freehold to Bear Lake. At Bear Lake, Route 958 turns right and travels east where it exits the watershed.

In New York, 11 state routes cross the watershed; Routes 8, 10, 12, 14, 15, 19, 23, 33, 35, 474, and 640. Route 8 travels east between Routes 474 and 23. Route 10 crosses the watershed from Route 15, to where it ends at Route 474 near Panama, NY. Route 12 travels east from Route 33 near Niobe, NY to where it exists in the watershed after it crosses Route 35. Route 14 travels west from Route 33, near Panama, NY to Route 640. Route 15 travels north from the Pennsylvania state line through Clymer. Route 19 runs parallel to Route 15 near Jaquins, NY. Route 23 travels north from the state line to Route 474 in the center of the New York portion of the watershed. Route 33 travels north from Pennsylvania to Panama, NY. Route 35 from the state line travels north through Watts Flat. Route 474 travels east through the watershed near Clymer, NY. Near Route 8, Route 474 travels north to North Harmony, NY, where it turns east and travels through Panama, NY. Route 640 begins in NE Junction, NY, travels north, and exits the watershed shortly after it crosses Route 14.



*There is a grass landing strip at the privately owned Brokenstraw Airport*

**Airports** have a vital role in transportation in today's society, with the ability to send passengers and goods all around the world. There are two airports within the study area, Brokenstraw and Corry-Lawrence. Neither airport provides passenger service. However, nearby are two international airports—Erie International and Buffalo Niagara International—that provide passenger services.

Brokenstraw Airport is located 6 miles east of the village of Pittsfield, and it is a general service airport. Privately owned, it is used by hobbyists. The airport features one turf runway. There are no commercial flights from the Brokenstraw Airport, which is supported by weekend and starter pilots.

Corry-Lawrence Airport is a municipal airport located south of the city of Corry. Classified as a business service airport, the majority of the flights are for recreation, starter pilots, pleasure, and weekend pilots. The airport features one runway.

There are 55.5 miles of **railroad** traversing the region. The majority are Conrail lines owned by the Western New York and Pennsylvania Railroad (WNYP) and Buffalo and Pittsburgh Railroad (BPRR).

Rail line transportation is important to the economics of the region. Historically, railroads were established for hauling a particular commodity to a particular market. For example, the BPRR primarily carried coal from central Pennsylvania to Rochester, New York.



*One of the 14 active rail lines in the project area*

Emergency Services

Access to emergency services is essential. Emergency services and facilities are found in centralized population areas, where responders can quickly react to emergencies. Ambulance services, police departments, fire departments, and hospitals are examples of emergency services and facilities. Services to communities outside the population center also are available, but with possible delays.

There are 27 facilities available to respond in case of an emergency within the project area. Typical of rural areas, the majority of these facilities are volunteer oriented. They include 19 fire stations and five local police departments. Corry, Youngsville, Bear Lake, Conewango Township, and the Village of Lakewood are the only municipalities to have police departments, all other municipalities are under the jurisdiction of the Pennsylvania State Police, New York State Police, or Chautauqua County sheriff’s office. The only hospital within the project area is Corry Memorial Hospital; other facilities are located nearby in Warren.

**Economy and Employment**

Major Employers

A company or organization that employs 200 or more people is designated as a major employer. Seven major employers identified in the project area are listed in Table 1-9.

**Table 1-9. Major Employers**

Facility	Number of Employees	Location
Wal-Mart Stores Inc	300	Corry, PA
Commissioners of The Rouse	290	Youngsville, PA
Ellwood National Crankshaft Co	230	Irvine, PA
Barnes Group Inc	200	Corry, PA
Corry Manufacturing Co	200	Corry, PA
Corry Memorial Hospital Assn	200	Corry, PA
Corry Regional Health Systems	200	Corry, PA

*(Harris Infosource, 2007)*

Time Traveled to Work

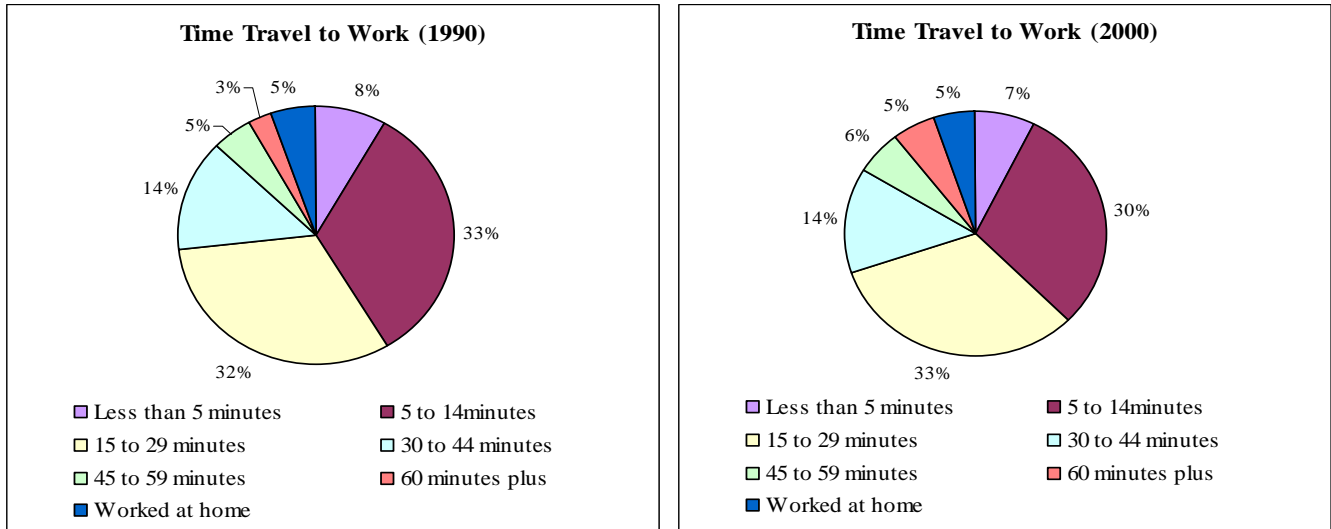
From 1990 to 2000, the majority of the employed population—over 70 percent—traveled less than 30 minutes to work. For the most part, travel times did not vary from 1990 to 2000, although a few more people traveled a little longer to get to work in 2000 than in 1990. It will be of interest to see if this pattern continues in the 2010 census, with the increased cost of fuel and potential to work from home.

Work Location

From 1990 to 2000, the local workforce continued the trend of working within their state of residence; only slightly more than nine percent worked in a different state. The majority of the workforce—over 70 percent—maintains residence within the county where they work. A smaller portion,

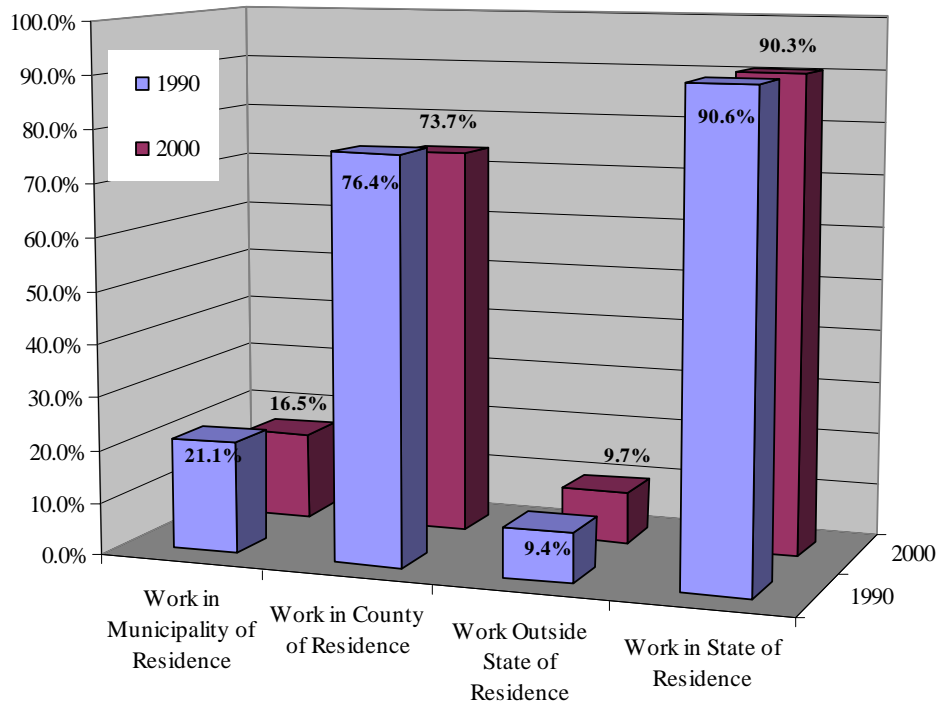
and the largest trend change from 1990 to 2000, showed less people living and working within the same municipality.

**Figure 1-10. Travel Time to Work Comparison 1990-2000**



(Source: Free Demographics, 2005; U.S. Census Bureau, 1990)

**Figure 1-11. Work Locations**



Employment Industry

Consistent with Pennsylvania and the U.S., manufacturing is the major employment industry, accounting for 29 percent of the workforce. Retail trade is second, with 13 percent. Healthcare and social services third, making up 11 percent of the local workforce. Table 1-9 displays the breakdown of employment by industry for the U.S., New York, Pennsylvania, and Brokenstraw Creek watershed.

**Table 1-9. Breakdown of Employment by Industry**

Occupation by Industry	Brokenstraw		New York		Pennsylvania		U.S.	
	Employees	%	Employees	%	Employees	%	Employees	%
Manufacturing	3,563	29.47	839,695	10.02	906,905	16.01	18,295,669	14.10
Retail trade	1,589	13.14	877,260	10.47	684,299	12.08	15,222,240	11.73
Health care and social assistance	1,360	11.25	1,165,252	13.91	739,805	13.06	14,459,058	11.15
Educational services	861	7.12	871,017	10.39	497,027	8.78	11,364,630	8.76
Accommodations and food service	715	5.91	454,809	5.43	324,036	5.72	7,902,849	6.09
Construction	660	5.46	434,453	5.18	339,682	6.00	8,811,981	6.79
Agriculture, forestry, fishing, and hunting	625	5.17	49,815	0.59	56,904	1.00	1,931,064	1.49
Other services (except public administration)	572	4.73	423,519	5.05	274,059	4.84	6,320,480	4.87
Transportation and warehousing	466	3.85	400,231	4.78	248,939	4.40	5,569,629	4.29
Wholesale trade	401	3.32	283,405	3.38	210,137	3.71	4,669,192	3.60
Public administration	250	2.07	433,305	5.17	235,867	4.16	6,212,425	4.79
Administrative and support and waste management services	199	1.65	269,306	3.21	167,338	2.95	4,395,117	3.39
Finance and insurance	184	1.52	558,669	6.67	293,969	5.19	6,483,758	5.00
Professional scientific and technical services	180	1.49	577,055	6.89	307,537	5.43	7,597,636	5.86
Information	140	1.16	340,585	4.06	148,846	2.63	3,996,594	3.08
Arts, entertainment, and recreation	131	1.08	156,249	1.86	73,855	1.30	2,306,263	1.78
Utilities	99	0.82	60,505	0.72	55,529	0.98	1,174,876	0.91
Real estate and rental and leasing	63	0.52	177,671	2.12	78,124	1.38	2,448,199	1.89
Mining	33	0.27	4,600	0.05	16,566	0.29	496,771	0.38
Management of companies and enterprises	0	0.00	2,594	0.03	4,140	0.07	70,434	0.05
<b>TOTAL</b>	<b>12,091</b>		<b>8,379,995</b>		<b>5,663,564</b>		<b>129,728,865</b>	

(Source: Free Demographics, 2005)

Education

Area youth enroll within four school districts. The entire enrollment of each district does not consist exclusively of residents of the watershed. In most cases, school facilities and the majority of students that attend each school are located within neighboring watersheds. Table 1-7 identifies each school district and school that obtains a portion of their enrollment from the watershed area.

No institutions of higher education exist within the project area; however, nine institutions are located within 20 miles of the watershed boundaries. Identified in Table 1-10 are these public and private institutions of higher education and their enrollments.

**Table 1-10. Schools Enrollments (2006)**

School	Grades	Enrollment
<i>Clymer Center School District</i>		
Clymer Elementary School	PK-12	484
<i>Corry Area School District</i>		
Columbus Elementary School	K-6	252
Concord Elementary School	K-6	256
Corry Area Middle School	7-8	445
Corry Area High School	9-12	820
Corry Elementary School	K-6	?
Conelway Elementary School	K-6	254
Sparta Elementary School	K-6	150
Wright Elementary School	K-6	292
<i>Panama Central School District</i>		
Panama K-8 School	K-8	447
Panama High School	9-12	256
<i>Private Schools</i>		
Warren County Christian School	K-12	108
St. Thomas School	K-8	83
<i>Warren County School District</i>		
Youngsville Elementary Middle School	K-7	594
Youngsville Middle School High School	8-12	496
<i>Colleges and Technical Schools</i>		
Allegheny College - Meadville	4-Year	2,095
Crawford County Vocational Technical School	<2 Years	25
DuBois Business College – Oil City	2-Year	44
Mercyhurst College - Erie	4-Year +	4,155
Penn State Erie	4-Year +	3,839
Precision Manufacturing	<2 Years	59
University of Pittsburgh – Titusville	2-Year	535
Venango County Vocational Technical School	<2-Years	28

(Source: National Center for Education Statistics, 2006)

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## CHAPTER 2. LAND RESOURCES

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This chapter provides a comprehensive overview of the land resources within the Brokenstraw Creek watershed, including physical characteristics, a description of present land uses, and a discussion of natural and manmade threats to the resources.

### Geology

Geology is the science that deals with the study of the earth, its history, and its natural processes and products. Geological investigations of an area can yield insight to the land's history, composition, structure, and natural resources. Today's landscapes reflect millions of years of natural events. Forces acting on the land surface have had varying effects, causing a vast array of landscapes.



*Lindstrom bog is a sphagnum bog located in the headwaters of Spring Creek; established in a kettle hole, this once shallow lake evolved into a swamp, and eventually a bog*

Glaciers have had a profound impact on the topography and hydrology of the project area. Prior to the glaciation of the region, streams flowed into Lake Erie. Ice sheets then blocked the drainage and filled former valleys with debris. Meltwater from the ice sheets initiated a southeast flow, forming temporary lakes that overflowed old stream divides, cutting new flow patterns (Sevon, Fleeger, & Shepps, 1999).

Evidence from the pre-Illinoian, late Illinoian, and late Wisconsinan glaciations is located throughout the project area. The first ice age that extended into the region was the pre-Illinoian, occurring 770,000 years ago. Thin, gray clay to silty patches of Mapledale till remain, covering up to 10 percent of the ground. Topography influences the underlying bedrock with thick, well-developed soil, typically having a yellowish-red color. The late Illinoian was the second ice age extending to the area about 132,000–198,000 years ago. Remaining from this period is the Titusville Till. It contains thin, gray clay to sand till covering 10–25 percent of the ground. The underlying bedrock is moderately thick with well-developed soils. The final ice age—late Wisconsinan—extended into the region 17,000–22,000 years ago. Only the third advance, referred to as the late Wisconsinan advance, entered into Pennsylvania. Remnants of this advance were left in the form of Kent Till. Kent Till is thick, gray clay to silty or sandy till covering over 75 percent of the ground. The topography is mainly gentle, undulating hills, but has some knobs and kettles (Sevon, Fleeger, & Shepps, 1999).

Shale, siltstones, and platy sandstones underlie the area. Brokenstraw Creek contains a portion of the Cattaraugus shale, sandstone, and redbeds of the Devonian period. A portion of Warren County is underlain by sandstones and shales from the Pocono formation of the Mississippian period and rocks from the Pottsville group of the Pennsylvanian period (Shepps, White, Droste, & Sitler, 1959).

Geology influences many attributes of watersheds. For example, the presence or absence of a species in a region relies on geology, along climate and soil type. Even the paths that waterways flow have been determined by geology. Physiographic provinces and ecological subregions have related geology and frequently overlap.

### Physiographic Provinces

Geologists have divided the earth into physiographic provinces in order to categorize landscapes and landforms with similar features to distinguish between those that differ. A physiographic province is a



region containing similar terrain shaped by geologic history. The watershed is located within the Appalachian Plateau Geomorphic province; the province is divided into 10 sections, within which the Northwestern Glaciated Plateau and High Plateau are located.

The Appalachian Plateau is an eroded plain of sedimentary rock that slopes gently towards the northwest. Elevation varies from a moderate to very high relief. Underlain with nearly horizontal rock strata, the plateau was covered by a glacier as recently as 10,000–12,000 years ago. Ice and the force of rivers have cut into the bedrock, giving the whole region a rugged, hilly aspect.

The headwaters of the watershed are located within the Northwestern Glaciated Plateau. It is characterized by broad, rounded uplands and deep, steep-sided, linear valleys partially filled with glacial deposits. Relief throughout the section is very low to moderate, and elevation ranges from 900–2,200 feet (Sevon, 2000).

The southern portion of the watershed is located within the High Plateau section. Characterized by broad, rounded to flat uplands with deep, angular valleys, this section has moderate to high relief. Elevation throughout the section ranges from 980–2,360 feet (Sevon, 2000).

### **Ecoregions**

Ecoregions describe the biophysical characteristics of a region. An ecoregion is the name given to an area having a distinctive composition and pattern of plant and animal species (Washington State Department of Natural Resources, 2003). Other features, such as climate, landform, soil, and hydrology, are important in the development ecosystems, and help define ecoregions. Although both province and ecoregion delineations consider the geology of an area, ecoregions also take into account the distribution of species and ecosystems across the landscape.

Environmental Protection Agency (EPA)-designated ecoregions, derived from the framework developed by James Omernik, denote areas within ecosystems that are generally similar. This approach is based upon the premise that ecological regions can be identified through the analysis of patterns and compositions. It also accounts for how the patterns and compositions affect the quality and integrity of the ecosystem. The importance of each characteristic varies from one region to another, regardless of hierarchical level. Developing regional biological criteria, water quality standards, and setting management goals for non-point source pollution are immediate needs that should be addressed. Two EPA ecoregions were identified within the project area—Erie Drift Plains and North Central Appalachians. The majority of the project area is located within Erie Drift Plains ecoregion (Wiken 1986; Omernik 1987, 1995, 2002; Woods, Omernik, & Brown, 1999).



*Tamarack swamp in Pennsylvania State Game Lands 197 is characteristic of the Erie Drift Plains with remnants of glacial deposits*

### **Erie Drift Plains**

Located in northwestern Pennsylvania and southwestern New York, the Erie Drift Plains ecoregion is characterized by low, rounded hills; scattered end moraines; kettles; and wetlands. The once-forested area was converted for agricultural uses, primarily dairy farming. A high percentage of threatened and endangered species reside in the abundant wetland areas in the western reach of this ecoregion (Woods, Omernik, & Brown, 1999).

The Erie Drift Plains ecoregion is further divided into two subregions, one of which is the Low Lime Drift Plain. Ground moraines, rolling terrain, broad over-fit valleys, and numerous dairy farms characterize this subregion. This region is poorly

suited for croplands, partially due to the short growing season, poorly drained soils, and acidic terrain. For the most part, ridges and lowlands are wooded or idle, and hilltop elevations range from about 1,100–2,000 feet, with a local relief around 250–400 feet (Woods, Omerinik, & Brown, 1999).

### North Central Appalachians

The North Central Appalachians ecoregion is mostly forested with high hills and low mountains, and was largely unaffected by continental glaciations. Located in northcentral Pennsylvania, this ecoregion is part of an elevated plateau composed of horizontally bedded sandstone, shale, siltstone, conglomerate, and coal (Woods, Omerinik, & Brown, 1999).

The North Central Appalachians ecoregion is divided into five subregions, among which is the Unglaciated Allegheny High Plateau. This subregion is a deeply dissected highland composed of plateau remnants, rounded hills, low mountains, and narrow valleys. It possesses extensive forests, a short growing season, nutrient-poor residual soils, high local relief, nearly horizontal strata, resistant rock, and oil wells. Local relief is typically between 550–700 feet, but can reach 1,300 feet in certain valleys (Woods, Omerinik, & Brown, 1999).

## Soil Characteristics

### Soil Associations

Soil associations are comprised of two or three major and a few minor soil types. There are 11 associations within the region. (Cerutti, 1985; Taylor, 1960; Yaworski, Rector, Eckenrode, Jensen, & Grubb, 1979)

***Allis-Ellery and Alden Soil Association*** is characterized by shallow, medium-textured soils of the glaciated upland and lake plains. In favorable climates, soils are used for vineyards; grape yields are low, but of good quality.

***Alvira-Lordstown-Shelmadine Soil Association*** is characterized by deep and moderately deep, poorly drained, somewhat poorly drained, and well drained soils. These mainly gently sloping to moderately steep soils formed in late the Wisconsinan glacial till. The seasonally high water table, slow permeability, and moderate depth to bedrock are major limitations of this association.

***Cavode-Ernest-Gilpin Soil Association*** is characterized by deep and moderately deep, somewhat poorly drained to well drained, mainly sloping, and moderately steep soils that formed in materials weathered dominantly from acid shale and sandstone. Major limitations of this association include slow permeability, seasonal high water table, slope and moderate depth to bedrock.

***Erie-Ellery and Alden-Langford Soil Association*** is characterized by deep, medium-textured soils in moderately limy till of the glaciated upland. Slopes are long and uniform, and extend from the top of the ridges to the outwash terrace. Soils in this association have an altered subsurface soil layer that restricts water flow and penetration. Most soils are used for dairy farming and livestock production.

***Gilpin-Cavode-Ernest Soil Association*** is characterized by moderately deep and deep, well drained through somewhat poorly drained, mainly sloping to very steep soils that formed in materials weathered from acid shale and sandstone. Soils have fair suitability for cultivated

crops, and are better suited for trees. Slope, hazard of erosion, moderate depth to bedrock, slow permeability, and seasonally high water table are major limitations.

***Hanover-Alvira-Shelmadine Soil Association*** is characterized by deep, well drained through poorly drained, mainly gently sloping and sloping soils that formed in late the Wisconsinan glacial till. Soils are moderately suited for general farm crops and are well suited for trees. The seasonally high water table and slow permeability are major limitations.

***Hazelton-Cookport-Cavode Soil Association*** is characterized by deep, well drained through somewhat poorly drained, mainly sloping and moderately steep soils that form in materials weathered dominantly from acid sandstone and shale. Major limitations include large stones on the surface, seasonally high water table, slow permeability, and steep slopes.

***Howard-Phelps-Fredon-Hasley Soil Association*** is characterized by gravelly soils on the outwash terraces deposited in larger valleys prior to the glaciation of the area. Drainage of the soils varies based on the water table. The soils are primarily used for croplands, with potatoes being the principal crop.

***Valois-Cambridge Soil Association*** is characterized by deep, well drained and moderately well drained, nearly level to very steep soils that formed in materials weathered from glacial till on uplands. Limitations of the association include restricted permeability, hummocky topography, and high water table.

***Venango-Mardin-Lordstown Soil Association*** is characterized by deep and moderately deep, somewhat poorly drained through well drained, mainly gently sloping soils that formed in the late Wisconsinan glacial till. Soils are moderately to well suited for general farm crops and well suited for trees. Major limitations include a seasonally high water table, slow permeability, and moderate depth to bedrock.

***Wayland-Chenango-Braceville Soil Association*** is characterized by deep, very poorly drained through well drained, nearly level and gently sloping soils that formed in water-deposited materials derived from acidic sandstone and shale. Most cash crops produced in Warren County are grown on the soils of this association. Slow permeability and a high water table are major limitations in the association.

### **Prime Agricultural Soils**

Soils that are important in meeting the short- and long-term needs for food production are **prime agricultural soils**. These soils meet certain physical, chemical, and slope characteristics that produce the highest yields with minimal input of energy and economic resources. The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) in each county is responsible for designating the prime agricultural soils based upon predetermined criteria. Typically, the criteria includes level to nearly level slopes, a well drained structure, deep horizons, an acceptable level of alkaline or acid components, and the capacity for producing food and crops. Figure 2-2 depicts areas that have prime agricultural soils. There are 122 prime agricultural soils in the project area; a listing of these soils is located in Appendix C.

### **Farmland of Statewide Importance**

**Farmland of statewide importance** consists of soil that did not meet the criteria to be designated as prime agricultural soil, but are important agricultural soils nonetheless. These soils, when managed properly, can produce high yields of crops, and may even produce yields as high as farmland containing prime agricultural soils (Farmland Protection Policy Act Annual Report FY 2000, 2001). Farmland of

statewide importance, designated by the State Rural Development Committee, may include soils selected for agriculture by state law. The 150 soils designated as farmland of statewide importance are listed in Appendix C.

## Agricultural Land Preservation

Agricultural lands are key properties sought for commercial and residential development. These large areas of open space require less preparation prior to development; and are therefore less expensive to develop. According to the USDA's Natural Resource Inventory conducted between 1992 and 1997, more than 11 million rural acres in the U.S. were converted to developed use, and over half of that acreage was agricultural land. That conversion translates into a loss of over one million acres of agricultural lands in the U.S. each year; more than 3,250 acres every day (USDA, 2000).

Agricultural preservation benefits the economy, community, environment, and food supply. The agricultural industry contributes \$1 trillion to the national economy through product exports and employment. Local agriculture provides 63 percent of the dairy foods and 86 percent of the fruits and vegetables that Americans consume. Open lands protect the environment through flood control, maintaining air quality, recharging groundwater, providing food and habitat for wildlife, and protecting wetlands and watersheds (American Farmland Trust, 2007).



*Agricultural preservation protects farmland from development and maintains its use for agriculture*

### Pennsylvania

Pennsylvania's farmland reached its pinnacle for quantity and acreage in 1900 when two-thirds of the state's land use was devoted to farming. Since that time, farmland and the number of farms in the state has been steadily declining. As the percentage of farmland declines, the average farm size has increased, which is in line with national trends of fewer, larger farms and an overall reduction in farmland. According to the Brookings Institute, between 1982 and 1997, approximately 1.14 million acres in Pennsylvania were converted from fields, natural lands, and open spaces to other land uses [Pennsylvania Department of Agriculture (PDA), 2007, 2008b].

Pennsylvania has been aggressively pursuing farmland preservation since 1988, when the **Farmland Protection Program** was formed by state legislature. The program has preserved over 389,000 acres on 3,521 farms in Pennsylvania since its inception, as of April 2008. With these impressive numbers, Pennsylvania leads the nation in both acreage and number of farmlands preserved. Erie County is the only county with a farmland preservation program in the project area. To qualify for the Farmland Protection Program, farms must be designated in agricultural security areas.

The **Agricultural Security Area (ASA)** program, created by the Pennsylvania legislature, is administered at the township level. ASAs are rural, agricultural areas targeted for protection from urban development. They receive special consideration regarding local ordinances affecting normal farming practices, state agency rules and regulations, and in eminent domain condemnation proceedings. To be eligible for an ASA designation, at least 250 acres must be nominated. The 250 acres do not have to be contiguous, but individual parcels must be no less than 10 acres. Lands eligible for the program include pasture, hayland, woodland, and cropland (PDA, 2008).

In addition to the ASA program, Pennsylvania administers the **Clean and Green Program**, which provides incentives to landowners for preservation of agricultural land, forestland, and open space. The

program provides real estate tax benefits by taxing land based on its “use value,” rather than its market value. The program is voluntary, and is administered by individual county assessment offices. The program is available to landowners who own and maintain 10 or more acres in active agriculture, agricultural reserve, or forest reserve uses; or landowners who earn an annual gross income of more than \$2,000 from agriculture (PDA, 2008).

### **New York**

In 1971, the New York legislature passed the **Agricultural Districts** law to encourage farmers to partner together and commit their land to agricultural uses in return for property tax relief and protection from outside intrusions. The law was amended many times, and in 1992, it was improved with the passage of the **Agricultural Protection Act**. The act strengthened farmers’ right to farm, placed greater scrutiny on state projects that might negatively affect agriculture, and set in motion the development of county agricultural and farmland protection strategies (American Farmland Trust, 1993).

New York’s Agricultural Districts are similar to ASAs in Pennsylvania. Several factors are considered before Agricultural District enrollment is granted—the viability of active agriculture, presence of viable farms not currently in active agriculture, nature and extent of other land uses, and county development patterns and needs. Landowners make their request to the county agricultural and farmland preservation board and county planning board, where a public meeting is held. The county legislature must approve the request, and the Commissioner of Agriculture and Markets must certify it before a district is established (American Farmland Trust, 1993).

Once a district is established, it is re-evaluated every 8, 12, or 20 years based on its initial determination. During the evaluation, it is determined to what extent the number of farms and farm acreage have furthered the purpose for which the district was originally created, and if the district is achieving its original objective. The degree to which the district is consistent with community economic land-use conditions is also reviewed, along with its effect on local government policies concerning community development, environmental protection, and preservation of the agricultural community (American Farmland Trust, 1993).

New York also offers a program to assist counties and municipalities in preparing **farmland protection plans**. A farmland protection plan identifies areas needing protection and suggests strategies to protect agricultural lands. Through the completion of a protection plan, areas in active agriculture and areas viable for agriculture but currently not in active use are evaluated. Agricultural areas and potential agricultural areas are compared with the developmental needs of the county.

Another program through the New York Agriculture and Markets Land Preservation Program is the **Purchase Development Rights Program**. This program provides funding to cover up to 75 percent of the cost to implement activities to protect viable farmland.



*Forestlands account for 61 percent of land use within the Brokenstraw Creek watershed*

## **Land Use**

The land use of a specific area can reveal a significant amount about that region. Evaluating land use can provide clues about the major economic catalysts in a region, and offer a glimpse into its past. Looking at a region’s land use can even identify trends not seen from everyday observation, such as

insights into possible sources of environmental degradation. It is important to continue monitoring land-use changes in a region in order to inform decision makers regarding planning and natural resources protection.

The land use is diversified throughout the project area, with a large amount of open space. Forest, agriculture, and open lands combine to comprise 90 percent of the land cover. Approximately two percent of the project area is developed. Water—in the form of streams, lakes, ponds, and wetlands—accounts for about three percent of the region.

### **Forestry**

Forests provide a variety of resources and environmental services, including timber, wildlife habitat, water filtration, aesthetics, recreation, and employment. Over 90 percent of the nation's threatened and endangered species have some or part of their habitat on private forestlands (Koehn, 2005).

In 1630, an estimated 95 percent of Pennsylvania was forested. Harvesting timber to support a growing nation reduced the forest coverage of Pennsylvania to 30 percent by 1907. Over the past century, the number has rebounded; today, Pennsylvania Department of Conservation and Natural Resources (PA DCNR) estimates that 58 percent of Pennsylvania's land area is forested (2004).

Nationally, Pennsylvania ranks first in hardwood production. Seventeen million of Pennsylvania's 28 million acres are covered by forest. Private landowners own the majority of forest in Pennsylvania—71 percent or 12.5 million acres. State forests and state game lands make up 22 percent of Pennsylvania's forest area; and three percent is national forestland. Within Crawford, Erie, and Warren counties in Pennsylvania, 82 percent of forestland is privately owned (Bureau of Forestry; Jacobson & Filipczak, 2008).

New York has 18.6 million acres of forestland, accounting for 62 percent of its land cover. Much of this land is privately owned and managed for wood or pulp. The majority of land owned by the state is forested. According to a study at Cornell University, the forestry industry contributes \$4.6 billion to the New York economy each year (New York Department of Environmental Conservation (NY DEC)<sup>7</sup>).

There are four New York State Forests—Panama, Hill Higher, North Harmony, and Brokenstraw—within the project area that account for more than 6,000 acres of public forestlands. In addition, there are more than 15,000 acres of public forestlands within Pennsylvania State Game Lands and New York Wildlife Management Areas in the region (NY DEC<sup>8</sup>).

**Table 2-1. Land Use**

<b>Land Use Type</b>	<b>Square Miles</b>	<b>Percent of Land Area</b>
<b>Forest</b>	<b>199.61</b>	<b>61.01%</b>
Deciduous Forest	149.40	45.66%
Evergreen Forest	22.54	6.89%
Mixed Forest	27.67	8.46%
<b>Agriculture</b>	<b>78.43</b>	<b>23.97%</b>
Pasture/Hay	54.15	16.55%
Cultivated Crops	24.28	7.42%
<b>Wetlands</b>	<b>18.55</b>	<b>5.67%</b>
Woody Wetlands	17.09	5.22%
Herbaceous Wetlands	1.46	0.45%
<b>Open Land</b>	<b>16.09</b>	<b>4.92%</b>
Shrub/Scrub	13.26	4.05%
Grassland/Herbaceous	2.83	8.65%
<b>Development</b>	<b>13.92</b>	<b>4.25%</b>
Developed Open Space	11.70	3.58%
Developed, Low Intensity	1.60	0.49%
Developed, Medium Intensity	0.50	0.15%
Developed, High Intensity	0.12	0.04%
<b>Water</b>	<b>0.43</b>	<b>0.13%</b>
<b>Barren Lands</b>	<b>0.16</b>	<b>0.05%</b>



Forestry is a key component to the history and future of many communities. Before settlement in the region, the landscape was forested and provided habitat for numerous species of wildlife. Due to the poor agricultural soils, the region remains an immense forestland, accounting for 61 percent of the landscape. The majority of forest—75 percent—is deciduous, while 14 percent is mixed, and 11 percent is coniferous.

The lumber industry in the region started in the 1800s, and is a major component of the local economy. Many livelihoods are based on the forest industry. Within Crawford, Erie, and Warren counties, standing timber is worth approximately \$1.8 billion. Value-added industries, such as wood and paper products, add \$158 million to the Pennsylvania economy annually.

**Agriculture**

Agriculture played a historically significant role in the development of the region, and continues to play an important role in the watershed’s economy, both in Pennsylvania and New York. Although agriculture is the top land use in the region, a drastic decrease in agricultural activity has been seen. Corporate farming companies and residential and commercial development companies are buying many of the small family farms that remain in the area. It is more profitable for landowners to sell their properties, as opposed to farming them. In 1959, there were 100,051 farms covering 11.6 million acres in Pennsylvania. As of 2001, there were 59,000 farms covering 7.7 million acres remaining. As technology advances in the agricultural industry, productivity increases, decreasing the amount of land needed (Shields).



*Slow permeability, seasonally high water tables, steep slopes, and soil depth to bedrock limit some agricultural uses; pasture farming is common in the region*

Several programs are available to assist farmland owners in maintaining their farms and keeping them in agricultural production. USDA Farm Service Agency (FSA) administers the 2008 Farm Bill programs identified in Table 2-2 (USDA, 2008). For more information about these programs contact FSA or visit their website <http://www.fsa.usda.gov>.

In 1959, there were 751,138 acres in agricultural use within Crawford, Erie, and Warren counties. In 2001, that area decreased to 472,000 acres. There are 78.43 acres of agricultural land within the Brokenstraw Creek watershed, 69 percent of which is pasture or hayland. Dairy is the top agricultural commodity produced in each county of the watershed, including Chautauqua County in New York.

**Table 2-2. Conservation Practices Identified in 2008 Farm Bill**

<b>Program</b>	<b>Program Description</b>
Conservation Reserve Program (CRP)	Provides annual rental payments for planting permanent vegetation on idle, highly erodible farmland
Conservation Reserve Enhancement Program (CREP)	Provides incentive payments for installing specific conservation practices that help protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water
Emergency Conservation Program (ECP)	Provides emergency funding and technology assistance to rehabilitate farmland damaged by natural disasters and carry out emergency water conservation measures in periods of severe drought

**Table 2-2. Conservation Practices Identified in 2008 Farm Bill (continued)**

<b>Program</b>	<b>Program Description</b>
Farmable Wetlands Program (FWP)	Reduces downstream flood damage, improves surface and groundwater quality, and recharges groundwater supplies by restoring wetlands
Grassland Reserve Program (GRP)	Helps landowners restore and protect grassland, rangeland, pasture land, and shrub land; and provides assistance for rehabilitating grasslands
Source Water Protection Program	Designed to help prevent source water pollution through voluntary practices installed by producers at local levels
Emergency Forest Restoration Program	Assists non-industrial private forestland owners who implement emergency measures to restore land after it is damaged by a natural disaster
Biomass Crop Assistance Program	Supports the establishment and production of crops for conservation to bio-energy in selected areas; and assists with collection, harvest, storage, and transportation of eligible material for use in a biomass conversion facility
Public Access Program	Grants available to state and tribal governments to encourage owners and operators of privately held farm, ranch, and forestlands to voluntarily make their land available to public access for wildlife dependent recreation, including hunting and fishing

(Source: U.S. Department of Agriculture Farm Service Agency, 2008)

### **Nutrient Management Program**

The Nutrient Management Program was enacted in 2005 through Act 38, which coordinates existing laws and regulations, such as Right to Farm and the Nutrient Management Act, along with new initiatives. The requirements of this act only apply to high-density animal operations, which are defined as operations with at least 2,000 pounds of animal weight per acre.

Act 38 was established to ensure that local government ordinances regulating normal agricultural operations were consistent with the authority given to them to protect citizens' health, safety, and welfare. Act 6, the previous Nutrient Management Act, was replaced with Act 38, which retained most of the current laws and regulations, adding manure setback and riparian buffer requirements. Manure cannot be applied to fields within 100 feet of a waterbody, unless a vegetative riparian buffer of at least 35 feet wide, meeting U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS) standards, is used to prevent runoff. The new act provides timely review of potentially unauthorized local ordinances and requires certain farms to develop odor management plans.

Odor management plans are site-specific plans that identify economically viable practices, technologies, standards, and strategies to manage impacts of odors generated from animal housing or manure storage. Concentrated Animal Operations (CAOs) and Concentrated Animal Feeding Operations (CAFOs) that build or expand animal housing facilities or manure storage facilities are required to have an odor management plan. New agricultural operations that will be regulated as a CAO or CAFO, and existing animal operations that increase in size, becoming a CAO or CAFO, also need odor management plans. The plans must be written by certified odor management specialist (Pennsylvania State University, 2005).

## **Development**

Development occurs and is needed, to some extent, to enhance the quality of life within watershed communities. Effectively managing development activities identified in county and municipal planning documents is vital. As discussed in the Project Area Characteristics chapter, land use plans and regulations protect communities from unwanted development and land uses.

The Warren County Comprehensive Plan identified two growth areas within the watershed: Columbus and Youngsville-Brokenstraw-Pittsfield Region growth areas. A modest growth of residential, commercial, and industrial uses is anticipated in the Columbus and Scotts Crossing communities. The majority of development is expected to follow major transportation routes, such as Route 957. However, growth areas expand beyond the targeted areas, because development does not always follow a linear pattern. Growth areas are designated to provide guidance for land-use determinations and future water and sewage services. The Youngsville-Brokenstraw-Pittsfield Growth Area is expected to be primarily highway oriented. New developments anticipated in this growth area include residential, mixed use, commercial, industrial, and some public/semi-public uses (Warren County Planning and Zoning Commission, 2005).



*A residential development near Corry, PA*

Existing development is notably located around the population centers of Corry, Columbus, Clymer, Panama, and Youngsville. However, the majority of existing development—84 percent—is rural residential development, also termed open space development. Low intensity development accounts for 11.5 percent of the land use, and is located around small towns, villages, and population centers. The medium and high intensity developments account for less than one percent of the land use, and are located on the outskirts of Corry, Clymer, and Youngsville in the growth areas designated by the Erie and Warren County Comprehensive Plans.

## **Mining**

Mining is not a major land use within the watershed. In fact, mineral extraction and barren areas account for less than one-half percent of the land use within the project area. Sand and gravel are the primary minerals extracted through mining; coal has not been found, nor is it believed to be within the area.

## **Oil and Gas Exploration**

For over a century, oil and gas exploration has been a common fixture. Pennsylvania's history of oil and gas exploration dates back to 1859, when the world's first intentional and successful oil well was drilled in Venango County near Titusville. Until oil fields were discovered in Texas during the 1900s, western Pennsylvania generated over half of the world's petroleum supply. Pennsylvania's annual contribution to the national petroleum supply since 2000 has been less than one percent, but is still notable due to the distinguishing lubrication properties of Pennsylvania crude oil (Shultz, 1999).

As the demand for oil and natural gas grows around the world, exploration for these resources expands. Due to increased demand and increased prices, oil and gas exploration in New York and Pennsylvania has been expanding since the 1970s, and even more so in recent years. In 2007, the Pennsylvania Department of Environmental Protection (PA DEP) issued 7,241 oil and gas well permits, which represents a 19 percent increase from 2006 (PA DEP, 2008b).

Erosion and sedimentation, forest fragmentation, and water pollution from abandoned wells are impacts associated with oil and gas drilling. The construction of wells and access roads can cause increased erosion and sedimentation. Forest fragmentation occurs as additional wells are developed, dissecting important forests that serve as critical habitats. Forest fragmentation affects wildlife through both habitat loss and increased susceptibility to predators. Polluted waters escaping from abandoned wells also pose a threat to natural resources.

**Table 2-3. Oil and Gas Wells Drilled in Watershed Municipalities**

County	2008	2007	2006	2005	2000
Chautauqua County, NY	23	21	36	15	8
Crawford County, PA	0	0	0	0	2
Erie County, PA	0	0	0	4	1
Warren County, PA	13	27	39	30	37

Note: Only sites located within the municipalities of the Brokenstraw Creek watershed are included. Other wells may have been drilled in other portions of these counties.

(Source: PA DEP, 2008a, NY DEC, 2008c)

## Land Ownership

Private landowners independently own the majority of land in the region. The Buckaloons Recreation Area, a small portion of the Allegheny National Forest, is located at the confluence of Brokenstraw Creek and the Allegheny River. Other public land holdings include 12,900 acres of Pennsylvania State Game Lands, and more than 74,000 acres of New York State Forest and Wildlife Management Units. Among the 1,726,949 acres of Crawford, Erie, and Warren counties, 82.4 percent of the land is privately owned.

Within Pennsylvania, surface land can be owned by one person or entity, while the sub-surface rights or mineral rights can be owned by different entities based on the mineral. For example, natural gas and oil for a property can each have a different sub-surface owner. A property purchased in “fee simple” means the surface and subsurface rights of a property are owned by a single proprietor (PA DEP, 2007).

Surface landowners who do not own the subsurface rights to their property cannot prevent subsurface owner’s reasonable access for development and production, but are afforded rights for the protection of resources, such as water quality. If presented with this situation, surface landowners should contact an attorney knowledgeable in oil and gas or mining laws.

In the case of oil or gas wells, landowners should work with well operators to ease tensions and develop a strategy that will compliment both parties’ interests. The selection of sites for the well, access roads, gathering pipelines, etc. should be up for discussion to minimize damage to the surface property and provide reasonable access for development and production. Landowners should request that the well operator hire a certified lab to analyze sources of water used for consumption or irrigation prior to drilling to document conditions incase of adverse impacts on the quality of water from the extraction activities (PA DEP, 2007).

## Critical Areas

Critical areas have constraints that limit development and various other activities. Critical natural areas contain rare, threatened, or endangered species; natural communities of concern; or significant ecological and geological landscapes worthy of protection. Steep slopes, ridgetops, floodplains, streambanks, and wetlands are all examples of critical natural areas. Figure 2-6 displays these environmentally sensitive areas.

### **Landslides**

A landslide is the movement of earth, rocks, or debris down a slope under the direct influence of gravity. Most landslides occur in areas with steep slopes, where loose colluvial soils exist. They can occur gradually, moving millimeters per year, or rapidly as a mass. The speed at which the landslide moves depends upon the angle of the slope, material type, and water content (USGS, 2005).

Typically, landslides occur as secondary or reactionary events to natural disasters, such as severe storms, hurricanes, earthquakes, and floods, and sometimes cause more damage than the initial disaster. Human activities and influences through sprawl are major factors for increased damage caused by landslides. Factors such as stream erosion, earth-moving activities, soil characteristics, weakened or fractured rock, mining debris, and weather, can determine the occurrence of a landslide (Delano & Wilshusen, 2001; USGS, 2005).

Landslides cause damage to transportation routes, utilities, and buildings. They can create travel delays and other side effects. The threat of landslides should always be assessed while planning any development project. Proactively avoiding a landslide is much cheaper than the clean-up and repair that is required after a landslide. If development within landslide-prone areas is ultimately chosen, additional precautionary measures during development, such as additional drainage features and proper site planning, are essential to minimize the risk of a landslide (Delano & Wilshusen, 2001).

**Landslide Hazards Program (LHP)** was established as a part of the United States Geological Survey (USGS) in the mid 1970s. Its role is to reduce long-term losses from landslide hazards by improving the understanding of the causes of ground failure and to suggest strategies to mitigate these causes. Through information gathering, research, and responding to emergencies and disasters, LHP is able to produce scientific reports to a variety of audiences. Within Landslide Hazards: A National Threat, the Brokenstraw Creek watershed is identified as being located within a region of the U.S. that has a low potential for the occurrence of landslides (USGS, 2005).

### **Subsidence Areas**

Subsidence is the downward movement of surface material involving little or no horizontal movement. Occurring naturally due to physical and chemical weathering of certain types of bedrock, subsidence usually takes place locally as a result of excessive pumping of groundwater, or subsurface erosion due to the failure of existing utility lines. Subsidence usually occurs slowly over a long periods, but also can happen rapidly. For example, sinkholes develop when the support of the land is gradually removed, causing the land surface to sag and finally collapse, leaving a hole or cavity. Although subsidence is not common in the watershed, the potential exists (Kochanov, 1999).

### **Erosion and Sedimentation**

Erosion is the transfer of soil particles through air or water. The relocation of these particles is termed sedimentation. Erosion and sedimentation are natural earthmoving processes, but poor land-use practices significantly increase the extent of this movement. Erosion and sedimentation are very serious issues, with the potential to cause substantial degradation to an area's waterbodies.

Erosion is common along streambanks, steep slopes, and ridgetops. Streambank erosion occurs when the banks of a creek or river erode and deposit sediment into a waterway. Typically, erosion is caused by improper land uses and a lack of vegetation



*Along Bear Creek, erosion is noticeable*

along the streambank. Vegetation anchors soil in place, preventing it from washing away during high stream levels or heavy rains. However, if the vegetation is removed or inadequate, soil is easily washed into the waterbody. A lack of vegetation also leaves soils vulnerable to high winds, which can induce erosion.

An increase in sediment in a waterbody itself is a cause for concern, as it alters native aquatic habitats. Excessive sedimentation clouds the water, which reduces the amount of sunlight reaching aquatic plants. It covers fish spawning areas and food supplies, and may clog their gills. Other pollutants attached to soil particles are deposited in waterbodies with the sediment. Downstream, sediment settles out of the water and is deposited in a new location, which can significantly alter the channel and flow of a stream.

Erosion occurring throughout the terrestrial portion of a watershed can also have a negative impact on the region's waterbodies. Soil eroded off construction sites, timber operations, or agricultural operations eventually reaches nearby streams, further exacerbating sedimentation problems.

In an effort to combat this problem, PA DEP and Pennsylvania Code regulated the disturbances of earth materials leading to erosion and sedimentation. Disturbances include any earth moving activities, such as timber harvesting, construction activities, agricultural plowing and tilling, etc. Disturbances of less than 5,000 square feet are required to minimize the potential for accelerated erosion and sedimentation through the implementation and maintenance of best management practices (BMPs). Disturbances over 5,000 square feet must have a soil and erosion control plan on site. It is critical that these plans are implemented and monitored to ensure their effectiveness (Pennsylvania Code, 2008).

### **Groundwater Recharge Areas**

Parking lots, sidewalks, roofs, and streets are examples of impervious surfaces that block the ability of water to penetrate the ground and recharge the ground water supply. Recharge areas occur where precipitation is capable of infiltrating the ground to the saturated zone— an area where all pore spaces and fractures are filled with waters. When a watershed is covered by 10-25 percent impervious cover it is deemed impacted. Watersheds where 25 percent or more of the area is covered by impervious surfaces are considered damaged (Center for Watershed Protection, 1999).

Impervious surfaces increase the volume of stormwater by 16 percent when compared to natural forest habitats, while impacting dry and wet weather stream flows, the shape and size of a stream channel, water quality, and habitats for plants and animals. The increased volume of stormwater leads to frequent flooding and increased severity of flood events. Due to the higher volume of stormwater, the velocity of the flow increases and leads to eroded streambanks, which deepens, widens, and straightens the streams channel. Sediment washed into the stream is carried downstream to where it is deposited, smothering habitat, decreasing the depth of the stream, and ultimately changing the path of the waterway (Center for Watershed Protection, 1999).

As the amounts of impervious surfaces in a watershed are increased, the number and diversity of aquatic life are decreased. Limiting the amount of impervious surfaces and installing best management practices, such as porous pavement, rain barrels, and swales, can increase groundwater recharge. It is important to protect the open spaces and limit the amount of impervious surfaces to allow groundwater the opportunity to recharge. During dry conditions and droughts, the amount of water in streams, lakes, and ponds is supplied by groundwater; if precipitation cannot recharge the groundwater supplies due to impervious surfaces, the impacts of dry conditions will be enhanced (Center for Watershed Protection, 1999).



### **Fish and Wildlife Habitat**

Habitats are the natural environments upon which animals and plants depend. Healthy habitats are important to maintaining a diversity of biological resources. Interferences and changes to habitats affect the plants and animals that depend on them. Habitats where rare, threatened, and endangered species reside are critical in nature. Important habitats in the watershed include forested and riparian areas, floodplains, and wetlands.

#### **Riparian Corridors**

Riparian corridors are lands located next to a body of water. When densely vegetated, they serve as a buffer against polluted runoff and provide habitat corridors for many species of wildlife. The Water Resources and Biological Resources chapters of this plan provide specific information about riparian corridors and their benefits.

#### **Floodplains**

Floodplains are land areas that lie adjacent to waterbodies, such as Brokenstraw Creek and its tributaries, that absorb the occasional overflow of water beyond the banks of the stream. Floodplains are delineated by the frequency of flooding events that cover them with water. Floodplains often contain rich sediments, as occasional flooding deposits nutrient rich soils from floodwaters. Floodplains are also inhabited by unique plants and wildlife accustomed to the periodic inundation. Many species found within floodplains are seldom seen in other areas.

#### **Wetlands**

Wetlands are areas that are inundated or saturated by surface or groundwater during a portion of the year, and contain plant species that thrive in or tolerate wet conditions. Wetlands are delineated according to hydrology, soil type, and vegetation. Whether constructed or naturally occurring, wetland areas can have a variety of appearances. They might appear as areas of standing water, inundated soils or apparently dry fields. Wetlands are a vital component to a healthy watershed, as they provide many unique and critical functions. Wetlands are further discussed in the Water Resources chapter.

### **Natural Resources Extraction**

Methods used to extract natural resources such as natural gas, oil, and coal, have the potential to be critical or hazardous to the surrounding environment. Erosion and sedimentation, water contamination, waste products produced in the extraction of minerals, and impacts to surface landowners are the concerns surrounding resource extraction. Groundwater and surface water resources need to be protected from contamination during the extraction of natural resources. The installation of best management practices decreases some of the risks of contamination. More information about the extraction of natural resources can be found in the Land Use section of this chapter.

### **Wind Energy**

In the search for alternative energy, a variety of methods are being explored. One of the front-runners in Pennsylvania is wind energy. Wind energy is a sustainable, economical, and fast growing alternative energy source. It reduces some of the negative effects of fossil fuel electricity generation.



*The presence of houses and other structures within the floodplain increases flooding and flood damage*

Although not identified within the top 35 sites for wind energy potential, Pennsylvania has moderate potential. PA DEP estimates there is potential to generate 45 billion kilowatt-hours annually. In order to establish a wind farm, six components are needed (PA DEP, 2002):

- **Open land**—each turbine requires a 15-foot diameter area with no vegetation; typically, one turbine is situated per every eight acres of land
- **Wind turbines**—supported by towers reaching over 200 feet, turbines generate electricity at wind speeds between 7–35 mph
- **Transmission lines**—proximity to transmission lines is an important factor in generating electricity in order to sell it to a utility
- **Substation**—voltages must be changed to match the voltage of transmission lines
- **Weather station**—wind data must be collected in order to adjust turbines for maximum efficiency
- **Access roads**—necessary construction and maintenance at the site require facilitated access

Desirable areas for wind energy coincide with areas of ecological significance. Forest ridges and other landscapes where high wind speeds are generated often are the most biologically rich forests and streams in the Commonwealth. For this reason, site selection for establishing winds farms can be very controversial.

Issues with wind farms vary among nuisance, safety, and ecological concerns. Nuisance issues include spoiling of views, noise, excessive lighting, and interference with communication signals, such as television. Impacts to wildlife include bird and bat mortality, habitat loss and fragmentation, and interfering with migration patterns (American Wild Energy Association). Additional information about wind farms and wind energy can be obtained from various websites identified in Appendix P. Useful Websites.

## **Hazardous Areas**

Hazardous areas have or could have potentially hazardous materials or conditions. Hazardous areas include Superfund sites, hazardous waste haulers and storage facilities, illegal dumpsites, auto salvage yards, landfills, brownfields sites, and abandoned mines.

### **Comprehensive Environmental Response Compensation and Liability Act**

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA), enacted in 1980 and commonly known as Superfund, provides broad federal authority to respond directly to releases of hazardous substances that may endanger public health or the environment [U.S. Environmental Protection Agency (U.S. EPA), 2004]. By creating a tax on the chemical and petroleum industries, a trust fund was established to provide for cleanup when no responsible party can be identified. In 1986, the Superfund Amendment and Reauthorization Act (SARA) amended CERCLA.

Short- and long-term action responses were identified in the law. Short-term actions require prompt response for releases or threatened releases. Long-term responses permanently and significantly reduce the dangers associated with releases or threats of releases of hazardous substances that are serious, but not immediately life threatening. These actions are conducted only at sites listed on U.S. EPA's National Priorities List (NPL), none of which are located within the project area.

### **Resource Conservation and Recovery Act**

The Resource Conservation and Recovery Act (RCRA)—a federal statute—regulates the transportation, handling, storage, and disposal of solid and hazardous materials. Federal facilities may control regulatory responsibilities, including obtaining permits, identifying and listing hazardous waste,

adhering to procedures when transporting or disposing of waste, developing risk management plans, and managing records (U.S. EPA, 2002). Requirements for underground storage tanks, including cover tank design, operation, cleanup and closures, are also contained in RCRA. There are 40 active RCRA sites in the area; listed in Appendix. D.

### **Illegal Dumping**

Illegal dumping, or the unauthorized disposal of household and hazardous wastes, occurs mostly along rural roadways that are not frequently traveled. Remote areas, streambeds, hillsides, back roads, and old coal mines are often littered with tires, old appliances, vehicle parts, electronics, and other hard-to-dispose-of items. Illegal dumps grow with continued use over time, and can cause a variety of health hazards and environmental impacts. Currently, it is the responsibility of each municipality to identify and clean-up illegal dumpsites.



*Illegal dumpsite along Hyde Road in Spring Creek Township*

PA CleanWays chapters and affiliates throughout Pennsylvania work to clean up and prevent illegal dumping through action and education. Local businesses, organizations, or clubs often “adopt” rural roadways, trails, and/or waterways to help curtail illegal dumping. These volunteers pick up trash in their adopted areas two or three times per year, similar to the Adopt-a-Highway Program run by Pennsylvania Department of Transportation. County governments or volunteer groups organize chapters and affiliates of PA CleanWays.

Although there are no active chapters or affiliates of PA CleanWays in the Brokenstraw Creek watershed, each county has, or is scheduled to have, an Illegal Dump Survey completed. These surveys identify the location and size of illegal dumps sites. They are intended to educate elected officials and citizens about illegal dumping, provide insight into the development of solid waste and recycling programs, and to engage communities to clean up dumpsites and prevent new illegal dumps from forming.

Illegal dumpsite surveys have been completed for Crawford, Erie, and Warren counties identifying approximately 126 tons of trash illegally dumped within the Brokenstraw Creek watershed. Erie County’s Illegal Dump Survey was completed in 2005 identifying site 75: Hereford Road as the only site within the project area. Crawford County’s Illegal Dump Survey was completed in 2008 with no illegal dumpsites located within the project area. In 2009, Warren County Illegal Dump Survey was completed with the identification of 19 dumpsites within the Brokenstraw Creek watershed. Individual dumpsites are identified in Appendix E.

### **Landfills**

Landfills continue to be the chief method of solid waste disposal. A landfill is simply a disposal site for various types of waste, which are discarded into or onto the land. In the past, landfills were situated for convenience, and did not utilize any measures to control leachate—the liquid formed when water infiltrates the waste and draws out chemicals, metal, and other materials. Without proper and now federally mandated measures, leachate can easily infiltrate and contaminate groundwater resources.

Federal regulations for municipal solid waste landfills (MSWLFs) mandated by U.S. EPA fall under Subtitle D (Part 258) of RCRA, which was last revised in 1991. The eight main components of the regulations are listed below (U.S. EPA, 2008).

- **Location restrictions** ensure that landfills are built in suitable geological areas away from faults, wetlands, floodplains, or other restricted areas
- **Composite liner requirements** include a flexible membrane (geomembrane) overlaying two feet of compacted clay soil lining the bottom and sides of the landfill to protect groundwater and the underlying soil from leachate releases
- **Leachate collection and removal systems** sit on top of the composite liner and remove leachate from the landfill for treatment and disposal
- **Operating practices** include compacting and covering waste frequently with several inches of soil to reduce odor; control litter, insects, and rodents; and protect public health
- **Groundwater monitoring** requires testing groundwater wells to determine whether waste materials have escaped from the landfill
- **Closure and post-closure care requirements** include covering landfills and providing long-term care of closed landfills
- **Corrective action provisions** control and clean up landfill releases and achieve groundwater protection standards
- **Financial assurance** provides funding for environmental protection during and after landfill closure (i.e. closure and post-closure care)

Landfills and landfill regulations are of particular importance in Pennsylvania due to the fact that since 1992, the state has been the nation's leading importer of waste (Action PA, 2005). Pennsylvania can attribute this title to its geographic proximity to a megalopolis—the dense urban band that stretches from Washington D.C. to Boston—and the large amount of inexpensive, rural lands within the state.

### Recycling

Recycling starts with community collection of approved materials, which generally include glass, plastic, paper, and metal materials. Community collection may be done through curbside collection, drop-off centers, buy-back centers, and/or deposit/refund programs. After sorting, recyclable materials are sold and purchased in the same manner as any other commodity. Material recovery facilities buy the recyclables and remanufacture them into new products.

The benefits of recycling are numerous and can have a positive impact on a community. Recycling materials keeps them out of municipal landfills, and therefore reduces the need for such facilities. Recycling also limits the amount of raw materials required to produce products, which reduces the need for resource extraction activities, reduces emissions, and saves a significant amount of energy in the process. Recycling programs also create numerous jobs. In Pennsylvania alone, 81,322 jobs are the result of recycling programs (PA DEP, 2006b).

Pennsylvania Act 101—the Municipal Waste Planning, Recycling, and Waste Reduction Act of 1988—mandated curbside recycling by September 1991 for municipalities with populations of at least 5,000 or a population density of at least 300 persons per square mile. Additionally, each county is responsible for developing its own municipal waste management plan (PA DEP, 2006b). The rural characteristics of the Brokenstraw Creek watershed limit curbside recycling opportunities due to economic feasibility. They are identified in Table 2-4. However, there are three drop-off locations that provide recycling services to area residents. For more information about recycling specialty products such as yard waste, automobile wastes, and electronics visit <http://myecoville.com/us/pa/home>.

### Brownfields

According to U.S. EPA, brownfields are “real estate property—the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.” Cleaning up and reinvesting in these properties takes development pressure off of undeveloped, open land, while improving and protecting the environment (U.S. EPA, 2006).

**Table 2-4. Drop-off Recycling Center**

Location	Materials excepted
Youngsville Borough Drop-off Site	#1 and #2 plastics, green and clear glass, aluminum cans
Mortenson Recycling, Sugar Grove Township	#1 and #2 plastics, brown, green, and clear glass, aluminum and steel cans, newspapers, magazines, and catalogs
Columbus Township Drop-off Site	#1 and #2 plastics, brown, green, and clear glass, aluminum and steel cans, phone books, newspapers, magazines, and catalogs

To address brownfield issues in Pennsylvania, PA DEP has created a Brownfields Action Team (BAT) and Land Recycling Program. BAT was formed to streamline the revitalization of brownfield sites and enhance the interaction between the local communities and PA DEP. Responsibilities of the team include expediting permits, coordinating funding, and obtaining liability protection for the sites. The Land Recycling Program encourages voluntary cleanup and reuse of contaminated commercial and industrial sites. There are three cleanup standards—background, statewide health, and site specific. Landowners of remediated properties receive liability relief for the property. The five properties participating in the Land Recycling Program in the project area are identified in Appendix F.

In New York, the Brownfield Cleanup Program (BCP) was established to enhance private sector cleanups of brownfields and to reduce development pressures on undeveloped lands. The BCP addresses the environmental, legal, and financial barriers that hinder redevelopment and reuse of contaminated properties. The program intends to encourage voluntary remediation of contaminated sites for reuse and redevelopment. Within the BCP, the Brownfields Opportunities Areas Program—a cooperation between NY DEC and New York Department of State—provides financial and technical assistance to municipalities and community based organizations to complete revitalization plans and implementation strategies for areas affected by brownfield sites, as well as site assessments for strategic sites (NY DEC<sup>4</sup>).

## CHAPTER 3. WATER RESOURCES

Brokenstraw Creek flows into the Allegheny River at the Buckaloons Recreation Area of the Allegheny National Forest near Irvine, Pennsylvania. Known for its excellent angling opportunities, this watershed has good overall water quality with a high diversity of species.

This chapter will provide an overview of water resources in the Brokenstraw Creek watershed and discuss laws and measures that can be used to protect its water resources.



*Spring Creek, one of the major tributaries to Brokenstraw Creek*

### Location

The project area is located within the 11,600 square mile Allegheny River watershed, and more specifically the Upper Allegheny Watershed, Hydrologic Unit (HU) 05010001. The project area encompasses approximately 380 square miles in Crawford, Erie, and Warren counties, PA and Chautauqua County, NY.

The HU is a cataloging system used to describe the locations of water resources within the U.S. The system divides and subdivides water resources into smaller units of water drainage. Waterways are divided into region, sub-region, basin, sub-basin, watershed, and subwatershed. The HU for the area can be described as:

Region 05: All waterways draining into the Ohio River Basin, excluding the Tennessee River Basin

Subregion 01: All waterways in the Allegheny River Basin in Pennsylvania and New York

Basin 00: All waterways in the Allegheny River Basin

Sub-basin 01: Upper Allegheny River

### **Brokenstraw Creek**

Brokenstraw Creek is designated as a Cold Water Fishery (CWF) in Pennsylvania and a Class C Waterway in New York. A CWF is a Pennsylvania waterway that is designated for the maintenance and propagation of plants and animals that thrive in a cold water environment, such as fish species from the family Salmonidae, such as trout. In New York, Class C Waterways are designated for fishing and are suitable for primary and secondary recreation, although other factors may limit the use of these purposes. Class C waters should not be used as public water supply for drinking, culinary, or food processing purposes. Waterways identified with (T) in New York are also designated as trout waters, meaning the water is suitable for fish, shellfish, and wildlife propagation and survival (NY DEC, 2008a).

There are 14 named tributaries directly entering Brokenstraw Creek; of those, four—Little Brokenstraw, Spring Creek, Hare Creek, and Coffee Creek—are considered major tributaries.

#### *Little Brokenstraw Creek*

Little Brokenstraw Creek begins northeast of Panama, NY, and joins Brokenstraw Creek near Pittsfield, PA.



**To qualify as a high-quality waterway, a stream must meet certain chemical or biological standards**

Chemical parameters: a waterway must maintain water quality capable of supporting the propagation of fish, shellfish, wildlife and recreation in and on the water by surpassing the water quality criteria standards identified in the Pennsylvania Code.

Biological parameters: surface waters must support a high-quality aquatic community based on information gathered using peer-review biological assessment procedures that consider physical habitat, benthic macroinvertebrates, or fish. Results must be based on Rapid Bioassessment Protocol for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish or another widely accepted and published peer-review biological assessment procedure approved by the department.

(Source: PA CODE, 1997)

Spring Creek

Spring Creek, from its headwaters near the village of East Branch to its confluence with Brokenstraw Creek along Route 426 south of the village of Spring Creek, is designated as a High Quality Cold Water Fishery (HQ-CWF).

Hare Creek

Hare Creek is designated as a CWF from its headwaters to where it intersects Scotia Street; from Scotia Street to its mouth it is designated as a Warm Water Fishery (WWF)—the only one in the Brokenstraw Creek watershed.

Coffee Creek

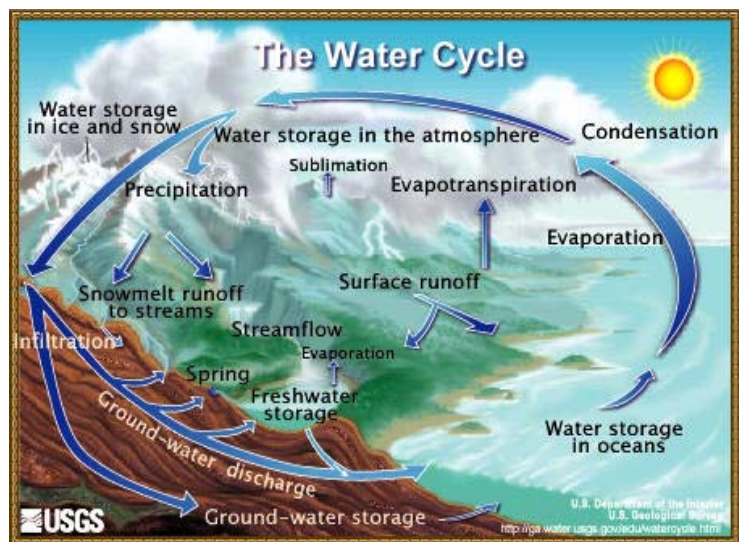
Coffee Creek flows 11.2 miles through the Town of Clymer in New York, and through Freehold and Columbus townships in Pennsylvania. It joins Brokenstraw Creek in Columbus Borough, PA. Table 3-1 and Figure 3-1 identify all of the named tributaries to Brokenstraw Creek and their designations.

## Water Attributes

Water—in the forms of precipitation, groundwater, and surface water—moves freely between the atmosphere, the land surface, and underground, by transforming between liquid, solid and gaseous states. This movement between states and locations is described as the hydrologic cycle.

In the hydrologic cycle, (Figure 3-2) energy from the sun evaporates water from plants, soils, and the surface, transforming it into water vapor in the atmosphere. When water vapors cool, they condense, forming clouds. Once enough vapors condense, they fall to the surface as precipitation. On the surface, some water seeps into the ground, becoming groundwater; the remaining water

Figure 3-2. The Water Cycle



runs off the land, increasing the flow to streams. Water is either used by vegetation or evaporates back into the atmosphere, continuing the cycle.

**Table 3-1. Tributaries**

Name of Tributary	Designation	Drainage (Square Miles)	Name of Tributary	Designation	Drainage (Square Miles)
Brokenstraw Creek	CWF	85.54	Blue Eye Run	EV	10.26
Irvine Run	CWF	9.31	Gar Run	CWF	9.87
McKinney Run	CWF	0.84	Homer Run	CWF	8.44
Indian Camp Run	CWF	2.43	Spring Creek	HQ-CWF	13.99
Matthews Run	CWF	6.11	Ferrin Run	HQ-CWF	2.09
Browns Run	CWF	1.78	Whitney Run	HQ-CWF	7.56
Lansing Run	CWF	1.87	Cobbs Run	HQ-CWF	1.86
Telick Run	CWF	1.17	East Branch	HQ-CWF	6.41
Patchen Run	CWF	5.49	Coolspring Creek	HQ-CWF	1.76
Mead Run	CWF	5.59	Brandy Run	HQ-CWF	5.34
Andrews Run	CWF	5.55	Damon Run	CWF	2.09
Rattlesnake Run	CWF	3.56	Hare Creek	CWF/WWF	23.35
Birch Springs Run	CWF	1.45	Winton Run	CWF	3.94
Wade Run	CWF	1.97	Bear Creek	CWF	2.87
Little Brokenstraw	CWF	59.06	Whites Run	CWF	BMS
Barton Road	CWF	2.55	Coffee Creek	CWF	11.33
Taylor Run	CWF	1.22	Prosser Creek	CWF	3.84
Page Hollow	CWF	3.04	Cold Spring Brook	CWF	2.85
Miles Run	CWF	5.01	Pine Valley Creek	CWF	7.12
Deadman Run	CWF	3.86	<i>Brownell Branch</i>	C	BMS
Stony Creek	CWF	3.26			
Deer Creek	CWF	1.46			
<i>Indian Brook</i>	C(T)	LBMS			
<i>East Branch</i>	C(T)	LBMS			

*Italics indicate New York tributaries*

BMS=subwatershed calculated into mainstem Brokenstraw Creek

LBMS=subwatershed calculated into mainstem Little Brokenstraw Cr.

### **Groundwater and Surface Water**

Groundwater and surface water are often considered two separate resources, but actually make up one resource. Groundwater and surface water are in constant interaction; when water is stored below the surface of the earth, it is called groundwater, while water in surface ponds, lakes, or wetlands is called surface water.

#### **Groundwater**

Groundwater is stored in empty spaces and cracks between soil and sand particles, gravel, and rock. When all the empty spaces and cracks have been filled by water which has permeated the ground, the ground becomes saturated, and the upper surface of the zone of saturation is called the water table. Springs are formed when the groundwater flow is blocked by non-permeable rocks and is forced to flow laterally in permeable layers until it is discharged at the surface.

The depth of the water table is strongly influenced by topography. In valleys, it is closer to the surface than it is in hilly and mountainous regions. Streams, lakes, and wetlands are evident where the water table is higher than the surface of land, and that water is then classified as surface water.

In Pennsylvania, 100 inches of water—equivalent to 80 trillion gallons—is stored underground. While underground, water flows through cracks and layers of rock. Gravity supplies the pressure needed to force the water's flow from higher elevations—such as hills and mountains—to valleys in lower elevations. However, unlike surface water, groundwater receives additional pressure from the weight of the water above it. This can cause water in the discharge area to flow upward; if enough pressure is achieved, the force of the water can overcome gravity. Slope and permeability impact the rate at which groundwater flows. Groundwater moves slowly at a rate of 35–1,100 feet per year (Fleeger, 1999; A brief explanation on groundwater flow systems and groundwater hydrogeology in Pennsylvania).

Due to the highly dissected terrain in the Appalachian plateaus, much of the region contains areas with steep slopes that rapidly flush precipitation off the land surface, limiting the amount of water able to infiltrate the ground and recharge the groundwater supply. Water flows downward until it reaches the aquifer layers, where it then flows horizontally through the aquifer until it is forced upward at the discharge area. Within this region, groundwater flows no more than a few hundred feet below the land surface.

In Pennsylvania, 37 percent of the population obtains drinking water from wells and springs. In rural and suburban areas, as much as 60 percent of the population acquires water from groundwater sources. Therefore, it is important that the quality of groundwater be protected. It is the well owner's responsibility to ensure that their drinking water is safe for consumption by conducting frequent water quality tests.

In New York, 26 percent of the population receiving public drinking water obtains it from groundwater sources; however, the majority of these residents—roughly 60 percent—are located in the Long Island area of New York located outside of the Brokenstraw Creek watershed.

If not protected, groundwater can become contaminated. Land-use practices impact the quality of our water. Waste disposal, resource extraction, agriculture, and urbanization can affect water.

**Waste disposal** is the primary source for groundwater contamination. In 1990, Pennsylvania had more rural residents than any other state, and a quarter of the homes utilized an on-lot septic system. Improperly installed or maintained systems can inadvertently introduce bacteria, viruses, nitrates, phosphorous, chlorides, and organic solvents into groundwater. Activities, such as draining household chemicals and using a garbage disposal, can impede the effectiveness of treatment within septic systems. However, septic systems are not the only waste disposal that impacts groundwater quality. Leachate from landfills and the 20 identified illegal dumpsites along with discarded household chemicals and motor oil into storm drains impact the quality of water (Fleeger, 1999; League of Women Voters; Raymond, 1988).

**Resource extraction** activities, such as oil and gas drilling, and abandoned, unsealed oil and gas wells are potential causes of groundwater contamination. Surface and deep mining can alter both the quality and quantity of groundwater. Quality can be altered through the formation of abandoned mine drainage (AMD) and the introduction of iron, manganese, sulfate, and dissolved solids into local waterways. Oil well drilling may produce brine that can leak into groundwater if storage lagoons are not properly lined. Private water wells can be contaminated from methane gas from nearby gas wells that are under pressure. Abandoned oil and gas wells that are not sealed leave the potential for groundwater contamination through illegal disposal into the well. The improper or deteriorated casings can allow contaminants to spread between aquifers (Fleeger, 1999; League of Women Voters; Raymond, 1988).



*Cows grazing at a farm in the Spring Creek subwatershed*

Human activities, such as construction and highway maintenance, have an impact on water quality. In **urbanized areas**, the amount of asphalt and concrete pavements impede water's ability to permeate the ground and recharge the groundwater supply. Instead, the water runs off the land surface and has the potential to pick up additional contaminants before entering a nearby waterway or eventually infiltrating the ground. Another major issue within urbanized areas is water quantity. Often, with a large demand for water, there is an over withdrawal of from the aquifer that leads to a drawdown. This reduces the water table and the amount of base flow in local streams. Other urbanized activities that affect the quality of groundwater include the use of road salt, storage tanks, chemical spills, and landfills (Fleeger, 1999; League of Women Voters; Raymond, 1988).

### Surface Water

Some streams, rivers, wetlands, springs, lakes, and ponds form when the water table intersects the land surface and groundwater reaches the surface to establish base flow. Once the groundwater reaches the surface, it becomes surface water. Surface water is all the water on the surface of the earth, including runoff.

Tributaries form in higher elevation where the groundwater is discharged to the surface. They grow in size and volume as the water flows to lower elevations, adding surface runoff and joining other tributaries to form runs, creeks, streams, rivers, and watersheds.

In Pennsylvania, all streams are protected through the Pennsylvania Clean Streams Law. According to the Pennsylvania Code (1997), streams are classified as intermittent, ephemeral, or perennial. This is based on relative position of stream bottom with respect to the water table. When detailed water table fluctuation data is unavailable, benthic macroinvertebrate communities are a good indicator of stream class.

An **intermittent stream** is a "body of water flowing in a channel or bed composed of substrates primarily associated with flowing water, which during periods of the year is below the water table and obtains its flow from both surface runoff and groundwater discharges."

An **ephemeral stream** is a "water conveyance, which lacks substrates associated with flowing waters, and flows only in direct response to precipitation in the immediate watershed or in response to melting snowpack and which is always above the water table."

A **perennial stream** is a "body of water flowing in a channel or bed composed primarily of substrates associated with flowing water and is capable, in the absence of pollution or other manmade stream disturbances, of supporting a benthic macroinvertebrate community composed of two or more recognizable taxonomic groups of organisms upon available substrates in a body

of water or water transport system.” Perennial streams flow year-round, because they are always below the water table.

Lakes, ponds, and reservoirs are inland bodies of water. Lakes and ponds are very similar and classifying them can be challenging because there is no one set of criteria to distinguish them as either a lake or a pond. Typically, features such as water clarity, plant growth, and temperature changes between top and bottom layers are used to classify these inland bodies of water as a lake or pond. Lakes are deeper, have more visible waves, have rooted plant growth near the shoreline, and water temperatures that vary with depth. Ponds are shallow, have rooted plant growth within the water body, and temperatures that do not vary with depth. Reservoirs are man-made structures, such as dams, that are built across waterways for the purpose of storing water for public water supply, safety, or recreation. Both lakes and ponds can form naturally, as the result of geological events (U.S. Environmental Protection Agency (U.S. EPA), 2007; Spring Creek Aquatic Concepts).

Lakes and ponds are formed in a variety of ways; while some are naturally occurring, others are manmade. Natural lakes are uncommon in Pennsylvania, except in northwestern and northeastern Pennsylvania, where glaciers once covered the region, leading to the development of glacial lakes. There are no glacial lakes located within the project area.

Other than glacial lakes, there are no natural lakes in Pennsylvania. Other types of naturally forming lakes include oxbow lakes, which form when the river channel is changed, isolating a portion of the river from its former channel. Beavers build dams across small waterways, backing up the flow of water to create a pond. Earthquakes and landslides can also create lakes, but these events are less common within the Brokenstraw Creek watershed (U.S. EPA, 2007; Spring Creek Aquatic Concepts).



*Lake Alice at Mead Park in Corry is one of many lakes in the project area*

Upstream impacts can threaten the health of lakes. An overabundance of nutrients and sediment; the addition of organic waste, metals, chemicals; and rapid fluctuations in water levels are major threats to the water quality of lakes. A variety of sources, such as malfunctioning sewage treatment systems and septic tanks, runoff from pavements, urbanized areas—parking lots, roads, and rooftops—lawns, agricultural practices, and the destruction of shoreline vegetation can increase erosion and sedimentation within these waterbodies.

### **Wetlands**

A wetland is an area of land that contains water-loving plants and has undrained, wet soils that are saturated or covered by shallow water at some point during the year. Wetlands have three functions—water storage, water filtration, and biological productivity. Approximately six percent of the watershed is covered by wetlands; of those, the majority—17.09 square miles—are woody wetlands, while the remaining 1.46 square miles are herbaceous wetlands. Figure 3-3 depicts wetland areas throughout the watershed.

Wetlands act like a sponge to absorb water then slowly release it. A one-acre wetland can store 1–1.5 million gallons of floodwater (U.S. EPA, 2001). This process allows groundwater to recharge, maintains a base flow during dry periods, and slows the flow of water, reducing the potential for erosion and flooding. The longer the water remains in the wetland, the more suspended materials are filtered out of the water.



Wetlands are one of the most biologically productive natural systems in the world. They provide unique habitats and are ecologically valuable to plant and animal species.

### Types of Wetlands

There are four types of wetlands—marshes, swamps, bogs, and fens. In western Pennsylvania, the term wetland is most often used to refer to a marsh. However, northwestern Pennsylvania and the Brokenstraw Creek watershed are home to several swamps and bogs.

**Marsh** wetlands are frequently or continually inundated with water. They are characterized by soft-stemmed vegetation adapted to saturated soil conditions. Marshes receive water and nutrients from surface and groundwater sources. They recharge groundwater supplies, moderate stream flow, reduce flooding, and filter pollution. Vernal pools—seasonal depressions covered by shallow water for variable periods of the year—are a type of marsh wetland (U.S. EPA, 2009).



*Bogs, one type of wetland, are prevalent in northwestern Pennsylvania because glaciers once covered the region*

**Swamps** are wetlands dominated by woody plants and characterized by saturated soils during the growing season and standing water during certain times of the year. There are two types of swamps—forested and shrubby. Swamps remove nutrients from water and prevent flooding (U.S. EPA, 2009).

**Bogs** are wetlands with spongy peat deposits and acidic waters. A thick layer of sphagnum moss blankets this type of wetland. Precipitation is the only external source of water and nutrients. Bogs are beneficial because they absorb precipitation and prevent or reduce flooding (U.S. EPA, 2009).

Peat-forming wetlands that receive nutrients from runoff and groundwater are **fens**. Although similar to bogs, fens are less acidic and can have higher nutrient values. Functionally, fens help improve water quality, reduce the risk of flooding, and provide habitats for unique plant and animal communities (U.S. EPA, 2009).

### Wetland Loss

Since early settlement in the 1600s, wetlands have been drained and filled for agricultural, developmental, and transportation uses. It is estimated that in the 1600s there were 221 million acres of wetlands within the U.S, and by 2004 approximately 108 million acres remained. Historically, agriculture was the dominant cause of wetland loss; since 1982, the dominant source of wetland loss has been development (Dahl and Allord, 1994; Dahl, 2006).

Historical events, technological advances, and the values of society have all played a role in the decreased number of wetlands. In the 1700s, wetlands were viewed as swampy lands that bred disease, restricted travel, hindered farming, and were not useful for survival. Technological advances in the development of equipment made it easier to access and drain wetlands. The federal government supported the drainage and reclamation of wetlands for settlement and development purposes. In 1849, congress passed the Swamp Lands Act; and in the 1930s, the government provided funding to assist farmers in draining wetlands to open additional acres of land for agriculture (Dahl and Allord, 1994).

Pennsylvania lost approximately 628,000 acres of wetlands between the 1780s and the 1980s (Dahl, 1990). In the same time frame New York lost 1,537,000 acres.



In 1987, wetland conversion rates began to slow when the government started increasing efforts to restore wetlands. As the value of wetlands increased, interest in their preservation grew. Between 1998 and 2004, there was a net gain of wetlands. These gains came from the conversion of agricultural lands and acres in transition (Dahl and Allord, 1994; Dahl, 2006).

### **Floodplains**

A floodplain is the land adjacent to a waterway that dissipates floodwaters, thereby reducing their flow. These scenic and valuable habitats are beneficial in reducing streambank erosion and sedimentation, flooding, loss of property, and the degradation of water quality. Some people consider floodplains to be a natural sponge due to their ability to absorb and slowly release floodwaters, recharging groundwater and decreasing the velocity and volume of floodwaters. Floodplains also improve water quality by trapping sediment and capturing pollutants, similar to the role of wetlands.



*Houses located in the floodplain are at a high risk of being damaged by flooding*

Floods and floodplains are typically delineated by the likelihood of a flood event. The “100-year flood” boundary is an area adjacent to the stream that has a one percent chance of flooding in a given year.

Beginning in 1968, Federal Emergency Management Agency (FEMA), through the National Flood Insurance Act, administered the National Flood Insurance Program (NFIP). This program was established to allow property owners to purchase flood insurance protection at a reduced rate in communities where floodplain ordinances are adopted. The floodplain ordinance must meet regulatory standards of the NFIP and the Pennsylvania Floodplain Management Act. Landowners residing in communities that have not adopted floodplain ordinances may still purchase insurance, but at a much higher rate (FEMA, 2002).

The threat of flooding and degree of damages fluctuates depending upon the impacts caused by human activities. Activities such as development in the floodplain, dredging, and channelization, alter the stream channel and increase the flow and velocity of water in the channel. For example, dredging a stream channel deepens the channel, allowing an increase in the flow of water. When the channel is straightened, the water has fewer obstacles to maneuver around and quickly gains speed. When velocity increases, water erodes streambank soil, which is deposited in the stream as sedimentation and decreases the size of the floodplain. With less area available to absorb water, streams overflow their banks and flooding results.

Floodplains provide critical habitat for common species, as well as rare, threatened, and endangered species. Plant and animal species that survive in floodplains have adapted to thrive in these unique conditions. Plant species are limited based on soil types and water tables, while animal species are limited based upon the habitat provided by the plant species. Plants and animals are further discussed in the Biological Resources chapter.

### **Riparian Zones**

The land area bordering a waterbody is the riparian zone. These areas, which are often floodplains as well, filter pollutants and sediments from runoff and provide a buffer



*Inside the plastic tubes are newly planted trees to help re-establish a vegetative riparian buffer to protect the streambank from erosion and control runoff*

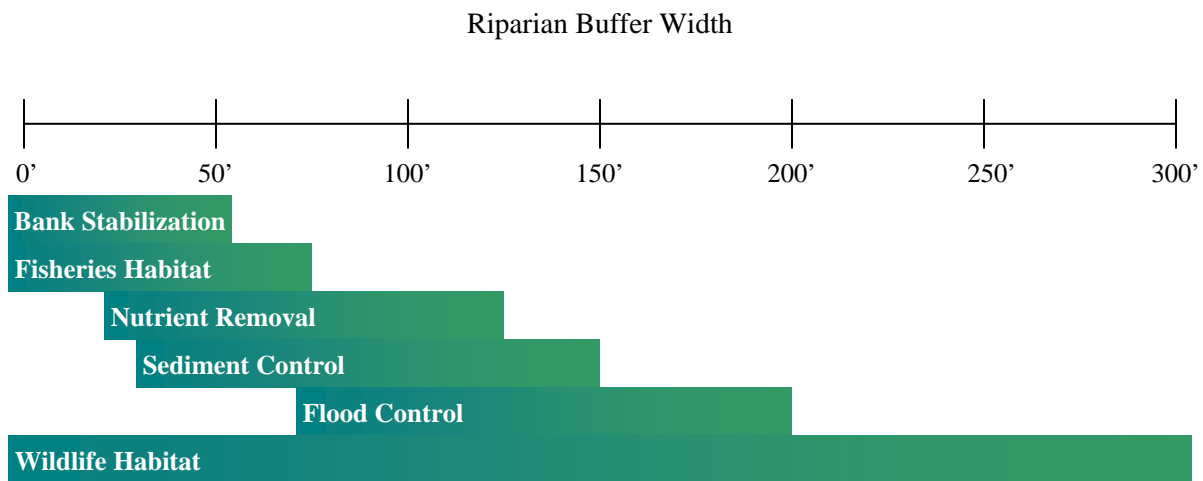
area between water and land. A functioning, vegetated riparian zone reduces flooding and erosion by decreasing the velocity of flow, retaining water, and stabilizing the surrounding soil. Riparian zones, or riparian corridors, as they are sometimes called, provide important passageways for wildlife, regulate water temperature, enhance recreational activities, and provide fish habitat.

Vegetative buffers prevent erosion and the undercutting of banks. The roots of plants and trees hold the soil in place, as opposed to non-vegetative buffers, in which the soil erodes into waterways. Plants slow down runoff, allowing more water to be absorbed, which recharges groundwater supplies. In addition to ecological benefits, vegetative riparian buffers may increase property values, decrease property loss due to erosion, and provide privacy and scenic beauty. Native plants and warm season grasses are the most effective vegetation for a functioning riparian area because they are tolerant of the surrounding environment, weather, and are naturally resistant to pest and diseases.

The wider the riparian zone, the more effective it becomes. Many agricultural and developed areas along waterways do not have a substantial riparian zone, which leads to bank erosion and the establishment of invasive species. Figure 3-4. displays the recommended riparian buffer width for each beneficial function.

A variety of programs and tools are available to assist landowners in protecting these areas. Each program may call for a minimum buffer requirement for cost share funding. Individual landowners should contact their local USDA Farm Service Agency to determine which program would work best for them.

**Figure 3-4. Recommended Riparian Buffer Widths**



Land Purchase

A Land purchase is used when a conservation organization or municipality purchases a property or has a property donated to them in order to protect, restore, conserve, or provide public access. The organization or municipality becomes the owner of the property and is responsible for maintenance and financial obligations.

Conservation Easements

Conservation easements are legal agreements between a landowner and a land trust or governmental agency. These agreements restrict the land use of the property and preserve it for future generations. These restrictions become part of the deed for the property and are transferred to new property owners

when the property is sold. The landowner maintains ownership of the land, but gives up some of the development rights while being compensated for the economic loss from the restrictions.

#### Municipal Planning

Through the Municipalities Planning Code, there are a variety of options for municipal planning. Comprehensive plans—whether county, individual, or joint—address development issues. Although these plans are non-regulatory, they influence municipal ordinances because all zoning ordinances must be consistent with a municipality’s comprehensive plan. The plan contains an official municipality map, which designates existing and proposed areas of open space, growth areas, and areas that restrict certain activities. Ordinances restrict activities within a certain distance of a stream based on size, slope, content, and location. This includes limiting the building of new structures in areas prone to flooding, removing riparian zones, and earth disturbances.

#### Transferable Development Rights

This tool is used to compensate landowners in areas where development is restricted, by allowing them to sell development rights to increase development densities in other areas. This tool is discussed further in the Biological Resources chapter.

#### Density Bonuses

This tool awards developers by allowing them to increase development density in exchange for conserving natural areas or contributing to an open space fund. Developments that utilize Conservation by Design strategies often utilize this tool.

#### Stormwater Credits

A stream buffer helps reduce stormwater runoff. Developers can receive stormwater credits, which result in the construction of less costly stormwater management facilities, in exchange for maintaining or restoring riparian buffers (ACB, 2004).

### **Stormwater**

Stormwater is precipitation that falls during storm events which is either used by vegetation or becomes surface water. When rapid or extended storm events occur, more precipitation falls than natural stormwater management processes can manage. Depending on existing conditions of the land, accelerated stormwater events can result in different outcomes. For example, if the water cannot permeate the ground, it is shed off the land surface as runoff. As runoff meanders across the land, soil particles and pollutants can adhere to it before it infiltrates the ground or enters surface waters. When runoff enters the surface water, it causes increased volumes and velocity, and can lead to the scouring of streambanks. This scouring alters stream channels and increases sedimentation and the risk of flooding. Groundwater levels may become depleted, because water cannot seep into the ground and recharge the supply.

In urbanized areas, such as Youngsville and Corry, impervious surfaces are often linked to negative stream impacts. Even when only 10 percent of the land is covered by impervious surfaces, there are significant consequences (Schueler, 1995). Impervious surfaces are areas where water cannot be absorbed by the ground. Concrete, pavement, rooftops, and highly compacted soil are examples of impervious surfaces. Minimizing the amount of impervious surface is one way to protect water resources. Zoning, residential design, open spaces, and new technologies can help minimize impervious surface areas in communities.



*Culverts are used to control the movement of stormwater under roadways and through urbanized areas*

Reducing impervious surfaces not only has environmental benefits, but reduces social, economic, and development costs as well.

Act 167 (Stormwater Management Act) was established in 1978 in an effort to reduce the impacts of accelerated stormwater runoff resulting from land developments. Each county is required to prepare and adopt a watershed-based stormwater management plan. In addition, municipalities are required to adopt and implement ordinances to regulate development that are consistent with these plans (PA DEP, 2007b).

Erie and Warren counties have developed a stormwater management plan, and are in phase II of the process, which addresses problems identified during phase I and develops best management practices (BMPs) and preventative measures for existing and future stormwater issues. Warren County's phase II is expected to be completed in late 2009, and will have a county-wide stormwater ordinance to be adopted by each municipality. This ordinance will serve as a tool to prevent future problems by addressing flooding and stormwater runoff (Ferry, 2008).

### **Dams**

Historically, dams were installed along streams and rivers to harness the natural power of water for a variety of operating mills, including saw, grist, and paper mills. Dams also are utilized on rivers for navigation purposes and the transportation of goods. The natural power of stream currents is still utilized for some industries today; it can be harnessed for hydroelectric power generation.

Often times, dams become obsolete and are abandoned. If not maintained, dams may fall into a state of disrepair and pose a safety risk. Dam failures may cause flooding, resulting in injury or death to humans, property damage, and interruption of transportation and emergency services. Dams obstruct



*An abandoned dam located on Brokenstraw Creek near Jacquins, NY*

migration paths of fish and may inhibit the movement and dispersal of other aquatic life. Abandoned dams also hinder paddlers' ease of transportation down a stream.

A decision to remove a dam must be determined based on maintenance costs, safety, and potential use. If a community decides to leave a dam in place, a portage trail may be constructed around the dam for paddlers and other water recreation purposes. Fish passage structures, such as fish ladders, may be constructed to open corridors for aquatic life within the stream. If it is determined that a dam should be removed, a plan must be developed for the removal process and to restore the stream and its habitat afterward.

There are a few organizations responsible for the oversight of dam maintenance, regulation, and removal in the region, including the U.S. Army Corps of Engineers, Pennsylvania Department of Environmental Protection (PA DEP), Pennsylvania Fish and Boat Commission (PFBC), New York State Department of Environmental Conservation (NY DEC), and American Rivers. Necessary permits must be obtained prior to removing a dam. Assistance is available to support the planning and restoration process. A useful resource for additional information about the benefits of dam removal, volunteer monitoring, and references for assistance is the *Citizen's Guide to Dam Removal and Restoration*, which can be obtained from the Pennsylvania Organization for Watersheds and Rivers (POWR) at [www.pawatersheds.org](http://www.pawatersheds.org).

## Watershed Protection Laws

### Clean Water Act

In 1977, the federal Water Pollution Control Act was amended and became known as the Clean Water Act (CWA). The basic structure for managing and regulating pollution discharges and water quality standards for surface waters was established with this Act. The purpose of the act is to reduce direct pollution discharges, finance wastewater treatment facilities, and manage polluted runoff. U.S. EPA is responsible for implementing the act and working with individual states to restore and maintain the chemical, physical, and biological integrity of the nation's waters, so they can support "the protection and propagation of fish, shellfish, wildlife, and recreation in and on the water" (Elder, Killam, & Koberstein, 1999).

### National Pollutant Discharge Elimination System

It is unlawful to discharge any pollutant from a point source—one specific, identifiable point—into navigable waters unless a permit is obtained. In the permit, legal limits are established for the types and amounts of pollution that may be discharged into public waters. Under section 304 of the CWA, the National Pollutant Discharge Elimination System (NPDES) lists all permitted discharges, key permits, and summaries of discharge monitoring reports. Each state is responsible for managing the NPDES permits and obtaining Discharge Monitoring Reports from permit holders on a regular basis (Elder, Killam, & Koberstein, 1999). More information about the NPDES will be discussed in the water quality section of this chapter.

### Integrated Waterbody Report and Assessment

Section 305(b) of the CWA requires states to report on the overall health of their surface waters every two years. These reports compare stream conditions to established clean water goals. Within the report, impaired waterways are identified along with known or suspected causes of contamination and proposed corrective actions.

Waterways that are not expected to meet water quality goals, even after current regulatory requirements are met, are considered to be impaired waters. Section 303(d) of the CWA requires states to identify impaired waters and create a timetable to develop action plans for improving them. Impaired waters, sources of impairments, and a plan of action to remediate these impairments are identified in watershed-specific cleanup and restoration plans, also known as Total Maximum Daily Load (TMDL) reports.

Beginning in 2006, the 305(b) report was combined with the 303(d) list in the Integrated Waterbody Report and Assessment that is submitted to the U.S. EPA every two years. This report summarizes water quality management programs, water quality standards, point and non-point source pollution control, and includes programs aimed at protecting lakes, wetlands, and groundwater quality. In New York, the integrated format was not feasible because of a five-year rotating cycle on water quality assessment monitoring. By the 2008 report, the majority of watershed assessments were completed, and the integrated report was feasible.

### Pennsylvania Clean Streams Law

In 1937, Pennsylvania passed the Clean Streams Law, granting the commonwealth power to enact legislation and regulations pertaining to stream protection. It was established to preserve and improve the quality of Pennsylvania waterways for the protection of public health, animal and aquatic life, industrial consumption, and recreational purposes. It is also responsible for the creation of the Clean Water Fund, a source of money that is used to eliminate pollution.



Prior to the passing of this law, intermittent and ephemeral streams were not awarded the same protections as perennial streams. Mining companies were able to reclassify perennial streams as ephemeral and intermittent, because they did not require special protection under the existing mining regulations. As a result of this legislation, intermittent and ephemeral streams now receive protection similar to perennial streams from the potentially harmful results of mining, logging, or other earth-moving activities.

The Clean Water Fund was established to eliminate pollution. Fines collected under penal provisions, civil penalties under section 605, permit fees excluding sections 202, 203, and 207, bond forfeitures, and costs recovered under Act 315 provide monetary support to the Clean Water Fund.

#### Pennsylvania Sewage Facilities Act

In 1960, Act 537—known as the Pennsylvania Sewage Facilities Act—was passed to correct and prevent sewage disposal problems. The act is part of Article II of the Pennsylvania Clean Streams Law, and it requires every municipality to develop and implement an official sewage plan addressing present and future sewage disposal needs. If new development projects or sewage disposal needs that were not originally identified in the plan arise, then an update of the plan is required.

In the Brokenstraw watershed, the majority of municipalities—67 percent—have Act 537 plans that have been created within the past 10 years. One municipality’s plan is 12 years old, and four municipalities have plans that were completed in the early 1970s. Municipalities with older plans are encouraged to review their plans to ensure they are accurate in addressing sewage disposal needs. Municipalities located in the designated growth areas in the Erie and Warren County Comprehensive Plans are among the municipalities with currently updated Act 537 plans completed in 2005 and 2007 (PA DEP, 2008b).

#### Pennsylvania Floodplain Management Act 166

Floodplain management regulation is under the Pennsylvania Floodplain Management Act (Chapter 106, Section 302 of the Pennsylvania Code). The purpose of this regulation is to (Pennsylvania Code, 1983):

- Encourage sound land-use practices during planning and development in floodplains
- Protect people and property in floodplains from danger and damages of floodwater and from debris carried by floodwater
- Prevent and eliminate urban and rural blight, which results from the damages of flooding
- Authorize a comprehensive and coordinated program of floodplain management based upon the National Flood Insurance Program (NFIP), designed to preserve and restore the efficiency and carrying capacity of streams and floodplains
- Assist municipalities in qualifying for NFIP
- Provide for and encourage local administration and management of floodplains
- Minimize expenditure of public and private funds for flood control projects and for relief, rescue, and recovery efforts

#### Floodplain Management in New York

In New York, floodplain management is conducted to reduce flood damages and qualify citizens to become eligible to purchase flood insurance. NY DEC can provide assistance when floodplain development is proposed and the intent of the project is to meet the “no-rise” and or “no adverse effect” criteria by using the effective hydraulic model. However, if development increases the base flood elevation or expanding as Special Flood Hazard Area it requires a revision of floodplain map by FEMA. Corrective and preventives measures are adopted by state and local governments who are ultimately



responsible for regulating these measures. Two programs—National Flood Insurance Program and Floodplain Mapping Program—are utilized in New York (NY DEC<sup>6</sup>).

## Water Quality

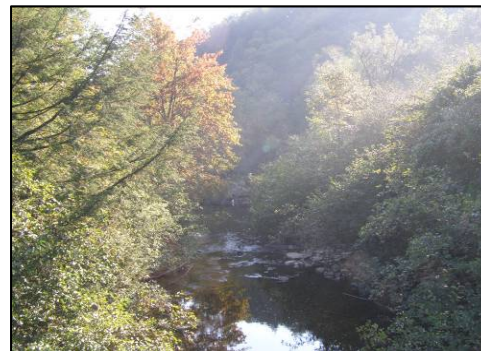
### **Classification of Water Pollution**

There are two categories of water pollution—point and non-point sources. Point sources are pollution discharges from an identifiable, individual source, such as discharge pipes from a factory or wastewater treatment plant. Non-point sources enter a waterbody through unidentifiable sources, such as AMD or agricultural runoff.

#### *Point Source Pollution*

Point source pollutants are easier to manage because they come from an identifiable location. They are regulated under the Clean Water Act through the NPDES.

In Pennsylvania, an earth disturbance from one to five acres requires a NPDES permit if there is a point source discharge at the site. A disturbance larger than five acres requires a permit, regardless of whether or not a point source discharge is located at the site. Agricultural operations (other than CAFOs) and timber operations that are less than 25 acres are not required to obtain a NPDES permit. Active NPDES permits may be found at the U.S. EPA's Enforcement and Compliance History Online (ECHO) website. A listing of NPDES permits for the Brokenstraw watershed as of January 2009 can be found in Appendix G.



*Spring Creek is the only designated High Quality Cold-Water Fishery in the Brokenstraw Creek watershed*

#### *Non-point Source Pollution*

Non-point source pollutants come from sources that are not visible without detailed analysis and research to identify their origin. Erosion and sedimentation, polluted stormwater, and agricultural runoff are examples of non-point source pollution that impact Brokenstraw Creek.

### **Impaired Waters**

U.S. EPA requires all states to assess and report the conditions of their waterways every two years. Both Pennsylvania and New York utilize the Integrated Water Quality Monitoring and Assessment Report. The report includes summaries of the water quality management programs and each waterway's condition in attaining its designated use for aquatic life, fish consumption, recreation, and/or potable water supply. Waterways that do not attain their designated use are required to have a TMDL report completed to identify the allowable pollutant load that a waterbody can handle to prevent a violation of water quality standards. TMDL reports are designed to reduce pollutant loads of impaired waters, enabling them to meet water quality standards (PA DEP, 2008a).

Two sections of the watershed have been identified as impaired and require the development of a TMDL. A 6.39-mile section of Bear Creek is listed for organic enrichment coming from natural sources, and an 8.57-mile segment of Brokenstraw Creek is listed for mercury coming from an unknown source. Both segments were identified on the 2002 List of Impaired Waters, and TMDL reports are scheduled for 2015 (PA DEP, 2008a).

## **Sources of Impairment**

### *Erosion and Sedimentation*

As a natural process, erosion is the displacement of solid materials, such as soils, sediment, or rocks, by wind and water. However, it is the accelerated movement of these materials, usually due to human interference, that causes the greatest ecological concern. An increase of sedimentation—solid materials displaced by erosion—impacts aquatic habitats, aquatic vegetation, aquatic species and their food supply; creates unstable streambanks; and increases sediment loads and cost for treating public drinking water supplies. Pollutants, such as heavy metals, pesticides, and excess nutrients, are carried in sediment by runoff to streams, affecting water quality.



*Sediment from old logging roads, construction sites, and unstable, steep slopes is carried to waterways via runoff*

Chapter 102 of the Pennsylvania Code was established in 1972 under the authority of the Pennsylvania Clean Streams Law, and later amended in 2000 to minimize impacts caused by accelerated soil erosion. According to this law, “anyone conducting earth disturbance activities must use BMPs to minimize the amount of sedimentation leaving the earth disturbance activity.” BMPs are a series of sustainable principles and recommendations that minimize the impacts to the land and water. PA DEP is responsible for overseeing Chapter 102 requirements, and has given County Conservation Districts with trained staff the responsibility to review erosion and sedimentation control plans (E&S plans), conduct trainings, perform site inspections, and the authority to conduct compliance and enforcement actions in certain counties (PA DEP, 2007a).

E&S plans must meet Chapter 102 requirements, be properly designed and implemented, and be available on-site for all earth disturbance activities. These plans must document how land and water resources will be protected from accelerated erosion through the implementation of BMPs. The timing and sequencing of the BMP installation must be accounted for in the plan. Minimizing disturbances, silt fences, mulch, diversion ditches, sediment traps, and sediment basins are examples of BMPs utilized to control erosion.

Excluding agricultural plowing and tilling, timber harvesting, and road maintenance activities, all other types of earth disturbances greater than five acres or disturbances between one and five acres with a point source discharge must obtain a NPDES stormwater permit. As previously mentioned, farmers that are not CAFOs and timber operations that are fewer than 25 acres are not required to obtain an NPDES permit, but are required to have a conservation plan or an E&S plan for their activities. Timber harvesting activities that are disturbing 25 acres or more for haul roads, skid trails, landing areas, and road maintenance activities are required to obtain an E&S permit. Agricultural uses do not require a permit, but do require an E&S plan (PA DEP, 2007a).

Agricultural and forestry practices, along with maintenance of dirt and gravel roadways, are human influences that accelerate erosion and sedimentation within the Brokenstraw Creek watershed. Streambank erosion accounts for 23.4 percent—over 8,500 milligrams per year—of the total sediment load in the watershed (Evans, Sheedes, & Lehning, 2003).

### *Dirt and Gravel Roads*

Dirt and gravel roads can increase the amount of sediment that is carried to area waterways if they are not designed, constructed, or maintained in an environmentally sensitive manner. In 1997, the Dirt

and Gravel Roads Maintenance Program was enacted through section 9106 of the Pennsylvania Vehicle Code in order to provide grant funding to eliminate stream pollution caused by runoff and sediment from unpaved roads. The program receives \$4 million annually from State Conservation Commission (SCC) through dedicated and earmarked funding that is given to County Conservation Districts based on identified need. Conservation Districts, in turn, disseminate funds to municipalities and other road-owning entities.

Funding is provided to address pollution problems previously identified in county-wide dirt and gravel road assessments. The first assessment, conducted in 2000, provided information from field investigations where dirt and gravel roads were identified and evaluated using 12 criteria. The criteria included the amount of road sediment in stream, wet site conditions, road surface material, road slope/grade, road shape, distance from stream, slope to stream, outlet to stream, outlet bleeder stability, road ditch stability, road bank stability, and average canopy cover. From the evaluations, worksites—locations where unpaved road runoff affects stream quality—were identified to establish the basis of the Dirt and Gravel Roads Maintenance Program. A second assessment was conducted in 2007 and 2008 on a voluntary basis to update and fill in gaps left void in the first assessment. Funding allocations will not be altered based on the new data until program funding is increased.

In order to be eligible for funding, the applicant must attend a two-day environmentally sensitive training workshop. Project sites must be site-specific, long-term solutions to prevent erosion and pollution. Activities such as chip-sealing and paving are not eligible expenses. Eligibility is based upon road ownership, not political boundaries. Federal roads, such as Allegheny National Forest roads, are not eligible for funding. Eligible roads include those that are owned by municipalities and counties; roads within state parks, state forests, state game lands; public boat launches; and Pennsylvania Fish and Boat Commission access roads. Within Crawford, Erie, and Warren counties, more than \$3.3 million have been spent on dirt and gravel roads projects since 1997. For more information on dirt and gravel roads, visit the Penn State Center for Dirt and Gravel Roads website at <http://www.dirtandgravelroads.org>.

### *Agricultural Practices*

Agricultural practices are responsible for 39 percent of the non-point source pollution in Pennsylvania (U.S. EPA, 2008). Improper fertilizer and manure management, including improper manure storage and unintended effects of pesticides, along with erosion and sedimentation, alter the quality of area waterways. The installation and use of BMPs can minimize the impacts to the land and water, and can improve herd health and crop yields.



*Dust and runoff from dirt and gravel roadways can enter streams adding sedimentat, which impacts water quality*

1. **High residue management** leaves at least 30 percent of the ground covered with crop residue, such as leaves and stalks, after crops are planted. This limits erosion by protecting and binding the soil.
2. A **cropland protection cover**, or cover crop, is usually grown for a year or less. A crop of close-growing grasses, legumes, or small grains is not grown for harvest, but for many different functions in crop rotations, such as preventing erosion and improving soil fertility.
3. **Nutrient management** is the management and crediting of nutrients from all sources, including legumes, manure, commercial fertilizers and soil reserves. Management includes the rate, method, and

timing of application for all sources of nutrients to minimize the amount of nutrients entering surface or groundwater. This practice includes manure nutrient testing, routine soil testing, and residual nitrogen soil testing.

**4. Pesticide management** is the management, handling, disposal and application of pesticides, including the rate, method, and timing of application to minimize the amount of pesticides entering surface and groundwater. This practice includes integrated pest management planning.

**5. Rotational grazing** is an intensive grazing management practice that divides pastures into multiple cells that receive a short, intensive grazing period, followed by a period of vegetative cover recovery. Rotational grazing can correct existing pasturing practices that result in degradation. When the practice of summer dry-lots results in water quality degradation, it should be replaced by this practice.

**6. Livestock fencing** encloses or divides an area of land with a suitable permanent structure that acts as a barrier to livestock or big game. The fencing excludes livestock from areas that should not be grazed, subdivides land to permit use of grazing systems, and protects new seeding and plantings from grazing.

**7. Channel crossings** are stable surfaces installed on the bottom of streams to provide a crossing for equipment or livestock. They are typically used to coincide with streambank fencing.

**8. A manure storage facility** is a structure used to store manure until it can be applied to the land. The facility is needed to store manure properly, so it does not become a non-point source of pollution.

**9. Field diversion** is a shallow channel constructed across the slope of the land to divert water from areas where it may cause flooding or erosion. The water is diverted to where it can be stored or safely transported.

**10. Terraces** are ridges and channels with appropriate spacing, constructed on the contour with a suitable grade to prevent erosion in the channel.

**11. Grassed waterways** are natural or constructed channels shaped, graded, and established with suitable cover as needed to prevent erosion.

**12. An agricultural sediment basin** is a structure designed to reduce the transport of sediment, agricultural waste, and other pollutants from agricultural fields and barnyards to surface waters, closed depressions, and wetlands.

**13. Shoreline and streambank protection** is the stabilization and protection of stream and lake banks against erosion, and the protection of fish habitat and water quality from impacts caused by livestock. Methods include fencing, shaping, and seeding of vegetation, along with the use of rock, riprap, bioengineering, or other structures to stabilize shorelines and/or provide fish habitat.

**14. Shaping and seeding** is the planting of vegetation, such as trees, shrubs, vines, grasses, or legumes, on highly erodible or critically eroding areas. This vegetation stabilizes the soil, reduces damage from sediment and runoff, and improves wildlife habitat and aesthetics.

**15. Streambank fencing** excludes livestock from the shore area to prevent trampling and grazing, protecting the riparian habitat.

**16. A Remote or alternate watering system** is a system of portable tanks, pumps, and pipes designed to bring water to livestock in all grazing cells rather than allow the animals to have direct access to streams where erosion can occur.

**17. Shoreline buffers** are permanent vegetated areas immediately adjacent to lakes, streams, channels, and wetlands, designed and constructed to manage critical non-point source pollution or to filter pollutants from non-point sources.

**18. Wetland restoration** is the construction of berms or the destruction of tile lines or drainage ditches to create conditions suitable for wetland vegetation.

**19. Barnyard runoff management** includes the structural measures to redirect surface runoff around the barnyard and collect, convey, or temporarily store runoff from the barnyard. Management includes measures such as sediment basins, roof gutters, and clean water diversions.

**20. Animal lot relocation** involves moving an animal lot from a critical site, such as a floodway, to a suitable site to minimize the amount of pollutants from the lot entering surface or groundwater.

#### Channelization

Channelization straightens, diverts, widens, and deepens the stream channel to drain wetlands, improve navigation, control flooding, or divert water for agricultural or construction purposes. These activities alter aquatic and terrestrial habitats, increase wetland loss, and destabilize streambanks leading to increased erosion and sedimentation problems. Through the channelization of a stream, the velocity and flow of the waterway is increased, which leads to increased streambank erosion, sedimentation addition, and flooding.

#### Acid Precipitation

Rainwater is normally acidic, generally having a pH of around 5.6, from the reaction of carbon dioxide with oxygen in the atmosphere, which forms carbonic acid. However, acidity from non-natural sources has caused rainwater in some areas to have a pH of 4.9 or lower.

Acidity in precipitation (rain, snow, fog, dew, etc.) that forms from the reaction of air pollutants with water in the air is called acid precipitation. These pollutants mainly include sulfur and nitrogen oxides, which turn into sulfuric and nitric acids. Other times, these pollutants fall as dry deposition or acidic gases, and particles that are blown onto buildings, cars, etc. When it rains, the particles are washed from objects, increasing the pH of the rain. Sources of this pollution include vehicles and industrial and power generating plants. The effects of acid precipitation are usually felt many miles away from the source. Most pollutants in the project area are caused by emissions from more populated areas in the East and Midwest and from coal-burning power plants to the West.

#### Acidic, Basic, and Neutral

The term pH is used to quantify whether a solution is acidic or basic. It is measured on a scale of 1–14, with a pH of 7 being neutral.

Acidity is created by the concentration of hydrogen (H<sup>+</sup>) ions in solution, while basicity is created by the concentration of hydroxide (OH<sup>-</sup>) ions. A solution with an equal number of hydroxide and hydrogen ions is considered neutral. The lower the pH, the more acidic a solution is, while higher pHs are more basic.



The best way to document the pH of rain is to collect rainwater by setting out containers or installing rain gauges. A pH below 5.0 may indicate acid precipitation.

The 1990 Clean Water Act amendments include the most significant legislation that has been enacted to lessen emissions contributing to acid precipitation. The amendments promote the use of market-based approaches to reduce emissions, including pollution trading; encouraging innovative technologies to reduce sulfur and other emissions, and promoting the use of low sulfur coal. Through the use of stricter standards for the emission of sulfur and the use of innovative sulfur scrubbers, sulfur emissions are now 20 percent lower than when the legislation was enacted. This has translated to a significantly lower concentration of sulfuric acid in precipitation. Unfortunately, affordable technologies have not been developed to remove the nitrogen component. As a result, nitrogen emissions have not decreased and nitric acid precipitation is still a serious problem (Driscoll et. al., 2001).

Acid precipitation can have additional effects on water quality, besides lowering the pH. Toxic metals that have been deposited in soils are leached into streams and groundwater when they react with the anions found in acid precipitation. In some cases, the concentrations are high enough to negatively impact aquatic life. It is possible that the project area is being affected by these impacts of acid precipitation as well. Aluminum is another common metal that is increased in waterways that receive acid precipitation. Both aluminum and acidity disrupt the water-salt balance in fish, causing red blood cells to rupture and contributing to heart attacks. Acid precipitation can also leach important nutrients from forest soils and decrease the growth of a forest.

Fortunately, ecosystems can recover from acid precipitation impacts. Research shows that macroinvertebrate life in a stream re-establishes itself within three years of decreased acidity, whereas fish populations may take up to 10 years (Driscoll et. al., 2001). A visible lowering of sulfuric acid in streams of the project area has occurred as a result of the 1990 legislation. However, 1990 reductions were not adequate to allow for the recovery of aquatic ecosystems. Further and stricter regulatory controls are needed to reduce emissions from industrial and power plants, as well as vehicles.

The acid precipitation issue is particularly difficult to handle because there is often little that can be done locally to solve the problem. The active addition of alkalinity-producing chemicals to streams can be a temporary solution, but often causes more problems for aquatic systems. Individuals interested in reducing the impacts of acid precipitation can make changes to reduce their personal contribution to emissions by driving more fuel-efficient cars and using less energy, for example. Additionally, constituents should encourage their legislators to support stricter regulations that would further reduce the pollution from smokestacks and cars.

Although evidence points to a significant decrease in water quality of the project area due to acid precipitation, more research is needed to determine normal pH reference conditions for the project area and the extent of the impact caused by low pH precipitation.

#### Sewage Waste

Contamination from both public sewage treatment facilities and private on-lot systems is a potential concern. Public services are available in a small geographic area, but are concentrated in boroughs, which are more populated than townships. All of these systems have a point source discharge permit to discharge treated sewage waste, which may contain some amount of nutrients and bacteria. These discharges have the potential to impact stream health and public water supplies, particularly if they are malfunctioning. This could cause drinking water contamination and increased drinking water treatment costs, because improperly treated effluence can enter surface water and groundwater.



Between 1983 and 1995 it is estimated that 3.5 million gallons of raw sewage and sewage sludge were directly released into Brokenstraw Creek from the Youngsville Wastewater Treatment Plant. Under the direction of the plant manager, a bypass gate was installed to allow untreated wastewater to flow directly into Brokenstraw Creek, the meter measuring the flow of water through the plant was left unrepaired, and the removal of sewage sludge was not conducted on a regular basis. In 2000, the director pleaded guilty in federal court to six violations of the Clean Water Act. Since then, Brokenstraw Valley Area Authority received funding to upgrade and expand the treatment plant facilities (Environmental Health and Safety Online, 2007).

Prior to 2002, the Corry Wastewater Treatment Plant was frequently debilitated with increased flows of stormwater and groundwater caused by deteriorated lines, loose joints, and leaking manholes. Improvement projects were conducted in 1986 and 1995, but the influx of stormwater continued causing the plant to overflow and discharge untreated wastewater into Hare Creek. In 2002, PA DEP ordered a long-term compliance assurance policy and Act 537 update, which was completed along with the first phase of needed improvements. The plant is now permitted for flows up to 4 million gallons a day (mgd) while the average flow is 2.9 mgd. Organic loading is limited to 2,400 pounds per day, while the current use is 1,500 pounds per day (Graney, Grossman, Colosimo, & Associates, Inc & Erie County Department of Planning, 2003).

Rural, on-lot sewage systems typically contribute a great amount of waste into streams when they are not maintained properly. Conventional systems consist of a large tank designed to hold about two days of wastewater and allow solids to settle out, and a drain field that distributes wastewater so that it can be slowly absorbed into the underlying soil. These systems remove much of the bacteria, but are not very effective at removing nitrogen. They often “fail” when the drain field becomes clogged, causing raw sewage to back up out of the tank or through the ground and end up in streams and groundwater. The systems must be pumped out every few years to prevent buildup and clogs (BF Environmental Consultants, 2004).

More advanced on-lot systems are designed to remove nitrogen by moving effluence through a series of chambers containing different kinds of microbes, which uptake the nitrogen. These systems have pumps, moving parts, and other components that need to be inspected every few years. These more advanced systems can remove twice the amount of nitrogen as conventional systems, but are more expensive and can have greater environmental impacts if not pumped out (BF Environmental Consultants, 2004).

Nutrients and organic matter from sewage can cause an increase in alkalinity and conductivity of water. It is believed that these inputs may actually mitigate the impacts of AMD by raising the pH in streams that would otherwise be acidic.

### **Water Quality Monitoring**

Currently, there are no water quality monitoring efforts being undertaken on a watershed basis, but the Brokenstraw Watershed Council (BWC) conducted a visual assessment on Spring Creek through a Coldwater Heritage Grant.

There is a U.S. Geological Survey (USGS) water monitoring station in Youngsville, PA. The gauge is in partnership with USGS and the U.S. Army Corps of Engineers (USACE). It is located 500 ft from Matthews Run and 3.7 miles from the mouth of Brokenstraw Creek. Installed in 1908, the gauge has been providing flow data since 1909. The USGS gauges are in jeopardy due to a lack of funding for maintenance. Increased funding is needed to sustain stream flow, groundwater, water quality, and rain gauges and to expand monitoring capabilities both in number of gauges and in technological advances.

A watershed-wide water quality assessment or monitoring program is needed, including baseline data. This data can assist in determining the impacts on water quality in the region, when and where new impacts may be coming from, and how specific impacts may change conditions in the watershed.

A watershed assessment consists of a visual, chemical, and biological survey of the entire watershed to assess and document the features of the watershed and the impacts upon it. A visual assessment documents features, such as land-use, channel conditions, riparian zones, in-stream habitat, and water appearance. Chemical parameters, including flow, pH, dissolved oxygen, temperature, turbidity, phosphates, nitrates, total dissolved solids, and total suspended solids, should be collected. Biological surveys of benthic macroinvertebrates should be conducted. Conducting fish, mussel, and herpetological surveys are also beneficial, if conditions warrant these surveys.

The presence, absence, and composition of mussel and macroinvertebrate communities can indicate the quality of water. Freshwater mussels are only found in good quality waterways with specific sediment and physical habitats. Some macroinvertebrate species are very sensitive and cannot tolerate pollution, while others are more tolerant. The community composition of macroinvertebrates and the dominance of groups within different tolerance levels can be used to determine water quality.

## Water Quantity

The amount of water available for use is dependent upon the amount of groundwater recharge. During periods of drought, more water is being withdrawn and used than can be recharged back into the ground. Some areas in Pennsylvania and across the U.S. withdraw more water than what can be recharged on a regular basis. In these areas water quantity, in addition to water quality, becomes an extremely important issue.

Water is withdrawn from both surface and groundwater sources. Many public water suppliers utilize surface water by pumping water out of waterways to ensure it is safe for drinking by treating it before it is used by consumers. In many rural and suburban areas, public water systems are not available, or consumers utilize groundwater.

There are two providers of public water within the project area, located in Corry and Youngsville. Due to the area's rural location, the majority of residents rely on private wells for their water systems.

In order to utilize groundwater, it must first be brought to the surface by drilling into the sub-surface aquifer zone that contains the voids and cracks in which groundwater is stored. Water is pumped out of the well, causing the water in the aquifer to draw down. Water from adjacent aquifers flow toward the well and refill it.

There are two kinds of aquifers—confined and unconfined. In a confined aquifer, there is a layer of low-permeability rock above it, putting the aquifer under pressure. When a well is drilled into the aquifer, the pressure causes the water to overcome gravity and rise above the top of the aquifer. These are called artesian wells, and some artesian wells receive so much pressure that they flow without being pumped. Unconfined aquifers have a water table within them, or they do not have a low permeability layer restricting flow into or out of the aquifer. Wells established in these aquifers need to be pumped (Fleeger, 1999).

### Pennsylvania State Water Plan

In 2008, a draft of the updated Pennsylvania State Water Plan was unveiled providing the vision, goals, and recommendations to sustain a water use supply. The plan includes an inventory of water

availability, an assessment of current and future water use demands and trends, and an assessment of resource management alternatives and proposed methods of implementing recommended actions. An analysis of problems and needs associated with specific water resource uses, such as navigation, stormwater management, and flood control, was also addressed (PA DEP, 2008f).

In the updated State Water Plan, information is broken down into six watershed regions—Ohio, Great Lakes, Potomac, Delaware, Upper/Middle Susquehanna, and Lower Susquehanna. The project area is located within the Ohio region, which is subdivided into smaller regions, one of which is Upper Allegheny River Region, containing Brokenstraw Creek.

#### Water Use

In 2000, it is estimated that Pennsylvanians withdrew 9,950 million gallons of water per day. Of the water drawn, 93 percent came from surface waters. In New York, it is estimated that 12,100 million gallons per day were withdrawn. Table 3-2 shows the water withdrawal trends in Pennsylvania and New York from 1990 to 2000 (Sources: Huston, Barber, Kenny, Linsey, Lumnia, & Maupin, 2004).

In the U.S. in 2000, it is estimated that the largest water withdrawals were used for thermoelectric power—48 percent—and irrigation—34 percent. Public water supply utilized 11 percent, while the remaining 7 percent was utilized for industrial, mining, livestock, and aquaculture purposes (Huston, et al., 2004).

**Table 3-2. Water Use**

	Year	Groundwater			Surface			Total		
		Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
PA	1990	1,020	0	1,020	8,810	0	8,810	9,830	0	9,830
	1995	860	0	860	8,820	0	8,820	9,680	0	9,680
	2000	666	0	666	9,290	0	9,290	9,950	0	9,950
NY	1990	839	1.5	840	9,650	8,490	18,100	10,500	8,490	19,000
	1995	1,010	1.5	1,010	9,270	6,500	15,800	10,300	6,500	16,800
	2000	893	0	893	6,190	5,010	11,200	7,080	5,010	12,100

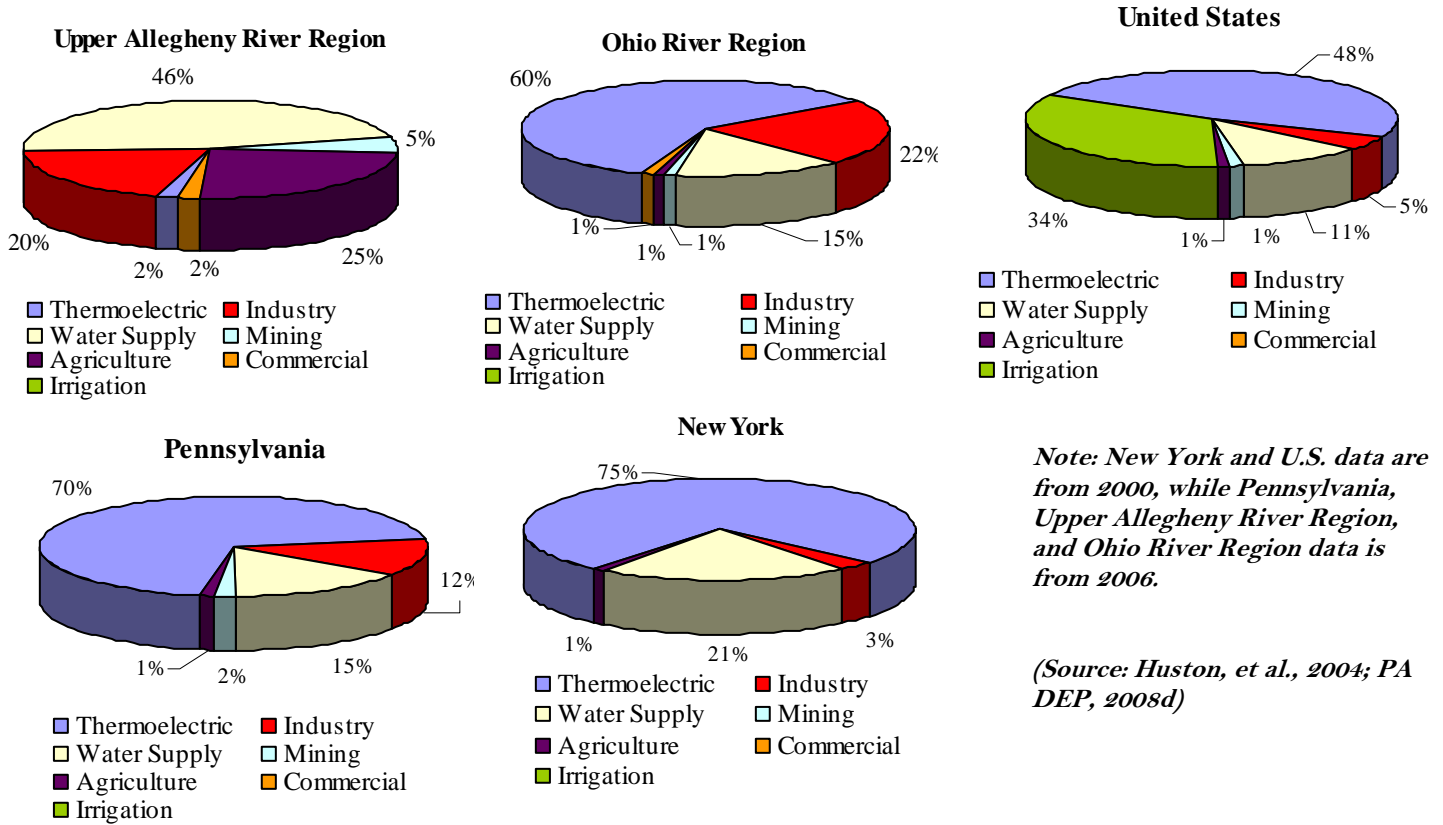
(Sources: Solley, Pierce, & Perlman, 1993 & 1998; Huston, et al., 2004)

The majority of the water withdrawn from the Ohio River region, the upper Allegheny River region, and in Pennsylvania and New York, as well as the U.S., was utilized for thermoelectric, industry, and public water supply uses. It is estimated that in 2000, the U.S. used 48 percent of the water withdrawn for thermoelectric uses. In the Ohio River region, thermoelectric processes used 60 percent of the water withdrawn and 2 percent in the upper Allegheny River Region. Figure 3-6 illustrates the uses of water withdrawn in the U.S., Ohio River Region, and upper Allegheny River region (PA DEP, 2008f).

## Water Quality Trading

Water quality trading is an innovative approach to reduce the overall pollution impact of a particular pollutant. It is achieved when one entity purchases the right to pollute from another entity in the form of credits—units of pollution reduction beyond levels required by federal or state rules (PSU, 2006). This method is only effective when there is a reason to decrease the amount of pollution being generated through a TMDL or NPDES permit, and if there is a difference in treatment cost and opportunities.

**Figure 3-6. Uses of Water Withdrawn by Region**



*Note: New York and U.S. data are from 2000, while Pennsylvania, Upper Allegheny River Region, and Ohio River Region data is from 2006.*

*(Source: Huston, et al., 2004; PA DEP, 2008d)*

In order for water quality trading to be effective, there must be a consensus among stakeholders and regulatory agencies to try an innovative approach and to engage in trading design and implementation issues. All trading should be conducted with legal, regulatory framework, such as the NPDES program, which requires point source polluters to obtain permits to discharge pollution in waterways of the U.S. and comply with the requirements of the Clean Water Act.

Within Pennsylvania, water quality trading is a voluntary program aimed at reducing nutrients from point and non-point sources. Credits can only be exchanged between comparable nutrients, such as nitrogen for nitrogen, expressed as a mass per unit time—lbs per year—between any combination of eligible parties. Trading may only occur in watersheds defined by DEP and may vary from stream segments to entire watershed basins, but must occur within the bounds of the same watershed.

Currently, water quality trading in Pennsylvania is limited to the Susquehanna and Potomac watersheds. There is a need to explore the potential for developing a trading program within the Allegheny River watershed and the framework needed to support it (PA DEP, 2008e).

## CHAPTER 4. BIOLOGICAL RESOURCES

Biological resources sustain and enhance the quality of our lives, while maintaining the health of ecosystems. Biological resources, like wood products, crops, and livestock, offer economic income. Wild game and fish offer opportunities for hunting, fishing, and wildlife watching. Trees, wildflowers, and wildlife can enhance our outdoor experiences. Plants clean water, air, and regulate temperature. Pollinators ensure sufficient crop yields and beautiful blooms. This chapter provides a comprehensive overview of the biology, habitats, and threats to these resources within the Brokenstraw Creek watershed.



*Bogs and other wetland habitats are common throughout the Brokenstraw Creek watershed*

### Natural Setting

#### Ecosystems and Biodiversity

An ecosystem is a group of plants and animals living together and interacting within a specific physical environment. Humans are as much a part of ecosystems as any other species. A biodiverse ecosystem includes a wide variety of species and community interactions; high biodiversity indicates a greater likelihood of a healthy, high-functioning ecosystem. The continued balance of nature depends on the existence of biodiversity. Each native species and wildlife community helps to maintain ecosystem integrity. Each species has a role to perform; whether a plant or animal provides food for wildlife or humans, pollinates, cleans water, decomposes, cycles nutrients, cleans air, or improves soils; they are fulfilling their individual role in maintaining ecosystem health and functionality. Losing one species can have profound effects on an entire ecosystem. The Brokenstraw Creek watershed—particularly the Spring Creek subwatershed—is believed to have very high biodiversity. Protecting water quality and surrounding land is critical in maintaining the diversity of life and healthy ecosystems within the project area.



*Skunk cabbage grows near a small pond*

#### Ecoregion Characteristics

An ecoregion is a geographic locality containing a compilation of distinct natural communities that interact and thrive in a particular area in ways that sustain their collective existence over a period of time (World Wildlife Fund, 2010). As mentioned in Chapter 2. Land Resources, two EPA-designated ecoregions were identified within the project area, the Erie Drift Plains and the North Central Appalachians ecoregions. In general, these regions are well-suited for trees. Predominately covered by hardwood forests, the dominant tree species are sugar maple, yellow birch, beech, and hemlock. Appalachian oak forests also occur, dominated by white and

red oaks. Wetlands—bogs, swamps, and marshes—are also found within the project area (Woods, Omerinik, & Brown, 1999).

In addition to EPA-designated ecoregions, the U.S. Forest Service (USFS) has delineated ecoregions, subregions, and subsections. Through this classification, the Brokenstraw Creek watershed is located within the Allegheny Plateau subsection of the Western Unglaciaded Allegheny Plateau subregion of the Eastern Broadleaf Forest ecoregion. This area is noted as being dominated by beech-maple forest, Appalachian oak forest, northern hardwood forest, mixed mesophytic forest, and a small extent of oak-

hickory forest. Less dominant forest types in the area include maple-ash-oak swamp forest, wet beech forest, beech-sugar maple forest, oak-maple forest, and mixed oak forest (McNab & Avers, 1994).

### **Natural Habitats**

A habitat is a specific area in which particular species of plants and animals naturally live or thrive. A variety of natural habitats occur within the Brokenstraw Creek watershed, ranging from unique wetland habitats, including bogs and fens, to forest and grassland habitats. Each habitat hosts its own diversity of plant and animal species, some of which cannot live elsewhere.

#### **Wetlands**

Wetlands are defined as areas having anaerobic or hydric soils, wetland vegetation, and evidence of the area being either permanently or seasonally inundated with water. They are functional ecological components of a watershed. Many feeder streams originate from wetlands in headwater areas, which aid in groundwater recharge. Wetlands in riparian areas and on the margins of farmlands are vital in filtering excess nutrients, chemical pollutants, and sediment from water before it enters streams. Also, wetlands harbor a multitude of plants and animals, making them biodiversity hot spots of the watershed. Several species of plants grow exclusively in wetlands. Wetland vegetation plays an important role in filtering water, slowing its flow to allow sediments to drop out, and allowing groundwater recharge. Wetland vegetation also provides a variety of food sources, cover, and nesting material for insects, birds, mammals, and other wildlife.



*Page Swamp exhibits woody vegetation characteristic to this type of wetland*

Throughout the Brokenstraw Creek watershed, an array of wetlands can be found. Six percent of the watershed is covered by wetlands, most of which are woody wetlands, usually swamps. The entire Brokenstraw Creek watershed, and the

Spring Creek subwatershed in particular, support some of the most outstanding glacial wetlands in Pennsylvania and southern New York. Several glacial fens supporting endangered and threatened plants and exceptional invertebrate diversity are widely scattered throughout the region (Bissel, J. Personal Communication, 2009).

Glaciers carved out kettles when they descended upon the area during the last ice age. These depressions have now filled up with water and peat, forming unique, acidic bog habitats that harbor rare plant and animal species. The glacial hills and wetland depressions within much of the Spring Creek valley are some of the most scenic vistas in northwestern Pennsylvania and southwestern New York (Bissel, J. Personal Communication, 2009).

Forested wetland areas provide critical habitat for species of waterfowl, turtles, and an assortment of other wildlife. They also play an important role in filtering water, controlling flood waters, groundwater recharge, and offering recreation potential. Forested wetlands are threatened by deforestation, hydrology alterations, draining, and the damming of associated streams.

#### **Rivers and Streams**

Many of the biological organisms that live in rivers and streams are indicators of water quality. These creatures are referred to as **bioindicators**. Freshwater mussels, aquatic macroinvertebrates, and lungless salamanders are all natural indicators of water quality and ecosystem health.



Characteristics of streams and rivers can vary greatly. Headwater streams are smaller and shallower than the larger order streams which they flow into. With these variations come an assortment of plants and animals that inhabit different sections of stream. Smaller, headwater streams are home to small fry (young fish) and aquatic macroinvertebrates. Small and fast flowing streams, especially those with an intact riparian forest buffer, tend to have cold water and host fish species, such as trout and dace. Streams that may be slightly warmer, but are still considered cool-water streams, are host to chubs, shiners, suckers, and other similar fish species. These fish provide food for larger fish, birds, and mammals.



*The confluence of two tributaries in the Brokenstraw Creek watershed*

In larger, slower flowing streams and rivers, adult fish and larger organisms can be found. In pool areas along streams, and in streams with little or no riparian vegetation to shade and cool the water, warm-water fish species, such as bass, bluegill, and sunfish, tend to thrive.

#### Forest Habitat

Forestlands provide habitat for plant and animal species, timber for fuel and wood products, income possibilities from other forest products for private forest owners, and recreational opportunities. Forests also play an important role in the regulation of global climate change and air quality. Carbon dioxide, one of the most abundant greenhouse gases, is naturally present in the atmosphere. When plants “breathe,” the process of photosynthesis converts water and carbon dioxide from the atmosphere into sugar for the plants’ growth and oxygen, which is released back into the air. The carbon removed from the atmosphere is stored in the plant’s leaves, stems, branches, roots and other components. When leaves or trees are downed, the carbon is contributed to the soil matter. Carbon dioxide is also released back into the atmosphere through respiration and the decomposition of organic matter. This natural exchange of carbon, along with other greenhouse gases, including those released from the burning of fossil fuels and gas combustion, contribute to the “greenhouse effect.”



*A forested area of Mead Park, located in Corry, PA*

In the absence of greenhouse gases, the earth would be a cold planet, void of life as we know it. Yet, excess greenhouse gases contribute to global warming. Human activities, such as deforestation, poor agricultural practices, vehicle exhaust and the burning of fossil fuels, have greatly increased the contribution of carbon dioxide to the atmosphere. The preservation of forests, maintenance of riparian forest buffers, and forest management practices that leave residual trees to grow at a faster rate, aid in carbon storage within plant and soil materials, rather than in the atmosphere.

Sustainable forestry practices and the use of Best Management Practices (BMPs) when utilizing forest resources will ensure the future health of forest ecosystems throughout the watershed. Often, foresters and landowners desire the quickest and greatest monetary return from a timber harvest, resulting in poor forestry practices, such as clear-cuts and high-grading. Clear-cuts eliminate all vegetation in a cut area, while high-grading removes the largest, most valuable timber in the lot. While both of these practices will provide a substantial return, they may not be the best ecological or economical choice. The return is a one-time gain; a forest of economic value may take 20 years or more to regenerate, and all of the best potential seed sources will have been eliminated from the area. Service Foresters are available to

assist private and public landowners with technical advice on sustainable forest management. Certified foresters provide cost-share assistance, Forest Stewardship Plans, regional planning, education, and assistance with tree planting and riparian buffer restoration (Pennsylvania Department of Conservation and Natural Resources [PA DCNR] Bureau of Forestry, 2009).

By selectively planning a harvest with a certified forester, one can ensure the continual return for their investment. Trees can be harvested on a staggered schedule to provide recurring income. The best quality trees can be left to reseed the area. Nearby, competing trees of less value can be removed to allow remaining trees a greater allocation of resources and nutrients, ensuring a faster growth rate and higher quality of wood. As tree leaves continue to fall to the ground each autumn, the soil is supplemented with organic matter and nutrients, which also contribute to better growth rates. Erosion and sedimentation are reduced by leaving some trees to stabilize the soil.

Maintaining a diversity of tree species is important to protect the forests from the devastating effects of insect and disease outbreaks. Plantation-style monocultures—areas consisting primarily of one species—are particularly vulnerable to invasive pest species that attack one species or family of trees. The emerald ash borer, an invasive beetle which has had devastating effects on ash tree populations, is one such insect. Invasive species will be further discussed later in this chapter.



*Selectively planning timber harvests and practicing sustainable forestry can help to maintain a healthy forest ecosystem while offering a continual return on investments*



*Many wildflowers, like this closed gentian—a species of concern in New York—grow in forest habitats*

Pruning and other maintenance activities will enhance the quality of timber in a forest lot. Selectively eliminating diseased and infested trees will improve the overall health of the forest. Wildlife should also be considered when harvesting a forested area. Brush piles made of cut limbs and saplings may provide cover for small game, birds, reptiles, and amphibians. Dead, standing trees, called snags, are utilized by cavity nesting birds and other wildlife for shelter. Insects that eat the decaying wood material provide food for many forest birds as well. While snags that are particularly large or hazardous should be downed to eliminate the safety risk, some snags should remain to provide habitat. Downed woody debris should also be left as habitat for creatures of the forest floor, such as amphibians, spiders, and insects.

Forestlands also offer products other than timber, which can be utilized for income by landowners. Herbs and mushrooms harvested in a sustainable manner may provide ample educational, recreational, and economical benefits. Botanicals and medicines may be derived from some forest species. Wreaths and other crafts can be made from limbs, vines, and other forest vegetation. Other forest products include maple syrup, fence posts, wood fuel, fruits, and nuts.

#### *Successional Forest Habitat*

Succession occurs after a forest habitat is disturbed by either a natural event, such as a tornado, or as a result of human actions, like logging. **Succession** is the natural process of forest regeneration over time. It can also occur as the edge of a forested area transitions gradually. For example, if an area once occupied by croplands lays fallow with herbaceous vegetation, like wildflowers and grasses, eventually



shrubs, small woody vegetation, and tree seedlings and saplings will grow. As time goes on, trees fully establish a mature forest covering the land. The entire process may take an extensive period of time and can occur on varying scales, from areas encompassing several hundred acres to areas created when an old tree falls in a forest and opens a gap in the canopy.

The period of succession referred to as the **early-successional** stage occurs when the land is primarily occupied by grasses, herbaceous vegetation, small shrubs, and tree saplings. During this critical phase, grasses, seeds, berries, and twigs provide abundant nutrition, and shrubs and dense vegetation offer cover and safety for birds and small mammals. An important successional stage, early-successional habitats are preferred by a variety of wildlife species, such as rabbits, certain warbler species, and the American woodcock (Rodewald, 2004).



*Middle-successional stage forests have a relatively dense understory and may be preferred by salamanders and interior-forest birds*

During the **middle-successional** stage of forest regeneration, otherwise known as the pole timber stage, trees grow and dominate the landscape. The understory is still relatively dense, harboring seedlings and some shrubby species that are more tolerant of shade. Salamanders and interior-forest birds may prefer this type of transitional habitat (Pennsylvania Envirothon, 2007).

Once trees are established, the habitat is referred to as a **mature forest** habitat. During this stage, trees that have been overtopped by competing, faster-growing, or longer-lived trees tend to die and form snags. These snags provide food, perches, and opportunities for cavity nesters, such as owls, woodpeckers, raccoons, and bats. Retaining downed wood on the forest floor also serves to provide habitat. In a mature forest, there is a greater abundance of mast-producing trees that offer acorns, nuts, and soft or fleshy fruits and seeds. Wild turkey, black bear, and pileated woodpeckers prefer mature forest habitats (Pennsylvania Envirothon, 2007).

Landowners and forest land managers should promote differing stages of successional forest habitats for wildlife species. Also, when timbering an area, foresters should stagger and soften the edges of cuts by leaving some older trees and shrubs on the perimeter, cutting in a meandering fashion to avoid abrupt transitions between habitats, which can lead to an increase in predation.

#### Urban and Backyard Natural Areas

Not only are rural forest blocks important for the sustainability of healthy ecosystems and water quality, but urban forestry also is an important aspect of watershed conservation. Trees planted in urban settings and along roadways perform a number of functions, ultimately improving the livability and attractiveness of communities. Trees in urban settings help to regulate heat radiation and ambient air temperature by shading sidewalks, parking lots, and roads. They can control erosion and help manage stormwater. Trees can also be utilized to reduce energy costs and improve property values. Trees in urban settings will also improve the air quality of the city, boost a community's sense of pride, and enhance business and economic development.



*Planting trees may attract many intriguing animals to your backyard, such as red squirrels*

Pennsylvania Community Forests and PA DCNR Bureau of Forestry are able to assist municipalities and commissions in organizing and implementing urban and community forestry management programs in Pennsylvania. In New York and Pennsylvania, the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture (USDA) offers the Environmental Quality Incentives Program (EQIP) to private forest lot owners. The New York State Urban and Community Forestry Council promotes comprehensive planning and urban forestry (PA DCNR Bureau of Forestry, 2009; NY DEC<sup>4</sup>).

Developing or maintaining woodlot natural habitats in backyards attracts a variety of wildlife, such as songbirds, butterflies, and toads, among other intriguing creatures, which may help reduce stress and anxiety. These species also help rid yards of harmful pests, which may reduce or eliminate the need for chemical pesticides.

Backyard natural areas offer opportunities for families to bond and learn about ecosystems together. Natural areas encourage outdoor recreation, which can help combat the obesity epidemic. Even small backyard habitats or nearby woodlots offer opportunities for the exploration of nature close to home.

Private property owners are encouraged to consider natural landscaping with native wildflowers, trees, and shrubs versus mowing their entire lawn, particularly in areas adjacent to water sources. Native plant species that are adapted to the local weather conditions are best for landscaping, as they require minimal watering and maintenance. Native plant species are often preferred by native wildlife for food and cover, as well. Reducing the amount of “lawn” on a property will save money in maintenance costs for gasoline powered equipment, as well as save energy used for powering the electrical equipment, reducing air pollution.



*A praying mantis searches for its next meal in a grassland habitat*

NRCS suggests planting drought tolerant warm-season grasses suitable to the region, such as big bluestem, little bluestem, buffalo grass, and beardgrass. These adapted grasses provide shelter and forage for wildlife, help improve soils, and require little upkeep. When maintaining a warm-season grassland, it is important to schedule hay harvest around the nesting season of ground-nesting birds, generally before May 1<sup>st</sup> and after August 15<sup>th</sup>, which will allow enough time for grass regrowth to provide cover throughout the winter months (USDA-NRCS, 2006). Snake mortality associated with mowing is another aspect to consider, especially with species of concern, such as the timber rattlesnake. If possible, mowing

**Table 4-1. Top 10 Most Popular Recreation Activities in Pennsylvania**

1. Walking
2. Picnicking
3. Visiting Historic Sites
4. Driving for Pleasure
5. Swimming
6. Wildlife Viewing
7. Night Sky Viewing
8. Dog Walking
9. Playground Use
10. Birding/Bird Watching

should take place in the colder months of December through March, when snakes and other reptiles and amphibians are overwintering. Another harvest practice that may reduce wildlife mortality is to begin mowing in the center of the field working your way out. This will give any animals time to take cover elsewhere.

## Wildlife

Wildlife species are a critical component in all ecosystems. In order to manage for a diversity of wildlife communities, a diversity of quality habitats must be preserved. Wildlife depends on the availability of food in all seasons, clean water, cover to protect them from predators and the elements, and space in which to forage, raise young, and expand their territory. Both year-round residents and migratory species rely on the resources of the Brokenstraw Creek watershed. Conserving natural areas, improving soil and water quality, and restoring degraded habitats will benefit wildlife populations.

Wildlife and fisheries diversity benefits recreation potential, which in turn improves the local economy and quality of life of watershed residents. According to *Pennsylvania's Recreation Plan* (PA DCNR, 2009), walking, wildlife watching, fishing, and birding were all among the top 10 favorite recreational activities among Pennsylvanians. These activities are enhanced by the presence of biodiversity, high quality habitats, and clean air and water. Therefore, these activities inherently include the preservation and conservation of wildlife, fisheries, and their associated habitats. A sampling of some of the wildlife of the Brokenstraw Creek watershed is highlighted in this section.



*Porcupines are one mammal species common to the project area*

### Mammals

Mammal diversity is typically associated with large, intact tracks of forest, which are more common to the Brokenstraw Creek watershed than in many places throughout the state. Habitats all along both Atlas Run and Spring Creek are somewhat pristine and diverse; they are capable of supporting more than 15–20 species of mammals of all sizes, both common and rare. The wetlands common along stretches of streams serve to support mammal species that have high moisture requirements, such as shrews and moles (Hart, J. Personal Communication, 2009).

Predominant mammal species of the region include the whitetail deer, red fox, woodchuck, raccoon, opossum, porcupine, striped skunk, cottontail rabbit, fox squirrel, long-tailed weasel, eastern chipmunk, short-tailed shrew, meadow jumping mouse, masked shrew, and hairy-tailed mole. Once common to the area, only small populations of black bear and bobcat remain. Historically common but now extirpated species include the bison, elk, mountain lion, and timber wolf. Both whitetail deer and beaver were once nearly or entirely extirpated, but have made remarkable recoveries (McNab & Avers, 1994).

### Whitetail Deer Management

Proper management of whitetail deer populations may help to keep the negative impacts associated with this species to a minimum. In areas that are overpopulated with deer, forest regeneration may be hindered, crops may be damaged, and resources may be scarce for other wildlife. Habitat destruction by overabundant deer populations has had a serious impact on songbird populations, especially woodland warblers. Many of the bird species affected are in decline. In addition, overabundant deer populations pose a significant risk to the safety of motorists and damage to vehicles when roadway collisions occur. Whitetail deer management at the state level is regulated in Pennsylvania through hunting permits

allocated by the Pennsylvania Game Commission (PGC), and in New York through hunting permits issued by the New York Department of Environmental Conservation (NY DEC).

Public land managers experiencing high density deer populations should incorporate considerations into land and habitat management techniques. Food plots may be established to improve herd health and decrease the animals' dependency on natural areas. Public and private landowners may now enroll in a program through PGC or NY DEC called the Deer Management Assistance Program (DMAP), which provides additional permits to hunt antlerless deer on registered properties to help reduce deer populations (PA DCNR<sup>1</sup>; NY DEC<sup>2</sup>).

### Beaver

Beavers are North America's largest rodent and the state animal of New York. Once trapped to extirpation throughout the region for their prized furs, reintroductions to the area occurred in the early 1900s. Those parent populations reproduced and expanded their territory, which now includes the Brokenstraw Creek watershed.

These small mammals are capable of extraordinary feats, like downing trees several feet in diameter, though they more commonly use smaller trees and saplings for food and the construction of their lodges and dams. By damming small streams, beavers create wetlands, thus providing habitat for a variety of other species. Sometimes their incessant behavior of damming to hush the sound of running water may lead to problems, especially when they clog drainage pipes used to regulate water levels in reservoirs and lakes or impact roadways. Beaver-proof cages can be constructed around drainage pipes to deter this behavior.

### Bats

Bats are common throughout Pennsylvania, and despite myths and common misperceptions, they do not readily spread rabies or entangle themselves in human hair. On the contrary, bats are both economically and environmentally beneficial, particularly in controlling insect populations. However, bats are currently being threatened by white-nose syndrome (WNS), which is devastating populations of all species of bats across Pennsylvania, New York, and the northeast. First documented in New York during the winter of 2006 and 2007, WNS is named for the white fungus that appears on the muzzles of dying bats. The exact cause of WNS is still unknown.

Depending on the species, bats may roost and/or hibernate in rock outcrops, cavities, mines, or caves. These habitats are highly vulnerable to degradation. Forestry and mining activities can disrupt and displace an entire colony of bats. If a bat species utilizing an abandoned mine is an endangered or threatened species, disturbances to those habitats could have damaging implications to the species as a whole. Gates constructed at the entrance of abandoned mines and caves allow for the passage of bats and exclusion of humans to limit disturbance to the habitat. Bat conservation is especially important now with the threat of WNS. Hibernacula—hibernation sites—should not be disturbed for any reason, in order to reduce the risk of spreading WNS and to avoid further distressing already sick bats (U.S. Fish and Wildlife Service [USFWS], 2009).

### Reptiles and Amphibians

While amphibian and reptile populations are most diverse in warmer climates, the wetlands within the Brokenstraw region attribute to a high level of herpetological diversity, despite harsher winters, during which these cold-blooded animals hibernate in order to survive. Amphibians depend on moisture to stay alive, while some reptiles are able to tolerate dryer conditions.



Amphibian and reptile species widespread within the region include the dusky salamander, American toad, spring peeper, snapping turtle, painted turtle, northern water snake, garter snake, smooth green snake, and milk snake. Many amphibians, particularly lungless salamanders, can be studied as indicators of water quality. Additionally, many terrestrial salamanders depend on the vernal pools present in forestlands of the Brokenstraw Creek watershed to lay eggs and reproduce. Reptiles, especially snakes, keep pest populations under control by consuming a variety of insects, mice, and voles (McNab & Avers, 1994).



*Spring peepers are easily identified by the X-shaped marking on their backs*

Eastern Hellbender Salamander

The eastern hellbender, a species of salamander found within the Brokenstraw Creek watershed, is considered to be very sensitive to pollution. It is completely aquatic, and depends on waterways that are cool and clear, containing many large rocks. Hellbenders are one of the largest salamanders in the world and the largest salamander in North America, reaching lengths of over two feet and weighing up to five pounds. Finding this species denotes a healthy stream ecosystem. Hellbender populations have declined throughout their range, primarily due to human misperceptions and pollution. Preserving healthy streams and restoring stream habitats that have become degraded will maintain current populations of hellbenders and other salamanders, as well as aid in increasing their numbers and distribution.

**Table 4-2. Amphibians**

American toad	Jefferson salamander	redback salamander
bullfrog	longtail salamander	spotted salamander
Cope’s gray treefrog	marbled salamander	spring peeper
dusky salamander	mountain dusky salamander	spring salamander
eastern hellbender	northern leopard frog	valley & ridge salamander
eastern newt	northern slimy salamander	Wehrle’s salamander
four-toed salamander	northern two-lined salamander	western chorus frog
gray treefrog	pickerel frog	wood frog
green frog	red salamander	Woodhouse’s toad

Timber Rattlesnake

This venomous pit viper has developed a bad reputation without much just cause. The secretive and docile timber rattlesnake, although quite poisonous, does not readily attack humans and is a rather important species of the forest, especially for pest control. Timber rattlesnakes will hide, move away, or warn humans with their signature rattle to avoid confrontation. They will only strike if surprised, cornered, or touched. Maintaining a buffer of three feet around even the largest adults should prevent any bites from occurring (PSU, 2004).

Timber rattlesnakes can be found in both black and yellow color phases throughout the Pennsylvania and New York portions of the watershed. They have a large, flat, triangular head; it is shaped in such a way due to the facial heat-sensing pits used for detecting prey. Rare specimens may grow up to 70 inches, while the average snake is between 35 and 50 inches in length. They have a rattle at the end of their tail

that is used to warn intruders before defending themselves. Segments are added to the rattle each time the snake sheds its skin, once or twice a year. However, the rattle is fragile and often breaks. Therefore, counting a snake’s rattle segments is not an accurate measure of age (PA DCNR<sup>3</sup>).

In both New York and Pennsylvania, timber rattlesnake populations are declining. They are threatened within New York State, and a candidate species in Pennsylvania. Their decline is due mostly to habitat loss and fragmentation, but their negative reputation with humans has also affected their numbers. Snakes are often killed by those who encounter them, simply because they feel that the snake poses a threat. However, timber rattlesnakes are very beneficial species, and their populations within the region and throughout their range are necessary in maintaining healthy ecosystems. If a timber rattlesnake becomes a nuisance, or is taking up temporary residence near buildings or homes, contact a local conservation officer to have the snake removed (PA Fish and Boat Commission [PFBC], 2004).

**Birds**

Birds vary from small, pollinator hummingbirds to forest dwelling warblers and robins. Larger birds of prey, such as eagles, hawks, and owls, hunt small rodents and fish. Birds provide hours of enjoyment for birdwatchers, they control insect and rodent pests, and pollinate wildflowers and trees.

Some birds common to the Brokenstraw Creek watershed are the red-tailed hawk, great horned owl, belted kingfisher, northern



*Redwing blackbirds are fairly common within the Brokenstraw Creek watershed*

flicker, great crested flycatcher, white-breasted nuthatch, eastern bluebird, gray catbird,

American redstart, scarlet tanager, chipping sparrow, and ruby-throated hummingbird. Wood duck populations, once nearly extirpated, made a recovery in the 20<sup>th</sup> century, and are once again fairly common (McNab & Avers, 1994).

**Bald Eagle**

Bald eagle populations were once ravaged by the secondary effects of excessive hunting and pesticide pollution; but bald eagles are now on the rebound. In the 1980s, only three breeding pairs remained in Pennsylvania; while as early as 1960, only one pair remained in New York. Reintroductions of juveniles in both Pennsylvania and New York and

protection through the Endangered Species Act led to a steady increase in populations. As a result, the bald eagle’s status was downgraded from endangered to threatened in Pennsylvania, New York, and on the federal level. PGC and NY DEC manage this important bird species in their respective states.

As a symbol of our nation, this regal creature is a top predator on its food chain, and it is one of the largest birds of prey, weighing up to 17 pounds with a wingspan of seven feet. Bald eagles primarily feed

**Table 4-3. Reptiles**

bog turtle
coal skink
common garter snake
common map turtle
common musk turtle
Dekay’s brown snake
eastern box turtle
eastern fence lizard
eastern hognose snake
eastern mud turtle
eastern ribbon snake
five-lined skink
milk snake
northern water snake
painted turtle
queen snake
racer
rat snake
red-bellied snake
ring-necked snake
short-headed garter snake
smooth earth snake
smooth green snake
snapping turtle
spotted turtle
timber rattlesnake
wood turtle
worm snake

upon fish, other birds, and small mammals, but they have often been observed stealing prey from other birds. In 2008, 15 breeding pairs of bald eagles were documented in NY DEC Region Nine, which encompasses the New York portion of the watershed. In Pennsylvania, Warren County has six confirmed nesting sites, and Erie County has three (NY DEC<sup>1</sup>; PGC, 2009a).

The greatest threat to the continued successful recovery of bald eagle populations is human disturbance. Over-use of recreational waters, which bald eagles heavily rely on for food sources, hinders their ability to thrive. In addition, too much human disturbance may lead to nest abandonment and decreased reproductive success (PGC, 2009b).

#### Short-eared Owl

The short-eared owl is an endangered bird in Pennsylvania and New York, getting its name from the lack of feather tufts on its head, which are referred to as “ears” in other owl species although owls have internal ears. Short-eared owls are migratory, and spend most of their time in the region during winter months. These owls prefer open spaces, and have been found to inhabit reclaimed mine areas (NY DEC<sup>6</sup>; PGC, 2009c).

Unlike most owls, the short-eared owl is not nocturnal, but crepuscular, meaning they are most active at dusk and dawn. All owls are beneficial to farmers because of their pest control capabilities, feeding on mice and other rodents that damage crops. Agricultural lands comprise a majority of the large, open areas throughout the watershed that this species prefers. Conservation programs on agricultural lands may help to sustain this species, especially if tall grasses are left on fields over the winter (PGC, 2009c).

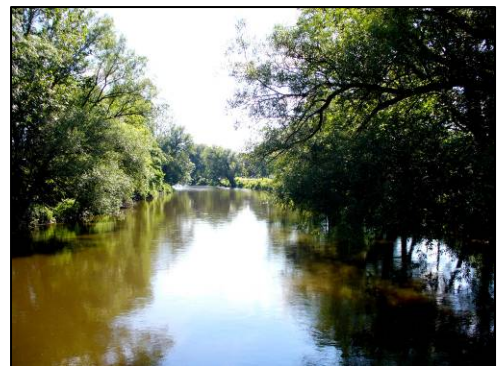
#### Northern Goshawk

The goshawk is a ferocious, yet secretive bird that requires large tracts of forest for nesting, unlike most hawk species. As expanses of mature, old-growth forests decline, so do goshawks. They are listed as a species of concern in New York, and considered imperiled in Pennsylvania. Goshawks build numerous large nests within their territory, but they only use and defend one nest each year, if any. The unused sites provide essential nesting opportunities for birds that do not build their own nests, such as spotted owls and great gray owls, as well as Cooper's hawks, red-tailed hawks, and great horned owls, among other species. Conserving large tracts of mature forests within the watershed will help ensure the survival of this great bird and many other forest species within the region (Center for Biological Diversity).

### **Fish and Aquatic Invertebrates**

Most of the waterways within the Brokenstraw Creek watershed are High-Quality Coldwater Fisheries (HQ-CWF) that support native trout populations, which provide sporting opportunities for fishermen. Some 135 species of fish can be found within the Ohio River watershed in Pennsylvania, which the smaller Brokenstraw Creek watershed is a part of (Appendix G). Of these, 12 species of fish known to inhabit Brokenstraw Creek and its tributaries are species of concern.

Fish species vary depending on the size, temperature, and degree of pollution in a particular stretch of stream. The most prevalent fish species include the common shiner, mottled sculpin, brook stickleback, honeyhead chub, and western lake chubsucker in streams; and largemouth bass, bluegill, channel catfish, and crappie in larger waterbodies (McNab & Avers, 1994).



*The mainstem of Brokenstraw Creek, near its mouth in Youngsville, PA*





*A riffle along Winton Run; many species of aquatic invertebrates prefer this type of habitat*

The watershed's high quality streams, some of which are considered to be Exceptional Value Coldwater Fisheries (EV-CWF), also support bottom-dwelling aquatic insect larvae and nymphs that can help conservationists determine the health of the watershed. Mayflies, caddisflies, water pennies and hellgrammites, among other macroinvertebrates, spend their larval phases in aquatic habitats. Detecting these sensitive species' larvae in a stream is an excellent indicator of high water quality and good in-stream habitat. At the bottom of the food chain, these species also serve as food for fish, amphibians, reptiles and crustaceans that call the waterways of the Brokenstraw home.

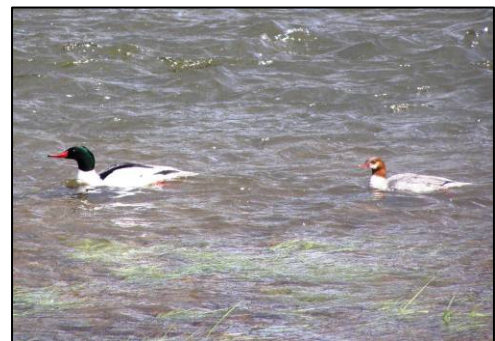
Yet another indicator of water quality within the Brokenstraw Creek watershed are its freshwater mussel populations. These filter feeders can only survive in water that is not overly polluted or degraded; they are considered the most imperiled fauna in North America. Brokenstraw Creek, as part of the Allegheny River system, has several endemic mussel populations, some of which are species of concern. Elktoe, creek heelsplitter, and round pigtoe are just some of the species of mussels that dwell within the Brokenstraw watershed.

## Species of Concern

Plants and animals are ranked on state and global scales based on the number of times the species has been documented in a geographic area. Most species are ranked, even if they are not threatened or endangered. In Pennsylvania, a "species of concern" has a ranking of "vulnerable" or lower. In New York, a "species of concern" is not yet considered threatened or endangered, but concern for its welfare has been documented. Global ranks are assigned based on data collected at similar state offices worldwide as a part of a network called NatureServe ([www.natureserve.org](http://www.natureserve.org)).

The Endangered Species Act of 1973 (and its amendments) provides broad protection for aquatic and terrestrial species of wildlife and plants listed as threatened or endangered. An **endangered** species is considered to be in danger of becoming extinct throughout its range. A **threatened** species is at risk of becoming endangered unless special action is taken. A **candidate** species is one that has been proposed by a state or federal agency for listing as threatened or endangered.

In New York, NY DEC determines the threatened or endangered status of all species. In Pennsylvania, threatened or endangered status is determined by the appropriate state agency. For instance, the PGC is responsible for assigning state statuses to bird and mammal species, while PFBC is responsible for fish, amphibians, and reptiles. Since there is no state agency that oversees invertebrates, such as moths and butterflies, these species can only receive threatened or endangered status if they are federally listed. Therefore, there may be some species that technically meet the state threatened or endangered criteria, but have not officially been designated. These species are typically monitored by Pennsylvania Natural Heritage Program (PNHP). New York also has a Natural Heritage Program which facilitates conservation of rare animals, plants, and natural communities (NY DEC<sup>5</sup>).



*Common mergansers are visitors to the watershed, but do not breed in the area*

Provisions are made for listing species, as well as for the development of recovery plans and the designation of critical habitat for listed species. As part of both federal and state acts, an environmental assessment of properties for species of concern is required before development projects can be permitted. However, rather than stopping development altogether, changes in design or timing of construction can often be made to protect these important species and habitats.

Within the Brokenstraw Creek watershed, 145 species of concern have been identified, including 75 plants, 13 birds, 31 invertebrates, six reptiles, 13 mammals, and two amphibians. In addition, two geologic features and 10 natural community types have been listed among the species of concern as important natural features and habitats of conservation significance. To protect these important species and landowners where they occur, exact locations of species cannot be provided. Appendix H lists state and global rankings for species of concern identified within the project area.

## Conservation Areas

### Pennsylvania Natural Heritage Areas

In the state of Pennsylvania, County Natural Heritage Inventories (CNHIs) are conducted by PNHP. PNHP is a collaborative organization dedicated to the collection, tracking, and interpretation of information regarding Pennsylvania's biodiversity. PNHP partners include Western Pennsylvania Conservancy, PA DCNR, PGC, and PFBC. PNHP is a member of NatureServe, which coordinates natural heritage efforts in all 50 U.S. states, Canada, Latin America and the Caribbean.

Natural heritage inventories identify and map the most significant natural places in a county for rare, threatened, and endangered species, as well as unique natural communities. Additionally, landscape-level elements, such as large contiguous blocks of forest and high-quality watersheds, are also identified. The final product of the CNHI is a report highlighting specific biological diversity and conservation areas, giving detailed management recommendations for their protection. These reports can be utilized by local municipalities, counties, utility companies, and groups involved with comprehensive planning, zoning, review of development proposals, and other objectives (PNHP, 2010).

Natural areas identified in CNHIs are called **Biological Diversity Areas (BDAs)**. BDAs are recognized as supporting species or natural communities of concern; high-quality natural communities or ecosystems; or exceptional natural diversity. The core of these areas is typically small and surrounded by a larger area of supporting habitat. **Landscape Conservation Areas (LCAs)** are larger areas of land that contain minimal human disturbance, and allow ecosystems to function on a landscape level. These areas often contain multiple BDAs. See Table 4-4 for a description of BDA significance rankings.

The Brokenstraw Creek watershed covers portions of the Pennsylvania counties of Crawford, Erie, and Warren; all of which have completed CNHIs. Following is a brief description of the 22 BDAs located within the Pennsylvania portion of the Brokenstraw Creek watershed, all of which are located in Warren County (Figure 4-1). Specific names and exact locations of rare species are sometimes omitted from this report and CNHIs to protect those species and the landowners where they occur. Complete CNHIs can be downloaded from the PNHP website at: [www.naturalheritage.state.pa.us](http://www.naturalheritage.state.pa.us).

**Table 4-4. Significance Rankings for BDAs**

Significance Rank	Description
Exceptional	Sites are of exceptional importance for the biological diversity and ecological integrity of the county or region, containing one or more occurrences of state or national species of concern or a rare natural community of adequate size, condition, and extent. These areas deserve complete and strong protection.
High	Sites are highly important for biological diversity of the county or region, and just like exceptional sites, contain species of concern or natural communities that are highly ranked. Typically large and primarily undisturbed, these sites deserve strong protection.
Notable	Sites contain occurrences of species of concern or natural communities that are either more common or of smaller size and extent than exceptional or high rank areas, or have activity and disturbance. These sites deserve protection within the context of their characteristics, degree of disturbance, and place in the community.
Local	Sites have great potential for protecting biodiversity in the county, but have not yet been found to contain species of concern or state significant natural communities. Because of their size, undisturbed character, or proximity to other significant areas, these sites deserve further study and investigation as possible high or exceptional sites.

**Allegheny River BDA**

Significance: Exceptional

Location: Only the portion of this BDA within Brokenstraw Township falls within the boundaries of the watershed, although it stretches through Conemaugh, Deerfield, Limestone, Pleasant, Triumph and Watson townships along the Allegheny River.

Description: The core of this BDA extends from the mouth of Brokenstraw Creek at Irvine, south into Forest County where it is referred to as the Middle Allegheny River Conservation Area. Only the portion of this BDA surrounding the mouth of Brokenstraw Creek falls within the boundaries of the watershed. In total, over 21 miles of aquatic and riverine habitats along the Allegheny River in Warren County support nine animal and four plant species of concern. High-quality silver maple floodplain forests are present along the river. These forests are dominated by silver maple, sycamore, and American elm. This section of the river supports a rich diversity of aquatic organisms, particularly freshwater mussels and fish.



*The confluence of Brokenstraw Creek and the Allegheny River*

Rare Occurrences: Three mussel species of concern, long-solid, round pigtoe, and wavyrayed lampmussel; one aquatic animal species of concern, Ohio lamprey; three plant species of concern, white trout-lily, stalked bulrush, and Tuckerman's panic-grass; two aquatic plant species of concern, grassy pondweed and red-head pondweed; and five additional species of concern that cannot be named can all be found within this BDA, but may not necessarily be found within the Brokenstraw Creek watershed portion of the BDA.

Threats and Stresses: The presence of numerous freshwater mussel populations and other aquatic species throughout the Allegheny River is indicative of high-quality water. Erosion, caused in part by deforestation, poor agricultural practices, and destruction of riparian zones, has led to



increased silt loads and shifting, unstable stream bottoms. Siltation and contaminants, such as heavy metals, pesticides, and abandoned mine drainage, have long been recognized as threats to mussels.

Recommendations: In the upstream watershed, timbering and road development or other construction activities should be kept away from riparian corridors in order to avoid degrading important aquatic and streamside habitat within the tributaries flowing into the Allegheny River and floodplain habitat along the river. Land use within the watershed has been compatible with maintaining the high-quality conditions within this site, but the anticipated upswing in gas development could pose a challenge to maintaining water quality. Any planning of future development within the watershed should seek to avoid potential impacts to both the physical character and water quality of the Allegheny River.

### **Benson Swamp BDA**

Significance: Exceptional

Location: Columbus and Freehold townships

Description: The core of this BDA is delineated around hemlock and mixed hardwood palustrine forest with pockets of scrub-shrub/emergent wetlands. Over half of this BDA's core is contained within State Game Lands 306. The headwaters section of Coffee Creek falls within this wetland complex, along with Cold Spring Brook and Pine Valley Creek. There are forb meadows and shrubby thickets. A variety of woody and herbaceous species populate the area, including six species of concern. The northern portion of the wetland is forested, and there are hummocks in hydric areas surrounded by slow moving water. The western end of the swamp is mostly pastured or has been pastured in the past; old fence lines still remain. Beaver activities and logging have limited the amount of forest in the western part of the wetland, while an Erie-Lackawanna Railroad right-of-way runs along the south side of Benson Swamp. Pastures and fields border the swamp to the north along Route 957. Oil and gas wells are present along the edges of the swamp, and much of the upland landscape surrounding the core of this BDA is in agricultural production.

Rare Occurrences: Six plant species of concern occur at this site, including Clinton's woodfern, soft-leaf sedge, red current, highbush cranberry, lesser panicled sedge, and a sensitive species of concern that cannot be named at the request of the jurisdictional agency overseeing its protection.

Threats and Stresses: Threats to the site include the invasive pest *Viburnum* leaf beetle, which eats highbush cranberry; degradation of the surrounding forest which could harm the water quality of this wetland; the influx of non-point source pollution due to runoff from agriculture and residential areas; damage from present gas wells and the threat of new gas well development; runoff from dirt and gravel roads; and the railroad right-of-way that is impeding the flow of water and threatening wetland plants.

Recommendations: Management options to control the *Viburnum* leaf beetle should be explored, remaining forest cover in the surrounding area should be left intact, establishing riparian buffers near streams will control runoff, and local landowners should be encouraged to use BMPs to properly manage agricultural nutrients.

### **Blue Eye Run BDA**

Significance: Notable

Location: Pittsfield Township

Description: The section of Blue Eye Run that lies within this site provides habitat for the American brook lamprey, an aquatic animal species of concern. Blue Eye Run, a medium gradient, small stream with sandstone geology, is a tributary to Brokenstraw Creek.

Rare Occurrences: A Pennsylvania imperiled species, the American brook lamprey.

Threats and Stresses: Because this BDA is within State Game Lands 143, it faces no imminent threats. Loss of forest cover in the area could be detrimental, and runoff from the dirt and gravel road that parallels Blue Eye Run for the entire stretch of this BDA are potential issues.

Recommendations: Preserve the forested river and stream corridor, and keep timbering and road development away from the area.

### **Brokenstraw Creek BDA**

Significance: High

Location: Columbus and Spring Creek townships

Description: This BDA contains forested wetlands east of the confluence of Brokenstraw Creek and Damon Run. This section of Brokenstraw Creek is a low-gradient, large stream with sandstone geology, sustaining two plant species of concern. The supporting landscape is comprised of forest slopes and agricultural development.

Rare Occurrences: Broad-leaved water plantain and pumpkin ash can be found at the site, both are critically imperiled plants in Pennsylvania.

Threats and Stresses: The emerald ash borer, and invasive beetle that feeds on all species of ash trees, threatens the population of pumpkin ash, a globally rare species. Removal of forest cover surrounding the area, especially on steep slopes, could be detrimental. Dirt and gravel roads near the waterway potentially pose an additional threat.

Recommendations: Remaining forest cover in the surrounding area should be left intact.

In areas that are not forested, establishing a riparian buffer next to the stream and encouraging landowners to control nutrient runoff through BMPs would ensure high water quality in the future.

### **Brokenstraw Creek at Horn Siding BDA**

Significance: Notable

Location: Pittsfield and Spring Creek townships

Description: Nearly half of this BDA is located within State Game Lands 143, where the river is a low-gradient, large stream with sandstone geology. It is habitat for the riffle snaketail dragonfly, a species of concern. The surrounding area is comprised of forested wetlands, upland fields, and steep, forested slopes.

Rare Occurrences: A Pennsylvania imperiled dragonfly species, the riffle snaketail.

Threats and Stresses: Forest cover removal in the surrounding area, especially on steep slopes, could threaten water quality. Dams, channelization, and runoff from dirt and gravel roads are additional potential threats.

Recommendations: The remaining forest cover surrounding the BDA should be kept intact, while landowners should be encouraged to use BMPs to establish riparian buffers and control nutrient runoff.

### **Brokenstraw Creek Impoundment Marsh and Route 77 Impoundment Marsh BDAs**

Significance: Notable, High

Location: Spring Creek Township

Description: These BDAs are designated around impoundment marshes along Brokenstraw Creek that support five plant species of concern. Brokenstraw Creek Impoundment Marsh BDA is an open marsh dominated by bur-reed, false water-pepper, willows and sedges. Route 77 Impoundment Marsh BDA is largely a forested wetland south of an open marsh. The marsh consists of open water with pockets of graminoid sedges and scrub-shrub swamp with scattered trees and snags. These two BDAs share a supporting landscape, which extends from core habitats upslope to the immediate watershed hydrologically linked to these wetlands. The landscape is in agricultural and residential development with steep, forested slopes and upland forest patches. Both BDAs have state roads passing through their core habitats.

Rare Occurrences: Five plant species of concern, bog bluegrass, highbush cranberry, lesser panicled sedge, red currant, and white adder's mouth, grow within these two BDAs.

**Threats and Stresses:** *Viburnum* leaf beetle, an introduced pest that eats highbush cranberry, threatens this vulnerable species. Given the roadside location of these sites, direct threats to all of the plant species of concern include disturbance to the plants and their habitats by roadside maintenance activities, such as chemical spraying and widening of the road. Non-point source pollution from agricultural development within the immediate watershed also presents a threat to these wetlands.

**Recommendations:** Management options for the control of the *Viburnum* leaf beetle should be investigated. Remaining forest cover in the immediate watersheds surrounding these marshes should be left intact. Workers involved in roadside maintenance should be informed of the presence of the plant species of concern, and application of herbicides should be avoided. Establishing riparian buffers adjacent to roads would aid in lessening the input of sediment to the creeks caused by road grading and stream crossing. Encouraging landowners to properly manage agricultural nutrients would help to limit the eutrophication of the streams.

### **Brokenstraw Valley Seepage Flats BDA and Plank Road BDA**

**Significance:** High, Exceptional

**Location:** Columbus Township

**Description:** These two BDAs, separated by Brokenstraw Creek, each support plant species of concern in Pennsylvania. Brokenstraw Valley Seepage Flats BDA is primarily forested with a seepage channel that flows to an intermittent stream that is a tributary to Brokenstraw Creek. Pockets of speckled alder scrub-shrub wetland are within the forested areas. Nearly half of the core habitat for this BDA lies within State Game Lands 197. Plank Road BDA is located south of Brokenstraw Creek and is known as the Hansen Tract to local botanists. This site is comprised of a densely vegetated herbaceous seep beneath a powerline right-of-way within a small patch of forest. Agricultural development is prominent in the surrounding landscape to the west, and much of the land is forested east of the core habitat. Two paved roads pass through the site. All plant species of concern found at both of these BDAs are associated with wetland habitats.

**Rare Occurrences:** Between these two sites, a total of eight species of concern can be found, including highbush cranberry, red currant, bog bluegrass, Bebb's sedge, Clinton's wood fern, naked bishop's cap, thin-leaved cotton-grass, and an additional plant species of concern that cannot be named.

**Threats and Stresses:** *Viburnum* leaf beetle is an introduced pest that eats highbush cranberry, threatening this species. Non-point source pollution from agricultural development and residential areas within the core habitat and immediate watersheds of these wetland habitats pose the greatest threat to both BDAs. Application of herbicides and mowing for maintenance of the powerline right-of-way in Plank Road BDA also poses a threat to rare species found in this BDA. Displacement by invasive exotic plant species that typically colonize disturbed habitats also may be a threat.

**Recommendations:** Management options for the control of the *Viburnum* leaf beetle should be investigated. Remaining forest cover in the immediate watershed surrounding both BDAs should be left intact to provide a buffer against non-point source pollutants, such as sediment and chemicals. Establishing riparian buffers adjacent to the wetland and encouraging local landowners to properly manage agricultural nutrients through BMPs would aid in lessening the input of runoff into these areas, and would limit eutrophication of streams that flow into them.

### **Cold Spring Brook BDA**

**Significance:** High

**Location:** Columbus Township

**Description:** The section of Cold Spring Brook within this site provides habitat for two fish species of concern. It is a tributary to Coffee Creek and a moderate-gradient, small stream with sandstone geology. The southern third of the site is within State Game Lands 306.

Rare Occurrences: Two fish species of concern can be found at this site, the American brook lamprey and the brook stickleback. Both are considered imperiled in Pennsylvania.

Threats and Stresses: Runoff from two roads that run through the BDA and the Erie-Lackawanna Railroad threaten the area. Non-point source pollution from agricultural development and residential areas within the immediate watershed of the stream also pose a threat. Additional loss of forest cover within the core areas may also cause problems.

Recommendations: Remaining forest cover in the immediate watershed surrounding Cold Spring Brook should be left intact. Establishing riparian buffers adjacent to the stream and encouraging local landowners to properly manage agricultural nutrients through BMPs would aid in lessening the input of runoff into the stream.

### **Columbus BDA**

Significance: High

Location: Columbus Township

Description: Columbus BDA contains aquatic habitat at the confluence of Coffee and Brokenstraw creeks, two low-gradient streams with sandstone geology, that supports three mussel species of concern. Because mussels are dependent upon good water quality and physical habitat conditions, as well as an environment that will support populations of host fish, they are considered good indicators of the health of aquatic ecosystems.

Rare Occurrences: Three species of freshwater mussels, the creek heelsplitter, elktoe, and wavy-rayed lampmussel, dwell in the waterways within this BDA.

Threats and Stresses: Erosion, caused in part by deforestation, poor agricultural practices, and destruction of riparian zones, can lead to increased silt loads and shifting, unstable stream bottoms. Siltation and contaminants, such as heavy metals, pesticides, and acid mine drainage, are all recognized as threats to mussels.

Recommendations: Forested stream corridors should be preserved; timbering and road development should not encroach upon the area, and a high degree of forest cover in the surrounding area should be maintained.

### **Confluence of Brokenstraw and Little Brokenstraw Creeks BDA**

Significance: High

Location: Brokenstraw and Pittsfield townships

Description: This BDA is delineated around aquatic habitat at the confluence of Little Brokenstraw and Brokenstraw creeks that supports three mussel species of concern. Because mussels are dependent upon good water quality and physical habitat conditions and an environment that will support populations of host fish, they are considered good indicators of the health of aquatic ecosystems.

Rare Occurrences: Three species of concern, elktoe, Ohio pebblesnail, and wavy-rayed lampmussel, can be found in this BDA.

Threats and Stresses: The presence of freshwater mussel populations is indicative of high water quality. Erosion, caused in part by deforestation, poor agricultural practices, and destruction of riparian zones, has led to increased silt loads and shifting, unstable stream bottoms; and therefore, declining mussel populations. Siltation and contaminants, such as heavy metals, pesticides, and abandoned mine drainage, are threats to mussels.

Recommendations: Preserve forested stream corridors; keep timbering, road development and other construction activities away from the area. A high degree of forest cover should be maintained for additional protection of the water quality and ecological integrity of the aquatic ecosystems.

**Eldred Hill BDA**

Significance: Notable

Location: Spring Creek Township

Description: This site provides habitat for an animal species of concern that cannot be named at the request of the jurisdictional agency overseeing its protection. This species relies on early successional habitats that are in or near wetlands. This animal was found near a group of small seepage wetlands in a forested area adjacent to hayfields. It may also be using the edges of the hayfields or a nearby tributary of Brokenstraw Creek as habitat.

Rare Occurrences: An animal species of concern, which cannot be named.

Threats and Stresses: The forest here is relatively young, and as it matures and the canopy closes, it may no longer support the species of concern. Pesticide use in the adjacent hayfields could harm the species of concern, which preys on invertebrates.

Recommendations: Maintaining a young forest with an open canopy by selective logging would help this species persist at this site. Likewise, letting a portion of the hayfield grow into a meadow would provide additional habitat. Chemical use should be avoided in these hayfields.

**Hyer Road Floodplain BDA**

Significance: Notable

Location: Spring Creek Township

Description: Floodplain habitat along Brokenstraw Creek forms the core of this BDA that supports a plant species of concern, which is considered vulnerable in Pennsylvania. At this site, the species was found on small islands at the confluence of Spring and Brokenstraw creeks and islands south in Brokenstraw Creek.

Rare Occurrences: A plant species of concern considered vulnerable in Pennsylvania, the white trout-lily.

Threats and Stresses: The greatest threats to the white trout-lily at this site are from residential/commercial development along the stream corridor and increased competition for resources by invasive exotic plant species already observed at the site, such as reed canary-grass and garlic mustard, which typically colonize disturbed habitats.

Recommendations: Any further development in the near vicinity that directly disturbs floodplains or introduces invasive exotic species should be avoided, and measures should be taken to control any non-native species present within the site.

**Little Brokenstraw Creek-North BDA**

Significance: High

Location: Freehold Township

Description: The section of Little Brokenstraw Creek that lies within this site provides habitat for two aquatic animal species of concern. Little Brokenstraw Creek, a low gradient, mid-reach stream with sandstone geology, is a tributary to Brokenstraw Creek. This site is entirely on private lands. Both animals of concern at this site are considered imperiled in Pennsylvania.

Rare Occurrences: Two fish species of concern, American brook lamprey and brook stickleback, can be found in this BDA.

Threats and Stresses: Several paved and dirt roads run through the BDA; runoff from dirt and gravel roads in close proximity to waterways can contribute to physical degradation of channels and erosion and sediment pollution in streams and rivers. Non-point source pollution from agricultural and residential areas within the immediate watershed of the stream also poses a threat. Additional loss of forest cover within the core areas could be detrimental. Removal of forest cover on steep slopes is especially problematic.

Recommendations: Remaining forest cover in the immediate watershed surrounding Little Brokenstraw Creek should be left intact. Establishing riparian buffers adjacent to the creek and



encouraging local landowners to properly manage agricultural nutrients though BMPs would aid in lessening the input of runoff into the creek.

### **Little Brokenstraw Creek-South BDA**

Significance: High

Location: Freehold and Pittsfield townships

Description: This BDA is designated along a section of Little Brokenstraw Creek that supports a mussel species of concern and a sensitive species of concern that cannot be named at the request of the jurisdictional agency overseeing its protection. Little Brokenstraw Creek is a mid-reach, low gradient stream with sandstone geology. The section of the creek where species of concern were found has a deep center u-shaped channel and substrate that is mostly firm sand with gravel and some cobble. The dominant plant community along the creek is second growth riparian mixed hardwood forest. Surrounding land use is agriculture with farms and fields in the area. Because mussels are dependent upon good water quality and physical habitat conditions and an environment that will support populations of host fish, they are considered good indicators of the health of aquatic ecosystems. The sensitive species of concern is a Pennsylvania threatened species dependent upon good water quality and physical habitat condition in the stream and adjacent riparian habitat. This species has been extirpated from much of its historic range, which includes the Mississippi River basin. In Pennsylvania, this species has only been recorded in northwestern counties within the upper Allegheny River and French Creek.

Rare Occurrences: A mussel species of concern, the creek heelsplitter, as well as a sensitive species of concern which cannot be named live within this BDA.

Threats and Stresses: The presence of freshwater mussel populations is indicative of high water quality. Erosion, caused in part by deforestation, poor agricultural practices, and destruction of riparian zones, has led to increased silt loads and shifting, unstable stream bottoms. Siltation and contaminants, such as heavy metals, pesticides, and abandoned mine drainage, have long been recognized as threats to mussels.

Recommendations: Forested stream corridors should be preserved; timbering and road development or other construction activities should be kept well away from riparian corridors in order to avoid degrading important aquatic and streamside habitat. Although the surrounding watershed is not as closely linked to the stream ecosystem as are the riparian zones, a high degree of forest cover should be maintained for additional protection of the water quality and ecological integrity of the aquatic ecosystems.

### **SGL 143 Seep BDA**

Significance: Notable

Location: Pittsfield and Spring Creek townships

Description: At the core of this BDA that lies within State Game Lands 143 is a forested seep upslope from a tributary to Hosmer Run that supports a plant species of concern. The site is a mosaic of hemlock–mixed hardwood palustrine forest with associated channels and upland forest. A maintained dirt road within State Game Lands 143 runs north to south through core habitat of the BDA. The supporting landscape of this BDA extends to the boundary of the immediate watershed of the seepage wetland.

Rare Occurrences: Mountain starwort, a plant species of concern, grows within this BDA.

Threats and Stresses: The intact condition of the landscape within the watershed serves to enhance the ecological value of the seepage wetland and forest communities by maintaining



*Hooded ladies'-tresses are endangered in Pennsylvania*

water quality and wetland health, as well as providing a large contiguous forest throughout which native species can move and disperse. However, runoff from activities, such as logging and road building, upslope from the population of mountain starwort may contribute to physical degradation of the site.

**Recommendations:** Any land management decisions regarding the watershed surrounding this site should take into consideration potential impacts to the seepage wetland, including alterations to the light, temperature, and hydrologic regimes. Timbering and road improvement/maintenance or other construction activities should be kept well away from the core habitat in order to avoid degrading important wetland and forest habitat.

### **Shayne's Fen BDA**

**Significance:** Exceptional

**Location:** Columbus Township

**Description:** A section of Brokenstraw Creek and a golden saxifrage-sedge rich seep, a Pennsylvania rare natural community, form the core of this BDA that supports four animal and five plant species of concern. The five plant species of concern were observed in the golden saxifrage-sedge rich seep. A small section of this BDA lies within State Game Lands 197. Surrounding land uses include cultivated fields, pasture, forest, gravel mining and rural residences.

**Rare Occurrences:** A rare natural community, a golden saxifrage-sedge rich seep, occurs within this BDA. Additionally, three dragonfly species of concern, blue-tipped dancer, river jewelwing, and Halloween pennant; a fish species of concern, brook stickleback; and five plant species of concern, autumn willow, downy willow-herb, hooded ladies'-tresses, slender cotton-grass, and a sensitive plant species of concern that cannot be named can all be found within this BDA.

**Threats and Stresses:** As with all aquatic species, maintaining suitable stream habitat is key to the continued success of these species. Runoff from dirt and gravel roads in close proximity to streams can contribute to physical degradation of stream channels and erosion and sediment pollution in streams, as well as impact the quality of adjacent wetland habitat. Loss of forest cover within the supporting landscape would probably result in physical degradation of the stream channels, erosion and sediment pollution in the streams, higher water temperatures, and disruption of natural nutrient cycling linked to the streams. Additionally, if forest cover is substantially reduced within the watersheds, water quality in wetlands is likely to decline from increased sediment loads.

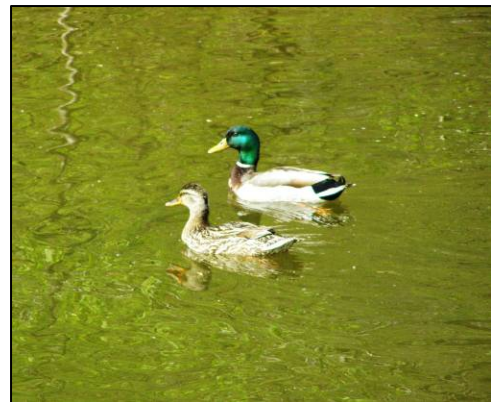
**Recommendations:** Preserving forested stream corridors is key to maintaining high water quality. Timbering and road development or other construction activities should be kept well away from riparian corridors in order to avoid degrading important aquatic and wetland habitats. A high degree of forest cover should be maintained for additional protection of the water quality and ecological integrity of the aquatic ecosystems and adjacent natural communities.

### **Slate Lot Road Beaver Pond BDA**

**Significance:** High

**Location:** Spring Creek Township

**Description:** At the core of this BDA is a forested, moist to dry shore along the western edge of a beaver pond that supports a plant species of concern. The wetland at this site serves as the headwaters of an unnamed stream that flows southward before entering Spring Creek, a low to moderate gradient, mid-reach stream with sandstone geology.



*Male and female mallard ducks*

Rare Occurrences: A plant species of concern, drooping bluegrass, occurs at this site.

Threats and Stresses: Changes in hydrological pattern, light levels, or the contiguity of surrounding forest habitat may negatively impact the downy willow-herb found within this BDA.

Recommendations: Any land management decisions regarding this site should take into consideration potential impacts to the wetland, including alterations in light, temperature and hydrologic regimes.

### **Spring Creek BDA**

Significance: Exceptional

Location: Spring Creek Township

Description: A mosaic of forest, emergent wetlands, and aquatic habitat that support nine plant and three animal species of concern to form the core of this BDA. A small population of Appalachian blue violet, a globally vulnerable species, was found in a mowed lawn north of Spring Creek. Three plant species of concern were recorded in a meadow, willow-speckled alder seepage flat, an open spring-fed channel on terrace flats adjacent to Spring Creek, and a sedge-grass seepage meadow at the base of a valley wall embankment supporting hemlock-mixed hardwood forest. An extensive beaver pond is located south of this area, and the wetlands downslope have been greatly altered by beaver dam flooding. An agricultural field is located on uplands above the plant species of concern, at the top of a valley wall embankment. Hemlock-mixed hardwood forest with seepage openings provide habitat for the five plants and one insect species of concern—a rare butterfly considered globally vulnerable—found within the BDA. An aquatic animal species of concern was observed in Spring Creek, a low to moderate gradient, mid-reach stream with sandstone geology. A mammal of concern that requires high-quality water and abundant cover, such as rocks, logs, or overhanging streambanks, was found within an unnamed tributary to Spring Creek that is three to eight feet wide and only a few inches deep.

Rare Occurrences: The nine plant species of concern that occur in this BDA are Appalachian blue violet, backward sedge, Hill's pondweed, northern water-plantain, bog sedge, Clinton's woodfern, soft-leaf sedge, naked bishop's-cap, and a sensitive plant species of concern that cannot be named. The three animal species of concern are West Virginia white, a butterfly; mountain brook lamprey; and northern water shrew.

Threats and Stresses: Maintaining suitable stream and wetland habitats is key to the continued success of these animal and plant species of concern. Runoff from dirt and gravel roads in close proximity to streams can contribute to physical degradation of stream channels and erosion and sediment pollution in streams, as well as impact the quality of adjacent wetland habitat. Loss of forest cover within the supporting landscape would probably result in physical degradation. Additionally, if forest cover is substantially reduced within the watersheds, water quality in wetlands is likely to decline from increased sediment loads. Removal of forest cover on steep slopes is markedly problematic because of the potential for increased runoff and erosion following storm events. Fragmentation of the forest is a serious threat to the West Virginia white, because these butterflies refuse to cross even small roads. The result is that populations are genetically isolated, and if a population is extirpated the chances are low that remaining populations will be able to recolonize the habitat. An even greater threat to the West Virginia white is the spread of garlic mustard. This invasive plant is in the same family (the mustard family) as toothworts, and the chemical signatures of the plants are similar enough that female butterflies will readily lay their eggs on garlic mustard. The caterpillars, however, cannot survive on garlic mustard, and the West Virginia white has disappeared from areas where garlic mustard is dominant. The effects of acid rain, particularly on the shrew's microhabitat and food supply, may pose a large threat to northern water shrew populations.

Recommendations: Preserving forested stream corridors is key to maintaining high water quality. Timbering and road development or other construction activities should be kept well away from

riparian corridors. A high degree of forest cover should be maintained. Garlic mustard should be controlled and native wildflower species, such as toothworts, should be promoted.

### Tamarack Swamp BDA

**Significance:** Exceptional

**Location:** Columbus Township

**Description:** The core of this BDA includes a buckthorn-sedge-golden ragwort fen, a Pennsylvania rare natural community, as well as an acidic glacial peatland complex. This complex of natural communities almost certainly contains natural communities of concern, although additional surveys are needed to verify preliminary data. Together, these natural communities support 17 plant and eight animal species of concern. The core of Tamarack Swamp BDA is nearly contained within State Game Lands 197 and the Toplovich Bog property of the Northern Allegheny Conservation Association. Sulphur Springs, Columbus Bog and Toplovich Bog, which lie in the southern half of this BDA, are combined under Tamarack Swamp in this report because of the overlap in rare species distribution. Tamarack Swamp BDA is one of the



*Slender cottongrass, a Pennsylvania endangered sedge, is indicative of a peat bog*

best examples of northern bogs—a classic kettlehole bog comprised of several zones of vegetation—in western Pennsylvania. The wetland we see today is built on top of 12,000 years of accumulated organic matter. The outer zone is a mucky coniferous forest dominated by eastern hemlock and eastern white pine. Moving inward, the forest transitions into willow/speckled alder scrub-shrub habitat, then floating sphagnum, with the innermost zone being an open pool of water with watershield and spatterdock growing in it. The floating mat of sphagnum moss contains an exceptionally abundant stand of sundews. The shrub zone includes leatherleaf, chokeberry, bog rosemary, Labrador tea, and pitcher plants. A number of the rare plants occur here because of the acidic,

nutrient-poor bog conditions. In contrast to the acid-adapted plants described above, some rare plants at this site are calciphiles, adapted to low-pH, high-calcium conditions. It is not unusual for different areas of a wetland complex such as this to have very different chemistry. Areas fed by surface water tend to be acidic, while areas fed by groundwater percolating through glacial deposits tend to be basic. Five butterfly species of concern occur at Tamarack Swamp along with two critically imperiled dragonfly species and one fish species of concern.

**Rare Occurrences:** Two rare natural communities, a buckthorn-sedge-golden ragwort fen and an acidic glacial peatland complex, support 17 plant and eight animal species of concern. The 15 plant species include bog rosemary, pod-grass, soft-leaf sedge, slender cotton-grass, southern twayblade, autumn willow, matted spike rush, prairie sedge, water sedge, downy willow-herb, hairy honeysuckle, mountain fly honeysuckle, mountain starwort, creeping snowberry, and one additional sensitive plant species of concern that cannot be named. Of the animal species of concern, five are butterfly species, including the Baltimore checkerspot, eyed brown, black dash, broad-winged skipper, and the dion skipper. Two more animal species are critically imperiled dragonfly species, comet darner and spatterdock darner. One fish species of concern, the brook stickleback, lives in Tamarack Swamp.

**Threats and Stresses:** Given that much of the core of this BDA is located within protected lands, the species of concern are under no immediate threat. However, the spread of invasive plants that are already present at the site may be a future problem.



**Recommendations:** The current management is compatible with maintaining the populations of the sensitive species present at this site. Monitoring and managing water levels in support of the wetland species utilizing this area year-round are recommended.

### **Turner Hill Seeps BDA**

**Significance:** Notable

**Location:** Spring Creek Township

**Description:** The core of this site is delineated around a graminoid seep. The groundwater-fed wetland seep at this site flows into Ferrin Run, a high gradient, headwater stream that empties into Spring Creek. Dogwood-steeplebush shrub swamp surrounds the seep, which is dominated by robust emergent plants. A paved road passes through the core of this BDA less than 300 feet from the rare plants. The supporting landscape extends to the boundary of the immediate watershed hydrologically linked to the wetland. This watershed is partially forested and has a powerline right-of-way bisecting the northern section.

**Rare Occurrences:** One plant species of concern, the downy willow-herb, grows within this BDA.

**Threats and Stresses:** Runoff from activities, such as logging upslope from the population of downy willow-herb, may contribute to degradation. Application of herbicides for maintenance of the powerline right-of-way poses a threat to the downy willow-herb. Mowing would have a lesser impact on the rare plants because of their location just to the south of the maintained area. Given the roadside location of this small population of downy willow-herb, chemical spraying by roadside maintenance crews also poses a threat to the species. Displacement by invasive exotic plant species that typically colonize disturbed habitats also may be a threat.

**Recommendations:** Timbering and road development or other construction activities should be kept well away from the core habitat in order to avoid degrading important seepage wetland and forest habitat. Workers involved in powerline right-of-way and roadside maintenance activities within the site should be informed of the presence of the rare plant species. The application of herbicides should be avoided and non-native, invasive plants should be removed (PNHP, 2010).

### **New York State Conservation Areas**

New York does not have designated conservation areas that coincide with Pennsylvania BDAs or LCAs. However, the New York Natural Heritage Program keeps track of the rare plant and animal species, as well as significant ecological communities throughout the state. These species and areas can be explored online via New York Nature Explorer, a tool provided by NY DEC that uses New York Natural Heritage Program data. Users may search by area or species to observe a map outlining biodiversity across New York. The Nature Explorer tool may be accessed at <http://www.dec.ny.gov/natureexplorer/app/> (NY DEC<sup>5</sup>).

Of the five New York state forests existing within the project area, three might be considered biodiversity areas. North Harmony, Panama, and Higher Hill state forests are specifically managed to support diverse animal and plant populations, among other purposes.

**North Harmony State Forest** contains Wiltsie Marsh, which attracts a broad variety of bird species, including ducks, geese, hawks and even bald eagles. **Panama State Forest** is home to various wildlife species, including whitetail deer, ruffed grouse, rabbit, raccoon, and wild turkey. There also are occasional fox, mink and bear sightings. Panama State Forest also provides habitat for a variety of songbirds, especially near heavily harvested areas



*Watts Flats WMA*

where there is thick seedling-sapling cover. Numerous wildlife species can be found in **Hill Higher State Forest**, including whitetail deer, ruffed grouse, rabbit, and wild turkey.

Additionally, **Watts Flats Wildlife Management Area** (WMA) was acquired for the production and use of wildlife, with an emphasis on game species. It is made up of 1,382 acres located in the headwaters of Little Brokenstraw Creek in the Town of Harmony, about three miles southeast of the village of Panama (NY DEC<sup>7</sup>).

### **Important Bird Areas**

Areas that support critical habitat for a diversity of birds species or bird species of concern are designated as Important Bird Areas (IBA) by National Audubon Society chapters in both Pennsylvania and New York. Site conservation plans are developed to guide conservation initiatives and management activities based on the specific needs of the area. Currently, no IBAs exist within the project area in either Pennsylvania or New York. However, in Pennsylvania, IBA 15—Akeley Swamp-SGL 282—and IBA 17—Hickory Creek/Hearts Content Natural Area—are both nearby the project area in Warren County. Both of these IBAs support a variety of species of rare birds and some breeding populations of birds, such as the least bittern and Swainson’s thrush. In New York, IBA 5—Allegheny Forest Tract—is also near the project area. This expansive IBA supports a diverse assemblage of woodland warblers and other representative forest species, including multiple breeding pairs of both osprey and bald eagles (National Audubon Society).

### **Important Mammal Areas**

Similar to IBAs, the Important Mammal Areas Project (IMAP) designates Important Mammal Areas (IMAs) that support mammal species of concern and a diversity of mammal species. IMAP is a partnership of sportsmen, scientists, conservation groups and professionals. Mammal diversity typically coincides with large, contiguous tracts of forestland. Although the Brokenstraw Creek watershed does not contain any IMAs, the Hickory Creek and Tionesta Creek Drainage IMA is located just south of the watershed, covering the corners of Warren, McKean, Forest, and Elk counties in Pennsylvania. Conserving habitats within the Brokenstraw watershed and connecting natural corridors to nearby IMAs will help sustain mammal species that depend on the resources of the region (IMAP).

## **Invasive Species**

Non-native, invasive species are defined as plants, animals, or other organisms introduced to an ecological system that cause economic or environmental harm or harm to human health. Invasive species are one of the most prominent threats to wildlife conservation in the project area. Not all non-native species are harmful to wildlife, but some exotic species may have severe impacts. Invasive plant species can impact agricultural activities and inhibit forest regeneration in areas where disturbance (by deer, erosion, or human activities) gives them a competitive advantage. They may out-compete native species, causing cascading effects throughout the food chain, and reducing food availability and quality for species, such as wild turkey, bear, and birds. They can be devastating to rare species that exhibit specific food preferences or requirements, when they displace that native food source.

Exotic species may have been introduced for a specific purpose or inadvertently. For example, autumn olive, an invasive shrub species, was introduced to many Pennsylvania state parks by PGC for food and cover for wildlife and as a soil stabilization tool. Alternatively, invasive insects may burrow into the wood pallets of packing material, unbeknownst to humans, to emerge to invade another country.

When invasive species dominate an area, they often cause decreased land value, increased maintenance and control costs, degraded soil or water quality, or direct human health concerns. West Nile



Virus is one example of a non-native pathogen that has the potential to affect human health. Weeds threaten natural areas and wildlife. Invasive pests may decrease crop yields, affect livestock health, and require costly control efforts. Invasive species may be aesthetically unpleasing, encroach upon homes and gardens, affect landscaping, and threaten pets and humans.

**Plants**

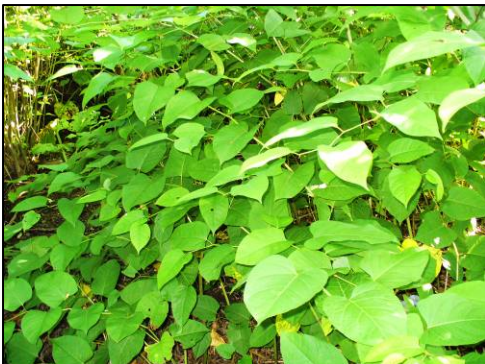
Invasive species pose the most significant threat in areas that have been altered by disturbances, such as an impoundment, development, mining, oil and gas extraction, poor forestry, and poor agriculture practices. In disturbed areas, invasive species can displace native plants intolerant to the changing conditions. Native wildlife species prefer native plant species for food, and tend to avoid invasive plants, which allows the invasive to proliferate. When a non-native species establishes itself in a foreign habitat, it is usually free of natural predators and pathogens, allowing it to spread and multiply with little natural controls.

Some invasive plants pose a threat to health and human safety, and these plants are categorized as **noxious weeds**. A list of Pennsylvania’s noxious weeds can be seen in Table 4-5. New York State has not defined any plants as noxious weeds. Noxious weeds are federally designated by USDA Animal and Plant Health Inspection Service (APHIS). This designation adds additional penalties and controls on those species. According to the Pennsylvania Department of Agriculture (PDA), it is illegal in Pennsylvania to propagate, sell, or transfer any of the state-designated noxious weeds (PDA).

A quality source of information on invasive plants is *Plant Invaders of Mid-Atlantic Natural Areas*, a guide produced by the National Park Service and U.S. Fish and Wildlife Service (Swearingen et al., 2002).

Japanese knotweed

One invasive, exotic plant species that was found within the project area that could pose serious threats to the native biodiversity of the area is Japanese knotweed. Japanese knotweed has been reliably identified in disturbed areas on the banks Brokenstraw Creek and some of its tributaries. It spreads mainly through its root system; one plant can grow to encompass miles of streambank. Very small root and stem fragments are capable of sprouting to generate new growth, and streambank erosion can transport these plant parts downstream to take root in new areas. In more urbanized areas, such as Corry, this species can cause major destruction to flood walls, pavement, and even buildings.



*Japanese knotweed grows and spreads aggressively; it is costly to control once it becomes established*

**Table 4-5. Noxious Weeds of Pennsylvania**

marijuana ( <i>Cannabis sativa</i> )
Canada thistle ( <i>Cirsium arvense</i> )
multiflora rose ( <i>Rosa multiflora</i> )
Johnson grass ( <i>Sorghum halepense</i> )
mile-a-minute ( <i>Polygonum perfoliatum</i> )
kudzu ( <i>Pueraria Montana v. lobata</i> )
bull or spear thistle ( <i>Cirsium vulgare</i> )
musk or nodding thistle ( <i>Carduus nutans</i> )
shattercane ( <i>Sorghum bicolor</i> )
jimsonweed ( <i>Datura stramonium</i> )
purple loosestrife ( <i>Lythrum salicaria</i> )
giant hogweed ( <i>Heracleum mantegazzianum</i> )
goatsrue ( <i>Galega officinalis</i> )

On trails and in natural areas, knotweed is unsightly, and may be considered a safety hazard. Areas dominated by one species are known as **monocultures**, and monocultures of invasives can be remarkably detrimental to the area. Monocultures of knotweed can encroach upon trails, inhibit growth of trees in riparian areas, and increase erosion. Knotweed offers little habitat value to native species, and it grows and spreads aggressively, making it very costly to control once established.

The best control method for well-established knotweed monocultures is to cut the stalks close to the base throughout the spring and summer to prevent flowering and seeding. Cutting also encourages regrowth and expenditure of stored energy, which weakens the plant's reserves. Do not mulch any cut vegetation, as regrowth can occur from each fragment. An herbicide application may be applied before the first killing frost in the fall, which will carry herbicide from the leaves to the roots, resulting in more effective control. A certified herbicide applicator should be contracted to ensure that regulations are followed and application procedures are appropriate. As with any control strategy for invasive species, persistence is the key to success.

### *Multiflora rose*

Multiflora rose was first introduced to the U.S. as rootstock for ornamental plants in 1866. The U.S. Soil Conservation Service and other organizations later promoted it for purposes, such as living fence around livestock pastures and as wildlife habitat for small game and bird species. The tenacious growing behavior of the plant enables it to quickly dominate large areas and consume resources that would otherwise benefit native shrubs and herbaceous species. The thickets formed by multiflora rose are dense, and it can completely overtake pastures, excluding livestock from grazing large portions of pasture. The large monocultures decrease biodiversity, as the variety of food and nesting habitat available to native birds and wildlife is decreased. Furthermore, the fruits do not contain the proper fat ratio migrating birds need to survive. Larger mammals, including humans, are often excluded from areas occupied by multiflora rose, as the thorny plant weaves a tight, impenetrable assemblage of stems.

To control multiflora rose, bushes may be pulled, but ensure that all of the root system was removed, otherwise regrowth will occur. Herbicides may be effective in controlling this persistent species. A naturally occurring virus spread by mites called rose rosette disease is an example of a biological control for multiflora rose. However, this disease also affects cultivated roses, and may be considered undesirable by some.

### *Mile-a-minute*

Mile-a-minute is a rapidly growing invasive vine that quickly dominates areas. It is thorny, with distinctive triangular leaves and circular leaf appendages. It produces purple-blue berry fruits, which are readily dispersed by bird species feeding upon them. Mile-a-minute's aggressive growth rate is its namesake and also the primary reason that this vine is so detrimental to the natural areas it invades. Quickly blanketing forests and smothering native plant species, it offers little habitat value for native wildlife and may reduce land value and sustainable forests.

## Animals

Invasive animal species include forest pests, such as the emerald ash borer, gypsy moth, and hemlock woolly adelgid, as well as aquatic species like the zebra mussel. The gypsy moth is prevalent throughout Pennsylvania and New York State, and the emerald ash borer is becoming a serious threat in both states. Although the zebra mussel is not confirmed to be in the Brokenstraw Creek watershed, it is a major threat in other Pennsylvania and New York waterways and has the potential to infect the project area.

### *Emerald Ash Borer*

The emerald ash borer (EAB), an invasive insect, was first positively identified in Pennsylvania on June 21, 2007 in Cranberry Township, Butler County, and its presence was confirmed in the town of Randolph in Cattaraugus



*Purple box traps seen hanging from ash trees within the watershed are being used to survey emerald ash borers, an invasive insect*

County, New York on June 15, 2009. The EAB has already defoliated millions of trees throughout the country, and now threatens forests in both Pennsylvania and New York. Quarantines have been implemented in both states on the transport of ash products and all firewood to prevent the spread of the beetle to uncontaminated areas. No counties within the watershed are currently known to harbor the emerald ash borer, but Chautauqua County, New York remains under strict quarantine because of its close proximity to where the beetle was confirmed in Cattaraugus County (PA DCNR<sup>2</sup>; NY DEC<sup>3</sup>).

It is not the adult emerald ash borer beetles that cause the devastating effects of girdling and killing trees, but rather their larvae that feed under the bark. As the larvae eat paths under the bark, called “galleries,” they disconnect the cells that carry nutrients and water to the limbs and leaves of the tree. Over time, usually within three years of the infestation, the tree dies as a result of stress and inability to circulate life-sustaining nutrients and water throughout the plant.

EAB presence is most easily identified by the D-shaped exit holes bored into the wood of a tree. Adult beetles are approximately a half-inch long and slender with dark green metallic coloration. If you suspect the presence of EAB in your area, please call the EAB hotline; 1-866-253-7189 in Pennsylvania, and 1-866-640-0652 in New York.

#### *Gypsy Moth*

The gypsy moth was introduced to the U.S. from Europe in the 1980s. The insects’ feeding, which causes extensive damage, occurs while in the larval (caterpillar) stage. Eggs are deposited in July, and overwinter on bark and stones. Gypsy moth caterpillars hatch and begin feeding in early- to mid-May in the northern part of Pennsylvania and southern New York. Oak, sugar maple, beech, and aspen trees are preferred food sources for this caterpillar’s voracious appetite. Large gypsy moth populations may strip entire trees of their foliage, leaving them weakened and susceptible to disease, drought, and attack by other pests. A tree begins to suffer when 30 percent or more of its leaf surface is lost (Purdue Research Foundation, 2004).

Gypsy moth populations are typically highest following wet, more temperate winters, while cold, dry winters cause death of egg masses. While there is no state program in New York to spray for gypsy moths, private landowners in Pennsylvania with forested land containing 250 or more egg masses per acre may be eligible for insecticide applications administered through the PA DCNR Bureau of Forestry. However, the biggest factor controlling populations is a natural fungus, which grows on most hardwoods, and adversely affects the gypsy moth. Additionally, the gypsy moth population goes through a natural boom and bust cycle, and spraying is not necessary every year (Purdue Research Foundation, 2004).

#### *Hemlock Woolly Adelgid*

This tiny, fluid-feeding insect was introduced from Japan in the early 20<sup>th</sup> century, and was first discovered in Pennsylvania in 1969 and New York in 1985. The hemlock woolly adelgid most commonly affects hemlocks, but can also affect spruce trees. Damage is inflicted when an immature nymph or adult sucks sap from twigs, which causes hosts to lose needles, and possibly die. Hemlock woolly adelgid eggs hatch in February or March. The species prefers mild conditions, and is most active from October to June. Cold weather may contribute to high mortality, and will likely limit expansion of this pest. Chemical pesticides seem to be the most effective management tool, most successfully used in late September through October (Spichiger, 2004).

### **Managing Invasives**

Integrated Pest Management (IPM) techniques incorporate science and information about the target pest, varying economic approaches, and utilization of ecologically sensitive control tactics to deal with infestations. The first step in effective invasive species management is prevention. Most invasives are opportunistic, and take advantage of disturbed areas or weakened species. Invasive species are less likely

to establish in effectively managed landscapes and well protected, pristine natural areas. By preventing an invasive species from establishing or spreading, money can be saved and chemicals need not be applied.

The second step is early detection, followed by quick application of management techniques. Early detection and rapid response will save money and effort required to control the species. In order to detect an invasive species early, correct identification is critical. Numerous tools and publications are available to help properly identify invasive species. Both the USDA National Invasive Species Information Center's (NISIC) website ([www.invasivespeciesinfo.gov](http://www.invasivespeciesinfo.gov)) and the Global Invasive Species online database ([www.issg.org/database](http://www.issg.org/database)) are quality identification tools available at no cost.

Once positive identification is confirmed, small, isolated populations of invasive species should be contained. Established invasives can be mechanically (physically pulling or cutting weeds), chemically (applying pesticides), or biologically (utilizing another living species to control the invasive target) controlled. Often, for well-established invasive species, a combination of control methods is necessary to efficiently and effectively control the invasive. When chemical means are necessary to control an invasive weed, insect, or animal; pesticides must be handled by an applicator certified by either the state of Pennsylvania or New York. Landowners and land managers should contact their County Cooperative Extension office or a private, certified applicator to seek assistance.

Education is a critical component in the management of invasive species. Volunteers, land managers, and citizens should be taught to correctly identify invasive species that threaten their watershed. This would facilitate easy, rapid detection and reporting to the proper agency at the first sign of encroachment. Addressing any invasive problems early helps minimize the negative impacts on native species and natural resources. Well established invasive species are much more difficult and costly to control. Fact sheets on invasive species can be downloaded from the U.S. Forest Service website: <http://www.fs.fed.us/invasivespecies/speciesprofiles/index.shtml>.

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## CHAPTER 5. CULTURAL RESOURCES

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This section provides an overview of the culture in the Brokenstraw Creek watershed, while examining historical and current activities that define the region. Included in this section are a summary of available recreational opportunities, environmental education efforts, and a historical overview of the area.

### Recreation

Any activity conducted for amusement during leisure time is considered recreation. In Pennsylvania, recreation is big business, ranked as the second-leading industry overall. For some areas within the state, it is the only industry. Recreation brings in revenue from tourists who seek food, accommodations, and mementos of their visit. Recreation is not only beneficial to the local economy, but also to the overall health of all those who participate. Panorama Recreation states that the benefits of recreation are an active lifestyle essential to personal health, balanced human development, increased quality of life, reduced self-destructive and anti-social behavior, strong families and healthy communities, economic stimulation, essential ecological survival, and reduced costs associated with health care, social services, police and justice.

As part of the Pennsylvania Wilds region, this watershed is an asset; it serves as a host to a diversity of recreational opportunities that appeal to a wide range of potential visitors, as well as local citizens. A well-managed and balanced tourism industry is essential to protecting the character of the region. Pennsylvania Wilds Planning Team compiled a “design guide” to guide planning and development within the communities to incorporate and maintain the rural nature of the region. Copies of the guide are available through the Lumber Heritage Region of Pennsylvania. A healthy tourism industry enhances a visitor’s experience without impacting the local character and wild, natural resources of the area, as these features are often what draw visitors to the region. A balanced tourism industry supplies the right amount of infrastructure to cover demand, without modifying community character.

### Recreational Opportunities

#### *Parks*

Parks can be categorized based upon size, service population, and intended use. Figure 5-1 displays the 14 parks located within the project area, while Appendix J highlights attributes of each facility.

Meade Park in Corry, Buckaloons Recreation Area in Irvine, and the Warren County Fairgrounds are **regional parks** within the watershed. Regional parks are large parks located within 30 to 60 minutes from the populations they serve. Meade Park is a municipal park that features Alice Lake, several lodges, picnic pavilions, ball fields, basketball and tennis courts, and playgrounds. Buckaloons Recreation Area, part of the Allegheny National Forest, provides recreational opportunities to hike, camp, fish, boat, and picnic.



*A picnic pavilion at Buckaloons Recreation Area*

**Community parks** are located within one to two miles of their users, and contain at least 25 acres. Three community parks—Hilltop Recreation Area and Island Park Recreation Area both located in



Youngsville and Mather Park in Columbus—have been identified in the region. Playgrounds at local elementary schools that are accessible by the public, such as the playgrounds at Brokenstraw and Panama elementary schools, are also considered community parks.

Smaller parks between five and 25 acres in size that are located within three-quarters of a mile of residents are **neighborhood parks**. These parks intend to provide recreational opportunities close to home. Three parks in the region are classified as neighborhood parks, they include Community Park in Columbus, Town Park in Corry, and Watts Flat Park in Panama.



### State Forests

Although no Pennsylvania state forests exist within the project area, there are five state forests within the New York portion of the watershed (Table 5-1). The State of New York established state forests as part of a reforestation program to deal with the increased abandonment of agricultural lands. These state forestlands provide a variety of resources, such as timber and abundant recreational opportunities. Cross-county skiing, camping, hunting, all-terrain vehicle (ATV) and snowmobile riding, and hiking are common activities that take place within state forests.

Within the state forests of the watershed, there are two Wildlife Management Areas (WMAs)—Jaquins Pond and Watts Flat. These WMAs were acquired for the production and use of wildlife, with an emphasis on game species. They are the equivalent of Pennsylvania state game lands. Fishing, hunting, and trapping are the primary uses of WMAs, but opportunities to hike, cross-country ski, and observe wildlife also exist. However, some recreational activities, such as camping, recreational vehicle riding, and picnicking, are not permitted within these areas.

The **Watts Flat WMA** is made up of 1,382 acres that include a wetland, hiking trail, and parking lot. The area offers bird watching, hunting, fishing, and trapping opportunities. It is located in the headwaters of Little Brokenstraw Creek, in the town of Harmony, New York, about three miles southeast of the Village of Panama (NY DEC, 2008d).

**Jaquins Pond WMA** is a 31-acre wetland/upland area just north of the Pennsylvania border in the Town of Clymer, New York. Hiking is permitted in the area, and there are nearby snowmobile trails (Western New York Outdoors).

### Trails

Trails are links among communities, providing alternative transportation, recreation, and educational opportunities. Trails are used for hiking, biking, horseback riding, or ATV and snowmobile riding. They are sometimes used for cultural and historic promotion and environmental education. In addition to numerous trails within state forests and state game lands, there are four known public trails in the watershed.

**Table 5-1. New York State Forest Lands**

Forest	Acres
Brokenstraw State Forest	951
Hill Higher State Forest	1,156
North Harmony State Forest	2,561
Panama State Forest	1,224
Whalen Memorial State Forest	1,325

(Source: NY DEC, 2008b)



**Bicycle Route Y** follows U.S. Route 6 for 409 miles in the northern-most counties of Pennsylvania. Used as a transportation corridor, cyclists can travel from metropolitan New York to Cleveland, Detroit, and Chicago on this trail (Bicycle PA Routes, 2004).

The **Seneca Interpretive Trail** is a one-mile loop around the Buckaloons Recreation Area of the Allegheny National Forest. Visitors will encounter 20 interpretive stops with information about the terrain and history of the area while they hike, cross-country ski, or mountain bike along the trail.



*A section of the Corry Junction Greenway Trail*

The **Corry Junction Greenway Trail**—formerly known as the Corry to Clymer, New York Rail Trail—consists of 5.2 miles that can be used to hike, bike, ride horseback, cross-country ski, and snowmobile. No ATVs are permitted on the trail (Northwest Pennsylvania Trail Association).

The **Fred J. Cusimano Westside Overland Trail** is part of the southwestern New York trail system. The trail travels 24 miles through six state forests, and is available for hiking, skiing, snowshoeing, and mountain biking. Designated campsites along the trail provide lean-to shelters, fire pits, latrines, and picnic tables (Hiking New York).

The potential for additional trails exists within the watershed. Acknowledged in the Northwest Pennsylvania Greenway Plan, potential trail routes from Columbus to Bear Lake, Youngsville to Titusville, and Youngsville to Warren were identified. The establishment of these trails could help connect communities and provide additional recreational opportunities. The 2009-2013 Statewide Comprehensive Outdoor Recreation Plan for Pennsylvania acknowledges the potential for a trail connecting Corry to Spartansburg to fill a trail gap recognized in the 2009 Pennsylvania Trail Gap Inventory (Pennsylvania Outdoors, 2009).

#### Recreational Vehicles

All-terrain vehicle and snowmobile use are popular recreational activities. All-terrain, off-road, or off-highway vehicles are motorized vehicles capable of cross-country travel on land, water, snow, ice, marsh, swampland, or other natural terrain. A snowmobile is an engine-driven vehicle designed to travel over snow or ice with an endless belt track or tracks and skis for steering. Snowmobile and ATV use is on the rise, and the improper or illegal use by some riders has given this activity a negative reputation.

The Pennsylvania Department of Conservation and Natural Resources (PA DCNR), along with the Commonwealth of Pennsylvania, regulate the use of ATVs and snowmobiles as defined in Chapter 77 of the Pennsylvania Vehicle Law. In 2001, Act 68 modified the law, requiring ATV owners and operators to register their vehicles. Snowmobile registration is required with PA DCNR. In addition, snowmobiles in Pennsylvania purchased after October 23, 2001 must have a title issued by PA DCNR. Older snowmobiles do not require a title until transferred to a new owner. Snowmobile and ATV registration fees are used to finance efforts to develop and maintain trails on public lands, encourage trail development on private lands, teach safety and trail etiquette, and for law enforcement (Pennsylvania Department of Motor Vehicles, 1976).



*Some area roadways allow shared snowmobile usage throughout winter*

The New York State Department of Motor Vehicles (NYS DMV) and the Office of Parks, Recreation and Historic Preservation (OPRHP) regulate the use of ATVs and snowmobiles in New York State. Both snowmobiles and ATVs require registration with the NYS DMV if they are to be operated on public property. Registration also is required for operating ATVs on private property, while snowmobiles do not require registration if operated on one's own private property or with contractual right from the landowner to operate the snowmobile on the property. Like in Pennsylvania, New York ATV and snowmobile registration fees are used to support snowmobile and ATV initiatives in New York (NYS DMV).

Enhanced efforts are necessary to educate riders to recreate in a sound manner. Currently, youth snowmobile operators between the ages of 10–16 must complete a snowmobile safety course to ride on public trails in Pennsylvania. Youth under the age of 10 cannot operate a snowmobile on any Pennsylvania public land. Youth ATV operators between eight and 16 years of age must complete an ATV safety course to ride on public lands, while youth under the age of eight cannot operate an ATV on any Pennsylvania public land. Youth operators under the age of 16 cannot cross or ride upon Pennsylvania roads or highways.

In New York, ATV operation has some restrictions for riders under the age of 16. Children 10 to 15-years-old can drive an ATV only with adult supervision, unless they are on their parent's or guardian's property or where ATV use is permitted and the child completed an ATV safety training course approved by the DMV. Children under the age of 10 may drive an ATV only with adult supervision or on their parent's or guardian's property (NYS DMV).

Public facilities for the exclusive use of ATVs are needed in the Brokenstraw region, as no specific recreational facilities are currently available for use by ATV enthusiasts. However, the Allegheny National Forest provides over 70 miles of ATV-accessible trails. It is illegal to ride ATVs on Pennsylvania state game lands, unless the ATV is operated by a disabled hunter. Establishing environmentally sound public trails or an ATV park within the project area would provide legal opportunities to ride, potentially reducing damages to private property and increasing safety for riders.

Recreational areas for snowmobile use are more available than those for ATVs, and snowmobile enthusiasts have a few options for recreation within the Brokenstraw Creek watershed. The Corry Junction Trail is open to snowmobile use throughout the designated season. In addition, some area roadways allow shared snowmobile usage in winter.

### Golfing

Golf, a precision club-and-ball sport, is a popular recreational activity within the Brokenstraw area. There are four public courses and one private golf course within the watershed (Table 5-2). In addition, multiple golf facilities are located just outside of the region.

**Table 5-2. Golf Courses**

<i>Golf Courses</i>	<i>Description</i>	<i>Location</i>
North Hills Municipal Golf Course	9 hole public course	Corry, PA
Carter Heights Golf Course	9 hole public course	Corry, PA
Timber Creek Golf Course	9-hole public course	Ashville, NY
Corry Country Club	18-hole private course	Corry, PA
Spring Creek Frontier Golf Course	9-hole public course	Spring Creek, PA

### Camping

Camping is a popular recreational activity within the watershed, and there are a variety of camping opportunities available. Three private campgrounds—Brokenstraw Valley, Harecreek, and Leisure campgrounds—provide opportunities with an assortment of available facilities and amenities. Backcountry camping is permitted in New York state forests and the Allegheny National Forest. However, camping on Pennsylvania state game lands is not permitted.

Only primitive camping is allowed within the Allegheny National Forest. However, some areas are restricted and visitors wishing to camp should be aware of these areas and prepare accordingly. The Buckaloons Recreation Area within the Allegheny National Forest has an improved campground that is open from May through mid-October. The campground has 57 sites, two double sites, and one group site. A dump station, electric hook ups, shower house, boat launch, trail, and several picnic areas are some of the amenities that Buckaloons has to offer.

Camping within New York state forests is limited to primitive or backcountry camping, and campers are expected to apply “leave no trace” practices. Campsites cannot be located within 150 feet of water, roads, or trails. Camping within unique areas, wildlife management areas, preserves, and easement properties is not permitted. Campers in parties of 10 or more or those that stay longer than three days are required to obtain a permit from the regional New York State Forest office.

In addition to the organized camping facilities in the Brokenstraw Creek watershed, numerous private camps exist in the region, which are primarily used by hunters and anglers. The structures of these camps vary from shacks without power or water to trailers and fully-equipped houses.

### Cabins, Lodges, and Bed and Breakfasts Facilities

Several cabins, lodges, and bed and breakfasts provide rental lodging throughout the region. These facilities provide services for guests traveling far distances and families with young children, and they expand the profile of potential visitors. Lodging varies from rooms at bed and breakfasts, such as the Ottawa Inn or The Victorian on Main, both in Corry, to rustic cabins like those available at Hare Creek Campground, as well as privately-owned houses. A list of cabins, lodges, and bed and breakfasts is located in Appendix J.

### Geocaching

Initiated in Portland, Oregon in May 2000, Geocaching has since been on the rise as a recreational activity. An adventurous treasure hunt game, it incorporates the use of a global positioning system (GPS) to find a hidden cache. The game is simple, and can be played almost anywhere in the world. Players obtain coordinates to a cache site via the Internet. They then travel to the coordinates and search for the cache. When a participant finds a cache, they may sign the logbook or take an item from the cache if they can replace it with one of same value. The logbook provides information about who has found the cache and when they found it. More information about geocaching is available on the [geocaching.com](http://geocaching.com) website.

A great variety of caches are available within the region. There are more than 750 caches within the Youngsville zip code alone. The Allegheny Geo Trail, which is a series of geocaches within a 10-county radius that surrounds the Allegheny National Forest and its gateway counties in Northcentral Pennsylvania, is located near the Brokenstraw area. Each county has 10–20 caches. Special county geocoins are given to geocachers who find six caches in a county; and those that find six caches in each of the 10 counties get an Allegheny Geo Trail coin. More information about the Allegheny Geo Trail is available online at [www.alleghenygeotrail.com](http://www.alleghenygeotrail.com).

### Fishing

Since 1866, the Pennsylvania Fish and Boat Commission (PFBC) has been responsible for the protection, management, and regulation of Pennsylvania's water resources for recreational purposes. Nearly two million people fish in Pennsylvania each year, with an estimated economic gain of \$1.35 billion (PFBC). The Pennsylvania Wilds region provides ample opportunities for anglers, which are compiled in the Pennsylvania Wilds Fishing Guide, available on the Pennsylvania Great Outdoors Visitors Bureau website [www.visitpago.com](http://www.visitpago.com).

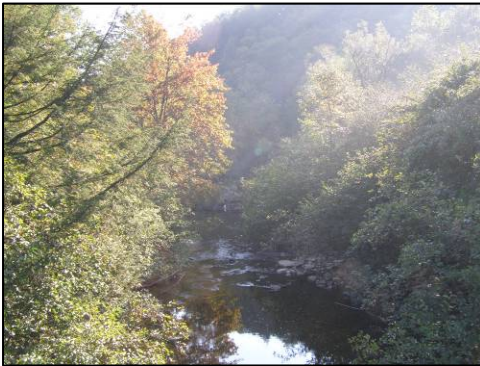


*Children fish at Alice Lake in Mead Park*

Some waterways within the Pennsylvania portion of the Brokenstraw Creek watershed have specific trout water designations. Classifications include Class A Wild Trout streams, Approved Trout Waters, Special Regulation Areas, Wilderness Trout Streams, and streams that support wild or naturally reproducing trout populations. There are no Special Regulation Areas or Wilderness Trout Streams within the watershed.

**Class A Wild Trout** streams support natural reproduction of trout that are of sufficient size and abundance to support a long-term fishery. Waterways under this designation are not stocked. Approximately 2.6 miles of Spring Creek, from State Route 30001 bridge to its mouth, are the only designated Class A Wild Trout waters within the project area (PFBC, 2008b).

**Approved Trout Waters** are waterways—lakes, ponds, and reservoirs—that meet criteria that qualify them to be stocked with trout by PFBC. Six waterways qualify as Approved Trout Waters—Brokenstraw Creek, Coffee Creek, Hare Creek, East Branch of Spring Creek, Blue Eye Run, and Little Brokenstraw Creek (PFBC, 2008b).



*The East Branch of Spring Creek supports wild trout populations*

Streams that **support naturally reproducing wild trout populations** are biologically designated; therefore this designation does not determine management of these streams. Some streams in this classification may be stocked, while others may not. Eight waterways are classified streams supporting wild trout populations; they include Blue Eye Run—headwaters to mouth, Andrews Run—headwaters to mouth, East Branch Spring Creek—headwaters to mouth, Hare Creek—New York state line to Route 6 bridge, Irvine Run—headwaters to mouth, Matthews Run—headwaters to mouth, Spring Creek—headwaters to mouth, and Whitney Run tributary to Spring Creek—headwaters to mouth (PFBC, 2008b).

In New York, the Department of Environmental Conservation (NY DEC) Bureau of Fisheries administers fishing and boating regulation and management. No fishing hot spots are identified in the New York state portion of the Brokenstraw Creek watershed. More information can be found on the DEC website addressing fishing in New York at [www.dec.ny.gov/outdoor/fishing.html](http://www.dec.ny.gov/outdoor/fishing.html).

### Boating

In Pennsylvania, the regulations for boating are under the jurisdiction of PFBC. An estimated 2.5 million people boat on the 83,000 miles of rivers and streams in Pennsylvania each year. In 2005,

approximately 350,600 boats were registered. Recreational boating generates an estimated \$1.7 billion every year (PFBC, 2008a).

PFBC manages 250 public access areas to Pennsylvania's waterways, while organizations and municipalities manage many other access points. In 2005, in an effort to increase public access to waterways, PFBC initiated the Boating Facility Grant Program. This program provides funding for public entities to establish stream access points that are open to the public. Grants are awarded for land acquisition, project design and engineering, development, expansion, and rehabilitation of public recreational boat access facilities. The grants require a 25 percent match.

In New York, NY DEC controls boating regulations on the 7,500 lakes, ponds and reservoirs and over 50,000 miles of rivers and streams within the state. For information about boat access points and more information about boating in New York, consult the NY DEC's boating website at [www.dec.ny.gov/outdoor/349.html](http://www.dec.ny.gov/outdoor/349.html) (NY DEC, 2010a).

### Hunting

Hunting is a popular recreation activity throughout northwestern Pennsylvania and southeastern New York. The Pennsylvania Game Commission (PGC) manages and regulates hunting in Pennsylvania. An individual can begin to hunt at 12 years of age after passing a hunter safety course. In New York, hunting is regulated by NY DEC, and junior hunters must be at least 12 years of age after completing the DEC's Sportsman Education Program and earning their Hunter Education Certificate (NY DEC, 2010b; PGC, 2010a).

The number of hunters in many states has been rapidly declining; Pennsylvania and New York are no exceptions. The recruitment of new hunters and trappers is essential for future wildlife management and for the preservation of the hunting and trapping heritage. Since 1998, the sale of licenses in Pennsylvania has decreased. Table 5-3 lists the number of licenses sold from 1998 to 2007 in Pennsylvania (PGC, 2009a).

In an effort to increase hunting, youth have been targeted by new programs in both Pennsylvania and New York. In Pennsylvania, two new programs are offered—Junior License and Mentored Youth. In New York, the Mentored Youth Hunting and Trapping Program is offered.

The **Junior Hunting License** program allows youth, ages 12 to 16, to hunt in Pennsylvania. The program provides special hunting days where only youth hunters can hunt for pheasant, wild turkey, or waterfowl. Junior hunters who have the proper tags may also harvest an antlerless deer during the permitted season (PGC, 2010b).

The **Mentored Youth Hunting Program** allows unlicensed youth younger than 12 to hunt with a licensed, adult mentor in Pennsylvania. Mentors must be at least 21, and are held liable and responsible for the youth they are mentoring. The program is designed to give youth the opportunity to gain experience and learn first-hand about Pennsylvania's hunting heritage. Through the mentor, youth learn about ethics, safety, responsibility, while experiencing the enjoyment hunting can bring. Mentored youth can hunt groundhogs, squirrels, and antlered deer. During the spring gobbler season, they may hunt turkey. More information about the Mentored Youth Hunting Program is available on the PGC website (PGC, 2010b).

**Table 5-3. Hunting Licenses Sold**

Year	Licenses
1998	1,071,205
1999	1,033,315
2000	1,038,846
2001	1,047,820
2002	1,017,154
2003	1,018,248
2004	1,013,866
2005	964,158
2006	945,842
2007	924,448
2008	926,898

(Source: PGC, 2009a)



The **Mentored Youth Hunting and Trapping Program** provides youth, ages 12 to 15, hunting opportunities in New York by hosting special youth hunts for wild turkey, pheasant, and waterfowl. The Mentored Youth Hunting and Trapping Program also allows hunters, at least 14 years of age, to hunt for big game when supervised by an experienced adult hunter.

Area sportsmen groups may organize hunts and youth programs in an effort to increase participation. In cooperation with PGC or NY DEC, they may also host hunter safety courses that educate new hunters about laws and safety.

Pennsylvania state game lands, New York state forests, and New York WMAs provide the public with lands that are open to hunting. In the Pennsylvania portion of the watershed, six state game lands account for 14,852 acres of public lands to hunt and trap. In New York, the Brokenstraw, Higher Hill, North Harmony and Panama state forests and one WMA—Watts Flat—are open to hunting, and provide more than 7,500 acres to hunt and trap.

The Pennsylvania state game lands (SGL) within the project area include SGL 143, which consists of 8,177 acres, SGL 154 is made up of 1,415 acres, SGL 197 covers 1,556 acres, SGL 263 has 668 acres, SGL 291 spans 1,193 acres, and SGL 306, with 892 acres.

### Wildlife Watching

For many residents in the area, wildlife and bird watching are favorite pastimes. The region has seen increased tourism for wildlife observation from recent advertisement efforts highlighting the Pennsylvania Wilds region. In addition to state game lands, public trails, and the Allegheny National Forest, natural areas offer ample wildlife viewing opportunities. See the listing of Biological Diversity Areas in Chapter 4 for a list of areas within the Brokenstraw Creek Watershed that may offer wildlife or bird watching opportunities. Some of these areas may be privately owned, and permission to access them may be required.



### Winter Recreation Opportunities

Outdoor recreation does not have to cease through the winter months. Within the Brokenstraw watershed, there is a plethora of recreational opportunities that can only be enjoyed during the season of snow and ice. Snowmobiling, cross-country skiing, snowshoeing, ice fishing, ice skating, and sledding are some of these winter activities.

Snowmobile use is a popular recreational activity throughout the area, with numerous trails open to snowmobiles throughout the winter months. The resources available for snowmobile use are discussed in further detail earlier in this chapter in the Recreational Vehicles section.

Cross-country skiing and snowshoeing were historically used as a means for transportation over snow. Today, their primary use is recreational. Snowshoes and skis distribute a person's weight equally over the snow's surface, so they do not sink in the snow. Skiing, the faster method of transportation, utilizes poles to propel the skier along. Snowshoeing does not utilize poles, leaving hands free.

Ice fishing carries the enjoyment of fishing into the winter months, while ice skating makes yet another use of the frozen lakes of the area. Ice thickness should be a minimum of four inches before

anglers and skaters consider accessing any lake or frozen body of water. Anglers and skaters are also encouraged to always carry safety equipment when ice fishing or ice skating.

Sled riding is another popular wintertime recreational activity that can be enjoyed on public or private lands with hills that are clear of hazards, such as trees and boulders. Many people, young and old, take to the hills with a variety of sledding equipment each year throughout the project area. This activity can be enjoyable for the whole family, though riders are reminded to take all safety precautions possible and to avoid hills that are too steep or that present too many hazards. Young sled riders should never be left unsupervised.

## Annual Events

Annual events bring people together to celebrate the heritage of an occasion, place, or time. This region hosts several events on an annual basis that highlight its heritage and preserve a traditional way of life.

The **Artist Guild Spring Art Show** is held by the Corry Artist Guild in Corry each year. The show features artwork of all disciplines by local artists and collaborative art projects that have been completed throughout the year by members of the guild. For more information about the Spring Art Show and the Corry Artists Guild, visit their website at [www.corryartistsguild.com](http://www.corryartistsguild.com) (Corry Artists Guild, 2010).

**Corry Fest** features a parade, 5K race, fireworks, a car show, live bands, vendors, artists, and Little Miss and Miss Corry pageants during the week of Independence Day each July in Corry.

**Youngsville Area Business Association (YABA) Days** are held in Youngsville during July, and have been an area tradition since 1992. This annual event consists of three days of garage sales, sidewalk sales, and local restaurants featuring specials. The event is organized by the Revitalization of Youngsville (ROY) Organization Promotion Committee and also features a car show. The Allegheny Artistry Co-op also has displays of local artwork available during this event (Youngsville Borough, 2010).

The **Corn Festival** is held each August in Youngsville. The lineup varies from year to year, but the event typically features live music, DJs, basketball and corn hole tournaments, lawn mower races, the corn cob creek race on Brokenstraw Creek, Chinese auctions and raffles, a community float down Brokenstraw Creek, food and craft vendors, a 5K race, a parade, wagon rides and corn mazes, a children's carnival with a petting zoo and pony rides, horse drawn trolley rides, a motorcycle cruise-in, a corn eating contest, a karaoke contest, fireworks, an open house at the Wilder Museum, a gardener's market, geo caching, glow-in-the-dark putt-putt golf, and a Medieval encampment, among other goings-on throughout the community. Proceeds of the event support Revitalization of Youngsville (ROY) (Youngsville Borough, 2010).

The **International Gifts Festival** is held at the Beaverdam Mennonite Church in Corry each fall. Although it is not a fundraiser for the church, the festival supports the efforts of artisans around the world by selling their hand-made gifts, home décor, jewelry and personal accessories through Ten Thousand Villages, a retailer of fair trade crafts from across the globe. The festival is a great opportunity to purchase unique holiday gifts for loved ones while supporting disadvantaged artisans. Refreshments are served and a baked goods sale usually covers the cost of the festival for the church. Festival dates are posted on the Ten Thousand Villages website at [www.tenthousandvillages.com](http://www.tenthousandvillages.com).

The Brokenstraw watershed boasts an abundance of talented artisans—quilters, painters, woodworkers, jewelers, potters, photographers, and others who are skilled in the arts. Artisans help to

define the wilderness and back-to-basics character of the area, because their work is unique and made by hand; providing a stark contrast to the ever-growing line of mass produced products. Watershed artisans also provide a major attraction for tourists, adding to the economy. Artisans of the watershed may seek inspiration in nature; some may even create artwork, like wreathes or other decorations, from items found in nature. The population of the Brokenstraw Creek watershed is frequently exposed to art, whether it is for sale in a local business or at another designated location. The Pennsylvania Wilds Planning Team formed an artisan network to identify all artisans located within the 12-county Pennsylvania Wilds region. Many local artisans and some locations where local art can be displayed or purchased are recognized on the Pennsylvania Wilds website.

One area outlet for artisans, the **Corry Area Fine Arts Council**, was formed in 1971 as a nonprofit organization dedicated to promoting artists and cultural activities within the rural community of Corry. The council strives to bring exhibits, performances and productions of artistic and cultural value to Corry to enrich the lives of its citizens and draw the community closer together. Visit the council's website at [www.tbssc.com/fac/](http://www.tbssc.com/fac/) for more information or to become a member.

A celebration of artisans, the **Wild Wind Folk Art and Craft Festival**, is held at the Warren County Fairgrounds during one weekend each September. Artisans display and sell their unique, handcrafted wares and participate in a variety of demonstrations and competitions throughout the weekend. Additionally, live music, food vendors, an exotic animal display, a live birds-of-prey exhibit, and wagon and pony rides take place during the festival. Wood carving, weaving, wool spinning, and blacksmithing demonstrations can be observed by festival-goers. A farmer's market is also set-up at the fairgrounds during the event to supply visitors with fresh, local produce and flowers. The Wild Wind website, [www.wildwindfestival.com](http://www.wildwindfestival.com), contains additional information, including festival dates and directions to the site.

## Local Attractions

The **Clinton Wilder Historical Museum** is located in Irvine, Pennsylvania, and provides a variety of local displays including Native American artifacts and Bentwood furniture. The museum, owned and operated by Warren County Historical Society, is open for tours from April through October on Fridays and Saturdays. The museum also hosts several events throughout the year, including a Victorian Christmas open house and a murder mystery presentation. Group tours may be scheduled outside of regular museum hours. More information about the museum is available on Warren County Historical Society's website: [http://www.warrenhistory.org/wilder\\_museum.htm](http://www.warrenhistory.org/wilder_museum.htm).



*The Clinton Wilder Historical Museum in Irvine, PA*

## Environmental Education

In 1984, the Pennsylvania Department of Education (PDE) and PA DCNR joined efforts with other environmental educators from the state to develop the Pennsylvania Master Plan for Environmental Education. The plan describes environmental education as “a learning process concerned with the interrelationships among components of the natural and human-made world, producing growth in the individual, and leading to responsible stewardship of the earth” (Pennsylvania Center for Environmental Education). Many groups throughout the state are invested in bringing this definition to life and educating students of all ages.

New York has a similar outlook on environmental education, and the New York Department of Environmental Conservation heads up most of the state's environmental education efforts. See NYS DEC's education website (<http://www.dec.ny.gov/26.html>) for more information.

### **Pennsylvania Department of Environmental Protection (PA DEP)**

PA DEP continues to support environmental education through the Pennsylvania Environmental Education Grants Program, by displaying curriculum and information on their website, and by regularly attending and presenting at community events.

### **Pennsylvania Department of Conservation and Natural Resources (DCNR)**

DCNR provides educational programs through its various divisions. The Bureau of Forestry is a leader in educating people about forestry and native wild plant conservation and management. Audiences include school-aged children, educators, organizations, local governments, private landowners, consulting foresters, industry, and the general public. The Office of Wild Resource Conservation produces a variety of education materials: posters, activity books, and videos for the state's conservation agencies, PDE, and conservation groups.

Watershed education programs are offered through Pennsylvania State Parks, a part of DCNR. Programs provide school-aged children with field-learning experiences through hands-on activities. Moraine State Park, although not located in the project area, provides three programs for the greater region.

### **Pennsylvania Fish and Boat Commission (PFBC)**

Through workshops, PFBC provides curriculum-based environmental education to teachers and other educators that want to enhance their instruction skills. Through PFBC, educators are able to access the International Conservation Education Program, Project Wild, and the Pennsylvania Amphibians and Reptiles Educator Workshop. PFBC also supplies the public with informational outreach, and assumes an active role in Envirothon competitions, which are further explained in the Envirothon section of this chapter.

### **Pennsylvania Game Commission (PGC)**

The amount of public land in the watershed allows for many opportunities to hunt and trap. PGC offers wildlife education to youth and adults in the form of hunter-trapper education. Through other programs (such as Project Wild) conducted in cooperation with a variety of organizations, PGC conveys a wildlife education message to citizens throughout the state.

### **Schools**

Creek Connections has forged an effective partnership between Allegheny College and regional K-12 schools to turn waterways in northwest Pennsylvania, southwest New York and the Pittsburgh area into outdoor environmental laboratories. Emphasizing a hands-on, inquiry-based investigation of local waterways, this project annually involves over 40 different secondary schools, several of which are located within the project area.

### **Pennsylvania County Conservation Districts**

County conservation districts collaborate with state agencies, watershed associations, school districts, and other groups to provide environmental education to their communities. A part of that work is to organize and conduct county Envirothon competitions.

### **Envirothons**

Envirothon programs in both Pennsylvania and New York provide environmental education to students throughout the states. County conservation districts organize regional Envirothon challenges where school groups compete against one another to test their knowledge of aquatic systems, forestry, soils, land use, wildlife, and current issues. The winning school from each county moves on to compete in the state Envirothon competition, and the winners of the state competitions compete at the national level.

The results of state Envirothon competitions show how well students within the Brokenstraw watershed are educated on environmental issues in comparison to other areas of Pennsylvania and New York. The 2009 Envirothon results are listed in Table 5-4.

**Table 5-4. 2009 Envirothon Results**

<b>County</b>	<b>Rank</b>	<b>Total Number of Teams</b>
Chautauqua	17	54
Crawford	19	67
Erie	4	67
Warren	3	67

*(Source: PA Envirothon, 2010; New York State Envirothon, 2010)*

### **Cooperative Extensions**

Cooperative extension offices, linked with Cornell University in New York and The Penn State University in Pennsylvania, provide environmental education outreach. Each office provides access to collegiate expertise and resources, while maintaining local service providers and accessibility. Programs run by cooperative extensions include after-school programs, youth development, 4-H, and economic and community development programs.

## **Historical Resources**

### **Historical Overview**

On March 12, 1800, an act separating Crawford, Mercer, Venango, Warren, and Erie counties from the territory of Allegheny County in Pennsylvania was passed. These counties temporarily formed one county under the name of Crawford.

Crawford County was named in honor of Colonel William Crawford who was a defender of the area against attacks from Native Americans. Meadville is the county seat (Crawford County, 2009).

Erie elected its own county officials in 1803, and was subsequently formally organized. The city of Erie is the county seat; both places borrow their names from Lake Erie, which forms the natural northern border of the county.

Warren County was formally organized in 1819, and it was named in honor of General Joseph Warren, a patriot who died at the battle of Bunker Hill during the American Revolution. The city of Warren is the county seat (Warren County Historical Society).

Chautauqua County, New York was partitioned from Genesee County on March 11, 1808. This partition was performed under the same terms that produced Cattaraugus and Niagara counties. The partition was performed for political purposes, but the counties were not properly organized, and they were all controlled as part of Niagara County. On February 9, 1811, Chautauqua County officially organized, and its separate government launched. Its name may be a contraction of a Seneca Native American word meaning “where the fish was taken out,” but this suggestion remains controversial.

### **Origin of names**

Taken from the translation of the Native American word “Koshanuadeago,” the name “Brokenstraw” was derived from the annual crop of tall prairie grasses that once grew in Irvine Flats at the mouth of the



creek. These grasses would break and bend after autumn flooding, then appearing as broken pieces of straw; hence, the name Brokenstraw was given to the waterbody and surrounding area (Marshall, 1920).

### Early Settlement

The early history of this area was besieged with a great deal of conflict, as the Seneca, French, English and Americans struggled for control of the land. With the arrival of settlers, communities were established with houses, farms, schools, businesses, and industries. Many features of this time are still visible today.

By the 16<sup>th</sup> century, the Seneca members of the Iroquois Nation controlled the area, which is now Warren County. In the 18<sup>th</sup> century, the most noted Seneca was the famous “Cornplanter,” the son of a Dutch trader from Albany and a Seneca woman. After fighting for the British during the Revolution, Cornplanter switched his allegiance, and became a defender of the new American government, and an instrument in establishing treaties between the American government and the Iroquois Nation.

Despite the opposition of some of his contemporaries, Cornplanter warded off Native American incursions from the west. He was rewarded for his efforts with several parcels of land from the Commonwealth of Pennsylvania, one of which—the Cornplanter Grant—became his home until his death in 1836. Until the waters of the Allegheny Reservoir flooded Cornplanter’s property, his heirs lived on their ancestral land.

In Corry, settlers began arriving in the late 1700s. One of the earliest was Michael Hare, who staked his claim on land given to him by the newly-formed government of the United States. He and his wife, Elizabeth, built a log cabin in 1795 on the bank of what is now known as Hare Creek, located one mile north of Corry.

### Industrialization

Industry played an important role in the settlement of the region. With the turn of the 18<sup>th</sup> century, lumbering operations were beginning in the Brokenstraw Creek drainage and all along the upper Allegheny River. Early mills were built on Brokenstraw Creek at Garland and Spring Creek in 1800 and 1802, and in Freehold Township along Little Brokenstraw Creek in 1815. In 1801, the first lumber rafts transported the output of the Garland mill to Pittsburgh. Soon after, mills lined both banks of the Brokenstraw. Rafts of lumber descended the Allegheny River, floating to Pittsburgh during seasonal flooding (Schenck, 1887).

The construction of railroad tracks through the piney woods in the early 1800s heralded a new era for the town of Corry, Pennsylvania. The discovery of oil in nearby Titusville, combined with railroad growth, contributed greatly to Corry’s development.

### Civilian Conservation Corps

On March 31, 1933, President Franklin D. Roosevelt signed the Emergency Conservation Act, leading to the formation of the Civilian Conservation Corps (CCC). The CCC—a work relief program for young men ages 18 to 25 during the Great Depression—provided jobs, training, and accommodations. Members were placed in camps where they lived and participated in conservation work to improve access and amenities to address recreational demand. Projects included building roads, bridges, foot trails, horse trails, cabins, and recreational impoundments. One camp, S-110, was situated in the Brokenstraw Valley in Panama, New York. Projects at this camp varied from fire protection to road and trail building.

In 1942, the U.S. involvement in World War II caused a depletion of resources and the workforce necessary to continue the CCC program, and it was subsequently unauthorized. However, the efforts of

these young men throughout a difficult time in history are evident at numerous state and national parks across the U.S.

### Postal Delivery

In colonial times, communications depended on friends, merchants, and Native Americans to carry messages between colonies. However, most correspondences ran between the colonies and England. William Penn established Pennsylvania's first post office in 1683 (U.S. Postal Service).

In May 1775, as the colonies separated from England, a Continental Congress was organized to establish an independent government. One of the first questions before its delegates was how to convey and deliver the mail. Benjamin Franklin was appointed chairperson of the committee to establish a postal system, and he was later appointed the first Postmaster General. The present day postal service descends from the system planned by Benjamin Franklin (U.S. Postal Service).

In the days prior to telephones, radios, and television, communication from the outside world was obtained through mail and newspapers. Mail was delivered to the post office and picked up by recipients. Many families waited days, weeks, or months to pick up their mail in order to coordinate trips for supplies, food, or equipment.

### Transportation

Transportation routes, in their most primitive form, were paths created by Native Americans. These paths provided a means for travel and trade among distant Native American communities. Settlers later followed these paths on foot and horseback, along with using canoes and Native American boats to travel between settlements. Packsaddles were often used to transport goods and commodities. In the early 1800s, the establishment of roadways began.

Prior to 1830, Keelboats provided the only transportation between Warren and Pittsburgh. Beginning with the arrival of the steamer "Allegheny" in 1830, a succession of steamboats from Pittsburgh served as transportation until the Sunbury and Erie Railroad was completed from Erie to Warren in the 1860s. By 1883, Warren was the hub of a network of railroads leading in all directions.

In 1849, a plank road was built from Westfield through Sherman and Clymer to the state line in order to provide transportation between Lake Erie and the Allegheny River.

The Buffalo, Corry and Pittsburgh Railroad runs through the town of Clymer. Clymer was bonded for \$20,000 shortly after the Civil War to assist the Buffalo Oil Creek Cross Cut Railroad. They had received a charter in 1865 to connect Brocton and Corry, spanning a distance of 43.2 miles. On June 8, 1878, the railroad was abandoned, but on January 7, 1879, it resumed its operations and became one of the greatest factors in the development of Clymer (Vidal, 1939).

In Corry, around 1861, two railroads known as the Sunbury & Erie and the Atlantic & Great Western railroads crossed each other's right-of-ways in the corner of the county. They established a frame ticket office at the junction point known as the "Atlantic and Erie Junction."



***Railroads were a great factor in the development of towns throughout the watershed***

### Education

Many early settlers within the watershed and throughout North America had limited educations, but wished to provide more for their children. As small towns and villages were established, so were early schools. Subscription schools were common in the Brokenstraw watershed, such as the log schoolhouses in Eldred and Spring Creek townships. A subscription school fee was commonly between one and five dollars per pupil. Textbooks used by early schools included the New Testament, Webster's Elementary Speller, the American Preceptor, Dillworth's Arithmetic, and the Columbian Orator. In 1838, the ratification of the Common Schools Act put an end to subscription schools, requiring a general system of education be established, providing all students with a free education.



*Hudson Corners School, established in 1857*

### Significant People

**Chief Cornplanter**, also known as John Abeel, was the son of a Dutch trader and Seneca Indian mother born around the year 1750 at Ganawagus, New York. He was a member of the Wolf clan. Cornplanter was the principal war chief of the Seven Nations. After initially cooperating with the white settlers, Cornplanter became disillusioned with them after 1812 because of their terrible treatment of his people. He burned his military uniform, broke his swords, and destroyed all his medals, closed the Indian schools and sent the missionaries away. He died on the Cornplanter Tract February 18, 1836. He was the first Native American Indian to be honored with a monument in the United States (Warren County Historical Society, 2008).

**Hiram Cory** once owned the land at the Atlantic and Erie Railroad Junction. In 1861, by request, a small piece of his 63-acre property was sold to the Atlantic & Great Western Railroad. The superintendent of the railroad was pleased by Hiram Cory's fair price and renamed the junction in his honor. However, the name of Cory was misspelled in the process, and the city of Corry, PA was created as a result. (Corry, Pennsylvania).

**Guy Hecker** was a Major League Baseball pitcher who played for Louisville and Pittsburgh. He was born on April 3, 1856 in Youngsville, Pennsylvania. He played for nine years, and threw a no-hitter in 1882. Guy Hecker is considered by some baseball historians to be the best combination pitcher and hitter to play in the 19<sup>th</sup> century. He died December 3, 1938 (Bailey).

**Robert Jackson**, Associate Justice of the Supreme Court of the United States, was born in Spring Creek, February 13, 1892. He was a legal advisor for much of the New Deal, and was considered as a successor for Franklin D. Roosevelt. He was named Assistant Attorney General in 1936, Solicitor General in 1938, Attorney General in 1940, and Associate Justice of the Supreme Court in 1941. President Truman appointed Mr. Jackson to Chief Counsel to represent the United States at the Nuremberg Trials. Jackson died in 1954 (Warren County Historical Society, 2008; Robert H. Jackson Center).

**Michael Shine** was an U.S. Olympic athlete in the 1976 Summer Olympics held in Montreal, where he earned the silver medal in the 400-meter men's hurdles. He was born on September 19, 1953, and was raised in Youngsville, Pennsylvania. Shine attended Youngsville High School, where he ran track before going on to compete at the Olympic level (<http://www.sports-reference.com/olympics/athletes/sh/mike-shine-1.html>) (McGill, 2005).

### **Historical Sites, Structures, and Districts**

In 1966, the National Historic Preservation Act established the National Register of Historic Places. Listed properties include districts, sites, buildings, structures, and other objects significant to American history, architecture, archeology, engineering, and culture. Although private property owners are encouraged to maintain and preserve historic integrity of registered sites and structures, owners can maintain or manage their property as they see fit.

The Pennsylvania Historical Museum Commission manages the register for Pennsylvania. The state historic preservation officer submits nominated properties to the state review board. If the property owners or the majority of the owners (if the property is owned by more than one person), object to the nomination, it is sent to National Parks Service for a determination of eligibility without the property being listed in the National Register (National Parks Service, 2001).



*Irvine United Presbyterian Church was built in 1837*



*The Little Red School House in Clymer, NY*

In Clymer, New York, the Little Red School House is on the register. Established in 1853 and used for almost 90 years, the Little Red School House functions as a museum today (Hoitink, 2005).

In Corry, the Amory is another historic place on the registry. Still serving its original function, the Corry Amory was listed in 1991 (National Register of Historic Places<sup>1</sup>).

The Irvine United Presbyterian Church is another watershed landmark on the Registry of Historic Places. The church was built in 1837, and has been listed since 1976 (National Register of Historic Places<sup>2</sup>).



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## CHAPTER 6. ISSUES AND CONCERNS

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Throughout the development of the Brokenstraw Creek Watershed Conservation Plan, interested community members, visitors, and those who work in the region—also known as stakeholders—were given several opportunities to provide their unique perspective on topics affecting the region. Western Pennsylvania Conservancy (WPC), Brokenstraw Watershed Council (BWC), and the project steering committee hosted a series of workshops, a municipal officials meeting, a field tour, and met with groups and individuals to ascertain the community’s perspective about the watershed. Issues and concerns identified at the various workshops and meetings along with the results from the public surveys, municipal surveys, and stakeholder interviews were compiled and are presented in this chapter. Expressed views and opinions represent those of the stakeholders, and do not necessarily reflect the views and opinions of WPC, BWC, or any of the representatives of the project steering committee.



*In February 2009, municipal officials gathered for an informational meeting about the Brokenstraw Creek Watershed Conservation Plan*

Receiving input from the local stakeholders is a crucial component to the success of the conservation plan. Gaining access to local knowledge is necessary to understand the strengths and weaknesses of the watershed values. The best sources of information and insight into the watershed are the people who live in it and have firsthand experience with the challenges it faces. The information gathered through surveys and interviews determines what recommendations are made to preserve the strengths and remediate the weaknesses affecting the Brokenstraw Creek watershed.

### Meeting Summaries

#### Initial Meetings

WPC, with funding provided by the Pennsylvania Department of Conservation and Natural Resources (DCNR) Community Conservation Partnerships Program and the Foundation for Pennsylvania Watersheds, hosted a series of meetings to engage the public in discussion about watershed concerns and issues, as well as provide information about the development of the conservation plan. This was the first opportunity for the local residents to express their concerns. In addition to the public meeting workshops, BWC hosted a public field tour that provided stakeholders an opportunity to share their issues and concerns on a one-to-one basis with the planning team.

#### School Visits

Between November of 2008 and January of 2009, three high schools in the area were visited to gather information from students regarding the watershed. The participating schools were Eisenhower High School, Falconer High School, and Youngsville High School. Information gained from the students included things they like, needed improvements, negative impacts on the environment, changes to the area, and potential projects for the watershed. The information gathered from the students is important, because it is the voice of the younger generation in the watershed, and it provides a different perspective on watershed issues.



*An educational session held during the public field tour in September 2008.*

### **Focus Group Meetings**

In February 2009, two focus group meetings were held. A special meeting of local municipal officials was held to inform them about the watershed conservation plan and its benefits to local municipalities. A second focus group meeting was held with advisory committee members to obtain their insight about the resources within the Brokenstraw Creek watershed.

### **Surveys and Interviews**

Both public and municipal surveys were conducted as part of the information gathering process. Municipal officials were surveyed to gain a better understanding of the area's characteristics. The public was surveyed in order to obtain insight into their values in regards to the watershed.

Thirteen key individuals who have significant knowledge of the watershed area were contacted and interviewed via telephone. This process pulls together in-depth knowledge from long-time residents that are familiar with the watershed's past, current, and future values, issues, and needs. The results of these interviews will be identified later in this chapter.

## **Issues and Concerns**

### **Water Resources**

#### **Gas and Oil Drilling**

A major concern is that gas and oil drilling in the region will lead to decreased water quality. The prevalence of Marcellus shale drilling in nearby watersheds has led to an increase of negative effects on the environment. The treatment of gas wells with brine water is also a concern because of its negative impact on water quality. Overall, the increase in drilling has heightened awareness among local residents.

#### **Runoff**

Residents expressed their concern over runoff from dirt roads, timbering, agriculture, and its effects on water quality. The use of brine water on dirt roads, which are plentiful in the region, may decrease water quality. One respondent felt that the brine water may be worse than the dust itself..

Another concern related to runoff is with large dairy farms located in the watershed region. Several stakeholders are concerned that these large farms, some having over 200 cows, are not controlling waste and manure properly, leading to runoff that affects adjacent waterways. The stakeholders want to know what kind of negative impact these concentrated farms are having on water quality.



*Runoff from a logging road*

#### **Sedimentation/erosion**

Erosion and sedimentation can be exacerbated by human influences on the land, such as development, roads and impervious surfaces, and removal of vegetated riparian buffers. There is also a need for better management of storm water and flooding. Many residents commented on the lack of management and the negative impacts that flooding can cause, which include erosion and sedimentation.



### Sewage

There are a few concerns regarding sewage in the watershed area. One such concern is the impact of sewage overflow on Hare Creek. The overflow has been corrected, but stakeholders are concerned with how long the negative impacts will affect the creek's aquatic life. In Columbus Township, public sewage systems are not available to all residents; the alternative is for landowners to utilize on-lot septic systems, which can malfunction and impact the water quality of Coffee Creek. On-lot systems built near waterways impact water quality in the region and are of concern to stakeholders.

### Infrastructure

The major issue regarding infrastructure deals with transportation-related problems. Many of the roads and highways are in need of work and repairs. There are many dirt and gravel roads in the area that contribute to runoff and sedimentation. Route 6 experiences heavy truck traffic and has been coined by one resident as "tanker alley." It is in need of extensive maintenance and repair due to the high volume of truck traffic, which is mainly due to the expansion of the oil and gas drilling industry in the area. Along with these problems, stakeholders point out that there is a lack of public transportation available. The main concern is that there is a lack of funding to help remedy these issues, and that little to no effort will be made to fix the problems.

Other issues with infrastructure involve a deficient backpacking trail system, the need for facility improvements at public access sites—such as upgraded restrooms and parking—and the development of lodging for visitors to the region. One of the major concerns is the suffering economy, and stakeholders feel that by fixing these issues, tourism will increase leading to an improved overall economy.

### Employment

The struggling economy was the biggest issue expressed in regards to employment. It has led to a poor job market, workforce downsizing and business closures. Many stakeholders mention that Corry, in particular, is in bad shape; several businesses have closed or are closing. Others suggest that employment opportunities are minimal, with the exception of the Cummins Engine Plant, as it supplies a decent amount of jobs. The overall feeling is that younger generations are leaving the area for education and better paying jobs. Businesses need improvement and the job market needs to be enhanced to help the local economy. Education is also a concern; many feel the lack of educational opportunities are causing the younger people to leave. The area fails to offer a means for untrained individuals to seek higher education and opportunities.

### Recreation

Access to public lands is an issue, and many want to see Pennsylvania State Game Lands used for other recreational activities, such as bird watching, hiking, and scenic vistas during the hunting off-seasons. There also was concern that many people avoid user fees at recreation areas such as Buckaloons by parking along National Forge Road and walking into the park to avoid paying, which creates safety and traffic issues. Local residents are concerned about fishing and hunting in the area, as well. Improvements need to be made to public access areas to the streams. Other comments range from a dwindling deer population for hunters, to the need for fishermen to be better educated on protecting the fish population in the area.



*A bicyclist taking a break to examine something on the side of the road*

In addition, respondents noted a need for improvements for canoeing and kayaking the waters of Brokenstraw Creek and Allegheny River; better regulation of ATV riding and snowmobiling; and improved control and management of disrespectful recreation, such as littering and fires. Overall, the feeling is that these recreational activities draw many tourists to the area, but necessary improvements and adjustments need to be made in order to keep it both attractive and environmentally friendly.

### **Biological**

One of the biggest biological concerns is the impact from invasive species, such as the gypsy moths, emerald ash borers, plume grasses, phragmites, knotweed, viburnum shrubs, viburnum leaf beetles, garlic mustard and canary grass. Each of these invasive species has an impact on the local habitat, and residents are concerned that if nothing is done to prevent their prevalence, the negative impacts will take a toll over time.

There also are concerns over farming and timber management in the area. Several local residents comment on how there is a lack of forest canopy in certain areas and they would like to see more done to regulate forestry practices. They also want to see the farming and agricultural industry better regulated in order to protect land and water quality.

Other issues include a general concern over bat habitat management for local wildlife. Two comments were made concerning bat conservation and the stocking of non-native fish. Residents feel that improvements need to be made in both of these areas to protect both the local bat population, as well as preserve the area's native fish population.

## **Public Meeting Results**

### **Positive Aspects**

- High biological diversity, wildlife, presence of eagles—variety of species throughout watershed (31)
- Abundance of natural resources and natural beauty (9)
- High quality streams (8)
- Buckaloons historical aspects and archeological digs (8)
- Wetlands provide unique habitat to region (8)
- Clean water (7)
- Jonny Appleseed began in this area; however, evidence was washed away (7)
- Hunter/Fisherman population and tourism attraction (6)
- Deer management in regards to forest undergrowth (6)
- Headwaters of Spring Creek, Whitney Run and Youngsville reservoir water quality (4)
- Potential to utilize micro-hydro renewable energy with low-impact stream flow dam to generate electricity and boost economy of Columbus (4)
- Low crime rate (3)
- Strong fine arts support –theater, gazebo summer music, fine arts council-student and children's (3)
- Brokenstraw Watershed Council awareness and cooperation strategy of providing each watershed municipality with a copy of the watershed map (3)
- Good quality public water systems and well water for residents (3)
- Pennsylvania Game Lands under public ownership (2)
- Excellent agricultural community—Progressive Farmer “Warren County #2 agricultural county in Pennsylvania to live” (2)
- Cooperation of groups involved in planning and studies could work together to increase chances of funding (2)

- Cornfield 500 and Hillbilly wedding were nationally televised (2)
- Corry Junction Greenway Trail (1)
- Robert Jackson memorial in Spring Creek (1)
- Local residents, friendly neighbors (1)
- Presence of elderberries, leeks, mushrooms, and black berries (0)
- Climax Engine-Locomotive Company in Corry and the museum (0)
- Recreational opportunities (0)
- Good municipal cooperation in Warren Council of Government (0)
- Maintain existing small family farms in the region (0)
- Lay of the land (0)
- Some major dirt and gravel roads improved with funding through dirt and gravel roads program (0)
- The natural beauty of the area. The extensive flood plane that surrounds Brokenstraw has restricted the influence of people to outside the flood plane and kept the creek bed natural. (e-mail)

### **Improvements**

- Improve enforcement of existing regulations, local, state, and federal (16)
- Impacts from invasive species both plant and animals, such as gypsy moths and emerald ash borers (14)
- Implement agricultural best management practices, especially in New York (10)
- Brine water treatment for oil and gas wells. State does not have adequate personnel to enforce regulations (9)
- Sedimentation from bridges and roads gets into streams because there are no edges or sides along bridges to stop sediment, road salt, and brine from falling over the bridge into streams (8)
- Improve quality of water in Hare Creek due to impacts from sewage overflows and point sources, such as Corry Concrete. How will the prolonged impacts from sewage overflow downstream of the Corry Treatment Plant affect Hare Creek? The overflow is corrected, now high chlorine discharge is impacting aquatic life (8)
- User fee at Buckaloons Recreation area deters local residents from using the recreation facility. “It is not worth the \$5 for short visits.” Many people also park along National Forge Road and walk into the park to avoid paying the fee, creating safety and traffic concerns (7)
- Younger generation is leaving the area for education and better paying jobs. Business improvement and job market needs enhanced (7)
- Economy needs help (6)
- “Milk Factories” –Large farms with 200+ cows—how are they controlling their waste and manure. What impacts are these concentrated farms having on the water quality? (6)
- Access to public lands—specifically Pennsylvania Game Commission lands—for other uses such as bird watching, hiking, scenic vistas. Some visitors are not willing to walk far for scenic vistas and wildlife watching opportunities. Work with PGC to increase access via gated state game land roads during hunting off seasons (5)
- Use of brine on roads for dust control impacts water quality. There is a need for an economic alternative (5)
- Riparian zones (5)
- Cooperation and awareness among agencies to help citizens contact the correct agency without getting the run around (4)
- Cooperation is needed between Allegheny National Forest and local visitors’ centers to share and distribute information. Increase awareness of available resources to community residents (4)
- Public access to waterways and posting of property (3)
- Old medicine disposal methods unknown to citizens (3)
- Vandalism by ATV users on Rails-to-Trails (2)
- Lack of lodging for visitors to the region – hotels, motels, bed & breakfasts (1)

- Increase availability of water quality data for Brokenstraw Creek (1)
- There are a variety of impacts affecting Brokenstraw Creek and its tributaries. Impacts depend upon portion and the location within the watershed. Prioritized studies are needed to determine which impacts should be addressed first (1)
- Columbus Township, not all residents are on public sewage systems. The on-lot systems are impacting the water quality of Coffee Creek (1)
- Columbus Dam (Easter Flood 1946) washed out recreational opportunities that once existed (1)
- In Columbus, 1,000 cottages are located in a blight area needing repair and maintenance that could become attractive and desirable with recreational opportunities (1)
- Infrastructure—roads in winter, extra water/flooding in spring (1)
- Improve facilities at public access sites, such as restrooms and parking (0)
- Personnel to maintain public camping facilities on state and federal lands, need for funding (0)
- Dirt and gravel road impacts—the roads need paved—money available isn't going to the townships (0)
- Negative impacts of road salt (0)
- Use resources available to attract business and tourism while protecting the resources (0)
- Improve fishing opportunities (0)
- Transportation into and out of the area (0)
- Soggy areas, has improved some, but is still an issue (0)
- Not enough deer for hunters (0)
- Corry Historical Society Museum could be improved (0)
- Wilder Museum – access/safety/attractiveness to visitors is a concern. However, a positive is the programs that are hosted at the center (0)
- Lack of dance studios or places to learn how to dance (0)
- Access to visitors' center is a concern. Office hours are only during the week, not on weekend when most tourists visit the area. Center is run by volunteers, need some paid staff to run visitors centers to ensure information is available and accessible to visitors (0)
- Impacts caused by geese (0)
- Potential for a strip mine from Plank Road to Smith Road to remove gravel. Operator is working with DEP to acquire the necessary permits. It would be a one mile area that would require withdrawing water from Brokenstraw Creek for mining activities (0)
- Clymer Milk Plant—no longer in production—had affected water quality of Brokenstraw Creek. The facility is now a pallet manufacture and this has helped improve Brokenstraw Creek (0)
- Dead deer floating in streams (0)
- On-lot systems built near waterways impact water quality (0)
- Oil and gas drilling will have a need for maintaining pipeline and treating brine from the wells. Marcellus shale is too shallow in Warren County so it should not be as big impact as in eastern counties of Pennsylvania. (0)
- Leave out commercial development and keep the Brokenstraw natural and beautiful. (e-mail)
- Increase the water quality through controls over the water quality and development within the watershed. (e-mail)

### **Projects**

- Environmental education is key to making the plan work. Educational opportunities for K-adult with opportunities leading to action (26)
- Invasive species removal and control program including outreach to control problem before it gets worse (20)
- Install more agricultural best management practices on large dairy farms and educate farmers on the latest techniques (13)
- Conduct a watershed assessment to investigate water quality concerns in Hare Creek, Coffee Creek, and other tributaries (8)

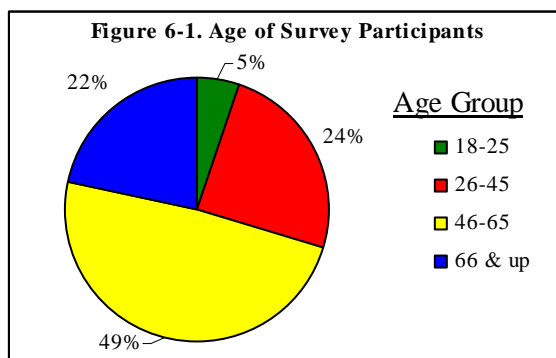
- Restore recreation to Columbus through low-head micro-hydro dam to generate electricity (8)
- Educate citizens about riparian buffers, their benefits, and landscaping etiquette towards conservation. For example not mowing to stream (7)
- Create public access to streams (6)
- Improve higher education opportunities (5)
- Conduct a pilot project to control road dust using an alternative product, such as soybean oil, etc. (4)
- Illegal dump cleanup (4)
- Protect all streams (4)
- Promote more funding to municipalities for dirt and gravel roads programs (4)
- Educate citizens on proper disposal of pharmaceuticals and return programs (3)
- Forest service budget to highlight history and its significance at Buckaloons Recreation Area (3)
- Connect NY and PA Rails-to-Trails and improve cooperation in trail development (3)
- Diversify jobs (2)
- Establish technical education about gas and timber extraction so local residents can obtain these higher paid positions (2)
- PFBC, DEP involvement in addressing point source discharges –Specifically Corry Concrete Company dumping remaining concrete materials over the streambank (1)
- Promote square dancing (1)
- Improve on-lot septic systems through community education (1)
- Better training for municipal road crews (0)
- Create ATV recreation area (0)
- Provide nature trails and parks that have environmental education about the sensitivity of nature and ways to protect it; along with plant, animal, and wildlife habitat identification. (e-mail)

## Survey Results

Public and municipal surveys were conducted to gather information on the issues and concerns from area stakeholders. The comments listed below are a compilation of the information received from the surveys. The comments listed in this section do not necessarily reflect the views of WPC or the organizations represented on the steering committee.

### Public Survey Results

Public surveys were available at public meetings, community events, area businesses, and on the



Internet. The results of these surveys were taken into consideration during the development of the management recommendations for this plan.

### General Demographics

The majority of the survey participants—84 percent—were local residents to the area. A total of 21 men and 16 women completed surveys.

As indicated in Figure 6-1, the majority of participants were among the 46 to 65 age group.



**Table 6-1. Location of Residents Completing Surveys**

County	Municipality	# of Participants
Chautauqua	North Harmony	1
Crawford	Spartanburg	1
Erie	Corry	8
Erie	Wayne	1
Warren	Brokenstraw	3
Warren	Clarendon	1
Warren	Columbus Township	6
Warren	Pittsfield	1
Warren	Spring Creek	2
Warren	Spring Creek	1
Warren	Warren	1
Warren	Wrightsville	1
Warren	Youngsville	4

Residents

**1. In what county and municipality do you reside?**

Of the residents that completed the survey, 20 were from Warren County, nine from Erie County, and one each from Crawford and Chautauqua counties. Residents within the City of Corry had the most returned surveys, with eight, while Columbus Township submitted six surveys. Table 6-1 identifies the location and number of surveys that were received from residents of the area.

**2. In what part of the Brokenstraw Creek watershed do you reside?**

- 19 Brokenstraw Creek
- 5 Spring Creek
- 3 Little Brokenstraw Creek
- 2 Hare Creek
- 2 Other/Don't Know

**3. How long have you lived in the area?**

- 0 Less than 1 year
- 6 1–10 years
- 6 11–20 years
- 3 21–30 years
- 4 31–40 years
- 3 41–50 years
- 4 51–60 years
- 4 60+ years

**4. How far do you travel to work?**

- 10 Less than one mile
- 11 1–15 miles
- 5 16–30 miles
- 0 31–45 miles
- 1 46–60 miles
- 3 Retired

Visitors

**1. Do you own property in the watershed**

- 2 Yes
- 4 No

**2. How far did you travel to visit?**

- 0 Less than one mile
- 3 1–30 miles
- 0 31–60 miles
- 1 61–90 miles
- 1 91–120 miles
- 0 121–150 miles
- 0 151–180 miles
- 1 180+ miles

**3. How long did you stay on this trip?**

- 4 Less than one day
- 0 1–2 days
- 0 3–4 days
- 0 5–6 days
- 0 One week
- 0 A week and a half
- 1 Two weeks
- 1 Longer

**4. Approximately how much did you spend?**

- |   |                 |   |               |
|---|-----------------|---|---------------|
| 4 | Less than \$100 | 1 | \$501-\$1,000 |
| 0 | \$100-\$500     | 0 | \$1,000+      |

**5. What were your two biggest expenses?**

- |   |         |   |                     |
|---|---------|---|---------------------|
| 3 | Food    | 2 | Recreation Supplies |
| 1 | Lodging | 2 | Other               |

**6. What was your reason for visiting?**

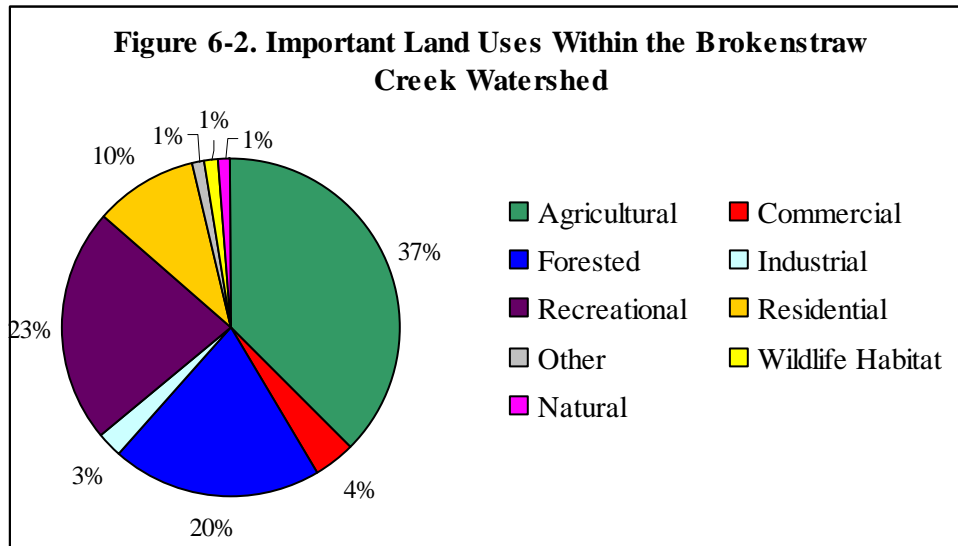
- |   |                |   |                     |
|---|----------------|---|---------------------|
| 1 | Business       | 3 | Recreation/Vacation |
| 1 | Family/Friends | 1 | Passing Through     |

**7. How often do you visit?**

- |   |            |   |                                     |
|---|------------|---|-------------------------------------|
| 0 | First time | 2 | Occasionally (every two-five years) |
| 2 | Seasonal   | 0 | Every five years                    |
| 0 | Yearly     | 0 | Other                               |

General Questionnaire

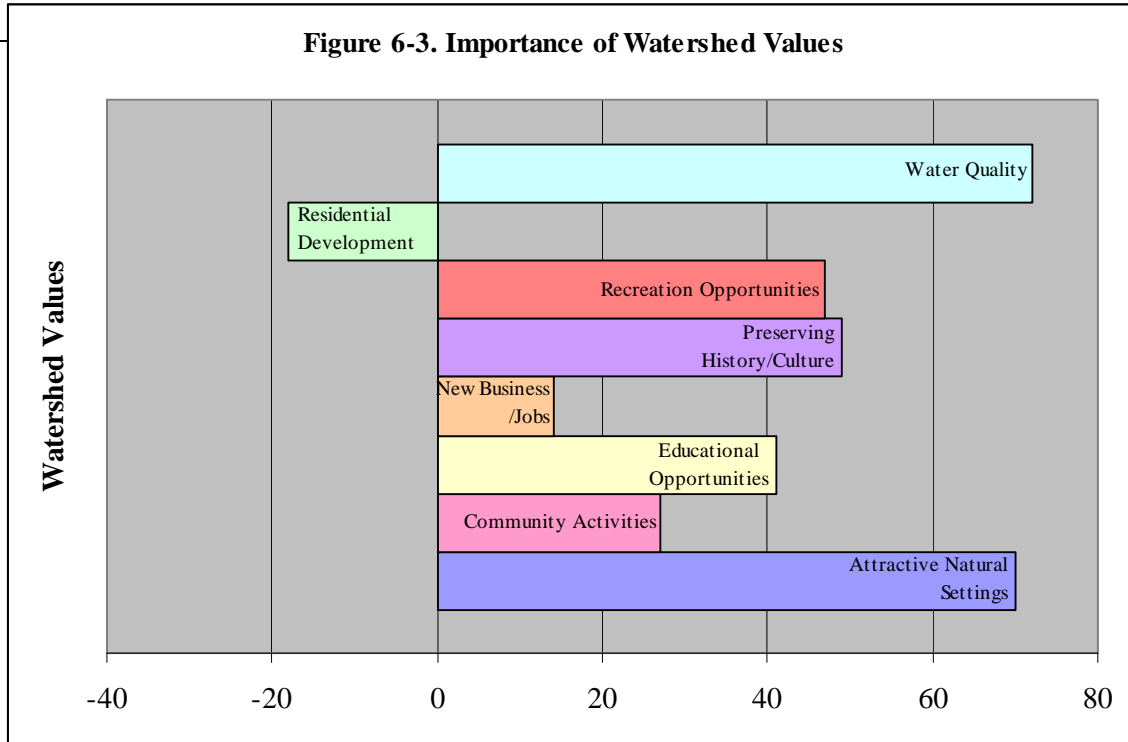
**1. What do you think are the two most important land uses within the Brokenstraw Creek watershed?**



**2. Where did you obtain this survey?**

- |   |                                |   |       |
|---|--------------------------------|---|-------|
| 9 | Brokenstraw Watershed Alliance | 4 | Event |
| 8 | Mail                           | 9 | Other |
| 6 | Business/Restaurant            |   |       |

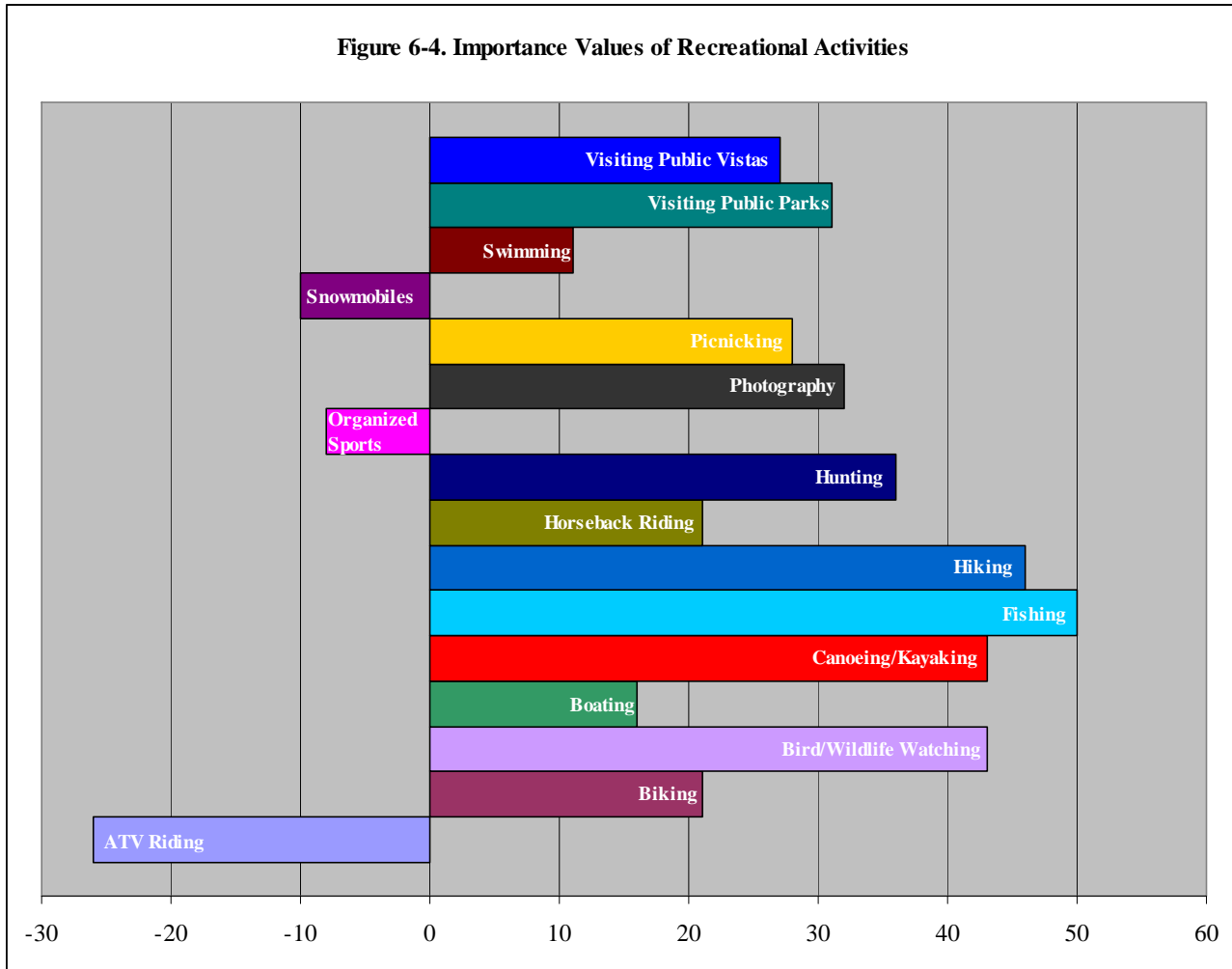
3. Please indicate the importance of the following watershed values.



**Table 6-2. Importance of Watershed Values**

	Very Important 2 points	Somewhat Important 1 point	Neutral 0 points	Not Likely Important -1 point	Not Important -2 points	Totals
Water Quality	34*2=68	4*1=4	0*0=0	0*-1=0	0*-2=0	72
Attractive Natural Settings	33*2=66	4*1=4	2*0=0	0*-1=0	0*-2=0	70
Preserving History/Culture	21*2=42	11*1=11	2*0=0	2*-1=-2	1*-2=-2	49
Recreation Opportunities	19*2=38	11*1=11	6*0=0	2*-1=-2	0*-2=0	47
Educational Opportunities	16*2=32	12*1=12	6*0=0	1*-1=-1	1*-2=-2	41
Community Activities	8*2=16	16*1=16	10*0=0	3*-1=-3	1*-2=-2	27
New Business/Jobs	13*2=26	6*1=6	9*0=0	2*-1=-2	8*-2=-16	14
Residential Development	3*2=6	5*1=5	8*0=0	11*-1=-11	9*-2=-18	-18
Other						
Green Energy Agriculture						

4. Please indicate the importance of the following recreational values in the watershed.



**Table 6-3. Importance of Recreational Values in Brokenstraw Creek Watershed**

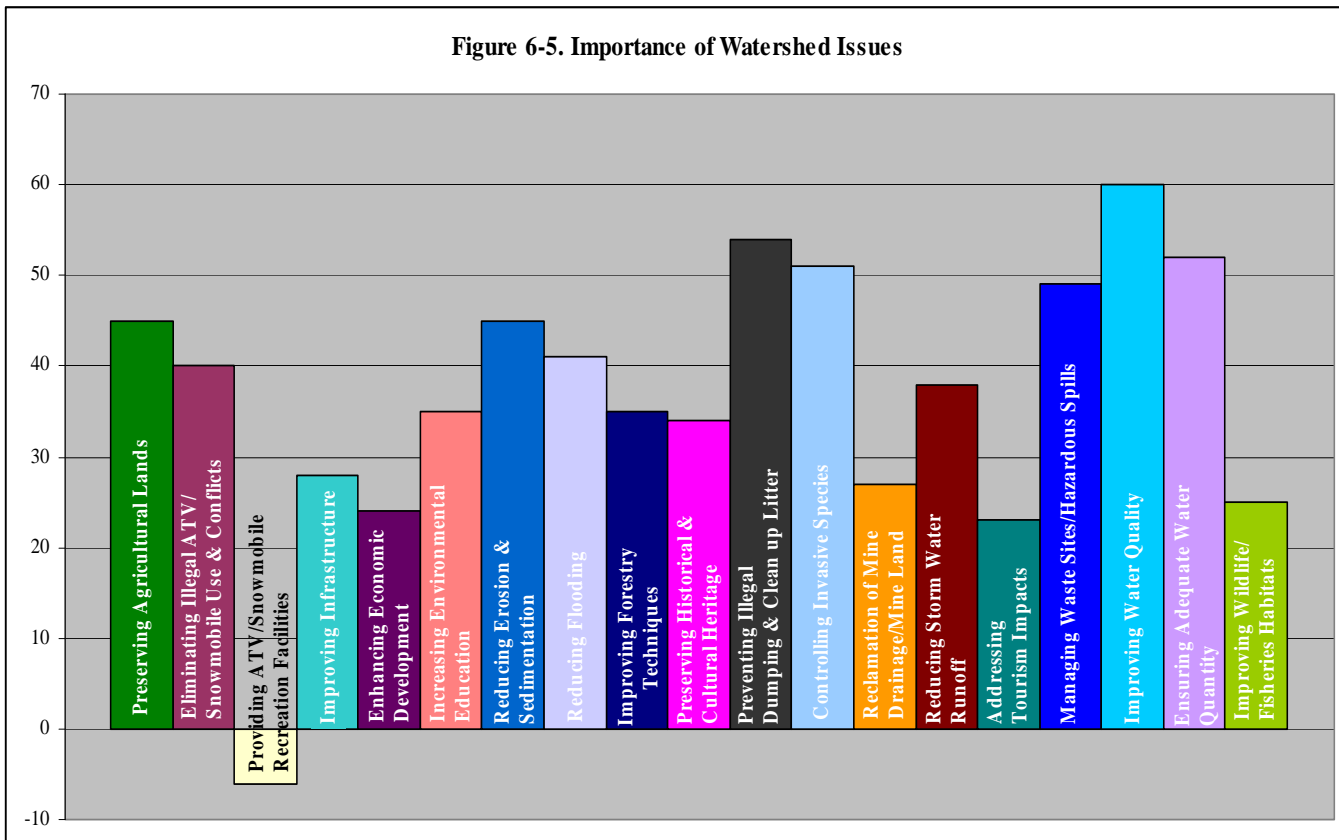
	Very Important 2 points	Somewhat Important 1 point	Neutral 0 points	Not Likely Important -1 point	Not Important -2 points	Totals
Fishing	22*2=44	10*1=10	3*0=0	0*-1=0	2*-2=-4	50
Hiking	20*2=40	9*1=9	4*0=0	1*-1=-1	1*-2=-2	46
Bird/Wildlife Watching	18*2=36	12*1=12	3*0=0	1*-1=-1	2*-2=-4	43
Canoeing/Kayaking	16*2=32	13*1=13	5*0=0	0*-1=0	1*-2=-2	43
Hunting	16*2=32	11*1=11	4*0=0	3*-1=-3	2*-2=-4	36
Photography	15*2=30	11*1=11	4*0=0	1*-1=-1	4*-2=-8	32
Visiting Public Parks	14*2=28	9*1=9	5*0=0	2*-1=-2	2*-2=-4	31
Picnicking	12*2=24	9*1=9	11*0=0	1*-1=-1	2*-2=-4	28

**Table 6-3. Importance of Recreational Values in Brokenstraw Creek Watershed (continued)**

	Very Important 2 points	Somewhat Important 1 point	Neutral 0 points	Not Likely Important -1 point	Not Important -2 points	Totals
Visiting Public Vistas	11*2=22	11*1=11	7*0=0	0*-1=0	3*-2=-6	27
Biking	9*2=18	12*1=12	9*0=0	3*-1=-3	3*-2=-6	21
Horseback Riding	9*2=18	13*1=13	8*0=0	4*-1=-4	3*-2=-6	21
Boating	6*2=12	14*1=14	9*0=0	2*-1=-2	4*-2=-8	16
Swimming	6*2=12	9*1=9	12*0=0	8*-1=-8	1*-2=-2	11
Organized Sports	2*2=4	9*1=9	13*0=0	3*-1=-3	9*-2=-18	-8
Snowmobiles	2*2=4	10*1=10	10*0=0	4*-1=-4	10*-2=-20	-10
ATV Riding	2*2=4	4*1=4	10*0=0	4*-1=-4	15*-2=-30	-26

5. Please indicate the importance of addressing the following watershed issues.

Figure 6-5. Importance of Watershed Issues





**Table 6-4. Importance of Recreational Values in Brokenstraw Creek Watershed**

	<b>Very Important 2 points</b>	<b>Somewhat Important 1 point</b>	<b>Neutral 0 points</b>	<b>Not Likely Important -1 points</b>	<b>Not Important -2 points</b>	<b>Totals</b>
Improving Water Quality	27*2=54	6*1=6	1*0=0	0*-1=0	0*-2=0	60
Preventing Illegal Dumping & Clean up Litter	27*2=54	3*1=3	2*0=0	1*-1=-1	1*-2=-2	54
Ensuring Adequate Water Quantity	23*2=46	7*1=7	2*0=0	1*-1=-1	0*-2=0	52
Controlling Invasive Species	22*2=44	8*1=8	2*0=0	1*-1=-1	0*-2=0	51
Managing Waste Sites/Hazardous Spills	22*2=44	7*1=7	3*0=0	0*-1=0	1*-2=-2	49
Preserving Agricultural Lands	22*2=44	6*1=6	2*0=0	1*-1=-1	2*-2=-4	45
Reducing Erosion & Sedimentation	20*2=40	7*1=7	3*0=0	2*-1=-2	0*-2=0	45
Reducing Flooding	19*2=38	9*1=9	2*0=0	2*-1=-2	2*-2=-4	41
Eliminating Illegal ATV/Snowmobile Use and Conflicts	20*2=40	1*1=1	11*0=0	1*-1=-1	0*-2=0	40
Reducing Storm Water Runoff	14*2=28	11*1=11	7*0=0	1*-1=-1	0*-2=0	38
Increasing Environmental Education	12*2=24	13*1=13	7*0=0	1*-1=-1	0*-2=0	35
Improving Forestry Techniques	15*2=30	7*1=7	10*0=0	0*-1=0	1*-2=-2	35
Preserving Historical & Cultural Heritage	14*2=28	11*1=11	4*0=0	3*-1=-3	1*-2=-2	34
Improving Infrastructure	12*2=24	9*1=9	8*0=0	3*-1=-3	1*-2=-2	28
Reclamation of Mine Drainage/Mine Lands	13*2=26	6*1=6	9*0=0	3*-1=-3	1*-2=-2	27
Improving Wildlife/Fisheries Habitats	21*2=21	6*1=6	6*0=0	0*-1=0	1*-2=-2	25
Enhancing Economic Development	13*2=26	6*1=6	7*0=0	2*-1=-2	3*-2=-6	24
Addressing Tourism Impacts	10*2=20	9*1=9	9*0=0	2*-1=-2	2*-2=-4	23
Providing ATV/Snowmobile Recreation Facilities	2*2=4	10*1=10	7*0=0	4*-1=-4	8*-2=-16	-6

Other

Recreational Access

Multi-use Trails

Agricultural Nonpoint Source Pollution

**6. Please indicate the top three services/amenities that are lacking within the watershed.**

- |                               |                          |   |
|-------------------------------|--------------------------|---|
| 5 Emergency services          | 2 Public swimming pools  | 1 Public parking                                    |
| 5 Public restrooms            | 2 Public support         | 1 Farm stand  |
| 4 Nature park                 | 2 Public septic systems  | 1 Prevention of agricultural & industrial pollution |
| 6 Restaurants                 | 1 Canoe/kayak rentals    |   |
| 4 Lodging                     | 1 Guided recreation      |   |
| 2 Agricultural riparian zones | 2 Trails                 |   |
| 2 Education                   | 1 Supporting good stores |   |
| 2 Gas service stations        | 1 Public access to creek |   |

## 7. Other comments or concerns

- Brokenstraw watershed has a big geo thermal opportunity that doesn't exist anywhere else in the eastern U.S. that could be a big green clean energy boom for electric and help this area
- Supervision of gas and logging industries is needed
- Runoff and erosion from roads and ditches

## Municipal Survey Results

Each of the municipalities in the Brokenstraw Creek watershed was contacted via telephone to complete an information gathering survey. Nineteen of the 21 municipalities participated in the survey. The survey gathered valuable information regarding the issues and concerns of the municipal leaders of the watershed that was used during development of the plan.

### 1. Does your municipality have a comprehensive plan?

- 11 of the 19 responded yes
- 8 of the 19 responded no

### 2. Does your municipality currently utilize zoning?

- 10 of the 19 responded yes
- 9 of the 19 responded no

### 3. Does your municipality currently utilize subdivision ordinances?

- 5 of the 19 responded yes
- One municipality did not know
- 13 of the 19 responded no

### 4. Does your municipality have a floodplain ordinance?

- 11 of the 19 responded yes
- Two municipalities did not know
- 6 of the 19 responded no

### 5. Are there any municipal parks within your municipality?

- Borough W. Lawson Park, Town of Busti
- Edward F. Lumas, Town of Busti
- Unnamed Park of Southwest Drive, Town of Busti
- Clymer-Town Park, Town of Clymer
- Playground Equipment, Town of Harmony
- Butts Park, Town of North Harmony
- Sen. General Presents Lighthouse Park, Town of North Harmony
- Veterans Memorial Park, Town of North Harmony
- Ashville Common, Town of North Harmony
- Mather Park, Columbus Township
- City Park, City of Corry
- Seneca Street Park, City of Corry
- Mead Park, City of Corry
- North Warren Playground, Conewango Township
- Starbrick Playground, Conewango Township
- North Warren ball field, Conewango Township
- Hilltop Recreation Area, Youngsville Borough
- Island Recreation Area, Youngsville Borough
- Davis Street Park, Youngsville Borough

- 6. Does your municipality have any public water service?**
- 7 of the 19 responded yes
  - 11 of the 19 responded no
  - One municipality did not know
- 7. Does your municipality foresee the need to upgrade or establish public water within the next 10 years?**
- 4 of the 19 responded yes
  - 13 of the 19 responded no
  - Two municipalities did not know
- 8. Does your municipality have any public sewage systems?**
- 10 of the 19 responded yes
  - 8 of the 19 responded no
  - One municipality did not know
- 9. Does your municipality foresee the need to upgrade or establish public sewage within the next 10 years?**
- 5 of the 19 municipalities responded yes
  - 13 of the 19 municipalities responded no
  - One municipality did not know
- 10. Is there anything unique, or well known about your municipality that you would like to have highlighted in the plan?**
- Jackson Run Creek is a flood prone creek that needs controlled—rain gardens.
  - Outdoor activities destination, Gateway to Allegheny
  - Very agricultural and small town communities
  - Maple syrup production
  - Amish community
  - Yorker Museum
  - School kids museum is one of a few museums started by school kids located in the village of Sherman.
  - Historic ferry system is the oldest in the U.S.
  - Large recreation lakefront property
  - Panama rocks—privately owned park for sale
  - Dutch heritage to Amish community
  - Farming has declined
  - Busti-Hamlet developed area
- 11. Who provides emergency services?**
- **FIRE**—Lakewood Volunteer Fire Department, Busti Volunteer Fire Department, Clymer Volunteer Fire Department, Mina Lake Volunteer Fire Department, Panama Fire District, Ashville Fire District, Stanley Hose Company, Spartansburg Fire Department, Corry Fire and Police, Elgin Beaver Dam Fire Department, Grand Valley Volunteer Fire Department, Wrightsville Volunteer Fire Department, Bear Lake Volunteer Fire Department, Spring Creek Volunteer Fire Department, Sugar Grove Volunteer Fire Department, and Youngsville Volunteer Fire Department
  - **POLICE**—Lakewood-Busti Police Department, New York State Police, Pennsylvania State Police, City of Corry Police Department, and Youngsville Borough Police Department
  - **EMS**—Lakewood Volunteer Fire Department, Busti Volunteer Fire Department, Clymer Volunteer Fire Department, Mina Lake Volunteer Fire Department, Panama Fire District, Corry Ambulance, Youngsville Volunteer Fire Department, County Control, Sugar Grove Volunteer Fire Department, and First Response Team

## Interview Results

Interviews were conducted with 13 individuals who have intimate knowledge of watershed values and concerns. Questions are designed to allow the interviewee to express his/her insight into the strengths and weaknesses of the watershed and provide suggestions for how to make the plan as successful as possible. The results of the interviews were summarized in the following section.

### **1. How has the watershed changed in the past 10 years?**

Since the formation of the Brokenstraw Watershed Council there has been an increase in environmental awareness. Columbus Elementary School added a nature program into the school curriculum. Community members have become more aware of their surroundings and proactive in protecting the natural resources treasured throughout the region. Responsible parties from the Youngsville Municipal Authority have been prosecuted for falsifying reports.

Although not isolated to the Brokenstraw Creek watershed, there has been an increase in the amount of oil and gas drilling and the concern for its impacts to the environment. Most of these concerns are being driven by the influx on the play within the Marcellus shale formation. Oil and gas drilling seems to be more active in the lower section of the watershed. Impacts on Irvine Run from oil and gas drilling are evident at the Buckaloons Recreation Area.

Agriculture has dominated the landscape throughout the region for many, many years; however, within the last 10 years, the number of agricultural operations has been reduced. Narrow profit margins have caused some farmers to go out of business, while others have been pushed to increase production while utilizing fewer acres, which can lead to an increase of environmental impacts. Erosion, increased runoff and poor management of nutrients are the main agricultural impacts experienced within the Brokenstraw Creek watershed. The installation of streambank fencing and riparian corridors can reduce some of the impacts caused by erosion and runoff. These are good practices that have been installed; however, maintenance of these practices is needed to ensure their continued effectiveness. Manure storage and management, especially during the winter months, is another major concern that faces the Brokenstraw Creek watershed. Nutrient management plans should be developed, and landowners need to be educated about the use and benefits of the plans.

There has been a slight increase in the number of homes that have been built in the region that have created some impacts; but overall, these impacts have not been significant. There is a little bit of urbanized sprawl occurring. There has been an increase in runoff, especially during storm events occurring in the spring during the same time the snowfall is melting. These increases can be abrupt and overwhelming.

### **2. How do the following currently meet the needs of the watershed community?**

#### *Transportation*

Overall, transportation throughout the region seems to be sufficient. Due to the rural characteristics of the region, vehicles are necessary for transportation throughout the region. There is very little public transportation available, but there is little demand for it, as well. Many of the local roadways are composed of dirt and gravel. Although they are mostly well maintained, some areas have erosion issues. General maintenance of roadways is occurring but needs to be more progressive and utilize new technologies available to reduce impacts to the environment. This is challenging due to the low funding available for local roadways.

Route 426 and Route 6 have a high volume of heavy truck traffic. Some local residents have even nicknamed Route 6 as “Tanker Alley.” Some of the respondents are concerned that the increased volume of truck traffic increases the risk of having a hazardous spill.

#### Infrastructure

A majority of the watershed’s residents utilize wells to obtain drinking water and private septic systems to treat waste water. Urbanized areas, such as Corry and Youngsville, offer public water and sewage. Historically, Corry and Youngsville have had issues surrounding their sewage treatment systems, but due to expansions and updates, the systems are currently functioning properly. Due to the rural landscape and gravelly soils that exist throughout the project area, private septic systems are efficient in treating sewage and there is no real need to establish additional public sewage treatment systems.

#### Employment

The region is economically depressed with minimal opportunities for employment and lacks quality, high paying jobs. Outside of manufacturing and farming, there are few opportunities for employment. The number of jobs continually decreases in the region, as do wages. Over the past few years, there has been a significant reduction of large employers, which has impacted the local economy. Because of the weak economy and the lack of a diversified job market, young adults often leave the region.

#### Education

Overall, education within the local school systems is efficient according to interview participants. The small, community-based school systems provide a good education but receive limited funding.

The effectiveness of post-secondary education within the region has a variety of opinions. Some participants feel that educational programs at community colleges and universities outside of the watershed region adequately serve the region, while some wish post-secondary education or job training opportunities were located within the project area.

#### Zoning

Most of the zoning throughout the watershed is linked to county-wide zoning ordinances. While some feel that zoning ordinances are monitored carefully, others feel that regulations and permitting are not enforced. The varying opinions could be based upon the differences in zoning and subdivision ordinances among individual municipalities, since some municipalities have stricter regulations. Enforcement of regulations also varies from municipality to municipality.

### **3. Do the recreational opportunities currently meet the needs of the watershed community?**

#### Parks and Picnic Sites

There are plenty of parks and picnic sites located throughout the project area. Access sites, while available, are often unknown or poorly signed. Establishing official access sites are needed; however, the establishment of parking areas at the sites should be limited and best management practices implemented during construction. Panama Rocks, a privately owned park currently for sale is the second oldest park in the U.S. It features great rock formations and has been designated by the Sierra Club as an ancient forest.

#### Trails

Throughout the project area there are a limited number of trails for hiking, bicycling, snowmobiling, and ATV use. A quality trail network is lacking; although trails exist, they do not link to one another creating a system of trails. There are a couple of hiking trails, such as Westside Overland Trail, throughout the area and nearby in the Allegheny National Forest; however, there are no trails that have amenities that support backpacking. There is one multi-use trail currently—Corry to Clymer Rails-to-

Trails. More trails are needed in the project area, especially in the lower section of the watershed. Efforts are currently underway for the development of a multiple use trail in Youngsville. There are sufficient opportunities for snowmobiling and ATV use. However, concerns are raised about legality and damages that are caused on privately owned property.

#### Boating and Swimming and Fishing

The region encompasses a plethora of waterways with good and excellent water quality. Utilizing these resources for recreational boating, swimming, and fishing should be enhanced throughout the project area. Additional access to the waterways is needed for fishing and canoe and kayak launch sites that included amenities, such as parking.

#### Hunting

The region is comprised of a vast amount of forestland that provides recreational opportunities and scenic beauty. Within the numerous acres of public and private lands, wildlife, such as the bald eagle, can be viewed. Hunting is thought to be the top recreational activity, and there is numerous amounts of public lands—state game lands, state forests, and Allegheny National Forest.

#### Historical Sites

Historical resources throughout the project area are well documented. Within the Town of Clymer in New York, there are a variety of historic houses and a wonderful museum. The City of Corry in Pennsylvania has an active historical society that also houses a museum and genealogy department with excellent records.

#### Other Recreation

- Cross-country skiing, downhill skiing, snowmobiling, and ice fishing are some of the winter recreational activities available throughout the region
- Corry has a trap shooting team

#### **4. What are some of the positive features of the watershed?**

The small close-knit, rural communities within the region contain caring, church oriented citizens that are willing to help others. The area seems to be a safe place to live, based on the relatively low crime rate. A good working relationship with the agricultural community also exists throughout the region.

Located within the glaciated region of the U.S., the project area contains unique biodiversity with various habitats. Rare species, wetlands, glacial bogs, fens, and forests are all contained within this scenic area. The area is a hotspot for bird and wildlife observation.

Recreational opportunities are abundant throughout the watershed, as it contains clusters of public land that support hunting and good quality waterways to support fishing. Peek'n Peak Resort, although not located within the watershed, provides residents and visitors with additional recreational opportunities year-round.

Overall, the region supports healthy streams that are populated with indicator species that are flourishing. Even in some degraded areas, the mayfly hatches are still good. Landowners are receptive in providing access for fishing; however, users must be educated to obtain permission before accessing private property.

#### **5. What are some of the negative impacts currently affecting the land, water, and biological resources?**

#### Agriculture and Forestry



Poor agricultural and forestry practices have a tendency to increase siltation and runoff and fragment forest. Some participants consider these impacts more threatening to the surrounding environment than urban sprawl. Best management practices can be utilized to reduce or eliminate adverse impacts, such as riparian corridor degrading, excessive use of fertilizers and pesticides, manure storage and management, and lack of forest canopy. Often, agricultural and logging operations are highly criticized because of the poor practices that are implemented by a small number of operators.

#### Native Species vs. Invasive Species and Non-native Species

The introduction of invasive species into the watershed has been problematic since the invasive species often overtake, out-compete, and replace native species for food, habitat, and natural resources. Invasive species, such as plume grasses, phragmites, and knotweed, could overtake swamps and other unique habitats. Urban sprawl can create forest fragmentation, which leads to the establishment of invasive species.

When non-native fish are stocked into streams where native fish are living and reproducing, the non-native species compete for food and nesting sites. Often times the non-native will not have a natural predator, which provides them an advantage to survival over native species.

#### Roadways

Due to its rural character, the watershed contains an extensive dirt and gravel road system. Sediment and runoff are generated from poorly designed and maintained dirt and gravel roadways. Furthering the impact of the poorly designed roadways, some townships unknowingly worsen conditions through inappropriate maintenance practices. One controversial treatment practice used to reduce dust is the application of brine water onto the roadways. Some participants felt this practice was worse than the dust itself, especially if there are waterways nearby where the brine could leach into.

#### Water Quality

The water quality in the region is good, with several high quality waterways. Participants are worried about the protection of water quality, especially with the increased interest in the oil and gas industry within the Marcellus shale formation. Also of concern is the amount of water that is withdrawn and discharged into the waterways. Runoff into area waterways where chemicals, such as fertilizers and pesticides are used is a concern for some participants.

Below Route 426, Brokenstraw Creek changes character when it meanders with tremendous switchbacks that slow the water flow causing the temperatures to warm up, creating habitat for carp and pike.

### **6. Do you have any specific projects or types of projects you would like to see identified in the plan?**

- Develop and publish an informational brochure about what a watershed is, issues affecting the health of the watershed, and increasing awareness.
- Purchase additional lands for conservation not for game commission or logging.
- Complete or expand the Carlisle Project by purchasing 1,300 acres of high biodiversity habitat to create corridors.
- Manage flooding and water control in low lying area.
- Identify funding or a buyer for the Panama Rock park who will conserve the property.
- Continue working with the agricultural community to earn the respect of the farms and continue implementation of best management practices, such as streambank fencing.
- Expand the management of bat habitats by expanding hibernating and maternity roosting sites and provide non-infested bats accessible and protected habitat sites.

- Encourage the Clymer Conservation Club to engage into conservation activities, not just recreational activities.
- Stop dredging local waterways for gravel.
- Organizations should not screw the environment for money.
- Address agricultural best management practices further as voluntary compliance does not seem to be working.
- Start environmental education programs with younger school students and strengthening of the environmental education curriculum is needed.
- Address environmental problems properly.
- Implement better forestry practices, education, and planning.
- Utilize less salt on area roadways to treat snowfall.
- Correct railroad and beaver problems.

**7. What must the watershed conservation plan say to be successful?**

- Address and improve access to public waterways and recreational sites.
- Protect nearby landowners from over regulation
- Do not encourage urban sprawl and stop new expansions. Purchase more public/protected lands to preserve them from development.
- Buy-in and public support are needed not just agreements. People need to be willing to change their lifestyles.
- Need to find a method to convince people to be respectful.
- Communities are starving for economic development which is viewed poorly. A better understanding of economics is needed.
- Respect private use—open areas to the public as long as the public is respectful.
- On the right track. No junkyards and improve urban areas.

**8. What must the watershed conservation plan not say to be successful?**

- Do not worry about business and economy and focus the plan on the water and the environment. Other people are worrying about businesses and jobs. Discuss the health of the watershed and drop paranoia about other issues. Cleaning up streams will not hurt jobs.
- Be careful about influences from business involved in natural resource extraction and land owners association.
- Must not over regulate or encourage over regulation of landowners.
- Be careful about banning chemicals and do not eliminate the use of chemicals, we need to eat still.
- Do not encourage roadside herbicide spraying.
- The plan must not include any type of dam or impoundment of the waterways.
- Do not displace the Amish community.
- Be conscious about the hunting seasons and observe the rules.
- Do not ignore bats.

**9. Do you have any other questions or comments?**

- No agricultural restrictions of waterways is good. Standing water is often seen as wetlands. Additional problems include taxes and preservation. Residents are very worried about restrictions.
- Railroads have caused problems with streams, channelizing and clogging them leading to flooding and disruptions.

- The area possesses unique biodiversity that needs protected and highlighted. A biological survey needs conducted. Small studies indicate the biodiversity may be greater than French Creek.

## School Workshops

In an effort to include the viewpoint of the next generation, school programs were conducted in three area high schools within the watershed. Approximately 300 students from Youngsville, Eisenhower, and Falconer high schools provided insight into the future of the watershed and what issues and concerns are most important when considering living in the watershed. The following results are a summary of the students' perspectives.

\* Indicates that the response was identified in two schools.

# Indicates that the response was identified in all three schools.

### What Do You Like About The Area?

- Diverse wildlife\*
- Clean environment#
- Changing seasons and the climate#
- Good population size#
- Scenery/environment hills (topography)
- Outdoor recreational opportunities#
- Forest and plant life\*
- Little development
- Miniature golf facility
- Clean water
- Close proximity to Allegheny National Forest
- Many streams/lakes in the area
- Nature preserve
- Quiet
- Low pollution
- Private/family businesses

### What About The Area Could Be Improved?

- More recreational and entertainment opportunities\*
- Improve roads and sidewalks and increase winter maintenance\*
- More off-road and ATV trails#
- Reduce litter and increase recycling efforts#
- Increase maintenance to older building and remove or renovate abandoned buildings\*
- Increase the number of restaurants, preferably non-chain facilities\*
- Less drug use
- Better public library
- Farm pollution
- School renovation
- New sports fields
- Public Swimming pool
- Taxes are too high
- Closer businesses
- Oil drilling in the Allegheny National Forest
- Logging practices
- Reduce car accidents caused by deer collisions
- Population
- Bigger and better malls
- Chaekoin River pollution
- 2<sup>nd</sup> Street in Jamestown
- More jobs

### Why Do You Visit State Parks And State Forests In Our Area?

- 4H Club meeting
- Hiking#
- Camping#
- Picnic\*
- Swimming\*
- Hunting#
- ATV riding\*
- Photography
- Biking
- Family reunion

- Rock climbing and rappelling<sup>#</sup>
- Elk viewing
- Horseback riding
- Fishing
- Snowmobiles
- Winter events
- Bird watching
- Sport fields

### **What Types Of Recreational Activities Do You Enjoy?**

- Hunting<sup>#</sup>
- Fishing<sup>#</sup>
- ATV's and off-road vehicle riding<sup>#</sup>
- Organized sports<sup>#</sup>
- Horseback riding/racing\*
- Hiking
- Computer/video games<sup>#</sup>
- Winter Sports—sled riding, skiing, ice skating, and snowboarding<sup>#</sup>
- Sleep
- Paintball
- Boating
- Reading
- Trapping
- BMX biking and motocross
- Skateboarding
- Archery
- Dance
- Civil War Reenactments
- Water ski
- Canoe
- Shopping\*
- Swimming
- Camping
- Outdoor sports
- Bowling
- Music
- Collect Leaves/insects

### **What Are Some Negative Impacts In The Area?**

- Industrial sites, such as Warren United Oil Refinery and Great Lakes Steel Plant\*
- Forge in Irvin\*
- Illegal dumping and roadside littering\*
- Sewage treatment plant
- Erosion from ATV's
- Road salt/ash
- Stream bank erosion
- Water pollution
- Burning leaves
- Leaking septic tanks
- Oil and natural gas drilling\*
- Farm pollution
- Car pollution
- Logging\*
- Campsites not properly cleaned after use
- Air pollution
- Veola Waste Management
- Jamestown
- Lack of school recycling
- Chautauqua Lake health

### **What Types Of Projects That Students Could Be Or Would Be Interested In Being Involved In?**

- Community service
- Clean up lake
- Recycling programs\*
- Help fundraising for charities
- Clean up streams (litter) Clean up trash along streams
- Spread conservation message Protest logging
- Roadside garbage pick up (adopt a highway) Pick up trash along roads
- Fish nursery
- Plants trees and other plants<sup>#</sup>
- Water quality tests on streams
- Work on the school Eco-Lab
- Build bird houses
- Energy saving project
- Improve nature areas
- Elderly assistance

### **What Changes Would You Like to See Within the Next 10 Years?**

- Healthier environment
- Better roads\*
- More recreation opportunities
- Fuel efficiency
- More jobs<sup>#</sup>
- Population increase<sup>#</sup>
- More technology
- Cleaner environment
- Movie theater/entertainment businesses
- ATV races and drag racing
- Water park
- Better schools and school facilities
- More restaurants
- More environmentally friendly recreational activities
- More wildlife diversity
- Horse arena
- Youth recreation center
- Remove/upgrade abandoned buildings
- Interstate through Allegheny
- Bus route
- Lower Fuel Prices
- Lower Taxes

**What Reasons Make You Want To Stay Or Return To The Area?**

- ATV\*
- “Best Town Ever”
- Four seasons and climate<sup>#</sup>
- Scenery/environment
- Family<sup>#</sup>
- Rural environment\*
- No natural disasters
- Population size
- Familiarity\*Like area
- Peaceful and safe
- Friends
- Cheap housing
- Variety of entertainment and recreational opportunities\*
- Good schools/community

**What Reasons Make You Not Want To Stay Or Return To The Area?**

- Too small of a town<sup>#</sup>
- Lack of job market and variety<sup>#</sup>
- No variety nothing to do boring
- Want to experience urban setting\*
- Want to move closer to family
- Climate<sup>#</sup>
- Alcohol abuse
- Want to travel
- Want to live closer to businesses
- Higher education
- Grew up somewhere else and would like to move back
- New experiences
- Mission work

## Municipal Officials Meeting

In February, 2009, a special municipal official meeting was held at the Warren County Conservation District to identify issues and concerns that area municipal officials had and to identify potential projects. Listed below are the results from the meeting.

- Columbus Township Comprehensive plan identifies the desire to re-establish a 300-acre reservoir that was removed in 1946. In 1965, Pennsylvania Fish and Boat Commission (PFBC) conducted a feasibility study to re-create the reservoir by establishing a dam. The site would provide recreational opportunities and would also create green energy utilizing a low hydro-low impact dam. Property is owned by Pennsylvania Game Commission. PFBC would administer the reservoir. Grant application through Energy Harvest program was turned down due to budget constraints. The township feels it would become an asset to their blighted community.
- Western Warren County is the location of one of three lava rock domes in North America. The rock dome is 2.5 miles down and would require drilling into the dome, putting in a heat exchange to generate steam, and building a plant to collect the steam. It would be a plant with no pollution. The university of Minnesota and Penn State University are conducting a joint study.
- Need funding.
- Revitalization of Youngsville (ROY) is working on revitalizing the downtown area. They are interested in using Brokenstraw Creek for its recreational potential to encourage businesses to be established in town. There is a need for fish habitat structures, improvement to water quality, and possibly a need for special angler regulations, such as delayed harvest or fly-fishing only. The focus would be on Eco-Tourism using Brokenstraw Creek.
- There needs to be a cooperative approach among states to take a regional approach. One example would be connecting Pennsylvania and New York trails.
- Route 6 is a state designated bike trail.
- The walking/bicycling trail being established in Youngsville could add an environmental component by placing plaques or signs along the trail emphasizing environmental features.
- Dirt and gravel (D&G) roadways is a very important issued, because of the number of dirt and gravel roadways. Having an updated inventory to prioritize the needs of dirt and gravel roadwork, although this may already be completed and up-to-date. Another issue is dust control on D&G roadways. Municipalities are currently using brine as an alternative to oil, due to cost control. However, there is some concern about the affects of brine on water quality and the possibility it may not be permitted in future years. Future alternatives are needed, current alternatives, such as soy bean oil, are cost prohibitive. The use of limestone works well, but is again cost prohibited.
- No lodging in northern Warren County. There is a need for a motel; there is nothing in City of Corry.
- The area surrounding the Corry Wal-Mart could use some amenities to pick up customer traffic of people traveling to Wal-Mart from areas in Ohio and New York in addition to local residents. Establishments could be food, convenience stores, or gas stations.



- Changes need to be made to the Deer Management program. There needs to be a comprehensive look into the program including economics of hunting. The areas available for hunting have unique habitats containing species of concern. There is a need to establish Sunday hunting in Pennsylvania to help it be competitive with neighboring states. It would also be good to begin hunting season the Friday after Thanksgiving adding an extra weekend for hunting.

## CHAPTER 7. MANAGEMENT RECOMMENDATIONS

This section highlights recommendations to improve the quality of life. These management recommendations are non-regulatory and available for use by any citizen, group, or agency. Potential partners are groups with the resources best suited to assist in meeting these objectives. Potential funding avenues are included in the matrix. Groups listed as possible partners or funding sources are suggestion and should not be limited to those provided due to ever-changing circumstances. Identified in the general classification of conservation organizations are groups, such as Western Pennsylvania Conservancy, Brokenstraw Watershed Council, Chautauqua Watershed Conservancy, sportsmen's clubs and other cultural and recreation groups.

Derived from correspondences, comments, issues, and concerns the recommendations reflect the views expressed by local citizens. Discussed in further detail in the Issues and Concerns chapter are the issues, topics, and concerns identified throughout the planning process. The watershed community developed the management recommendations through comments, interview, public meeting workshops, and the completion of surveys. The prioritization of the recommendations was determined by the local steering and advisory committees and by the public during the draft review phase. Committee members prioritized the recommendations based upon impacts to the watershed, feasibility, and probability of funding.

This matrix of recommendations includes goals, methods to achieve the goals, potential partners, and potential funding sources. They are listed by priority, with the higher priorities for each goal listed first. An additional listing of potential funding sources and the types of projects funded by each source is included in Appendix L. Listed in Table 7-1 are acronyms used in the management recommendations.

**Table 7-1. Acronyms Used in Management Recommendations Matrix**

ANF	Allegheny National Forest	PAGS	Pennsylvania Geological Survey
COG	Council of Governments	PALMS	Pennsylvania Lake Management Society
FEMA	Federal Emergency Management Agency	PDA	Pennsylvania Department of Agriculture
FSA	Farm Service Agency	PEMA	Pennsylvania Emergency Management Agency
HUD	Housing and Urban Development	PennDOT	Pennsylvania Department of Transportation
NRCS	U.S. Department of Agriculture - Natural Resources Conservation Service	PENNVEST	Pennsylvania Infrastructure Investment Authority
NYDEC	New York State Department of Environmental Conservation	PGC	Pennsylvania Game Commission
NYNHP	New York Natural Heritage Program	PNHP	Pennsylvania Natural Heritage Program
NYSDAM	New York State Department of Agriculture and Markets	PSAB	Pennsylvania State Association of Boroughs
NYSDOH	New York State Department of Health	PSATS	Pennsylvania State Association of Townships
NYSDOT	New York State Department of Transportation	RWA	Rural Water Authority
NYSEMO	New York State Emergency Management Office	SEO	Sewage Enforcement Officer
		TPA	Tourist Promotion Agency
		U.S. DOE	U.S. Department of Energy

**Table 7-1. Acronyms Used in Management Recommendations Matrix**

NYSOCR	New York State Office of Community Renewal	U.S. EPA	U.S. Environmental Protection Agency
NYSOPRHP	New York State Office of Parks, Recreation, & Historic Preservation	USACE	U.S. Army Corps of Engineers
PA DCED	Pennsylvania Department of Community and Economic Development	USDA	U.S. Department of Agriculture
PA DCNR	Pennsylvania Department of Conservation and Natural Resources	USFS	U.S. Forest Service
PA DEP	Pennsylvania Department of Environmental Protection	USFWS	U.S. Fish and Wildlife Service
		USGS	U.S. Geological Survey
		WREN	Water Resources Education Network

### Project Area Characteristics

**Goal 1-1: Proactively plan for future development.**

<i>Method to achieve goal</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Develop municipal or multi-municipal comprehensive plans in municipalities lacking plans in order to better guide the future direction of each municipality.	Planning Departments, Municipalities, Citizens, Counties, COG	Foundations, Private Sources, PA DCED, NYSOCR	
2. Develop land-use ordinances or subdivision regulations in accordance with municipal and county comprehensive plans to protect the character of communities and valuable resources from undesirable land uses.	Planning Departments, Municipalities, Citizens, Counties, COG	Foundations, Private Sources, PA DCED, NYSOCR	
3. Strengthen zoning and land-use regulations, so they are adhered to and not easily changed, and increase enforcement of these regulations.	Planning Departments, Municipalities, Counties, COG	Foundations, Private Sources, PA DCED, NYSOCR	
4. Establish a subdivision ordinance in Crawford County and encourage municipalities, such as Sparta Township to adopt it.	Planning Departments, Municipalities, County Commissioners, COG	Foundations, Private Sources, PA DCED, NYSOCR	
5. Utilize responsible zoning to protect agricultural lands, without significantly impeding landowner rights.	Planning Departments, Conservation Groups, Conservation Districts, Municipalities, Counties, PDA	Foundations, Private Sources, PA DCED, PDA, NYSOCR, NYSDAM,	
6. Establish ordinances to regulate the desired location and number of wells within municipalities based upon geology of the region.	Planning Departments, Conservation Districts, PA DEP, PA DCNR, USGS, PAGES	Foundations, Private Sources, PA DCED, NYSOCR	

**Goal 1-2: Carefully plan development to ensure economic enhancement while preserving community character without adversely affecting quality of life.**

<i>Method to achieve goal</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Plan for commercial or residential development, based upon limitations of the physical characteristics of the region, including the consideration of water-use limitation in permitting decisions, water quantity, soil type, etc.	Planning Departments, Conservation Groups, Municipalities, NRCS, PA DEP, USGS, HUD, PAGES	Foundations, Private Sources, PA DCED, NYSOCR	
2. Consult the Pennsylvania Wilds Design Guide when designing and/or approving potential development sites especially within Warren County to ensure that they remain consistent within the region's character.	Municipalities, Developers, Planning Departments, PA Wilds Planning Team, COG	Foundations, Private Sources	
3. Utilize county and municipal comprehensive plans to guide development activities to occur in designated growth areas and encourage the use of the Pennsylvania Wilds Design Guide to ensure that new developments are within the character of the region.	Planning Departments, PA Wilds Planning Team, Municipalities, Counties, Conservation Groups, NRCS, PA DEP, HUD, COG	Foundations, Private Sources, PA DCED, NYSOCR	
4. Implement Smart Growth Principals or Conservation by Design practices when development opportunities arise to maintain natural setting in existing and new communities.	Planning Departments, Municipalities, Counties	Foundations, Private Sources, PA DCED, NYSOCR, HUD,	
5. Repopulate current downtown and small town business through incentive programs deterring relocation to areas not identified as growth areas in County Comprehensive Plans.	Planning Departments, Counties, Municipalities	Foundations, Private Sources, Legislature, PA DCED, NYSOCR	
6. Conduct a demonstration project utilizing low-impact, Smart Growth principals and Conservation by Design practices at a local site for educational purposes.	Planning Departments, Conservation Groups, Municipalities, NRCS, PA DEP, HUD	Foundations, Private Sources, PA DCED, NYSOCR, HUD,	
7. Educate taxpayers about the connection between taxes, available services, and how their tax dollars are being spent.	Elected Officials, Citizens, Municipalities, NYSOCR, PA DCED, PSATS, PSAB	Foundations, Private Sources	

### Goal 1-3: Enhance marketability to prospective business and establish economic stability to maintain a balanced workforce.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Forge an alliance or network among local business and develop a local business directory and coordinating website promoting local businesses	Businesses, Chambers of Commerce, Planning Commissions	Private Sources	
2. Offer incentives and tax breaks in order to attract new business and provide quality jobs increasing the number of young adults capable or remaining in the area.	Municipalities, Counties, Businesses	Foundations, Private Sources, PA DCED, NYSOCR	
3. Increase economic stability that promotes sustainable natural resource use, such as establishing local resources-oriented sustainable industries like value-added products and farmers' markets	Businesses, Planning Commissions, Chambers of Commerce, DCNR, DEC, PDA, NYSDAM	Foundations, Private Sources, PA DCED, NY DEC, NYSOCR	
4. Enhance the regions ability to increase the local workforce utilizing nature based tourism.	Businesses, Chambers of Commerce, Planning Commissions	Foundations, Private Sources, PA DCED, NYSOCR	
5. Support value-added agriculture processing to provide income opportunities for small agricultural producers	Conservation Groups, PDA, USDA, NYSDAM	Private Sources	
6. Upgrade and maintain technology, such as high-speed internet and cable, to enable the region to be competitive and attract new businesses.	Telephone, Cable, and Satellite Companies, Municipalities	Foundations, Private Sources, PA DCED, NYSOCR	
7. Promote sustainable industries to keep young adults in the region and improve economic viability.	Municipalities, Counties, Planning Commissions	Foundations, Private Sources, PA DCED, NYSOCR	
8. Establish a post secondary technical education center to educate interested citizens about mineral extraction and lumber harvesting careers so local residents can compete for these higher paying jobs.	Counties, Logging Companies, Drilling Companies, Career Links	Private Sources, Career Links	

### Goal 1-4: Encourage economic growth with minimal impacts to the environment.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1 Promote alternative energy practices, increasing job markets and decreasing dependency on gas and oil.	Conservation Groups, EPA, DEP, DEC	Foundations, Private Sources, PA DEP, EPA	

**Goal 1-4: Encourage economic growth with minimal impacts to the environment (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
2. Study impacts new businesses have on local communities, streams, groundwater, and their effects downstream.	Conservation Groups, DEP, DEC	Foundations, Private Sources, PA DEP, EPA, NY DEC	
3. Conduct feasibility studies and demonstration projects designed to integrate biological by-products of agriculture and forestry with energy production in ways that make these industries more self-sufficient, economically sustainable, and less of an environmental impact.	Conservation Groups, PDA, NYSDAM, EPA	Foundations, Private Sources, PA DEP, EPA, NY DEC	

**Goal 1-5: Increase communications and cooperation among municipalities and counties within the region to promote sharing of services and improve conditions collectively affecting the watersheds.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Establish an environmental advisory council encouraging local communities and government to work together.	Conservation Groups, Municipalities, Counties, COG	Private Sources, PA DCED, NYSOCR	
2. Establish joint or shared management of non-road issues among townships.	Municipalities, Counties	Private Sources, PA DCED, NYSOCR	
3. Establish joint or regional planning commissions to facilitate regional planning initiatives.	Municipalities, Counties, Planning Commissions	Private Sources, PA DCED, NYSOCR	
4. Establish regional or county-based planning and zoning in addition to municipal zoning.	Municipalities, Counties, Planning Commissions	Private Sources, PA DCED, NYSOCR	
5. Foster communication and cooperation between municipalities, counties, and states.	Municipalities, Counties, COG	Private Sources, PA DCED, NYSOCR	
6. Establish memorandums of understanding between municipalities and public entities to share equipment to clean up after local disasters, such as flooding and tornados.	Municipalities, Counties, DCED, PA DCNR, PA DEP, NYSOCR, COG	Private Sources, PA DCED, NYSOCR	

**Goal 1-6: Identify impacts of acid precipitation to minimize and remediate these impacts.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Conduct an acid neutralization project to determine if such treatment could decrease acidity to the land and water.	Conservation Groups, Conservation Districts, PA DEP, EPA	Foundations, Private Sources, PA DEP, EPA	



**Goal 1-6: Identify impacts of acid precipitation to minimize and remediate these impacts (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
2. Map and identify acid precipitation patterns to determine negative impacts to aquatic life.	Conservation Groups, Conservation Districts, PA DEP, EPA	Foundations, Private Sources, PA DEP, EPA	
3. Develop a network of volunteers to identify acid precipitation impaired waterways by collecting rainwater and measuring its pH.	Conservation Groups, Conservation Districts, PA DEP, EPA	Foundations, Private Sources, PA DEP, EPA	
4. Educate residents about the impacts that acid precipitation and mercury have on the environment impacting air quality.	Conservation Groups, EPA, PA DEP, DEC	Foundations, Private Sources, EPA, PA DEP, NY DEC	

**Goal 1-7: Enhance transportation infrastructure.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Include sound geologic investigation and best management practices during maintenance and construction of roadways to minimize impacts.	Conservation Groups, Road masters, PennDOT, NYSDOT	Foundations, Private Sources, PennDOT, NYSDOT, PA DCED, NYSOCR	
2. Determine what impact road salt, ashes, and brine water have on roadways and water quality and investigate alternative practices.	Conservation Groups, Universities, PennDOT, NYSDOT, USGS, PA DEP, NY DEC, EPA	Foundations, Private Sources, PA DEP, NY DEC, EPA	
3. Implement best management practices that protect water resources when improving and upgrading dirt and gravel, secondary, or rural roadways.	Conservation Groups, Municipalities, Road masters, PA DEP	Foundations, Private Sources, PA DCED, NYSOCR, PennDOT, NYSDOT	
4. Support municipal participation in the Dirt and Gravel Road Program to reduce erosion and sedimentation.	Conservation Groups, Conservation Districts, Municipalities, PA DEP	Foundations, Private Sources, PA DCED, NYSOCR, PennDOT, NYSDOT, PA DEP	

**Goal 1-8: Enhance financial support and services to prepare emergency response providers.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Improve emergency services through additional funding, upgraded equipment, and training for volunteer or professional responders	Emergency Service Providers	Foundations, Private Sources, PA DEP, NY DEC, PA DCED, NYSOCR	

**Goal 1-8: Enhance financial support and services to prepare emergency response providers (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
2. Establish dry hydrants throughout the watershed to assist local firefighters in protecting the residents and dwellings.	Conservation Districts, Fire Departments, Landowners	Foundations, Private Sources, PA DEP, NY DEC, PA DCED, NYSOCR	
3. Develop a maintenance program for dry hydrants	Conservation Districts, Fire Departments, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, PA DCED, NYSOCR	

**Goal 1-9: Educate stakeholders how land use planning can be affective.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Provide educational sessions for municipal officials on integrated land-use planning, habitat conservation, and protecting and enhancing biodiversity.	Conservation Groups, Municipalities, PA DCED, NYSOCR, PSATS, PSAB	Foundations, Private Sources, PA DCED, NYSOCR, PSATS, PSAB	
2. Host workshops to educate and encourage municipal officials to create, review, update, and enforce ordinances that support watershed-wide planning.	Conservation Groups, Municipalities, PA DCED, NYSOCR, PSATS, PSAB	Foundations, Private Sources, PA DCED, NYSOCR, PSATS, PSAB	
3. Provide educational programs for municipal and county officials about land-use planning and other tools that incorporate conservation goals into making communities more attractive and protecting biodiversity.	Conservation Districts, Conservation Groups, Municipal and County Officials	Foundations, Private Sources, PA DEP, NY DEC	

**Goal 1-10: Educate stakeholders about benefits of watershed protection and the use of best management practices.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Conduct workshops, seminars, and demonstrations for decision-makers, from developers to government leaders, emphasizing best management practices.	Conservation Groups, Planning Departments, Municipalities, Developers, PA DEP, PA DCNR, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	
2. Increase municipal awareness of the values of preserving, protecting, and restoring the natural resources within the watershed, and promote inter-municipal cooperation.	Conservation Districts, Conservation Groups, Municipalities	Foundations, Private Sources, PA DCED, PA DCNR, PA DEP, NY DEC	
3. Provide public education and awareness programs about the economic benefits and importance of watershed protection	Conservation Districts, Conservation Groups, Citizens	Foundations, Private Sources, PA DCED, PA DEP, NY DEC	

### Goal 1-10: Educate stakeholders about benefits of watershed protection and the use of best management practices (continued).

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
4. Provide required workshops and/or training session on sustainable maintenance practices.	Conservation Groups, Municipalities, PA DCED, NYSOOCR, PSATS, PSAB, NY DEC	Foundations, Private Sources, PA DCED, PSAS, PSAB	

### Goal 1-11: Support community libraries and expand service opportunities.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Enhance public libraries through increased funding, networking with elected officials, and encouraging community members to volunteer their services.	Counties, Municipalities, Libraries, Legislators	Foundations, Private Sources, Legislature	
2. Establish traveling bookmobiles throughout rural areas in the region.	Counties, Municipalities, Libraries, Legislators	Foundations, Private Sources, Legislature	
3. Expand services available at local public libraries through the acquisition of additional funding for general support and collection enhancement.	Counties, Municipalities, Libraries, Legislators	Foundations, Private Sources, Legislature	

## Land Resources

### Goal 2-1: Explore opportunities to generate alternative energy.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Host an open forum and establish a ballot referendum to determine the desirability of re-establishing the Columbus dam for hydroelectricity generation and recreational opportunities. If supported by the majority of residents then conduct an updated feasibility study.	Columbus Township, Citizens, Conservation Groups, PA DEP, U.S. EPA, PFBC	Foundations, Private Sources, PA DEP, U.S. EPA	
2. Follow up on the study conducted by the University of Minnesota and Penn State University to collect thermal energy gathered from the lava rock domes located in western Warren County and conduct a feasibility or demonstration project to harvest the energy.	Columbus Township, Citizens, Conservation Groups, DEP, U.S. DOE, USGS, U.S. EPA	Foundations, Private Sources, PA DEP, U.S. EPA, U.S. DOE	

### Goal 2-2: Reduce impacts caused by dirt and gravel roadways.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Conduct updates to the dirt and gravel road inventory and prioritization on a biannual basis.	Conservation Districts, Conservation Groups, PA DEP	DEP, EPA, USFWS, Foundations, Private Sources, PA DEP, U.S. EPA, USFWS	

**Goal 2-2: Reduce impacts caused by dirt and gravel roadways (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
2. Study impacts the use of brine on dirt and gravel roadways has caused on the water quality of neighboring waterways.	Conservation Groups, PennDOT, NYSDOT, USGS, PA DEP, NY DEC, U.S. EPA,	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
3. Enforce regulations of the use of brine water treatment on oil and gas well roads.	NY DEC, PA DEP, U.S. EPA	NY DEC, PA DEP, U.S. EPA	
4. Implement best management practices, such as regrading and drainage pipe installations on dirt and gravel roadways identified in the County Dirt & Gravel Road Inventory.	Counties, Conservation Groups, Conservation Districts, Municipalities	PennDOT, NYSDOT, DEP, Private Sources, Foundations	
5. Research an economical alternative to reduce the impacts on local waterways.	Conservation Groups, Municipalities, Universities, PennDOT, NYSDOT	Foundations, Private Sources, PennDOT, NYSDOT	
6. Conduct a pilot project to control road dust using an alternative product, such as soybean oil	Conservation Districts, Penn State Center for Dirt & Gravel Roads, Municipalities	Foundations, Private Sources, PA DEP, U.S. EPA, NY DEC	

**Goal 2-3: Establish cooperation between surface and subsurface rights landowners and develop protection rights for surface landowners in order to protect their property.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Establish protection and rights for surface landowners to hold subsurface right owners responsible for ecological and physical damages caused on the property.	Landowners, Legislators, Drilling Companies	Legislature	
2. Research mineral rights of your properties and if you are able to purchase these rights.	Conservation Districts, Conservation Groups, Landowners	Private Sources	
3. Establish cooperation between surface and subsurface rights owners to minimize conflicts and impacts to the natural resources.	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP	
4. Organize third-party moderated discussions between surface and subsurface rights owners prior to beginning exploration, construction, and production activities to address and resolve issues.	Landowners, Subsurface Right Owners, PA DEP	Foundations, Private Sources	

**Goal 2-4: Preserve agricultural lands and culture for future generations.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Establish farmland preservation programs in Crawford and Warren counties in order to protect existing agricultural lands	Conservation Districts, Counties, PDA	Foundations, Private Sources, PDA, NRCS, USDA	
2. Enroll available agricultural and forestry lands into the Clean and Green program taking advantage of real estate tax benefits.	Municipalities, Counties, Planning Commissions, Landowners	Foundations, Private Sources, PDA	
3. Enroll agricultural lands in cost-incentive programs, such as Environmental Quality Incentives Program, Conservation Reserve Enhancement Program, Conservation Reserve Program, and Wildlife Habitat Improvement Program.	Conservation Districts, Conservation Groups, Cooperative Extensions, NRCS	Foundations, Private Sources, PA DEP, NRCS, PGC	
4. Participate in Agricultural Security Area Program, to protect agricultural lands for future generations	Municipalities, Planning Commissions, Conservation Groups	Foundations, Private Sources, NRCS	

**Goal 2-5: Establish or enhance incentives for land protection and conservation practice implementation.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Create tax incentives for private landowners who implement conservation practices, such as conservation easements and riparian buffers, and those who maintain large unfragmented tracks of land.	Conservation Groups, Legislators, Cooperative Extensions, NRCS, PA DCNR, PA DEP	Legislature, Private Sources, Foundations, PA DEP, NRCS, PGC	
2. Create tax incentives or other incentives for private landowners who implement conservation practices.	Conservation Groups, Legislators, NRCS, PA DCNR, PA DEP	Legislature, Private Sources, Foundations	

**Goal 2-6: Identify, inventory, cleanup illegal dumpsites, and prosecute violators using illegal dumpsites.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Establish chapters of PA CleanWays in Crawford, Erie, and Warren counties and an equivalent program in Chautauqua county.	PA CleanWays, Solid Waste Authorities, Counties	Foundations, Private Sources	
2. Reduce the amount of illegal dumping and litter being disposed of along roadways and hillsides by educating residents, monitoring existing dumpsites, and prosecuting violator.	PA CleanWays, Solid Waste Authorities, Civic Groups, Counties, Citizens, Municipalities, Conservation Groups, Law Enforcement, PA DEP	Foundations, Private Sources, PA DEP, PA CleanWays,	

**Goal 2-6: Identify, inventory, cleanup illegal dumpsites, and prosecute violators using illegal dumpsites (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Clean up litter and illegal dumpsites	Conservation Groups, Citizens, Civic Groups, Municipalities	Foundations, Private Sources, PA CleanWays, PennDOT, PA DEP, NY DEC	
4. Renovate or remove abandoned or unsafe older buildings	Municipalities, Counties, Landowners	Foundations, Private Sources, PA DCED	
5. Provide curbside recycling programs where economically feasible in municipalities throughout the Brokenstraw Creek watershed.	Trash Haulers, Solid Waste Authorities, Municipalities, Counties	Foundations, Private Sources, PA DEP, NY DEC	
6. Conduct cleanup activities at the five sites participating in the Pennsylvania Land Recycling Program	Counties, Businesses, PA DEP	Foundations, Private Sources, PA DEP, U.S. EPA	

**Goal 2-7: Work with agriculturalist to install best management practices at their farms to reduce impacts on herds and area waterways.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Develop nutrient management plans to boost productivity and protect water resources on agricultural lands.	Farmers, Conservation Districts, NRCS, PA DEP, NY DEC, FSA	Foundations, Private Sources, Cost Share Programs, PA DEP, U.S. EPA	
2. Minimize the concentration of animals in feedlots by encouraging extensive use of pasture on animal-dependent farms (e.g. dairy and beef).	Cooperative Extensions, PDA, NRCS	Foundations, Private Sources, USDA, PA DEP, NY DEC, U.S. EPA, PDA, NYSDAM	
3. Utilize organic sources of nutrients for crop production, including bioenergy crop production, as a component of nutrient management planning.	Conservation Districts, Conservation Groups, Cooperative Extension, PDA, NYSDAM, NRCS	Foundations, Private Sources, PA DEP, NY DEC, NRCS	
4. Promote conservation practices, such as cover crops, crop residue, contour strips, grassed waterways, riparian buffers, streambank fencing, and responsible pesticide/herbicide use.	Conservation District, Conservation Groups, Cooperative Extensions, PDA, NRCS	Foundations, Private Sources, PA DEP, NY DEC, NRCS	



**Goal 2-7: Work with agriculturalist to install best management practices at their farms to reduce impacts on herds and area waterways (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
5. Develop a model farm to demonstrate agricultural best management practices and offer educational tours for agricultural producers, agencies, and other interested parties.	Conservation District, Conservation Groups, Cooperative Extensions, PDA, NYSDAM, NRCS	Foundations, Private Sources, PA DEP, NY DEC, USDA, PDA, NYSDAM	
6. Stabilize barnyard and livestock areas to properly manage runoff.	Conservation District, Conservation Groups, Cooperative Extensions, PDA, NYSDAM, NRCS	Foundations, Private Sources, PA DEP, NY DEC, USDA, PDA, NYSDAM	
7. Implement a riparian restoration program to install streambank fencing to exclude livestock from streams, stabilize stream crossings, provide alternative watering sources to livestock, enhance riparian corridors with native vegetation, and minimize nutrients and sediments entering waterways.	Conservation District, Conservation Groups, Cooperative Extensions, PDA, NYSDAM, NRCS	Foundations, Private Sources, PA DEP, NRCS, PGC, NY DEC	
8. Strategically place open pit silos away from drainage areas.	Conservation Districts, Farmers, NRCS, PA DEP, NY DEC	USDA, PA DEP, NY DEC, Foundations, Private Sources	

**Goal 2-8: Minimize impacts caused by exploration, production, retirement, and abandonment of wells.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Institute closer government oversight on gas-well exploration and production, including the impacts to the natural resources.	Conservation Groups, Landowners	Foundations, Private Sources, PA DEP	
2. Monitor the cumulative impacts of oil and gas wells to protect watershed resources and the rural character.	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP	
3. Plug abandoned gas wells in the watershed to prevent brine water and abandoned mine drainage from entering the streams and potable water supplies	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP	
4. Develop, enforce, and implement best management practices specific to gas and oil exploration.	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP	

**Goal 2-9: Reclaim abandoned wells, mines, and quarries.**

<u>Method to Achieve Goal:</u>	<u>Potential Partners</u>	<u>Potential Funding</u>	<u>Priority</u>
1. Inventory abandoned wells, quarries, and mines and develop a plan for remediation	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP, U.S. EPA	
2. Redevelop abandoned sites through programs similar to brownfield redevelopment.	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP, U.S. EPA	
3. Support industry reclamation incentives	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP, U.S. EPA	
4. Expand current reclamation programs, as well as implement high quality reclamation techniques	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP, U.S. EPA	

**Goal 2-10: Protect ecologically significant lands.**

<u>Method to Achieve Goal:</u>	<u>Potential Partners</u>	<u>Potential Funding</u>	<u>Priority</u>
1. Develop a strategic plan to prioritize and protect ecologically significant areas through acquisition, conservation easement purchases, or other conservation practices.	Conservation Groups, Municipalities, PA DCNR	Foundations, Private Sources, DCNR	
2. Establish a local land trust to conduct outreach to watershed communities, hold land, and work with agencies and other organizations.	Conservation Groups, Conservation Districts, PA DEP, NY DEC, PGC, PFBC	Foundations, Private Sources	
3. Encourage farmland/forestland tax matching programs to provide incentives to keep land in agriculture/forest and not convert it to residential use.	Conservation Groups, Conservation Districts, Legislators, Counties, PA DEP, PA DCNR, NRCS	Foundations, Private Sources, Legislature	
4. Work with forest landowners to sustainably manage their property	Conservation Districts, NRCS, PA DCNR, NY DEC, PGC	Foundations, Private Sources, USDA, PA DCNR, NY DEC	
5. Develop a program or means through which landowners can obtain conservation easements for biologically diverse areas on their properties.	Conservation Groups, Landowners, Legislators, PA DEP, NRCS, PDA, U.S. EPA, USDA	Foundations, Private Sources, Legislature	

**Goal 2-10: Protect ecologically significant lands (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
6. Ensure that tax advantages of granting conservation easements remain as an encouragement to landowners.	Conservation Groups, Legislators, PA DEP, NRCS, PDA, U.S. EPA, USDA	Foundations, Private Sources, Legislature	
7. Complete or expand the Carlisle Project by purchasing 1,300 acres of high biodiversity habitat.	Conservation Groups, Landowners	Foundations, Private Sources, PA DCNR	
8. Purchase additional lands for conservation not for game commission of logging activities.	Conservation Groups, Landowners	Foundations, Private Sources, PA DCNR	

**Goal 2-11: Increase awareness about practices to assist agricultural and forest landowner in managing their lands effectively.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Educate agricultural landowners through workshops and other programs available to increase sustainability and assist them financially; such as best management practices and new technology.	Conservation Districts, Conservation Groups, Landowners, NRCS, USDA, PDA, NYSDAM	Foundations, Private Sources, PA DEP, PDA, NYSDAM, USDA, NRCS	
2. Educate forestland owners, by providing them with accurate information regarding sound silviculture practices, forest management plan development and insect and disease problems that can affect forest health.	Conservation Groups, Landowners, Foresters, DCNR, DEC	Foundations, Private Sources, PA DCNR, NY DEC	
3. Educate loggers, landowners, and municipal officials about forestry best management practices, sustainable forestry management, and sustainable forestry certification through workshops and other programs.	Conservation Groups, Landowners, Foresters, Municipal Officials, USFS, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, USFS, NY DEC	

**Goal 2-12: Increase awareness about the impacts from litter, illegal dumps, and abandoned vehicles.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Educate citizens about the impacts illegal dumping has on water quality and the environment, aesthetics, health and human safety, and the economy.	Conservation Groups, Municipalities, PA CleanWays, PA DEP, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
2. Educate the public to utilize practices such as "Leave no trace."	Conservation Groups, Municipalities, Media, PA CleanWays, PA DEP, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	

**Goal 2-12: Increase awareness about the impacts from litter, illegal dumps, and abandoned vehicles (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Develop public service announcements about proper waste disposal.	Conservation Groups, Municipalities, Media, PA CleanWays, PA DEP, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
4. Educate citizens about traditional and innovative ways to reduce, reuse, and recycle.	Conservation Groups, Citizens, PA CleanWays, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
5. Educate residents to properly dispose of household hazardous waste, by providing recycling workshops and other educational outreach programs.	Conservation Groups, Municipalities, PA CleanWays, PA DEP, NY DEC, PA DCNR	Foundations, Private Sources, PA DCNR, NY DEC	
6. Renew public interest in litter control education.	Conservation Groups, Civic Groups, Citizens, Municipalities, School Districts, PA CleanWays, PA DEP, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
7. Educate residents about safety, human health, and the environmental impacts caused by unlicensed or abandoned vehicles, and encourage proper disposal.	Conservation Groups, Municipalities, PA CleanWays	Foundations, Private Sources	

**Water Resources**

**Goal 3-1: Protect area waterways while increasing wildlife habitat opportunities.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Install fish habitat structures	Conservation Groups, Conservation Districts, Sportsmen Groups, NY DEC, PFBC	Foundations, Private Sources, NY DEC, PFBC	
2. Increase the number of miles containing riparian buffers along the waterway especially in Columbus Township	Conservation Groups, Conservation Districts, Sportsmen Groups, PA DEP, NY DEC, PFBC	Foundations, Private Sources, PA DEP, NY DEC, USDA,	

**Goal 3-1: Protect area waterways while increasing wildlife habitat opportunities (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Establish and maintain riparian vegetation and implement best management practices using smart growth principles as a cost-effective means of reducing non-point source pollution.	Conservation Groups, Conservation Districts, Landowners, PA DEP	Foundations, Cost-Share Programs, Private Sources, PA DEP, U.S. EPA	
4. Maintain an adequate vegetative buffer from the edge of the stream, for example encourage landowners not to mow to the stream.	Conservation Groups, Conservation Districts, Landowners, PA DEP	Foundations, Cost-Share Programs, Private Sources, PA DEP, U.S. EPA	
5. Protect and enhance existing riparian buffers to achieve maximum protection of water resources .	Sportsmen Groups, Conservation Groups, Conservation Districts, Landowners, PA DEP, NY DEC, PFBC	Foundations, Cost-Share Programs, Private Sources, PA DEP, U.S. EPA	
6. Conduct a visual assessment of streambanks and riparian areas, and prioritize areas in need of restoration.	Sportsmen Groups, Conservation Groups, Conservation Districts, Landowners, PA DEP, NY DEC, PFBC	Foundations, Cost-Share Programs, Private Sources, PA DEP, U.S. EPA	
7. Increase wildlife habitat by planting diverse natural plant communities along riparian buffers.	Conservation Groups, Conservation Districts, Landowners, PA DEP, PFBC, NY DEC, USACE	Foundations, Cost-Share Programs, Private Sources, PA DEP, U.S. EPA	
8. Develop partnership and community involvement to implement riparian and streambank restoration projects.	Conservation Groups, Conservation Districts, Landowners, PA DEP, PFBC, USACE	Foundations, Cost-Share Programs, Private Sources, PA DEP, U.S. EPA	

**Goal 3-2: Increase awareness about the benefits of riparian corridors.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Educate citizens about riparian buffers, their benefits, and landscaping etiquette towards conservation. For example not mowing to stream .	Conservation Groups, Conservation Districts, NRCS, PA DEP, PA DCNR, NY DEC	Foundations, Private Sources, NY DEC, PA DEP	
2. Conduct outreach, education, and implementation programs on cost-share and easements for streamside corridor conservation.	Conservation Groups, DEP, DEC, NRCS, PFBC, PGC, USDA, EPA	EPA, DCNR, NRCS, PFBC, PGC, USDA, Private Sources, Foundations	

**Goal 3-2: Increase awareness about the benefits of riparian corridors (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Preserve and enhance vegetated streamside buffers through education about their benefits for wildlife, water quality, and flood prevention.	Conservation Groups, PA DEP, NRCS, PFBC, PGC, USDA, U.S. EPA	Foundations, Private Sources, U.S. EPA, PA DCNR, NRCS, PFBC, PGC, USDA	
4. Educate watershed stakeholders about the importance of riparian corridors, and encourage establishment of riparian buffers.	Conservation Groups, PA DEP, NRCS, PFBC, PGC, USDA, U.S. EPA	Foundations, Private Sources, U.S. EPA, PA DCNR, NRCS, PFBC, PGC, USDA	

**Goal 3-3: Further investigate wetlands and their functions and protect their resources.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Inventory and assess the functionality of watershed wetlands, and develop restoration strategies based upon the assessment.	Planning Commissions, Conservation Groups, DCNR, PGC, PA DEP, NY DEC	PA DEP, NY DEC, PA DCNR, Private Sources, Foundations	
2. Update wetland maps, and develop a digital coverage's database.	Conservation Groups, Planning Commissions, DCNR, PGC, DEP, DEC, EPA	Foundations, Private Sources, PA DEP	
3. Study the impacts that economic development has had on historical wetland loss.	Conservation Groups, Planning Commissions, PA DCNR, PGC, PA DEP, NY DEC	Foundations, Private Sources, DEP	
4. Protect wetland habitats and surrounding buffers for birds and wildlife by limiting development, storm runoff, and other disturbances.	Conservation Groups, Planning Commissions, PA DCNR, PGC, PA DEP, NY DEC	PA DEP, PA DCNR, Private Sources, Foundations	
5. Modify municipal ordinances to protect wetland areas of biological importance.	Conservation Groups, Municipalities, Planning Commissions, PA DEP, NY DEC	Private Sources, PA DEP, NY DEC, DCED	
6. Acquire or purchase conservation easements protecting important wetlands habitats.	Conservation Groups, Planning Commissions, PA DCNR, PGC, PA DEP	Foundations, Private Sources, PA DEP, PA DCNR	



**Goal 3-3: Further investigate wetlands and their functions and protect their resources (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
7. Establish interstate collaboration on standardizing methods used to delineate and identify wetlands.	Conservation Groups, Legislators, USACE, PA DEP, U.S. EPA	Legislature, U.S. EPA, USACE, PA DEP	

**Goal 3-4: Educate stakeholders about the value and importance of wetlands.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Develop or expand outreach program on the function and value of wetlands and bogs	Conservation Groups, PA DEP, NY DEC, U.S. EPA	Foundations Private Sources, PA DEP, NY DEC, U.S. EPA	
2. Investigate the geology of bogs and develop an environmental education program including a preservation plan.	Conservation Groups, Conservation Districts	Foundations Private Sources, PA DEP, NY DEC, U.S. EPA	
3. Educate municipal, county, state, and federal officials about planning and implementation of wetland mitigation and the establishment of replacement wetlands.	Conservation Groups, Municipalities, PA DEP, NY DEC, U.S. EPA	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	

**Goal 3-5: Reduce the amount of erosion and sedimentation entering waterways.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Conduct a watershed study to determine sources of sedimentation and develop strategies to reduce impacts by implementing best management practices.	Conservation Districts, Conservation Groups, PA DEP	Foundations, Private Sources, U.S. EPA, PA DEP, NY DEC	
2. Establish a permit process that requires all earth moving industries to abide by the same erosion and sedimentation control standards.	Conservation Groups, Conservation Districts, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, U.S. EPA	
3. Promote stronger use of best management practices to control erosion and sedimentation in farming, forestry, development, and mining industries; conduct more site inspections.	Conservation Groups, Conservation Districts	Private Sources, Foundations, PA DEP, NY DEC, U.S. EPA	
4. Establish steep slope ordinances for earth moving industries.	Conservation Groups, Conservation Districts, Municipalities, PA DEP	Foundations, Private Sources, DEP, EPA	
5. Incorporate environmentally sensitive construction and maintenance techniques on dirt and gravel roads.	Conservation Groups, Conservation Districts, Municipalities, PA DEP	Foundations, Private Sources, PA DEP, U.S. EPA	

**Goal 3-5: Reduce the amount of erosion and sedimentation entering waterways (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
6. Partner with local conservation districts to educate stakeholders about ways to reduce erosion and sedimentation impacts through wetland development.	Conservation Districts, Conservation Groups, Citizens, NRCS, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA, NRCS	
7. Increase enforcement of NPDES permits, especially permits related to road construction and timbering.	Conservation Groups, PA DEP, NY DEC, U.S. EPA	Private Sources, PA DEP, NY DEC, U.S. EPA	
8. Establish streambank fencing and riparian corridors on active agricultural lands to reduce the amount of sediment from entering waterways.	Conservation Groups, Conservation Districts, NRCS, PGC	Foundations, Private Sources, PA DEP, NY DEC	

**Goal 3-6: Monitor water quantity to ensure demand does not exceed water supply.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Work with U.S. Geological Survey on updating stream gauging station database to include current groundwater flow, depths and quality information.	Conservation Groups, Conservation Districts, USGS, PFBC, PA DEP	Foundations, Private Sources, USGS, PA DEP, U.S. EPA	
2. Develop a water budget in order to better understand the sources and amounts of water available and the types of development activities that can be supported with the available resources.	Conservation Groups, Conservation Districts, USGS, PFBC, PA DEP	Foundations, Private Sources, USGS, PA DEP, U.S. EPA	
3. Study and monitor the effects of well drilling on surface water and groundwater to determine impacts on water quality, and work to minimize those impacts.	Conservation Groups, Conservation Districts, PA DEP	Foundations, Private Sources, PA DEP, U.S. EPA	
4. Monitor groundwater levels in critical areas that can be used as baseline data to determine loss of groundwater.	Conservation Groups, Conservation Districts, Citizens, Schools	Foundations, Private Sources, PA DEP, U.S. EPA	
5. Conserve groundwater through the installation of riparian buffers, porous pavement, and other best management practices.	Conservation Groups, Conservation Districts, Landowners	Foundations, Private Sources, Cost-share Programs, DEP	
6. Develop a locally based program for disseminating information about protecting private well supplies to homeowners.	Conservation Groups, Conservation Districts, PA DEP, NY DEC, LWV, RWA	Foundations, Private Sources, DEP, WREN	
7. Conduct a Source Water Assessment Project survey for the Brokenstraw Creek watershed.	Conservation Groups, Conservation Districts, PA DEP, LWV, RWA	Foundations, Private Sources, WREN	

**Goal 3-7: Monitor the use of brine water as a treatment on dirt and gravel roads.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Study impacts the use of brine on dirt and gravel roadways has caused on the water quality of neighboring waterways, and develop an economical alternative to reduce the impacts on local waterways.	Conservation Districts, Conservation Groups, Center for Dirt & Gravel Roads, Municipalities, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	
2. Enforce regulations of the use of brine water treatment on oil and gas well roads.	Conservation Districts, Conservation Groups, Center for Dirt & Gravel Roads, Municipalities, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	

**Goal 3-8: Minimize potential flooding damages by taking a proactive approach to managing floodplains.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Conduct a detailed flood-prone area assessment, and update floodplain maps.	Conservation Groups, Municipalities, PEMA	Foundations, Private Sources, FEMA, PEMA, DCED, PA DEP	
2. Consult a hydrologist and discuss the potential use of natural stream channel design techniques to decrease the risk of flooding.	Conservation Groups, Municipalities, PEMA	Foundations, Private Sources, FEMA, PEMA, DCED, PA DEP	
3. Establish a dedicated flood-control program to minimize the risk and severity of flooding	Conservation Groups, Municipalities, PEMA	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP	
4. Acquire properties that are frequently impacted by serious flooding and convert them to public open spaces, such as parks and natural areas.	Conservation Groups, Municipalities, PEMA	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP	
5. Discourage the development of primary and secondary residences in floodplain areas.	Conservation Groups, Municipalities, PEMA	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP	
6. Maintain culverts free of debris to alleviate flooding.	Conservation Groups, Municipalities, PEMA	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP	

**Goal 3-8: Minimize potential flooding damages by proactively managing floodplains (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
7. Develop an education program addressing flood issues, flood prevention, flood recovery, and floodplain protection.	Conservation Groups, Municipalities, FEMA, PEMA, NYSEMO	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP, NYSEMO	

**Goal 3-9: Encourage non-structural approaches to floodplain management.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Establish adequate riparian area vegetation and floodplain integrity to limit degradation of water quality and biological resources.	Conservation Groups, Municipalities, Landowners, PA DEP	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP	
2. Implement channel improvement projects that use bioremediation techniques to limit flooding.	Conservation Districts, Conservation Groups, PA DEP	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP	
3. Create and maintain projects that promote alternative methods of flood control, reserving dredging as a last resort.	Conservation Districts, Conservation Groups, PA DEP	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP	
4. Identify areas where the floodplain can be re-established for flood control purposes.	Conservation Groups, Municipalities, PEMA, FEMA, PA DEP, NYSEMO	Foundations, Private Sources, FEMA, PEMA, PA DCED, PA DEP	

**Goal 3-10: Minimize impacts from stormwater through planning.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Develop and implement a watershed-wide stormwater management plan.	Conservation Districts, Conservation Groups, Counties, Planning Commissions, Municipalities	Foundations, Private Sources, PA DEP, PA DCED	
2. Incorporate water quality design and pollution reduction in stormwater management.	Conservation Districts, Conservation Groups, Counties, Planning Commissions	Foundations, Private Sources, PA DEP, PA DCED	
3. Develop a demonstration area of stormwater best management practice that incorporates water quality improvement techniques.	Conservation Districts, Conservation Groups, Counties, Planning Commissions, Municipalities	Foundations, Private Sources, PA DEP, PA DCED	

**Goal 3-10: Minimize impacts from stormwater through planning. (continued)**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
4. Address current drainage issues by consulting with state management agencies.	Conservation Districts, Conservation Groups, Counties, Planning Commissions, Municipalities	Foundations, Private Sources, PA DEP, PA DCED, PENNVEST	
5. Educate municipal and county officials about planning for stormwater best management practice implementation.	Conservation Groups, Municipalities, Counties, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	

**Goal 3-11: Establish, maintain, or upgrade sewage treatment facilities.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Encourage landowners with on-lot sewage or septic tanks to conduct maintenance activities on a routine basis as needed by their system.	Conservation Districts, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	
2. Update Act 537 Sewage Facility Plans in municipalities where the plan is out-dated in order to prepare for future development activities.	Conservation Groups, Municipal Authorities, Municipalities, PA DEP, PA DCED	Foundations, Private Sources, PA DEP, PA DCED	
3. Work with municipalities and landowners to install proper septic tanks, wastewater treatment systems, or other alternatives to reduce the amount of untreated sewage entering the streams.	Municipalities, Landowners, Conservation Groups, Municipal Authorities, SEO, DEP, DCED	Foundations, Private Sources, PA DEP, PA DCED, NY DEC	
4. Repair failing sewage lines, and add new infrastructure in growth areas as identified in the Warren, Erie, and Chautauqua counties comprehensive plans.	Municipalities, Counties, Municipal Authorities	Foundations, Private Sources, PA DEP, PA DCED, NY DEC	
5. Upgrade or expand wastewater systems in City of Corry, Sugar Grove Township, Town of Busti, and Town of North Harmony within the next 10-15 years.	Water Authorities, Municipalities, PA DEP, NYSDOH, U.S. EPA	Foundations, Private Sources, PA DEP, PA DCED, NY DEC	
6. Design wastewater treatment systems to adequately serve communities, by separating stormwater from wastewater systems, in order to ease the occurrence of combined sewage overflows.	Municipal Authorities, Conservation Groups, Municipalities, SEO, PA DEP, PA DCED	Foundations, Private Sources, PA DEP, PA DCED, NY DEC	
7. Educate homeowners about alternative sewage treatment systems, proper testing and maintenance of existing on-lot sewage systems.	Conservation Groups, Municipal Authorities, Municipalities, SEO, PA DEP, PA DCED, NY DEC	Foundations, Private Sources, PA DEP, PA DCED, NY DEC	

**Goal 3-11: Establish, maintain, or upgrade sewage treatment facilities (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
8. Study prolonged impacts from sewage overflows on Hare Creek from the Corry Wastewater Treatment Plant.	Conservation Groups, Conservation Districts, PA DEP, NY DEC, PFBC	Foundations, Private Sources, PA DEP, NY, DEC, U.S. EPA, USFWS	

**Goal 3-12: Establish, maintain, or upgrade water treatment facilities.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Repair failing water lines, and add new infrastructure in growth areas as identified in the Warren, Erie, and Chautauqua counties comprehensive plans.	Municipalities, Counties, Municipal Authorities	Foundations, Private Sources, PA DEP, PA DCED	
2. Upgrade or expand water systems in City of Corry, Columbus Township, Town of Busti, and Town of North Harmony within the next 10-15 years.	Water Authorities, Municipalities, PA DEP, NYSDOH, U.S. EPA	Private Sources, PA DEP, NY DEC, PA DCED	
3. Update the Youngsville Water System to adequately service the existing and future demands of the region including the repair of faulty lines and the extension into Pittsfield and Irvine areas.	Conservation District, Conservation Groups, Youngsville Water Authority	Private Sources, PA DEP, NY DEC, PA DCED	
4. Educate community residents and water suppliers about potential threats to public water supply.	Conservation Districts, conservation Groups, Water Suppliers, Citizens	Foundations, Private Sources, PA DEP, NY DEC	
5. Develop or implement educational outreach programs for private well owners, specifically concerning sole source aquifer protection programs and protecting ground water supplies.	Conservation Districts, Conservation Groups, Landowners, RWA, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	
6. Promote groundwater quality awareness when conducting education and outreach programs, and provide educational information about potential threats to water supply.	Conservation Districts, Conservation Groups, Water Suppliers, Municipalities	Foundations, Private Sources, PA DEP, NY DEC, PA DCED, U.S. EPA	

**Goal 3-13: Investigate the need and effectiveness of establishing a water quality trading program within the Brokenstraw Creek watershed.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Explore and develop institutional framework for water quality trading.	Conservation Districts, Conservation Groups, PA DEP, U.S. EPA	Foundations, Private Sources, PA DEP, NY DEC	



**Goal 3-13: Investigate the need and effectiveness of establishing a water quality trading program within the Brokenstraw Creek watershed (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
2. Support and strengthen the water quality trading program to improve overall water quality and industrial discharges.	Conservation districts, Conservation Groups, PA DEP, U.S. EPA	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	

**Goal 3-14: Develop a monitoring plan for the watershed or completed project areas, integrating quality assurance/quality control standards into the plan.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Conduct a seasonal chemical, biological, and visual assessment of Brokenstraw Creek and its tributaries for at least one year to determine what areas of the watershed are impacted, how they are impacted, and to prioritize future projects.	Conservation Groups, Conservation Districts, Community Groups, Schools, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
2. Collect water quality information on a seasonal basis and compare past and present monitoring results to check for changes in conditions.	Conservation Groups, Conservation Districts, Community Groups, Schools	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
3. Monitor the biochemical oxygen demand above and below sewage effluents.	Conservation Groups, Conservation Districts, Community Groups, Schools	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
4. Analyze water samples for bacteria to identify problem areas.	Conservation Groups, Conservation Districts, Community Groups, Schools	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
5. Involve schools and community groups in water quality monitoring programs.	Conservation Groups, Conservation Districts, Community Groups, Schools	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
6. Compile a database of all background monitoring data.	Conservation Groups, Conservation Districts, Community Groups, Schools	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
7. Conduct sub-watershed assessments on tributary streams that rate as impaired or high quality through the initial Brokenstraw Creek assessment.	Conservation Groups, Conservation Districts, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	
8. Conduct a groundwater quality assessment for Brokenstraw Creek and its tributaries.	Conservation Groups, Conservation Districts, PA DEP, NY DEC, USGS	Foundations, Private Sources, PA DEP, NY DEC	

### Goal 3-14: Develop a monitoring plan for the watershed or completed project areas, integrating quality assurance/quality control standards into the plan (continued).

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
9. Conduct a groundwater quality assessment of Spring Creek to assist in the re-designation process.	Conservation Groups, Conservation Districts, PA DEP, NY DEC, USGS	Foundations, Private Sources, PA DEP, NY DEC	

### Goal 3-15: Establish and implement after conservation practices to reduce water consumption.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Launch a watershed-wide water conservation program to educate the public about the value of reducing water consumption and utilizing water conservation products and techniques.	Conservation Districts, Conservation Groups, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, WREN	
2. Establish an ongoing program for regional schools to promote water conservation.	Conservation Districts, Conservation Groups, Schools	Foundations, Private Sources, PA DEP, NY DEC	
3. Establish guidelines that require installation of low-flow devices for all new construction.	Conservation Groups, Developers, Legislators, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	
4. Work with landowners and developers to incorporate environmental friendly water conservation practices in the homes and business.	Conservation Groups, Landowners, Developers, PA DEP, NY DEC	Private Sources	
5. Educate citizens on the importance of water quantity and the benefits of water conservation.	Conservation Districts, Conservation Groups	Foundations, Private Sources, PA DEP, NY DEC	
6. Promote and establish a program for retrofitting homes and businesses for water conservation practices through tax breaks, rebates, and other incentives.	Conservation Groups, Landowners, Legislators, PA DEP, NY DEC	Private Sources, PA DEP, NY DEC	

### Goal 3-16: Conduct an assessment of natural and man-made impoundments, and implement recommendations to enhance their ecosystems.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Assess, control, monitor, and mitigate exotic species that directly affect lake uses.	Conservation Groups, Conservation Districts, PALMS, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, U.S.EPA	

### Goal 3-16: Conduct an assessment of natural and man-made impoundments, and implement recommendations to enhance their ecosystems (continued).

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
2. Assess and inventory lakes, wetlands, and ponds in the watershed for size, use, water quality, and aquatic life.	Conservation Groups, Conservation Districts, PALMS, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, U.S.EPA	
3. Inventory dams for their uses, and evaluate maintenance versus removal, while considering public safety, recreation, and present use.	Conservation Groups, Conservation Districts, American Rivers, USACE, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, U.S.EPA	
4. Gradually discharge overflows from flood control structures in order to protect aquatic life and stream habitats.	Conservation Groups, USACE, PA DCNR, PA DEP, NY DEC, PFBC	Foundations, Private Sources, USACE, PFBC, PA DCNR, NY DEC	
5. Conduct bathymetry mapping on Bear Lake (PA) to determine the true depth and to better manage the lake's wildlife habitat opportunities.	Conservation Groups, Landowners, PFBC	Foundations, Private Sources, PA DEP, PFBC	

### Goal 3-17: Protect and evaluate waterways that are designated or eligible for classification as High Quality or Exceptional Value

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Redesignate Spring Creek as exceptional value waterway, outreach, and gain community support for added protection of this unique, high biodiversity area.	Conservation Groups, Conservation District, PA DEP, PFBC	Private Sources	
2. Work with local and state agencies to better enforce regulations protecting water quality, particularly for High Quality and Exceptional Value designated streams.	Conservation Groups, Conservation Districts, PA DEP	PA DEP	

### Goal 3-18: Reduce water quality impacts by properly disposing of un-needed medication.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Establish a drug return program to properly dispose of old or un-needed medications, whether prescription or over the counter.	Conservation Groups, Conservation Districts, Police Departments	Foundations, Private Sources, Departments of Health, PA DEP, NY DEC	
2. Disseminate information to community members about how to properly dispose of old prescription drugs.	Conservation Groups, Conservation Districts, PA State Police, Departments of Health	Foundations, Private Sources, Departments of Health, PA DEP, NYSOPRHP	

**Goal 3-18: Reduce water quality impacts by properly disposing of un-needed medication (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Host a special collection day to assist residents in properly disposing old or unwanted prescriptions or over the counter medications.	Conservation Groups, Conservation Districts, Police Departments	Foundations, Private Sources, Departments of Health, PA DEP, NY DEC	

**Goal 3-19: Provide educational programs educating residents about impacts and pollution sources.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Host stream monitoring workshops or trainings for adult and student volunteers.	Conservation Groups, Stakeholders, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC	
2. Develop and implement education programs about point source pollution, how to report point source violations, and how to research permit information.	Conservation Districts, Conservation Groups, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
3. Develop and implement education programs about non-point source pollution discharges in the watershed and how to remediate them.	Conservation Districts, Conservation Groups, PA DEP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA	
4. Educate homeowners about the significance of water-use designations and ways to minimize non-point source pollution.	Conservation Districts, Conservation Groups, Citizens	Foundations, Private Sources, PA DEP, NY DEC	

**Biological Resources****Goal 4-1: Reduce impacts caused by invasive and nuisance species.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Reduce the Canada goose population around the Clymer Pond, nutrients from their feces in impact water quality, in addition to the aesthetics of the region.	Sportsmen Groups, Conservation Groups	Foundations, Private Sources	
2. Continue invasive species removal and control program.	Conservation Groups, Conservation Districts, ANF, PA DCNR, NY DEC, PA DEP	Foundations, Private Sources, PA DEP, PA DCNR, NY DEC	
3. Incorporate an outreach program to educated citizens about invasive species and they can be controlled and/or removed safely without fear of additional spreading.	Conservation Groups, Conservation Districts, PA DCNR, ANF	Foundations, Private Sources, PA DEP, PA DCNR, NY DEC	

**Goal 4-2: Develop, adopt, and implement management plans to protect forest and wildlife resources.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Develop and use forest stewardship or forest management plans and participation in the Pennsylvania Forest Stewardship Program and/or the Tree Farm Program.	Conservation Groups, Planning Departments, Landowners, PA DCNR	Foundations, Private Sources, PA DCNR	
2. Adopt and utilize management plans that protect forest landscapes.	Conservation Groups, Planning Departments, Landowners, PA DCNR	Foundations, Private Sources, PA DCNR	
3. Develop forest and wildlife management plans.	Conservation Groups, Landowners, PA DCNR, PGC, NY DEC	Private Sources, PA DCNR, PGC, NY DEC	
4. Develop wildlife management plan on private forestland properties.	Landowners, PGC, NY DEC	Private Sources, PA DCNR, PGC, NY DEC	
5. Develop detailed management plans for landowners of biologically diverse areas, including inventories of natural features and invasive or exotic species monitoring plans.	Conservation Groups, Landowners, PA DCNR, PGC, NY DEC	Private Sources, PA DCNR, PGC, NY DEC	
6. Conduct studies in conjunction with Natural Heritage Programs to monitor biodiversity, including surveys for historical species of concern for which the current status is unknown.	Conservation Groups, Sportsman Groups, PA DCNR, PNHP, PGC, NY DEC, NYNHP	Foundations, Private Sources, PA DCNR	
7. Educate the public about the use and purpose of Natural Heritage Inventories in planning, with an additional focus on understanding the importance of the natural resources that exist.	Conservation Groups, Municipalities, Counties, PNHP, NYSNHP	Private Sources, PA DCNR, NY DEC	
8. Provide educational field trips to elected officials emphasizing natural resources and the value of those resources to the region.	Conservation Groups, Elected Officials, NY DEC, USFWS, PGC, PA DCNR	Foundations, Private Sources, PA DCNR	

**Goal 4-3: Implement best management practices to protect forest resources.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Promote tree plantings, sustainable harvesting, and other best management practices	Conservation Groups, Landowners, Civic Groups, PA DCNR	Foundations, Private Sources, PA DCNR, NY DEC	

**Goal 4-3: Implement best management practices to protect forest resources (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
2. Work with Woodland Owner Associations to educate the public, restore degraded areas, and develop demonstration areas.	Conservation Groups, Landowners, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
3. Discourage the use of high-grading practices, such as diameter limit harvest and selective cutting, and encourage timber harvesters to use sustainable best management practices based upon forest type and since under the direction of a professional forester.	Conservation Groups, Landowners, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
4. Establish cooperation between conservation districts and state agencies to enforce regulations on the logging industry to minimize erosion and sedimentation.	Conservation Groups, Conservation Districts, Landowners, PA DCNR, PA DEP	Foundations, Private Sources, PA DCNR, NY DEC	
5. Decrease forest fragmentation by maintain contiguous forest tracts and/or travel corridors between existing non-contiguous forest tracts.	Conservation Groups, Sportsman Groups, Landowners, PA DCNR, DEC	Private Sources, PA DCNR, PGC, NY DEC	

**Goal 4-4: Identify Important Bird and Mammal Areas**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Identify, characterize, and recommend Important Bird Areas by partnering with local Audubon chapters and birding clubs.	Conservation Groups, Landowners, PA DCNR, NY DEC	Foundations, Private Sources, Audubon Society, PA DCNR, NY DEC	
2. Identify and recommend Important Mammal Areas.	Conservation Groups, Landowners, PGC	Foundations, Private Sources, PA DCNR, PGC, NY DEC	
3. Protect biological diversity areas through collaborative partnerships among the present owner, citizens, local organizations, and Pennsylvania Department of Transportation.	Conservation Groups, Landowners, NYSDOT, PennDOT, PA DCNR, PGC, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
4. Educate citizens about biological diversity and the vital importance of conserving habitats and protecting species.	Conservation Groups, PGC, PA DCNR, USFWS, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	



### Goal 4-5: Identify and protect biologically diverse areas.

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Develop a land steward program for Biological Diversity Areas through which volunteers would be responsible for regular monitoring of these areas and educating landowners.	Conservation Groups, Landowners, PA DCNR, PGC, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
2. Develop new biotic study areas throughout the watershed and encourage local schools to utilize this resource, thereby fulfilling state curriculum requirements and broadening educational understanding of ecological resources.	Conservation Groups, Landowners, School Districts, Universities, PA DCNR, PGC, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
3. Protect biological diversity areas through collaborative partnerships among the present owner, citizens, local organization, and Departments of Transportation.	Conservation Groups, Landowners, NYSDOT, PennDOT, PA DCNR, PGC, NY DEC	Foundations, Private Sources, PA DCNR	
4. Restrict activities, such as grazing and off-road vehicles, and control invasive species within biological diversity areas.	Conservation Groups, Landowners, PA DCNR, PGC	Foundations, Private Sources, PA DCNR, NY DEC	
5. Limit herbicide use and utilize alternative management techniques in right-of-ways by working with utility companies.	Conservation Groups, Adjacent Landowners, Utility Companies	Private Sources, PA DCNR, NY DEC	
6. Refine information on Biological Diversity Areas contained in Natural Heritage Inventories.	Conservation Groups, Counties, PA DCNR, PFBC, PGC, NY DEC, PNHP, NYNHP	Foundations, Private Sources, PA DCNR, NY DEC	
7. Implement strategies to improve habitat within Biological Diversity Areas.	Conservation Groups, Landowners, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, NY DEC	
8. Establish biodiversity indices for selected stream segments to document the current status of biodiversity and to track changes over time as management recommendations are implemented.	Conservation Groups, Sportsman Groups, PA DCNR, PA DEP, NY DEC, PFBC, USFWS	Foundations, Private Sources, PA DEP, NY DEC, PA DCNR, PFBC, PGC, USFWS	

**Goal 4-5: Identify and protect biologically diverse areas (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
9. Develop an incentive program to encourage and reward landowners who develop management plans, decrease development, and employ other conservation practices in and around riparian corridors and biologically diverse areas.	Conservation Groups, Sportsmen Groups, Landowners, PA DCNR, PGC, PA DEP, NY DEC	Foundations, Private Sources, Cost-Share Programs, PA DCNR, PA DEP, PGC, NY DEC	

**Goal 4-6: Enhance aquatic habitats.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Improve aquatic habitat for fish, mussels, and other organisms by implementing best management practices and other restoration activities.	Conservation Groups, Landowners, PNHP, NYNHP, PA DCNR, NY DEC, PFBC	Foundations, Private Sources, PA DCNR, PFBC	
2. Increase habitat and passage for fish, mussels, and other aquatic organisms by removing dams on small tributaries and maintaining stable flow regimes downstream.	Conservation Groups, Landowners, PNHP, NYNHP, NY DEC, PFBC, PA DCNR	Foundations, Private Sources, American Rivers, PA DEP, NY DEC, PFBC	
3. Incorporate aquatic habitat improvements into streambank stabilization and water quality remediation projects.	Conservation Groups, Landowners, PA DEP, PFBC, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, PFBC	
4. Utilize volunteers to quantify the amount of large wood debris, in key stream reaches and headwater areas.	Conservation Groups, Conservation Districts, Sportsmen Groups, PFBC, PA DEP, NY DEC	Foundations, Private Sources, PFBC, PA DEP, NY DEC	

**Goal 4-7: Protect rare, threatened, and endangered species and their habitats.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Develop monitoring strategies and management plans for species of concern that are particularly vulnerable to habitat destruction by working with Natural Heritage Programs.	Conservation Groups, Landowners, PNHP, NYNHP, PFBC, PA DCNR	Foundations, Private Sources, PA DCNR, PFBC	
2. Protect or improve habitats that support threatened and endangered species and species of concern through acquisition, easements, and/or landowner education.	Conservation Groups, Landowners, PNHP, NYNHP, PFBC, PA DCNR	Foundations, Private Sources, PA DCNR, PFBC, NY DEC	

**Goal 4-7: Protect rare, threatened, and endangered species and their habitats (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Appoint a liaison to work with members of PA Biological Survey to submit recent identification of rare, threatened, and endangered species within the watershed and to report the condition of these species' habitats.	Conservation Groups, Landowners, PNHP, PFBC, PA DCNR, PABS	Foundations, Private Sources, PA DCNR, PFBC, PGC	

**Goal 4-8: Identify and protect important habitats for plant and animal species.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Identify and protect additional environmentally sensitive areas and areas of high biodiversity.	Conservation Groups, Landowners, PNHP, NYNHP, PFBC, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, PFBC, NY DEC	
2. Establish private backyard conservation areas to serve as wildlife habitat and travel corridors by providing activities and programs for landowners.	Conservation Groups, Landowners, PNHP, NYNHP, PFBC, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, PFBC, NY DEC	
3. Maintain grassland species habitats on public lands through practices, such as controlled burns and limited mowing activity.	Conservation Groups, Landowners, PNHP, NYNHP, PFBC, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, PFBC, NY DEC	
4. Identify high quality wetlands located in the watershed.	Conservation Groups, Landowners, PNHP, NYNHP, PFBC, PA DCNR, NY DEC	Foundations, Private Sources, PA DCNR, PFBC, NY DEC	
5. Protect unique habitats, including swamps and bogs, where several state and federally listed rare, threatened, and endangered species are located.	Conservation Groups, PA DCNR, PGC, PFBC, NY DEC, PNHP	Foundations, Private Sources, PA DCNR, PFBC, NY DEC, PGC	
6. Establish a no mow strategy for some fields in public lands allowing them to return to a more natural state providing habitat for wildlife.	Conservation Groups, PA DCNR, PGC, PFBC, NY DEC, PNHP	Foundations, Private Sources, PGC, PA DCNR, NY DEC	
7. Delay moving of fallow fields until July to protect bird-nesting sites.	Conservation Groups, PA DCNR, PGC, PFBC, NY DEC, PNHP	Foundations, Private Sources, PGC, PA DCNR, NY DEC	
8. Monitor activities in critical habitat areas.	Conservation Groups, Landowners, PA DCNR, NY DEC	Foundations, Private Sources, PGC, PA DCNR, NY DEC	

**Goal 4-8: Identify and protect important habitats for plant and animal species (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
9. Expand the management of bat habitats by expanding hibernating and maternity roosting sites and provide inon-infested bats accessible and protected habitat sites.	Conservation Groups, PGC, PA DCNR, NY DEC, USFWS	Foundations, Private Sources, USFWS	

**Goal 4-9: Implement strategies to conserve rare and unique plant and animal communities.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Conduct a study to determine what if any species of bats are located within the project area.	Conservation Groups, Universities, NY DEC, PA DCNR	Foundations, Private Sources, NY DEC, PA DCNR, USFWS	

**Goal 4-10: Increase the use of native plants in landscaping and remediation projects.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Utilize native species in agricultural and landscaping projects	Conservation Groups, Landowners		
2. Use native plants in landscaping, wildlife habitat plantings, and educational activities.	Conservation Districts, Conservation Groups, PA DCNR, NY DEC	Foundations, Private Sources, NY DEC, PA DCNR	
3. Use native tree plantings in remediation projects, such as streambank fencing, streambank stabilization, or mine reclamation projects.	Conservation Districts, Conservation Groups, PA DCNR, NY DEC	Foundations, Private Sources, NY DEC, PA DCNR	
4. Conduct an assessment and develop a management plan for native species.	Conservation Districts, Conservation Groups, PA DCNR, NY DEC	Foundations, Private Sources, NY DEC, PA DCNR	
5. Establish a reserve seed bank of native species that can be used in remediation efforts.	Conservation Districts, Conservation Groups, PA DCNR, NY DEC	Foundations, Private Sources, NY DEC, PA DCNR	

**Goal 4-11: Implement wildlife management practices to protect biodiversity.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Foster continued involvement in hunting activities among all age groups, and educate hunters on the importance of population control.	Conservation Groups, Sportsmen Groups, PA DCNR, PGC	Foundations, Private Sources, PGC	
2. Promote and support deer management strategies, such as special hunting tags and deer exclosures in natural areas.	Conservation Groups, Sportsmen Groups, Pa DCNR, PGC, ny DEC	Foundations, Private Sources, PGC, NY DEC	

**Goal 4-11: Implement wildlife management practices to protect biodiversity (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Support laws and regulation to maintain whitetail deer populations at levels that will ensure healthy forests, productive agricultural lands, and healthy deer populations.	Conservation Groups, Sportsmen Groups, PA DCNR, PGC, NY DEC	Foundations, Private Sources, PGC, NY DEC	
4. Develop areas for wildlife viewing and education to raise awareness about biodiversity.	Conservation Groups, Sportsmen Groups, Landowners, PA DCNR, PGC, NY DEC	Foundations, Private Sources, PGC, NY DEC	
5. Increase public and private lands available for hunting by working with sportsmen's groups and landowners.	Conservation Groups, Sportsmen Groups, Landowners, PA DCNR, PGC, NY DEC	Foundations, Private Sources, PGC, NY DEC	
6. Encourage hunters to participate in Deer Management Assistance Program to keep deer herds at ecologically healthy levels.	Conservation Groups, Sportsman Groups, Landowners, PA DCNR, PGC	Foundations, Private Sources, PGC	
7. Encourage private landowners to register their land in Deer Management Assistance Program to keep deer herds at ecologically healthy levels.	Conservation Groups, Sportsman Groups, PA DCNR, PGC	Foundations, Private Sources, PGC	
8. Sponsor outreach programs to educate landowners about wildlife management practices.	Sportsmen Groups, PGC, NY DEC	Foundations, Private Sources, PGC, NY DEC	

**Cultural Resources****Goal 5-1: Increase awareness of recreational resources through marketing and outreach.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Establish a campaign to market recreational and historical resources to community residents.	Historical Societies, Conservation Groups, Chambers of Commerce, Municipalities, TPA	Private Sources, Foundations, TPA, NY DEC, PA DCNR, NYSOPRHP	
2. Enhance local visitor's centers capability to serve tourist by being accessible and providing information during the weekends when most tourist visit and/or arrive.	Chambers of Commerce, TPA	Foundations, Private Sources, TPA	

**Goal 5-1: Increase awareness of recreational resources through marketing and outreach (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Utilize local recreational facilities to host community festivals and events	Historical Societies, Conservation Groups, Chambers of Commerce, Municipalities, TPA	Private Sources, Foundations, TPA, PA DCNR, NYSOPRHP	
4. Utilize local tourism promotion agencies (TPA) to highlight recreational opportunities	Historical Societies, Conservation Groups, Chambers of Commerce, Municipalities, TPA	Private Sources, Foundations, TPA, PA DCNR, NY DEC, NYSOPRHP	
5. Conduct an economic impact study of recreational activities to determine the impact that recreation has on the local economy.	Historical Societies, Conservation Groups, Chambers of Commerce, Municipalities, TPA	Private Sources, Foundations, TPA, PA DCNR, NY DEC, NYSOPRHP	
6. Promote tourism utilizing natural, cultural, and recreational resources.	Historical Societies, Conservation Groups, Chambers of Commerce, Municipalities, TPA	Private Sources, Foundations, TPA, PA DCNR, NY DEC, NYSOPRHP	
7. Conduct a tourism study to determine what attractions draw tourist to the region in order to target future outreach and marketing campaigns.	Area Businesses, TPA, PA DCNR, NYSOPRHP	Foundations, Private Sources, TPA	
8. Establish additional accommodations for visitors to the region including, motels, bed & breakfast, campgrounds, restrooms, and places to eat.	Chambers of Commerce, Counties	Foundations, Private Sources	
9. Work with tourist promotion agencies and local business to establish a recreation guide for the region including camping, lodging, and food destinations.	Conservation Groups, Trail Associations, Businesses, Chambers of Commerce, PTA	Foundations, Private Sources, DCNR	
10. Increase signage and awareness of public lands to encourage recreational uses on public lands and deter them from recreating on privately owned lands.	PGC, NY DEC, PA DCNR	Foundations, Private Sources, PGC, NYSOPRHP	
11. Enhance the Wilder museum to be more attractive to visitors through increased signage to locate the museum and additional hours.	Warren County Historical Society, TPA	Foundations, Private Sources	



**Goal 5-1: Increase awareness of recreational resources through marketing and outreach (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
12. Highlight local attractions that provide winter recreational opportunities, such as snowmobile and cross-country skiing trails.	Conservation Groups, Snowmobile Clubs, Trail Groups, TPA	Foundations, Private Sources, TPA	
13. Increase awareness about geocaching and the Allegheny Geo Trail	Conservation Groups, Counties, ANF	Foundations, Private Sources, TPA	

**Goal 5-2: Enhance recreational opportunities for sportsmen and outdoor enthusiasts.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Encourage agricultural landowners to participate in the Cooperative Farmland Program opening additional land to public hunting.	Conservation Groups, Sportsmen Groups, Landowners, PGC	Foundations, Private Sources, PGC	
2. Encourage woodlot landowners to participate in the Cooperative Forestry Program opening additional land to public hunting.	Conservation Groups, Sportsmen Groups, Landowners, PGC, PA DCNR	Foundations, Private Sources, PGC, PA DCNR	
3. Establish Sunday hunting in Pennsylvania in order to make it competitive with neighboring states.	Sportsmen Groups, Chambers of Commerce, Legislators, PGC, TPA	Legislators, PGC	
4. Change the start of the Pennsylvania hunting season to the Friday after Thanksgiving to add an extra weekend of hunting.	Sportsmen Groups, Chambers of Commerce, Legislators, PGC, TPA	Legislators, PGC	
5. Identify new, and protect existing areas open to hunting.	Conservation Groups, Sportsmen Groups, Landowners, PGC, NYSOPRHP	Foundations, Private Sources, PGC, NY DEC	
6. Offer incentives to landowners encouraging them to allow hunting on their properties.	Conservation Groups, Sportsmen Groups, Landowners, PGC, NYSOPRHP	Foundations, Private Sources, PGC, NY DEC	
7. Increase access to stage game lands for non-hunting recreational opportunities, such as wildlife watching, bird watching, and hiking during non-hunting seasons.	Conservation Groups, Sportsmen Groups, PGC	Foundations, Private Sources, PGC	

**Goal 5-2: Enhance recreational opportunities for sportsmen and outdoor enthusiasts (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
8. Improve water quality in order to aid the recovery of the local fishery as a local resource for recreation and tourism.	Conservation Groups, Sportsmen Groups, PFBC, PA DEP, NYSOPRHP	Foundations, Private Sources, PA DEP, NYSOPRHP, PFBC	
9. Protect and improve area waterways to maintain or expand fisheries and fishing opportunities.	Conservation Groups, Sportsmen Groups, PFBC, PA DEP, NYSOPRHP	Foundations, Private Sources, PA DEP, NYSOPRHP, PFBC	
10. Designate a section of Brokenstraw Creek as a delayed harvest or fly-fishing only area.	Conservation Groups, Sportsmen Groups, PFBC	PFBC	
11. Create additional public access sites to area waterways for fishing and paddling.	Conservation Groups, Landowners, PFBC	Foundations, Private Sources, PA DEP, NYSOPRHP, PFBC, NY DEC	
12. Work with private landowners to provide access to waterways for anglers and small non-powered watercraft.	Conservation Groups, American Rivers, PFBC, PA DCNR, NYSOPRHP	Foundations, Private Sources, PA DEP, NYSOPRHP, PFBC	
13. Remove some low head dams to improve canoeing, kayaking, and natural fish passage.	Conservation Groups, American Rivers, PFBC, PA DCNR, NYSOPRHP	Foundations, Private Sources, PA DEP, NYSOPRHP, PFBC, NY DEC	
14. Establish a water trail and access points for canoeing and kayaking, including maps and signage.	Conservation Groups, Trail Associations, Businesses, Chambers of Commerce, Citizens, PFBC, PA DCNR, NYSOPRHP, TPA	Foundations, Private Sources, NYSOPRHP, PFBC	
15. Enhance area fisheries by installing fish habitat structures.	Conservation Groups, PFBC	Foundations, Private Sources, PFBC	
16. Acquire and develop areas along the stream for primitive camping.	Conservation Groups, Businesses, PA DCNR, NYSOPRHP	Foundations, Private Sources, PFBC, PA DCNR, NYSOPRHP	
17. Enhance camping experience through facility and program updates, encouraging more visitors to experience the natural environment.	Conservation Groups, Businesses, PA DCNR, NYSOPRHP	Foundations, Private Sources, PFBC, PA DCNR, NYSOPRHP	

**Goal 5-3: Increase recreational opportunities for area youth by establishing programs, encouraging outdoor recreational activities and opportunities.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Organize community sport leagues, such as baseball, basketball, and football.	Park and Recreation Authorities, School Districts, Communities	Foundations, Private Sources, PFBC, PA DCNR	
2. Establish community or school programs to teach children how to swim.	School Districts, Communities	Foundations, Private Sources	
3. Establish community or school programs to teach children about outdoor recreational opportunities, such as hiking, camping, fishing, hunting, etc.	School Districts, Civic Groups, Communities, PFBC, PGC, PA DCNR, NYSOPRHP	Foundations, Private Sources	
4. Encourage participation by youth in outdoor recreation including hunting and fishing.	Conservation Groups, PFBC, PGC, PA DCNR	Foundations, Private Sources, PFBC, PGC, PA DCNR	
5. Establish a place where teens can safely and legally gather during evenings, weekends, and summers.	Community Groups, Municipalities, Churches	Foundations, Private Sources	

**Goal 5-4: Improve recreational facilities and ensure availability and access.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Provide and enhance amenities, such as bathrooms and parking lots, at recreational facilities, including trail heads and municipal parks.	Community Groups, Municipalities, PFBC	Private Sources, Foundations, PA DCNR, PFBC	
2. Eliminate or redesign daily usage fees at Buckaloons Recreation area to increase usage of the facility for picnicking and hiking.	Conservation Groups, ANF	Private Sources, ANF	
3. Establish a community center to host community events or classes, such as bingo and dance classes.	Municipalities, Civic Organizations, Citizens	Private Sources, Foundations	
4. Redevelop recreational facilities for multiple uses providing a variety of activities and amenities.	Park and Recreation Authorities, Citizens, Municipalities	Foundations, Private Sources, PA DCNR, NYSOPRHP	
5. Update equipment and safety feature at existing community parks.	Park and Recreation Authorities, Citizens, Municipalities	Foundations, Private Sources, PA DCNR, NYSOPRHP	

**Goal 5-4: Improve recreational facilities and ensure availability and access (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
6. Develop low-impact recreational facilities for camping, hiking, biking, wildlife viewing, bird watching, picnicking, fishing, and hunting.	Conservation Groups, Community Groups, PA DCNR, NYSOPRHP	Foundations, Private Sources, PA DCNR, NYSOPRHP	
7. Utilize resources of Brokenstraw Creek and its tributaries for recreational opportunities.	Conservation Groups, Businesses	Foundations, Private Sources, PA DCNR, NYSOPRHP	
8. Educate visitors to utilize recreational resources available to the public and respect private property owner rights.	Conservation Groups, Municipalities, Landowners	Foundations, Private Sources, PA DCNR	
9. Establish recreational centers and community service opportunities throughout the watershed for the area's senior citizens.	Community Groups, Municipalities, Churches	Foundations, Private Sources	
10. Preserve Panama Rocks by identifying funding or a conservation buyer who will conserve the property and keep public access to the park.	Conservation Groups, Community Groups, Landowner	Foundations, Private Sources	

**Goal 5-5: Establish, expand, and improve area trails.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Increase maintenance of trail corridors to provide a safer recreational opportunity.	Conservation Groups, Civic Groups, Trail Groups	Foundations, Private Sources, PA DCNR, NYSOPRHP	
2. Increase safety for trails along roadways by erecting highway signage, alerting motorists of the trails, and offering trail safety seminars for trail users.	Municipalities, Trail Groups, PennDOT, NYSDOT	Foundations, Private Sources, PA DCNR, NYSOPRHP, PennDOT, NYSDOT	
3. Maintain trail paths, whether water or land, free of debris and hazards.	Conservation Groups, Civic Groups, Trail Groups	Foundations, Private Sources	
4. Develop additional trails throughout the region including those identified in Northwest Pennsylvania Greenway Plan--Columbus to Bear Lake, Youngsville to Titusville, and Youngsville to Warren.	Trail Associations, Conservation Groups, PA DCNR, NYSOPRHP	Foundations, Private Sources, PA DEP, PA DCNR	

**Goal 5-5: Establish, expand, and improve area trails (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
5. Add environmental components to existing walking and hiking trails in the region by establishing plaques or signs along the trail to emphasize environmental features.	Trail Associations, Conservation Groups	Foundations, Private Sources, PA DEP, PA DCNR, NYSOPRHP	
6. Establish additional recreational opportunities and trails for snowmobile users that could also serve as an ATV, bike, or hiking trail during the off-season.	Trail Associations, Off Road & Snowmobile Clubs, PA DCNR	Foundations, Private Sources, PA DCNR	
7. Establish stewardship programs to enhance and maintain area trails, including hiking, biking, and off-road vehicle trails	Trail Associations, Off Road & Snowmobile Clubs, PA DCNR	Foundations, Private Sources, PA DCNR	
8. Establish an ATV trail or pathways through the area that connects with the trails in the Allegheny National Forest.	Trail Associations, Off Road & Snowmobile Clubs, DCNR, ANF	Foundations, Private Sources, PA DCNR, ANF	
9. Develop or designate certain areas of trails for specific uses, such as off road vehicle riding, snowmobiling, hiking, biking, cross-country skiing, and horseback riding.	Recreational Vehicle Riding Clubs, Trail Groups, Conservation Groups, Municipalities	Foundations, Private Sources, PA DCNR, NYSOPRHP	
10. Reduce vandalism along rails-to-trails caused by motorized vehicles, such as all-terrain vehicles	Trail Associations	Foundations, Private Sources, PA DCNR, NYSOPRHP	
11. Conduct a feasibility study investigating the preservation of abandoned railroad corridors for uses, such as rails-to-trails, that preserve these corridors and offer recreational opportunities.	Conservation Groups, Historical Societies, Municipalities, Civic Groups, Landowners, Trail Groups	Foundations, Private Sources, PA DCNR, NYSOPRHP	

**Goal 5-6: Link recreational facilities to each other.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Establish a network of multi-use trails by connecting existing and new recreational trails.	Conservation Groups, Park and Recreation Authorities, Counties, Municipalities	Foundations, Private Sources, PA DCNR, NYSOPRHP	

**Goal 5-6: Link recreational facilities to each other (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
2. Explore the possibility of connecting railroad corridors and trails from surrounding areas to existing trails.	Conservation Groups, Park and Recreation Authorities, Counties, Municipalities	Foundations, Private Sources, PA DCNR, NYSOPRHP	
3. Develop highway bike/hike trails connecting communities by enhances existing roadways.	Conservation Groups, Park and Recreation Authorities, Counties, Municipalities, PennDOT, NYSDOT	Foundations, Private Sources, PA DCNR, NYSOPRHP, NYSDOT, PennDOT	
4. Establish greenway corridors and trails tin the watershed to connect activity hubs and greenway for public use.	Conservation Groups, Park and Recreation Authorities, Counties, Planning Commissions, Municipalities	Foundations, Private Sources, PA DCNR, NYSOPRHP	

**Goal 5-7: Encourage environmentally sound practices when operating recreational vehicles, and enforce existing laws to minimize intrusion on private lands.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Increase enforcement of illegal off-road vehicle use on private and public lands.	Police Departments, Municipalities, Counties, PA DCNR	Police Departments, Municipalities, PA DCNR, PGC	
2. Prohibit the use of recreational vehicles in areas at risk of being affected by their use, such as steep slopes, streambanks, stream crossings, and habitat for rare, threatened, or endangered species.	Conservation Groups, Police Departments, Municipalities, Counties, PA DCNR, PGC, NYSOPRHP, NY DEC	Foundations, Private Sources, PA DCNR, PGC, NY DEC, NYSOPRHP	
3. Conduct feasibility studies for the development of recreational areas and trails for off-road vehicles.	Conservation Groups, Police Departments, Recreational Vehicles Riding Clubs, Counties, Municipalities, PA DCNR, PGC, NYSOPRHP, NY DEC	Foundations, Private Sources, PA DCNR, PGC, NY DEC, NYSOPRHP	
4. Establish environmentally sound public trails or parks for off-road vehicles.	Conservation Groups, Police Departments, Recreational Vehicles Riding Clubs, Counties, Municipalities, PA DCNR, PGC, NYSOPRHP, NY DEC	Foundations, Private Sources, PA DEP, NY DEC, PA DCNR, NYSOPRHP	



**Goal 5-7: Encourage environmentally sound practices when operating recreational vehicles, and enforce existing laws to minimize intrusion on private lands (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
5. Work with dealerships to offer incentives for customers attending riding etiquette and safety programs.	Conservation Groups, Recreational Vehicle Riding Clubs, Businesses, PA DCNR, NYSOPRHP	Foundations, Private Sources, PA DCNR, NYSOPRHP	

**Goal 5-8: Expand awareness, appreciation, and support for the arts.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Increase awareness for the visual and performing arts, especially as it relates to nature are.	Businesses, Schools, Universities, Cultural Council, Locate Artists, PA Wild Artisans Network	Foundations, Private Sources	
2. Establish or expand an arts appreciation section in public and private school curricula.	Schools, Cultural Councils, Local Artists, PA Wilds Artisans Network	Foundations, Private Sources	
3. Broaden quantity and quality of the volunteer pool supporting the arts.	Citizens, Schools, Universities	Foundations, Private Sources	
4. Expand space available for displays, storage, and instruction in the visual and performing arts.	Businesses, Schools, Universities	Foundations, Private Sources	
5. Use an existing cultural council or establish a taskforce to expand, finance, coordinate, and promote art activities.	Cultural Council, Theaters, Universities, Local Artists, TPA	Foundations, Private Sources	
6. Offer affordable, local, cultural activities, such as plays, concerts, etc.	Schools, Universities, Cultural Councils, TPA	Foundations, Private Sources	

**Goal 5-9: Highlight and preserve local history within the region.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Inventory historical sites throughout the watershed and preserve historical sites and landmarks.	Municipalities, Citizens, Historical Societies, PHMC, NYSOPRHP	Foundations, Private Sources	
2. Install interpretive signage at historical locations.	Municipalities, Citizens, Historical Societies, PHMC, NYSOPRHP	Foundations, Private Sources	

**Goal 5-9: Highlight and preserve local history within the region (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
3. Protect historical sites from vandalism.	Municipalities, Citizens, Historical Societies	Foundations, Private Sources	
4. Establish driving, walking, and/or biking tours highlighting historical sites and structures to increase awareness of local history.	Municipalities, Citizens, Historical Societies	Foundations, Private Sources	
5. Establish a network within the historical community for projects and funding.	Municipalities, Citizens, Counties, Historical Societies	Foundations, Private Sources	
6. Determine if local historical sites and structures could be added to the National Register.	Municipalities, Citizens, Historical Societies, PHMC, NYSOPRHP	Foundations, Private Sources	
7. Establish a rail tour highlighting scenery and history of the railroad.	Historical Societies, Conservation Groups, Railroad Companies	Foundations, Private Sources, PA DCNR, PHMC, NYSOPRHP	

**Goal 5-10: Promote appreciation for the local history.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Incorporate local history into classes taught at local school districts.	Schools, Historical Societies, Citizens	Foundations, Private Sources	
2. Increase awareness of the watershed historical Native American culture.	Historical Societies, Ancestors, Schools	Foundations, Private Sources	
3. Host community events or festivals commemorating local historical events, places, and cultures.	Historical Societies, Communities, Civic Groups	Foundations, Private Sources	
4. Conduct an archeological study within the Spring Creek region.	Historical Societies, Landowners, PHMC	Foundations, Private Sources, PHMC	
5. Establish an organization to preserve historic sites, structures, and relics.	Municipalities, Citizens	Foundations, Private Sources	
6. Promote the historical significance of the Buckaloons through interpretive signage and educational programs at the Buckaloons Recreation Area.	Historical Societies, PHMC, ANF	Foundations, Private Sources, PHMC, ANF	
7. Support annual events and attractions honoring the history of the region and supporting the local artisans.	Historical Societies, Artisan Networks	Foundations, Private Sources	

**Goal 5-11: Promote community involvement in conservation and educational initiatives.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Involve students and citizen in watershed activities, such as water quality monitoring and stream cleanups.	Conservation Districts, Conservation Groups, School Districts	Foundations, Private Sources, PA DEP, PA DCNR, NY DEC	
2. Create a watershed-wide recognition rewarding those advancing environmental education.	Conservation Districts, Conservation Groups	Foundations, Private Sources	
3. Establish additional environmental education opportunities for children and adults that lead toward action.	Conservation Districts, Conservation Groups, Cooperative Extensions, School Districts	Foundations, Private Sources, PA DEP, PA DCNR	
4. Partner with businesses and industries to support local watershed work.	Conservation Groups, Businesses	Private Sources	
5. Establish a Forestry in the Classroom program similar to Trout Unlimited Trout in the Classroom program.	Timber Harvesters, PA DCNR, PGC, NY DEC	Foundations, Private Sources, PA DCNR, PGC, NY DEC	
6. Establish a communication network for school districts with the Brokenstraw Creek watershed to share information collected.	School Districts, Conservation Groups	Private Sources	
7. Identify opportunities to engage local citizens in conservation and stewardship efforts with opportunities of varying degrees of involvement to enable a wide range of able individuals to contribute.	Conservation Districts, Conservation Groups	Private Sources, Foundations	
8. Establish volunteer corps to assist efforts of community planners, conservation organizations, and civic groups.	Conservation Groups, Civic Groups	Foundations, Private Sources, PA DEP	
9. Establish "Friends" groups to maintain public parks and trails, and to diffuse conflicts between adjacent property owners, and park or trail users.	Concerned Citizens, Conservation Groups, Municipalities, Counties, PA DCNR, NY DEC, NYSOPRHP	Foundations, Private Sources	
10. Recruit maintenance and patrol crews to clean-up litter and maintain order at public sites and trails.	Conservation Groups, Concerned Citizens, PA DCNR	Foundations, Private Sources	

**Goal 5-11: Promote community involvement in conservation and educational initiatives (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
11. Establish a partnership among school districts, conservation groups, and agencies to educate students about watersheds.	Conservation Districts, Conservation Groups, School Districts	Foundations, Private Sources	
12. Expand Clymer Conservation Club's focus to engage into conservation activities, not just recreational activities.	Clymer Conservation District, Conservation Groups	Foundations, Private Sources	

**Goal 5-12: Establish ongoing environmental education programs and displays.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Incorporate the sensitivity of nature and its protection into environmental education displays at nature parks and trails in order to protect the plants, animals, and habitats being highlighted.	Conservation Groups, Conservation Districts, Environmental Educators	Foundations, Private Sources, PA DCNR, NY DEC	
2. Conduct outreach campaign to educate watershed residents about how the land-uses in their communities impact the environment.	Conservation Districts, Conservation Groups, Cooperative Extensions	Foundations, Private Sources, PA DCNR, NY DEC	
3. Utilize media, such as newspapers, radio stations, and television stations, to outreach to residents for increased participation and educational messages.	Conservation Districts, Conservation Groups, Media	Foundations, Media Outlets, Private Sources, PA DEP	
4. Increase awareness of watershed-related issues through the distribution of materials and educational programs the focus on the Brokenstraw Creek watershed.	Conservation Districts, Conservation Groups, Cooperative Extensions	Foundations, Private Sources, PA DEP, NY DEC	
5. Promote environmental education campaigns, such as "Everybody lives downstream" and storm drain stenciling.	Conservation Districts, Conservation Groups, Schools	Foundations, Private Sources, PA DEP, NY DEC, U.S. EPA, WREN	
6. Expand Brokenstraw Watershed Councils environmental education role.	Conservation Districts, Conservation Groups, Schools	Foundations, Private Sources	
7. Develop and publish an informational brochure about what a watershed is, issues affecting the health of the watershed, and increasing awareness.	Conservation Districts, Conservation Groups	Foundations, Private Sources, WREN	

**Goal 5-12: Establish ongoing environmental education programs and displays (continued).**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
8. Strengthen the environmental education curriculum in local schools.	Departments of Education, School Districts	Foundations, Private Sources	

**Goal 5-13: Educate recreation users about proper and safe practices.**

<i>Method to Achieve Goal:</i>	<i>Potential Partners</i>	<i>Potential Funding</i>	<i>Priority</i>
1. Educate hunters, fishermen, and other outdoor sportsmen about the importance of land etiquette.	Conservation Groups, Sportsmen Groups, PGC, PFBC, NY DEC, NYSOPRHP	Foundations, Private Sources, PFBC, PGC, NY DEC, NYSOPRHP	
2. Educate sportsmen about areas open to public usage providing detailed maps delineating public-use areas.	Conservation Groups, Sportsmen Groups, NYSOPRHP, NY DEC, PFBC, PGC	Foundations, Private Sources, PFBC, PGC, NY DEC, PA DCNR, NYSOPRHP	
3. Educate off-road vehicle operators to recreate in an environmentally sound manner.	Conservation Groups, Recreational Vehicle Riding Clubs, PA DCNR, NY DEC, NYSOPRHP	Foundations, Private Sources, PA DCNR, NY DEC, NYSOPRHP	

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