Lower Mahoning Creek Regional Watershed Conservation Plan

Final June 2011

Western Pennsylvania Conservancy

water, land, life.

pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

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The Pennsylvania Rivers Conservation Program

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Prepared for:

Little Mahoning Creek Watershed Association
Pine Creek Sportsmen Club

Prepared by:

Western Pennsylvania Conservancy
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ACKNOWLEDGEMENTS

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- Evergreen Conservancy
- Indiana County Conservation District
- Indiana County Planning Department
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- Ken Sink Chapter Trout Unlimited
- Little Mahoning Creek Watershed Association
- Marion Center School District
- Municipalities
- Pennsylvania Department of Conservation and Natural Resources
- Pennsylvania Department of Environmental Protection
- Pennsylvania Geological Survey
- Pine Creek Sportsmen Club
- Rachel Carson Trails Conservancy

ACRONYMS

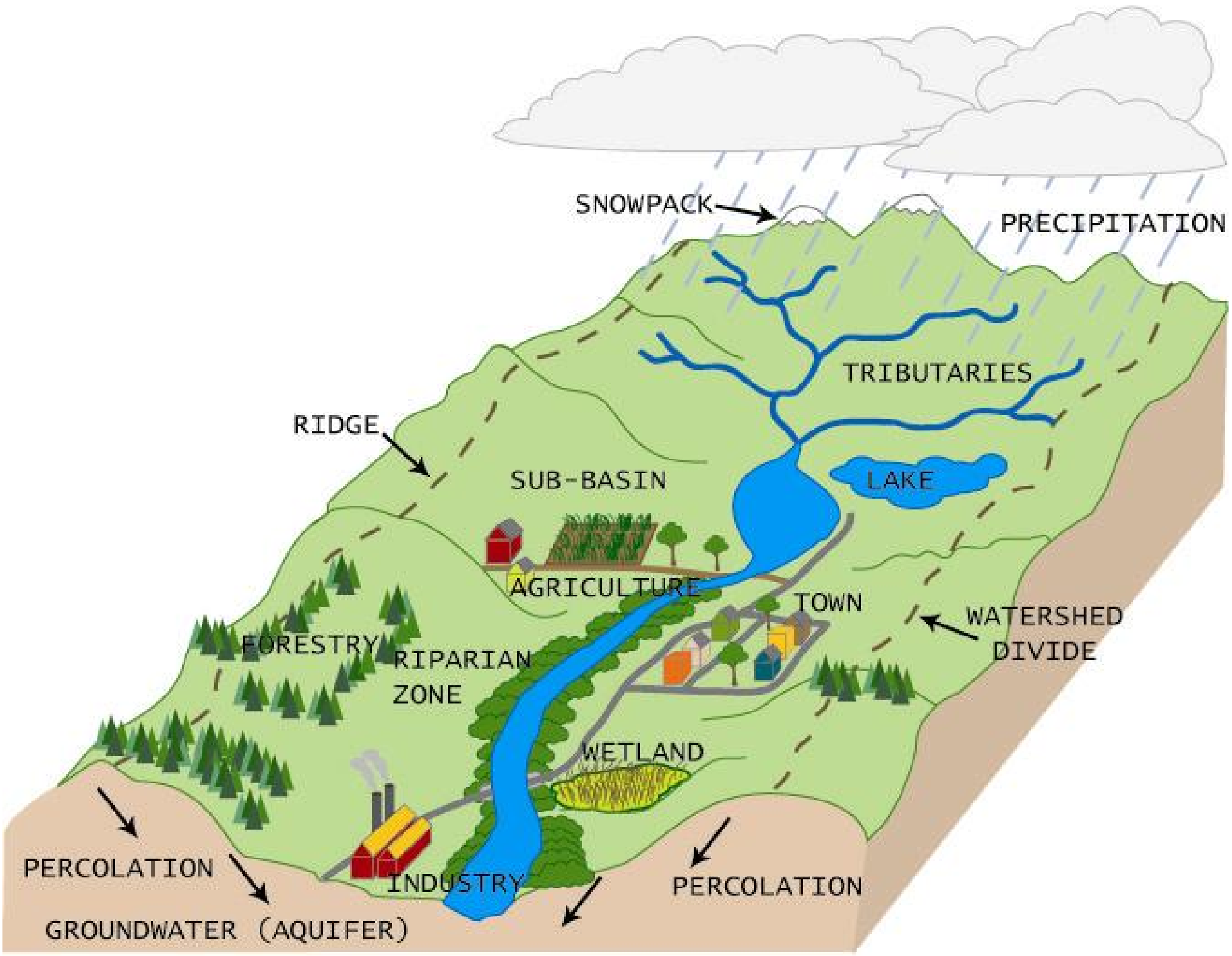
ACB	Alliance for the Chesapeake Bay
AFO	Animal Feeding Operation
AMD	Abandoned Mine Drainage
APHIS	Animal and Plant Health Inspection Service
ASA	Agricultural Security Areas
ATA	Area Transit Authority
ATV	All Terrain Vehicles
BAMR	Bureau of Abandoned Mine Reclamation
BAT	Brownfield Action Team
BDA	Biological 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
NOx	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

WATERSHED DEFINITION

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.



EXECUTIVE SUMMARY

Overview of the Little Mahoning Creek watershed

The Lower Mahoning Creek Regional Watershed Conservation Plan is a comprehensive study that compiles broad-based data about recreational, historical, socio-economic, and natural resources throughout the lower Mahoning Creek, Pine Creek, and Hays Run watersheds. 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.

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 Lower Mahoning Creek Regional 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 into the development of a future vision for the watershed and creates a prioritized list of recommendations to achieve this vision.

Project Background

Electrofishing to determine fish populations in the Little Mahoning Creek watershed

In 2006, Western Pennsylvania Conservancy (WPC) received funding from the Colcom Foundation to begin a comprehensive restoration and protection effort, assessing and restoring Little Mahoning Creek. As part of the Saving Little Mahoning Creek Project, WPC has conducted a threats assessment and annual aquatic surveys for fish, mussels, macroinvertebrates, and hellbenders.

In 2007, WPC received funding from Pennsylvania Department of Conservation and Natural Resources (DCNR) Bureau of Recreation and Conservation to prepare a watershed conservation plan for the lower Mahoning Creek watershed region.

In 2008, planning efforts began with the formation of the steering committee, development of outreach materials, and data collection.

In 2009, public outreach was initiated through kickoff public meeting workshops, public surveys, municipal interviews, a focus group meeting, and school workshops. Development of resource chapters began to take shape.

In 2010, key individual interviews were held and the draft and final version of the Lower Mahoning Creek Watershed Conservation Plan was completed in 2011.

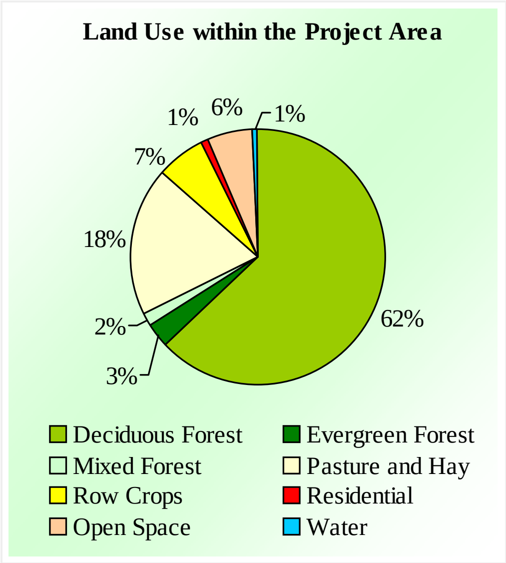
Through the Saving Little Mahoning Creek Project, efforts towards the restoration and preservation of the Little Mahoning Creek watershed continue, with approximately 20 miles of streambank being stabilized. In cooperation with Pennsylvania Fish and Boat Commission, WPC has installed streambank stabilization and fish habitat structures. In cooperation with Indiana County Conservation District, WPC has assisted in three dirt and gravel roads improvement projects that reduce the amount of erosion and sedimentation entering Little Mahoning Creek. Partnering with landowners, Pennsylvania Fish and Boat Commission, and Pennsylvania Department of Environmental Protection, WPC has removed the Savan Dam.

Chapter Summaries

Project Area Characteristics

Amish school located near Smicksburg

- The lower Mahoning Creek watershed comprises 276 square miles within 24 municipalities of Armstrong, Indiana, and Jefferson counties. The landscape is primarily rural with only three boroughs—Dayton, Smicksburg and Timblin—that account for four percent of the watershed's population.
- The communities of Dayton and Smicksburg contain a population of more than 325 Amish families. These families live a simple life, without modern conveniences, such as electricity, telephones, and automobiles.
- The watershed consisted of 8,193 residents in 2000. This was a 16 percent increase from 1990.
- Land-use regulations, such as zoning and subdivision ordinances, are not utilized within the project area. Most municipalities utilize their county's comprehensive plan to address and regulate land-use.
- Automobile transportation is the primary method of transportation throughout the area. Two active railroads traverse the region, but do not offer passenger services within the project area.
- In 2000, the average household income within the project area was $35,618, roughly $17,000 less than Pennsylvania's average household income.



Land Resources

- Forestlands dominate the land cover at 67 percent. The majority is deciduous forest. Agriculture is the second-leading land use, accounting for 25 percent of the land cover, primarily dominated by pastures and hay lands.

- The landscape of the watershed is very rural; only one percent of the land use is residential and this occurs near the population centers of Dayton, Smicksburg, Timblin, and Templeton.

- Typical in rural landscapes, illegal dumping has ravaged the watershed. There are 39 illegal dumpsites with more than 175 tons of trash. The trash not only impacts the region's aesthetics, but can impact water quality and attract disease-spreading pests.

- It contains 12 soil associations, 45 prime agricultural soils, and 80 soils identified as farmland of statewide importance. Approximately 21 square miles have been enrolled in Agricultural Security Areas, preserving the land for agricultural uses.

- Mineral extraction activities within the watershed include industrial mining, coal mining, oil and gas well drilling, including Marcellus shale gas and coalbed methane.

- In 2008, DEP issued 406 permits within the municipalities that comprise the lower Mahoning Creek regional watershed, of which three were Marcellus shale wells.

- As of 2009, there were 15 active coal mining permits and seven active industrial mining permits within the watershed.

Water Resources

- Mahoning Creek is a Warm Water Fishery that enters the Allegheny River between Lock and Dams #8 and #9. The tributaries that feed Mahoning Creek are Cold Water Fisheries, while the Little Mahoning Creek subwatershed is a High Quality Cold Water Fishery.

- Pine Creek is a High Quality Cold Water Fishery that flows into the Allegheny River near Mosgrove, Pa. North Fork and South Fork are the two major tributaries that join to form Pine Creek.

- Hays Run is a small tributary (2.28 square miles) that enters the Allegheny River near Mosgrove, Pa. below the entrance of Pine Creek. It is a Warm Water Fishery that is impacted by abandoned mine drainage.

- Approximately 78 square miles within the lower

Mahoning Creek Dam

Mahoning Creek region have been identified as being impaired in the Integrated Water Quality Monitoring and Assessment Report.

- Impairments are the result of enhanced erosion and sedimentation, poorly managed agricultural practices, acid precipitation, abandoned mine drainage, and channelization.

Biological Resources

- The lower Mahoning Creek region, according to the U.S. Environmental Protection Agency's designation of ecoregions, is located within the Pittsburgh Low Plateau section of the Western Allegheny Plateau ecoregion.

- According to U.S. Forest Service's designation, the lower Mahoning Creek region is located within the Unglaciated Allegheny Plateau section of the Eastern Broadleaf Ecoregion.

Deer crossing one of the many secondary roadways throughout the project area

- There are 23 invasive plant species and five invasive animal species that are known to inhabit the region. Additional invasive species located in adjacent watersheds also threaten the region.

- There are 17 Biological Diversity Areas and two Landscape Conservation Areas identified in the region.

- There are 44 invertebrates, 32 vertebrates, and 30 plant species of concern. There also are four natural communities and two geological features identified in the project area.

Cultural Resources

- A variety of recreational opportunities and facilities exist within the project area. Some facilities, such as campgrounds and golf courses, are privately owned; while other facilities, such as trails and state game lands, are open to the public. Recreational facilities include:
    - 15 park sites
    - One golf course
    - Five campgrounds
    - Six trails (hiking, rail-trails, etc.)
    - Eight historical sites, of which four are on the national registry
    - Three state game lands
    - Five streams designated as approved trout waterways
    - One year-round approved trout waterway
    - One catch-and-release fly-fishing only special regulation area

Issues and Concerns

- Issues and concerns identified during the watershed plan's development were derived from public input via public meeting workshops, student workshops, focus group meetings, public and municipal surveys, and key individual interviews.

- The most important watershed values were identified as (1) water quality, (2) attractive natural settings, and (3) preserving the history and culture of the region.

Recently planted vegetative riparian corridor

- The top three watershed issues of importance were (1) improving water quality, (2) reducing erosion and sedimentation, and tied were (3) preventing and cleaning illegal dumpsites and (3) reclaiming mine drainage and mine lands.

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.

Project Area Characteristics Goals

- Utilize planning to proactively plan for the future while improving quality of life.
- Increase economic stability and attractiveness to potential businesses.
- Enhance infrastructure to enable the region to be a competitive market to attract new businesses.
- Expand community services, such as public libraries and emergency services.
- Identify and reduce impacts caused by acidic precipitation.
- Increase communication and cooperation among organizations.

Land Resources Goals

- Develop a strategic plan to prioritize and protect agricultural and ecologically significant areas.
- Promote local agricultural products, producers, markets and related programs.
- Reduce conflict among surface and subsurface land ownership and their rights and responsibilities.
- Prevent, reclaim, and/or improve impacts associated with mineral extraction activities.
- Protect natural resources and utilize of management practices to minimize impacts caused through the identification and extraction of natural gas within the Marcellus shale formation.
- Control illegal dumping through educational efforts and community participation.

Water Resources Goals

- Reduce the risk of flooding.
- Manage stormwater.
- Reduce erosion and sedimentation impacts.
- Expand the protection, study, and understanding of wetlands.
- Monitor water quantity to ensure demand does not exceed water supply.
- Protect and improve area waterways.

Biological Resource Goals

- Protect forest and wildlife resources.
- Improve habitats.
- Reduce invasive species populations while increasing the use of native species.
- Control wildlife populations.

Cultural Resource Goals

- Enhance recreational opportunities for sportsmen and outdoor enthusiasts.
- Highlight and promote natural, cultural, historical, and recreational opportunities.
- Enhance recreational facilities and expand resources for a diversity of uses.
- Utilize trails.
- Encourage environmentally sound practices when operating recreational vehicles, and enforce existing laws to minimize intrusions on private lands.
- Highlight and preserve local history.
- Expand awareness, appreciation, and support for the arts.
- Involve community residents in watershed activities.

CHAPTER 1. PROJECT AREA CHARACTERSITICS

Project Area

Location and Size

The focus of this plan is the lower Mahoning Creek region, including Little Mahoning Creek, Mahoning Creek mainstem from the confluence of Little Mahoning Creek to the mouth on the Allegheny River, as well as several direct tributaries to the Allegheny River—an unnamed tributary downstream of the Mahoning Creek outlet, Pine Creek, and Hays Run. The latter three streams, while not direct tributaries to the Mahoning Creek watershed, were included in this study to address the conservation concerns that would not have warranted funding to complete separate conservation plans due to their smaller geographic areas. The project area includes approximately 276 square miles of land and water within Indiana, Jefferson, and Armstrong counties in western Pennsylvania. Included within the project area are 24 municipalities (Table 1-1). The watersheds drain into the Allegheny River north of Kittanning.

Overview of Mahoning Creek watershed from Little Mahoning Creek Bible Church Camp

Table 1-1. Watershed Municipalities

Municipality	Acres	Square Miles	Percentage of watershed
***Indiana* County**			
West Mahoning Township	12,288.66	19.20	6.95%
North Mahoning Township	10,178.61	15.90	5.76%
East Mahoning Township	12,933.87	20.21	7.32%
South Mahoning Township	4,846.64	7.57	2.74%
Grant Township	16,990.53	26.55	9.61%
Canoe Township	10,437.41	16.31	5.91%
Banks Township	4,422.09	6.91	2.50%
Smicksburg Borough	99.87	0.16	0.06%
Green Township	1,222.01	1.91	0.69%
Montgomery Township	965.63	1.51	0.55%
Armstrong County			
Boggs Township	15,376.58	24.03	8.70%
Cowanshannock Township	3,899.94	6.09	2.21%
Dayton Borough	289.84	0.45	0.16%
Madison Township	6,321.81	9.88	3.58%
Mahoning Township	11,641.77	18.19	6.59%
Pine Township	3,223.55	5.04	1.82%
Rayburn Township	2,097.65	3.28	1.19%
Redbank Township	14,720.50	23.00	8.33%
Valley Township	3,183.39	4.97	1.80%
Wayne Township	28,023.17	43.79	15.86%
***Jefferson* County**			
Perry Township	1,158.87	1.81	0.66%
Timblin Borough	607.89	0.95	0.34%
Porter Township	6,768.96	10.58	3.83%
Ringgold Township	5,032.56	7.86	2.85%
Totals:	**176,731.80**	**276.15**	

Climate

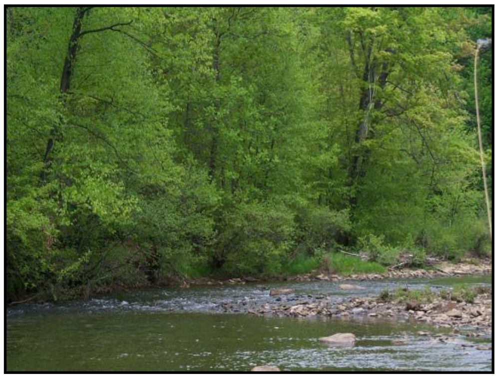
The climate follows that of a modified continental climatic region with hot, dry summers and long, cold winters. Sunshine and humidity combine for three months—June, July, and August—of warm temperatures. The region receives 43 to 46 inches of precipitation per year. The average temperature during the course of the year is 48.5 degrees Fahrenheit. The highest temperature ever recorded was 103 degrees Fahrenheit, and the coldest temperature recorded was -28 degrees Fahrenheit. Typically, the month that receives the most precipitation is June, the warmest month is July, and the coldest month is January (Weather Channel, 2009).

Topography

The watershed is in the Pittsburgh Low Plateau Section in the Appalachian Plateaus Province. The Appalachian Plateau is an eroded plain of sedimentary rock that slopes gently towards the northwest. Elevation varies throughout the region with a moderate to very high relief. The Pittsburgh Low Plateau Section consists of a smooth undulating upland surface cut by multiple, narrow, relatively shallow valleys. The uplands are developed on rocks containing the bulk of the bituminous coal in Pennsylvania. The landscape reflects this by the presence of some operating surface mines, many old strip mined areas, and many reclaimed strip mine lands. The local relief of the uplands is less than 200 feet, on average. Local relief between valley bottoms and higher upland surfaces may be as much as 600 feet. Valley sides are usually fairly steep, except in the upper reaches of streams, where the side slopes are fairly gentle. Elevations range from 660 to 1,700 feet). The geological formations that exist in this section include Pottsville, Allegheny, Glenshaw, and Casselman formations. These formations include limestone, slate, shale, sandstone, and other coal-containing bedrock formations (Pennsylvania Department of Conservation and Natural Resources (DCNR)[2]).

Major Tributaries

The lower Mahoning Creek watershed contains nine major tributaries, including Little Mahoning Creek, Mahoning Creek, Scrubgrass Creek, Glade Run, Pine Run, Ross Run, Pickering Run, Straight Run and East Run.



Little Mahoning Creek is a High Quality Cold Water Fishery

Little Mahoning Creek is designated as a High Quality Cold Water Fishery (HQ-CWF). There are eight major tributaries directly entering Little Mahoning Creek, all of which are classified as Cold Water Fisheries (CWF).

Pine Creek, Hays Run, and an unnamed tributary, although separate watersheds that drain directly to the Allegheny River, have been included in the study. These watersheds have similar characteristics to lower Mahoning Creek and based on their smaller size would have otherwise not had a watershed plan completed.

Air Quality

Each year, nearly 200 million tons of toxic emissions pollute the air in the U.S., to make air pollution the nation’s larges environmental risk (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. It is complicated to identify sources of airborne pollutants to a body of water. Pollutants enter waterways through direct deposition (directly into waterways) or through indirect deposition (being washed in waterbodies as runoff). Researchers developed the concept of airsheds to assist in the study of atmospheric deposition, which is the process of how 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

Atmospheric deposition is the process by which airborne pollutants fall to the ground. There are two types of atmospheric deposition: dry and wet. Dry deposition refers to gases and particles that fall to the earth. They deposit on buildings, cars, homes, and trees, where particles are washed away in runoff during storm events.

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 in lakes and streams; terrestrial and aquatic wildlife and their habitats; forests; human health; visibility; and materials, such as automobiles, statues, and buildings. More information about the effects of acid precipitation is located within the Water Resources chapter.

Critical Pollutants

Six critical pollutants identified nationally affect air quality. They are carbon monoxide, lead, nitrogen oxides, ozone, particulate 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 (DEP[7]). All three counties that the watershed exists within are ranked in the 60th percentile for dirtiest counties in the U.S. (Green Media Toolshed, 2005).

Lead

The use of leaded fuel and industrial processes, such as battery manufacturing and lead smelters, emit lead particles into the atmosphere. The metal development process is a major source of lead emissions. Ingested or inhaled, lead causes poisoning which 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 (DEP[7]).

Nitrogen Oxides

Fossil fuels burned at temperatures in excess of 1,200 degrees Fahrenheit produce nitrogen oxides (NO_x). Automobiles, trucks, buses, airplanes, industries, and power plants emit NO_x into the atmosphere contributing to the deposition of nitrogen in soil and water through acid precipitation. They play a major role in the formation of ground-level ozone. Human health is impacted when NO_x enters the lungs, making it more difficult to breathe (DEP[7]). Jefferson County ranks in the 70th percentile of dirtiest counties in the U.S., while Indiana and Armstrong counties rank in the 90th 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, and filters 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 NO_x combine and react with volatile organic compounds in the presence of sunlight and warm temperatures (DEP[7]). Ozone, and the pollutants that cause it, can travel hundreds of miles away from their source.

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

Particulate Matter

Particulates are tiny drops of liquid or small particles of dust, metal, or other materials that float in the air. Particulate matter is a mixture of these particles. Particles travel into the lungs and become trapped, where they can cause respiratory ailments, and can carry chemicals that can cause cancer and produce greater health problems. Four different types and sizes exist (DEP[7]).

Total suspended particulates vary in size, ranging up to 45 micrometers in diameter. They can remain suspended in the air for a few seconds, or up to several months (DEP[7]). Federal or state air quality standards do not exist for total suspended particulates.

Particulate matter 10 (PM_{10}) 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. Indiana and Armstrong counties rank in the 50th percentile for the worst in the U.S., while Jefferson ranks in the 20th percentile (Green Media Toolshed, 2005).

Particulate matter 2.5 ($PM_{2.5}$) 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 (DEP[7]). Indiana and Armstrong counties rank in the 60th percentile for dirtiest counties in the U.S., while Jefferson ranks in the 30th percentile (Green Media Toolshed, 2005).

Sulfates and Nitrates

Classified together as a critical pollutant are sulfates and nitrates. Sulfates are one of the key components in the formation of acid precipitation. Studies to determine the impacts nitrates have 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. In addition, it can accelerate the corrosion of materials such as monuments, buildings, and iron-containing metals (DEP[7]). 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 the negative health effects of this pollutant. Indiana and Armstrong counties rank in the 90th percentile for dirtiest counties in the U.S., while Jefferson County ranks in the 60th percentile (Green Media 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 released is from power plants that burn coal. 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 that accumulates in fish, shellfish, and organisms that consume 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 their trophic level.

Humans are exposed to methylmercury primarily through the consumption of fish and shellfish. High levels of 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 based on their ability to convey contaminants, such as PCBs, chlordane, and mercury. These advisories suggest limitations on 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 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 (DEP, 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, increased medical expenses and employee absenteeism (Kling & Wuebbles, 2003).

Socioeconomic Profile

Land-Use Planning and Regulation

Land-use plans and regulations protect communities from development and unwanted land uses. The Pennsylvania Municipalities Planning Code grants Pennsylvania municipalities land-use regulation control powers, including comprehensive planning, subdivision regulation, and zoning. As the majority of the municipalities within the watershed are small, rural communities, most use county-wide comprehensive plans to regulate land use. Many of the municipalities have their own floodplain ordinances, however. Land use controls are identified in Table 1-2.

Village sampler and eating house, two of the specialty shops in Smicksburg, PA

Comprehensive Plans

Comprehensive plans guide 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. Banks and South Mahoning townships have implemented their own comprehensive plans, while the remainders of the municipalities follow their respective county's comprehensive plan.

Table 1-2. Land Use Regulations

Municipality	Comprehensive Plan	Zoning	Subdivision Ordinance	Floodplain Ordinance
Indiana County				
West Mahoning Township	County	No	No	No
North Mahoning Township	County	No	No	Yes
East Mahoning Township	County	No	No	Yes
South Mahoning Township	Yes	No	No	Yes
Grant Township	County	No	No	Yes
Canoe Township	County	No	No	No
Banks Township	Yes	No	No	Yes
Green Township	County	No	No	Yes
Montgomery Township	County	No	No	Yes
Smicksburg Borough	County	No	No	No
Jefferson County				
Timblin Borough	County	No	No	No
Perry Township	County	No	No	Yes
Porter Township	n/a	n/a	Na/	n/a
Ringgold Township	County	No	No	Yes
Armstrong County				
Boggs Township	County	No	No	Yes
Cowanshannock Township	County	No	No	Yes
Dayton Borough	County	No	No	No
Madison Township	County	No	No	Yes
Mahoning Township	County	No	No	Yes
Pine Township	n/a	n/a	n/a	n/a
Rayburn Township	County	No	No	Yes
Redbank Township	County	No	No	Yes
Valley Township	County	No	No	Yes
Wayne Township	County	No	No	No

YES=Individual/Joint Municipal Plan County=County Wide Plan

Subdivision Regulations

Subdivision regulations limit the number of times that a parcel can be divided into two or more smaller parcels; therefore representing 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. None of the municipalities have their own subdivision ordinances, but Indiana and Armstrong counties have implemented their own through the comprehensive plans.

Zoning and Land Use

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 the 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. None of the municipalities or counties have zoning regulations, with the exception of a few county parks in Indiana County.

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 utilizing Conservation by Design strategies, development is rearranged 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 living 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 where roads and trails should go; this is the reverse of the conventional development process of identifying roads first

Step 4 – Determine the boundary 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.

Smart Growth

When new developments are being proposed, municipalities and counties should consider implementing cooperative land-use strategies to improve quality of life throughout the area. They also should consider initiating 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

Implementing Smart Growth practices into existing communities provides a balanced, well-rounded community. Smart Growth invests time, attention, and resources in restoring community and vitality to central cities and older suburbs. New Smart Growth principles are more town-centered, transit and pedestrian oriented, and have a greater mix of housing, commercial, and retail uses. Smart Growth also preserves open space and many other environmental amenities (Sustainable Community Network).

Demographics and Population Patterns

The population throughout the project area increased between 1990 and 2000. The population was calculated using census block group data from 1990 and 2000 census. Table 1-3 and figures 1-4 and 1-5 illustrate population and population changes within the watershed.

Among municipalities that have half of their land area located within the watershed West Mahoning Township had the largest population with an estimated 1,791 residents in 2008. However, the entire population does not reside within the project area

According to the 2000 Census the ratio of males to females is practically one to one. Table 1-4 displays the population breakdown by sex and age.

Table 1-3. Population and Population Change

	Population 1990	Population 2000	Percent Change 1990-2000
Population	16,270	18,193	16%
Female	7,781	9,138	15 %
Male	7,489	9,055	17 %

(Source: U.S. Census Bureau, 1990; U.S. Census Bureau, 2000)

Table 1-4. Population by Sex and Age

Age (years)	Male	Female	Total
Under 5 years	589	546	1,135
5 to 17	1,893	1,822	3,715
18 to 24	737	689	1,426
25 to 39	1,702	1,711	3,413
40 to 61	2,673	2,493	5,166
≥62	1,461	1,877	3,338
Total:	9,055	9,138	18,193

(Source: Free Demographics, 2009; Census Bureau, 1990; U.S. Census Bureau, 2000)

There are only a few population centers within the lower Mahoning watershed—Timblin, Dayton, and Smicksburg. The overall population in these centers has decreased slightly since 2000. No major population centers exist within the drainage areas of the unnamed tributary, Pine Creek, or Hays Run. Table 1-5 displays the total population for each municipality in the project area.

Table 1-5. Municipal Populations

Municipality	Population in 2000	Size (miles2)	Population per mile2)	Size in Project Area	% Municipality in Project Area
Armstrong County					
Boggs Township	979	24.1	40.62	24	100
Cowanshannock Township	3006	45.63	65.88	6	13
Dayton Borough	543	0.45	1208.09	0	100
Madison Township	943	30.32	31.1	10	33
Mahoning Township	1502	24.84	60.46	18	73
Pine Township	499	4.91	101.64	5	100
Rayburn Township	1811	11.89	152.65	3	28
Redbank Township	1296	32.36	40.05	23	71
Valley Township	681	14.73	46.23	5	34
Wayne Township	1117	44.66	25.01	44	98
Indiana County					
Banks Township	997	31.84	31.31	7	22
Canoe Township	1670	27..14	61.53	16	60
East Mahoning Township	1196	31.38	38.12	20	64
Grant Township	696	26.99	25378	27	98
Green Township	3995	52.76	75.72	2	4
Montgomery Township	1706	28.66	59.52	2	5
North Mahoning Township	1383	38.31	48.85	16	56
Smicksburg Borough	49	0.14	362.5	0	100
South Mahoning Township	1852	28.59	64.77	8	26
West Mahoning Township	1128	29.37	38.41	19	65
Jefferson County					
Perry Township	1289	28.7	44.91	2	6
Porter Township	282	17.71	15.92	11	60
Ringgold Township	764	19.15	39.89	8	41
Timblin Borough	151	0.91	166.43	1	100

Dayton

Incorporated on July 10, 1873, Dayton Borough had an estimated population of 498 residents as of January 1, 2008. Between 1980 and 1990 the population within the Borough decreased by nine percent and similar to Smicksburg the community contains a large Amish population (U.S. Census Bureau, 1990; U.S. Census Bureau, 2000; U.S. Census Bureau).

Smicksburg

Laid out in 1827 on 12 acres purchased from the Holland Land Trust, Smicksburg is, named after its founder Rev. J George Smick. It was incorporated as a borough on June 28, 1854, and is among the smaller boroughs in Pennsylvania. Between 1990 and 2000, Smicksburg experience a population decrease of 55 percent. As of January 1, 2008 it is estimated that there were 45 residents living within the Borough. The majority of residents within Smicksburg are Amish (U.S. Census Bureau, 1990; U.S. Census Bureau, 2000; U.S. Census Bureau).

An old bank building dating back to 1920 located in Timblin. PA

Timblin

Incorporated in 1922, Timblin Borough had an estimated population of 142 residents as of January 2008. Between 1990 and 2000, the population decreased from 165 to 151 (U.S. Census Bureau, 1990; U.S. Census Bureau, 2000; U.S. Census Bureau).

Infrastructure

Infrastructure is a set of interconnected structural elements that provide the framework supporting an entire structure or community. Although the term has diverse meanings, mention of it in this plan typically 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 is located. A lack of clean water and proper sewage treatment and disposal can hinder development and economic conditions, as well as lead to environmental pollution. Planning for infrastructure, development, and redevelopment are key to the future of the area.

Sanitary Sewer Systems

Septic systems or sewage systems treat wastewater. Septic systems are individual sewage systems that treat waste on-site and then discharge the treated water back into the ground. In North America, approximately 25 percent of the population relies on septic tanks, typically in small towns, as well as rural areas (Septic Tank, 2007).

Sewage systems collect wastewater and transport it for treatment at off-site locations where it is then discharged to nearby surface waters bypassing the hydrologic cycle reducing groundwater storage and increasing stream flows. There are three types of sewer systems: storm, sanitary, and combined. Stormwater systems carry stormwater runoff through pipes and ditches where they eventually enter into streams. 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 reaching the sanitation plant during storm or snow melt events, causing polluted water to enter streams. Table 1-6 identifies the public sewage systems within the project area. Please note that in Table 1-6 where it identifies the communities served that only a portion of the municipalities identified may have public sewage.

Table 1-6. Public Sewage Systems

Facility	Communities served
Green Township Municipal Authority	Green Township
Rayburn Township Municipal Authority	Rayburn Township
Dayton Borough Sewage Treatment Plant	Dayton Borough
Cowanshannock Township Municipal Authority	Cowanshannock Township
Indiana County Municipal Sewer Authority	Montgomery Township, Pine Township
Hawthorn Redbank Ringgold Municipal Authority	Redbank Township, Ringgold Township

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

Every municipality within Pennsylvania is required to have an Act 537 Pennsylvania Sewage Facility Plan. This plan identifies how the municipality will manage sewage. Of the 24 municipalities in the project area, 67 percent have Act 537 plans older than 20 years, with most of them dating back to the early 1970s. Updating older plans is essential, especially in areas where tourism is spurring development.

Public Water Supply

Access to clean water is very important. In Pennsylvania, 89 percent of the population obtains drinking water from a public water supplier (DEP[6]). There are 5 public water suppliers providing drinking water to area residents (Table 1-7). However, the entire municipalities identified within the communities served in Table 1-7 may not have public water; they are identified because a portion of the municipality receives public water. Rural residents are less likely to have public water, and rely on springs and wells for their daily needs.

Table 1-7. Public Water Suppliers

Facility	Communities Served
Green Township Municipal Authority	Green Township
Dayton Borough Municipal Water Plant	Dayton Borough
Shannock Valley General Services Authority	Cowanshannock Township
Pennsylvania American Water	Mahoning Township
Hawthorn Redbank Ringgold Municipal Authority	Redbank Township, Ringgold Township

Phone Services

There is much debate over the establishment or enhancement of wireless communication throughout the region. Many area residents chose to reside in this area for its rural aesthetics and pace of life. The establishment of towers to enhance wireless communications could be viewed as an eyesore in the viewscape and a disruption to the rural way of life.

The availability of contacting emergency services also lies in this debate. New technologies with wireless communication can help emergency responders pin point a caller's location using global positioning systems (GPS). Inadequate signals lead to no dial tone, dropped calls, busy signals and bad connections. Having wireless communication can increase response time with quicker notification of emergencies, and could save lives.

Phone booths and pay phones are gradually disappearing. Between 1998 and 2006, the number of pay phones decreased by 1.1 million, according to findings from the Federal Communications Commission (Miller, 2005; Schleicher, 2007). The increased popularity of cell phones led to fewer people needing or using public pay phones. Due to the decreasing number of pay phones and the rural nature of the region, the likelihood of locating a public pay phone during an emergency is minimal. Although within the Lower Mahoning watershed the existence of pay phones are still needed due to the large Amish community in the region.

Technologies are available to help minimize or mask eyesores with the establishment of wireless communication towers. Although the project area is not located within Pennsylvania Wilds, the Design Guide developed for that region identifies practices to reduce the visibility of these structures: stealth telecommunication structures, co-locations, and height regulations that would be applicable to rural areas throughout Pennsylvania (The Pennsylvania Wilds Planning Team, 2007).

Stealth telecommunication structures – are concealed structures disguised to blend into the surrounding environment, lessening the obtrusive nature, and be unnoticeable to a casual observer.

Co-location – are structures, such as water tanks, church steeples, and billboards, that all ready exist in which new antennas can be attached. Municipalities can provide incentives for co-location in the municipal zoning ordinance by making a quicker and easier permitting process for co-location as opposed to building new structures.

Height regulations – are municipal zoning ordinances that can limit the size of telecommunication structures, and ensure that they do not protrude the viewscape.

Transportation and Safety

Transportation and safety throughout the watershed are extremely important. Vehicle transportation is the most popular form of transportation. Emergency services are essential to the area, especially due to the rural character of the region and the ease of mobility to surrounding safety services.

Methods of Transportation

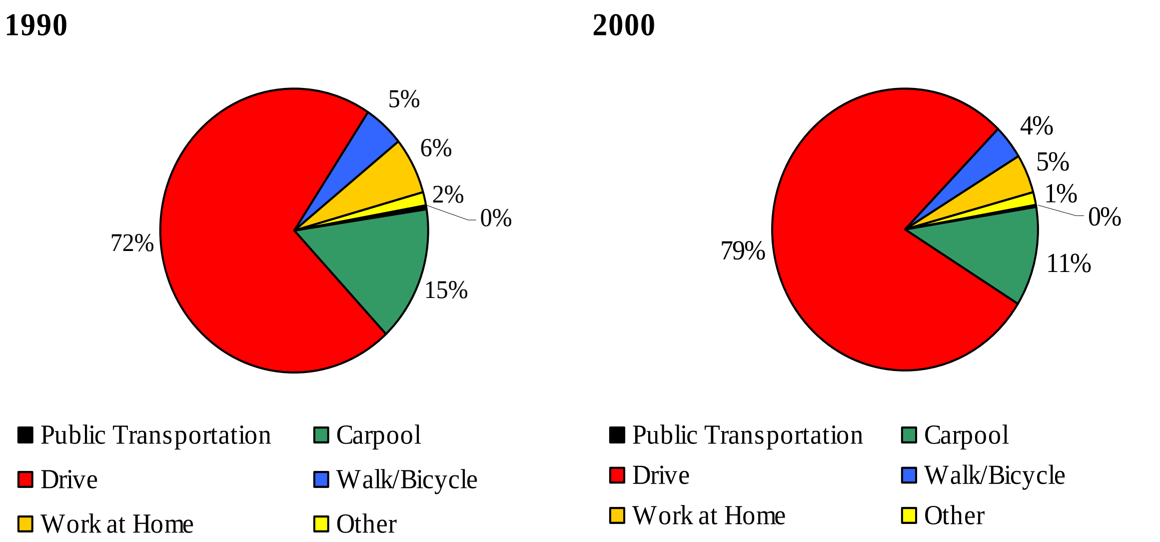
The most popular method of transportation used by residents is the automobile. Within the project area, 79 percent of the working population drive to work, while 11 percent carpool, four percent walk, and five percent work at home. Between 1990 and 2000, the number of people carpooling decreased while the number of people driving alone increased. The percentages of people who worked from home, walked to work, or utilized other means of transportation were stable fluctuating by one percentage point. Figure 1-8 compares transportation methods used in 1990 to those used in 2000.

Roadways that traverse the region are categorized as principal arteries, minor arteries, collector, or local. The majority of roads in the region are minor arteries, collector, and local. There are no interstates freeways, or principal arteries located within the project area.

U.S. Route 119 crosses the eastern portion of the watershed in East Mahoning and North Mahoning townships is the only roadway in the project area that is classified as a minor artery. Minor arterial roadways provide land access at a lower thru-traffic mobility than principal arteries. These roads connect smaller urban communities. U.S. Route 119 connects Punxsutawney, Pa with Indiana, Pa.

Collector roads collect traffic between local and arterial streets. They provide access to smaller rural communities Routes 28/66, 210, 839, and 954 are designated as collector roadways. For example, Route 259 provides access to the specialty shops in Smicksburg from Route 119.

Figure 1-8. Transportation Methods



Local roadways are neighborhood and township roads that serve farms, residences, and local businesses. These roads are primarily maintained by local municipalities and are not under the jurisdiction of the Pennsylvania Department of Transportation. Many roadways in the project area are composed of dirt and gravel, these roads are classified as local roads, although, not all local roads are composed of dirt and gravel.

Airports have a vital role in transportation in today's society, moving passengers and goods all around the world. There are no airports located within the study area. Located nearby are two municipal airports that provide flight training and sight seeing ventures, but do not provide passenger services. Pittsburgh International Airport is the closes airport to provide passenger services.

Railroads—originally established to transport commodities from their origin to market—most of the railroad lines within the region were used for hauling coal from the coal mines. There are two railroads that are active within the project area—Buffalo and Pittsburgh Railroad (BPRR) and Pittsburgh and Shawmut Railroad (PSR). Some older railroads, such as the Allegheny Valley Railroad, have been abandoned and converted into Rails-to-Trails. These abandoned lines are now used for recreational purposes while preserving the railroad corridor and will be discussed in the Cultural Resources chapter.

Railroad bridge over South Fork Pine Creek near Echo. PA

The BPRR maintains three rail lines, two main lines and the Indiana Branch. The first main line travels 32.61 miles through the project area on its way from Butler County to Indiana County. The second main line extends 8.61 miles as it travels from Armstrong County along South Fork Pine Creek where it continues by following North Branch, crossing Glade Run north of Dayton, and then runs parallel to Mahoning Creek into Punxsutawney, Jefferson County. The Indiana Branch traverses 24.28 miles from Jefferson County to Creekside, Indiana County where it parallels Little Mahoning Creek and Route 119 for a portion of its journey.

The PSR maintains three rail lines, a main line, Pittsburg and Shawmut line, and Widnoon Branch. The main line travels from Armstrong County to Brockway a distance of 45.49 miles. The Pittsburg and Shawmut line traverses 44.8 miles beginning in Freeport and paralleling the west bank of the Allegheny River to where it crosses the Allegheny River near the mouth of Mahoning Creek. From there it follows Mahoning Creek to Eddysville where it then parallels Pine Run through Timblin continues in a northeastern direction through Jefferson County. The Widnoon Branch covers a distance of 2.98 miles.

Emergency Services

Having access to emergency services is essential. Emergency services and facilities are typically found in centralized population areas, where responders can quickly reach emergency situations. Ambulance, police departments, fire departments, and hospitals are examples of emergency services and facilities. Services to communities outside the population centers also are available, but with possible delays.

Dry hydrant located at Putneyville Park is used by firemen needing access to water in emergency situations where there is no public water system and a lack of fire hydrants

Because the majority of the project area is rural infrastructure capabilities are often limited. The establishment of dry hydrants throughout the region is an important safety feature that can save lives and decrease damages caused by fires. Dry hydrants are non-pressured pipe systems installed on ponds, lakes, or streams that provide fire companies with access to water in order to respond to fires where public water systems do not exist. The dry hydrants save money, reduce operating cost, utilize freshwater as opposed to treated water, and may decrease insurance premiums. It is recommended to establish dry hydrants throughout locations within the project area that lack public water and existing dry hydrants.

Economy and Employment

Economic conditions are constantly changing. Monitoring economic conditions uses various tools, including the average household income and unemployment rate. Table 1-8 compares the average household income and the unemployment rate within the watershed to that of Pennsylvania and the U.S. Consistent with Pennsylvania and the nation, unemployment within the counties in which the project area is located has increased significantly since 2005.

Table 1-8. Economic Comparison

	Lower Mahoning Creek Regional Watershed	Pennsylvania	U.S.
Average Household Income			
1990	$8,675	$36,675	$38,464
2000	$35,618	$52,682	$56,643

Unemployment Rate (Not Seasonally Adjusted)

	Armstrong	Indiana	Jefferson	Pennsylvania	U.S.
Aug-1990	6.2%	7.1%	5.9%	5.0%	5.5%
Aug-1995	8.8%	9.2%	6.9%	5.7%	5.6%
Aug-2000	5.7%	5.7%	5.1%	4.8%	4.1%
Aug-2005	5.5%	5.3%	5.0%	4.8%	4.9%
Aug-2009	9.6%	8.3%	9.9%	8.5%	9.6%

(Source: Bureau of Labor Statistics, 2009; Free Demographics, 2009)

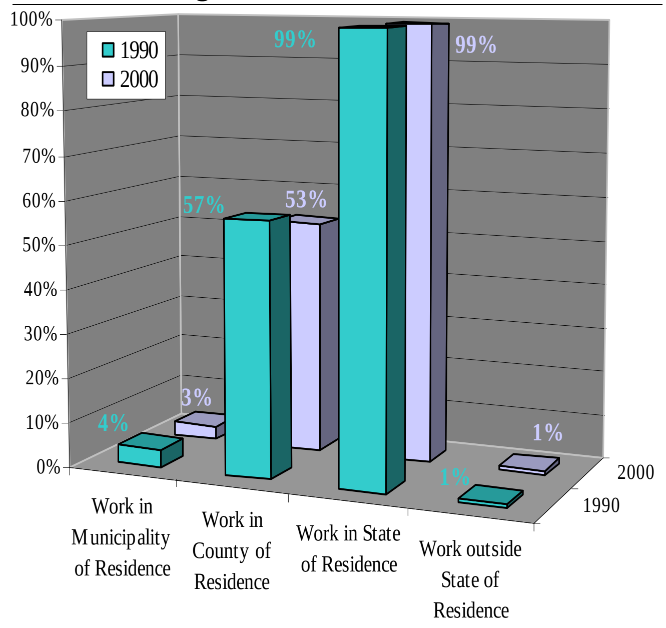
Major Employers

A company or organization that employs 200 or more people is designated as a major employer. There are no major employers located within the project area.

Employment Industry

Consistent with the U.S. and Commonwealth of Pennsylvania, manufacturing is the leading employment industry, accounting for 16.89 percent of the workforce. Retail trade was second with 12.85 percent. Healthcare and social services is the third major industry in the area with 10.37 percent of the local workforce. Table 1-9 displays the breakdown of employment by industry for the U.S., Pennsylvania, and lower Mahoning Creek watershed.

Figure 1-9. Work Location

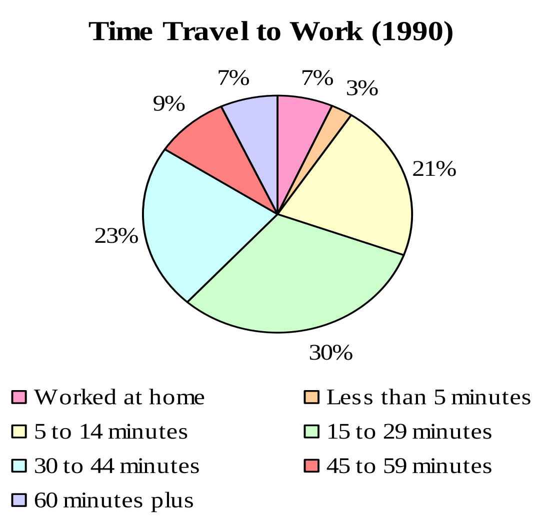


Work Location and Time Traveled to Work

From 1990 to 2000, there were no significant changes in the location of the project area workforce. Almost the entire working population, 99 percent, worked in Pennsylvania. Approximately half of the workforce was employed within the county of their residence while a small fraction worked within the municipality where the lived. Figure 1-9 displays the work location of residents in 1990 and 2000.

Between 1990 and 2000, the time people traveled to work within the project area is largely unchanged. In 2000, a slight increase among those traveling less than 5 minutes and those who travel more than 60 minutes to work. However, there were decreases among those who drive within 5 to 14 minutes and those working at home.

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



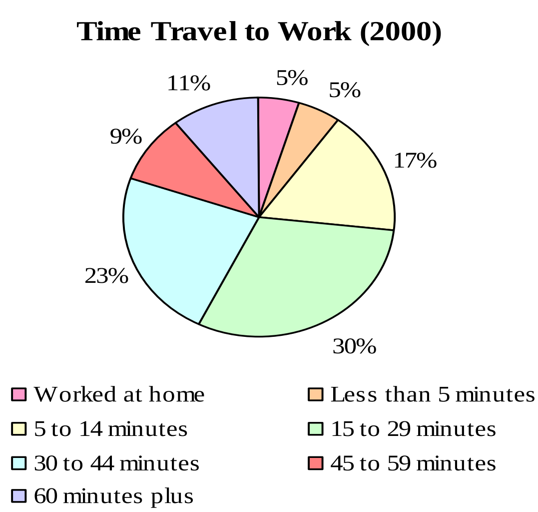


Table 1-9. Breakdown of Employment by Industry

Industry	Lower Mahoning Absolute Employment	%	Pennsylvania Absolute Employment	%	U.S. Absolute Employment	%
Manufacturing	1,146	16.89	906,398	16.03	18,286,005	14.10
Retail trade	872	12.85	684,179	12.10	15,221,716	11.73
Health care and social assistance	704	10.37	740,036	13.09	14,471,823	11.16
Construction	651	9.59	339,363	6.00	8,801,507	6.78
Agriculture, forestry, fishing, and hunting	595	8.77	73,459	1.30	2,426,053	1.87
Transportation and warehousing	587	8.65	248,823	4.40	5,565,853	4.29
Educational services	442	6.51	497,054	8.79	11,371,206	8.77
Other services (except public administration)	409	6.03	274,028	4.85	6,320,632	4.87
Accommodations and food services	303	4.46	324,025	5.73	7,903,810	6.09
Professional, scientific, management; administrative; and waste management services	243	3.58	478,937	8.47	12,061,865	9.30
Finance and insurance	200	2.95	294,022	5.20	6,486,572	5.00
Wholesale trade	179	2.64	201,084	3.56	4,666,757	3.60
Public administration	153	2.25	235,767	4.17	6,212,015	4.79
Utilities	142	2.09	55,512	0.98	1,174,249	0.91
Information	90	1.33	148,841	2.63	3,996,564	3.08
Arts, entertainment, and recreation	50	0.74	73,846	1.31	2,306,485	1.78
Real estate, rental and leasing	21	0.31	78,128	1.38	2,448,400	1.89
Total	**6,787**		**5,653,502**		**129,721,512**	

(Source: U.S. Census Bureau, 2000)

Education

Area youth enroll within three school districts. The entire enrollment of each school does not entirely reside within the project area. No institutions of higher education exist within the project area; however 4 are located within 20 miles of the watershed area. They include Indiana University of Pennsylvania (IUP) main campus, Indiana Pa.; IUP branch campuses in Kittanning and Punxsutawney; and IUP Academy of Culinary Arts, Punxsutawney, Pa. Table 1-10 identifies each school district and school that obtains a portion of their enrollment from the watershed area.

Table 1-10. Schools Enrollments

School	Grades	Enrollment
Private Schools		
Dry Knob Amish Parochial School	1-8	28
Owl Hollow Amish School	1-8	28
Pine Grove Amish School	1-8	22
Shady Lane Amish School	1-8	37
Spring Hollow Amish School	1-8	22
Stony Flat Amish School	1-8	31

Table 1-10. Schools Enrollments

School	Grades	Enrollment
Marion Center Area School District		
Marion Center Area High School	9-12	514
Marion Center Area Middle School	5-8	490
Canoe Grant Elementary School	K-4	131
Rayne Township Elementary School	K-4	330
Creekside Washington Elementary School	K-4	160
Armstrong County School District		
Elderton Elementary School	K-6	268
Dayton Elementary School	K-6	315
Shannock Valley Elementary School	K-6	409
West Shamokin Jr/Sr High School	7-12	650
Elderton Jr/Sr High School	7-12	351
Punxsutawney Area School District		
Punxsutawney Area High School	9-12	925
Punxsutawney Area Middle School	6-8	692
West End Elementary School	K-6	100
Bell Township Elementary School	K-6	127
Jenks Hill Elementary School	K-6	106
Longview Elementary School	K-6	97
Parkview Elementary School	K-6	105
Mapleview Elementary School	K-6	206
Mary A. Wilson Elementary School	K-6	260

(Source: National Center for Education Statistics, 2008)

CHAPTER 2. LAND RESOURCES

This section provides an overview of the land resources within the lower Mahoning Creek, Pine Creek, and Hays Run watersheds. Discussion topics include geology, soils, land-use, agricultural land preservation, ownership, critical and hazardous areas, landfills, recycling, and brownfield sites.

Geology

Geology is the scientific study of the earth, its history, and its natural processes and products. Geologic investigations of an area can yield insight into the land's history, composition, structure, and natural resources. The landscape reflects millions of years of natural events. Forces acting on the land surface have varying effects, causing a vast array of landscapes.

Overview of the Little Mahoning Creek watershed

Geology greatly influences many attributes of watersheds. The presence or absence of a species in a region relies on geology, climate, and soil type. The path and flow of waterways have been determined by geology. Physiographic provinces and ecological subregions have related geology and frequently overlap. Figure 2-1 displays the surface geology of the region.

Physiographic Provinces

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

The project area is located entirely within the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. Characterized by the smooth, undulating upland surfaces cut by numerous, narrow, relatively shallow valleys; this geomorphic province covers most of western and southwestern Pennsylvania. The bulk of significant bituminous coal in Pennsylvania was developed on rocks in the upland areas, evident by the presence of operating surface mines, old strip mines, and reclaimed strip mines. The local relief—the difference in elevation between two points—varies upon location within the project area. In the uplands, relief is generally less than 200 feet; between the uplands and valley bottoms it can fluctuate up to 600 feet. Valley sides are usually moderately steep, except in the upper reaches of the streams. Some of the land surface is susceptible to landslides. Elevations range from 660–1,700 feet (Sevon, 2000).

Ecoregions

Ecoregions are determined by biophysical characteristics; each ecoregion has 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 of an ecosystem and thus help define ecoregions. Although both province and ecoregion delineations consider the geology of an area, ecoregions also view the distribution of species and ecosystems across the landscape.

Ecoregions can be delineated in different ways by different entities; the two most commonly respected entities being the U.S. Environmental Protection Agency (U.S. EPA) and U.S. Department of

Agriculture Forest Service (USFS). Although both the U.S. EPA and USFS designations cover the entire project area, the boundaries of each designation are not exactly the same. Therefore, the descriptions of each designated region may vary slightly.

Environmental Protection Agency

U.S. EPA designated ecoregions, derived from the framework developed by James Omernik, indicate 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. The most immediate needs are to develop regional biological criteria, water quality standards, and set management goals for non-point source pollution problems.

The project area is located entirely within the Pittsburgh Low Plateau subregion of the Western Allegheny Plateau ecoregion. This ecoregion is unglaciated and characterized by having rounded hills, narrow valleys, fluvial terraces, and entrenched rivers. The landscape is well-dissected with a maximum local relief of 550 feet and is prone to landslides. Hilltop elevations commonly range from 1,100–1,400 feet. The terrain is rugged, but lacks folded ridges (Woods, Omernik, & Brown, 1999).

Farming and bituminous coal mining are prevalent general uses of this region. Sloping terrain, soil wetness, low soil fertility, and a short growing season impact agricultural opportunities. The majority of farming operations are general and dairy. Widespread coal mining operations have scarred the landscape; leaving areas barren, un-reclaimed, and polluted with abandoned mine drainage (AMD) (Woods, et al., 1999).

U.S. Forest Service

USFS ecoregion designations are based on the National Hierarchical Framework of Ecological Units. This framework provides a scientific base for regionalizing ecosystems into smaller, alike units by standardizing methods for classifying, mapping, and describing ecological units. Biotic and environmental factors, such as climate, physiography, water, soil, air, hydrology, and potential natural communities, directly or indirectly regulate the structure and function of ecosystems (McNab & Avers, 1994).

The watersheds are located within the Southern Unglaciated Allegheny Plateau Section of the Eastern Broadleaf Forest ecoregion. A maturely dissected plateau of high hills, sharp ridges, and narrow valleys; the bedrock of this ecoregion is mainly sandstone, siltstone, and shale with some limestone and coal. Much of the land has been mined and exhibits topographical gouges. Major coal seams are located within the Pennsylvanian aged bedrock, with the youngest bedrock lying in the center of the section. Elevation ranges from 650–1,300 feet with local relief around 160–325 feet (McNab & Avers, 1994; McNab, Cleland, Freeouf, Keys, Jr., Nowacki, & Carpenter, 2005).

The region is characterized with a dendritic (branching) drainage pattern and a diversity of streams with gradients ranging from high, steep, headwater streams to low gradient rivers flowing into the Ohio River. Small springs are numerous, but seasonal. The natural stream flow and water quality are impacted by natural resource extraction activities, such as oil and gas drilling and coal mining (McNab & Avers, 1994).

Vegetation consists of mixed mesophytic forests and Appalachian oak, with mixed oak forests, oak-hickory-chestnut forests, oak-pine, hemlock, beech, floodplains and swamp forest communities. Common fauna of the region includes whitetail deer, gray fox, opossum, gray squirrel, turkey, ruffed grouse, pileated woodpecker, red-spotted newt, dusky salamander, eastern hellbender, and various species of birds, turtles, and snakes. Aquatic species located here are typical of headwater tributaries, such as redbelly dace, creek chub, barred fantail darter, and greenside darter. Historically, mussel populations were diverse but have since decreased, causing many species to be identified as threatened or endangered at the state or federal level (McNab, et al., 2005; McNab & Avers, 1994).

Stratification

Sedimentary rocks cover 75 percent of the earth's surface. They form from weathered, eroded rocks, or dissolved materials that precipitate out of solution. The sequence, or layering, of sedimentary rocks is known as stratification. Changes in the sequence reflect changing conditions during deposition. The project area contains three stratifications from the Pennsylvania period occurring 286–320 million years ago.

The **Conemaugh Formation** is the youngest formation, consisting of geologic materials between the base of the Pittsburgh coal seam and the top of the Upper Freeport coal. It is 600–700 feet thick and the most extensively exposed formation. It is composed largely of olive-drab and reddish shale and sandstone mixed with minor beds of red and gray clay shale and thin limestone and coal. It shows gray and red shale interbedded with siltsone, fine-grained sandstone, and thin beds of limestone. It contains beds of coal (Martin, 1977; Weaver & Ruffner, 1991).

Refuse pile located in the Pine Run watershed where coal formed in the Conemaugh and Allegheny formations was mined

The **Allegheny Formation,** the second most extensively exposed formation, averages 300 feet in thickness. The limits of the formation are poorly-defined; the top of the formation being marked by the Upper Freeport coal seam and the base marked by the massive Homewood sandstone. It includes most of the productive and economically mineable coals in Pennsylvania. Between the coal beds are strata of gray-clay shale, olive-drab shale, shaley to massive sandstone, and thin beds of limestone. It contains interbedded siltstone, shale, sandstone, and limestone with some productive veins of coal (Martin, 1977; Weaver & Ruffner, 1991).

The **Pottsville Formation** is only found in a few places, including Little Mahoning Creek. The thickness varies from less than 20 feet to more than 250 feet. Dominated by sandstone, the coal layers are thin and accompanied by underclay and thin-bedded sandstone at the base; mining within this formation is minimal. Very stony Dekalb soils cover most of the upland areas and very stony Ernest soils are on the lower valley slopes. Massive sandstone interbedded with thin layers of shale and coal is exposed in the valleys (Martin, 1977; Weaver & Ruffner, 1991).

Soil Characteristics

Soil Associations

Soil associations are landscapes with a distinctive pattern of soils. Typically, they contain one or two major soil types and a minor soil type. They are named for the major soil types in the association. Different associations may have the same soils, but they appear in different patterns. The most dominant soil series in each association is identified first. Figure 2-2 displays the 12 soil associations located within the project area. Specific soil information for a particular parcel can be obtained from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey at http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

The **Cavode-Brinkerton-Armagh** soil association is located in the Jefferson County portion of the Mahoning Creek watershed. Soils in this association are somewhat poorly drained, except on uplands where they are poorly drained. The main soils are underlain by clay shale and located on broad upland flats and gentle slopes. Strip mining is extensive, especially within areas of the steeper Gilpin soils, and in has rendered the soils unsuitable for crops in some locations. Dairy farming is also common on the soils of this association, where pasture crops, cultivated crops, and hay grow well. Some wet spots require practices such as strip-cropping, terracing, and artificial drainage (Zarichansky, Steputis, Cerutti, Harwell, Seglin, & Hixson, 1992).

The **Cookport-Hartsells-Dekalb** soil association is located in the Jefferson County portion of the Mahoning Creek watershed. The soils of this association are located on sloping ridges and in rolling areas on broad ridgetops at higher elevations. These soils formed from sandstone on broad ridgetops and slopes. This association is often located in forested areas, of which most have been cut over, but trees in the second growth stands are large enough to produce saw logs, chemical wood, and pulpwood. Dairy farming and farms where beef cattle are raised are common on the less sandy soils that have been cleared for farming. A large part of the cleared acreage is no longer in active agricultural use, but has grown trees and brush, or is used for pasture. Most of the small farms within this association are operated on a part-time basis (Zarichansky, et al., 1992).

The **Dekalb-Clymer-Cookport** soil association is composed of medium and moderately-coarse textured soils located on the steep valley slopes, ridges, and broad, gently rolling ridgetops of the Little Mahoning Creek watershed in Indiana County. The lower part of the valley slopes contain a narrow band of colluvium, while colluvial slopes are broader and bowl shaped in the headwater regions. Woods and woodland pastures cover most of this association, with much of the farmland converted to forest or Christmas tree plantations. Other formerly cultivated areas are idle and covered with laurel, huckleberry, and small saplings. Farming within the association is primarily dairy or part-time farming. Residential development occurs mostly in the small towns and village, and along improved highways. Development opportunities are slightly to severely limited by shallow soil depths and high water table areas (Weaver & Ruffner, 1991).

The **Gilpin-Wellston-Ernest** soil association contains rolling, shallow to deep, well drained and moderately well drained, silty soils in the Jefferson County portion of the Mahoning Creek watershed. The major soils are located on long slopes of rolling plateaus and on the lower portions of the slopes. Coal mining is extensive in this area; mine dumps and strip mines are numerous. Dairy farming in the area is prevalent, but general farms are also common. Many farms have been planted to Christmas trees or are part-time operations (Zarichansky, et al., 1992).

The **Gilpin-Wharton-Cavode** soil association contains medium-textured soils on moderately sloping to moderately steep valley slopes and broad, gently sloping hilltops and benches in the Little Mahoning Creek watershed in Indiana County. This is an area of rolling hills carved out by streams, forming a dendritic drainage pattern. The broad, gently sloping hilltops and narrow valleys give the area a somewhat undulating relief. This area is used to a great extent for agriculture due to its location on gentle or moderate slopes. Most of the strip mines in Indiana County are located within this association. The soils have moderate or severe limitations for residential development. Gilpin and Weikert soils generally are too shallow for septic-tank systems and Wharton and Cavode soils have a seasonal high water table which limits desirable home sites and highway locations (Weaver & Ruffner, 1991).

The **Gilpin-Weikert-Ernest** soil association is located within the South Fork Pine Creek subwatershed in Armstrong County and Little Mahoning Creek watershed in Indiana County. The area is characterized by rolling hills with narrow to broad rolling ridgetops and narrow stream-cut valleys with gently sloping to steep sides. There are a number of small streams within this association. The soils are formed of material weathered from shale, siltstone, and sandstone. They are medium-textured to moderately course, and well to moderately-well drained. The dissected landscape and complex soils of this association make farming difficult; however, the rolling ridgetops and gentle slopes provide opportunities for dairy farming—the main type of active agriculture. Areas previously farmed are idle and growing natural vegetation, or have been planted with Christmas trees. Some areas with Ernest soils are suited to limited urban development, while the remaining areas are too steep (Martin, 1977; Weaver & Ruffner, 1991).

Agricultural fields provide cover and food for wildlife during the winter

The **Guernsey-Westmoreland** soil association is composed of soils that are moderately-well drained, or well drained when containing lime. Largely, they are gently sloping and moderately steep in the uplands where the bedrock contains limestone. This association is in small areas scattered throughout Jefferson County where limestone is near the surface or appears as an outcrop. These soils are well suited to farm crops, with some artificial drainage needed to remove excess surface and subsurface water. Dairy and beef cattle operations are a specialty of this association; much of the feed for the cattle is grown on these soils. Quarrying for limestone has been profitable in some locations. Land slippage is common, especially in saturated upper portions of the Guernsey soil profile. (Zarichansky, et al., 1992).

The **Monongahela-Allegheny-Pope-Philo** soil association contains medium-textured soils on terraces and floodplains in Indiana County. It is an area of meandering streams, smooth floodplains, and dissected terraces. In most places, the terraces gradually blend into the uplands, but the edges of the terraces that border floodplains are steep. The well drained and moderately well drained soils on the floodplains are farmed intensively, but the choice of crops is affected by the frequency of flooding. The wet soils are used for trees or limited grazing. Most of the farm buildings are located on the terraces. Some of the major roads in Indiana County run through this association, providing access to markets. The better drained, level terraces adjacent to good roads have been developed for industrial and residential use (Weaver & Ruffner, 1991).

The **Rainsboro-Melvin-Steff** soil association is located throughout portions of the project area, primarily at the mouths of streams and within the floodplain of the Allegheny River. Soils are moderately well drained to poorly drained, deep, and nearly level to gently sloping on terraces and floodplains. The soils are underlain by stream sediment. Most of the early settlement occurred in this association, and much of the recent development has occurred on the terraces adjacent to these towns. Railroads and early highways were built on this association because construction was easy on the gently sloping soils. Further development on the floodplains is limited by the hazards of flooding. The potential for having a high water table is a development limitation. Many of the terraces have been quarried for sand and gravel (Martin, 1977).

The **Rayne-Ernest-Hazelton** soil association is primarily located within the Mahoning Creek watershed in the Armstrong County portion of the project area. This association consists of narrow ridgetops and knolls with some low-lying depressions and toe slopes. Most of the soils formed in material weathered from shale, but some formed in colluviums at the base of slopes or on ridges formed in material weathered from sandstone. Soils are well to moderately well drained, deep, gently sloping to moderately steep in low-lying areas on ridgetops and on hillsides. Many streams divide this association. There are some productive farms, and many of the soils have only moderate development limitations (Martin, 1977).

The **Wharton-Rayne-Cavode** soil association is located within the Pine Creek and Mahoning Creek watersheds in Armstrong County. The soils are well drained to somewhat poorly drained, deep, and nearly level to moderately steep on ridges, benches, and hillsides. They were formed in material weathered from interbedded clay-shale, shale, siltstone, and sandstone. This association consists of uplands crisscrossed by small streams. Many areas need artificial drainage; if drained, they are suited for general field crops. In many places, slow permeability and a seasonally high water table are limitations affecting on-lot sewage disposal (Martin, 1977).

The **Weikert-Gilpin** soil association is located in Hays Run, Pine Creek, and Mahoning Creek watersheds. Soils are well drained, shallow and moderately deep, steep, and very steep on uplands. This association consists of long, narrow, steep, dissected areas adjacent to rivers, creeks, and streams. The soils formed in material weathered from interbedded shale, siltstone, and sandstone. Steep slopes severely limit the use of the soils in this association. Much of the association is wooded, and areas that were cleared are now developing natural vegetation. Some of the most scenic areas of Armstrong County, as well as many areas that have been strip mined, are in this association (Martin, 1977).

Prime Agricultural Soils

Soils that are important in meeting short-term and long-term food production needs are classified as 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. NRCS office in each county is responsible for designating the prime agricultural soils based upon a predetermined criterion. Typically, the criteria includes level to nearly level slopes, a well drained structure, deep horizons, acceptable levels of alkaline or acid components, and the capacity for producing food and crops. Figure 2-3 depicts the areas that have prime agricultural soils. There are 45 prime agricultural soils within the counties of the project area, and a listing of these soils is located in Appendix C.

Farmland of Statewide Importance

Farmland of statewide importance is an area containing soil that did not meet the criteria for prime agricultural soil, but is nonetheless agriculturally important. These soils, when managed properly, can produce high yields of crops and may even produce yields as high as prime farmland (Farmland Protection Policy Act annual report FY 2001, 2002). Farmland of statewide importance, designated by the State Rural Development Committee, may include soils selected for agriculture by state law. The 80 soils identified as farmland of statewide importance in the project area are identified 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 areas in the U.S. were converted to a developed use and over half of that acreage was agricultural land. That conversion translates into a loss of over one million acres of agriculture lands each year; more than 3,250 acres every day (USDA, 2000).

Cattle grazing in one of the many pasture lands in the project area

Pennsylvania's farmland, in quantity and in land cover, reached its pinnacle in 1900, when two-thirds of the state's land use was devoted to farming. Since that time, farmland and the number of farms have been steadily declining. As the percentage of farmland declines, the average farm size has increased. This statistic is inline 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], 2007b).

Pennsylvania has been actively pursuing farmland preservation since 1988, when the Farmland Protection Program was formed by state legislature. Since its inception, the program has preserved 411,892 acres on 3,745 farms (PDA, 2009). With these impressive numbers, Pennsylvania leads the nation in both acres of farmland preserved and number of farms preserved. To qualify for the Farmland Protection Program, a farm must be designated as an agricultural security area (ASA). Indiana and Armstrong counties have agricultural land preservation programs, while Jefferson County does not.

In 1988, Indiana County formed a farmland easement program to balance agricultural land uses with development needs. The program was established to purchase conservation easements in agricultural zones identified in the Indiana County Comprehensive Land Use Management Plan in order to preserve land needed for agricultural uses. To determine eligibility for the program, please contact the Indiana County Conservation District (Indiana Conservation District).

In 2003, the Armstrong County Agricultural Preservation Board was established to oversee the county's agricultural preservation program. The program protects viable agricultural lands by obtaining conservation easements. In order to qualify for the program, land must be agriculturally active. To determine eligibility for the program, please contact the Armstrong County Conservation District (Armstrong Conservation District).

Within the project area, the McConaughey Farm located in North Mahoning Township is the only farmland enrolled in a conservation easement that protects the land for agricultural uses.

Agricultural Security Areas

The ASA program 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 each. Lands eligible for the program include pasture, hayland, woodland, or cropland (PDA, 2007a).

Within the project area, there are 33 parcels enrolled in ASAs. These 21 square miles account for approximately 10 percent of land and are identified in Figure 2-3. There are 15 parcels enrolled in Armstrong County and 18 parcels enrolled in Indiana County.

Landowners benefit by enrolling their land into an ASA. Benefits include limited government ability to condemn land for roads, parks, and other infrastructure projects; a municipal agreement not to create "nuisance laws," including odor and noise ordinances that would limit agricultural practices; and eligibility to sell development rights as a conservation easement to the Commonwealth of Pennsylvania (Farmland Preservation).

A conservation easement is a deed restriction that landowners may voluntarily place on their property, with the cooperation of another entity, which establishes a material interest in the property to protect its natural resources. With an easement agreement, the owner authorizes the easement holder to monitor and enforce restrictions set forth in the agreement and ensures that the property will be protected indefinitely.

Clean and Green Program

Established by Act 319 in 1974 by the Pennsylvania legislature, the Clean and Green Program preserves agricultural and forestry lands by providing tax benefits through assessing property based on its “use value” as opposed to the normal “market value.” The program is voluntary and administered by individual county assessment offices. Owners who enroll must agree to maintain the land solely for agricultural use, agricultural reserve, or forest reserve use. Areas in an agricultural reserve are non-commercial open space that is used for outdoor recreation or scenic enjoyment and open to the public.

In order for a property to be eligible, it must be at least 10 acres contiguous to farm, forest, or open land. An exception is agriculture lands that are less than 10 acres and earn a minimum of $2,000 gross income from farming activities. Agriculture or forest land uses must occur on the land for three years prior to applying for the Clean and Green Program. All land, including residence and agricultural buildings, are considered part of the farmstead and eligible for enrollment. Interested landowners should contact their local agriculture preservation boards, township office, or county assessment office for an application (Kanagy, 2001; PDA, 2007b).

Owners who wish to withdrawal from the program face a rollback penalty for up to seven years—the current year and previous six years. The rollback is the difference in taxes paid and what taxes would have been paid if land was not enrolled in the program. Each year’s rollback is subject to interest at a rate of six percent. Enrollment in the program transfers with ownership of the property; if sold, the new owners would be subject to the rollback if they change the land use (Kanagy, 2001).

Conservation Programs

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 programs identified in the 2008 Farm Bill. Each program is described briefly in Table 2-1; however, for more information about these programs contact the local FSA office or visit their website http://www.fsa.usda.gov (USDA, 2008).

Table 2-1. Conservation Practices Identified in 2008 Farm Bill

Program	Program Description
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
Farmable Wetlands Program (FWP)	Reduces downstream flood damage, improves surface and groundwater quality, and recharges groundwater supplies by restoring wetlands

Table 2-1. Conservation Practices Identified in 2008 Farm Bill (continued)

Program	Program Description
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: USDA, 2008)

Nutrient Management Program

The Nutrient Management Program was enacted in 2005 through Act 38. Existing laws and regulations, such as Right to Farm and Nutrient Management Act, along with new initiatives are coordinated in Act 38. The requirements of this act apply only to high-density animal operations. A high-density operation is one having 2,000 pounds of animal weight per acre.

Act 38 was established to ensure that local government enacted ordinances regulating normal agricultural operations consistent with the authority given to them to protect citizens' health, safety, and welfare. Act 6, the old nutrient management act, was replaced with Act 38. Most of the current laws and regulations were retained with the addition of manure setbacks 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 in width is used to prevent runoff and it meets standards set forth by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). 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 that, when implemented, manage impacts of odor generated from animal housing or manure storage. Concentrated Animal Operations (CAOs) and Concentrated Animal Feeding Operations (CAFOs) that build or expand animal housing 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 require odor management plans. The plans must be written by certified odor management specialists (Pennsylvania State University, 2005).

Land Use

Analyzing existing land uses can reveal a significant amount about an area and how it has changed. Land uses provide information about major economic catalysts and offer a glimpse into how the past has influenced present-day conditions. Examining the land use can identify future trends or explain existing conditions not recognizable by casual observations, such as insight into possible sources of environmental degradation. It is important to continually monitor land-use changes in order to guide decision making. Land uses within the watershed are documented in Table 2-2 and figures 2-4 and 2-5.

Figure 2-4. Land Use within the Project Area

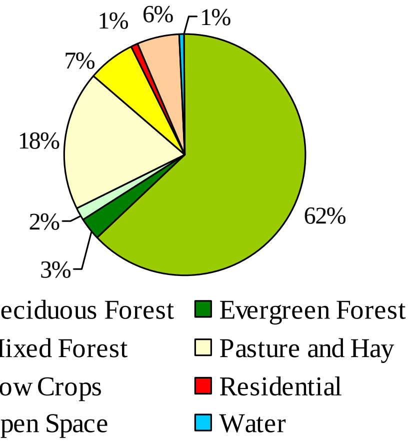


Table 2-2. Land Use

Land-Use	Square Miles	%
Forest	**183.98**	**67.16%**
Deciduous Forest	171.35	62.55%
Evergreen Forest	8.23	3.00%
Mixed Forest	4.40	1.61%
Agriculture	**69.49**	**25.37%**
Pasture and Hay	51.74	18.89%
Row Crops	17.75	6.48%
Open Space	**17.17**	**6.27%**
Open Space	16.17	5.90%
Barren Lands	1.00	0.37%
Residential	**1.73**	**0.63%**
Low Intensity Residential	1.54	0.56%
Medium Intensity Residential	0.18	0.07%
High Intensity Residential	0.01	0.00%
Water	**1.592**	**0.58%**
Water	1.59	0.58%
Wetlands	0.002	0.00%
Total	273.96	

Forest and agricultural land account for the majority of land uses within the project area. The next most prevalent land use is open space, occupying six percent of the project area. Each taking up less than one percent of the area are residential development and water resources.

Forestry

In 1630, an estimated 95 percent of Pennsylvania was covered with forestland. Harvesting timber to support a growing nation reduced the forestland cover to 30 percent by 1907. Over the past century, the amount of forested land has rebounded to cover 58 percent of Pennsylvania. The majority of Pennsylvania's forestlands—69 percent—are privately owned. Public agencies own the remaining 31 percent Seventeen million of Pennsylvania's 28 million acres are covered by forests. Nationally, Pennsylvania ranks number one in hardwood production.

Forests provide a variety of resources and services including wildlife habitat, timber, water filtration, aesthetics, recreation, and employment. Over 90 percent of the nation's species of concern inhabit private forestlands (Koehn, 2005; DCNR-Bureau of Forestry).

Within Armstrong, Indiana, and Jefferson counties, there are 785,202 acres of forestland. Forests cover 60 percent of Indiana and Jefferson counties, and 52 percent of Armstrong County. Private ownership accounts for 674,657 acres—86 percent—of the forested land in these counties. More than 1,300 people are employed in the forestry and wood product industries, adding $96 million annually to the economy.

Forested areas within the watershed are the dominant feature, accounting for 67 percent of the land-use activities. The watershed contains 171 square miles of deciduous forests, eight square miles of evergreen forests, and four square miles of mixed forests with a combination of deciduous and coniferous trees.

Agriculture

Farming in Pennsylvania dates back to the original, Native American inhabitants of the area. Since that time, numerous technological advancements have changed and shaped the farming industry. Agriculture is currently the leading industry in Pennsylvania, and dairy farming is Pennsylvania's top agricultural industry. Pennsylvania ranks fourth nationally for the production of milk and ice cream. Today, there are two different types of farm management practices —family farms and factory farms. All of the farms located within the project area are family farms. In fact, 59 percent of the farms located within Armstrong, Indiana, and Jefferson counties in 2007 were secondary occupations or hobby farms (NASS, 2009).

Family farms are typically smaller farms that have been in operation for several generations. For the most part, owners of family farms manage and work on their farms following sustainable agricultural practices. The majority of the farms in this region are family farm operations. There are numerous family farms that are operated by Amish communities near Smicksburg and Dayton. Veal farms are common in the region and can be recognized by the ventilation on the roofs.

Factory farms are larger, corporate-based industries. Many of these farms control production from animal breeding and processing to the market shelf. Factory farms emphasize high volume and profit. There are several different types of farming operations which are considered factory farms, including Concentrated Animal Feeding Operations (CAFOs), Confined Animals Feeding Operations, Conventional Farming, Industrial Agricultural Operation, and Industrial Livestock Operations.

Table 2-3. Agricultural and Forestry Statistics for Armstrong, Indiana, and Jefferson Counties

	Watershed	Armstrong	Indiana	Jefferson
General Statistics				
Acres in Total	175,335	418,531	530,887	419,536
Acres of Forestland	117,748	215,949	317,317	251,936
Acres of Agriculture	44,474	122,275	187,711	87,043
% Area Forested	67%	52%	60%	60%
% Area Agriculture	25%	29%	35%	21%
% Forestland Privately Owned	99.4%	95.40%	87.38%	75.96%
Estimated # Forestland Owners	--------------	9,689	11,258	8,357
Estimated # Farms	--------------	794	1,544	597
Economic Contributions				
# Forestry and Wood Product Industries		12	19	30
# Employees in Forestry and Wood Product Industries		386	475	471
Annual Economic Contribution from Forestry and Wood Product Industries (in millions)		18.69	39.64	40.8
Annual Economic Contribution from Agricultural Industries (in millions)		32.12	24.76	8.75

(Source: NASS, 2009; Jacobson & Filipczak, 2008)

Within the lower Mahoning, Pine Creek, and Hays Run watersheds, agriculture is the second-largest land use. Agriculture in the watershed utilizes almost 70 square miles of the land area—75 percent of which is used for pasture and hay, and the remaining 25 percent for row crops. Cattle, calves, and pheasants are at the top of the livestock inventory in Armstrong, Indiana, and Jefferson counties, while forage—land used for hay, haylage, and grass silage—and corn for grain are the top crops, based on acreage.

Agriculture is an important commodity to the region; so important that Indiana County is known as "The Christmas Tree Capital of the World," although no Christmas tree farms are located within the project area. Indiana, Armstrong, and Jefferson counties rank 22nd, 32nd, and 46th, respectively, in total value of agriculture within Pennsylvania.

Table 2-4 compares agricultural lands and market value of production in 2002 and 2007 for each county located within the watershed, providing insight into the regional trend of this tri-county area (NASS, 2009).

Table 2-4. Agricultural Lands and Value by County

	Armstrong County			Indiana County			Jefferson County		
	2007	2002	Percent Change	2007	2002	Percent Change	2007	2002	Percent Change
Number of Farms	794	739	7%	1,544	903	71%	597	548	9%
Land in Farms (acres)	122,275	130,637	-6%	187,711	157,286	19%	87,043	86,899	0%
Market Value of Production (thousands)	$51,976	46,326	12%	$76,428	$55,990	37%	$25,317	$12,076	110%
Crop Sales (thousands)	$34,464	$35,249	-2%	$41,362	$36,581	13%	$14,964	$3,804	293%
Livestock Sales(thousands)	$17,512	$11,077	58%	$35,066	$19,410	81%	$10,353	$8,271	25%

(Source: NASS, 2004; NASS, 2009)

Oil and Gas Exploration

Pennsylvania's 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. Prior to the discovery of oil fields in Texas during the 1900s, western Pennsylvania generated over half of the world's petroleum supply. Today, Pennsylvania's annual contribution to national petroleum production is less than one percent, but is still notable due to the distinguishing lubrication properties of Pennsylvania crude oil (Shultz, 1999).

One of the gas wells located within the Lower Mahoning Creek watershed

Due to increased demand, and therefore increased prices, oil and gas exploration in Pennsylvania has been expanding since the 1970s; even more so in recent years. In 2008, Pennsylvania Department of Environmental Protection (DEP) issued 7,883 permits for oil and gas well development, representing an eight percent increase over the record 7,292 permits issued in 2006. Table 2-7 displays the location of active, inactive, abandoned, and proposed oil and gas well sites (DEP[1]; DEP, 2009a; Environmental News Service, 2008).

It is estimated that Pennsylvania has 2.8 trillion cubic feet of natural gas available for development. The U.S. produces 30 trillion cubic feet of natural gas annually. Since the detection of natural gas within the Marcellus Shale formation, the interest in natural gas well drilling in Pennsylvania has increased.

Table 2-5. Wells Drilled within Municipalities of the Lower Mahoning Creek Watershed

County	2008	2007	2006	2005	2000
Armstrong County	80	110	186	147	34
Indiana County	76	97	115	118	90
Jefferson County	55	78	58	40	19
Total	211	285	359	305	143

(Source: DEP[1]; DEP[2]; DEP[3]; DEP, 2008a; DEP, 2009a)

Among the municipalities of the project area within Armstrong, Indiana, and Jefferson counties, more than 1,160 wells have been drilled since 2005 (Table 2-5). Based on rig activity reports, the number of wells drilled peaked in 2006, and has since been declining within the region. This decline could be caused in part by the ailing economic conditions and lack of investor interest in funding drilling operations.

A good indicator of future of drilling activities in the region is the number of new drilling permit applications issued. Table 2-5 displays the number and types of permits applied for in each county. The majority of permits granted in the region are for the development of gas wells.

Marcellus Shale

Black shale from the Devonian period that is slightly radioactive. It has a low density and is organically rich.

Found in the Appalachian Region, it extends 575 miles through West Virginia, Ohio, Pennsylvania, and New York.

<u>Marcellus Shale</u>

The Marcellus shale is the second largest shale formation in the U.S. and is among the top natural gas shales in the world. Found in the Appalachian Region it extends 575 miles through West Virginia, Ohio, Pennsylvania, and New York. It received its name from the discovery of the first outcrop in Marcellus, New York in 1839. Formed during the Devonian period, the black shale is slightly radioactive with a low density and is organically rich. These naturally occurring organic carbons may include methane, ethane, propane butane, and other hydrocarbons (petroleum). Naturally occurring radioactive materials, or NORM, found in Marcellus shales may include elements, such as uranium, radium, thorium, and radon (Bishop, 2009).

In 2002, it was believed that 1.9 trillion cubic feet of natural gas was available for development within the Marcellus Shale formation in Pennsylvania (National Park Service, 2009). Since then, additional studies have been conducted, and now the Marcellus Shale formation is believed to have the potential to produce nearly 500 trillion cubic feet of natural gas. It is believed that the amount of natural gas produced from the Marcellus Shale formation could support the entire U.S. for more than 20 years (Engelder, 2009).

<u>What's in the Slick Water?</u>

Friction Reducer:
An organic polymer or potassium chloride

Wetting agent:
A non-ionic surfactant or soap

Biocide:
Toxic compound to control micro-organism growth

Scale inhibitor:
An organic polymer or phosphonate

Natural gas recovery within the Marcellus shale formation is a relatively new industry in Pennsylvania. The number of permits issued within Pennsylvania for Marcellus shale gas wells increased from 475 permits in 2008 to 3,314 permits issued in 2010 (DEP, 2011).

Natural gas within the Marcellus shale formation occurs within pore spaces, fractures, or breaks in the shale. It can also be absorbed in mineral grains and organic material. The Marcellus gas is an unconventional gas, meaning that it requires stimulation and work in order to recover it. The majority of the gas is located within pore spaces, which are fine and poorly connected,

Table 2-6. Oil and Gas Well Permits by County

County &	Year	Gas	Oil	Combined	Coalbed Methane	Total
Armstrong County	2008	549	0	21	23	593
	2007	577	0	10	0	587
	2006	640	3	19	0	662
	2005	559	1	48	2	610
Indiana County	2008	485	0	4	90	579
	2007	491	0	0	23	514
	2006	558	3	7	28	596
	2005	461	1	4	17	483
Jefferson County	2008	473	0	18	0	491
	2007	320	0	15	0	335
	2006	364	0	13	0	377
	2005	239	0	12	0	251

Note: All sites in each county may not be located within the project area and permit data for 2000 was not available.
(Source: DEP[1]; DEP[2]; DEP[3]; DEP, 2008a; DEP, 2009a)

making it difficult for the gas to escape. Gas that is naturally discharged escapes very slowly. Utilizing hydrofracturing techniques—blasting large amounts of water, sand, and other chemicals at the shale causing it to fracture—can establish a network for the natural gas to easily flow through the created cracks and into wells (DEP, 2010c).

When drilling for natural gas, a vertical well is bored into the ground. In order to increase permeability and recover the gas from the Marcellus formation, horizontal drilling and hydrofracturing are used. When horizontal drilling techniques are used, the cost can more than double, but productivity can increase by 15–20 times. Hydrofracturing techniques work well in recovering the gas; however, it requires a large volume of water, up to 300,000 gallons per day per well, which becomes contaminated during the process. Initially, hydrofracturing one horizontal Marcellus well may use from two to nine million gallons of water, and additional hydrofracturing may occur over the productive life of the well (five to 25 years or more) (The Pennsylvania State University, 2009b).

In addition to the millions of gallons of water, chemicals—including a friction reducer, wetting agent, biocide, and scale inhibitor—are added to create slick water. The slick water mixes with water naturally found in the formation to create the fracturing solution, termed “frac” water. Each drilling company is required by law to provide the DEP with the material safety data sheet for the slick water. Appendix T provides a summary of hydraulic fracture solutions used within the Marcellus shale formation.

The necessary use of this volume of water and the resulting contamination has caused drilling for gas in the Marcellus Shale to be met with resistance. One of the main concerns is that only 5–10 percent of the injected water is recovered, leaving the majority of water and chemicals underground where they have the potential to cause additional problems. The development of a method for fracturing the formation without contaminating millions of gallons of water and efforts to increase recovery rate are imperative.

Even before the addition of injected water, Marcellus shale has been shown to contain radioactive materials. The evidence of high radionuclide content in the shale is present in geochemical studies and in gamma-ray logs from wells drilled into the Marcellus formation. In a study of trace elements and uranium in the Devonian shale of the Appalachian Basin, 17 cores were analyzed from wells in Pennsylvania, New York, Ohio, West Virginia, Kentucky, Tennessee, and Illinois (Leventhal, 1981). The radioactivity in the Marcellus was found to be more than 20 times higher than background. Gamma ray detectors have also been used historically to detect Marcellus formations by producing a chart of radioactivity versus depth. This was portrayed when radioactivity of rock cuttings from two wells in Lebanon and Bath, NY were found to be far higher than background concentrations in New York State (NYSDEC, 2009).

Wastewater production from Marcellus shale gas extraction efforts in Pennsylvania is estimated to be well above current treatment capacity. Currently three types of treatments are being used—pretreatment and discharged at publicly owned treatment works, evaporation with and without pretreatment, and chemical precipitation followed by discharge, recycle, or evaporation.

Efforts to recycle frac water are currently being explored and implemented. Before the frac water can be reused it needs to be filtered and treated. The reuse of the recycled water can decrease cost to the drilling companies and reduce the amount of water being withdrawn from area streams. Further studies are needed to increase frac water recovery, recycling opportunities, and wastewater treatment to ensure that the discharged water meets the standards of the receiving waters where it will be discharged (Abdalla et al., 2011b).

For more information about potential impairments to water resulting from Marcellus shale gas extraction, see the Chapter 3. Water Resources Impairments section. For more information about Marcellus shale and gas well drilling, visit Penn State Cooperative Extension's website at http://naturalgas.extension.psu.edu/publications.htm.

Coal Bed Methane

Retrieval of methane gas from coal beds is another ongoing resource extraction operation within the project area. Since 2005, within the municipalities located in the lower Mahoning Creek, Pine Creek, and Hays Run watersheds, 183 permits have been issued to drill for coal bed methane (CBM). In 2008, the number of permits for CBM increased by 80 percent from those issued in 2007.

When plant materials are converted into coal, large quantities of methane-rich gas are created and stored within the coal field. Originally considered a hazardous byproduct, the methane gas was vented and released into the atmosphere. However, the recovery of methane from the coal beds has been found desirable and profitable.

The volume of methane collected varies depending on quality of the coalfield and depth of the deposit. Higher energy values of the coal and deeper locations of the coal bed increase the volume of methane gas produced. Due to the large internal surface area of coal, it is able to store six to seven times more gas than the equivalent rock volume of a conventional gas reservoir; however, daily CBM production is lower than gas production in conventional wells. CBM wells average 100,000–500,000 cubic feet (Mcf) a day, where as conventional wells average 1.7 million Mcf (Energy Justice Network).

In order to recover methane gas, wells are drilled into the coal bed where the methane is loosely attached to the coal and held in place by water. Pumping the water out of the well decreases the pressure that keeps the methane attached to the coal. The lack of pressure allows the methane to detach from the coal and flow up the well.

Moore Mine complex in East Mahoning Township; an active surface mine operation

There are two methods used to force methane out of the ground; hydraulic fracturing—as is used in the Marcellus Shale formation—is one technique. Cavitation, or open-hole cavity completion, is the second method; however, it is rarely used in the U.S. Water, air, and foam are pumped into the well during the cavitation process, which increases pressure in the coal bed. The pressure is released suddenly when the well blows out, spewing gas, water, coal, and rock fragments into an earthen berm. This process is repeated several dozen times over a two week period. The gas is burned or flared, and the coal fines and fluids initially collect in a pit at the base of the berm, where they are burned.

Primary issues surrounding CBM include water quality and quantity disruption, spontaneous combustion of dewatered coal beds, subsidence, methane gas leaks, as well as noise and air pollution. The severity of issues varies upon location, geology, and techniques used during extraction.

Mining

Mining is the extraction of minerals from the earth, such as coal, limestone, sand, and gravel, which are brought to the surface from underground. There are two methods used for recovering the minerals—surface mining and subsurface mining. Strip mining, quarrying, open-pit mining, and mountain top removal are examples of surface mining techniques used to reach mineral resources underground. In these methods, the land surface and bedrock above the minerals is stripped off to provide access to the minerals. Subsurface or underground mining requires the digging of tunnels or shafts into the earth to remove minerals. Longwall mining, room and pillar, drift mining, slope mining, and shaft mining are examples of underground mining techniques.

This region contains a variety of mineral resources, and the removal of these minerals has been divided into two categories for management and oversight—coal and non-coal mining. Figure 2-6 depicts where active, inactive, abandoned, and proposed mine sites are located within the project area.

Coal Mining

There is about 21.8 billion tons of bituminous coal located within 21 counties in western Pennsylvania. Coal is located in flat layers between veins of non-fuel minerals, such as sandstone, shale, and limestone, which are referred to as overburden in the coal mining process. There are 40 layers of coal, varying from just inches to over eight feet in thickness. The majority of it is located within the Pittsburgh, upper Freeport, lower Freeport, upper Kittanning, and lower Kittanning coal seams (DEP, 2005a; DEP[5]).

Table 2-7. Active Mining Permits

County	Municipality	Type	Mine Name	Company	Permit #
Armstrong	Madison	Surface	George Mine	Amerikohl Mining, Inc.	3050105
Armstrong	Boggs	Surface	Mine 41	Thomas J. Smith Inc.	3040102
Armstrong	Redbank	Surface	Smith 46 Mine	Thomas J. Smith Inc.	3070103
Armstrong	Redbank	GFCC-surface	Daugherty Project	J&J Snyder Inc.	03-05-02
Armstrong	Redbank	GFCC-surface	Snyder 1 Project	J&J Snyder Inc.	03-05-01
Armstrong	Redbank	GFCC-surface	Daugherty 2 Project	J&J Snyder Inc.	03-07-01
Indiana	Grant	Surface	Stitt	ABM Mining Company Inc.	32990104
Indiana	East Mahoning	Surface	McAdoo Mine	Fossil Fuels Inc.	32030110
Indiana	Grant	Surface	Rice Mine	Kraynak Coal Company	32020105
Indiana	East Mahoning	Surface	Moore Mine	P&N Coal Company Inc.	32030105
Indiana	South Mahoning	Surface	Smith No 28 Mine	Thomas J. Smith Inc.	32020104
Indiana	South Mahoning	Surface	Smith No 39 Mine	Thomas J. Smith Inc.	32060102
Indiana	South Mahoning	Underground	Rossmoyne No 1	TJS Mining Inc.	32021301
Jefferson	Ringgold	Surface	Schreckengost Mine	Bedrock Mines, LP	33960108
Jefferson	Ringgold	Surface	Neal Mine	Reichard Contractor Inc.	33070103

(Source: DEP, 2009b)

As mentioned in the geology section, this region contains significant reserves of bituminous coal and has a long history of coal mining activities. Armstrong County produces the third highest tonnage of coal in Pennsylvania. Indiana County is fourth, and Jefferson County ranks eighth. Within the project area, coal mining operations are occurring in the upper Freeport, lower Freeport, upper Kittanning, and Mahoning layers. There are 15 active mine sites; 11 sites that are proposed, not started, or awaiting authorization to begin mining; and 23 sites undergoing reclamation activities. There have been 101 surface mines that have completed remediation and 29 sites that have been abandoned or forfeited. Active mining permits for the region are identified in Table 2-7, and all coal mining permits are located in Appendix D (DEP, 2005a).

Mahoning Creek Dam Recreation Area provides 2,967 acres of land open to the public for recreational purposes

Active mining operations work under strict regulations, more so than past operations, in order to prevent impacts that would ultimately affect the health and safety of nearby residents. Decreased water quality, decreased water quantity, erosion, and sinkholes are all negative effects of mining that can occur if the operation is not under strict regulations. Abandoned mines have left behind a legacy of water quality problems due to lenient regulations and control during operational mining activities prior to 1977—more information on abandoned mine drainage is located within the Water Resources chapter.

Non-Coal Mining

Non-coal mining is the extraction of non-fuel or industrial minerals, such as aggregate, shale, or crushed stone. It is estimated that industrial mineral production generates $1.25 billion annually and provides jobs and taxes to local municipalities while supporting local businesses. Pennsylvania is among the top 10 states for producing aggregate and crushed stone. Table 2-8 identifies the active industrial mining permits (DEP[4]).

Table 2-8 Active Industrial Mining Permits

County	Municipality	Size	Mine Name	Company	Permit #
Armstrong	Cowanshannock	Small	Smith Shale Pit	D. Eugene Smith	3942301
Armstrong	Wayne	Small	Earl O. Houser Strip	Earl O. Houser	3972301
Armstrong	Rayburn	Large	Continental Clay Mine	Continental Clay Company	3920301
Armstrong	Rayburn	Small	Rupp Mine	Merle Rupp	2842302
Armstrong	Wayne	Small	Huff Farms	Thomas Huff	3962301
Indiana	North Mahoning	Large	Griffith Quarry	Edward C. Griffith Quarrying Inc.	32900301
Jefferson	Perry	Medium	Grange Mine	Original Fuels Inc.	33012806

Small = <2,000 tons Medium = <10,000 tons Large = >10,000 tons

(Source: DEP, 2009c)

Home and roadway construction, agriculture, landscaping, and industrial processes utilize a variety of mineral resources that are recovered in Pennsylvania. Concrete made from aggregates, such as sand, gravel, or limestone, is used for constructing building foundations and bridges. Lime is added to agricultural fields to raise the pH of acidic soils. Crushed stones and minerals, such as bluestone, flagstone, and shale, are used in landscaping. Non-fuel minerals are used as abrasives, binders, or additives in industrial processes or in the treatment of air or water as part of the manufacturing process.

Land Ownership

Due to the rural location of the watersheds, the majority of the project area land is privately owned. Pennsylvania Game Commission (PGC) owns 443 acres on State Game Lands 262. The U.S. Army Corps of Engineers (USACE) owns 2,967 acres at the Mahoning Creek Dam, of which 2,168 acres are leased to other agencies.

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, oil, and coal on one property may 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 one owner (DEP, 2007b).

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

Oil and Gas Well Drilling

Landowners should work with oil or gas 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, and other components should 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 to document conditions prior to drilling incase there are adverse impacts on water quality from the extraction activities (DEP, 2007b).

The Western Pennsylvania Conservancy developed a conservation guidance document to assist in decision-making around natural gas exploration and extraction for landowners, partners and others. The guidance document is titled "Conservation Guidance for Landowners on Natural Gas Development" and can be found on the www.WaterLandLife.org website, as well as Appendix R.

Underground Mining

In the case of underground mining, surface owner rights are protected under the Bituminous Mine Subsidence and Land Conservation Act. The act protects water supplies—quality and quantity—and structural damages caused by underground mining. In both instances, surface land owners must grant the mine operator the authority to conduct pre-mining and post-mining surveys and samples. If access is denied the landowner relinquishes the right for compensation (DEP, 2008h).

Mine operators are responsible for repairing or replacing impacted water supplies to pre-mining conditions or Pennsylvania Safe Drinking Water Act standards. This includes quality, quantity, or both. The cost of treatment, or the cost of establishing a new water source, may not cost the water user more to operate and maintain than the previous source. If the cost is increased, the mine operator is responsible for providing permanent payment of the increased cost (DEP, 2008h).

The Bituminous Mine Subsidence and Land Conservation Act requires a mine operator who causes damage to certain structures—homes; structures associated with homes, such as garages, sheds, greenhouses, sewage systems, inground swimming pools, and retaining walls; commercial, industrial, and recreational buildings securely attached to the land surface; noncommercial buildings, such as schools, hospitals, and churches; barns and silos; and certain agricultural buildings greater than or equal to 500 square feet—to repair the damage, compensate the owner for the reasonable cost of repairs, or replace the structure if irreparable (DEP, 2008h).

Critical Areas

Critical areas have constraints that limit development and 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 examples of critical natural areas. Figure 2-8 depicts the environmentally sensitive areas within the watersheds.

Landslides

Ground movements, such as rock falls, slope failures, and shallow debris flows, which change the stability of a slope from stable to unstable, are landslides. Most landslides occur in areas of steep slopes where loose colluvial soils exist. Gravity eventually forces this rock and debris down the slope in a gradual or sudden, flashy manner. Typically, landslides occur along road cuts having unstable bank conditions (Delano & Wilshusen, 2001).

Landslides can be caused by natural or human occurrences. Groundwater pressure can destabilize the slope making it susceptible to landslides. A lack of vegetation, soil nutrients, and soil structures increase the vulnerability of a slope. Erosion, permeability after precipitation, and earth quakes can also trigger landslides. Vibrations from machinery or traffic, blasting, earth moving activities, vegetation removal, and construction activities are human influences which may result in landslides. Any activity that changes the amount of water that infiltrates the soils, natural or man-made, can increase the likelihood of landslides. The landslide that occurred on Route 65 in Kilbuck Township in Allegheny County in 2006 was the result of construction activities on an unstable slope.

In the mid 1970s, the Landslide Hazards Program (LHP) was established as part of the U.S. Geological Survey (USGS). The role of the program 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 for a variety of audiences.

Landslides occur throughout Pennsylvania, but are heavily concentrated in southwestern Pennsylvania. Within *Landslide Hazards: A National Threat*, Mahoning Creek, Pine Creek, and Hays Run were identified as being located with a region of the U.S. that has a very high potential for the occurrence of landslides (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 when planning any development project. Proactively avoiding a landslide is cheaper in the long run than the clean up, repair, and time that is required to restore an area after a landslide. If development within a landslide-prone area 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).

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 underground mining, excessive pumping of groundwater, or subsurface erosion due to the failure of existing utility lines. Subsidence usually occurs slowly over long periods, but also can happen rapidly. The development of a sinkhole, for example, occurs 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, especially in areas previously mined (Kochanov, 1999).

Muddy waters show the visible impact of increased sedimentation following a storm event

Erosion and Sedimentation

Erosion is the transfer of soil particles through air or water. The relocation of these particles is sedimentation. Erosion and sedimentation are natural earthmoving processes, but the extent and negative impact of these processes can be increased due to poor land-use practices. Erosion and sedimentation are very serious issues, with the potential to cause significant degradation to streams.

Erosion is common along streambanks, steep slopes, and ridgetops. Streambank erosion occurs when the banks of a creek or river erode, depositing sediment into a waterway. Typically, erosion is caused by improper land use and a lack of vegetation along the streambank. Vegetation anchors soils, preventing them from washing away during high stream levels or heavy rains. However, if the vegetation is removed or inadequate, the 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 the waterbody itself is a cause for concern, as it alters native aquatic habitats. Excessive sedimentation clouds water, reducing 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 along with the sediment. Downstream, sediment settles and deposits in new locations with the potential to significantly alter the channel and flow of the stream.

Erosion can negatively impact the water quality of a stream. Eroded soil from construction sites, timber operations, or agricultural operations eventually reaches nearby streams, further exacerbating sedimentation problems. Particles from poorly designed and managed dirt and gravel roadways enter waterways by runoff or can be transported in a cloud of dust and deposited in waterways as dry deposition.

In an effort to reduce erosion and sedimentation, the disturbance of earth materials is regulated by DEP through the Erosion and Sedimentation Program administered by county conservation districts. Any earth moving activities, such as timber harvesting, construction activities, agricultural plowing and tilling, etc. over and area of 5,000 square feet must have an erosion and sediment control (E&S) plan on site. 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). Contact your county conservation district for more information regarding erosion and sedimentation concerns (Pennsylvania Code, 2000).

Groundwater Recharge Areas

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

Impervious surfaces increase stormwater volume by 16 percent (when compared to natural forest habitats) and negatively impact dry and wet weather stream flows, the shape and size of a stream channel, water quality, and habitat 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, flow velocity increases and leads to eroded streambanks, which deepens, widens, and straightens the stream channel. Sediment that is washed into the water 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 amount of impervious surface increases, the diversity and abundance of aquatic life decreases. Limiting the amount of impervious surfaces and installing best management practices, such as porous pavement, rain barrels, and swales, can increase the amount of groundwater recharge. It is important to protect open spaces and limit the amount of impervious surface to allow water to penetrate the ground. During dry conditions and droughts, the amount of water in streams, lakes, and ponds is supplied by groundwater, and if the groundwater supplies cannot be recharged, the impacts caused by dry conditions will be enhanced (Center for Watershed Protection, 1999).

Fish and Wildlife Habitat

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

Vegetative riparian corridor along South Fork Branch Pine Creek

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 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 and 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. Floodplains are also inhabited by unique plants and wildlife accustomed to the periodic inundation of water. Many species found in 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 tolerate or thrive in wet conditions. They are delineated according to hydrology, soil type, and vegetation. Both man-made and naturally occurring wetland areas have a variety of appearances— they may exist as areas of standing water, hydric soils, or as apparently dry fields. Wetlands are vital components of a healthy watershed, as they provide many unique and critical functions. More information about wetlands can be found in the Water Resources chapter.

Natural Resource 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 production, and impacts to surface landowners are concerns associated with 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 is discussed in the Land Use section of this chapter.

Hazardous Areas

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

Comprehensive Environmental Response Compensation and Liability Act

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA), commonly known as Superfund, was enacted in 1980. Superfund provides broad federal authority to respond directly to releases of hazardous substances that may endanger public health or the environment (U.S. EPA, 2004). By creating a tax on 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 CERCLA. Short-term actions require

Table 2-9. Resource Conservation Recovery Act Sites

Handler	Permit #	Type	Address	City	State	Zip
Terry & Sons Auto Body	PAR000029850	CESQG	RT 210 N, 3.5 miles north Route 85	Smicksburg	PA	16256
Teppco Rochester Mills Stations	PAD982565400	CESQG	Craig Road, 5 miles south LR32172	Rochester Mills	PA	15771
Schrecs Auto Body	PAR000022137	CESQG	RT 839, 1 mile west Route 85	Dayton	PA	16222
Crissman Transmission Services	PAD981937956	SQG	RD 2	Templeton	PA	16259
Hawk Transmission	PAD987283561	SQG	RD 2	Templeton	PA	16259
Reeseman Body Shop	PA0000368506	CESQG	Moorehead Road, 1/4 mile west Route 66	Spaces Corners	PA	16201

(Source: U.S. EPA, 2009b)

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 this project area.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) is a federal statute that 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 six active RCRA sites in the area that are listed in Table 2-9.

Salvage Yards

Salvage yards, commonly referred to as junkyards or wrecking yards, serve as locations for decommissioned and wrecked vehicles that are useable for parts and materials. Environmental impacts are related to fluids which result from operations at the salvage yard including crank case oil, hydraulic oil, brake fluid, oil recovered from stream cleaning, gasoline, antifreeze, transmission fluid, window cleaner, and wastewater recovered from stream cleaning. In addition, tires and lead acid batteries must be properly stored or disposed of. All generated wastes and associated procedures must be managed in compliance with municipal ordinances, DEP, and U.S. EPA regulations. There are no salvage yards identified in the project area.

Landfills

A landfill is simply a disposal site for various types of waste which are discarded into or onto the land. Landfills are the chief method for the disposal of solid waste in Pennsylvania. In fact, Pennsylvania has been the nation's leading importer of waste since 1992. In 2005, Pennsylvania imported 7.9 million tons of municipal solid waste and 1.7 million tons of other non-hazardous waste accounting for 19 percent of all the imported waste in the U.S. However, this is a decrease of 2.7 million tons compared to waste imported in 2001, largely due to increases in tipping fees and the lack of railroad service to landfills. Pennsylvania is a major importer of trash due to its geographic proximity to major urbanized areas, such as New York City and Washington, D.C. The majority of the trash imported—96 percent—comes from New York and New Jersey (McCarthy, 2007).

In the past, landfills were situated for convenience and did not utilize any measures to control leachate, which is the liquid formed when water pervades the waste and draws out chemicals, metals, 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 (MSWLF) mandated by the 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, 2008b).

- **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) overlying 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 soils 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).

There are no active municipal waste landfills within the project area. The nearest landfills are located in Center Township, Indiana County and in Fox Township, Elk County.

Illegal Dumpsites

Illegal dumping is the unauthorized disposal of household and hazardous waste. Most illegal dumping activities occur in rural, out-of-the-way areas within close proximity of urbanized areas. Remote places, such as secluded streams, hillsides, back roads, and old coal mines are often strewn with tires, old appliances, vehicle parts, electronics, and other items which are difficult to dispose of properly. The dumpsites grow over time with continued use, and cause a variety of negative environmental and health impacts. Currently, it is the responsibility of each municipality to identify and clean up illegal dumpsites.

Illegal dumping impacts the quality of life within a region. Physical injuries from debris provide a direct threat to the health of the people, animals, and plants nearby. Soils, surface and groundwater supplies, and air quality are polluted by waste at these sites. In addition, dumpsites attract disease-spreading pests, such as rodents and mosquitoes. Trash and debris are not only unhealthy, but unsightly, and can cause decreased property values and increased liability for property owners.

Illegal dumpsite at Fry Cemetery Road before (above photo) and after (lower photo) cleanup activities in October 2009

PA CleanWays, a non-profit organization with chapters and affiliates across 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 to three times a year, similar to the Adopt-A-Highway Program run by the Pennsylvania Department of Transportation (PennDOT). County governments or volunteer groups organize chapters and affiliates of PA CleanWays. Indiana County is home the only active chapter of PA CleanWays in the project area. Reestablishing chapters or affiliates within Armstrong and Jefferson counties would benefit the region.

PA CleanWays is conducting illegal dump surveys in every county in Pennsylvania, regardless of whether an active chapter or affiliate currently serves the counties. These surveys assess and document illegal dumpsites, and develop an action plan to remediate each site. The surveys will identify and documents problem areas, prioritize sites for cleanup and abatement, and provide benchmarks to measure the progress of the cleanup. Insight into the needs for solid waste and recycling programs, public awareness and education, and increased funding to address illegal dumping is often identified through the completion of these surveys.

There are 39 illegal dumpsites in the lower Mahoning Creek watershed, equaling a total of 175.13 tons of trash, identified through dump surveys in Armstrong, Indiana, and Jefferson counties. The sites are located in Boggs, Cowanshannock, Madison, Mahoning, Pine, Rayburn, Redbank, and Wayne townships in Armstrong County; Canoe, Grant, North Mahoning, and West Mahoning townships in Indiana County; and Porter and Ringgold townships in Jefferson County. Appendix E provides specific information about each dumpsite (PA CleanWays, 2007a; PA CleanWays, 2007b; PA CleanWays, 2009).

The dumpsite on Fry Cemetery Road in Canoe Township, Indiana County was the most severe site, with an estimated 32.5 tons of debris, including 200 tires and 100 appliances according to the Illegal Dump Survey completed in 2007. In October 2009, a total of 23 volunteers—led by WPC and Little

Mahoning Creek Watershed Association—over a four day stretch removed 192 tires, 13.74 tons of appliances and metal, and 20 tons of trash at the site. Funding for the project was provided by a DEP Bureau of Waste Management grant.

Two additional dumpsite cleanups, organized by PA CleanWays, were held in October 2009 at the North Elkin Road and Buterbaugh Road dumpsites. At the North Elkin Road, crews removed approximately 2.5 tons of trash located with 50-100 feet of an unnamed tributary to Little Mahoning Creek in North Mahoning Township, Indiana County. Crews removed approximately 2.9 tons of trash and 36 tires at the Buterbaugh Road location. Both sites were only partially cleaned and additional cleanup efforts are being scheduled for Spring 2010 (PA CleanWays Cleanups held, 2009).

Recycling

The benefits of recycling are numerous and can positively impact a community. Through recycling, materials are kept out of municipal landfills, reducing the need for such facilities. Recycling also limits the amount of raw materials required to produce products which, in turn, reduces emissions, the need for resource extraction, and saves a significant amount of energy.

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

Pennsylvania Act 101—the Municipal Waste Planning, Recycling, and Waste Reduction Act of 1988—mandated recycling for municipalities with populations of at least 5,000 or a population density of at least 300 people per square mile by September 2001. Due to the rural address of the watershed, none of the communities in the project area meet these requirements; all recycling activities are on a voluntary basis.

In addition to the main recycling centers for each county, recycling activities within the project area include seven nearby community drop-off centers. In Armstrong County, drop-off recycling centers are located at the Dayton Fire Hall, the community park in Templeton, and the Shannock Valley Industrial Center. In Jefferson County, the only site is located at the Ringgold Township Fire Hall. In Indiana County, satellite drop-off locations provides recycling opportunities during certain hours on specified days at Marion Center Agway, Hillsdale Service Center, and the entrance of Smicksburg Park. For more information about dates and times, please refer to Indiana County Recycling Center's website at http://www.indianapa.com/icswa/satellitedropoff.htm.

Recycling drop-off at the community park in Templeton

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. As of January 2009, no brownfield sites have been identified within the project area (U.S. EPA, 2006).

CHAPTER 3. WATER RESOURCES

Water is an important, under-valued natural resource. This section will provide an overview of resources available within the lower Mahoning Creek, Pine Creek, and Hays Run watersheds. The following documentation will discuss the law and measures that can be taken to protect water quality and quantity.

Location

The project area is located within the 11,600 square-mile Allegheny River watershed; more specifically, the Middle Allegheny watershed Hydrologic Unit (HU) 05010006. The project area encompasses approximately 274 square miles in Armstrong, Indiana, and Jefferson counties (Figure 3-1).

The HU is a cataloging system that describes the location of water resources in the U.S. The system divides and subdivides water resources into smaller drainage units. Waterways are divided into regions, subregions, basins, sub-basins, watersheds and subwatersheds. The HU for the general 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 06: Middle Allegheny River and Redbank watersheds, Pennsylvania

Lower Mahoning Creek

Mahoning Creek enters the Allegheny River near Mahoning, Pa. between Lock and Dams eight and nine. The mainstem of Mahoning Creek is designated as a Warm Water Fishery (WWF), while the tributaries that join it are Cold Water Fisheries (CWF). Little Mahoning Creek and its tributaries are designated as High Quality Cold Water Fisheries (HQ-CWF).

Eight major tributaries enter the lower portion of Mahoning Creek. Little Mahoning is the largest tributary; its headwaters begin near Deckers Point, and flow northwest to where it joins Mahoning Creek. Table 3-1 and Figure 3-2 identify the tributaries to Mahoning Creek.

Unnamed Tributary to Allegheny River

Between Pine Creek and Mahoning Creek is a small tributary that enters the Allegheny River near Templeton, Pa. below the Pennsylvania Fish and Boat Commission's (PFBC) boat launch. This tributary is designated as a WWF and has no named tributaries that feed into it.

To qualify as a high quality waterway, a stream must meet either chemical or biological parameters.

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

Biological parameters: require surface waters to 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)

Table 3-1. Lower Mahoning Creek Tributaries

Name of Tributary	Designation	Drainage (Sq. Miles)
Mahoning Creek	WWF	37.53
Scrubgrass Creek	CWF	10.41
Cathcart Run	CWF	2.34
Little Mudlick Creek	CWF	4.63
Pine Run	CWF	15.56
Middle Branch	CWF	1.80
Mudlick Creek	CWF	3.79
Sugarcamp Run	CWF	1.32
Caylor Run	CWF	1.58
Nye Branch	CWF	4.43
Painter Run	CWF	2.36
Eagle Run	CWF	1.72
Camp Run	CWF	3.66
Glade Run	CWF	9.68
Foundry Run	CWF	1.65

Name of Tributary	Designation	Drainage (Sq. Miles)
Little Mahoning Creek	HQ-CWF	54.48
Ross Run	HQ-CWF	7.66
Pickering Run	HQ-CWF	7.1
Leasure Run	HQ-CWF	2.88
Crooked Run	HQ-CWF	3.74
Broadhead Run	HQ-CWF	2.64
Hess Run	HQ-CWF	0.96
Brewer Run	HQ-CWF	2.1
North Branch	HQ-CWF	5.53
Salsgiver Run	HQ-CWF	2.28
Straight Run	HQ-CWF	6.75
Rairigh Run	HQ-CWF	3.08
East Run	HQ-CWF	6.41
Beech Run	HQ-CWF	1.45
Barrett Run	HQ-CWF	0.62
Rishell Run	HQ-CWF	0.50

Pine Creek

Pine Creek is a HQ-CWF that flows into the Allegheny River near Mosgrove, Pa. North Fork and South Fork are the two major tributaries that join to form Pine Creek. The headwaters of South Fork begin in Cowanshannock Township near the village of Bryan and flow west. North Fork begins near the village of Muff in Wayne Township, and flows through Slabtown before joining South Fork near Mosgrove, where jointly Pine Creek enters the Allegheny River. Table 3-2 and Figure 3-3 identifies the tributaries to Pine Creek.

Table 3-2. Pine Creek Tributaries

Name of Tributary	Designation	Drainage (Sq. Miles)
Pine Creek	HQ-CWF	0.34
North Fork	HQ-CWF	10.49
Bullock Run	HQ-CWF	2.49
South Fork	HQ-CWF	17.47
Laurel Run	HQ-CWF	0.57
North Branch	HQ-CWF	11.05
Deaver Run	HQ-CWF	1.01
South Branch	HQ-CWF	7.49

Hays Run

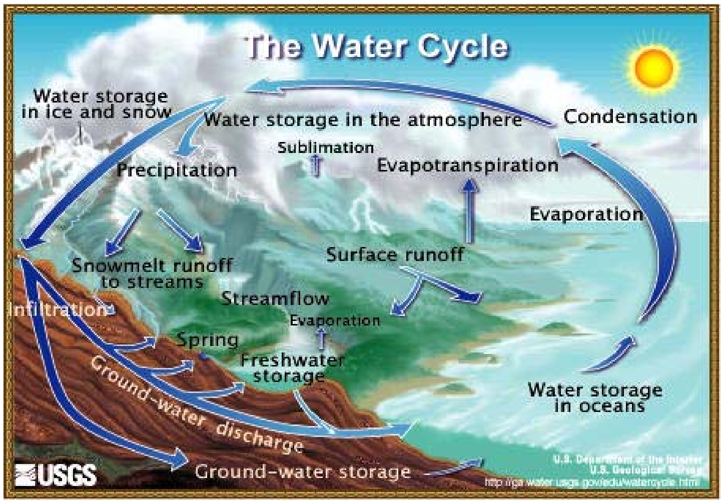
Hays Run is a small tributary that enters the Allegheny River near Mosgrove, Pa. below the entrance of Pine Creek. It is a WWF impacted by abandoned mine drainage (AMD). There are no major or named tributaries that enter Hays Run. It drains 2.28 square miles.

Water Attributes

Water—in the form of precipitation, groundwater, and surface water—moves freely between the atmosphere, land, and underground by changing states of matter; from liquid to solid or gas. This movement is described as the hydrologic cycle.

In the hydrologic cycle (Figure 3-4), energy from the sun evaporates water from plants, soils, and surfaces, transforming it into water vapor in the atmosphere. When water vapor cools, it condenses to form clouds, and precipitation falls to the earth's surface once enough vapors condense. Some water seeps into the ground, becoming groundwater. While the remaining water runs off the land contributing to stream flow, is used by vegetation, or evaporates back into the atmosphere, continuing the cycle.

Figure 3-4. The Water Cycle



Groundwater and Surface Water

When water is stored below the surface it is called groundwater. Water that is stored on the surface in ponds, lakes, or wetlands is surface water. Groundwater and surface water are often considered separate resources when in reality they are the same; water is constantly moving back and forth from surface level to below ground.

Base flow is the flow of a waterway supplied solely by the groundwater with no surface water or runoff joining it. When a waterway is dry, the water table has dropped below the land surface. During dry seasons the entire flow of many waterways is provided explicitly by groundwater. This causes the water table to drop slowly due to a diminished recharge of the groundwater supply as a result of a lack of precipitation and the use of precipitation by growing plants.

Groundwater

Groundwater is stored in empty spaces and cracks between soil and sand particles, gravel and rock. As previously mentioned, rain causes some water to permeate the ground and replenish the supply. When all the empty spaces and cracks have been filled, the water table has reached the upper surface of the zone of saturation.

The depth of the water table is influenced by topography. In valleys, it is closer to the surface than in hilly and mountainous regions. When the water table intersects the surfaces it forms streams, lakes, and wetlands; the 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 the cracks and layers of rock. Gravity supplies the pressure needed to force the water's flow from higher elevations—such as the hills and mountains—to the valleys and lower elevations where the water table is exposed. 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, gravity can be overcome. Slope and permeability impact the rate at which groundwater flows. Groundwater moves slowly at an average rate of 35–1,100 feet per year (Fleeger, 1999; A brief explanation on groundwater flow systems and groundwater hydrogeology in Pennsylvania).

In Pennsylvania, 37 percent of the population gets drinking water from wells and springs. Springs are formed when groundwater flow is blocked by non-permeable rocks and is forced to flow laterally in permeable layers until it is discharged at the surface. Therefore, it is important that the quality of groundwater is protected. It is a well owner's responsibility to ensure their drinking water is safe for consumption by conducting frequent water quality tests.

Groundwater, if not protected, can become contaminated. The methods in which we utilize land resources may impact the quality of our water. Waste disposal, resource extraction, agriculture, and urbanization can affect water quality.

Waste disposal is the primary source of groundwater contamination. In 1990, Pennsylvania had more rural residents than any other state, and one-quarter of homes utilized on-lot septic systems. 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. Unlike public wastewater systems that discharge waters to the surface, individual septic systems discharges are released into groundwater system. However, septic systems are not the only waste disposal that impacts groundwater quality. Leachate from the 39 illegal dumpsites and the discarding of household chemicals and motor oil into storm drains can also impact the quality of water (Fleeger, 1999; League of Women Voters; Raymond, 1988).

Resource extraction activities, such as mining, oil and gas drilling, and abandoned, unsealed oil and gas wells, are other potential sources of groundwater contamination. Within the project area there are 15 active coal mining permits, 7 active industrial mining permits. Surface and deep mining can alter both the quality and quantity of groundwater. Quality can be altered through the formation of AMD and the introduction of iron, manganese, sulfate, and dissolved solids. Oil well drilling can produce brine that can leak in groundwater if storage lagoons are not properly lined. In 2008, there were 211 wells drilled within the watershed municipalities. 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; improper or deteriorated casings can allow contaminants to spread between aquifers (Fleeger, 1999; League of Women Voters; Raymond, 1988).

Some a**gricultural practices**, impact the quality of ground and surface waters. The improper or ill-timed application and over-use of fertilizers can increase nitrate and bacteria levels in nearby waterways. The excessive, ill-timed use and improper storage and handling of pesticides can cause them to leach into the soil or run off into nearby waterways. The contamination can affect humans, land animals that drink the water, plant growth, and aquatic life (Fleeger, 1999; League of Women Voters; Raymond, 1988).

Human activities, such as construction and highway maintenance, have an impact on water quality. In **urbanized areas**, asphalt and concrete pavement impede water infiltration and groundwater recharge. Instead, water runs off the land, having the potential to pick up additional contaminants before entering a nearby waterway or eventually penetrating the ground. Water quantity is another major issue within urbanized areas. Often with large demand, there is an over withdrawal of water within the aquifer that leads to a drawdown, reducing the water table and the amount of base flow in local streams. Other urbanized activities that can 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 with the land surface, and groundwater reaches the surface to establish the base flow. Once the water reaches the surface, it becomes surface water. Surface water includes all the water on the surface of the earth, including runoff.

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

Mahoning Creek from historic Madison-Mahoning Township Bridge

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."

In an **ephemeral stream,** "water conveyance 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 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.

Larger waterways are impacted by the quality of water in the tributaries and the quality of groundwater that discharges into them. Alterations to the quality of water, whether natural or man-made, have an impact on the quality of the stream and anyone who uses it.

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 single set of criteria to distinguish them. 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 lakes or ponds. Lakes are deeper, have more visible waves, 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. Lakes and ponds tend to form more naturally and are usually the result of geological events (U.S. EPA, 2007; Spring Creek Aquatic Concepts).

One of several lakes within the project area

While lakes and ponds do form naturally, some are man-made. 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.

There are no natural lakes in Pennsylvania other than glacial lakes; however, lakes have the potential to be form by natural events, but these lakes do not typically get termed as natural lakes. Oxbow lakes 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 creating a pond. Earthquakes and landslides can also create lakes and ponds, but these events are unlikely within the lower Mahoning Creek, Pine Creek, and Hays Run watersheds (U.S. EPA, 2007; Spring Creek Aquatic Concepts).

Upstream impacts can threaten the health of lakes. An overabundance of nutrients and sediment; the addition of organic waste, metals, and other organic 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 like parking lots, roads, and rooftops; urbanized areas, lawns, agricultural practices, and the destruction of shoreline vegetation can increase the amounts of erosion and sedimentation.

There are three lakes located within the project area (See Figure 3-5). Mahoning Creek Lake is an impoundment that was formed by the Mahoning Creek Dam. Utilized for flood prevention and recreational activities it is the largest lake within the project area occupying 280 acres. Hemlock Lake is an impoundment within the Little Mahoning Creek subwatershed that was formed by Straight Run Dam. The dam creates a 60-acre impoundment that is operated as an Indiana County Park, although it is owned by the Pennsylvania Fish and Boat Commission. Located on an unnamed tributary to North Fork Pine Creek is Rainbow Lake. Information about this lake is unavailable. Conducting an assessment of the lake would be beneficial in determining management options for the lake.

Wetlands

A wetland is an area that contains water-loving plants and has undrained wet soils that are saturated or covered by shallow water at some point during the year. They have three benefits: water storage, water filtration, and biological productivity.

Wetlands act like a sponge, absorbing water then slowly releasing it. A one-acre wetland can store one to one and a half million gallons of floodwater. 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 and diverse natural systems in the world. They provide unique habitats and are ecological valuable to plant and animal species. Figure 3-5 depicts the wetlands within the project area.

Types of Wetlands

There are four types of wetlands—marshes, bogs, fens, and swamps. In the western Pennsylvania region the term wetland most often refers to a marsh wetland.

Marsh wetlands are frequently or continually inundated with water. They are characterized by soft stemmed vegetation that adapts 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 and sometimes completely dry during others—are a type of marsh wetland.

Bogs are wetlands with spongy peat deposits and acidic waters. A thick layer of sphagnum moss blankets the bog wetland. Precipitation is the only source of water and nutrients. Bogs are beneficial because they absorb precipitation and prevent or reduce flooding.

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.

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 shrub. Swamps are beneficial in removing nutrients and preventing flooding.

Potential wetland enhancement site within the Little Mahoning Creek subwatershed

Wetland Loss

Since early settlement in the 1600s, wetlands were drained and filled for agricultural, developmental, and transportation purposes. It is estimated that in the 1600s there were 221 million acres of wetlands within the conterminous U.S. 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 through development (Dahl and Allord, 1994; Dahl, 1990; Dahl, 2006).

Historical events, technological advances, and the values of society all played a role in the decline of the number of wetlands. In the 1700s, wetlands were viewed as swampy lands that bred disease, restricted travel, impeded 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, opening additional acres of land for agriculture (Dahl and Allord, 1994).

Starting in 1987, wetland conversion rates slowed when the government started increasing efforts to restore wetlands. As the value of wetlands increases, the interest in their preservation grows. Between 1998 and 2004, there was a net gain of wetlands. These gains came from the conversion of agricultural lands and acres in transition—areas in the natural process of changing land cover—back into wetlands (Dahl and Allord, 1994; Dahl, 2006).

Floodplains

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

Floods and floodplains are typically defined by the likeliness of a flood event. A “100-year” flood is a flood that has a one percent chance of occurring 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 were adopted. The floodplain ordinances must meet regulatory standards of the NFIP and the Pennsylvania Floodplain Management Act. Landowners residing in communities not adopting floodplain ordinances are also capable of purchasing insurance, but at a much higher rate (FEMA, 2002).

The threat of flooding and the degree of damage fluctuates depending upon the impacts of human activity. 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 to accommodate an increased volume of water; when the channel is straightened, the water has fewer obstacles to maneuver around and quickly gains speed. With a deeper, straighter channel the velocity of flow increases. When the force of water hits the streambank, the soil erodes, adding sedimentation to the waterway and decreasing the size of the floodplain. With less area available to absorb the water in the floodplain, flooding occurs when streams breach their banks.

Mahoning Creek dam located 21.6 miles upstream from the Allegheny River

Floodplains provide critical habitat for common species, as well as rare, threatened, and endangered species. Plant and animal species that flourish in floodplains have adapted to 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. Floodplain flora and fauna are discussed in more detail in the Biological Resources chapter.

Dams

Historically, dams were often installed along streams and rivers to harness the natural power of water for operating mills of varying sorts, 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, and it can be harnessed for hydroelectric power generation. Other times, dams are built for flood protection purposes.

Mahoning Creek Dam was built in response to the St. Patrick's Day flood in 1936. The City of Pittsburgh was flooded after melting snow caused tributaries of the Allegheny River, such as Mahoning Creek, Pine Creek, and Hays Run, to rise and overflow.

The Mahoning Creek Dam, located 21.6 miles upstream from the confluence of Mahoning Creek with the Allegheny River, was completed in 1941. The dam is 926 feet long, 154 feet wide, and extends 162 feet above the streambed. It cost approximately six million dollars to build, but is estimated to have saved over 662 million dollars in flood prevention. It is owned and managed by the U.S. Army Corps of Engineers. The site is also used for recreational purposes.

There are several small dams that are no longer being used within the watershed (Figure 3-6). Often times, dams that no longer serve a purpose are abandoned. If not maintained, they may fall into a state of disrepair and pose a safety risk. Dam failures may cause flooding, resulting in injury or death, property damage, and interruption of transportation and emergency services. Dams obstruct 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.

Savan Dam located on Little Mahoning Creek in Grant Township, Indiana County

Some dams are located on private property. Efforts to reach out to individual landowners and educate them about the liability and risks of abandoned dams would benefit the watershed and the landowner. However, if a landowner decides to remove a dam, the decision must be qualified based on maintenance costs, safety, and potential uses of the dam; and a plan must be developed for the removal process and to restore the stream and its habitat afterwards. It is recommended that some of the smaller dams that are no longer functional be removed to allow the stream to flow naturally.

The Savan Dam located on Little Mahoning Creek is an example of a non-functional dam. Built in 1938, its primary purpose was to reduce flooding. Located on private property, this old dam restricts the movement of aquatic species, including fish, macroinvertebrates, and mussels.

There are a few organizations responsible for the oversight of dam maintenance, regulation, and removal in western Pennsylvania, including the U.S. Army Corps of Engineers, PA Department of Environmental Protection (DEP), PFBC, and American Rivers. Necessary permits must be obtained prior to removing a dam, and 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 Watershed and Rivers (POWR) at www.pawatersheds.org.

Riparian Zones

The land area bordering the waterfront of the stream is its riparian zone. These areas, which are often floodplains as well, filter pollutants and sediments from runoff and provide an area of transition between water and land. A highly functional riparian zone acts as a floodplain by reducing flooding and erosion by decreasing the velocity of the flow, retaining water, and stabilizing the surrounding soil. Riparian zones or corridors, as they are sometimes called, regulate water temperature, create fish habitat, provide important corridors for wildlife, and enhance recreational activities.

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, where the destabilized soil erodes into waterways. The above-ground portion of the plants slows down runoff, allowing more water to be absorbed and recharge groundwater supplies. In addition to ecological benefits, vegetative riparian buffers can increase property values, decrease property loss due to erosion, and provide privacy and scenic beauty. Native plants and warm season grasses are most effective, because they tolerate the surrounding environment and weather conditions, and are naturally resistant to pests and disease.

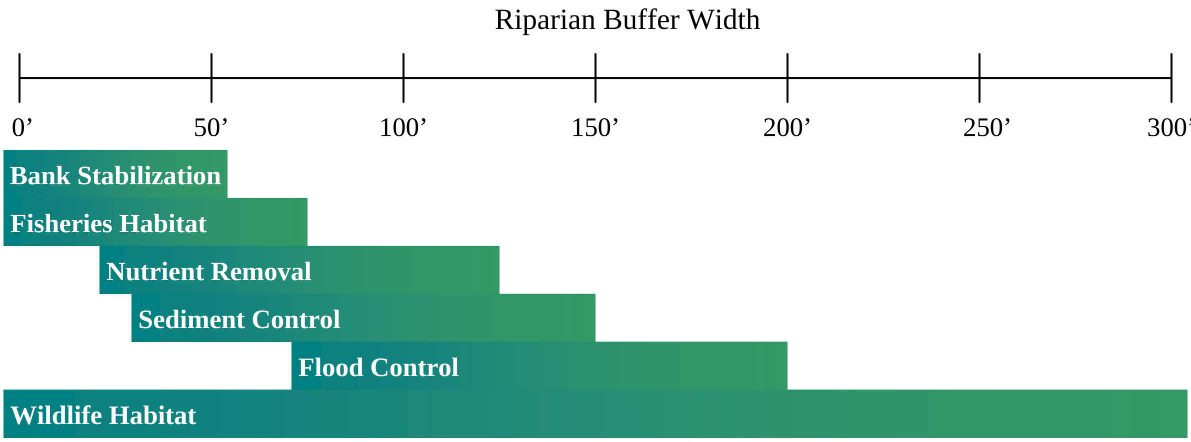
Riparian corridor planting in the Pine Creek subwatershed

The wider the riparian zone, the more effectively it functions. Many agricultural and developed areas along waterways do not have a substantial riparian zone. This leads to bank erosion and the establishment of invasive species.

Figure 3-7 displays the recommended riparian buffer width for each beneficial use.

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

Figure 3-6. Recommended Riparian Buffer Widths



Land Purchase

A conservation organization or municipality may purchase land or have property donated to them in order to protect, restore, conserve, or provide public access to that property. 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—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

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

Density Bonuses

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

Stormwater Credits

A stream riparian buffer reduces stormwater runoff. Developers can receive stormwater credits, which result in 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 that is used by vegetation, or becomes surface water. When rapid or extended storm events occur, more precipitation falls than the natural processes can manage. Depending on existing conditions, accelerated stormwater can produce different results. When the water cannot permeate the ground, it is shed off the land, becoming runoff. Soil particles and pollutants can adhere to the runoff as it meanders across the land before pervading the ground or entering surface waters. When runoff enters surface water, it causes increased volumes and rates for area streams. This sometimes leads to the scouring of streambanks as increased water volume and velocity erodes the streambank. Scouring alters the stream channel, increasing sedimentation and the risk of flooding.

Stormwater pipe that enters into Hays Run

In areas, such as Dayton, Smicksburg, and Timblin, impervious surfaces are often linked to stream impacts. Impervious surfaces are areas where water cannot be absorbed into the ground. These include concrete, pavement, rooftops, and areas with highly compacted soils. Even when only 10 percent of the land cover is comprised of impervious surfaces, significant impacts occur (Schueler, 2003). Minimizing the amount of impervious surface can protect water resources. Zoning, residential design, open spaces, and new technologies are available to help with planning minimal impervious surfaces. 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 respond to 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 consistent with these plans to regulate development.

Armstrong and Indiana counties are two of the nine counties in Pennsylvania that have not yet conducted Act 167 stormwater management plans. Act 167 mandates that stormwater management plans be completed for each county. Jefferson County will complete a stormwater management plan by summer 2010.

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. Its purpose is to reduce direct pollution discharges, finance wastewater treatment facilities, and manage polluted runoff. U.S. Environmental Protection Agency (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 specific source 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). NPDES permits will be discussed further 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 corrective actions are proposed. In 2006, the results of the assessment indicated that approximately 120 miles of streams within the lower Mahoning Creek, Pine Creek, and Hays Run watersheds were impaired and could not support aquatic life.

Waterways that are not expected to meet water quality goals even after current regulatory requirements are met are considered impaired waters. Section 303(d) of the CWA requires states to identify impaired waters and create a timetable to develop action plans. 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. More information about TMDLs can be found in the water quality section of this chapter.

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 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 descriptions of programs aimed at protecting lakes, wetlands, and groundwater quality. Waterways not meeting their expected water quality goals are identified in Figure 3-6 and Appendix F.

Pennsylvania Clean Streams Law

In 1931, Pennsylvania passed the Clean Streams Law granting the commonwealth the power to enact legislation and regulations pertaining to stream protection. It was established to preserve and improve the purity 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 that is used to eliminate pollution.

Prior to the passing of this law, intermittent and ephemeral streams were not awarded the same protection 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 receive protection similar to perennial streams before mining, logging, or other earth-moving activities are approved.

The Clean Water Fund was established to eliminate pollution. Monetary support behind the Clean Water Fund is provided by the 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.

Pennsylvania Sewage Facilities Act

In 1960, Act 537—known as the Pennsylvania Sewage Facilities Act—was passed to correct existing sewage disposal problems and to prevent future 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 not originally identified in the plan arise, then an update of the plan will be required.

All of the watershed municipalities have Act 537 plans that are older than 10 years, with the majority being 20 years or older. Eight municipalities have plans that are at least 40 years old being completed in 1969 and 1970. Municipalities with older plans are encouraged to review their plans to ensure they are accurate in addressing sewage disposal needs in their municipality (DEP 2008c).

Pennsylvania Floodplain Management Act 166

Floodplain management regulation is specified in the Pennsylvania Floodplain Management Act and Chapter 106 of the Pennsylvania Code. The purpose of this regulation is to (Pennsylvania Code, 1983):

- Encourage planning and development in floodplains consistent with sound land-use practices
- Protect people and property in floodplains from danger and damages of floodwater and from materials carried by such events
- Prevent and eliminate urban and rural blight resulting from flood damage
- Authorize a comprehensive and coordinated program of floodplain management based upon the NFIP designed to preserve and restore the efficiency and carrying capacity of the streams and floodplains of the Commonwealth of Pennsylvania
- 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

Surface Mining Control and Reclamation Act

Pine Creek is impacted by AMD

Surface Mining Control and Reclamation Act (SMCRA) is a federal act that established uniform standards for coal mining activities on state and federal lands. The standards include environmental performance protection standards to reduce adverse effects on aquatic and terrestrial wildlife and other environmental values. Under this regulation, mining companies are required to conduct remediation efforts for environmental degradation caused after the establishment of this act in 1977. It gives companies an incentive to reduce environmental impacts in order to avoid the high costs of remediation. Through this program the Abandoned Mine Reclamation (AMR) fund was created to provide financial assistance to clean up mine lands abandoned prior to the passing of the act, which are not covered by the new standards and regulations (Environmental Literacy Council, 2002).

SMCRA and CWA have important implications for mining activities throughout Pennsylvania. Future mining activities in the lower Mahoning Creek region must comply with SMCRA and the anti-degradation component of the CWA (Environmental Literacy Council, 2002).

Water Quality

As humans, we influence the flow, quality, and quantity of water. Our actions and inaction directly relate to the quality of our resources. For example, early oil wells were drilled on a hunch, as opposed to sound geologic investigation. When these wells did not produce oil as desired, they were abandoned, as new wells were drilled based upon the next hunch. The abandoned wells were left unplugged, providing a vessel for contaminating groundwater supplies through illegal dumping and runoff.

Classification of Water Pollution

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

Point Source Pollution

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

In Pennsylvania, an earth disturbance from one to five acres in size 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 uses, other than CAFOs, and timber operations that are fewer than 25 acres are not required to obtain a NPDES permit.

Table 3-3. National Pollutant Discharge Elimination System Permits

Municipality	Site	Receiving Waters	Expiration Date	Permit #	Permit
Smicksburg Borough	Mahoning Swiss Cheese Cooperation	Little Mahoning Creek	7/17/2007	PA0218499	Individual; minor
Dayton Borough	Dayton Borough Sewage Treatment Facility	Glade Run	1/31/2013	PA0205915	Individual; minor
Canoe Township	Laurel Lake Camp & Retreat Center	Straight Run, tributary to Little Mahoning Creek	13/31/2010	PA0043036	Individual; minor
Madison Township	Redbank Valley School District (Mahoning Elementary School)	Unnamed tributary to Mahoning Creek	4/30/2009	PA029785	Individual; minor
Ringgold Township	Village Farms, LP	Unnamed tributary to Pine Run	5/6/2008	PA104396	Individual; minor
Templeton Borough	Nautical Mile Marina	Allegheny River	2/28/2013	PA0004740	Individual; minor
Templeton Borough	Pine Township Supervisors	Allegheny River	2/28/2010	PA0252760	Individual; minor

Expired permits are normally administratively extended and kept effective until the new permit is issued
(Source: U.S. EPA, 2009a)

Non-point Source Pollution

Causes of non-point source pollutants are not visible without detailed analysis and research to identify their origins. Erosion and sedimentation, stormwater, and agricultural sources are potential culprits of non-point source pollution.

Sources of Impairment

Erosion and Sedimentation

Agricultural and forestry practices, along with dirt and gravel roadways, are human influences that accelerate erosion and sedimentation rates within the lower Mahoning Creek watershed.

Erosion is a natural process that involves the displacement of soils, sediment, or rocks by wind or water. However, it is the accelerated movement of these materials—usually following human influences—that cause the greatest ecological concern. Increased rates of erosion and sedimentation impact aquatic habitats, aquatic vegetation, and other aquatic species and their food supply, creates unstable streambanks, and increases drinking water treatment costs. Pollutants, such as heavy metals, pesticides, and excess nutrients, are carried with the sediment by runoff and with the stream flow, which affects conditions downstream, as well as at the source.

In order to minimize impacts caused by accelerated soil erosion, Chapter 102 of the Pennsylvania Code, under the authority of the Pennsylvania Clean Streams Law, was established in 1972 and later amended in 2000. According to the law in the Pennsylvania Code, "anyone conducting earth disturbance activities must use best management practices (BMPs) to minimize the amount of sediment leaving the site of the earth disturbance activity." DEP is responsible for overseeing Chapter 102 requirements, and has given conservation districts with trained staff the responsibility to review erosion and sedimentation control (E&S) plans, conduct trainings, perform site inspections, and—in some counties—the authority to conduct compliance and enforcement actions (DEP, 2007c).

Erosion and control sedimentation permit on a gas well operation in the Little Mahoning Creek watershed

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

Excluding agricultural plowing and tilling, timber harvesting, and road maintenance activities, all other 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, farms that are not CAFOs and timber operations that are fewer than 25 acres are not required to obtain a NPDES permit, but are required to have a conservation plan or an E&S plan for their activities. Timber harvesting activities that disturb 25 acres or more for haul roads, skid trails, and landing areas, as well as road maintenance activities disturbing 25 acres or more, is required to obtain a NPDES permit. Agricultural activities do not require a permit, but do require an E&S plan (DEP, 2007c).

The Dirt and Gravel Roads Maintenance Program was enacted in 1997 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 four million dollars annually from the State Conservation Commission (SCC) through dedicated and earmarked funding that is given to county conservation districts based on need. Conservation districts, in turn, disseminate funds to municipalities and other road-owning entities.

Mottarn road dirt and gravel road project during construction phase in July 2008, where 11 culverts were installed and the roadway was re-graded

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: 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, establishing the basis of the Dirt and Gravel Roads Program in each county. A second assessment was conducted through 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. Projects must be site-specific, and require 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 are not eligible for funding; while roads owned by a municipality or county, roads within state parks, state forests, and state game lands, as well as public boat launches and PFBC access roads are eligible. Within Armstrong, Indiana, and Jefferson counties, more than 3.1 million dollars have been spent on dirt and gravel roads projects since 1997; however, all of these sites are not located within the project area (Center for Dirt and Gravel Road Studies, 2009). For more information on dirt and gravel roads, visit the Penn State Center for Dirt and Gravel Roads' website at http://www.dirtandgravelroads.org.

Newly installed culvert pipe under Mottarn road

Western Pennsylvania Conservancy (WPC), Indiana County Conservation District (ICCD), and various other partners are addressing dirt and gravel road issues within the Little Mahoning Creek subwatershed. Thanks to a grant secured by WPC, the groups were able to conduct a prioritization plan to determine the top 50 sediment discharges caused by dirt and gravel roads that impact Little Mahoning Creek. In 2008, WPC and ICCD, along with the Penn State Center for Dirt and Gravel Roads, North Mahoning Township, Falcon Drilling, and Boyd & Shriver, Incorporated were able to repair a half-mile segment of Mottarn Road where, prior to restoration, runoff entered Little Mahoning Creek via the hillside. The project entailed the installation of 11 underground pipes and the regrading and resurfacing of the roadway with more eco-friendly materials to prevent sediment and dust pollution and save resources by extending the life of the roadway.

Efforts to reduce the amount of sediment reaching area streams through the remediation of dirt and gravel roadways through the partnership continued with the completion of Wise Road in 2009 and Kohlhepp Road in 2010. WPC and ICCD will continue to address the 50 dirt and gravel road projects identified in the prioritization plans as part of the Saving Little Mahoning Creek Project.

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, 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 heard health and crop yields.

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. **Cropland protection cover**, or cover crop, is a crop of close-growing grasses, legumes, or small grains usually grown for a year or less. It 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, and soil reserves, for the application of manure and commercial fertilizers. Management includes the rate, method, and timing of the 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 pesticide pollution entering surface and groundwater. This practice includes integrated pest management (IPM), which is the practice of using economical and efficient means of pest control that will have the least detrimental impact to people, property, and the environment (U.S. EPA).

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

6. **Livestock fencing** encloses or divides an area of land with a 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. **Streambank fencing** excludes livestock from the near-shore area to prevent trampling and grazing to protect the riparian habitat.

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

9. **Manure storage facilities** are structures used to store manure until it can be applied to the land as fertilizer. The facility is needed to properly store manure so that it does not leach into the soil and become a non-point source of pollution.

10. Field diversions are shallow channels 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.

11. Terraces are a system of ridges and channels with appropriate spacing constructed on the contour with a suitable grade to prevent erosion in the channel.

12. Grassed waterways are natural or constructed channels that are shaped, graded, and established with suitable cover to prevent erosion by runoff water.

13. Agricultural sediment basins are structures designed to reduce the transport of sediment, agricultural waste, and other pollutants from agricultural fields and barnyards to surface waters, closed depressions, and wetlands.

WPC and volunteers installing streambank stabilization and habitat structures on a tributary to Little Mahoning Creek

14. Shoreline and streambank protection is the stabilization and erosion protection of stream and lake banks and the protection of fish habitat and water quality from impacts caused by livestock. Methods include fencing, shaping, and seeding the banks with vegetation; as well as using rock, riprap, bioengineered materials, or structures to stabilize shorelines and/or provide fish habitat.

15. 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 visual resources.

16. Remote watering systems are a combination of portable tanks, pumps, and pipes designed to bring water to livestock in all grazing cells rather than allowing the animals to have direct access to the stream, where erosion can occur.

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

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

19. Barnyard runoff management includes structural measures to redirect barnyard runoff and collect, convey, or temporarily store it. Management includes as the use of 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 more suitable site to minimize the amount of pollutants entering surface or groundwater.

Channelization

Channelization is the intentional straightening, diversion, widening, and deepening of a 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 the stream, the velocity and flow of the waterway is increased, which may also cause increased flooding.

Acid Precipitation

Rainwater is naturally acidic, generally having a pH of around 5.6, due to the atmospheric reaction of carbon dioxide and oxygen to form carbonic acid. However, acidity from unnatural sources has caused rainwater in some areas to have an acidic 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, pollutants fall as dry deposition, or acidic gases and particles that deposit onto buildings, cars, etc. When it rains, the particles are washed from objects and increase the pH of the runoff. Sources of this pollution include vehicles, industrial sources and power generating plants. The effects of acid precipitation are usually felt many miles away from the source. Most pollutants in the project area come from 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 an acid or a base. It is measured on a scale of 1–14, with a pH of 7.0 being neutral.

Acidity is created by the concentration of hydrogen (H+) ions in solution, while basicity is created by the concentration of hydroxide (OH-) 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. Rain that is not affected by pollutants will naturally be acidic, with a pH of 5.0 to 6.0. A pH below 5.0, however, 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. In fact, precipitation within western and central Pennsylvania is located within the portion of the U.S that contains the highest levels of nitrogen-containing compounds (Driscoll et. al., 2001).

Acid precipitation can have additional effects on water quality, besides the impacts of low pH. Toxic metals previously deposited in soils can be 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. Aluminum is another common metal that is amplified 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 impacted by acid precipitation can recover. 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 to recuperate (Driscoll et. al., 2001). A visible lowering of sulfuric acid in streams has occurred as a result of the 1990 legislation. However, 1990 reductions were not adequate to allow for the full, or even partial, 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 because there is little that can be done locally to solve the problem. The alkalinity-producing chemicals can be added to streams, but this is a temporary solution that may cause more problems for aquatic systems. Individuals interested in reducing the impacts of acid precipitation can make changes to reduce their personal contribution to emissions through activities, such as driving fuel-efficient cars and using less energy. Additionally, constituents should encourage their legislators to support stricter regulations that would further reduce the pollution released by smokestacks and cars.

Although evidence points to a significant decrease in the quality of water 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.

Total Maximum Daily Load

All waterways are classified with an expected use based on water quality and waterways that do not attain this use are considered impaired and must have a Total Maximum Daily Load (TMDL) study conducted. The study is performed to determine the maximum amount of pollution that a waterbody can handle, while meeting certain safe water quality standards. The subsequent report on the study identifies objectives and methods to restore and maintain good water quality. The targeted pollutant load reduction is the difference between the maximum pollution load a waterway can tolerate and its existing amount of pollution.

More than 75 miles of waterways within the project area have been identified as Category 5 impaired waterways on the 2008 Pennsylvania Impaired Waterbody List. A listing of these 54 waterways and anticipated TMDL dates are available in Appendix F. To date, four TMDL studies have been completed; they include South Branch South Fork Pine Creek, Pine Run, Foundry Run, and Ross Run.

In 2007, a TMDL was completed to address five segments within the Pine Run subwatershed that were identified on the 1996 List of Impaired Waters. The waters were impaired by aluminum, iron, manganese, and low pH caused by AMD (DEP, 2007d).

In 2007, a TMDL was completed to address a 1.1 mile segment of Foundry Run that was identified on the 1996 List of Impaired Waters. The waters were impaired by aluminum, iron, manganese, and low pH caused by AMD (DEP, 2007a).

In 2008, a TMDL was completed to address a 3.6 square mile segment of the upper South Branch South Fork Pine Creek watershed that directly impacts nine miles of stream. It was identified on the 1998 List of Impaired Waters for sediment and nutrient impairments resulting from agricultural land uses (DEP, 2008f).

In 2008, a TMDL was conducted to address sediment issues within the 7.7 square mile Ross Run watershed, a tributary to Little Mahoning Creek in Indiana County. Identified on the 2006 Integrated Water Quality Monitoring and Assessment Report, Ross Run is impacted by sediment from agricultural operations. In the TMDL report, 16 areas were identified as problematic due to over–grazing, trampled riparian areas, undercut and eroding streambanks, mowed riparian corridors, and dust and runoff from dirt and gravel roads adding sediment to the waterway. (DEP, 2008g)

Abandoned Mine Drainage

Historically, the region has been heavily mined, and past coal-mining activities have left the landscape altered. Abandoned mine drainage (AMD) impacts water quality throughout portions of the lower Mahoning Creek region. Unlike many other sources of pollution, AMD is formed when mining activities fracture bedrock over coal seams, allowing rain, groundwater, and oxygen to come into contact with the seam and surrounding bedrock. This contact causes chemical and biological reactions to occur, resulting in water contaminated with dissolved metal byproducts of those reactions, including iron, manganese, and aluminum.

AMD seep surfacing from an old deep mine before entering Mudlick Creek

AMD can be either acidic or alkaline. When sulfur-oxidizing bacteria in the rock convert inorganic sulfur to sulfate and sulfuric acid, and there are insufficient neutralizing compounds, the water will become acidic. When the rock material contains calcite and/or dolomite the discharge tends to be alkaline.

Polluted water discharges into streams and groundwater through mine openings, springs, and seeps. When the water is exposed to oxygen in the air, the metals precipitate, or drop out of the solution, as silt-like solids, and coat stream bottoms. High levels of iron and aluminum can poison fish and threaten drinking water supplies (Fripp, Ziemkiweicx, & Charkavorki, 2000). Siltation from the metals and the altered pH can affect the survivability of aquatic macroinvertebrates which form the base of the food chain and thus the basis of a healthy, functioning stream ecosystem.

AMD discharges vary due to geology, hydrology, and flow; therefore, a treatment that works at one site may not be suitable at another. The goal of an AMD treatment system is to neutralize, isolate, stabilize, and remove pollutants from the water. This is done by adding alkalinity to increase the pH—except in discharges that are already alkaline—and then focusing on the capture and removal of metals. There are two treatment methods used to remediate AMD—active and passive. More detailed information about mine drainage treatment is available at http://amrclearinghouse.org.

Active treatment of mine drainage uses alkaline chemicals, such as lime, soda ash, or ammonia, to decrease acidity and speed up the removal of metals. This method of treatment can be very expensive, but can work in areas where there is limited land availability for a passive treatment system.

Passive treatment utilizes a series of ponds or wetlands to collect and treat AMD discharges. Several sources of AMD can be collected and diverted to the treatment system. Polluted discharge water slowly flows by the force of gravity through the series of ponds or wetlands, where sediment particles settle out, metals are oxidized, and organic materials used to line the bottom of the ponds and limestone that lines the channels connecting the ponds reduce acidity. Because the chemical make-up and flow of discharges differ, each treatment system requires

AMD impacts on Little Mudlick Creek

a specialized strategy to effectively clean up and improve the water quality. Passive treatment systems are typically limited to areas where land is available to establish a treatment system composed of several ponds.

Within the Mahoning Creek watershed, four major tributaries—Pine Run, Little Mahoning Creek, Cessna Run, and Salsgiver Run—are primarily impacted by AMD.

Pine Run is impacted by four major discharges—Weisner Hollow, Caylor Run, Corbettown, and Harmon Tipple. More information about these discharges is located in the Pine Run Watershed Implementation Plan section of this chapter under *existing studies* and *watershed monitoring*.

Little Mahoning Creek is impacted by AMD in a few areas. A passive treatment system was constructed in 2005 using anoxic limestone channels and settling ponds to treat 262,000 gallons of discharge per day on Cessna Run. ICCD has a FACTS grant monitoring the treatment system on Cessna Run. Salsgiver Run, another tributary to Little Mahoning Creek, has been identified as AMD impacted. In fact, Salsgiver Run is the only tributary in the Little Mahoning Creek subwatershed where AMD was identified as a priority contaminant.

Marcellus Shale Gas Extraction

In order to recover the gas in the Marcellus shale formation, a large volume of water is required, which becomes contaminated during the extraction through a process called hydrofracking. As a part of the permitting process for Marcellus shale operations, drilling companies are required to complete a water management plan for each site. The management plan identifies where the operator intends to obtain and store the water needed for the drilling process and to ensure it coincides with Act 220—Water Resources Planning Act (PA DEP, 2010c).

In addition, drilling companies must account for the wastewater that is generated, including how it will be stored, treated, and/or disposed. Under the Pennsylvania Clean Streams Law, DEP finalized new regulations to protect Pennsylvania's water bodies and public drinking water in 2010, by limiting the amount of total dissolved solids (TDS) that could be discharged into waterways from wastewater of the natural gas industry (Abdalla, Drohan, Saacke Blunk, & Edson, 2011b). Wastewater fluids that are recovered must be reused, recycled, or collected and treated at an authorized treatment facility.

Several steps exist in the Marcellus shale drilling process that allow radionuclides, particularly Radium-226 (please see Chapter 2 for more details), to concentrate in liquid wastewater. Drilling fluids that include various chemical additives are artificially introduced into the borehole by high pressure injection to cool and lubricate the drill bit, to prevent the well hole from caving in, and to circulate drill cuttings to the well surface. Formation water, or natural brine, contained within the pore spaces and fractures of the rock can mix with the drilling fluid and be circulated to the well surface. The formation water can be contained in the rock formations for centuries and can contain extremely high levels of water-soluble radionuclides. In addition to mixing with brine, the drilling fluid may also become contaminated when it comes in contact with the NORM in Marcellus shales discussed prior (Resnikoff, Alexandrova, & Travers, 2010).

As mentioned prior in Chapter 2, the reuse of recycled water can decrease costs to the drilling companies and reduce the amount of water being withdrawn from area streams. Although drilling fluid has potential to be reused many times, so does radium have the potential to progressively concentrate in it after each reuse. Publicly-owned water treatment works have been identified as not being currently capable to properly treat industry wastewater (Resnikoff, et al, 2010). New technologies for treating Marcellus wastewater are currently an area of intense research. Most involve evaporation and crystallization of salts and mobile evaporator units. Advantages of this kind of advanced treatment option include the effluent meeting new state standards and direct reusability of the treated water in fracking other wells. However, disadvantages include production of a large solid waste residue (salts) and high costs. In Lycoming County, one of the first facilities for treating flowback and produced water in the Marcellus shale area became operational in April 2010. As of September 2010, the facility had treated and returned 12 million gallons of water to clients for reuse in fracking. An additional facility is planned for Tioga County and two for Bradford County. If expanded, this process should reduce the need for future water withdrawal permits (Abdalla et al., 2011b).

The major water resource concerns surrounding the Marcellus shale gas extraction include the volume of water required to extract the gas and the impacts the irretrievable wastewater might cause to nearby aquifers. Drilling and fracking water and wastewater is also increasingly being transferred between river basins, further complicating permitting and big-picture water management (Abdalla, Drohan, & Becker, 2010).

Precedent among concerns for pollution of nearby aquifers is its potential effect on human drinking water. The Pennsylvania Oil and Gas Act includes language to protect drinking water supplies near gas wells, including a requirement that gas well drilling operators restore or replace any water supply determined by DEP to be polluted as a result of nearby gas well drilling, defined as being within 1,000 feet. The gas well operator is presumed responsible for pollution of any public or private drinking water supply only if it occurs within six months after completion of drilling or alteration of the gas well. During the six-month period, the gas well operators can use any one of five defenses to prove they are not responsible for water contamination: the pollution existed prior to the drilling; the landowner or water supplier refused to allow the operator access to conduct a pre-drilling water test; the water supply is not within 1,000 feet of the gas well; the pollution occurred more than six months after completion of gas well drilling; or the pollution occurred as the result of some cause other than gas well drilling (Abdalla, Drohan, Swistock, & Boser, 2011a).

New regulations, including many oil and gas well construction standards that the industry must follow to prevent methane gas migration, became effective on February 5, 2011 in response to recent incidents in some parts of Pennsylvania where gas had migrated into drinking water supplies or homes, posing health and safety threats. The regulations also require drillers to detail the chemicals found in flowback water, and to electronically report production and waste volume data (Abdalla et al., 2011b).

An Ohio River Basin Commission

Some regions of the state are protected by quantitative threats to water by the presence of river basin commissions. Commissions such as the Susquehanna River Basin Commission (SRBC) and Delaware River Basin Commission (DRBC) are granted extensive authority over allocation of basin water. They review both surface and groundwater withdrawals that may have a “substantial effect” on basin waters. Commissions are also concerned with the lowering of groundwater levels, water quality degradation, and any loss of aquifer storage capacity or major impact of flow and play a vital role in regulating such parameters (The Pennsylvania State University, 2009b).

With the exception of state laws regulating the withdrawal of surface water by public water supply agencies, Pennsylvania has no statewide regulatory program mandating the acquisition of permits for withdrawing surface or ground waters. Basin level regulatory programs of the SRBC and DRBC have largely displaced the courts as the authority of water rights issues in the eastern two-thirds of the Commonwealth. Due to the water consumption requirements where commissions are present, gas companies may not begin gas well construction, drilling, or fracking without commission approval. This requirement has allowed the commission to regulate individual and cumulative impacts of the gas industry on water resources, playing an important role in the development of the industry in Pennsylvania (Abdalla et al., 2011a).

The Ohio River basin is currently without a basin commission, raising a number of issues about justice and consistent permit requirements in this gap of authority coverage. Many stakeholders have suggested that the Ohio River basin would benefit from creation of a water quantity–focused river basin commission with powers similar to those of the SRBC and DRBC.

Benefits of river basin commission established in the Ohio river basin would be countless. River basin commissions take a regional view and can work across state jurisdictional boundaries to settle disputes before they escalate. The interstate compact process gives states the ability to address mutual problems through consensus building rather than legal action. An important strength of the river basin approach stems from their flexibility to deal with changing situations, such as those presented by shale gas extraction.

The Army Corps of Engineers in Pittsburgh, along with three other Corps districts and the 15 Ohio river basin states, is participating in the Ohio River Basin Comprehensive Reconnaissance Study. Among other objectives, an official water quantity–focused commission for the basin is one ultimate goal of the study (Abdalla et al., 2010).

Water Quality Trading

Water quality trading is an innovative approach to reduce the overall impact of a particular pollutant. It is achieved when one entity purchases the right to pollute from another entity in the form of credits, or units of pollution reduction beyond federal or state required levels (Penn State University, 2006a). This method is only effective when there is 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.

In order for water quality trading to be effective, there must be consensus among stakeholders and regulatory agencies to try innovative approaches and to engage in trading design and implementation. 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 pollution sources. Only comparable nutrients credits expressed as a mass per unit time, for example pounds per year, can be exchanged between eligible parties. Trading may only occur within the bounds of the same watershed as defined by DEP, but may vary from stream segments to the entire watershed basin. Currently, water quality trading is limited to the Susquehanna and Potomac watersheds. The potential for developing a trading program within the Allegheny River watershed and the framework needed to support it is currently being explored, referencing the trading programs in the Susquehanna and Potomac watersheds (DEP, 2008e).

Water Quantity

The amount of water available for use is dependent upon the amount of groundwater recharge. Groundwater recharge is the amount of water that has permeated the ground during periods of precipitation. During periods of drought, more water is being withdrawn and used than can be recharged into the ground. Some areas in Pennsylvania and across the U.S. withdraw more water than 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 groundwater or surface water from local waterways, and treat it to ensure that it meets safety standards for drinking water. In many rural and suburban areas, public water systems are not available, and residents depend upon private wells and springs.

Due to the rural location of the project area, the majority of residents rely on private wells and springs for their water needs. Public water suppliers are available in some of the more populated areas of the watershed, such as Dayton. In Armstrong County, there are three public water suppliers within the lower Mahoning region—Dayton Borough, Templeton Water Company, and Redbank Valley Municipal Authority in Mahoning Township. Within the Indiana and Jefferson counties portion of this watershed there is no infrastructure for public water or public sewage.

When groundwater is utilized, a well is drilled into the **aquifer**—an underground area containing sufficient porosity and permeability to transmit an adequate supply of groundwater. Water is pumped out of the well, causing the aquifer to draw down. When this occurs water from adjacent aquifers flows toward the well to refill it.

There are two kinds of aquifers—confined and unconfined. In a **confined aquifer**, groundwater is under pressure because there is typically a layer of impermeable or nearly impermeable rock above it to confine the groundwater. When a well is drilled into the aquifer, pressure forces the water up the borehole. These are called artesian wells, and some artesian wells receive so much pressure that they flow without being pumped. **Unconfined aquifers** contain a water table or do not have a layer of low permeability above to restrict flow through the aquifer. Wells established in unconfined aquifers must be pumped (Fleeger, 1999; Reese, personal communication, 2009).

Pennsylvania State Water Plan

In 2008, an updated draft of the Pennsylvania State Water Plan was unveiled, providing a vision to sustain water supply with goals and recommendations. 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 implementation. It also provides an analysis of problems and needs associated with specific water resource uses, such as navigation, stormwater management, and flood control (DEP, 2008e).

In the updated Pennsylvania State Water Plan, information is broken down into six watershed regions—Ohio River, Great Lakes, Potomac River, Delaware River, upper/middle Susquehanna River, and lower Susquehanna River. The lower Mahoning Creek project area is located within the Ohio region, which is subdivided into smaller regions, of which Mahoning Creek, Pine Creek, and Hays Run are located within the central Allegheny River region.

Water Use

In 2000, it was estimated that Pennsylvania withdrew 9,950 million gallons of water per day. Of the water withdrawn, 93 percent came from surface waters. Table 3-3 shows water withdrawal trends in Pennsylvania from 1990 to 2000 (Hutson, et al., 2004).

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

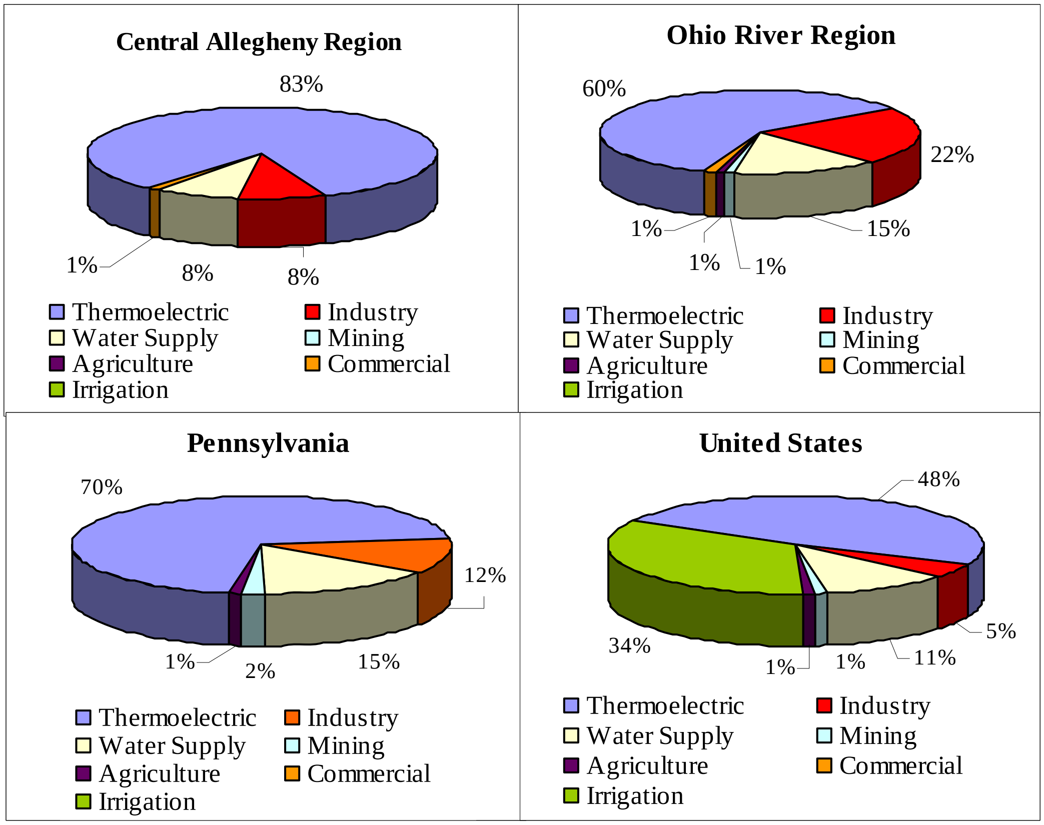
Table 3-4. Water Use

	Groundwater			Surface			Total		
Year	**Fresh**	**Saline**	**Total**	**Fresh**	**Saline**	**Total**	**Fresh**	**Saline**	**Total**
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

All values are in millions of gallons per day
(***Sources***: ***Solley, Pierce, & Perlman, 1993 & 1998; Hutson, et al., 2004***)

The majority of the water withdrawn from the Ohio River region, central Allegheny River region, Pennsylvania, and the U.S. was utilized for thermoelectric, industry, and public water supply uses. It was estimated that in 2000, the U.S. used 48 percent of the withdrawn water for thermoelectric uses. In the Ohio River region, 60 percent of the withdrawn water and 83 percent from the central Allegheny River region was used for thermoelectric purposes. Figure 3-9 illustrates the withdrawn water uses in the U.S., Ohio River region, and central Allegheny River region (DEP, 2008e).

Figure 3-8. Uses of Water Withdrawn by Region



(Source: Hutson, et al., 2004; DEP, 2008e)

Existing Studies and Water Quality Monitoring

Saving Little Mahoning Creek

In 2006, WPC began the Saving Little Mahoning Creek project. The project consisted of a visual assessment, and fish, mussel, macroinvertebrate, and hellbender salamander surveys to determine the health of the Little Mahoning Creek watershed. It also features reclamation projects that include improving dirt and gravel roads, streambank stabilization and fish habitat, and the removal of invasive species. For reporting and comparison purposes, the watershed was subdivided into three segments: the lower segment—from the mouth of Little Mahoning Creek at its confluence with Mahoning Creek to Ross Run; the middle segment—from Ross Run to Broadhead Run; and the upper segment—from Broadhead Run to the headwaters of Little Mahoning Creek.

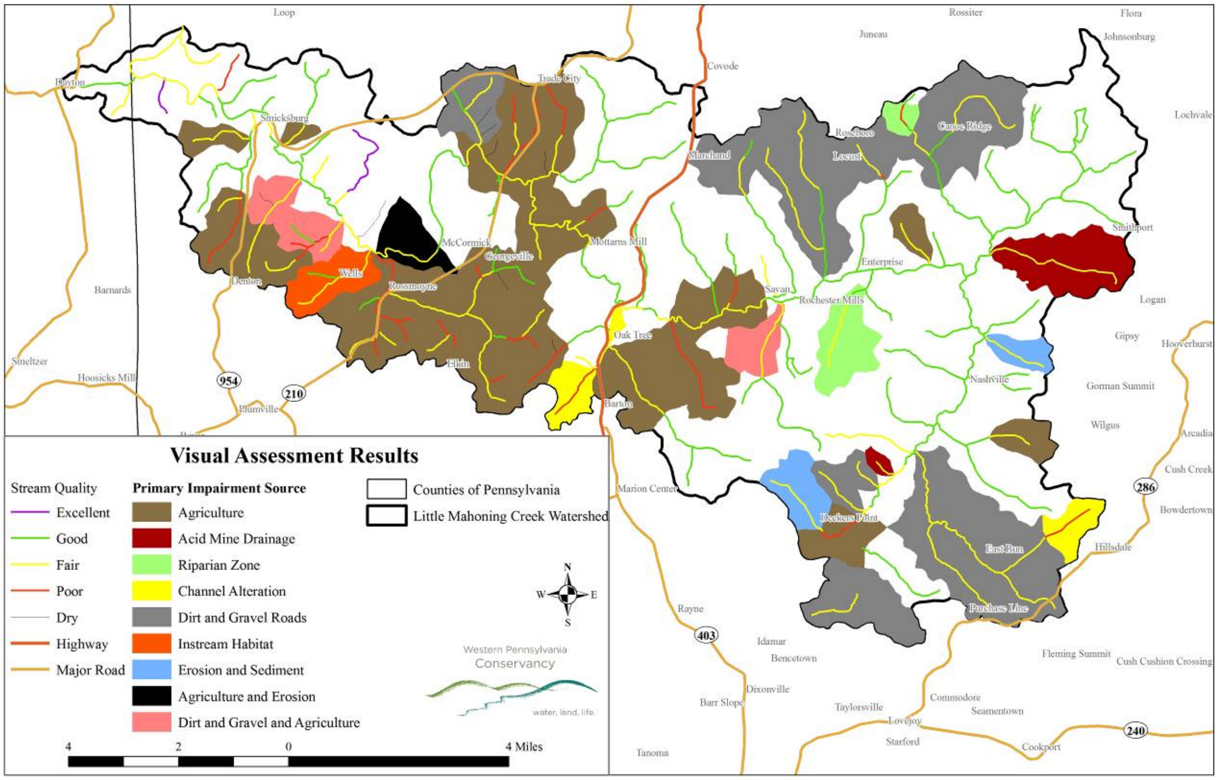
Visual Assessment

The first phase of the project was to conduct a visual assessment of the region. WPC modified the USDA rapid bioassessment protocol to assess the entire Little Mahoning Creek watershed. Features of the watershed, such as land-use, channel conditions, riparian zone, in-stream habitat, water appearance, etc., were documented. Appendix G includes the data sheet used to complete the visual assessment.

In addition to the visual assessment, chemical parameters—flow, pH, dissolved oxygen, temperature, turbidity, phosphates, nitrates, and total dissolved solids—of water quality samples were analyzed. Sites located near AMD discharges were also tested for iron, aluminum, acidity, and alkalinity. In total, 27 sites were sampled for baseline data.

The assessment identified water quality impairments, including erosion, sedimentation, and AMD. Sedimentation was identified as the most significant impairment to the watershed; and agriculture, natural gas extraction, and dirt and gravel roads were identified as major contributors to increased sediment in area waterways. Figure 3-9 displays the watersheds identified as restoration priorities based upon their impairments.

Figure 3-9. Little Mahoning Creek Visual Assessment Results



Eastern Hellbender Salamander Surveys

Beginning in 2007, WPC forged a partnership with PFBC, the Pittsburgh Zoo and PPG Aquarium, Pennsylvania Natural Heritage Partnership, Little Mahoning Watershed Association, Ken Sink Chapter of Trout Unlimited, Indiana University of Pennsylvania, and St. Francis University to conduct annual surveys of eastern hellbender salamanders within the Little Mahoning Creek watershed.

Volunteers collecting hellbenders on Little Mahoning Creek

Hellbenders are exclusively aquatic salamanders that live only in healthy streams located in eastern U.S. mountainous and foothill areas. Therefore, the presence of hellbenders within Little Mahoning Creek validates the good water quality of the watershed.

The first year of the survey resulted in 24 hellbenders being caught and released within five 100-meter reaches that were selected based on visible attributes. Once caught, individuals were measured and weighed, notes were taken on any evident abnormalities or scarring, and then each animal was marked with a passive integrated transponder (PIT) tag before being released under the same rock where they were found. Physical habitat features, such as rock size and location, were also recorded. In some instances, blood work was drawn from the animal for general health analysis by a veterinary staff person from the Pittsburgh Zoo and PPG Aquarium. The largest hellbender caught during this first season of surveys was 25.34 inches long and weighed 3.3 pounds.

During subsequent years, the search area was broadened and successful sites were revisited. The second year resulted in 32 hellbenders being caught, of which nine were previously caught in 2007. In 2009, 27 hellbenders were caught and 46 were caught in 2010. It is believed that the population of hellbenders within the Little Mahoning Creek watershed is an older population with little active recruitment, or regeneration. Future surveys will emphasize attempts at juvenile capture. In 2010, the first juvenile hellbender was caught. Individual hellbender collection sites will not be identified in order to protect and the species and its habitat.

Freshwater Mussel Surveys

The presence or absence of freshwater mussels is a water quality indicator. Mussels are only found in good quality waterways with certain sediment types and physical habitats. Most often, they are found in medium and large waterways. Freshwater mussels also depend upon healthy fish populations, supported by clean water, for reproductive dispersal of their young.

Observing the streambed of Little Mahoning Creek in search of freshwater mussels

In 2007, WPC conducted freshwater mussel surveys at 15 sites along Little Mahoning Creek. Sites were selected in two ways—previously surveyed sites—conducted by Ortmann in 1909 and Bogan & Davis 1992—were revisited and new sites were selected based upon geographical information systems (GIS) and data collected during the visual assessment. Each site was 100 meters, surveyed using a timed-search protocol. The survey time was calculated based on the width of the stream at each site.

The mussel surveys indicated that there is an established community of freshwater mussels with an increasing distribution. Within nine of the survey locations, there were 812 individuals collected, representing 10 species. However, six sites near the headwaters of the watershed were void of mussels. It is believed that the Savan Dam may be restricting the movement and distribution of mussels upstream of the obstruction. The sampling site closest to the dam was the least diverse site (Chapman & Smith, 2009).

Aquatic Fish and Macroinvertebrate Surveys

Aquatic surveys were conducted to document fish and macroinvertebrate communities within the lower Mahoning Creek watershed.

In June 2007, WPC conducted fish surveys using electrofishing methods at nine locations in Little Mahoning Creek.

Electrofishing on Little Mahoning Creek

Electrofishing is a survey method that stuns fish for up to two minutes when an electrode delivers a current through the water. At each location, three 100-meter segments were sampled following a single pass survey protocol. Overall, 1,288 individuals representing 29 species were identified. The distribution of fish species was diversified from the headwaters to the confluence of Little Mahoning Creek with Mahoning Creek. Six species—bluntnose minnow, central stoneroller, emerald shiner, fantail darter, Johnny darter, and northern hogsucker—were identified in at least seven of the nine locations. Within the upper and lower sections of the watershed, 20 different species were collected at each location, while 18 species were collected the middle section (Chapman, personal communication, 2009).

AmeriCorps volunteers collecting macroinvertebrates

Twenty-seven 100-meter reaches of Little Mahoning Creek were surveyed for benthic macroinvertebrates. **Macroinvertebrates** are animals that have no backbone and are large enough to be seen by the unaided eye. **Benthic** means the lowest level of a waterbody; here it is used to describe macroinvertebrates that live on the bottom of the stream.

Macroinvertebrate survey sites were selected where no bridges occurred and no tributaries entered at the sampling location. The U.S. EPA single habitat approach protocol was followed using a Surber sampler and collecting three samples in riffle areas. A total of 5,800 individuals from 119 different specimens were collected and identified to the genus level.

The presence and dominance of certain types of macroinvertebrates can indicate the quality of water. Some species are very sensitive and cannot tolerate pollution, these species—stoneflies, mayflies, and caddisflies—indicate good water quality.

The Index of Biological Integrity (IBI) is a measurement of stream health. It takes into account pollution tolerance levels, predators, and the number and abundance of species present at a site. Using the IBI provides quantitative, qualitative, verbal, and graphical descriptions, as well as insight into a stream's ability to provide healthy habitat for aquatic organisms. Measuring a stream's plant and animal composition is a direct assessment of water resource conditions, and it reflects on human influences to those resources. Figure 3-11 depicts the IBI score for each of the macroinvertebrate sampling sites on Little Mahoning Creek. The higher the IBI score, the better the diversity of species.

Pine Run Watershed Implementation Plan

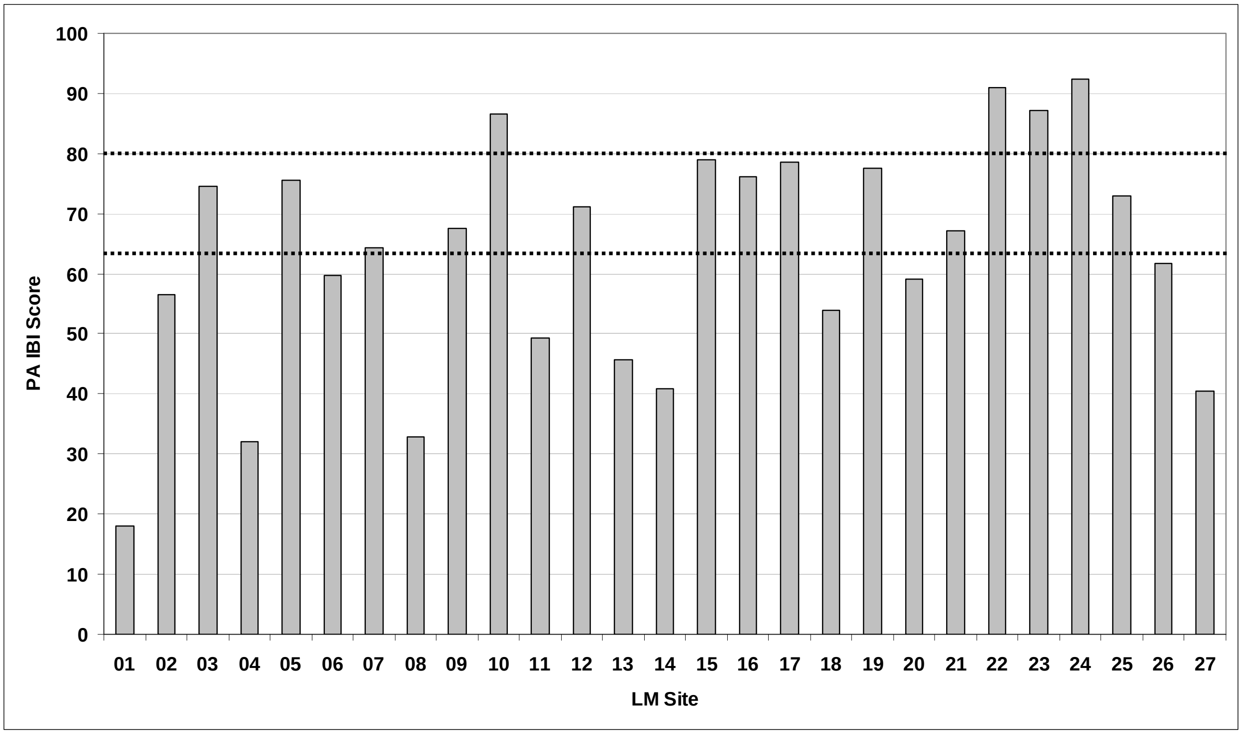
The Pine Run Watershed Implementation Plan was completed by Jefferson County Conservation District in 2005. The plan, funded through section 319 of the Clean Water Act, identified non-point source pollution discharges that impact the water quality of the Pine Run watershed. The plan also addressed potential management solutions to remediate these impacts.

The study identified four main sources of non-point source pollution—AMD, resource extraction, agriculture, and urban influence. High concentrations of metals and acidity from AMD have varying impacts on water quality. Impacts can be very degrading or non-existent. Four major AMD-impacted tributaries were identified as high priorities for remediation—Weisner Hollow, Caylor Run, Corbettown Discharge, and Harmon Tipple Area (Jefferson County Conservation District & CWM Environmental, 2005).

Weisner Hollow, a former coal cleaning facility, consists of two refuse piles with the larger pile situated as a dam. Pennsylvania Bureau of Abandoned Mine Reclamation (BAMR) took over the site after the bond for the site was forfeited. BAMR conducted a site assessment and conceptual design for remediation; however, the amount of the bond was not enough money to cover the extent of the reclamation needed.

Caylor Run is impacted from nine major discharges in the lower portion of its watershed. The flow from these nine discharges makes up the entire source of water for Caylor Run. During

Figure 3-10. Index of Biological Integrity for Macroinvertebrate Sampling Locations



field assessments for the Pine Run Implementation Plan, the upper portion of the watershed—which is dammed up for a private recreation area—did not flow into the lower portion. This flow disruption may also have been due to unseasonably dry conditions. Regardless, the deficit of groundwater may be enhancing the mine drainages impact on Pine Run. In 2004, Jefferson County Conservation District, in partnership with Pine Run Watershed Association, received a Growing Greener grant to develop a passive treatment system to treat the Caylor Run discharge. Once the design is completed, another application will be submitted to construct the treatment facility.

The **Corbettown Discharge** is the largest producer of iron in the Pine Run watershed, contributing 610 pounds of iron per day. The discharge is located at the entrance of an abandoned deep mine. In 2004, Jefferson County Conservation District received a grant from the U.S. EPA Program Clean Water Act Section 319 program for the final design and construction of a passive treatment system to treat the discharge.

In the **Harmon Tipple** area, deep mine discharge and seeps from an abandoned strip mining operation are releasing a net alkaline discharge with high iron and manganese concentrations. Treatment at the site would require reclaiming nine acres, including a large highwall.

There are five areas where non-point source pollution from refuse piles resulting from resource extraction activities is evident. The concern surrounding the five coal refuse piles is due to their close proximity to Pine Run and the potential for additional metals to be discharged into the waterway.

Agricultural impairments are also prevalent within the 33 square-mile watershed, particularly in the headwaters region. Impacts from agriculture are due to poor riparian corridors and a lack of streambank fencing and stabilized livestock crossings.

Erosion is one of the major impacts to the Pine Run watershed. Streambanks are eroding due to the lack of adequate riparian buffers. There are four residential areas, accounting for 401 feet of eroded streambanks in need of stabilization and riparian corridor improvement. Landowners mowing their lawns to the streambank, along with existing inadequate riparian buffers, contribute to the erosion problem. Many of the riparian buffers are comprised of grass and low-lying shrubs. Absent are deep rooted plants and trees—better species for a riparian corridor because their roots hold soil in place.

CHAPTER 4. BIOLOGICAL RESOURCES

Natural Setting

Ecosystem and Biodiversity

A group of plants and animals—including humans—living and interacting together within a specific physical environment is an ecosystem. An ecosystem that is biologically diverse incorporates a wide variety of species and community interactions. The more biologically diverse a community, the healthier and higher functioning its ecosystem.


Riparian corridors provide essential habitat as indicated in this photograph of Scrubgrass Creek

Each native species and wildlife community helps to maintain the ecosystem's integrity. Each species has a specific 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 the ecosystem's health and functionality. Losing just one species can have a profound effect on the entire ecosystem.

Ecoregion Characteristics

An ecoregion is a geographic locality containing a compilation of distinct natural communities that interact and thrive in ways that sustain their collective existence over a period of time (World Wildlife Fund, 2010). The project area is located within the Pittsburgh Low Plateau section of the Western Allegheny Plateau ecoregion as designated by the U.S. Environmental Protection Agency (EPA). In addition to EPA-designated ecoregions, the U.S. Forest Service (USFS) has delineated domains, divisions, provinces, ecoregions, and sections. Through this classification, the lower Mahoning Creek region is located within the Unglaciated Allegheny Plateau Section of the Eastern Broadleaf Forest ecoregion. Both ecoregion designations are discussed in more detail within the Land Resources chapter.

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 lower Mahoning Creek, Pine Creek, and Hays Run watersheds.

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. Wetlands harbor a multitude of plants and animals, making them biodiversity hot spots of the watershed. Several plant species 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 to recharge. Wetland vegetation also provides a variety of food sources, cover, and nesting material for insects, birds, mammals, and other wildlife.

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.

Painter Run, a tributary to Pine Run near Timblin, PA

Characteristics of streams and rivers can vary greatly. Headwater streams are typically smaller and shallower than the larger order streams, which they flow into. With theses variations, come an assortment of plants and animals that inhabit different sections of a waterway. Small, headwater streams are home to small fry (young fish) and aquatic macroinvertebrates. Small and fast flowing streams, especially those with an intact vegetative riparian 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 serve as food for larger fish, birds, and mammals.

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 vegetative riparian buffer to shade and cool the water, warm-water fish species, such as bass, bluegill and sunfish, tend to thrive.

Forest Habitats

Forestlands provide habitat for plant and animal species, timber for fuel and wood products, income possibilities from other forest products, and recreational opportunities. The majority of the project area contains forestland. Of the approximately 184 square miles of forestland the majority—93 percent—is deciduous forest.

Forests 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. During photosynthesis, plants covert 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 sequestered 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."

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 fuel, have greatly increased the contribution of carbon dioxide to the atmosphere. The preservation of forests, maintenance of vegetative riparian buffers, and forest management practices that leave residual trees to grow at a faster rate, aid in carbon storage within plants 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. 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 great allocation of resources and nutrients, ensuring a faster growth rate and high 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—area 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 devastating effects on ash tree populations, is one such insect. Invasive species will be further discussed later in this chapter.

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.

Old growth hemlock forest located along Little Mahoning Creek

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 economic 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.

<u>*Successional Forest Habitat*</u>

Succession is the natural process of forest regeneration over time. 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. 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, eventually shrubs, small woody vegetation, and tree seedlings and saplings will grow. As time goes on, trees establish into a mature forest. 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 for forest animals, while shrubs and dense vegetation offer cover and safety for birds and small mammals. Early-successional habitats are preferred by a variety of wildlife species, such as rabbits, certain warbler species, and the American woodcock (Rodewald, 2004).

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 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 increased 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 control erosion and help manage stormwater. Trees can also be utilized to reduce energy costs and improve property values. Trees in urban settings will improve air quality, boost a community’s sense of pride, and enhance business and economic development.

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. Natural Resources Conservation Service (NRCS) offers the Environmental Quality Incentive Program (EQIP) to private forest lot owners (PA DCNR, Bureau of Forestry, 2009).

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 time and money—in maintenance costs for gasoline powered equipment—and energy used for powering the electrical equipment, reducing air pollution.

Grasslands Habitat

Native wildflowers, grasses, forbs, and prairie-type habitats can be used to beautify property, enhance ecological interactions, and reduce lawn maintenance. Native grassland habitats, small or large, provide food, cover, and nesting material for a diversity of wildlife. Many native species attracted to grasslands offer natural pest control and pollination services. This reduces pesticide costs, and is also more environmentally friendly than using harsh chemical pesticides.

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 nutrition 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 1st and after August 15th, which will allow enough time for grass regrowth to provide cover throughout the winter months (NRCS, 2006). Snake mortality associated with mowing is another aspect to consider. If possible, mowing should take place in the colder months of December through March, when snakes and other reptiles and amphibians are hibernating. 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, 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 within the lower Mahoning Creek, Pine Creek, and Hays Run watersheds. Conserving natural areas, improving soil and water quality, and restoring degraded habitats will benefit wildlife populations.

Black bear along Route 839 north of Dayton, PA

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 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 within the project area is highlighted in this section.

Mammals

Mammal diversity is typically associated with large, intact tracts of forest. Predominant mammal species of the region include the whitetail deer, gray fox, woodchuck, opossum, gray squirrel, white-footed mouse, and short-tailed shrew. The hairy-tailed mole, smoky shrew, and eastern woodrat are rare species that may exist. Once common to the area, only small populations of black bear and bobcat remain. Historically common, but now extirpated, species include 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).

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 enroll in a program through PGC 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[1]).

Reptiles and Amphibians

Amphibian and reptile species within the region include the red-spotted newt, dusky salamander, fence lizard, American toad, wood frog, box turtle, snapping turtle, painted turtle, ringneck snake, northern water snake, black rat snake, copperhead, timber rattlesnake, and green salamander. 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 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).

Eastern Hellbender Salamander

The eastern hellbender, a species of salamander found in Little Mahoning Creek, 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.

Eastern hellbender salamander on a rocky substrate

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 (Pennsylvania State University, 2006b).

Timber rattlesnakes can be found in both black and yellow color phases throughout the Pennsylvania. 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[3]).

In Pennsylvania, the timber rattlesnake is a candidate species with declining populations. 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 lower Mahoning Creek region are wild turkey, ruffed grouse, barred owl, pileated woodpecker, eastern phoebe, blue-gray gnatcatcher, Acadian flycatcher, white-eyed vireo, ovenbird, Kentucky warbler, yellow-breasted chat, and summer tanager (McNab & Avers, 1994).

Pileated Woodpecker

The pileated woodpecker is the largest woodpecker in North America and is the same size as an average crow. It primarily feeds on carpenter ants, wood-boring beetle larvae, fruits, and nuts; and it prefers to reside in cavities of large, dead trees, but will reside in live trees if no dead trees are available. They are extremely protective of territory, remaining there year-round. Cavities created by the pileated woodpecker are easily identifiable, as the holes are rectangular is shape and often large.

Fish and Aquatic Invertebrates

Within Pennsylvania waterways, the Aquatic Community Classification system recognizes patterns in aquatic biodiversity, and systematically identifies stream communities and habitat types for freshwater mussels, macroinvertebrates, and fish. Communities are groups of organisms that occur together in a particular habitat that require similar habitat features and may or may not directly depend on each other for survival. The community types provide a general account of what organisms are likely to occur, and not every organism within the designated community will exist. The aquatic communities for each type of organism can be used to describe the aquatic resources, habitat, type, and stream quality. Appendix I identifies the macroinvertebrate, freshwater mussel, and fish communities within the project area.

Electrofishing surveys determine the health of Little Mahoning Creek

Table 4-1. Aquatic Community Classification Designations

Subwatershed	Fish Community	Macroinvertebrate Community	Mussel Community
South Fork Pine Creek	Coolwater Stream	High Quality Headwater Stream	(undesignated)
Mahoning Creek	Coolwater Stream	(undesignated)	(undesignated)
Little Mahoning Creek	Warmwater Stream	(undesignated)	spike mussel
Pine Creek	Coolwater Stream	(undesignated)	(undesignated)
Little Mahoning Creek	Coolwater Stream	(undesignated)	(undesignated)

Macroinvertebrate Communities

Only one macroinvertebrate community—**High Quality Headwater Streams**—has been designated within the project area, and that is within the South Fork Pine Creek subwatershed. Located in small, high gradient and high elevation streams this community contains a diverse group of organisms that are sensitive to organic pollution. Typical organisms include little plain brown sedge, slender winter stonefly, and spiketail dragonflies. Agriculture is typically a large component within watersheds in this community and may negatively influence habitats that support this community. Abandoned mine drainage and acid deposition are additional threats that can impact habitat within the High Quality Headwater Streams community (Walsh, Deeds, & Nightingale, 2007).

South Fork Pine Creek is designated as a high quality headwater stream in the Aquatic Community Classification

Mussel Communities

The **Spike Mussel Community** inhabits medium sized streams to large rivers that contain sand and gravel substrate within riffle areas of fast-moving and low-gradient waterways. It is only found in the Little Mahoning Creek. Species that typify this community include spike mussel and black sandshell. Other mussels, such as mucket, fatmucket, fluted-shell, and pocketbook, are also commonly found within this community, but are common in other communities as well (Walsh, Deeds, & Nightingale, 2007).

Habitats that support this community are often located in areas that have substantial agricultural operations that likely impact the water quality. Managing agricultural runoff through installation of vegetative riparian buffers and riparian fencing should improve conditions. Strategies for retention of stormwater and encouraging groundwater recharge could be applied where impervious surfaces create runoff. Implementing additional proactive approaches to reducing sediment and nutrient loading that is caused by agriculture operations, such as the management of livestock, crops, and soils can minimize degradation (Walsh, Deeds, & Nightingale, 2007).

Fish Communities

Two fish communities have been identified within the lower Mahoning Creek region—coolwater and warmwater. The majority of the project area is located within coolwater habitats, except for one section of Little Mahoning Creek, which contains warmwater habitat conditions.

A **Coolwater Fish Community** typically occurs in small to medium sized waterways that are fairly fast flowing and have intermediate temperatures often designated as Cold Water Fisheries (CWF) by PA Department of Environmental Protection (DEP). Habitats are valley streams with cobble and gravel substrates with available cover for fish species. Blacknose dace, creek chub, stocked brown trout, white sucker, redside dace, longnose dace, fathead minnow, pearl dace, and slimy sculpin are typical species found within this community; although, fish tolerant of cool and warm temperatures are also present. This community often represents a transition between coldwater and warmwater communities.

Often located in waterways with low to moderate water quality, coolwater fish communities face a variety of pollution sources that impact conditions—agricultural operations, urban runoff, wastewater outfalls, and a lack of vegetative riparian buffers. Restoration of stream temperature, habitat, and water quality are needed. Managing stormwater runoff, restoring vegetative riparian buffers, and reducing erosion and sedimentation would improve conditions.

Warmwater Fish Community is found in larger streams that are characterized by a diverse fish community. Species, such as greenside darter, central stoneroller, rainbow darter, johnny darter, fantail darter, logperch, stonecat, silver shiner, golden redhorse, mimic shiner, pumpkinseed, yellow bullhead, largemouth bass, green sunfish, tonguetied minnow, and Ohio lamprey, are typically found within this community. Warm water temperatures are common, and there are more thermal-tolerant fish species in this community group than coldwater or coolwater communities. Streams within this community represent small to medium-sized warmwater systems with little silt and turbidity. Impaired waterways within this community have poor water quality, increased turbidity, and low dissolved oxygen levels.

Golden redhorse caught during an electrofishing survey on Little Mahoning Creek

Non-point source pollution from agricultural runoff, impervious surfaces, and poorly managed agricultural areas are threats within warmwater communities. Supporting streams may be impaired by siltation, low dissolved oxygen, organic enrichment and hydro modifications from agricultural operations. Point sources, such as sewage treatment plants, may damage stream habitats, increasing the nutrient load. Warmwater streams typically occur in valleys downstream from human influences and are subject to pollution. Stormwater management, riparian buffer restoration, erosion control, and streambank fencing are needed to improve conditions.

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 have a rank assigned to them, even if they are not threatened or endangered. In Pennsylvania, a species is commonly considered to be of concern if it has a ranking of vulnerable or lower. Global ranks are assigned based on data collected at similar state offices worldwide as a part of a network called NatureServe.

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

In Pennsylvania, threatened or endangered status is determined by the appropriate state agency. For instance, PGC is responsible for assigning state statuses to bird and mammal species, while Pennsylvania

Fish and Boat Commission 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 requirements, but have not officially been given this designation. These species are typically monitored by Pennsylvania Natural Heritage Program (PNHP).

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 the habitat for these resources.

Within the lower Mahoning Creek watershed, 44 invertebrates, 32 vertebrates, and 30 plant species have been identified as species of concern. In addition, four natural communities and two geological features have been listed among the species of concern as important natural features and habitats of conservation significance. To protect these important species and landowners, the location of individual species cannot be provided. Appendix H lists state and global rankings for species of concern identified within the project area.

Invasive Species

Plant and animal species that do not naturally occur in the area and are likely to cause harm to the natural environment, the economy, or human health are termed invasive species. Not all non-native species are harmful to other species or to wildlife, but some exotic species may have severe impacts. They impose enormous economic costs to agriculture, forestry, fisheries, and other enterprises, as well as human health. They are a major threat to biodiversity, because they out compete native species due to their fast spreading tendencies. Once these species overtake an area, they degrade the habitat value for other plants, insects, birds, and other animals.

These non-native species have been introduced to Pennsylvania, whether purposely or accidentally, since the 17th century (Thompson, 2002). Some of the non-natives that have been identified in the project area were originally introduced for wildlife cover, to reduce erosion, or for food cultivation. Other species have accidently been introduced unknowingly as contaminants in seed, through ship ballast, or in wooden pallets used in packing materials that are transported between countries. When an invasive species dominates an area, they often decrease land value, increase maintenance and control costs, degrade soil or water quality, direct human health concerns, or reduce yields and health of agricultural operations.

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. In order to be effective at managing invasive species, the first step is prevention. Most

Eight Ways to Combat Invasive Species

1. *Only purchase non-invasive species and request that plant suppliers only sell non-invasive species.*
2. *Seek information about invasive species.*
3. *Scout your property for invasive species and remove invasive species before they become problematic. If you can't remove them, at least prevent them from going to seed.*
4. *Clean your boots before and after visiting natural areas to prevent the spread of invasive species.*
5. *Don't release aquarium plants and animals into the wild.*
6. *Volunteer at local parks and natural areas to assist efforts to diminish the threats of invasive species.*
7. *Help educate your community about invasive species.*
8. *Support public policies and programs to control invasive species.*

invasive species are opportunistic, and take advantage of disturbed areas and weakened species. By managing landscapes and protecting pristine natural areas, invasive species are less likely to overtake an area. By preventing an invasive species from establishing or spreading to an area, little or no money and/or chemicals will be necessary to control it.

The second step is to detect early, and begin control as soon as possible. Early detection and rapid response will result in less money and effort required to control the species. Numerous tools and publications are available to help one properly identify invasive species. Two starting points to access the information are USDA National Invasive Species Information Center (NISIC) at http://www.invasivespeciesinfo.gov and the Global Invasive Species Database at http://www.issg.org/ database.

Small, isolated populations should be contained to control spreading. Once established, invasive pests may be controlled by manual (physically pulling, cutting, or mowing weeds), chemical application of herbicides and pesticides, or biologically (utilizing another living species to control the invasive target) methods. Often, for well-established invasive species, a combination of control methods is necessary to effectively and efficiently control the invasive. When chemical means are necessary to control an infestation the person(s) applying the pesticide must be certified by the Commonwealth of Pennsylvania. 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 in general should be taught the correct identification of invasive species that threaten the watershed, so they can be detected and reported to the proper agency at the first sign of encroachment. Addressing the problem early also helps to minimize the negative impacts on native species and natural resources. Once well established, many of these species are difficult and costly to control

Plants

Invasive plant species pose the most significant threat in areas that have been altered by disturbances, such as impoundments, development, oil and gas extraction, poor forestry and agricultural management practices, or those that border invasive plants in the landscaping. In disturbed areas, invasive species can displace native plants intolerant to the changing conditions. Native wildlife often prefer native species, and thus avoid feeding on invasive plants, which allows the invasive to proliferate.

Invasive plants that pose a threat to health and human safety are categorized as noxious weeds. This federal designation, set forth by USDA Animal and Plant Health Inspection Service (APHIS), 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, 2007c). Noxious weeds within the project area are identified in Table 4-2.

An infestation of autumn olive at State Game Lands 262 in Indiana County

The sections below identify current invasive plant species which have been identified within the project area.

Table 4-2. Noxious Weeds of Pennsylvania

Noxious Weed	Located in Project Area
bull or spear thistle (*Cirsium vulgare*)	☑
Canada thistle (*Cirsium arvense*)	☑
giant hogweed (*Heracleum mantegazzianum*)	
goatsrue (*Galega officinalis*)	☑
jimsonweed (*Datura stramonium*)	
Johnson grass (*Sorghum halepenses*)	
kudzu (*Pueraria Montana v. lobata*)	
marijuana (*Cannabis sativa*)	
mile-a-minute (*Polygonum perfoliatium*)	☑
multiflora rose (*Rosa Multiflora*)	☑
musk or nodding thistle (*Carduus nutans*)	
purple loosestrife (*Lythrum salicaria*)	☑
shattercane (*Sorghum bicolor*)	

Autumn Olive

Autumn olive is a deciduous shrub or small tree that can grow up to 20 feet tall. The woody stems contain silvery scales that are predominant in younger plants. Each plant is capable of producing up to 80 pounds of fruit per growing season. Native to Asia, autumn olive can thrive in poor soils. It was introduced in the U.S. in 1830 as an ornamental plant. Autumn olive was cultivated for use in wildlife habitat and erosion control because of its fast growth rate and ability to grow into deep thickets. It is widely dispersed by birds.

It aggressively overtakes native species due to its nitrogen fixing capabilities that adversely affects the nitrogen cycle of the native communities. It creates heavy shade, suppressing plants that require direct sunlight for growth.

Due to its rapid growth rate, controlling populations of autumn olive and Russian olive can be challenging. Avoid cutting and mowing areas that contain populations of autumn olive and Russian olive, these activities cause vigorous resprouting—even when frequently cut—increasing the species' ability to spread. It can be hand pulled, or the use of herbicides following cutting during the growing season may be effective. It may take multiple treatments before eradication of the species is successful (Invasive Plant Species Assessment Working Group (IPSAWG), 2006).

Autumn olive has been identified in Armstrong, Indiana, and Jefferson counties.

Exotic Bush Honeysuckles

Tartarian and morrow honeysuckles are often grouped together as exotic bush honeysuckles. Native to eastern Asia, they were introduced into the U.S. as early as 1752 for wildlife cover, erosion control, and as ornamental plants.

These species of honeysuckle are approximately six to 15 feet high, and grow as a deciduous shrub. The flower color varies from cream to pink or crimson. They are shade intolerant and mostly located along forest edges, abandoned fields, pastures, roadsides, and other open upland areas.

Morrow honeysuckle, unlike Tartarian honeysuckle, is capable of invading bogs, fens, lakeshores, sand plains, and other uncommon habitats. Populations of Morrow honeysuckle have been established in Armstrong, Indiana, and Jefferson counties, while Tartarian honeysuckle populations have been established in Jefferson County.

Honeysuckles rapidly invade areas, overtaking a site by forming a dense shrub layer that crowds and shades out native plant species. It alters habitats by decreasing light availability, depleting soil moisture and nutrients, and possibly releasing toxic chemicals that prevent other plant species from growing in the vicinity. They compete for pollinators, reducing seed sets for native species.

Prevention is the easiest control method available. Once the species are established, a variety of removal methods could be implemented; however, any control method should be initiated prior to seed dispersal. Manually pulling the plants can be effective, but is very labor intensive, especially on large infestations, and requires several years to exhaust the seed bank. Chemical treatment using herbicides is also effective, and becomes even more effective when combined with manual removal techniques. Large infestations in open fields can be controlled with prescribed burning.

Canada Thistle and Bull Thistle

Both non-native species of thistle have established throughout Armstrong and Indiana counties. In addition, bull thistle has also established in Jefferson County. Thistles are problematic in crowding native species and reducing crop and forage areas. The plants typically start growing in disturbed areas, such as ditches and abandoned lands, and begin spreading into open fields and farmland. Thistles reduce pasture lands, because cattle typically will not graze near an infestation of the species.

Accidentally introduced through shipments of farm seed in the 1600s, Canada thistle is a creeping, perennial weed that is difficult to control. It reproduces via seeds and vegetative buds in its root system, and within two years, one plant can colonize an area three to six feet in diameter, and can produce 1,000–1,500 seeds per flowering shoot. Canada thistle seeds remain viable in soil up to 22 years. Seeds are dispersed via wind, water, animals, farm equipment, and vehicles. The root system is very extensive, being able to grow 6–15 feet deep and over 15 feet horizontally. New plants can sprout from vegetative buds on the roots at anytime.

In order to control the species, the plant must be stressed, so it is forced to use stored root nutrients. Control methods should be repeated, and it takes several years before there are any signs of success. Mechanical control is ineffective, unless it is conducted at one month intervals for several growing seasons and/or is combined with chemical, biological, or cultural treatment (Beck, 2010).

Bull thistle is a biennial plant—two-year life cycle—that infests grassy areas, excluding other herbaceous plants. Each flower head produces up to 250 seeds, with each plant producing approximately 4,000 seeds. The seeds are dispersed by wind and rapidly colonize in disturbed areas, with flowers typically present from June to October.

Similar to Canada thistle, controlling the spread of bull thistle requires the combined use of biological, chemical, and manual techniques. During manual treatment, flower heads are removed. If flower heads are removed before seeds are produced, then the dead plants can be left on site; however, if the flower heads are removed once seed production has begun, then they should be placed in bags, removed from the site, and burned.

Crownvetch

Introduced into the U.S. in 1950 for erosion control purposes the Europe, Asia, and Africa, crownvetch is a herbaceous legume with creeping stems that can grow two to six feet long. It is used as a ground cover in areas susceptible to erosion, such as road banks and right-of-ways, because of its rapid growth. It spreads via seed dispersal and creeping root system. It has been known to invade woodland edges, agricultural fields, pastures, hayfields, streambanks, and gravel bars. Populations of crownvetch have been established in Armstrong, Indiana, and Jefferson counties.

Manual and chemical control options are available. Prescribed burning that is conducted in late spring and repeated annually for several years may effectively exhaust the seed bank. Mowing conducted in late spring or multiple mowing sessions in June and late August—to correspond with successive leaf-out periods—will reduce populations. Chemical control with herbicides can be applied in early spring, following instructions on the selected herbicide (Wisconsin Department of Natural Resources, 2004a).

Dame's rocket

Established within Armstrong and Indiana counties, dame's rocket is a showy, short-lived perennial plant with large, loose clusters of white, purple, or pink flowers that bloom from May to August. Native to Eurasia, it was introduced into the U.S. in the 1600s as an ornamental plant, which escaped cultivation.

Dame's rocket grows in mesic woodlands, woodland edges, roadsides, and open areas. It is not listed as an invasive species in some places, because the size of the infestations is not significant and because there is little information available about its impacts due to a lack of studies. It is widely distributed in wildflower seed mixes.

Manual and chemical control methods can be used to reduce a population. In order to prevent the spread of the species, control should be conducted before seeds are set, and may take several years to exhaust the seed bank. Once the flower blooms, the heads can be cut off and either placed in a plastic bag and sent to the landfill or dried and burned. Removed plants, especially those with seeds, should not be placed in compost piles, because the seeds could still ripen and spread. Chemical treatment using herbicides are effective if applied in late fall while rosettes are still green (Wisconsin Department of Natural Resources, 2004b).

Eurasian watermilfoil

Native to Europe, Eurasian watermilfoil was introduced into the U.S. in the 1900s accidently via watercraft equipment and water birds. It has a hard time establishing in lakes with healthy populations of native plants. Eurasian watermilfoil is likely to inhabit nutrient-rich lakes where it can form thick underwater strands of tangled stems and vast mats of vegetation at the water's surface. This mass of vegetation can interfere with recreational uses and crowd out native water plant species.

Eurasian watermilfoil reproduces via stem fragmentation and underground runners. Mechanical clearings for beaches, docks, and boat launches creates thousands of new fragments for new growth and clears out native species, providing more space for the invasive watermilfoil. Fragments that cling to boats and trailers can spread the infestation to other lakes. It is extremely important to power wash watercraft equipment after each use to reduce the transfer of invasive species like Eurasian watermilfoil to other lakes, rivers, or stream habitats. Populations have been established in Indiana and Armstrong counties.

Garlic mustard

Native to Europe, garlic mustard was introduced to the U.S. in the 1868, when it was cultivated for food and medical use.

This cool season biennial herb has stalked, triangular to heart shaped, coarsely toothed leaves that, when crushed, give off an odor of garlic. Garlic mustard can reach two to three and a half feet in height, and produces button-like clusters of small white flowers, each with four petals in the shape of a cross. A single plant can produce 1,000 seeds. The seeds are produced in erect, slender pods that, when mature, become shiny black, beginning in May. By late June, the plants die, holding their seeds throughout the summer. The seeds remain viable for five or more years. Identification is critical, because it resembles several native species that grow along side of it, such as toothwarts, sweetcicely, and early saxifrage.

Garlic mustard crowds out native species by aggressively utilizing needed resources, such as light, moisture, nutrients, soil, and space. This affects wildlife, depriving them of the essential food source the displaced native species provided.

For example, one rare insect species West Virginia white butterfly is suppressed by garlic mustard's dominating presence and destruction of toothwarts, native plants that serve as the primary food source and habitat for West Virginia white caterpillars. Due to the lack of toothwarts, the West Virginia white lays its eggs on the garlic mustard, which produces a chemical toxin that affects the eggs ability to hatch.

Effectively managing garlic mustard requires a long-term commitment. Management options involve a combined effort of mechanical and chemical treatments, and vary, depending on the size of the infestation. Small infestations, and where desirable native species reside, manual removal is possible; although efforts to remove the entire plant, including the root system, need to be taken to prevent re-growth. Larger infestations require clipping the plant's stem at ground level once seedpods are present, but before the seeds mature and scatter to prevent seed production. In both instances, the clippings and plant materials need to be carefully removed from the site, so seeds are not dispersed, starting a new infestation. Where heavy infestations exist and where risk to desirable species is minimal, chemical treatment using an herbicide can be effective.

Burning can also be used to control large natural areas infested with garlic mustard. Burning opens the understory and can encourage germination of stored seeds and promote growth of emerging garlic mustard. In order to combat re-growth when burning is used, it must be conducted for three to five consecutive years, regardless of other control methods employed to ensure seed stores have been exhausted (Plant Conservation Alliance's Alien Plant Workgroup (PCAAPW), 2010).

Glossy buckthorn

Native to Europe, glossy buckthorn was introduced to the U.S. for wildlife habitat and to create fence rows in 1800s, and has been established within Jefferson County. A woody shrub or small tree that can reach 20 feet high, this invasive has gray-brown bark with lightly colored lenticels, giving the bark a speckled appearance. The greenish-white flowers blossom from May until the first frost. Red fruits are produced, and then turn purplish-black when they ripened in early June through September (Wieseler & Swearingen).

Glossy buckthorn forms dense, even-aged thickets that crowd and shade native plants. Even the saplings form a dense understory that prevents native plant regeneration. Wetland, swamp, bogs, fens, and wet meadow habitats are typically invaded, although woodland edges, old fields, and roadsides may also be impacted.

Goatsrue

Goatsrue is a perennial herb that ranges from two to six feet tall, and produces up to 20 stems per plant. It has a deep tap root, and has established a population in Indiana County. Each white to bluish or purplish pea like flower produces a seed pod containing nine seeds. A single goatsrue plant can produce 15,000 pods or more each growing season, and the seeds remain viable in soil for 5–10 years (USDA Forest Service, 2005a).

Capable of growing in nutritionally poor soils, this plant grows in marshy fields, woodlands, sunny forest edges, semi-shaded fields, along roadsides, and streambanks. It forms dense crowns, preventing the growth of native plants, out-competing native species for the available resources. The plant is also a nuisance in agricultural areas, because it is toxic to sheep and other ruminants (USDA Forest Service, 2005a).

Standard manual control methods of mowing, clipping, and cutting are not effective with goatsrue because of the plant's ability to rapidly reproduce and flower and seed when very small. Chemical application of herbicides can be affective, but requires reapplication or excavation, because the crowns of treated plants can remain viable for up to seven years (USDA Forest Service, 2005a).

Japanese barberry

Introduced into the U.S. in 1875 as an ornamental plant, Japanese barberry is a dense, deciduous shrub, approximately two to eight feet high. From mid April to May, it has pale yellow flower. Its bright red berries—approximately one centimeter in length—mature in late summer and fall, and persist through the winter. It is a prolific seed producer, and has a 90 percent germination rate. Because of its ornamental interest, nurseries in some states still sell Japanese barberry for landscaping purposes. Populations of Japanese barberry have been established in Armstrong, Indiana, and Jefferson counties (PCAAPW, 2010).

Japanese barberry forms dense stands in natural habitats, such as canopy forest, open woodlands, wetlands, and pastures. It is a shade-tolerant and drought-resistant species that is adaptable to a variety of habitats. It alters the pH, nitrogen levels, and biological activity of the soil. Once established, it displaces native plants, reducing wildlife habitat and forage. Further increasing the reduction of native plants, whitetail deer avoid feeding on it.

Since Japanese barberry reproduces from root fragments in addition to seeds, control methods must remove the entire plant, including its root system, from the infestation site. Small infestations can be removed using manual and mechanical practices, such as pulling plants and mowing. Hand removal of plants should occur in early spring, while the root systems are shallow and soils are moist. Mowing should occur during late summer, before seeds are produced. Chemical treatment is effective on large infestations and should occur early in the season, before native species mature, to minimize the impacts on native species. However, herbicide application during the late summer during fruit production is the most effective.

Japanese knotweed

Commonly found near waterways, in low-lying areas, waste places, utility rights-of-ways, and old home sites, Japanese knotweed was introduced in the U.S. during the late 1800s. It is an ornamental plant that was used for soil and erosion control because of its ability to spread quickly, forming dense thickets. However, the dense thickets of Japanese knotweed excluded native vegetation, altering the natural ecosystem.

Japanese knotweed grows from seeds and is able to regenerate from vegetative pieces. It can grow to over 10 feet in height. The very small, shiny, triangular shaped seeds can be dispersed via wind, water, fill-dirt, and on the soles of shoes. It is a very durable plant, capable of surviving high temperatures, droughts, and flooding.

In order to control populations of Japanese knotweed, a combination of mechanical and chemical treatment techniques should be employed. Single young plants may be pulled by hand if soil conditions and root development is right. However, to prevent resprouting, all roots and runners need to be removed from the site. Chemical treatment using herbicides can be applied to freshly cut stems or foliage (Swearingen, Reshefiloff, Slattery, & Zwicker, 2002).


Japanese knotweed in flower

Japanese honeysuckle

Japanese honeysuckle is a perennial vine that escaped cultivation and invaded natural areas. Introduced to the U.S. from eastern Asia during the 1800s, it was used to control erosion and as cover and food for wildlife.

Populations of Japanese honeysuckle have been established in Armstrong and Indiana counties, while no populations have been reported in Jefferson County.

It is capable of spreading rapidly, due to its vigorous root competition and its ability to twine itself up trees and shrubs in order to dominate the light source. These activities destroy nearby vegetation and girdle trees and shrubs. Like evergreens, Japanese honeysuckle is able to continue growing while most native species are dormant, providing additional opportunities to overtake the native vegetation.

Manual and chemical control methods can be utilized to reduce Japanese honeysuckle populations. Manual removal of small infestations can be effective when the whole plant, including the root, is removed. Sites undergoing manual treatment should be frequently monitored, and removal of new outcrops employed. Creeping vines should be cut and removed in order to protect trees and shrubs from being girdled. In order to remove larger patches of honeysuckle, hold the vine mass above the ground with a rake, while cutting the stem as close to the ground as possible. Mowing is also applicable, but requires two treatments—mid July and mid September. Combining the mowing with chemical treatment increases the effectiveness of treatment. Chemical treatment is most effective when desirable native species are dormant and Japanese honeysuckle continues growing. Apply the herbicide to healthy green leaves during temperatures in which the honeysuckle continues to grow. This will control the honeysuckle population with reduced risk to native species.

Mile-A-Minute

Initially introduced to the U.S. in the late 1800s, mile-a-minute is native to eastern Asia and the Philippines. It is an herbaceous, annual, trailing vine that contains recurved barbs on the stems and leaf blades that can self pollinate. The leaves, light green in color, are shaped like triangles. Ocreae—cup shaped leaf structures that surround the stem and nodes—are where the flowers and fruits emerge. The deep blue fruits are located in clusters at the terminals, with each berry-like fruit containing a single glossy black or reddish-black seed, known as an achene. Mile-a-minute is a prolific seeder, producing many seeds from a single plant. The seeds are durable, remaining viable in soil up to six years, with staggered germination and buoyancy in water for seven to nine days (PCAAPW, 2010).

Mile-a-minute invades open fields, forest edges, roadsides, ditches, streambanks, and uncultivated fields. Its rapid growth allows it to cover existing vegetation and restricts light availability, potentially killing plants below. Dense mats of mile-a-minute weed can restrict the establishment of new vegetation. It is often found in extremely wet soils with poor soil structure and prefers sunlight, but can tolerate shade.

Populations of mile-a-minute have established in Armstrong and Indiana counties. A variety of control methods can be implemented to reduce or eradicate Mile-a-minute populations, such as biological, chemical, manual, and mechanical practices. Containing and eradicating existing populations is the most effective and economical control in preventing the spread of the species. Previously infested sites need monitored several times a year and new plants removed until the seed bank is exhausted.

Multiflora rose

Multiflora rose is a thorny, perennial shrub that was introduced in the U.S. in 1866 from Japan as a rootstock for ornamental roses. In the 1930s, this plant was also used for erosion control and living fences to contain livestock. Over the years, multiflora rose was also used for wildlife habitat and as crash barriers on some roadways (PCAAPW, 2010).

Multiflora rose is a productive plant that can grow rapidly into impenetrable thickets that exclude native plants. It can be found in woodlands, forest edges, and successional fields, and can tolerate various soils, moisture, and light conditions. On average, each plant can produce up to a million seeds per year, and those seeds remain viable in soil up to 20 years. Seeds can be dispersed via wind, wildlife, and water. Germination of the seeds enhances as it progresses through the digestive system of birds.

To control populations of multiflora rose, chemical and manual techniques are currently being utilized, while biological controls are still being developed. Repetitive cutting and mowing of three to six times per a growing season over two to four years have been effective in stressing the plant and reducing the seed reserve. Herbicides can also be used, but require regular reapplication. Combining the two methods increases the efficiency of control methods. Currently populations of multiflora rose have been established in Armstrong and Indiana counties.

Narrowleaf cattail

An aquatic freshwater perennial, populations of narrowleaf cattail have been identified in Indiana and Jefferson counties. Originally introduced into the U.S. from Eurasia, the plant grows three to six feet tall with leaves emerging in the spring and velvety-brown, cigar-shaped spikes approximately two to six inches long maturing in the summer. Narrowleaf cattail reproduces via thick, rapidly spreading, lateral rhizomes and the 250,000 seeds that each plant produces each year. Seeds are dispersed in the wind, and remain viable up to 100 years (USDA Forest Service, 2006a).

A riparian dominant plant, narrowleaf cattail forms thick populations that limit biodiversity. The plant thrives in nutrient rich or slightly saline soils and cannot tolerate shade. It establishes in wetlands, lake shores, river backwaters, roadsides, ditches, disturbed wet areas, bog, fresh, or brackish marshes, lakes, and ponds. The dense rhizome mats reduces the opportunities for native plants to establish or grow.

Management or control for cattail species entails curtailing the spread and density of the population. Management of each site is specific depending on the hydrologic state of the site, its size, and whether water levels can be altered in order to conduct manual or chemical treatment (USDA Forest Service, 2006a).

Purple loosestrife

Native to Eurasia, purple loosestrife was introduced in the U.S. as an ornamental plant and for medicinal uses. The plant grows 4–10 feet in height and produces a showy display of magenta-colored flower spikes. Mature plants are capable of producing 30–50 stems from a single rootstock. Flowers are produced from June to September, and can produce two to three million seeds per year. The flowers are pollinated by insects. In addition to seed dispersal, purple loosestrife can vegetatively reproduce at a rate of one foot per year.

Purple loosestrife adapts to natural and disturbed wetlands. It out-competes native grasses, sedges, and other flowering plants. Purple loosestrife forms dense, homogeneous stands that restrict native wetland plants and reduce habitat for wildlife.

Established in Armstrong County, management opportunities are limited. Manual and chemical treatments are effective for small infestations, while biological controls are more effective on larger infestations. Infestation of young plants can be manually removed prior to seed set. In older, more established populations, the use of herbicides is recommended. Herbicides are most effective when applied late in the season, while the plants are preparing for dormancy. However, an initial treatment mid-summer along with the late treatment would be effective to reduce the amount of seeds being produced.

Spotted Knapweed

Accidentally introduced to the U.S. in the late 1800s as a contaminant in seeds and discarded soil from ship ballasts. This short-lived, perennial, herbaceous plant derived its name from spots that are formed by the black margin on the flower’s bract tips.

Spotted knapweed forms a basal rosette of leaves during its first year, then blooms in subsequent years, typically for three to seven years. It has a deep and stout taproot that allows it to draw-in water from deep in the soil during dry conditions. The flowering stems reach 8–50 inches tall and contain 25 to 35 purple-to-pink flowers per head. Each year—between June and October—the plant produces 500–4,000 seeds per square foot; and the seeds remain viable in soil for five to eight years. Seeds are dispersed via humans, wildlife, livestock, vehicles, fill dirt, crop seed, and contaminated hay.

Spotted knapweed infests natural and semi-natural habitats including barrens, fields, forest, prairies, meadows, pastures, and rangeland. In addition to outcompeting native species, it reduces native plant and animal biodiversity, decreases foliage production, and increases erosion, surface runoff, and stream sedimentation. It prefers to establish in well-drained, light-textured soils that received summer rainfall. However, it does not compete well with vigorously growing grasses in moist areas.

Tree of heaven is an invasive species that has been identified in Armstrong and Indiana counties

Manual, biological, and chemical treatments can be used to combat spotted knapweed populations and combining these efforts increases the effectiveness of their use. Persistent hand pulling of the species prior to seed set is effective when the entire crown and taproot is removed. Two larvae, three moth species, and a weevil are natural predators of spotted knapweed and when introduced into large infestations they can reduce seed production by half. A variety of herbicides are also available treatment options; however each one has advantages and disadvantages. Before using any treatment method determine which method is the best for the infested site and consider a combination of treatment methods.

Star-of-Bethlehem

Native to North Africa, Portugal, Spain, Italy, France, and Turkey, star-of-Bethlehem is an herbaceous plant that grows annually from a bulb. Originally introduced to the U.S. as an ornamental plant, it escaped cultivation (USDA Forest Service, 2005b).

Blooming from May to June, the flowers consist of six white petals that resemble a star and grow at the end of the stem to a maximum height of one foot. The plant produces a fruit that consists of a three-lobed capsule containing several oval black seeds. Growth occurs in moist to wet habitats, characteristic of streambanks, disturbed areas, early successional forest, forest edges, floodplain forest, wet meadows, yards, and gardens (USDA Forest Service, 2005b).

Populations of star-of-Bethlehem have established within Armstrong County, and should be eradicated. Not only does it potentially threaten the native vegetation, but ingesting the flower or bulb can be poisonous (USDA Forest Service, 2005b).

Tree-of-Heaven

Native to China, tree-of-heaven was introduced into the U.S. in the late 1700s as an ornamental plant. Populations of this rapidly growing, deciduous tree have established in Armstrong and Indiana counties. Reproducing via seeds, vegetative sprouts, and sprouts from cut stumps and root fragments; it has the capability to form dense thickets, which overrun native vegetation. Growth typically occurs in disturbed soils, fields, roadsides, fencerows, woodland edges, forest openings, and rocky areas, thriving in poor soils and can tolerate pollution. It is not found in wetlands or shaded areas (USDA Forest Service, 2006b).

Population control can be achieved via manual and chemical methods. Young saplings can be pulled or dug out when soil is moist. However, caution must be taken to remove the entire plant, including its root structure, to prevent regrowth at the site. Cutting mature seed-producing trees would be beneficial in reducing seed spread, but site monitoring must continue frequently to eradicate new saplings. A variety of chemical treatment methods, such as basal bark, cut stump, and hack and squirt, are available; and research should be conducted to determine, which treatment would be the most effective for each site (USDA Forest Service, 2006b).

Wild Parsnip

Established populations of wild parsnip were identified in Armstrong and Indiana counties. Native to Eurasia, it was cultivated in the U.S. for food. Seedlings of this herbaceous plant emerge from February to April forming rosettes and growing for a year or more before forming an aerial shoot and flower that can grow to over four feet high. Each plant produces hundreds of small, yellow flowers that bloom in June to mid July. After producing seeds, the plant dies, leaving the seeds viable for up to four years.

Growth occurs in a variety of habitats, but is commonly found along roadsides, pastures, and in abandoned fields. Wild parsnip invades and modifies open disturbed areas, spreading across the areas to form dense stands. The leaves, stems, flowers, and fruits contain a chemical, that when it comes in contact with skin, causes an intense, localized burning rash and/or blistering (USDA Forest Service, 2006c).

Populations can be controlled through the implementation of manual and chemical practices. Since parsnip is among the first plants to inhabit an area, its detection should be easily identified and removed. On large infestations, brush cutting near the base of the stem can be effective; however, resprouting may occur, requiring frequent monitoring of the site to prevent new infestations. Chemical treatments of herbicide may be used to spot treat basal rosettes (USDA Forest Service, 2006c).

Animals

Invasive animal species include forest pests, such as gypsy moth, Sirex woodwasp, and emerald ash borer, as well as European starling and common pine shoot beetle, and the aquatic species—Asian clam. Information regarding invasive animal species is not readily available and as numerous as that for invasive plant species. The section below details the known invasive animal species.

Asian Clam

The Asian clam is a small, bivalve filter-feeder that removes particles from the water column. Native to Asia, it was introduced into the U.S. in 1938 by Chinese immigrants for food. It resides in the sediment surface or is slightly buried in the substrate of rivers and streams. It has the ability to reproduce rapidly, and populations fluctuate based upon water temperature, because the Asian clam has a low tolerance for cold water.

A surveillance trap used to detect the presence of emerald ash borer and other insect populations

A nuisance to power plants and industrial water plants, the larvae are unknowingly sucked into the plant when water is withdrawn from area waterways for cooling purposes. The mussels form in condenser tubes and pipes, ultimately clogging them, leading to economic problems due to the reduced efficiency of energy generation or the plant's ability to treat wastewater or drinking water. The warm water effluent from these facilities provide excellent habitat for the Asian clam to be able to establish and stabilize its population. Within the project area, the Asian clam has been established in Armstrong County.

<u>*Common Pine Shoot Beetle*</u>

Native to Europe, the common pine shoot beetle was accidentally introduced into the U.S. from infested packaging materials in 1992. This invasive beetle impacts pine trees by breeding under the bark at the base of the trees. The entire State of Pennsylvania remains in a quarantined area, restricting the movement of pine materials in order to prevent further infestation of the species.

The adult beetles range in size from three to five millimeters long and are brown or black and cylindrical. The larva is approximately five millimeters long, with a legless, white body and brown head.

In March and April, the adult beetles become active, leaving their overwintering sites in order to mate and lay eggs in dying or stressed pine trees, freshly cut trees, stumps, logs, and bark mulch. The adult females deposit their eggs into gallery systems bored approximately 10 to 25 centimeters long between the inner bark and outer sapwood of the host. From April to June, the larvae feed and mature under the pine bark in separate feeding galleries. When matured, they stop feeding, pupate, and tunnel through the bark to emerge as adults from July to October. Once they emerge, they fly to new or one-year-old pine shoots to begin maturation feeding. The beetles enter the shoot approximately 15 centimeters or less from the shoot tip, and move up the shoot, hollowing out the center of the shoot 2.5 to 10 centimeters, causing the infected shoot to droop, turn yellow, and fall off. When shoot feeding is severe, the diameter and height growth are reduced, weakening the tree to the point where the beetles begin using the tree as a host for laying their eggs (USDA, 2002).

<u>*Emerald Ash Borer*</u>

Introduced into the U.S. accidentally through wood packaging materials, the emerald ash borer (EAB) is an invasive beetle from eastern Asia and China. It was first discovered in the U.S. in 2002 and in Pennsylvania in 2007. It has been identified in Armstrong and Indiana counties, which are currently under quarantine.

This invasive, metallic-green beetle is approximately 13 millimeters long, and impacts the health of ash trees. Infections of EAB are fatal within one to three years, with no available cure. From May to August, the adults emerge from overwintering sites under the bark to mate. The females lay their eggs in bark crevices, and within 10 days, larvae hatch. The larvae tunnel under the bark to feed and grow through the fall. They remain dormant during winter, when they pupate and emerge as adults in the spring, exiting the tree in a unique D-shaped exit hole.

The most effective management method is to prevent further infestation. Infected counties are placed in a quarantine, which does not permit the transportation of ash products, such as lumber or firewood into or out of the infected counties. Since tree species identification is difficult for the general public, a general firewood quarantine is effective. Campers should purchase firewood near where they will burn it, and should leave any unused wood at the site. The use of pesticides can be effective in controlling EAB populations, but once a tree is infested, it will die. Wood peckers and two parasitic insect species are natural enemies of EAB, and can reduce populations of EAB (USDA, 2009).

<u>*European starling*</u>

The European starling is a hole-nesting species that was introduced into the U.S. in 1890 as part of a plan to introduce all the birds mentioned in the works of Shakespeare. Native to Europe, the starling competes with native species for habitat and destroys crops.

The European starling is a shiny black, glossed-purple or green bird that is speckled with white spots. It is approximately 19–22 centimeters long and weighs 60–90 grams. It prefers urban and suburban habitats, but is also common in grassy areas, such as agricultural fields, pasture, ball fields, and golf courses. Occasionally, the European starling will inhabit open forest and woodland areas, but rarely inhabits dense or wet forest habitats.

European Gypsy Moth

The European gypsy moth was introduced to the U.S. in 1869 for the production of silk, and it escaped confinement. The entire Commonwealth of Pennsylvania is infested by European gypsy moths. Female moths lay their egg mass—cluster of eggs—from which approximately 1,000 hungry caterpillars hatch and feeds upon the leaves of 300 species of trees and shrubs.

Infestations of the European gypsy moth are being reduced and controlled by fungal and viral pathogens. *Entomophaga maimaigo* is a fungus that attacks the gypsy moth caterpillars, and was first reported in 1989. Nuclopolyhedrovirus was accidently introduced in Boston in 1906. The virus infects gypsy moth caterpillars and is used by the U.S. Forest Service to control European gypsy moth populations.

Conservation Areas

Areas designated as conservation areas are limited throughout the region, since no Important Bird Areas or Important Mammal Areas have been identified to date. The majority of conservation areas are biological diversity areas identified in County Natural Heritage Inventories conducted in Armstrong, Indiana, and Jefferson counties (PNHP, 2010a; PNHP, 2010b; PNHP, 2010c).

Natural Heritage Areas

County Natural Heritage Inventories (CNHIs) identify and map areas that sustain species of concern, exemplary natural communities, and broad expanses of intact natural ecosystems that support important components of Pennsylvania's native species biodiversity. Through the completion of a CNHI, biological diversity areas and landscape conservation areas are identified.

Landscape Conservation Area

A Landscape Conservation Area (LCA) is a large, contiguous area that is important because of its size, open space, habitats, and/or inclusion of one or more conservation areas. They include large forest blocks, extensive wetland complexes, and/or areas linking rare element occurrences, such as those recognized in Biological Diversity Areas. There are two LCAs located within the project area.

The **Allegheny River Landscape Conservation Area** is comprised of a variation of owners that include public, private, and corporate entities that stretch the lengths of Allegheny River in Armstrong County. The region is threatened by runoff from land-based human activities (including agriculture and road development), loss of soil and subsequent siltation of any water course, runoff of pesticides and herbicides, and changes in water temperature due to shading, ponding, and/or alterations to the hydrology.

Forest fragmentation is a concern within the Allegheny River LCA; however, impacts can be minimized by utilizing existing disturbed areas for new projects (rather than clearing additional forests), consolidating roads and rights-of-ways where multiple routes exist, and by restoring unused cleared areas, such as abandoned roads or railways. When planning development, it is preferable to avoid complete division of the LCA. The impacts of individual features, such as wells, roads, right-of-ways, and other land clearing can also be minimized by the use of ecologically-informed best management practices in construction and maintenance.

Abandoned mine drainage (AMD) is the main source of water pollution in Armstrong County, although agricultural runoff is also a large contributor. Reduce the effects of AMD and ensure the amount and frequency of fertilizer application will not exceed the ability of the land and water to process it through nutrient management planning. Incentives and education programs to encourage landowners to provide riparian buffers and adopt best management practices would limit inputs of nutrients into the water. Incorporating protection strategies into county and municipal comprehensive plans, carefully monitoring and enforcing regulations for activities on rivers and their tributaries, and developing a vision and planning strategy that meets the needs of the stream and people living within the watershed are needed to protect the watershed's resources.

The **Little Mahoning Creek Landscape Conservation Area** includes the entire Little Mahoning Creek subwatershed, and encompasses all of the biological diversity areas within the Indiana County portion of the project area. The lower portion of Little Mahoning Creek is in the flood zone for the Mahoning Creek Lake flood control project, and is occasionally inundated. Upstream of this area, Little Mahoning Creek is free-flowing.

The majority—92.3 percent—of the Little Mahoning Creek LCA is privately owned, and there is a portion of public land in State Game Lands, as well as the federally-owned Mahoning Creek Lake.

Maintaining suitable stream habitat is essential in order to protect all aquatic species occurring within the Little Mahoning Creek LCA. High water quality, adequate forest cover to maintain water temperatures, and the input of detritus and other organic material from the surrounding forest is essential to the survival of many of the species of concern found throughout the watershed. Removal of forest cover, especially on steep slopes, causes the potential for increased runoff and erosion following storm events.

Non-point source pollution, resulting from runoff from land-based human activities, such as agriculture and road development, causes loss of soil and subsequent siltation of water courses, input of nutrients, runoff of pesticides or herbicides, changes in water temperature due to loss of shading or ponding, and alterations to hydrology that can be detrimental to the stream communities present within the watershed.

Long-term, comprehensive planning in watersheds should take place to protect these resources. Incentives and educational programs to encourage land owners to provide riparian buffers and adopt best management practices may greatly reduce inputs of nutrients and other contaminants into the watershed.

The county and its municipalities should incorporate protection strategies into comprehensive plans and regulations. Careful monitoring and enforcement of regulations for activities on waterways and their tributary streams is important to protect and restore this stream ecosystems. Local and county governments should work with residents to develop a vision that protects water quality while meeting the needs of people living within the watershed.

Invasive species should also be controlled within the Little Mahoning Creek LCA. Control methods can range from mechanical methods (e.g. mowing) to herbicides and pesticides. Chemical control should only be performed by individuals with proper training who are licensed by the Pennsylvania Department of Agriculture. When working in sensitive habitats such as wetlands, a wetland-safe herbicide should be used to avoid indirect effects on other organisms. Each invasive species present on a site may require a different technique for effective control. Recommended control methods are detailed in the invasive species section of this chapter.

Biological Diversity Areas

A Biological Diversity Area (BDA) is a natural area identified in CNHI that supports 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. Table 4-3 identifies the 17 BDA within the project area.

Table 4-3. Biological Diversity Areas

ARMSTRONG TRAIL SOUTH OF TEMPLETON BIOLOGICAL DIVERSITY AREA

Description:	Railroad bed paralleling the Allegheny River, passing between a steep wooded hillside and a large wetland complex. The north-facing wooded slope contains a rich plant assemblage, characteristic of a sugar maple-basswood forest. The large trees and north facing slope aspect provide a cool moist habitat that supports a rich spring wildflower community.
Significance	high
Location:	Boggs Township, Armstrong County
Rare Occurrence:	West Virginia white (butterfly), shiny gray carpet moth (moth), Harbinger of spring (plant), stalked bulrush (plant)
Threats:	1. Fragmentation of forested hillside by roads, utility right-of-ways, or logging
	2. Invasive species, particularly garlic mustard
	3. Excessive deer populations and overbrowsing
	4. Chemical treatment for gypsy moths
Recommendations:	1. Conserve forested habitats, avoid fragmentation, and allow forested habitats to achieve and maintain old-growth conditions
	2. Control invasive species
	3. Maintain a balanced deer population

SOUTH FORK PINE CREEK AT OSCAR BIOLOGICAL DIVERSITY AREA

Description:	A narrow band of forest along South Fork of Pine Creek that has roads and agricultural areas fragmenting the forest into small sections.
Significance	notable
Location:	Boggs, Wayne, and Valley townships, Armstrong County
Rare Occurrence:	sensitive species not identified at jurisdictional agency's request
Threats:	Removal of riparian vegetation
Recommendations:	Maintain and restore vegetative riparian corridors.

TEMPLETON MINE BIOLOGICAL DIVERSITY AREA

Description:	Abandoned mine shaft that mimics natural cave habitats that are capable of supporting a species of concern that has not been identified at the jurisdictional agency's request.
Significance	notable
Location:	Boggs and Pine townships, Armstrong County
Rare Occurrence:	sensitive species not identified at jurisdictional agency's request
Threats:	1. Forest fragmentation
	2. Use of insecticides
	3. Trespassing and vandalism

TEMPLETON MINE BIOLOGICAL DIVERSITY AREA (CONTINUED)

Recommendations:	1. Maintain existing forest and replant cleared areas with native vegetation. 2. Continue to gate mine entrance for safety and to protect site from vandalism and trespassing.

MAHONING CREEK AT PUTNEYVILLE BIOLOGICAL DIVERSITY AREA

Description:	This stretch of Mahoning Creek is forested and adjacent to agricultural fields and residential areas.
Significance	high
Location:	Mahoning Township, Armstrong County
Rare Occurrence:	sensitive species not identified at jurisdictional agency's request
Threats:	1. Removal of vegetative riparian buffer
	2. Use of fertilizer or pesticides
	3. Changes in water flow below Mahoning Dam
Recommendations:	Maintain a vegetative riparian buffer to provide habitat and protect water quality.

MAHONING CREEK DAM OUTFLOW BIOLOGICAL DIVERSITY AREA

Description:	This section of Mahoning Creek maintains a 328 foot forested riparian buffer.
Significance	high
Location:	Mahoning, Redbank, and Wayne townships, Armstrong County
Rare Occurrence:	sensitive species not identified at jurisdictional agency's request
Threats:	Removal of vegetative riparian buffer
Recommendations:	Maintain a vegetative riparian buffer to provide habitat and protect water quality.

MAHONING CREEK RESERVOIR SHORELINE BIOLOGICAL DIVERSITY AREA

Description:	This reservoir was created in 1941 with the damming of Mahoning Creek to control floodwaters in the lower Allegheny and Ohio rivers. Water levels in the reservoir fluctuate as floodwaters fill and are released.
Significance	notable
Location:	Redbank and Wayne townships, Armstrong County
Rare Occurrence:	cattail sedge, sensitive species not identified at jurisdictional agency's request
Threats:	Poorly sited infrastructure improvements could eliminate habitat
Recommendations:	1. Future infrastructure improvements should remain a respectful distance from the active floodplain of the reservoir.
	2. Limit accessibility to nesting sites.

GLADE RUN AT DAYTON BIOLOGICAL DIVERSITY AREA

Description:	Glade Run meanders within its wide, marshy floodplain. The floodplain wetland is dominated by shrubs, grasses, and mixed forbs. As Glade Run approaches the Mahoning Creek reservoir, it narrows and begins a steeper descent through a forested ravine. This forested slope, adjacent to the creek, provides critical habitats and serves as a migration corridor.
Significance	notable
Location:	Wayne Township, Armstrong County
Rare Occurrence:	stalked bulrush (plant), featherbells (plant)
Threats:	no specific threats identified
Recommendations:	1. Conserve streams natural hydrology, floodplain, vegetation, and adequate forested buffer.
	2. Keep infrastructure improvements a respectful distance from the creek's floodplain.
	3. Maintain forested riparian buffers and restore buffers lacking vegetation.

SAINT JAMES CHURCH BIOLOGICAL DIVERSITY AREA

Description:	A slope along St. James Road that supports a population of drooping bluegrass.
Significance	notable
Location:	Ringgold Township, Jefferson County
Rare Occurrence:	drooping bluegrass (plant)
Threats:	1. Invasive species
	2. Road management practices
Recommendations:	1. Annually monitor for invasive species and remove any discovered invasive species.
	2. Survey surrounding landscape for additional populations.
	3. Implement long-term site protection.

ROCHESTER MILLS BIOLOGICAL DIVERSITY AREA

Description:	A patch of old-growth hemlock forest containing many large hemlock and beech trees. Surveys of this site indicated that the core of the forest appears not to have been cut in 150 years.
Significance	notable
Location:	Canoe Township, Indiana County
Rare Occurrence:	Old-growth forest
Threats:	Invasive species, specifically the hemlock woolly adelgid
Recommendations:	Prevent and reduce the risk of an invasion of invasive species.

NASHVILLE SWAMP BIOLOGICAL DIVERSITY AREA

Description:	A hemlock swamp that supports northern pygmy clubtail (drafonfly). This swamp forest is characterized by a "drunken" stand of hemlock and yellow birch that tilt and lean, exposing roots on raised mounds of sphagnum moss. A rich diversity of wetland plants occupies the understory.
Significance	notable
Location:	Grant and Canoe townships, Indiana County
Rare Occurrence:	Hemlock palustrine forest
Threats:	1. Invasive species, particularly hemlock woolly adelgid
	2. Excess input of nutrients from human activities in the watershed degrade water quality. Timber harvesting may increase erosion and siltation, degrading high water quality essential for the support of the northern pygmy clubtail.
Recommendations:	1. Within the wetland, activities of greater intensity than occasional foot traffic should be avoided due to the sensitivity of the habitat. 2. Forest canopy removal operations should be avoided within a 400 meter (~1350 foot) buffer zone surrounding the wetland in order to maintain water quality and natural microclimate. 3. Timber harvesting and road construction should be limited on the slopes overlooking the wetland complex. 4. Management of the forests in this area should include periodic monitoring for the hemlock woolly adelgid and other non-native forest pests. Any proposed treatments for insect outbreaks should take into consideration impacts to aquatic and other forest organisms.

LITTLE MAHONING CREEK AT NASHVILLE BIOLOGICAL DIVERSITY AREA

Description:	Along Mahoning Creek adjacent to State Game Lands 262, this section supports two dragonfly species of concern.
Significance	notable
Location:	Grant Township, Indiana County
Rare Occurrence:	northern pygmy clubtail (dragonfly), ocellated darner (dragonfly)
Threats:	1. Excessive nutrients from human activities
	2. Timber harvesting
Recommendations:	Protect aquatic and riparian habitat.

MUDLICK RUN BIOLOGICAL DIVERSITY AREA

Description:	This site contains a population of featherbells, which rely on early successional habitat in moist meadows with reduced grazing pressure from deer and reduced competition from invasive species.
Significance	notable
Location:	North Mahoning Township, Indiana County
Rare Occurrence:	featherbells (plant)
Threats:	1. Invasive species
	2. Deer overbrowsing
	3. Improper forestry practices

MUDLICK RUN BIOLOGICAL DIVERSITY AREA (CONTINUED)

Threats (continued):	4. Lack of sunlight
Recommendations:	1. Maintain undisturbed forest habitat near a healthy river.
	2. Monitor for invasive species and control species.
	3. Mitigate existing disturbances at site.

LITTLE MAHONING CREEK UPPER BIOLOGICAL DIVERSITY AREA

Description:	The water quality and historically low impacts to aquatic species make this section of Little Mahoning Creek ideal habitat for a variety of aquatic species. The historic diversity that once populated this section has been greatly reduced through mining, improper forestry practices, pollution, and development.
Significance	exceptional
Location:	North Mahoning, West Mahoning, and East Mahoning townships, Indiana County
Rare Occurrence:	Elktoe (mussel), Rainbow mussel (mussel), Round pigtoe (mussel), Wavy-rayed lampmussel (mussel), sensitive species not identified at jurisdictional agency's request
Threats:	1. Natural gas extraction, including Marcellus shale
	2. Excess nutrients and sediments from improper farming, forestry, and development practices
	3. Removal of vegetative buffers
	4. Dams increasing thermal pollution and prohibiting species dispersal
Recommendations:	1. Create vegetative riparian buffers.
	2. Monitor gas wells.
	3. Remove dams and other barriers.

LITTLE MAHONING CREEK LOWER BIOLOGICAL DIVERSITY AREA

Description:	High water quality and limited historical impacts make this section of Little Mahoning Creek ideal habitat for a variety of aquatic species. The historical diversity that once populated this segment of Little Mahoning Creek has been greatly reduced through mining, improper forestry activities, pollution, and development.
Significance	exceptional
Location:	West Mahoning and South Mahoning townships, Indiana County
Rare Occurrence:	mustached clubtail (dragonfly), rapids clubtail (dragonfly), elktoe (mussel), rainbow mussel (mussel), round pigtoe (mussel), wavy-rayed lampmussel (mussel), and three sensitive species not identified at the jurisdictional agencies' request
Threats:	1. Natural gas extraction, including Marcellus shale
	2. Excess nutrients and sediments from improper farming, forestry, and development practices
	3. Removing vegetative riparian buffers

LITTLE MAHONING CREEK LOWER BIOLOGICAL DIVERSITY AREA (CONTINUED)	
Threats (continued):	4. Dams increasing thermal pollution and prohibiting species dispersal
Recommendations:	1. Create and maintain vegetative riparian buffers of at least 300 feet
	2. Remove man-made barriers
	3. Closely monitor natural gas extraction sites, especially Marcellus shale wells

MAHONING CREEK BIOLOGICAL DIVERSITY AREA	
Description:	Largely intact floodplain with good water quality that provides habitat for a wealth of terrestrial and aquatic species. The historical diversity that once populated this section has been greatly reduced through mining, improper forestry practices, pollution, and development. The terrestrial species residing within this site depend on the continued presence of a wide, forested, and undisturbed floodplain to provide the habitat they need.
Significance	exceptional
Location:	West Mahoning Township, Indiana County
Rare Occurrence:	elktoe (mussel), mountain bugbane (plant), rainbow mussel (mussel), round pigtoe (mussel), wavy-rayed lampmussel (mussel); three sensitive species not identified at the jurisdictional agencies' request
Threats:	1. Natural gas extraction, including Marcellus shale
	2. Excess nutrients and sediments from improper farming, forestry, and development practices
	3. Removing vegetative riparian buffers
	4. Abandoned mine lands
Recommendations:	1. Create and maintain vegetative riparian buffers of at least 300 feet.
	2. Reclaim abandoned mine lands.
	3. Closely monitor natural gas extraction sites, especially Marcellus shale wells.

ALLEGHENY RIVER POOL #7 BIOLOGICAL DIVERSITY AREA	
Description:	The Allegheny River has a large diversity of fish and mussel species. The lock and dam system within this section of the Allegheny River, slows and deepens the waterway; however, there are still some segments that mimic free-flowing conditions with shallow and quick-moving riffles that support mussel species.
Significance	exceptional
Location:	Boggs, East Franklin, Rayburn, and Washington townships and Kittanning Borough, Armstrong County
Rare Occurrence:	river redhorse (fish), elktoe (mussel) wabash pigtoe (mussel), fragile papershell (mussel), pink heelsplitter (mussel), paper pondshell (mussel), and three sensitive species of concern not identified at the jurisdictional agencies' request
Threats:	1. Abandoned mine drainage

ALLEGHENY RIVER POOL #7 BIOLOGICAL DIVERSITY AREA (CONTINUED)

Threats (continued):	2. Sand and gravel dredging 3. Agriculture and mining on the river banks 4. Invasive species
Recommendations:	1. Maintain and restore natural hydrology. 2. Restore floodplain habitats to slow and filter runoff. 3. Establish vegetative riparian buffers. 4. Stop river dredging. 5. Control invasive species.

ALLEGHENY RIVER POOL #8 BIOLOGICAL DIVERSITY AREA

Description:	The Allegheny River has a large diversity of fish and mussel species. The lock and dam system within this section of the Allegheny River, slows and deepens the waterway; however, there are still some segments that mimic free-flowing conditions with shallow and quick-moving riffles that support mussel species.
Significance	exceptional
Location:	Boggs, Madison, Pine, and Washington townships, Armstrong County
Rare Occurrence:	river carpsucker (fish), river redhorse (fish) longhead darter (fish), elktoe (mussel), wabash pigtoe (mussel), wavy-rayed lampmussel (mussel), fragile papershell (mussel), round pigtoe (mussel), pink heelsplitter (mussel), red-head pondweed (plant) and four sensitive species of concern not identified at the request of the jurisdictional agencies.
Threats:	1. Abandoned mine drainage 2. Sand and gravel dredging 3. Agriculture and mining on the river banks 4. Invasive species
Recommendations:	1. Maintain and restore natural hydrology. 2. Restore floodplain habitats to slow and filter runoff. 3. Establish vegetative riparian buffers. 4. Stop river dredging. 5. Control invasive species.

CHAPTER 5. CULTURAL RESOURCES

The lower Mahoning, Pine Creek, and Hays Run watersheds, being located in a rural portion of southwestern Pennsylvania, have deep-rooted local histories. Within the Smicksburg and Dayton communities, more than 325 Amish families reside and live simply on the land, declining modern conveniences, such as electricity, telephones, and automobiles. This chapter provides an overview of the region's history, recreational facilities and opportunities, environmental education opportunities, and local events celebrating its culture.

History

Historical Overview

Early Settlement

The first inhabitants of Pennsylvania and the project area were Native Americans, as is evident by the number of historic artifacts, such as arrowheads and clay bowls, which have been found throughout the region.

A Native American camp or settlement is believed to have been located at the mouth of Mahoning Creek. Most likely founded prior to 1790, the village belonged to the Seneca or Cornplanter. Based on artifacts found at the site, the area is believed to have been a market place for trading among Native Americans, French, and English traders. By 1804, the village consisted of 30 huts and 150 people.

Settlement

European settlement of the region was slowed by Native American resistance. Members of the nations of Mohawk, Oneida, Onondaga, Cayuga, and Seneca joined forces during the 16th century with the Tuscarora nation joining in the 18th century to form the Iroquois League known as the Six Nations. The majority of territory within Indiana County was first opened to settlers in 1768 with the signing of the Treaty of Fort Stanwix. In this treaty, Pennsylvania purchased the southern and central portions of Indiana County from the Six Nations, leaving the northern portion, termed as "Mahoning Country," under the ownership of the Six Nations. The line dividing Mahoning Country from the land to the south was known as the Purchase Line. It is the site of the current community of Purchase Line (Helman, 1953).

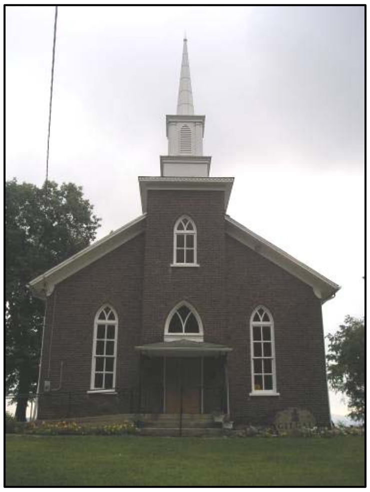
Replica of Fort Mahoning located at Windgate Winery in Smicksburg

Prior to signing the Treaty of Fort Stanwix, early settlers who conducted business with the Native Americans could obtain a permit to live in the region. However, others unlawfully established residences in the region, risking their lives by squatting on these lands, receiving no protection from the government. It was not until 1784, when the second Treaty of Fort Stanwix was signed, that the Mahoning Country became available to European settlers (Helman, 1953).

The lifestyle of earlier settlers was harsh, as they feared for their lives while conducting daily tasks. Among their concerns were attacks from wildlife and hostile Native Americans. While working in agricultural fields, men carried rifles on their sides, especially during harvesting season, the most opportune time for Native Americans to attack.

Among the early settlers in the region were John Ross, William Turnbill, Peter Brice, and William and John Work, a few pioneers that chose the lower Mahoning and Pine Creek watersheds for their homes, despite rugged terrain and constant dangers (Stewart, 1913).

John Ross, who traded with Native Americans, was believed to be one of the first settlers. Although the date of his arrival is unknown, he established himself in the Ross Run area. The stream was later named after him. Many believe that he was the first settler to establish north of the Purchase Line (Stewart, 1913).



Gigal Church, located in East Mahoning Township, Indiana County, is one of the oldest churches in the region

William Turnbill arrived in the region in 1790. He built a sawmill at Pine Creek, which he sold to William Pearst in 1806 after repeated invasions by spies and Native Americans. Pearst rebuilt the sawmill and added a gristmill at the site; both were destroyed by fire in 1813.

Arriving in 1803, Abraham Parkinson settled on 400 acres near Templeton, which he abandoned within a year. In 1804, Peter Brice was the second person to settle in this region. He was the first African American settler in the area. Brice was a friendly person and had a good rapport with Native Americans and other visitors. "During one visit, a group of Native Americans left their canoes on the shore to go on a hunting party. During that time water rose and their canoes would have drifted away had it not been for Brice's assistance (Smith, 1883)."

William Work was an early pioneer who settled in East Mahoning Township in 1804. He was among the first teachers to educate students in the region at a subscription school—a school in which students paid a fee in order to attend. He, along with the Thomas family and his brother John, formed the Gigal Church, dating back to 1797. The existing church building was erected in 1806 (Stewart, 1913).

<u>Industrialization</u>

From the initial settlement, agriculture was the first industry within the region. One of the first tasks the settlers set out to complete upon establishing residence was clearing the land and planting agricultural fields in order to provide the food necessary for their survival. Often during the first couple years, neophyte settlers had to purchase harvests from established neighbors because newly planted fields took several years to become productive.

Gristmills were erected early on in community development, typically by one of the first settlers of the region. Gristmills grind grain into flour for storage and use during winter months. Erection of a gristmill depended upon the distance from the nearest settlement with an existing gristmill.

Due to the late settlement, the lumbering industry was already in full swing as the region was being established. Most of the logging activities occurred during the winter months, because it was easier to transport the logs to waterways and sawmills while the ground was frozen. Once at the sawmills, the logs were cut into lumber or used to build rafts for transporting lumber downstream during spring floods.

Early gristmills and sawmills were located along waterways. The mills used the force of the water in the stream to turn the waterwheel or turbines in the mills in order to make them grind and cut. Their location along waterways also made it easy to transport products downstream.

Iron works played an important role into the region's history. Several iron and charcoal furnaces were located within the project area. Two of the furnaces were directly located on Mahoning Creek. The Phoenix Furnace was built below Milton in 1846. The furnace used hematite found nearby, but was never successful before it blew out in 1853. Remnants of the Phoenix Furnace are buried in the rubble behind Mahoning Creek Dam. One mile below Mahoning Creek Dam, the McCrea Furnace was built in 1857. The stack of the charcoal furnace fell in the 1960s. Ruins of the furnace remain visible at the site.

Postal Delivery

Postal delivery advanced during the 1800s from messenger and horseback delivery to the postal system utilized in the U.S. today. In colonial times, communications depended on friends, merchants, and Native Americans to carry messages between colonies. Most correspondences ran between the colonies and England, strictly through mail and newspapers.

Started by private services, mail delivery occurred every two weeks. Dependant upon weather conditions, the trip took three to five days. By 1801, the U.S. Postal Service took over weekly delivery. Mail was delivered to the nearest tavern or store. By 1818, delivery increased to twice a week, and daily delivery began in 1827.

William Penn established Pennsylvania's first post office in 1683. By 1818, only one post office existed between Indiana and Kittanning. Mail was delivered by horseback once a week. Over time, routes expanded and more post offices were opened, leading to the use of stage coaches as a more effective way to transport mail.

Within the lower Mahoning region, the first post office opened in Orrsville—near the present day village of Mahoning—in 1838. By 1913, there were seven post offices within the region in the towns of Dayton, Echo, Mahoning, Mosgrove, Seminole, Templeton, and Widnoon (U.S. Postal Service; Smith, 1883). In 1822, with the completion of the turnpike, stage coaches were finally able to journey to this region, bringing mail three days a week.

Many families waited days, weeks, or even months, coordinating trips to town for supplies, to pick up their mail until 1893 when rural delivery was introduced. Proponents against rural delivery claimed that safety and cost were not worth the convenience. In those days, the cost to send a letter varied based on the destination. In 1799, letters that traveled less than 40 miles cost 8 cents, 40-90 miles cost 10 cents, 90-500 miles cost varied from 12.5 to 20 cents and 25 cents was the cost for anything over 500 miles. Beginning in 1863, postal rates were established based on weight of the envelope— two cents per half ounce—as opposed to distance of travel (U.S. Postal Service).

As mail delivery grew, infrastructure became necessary. A byproduct of postal delivery was the development of roadways. Local government began to extend and improve highways after the postal service refused rural delivery on routes that were in poor condition. As time went on, the introduction of the railroad further advanced postal delivery. Trains were able to transport mass volumes of mail more rapidly.

Transportation

Transportation was harsh during the early settlement; the lack of roads required the majority of transportation to take place on foot or horseback. A Native American path traveled from southern Erie County, terminating at Mahoning Creek. All travel was dangerous due to a lack of bridges, forcing travelers to ford streams.

Early on, commercial traffic consisted of canoes, rafts, and keelboats traveling down the Allegheny River to Pittsburgh. In 1798, the Allegheny River was declared a public highway. It was used to transport passengers, goods, and freight in steamboats and barges. With the completion of the Pennsylvania Canal around 1828, river transportation began to decline.

Around the same time, stage coaches began transporting passengers and mail from Mahoning Creek to Brookville. At one time there were two stage lines competing for business in the region.

In 1837, a charter was issued for the construction of the Pittsburgh, Kittanning, and Warren Railroad; the name was changed to Allegheny Valley Railroad prior to construction.

Education

Early schools were established by church organizations or through subscription services. Many of the early schools that formed were organized by religion, especially in smaller communities that only had one religious denomination. In the more rural areas, where students could not walk to churches to attend school, families jointly established subscription schools. In these schools, pupils paid the teacher in order to attend classes.

Old Crawford Schoolhouse, a one-room school house located near Pine Grove Cemetery

Students that were able to attend early schools were predominately male; they attended during the winter months when they were not needed to help in the agricultural fields. Young females stayed at home to help their mothers with housework, such as cooking, cleaning, and sewing.

The Common School Law passed in 1834, making it possible for anyone to attend classes regardless of age, sex, class, or race, at no cost. At this time, most of the schools were established within the region.

Prior to 1850, the standard of education was very low; the educator was often just a few lessons ahead of the pupils. Rapid development of the region demanded a higher standard of education, leading to the formation of private and parochial schools.

Glade Run Academy was formed in 1851, associated with Glade Run Church. Students were charged tuition based upon the classes in which they enrolled, plus one dollar and fifty cents per week for room and board. The school attracted students from Armstrong, Indiana, Clarion, Jefferson, Westmoreland, Clearfield, and Washington counties. By 1861, school enrollment had reached 356 students. Beginning in 1880, enrollment dwindled, leading to the school's closing in 1895.

Currently the American Cadet Training Center, this was originally the Dayton Normal Institute, then the Dayton Joint High School, which was located at the site of the former Dayton Orphans School

Dayton Union Academy was formed as a non-sectarian institution in 1852 as a joint effort between United Presbyterian and Methodist Episcopal congregations. After initially flourishing, the school's enrollment diminished. In 1905, the Dayton Union Academy merged with the Dayton Normal Institute.

Originally established as a home for children of deceased soldiers, the **Dayton Orphans School** opened in 1873 to the first 51 students. It was located on 35 acres. By 1876, enrollment had reached 208 students. The school was disbanded in 1888 when fire destroyed all but one building. Students were transferred to neighboring schools.

The **Dayton Normal Institute** was founded in 1905. Located at the site of the Old Dayton Orphans School, it operated until 1917 when the community decided to make it a public high school, and then a vocational school two years later. It attracted students from outside the school district for classes in agriculture and home economics. In 1948, the school became the Dayton Joint High School.

Origin of Names

Mahoning Creek was previously named “Mo-hul-buc-ti-ton” or “Mackol Pakston,” meaning “where we abandoned our canoes.” It is not known when or why the stream’s name was changed to Mahoning Creek (Smith, 1883).

Native Americans called Pine Creek “Cuwen-hanne,” meaning “stream flowing through pine lands” (Smith, 1883).

Significant People

John McCormick was a well known and well versed individual from the region who has been recognized at the Smithsonian Institution’s Museum of Science and Technology in Washington, D.C. Born in Blair County, he moved with his family to the Smicksburg region at a young age. Throughout his life, McCormick held positions as a craftsman on the Allegheny River, cabinet maker, wood carver, and painter. He became a well known music teacher, traveling over 40,000 miles by foot for his traveling music school. Between 1868 and 1870, he moved to Massachusetts to further the development of an invention of his—a water turbine—which took first place at the Edinburg Exposition in 1890.

Historical Sites, Structures, and Districts

The National Historic Preservation Act, enacted in 1966, established the National Register of Historic Places. This register honors historical sites, structures, and districts significant to American history, architecture, archeology, engineering, and culture, while respecting private ownership and management of the sites. Private property owners are encouraged to maintain and preserve historic integrity of registered sites and structures, but may maintain or manage their property with their own discretion.

The McCormick House is a privately owned residence; please respect private landowner rights when visiting

The Pennsylvania Historical and Museum Commission (PHMC) manages the register for Pennsylvania and submits nominated properties to the National Parks Service for approval. If the owner—or majority of owners, if the property is owned by more than one person—of a nominated property objects to the nomination, it is sent to the National Parks Service for determination of eligibility without formally listing the property in the National Register (National Parks Service, 2001).

Within the lower Mahoning Creek watershed, four sites are identified on the National Register of Historic Places. There are no sites within the Pine Creek or Hays Run watersheds. These sites are identified on Figure 5-1.

The **John B. McCormick House** was placed on the registry in 1974. Built for Judge Joshua Lewis in 1825, the house was sold to John McCormick in 1896. The listing on the registry is for the architecture of the house and for McCormick’s contributions to inventing and engineering.

In 1976, the **Thomas Marshall House** was the first site in Armstrong County to be placed on the National Historic Registry. Built in 1865, it was placed on the registry primarily for its significance in refinements of emerging architectural trends in the rural community. The property also was selected for placement based on the family's history in the region. Thomas was a local farmer who was believed to be an ally of the Underground Railroad and fugitive slaves. His grandparents are credited as being the first European settlers in the area, arriving in 1803.

Madison-Mahoning Township Bridge located near Thayerton, PA

Coldwell Cut Viaduct—or Hogback Hill Bridge, as it is otherwise known—was added to the registry in 1988. Built in 1922, the viaduct is a typical open-spandrel concrete arch bridge that spans 128 feet over the Pittsburgh and Shawmut Railroad near Seminole. It has been placed on the registry because of its unique design and use in western Pennsylvania.

The **Bridge between Madison and Mahoning Townships** also was placed on the registry in 1988. It spans over Mahoning Creek on State Route 1007, between Deanville and Thayerton, connecting Madison and Mahoning townships in Armstrong County.

Recreation

Any activity conducted for amusement during leisure time is considered recreation. Recreation is not only beneficial to the local economy, it is a healthy endeavor. In Pennsylvania, recreation is a big business, ranking as the second-leading industry. For some areas in Pennsylvania, recreation is the only industry. It brings in revenue from tourists who seek food, accommodations, and mementos of their visits.

Within the project area, the communities of Smicksburg and Dayton are popular tourist destinations. Among these rural towns resides an Amish community, living a simple life without everyday, modern conveniences, such as indoor plumbing or electricity. Tourists flock to the area for a peek at the simple lifestyle, and to marvel at how these communities survive without modern schools, automobiles, and telephones. Visitors also patronize the numerous specialty shops that thrive in the region, selling products and goods either needed or developed by the Amish community. Figure 5-2 displays the recreational facilities within the project area.

Recreational Opportunities

Parks

Parks can be classified into categories based upon size, service population, and intended use. Figure 5-1 displays the park locations, while Appendix J highlights attributes of each facility.

Mahoning Creek Lake, Dayton Fairgrounds, and Hemlock Lake are **regional parks**. They are located within 30 to 60 minutes of the population they serve. Mahoning Creek Lake is owned by the U.S. Army Corps of Engineers (USACE). It provides recreational opportunities for hiking,

Hemlock Lake, located in North Mahoning Township, is under the management of Indiana County Parks and Trails

boating, fishing, camping, and picnicking. The Dayton Fairgrounds encompass 107 acres and provide a camping area, carnival area, show arena, and a racetrack with a grandstand. Hemlock Lake provides 205 acres, including a 60-acre lake, two boat launches, picnic shelters, restrooms, and hiking trails.

In the project area, 45 percent of the parks are located within one to two miles of their users and are considered **community parks**. They range in size from 1.4 to 26 acres, and are all located within the Mahoning Creek watershed. Community parks include: Greenwall Community Park, Dayton Ball Field, Dayton Fire Hall Park, Timblin Park, Old Smicksburg Park, and Templeton Community Park.

Smaller parks located within three-quarters of a mile of residents are **neighborhood parks**. These parks are intended to provide recreational opportunities close-to-home. Dayton Grove, a small 0.5-acre park with a playground, pavilion, and memorial, is the only neighborhood park identified within the project area. However, some elementary school playgrounds also fulfill the role of neighborhood parks. Playgrounds located at Dayton Elementary School and Mahoning Elementary School are open to the public when not in use by the schools, and can be considered neighborhood parks.

Trails

As links among communities, trails provide alternative transportation, recreation, and educational opportunities. Trail activities include hiking, bicycling, horseback riding, environmental education, and historic cultivation. There are four trails that provide recreational opportunities within the project area—Armstrong Trail, Baker Trail, Jefferson County Multi-Use Trail and the Wood Duck Trail.

The **Armstrong Trail** is a 52.5-mile trail that follows the Allegheny River through Armstrong and Clarion counties. The trail provides access for walking, bicycling, horseback riding, cross-country skiing, in-line skating, mountain biking, and fishing. Established in 1992, the trail follows a portion of the old Allegheny Valley Railroad that was once owned by Conrail. Within the project area, the Armstrong Trail follows the Allegheny River for approximately 5 miles from the mouth of Hays Run to the mouth of Mahoning Creek.

The **Baker Trail** is a 132-mile hiking and backpacking trail that follows forest paths, old jeep trails, and dirt roadways from Freeport to the Allegheny National Forest near Cook Forest State Park. It was established in 1950 in honor of Horace Forbes, a former attorney from Pittsburgh. Along the trail, there are nine Adirondack shelters available for use. The trail enters the project area in South Mahoning Township in Indiana County, and continues in a northwest direction before exiting the watershed in Redbank Township, Armstrong County.

A stretch of the Jefferson County multi-use trail

The **Jefferson County Multi-Use Trail** is a rail-trail within the project area, which passes through Ringgold Township and Timblin Borough before connecting with the Baker Trail just north of Eddyville in Armstrong County.

The **Wood Duck Trail** is a hiking trail loop located on the western side of Hemlock Lake that provides access for nature study at the park.

Golfing

White Oak Golf Course is the only golf course located within the project area. It is a nine-hole public course and occupies 2,743 acres.

Camping

There are a few opportunities available for camping, a popular recreational activity within the watershed. Three public campgrounds provide a variety of facilities and amenities to guests. Also located within the region are two private church camps that offer a spiritual camping experience to visitors.

Milton Loop Campground

Milton Loop Campground is located on 28 acres near the Milton Loop access to Mahoning Creek Lake. It provides 52 campsites, modern restrooms, and a sanitary disposal station.

Creekbend Campground is located near the entrance of the Mahoning Creek dam and reservoir. The campground provides showers, electric and water hook-ups, and a dump station. Access for fishing, hiking, and boating is located nearby.

Nautical Mile Campground and Marina is located along the Allegheny River in Templeton, adjacent to the Armstrong Trail. The campground provides primitive camping opportunities in addition to full hook-ups. Also available at this site are a playground, shower house, and boat launch.

In addition to campgrounds open to the public, the two private church camps within the project area are the **Little Mahoning Bible Camp** and **Laurel Lake Camp and Retreat Center.** These facilities are religious camps located in Smicksburg, Pa. and Rossiter, Pa., respectively. They provide numerous recreational activities and environmental education opportunities to campers.

Fishing

Since 1866, protection, management, and regulation of Pennsylvania’s water resources for recreational purposes have been the responsibility of the Pennsylvania Fish and Boat Commission (PFBC). Nearly two million people fish in Pennsylvania each year, with an estimated economic impact of $1.35 billion (PFBC).

Some waterways within the lower Mahoning Creek region are designated as trout approved waters or special regulation areas. **Approved Trout Waters** are waterways that are open to the public for fishing and meet criteria qualifying them to be stocked with trout by PFBC. North Fork Pine Creek and South Fork Pine Creek within the Pine Creek watershed have been designated. Glade Run, Mudlick Run, and Little Mahoning Creek (at the intersection of T-838 and SR 1037 downstream to McCormick Bridge SR4018) have been designated within the Mahoning Creek watershed (PFBC, 2009).

Mahoning Creek in Armstrong County, from the dam outflow to the confluence of Pine Run, has been designated as a **Year-Round Trout Approved Waterway**; meaning that during the extended season (January 1–February 28 and September 8–December 31) anglers can harvest fish caught using extended season size and creel limits. From March 1 to opening day, fishing is permitted on a catch and release basis; no trout can be taken or be in the possession of an angler (PFBC, 2009).

A 4.1-mile segment of Little Mahoning Creek from the Oberlin Road Bridge abutments to Cessna Run is designated as a **Catch & Release Fly-fishing Only Area**, restricting its use to fly-fishing and requiring the release of all fish caught (PFBC, 2009).

Hunting

The Pennsylvania Game Commission (PGC) manages and regulates hunting, a popular recreation activity throughout western Pennsylvania. An individual can begin hunting at 12 years of age, after passing a hunter safety course.

In many states, the number of hunters is rapidly declining. This holds true in Pennsylvania. The recruitment of new hunters and trappers in Pennsylvania is essential for future wildlife management and for the preservation of the hunting and trapping heritage of the state. Since 1998, the sale of licenses has decreased. Table 5-1 lists the number of licenses sold from 1998 to 2008 (PGC, 2009).

In an effort to increase hunting, youth have been targeted in two new programs—Junior License and Mentored Youth.

The **Junior Hunting License Program** allows youth between the ages of 12 and 16 to hunt. The program provides special hunting days where only youth hunters can hunt for pheasants, wild turkey, and waterfowl. Junior hunters who have the proper tags may harvest an antlerless deer during the permitted season.

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

Table 5-1. 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	926,892

(Source: PGC, 2009)

Area sportsmen groups organize hunts and youth programs in an effort to increase participation. Local sportsmen's clubs, in cooperation with PGC, host hunter safety courses that educate new hunters about laws and safety.

Pennsylvania state game lands are public lands (SGL) dedicated to wildlife enhancement. They are managed with an emphasis on game species. Three state game lands—SGL 137, 262, and 287—provide 2,539 acres for hunting within the watersheds.

Boating

In Pennsylvania, boating regulations are under the jurisdiction of PFBC. An estimated 2.5 million people boat on lakes and 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 to the economy each year (PFBC, 2008).

PFBC manages 250 public access areas to Pennsylvania's waterways. In addition, organizations and municipalities manage many other access points. Within the project area, there are five official boat launch sites: Templeton, Sportsman's Access, Milton Loop, and two Hemlock Lake sites.

The **Templeton Access** is a PFBC access along the eastern bank of the Allegheny River. It provides access for powered and non-powered watercrafts and parking for 10–20 vehicles.

Sportsman's Access is owned by USACE and is leased to PFBC to manage. Only canoes, kayaks, and car-top vessels are permitted at the site. Parking is available for 18 cars, but trailers are not allowed.

Milton Loop Boat Launch is owned by the USACE and is leased to PFBC. It is located along Route 839, and shares an access road with the Milton Loop Campground. The ramp is available for use from mid-April to mid-October; however, conditions may not be safe for launching until mid-May.

Milton Loop Boat Launch

Hemlock Lake, a 60-acre impoundment, is owned by PFBC and leased to Indiana County Parks and Trails for management at the site. The east and west sites provide access to the reservoir for electric motor and hand-propelled watercrafts, such as canoes, kayaks, and row boats.

In addition to the official access sites, the region possesses several more potential access sites, some of which are already being used unofficially. For example, the park in Putneyville has a fairly level streambank ideal for canoe and kayak access, along with available parking at the site. Formalizing these unofficial access sites and developing a water trail guide would benefit this region.

In 2005, PFBC initiated the Boating Facility Grant Program in an effort to increase public access to waterways. This program funds 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.

Geocaching

Initiated in Portland, Oregon in May of 2000, geocaching is on the rise as a recreational activity. An adventurous treasure hunt game, it requires players to use a global positioning system (GPS) unit to find a hidden cache. At first, the game was called "GPS Stash Hunt," but was later changed to geocaching due to the negative connotation of the word "stash." The name geocache comes from "geo," meaning "earth," and "cache," a French word referring to a place to store or hide items.

The game is simple and can be played almost anywhere in the world. Players obtain coordinates to a cache location via the Internet. They then travel to the cache coordinates and search for the hidden treasure. When a participant finds a cache, they may take an item from the cache if they can replace it with one of same value and sign the logbook. The logbook provides information to the cache hider about who has found the cache and when they found it. A variety of caches are available within the region. As of August 2009, there were 545 caches located within 30 miles of Dayton, Pa. More information about geocaching is available at http://www.geocaching.com.

Recreational Vehicles

All-terrain Vehicle (ATV) use is a popular recreational activity within the watershed. An off-road vehicle, off-highway vehicle, or ATV, is any motorized vehicle capable of cross-country travel on land, water, snow, ice, marsh, swampland, and other natural terrain. ATV use is on the rise, and the improper or illegal use of ATVs by some has given this activity a bad reputation.

The Pennsylvania Department of Conservation and Natural Resources (DCNR), along with the Commonwealth of Pennsylvania, regulate the use of ATVs Defined in Chapter 77 of the Pennsylvania Vehicle Law, ATV owners and operators are required to register their vehicle. 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.

There are no specific recreational facilities available for use by ATV enthusiasts within the watershed. Establishing an environmentally sound public trail or an ATV park would provide riders with legal opportunities to ride, potentially reducing damages to private property and increasing safety for riders. Public facilities, like those developed at Rock Run in Cambria County, for the exclusive use of ATVs would benefit the area.

Environmental Education

Environmental education is "a learning process dealing 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). Environmental education is an ongoing venture with roots in the agricultural community; it is expanding as new techniques and technologies are discovered.

Many organizations and agencies provide environmental education to everyone from preschool-aged students to senior citizens. Local conservation districts, Pennsylvania Department of Environmental Protection (DEP), PFBC, PGC, and USACE partner with local organizations, such as Little Mahoning Watershed Association and Western Pennsylvania Conservancy (WPC) to host public workshops, provide school workshops, or work with individual landowners.

The Envirothon is one example of the collaboration among local and state agencies in environmental education. An Envirothon is a competition in which teams of high school students contend to answer questions on aquatics, forestry, soils, land use, wildlife, and current environmental issues. Competitions are held at the county level. The winner of county competitions advances to the state competition, with the opportunity to advance to the national competition.

Organizations, such as DEP, PFBC, PGC, conservation districts, and WPC provide environmental education as one of their ongoing responsibilities. Individual visits to landowners, although casual, provide excellent educational opportunities for specific environmental issues. WPC also partners with schools, such as Marion Center High School, to provide students with an opportunity to assess the quality of area streams via conducting visual, chemical, and biological surveys.

Students from Marion Center High School electrofishing in a section of Little Mahoning Creek with WPC staff

Local Attractions

Dayton Fairgrounds

The Dayton Fairgrounds plays host to the Dayton Fair. The Dayton Fair is held in August, and serves as the Armstrong County fair. The fair features livestock, a carnival, tractor pulls, and a demolition derby.

Marion Center Speedway

Marion Center Speedway is a half-mile, semi-banked race track that hosts stock car races featuring late model, limited late model, street stock, strictly stocks, and four-cylinder vehicles. Races are held on Saturdays from May through September, with Sundays held as rain dates. More information about the Marion Center Speedway is available on their website, http://www.marioncenterspeedway.com.

Thomas Marshall House in Dayton, PA

Thomas Marshall House

The Thomas Marshall House is the home of the Dayton Historical Society. A museum in the house is open on Saturdays from Memorial Day to mid-October from 2:00–4:00 p.m. for tours and on other days by appointment.

Dayton Historical Society also hosts dinners and entertainment several times a month for any requesting organizations or groups. All events must be scheduled well in advance. More information about the Thomas Marshall House is available on the historical society's website, http://www.daytonpa.org.

John Schmick Museum

The John Schmick museum is run by the Smicksburg Area Heritage Society. The museum exhibits the local history of Smicksburg, Pa. and its founder, John Schmick. The museum contains a gift shop, genealogical library, and visitor information.

Smicksburg Specialty Shops

Smicksburg Specialty Shops are a series of quaint shops in and around the town of Smicksburg, Pa. The stores, although not usually owned by the Amish, sell goods produced by the Amish community. Specialty shops include shoe repair, wood crafts, bulk foods, home-baked goods, and quilt shops. In addition, The Village Sampler and Eating House, Smicksburg Pottery, and various antique shops may interest patrons.

Windgate Winery

Windgate winery was established outside of Smicksburg in 1987 by Daniel and Lillian Enerson. The winery produces 6,000 gallons of fine, estate-grown wine each year. Group tours for 15 or more people are available if they are scheduled in advanced. In addition, two wine making courses are held at Windgate—Goof Proof Red and White Home Winemaking, as well as Rose and Fruit Winemaking are held during the spring and fall. For more information about wine making classes, scheduling a tour, or the winery, visit their website, http://www.windgatevinyards.com.

Also located at the winery is a historical display and replica of Fort Mahoning. Inside the fort are several educational displays about how the fort was built, the Great Shamokin Path, and Native American paths of Pennsylvania.

Annual Events

Smicksburg Specialty Shops and Borough of Smicksburg host a variety of events throughout the year. In June, the community holds its annual Smicksburg Country Summer Festival. Over the Fourth of July, it's the Celebrate our Country in the Country celebration featuring live music and horse drawn wagon rides through Historic Smicksburg Park. During the fall, the area hosts three events—Apple Festival in September, Smicksburg Community Fall Festival in October, and Smicksburg Pumpkin Festival in October. Rounding out the year the Smicksburg Old Fashioned Country Christmas Open House is held in November featuring hay rides, bon fire, visits with Santa and the community's holiday light up night. More information about the events is available at http://www.smicksburg.net/events.html.

CHAPTER 6. ISSUES AND CONCERNS


Area residents share concerns for the region at a regional focus group meeting

The development of the Lower Mahoning Regional Watershed Conservation Plan provided interested community members, visitors, and those who work in the region—also known as stakeholders—several opportunities to provide their unique perspective on topics affecting the region. Western Pennsylvania Conservancy (WPC), Little Mahoning Creek Watershed Association (LMCWA), and the project committee hosted a series of workshops, a focus group meeting, interviewed areas residents, and conducted a public survey to ascertain the community's perspective about the watershed. Issues and concerns identified through the various public outreach methods were compiled and are presented within this chapter. The expressed views and opinions represent those of the participating stakeholders, and do not necessarily reflect the views and opinions of WPC, LMCWA, or any of the representatives or representative organizations on the project steering committee.

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 first-hand 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 lower Mahoning Creek, Pine Creek, and Hays Run watersheds.

Meeting Summaries

Initial Meetings

Two informational public meetings were held in early 2009 to engage the public in discussion about the watershed's concerns and issues, as well as provide information about the development of the watershed conservation plan. The first meeting was held at the Dayton United Methodist Church on January 28, 2009. The second meeting was held at the Marion Center Community Building rescheduled to February 18, 2009, after inclement weather postponed the original January meeting date.

Student Workshops

In January 2009, approximately 300 students from Marion Center School District shared their insight about the watershed region while they discussed what they liked about the area, what could be improved, changes to the area, recreational opportunities, and potential projects for the area. The information gathered from the students is important, because it provides a different perspective representation of the younger generation. The results of the school visits will be identified later in this chapter.

Focus Group

In April 2009, a specialized meeting was held with members of the advisory committees that focused on the resources within the project area. The results of that meeting will be identified later in this chapter.

Issues and Concerns

Issues and concerns of community members in the watershed region will be identified and summarized in the following sections. The issues and concerns about to be discussed have been developed from the information gathered through the initial meetings, school visits, surveys, and individual interviews.

Natural Resource Extraction

Being able to recover natural resources stored below the earth's surface should not come at the expense of the environment. There needs to be a balanced approach to retrieve these important mineral resources while preserving the quality of environment. There are two major natural resource extraction activities occurring within the watershed—gas drilling and mining.

Gas Wells

Drilling for gas throughout the project area is a major concern of area residents. Mostly due to the increased attention that drillers are receiving from their exploration within the Marcellus shale formation and a lack of quality information available about the process. Most residents are scared of the unknown impacts that could threaten the region's air, land, and water quality. They do not want a repeat of what happened with the mining industry.

In order to appease landowners, drilling companies should prove to landowners that impacts to the quality of life that landowners are accustomed to will not be impacted. They need to be upfront about the process, chemicals used in the fracking process, groundwater contamination, and take responsibility in the event of a disaster, such as the Marcellus well explosion in Clearfield County in 2010.

Another concern area residents have about the exploration of gas within the Marcellus shale formation is the economical impacts to the community. Area residents understand that gas well drilling creates jobs, but for how long and who gets these jobs—local citizens or current drilling company employees from out of the area. Citizens also want to know who pays for the destruction caused to the local roadways from hauling heavy equipment to the drilling sites and whether or not local communities are compensated for the use of their resources, such as fire departments and police. Local municipalities are strapped financially by maintaining municipal roadways without increased stresses put on them by heavy drilling equipment.

An active coal mine site in East Mahoning Township

Mining

Although the degree of mining within the project area has been significantly reduced from decades ago, area residents still have concerns about the process. Efforts to remediate abandoned mine drainage that degraded the quality of many streams throughout the region are ongoing. Thankfully, there are regulations today that were not in place prior to the 1970s that protect water quality and hold the mining companies responsible, though more work is needed to reduce abandoned mine drainage.

Infrastructure

There are many issues relating to the infrastructure of the watershed area. However, roadways and telecommunication were reoccurring themes when area residents were asked what improvements were needed throughout the region.

Roadways

Dirt and gravel roadways dominate the project area. They can increase sedimentation in nearby streams, unless preventive best management practices are implemented. However, municipalities are receiving less funding for the maintenance of roadways, with most road money being used to repair outdated bridges. Some dirt and gravel road projects have been implemented to manage road runoff and reduce the amount of sedimentation that enters area waterways.

Telecommunication

Cell phone connectivity and high speed internet connections are inadequate throughout the region. Service is available in isolated, populated areas. Local businesses and students suffer due to the lack of quality internet service in the region. The lack of cell phone reception is a safety concern for potential tourists.

Both internet and cell phone services rely on private providers to establish service. Providers invest in communities where they receive a financial return via customers purchasing their services. Due to the low population within the lower Mahoning Creek region, it is unlikely the area will be capable of improving these services unless a grant could be obtained to help offset the service providers' cost for installing the needed service towers.

Recreation

The region encompasses a variety of recreational possibilities; however, the majority of these opportunities involve personal discovery of nature, such as wildlife and bird observation, hunting, and fishing. There are a few facilities for recreation, such as county and municipal parks.

Stream Access

One of the common themes through the outreach process has been a desire for the establishment of stream access sites for fishing and paddling. The development of a water trail for Mahoning Creek, along with the formalized establishment of canoe and kayak launch sites is needed. The area possesses many sites that are already informally being utilized as launch sites. Upgrading these sites to include parking, access, and signage would be an added benefit to the region.

Hikers along the trail at Mahoning Dam

Trails

There are a variety of trail types throughout the project area. The Baker Trail is a hiking and backpacking trail, while the Armstrong Trail provides hiking, walking, and bicycling along its corridor. With a variety of trails for users, there should be a network established in order to link trails to one another or to other recreational sites, such as parks, campgrounds, or downtown community areas.

Off-Road Vehicles

The use of Off-Road Vehicles (ORVs) within the project area is a very controversial issue that primarily draws the watershed community into two visions. Half of the area enjoys using ORVs, and would like to have more opportunities to ride them, while the other half of the community would like to ban their existence due to damages caused by illegal operation. Obviously, the issues are not going to go away, and residents need to work together to come to a reasonable alternative that benefits both parties.

Many landowners are against the use of ORVs, because of destruction to their properties and liability issues. These illegal activities, such as trespassing, cause landowners, who might not otherwise post the property, to do so. If users of ORVs would obtain permission and follow instructions from landowners before venturing on their property, more landowners may be willing to permit their use. Often times, landowners just want to know who is on their property and what they are doing. Another alternative would be the development of trails and/or a park for the exclusive use of ORVs.

Illegal Dumpsites

As with most rural areas, the lower Mahoning Creek region is plagued by illegal dumping. PA CleanWays has been partnering with municipalities and other organizations, such as LMCWA and WPC, to clean up and prevent illegal dumping. More effort to clean these sites is needed; however, efforts to stop illegal dumping are also needed. A combination of education, alternative options and enforcement with strict penalties must occur to make an impact.

Public Meeting Results

Project Area

Positives:

- Fly Project (for locals, as well as for tourists) (Orvis visits the Little Mahoning every year)
- Smicksburg tourism

Improvements:

- Canoe access is limited (particularly along Route 119)
  - Map of locations that can be used for access
  - Locals are able to utilize the canoe access, while visitors are unaware
  - Not only on the Little Mahoning Creek, but also on Mahoning Creek main stem
- Sedimentation is a large problem around Nashville, particularly referring to dirt and gravel roads and their negative impact
- Smicksburg park is working on a trail and possibly canoe access; particularly where the Mahoning and Little Mahoning creeks converge
- Include the Amish community in the planning/development of the watershed

Land Use

Positives:

- Very few areas along the Little Mahoning are posted
- Few illegal dump sites or industrial issues
- There were two illegal dump sites identified and cleaned-up within the watershed

Improvements:

- Improvement in riparian buffers and streambank fencing for the local farming community
  - Specifically widening the buffers themselves
- Landowner education, in terms of best management practices
- Involving easements for the farming community
- Restricting the posting of private lands
  - Positively influencing the sportsmanship of the people fishing along the Little Mahoning would go a long way towards keeping un-posted lands un-posted.
  - Post signs that promote good sportsmanship

Water Resources

Positive:

- Marcellus shale drilling will probably not be a major impact in terms of water quality
  - The issue with the drilling is in terms of the wastewater disposal/usage
  - Only a few permits have been issued in Indiana County, to date (2009)
  - The amount of water necessary for the fracking process of the well is much higher than normal gas well drilling
- The sedimentation along certain stretches of the Little Mahoning has visibly improved in the past several years

Improvements:

- Limiting surface mine permits
- The Pine Run area around Timblin has been identified by Jefferson County as needing remediation
- Savan dam needs to be removed, and the LMCWA is attempting to get the dam removed
  - A channel is being cut around the dam
  - Sedimentation in this area is a major problem
  - The biodiversity above Savan dam is much less than below
  - The Civilian Conservation Corps originally built the dam
- Three other dams possibly need removed (Pollock property); these are lower dams
- There might be a need to change the designation of some stretches of the Little Mahoning to “Exceptional Value” in order to further protect them
- Retrofit Mahoning Dam with hydroelectric capabilities

Biological Resources

Positive:

- Hellbender/mussel populations
- Very few invasive plant species thrive along the Little Mahoning

Improvements:

- Boot cleaning stations could assist in the limiting of invasive species spreading
- Multiflora rose is a problem in the watershed.
- Ailanthus (tree-of-heaven) particularly near construction sites and gas wells
- Climate change impact on various types of wildlife, particular impacts to pine siskins (bird) and other types of insects, plants, and animals have been noticed

Cultural Resources

Positives:

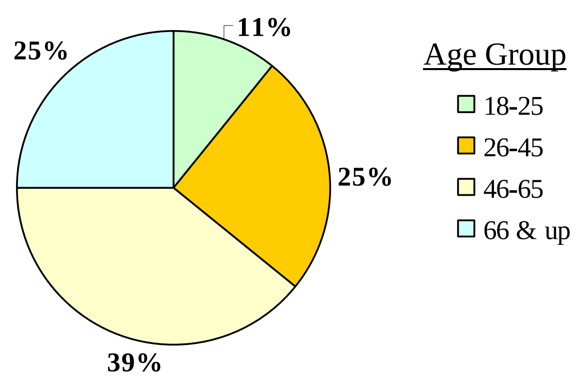
- Old school building in Rochester Mills
  - Recent renovations/restorations have been completed
- Educational outreach
  - Has been positive in the past, but more needs to be done to educate the community about the needs/benefits of Little Mahoning

Cultural Resources (continued)

Improvements:

- Trail connections, particularly along Baker Trail
- Smicksburg Park
- Lewisburg Bridge
- Little Mahoning millstone
- The push is being made to include the school districts in the area, particularly in the monitoring of the tributaries.

Figure 6-1. Age of Survey Participants



Survey Results

Two types of public input surveys—general public and municipality—were conducted to gather information on the issues and concerns of watershed stakeholders. The comments listed below do not necessarily reflect the views of WPC or the organization represented on the steering committee. All comments and suggestions from the public were recorded and taken into consideration while developing the conservation plan.

Public Survey Results

Public surveys were distributed from January 2009 to March 2010. Surveys were available at public meetings, community events, and on the Internet. A total of 28 completed public surveys were returned. The results of the surveys were taken into consideration during the development of the management recommendations for this plan.

General Demographics

The majority of survey participants—61 percent—were local residents to the area. A total of 14 men and 14 women completed surveys.

As indicated in Figure 6-1, the majority of participants were among the 46 to 65 age group. There were no participants under the age of 18.

Residents

Area residents from a variety of municipalities participated in the survey (Table 6-1). Most of the participants—63 percent—reside within the Little Mahoning Creek watershed, while 10 percent resided within Pine Creek watershed and 10 percent within the Mahoning Creek Watershed.

Table 6-1. Locations Where Resident Survey Participants Reside

Indiana County	*Armstrong County*
Covode	Cowanshannock Township
Washington Township	Dayton Borough
Rochester Mills	
East Mahoning Township	***Jefferson County***
Creekside	Timblin Borough
Grant Township	
Marion Center	
Montgomery Township	
Smicksburg	

Figures 6-2 and 6-3 display the length of time participants have lived in the project area and how far they travel to work. The majority of the participants work within one to 15 miles of their residence.

Figure 6-2. Length of Time Residing in Project Area

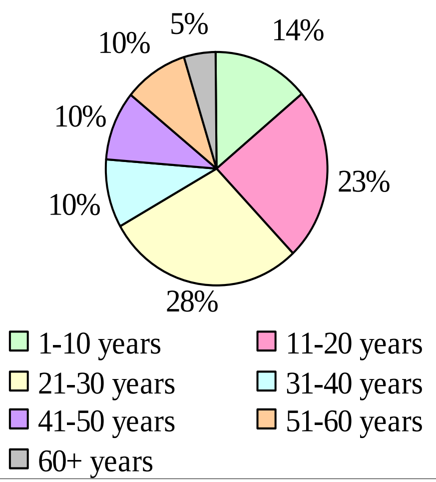
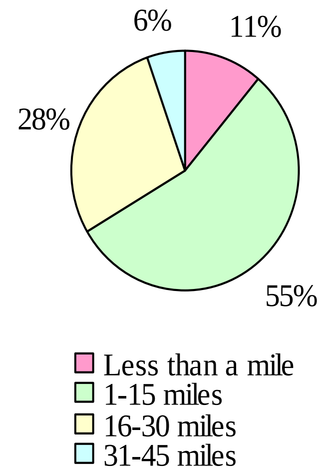


Figure 6-3. Distance Traveled to Work



Visitors

Only 27 percent of the participating visitors own property within the project area. Most visitors traveled less than 60 miles to get here; however, one person traveled 1,200 miles. Visitors come for a variety of reason, though most come for recreational purposes or to visit family and friends. A few of the participating visitors came to the region for business. The majority of visitors—67 percent come seasonally, while 25 percent come annually. One visitor comes to the area periodically, once every five or more years.

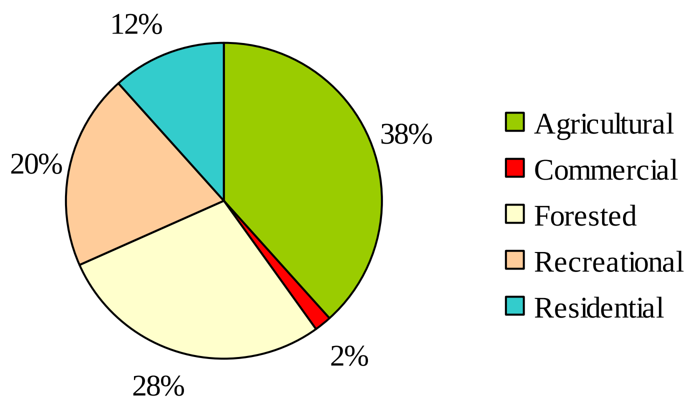
Seventy-five percent of the participating visitors spent less than a day in the region. A few spent between one and four days, and one stayed longer than two weeks.

Most visitors spent less than $100 in the region, with two spending up to $500. One visitor spent over $5,000 on their trip. Visitor’s primarily spent money on food, lodging, and recreational supplies. One visitor purchased a secondary residence.

General

1. What do you think are the two most important land uses within the lower Mahoning Creek regional area?

Figure 6-4. Important Land Uses



2. Where did you obtain this survey?

6%	Business/Restaurant	42%	Watershed group
26%	Event	26%	Other

3. Please indicate the importance of the following watershed values.

Figure 6-5. Importance of Watershed Values

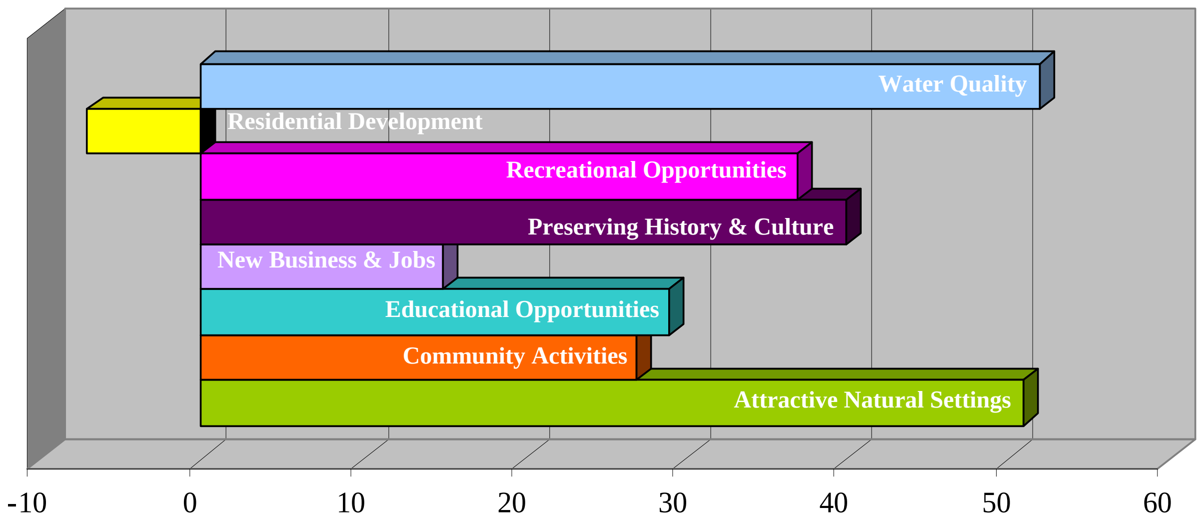
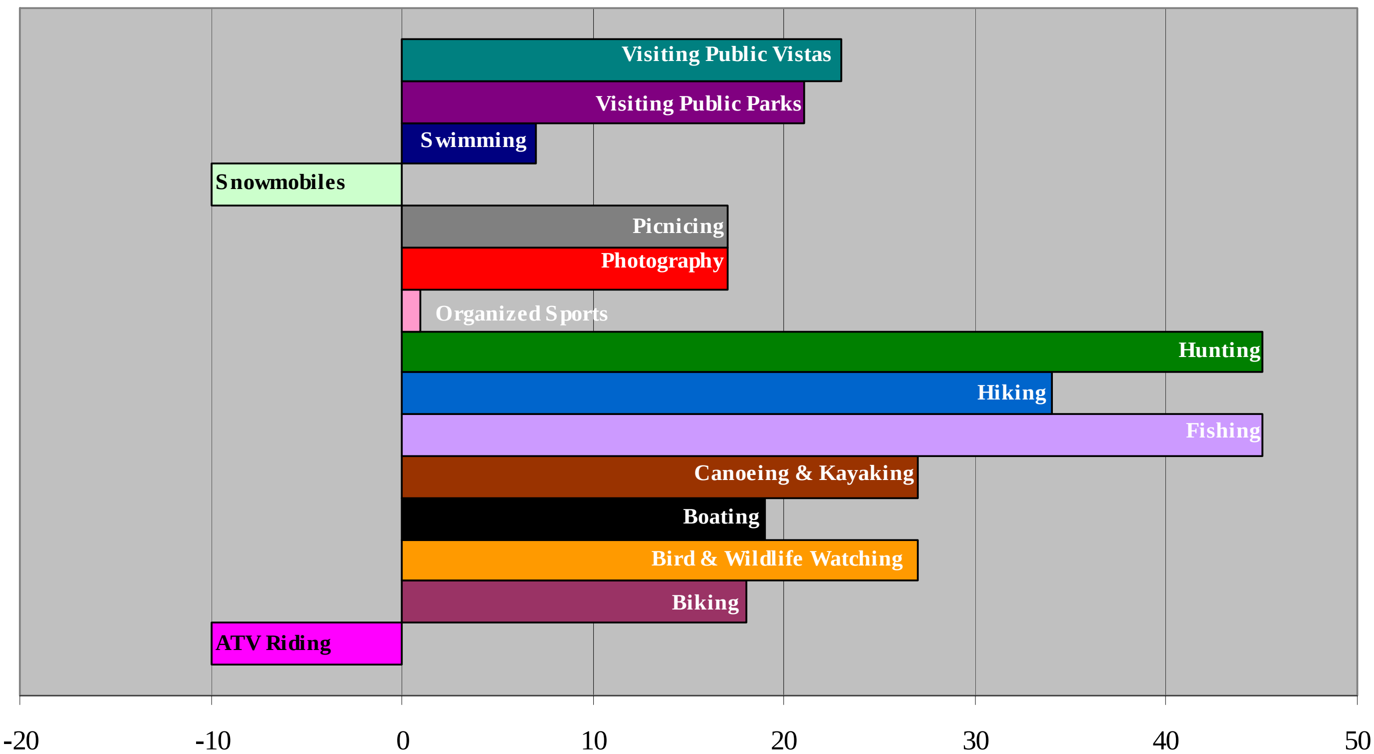


Table 6-2. Importance of Watershed Values

	Very Important 2 points	Somewhat Important 1 point	Neutral 0 points	Not Likely Important -1 point	Not Important -2 points	Total
Water Quality	2*25=50	1*2=2	0*1=0	-1*0=0	-2*0=0	52
Attractive Natural Settings	2*23=46	1*5=5	0*0=0	-1*0=0	-2*0=0	51
Preserving History/Culture	2*15=30	1*10=10	0*3=0	-1*0=0	-2*0=0	40
Recreational Opportunities	2*15=30	1*8=8	0*4=0	-1*1=-1	-2*0=0	37
Educational Opportunities	2*9=18	1*11=11	0*8=0	-1*0=0	-2*0=0	29
Community Activities	2*8=16	1*11=11	0*9=0	-1*0=0	-2*0=0	27
New Business/Jobs	2*9=18	1*4=4	0*10=0	-1*3=-3	-2*2=-4	15
Residential Development	2*1=2	1*7=7	0*10=0	-1*4=-4	-2*6=-12	-7

Figure 6-6. Importance Values of Recreational Activities



4. Please indicate the importance of the following recreational values in the watershed.

Table 6-3. Importance of Recreational Values

	Very Important 2 points	Somewhat Important 1 point	Neutral 0 points	Not Likely Important -1 point	Not Important -2 points	Total
Fishing	2*22=44	1*3=3	0*1=0	-1*0=0	-2*1=-2	45
Hunting	2*22=44	1*3=3	0*2=0	-1*0=0	-2*1=-2	45
Hiking	2*11=22	1*12=12	0*4=0	-1*0=0	-2*0=0	34
Bird/Wildlife Watching	2*11=22	1*6=6	0*9=0	-1*1=-1	-2*0=0	27
Canoeing/Kayaking	2*11=22	1*9=9	0*5=0	-1*0=0	-2*2=-4	27
Visiting Public Vistas	2*7=14	1*11=11	0*10=0	-1*2=-2	-2*0=0	23
Visiting Public Parks	2*7=14	1*11=11	0*6=0	-1*2=-2	-2*1=-2	21
Boating	2*7=14	1*11=11	0*6=0	-1*0=0	-2*3=-6	19
Biking	2*5=10	1*10=10	0*10=0	-1*2=-2	-2*0=0	18
Photography	2*7=14	1*8=8	0*6=0	-1*5=-5	-2*0=0	17
Picnicking	2*5=10	1*10=10	0*9=0	-1*3=-3	-2*0=0	17
Swimming	2*3=6	1*9=9	0*10=0	-1*4=-4	-2*2=-4	7
Organized Sports	2*3=6	1*7=7	0*9=0	-1*6=-6	-2*3=-6	1

Table 6-3. Importance of Recreational Values (continued)

	Very Important 2 points	Somewhat Important 1 point	Neutral 0 points	Not Likely Important -1 point	Not Important -2 points	Total
Horseback Riding	2*3=6	1*5=5	0*11=0	-1*5=-5	-2*3=-6	0
ATV Riding	2*3=6	1*3=3	0*10=0	-1*3=-3	-2*8=-16	-10
Snowmobiles	2*4=8	1*3=3	0*7=0	-1*5=-5	-2*8=-16	-10

5. Please indicate the importance of addressing the following watershed issues.

Figure 6-7. Importance of Watershed Issues

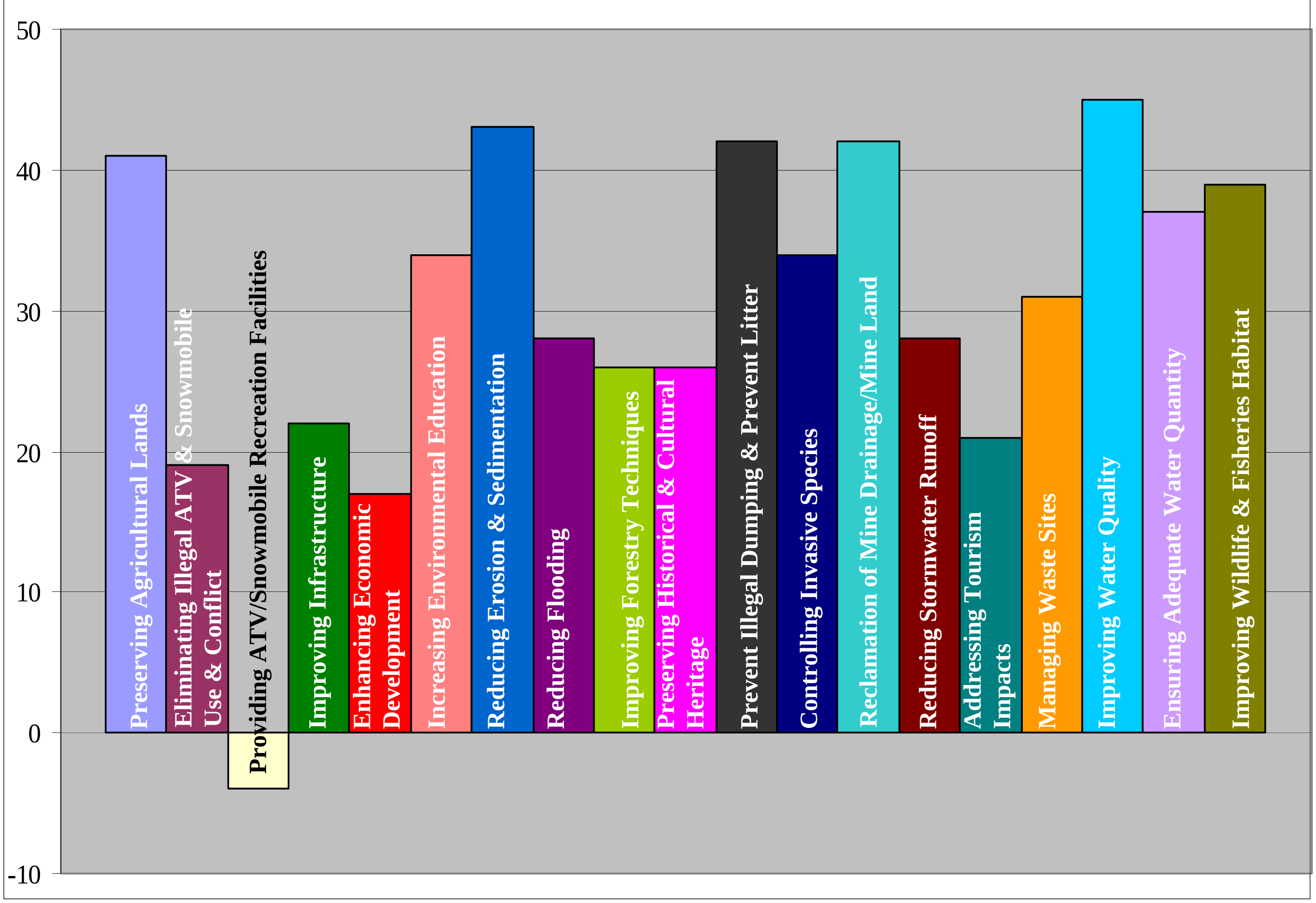


Table 6-4. Importance of Watershed Issues

	Very Important 2 points	Somewhat Important 1 point	Neutral 0 points	Not Likely Important -1 point	Not Important -2 points	Total
Improving Water Quality	2*20=40	1*5=5	0*1=0	-1*0=0	-2*0=0	45
Reducing Erosion & Sedimentation	2*19=38	1*5=5	0*2=0	-1*0=0	-2*0=0	43
Preventing Illegal Dumping & Clean Up Litter	2*19=38	1*4=4	0*3=0	-1*0=0	-2*0=0	42
Reclamation of Mine Drainage/Mine Lands	2*19=38	1*4=4	0*3=0	-1*0=0	-2*0=0	42
Preserving Agricultural Lands	2*20=40	1*3=3	0*2=0	-1*0=0	-2*1=-2	41
Improving Wildlife/Fisheries Habitats	2*19=38	1*2=2	0*4=0	-1*1=-1	-2*0=0	39
Ensuring Adequate Water Quantity	2*17=34	1*5=5	0*3=0	-1*0=0	-2*1=-2	37
Controlling Invasive Species	2*15=30	1*5=5	0*5=0	-1*1=-1	-2*0=0	34
Increasing Environmental Education	2*12=24	1*10=10	0*4=0	-1*0=0	-2*0=0	34
Managing Waste Sites/Hazardous Spills	2*15=30	1*5=5	0*3=0	-1*2=-2	-2*1=-2	31
Reducing Flooding	2*15=30	1*3=3	0*5=0	-1*1=-1	-2*2=-4	28
Reducing Storm Water Runoff	2*10=20	1*10=10	0*6=0	-1*0=0	-2*1=-2	28
Improving Forestry Techniques	2*10=20	1*8=8	0*5=0	-1*2=-1	-2*0=0	26
Preserving Historical & Cultural Heritage	2*9=18	1*8=8	0*9=0	-1*0=0	-2*0=0	26
Improving Infrastructure	2*9=18	1*8=8	0*6=0	-1*2=-2	-2*1=-2	22
Addressing Tourism Impacts	2*10=20	1*7=7	0*5=0	-1*2=-2	-2*2=-4	21
Eliminating Illegal ATV/ Snowmobile Use and Conflicts	2*9=18	1*4=4	0*11=0	-1*1=-1	-2*1=-2	19
Enhancing Economic Development	2*7=14	1*7=7	0*8=0	-1*4=-4	-2*0=0	17
Providing ATV/Snowmobile Recreation Facilities	2*4=8	1*3=3	0*11=0	-1*3=-3	-2*6=-12	-4

6. Please indicate the top three services/amenities that are lacking within the watershed.

12 Restaurants
7 Public Restrooms
6 Emergency Services
5 Lodging
4 Gas Stations
4 Prevention of agricultural and industrial pollution
3 Canoe Access
3 Stores
2 Nature Parks
2 Canoe/Kayak Rentals
2 Agricultural Riparian Zones
1 Septic Systems
1 Trails
1 Guided Recreation
1 Picnic Tables
1 Education
1 Public Support
1 Job Opportunities

7. Other comments or concerns.

- Concerned about bacteria contaminating our waterways.
- Fix the roads!
- Great Fishing!
- Keep it in its natural state as much as possible.
- Road Maintenance!
- Oil leases, new pipe lines, stop planting flowers on game lands, more cover and feed for wildlife.

Municipal Survey

Each of the municipalities within the lower Mahoning Creek region was contacted via telephone to complete an information gathering survey. Twenty-two of the 24 municipalities participated in the survey. The survey gathered valuable information about the issues and concerns of municipal leaders of the watershed that was used during development of the plan.

1. **Does your municipality have a comprehensive plan?**
   - 3 of the 22 responded yes
   - 10 of the 22 responded no

2. **Does your municipality currently utilize zoning?**
   - 1 of the 22 responded yes
   - 21 of the 22 responded no

3. **Does your municipality currently utilize subdivision ordinance?**
   - 2 of the 22 responded yes
   - 20 of the 22 responded no

4. **Does your municipality have floodplain ordinances?**
   - 16 of the 22 responded yes
   - 6 of the 22 responded no

5. **Are there any municipal parks within your municipality?**
   - Old Smicksburg Park
   - Marion Center Park
   - Greenwall Park
   - Sports fields in Dayton
   - Grove in Dayton
   - Dayton Fire Hall Park
   - Madison Township Park
   - Timblin Park

6. **Does your municipality have any public water service?**
   - 7 of the 22 responded yes
   - 15 of the 22 responded no

7. **Does your municipality foresee the need to upgrade or establish public water within the next 10 years?**
   - 1 of the 22 responded yes
   - 21 of the 22 responded no

8. **Does your municipality have any public sewage systems?**
   - 7 of the 22 responded yes
   - 15 of the 22 responded no

9. **Does your municipality foresee the need to upgrade or establish public sewage within the next 10 years?**
   - 1 of the 22 responded yes
   - 21 of the 22 responded no

10. Is there anything unique, or well known about your municipality that you would like to have highlighted in the plan?

- Amish Community
- Dayton Fair
- State Game Lands
- Fordham rail-trail
- Specialty shops in Smicksburg including Windgate Winery
- Historical properties—such as Gilgal Church, McCormick Mansion, Old Dayton High School, and Old Marshall House

11. Who provides emergency services?

- **FIRE**—Dayton Volunteer Fire Department, Distant Volunteer Fire Department, Plumville Volunteer Fire Department, Rossiter Fire Company, Big Run Fire Department, Hawthorn Volunteer Fire Department, Rural Valley Volunteer Fire Department, Rayburn Volunteer Fire Department, Ringgold Volunteer Fire Department, Perry Township Volunteer Fire Department, Valier Fire Department, Pine Township Fire Department
- **POLICE**—Pennsylvania State Police
- **EMS**—Citizen's Ambulance Service, Kittanning #6 Station

Interview Results

One-on-one interviews with selected key individuals having intimate knowledge of the watershed, its values, and concerns were conducted. These nine individuals were selected as representatives of the watershed community and asked to express their insight into the strengths, weaknesses, and certain aspects about the project area. The results of the interviews are summarized in the following section.

1. <u>How has the area changed in the past 10 years?</u>

Water Quality and Natural Resources

Overall the water quality and natural resources have significantly improved, and citizens are more aware of the resources and need for protection. Improvements have been made by treating abandoned mine drainage and stabilizing streambanks. However, efforts should not cease as there is still more work and new impacts that threaten the natural resources.

Natural gas drilling is on the rise, and with the exploration within the Marcellus shale formation, it is expected to double. The increase in drilling activities can stress local communities and the environment. Increased traffic with heavy drilling equipment can degrade many municipal roadways, of which many are not paved, increasing the amount of erosion that enters area waterways. The main issues are the use hydraulic fracturing and the repercussions of that method. Area residents want to know what chemicals are being used, what impact it will have on their water quality, and how the waste products are being treated.


Historic bank building in Timblin Borough

Community and Culture

The rural landscape that dominates the area has seen a few changes in the past 10 years. Agricultural operations have declined, while residential development and tourism have increased. The presence of the Amish community, numerous recreational opportunities, and natural beauty of the region attracts visitors from all over, creating a viable ecotourism industry.

The increase in tourism brings a few concerns for area residents, such as increased traffic on secondary and tertiary roads, impacts to wildlife and natural habitats, and private property owner rights, as well as potential business opportunities for creative entrepreneurs.

2. How do the following meet the needs of the community?

Transportation

Due to the rural landscape, the majority of transportation within the region is via automobile or horse and buggy, with a few public transportation opportunities. There are a few trails throughout the watershed; however, these are primarily used for recreational purposes, as opposed to alternative transportation opportunities.

Local municipalities are ultimately responsibile for getting area residents to highways, and therefore, are responsible for the secondary and tertiary roadways throughout the project area. Many of the roadways are dirt and gravel, and could use some improvement to enhance the traveling path and to reduce pollution coming from these roadways. One of the major inhibitors to road repairs is funding. Currently, there is not enough funding to provide adequate roads and bridges and to keep up with the maintenance costs. New construction is almost impossible, as the majority of funding is being used to replace and repair bridges. Another concern from many citizens is the impact that drilling rigs and equipment are going to have on municipal roads and who is going to fork out the money to pay for the repairs to these roadways, since municipalities are so financially strapped.

Public transportation throughout the region is scarce to non-existent in some areas. However, opinions vary on whether improvements need to be made. Some participants believe that there is no need for public transportation, because of the low populations. Others feel there should be some enhancements, extending services that are currently available to the region. For example, there is a weekly bus service from Smicksburg to Indiana that is always full. Extending that service to twice a week or offering the service over the weekend or during the variety of festivals that are held could enhance tourism within the region.

Trails for transportation purposes are currently not available through most of the region, as bicycling along the rural routes can be hazardous. There should be established bike lanes or share-the-road signage installed to alert motorist about the potential of cyclists in the region.

Infrastructure

Infrastructure improvement is an ongoing endeavor, as technology advances and new methodologies are discovered. Improvements to water, sewage, and telecommunication infrastructure are needed throughout the project area.

For the most part, public water and sewage systems are lacking throughout the project area. The upgrade, repair, or installation of new systems is cost prohibitive in rural areas, where miles of piping and pumping would be required. Most residents have on-lot septic systems or sand mounds to treat wastewater and private wells to obtain their drinking water. During droughts, water levels decrease, and depending on the severity of the drought, some residents can be left without water.

Most areas throughout the project area lack consistent, quality internet services. Having affordable, quality internet services may help expand the small businesses within the project area connect with potential customers via social media. Current internet options include dial-up, satellite, and DSL in select urbanized areas. One of the major challenges is that private providers decide where they offer services. These decisions are based upon the potential customer base versus the cost of installation. The lack of quality internet services hinders the education of the area's youth, as many schools rely on internet resources for classroom and homework assignments.

Cell phone service is also limited throughout the project area. There are many "dead zones," which can be a safety concern along recreational corridors. The cell phone industry, like internet service providers, is dependent upon private companies. Service can be enhanced by individual homeowners by installing boosters to enhance the service.

Employment Opportunities

Employment opportunities within the project area are limited; however, the surrounding communities of Indiana, Punxsutawney, and Kittanning provide most residents with employment. Most of the local employment opportunities are in agriculture and tourism. New opportunities are expected as a result of the increased interest in gas extraction within the Marcellus shale formation that underlies the region.

The region holds potential for green businesses that include value-added industries, eco-tourism, and alternative power. The region needs more small businesses and creative entrepreneurs to provide quality employment opportunities. There are various organizations to help candidates prepare and find employment; however, in order for the area to become a booming industrial center, it would need strong transportation ties to attract business, such as an Interstate. Due to current economical challenges, this is unlikely to occur.

Educational Opportunities

Education is one of the region's strengths; although, there are no post-secondary educational opportunities within the watershed area to provide the necessary opportunities. Various trade and vocational schools also service the area's needs for training a skilled labor force. The public and parochial school systems provide students with necessary life skills. However, smaller school districts, which are typical for this region, are often limited, compared to larger schools that provide students more academic opportunities.

Land-use Ordinances and Zoning

Land-use ordinances and zoning are not highly utilized throughout the project area. Most municipalities rely on county-wide ordinances and zoning. Most of the municipalities do not have the capabilities to enforce ordinances and/or try to avoid them. Ordinances along with municipal planning can provide municipalities with a long-term vision, which is currently lacking. Establishing a vision and implementing ordinances and zoning to achieve that vision can balance competing interests and improve the quality of life within the community.

3. Do the recreational opportunities currently meet the needs of the community and visitors?

Parks and Picnic Sites

There are a variety of parks and picnic sites located throughout the project area. Of note, Hemlock Lake Park is a big attraction among fisherman and members of the Amish community. The transfer of Smicksburg Park to Indiana County Parks and Recreation was a good addition that will allow the site to be managed and marketed wisely for the watershed community.

Trails

Trails are important corridors in connecting people with their environment. There are a few trails throughout the region, but enhancing these trails through increased access and supporting infrastructure, such as designated trail heads, parking areas, and camping areas, is needed. There also is a need for new trails that offer a variety of uses from cross-country skiing, bicycling, horseback riding, and motorized recreational vehicle riding.

The Baker Trail provides some of the most scenic views of the watershed and provides excellent wildlife and bird observation opportunities. It could use some marketing and additional campsites and shelters for trail users.

Armstrong Trail bridge over Mahoning Creek near Templeton, Pa.

There is potential for establishing a rail-trail along abandoned railroad lines. The Armstrong Trail is a rail-trail that is open for bicycling, walking, and hiking. Establishing additional trail linkages between existing and new trails also is needed.

Currently, there are no public off-road vehicle trails within the region. The illegal uses by some riders who trespass on private and restricted properties are causing extensive damage. An increase in enforcement is essential, according to many residents. Establishing a designated area for off-road vehicle riding would deter users from trespassing on private property.

<u>Boating</u>

A few options for boating are available within the project area—Hemlock Lake and Mahoning Creek Reservoir. Hemlock Lake is open for electric-motored and hand-propelled boats, while Mahoning Creek Reservoir also provides opportunities for gasoline-powered engines with a limited horsepower.

Many of the area's waterways are utilized by paddlers in canoes and kayaks. However, designated launch areas are not available. Establishing formalized access sites throughout the project area is needed. Smicksburg Park—recently transferred to Indiana County Parks and Trails—and the park in Putneyville are already being utilized as access sites. Other areas also hold potential for access sites, such as Bullfrog Campground and the confluence of Mahoning Creek and Little Mahoning Creek

<u>Community Landscape</u>

The lower Mahoning Creek region possesses some beautiful scenic vistas, balancing forestland and agriculture with historical sites. The most notable location within the project area is the Smicksburg area. The Amish community, village shops, historical sites, and open land remind visitors of life in an earlier era. Transportation through the area can be tricky, with the rustic terrain of northern Indiana and southern Armstrong counties. Establishing a self-guided scenic tour, highlighting notable features, such as McCormick Castle, Mahoning Dam, and quaint shops, throughout the area could increase tourism.

However, over the past several years, many of the shops have closed. Establishing new businesses that support the low-impact recreational opportunities and tourism in the region could be beneficial. For example, establishing a sporting goods store to supply fishing bait and equipment, as well as bike, canoe, and kayak rentals, could help increase visitors to the region. Establishing businesses, such as eateries or a bed and breakfast, could enhance the region's marketability without altering the landscape.

4. **<u>What are some of the positive features of the watershed area?</u>**

One of the most significant positive features of the watershed is its vast natural resources that remain mostly undeveloped. The remote solitude and natural landscape provide excellent scenery, especially during fall foliage and spring wildflowers. Smicksburg has the 7th largest Amish community in the U.S., according to one participant.

Another major quality this region has that promotes healthy living is the people who reside in its communities. This area attracts strong volunteers with natural interest in preserving and improving quality of life, which helps the region grow. The local elected officials understand the values of their constituents, and are willing to work with them to enhance the region. The region also has a deep-rooted history, and many people who live here, have done so for many years. These folks are dedicated to improving their home town and have a long history of civic duty.

5. What impacts are currently affecting the land, water, and biological resources?

Impacts from resource extraction industries top the list of concerns area residents have in the watershed. Illegal dumping is of concern, along with increased erosion and sedimentation in area streams, primarily from agricultural practices and dirt and gravel roadways. The use of chemicals in conventional farming operations also concerns some residents.

Most residents are fearful of the drilling for natural gas within the Marcellus shale formation and the impacts that it causes. The area currently has good water quality, but residents feel that once extraction activities within the Marcellus shale formation occur, that will no longer be the case. There are a lot of unknown factors surrounding the extraction of the natural gas, which concerns residents. They would like to know how wildlife and biodiversity will be impacted, who is going to compensate local municipalities for damages to local roadways caused by the increased heavy equipment traffic, how the wastewater will be treated and disposed, and what source of water will be used for the fracking process. There needs to be a balance between the environmental impacts and economic benefits received from extracting the gas. Area waterways need to be protected, maintaining high water quality standards to ensure there is not a repeat of the mining industry prior to the 1970s. Many participants believe there should be a tax collected from the drilling operations.

6. Do you have any specific projects or type of projects you would like to see identified in the plan?

Trails

- Establish new trails that will link with existing trails in the region to create a regional trail system
- Relocate portions of the Baker Trail away from roadways, such as the segment along Route 839
- Link trails around Griffith Road below Smicksburg to Rossmoyne to Baker Trail
- Extend Baker Trail along Mahoning Creek to bring it closer to dam and Smicksburg area
- Establish more shelters and camping areas for hikers along the Baker Trail
- Add hiking trail through Creekbend Campground

Increase access

- Increase access to trails and waterways
- Establish canoe/kayak launch in Smicksburg
- Need for an Indiana County Park in northern Indiana County
- Complete Smicksburg Park

Other

- Monitor and maintain dirt and gravel roads.
- Establish jack dams in Pine Creek to improve fishing habitat
- Recreational development both public and private to increase economics
- Market natural resources
- Preserve historic sites

<u>*Other (continued)*</u>

- Control erosion, especially along roads
- Remediate invasive species
- Establish easements to protect land
- Outdoor recreation in Smicksburg
- Clean streams from source of impairment and keep streams flowing freely

School Workshops

In an effort to include the viewpoint of the younger generation, school programs were conducted in cooperation with Marion Center School District. Approximately 300 students provided insight into the future of the watershed and what issues and concerns are most important in the watershed. The following results are a summary of the students' perspective.

* Indicates that the response was identified in both sessions that were held.

<u>What do you like about the area?</u>

- All-terrain vehicles
- Climate (4 seasons)*
- Fishing
- Good population size*
- Healthy streams
- Hunting
- Landscape*
- Natural resources
- Quiet*
- Rural environment
- Wildlife*
- Civil War history
- Clean air
- Forest lands
- Open space
- Peaceful
- Pretty environment
- Scenery

<u>What about the area could be improved?</u>

- Better cell phone service*
- Better roads
- Better buildings
- Better infrastructure
- Better water drainage to prevent erosion
- Clean up and reduce trash/litter*
- Control deforestation
- Environmental awareness
- Fast food restaurants
- Fuel cost
- Golf course
- Government infrastructure
- High-speed internet availability
- Mine drainage
- More activities
- More all-terrain vehicle trails
- More businesses*
- More fish stockings
- More local healthcare
- More outdoor supply stores
- More public lands for hunting – less posted property
- More public parks
- More recreational opportunities
- More wildlife reserve areas
- Need a Sheetz
- Need book stores
- Quality of industry
- Reduce vandalism
- Repair neglected buildings*
- Road flooding
- Roads
- School funding
- School maintenance
- Sports fields
- Tourist lodging

Why do you visit State Parks and State Forests?

- All-terrain vehicles
- Bird watching
- Boating
- Camping*
- Climbing the fire tower
- Cross country
- Environmental education
- Family picnic/reunion*
- Festival of lights
- Field trip*
- Fishing*
- Hiking trails*
- Horticulture
- Hunting*
- Nature walk
- Shooting
- Sight seeing*
- Swimming*
- Swing sets
- Tubing
- Volleyball*

What types of recreational activities do you enjoy?

- Biking*
- BMX
- Bonfires
- Camping
- Canoe/Kayak
- Chess
- Fishing*
- Golf
- Hay rides
- Hiking
- Horseback riding
- Hunting*
- Indiana County Fair
- Internet/technology*
- Movies
- Music
- Off-roading *
- Organized sports*
- Outdoor sports
- Paintball
- Public dining
- Reading
- ROTC program
- Running*
- Skate boarding & skate park*
- Star gazing
- Swimming
- Trap shooting
- Trapping
- Video games*
- Winter sports: ice skating, skiing, snowboarding, sledding*
- Working out

What are some negative impacts in the area?

- Abandoned Mine Drainage/Coal Mining
- Air pollution from exhaust & paper mills
- Amish – farming impacts
- All-terrain vehicle induced erosion*
- Brush fires
- Burglary
- Car Exhaust
- Coal Trucks
- Deer-car collisions
- Drinking and smoking
- Erosion
- Farm pollution*
- Illegal dumpsites & littering*
- Logging*
- Mining (Coal)
- Natural gas drilling*
- Pesticides
- Pet waste runoff
- Poaching
- Power plants*
- Urban expansion
- Vandalism

What type of projects would students be interested in being involved in?

- Alternative energy/green technology
- Abandoned mine drainage & reclamation
- Better fishing opportunities
- Carpentry-blue bird boxes
- Clean streams*
- Cleanup litter including roadways*
- Community maintenance
- Control animal populations
- Hybrid vehicles
- Make a pond
- Nature walks for children
- Photograph the environment
- Plant trees or gardens*
- Raise money for environmental organizations*
- Recycle*
- Trail development
- Utilize and encourage alternative transportation
- Volunteering *

What changes would you like to see within the next 10 years?

- Better cell phone services
- Better quality businesses*
- Better road maintenance
- Book store
- Cleaner streams
- Less logging
- Less poaching
- Less pollution
- More fish stockings/better fish management
- More jobs*
- More open area to hunt
- More/better healthcare
- More restaurants
- Need public transportation
- Population size decrease
- Sheetz*
- Technological advances

What reasons make you want to stay or return to the area?

- Clean
- Climate–snow*
- Community
- Country atmosphere
- Cost of living
- Environment & wildlife
- Familiarity*
- Family and friends*
- Farming
- Friends
- Hunting & fishing*
- Logging industry jobs
- Open spaces
- Outdoors*
- Population size
- Quiet/peaceful*
- Rural area/ not a city
- Safety
- Strong fan base for sports

What reasons make you not want to stay or return to the area?

- Climate*
- Family is elsewhere
- Job market*
- Limited recreational opportunities
- Low deer population
- More excitement
- More people
- Move back home
- Need more privacy
- New experiences & new people*
- Road conditions
- No shopping opportunities
- Too quiet
- Want to travel
- Want urban environment
- Want to live on the beach

Focus Group Meeting

Project Area Characteristics

- A large percentage of the watershed has dirt and gravel roads and many of them are in need of maintenance, especially those in East Mahoning Township
- There is a need for more canoe access points throughout the watershed. There is one present at Mahoning Dam
- There are limited lodging opportunities throughout the watershed, except for a campground on Steel Road and a few bed and breakfasts
- There is one restaurant in Rochester Mills and some other small restaurants throughout the project area

Land Resources

- The agricultural lands have been in existence for a long time and seem to be stable
- The oil and gas wells are the leading cause of road problems
- Posted land
    - Mainly to protect hunting grounds
    - Protections from all-terrain vehicle (ATV) abuse
    - Prevent hunting opportunities
- ATV use
    - Impacts township roads
    - Liability issues
    - Affects landowner ability to timber their land
    - Affects drainage to creeks
    - Abuse on private land results in more posted land
- Gas wells with no diversion ditches create runoff issues and plug culverts
- Illegal dump sites
    - Moraine Road
    - Glen Campbell
    - Banks Township

Water Resources

- Exceptional value wetlands in need of protection
    - Near edge of Dayton at headwaters of Glade Run
    - Below Templeton Bridge
    - Two tributaries north of Route 119 (on left side) near State Game Lands, on East Creek Road – seasonal pools
    - Little Scrubgrass
    - North Branch of Pine Creek
    - Bullock Run
- Need major improvement/are impacted
    - Treatment system on Cessna Run
    - Ross Run has agricultural best management practices
    - Little Mudlick
    - Cathcart – below Mudlick
    - Pine Run – dead stream from mine drainage
    - Goheenville on Little Scrubgrass – on-site sewage problems

Water Resources (continued)

- Erosion on West Creek Road right before the bend on Little Mahoning Creek west of Route 119; witnessed 10 feet of erosion over the past 20 years, and getting close to blacktop road; PennDOT would not put in rip rap
- Dams
    - 2 small slit dams
    - 1 rock dam at McCormick – stream slowly taking out
    - 1 silt dam above Savan Dam
    - Savan Dam - concerned landowner
- Groundwater in Marion Center impacted by iron from old mines
- Temperature impacts on South Fork of Pine Creek above Oscar (coldwater fishery); just had Total Maximum Daily Load plan written for agriculture; not final yet
- Deckers Point near Grant Township has good quality and quantity spring waters

Biological Resources

- Nesting bald eagles near Mahoning Dam, Templeton, and downstream of Route 119. They are along the ridge with steep slopes
- Strong merganser and wood duck population from Savan Dam to Mudlick
- Invasive plants
    - Floodplain at U.S. Army Corps of Engineers is good supporting habitat
    - State Game Lands 137 is severely impacted by multiflora rose
    - State Game Lands 266 is severely impacted by autumn olive
    - Knotweed present along entire mainstem Mahoning corridor
    - There has been no species control programs other than autumn olive removal by the Western Pennsylvania Conservancy
- Native trout
    - North Fork Bullock
    - North Pine Creek
    - Millers Run (above Oscar)
- Reports of golden eagle at Templeton near Lock #8 (NOT confirmed), may be immature bald eagle
- Wildlife
    - Significant bear population in lower corridor (East, Grant, Canoe & Banks townships)
    - There is good habitat created by reclaimed mine lands, great scrub/shrub habitats
    - Bobcats and fishers found from Cessna Run north
    - Overpopulation of deer near Mahoning Dam affecting plant life in woods
    - View of deer population strength is mixed
    - 2008 was an excellent year for coyote trappers

Cultural Resources

- There is a need for a park near Rochester Mills
- Add Hemlock Lake Park to the map
- Virgin stand of Hemlock near Rochester Mills
    - Listed on NHI
    - Some historical value
    - Need protection
    - Signage needs

<u>Cultural Resources (continued)</u>

- Trails
    - Armstrong County is negotiating for abandoned rail bed along Mahoning for rail-trail Planning commissions has been trying to acquire, but unsure of the current status
    - Foot trails should remain a way that restricts all-terrain vehicle use-blocking structures
- Armstrong Conservancy owns several tracts of land along Mahoning in Pine Township
- Arlyn Ryan is cooperative with public access to land and water
- Canoe Access
    - Rip rap makes it tough to drag a canoe and get out of creek
    - Rt. 210 has no parking
    - 28/66 crossing do not post land and may allow for water access
    - Eddyville intend on adding access
    - Rod and Gun clubs
    - Children & handicap area
        - Improvements have been done and planning to do more
        - On north branch of Pine Creek near Bob's pump station (Slabstown)
        - Sponsored by Pine Creek Sportsman Club → has cooperative nursery in Templeton
- Historical
    - Goodville R.R. bridge, where Little Mahoning Creek crosses Mahoning Creek– among top three highest R. R. bridges in PA (about 225 ft high)
- Environmental Education
    - Mahoning Dam education
    - Camp ground at Creek Bend – summer 2009 programs
    - Tom Diaz - world adventurer with slide show that highlighted his outdoor adventures (need more similar events)
- Illegal Dumps Irvine
    - State Game Lands 262 has abandoned mine drainage issues and illegal dumps
    - Deckers Point
- Hunting Club – Big stone horse (historical Monument) might be privately owned
- Archeological Sites
    - Need to identify
    - Guy from Redbank who did archaeological studies (Seminole – Putneyville)
- Flow issues
    - Little Mahoning filling in with sediment in some areas and making the channel widen and slow flow in dry times
    - Rain event cause sudden flow rate change and it dissipates shortly after rain ends

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, Evergreen Conservancy, Little Mahoning Creek Watershed Association, sportsmen's clubs and other cultural and recreational 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 N. Listed in Table 7-1 are acronyms used in the management recommendations.

Table 7-1. Acronyms used in Management Recommendations Matrix

BAMR	Pennsylvania Department of Environmental Protection Bureau of Abandoned Mine Reclamation
DCED	Pennsylvania Department of Community and Economic Development
DCNR	Pennsylvania Department of Conservation and Natural Resources
DEP	Pennsylvania Department of Environmental Protection
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
HUD	Housing and Urban Development
LWV	League of Women Voters
NRCS	United States Department of Agriculture Natural Resources Conservation Service
OSM	United States Department of Interior Office of Surface Mining
PABS	Pennsylvania Biological Survey
PACD	Pennsylvania Association of Conservation Districts
PALMS	Pennsylvania Lake Management Society
PASA	Pennsylvania Association for Sustainable Agriculture
PDA	Pennsylvania Department of Agriculture
PEMA	Pennsylvania Emergency Management Agency
PennDOT	Pennsylvania Department of Transportation
PENNVEST	Pennsylvania Infrastructure Investment Authority
PGC	Pennsylvania Game Commission
PNHP	Pennsylvania Natural Heritage Program
PSAB	Pennsylvania State Association of Boroughs
PSATS	Pennsylvania State Association of Townships
RWA	Rural Water Authority
SEO	Sewage Enforcement Officer
USACE	United States Army Corps of Engineers
USDA	United State Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WPCAMR	Western Pennsylvania Coalition for Abandoned Mine Reclamation
WREN	Water Resources Education Network

Project Area

GOAL 1-1: UTILIZE PLANNING TO PROACTIVELY PLAN FOR THE FUTURE WHILE IMPROVING QUALITY OF LIFE.

Objective 1: Carefully plan development to ensure economic enhancement while preserving community character without adversely affecting quality of life.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
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 decision, water quantity, soil type, etc.	Planning Departments, Conservation Groups, Municipalities, NRCS, DEP, USGS, HUD	Foundations, Private Sources, DCED	High
2.	Revitalize downtown areas to encourage the establishment of new businesses that preserve historic architecture and compliment community character.	Planning Departments, Conservation Groups, Historical Societies, Municipalities, DEP, HUD	Foundations, Private Sources, DCED	High
3.	Implement the use of smart growth principles or Conservation by Design practices when development opportunities arise to maintain the natural setting valued by residents and tourists.	Conservation Groups, Planning Departments, Municipalities, NRCS, DEP, HUD	Foundations, Private Sources, DCED	Medium
4.	Conduct a demonstration project utilizing low-impact, Smart Growth principals, and Conservation by Design practices at a local site.	Conservation Groups, Planning Departments, Municipalities, NRCS, DEP, HUD	Foundations, Private Sources, DCED, HUD	Medium

Objective 2: Proactively plan for the future.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish individual or joint municipal comprehensive plans for municipalities that currently do not have plans and update plans that are 10 years or older.	Planning Commissions, Municipalities, Counties	Foundations, Private Sources, DCED	High
2.	Re-evaluate the need for establishing zoning or subdivision ordinances in accordance with municipal and county comprehensive plans to protect the character of communities and valuable resources from undesirable land uses.	Planning Commissions, Municipalities, Counties	Foundations, private Sources, DCED	Medium

GOAL 1-1: UTILIZE PLANNING TO PROACTIVELY PLAN FOR THE FUTURE WHILE IMPROVING QUALITY OF LIFE (CONTINUED).

Objective 2: Proactively plan for the future (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
3.	Protect agricultural lands, without significantly impeding landowner rights through the use of responsible zoning.	Conservation Groups, Conservation Districts, Planning Commissions, Municipalities, Counties	Foundations, Private Sources, DCED, PDA	High
4.	Build partnerships with municipal officials, businesses, developers, and other stakeholders to alter negative perceptions of zoning through education and awareness programs.	Planning Commissions, Municipalities, Counties	Foundations, Private Sources, DCED	Medium

Objective 3: Provide educational programs about land-use planning and other tools that incorporate conservation goals into making communities more attractive and protecting biodiversity.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Provide education sessions about integrated land-use planning, ordinance development, habitat conservation, and protecting and enhancing biodiversity. Include a session about the economic benefits and importance of watershed protection.	Conservation Groups, Conservation Districts, Municipalities, DCED, PSATS, PSAB	Foundations, private Sources, DCED, PSATS, PSAB	Medium
2.	Host workshops to educate and encourage municipal officials to create ordinances that support watershed-wide planning.	Municipalities, DCED, PSATS, PSAB	Foundations, Private Sources, DCED, PSATS, PSAB	Medium
3.	Conduct workshops, training seminars, and demonstration projects emphasizing the use of best management and sustainable maintenance practices.	Conservation Groups, Municipalities, Developers, DCNR, DEP	Foundations	Medium
4.	Increase municipal awareness of the values of preserving, protecting, and restoring the natural resources within the watershed, and promote inter-municipal cooperation.	Conservation Groups, Conservation Districts, Citizens	Foundations, Private Sources, DEP, DCNR	Medium

GOAL 1-2: INCREASE ECONOMIC STABILITY AND ATTRACTIVENESS TO POTENTIAL BUSINESSES.

Objective 1: Encourage economic growth with minimal impacts to the environment.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Study impacts new businesses have on local communities, streams, groundwater, and their effects downstream.	Planning Commissions, Conservation Groups	Foundations, Private Sources, DCED, DEP, DCNR	High
2.	Incorporate Natural Heritage Inventories into county and municipal comprehensive plans.	Conservation Groups, Municipalities, Counties, PNHP	Foundations, Private Sources, DCED	High
3.	Establish a plan for economic revitalization of downtown areas, such as Dayton and Smicksburg, and surrounding communities.	Planning Commissions, Counties, Businesses, Municipalities	Foundations, Private Sources, DCED, DCNR	High
4.	Conduct a study to determine what impacts salt and ashes, utilized to remove snow and ice on roadways, have on the water quality, and investigate alternative practices.	Conservation Groups, Universities, DEP, PennDOT, EPA	Foundations, Private Sources,	Medium
5.	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, Conservation Districts, DEP	Foundations, Private Sources, DEP, EPA	Medium

Objective 2: Establish economic stability and enhance marketability of the region to prospective businesses.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Diversify the job market by developing and offering incentives and tax breaks to attract new businesses.	Planning Commissions, Municipalities, Counties	Counties, Private Sources, Municipalities	Medium
2.	Capitalize on the nature-based tourism opportunities by conducting an economic impact study to determine the impacts tourism has on the local economy and how additional revenue could be generated.	Conservation Groups, Businesses, Business Associations, Chambers of Commerce, Planning Commissions, TPA	Foundations, Private Sources, DCNR	Medium
3.	Establish local resource-oriented sustainable industries like value-added products and farmers' markets to keep young adults in the region and improve economic viability.	Planning Commissions, PDA, Businesses, Chambers of Commerce, DCNR	Foundations, Private Sources, DCNR	Medium

GOAL 1-2: INCREASE ECONOMIC STABILITY AND ATTRACTIVENESS TO POTENTIAL BUSINESSES (CONTINUED).

Objective 2: Establish economic stability and enhance marketability of the region to prospective businesses (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
4.	Establish a coalition among area business associations and chambers of commerce to promote and support local businesses in the region, such as creating a web site and/or business guide for areas residents.	Businesses, Business Associations, Chambers of Commerce, Planning Commissions, TPA	Private Sources	Medium
5.	Incorporate alternative energy practices, increasing job markets and decreasing dependency on gas and oil.	Conservation Groups, EPA, DEP	Foundations, Private Sources, DCED	Low

GOAL 1-3: ENHANCE INFRASTRUCTURE TO ENABLE THE REGION TO BE A COMPETITIVE MARKET TO ATTRACT NEW BUSINESSES.

Objective 1: Enhance the technology to aide in communication and entertainment.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Increase cell phone services without obstructing the view through the installation of stealth cell phone towers.	Municipalities, Cell Phone Service Providers	Cell Phone Service Providers	Medium
2.	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	Telephone, Cable, and Satellite Companies	Medium

Objective 2: Enhance transportation infrastructure.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Implement best management practices that protect water resources when improving and upgrading dirt and gravel, secondary, or rural roadways.	Conservation Groups, Municipalities, Road Masters, DEP	Foundations, Private Sources, PennDOT, DCED	High
2.	Include sound geologic investigation and best management practices during maintenance and construction of roadways to minimize impacts.	Conservation Groups, Road Masters, PennDOT	Foundations, Private Sources, PennDOT, DCED	High
3.	Conduct impact studies on highway and industrial development to minimize threats to the resources of the watershed.	Conservation Groups, Municipalities, PennDOT, DEP	Foundations, Private Sources, PennDOT, DCED	High

GOAL 1-3: ENHANCE INFRASTRUCTURE TO ENABLE THE REGION TO BE A COMPETITIVE MARKET TO ATTRACT NEW BUSINESSES (CONTINUED).

Objective 2: Enhance transportation infrastructure (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
4.	Increase funding and maintenance using sustainable practices on area roadways, including the dirt and gravel roads program.	Conservation Groups, Conservation Districts, Municipalities, Penn State, PennDOT, DEP	Foundations, Private Sources, PennDOT, DEP	High

Objective 3. Enhance public and private sewage treatment facilities.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Install proper septic tanks, wastewater treatment facilities, or other alternatives to reduce the amount of untreated sewage entering the stream.	Municipal Authorities, Conservation Groups, Municipalities, SEO, DEP, PENNVEST	Foundations, Private Sources, DEP, DCED, PENNVEST	High
2.	Design wastewater treatment systems to adequately serve communities, by separating stormwater from wastewater systems, in order to ease the occurrence of combined sewage overflows and improve capacity of existing sewage treatment plants.	Municipal Authorities, Municipalities, DEP, PENNVEST	Foundations, Private Sources, DEP, DCED, PENNVEST	High
3.	Upgrade failing and antiquated sewage lines and add new infrastructure in growth areas as identified in county and municipal comprehensive plans.	Municipal Authorities, Municipalities, DEP, PENNVEST	Foundations, Private Sources, DEP, DCED, PENNVEST	High
4.	Review Act 537 plans that are over 20 years old to ensure they are adequately addressing the current wastewater needs within the jurisdiction, if not update the plans.	Municipal Authorities, Conservation Groups, Municipalities, SEO, DEP, DCED	Foundations, Private Sources, DEP, DCED	High
5.	Educate homeowners about alternative sewage treatment systems, proper testing and maintenance of existing on-lot sewage systems and establish or continue cost-share programs and grants to assist homeowners in septic repair, maintenance, and replacement.	Conservation Groups, Municipalities, DEP, PENNVEST	Foundations, Private Sources, DEP, PENNVEST	Medium
6.	Update and improve wastewater treatment facilities in Rayburn Township, Armstrong County.	Municipal Authority, Conservation Groups, Rayburn Township, SEO, DEP, DCED	Foundations, Private Sources, DEP, DCED	Medium

GOAL 1-3: ENHANCE INFRASTRUCTURE TO ENABLE THE REGION TO BE A COMPETITIVE MARKET TO ATTRACT NEW BUSINESSES (CONTINUED).

Objective 4: Enhance public and private water services.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Upgrade failing and antiquated water lines and add new infrastructure in growth areas as identified in county and municipal comprehensive plans.	Municipal Authorities, Municipalities, DEP, PENNVEST	Foundations, Private Sources, DEP, DCED, PENNVEST	Medium
2.	Identify if additional public water supplies are necessary.	Municipal Authorities, Municipalities	Foundations, Private Sources, DEP	Low

GOAL 1-4: EXPAND COMMUNITY SERVICES, SUCH AS PUBLIC LIBRARIES AND EMERGENCY SERVICES.

Objective 1. Enhance access to literature for area residents.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Increase funding for libraries so that services can be expanded.	Municipalities, Citizens	Foundations, Private Sources	Medium
2.	Open school library collections to area residents in locations where no public library is available.	School Districts, Citizens	Foundations, Private Sources	Medium
3.	Establish bookmobile routes in rural areas.	Municipalities, Citizens	Foundations, Private Sources	Low

Objective 2. Enhance financial support and services to prepare emergency response providers.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Improve emergency services through additional funding, upgraded equipment, and training for volunteer or professional responders.	Police Departments, Fire Departments, Paramedics, Hospitals, Emergency Call Operators	Foundations, Private Sources, DCED	Medium
2.	Install dry hydrants in rural areas where public water supply is limited.	Planning Commissions, Fire Departments, Municipalities, Counties	Foundations, Private Sources, DCED	Medium

3. Develop a map detailing the locations of fire hydrants and dry hydrants that could be used by fire fighters in cases of emergency.	Fire Departments, Planning Commissions, Emergency Call Operators	Foundations, Private Sources, DCED	Low
4. Develop a maintenance program for dry hydrants.	Fire Departments, Municipalities, Counties	Foundations, Private Sources, DCED	Low

GOAL 1-5: IDENTIFY AND REDUCE IMPACTS CAUSED BY ACIDIC PRECIPITATION.

Objective 1. Identify impacts of acidic precipitation.

Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1. Establish a program to monitor groundwater and wells to determine if acidic precipitation is impacting water quality.	Conservation Districts, Conservation Groups, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium
2. Map and identify acid precipitation patterns to determine impacts to aquatic life.	Conservation Districts, Conservation Groups, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium
3. Develop a network of volunteers to identify acid precipitation by collecting rainwater and measuring its pH.	Conservation Districts, Conservation Groups, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium
4. Educate residents about the impacts acid precipitation and mercury have on the environment impacting air quality.	Conservation Districts, Conservation Groups, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium

Objective 2. Identify practices to reduce impacts of acidic precipitation.

Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1. Conduct an acid neutralization project to determine if such treatment could decrease acidity to the land and water.	Conservation Districts, Conservation Groups, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium

GOAL 1-6: INCREASE COMMUNICATION AND COOPERATION AMONG ORGANIZATIONS.

Objective 1. Foster communication and cooperation between municipalities, counties, and states.

1. Establish memorandums of understanding between entities to share equipment in responding to disasters and other emergency situations.	Municipalities, States, Counties, DCNR, DEP, DCED	Private Sources	Medium
2. Form a Council of Governments to establish joint or shared management of non-road issues among townships.	Municipalities, Counties	Private Sources, DCED	Medium
3. Establish regional or county-based planning and zoning, in addition to municipal zoning.	Planning Commissions, Municipalities, Counties	Private Sources, DCED	Medium

Objective 2. Foster communication and cooperation between municipalities, counties, and states and environmental organizations.

1. Establish collaboration amongst environmental groups, including the development and support for new groups.	Conservation Groups, Conservation Districts	Private Sources, Foundations	Medium
2. Establish an environmental advisory council encouraging local communities and governments to work together.	Conservation Groups, Municipalities, Counties	Private Sources, DCED	Medium

Land Resources

GOAL 2-1: DEVELOP A STRATEGIC PLAN TO PRIORITIZE AND PROTECT AGRICULTURAL AND ECOLOGICALLY SIGNIFICANT AREAS.

Objective 1: Establish incentives for land protection and conservation practice implementation.

Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1. Create tax incentives or tax reform to assist landowner in being able to maintain their property for conservation purposes.	Conservation Groups, Legislators, NRCS, DCNR, DEP	Foundations, Private Sources, Legislature, DEP, DCNR, EPA	High
2. Establish tax incentives to maintain large tracts of land unfragmented.	Conservation Groups, Legislators, NRCS, DCNR, DEP	Foundations, Private Sources, Legislature, DEP, EPA, DCNR	High

GOAL 2-1: DEVELOP A STRATEGIC PLAN TO PRIORITIZE AND PROTECT AGRICULTURAL AND ECOLOGICALLY SIGNIFICANT AREAS (CONTINUED).

Objective 1: Establish incentives for land protection and conservation practice implementation (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
3.	Ensure tax advantages and other incentives for enrolling in conservation programs remain as an encouragement to landowners.	Conservation Groups, Legislators, DEP, NRCS, PDA, EPA, USDA	Foundations, Private Sources, Legislature	High

Objective 2: Protect agricultural and ecologically significant lands through acquisitions, conservation easements, or enrollment into conservation programs.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Increase the acreage of land enrolled in cost-incentive programs, such as the Environmental Incentive Program, Conservation Reserve Enhancement Program, Conservation Reserve Program	Conservation Groups, Conservation Districts, Cooperative Extensions, PDA, NRCS, USDA	Foundations, Private Sources, DEP, NRCS, PGC	High
2.	Increase the acreage of land enrolled in the Agricultural Security Area Programs, conservation easements, or other conservation programs in order to maintain active agricultural production.	Planning Commissions, Conservation Groups, Municipalities	Foundations, Private Sources, NRCS, PDA	High
3.	Establish incentives to reward landowners who purchase conservation easements or participate in conservation programs.	Conservation Groups, Legislators, DEP, NRCS, PDA, EPA, USDA	Foundations, Private Sources, Legislature	High
4.	Protect large forest tracts and key riparian areas by working with landowners to keep these tracts intact through enrollment in forestland stewardship programs, purchase of conservation easements, land acquisition, or establish zoning ordinances.	Conservation Groups, Planning Commissions, Municipalities, Landowners, DCNR	Foundations, Private Sources, DCNR	High
5.	Protect prime farmland from conversion to non agricultural uses by purchasing conservation easements, assisting in multi-generation transfer of ownership, or utilize farmland preservation programs.	Conservation Groups, Planning Commissions, Municipalities, Landowners	Foundations, Private Sources, NRCS, PDA	High

GOAL 2-1: DEVELOP A STRATEGIC PLAN TO PRIORITIZE AND PROTECT AGRICULTURAL AND ECOLOGICALLY SIGNIFICANT AREAS (CONTINUED).

Objective 3: Preserve natural resources and agricultural lands through efficient land-use by redeveloping existing commercial and industrial properties.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct a study to inventory brownfield and grayfield sites and evaluate the feasibility of their reuse for economic development purposes.	Conservation Groups, Planning Commissions, DCED, DEP	Foundations, Private Sources, DCED, DEP	Medium
2.	Conduct a study to inventory abandoned, under utilized and vacant buildings and lands; and determine the feasibility of their reuse for economic development purposes.	Conservation Groups, Planning Commissions, DCED, DEP	Foundations, Private Sources, DCED, DEP	Medium

Objective 4: Increase awareness about practices to assist agricultural and forest landowners in managing their land effectively.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
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 Groups, Conservation Districts, Landowners, NRCS, PDA, USDA	Foundations, Private Sources, DCNR	High
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	Foundations, Private Sources, DCNR	High
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, DCNR, USFS	Foundations, Private Sources, DCNR	High

GOAL 2-1: DEVELOP A STRATEGIC PLAN TO PRIORITIZE AND PROTECT AGRICULTURAL AND ECOLOGICALLY SIGNIFICANT AREAS (CONTINUED).

Objective 5: Work with the agricultural community to implement best management practices on their property.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Develop and implement nutrient management plans on agricultural lands to boost productivity and protect water resources.	Conservation Districts, Conservation Groups, NRCS	Foundations, Private Sources, Cost-Share Programs, USDA, PDA, NRCS	High
2.	Install conservation practices, such as cover crops, crop residue, contour strips, grassed waterways, riparian buffers, streambank fencing, and responsible pesticide/herbicide use.	Conservation Districts, Conservation Groups, Cooperative Extension, PDA, NRCS	Foundations, Private Sources, DEP, NRCS	High
3.	Develop a model farm to demonstrate agricultural best management practices and offer educational tours for agricultural producers, agencies, and other interested parties.	Conservation Districts, Conservation Groups, Cooperative Extension, PDA, NRCS	Foundations, Private Sources, DEP, NRCS, USDA	High
4.	Stabilize barnyard and livestock areas to properly manage runoff.	Conservation Districts, Conservation Groups, Cooperative Extension, PDA, NRCS	Foundations, Private Sources, DEP, NRCS, USDA, PGC	High
5.	Increase the miles of stream protected through riparian buffers and streambank fencing installation and increase the width of existing riparian buffers to a minimum of 100 feet.	Conservation Districts, Conservation Groups, Cooperative Extension, PDA, NRCS	Foundations, Private Sources, DEP, NRCS, PGC	High
6.	Increase financial and technical assistance to small-scale agriculture operations to increase economic viability and environmental responsibility.	Conservation Groups, NRCS, USDA, PDA	Foundations, Private Sources, DEP, NRCS, USDA, PDA, EPA	High

GOAL 2-1: DEVELOP A STRATEGIC PLAN TO PRIORITIZE AND PROTECT AGRICULTURAL AND ECOLOGICALLY SIGNIFICANT AREAS (CONTINUED).

Objective 6: Increase awareness about the benefits of vegetated riparian corridors.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct outreach, education, and implementation programs on cost share and easements for streamside conservation.	Conservation Districts, DEP, NRCS, PFBC, PGC, USDA, EPA	Foundations, Private Sources, EPA, DCNR, NRCS, PFBC, PGC, USDA	Medium
2.	Host education events to promote the preservation and enhancement of vegetated streambank buffers in order to educate residents about their benefits for wildlife, water quality, and flood prevention.	Conservation Groups, DEP, NRCS, PFBC, PGC, USDA, and EPA	Foundations, Private Sources, DEP, NRCS, USDA, PDA, EPA, PFBC	Medium
3.	Educate all watershed stakeholders about the importance of riparian corridors, and encourage the establishment of riparian buffers.	Conservation Groups, DEP, NRCS, PFBC, PGC, USDA, EPA	Foundations, Private Sources, DEP, NRCS, USDA, DEP, PDA, EPA, PFBC	Medium

GOAL 2-2: PROMOTE LOCAL AGRICULTURAL PRODUCTS, PRODUCERS, MARKETS AND RELATED PROGRAMS.

Objective 1: Purchase agricultural products from local producers.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish and support locally produced farmers markets.	Cooperative Extension, Conservation Districts, Conservation Groups	Foundations, Private Sources	Medium
2.	Establish "Buy Local" campaigns to support the family farms located within the region.	Cooperative Extension, Conservation Districts, Conservation Groups	Foundations, Private Sources	Medium

GOAL 2-2: PROMOTE LOCAL AGRICULTURAL PRODUCTS, PRODUCERS, MARKETS AND RELATED PROGRAMS (CONTINUED).

Objective 2: Promote businesses that utilize agricultural products from local producers.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Promote importance and economic viability of small farms through marketing and education.	Cooperative Extension, Conservation Districts, Conservation Groups	Foundations, Private Sources	Medium
2.	Establish or highlight businesses that through value-added processes support local farmers.	Cooperative Extension, Conservation Districts, Conservation Groups	Foundations, Private Sources	Medium

GOAL 2-3: REDUCE CONFLICT AMONG SURFACE AND SUBSURFACE LAND OWNERSHIP AND THEIR RIGHTS AND RESPONSIBILITIES.

Objective 1: Establish cooperation among surface and subsurface owners without significantly impeding each others rights.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish laws to protect surface owner's rights and property from damage caused by subsurface mineral rights owners' access and resource extraction operations.	Conservation Districts, Conservation Groups, Legislators, DCNR, DEP	Foundations, Private Sources, Legislature	High
2.	Determine sub-surface ownership for private properties and encourage the landowners to purchase those rights if capable.	Landowners, Counties, DEP	Foundations, Private Sources, DEP	Medium
3.	Organize third-party moderated discussions between surface and subsurface rights owners prior to beginning exploration, construction, and production activities to address and resolve issues and minimize impact to the natural resources.	Conservation Groups, Conservation Districts, Landowners	Foundations, Private Sources, DEP	Medium

GOAL 2-4: PREVENT, RECLAIM, AND/OR IMPROVE IMPACTS ASSOCIATED WITH MINERAL EXTRACTION ACTIVITIES.

Objective 1: Reclaim abandoned wells, mines, and quarries.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Inventory abandoned wells and develop a remediation plan to plug the wells and reclaim the sites.	Conservation Groups, DEP	Foundations, Private Sources, DEP, EPA	High
2.	Inventory abandoned quarry sites and work with the landowner to establish a remediation plan that incorporates hazard reduction.	Conservation Groups, Concerned Citizens	Foundations, Private Sources	High
3.	Reduce hazards on active and abandoned industrial mining sites and redevelop abandoned sites through programs similar to brownfield redevelopment.	Conservation Districts, Conservation Groups, DEP	Foundations, Private Sources, DEP, EPA	High
4.	Expand current reclamation programs, as well as implement high quality reclamation techniques, and support incentives for industry-based reclamation.	Conservation Districts, Conservation Groups, DEP	Foundations, Private Sources, DEP, EPA	High
5.	Seal abandoned and inactive mine entrances to eliminate unauthorized access.	Conservation Districts, Conservation Groups, DEP	Foundations, Private Sources, DEP, EPA	High

Objective 2: Promote management practices on active mining sites to minimize and prevent impacts and to improve conditions where possible.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Promote strict enforcement of erosion and sedimentation regulations and dust control plans on active mining sites.	Conservation Districts, DEP, EPA	DEP, EPA	High
2.	Establish and enforce requirements for sealing core-drillings preventing the contamination of water sources.	Conservation Groups, Conservation Districts, DEP	Foundations, Private Sources, DEP, EPA	High
3.	Utilize high-value hardwood tree plantings as one method to reclaim abandoned mine lands, and support the Pennsylvania Department of Environmental Protection and United States Department of Interior's Office of Surface Mining Reforestation Initiative on active mine sites.	Conservation Groups, Conservation Districts, DEP	Foundations, Private Sources, DEP, EPA	High

GOAL 2-4: PREVENT, RECLAIM, AND/OR IMPROVE IMPACTS ASSOCIATED WITH MINERAL EXTRACTION ACTIVITIES (CONTINUED).

Objective 2: Promote management practices on active mining sites to minimize and prevent impacts and to improve conditions where possible (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
4.	Utilize management techniques, such as land liming, alkaline addition in backfill, and filling mine voids with flyash at active mine sites to prevent future mine drainage discharges.	Conservation districts, conservation Groups, DEP	Foundations, Private Sources, DEP, EPA	High

Objective 3: Minimize impacts caused by exploration, production, retirement, and abandonment of oil and gas wells.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Institute closer government oversight on gas-well exploration and production, including impacts to the natural resources.	Conservation Groups, Landowners, DEP	Foundations, Private Sources, DEP	High
2.	Establish water quality monitoring program for water wells located near proposed, existing, and abandoned oil and gas well sites.	Conservation Groups, Landowners, Drilling Companies	Foundations, Private Sources, DEP	High
3.	Plug abandoned gas wells to prevent brine water from entering streams and aquifers.	Conservation Groups, Landowners	Foundations, Private Sources, DEP	High
4.	Monitor cumulative impacts of oil and gas wells and implement best management practices to reduce impacts protecting watershed resources.	Conservation Groups, Conservation Districts, DEP	Foundations, Private Sources, DEP	High

Objective 4: Encourage the remediation and removal of refuse piles.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Prioritize refuse pile remediation; giving those located along riparian areas a higher priority for removal.	Conservation Districts, Conservation Groups, DEP, OSM	Foundations, Private Sources, DEP, EPA, OSM	High
2.	Evaluate refuse piles for value and possible re-use by cogeneration or reprocessing plants.	Conservation Districts, Conservation Groups, DEP, OSM	Foundations, Private Sources, DEP, EPA, OSM	Medium

GOAL 2-4: PREVENT, RECLAIM, AND/OR IMPROVE IMPACTS ASSOCIATED WITH MINERAL EXTRACTION ACTIVITIES (CONTINUED).

Objective 5: Identify, study, and treat abandoned mine drainage discharges.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct an assessment of abandoned mine drainage contamination and develop a prioritized remediation and implementation plan.	Conservation Districts, Conservation Groups, DEP, OSM	Foundations, Private Sources, DEP, EPA, OSM	High
2.	Upgrade treatment systems based on continued monitoring at the discharge sites.	Conservation Districts, Conservation Groups, DEP, OSM	Foundations, Private Sources, DEP, EPA, OSM	Medium

GOAL 2-5: PROTECT NATURAL RESOURCES AND UTILIZE OF MANAGEMENT PRACTICES TO MINIMIZE IMPACTS CAUSED THROUGH THE IDENTIFICATION AND EXTRACTION OF NATURAL GAS WITHIN THE MARCELLUS SHALE FORMATION.

Objective 1: Identify and alleviate impacts and concerns cause by the exploration of natural gas within the Marcellus shale formation.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Develop a method for fracturing the Marcellus shale formations without contaminating millions of gallons of water, such as reusing fracturing water and/or utilizing reverse osmosis units to remove salts and heavy metals from production water.	Oil Companies, DEP, EPA	Foundations, Private Sources, Oil Companies, DEP, EPA	High
2.	Avoid potentially toxic substances in fracturing fluids and inform landowners about what substances are being used if and when they request the information.	Conservation Groups, Concerned Citizens, Oil Companies, Landowners, DEP, EPA	Oil Companies	High
3.	Conduct an environmental impact assessment of potential Marcellus shale drilling sites in order to alleviate impacts before development activities occur.	Conservation Groups, Oil Companies DEP, EPA	Foundations, Private Sources, DEP, EPA	High
4.	Treat fracking water at permitted facilities capable of treating the chlorides and toxins.	Conservation Groups, Oil Companies, DEP, EPA	Oil Companies	High

GOAL 2-5: PROTECT NATURAL RESOURCES AND UTILIZE OF MANAGEMENT PRACTICES TO MINIMIZE IMPACTS CAUSED THROUGH THE IDENTIFICATION AND EXTRACTION OF NATURAL GAS WITHIN THE MARCELLUS SHALE FORMATION (CONTINUED).

Objective 1: Identify and alleviate impacts and concerns cause by the exploration of natural gas within the Marcellus shale formation (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
5.	Adopt the precautionary principle when fracturing formations and conduct no fracturing above the base of groundwater until a guarantee that there will not be any harmful impacts to groundwater supplies.	Conservation Groups, PAGS, USGS, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium

Objective 2: Coordinate efforts among agencies, conservation groups, and industries in order to protect infrastructure and natural resources, while recovering natural gas within the Marcellus shale formation.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Require companies to host public meeting workshops prior to development activities to inform and educate areas residents about the process to alleviate their concerns.	Conservation Groups, Gas Companies, DEP	Private Sources, Gas Companies, DEP, EPA	High
2.	Change bonding requirements for existing vertical wells to cover the likely higher plugging cost required for Marcellus wells by working with neighboring states to establish sufficient bonding rates to cover the plugging costs if wells are abandoned.	Conservation Groups, Legislators, DEP, EPA	Foundations, Private Sources, DEP, EPA	High
3.	Work with Department of Environmental Protection to establish protection for Exceptional Value, High Quality, and Wilderness Trout streams requiring individual permits for gas development providing the public an opportunity to review, comment, or request a public meeting about the proposed drilling activities or not permits the sites at all.	Conservation Groups, DEP, PFBC	Foundations, Private Sources, DEP, PFBC	High
4.	Evaluate the overall impacts to groundwater and surface water flows and place a cap on permits to prevent total Maximum Daily Loads from being reached.	Conservation Groups, Conservation Districts, Gas Companies, DEP	Foundations, Private Sources, DEP, USGS	High

GOAL 2-5: PROTECT NATURAL RESOURCES AND UTILIZE OF MANAGEMENT PRACTICES TO MINIMIZE IMPACTS CAUSED THROUGH THE IDENTIFICATION AND EXTRACTION OF NATURAL GAS WITHIN THE MARCELLUS SHALE FORMATION (CONTINUED).

Objective 2: Coordinate efforts among agencies, conservation groups, and industries in order to protect infrastructure and natural resources, while recovering natural gas within the Marcellus shale formation (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
5.	Establish a severance tax or severance fee on natural gas extraction to develop a fund to reimburse impacted municipalities for road infrastructures, remediate impacts cause by the recovery of natural gas, and cover Pennsylvania Department of Environmental Protection's administrative costs, such as permitting, inspections, and enforcement.	Conservation Groups, Legislators, Municipalities, DEP, EPA	Foundations, Private Sources, DEP, EPA	High

GOAL 2-6: CONTROL ILLEGAL DUMPING THROUGH EDUCATIONAL EFFORTS AND COMMUNITY PARTICIPATION.

Objective 1: Increase awareness about the impacts from litter, illegal dumps and abandoned vehicles.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
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, DCNR, DEP	Foundations, Private Sources, DEP	Medium
2.	Develop public service announcements about proper waste disposal and recycling opportunities.	Conservation Groups, Municipalities, Media, PA CleanWays, DEP	Foundations, Private Sources, DEP	Low
3.	Educate citizens about traditional and innovative ways to reduce, reuse, and recycle and how to properly dispose of household hazardous waste by providing workshops and other outreach campaigns.	Conservation Groups, Municipalities, PA CleanWays, DEP	Foundations, Private Sources, DEP	Low
4.	Increase the number of people practicing "leave no trace" or pack it in pack it out practices through outreach campaign and demonstrations at community events.	Conservation Groups, Municipalities, Media, PA CleanWays, DEP	Foundations, Private Sources, DEP	Low

GOAL 2-6: CONTROL ILLEGAL DUMPING THROUGH EDUCATIONAL EFFORTS AND COMMUNITY PARTICIPATION (CONTINUED).

Objective 1: Increase awareness about the impacts from litter, illegal dumps and abandoned vehicles (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
5.	Educate residents about safety, human health, and the environmental impacts cause by unlicensed or abandoned vehicles, and encourage proper disposal.	Conservation Groups, PA CleanWays, DEP	Foundations, Private Sources	Medium
6.	Reestablish PA CleanWays chapters in Armstrong, Indiana, and Jefferson counties or establish a multiple county chapter.	Conservation Groups, Concerned Citizens, PA CleanWays	Foundations, Private Sources	Medium

Objective 2: Reduce illegal dumping activities.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Monitor dumpsites for recent activity and increase enforcement and penalties for violators	Municipalities, Solid Waste Authorities, PA CleanWays, DEP	Foundations, Private Sources, Municipalities, DEP	Medium
2.	Increase access for recycling through expanded hours and/or drop-off locations.	Municipalities, Solid Waste Authorities, PA CleanWays, DEP	Foundations, Private Sources, Municipalities, DEP	Medium
3.	Increase participation in recycling programs through education and incentives for citizens, and regular receptacle maintenance and collection by service providers.	Municipalities, Solid Waste Authorities, PA CleanWays, DEP	Foundations, Private Sources, Municipalities, DEP	Medium
4.	Host cleanup events to eliminate illegal dumpsites and establish surveillance, monitoring to decrease the reoccurrence of dumping.	Conservation Districts, Conservation Groups, Municipalities, Solid Waste Authorities, PA CleanWays	Foundations, Private Sources, DEP	Medium
5.	Identify and secure local, state, and federal funding to adequately fund efforts to identify and remove illegal dumpsites, address waste disposal needs of the areas, and assist in establishing curbside recycling programs.	Conservation Groups, Municipalities, Civic Groups, PA CleanWays	Foundations, Private Sources, DEP	Medium

Water Resources

GOAL 3-1: REDUCE THE RISK OF FLOODING.

Objective 1: Minimize potential flooding damages by taking a proactive approach to managing floodplains.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct a detailed flood-prone area assessment that includes mapping to determine risk levels of flooding and establish a dedicated flood-control program and discourage development in floodplain areas.	Conservation Groups, Municipalities, PEMA	Foundations, Private Sources, FEMA, PEMA, DCED, DEP	Medium
2.	Acquire properties that are frequently impacted by serious flooding or at risk for serious flooding and convert them to public open spaces, such as parks, trails, or natural areas.	Conservation Groups, Municipalities, Counties, PEMA	Foundations, Private Sources, FEMA, PEMA, DCED, DCNR	Medium
3.	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, DEP	Medium
4.	Take proactive steps, such as maintaining culverts free of debris or establishing zoning ordinances in floodplains to alleviate the risk of flooding.	Conservation Groups, Municipalities, Civic Groups, Counties	Foundations, Private Sources, FEMA, PEMA, DCED, DEP	Medium
5.	Develop and education program addressing flood issues, flood prevention, flood recovery, and floodplain management.	Conservation Groups, Municipalities, PEMA	Foundations, Private Sources, DEP, EPA, PEMA, FEMA	Medium

Objective 2: Encourage non-structural approaches to floodplain management.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Identify areas where adequate riparian area vegetation and floodplain integrity can be re-established for flood control purposes and to limit degradation of water quality and biological resources.	Conservation Groups, Municipalities, Landowners, DEP	Foundations, Private Sources, FEMA, PEMA, DCED, DEP	High
2.	Implement channel improvement projects that use bioremediation techniques to limit flooding.	Conservation Districts, Conservation Groups, DEP	Foundations, Private Sources, FEMA, PEMA, DCED, DEP	High
3.	Discourage development of primary and secondary residences in floodplain areas.	Conservation Groups, Municipalities, PEMA	FEMA, PEMA, DCED, DEP	High

GOAL 3-1: REDUCE THE RISK OF FLOODING (CONTINUED).

Objective 2: Encourage non-structural approaches to floodplain management (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
4.	Create and maintain projects that promote alternative methods of flood control, reserving dredging as a last resort.	Conservation Districts, Conservation Groups, DEP	Foundations, Private Sources, FEMA, PEMA, DCED, DEP	Medium

GOAL 3-2: MANAGE STORMWATER.

Objective 1: Utilize planning to minimize impacts from stormwater.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Educate municipal and county officials about planning for stormwater best management practice implementation and increase local, state, and federal funding for installation of best management practices.	Conservation Districts, Conservation Groups, Municipalities, Counties, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium
2.	Develop and implement stormwater management plans for Armstrong and Indiana counties that incorporate water quality design and pollution reduction.	Conservation Districts, Conservation Groups, Planning Commissions, Municipalities, Counties	Foundations, Private Sources, DEP, DCED	Medium
3.	Develop a demonstration area of stormwater best management practices that incorporate water quality improvement techniques.	Conservation Districts, Conservation Groups, Planning Commissions, Counties	Foundations, Private Sources, DEP, DCED	Medium

Objective 2: Decrease the amount of impervious cover by 10 percent.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Minimize the amount of impervious cover by implementing stormwater management practices, such as installing pervious pavement and green roofs.	Conservation Districts, Conservation Groups, Municipalities	Foundations, Private Sources, DEP	Medium
2.	Inventory individual subwatersheds to determine percent impervious cover to use as a reference when managing and stormwater impacts and planning future land use changes.	Conservation Districts, Conservation Groups	Foundations, Private Sources, DEP	Low

GOAL 3-2: MANAGE STORMWATER (CONTINUED).

Objective 2: Decrease the amount of impervious cover by 10 percent (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
3.	Promote watersheds with 10 percent or less impervious cover.	Conservation Districts, Conservation Groups	Foundations, Private Sources, DEP	Low

GOAL 3-3: REDUCE EROSION AND SEDIMENTATION IMPACTS.

Objective 1: Increase the miles of streams with riparian buffers to achieve maximum protection of water resources.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct an assessment of streambanks and riparian areas, and prioritize areas in need of restoration.	Conservation Districts, DEP, Conservation Groups, Landowners	Foundations, Private Sources	High
2.	Establish and maintain vegetated riparian corridors and implement best management practices using smart growth practices as a cost-effective means of non-point source pollution reduction.	Conservation Groups, DEP, Conservation Districts, Landowners, PFBC	Foundations, Private Sources, Cost-Share Programs, DEP, EPA	High
3.	Increase wildlife habitat by planting diverse natural plant communities along riparian buffers.	Conservation Groups, DEP, Conservation Districts, Landowners, PFBC	Foundations, Private Sources, Cost-Share Programs, DEP, EPA	High
4.	Promote the preservation and enhancement of vegetated streamside buffers through education about their benefits for wildlife, water quality, and flood prevention.	Conservation Groups, DEP, NRCS, PFBC, PGC, USDA, EPA	Foundations, Private Sources, DEP, NRCS, USDA, PDA, EPA, PFBC	High

Objective 2: Determine sources of erosion and sedimentation.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct a watershed study to determine source of sedimentation and develop strategies to reduce impacts by implementing best management practices.	Conservation Groups, Conservation Districts, DEP	Foundations, Private Sources, DEP, EPA	Medium
2.	Support updates to the Pennsylvania Non-Point Source Management Plan and implement practices to reduce erosion.	Conservation Groups, DEP, NRCS, PDA	Foundations, Private Sources, DEP, EPA	Medium

GOAL 3-3: REDUCE EROSION AND SEDIMENTATION IMPACTS (CONTINUED).

Objective 3: Implement practices to reduce erosion and sedimentation impacts.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Incorporate environmentally sensitive construction and maintenance techniques on dirt and gravel roadways and install best management practices to minimize erosion and sedimentation form entering area waterways.	Conservation Districts, conservation Groups, Center for Dirt & Gravel Roads, Municipalities, DEP	Foundations, Private Sources, DEP, EPA	High
2.	Use best management practices to control erosion and sedimentation in farming, forestry, development, mining, and oil and gas industries; and conduct more site inspections.	Conservation Districts, Conservation Groups, DEP, DCNR	Foundations, Private Sources, DEP, EPA	High
3.	Conduct additional dirt and gravel road projects to minimize erosion and sedimentation entering area waterways.	Conservation Groups, Conservation Districts, Municipalities, DEP	Foundations, Private Sources, DEP, EPA	High

Objective 4: Establish controls to reduce erosion.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish a permit process that requires all earth moving industries to abide by the same erosion and sedimentation control standards.	Conservation Groups, Conservation Districts, DEP	Foundations, Private Sources, DEP, EPA	High
2.	Establish steep slope ordinances for earth moving industries.	Conservation Groups, Conservation Districts, Municipalities, DEP	Foundations, Private Sources, DEP, EPA	High
3.	Transfer permit violation fees to a local organization for water quality improvements within the watershed.	Conservation Districts, Conservation Groups, DEP	Private Sources	High

GOAL 3-4: EXPAND THE PROTECTION, STUDY, AND UNDERSTANDING OF WETLANDS.

Objective 1: Protect wetlands.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Acquire important wetland areas and protect hydrology supporting wetlands.	Planning Commissions, Conservation Groups, DCNR, PGC, DEP	Foundations, Private Sources, DEP, DCNR	High
2.	Protect wetland habitats and surrounding buffers for birds and wildlife by limiting development, storm runoff, and other disturbances.	Planning Commissions, Conservation Groups, DCNR, PGC, DEP	Foundations, Private Sources, DEP, DCNR	High
3.	Enhance and promote programs that restore wetlands from agricultural and streamside areas of limited use.	Planning Commissions, Conservation Groups, DCNR, PGC, DEP, USDA	Foundations, Private Sources, DEP, USDA	Medium
4.	Modify or establish municipal ordinances to protect wetland areas of biological importance.	Conservation Groups, Planning Commissions, Municipalities, DEP	Private Sources, DEP, DCED	Medium

Objective 2: Investigate wetlands and their functions.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Inventory and assess the functionality of wetlands, and develop restoration strategies based upon the assessment.	Planning Commissions, Conservation Groups, DCNR, PGC, DEP	Foundations, Private Sources, DEP, EPA	Medium
2.	Update wetland maps and develop a digital coverage database.	Planning Commissions, Conservation Groups, DCNR, PGC, DEP	Foundations, Private Sources, DEP, EPA	Medium
3.	Study the impacts that economic development has had on historical wetland loss.	Planning Commissions, Conservation Groups, DCNR, PGC, DEP	Foundations, Private Sources, DEP, DCNR, EPA	Low

GOAL 3-4: EXPAND THE PROTECTION, STUDY, AND UNDERSTANDING OF WETLANDS (CONTINUED).

Objective 3: Conduct activities to educate the public about the benefits of wetlands.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Develop or expand outreach programs on the function and value of wetlands.	Conservation Groups, Conservation Districts, DEP	Foundations, Private Sources, DEP, EPA	Medium
2.	Educate municipal, county, state, and federal officials about planning and implementation of wetland mitigation and the establishment of replacement wetlands.	Conservation Groups, Elected Officials, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium
3.	Educate stakeholder about reducing erosion and sedimentation impacts through wetland development.	Conservation Groups, Conservation districts, Citizens, DEP, NRCS	Foundations, Private Sources, DEP, EPA, NRCS	Medium

GOAL 3-5: MONITOR WATER QUANTITY TO ENSURE DEMAND DOES NOT EXCEED WATER SUPPLY.

Objective 1: Protect the quality of drinking water.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	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 Districts, Conservation Groups, DEP	Foundations, Private Sources, DEP, EPA	High
2.	Develop a locally based program for disseminating information about protecting private well supplies to homeowners.	Conservation Districts, Conservation Groups, DEP, LWV, RWA	Foundations, Private Sources, DEP, WREN	Medium
3.	Conduct Source Water Assessments and Protection Plans for Dayton Borough Municipal Water Plant, Shannock Valley General Services Authority, and the Hawthorne, Redbank, Ringgold Municipal Authority in order to identify and protect public drinking water sources.	Conservation Districts, Conservation Groups, Municipalities, Water Authorities, DEP, LWV, RWA	Foundations, Private Sources, DEP, WREN\	Medium

GOAL 3-5: MONITOR WATER QUANTITY TO ENSURE DEMAND DOES NOT EXCEED WATER SUPPLY (CONTINUED).

Objective 2: Monitor levels of water available and implement practices to increase the flow of groundwater.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Work with U.S. Geological Survey on updating stream gauging station database to include current groundwater flow, depths, and quality information.	Conservation Districts, Conservation Groups, PFBC, USGS, DEP	Foundations, Private Sources, DEP, EPA, USGS	Medium
2.	Monitor groundwater levels in critical areas that can be used as baseline data to determine loss of groundwater.	Conservation Districts, Conservation Groups, School Districts, Citizens	Foundations, Private Sources, DEP, EPA	Medium
3.	Conserve groundwater through the installation of riparian buffers, porous pavement, rain barrels, swales, and other best management practices.	Conservation Districts, Conservation Groups, Landowners	Foundations, Private Sources, Cost-share Programs, DEP	Medium
4.	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 Districts, Conservation Groups, PFBC, DEP, USGS	Foundations, Private Sources, DEP, EPA, USGS	Medium
5.	Install best management practices to increase the infiltration rate of stormwater to recharge groundwater supplies.	Conservation Districts, Conservation Groups, Water Authorities, DEP	Foundations, Private Sources, DEP, EPA	Medium

Objective 3: Reduce water consumption through implementation of water conservation practices.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Launch a watershed-wide water conservation program to educate the public about the benefits of reducing water consumption, utilizing water conservation products and techniques, and incorporating environmentally friendly water conservation practices into homes and businesses.	Conservation Districts, Conservation Groups, Citizens, Businesses, School Districts, Developers, Legislators	Foundations, Private Sources, DEP, WREN	Medium

GOAL 3-5: MONITOR WATER QUANTITY TO ENSURE DEMAND DOES NOT EXCEED WATER SUPPLY (CONTINUED).

Objective 3: Reduce water consumption through implementation of water conservation practices (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Establish a program to promote and retrofit homes and businesses for water conservation practices and establish guidelines that require installation of low-flow devices for all new construction.	Conservation Groups, Developers, Legislators, Landowners, DEP	Foundations, Private Sources, DEP, WREN	Medium
3.	Establish an ongoing program for school districts to promote and practice water conservation practices.	Conservation Groups, Conservation Districts, School Districts	Foundations, Private Sources, DEP, WREN	Medium

Objective 4: Investigate the need and effectiveness of establishing a water quality trading program within the watershed.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Explore and develop institutional framework for water trading.	Conservation Districts, Conservation Groups, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium
2.	Support and strengthen the water quality trading program to improve overall water quality and industrial discharges.	Conservation Districts, Conservation Groups, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium

GOAL 3-6: PROTECT AND IMPROVE AREA WATERWAYS.

Objective 1: Monitor conditions of area waterways.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Develop a monitoring plan that integrates quality assurance and quality control standards.	Conservation Districts, Conservation Groups, Community Groups, School Districts	Foundations, Private Sources, DEP, EPA	High
2.	Conduct seasonal chemical, biological, and visual assessments to initial provide background data and to prioritize future project, and then to monitor changes in conditions.	Conservation Districts, Conservation Groups, School Districts	Foundations, Private Sources, DEP, EPA	High

GOAL 3-6: PROTECT AND IMPROVE AREA WATERWAYS (CONTINUED).

Objective 1: Monitor conditions of area waterways (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
3.	Incorporate schools and community groups into water quality monitoring programs and compile a database to record and compare monitoring data.	Conservation Districts, Conservation Groups, Community Groups, School Districts	Foundations, Private Sources, DEP, EPA	High
4.	Establish monitoring sites near withdrawal and discharge sites and analyze water samples for bacteria and biochemical oxygen demand.	Conservation Districts, Conservation Groups, Community Groups, School Districts, Water Authorities, Wastewater Plants	Foundations, Private Sources, DEP, EPA	High

Objective 2: Access conditions at lakes and ponds.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct an assessment of natural and man-made impoundments for size, use, water quality, and aquatic life, and implement recommendations to enhance their ecosystems.	Conservation Groups, Conservation Districts, DEP, PALMS	Foundations, Private Sources, DEP, EPA	Medium
2.	Assess, control, monitor, and mitigate exotic species that directly affect lake uses.	Conservation Groups, Conservation Districts, DEP, PALMS	Foundations, Private Sources, DEP, EPA	Medium
3.	Inventory dams for their uses, and evaluate maintenance versus removal, while considering public safety, recreation, and present use.	Conservation Groups, American Rivers, PFBC, DCNR, DEP	Foundations, Private Sources, American Rivers, DEP, PFBC	Medium
4.	Protect aquatic life and stream habitats by gradually discharging overflows from flood control structures.	Conservation Groups, PFBC, DCNR, DEP	Private Sources	Medium
5.	Conduct bathymetry mapping for Mahoning Creek Reservoir.	Conservation Groups, USACE	Foundations, Private Sources, USACE	Medium

GOAL 3-6: PROTECT AND IMPROVE AREA WATERWAYS (CONTINUED).

Objective 3: Improve water quality and wildlife habitat and enhance the local fishery as a resource for recreation and tourism.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Enforce regulations protecting water quality, particularly for High Quality and Exceptional Value designated streams.	Conservation Groups, Conservation Districts, DEP, PFBC	Foundations, Private Sources, DEP	High
2.	Develop total maximum daily load studies for the impaired waterways that are identified in category five.	Conservation Groups, DEP, EPA	DEP, EPA	High
3.	Re-designate section of Little Mahoning Creek to "Exceptional Value" in order to further protect the waterway's resources.	Conservation Groups, DEP	DEP	High
4.	Increase the miles of stream that have a vegetated riparian corridor while protecting and enhancing existing corridors to achieve maximum protection of water resources.	Conservation Groups, Conservation Districts, Landowners, DEP	Foundations, Private Sources, Cost-Share Programs, DEP, EPA	High
5.	Conduct an assessment of streambanks and riparian areas prioritizing areas in need of restoration and implement the use of best management and smart growth practices as a cost-effective means of non-point source pollution reduction.	Conservation Groups, Conservation Districts, Landowners, DEP, USACE	Foundations, Private Sources, Cost-Share Programs, DEP, EPA	High
6.	Increase wildlife habitat by planting diverse natural plant communities along riparian buffers.	Conservation Groups, Conservation Districts, Landowners, DEP, PFBC, USACE	Foundations, Private Sources, Cost-Share Programs, DEP, EPA	High

Objective 4: Increase awareness about conservation practices to protect water quality and quantity.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Promote groundwater quality awareness when conducting education and outreach programs, and provide educational information about potential threats to water supply.	Conservation Groups, Conservation Districts, Municipalities, Water Suppliers	Foundations, Private Sources, DEP, DCED, EPA	Medium

GOAL 3-6: PROTECT AND IMPROVE AREA WATERWAYS (CONTINUED).

Objective 4: Increase awareness about conservation practices to protect water quality and quantity (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Educate homeowners about the effects of the overuse of fertilizers, pesticides, and herbicides on groundwater.	Conservation Groups, Conservation Districts, Landowners	Foundations, Private Sources, DEP	Medium
3.	Educate homeowners about the significance of water-use designations and ways to minimize non-point source pollution.	Conservation Groups, Conservation Districts, Citizens	Foundations, Private Sources, DEP	Medium
4.	Develop or implement educational outreach programs for private well owners, specifically concerning sole source aquifer protection programs and protecting groundwater supplies.	Conservation Groups, Conservation Districts, Landowners, DEP, RWA	Foundations, Private Sources, DEP	Medium

Biological Resources

GOAL 4-1: PROTECT FOREST AND WILDLIFE RESOURCES.

Objective 1: Develop, adopt, and implement plans.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Develop and implement forest stewardship, forest management, or wildlife management plans on privately owned property.	Conservation Groups, Planning Departments, Landowners, DCNR, PGC	Foundations, Private Sources, DCNR, PGC	Medium
2.	Increase participation in Pennsylvania Forest Stewardship and Tree Farm programs.	Conservation Groups, Planning Departments, Landowners, DCNR	Foundations, Private Sources, DCNR	Medium
3.	Develop detailed management plans for landowners of biologically diverse areas, including inventories of natural features and monitoring plans for invasive or exotic species.	Conservation Groups, Landowners, PGC, DCNR	Foundations, Private Sources, DCNR, PGC	Medium

GOAL 4-1: PROTECT FOREST AND WILDLIFE RESOURCES (CONTINUED).

Objective 1: Develop, adopt, and implement plans (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
4.	Conduct studies in conjunction with Pennsylvania Natural Heritage Program to monitor biodiversity, including surveys for historical species of concern for which the current status is unknown.	Conservation Groups, Sportsmen Groups, DCNR, PGC, PNHP	Foundations, Private Sources, DCNR	Medium

Objective 2: Implement best management practices to enhance forest and wildlife habitat.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct a demonstration project utilizing best management practices to restore degraded areas.	Conservation Groups, Landowners, DCNR	Foundations, Private Sources, DCNR	High
2.	Utilize sustainable management practices based upon forest type, management type, and size under the direction of a professional forester.	Conservation Groups, Landowners, DCNR	Foundations, Private Sources, DCNR	High
3.	Decrease forest fragmentation by maintaining contiguous forest tracts and/or travel corridors between existing non-contiguous forest tracts.	Conservation Groups, Sportsmen Groups, Landowners, DCNR, PGC	Foundations, Private Sources, DCNR, PGC	High
4.	Develop incentives to encourage the forest and logging industries to utilize sustainable management practices and promote tree plantings, sustainable harvesting, and other best management practices.	Conservation Groups, Landowners, Civic Groups, DCNR, USFS	Foundations, Private Sources, USFS, DCNR	Medium

Objective 3: Identify and protect biologically diverse areas and important habitats.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Identify, characterize, and recommend Important Bird Areas and Important Mammal Areas.	Conservation Groups, Landowners, DCNR, PGC	Foundation, Private Sources, Conservation Groups, DCNR, PGC	Medium

GOAL 4-1: PROTECT FOREST AND WILDLIFE RESOURCES (CONTINUED).

Objective 3: Identify and protect biologically diverse areas and important habitats (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Develop biological study areas and encourage local school districts to utilize these resources, thereby fulfilling state education curriculum of broadening the understanding of ecological resources.	Conservation Groups, Universities, School Districts, Landowners, DCNR, PGC	Foundations, private Sources, Universities, DCNR	Medium
3.	Develop a land steward program through which volunteers would be responsible for regular monitoring of important habitats and working with the landowners.	Conservation Groups, Landowners, DCNR, PGC	Foundations, Private Sources, DCNR	Medium
4.	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, DCNR, PGC, DEP	Foundations, Cost-Share Programs, Private Sources, DCNR, DEP, PGC	Medium
5.	Develop biodiversity indices for selected stream segments to document the current biodiversity status and to track changes over time as projects are implemented.	Conservation Groups, Sportsmen Groups, DCNR, DEP, PFBC, USFWS	Foundations, Private Sources, DEP, DCNR, PFBC, PGC, USFWS	Medium

Objective 4: Identify and protect important habitats for plant and animal species.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Identify and protect additional environmentally sensitive areas and areas of high biodiversity and monitor activities within critical habitat areas.	Conservation Groups, Landowners, PNHP, PFBC, DCNR	Foundations, Private Sources, DCNR, PFBC	High
2.	Identify high quality wetlands and work with landowners to protect these sites through acquisition or conservation easement purchases.	Conservation Groups, DCNR	Foundations, Private Sources, DCNR	High

Objective 5: Increase awareness about the importance of biodiversity and protecting wildlife and natural resources.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Sponsor outreach programs to educate landowners about wildlife management practices.	Sportsmen Groups, PGC	Foundations, Private Sources, PGC	Medium

GOAL 4-1: PROTECT FOREST AND WILDLIFE RESOURCES (CONTINUED).

Objective 5: Increase awareness about the importance of biodiversity and protecting wildlife and natural resources (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Educate citizens 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	Foundations, Private Sources, DCNR	Medium
3.	Educate citizens about biological diversity and the vital importance of conserving habitats and protecting species.	Conservation Groups, DCNR, PGC, USFWS	Foundations, Private Sources, DCNR	Medium
4.	Provide educational field trips to elected officials emphasizing natural resources and the value of those resources to the region.	Conservation Groups, Elected Officials, DCNR, PGC, USFWS	Foundations, Private Sources, DCNR	Medium

GOAL 4-2: IMPROVE HABITATS.

Objective 1: Implement strategies to improve conditions for biologically diverse and important habitats.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Restrict activities, such as grazing and off-road vehicles, within biological diversity areas to minimize erosion and sedimentation impacts to control the spread of invasive species.	Conservation Groups, Landowners, DCNR, PGC	Foundations, Private Sources, DCNR	High
2.	Decrease the use of herbicide along highway right-of-ways and develop an alternative management technique that can be implemented.	Conservation Groups, Adjacent Landowners, Utility Companies, PennDOT	Foundations, Private Sources, DCNR	Medium
3.	Develop and 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 divers areas.	Conservation Groups, Sportsmen Groups, Landowners, DCNR, PGC, DEP	Foundations, Private Sources, Cost-Share Programs, DCNR, DEP, PGC	Medium

Objective 2: Implement strategies to improve aquatic habitats for fish, mussels, and other organisms.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Incorporate aquatic habitat improvements into streambank stabilization and water quality remediation projects.	Conservation Groups, Landowners, PFBC, DEP	Foundations, Private Sources, PFBC, DEP	High

GOAL 4-2: IMPROVE HABITATS (CONTINUED).

Objective 2: Implement strategies to improve aquatic habitats for fish, mussels, and other organisms (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Increase habitat and passage for fish, mussels, and other aquatic organisms by removing non-functional dams, such as Savan Dam, and establishing fish ladders at functioning dams.	Conservation Groups, Sportsmen Groups, Landowners, PNHP, PFBC, DCNR, USACE	Foundations, Private Sources, DCNR, PFBC	High
3.	Utilize volunteers to quantify the amount of large woody debris, in key stream reaches and headwater areas.	Conservation Groups, Conservation Districts, Sportsmen Groups, PFBC, DEP	Foundation, Private Sources, PFBC, DEP	Low

Objective 3: Implement strategies to enhance habitats for wildlife.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Increase the number of private backyard conservation areas to serve as wildlife habitat and travel corridors by providing activities and programs for landowners.	Conservation Groups, Landowners, PNHP, PFBC, DCNR, PGC	Foundations, Private Sources, DCNR, PFBC	Medium
2.	Refrain from using manicuring techniques on some fields in public ownership reducing maintenance costs and providing wildlife habitat.	Conservation Groups, Landowners, PNHP, PFBC, DCNR, PGC	NA	Medium
3.	Maintain grassland species habitats on public lands through practices, such as controlled burns and limited mowing.	Conservation Groups, Landowners, PNHP, PFBC, DCNR, PGC	Foundations, Private Sources, DCNR, PFBC	Medium
4.	Delay hay harvesting and mowing of fallow fields until July protecting bird nesting sites and young wildlife, if economic situation permits.	Conservation Groups, Landowners, PNHP, PFBC, DCNR, PGC	Foundations, Private Sources, DCNR, PFBC	Medium

Objective 4: Protect rare, threatened, and endangered species and their habitats.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	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, PFBC, DCNR	Foundations, Private Sources, DCNR, PFBC	High

GOAL 4-2: IMPROVE HABITATS (CONTINUED).

Objective 4: Protect rare, threatened, and endangered species and their habitats (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Develop monitoring strategies and management plans for species of concern that are particularly vulnerable to habitat destruction by working with the Pennsylvania Natural Heritage Program.	Conservation Groups, Landowners, PNHP, PFBC, DCNR	Foundations, Private Sources, DCNR, PFBC	Medium
3.	Submit recent identification of rare, threatened, or endangered species and their habitats to Pennsylvania Biological Survey.	Conservation Groups, Landowners, PNHP, PFBC, DCNR	Foundations, Private Sources, DCNR, PFBC	Medium

GOAL 4-3: REDUCE INVASIVE SPECIES POPULATIONS WHILE INCREASING THE USE OF NATIVE SPECIES.

Objective 1: Monitor and control invasive species.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Monitor riparian buffers for invasive species and implement control practices to deter the spread of invasive species downstream.	Conservation Groups, Conservation Districts, Landowners, DCNR	Foundations, Private Sources, DCNR	Medium
2.	Develop a prioritized early detection and rapid response control strategy for removing invasive species by partnering with public and private landowners.	Conservation Groups, Conservation Districts, DCNR	Foundations, private Sources, DCNR	Medium
3.	Conduct a watershed-wide invasive species plant survey to identify areas where invasive species pose the greatest threats to biodiversity and develop prioritization and remediation plans.	Conservation Groups, Conservation Districts, DCNR	Foundations, Private Sources, DCNR	Medium
4.	Compile a publicly assessable Internet database of exotic and invasive species that allows moderated submissions from the public.	Conservation Groups, Conservation Districts, DCNR	Foundations, Private Sources, DCNR	Low
5.	Install wader or boot washing stations at popular fishing access sites to reduce the spread of invasive species.	Conservation Groups, Sportsmen Groups, PFBC	Foundations, Private Sources, PFBC, DCNR	Low

GOAL 4-3: REDUCE INVASIVE SPECIES POPULATIONS WHILE INCREASING THE USE OF NATIVE SPECIES (CONTINUED).

Objective 2: Increase the use of native plants.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Use native plants in landscaping, wildlife habitat plantings, and educational activities.	Conservation Groups, Conservation Districts, DCNR	Foundations, Private Sources, DCNR	High
2.	Promote native tree plantings in remediation projects, such as streambank fencing, streambank stabilization, or surface mine reclamation.	Conservation Groups, Conservation Districts, DCNR	Foundations, Private Sources, DCNR	High
3.	Conduct an assessment and develop a management plan for native species.	Conservation Groups, Conservation Districts, DCNR	Foundations, Private Sources, DCNR	Medium
4.	Establish a reserve seed bank of native species that can be used in remediation efforts.	Conservation Groups, Conservation Districts, DCNR, USFS	Foundations, Private Sources, DCNR, USFS	Medium

GOAL 4-4: CONTROL WILDLIFE POPULATIONS.

Objective 1: Increase opportunities for hunting.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Register additional acres into the Deer Management Assistance Program to keep deer herds at ecologically healthy levels.	Conservation Groups, Sportsmen Groups, DCNR, PGC	Foundations, Private Sources, PGC	Medium
2.	Establish incentives to landowners who permit the public to hunt on their property.	Conservation Groups, Sportsmen Groups, PGC	Foundations, Private Sources, PGC	Medium
4..	Promote deer management strategies, such as special hunting tags and deer exclosures in natural areas.	Conservation Groups, Sportsmen Groups, DCNR, PGC	Foundations, Private Sources, PGC	Medium
5.	Increase the number of hunters participating in the Deer Management Assistance Program.	Conservation Groups, Sportsmen Groups, DCNR, PGC	Foundations, Private Sources, PGC	Medium

GOAL 4-4: CONTROL WILDLIFE POPULATIONS (CONTINUED).

Objective 2: Increase participation and interest in wildlife management.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Foster continued involvement in hunting and trapping activities among all age groups and educate hunters, trappers, and citizens on the importance of population control.	Conservation Groups, Sportsmen Groups, DCNR, PGC	Foundations, Private Sources, PGC	Medium
2.	Develop area for wildlife viewing and educational programs to raise awareness about biodiversity.	Conservation Groups, Sportsmen Groups, DCNR, PGC	Foundations, Private Sources, DCNR, PGC	Medium
3.	Support laws and regulations to maintain whitetail deer populations at levels that will ensure healthy forests, productive agricultural lands, and healthy deer populations.	Conservation Groups, Sportsmen Groups, DCNR, PGC	Foundations, Private Sources, PGC	Medium

Cultural Resources

GOAL 5-1: ENHANCE RECREATIONAL OPPORTUNITIES FOR SPORTSMEN AND OUTDOOR ENTHUSIASTS.

Objective 1. Increase the acreage of private land open to public hunting.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Enroll private lands into Cooperative Farmland, Cooperative Forestland, and Deer Management Assistance Program.	Conservation Groups, Sportsmen Groups, Landowners, PGC	Foundations, Private Sources, PGC, DCNR	High
2.	Establish an incentive to encourage private landowners to permit public hunting on their property.	Conservation Groups, Sportsmen Groups, Landowners, PGC	Foundations, Private Sources, Conservation Groups, PGC	High
3.	Establish new or expand existing state game lands increasing the acreage of public land open to hunting.	Conservation Groups, Sportsmen Groups, Landowner, PGC	Foundations, Private Sources, Conservation Groups, PGC	Medium

GOAL 5-1: ENHANCE RECREATIONAL OPPORTUNITIES FOR SPORTSMEN AND OUTDOOR ENTHUSIASTS (CONTINUED).

Objective 2. Enhance fishing and boating access and opportunities.

Method to achieve objective:	Potential Partners	Potential Funding	Priority
1. Formalize unofficial access sites and develop a water trail guide for the Mahoning Creek and Little Mahoning Creek watersheds.	Conservation Groups, Citizens, Businesses, Municipalities, PFBC, DCNR, TPA	Foundations, Private Sources, PFBC, DCNR, TPA	High
2. Develop public access to area waterways for anglers and small non-powered watercraft.	Conservation Groups, Landowners, PFBC, DCNR, USACE	Foundations, Private Sources, PFBC, DEP	High
3. Remove non-functional dams, such as Savan Dam, to improve canoeing, kayaking, and natural fish passage.	Conservation Groups, American Rivers, PFBC	Foundations, Private Sources, PFBC, DEP	High

Objective 3. Enhance the opportunities for camping.

Method to achieve objective:	Potential Partners	Potential Funding	Priority
1. Acquire and develop areas along the stream for primitive camping.	Conservation Groups, Businesses, USACE, DCNR	Foundations, Private Sources, PFBC, DCNR	Medium
2. Enhance camping experience through facility and program updates.	Businesses, USACE, DCNR	Foundations, Private Sources, PFBC, DCNR	Medium

GOAL 5-2: HIGHLIGHT AND PROMOTE NATURAL, CULTURAL, HISTORICAL, AND RECREATIONAL OPPORTUNITIES.

Objective 1. Develop a campaign to market the recreational and historical resources throughout the area.

Method to achieve objective:	Potential Partners	Potential Funding	Priority
1. Develop outreach programs to educate visitors about recreation resources available to the public and to respect private property owner rights.	Conservation Groups, Historical Societies, TPA	Foundations, Private Sources, TPA	Medium
2. Develop a local recreation guide advertising the historical, cultural, and recreational resources in the region including public lands and fishing opportunities.	Conservation Groups, Historical Societies, Municipalities, Businesses, TPA	Foundations, Private Sources, TPA	Medium

GOAL 5-2: HIGHLIGHT AND PROMOTE NATURAL, CULTURAL, HISTORICAL, AND RECREATIONAL OPPORTUNITIES (CONTINUED).

Objective 1. Develop a campaign to market the recreational and historical resources throughout the area (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
3.	Develop a campaign utilizing local and social media to advertise the region's recreational and historical assets.	Conservation Groups, Historical Societies, Chambers of Commerce, TPA	Foundations, Private Sources, TPA	Medium
4.	Utilize local recreational facilities, such as Dayton Fairgrounds, Smicksburg Park, and Timblin Park, to host community festivals and events.	Conservation Groups, Historical Societies, Chambers of Commerce, Municipalities, Businesses, TPA	Foundations, Private Sources, TPA	Medium

Objective 2. Develop an educational campaigns encouraging good sportsmanship while protecting private property owner's rights.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Educate hunters, fishermen, and other outdoor recreation enthusiasts on the importance of land etiquette.	Conservation Groups, Sportsmen Groups, Landowners, PFBC, PGC, DCNR	Foundations, Private Sources, PGC, PFBC, DCNR	Medium
2.	Educate sportsmen about areas open to public usage providing detailed maps delineating public-use areas.	Conservation Groups, Sportsmen Groups, Landowners, PFBC, PGC, DCNR	Foundations, Private Sources, PGC, PFBC, DCNR	Medium
3.	Establish signage positively influencing and promoting good sportsmanship practices, such as leave no trace or pack it in, pack it out.	Conservation Groups, Sportsmen Groups, Trail Groups, DCNR	Foundations, Private Sources, DCNR	Low

GOAL 5-3: ENHANCE RECREATIONAL FACILITIES AND EXPAND RESOURCES FOR A DIVERSITY OF USES.

Objective 1: Improve recreational facilities and ensure availability and access.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct playground safety audits at local playgrounds and implement recommendations from the audits.	Municipalities, Park & Recreation Authorities, Counties, DCNR	Foundations, Private Sources, Municipalities, Counties, DCNR	Medium

GOAL 5-3: ENHANCE RECREATIONAL FACILITIES AND EXPAND RESOURCES FOR A DIVERSITY OF USES (CONTINUED).

Objective 1: Improve recreational facilities and ensure availability and access (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Upgrade equipment and safety features at existing community parks and upgrade recreational facilities to comply with American Disability Act guidelines.	Municipalities, Park & Recreation Authorities, Counties, Citizens	Foundations, Private Sources, DCNR	Medium
3.	Establish or enhance amenities, such as bathrooms and parking lots, at recreational facilities, including trail heads and municipal parks.	Municipalities, Park & Recreation Authorities, PFBC, DCNR	Foundations, Private Sources, DCNR, PFBC	Medium
4.	Establish additional or enhance existing public access points to streams and trails, including amenities, such as parking and restroom facilities.	Municipalities, Park & Recreation Authorities, PFBC, DCNR	Foundations, Private Sources, DCNR, PFBC	Medium
5.	Renew the lease between Indiana County and Pennsylvania Fish and Boat Commission to continue the operation of Hemlock Lake as an Indiana County Park.	Indiana County Parks, Indiana County Commissioners, PFBC	N/A	Medium
6.	Develop a pedestrian bridge at the spillway of Hemlock Park to connect the east and west sides of the park.	Indiana County Parks, Indiana County Commissioners, PFBC	Foundations, Private Sources, Indiana County, DCNR	Medium

Objective 2: Expand recreational opportunities at local facilities to provide a variety of activities and amenities.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish winter recreational activities at existing facilities, such as sledding, ice skating, and cross-country skiing.	Community Groups, Municipalities, Park & Recreation Authorities, Landowners, USACE	Foundations, Private Sources, DCNR	Medium
2.	Develop low-impact recreational facilities for camping, hiking, biking, wildlife viewing, bird watching, picnicking, fishing, and hunting.	Conservation Groups, Community Groups, DCNR	Foundations, Private Sources, DCNR	Medium
3.	Develop the old Smicksburg Park and the Route 119 Little Mahoning Creek canoe access sites.	Conservation Groups, Community Groups, DCNR, PFBC	Foundations, Private Sources, DCNR, PFBC, WPC	Medium

GOAL 5-3: ENHANCE RECREATIONAL FACILITIES AND EXPAND RESOURCES FOR A DIVERSITY OF USES (CONTINUED).

Objective 3: Investigate the need for the development of additional recreational facilities and how to better manage existing sites.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Conduct a feasibility study investigating the preservation of 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, DCNR	Medium
2.	Conduct a feasibility study to determine availability of suitable land for development of all-terrain vehicle trails and/or facilities.	Trail Groups, Counties, Municipalities, Park & Recreation Authorities, DCNR	Foundations, Private Sources, DCNR	Medium
3.	Conduct a feasibility study for the development of recreational areas and trails for multiple uses including the use of off-road vehicles.	Conservation Groups, Municipalities, Trail Groups, Counties, ATV Clubs, DCNR	Foundations, Private Sources, DCNR	Medium
4.	Develop a master site plan for Hemlock Park to manage future site developments.	Indiana County Parks, Friends of the Park, Indiana County Commissioners, PFBC	Foundations, Private Sources, DCNR, PFBC	Medium
5.	Conduct an economic impact study of recreational activities to determine the impact that recreation has on the local economy.	Conservation Groups, Historical Societies, Municipalities, Businesses, TPA	Foundations, Private Sources, TPA	Medium

GOAL 5-4: UTILIZE TRAILS.

Objective 1: Expand the network of area trails.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Develop or designate certain areas of trails for specific uses, such as off road vehicle riding, snowmobiling, hiking, biking, and horseback riding.	Conservation Groups, Trail Groups, Civic Groups, Municipalities	Foundations, Private Sources, DCNR	High
2.	Develop highway bike/walking trails a connecting communities by enhanced existing roadways.	Conservation Groups, Municipalities, Park & Recreation Authorities, Counties, PennDOT	Foundations, Private Sources, PennDOT, DCNR	High

GOAL 5-4: UTILIZE TRAILS (CONTINUED).

Objective 1: Expand the network of area trails (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
3.	Expand area trail networks by connecting existing and new trails to recreational and historical facilities.	Conservation Groups, Trail Groups, Park & Recreation Authorities, Municipalities, Counties	Foundations, Private Sources, DCNR, DCED	High
4.	Develop the Pine Creek Rail-With Trail from the Allegheny River through the village of Echo into Dayton connecting the Great Shamokin Path to Armstrong Trail in Echo.	Railroad Company, Landowners, Trail Groups, Municipalities, Counties, DCNR	Foundations, Private Sources, DCNR	High
5.	Develop the Mahoning Creek-Pine Run Rail Trail, a walking and biking trail that travels along Mahoning Creek.	Municipalities, Trail Groups, Landowners, Counties, DCNR	Foundations, Private Sources, DCNR	High
6.	Establish greenway corridors and trails in the watershed to connect activity hubs and greenway for public use.	Conservation Districts, Conservation Groups, Planning Commissions	Foundations, Private Sources, DCNR	Medium
7.	Increase access to Bake Trail through the addition of connecting links and additional trailheads.	Conservation Groups, Trail Groups	Foundations, Private Sources, DCNR	Medium

Objective 2: Enhance area trails through maintenance, signage, and safety.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Develop and adopt a trail maintenance plan for each trail that includes monitoring, annual maintenance, remediation, and enhancement efforts.	Conservation Groups, Trail Groups, Civic Groups	Foundations, Private Sources, DCNR	Medium
2.	Increase safety for trails along roadways by erecting highway signage, alerting motorist of the trails, and offering trail safety seminars for trail users.	Municipalities, Trail Groups, PennDOT	Foundations, Private Sources, PennDOT, DCNR	Medium
3.	Establish well-defined trailheads that include signage and amenities, such as parking and restrooms.	Conservation Groups, Trail Groups	Foundations, Private Sources, DCNR	Medium

GOAL 5-4: UTILIZE TRAILS (CONTINUED).

Objective 2: Enhance area trails through maintenance, signage, and safety (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
4.	Develop volunteer programs to assist in maintenance of area recreational facilities.	Trail Groups, Park & Recreation Authorities, Conservation Groups, Municipalities	NA	Medium
5.	Improve signage along area trails, including mileage, educational information, and directions to local sites and nearby amenities.	Business Associations, Trail Groups, Chambers of Commerce	Foundations, Private Sources, DCNR	Medium

Objective 3: Utilize area trails to highlight the regions history, natural, and cultural resources.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish self-guided walking, biking, or automobile tours featuring historical and cultural sites of the region to increase awareness of local history.	Conservation Groups, Historical Societies, Trail Groups, Citizens, Municipalities	Foundations, Private Sources	Medium
2.	Establish a rail tour highlighting scenery and history of the railroad.	Conservation Groups, Historical Societies, Railroad Companies	Foundations, Private Sources, DCNR	Medium
3.	Install interpretive signage along area trails.	Conservation Groups, Trail Groups, School Districts, Historical Societies	Foundations, Private Sources, DCNR	Medium

GOAL 5-5: ENCOURAGE ENVIRONMENTALLY SOUND PRACTICES WHEN OPERATING RECREATIONAL VEHICLES, AND ENFORCE EXISTING LAWS TO MINIMIZE INTRUSIONS ON PRIVATE LANDS.

Objective 1: Utilize environmental sound practices when operating recreational vehicles.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish ordinances to prohibit the use of recreational vehicles in areas at risk of being affected by their use, such as steep slopes, streambeds, stream crossings, and habitat for rare, threatened, or endangered species.	Conservation Groups, Municipalities, Counties, DCNR, PGC	Foundations, Private Sources, DCNR, PGC	Medium

GOAL 5-5: ENCOURAGE ENVIRONMENTALLY SOUND PRACTICES WHEN OPERATING RECREATIONAL VEHICLES, AND ENFORCE EXISTING LAWS TO MINIMIZE INTRUSIONS ON PRIVATE LANDS (CONTINUED).

Objective 1: Utilize environmental sound practices when operating recreational vehicles (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Monitor the use of recreational vehicles to minimize their impacts on the environment.	Conservation Groups, Conservation Districts, Municipalities, DEP	Foundations, Private Sources, DCNR, DEP	Medium
3.	Establish environmentally sound public trails or parks for the exclusive use by off-road vehicles.	Conservation Groups, Trail Groups, Counties, Municipalities, DCNR	Foundations, Private Sources, DCNR	Medium

Objective 2: Educate riders about safe, ethical practices.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Educate off-road vehicle operators to recreate in an environmentally sound manner.	Conservation Groups, Dealerships, DCNR	Foundations, Private Sources, DCNR	Medium
2.	Work with dealerships to offer incentives for customers attending riding etiquette and safety programs.	Conservation Groups, DCNR	Foundations, Private Sources, Businesses, DCNR	Low
3.	Form a local off-road vehicle, non-profit organization to take a lead role in facility development and safety promotion while encouraging ethical riding.	Dealerships, Trail Groups, ATV Enthusiast	Foundations, Private Sources, DCNR	Low

Objective 3: Enforce existing laws to minimize intrusions on private lands.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Increase enforcement of illegal off-road vehicle use on private and public lands.	Police Departments, Municipalities, Counties	Police Departments, Municipalities, DCNR	Medium
2.	Strengthen the penalties for riders cited in authorized areas, such as public lands, non-designated roadways, and privately owned land without landowner's permission.	Police Departments, Municipalities, Counties, Landowners	Police Departments, Municipalities, DCNR	Medium

GOAL 5-6: HIGHLIGHT AND PRESERVE LOCAL HISTORY.

Objective 1: Preserve historical sites and landmarks.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Inventory historical sites throughout the watershed and work with Pennsylvania Historical Museum Commission, individuals, and agencies to determine if local historical sites and structures, such as Gilgal Church and old Dayton High School, could be added to the National Register.	Historical Societies, Municipalities, Citizens, PHMC	Foundations, Private Sources	High
2.	Install interpretive signage at historical site locations.	Historical Societies, Municipalities, Citizens, PHMC	Foundations, Private Sources	Medium
3.	Protect historical sites from vandalism through increased monitoring and surveillance.	Historical Societies, Police Departments	Foundations, Private Sources	Medium

Objective 2: Promote awareness and appreciation for the local history.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Increase awareness and use of local museums, such as Marshall House and Schmick museums.	Historical Societies, PHMC, TPA	Foundations, Private Sources, PHMC	High
2.	Establish a regional network among historical societies and museums for support and collaboration in conducting projects and identifying funding.	Municipalities, Counties, Historical Societies, Citizens, PHMC, TPA	Foundations, Private Sources, PHMC	High
3.	Incorporate local history into classes taught at local school districts including the Native American culture.	Historical Societies, Schools, Citizens	Foundations, Private Sources, PHMC	Medium
4.	Host community events or festival commemorating local historical events, places, and cultures.	Historical Societies, Municipalities, Civic Groups	Foundations, Private Sources	Medium

GOAL 5-7: EXPAND AWARENESS, APPRECIATION, AND SUPPORT FOR THE ARTS.

Objective 1: Increase awareness for the arts, especially as it relates to nature art.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish or expand art appreciation section in public and private school curricula.	Schools, Local Artists, Cultural Councils	Foundations, Private Sources	Medium

GOAL 5-7: EXPAND AWARENESS, APPRECIATION, AND SUPPORT FOR THE ARTS (CONTINUED).

Objective 1: Increase awareness for the arts, especially as it relates to nature art (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Establish a taskforce to expand, finance, coordinate and promote art activities.	Cultural Councils, Theaters, Local Artists, Universities, TPA	Foundations, Private Sources	Medium
3.	Increase awareness for the visual and performing arts, especially as it relates to nature art.	Businesses, Schools, Universities, Cultural Council, Local Artists	Foundations, Private Sources	Medium

Objective 2: Increase support for the art industry.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Broaden quantity and quality of volunteer pool supporting the arts.	Citizens, Schools, Universities	N/A	Medium
2.	Expand space available for displays, storage, and instruction in the visual and performing arts.	Businesses, Schools, Universities	Foundations, Private Sources	Medium

GOAL 5-8: INVOLVE COMMUNITY RESIDENTS IN WATERSHED ACTIVITIES.

Objective 1: 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.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Establish volunteer corps to assist efforts of community planners, conservation organizations, and civic groups.	Conservation Groups, Civic Groups	Foundations, Private Sources, DEP	Medium
2.	Host stream monitoring workshops to train volunteers about water quality monitoring.	Conservation Groups, Stakeholders, DEP	Foundations, Private Sources, DEP	Medium
3.	Recruit maintenance and patrol crews to clean-up litter and maintain order at public sites and trails.	Conservation Groups, Concerned Citizens, DCNR	Foundations, Private Sources	Medium
4.	Develop a watershed monitoring program for area school districts and establish a communication network for school districts within the project area to share information collected.	Conservation Groups, School Districts	Foundations, Private Sources, DEP	Medium

GOAL 5-8: INVOLVE COMMUNITY RESIDENTS IN WATERSHED ACTIVITIES (CONTINUED).

Objective 1: 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 (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
5.	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, DCNR	Foundations, Private Sources	Medium

Objective 2: Promote environmental stewardship through education and scientific study.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Create a watershed-wide recognition rewarding those advancing environmental education.	Conservation Groups	Foundations, Private Sources	Medium
2.	Establish a communication network for school districts within the Mahoning Creek watershed to share information collected.	Conservation Groups, School Districts	Foundations, Private Sources, DEP	Medium
3.	Expand the Little Mahoning Creek Watershed Association, Mahoning Creek Watershed Association, and Pine Creek Sportsmen Club's role in environmental education.	Conservation Groups, Conservation Districts, School Districts	Foundations, Private Sources, DEP	Medium
4.	Develop and implement locally based environmental/ social educational programs that focus on the Mahoning Creek, Pine Creek, and Hays Run watersheds.	Conservation Districts, Conservation Groups, Cooperative Extensions	Foundations, Private Sources, DEP	Medium
5.	Advocate for increased funding for environmental education in local school districts.	Conservation Groups, School Districts, Legislators	Foundations, Private Sources, Legislature, DEP, EPA	Medium

Objective 3: Increase awareness of watershed-related issues through the distribution of materials and educational programs.

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
1.	Develop and implement education programs for schools about abandoned mine drainage and other sources of non-point source pollution.	Conservation Districts, Conservation Groups, WPCAMR, DEP	Foundations, Private Sources, DEP, EPA	Medium

GOAL 5-8: INVOLVE COMMUNITY RESIDENTS IN WATERSHED ACTIVITIES (CONTINUED).

Objective 3: Increase awareness of watershed-related issues through the distribution of materials and educational programs (continued).

	Method to achieve objective:	*Potential Partners*	*Potential Funding*	*Priority*
2.	Develop and implement education workshops and/or outreach programs about point source pollution, how to report point source violations, and how to research permit information.	Conservation Groups, Sportsmen Groups, Citizens, DEP, EPA	Foundations, Private Sources, DEP, EPA	Medium
3.	Utilize media, such as newspapers, radio stations, television stations, Facebook, Twitter, and YouTube to outreach to residence for increased participation and educational messages.	Conservation Districts, Conservation Groups, Media	Foundations, Private Sources, DEP	Medium

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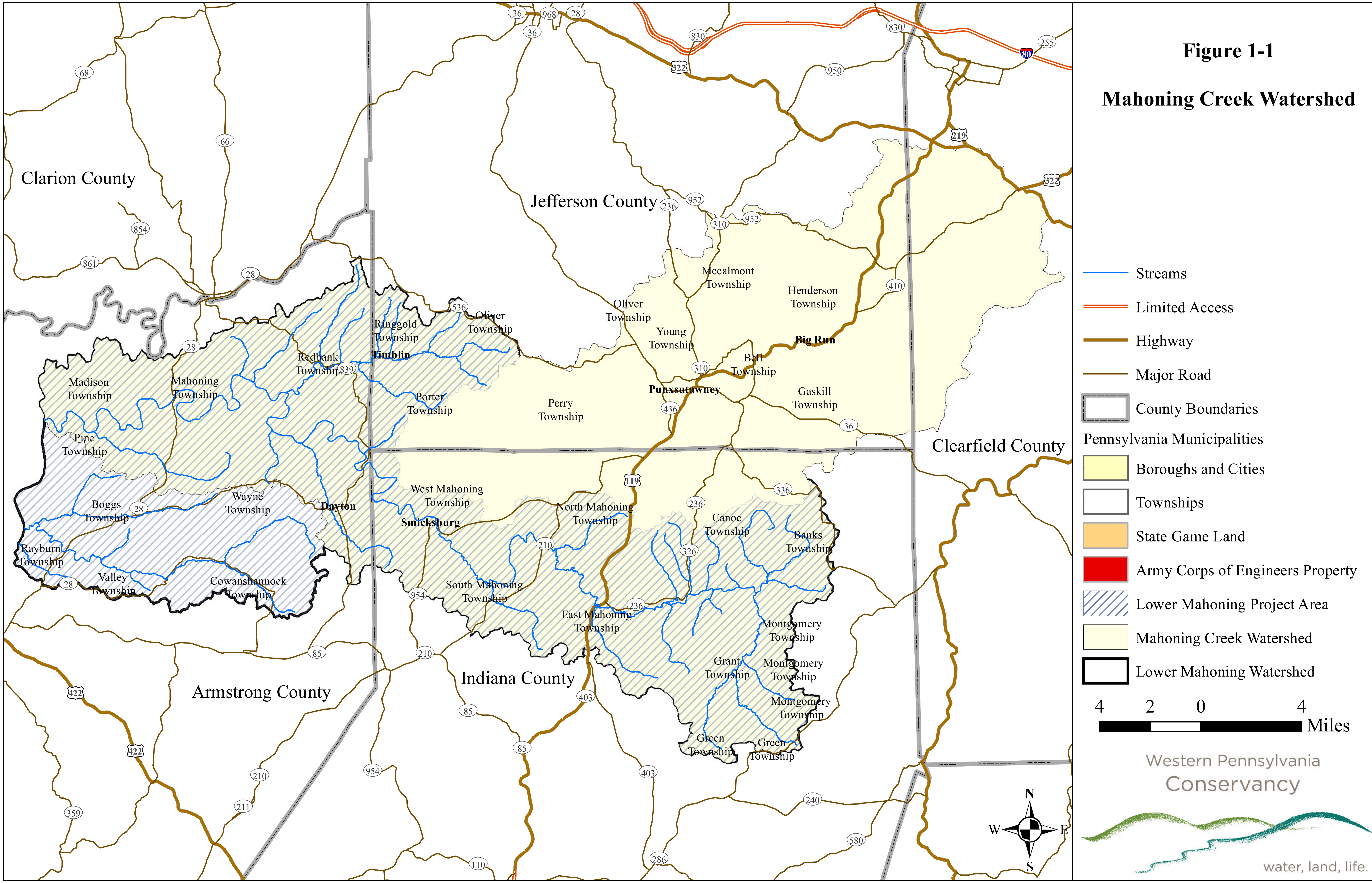
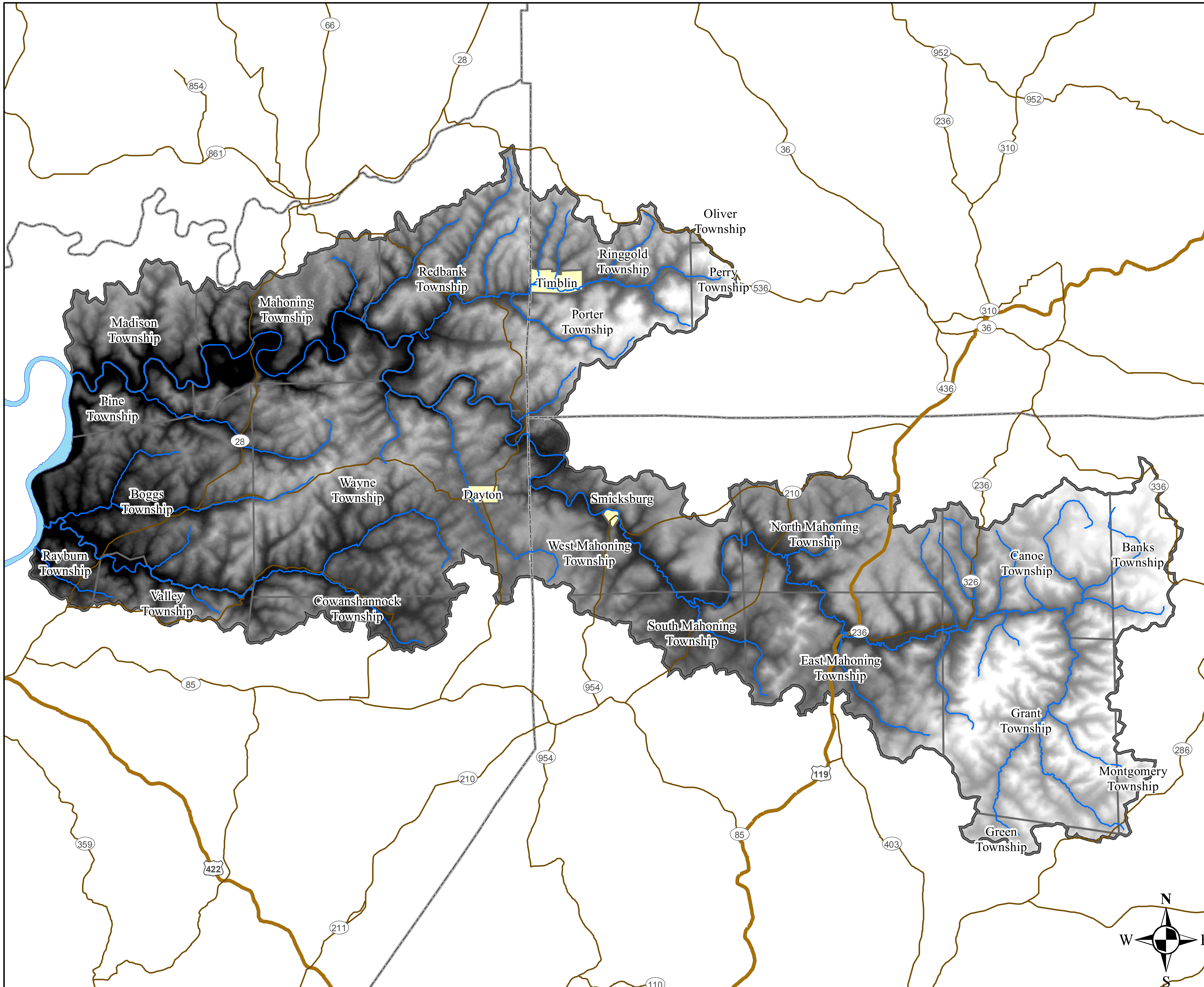


Figure 1-1
Mahoning Creek Watershed
Clarion County
Jefferson County
Clearfield County
Indiana County
Armstrong County
Madison Township
Mahoning Township
Redbank Township
Ringgold Township
Oliver Township
Timblin
Porter Township
Perry Township
Pine Township
Boggs Township
Wayne Township
Rayburn Township
Valley Township
Cowanshannock Township
Dayton
West Mahoning Township
Smicksburg
North Mahoning Township
South Mahoning Township
East Mahoning Township
Canoe Township
Banks Township
Montgomery Township
Grant Township
Green Township
Mccalmont Township
Henderson Township
Young Township
Big Run
Bell Township
Punxsutawney
Gaskill Township
Streams
Limited Access
Highway
Major Road
County Boundaries
Pennsylvania Municipalities
Boroughs and Cities
Townships
State Game Land
Army Corps of Engineers Property
Lower Mahoning Project Area
Mahoning Creek Watershed
Lower Mahoning Watershed
4 2 0 4
Miles
N
S
E
W
Western Pennsylvania
Conservancy
water, land, life.

Figure 1-2

Topography



Streams
Limited Access
Highway
Major Road
County Boundaries
Boroughs and Cities
Townships

Elevation
2080 feet
770 feet

3 1.5 0 3 Miles

Western Pennsylvania Conservancy

water, land, life.

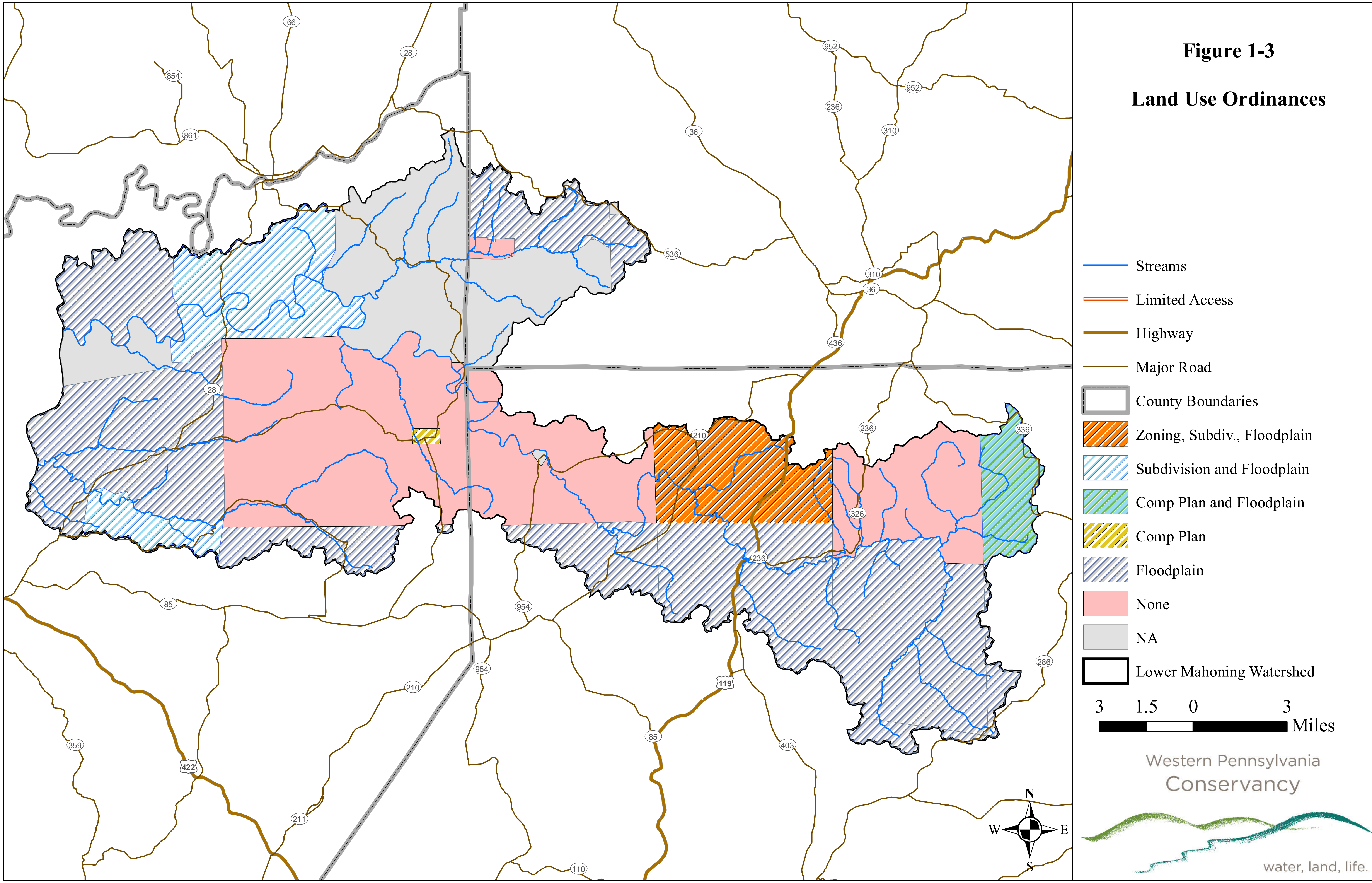


Figure 1-3
Land Use Ordinances
Streams
Limited Access
Highway
Major Road
County Boundaries
Zoning, Subdiv., Floodplain
Subdivision and Floodplain
Comp Plan and Floodplain
Comp Plan
Floodplain
None
NA
Lower Mahoning Watershed
3 1.5 0 3
Miles
N
W
E
S
Western Pennsylvania Conservancy
water, land, life.

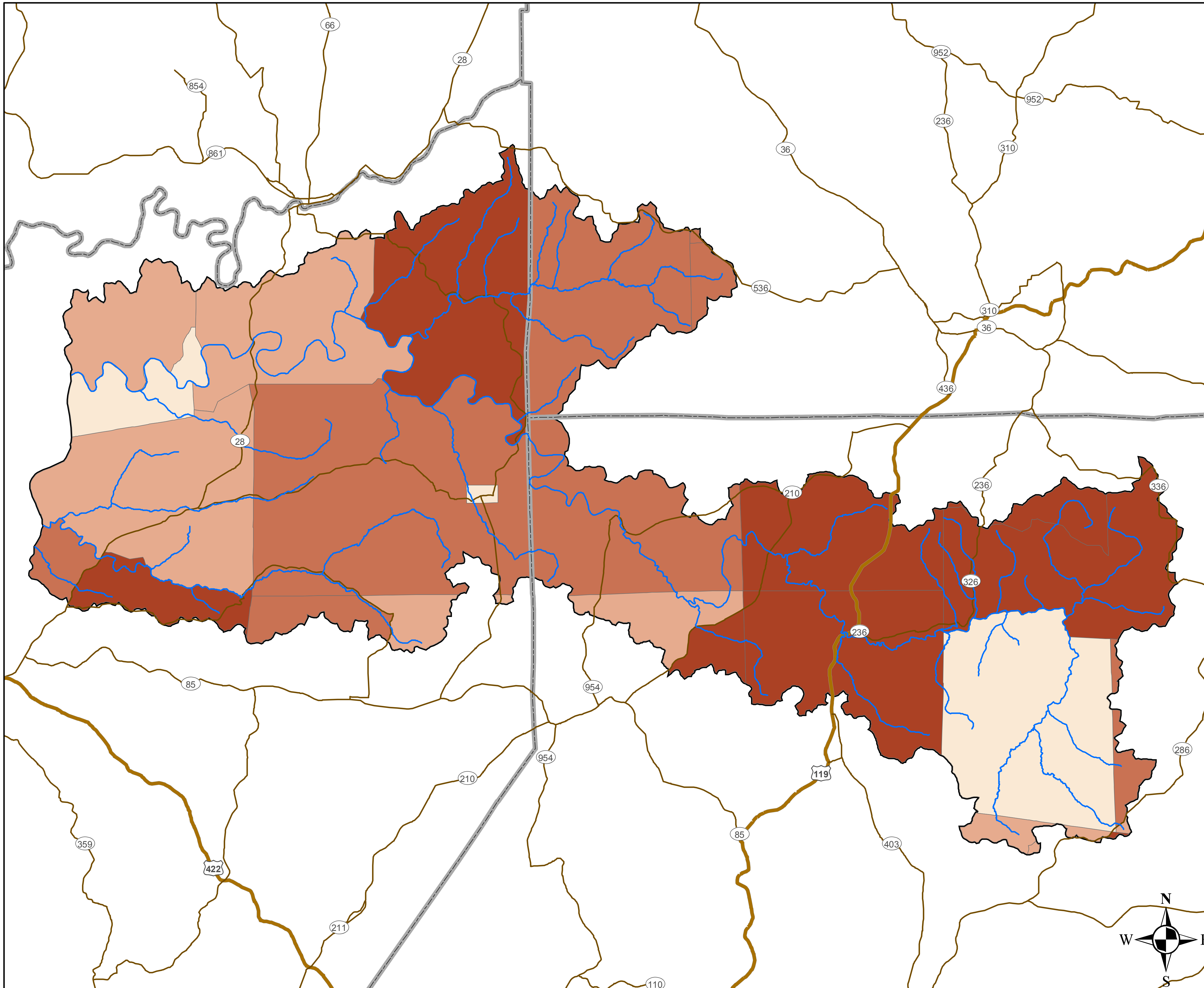


Figure 1-4

Population by Census Block Group

Streams
Limited Access
Highway
Major Road
County Boundaries

Population by Block Group
515 - 696
697 - 1008
1009 - 1289
1290 - 1647

Lower Mahoning Watershed

3 1.5 0 3 Miles

Western Pennsylvania Conservancy
water, land, life.

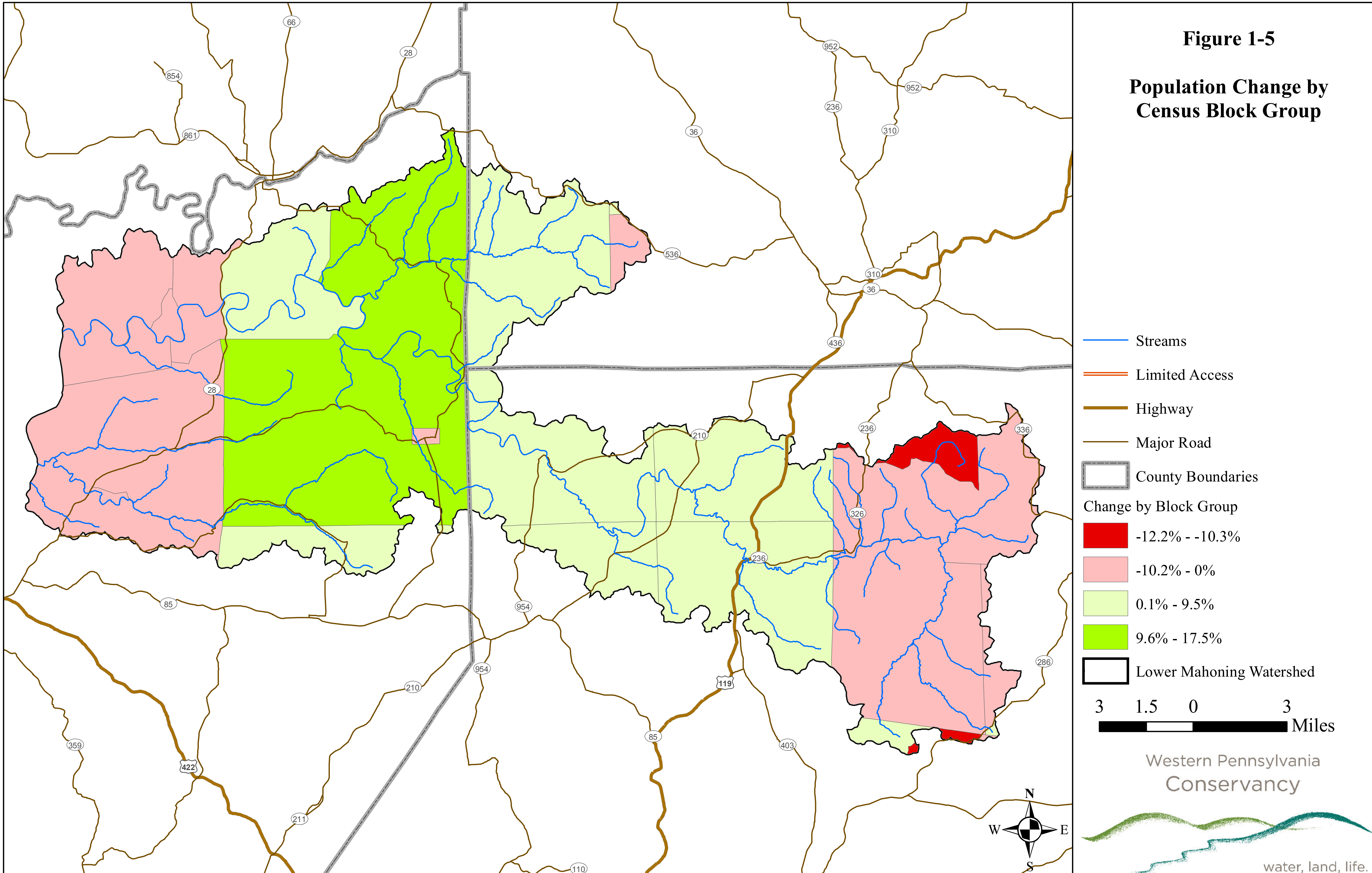


Figure 1-5

Population Change by Census Block Group

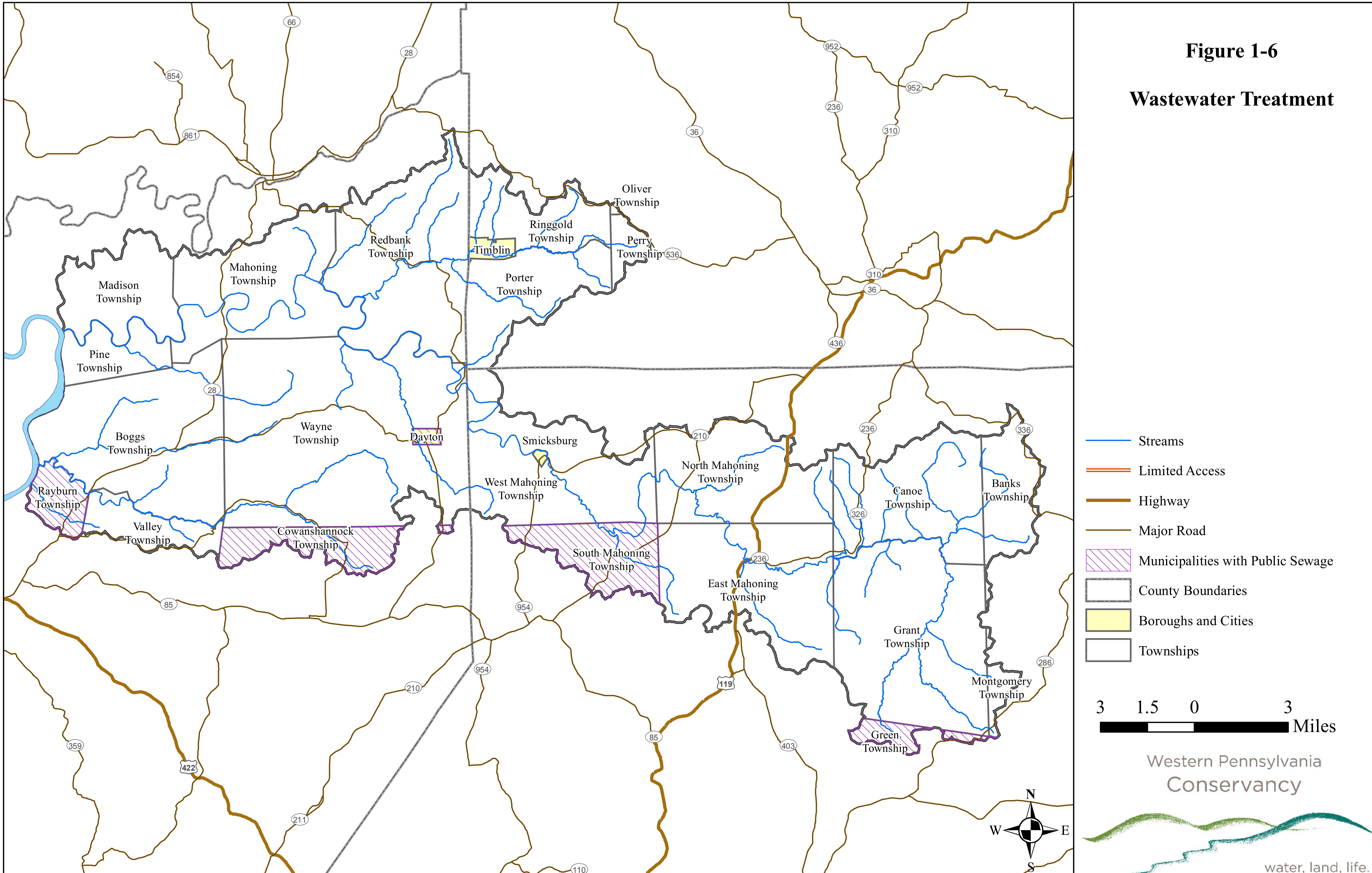


Figure 1-6

Wastewater Treatment

Figure 1-7

Public Water Suppliers

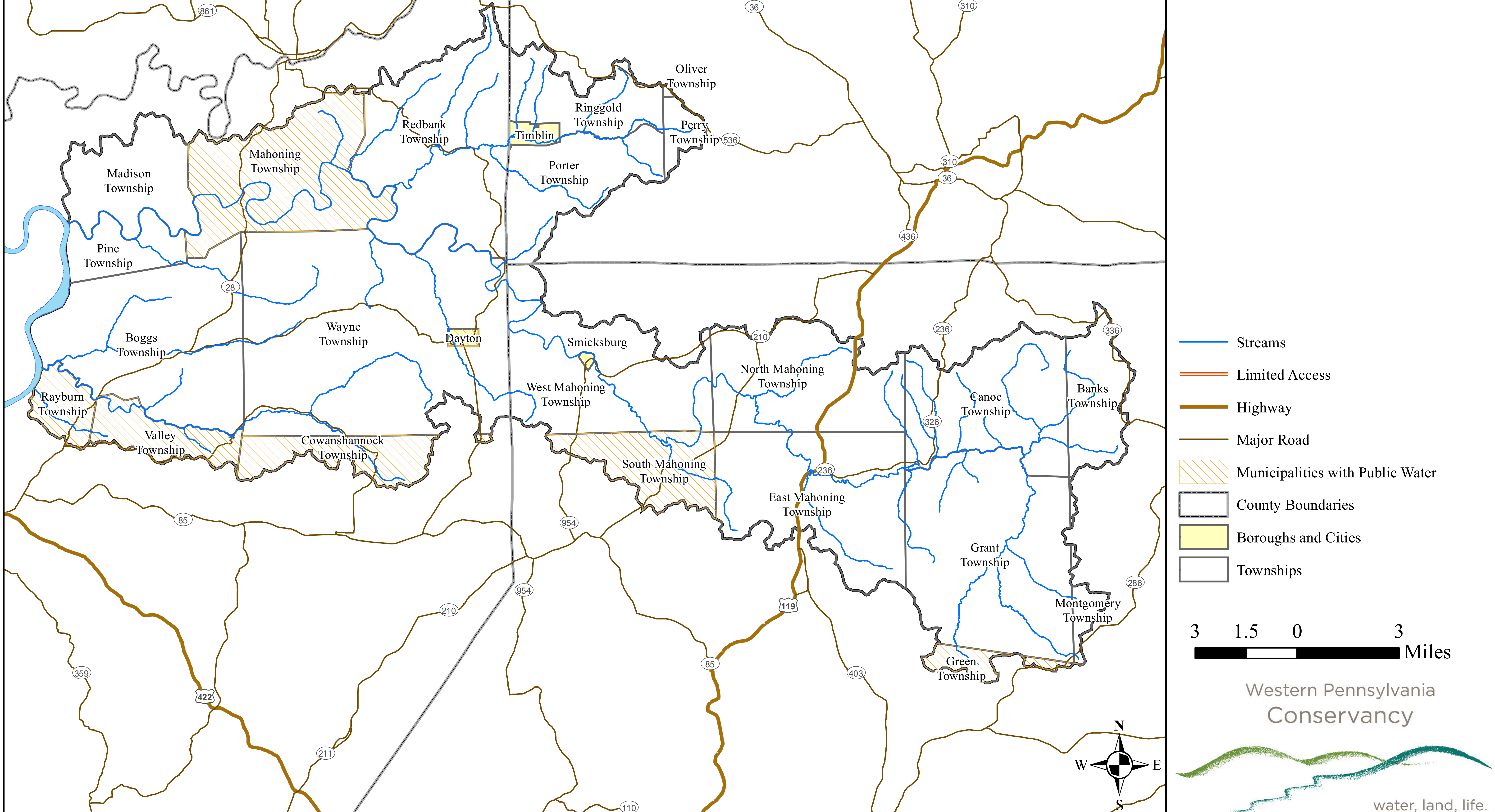
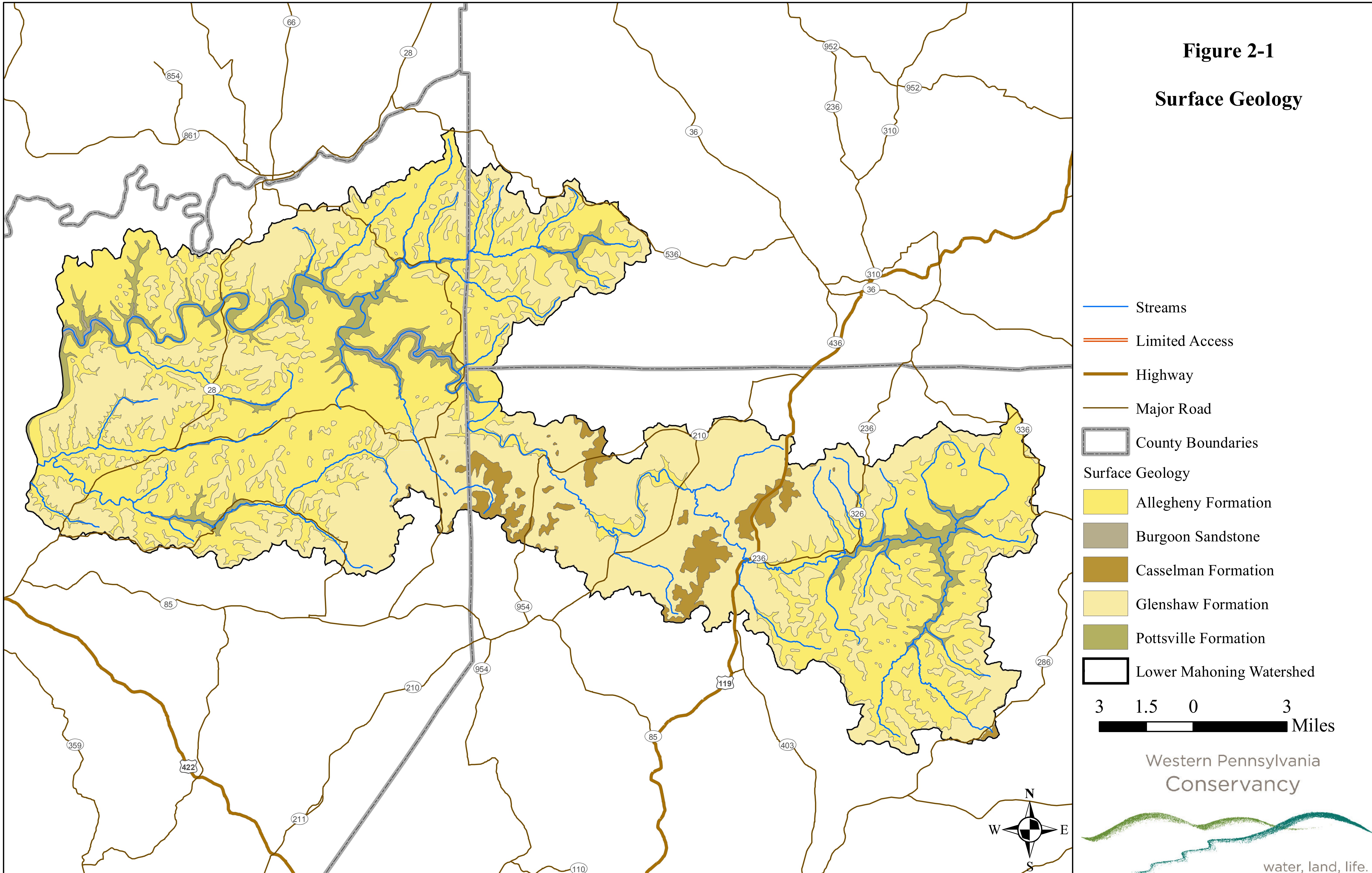


Figure 2-1

Surface Geology



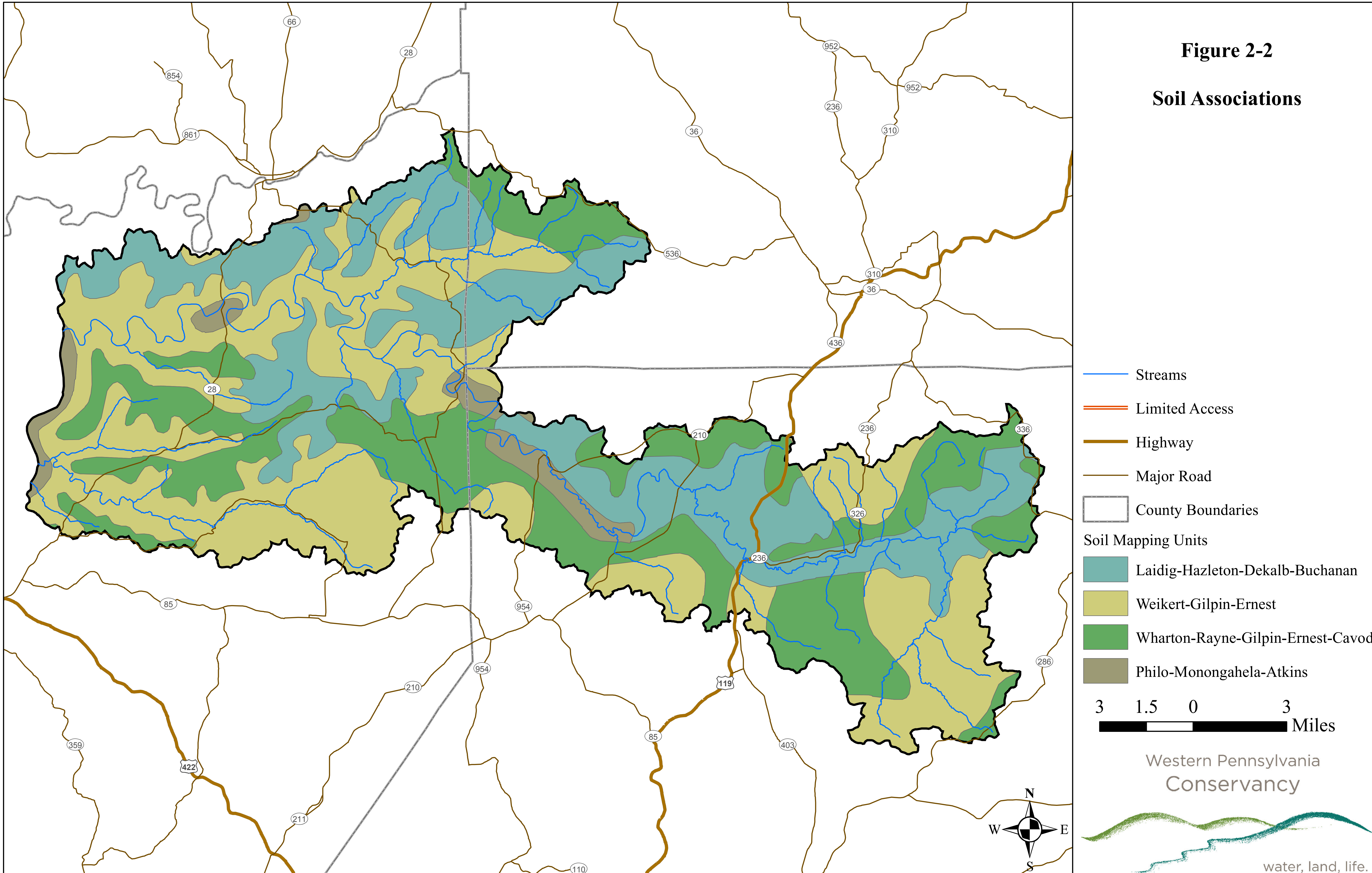
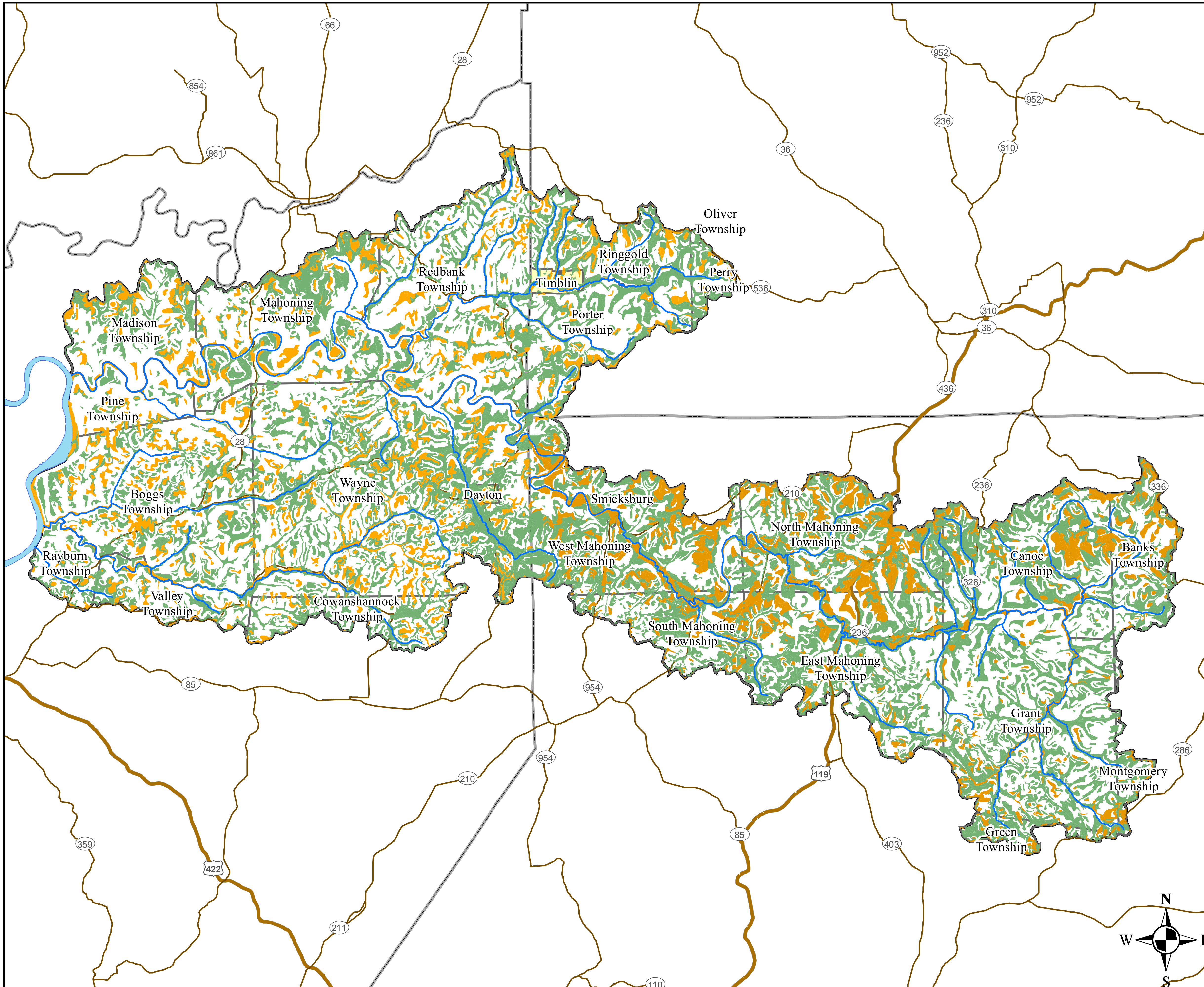


Figure 2-2

Soil Associations

Figure 2-3

Agricultural Lands



Western Pennsylvania Conservancy

water, land, life.

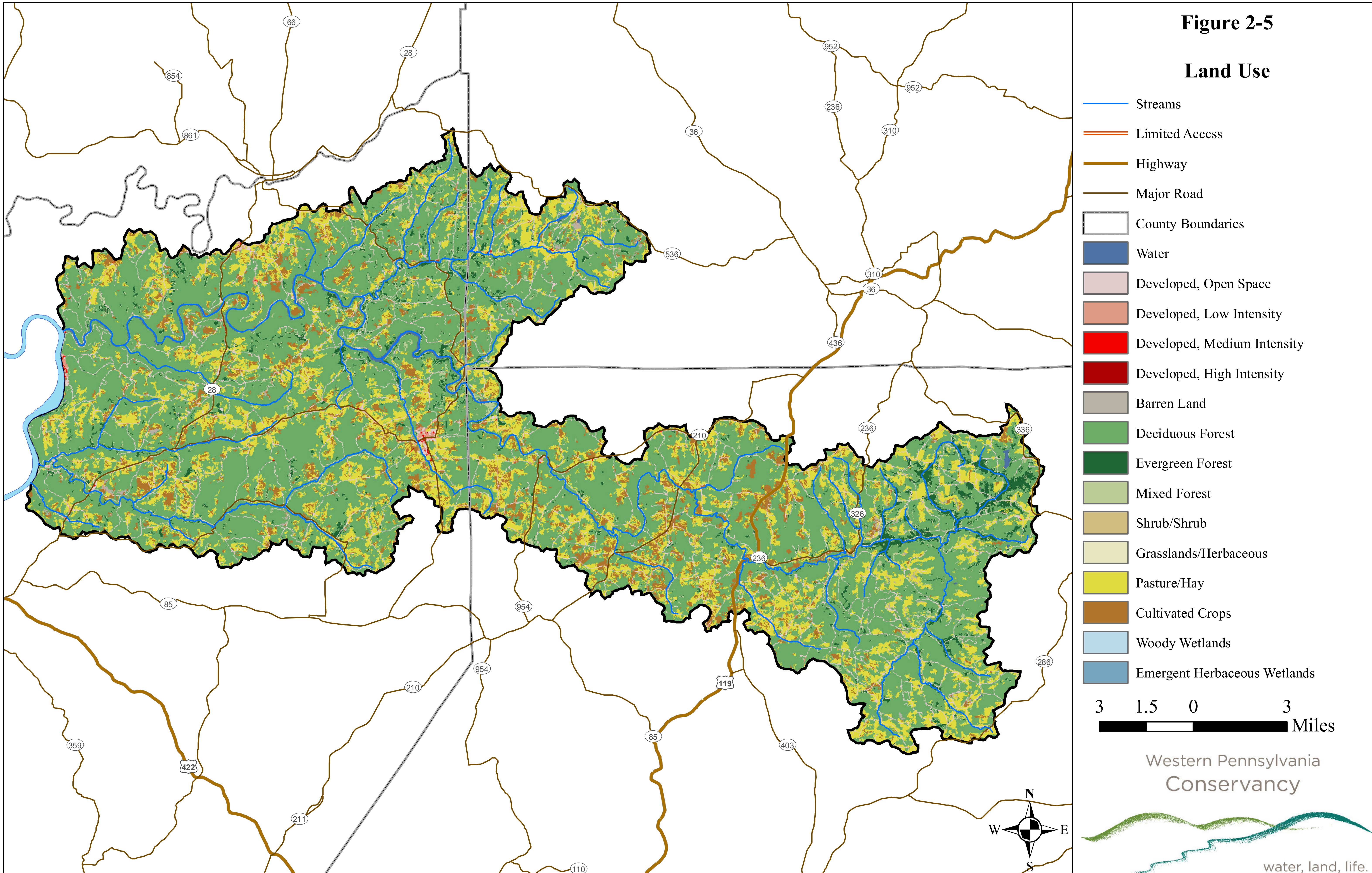


Figure 2-5
Land Use
Streams
Limited Access
Highway
Major Road
County Boundaries
Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Shrub
Grasslands/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
3 1.5 0 3
Miles
Western Pennsylvania Conservancy
water, land, life.
N
W
E
S

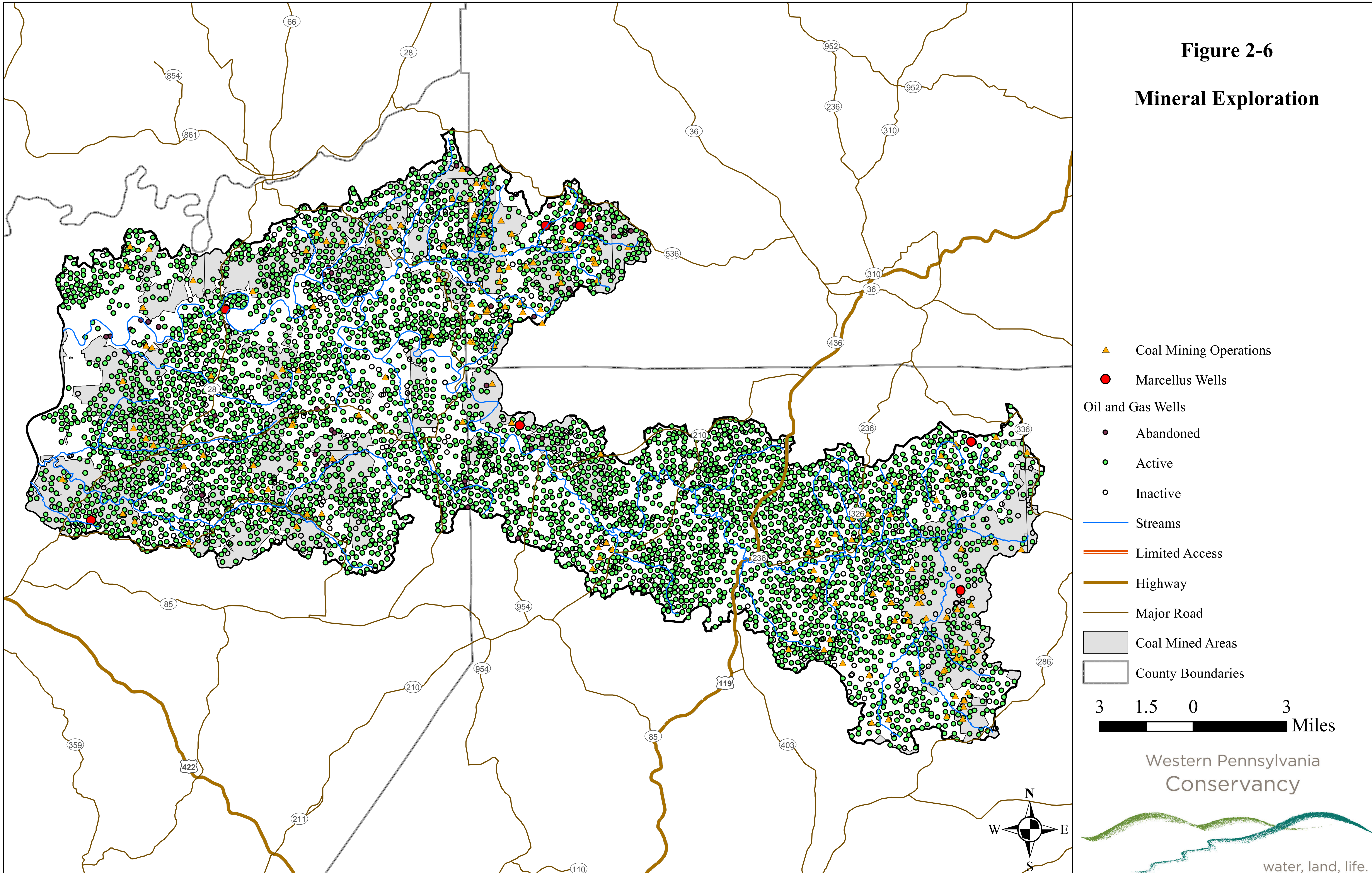
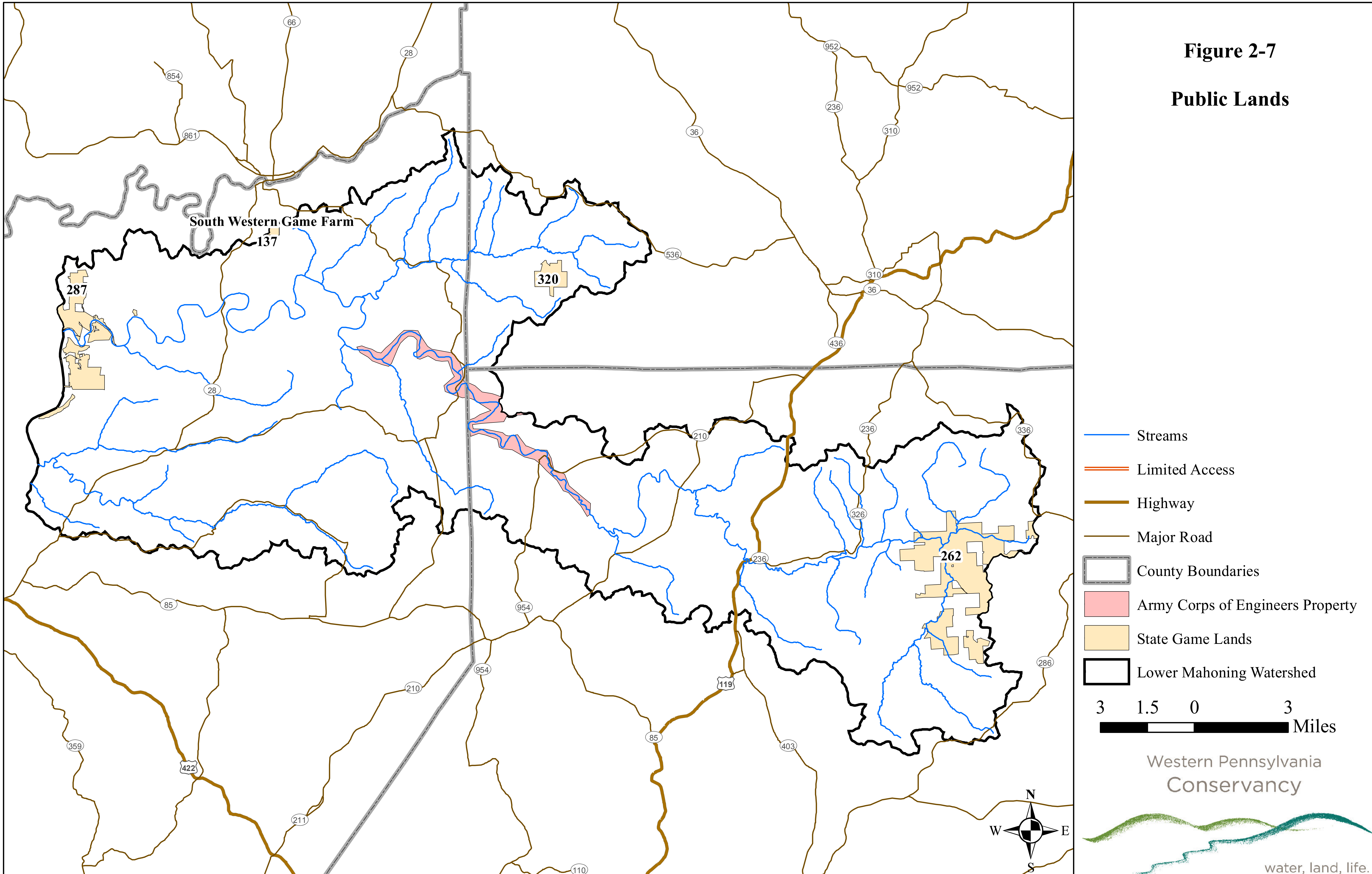


Figure 2-6

Mineral Exploration

Figure 2-7

Public Lands



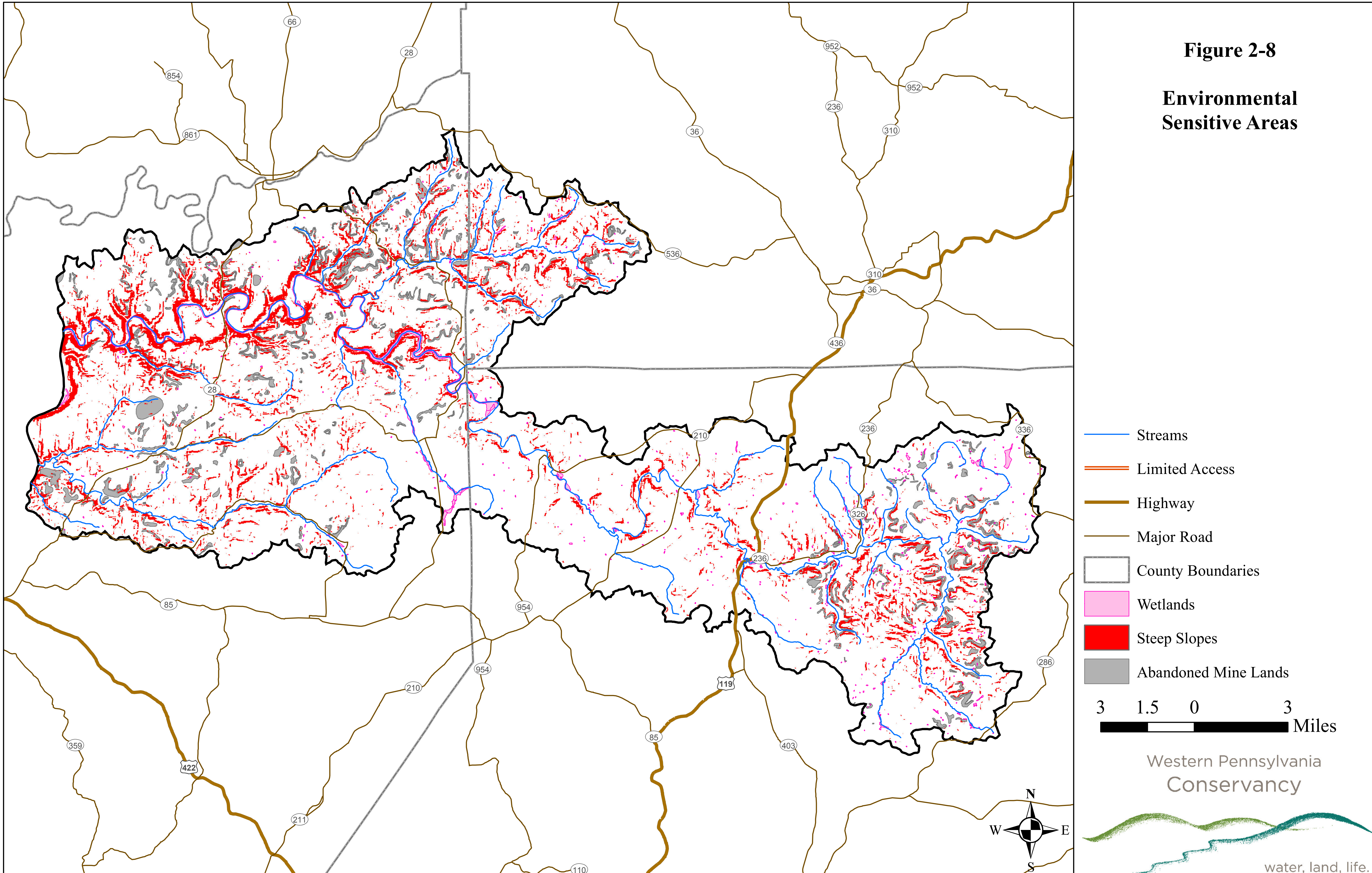


Figure 2-8

Environmental Sensitive Areas

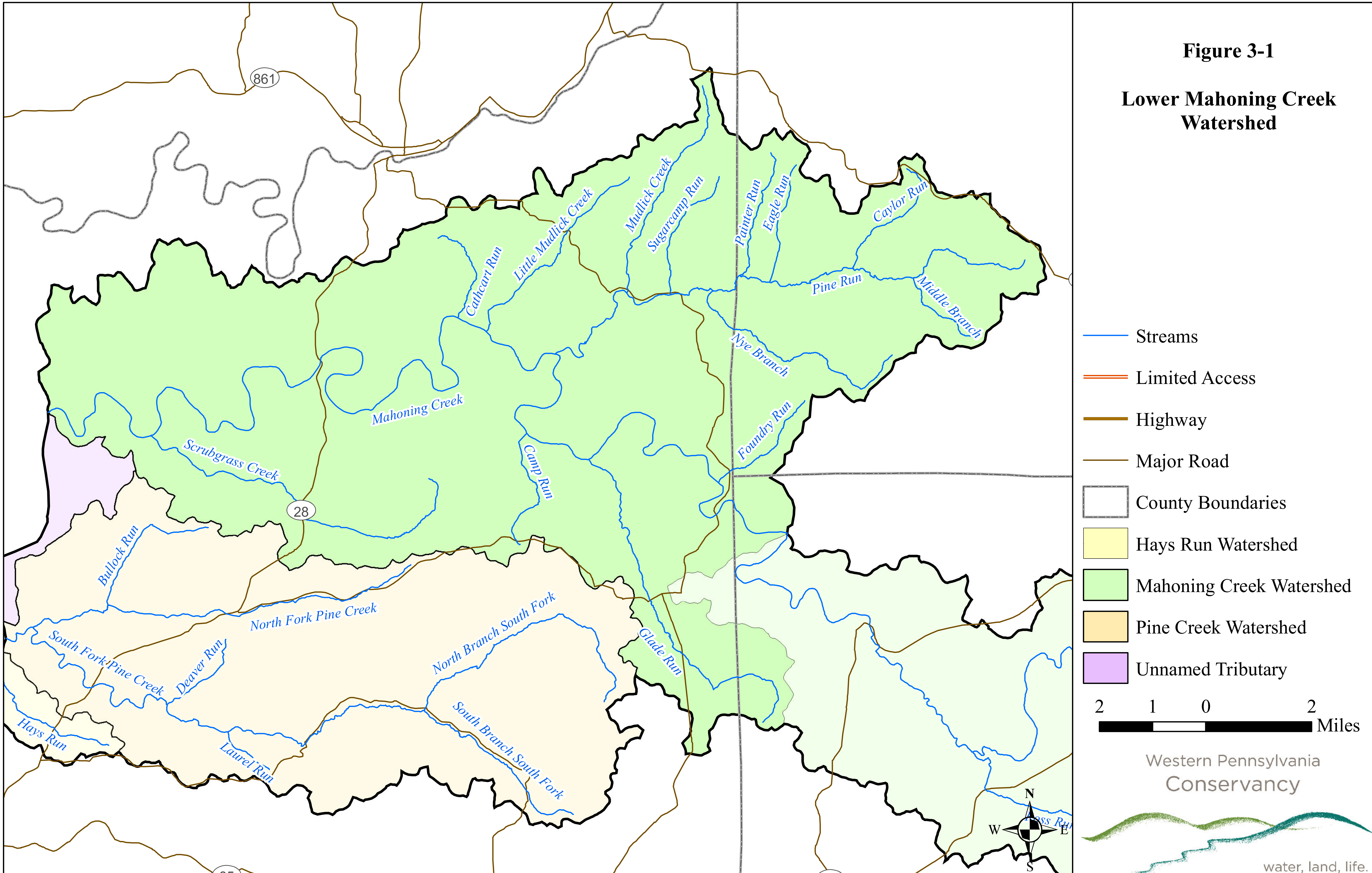


Figure 3-1

Lower Mahoning Creek Watershed

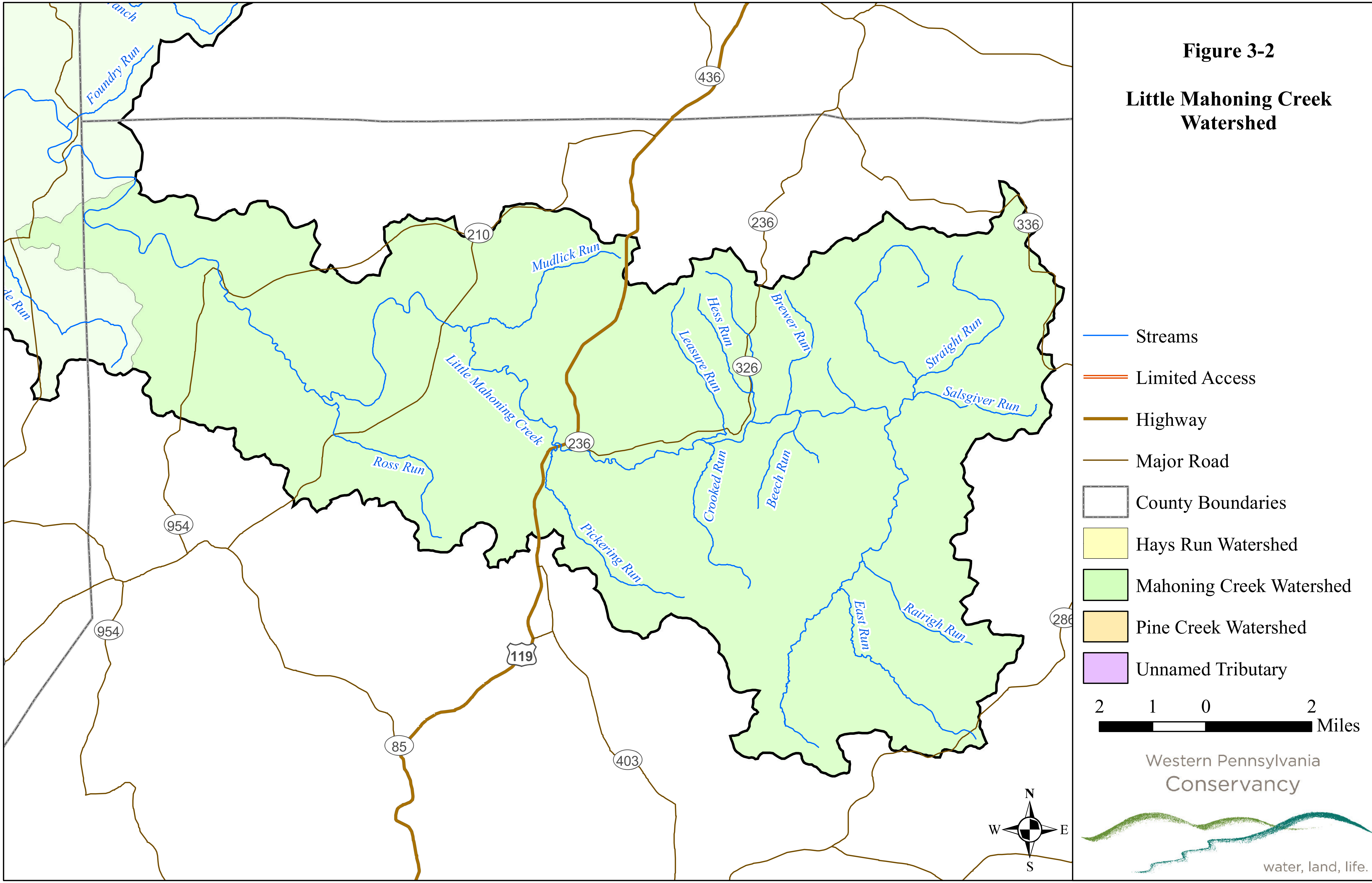


Figure 3-2
Little Mahoning Creek Watershed
Streams
Limited Access
Highway
Major Road
County Boundaries
Hays Run Watershed
Mahoning Creek Watershed
Pine Creek Watershed
Unnamed Tributary
2 1 0 2
Miles
Western Pennsylvania Conservancy
water, land, life.
N
S
E
W
Foundry Run
Mudlick Run
Little Mahoning Creek
Ross Run
Pickering Run
Hess Run
Leasure Run
Brewer Run
Straight Run
Salsgiver Run
Crooked Run
Beech Run
East Run
Rairigh Run
436
210
236
326
336
954
119
85
403

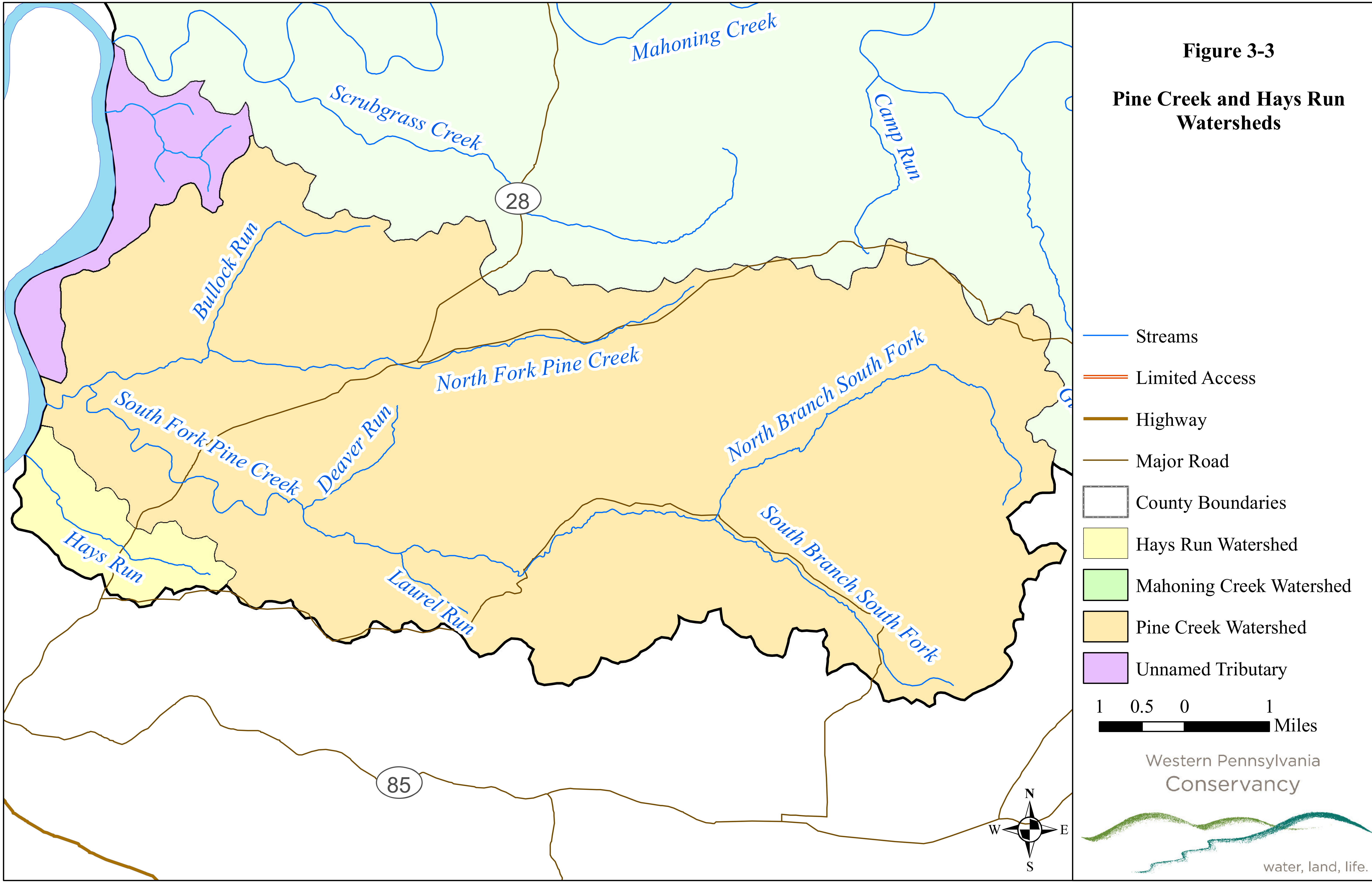


Figure 3-3
Pine Creek and Hays Run Watersheds
Mahoning Creek
Scrubgrass Creek
Camp Run
28
Bullock Run
North Fork Pine Creek
South Fork Pine Creek
Deaver Run
North Branch South Fork
South Branch South Fork
Hays Run
Laurel Run
85
Streams
Limited Access
Highway
Major Road
County Boundaries
Hays Run Watershed
Mahoning Creek Watershed
Pine Creek Watershed
Unnamed Tributary
1 0.5 0 1
Miles
N
S
E
W
Western Pennsylvania Conservancy
water, land, life.

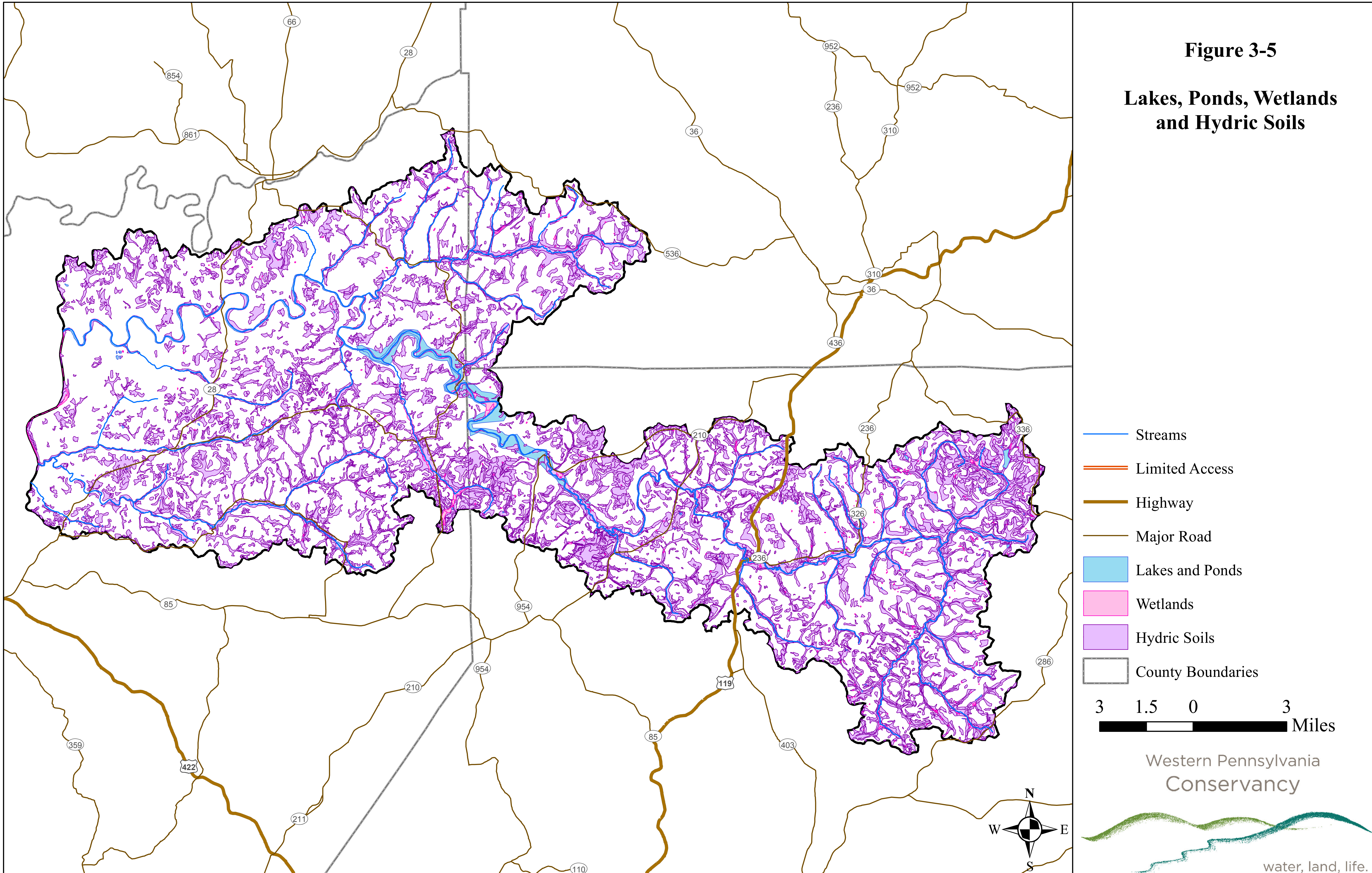
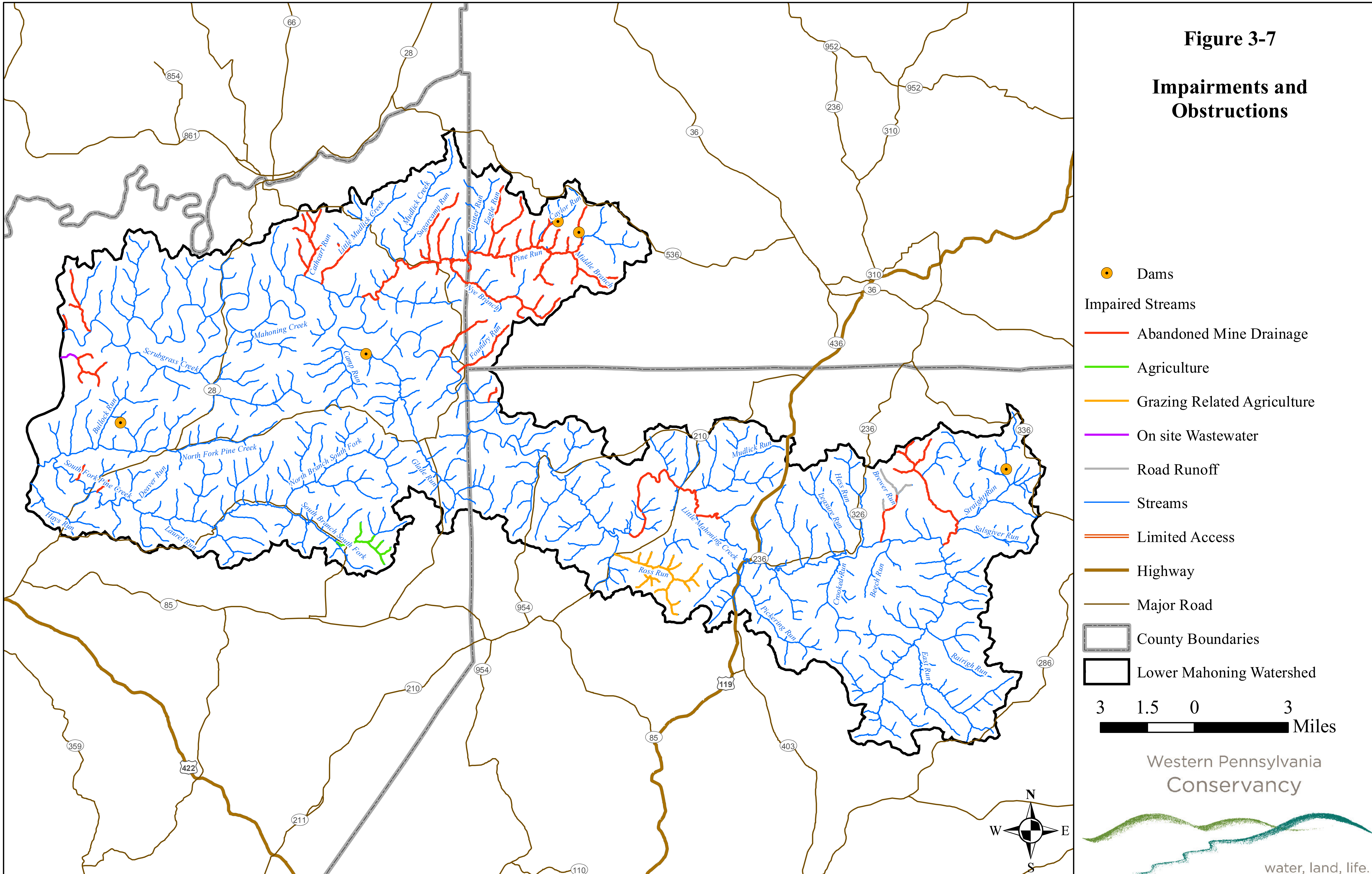


Figure 3-5

Lakes, Ponds, Wetlands and Hydric Soils

Figure 3-7

Impairments and Obstructions



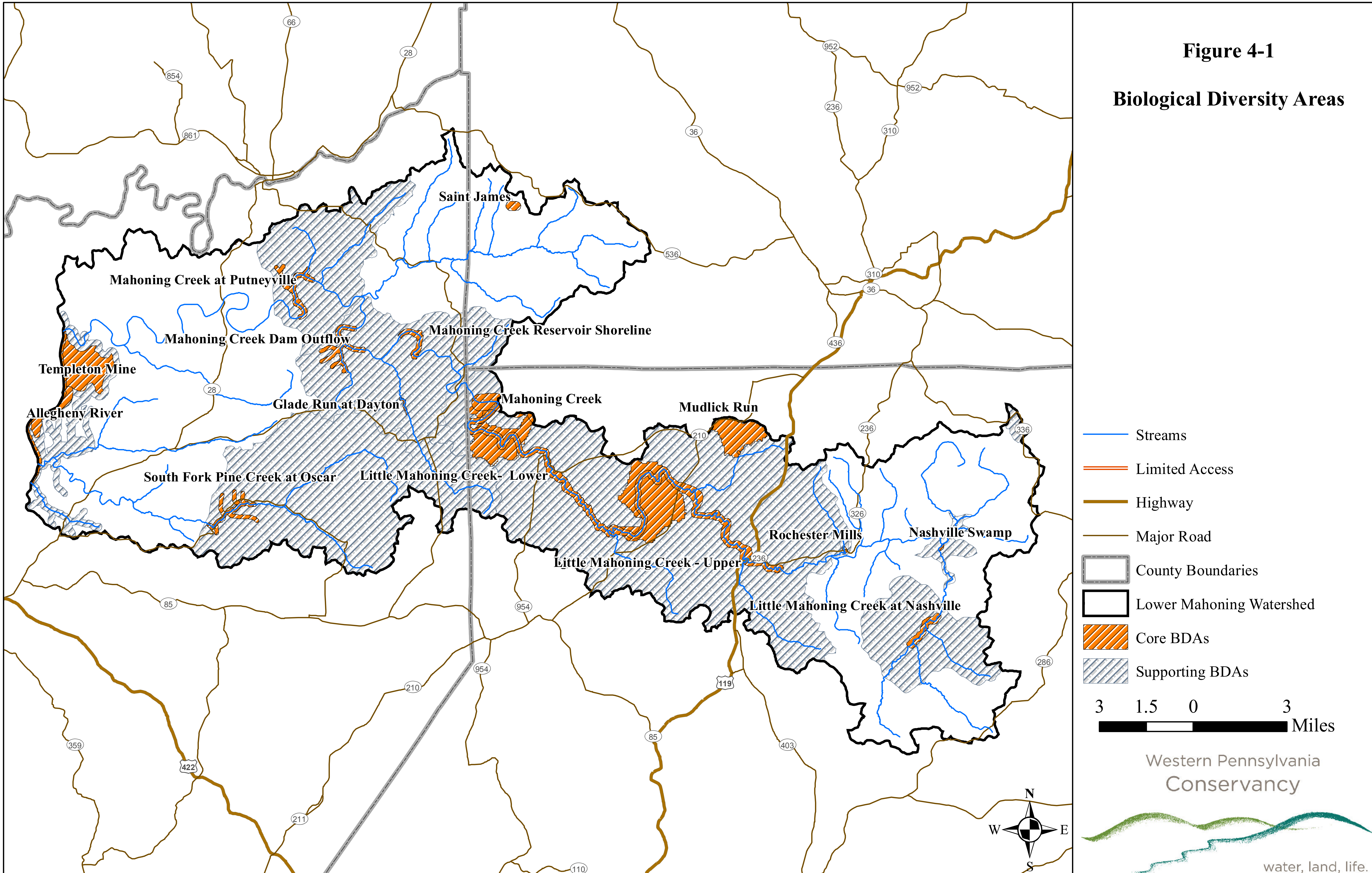


Figure 4-1
Biological Diversity Areas
Saint James
Mahoning Creek at Putneyville
Mahoning Creek Dam Outflow
Mahoning Creek Reservoir Shoreline
Templeton Mine
Allegheny River
Glade Run at Dayton
Mahoning Creek
Mudlick Run
South Fork Pine Creek at Oscar
Little Mahoning Creek- Lower
Rochester Mills
Nashville Swamp
Little Mahoning Creek - Upper
Little Mahoning Creek at Nashville
Streams
Limited Access
Highway
Major Road
County Boundaries
Lower Mahoning Watershed
Core BDAs
Supporting BDAs
3 1.5 0 3
Miles
N
W
E
S
Western Pennsylvania Conservancy
water, land, life.

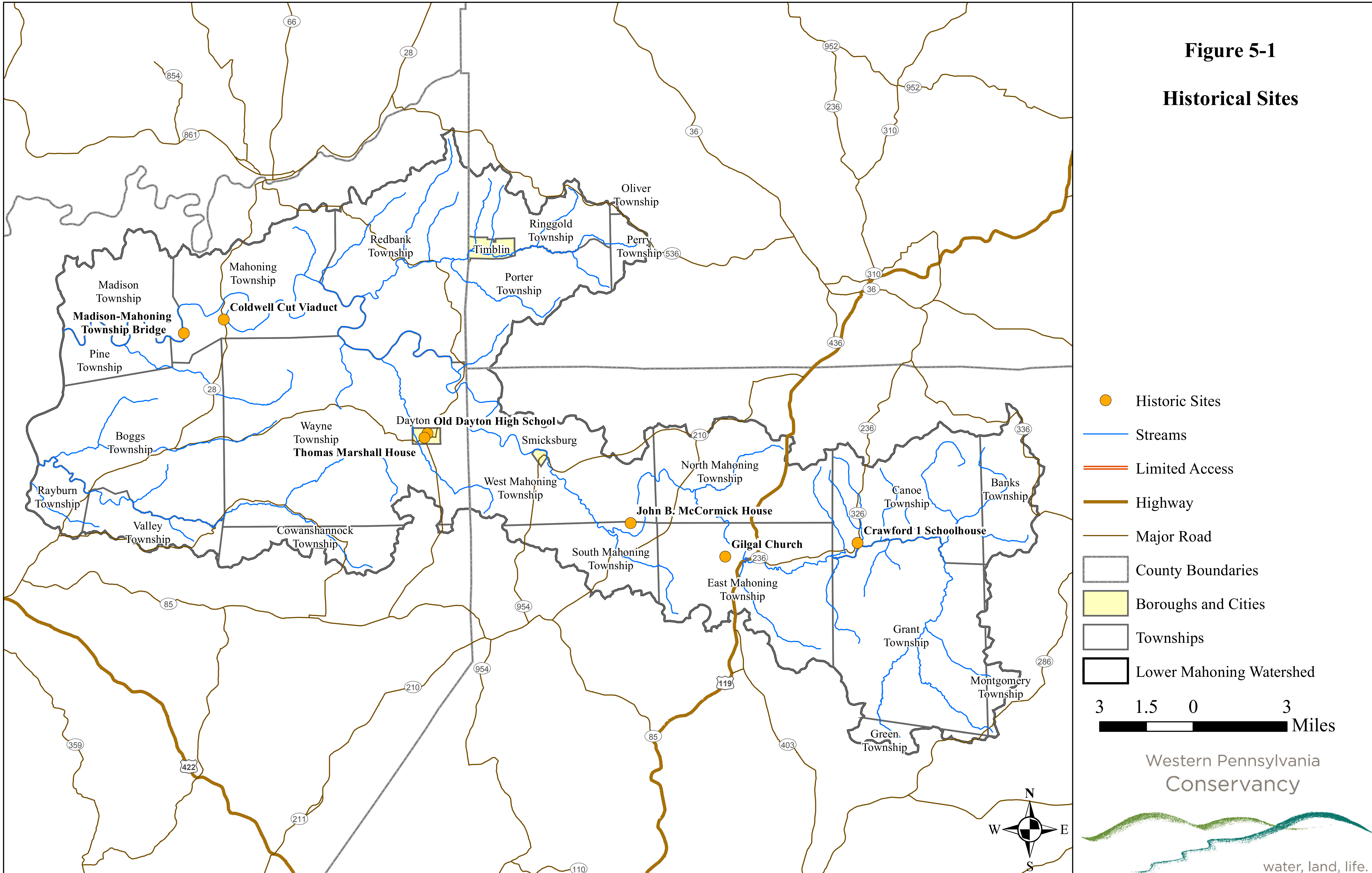


Figure 5-1

Historical Sites

Figure 5-2

Recreational Facilities

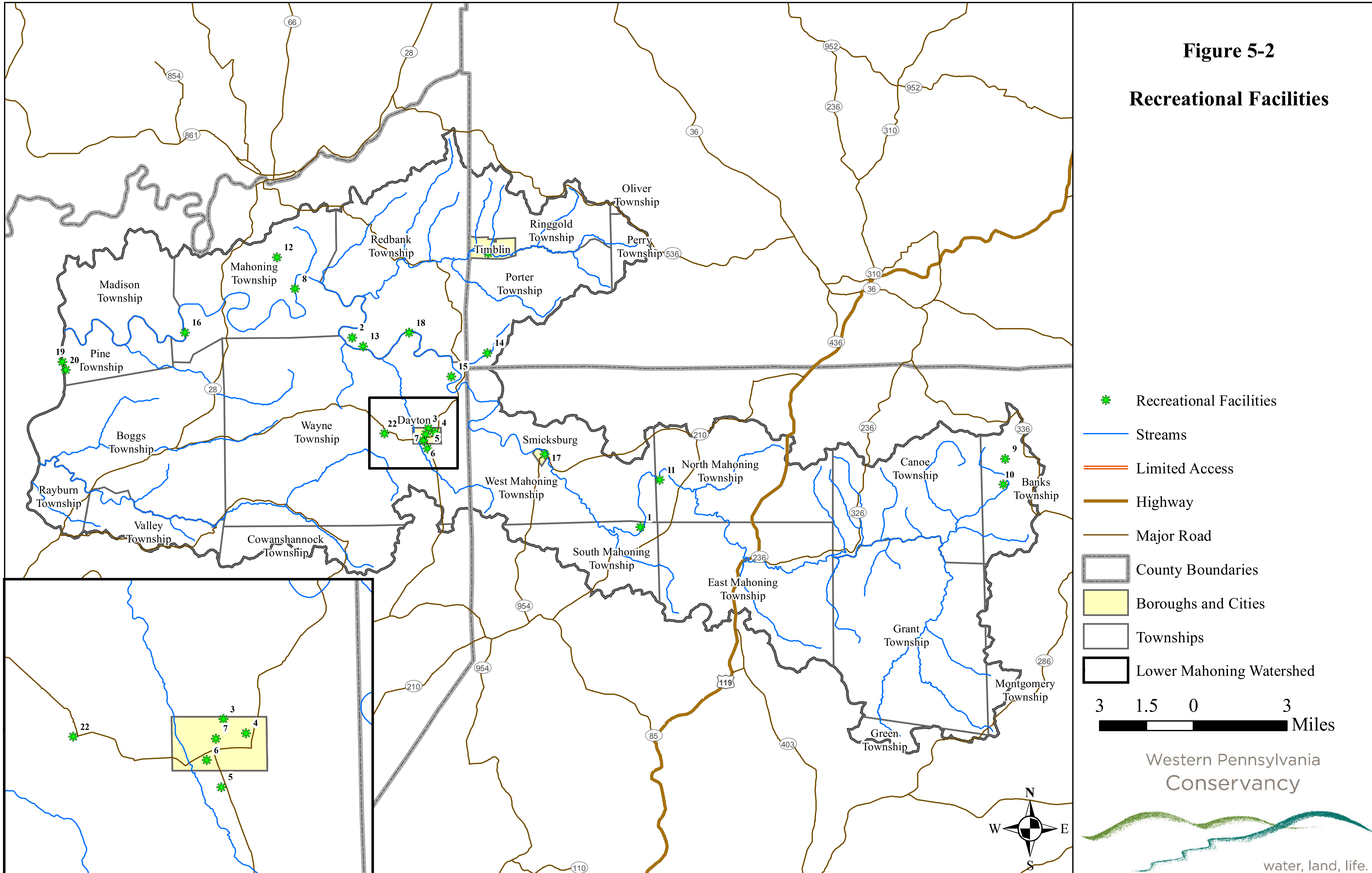
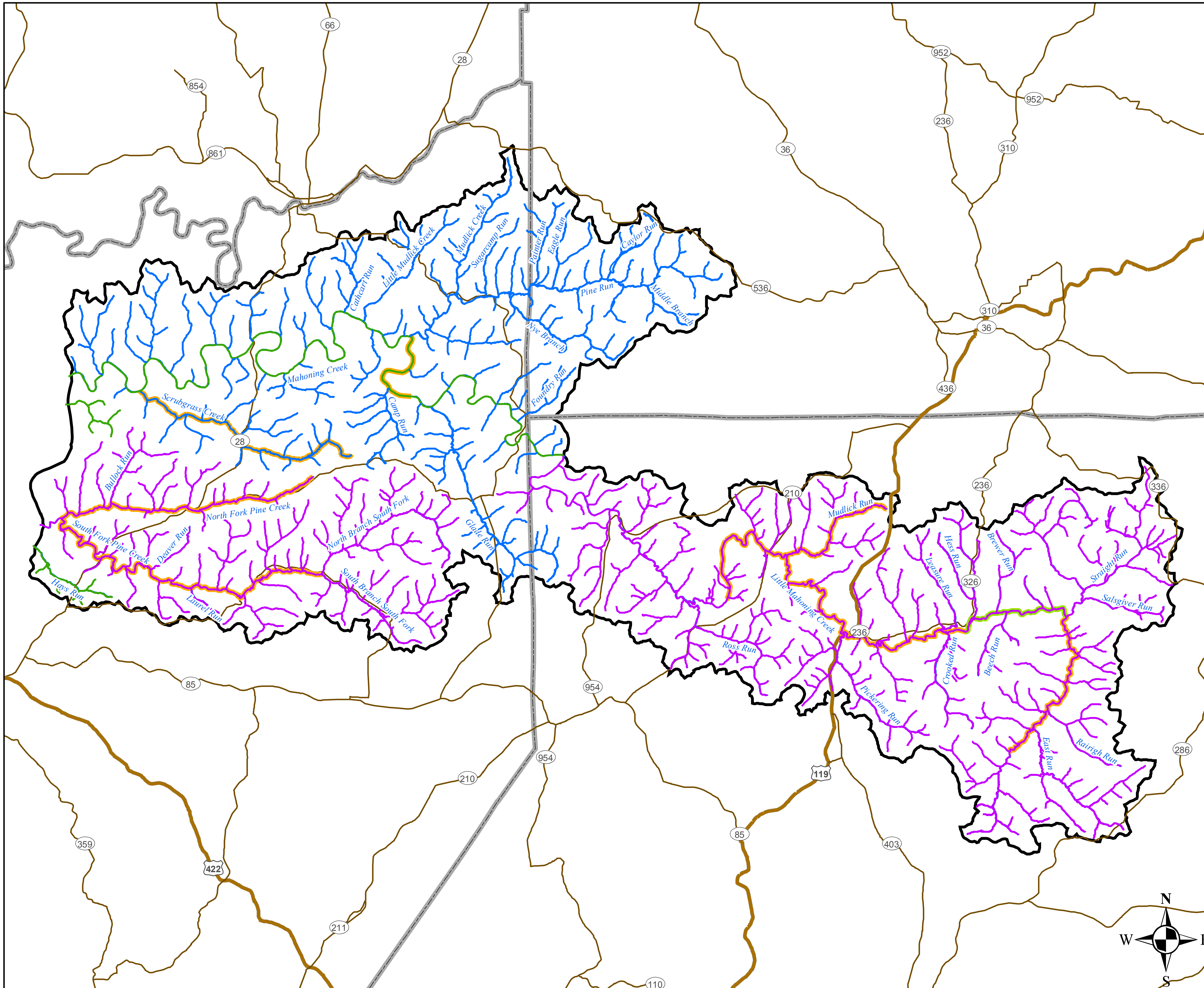
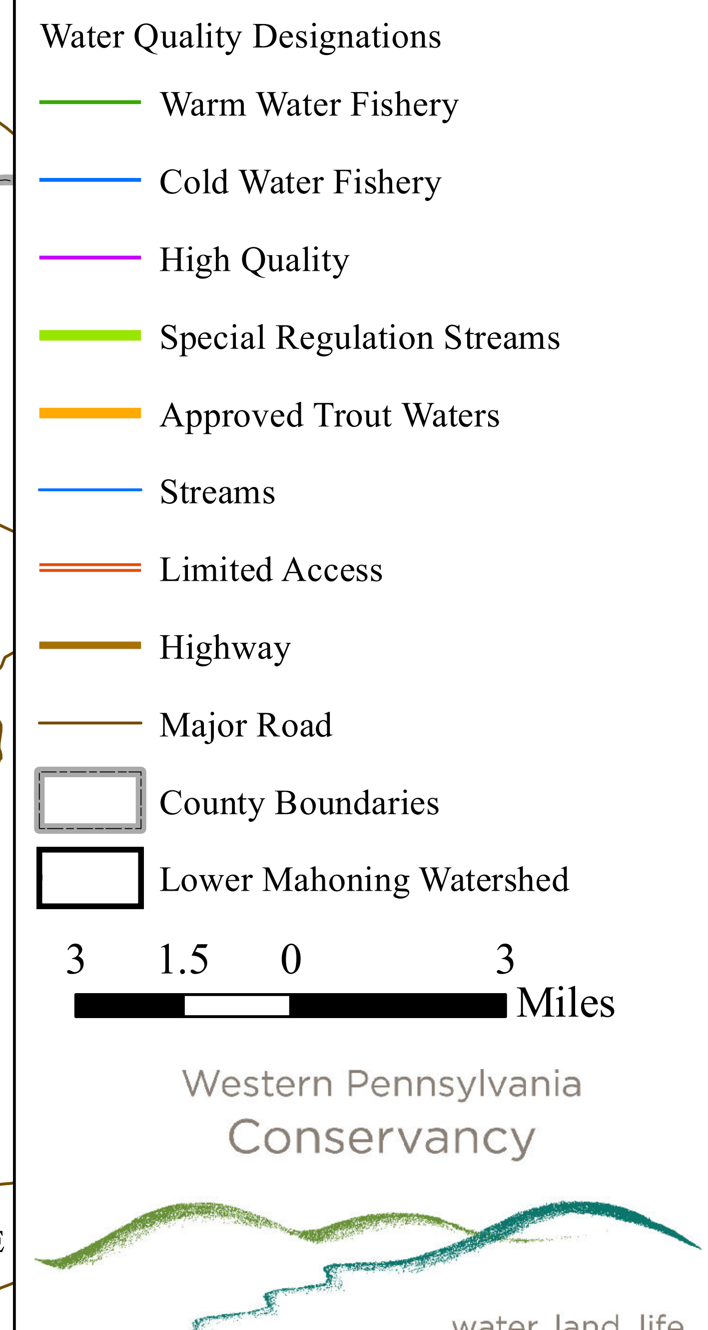


Figure 5-3

Fishing Opportunities





APPENDIX A. GLOSSARY

Acidity	The capacity of water for neutralizing a basic solution.
Agricultural Preservation Areas	Lands enrolled in a statewide program that has been established to promote the conservation and preservation of agricultural lands and the agricultural community.
Air Pollutant	Any substance in the air that causes damage to life, ecosystems, or property.
Airsheds	Geographic areas responsible for emitting 75 percent of the air pollution reaching a body of water.
All Terrain Vehicle	A small, open motor vehicle having one seat and three or more wheels fitted with large tires. It is designed chiefly for recreational use over roadless, rugged terrain.
Atmospheric Deposition	The process of airborne pollutants falling to the ground.
Basicity	The extent to which a substance is a base, which is defined as having a pH over seven.
Bedrock	The solid rock that underlies the soil and other unconsolidated material, or that is exposed at the surface.
Best Management Practices	Refer to the most environmentally appropriate techniques for agriculture, forestry, mining, development, urban storm water management, and other practices that are potential threats to natural resources.
Biological Diversity	The number and variety of organisms found within a specific geographic region, or a particular habitat; the variability among living organisms on the earth, including the variability within and between species and within and between ecosystems.
Biological Diversity Area	An area of land recognized as supporting populations of state, nationally, or globally significant species or natural communities, high-quality examples of natural communities or ecosystems, or natural exceptional native diversity.
Canal	A man-made waterway that is usually used to connect existing bodies of water.
Carbon Monoxide	A colorless, odorless, poisonous gas that results from the incomplete burning of carbon fuels.

Comprehensive Plans	A general policy guide for the physical development of a municipality, taking into account many factors including locations, character, and timing of future development.
Concentrated Animal Feeding Operation	A farm where large quantities of livestock or poultry are housed inside buildings or a confined area and all units of production, including feed, wastes and dead animals are concentrated in one area.
Conservation	The maintenance of environmental quality and resources; resources include physical, biological, or cultural. Ecosystem management within given social and economic constraints; producing goods and services for humans without depleting natural ecosystem diversity, and acknowledging the natural character of biological systems.
Conservation Lands	Public or private lands with management plans that include the protection of natural areas as a primary objective.
Dedicated Area	An area of land recognized because of an owner's specific intention to protect it, which could result in the improving to become either a biological diversity area in the future or an even better high-quality area within an already designated biological diversity area.
Degradation	A degeneration to a poorer quality, condition or state.
Direct Deposition	Occurs when pollutants enter a waterway by falling directly into it.
Drainage Pattern	The arrangement of streams in a landscape in response to local topography and subsurface geology.
Easement	A deed restriction that landowners may voluntarily place of their property to protect its future uses.
Eco-region	A geographical unit based on associations of those biotic and environmental factors that directly affect or indirectly express energy, moisture, and nutrients regulating the structure and function of ecosystems.
Ecosystems	An area and its living and non-living components.
Environmental Education	A learning process that increases knowledge and awareness of the environment and associated challenges, develops skills and expertise to address these challenges, and fosters attitudes, motivation, and commitment to make informed decisions and take responsible actions.
Erosion	The processes by which solids are displaced from the earth's surface; includes weathering, dissolution, abrasion, corrosion, and transportation.

Factory Farms	Larger, corporate-based farms that emphasize high volume and profit.
Family Farms	Smaller farms that have been in operation for several generations.
Floodplain	The level land among the course of a river or stream formed by the deposition of sediment during periodic floods.
Forest Management	The art and science of treating a forest to promote a desired outcome.
Geology	Geology is the science that deals with the study of the earth and its history, and is the name of the natural features of our plant.
Ground-level Ozone	A harmful secondary pollutant formed in the atmosphere when nitrogen oxide (NOx) combines and reacts with volatile organic compounds in the presence of sunlight and warm temperatures.
Groundwater	Water beneath the earth's surface; found in pore spaces in rock material. Supplies wells and springs as a source of drinking water for many; also
High-Grading	Involves cutting of only the biggest, most profitable trees in a stand; considered a non-sustainable practice.
Hydric Soils	Soils that are adequately moist in the upper section to cultivate anaerobic conditions during the growing season.
Hydrologic Unit Code	A system for organizing watersheds of the United States that divides and subdivides the watershed into successively smaller hydrologic units and is then assigned an identifying number.
Hydrology	The study of movement of water on the earth; includes surface water and groundwater.
Indirect Deposition	Occurs when a pollutant enters a waterway by falling onto land and being washed into waterbodies as runoff.
Invasive species	Environmentally noxious weeds that grow aggressively, spread easily, and displaces other plants.
Karst	An area of limestone marked by irregularities such as sinkholes, fissures, caves, and underground streams, which are created by erosion.
Landscape Conservation Area	A larger area of land that contains minimal human disturbance and allows ecosystems to function on a landscape level.
Landslide	Ground movements that change the stability of slope from stable to unstable are landslides

Lichens	A symbiosis between a fungal and algal life form that usually grows on trees or rocks.
Major Employers	Companies having a minimum of 200 employees.
Management Recommendations	Non-regulatory suggestions to improve the quality of life.
Methylmercury	A neurotoxin formed by the transformation of mercury by certain microorganisms; it is highly toxic and easily accumulates in fish, shellfish and animals that eat fish.
Natural Heritage Inventories	A method of assessing areas of important plants, animals, and ecological communities.
Natural Resources	A naturally-occurring material with economic value.
Nonpoint Source	Pollutants that have no readily visible source and often require detailed analysis and research to discern the source.
Ozone	A colorless, odorless, gas that forms in the atmosphere.
Ozone Layer	A colorless, odorless, gas located in the upper atmospheric layer that filters the sun's harmful ultraviolet rays.
Particular Matter	Tiny drops of liquid or small particles of dust, metal or other materials that float in the air.
Physiographic Provinces	A region with a particular type of landscape and geology.
Point Source	Pollutants that can be easily traced to their source.
Precipitation	Any form of water that falls from the sky, including, rain, snow, sleet, fog, and hail.
Preservation	The act or process of keeping something safe from harm or injury; the act of maintaining or reserving.
Prime Agricultural Soils	Soils that are extremely well suited for agricultural uses and meet certain physical, chemical, and slope characteristics.
Red beds	Stratosphere of reddish-colored sedimentary rocks, such as sandstone, siltstone, and shale.
Restoration	Returning to its original state or condition.

Riparian Areas	Areas of protective vegetation next to a body of water that serves as a barrier against polluted runoff and provides habitat corridors for wildlife.
Runoff	Rainfall or snowmelt not absorbed by soil that flows over the surface of the ground to a receiving waterway.
Secondary Pollutant	A new air pollutant formed when primary pollutants react in the atmosphere.
Sedimentary Rock	Rocks formed by the deposition of sediment.
Sedimentation	The deposit of particles moved by erosion.
Silviculture	The art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands.
Smart Growth Practices	A current movement that focuses on redevelopment of established urban areas and other ways to reduce sprawl pressures on undeveloped countrysides.
Soil Associations	A classification of soil types that comprise two to three major soil types and a few minor soil types.
Stormwater	Water that runs off the land into surface waters during and immediately following periods of precipitation.
Stormwater Management Plan	Planning for surface runoff into streams and river systems during rain and/or snowmelt events.
Streambed	The channel base of a stream or river or creek; it serves as an interchange between groundwater and surface water.
Subsidence	The downward movement of surface material involving little or no horizontal movement.
Sustainable	The ability to provide for the needs of the world's current population without damaging the ability of future generations to provide for themselves. When a process is sustainable, it can be carried out over and over without negative environmental effects or impossibly high costs to anyone involved.
Symbiosis	An alliance between two or more species that benefits each member.
Synthetic Processes	Human-controlled processes, such as burning fossil fuels.
Temperate Continental Climate	A climate without extremes of temperatures or precipitation.

Topography	Describes landscape features of an area.
Total Maximum Daily Load (TMDL)	A limit for pollutant load placed on a waterway by Department of Environmental Protection. TMDLs are determined for a waterway based on how much pollutant it is determined that the waterway can assimilate and still meet its designated use criteria. TMDLs will be used to regulate the percentage of total pollutant load that each source in a watershed can contribute.
Unemployment Rate	The percentage of people of the total labor force that are actively seeking a job but cannot find employment.
Value Added	The additional value added to a product at a stage of production.
Water Gap	An opening or notch which occurs when a section of a ridge has a weaker geological structure and a stream essentially cuts through a ridge to end up
Water Quality Trading	A program which allows facilities with higher pollution control costs to purchase the right to pollute from facilities that have reduced their pollution output below their required limits.
Watershed	The area of land that drains to a particular point along a stream. Each stream has its own watershed. Topography is the key element affecting this area of land. The boundary of a watershed is defined by the highest elevations surrounding the stream. A drop of water falling outside of the boundary will drain to another watershed.
Wetland	An area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances support, a prevalence of vegetation typically adapted for life in saturated soil conditions.
Wildlife Management Areas	Areas dedicated to wildlife management activities and low-intensity, wildlife-related recreation, including hunting and wildlife observation.
Zoning	A legal mechanism by which government bodies, for the sake of protecting public health, safety, morals and general welfare, can limit a landowner's right to use privately owned land by dividing land into districts and creating land-use regulations.

APPENDIX B. PLANNING COMMITTEES

Lower Mahoning Creek Regional Watershed Conservation Plan Steering Committee

Dave Beale	Armstrong Conservation District
Tom Betts	Marion Center School District
Tom Clark	Ken Sink Trout Unlimited Evergren Conservancy
Jessica Coil	Armstrong County Tourist Bureau
Anne Daymut	Indiana Conservation District
Jeff Fliss	DEP - Watershed Manager
Art Hamley	PA Game Commission
Mike Holiday	Little Mahoning Watershed Association
Kristin Hulihen	Jefferson County Department of Development
Rich Muth	Pine Creek Sportsmen Club
Jeff Raykes	Indiana County Office of Planning and Development
Amber Siar	Jefferson Conservation District
Tracy Stack	DCNR - Southwest Regional Office

Lower Mahoning Creek Regional Watershed Conservation Plan AdvisoryCommittees

Project Area Characteristics

Bertha Ackerson	East Mahoning Township
Nathan Wells	Little Mahoning Creek Watershed Association

Land Resources

Bertha Ackerson	East Mahoning Township
Fred Doverspike	East Mahoning Township
Gary Fleeger	Pennsylvania Geological Survey
Franklin Payne	Montgomery Township
Nathan Wells	Little Mahoning Creek Watershed Association

Water Resources

Fred Doverspike	East Mahoning Township
Gary Fleeger	Pennsylvania Geological Survey
Franklin Payne	Montgomery Township
Nathan Wells	Little Mahoning Creek Watershed Association

Biological Resources

Nathan Wells	Little Mahoning Creek Watershed Association

Cultural Resources

Fred Doverspike	East Mahoning Township
Nathan Wells	Little Mahoning Creek Watershed Association

APPENDIX C. AGRICULTURAL SOILS

Prime Agricultural Soils

Map Symbol	Soil Name	Slope Character (% slope)
Armstrong County		
AlB	Allegheny silt loam	3 to 8
EnA	Ernest silt loam	0 to 3
GcB	Gilpin channery silt loam	3 to 8
HaB	Hazleton channery loam	3 to 8
MoA	Monongahela silt loam	0 to 2
MoB	Monongahela silt loam	2 to 6
Ph	Philo silt loam	
Pm	Pope fine sandy loam	
Po	Pope loam	
RaA	Rainsboro silt loam	0 to 3
RnB	Rayne silt loam	3 to 8
Se	Steff loam	
Sf	Steff loam, high bottom	
UgB	Upshar-Gilpin silt loams	3 to 8
WrB	Whartonsilt loam	3 to 8
WtB	Wharton-Gilpin silt loams	3 to 8
WvB	Wharton-Vandergrift complex	3 to 8
Indiana County		
AhA	Allegheny silt loam	0 to 3
AhB2	Allegheny silt loam, moderately eroded	3 to 8
CkB2	Clarksburg silt loam, moderately eroded	3 to 8
ClA2	Clymer channery loam, moderately eroded	0 to 5
ClB2	Clymer channery loam, moderately eroded	5 to 12
CoA	Cookport loam	0 to 3
CoB2	Cookport loam, moderately eroded	3 to 8
ErA2	Ernest silt loam, moderately eroded	0 to 3
GcA2	Gilpin channery silt loam, moderately eroded	0 to 5
GcB2	Gilpin channery silt loam, moderately eroded	5 to 12
Indiana County (continued)		
GyB2	Guernsey silt loam, moderately eroded	3 to 8
MoA2	Monongahela silt loam, moderately eroded	0 to 3
MoB2	Monongahela silt loam, moderately eroded	3 to 8
Ph	Philo silt loam	
Pm	Pope fine sandy loam	
Po	Pope silt loam	
RyB	Rayne silt loam	3 to 8
UgB2	Upshur-Gilpin silty clay loams, moderately eroded	3 to 8
WrA	Wharton silt loam	0 to 3
WrB2	Wharton silt loam, moderately eroded	3 to 8
Jefferson County		
CkA	Cookport channery loam	0 to 3
CkB	Cookport channery loam	3 to 8
CkB2	Cookport channery loam, moderately eroded	3 to 8
CpA	Cookport loam	0 to 3
CpB	Cookport loam	3 to 8
CpB2	Cookport loam, moderately eroded	3 to 8
EnA	Ernest silt loam	0 to 3
GcA	Gilpin channery silt loam	0 to 5
GcB	Gilpin channery silt loam	5 to 12
GcB2	Gilpin channery silt loam, moderately eroded	5 to 12
HaA	Clymer loam	0 to 5
HaB	Clymer loam	5 to 12
HaB2	Clymer loam, moderately eroded	5 to 12
HlB	Hazleton channery loam	3 to 8
HoA	Allegheny silt loam	0 to 5
MoA	Monongahela silt loam	0 to 3
MoB	Monongahela silt loam	3 to 8

Map Symbol	Soil Name	Slope Character (% slope)
Jefferson County (continued)		
Ph	Philo silt loam	
Pp	Pope fine sandy loam	
Ps	Pope silt loam	
RaB	Rayne silt loam	3 to 8
ScA	Chavies silt loam	0 to 5
ShB2	Shelocat silt loam, moderately eroded	3 to 8

Map Symbol	Soil Name	Slope Character (% slope)
Indiana County (continued)		
WnA	Wellston silt loam	0 to 5
WtA	Wharton silt loam	0 to 3
WtB	Wharton silt loam	3 to 8
WtB2	Wharton silt loam, moderately eroded	3 to 8
ZoA	Zoar silt loam	0 to 3

Farmland of Statewide Importance

Map Symbol	Soil Name	Slope Character (% slope)
Armstrong County		
AlC	Allegheny silt loam	8 to 15
At	Atkins silt loam	
CaB	Cavode silt loam	3 to 8
CaC	Cavode silt loam	8 to 15
EnB	Ernest silt loam	3 to 8
EnC	Ernest silt loam	8 to 15
GcC	Gilpin channery silt loam	8 to 15
GwB	Gilpin-Weikert complex	3 to 8
GwC	Gilpin-Weikert complex	8 to 15
HaC	Hazleton channery loam	8 to 15
Me	Melvin silt clay loam	
RaB	Rainsboro silt loam	3 to 8
RaC	Rainsboro silt loam	8 to 15
RnC	Rayne silt loam	8 to 15
UgC	Upshur-Gilpin ilt loams	8 to 15
WeB	Weikert shaly silt loam	3 to 8
WeC	Weikert shaly silt loam	8 to 15
WrC	Wharton silt loam	8 to 15
Wtc	Wharton-Gilpin silt loams	8 to 15
WvC	Wharton-Vandergrift complex	8 to 15
Indiana County		
AhC2	Allegheny silt loam, moderately eroded	8 to 15
At	Atkins silt loam	
CaA	Cavode silt loam	0 to 3

Map Symbol	Soil Name	Slope Character (% slope)
Indiana County (continued)		
CaB2	Cavode silt loam, moderately eroded	3 to 8
CaC2	Cavode silt loam, moderately eroded	8 to 15
CkC2	Clarksburg silt loam, moderately eroded	8 to 15
CoC2	Cookport loam, moderately eroded	8 to 15
DaA2	Dekalb channery sand loam, moderately eroded	0 to 5
DaB2	Dekalb channery sand loam, moderately eroded	5 to 12
DaC2	Dekalb channery sand loam, moderately eroded	12 to 20
ErB2	Ernest silt loam, moderately eroded	3 to 8
ErC2	Ernest silt loam, moderately eroded	8 to 15
GcC2	Gilpin channery silt loam, moderately eroded	12 to 20
GwA2	Gilpin-Weikert shaly silt loams, moderately eroded	0 to 5
GwB2	Gilpin-Weikert shaly silt loams, moderately eroded	5 to 12
GyC3	Guernsey silt loam, severely eroded	8 to 15

Map Symbol	Soil Name	Slope Character (% slope)
Indiana County (continued)		
Me	Melvin silty clay loam	
MoC2	Monongahela silt loam, moderately eroded	8 to 15
RyC	Rayne silt loam	8 to 15
TrA	Tygart silt loam	0 to 3
TrB2	Tygart silt loam, moderately eroded	3 to 8
UgC2	Upshur-Gilpin silty clay loams, moderately eroded	8 to 15
VaB2	Vandergrift silt loam, moderately eroded	3 to 8
VaC2	Vandergrift silt loam, moderately eroded	8 to 15
WmB2	Westmoreland silt loam, moderately eroded	5 to 12
WmC2	Westmoreland silt loam, moderately eroded	12 to 20
WrC2	Wharton silt loam, moderately eroded	8 to 15
Jefferson County (continued)		
Aw	Atkins silt loam	
CaA	Cavode silt loam	0 to 3
CaB	Cavode silt loam	3 to 8
CaB2	Cavode silt loam, moderately eroded	3 to 8
CaC	Cavode silt loam	8 to 15
CaC2	Cavode silt loam, moderately eroded	8 to 15
CkC	Cookport channery loam	8 to 15
DcA	Dekalb channery loam	0 to 5
DcB	Dekalb channery loam	5 to 12
DcB2	Dekalb channery loam, moderately eroded	5 to 12
DcC	Dekalb channery loam	12 to 20
DcC2	Dekalb channery loam, moderately eroded	12 to 20
DhA	Dekalb loam	0 to 5
DhB	Dekalb loam	5 to 12
DhB2	Dekalb loam, moderately eroded	5 to 12

Map Symbol	Soil Name	Slope Character (% slope)
Jefferson County (continued)		
DhC	Dekalb loam	12 to 20
DhC2	Dekalb loam, moderately eroded	12 to 20
EnB	Ernest silt loam	3 to 8
EnB2	Ernest silt loam, moderately eroded	3 to 8
EnC	Ernest silt loam	8 to 15
EnC2	Ernest silt loam, moderately eroded	8 to 15
EnC3	Ernest silt loam, severely eroded	8 to 15
GcC	Gilpin channery silt loam	12 to 20
GcC2	Gilpin channery silt loam, moderately eroded	12 to 20
GgB	Gilpin silt loam	5 to 12
GgB2	Gilpin silt loam, moderately eroded	5 to 12
GgC	Gilpin silt loam	12 to 20
GgC2	Gilpin silt loam, moderately eroded	12 to 20
HaC2	Clymer loam, moderately eroded	12 to 20
HlC	Hazleton channery loam	8 to 15
HoB	Allegheny silt loam	5 to 12
HoC2	Allegheny silt loam, moderately eroded	5 to 12
HrB	Hartleton channery silt loam	3 to 8
HrC	Hartleton channery silt loam	8 to 15
MvA	Weikert-Gilpin channery silt loams	0 to 5
RaC	Rayne silt loam	8 to 15
Ty	Tyler silt loam	
WnB2	Wellston silt loam, moderately eroded	5 to 12
WnC2	Wellston silt loam, moderately eroded	12 to 20
WsB2	Westmoreland silt loam, moderately eroded	5 to 12
WsC2	Westmoreland silt loam, moderately eroded	12 to 20
WtC2	Wharton silt loam, moderately eroded	8 to 15

APPENDIX D. MINING PERMITS

Non Coal Mining Permits

County	Municipality	Size	Mine Name	Company	Permit #
Armstrong	Cowanshannock	Small <2,000 tons	Smith Shale Pit	D. Eugene Smith	3942301
Armstrong	Wayne	Small <2,000 tons	Earl O. Houser Strip	Earl O. Houser	3972301
Armstrong	Rayburn	Large	Continental Clay Mine	Continental Clay Company	3920301
Armstrong	Rayburn	Small <2,000 tons	Rupp Mine	Merle Rupp	2842302
Armstrong	Wayne	Small <2,000 tons	Huff Farms	Thomas Huff	3962301
Indiana	North Mahoning	Large	Griffith Quarry	Eward C. Griffith Quarrying Incorporated	32900301
Jefferson	Perry	<10,000 tons	Grange Mine	Original Fuels Incorporated	33012806

(Source: DEP, 2009c)

Active Bituminous Coal Mining Permits - January 2009

County	Municipality	Type	Mine Name	Company	Permit #
Indiana	Banks	Prep Plant	Hillman Tip	P&N Coal Company Incorporated	32851601
Indiana	North Mahoning	Prep Plant	Sprankle Mills Tipple V	Sprankle Mills Tipple	32921601
Indiana	Green	Refuse Disposal	Roxcoal Rock Refuse D	Rox Coal Incorporated	32980701
Armstrong	Madison	Surface	George Mine	Amerikohl Mining Incorporated	3050105
Armstrong	Madison	Surface	Mannion Mine	Original Fuels Incorporated	3050103
Armstrong	Boggs	Surface	Mine 41	Thomas J. Smith Incorporated	3040102
Armstrong	Redbank	Surface	Smith 46 Mine	Thomas J. Smith Incorporated	3070103
Indiana	Grant	Surface	Stitt	ABM Mining Company Incorporate	32990104
Indiana	East Mahoning	Surface	McAdoo Mine	Fossil Fuel Incorporated	32030110
Indiana	Grant	Surface	Rice Mine	Kraynak Coal Company	32020105
Indiana	East Mahoning	Surface	Moore Mine	P&N Coal Company Incorporated	32030105
Indiana	Banks	Surface	Lamkie	P&N Coal Company Incorporated	32070104
Indiana	South Mahoning	Surface	Smith NO 28 Mine	Thomas J. Smith Incorporated	32020104
Indiana	South Mahoning	Surface	Smith NO 39 Mine	Thomas J. Smith Incorporated	32060102
Indiana	East Mahoning	Surface	Smith Mine	THL Coal Company	32060103

Active Bituminous Coal Mining Permits - January 2009 (continued)

County	Municipality	Type	Mine Name	Company	Permit #
Indiana	East Mahoning	Surface	Joseph Mine	THL Coal Company	32010102
Jefferson	Ringgold	Surface	Schreckengost Mine	Bedrock Mines Limited Partnership	33960108
Jefferson	Perry	Surface	Means 2 Mine	Cookport Coal Company Incorporated	33050103
Jefferson	Perry	Surface	Hamilton Mine	McKay Coal Company Incorporated	33990102
Jefferson	Perry	Surface	Hamilton 2 Mine	McKay Coal Company Incorporated	33010102
Jefferson	Perry	Surface	Williams Run Mine	Original Fuels Incorporated	33080105
Jefferson	Ringgold	Surface	Neal Mine	Reichard Contr Incorporated	33070103
Jefferson	Perry	Surface	Hamilton III mine	Strishock Coal Company	33990109
Armstrong	Rayburn	Underground	Stitt Mine	Rosebud Mining Company	3991302
Indiana	Green	Underground	Starford Mine	Parkwood Resources Incorporated	32061301
Indiana	Green	Underground	North Branch Mine	Rox Coal Incorporated	32981301
Indiana	South Mahoning	Underground	Rossmoyne No 1	TJS Mining Incorporated	32021301
Jefferson	Perry	Underground	Dora 8 Deep Mine	Amfire Mining Co, Limited Liability Corp	33971301
Armstrong	Redbank	GFCC	Daugherty Project	J&J Snyder Incorporated	03-05-02
Armstrong	Redbank	GFCC	Snyder 1 Project	J&J Snyder Incorporated	03-05-01
Armstrong	Redbank	GFCC	Daugherty 2 Project	J&J Snyder Incorporated	03-07-01

(Source: DEP, 2009b)

APPENDIX E. ILLEGAL DUMPSITES

Site ID	Dumpsite	Municipality	Tons	Proximity to Waterway	Visibility from Road	Terrain	Recent Activity
Armstrong County							
5	East Caldwell Road	Boggs Township	4	Within 50 feet	Partially	Steep slope	Yes
6	North Bullock Road	Boggs Township	0.5	No waterway/wetland	Partially	Medium slope	No
7	Heffelfinger Road	Boggs Township	1	In waterway/wetland	Partially	Steep slope	No
8	Pine Creek Road	Boggs Township	5	More than 100 feet	Partially	Extremely stee	Yes
9	South Bullock Road	Boggs Township	12.5	In waterway/wetland	Partially	Steep slope	Yes
10	River Mill	Boggs Township	1.5	More than 100 feet	Partially	Steep slope	Yes
24	Logan Road	Cowanshannock Township	0.125	More than 100 feet	Yes	Gentle slope	No
80	SR 1003 site 1	Madison Township	1.5	More than 100 feet	Partially	Steep slope	No
82	Deanville Road	Madison Township	1	More than 100 feet	Partially	Medium slope	No
87	Patrick Road	Mahoning Township	1.5	More than 100 feet	Partially	Extremely stee	Yes
88	Deanville Road	Mahoning Township	9	More than 100 feet	Yes	Steep slope	Yes
91	Crickets Road	Mahoning Township	17.5	No waterway/wetland	Yes	Steep slope	Yes
93	Mill Seat Road	Mahoning Township	3	More than 100 feet	Partially	Steep slope	Yes
94	Farm Road	Mahoning Township	2	No waterway/wetland	Partially	Medium slope	No
122	Wilinson Road	Pine Township	3	In waterway/wetland	Yes	Steep slope	No
123	Stewartson Road	Pine Township	10	More than 100 feet	Yes	Steep slope	Yes
131	McCauley Falls Road	Rayburn Township	2	50 to 100 feet	Partially	Steep slope	Yes
132	Lower Hayes Run Road	Rayburn Township	2	In waterway/wetland	Partially	Extremely stee	No
139	Sames Road	Redbank Township	1.5	In waterway/wetland	No	Steep slope	Yes
140	Creek Road	Redbank Township	1	Within 50 feet	Yes	Steep slope	No
141	German Road	Redbank Township	1	No waterway/wetland	Partially	Medium slope	Yes
142	SR 1010	Redbank Township	1	More than 100 feet	No	Steep slope	No
143	Minich Hollow Road	Redbank Township	14	Within 50 feet	Yes	Medium slope	Yes
145	Upper Mudlic Road	Redbank Township	0.5	In waterway/wetland	Yes	Gentle slope	No
170	Ridge Raod	Redbank Township	0.125	More than 100 feet	Yes	Medium slope	No
171	Kelly Hollow Rioad	Wayne Township	12.5	50-100 feet	Partially	Steep slopes	Yes
172	Laurel Road	Wayne Township	1.5	More than 100 feet	Partially	Medium slope	No
173	Miller Hollow Road	Wayne Township	1.5	More than 100 feet	Yes	Gentle slope	Yes
174	Pebble Road	Wayne Township	0.25	More than 100 feet	Yes	Gentle slope	No

Site ID	Dumpsite	Municipality	Tons	Proximity to Waterway	Visibility from Road	Terrain	Recent Activity
Indiana County							
4	Big Two	Grant Township	2.5	Within 50 feet	No	Steep slope	Yes
5	Butterbaugh	Grant Township	2.5	No waterway	Yes	Flat	Unknown
91	Wolfe Road	West Mahoning Township	2.5	More than 100 feet	Yes	Steep slope	N
92	North Elkin	North Mahoning Township	5	Within 50-100 feet	Partially	Steep slope	N
93	Bosh Road	North Mahoning Township	4	Within 50-100 feet	Yes	Flat	Unknown
137	Fry Cemetery Road	Canoe Township	32.5	Within 50 feet	Partially	Very steep	Yes
			49				
Jefferson County							
76	Orchard Road	Ringgold Township	0.5	No waterway	No	Gentle slope	Yes
77	South Slate Road	Porter Township	0.13	No waterway	Yes	Flat	Yes
78	Windy Whiz Road	Porter Township	12.5	No waterway	Yes	Flat	Yes
79	Freedline	Porter Township	1	Within 50 feet	Yes	Gentle slope	Yes
			14.13				

Site ID	Dumpsite	Tires	Appliances	Electronics	TVs	Furniture	Mattresses	Car Batteries	Car Parts	Bag Trash	Household Waste	Recyclables	Houshold Hazardous Waste	Clean Fill	Construction/ Demolition Waste	Yard Waste
Armstrong County																
5	East Caldwell Road	5	0	0	1	2	0	0	No	Yes	No	No	No	No	Yes	No
6	North Bullock Road	5	0	1	0	1	1	0	Yes	Yes	Yes	No	No	No	Yes	No
7	Heffelfinger Road	0	1	0	0	1	0	0	Yes	No	Yes	No	No	No	No	No
8	Pine Creek Road	0	0	0	0	1	2	0	Yes	No	Yes	No	No	No	Yes	Yes
9	South Bullock Road	60	3	2	5	5	1	0	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
10	River Mill	5	0	1	6	2	0	0	Yes	Yes	Yes	No	No	No	Yes	No
24	Logan Road	0	1	0	0	0	0	0	No	No	No	No	No	No	Yes	No
80	SR 1003 site 1	4	0	0	0	1	0	0	No	Yes	Yes	No	No	Yes	Yes	Yes
82	Deanville Road	10	0	0	0	0	0	0	Yes	No	Yes	No	No	Yes	No	Yes
87	Patrick Road	4	3	0	0	0	0	0	No	Yes	Yes	No	No	Yes	Yes	No
88	Deanville Road	60	3	2	1	2	1	0	Yes	Yes	Yes	No	No	Yes	Yes	Yes
91	Crickets Road	60	18	2	5	5	2	0	Yes	Yes	Yes	No	No	Yes	Yes	Yes
93	Mill Seat Road	15	8	0	5	2	2	0	No	Yes	Yes	No	No	Yes	No	Yes
94	Farm Road	15	6	0	1	0	0	0	Yes	No	No	No	No	Yes	Yes	Yes
122	Wilinson Road	20	2	0	1	1	0	0	No	No	Yes	No	No	Yes	Yes	No
123	Stewartson Road	50	4	0	4	6	0	0	Yes	Yes	Yes	No	No	Yes	Yes	Yes
131	McCauley Falls Road	0	0	0	0	0	1	1	Yes	Yes	Yes	No	Yes	No	Yes	No
132	Lower Hayes Run Road	2	2	1	1	2	0	0	Yes	Yes	Yes	No	Yes	No	Yes	No
139	Sames Road	8	7	1	2	0	0	0	No	Yes	Yes	No	No	No	No	No
140	Creek Road	4	3	0	1	0	0	0	No	Yes	No	No	No	No	Yes	No
141	German Road	8	0	0	0	1	0	0	Yes	No	Yes	No	No	No	No	No
142	SR 1010	4	2	1	0	0	0	0	Yes	No	Yes	No	No	No	Yes	No
143	Minich Hollow Road	80	6	2	4	5	2	0	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
145	Upper Mudlic Road	3	0	0	0	0	0	0	No	Yes	Yes	No	No	No	No	No
170	Ridge Raod	4	0	0	0	0	0	0	No	No	No	No	No	No	No	No
171	Kelly Hollow Rioad	10	2	0	0	1	1	0	No	No	Yes	No	No	No	Yes	No
172	Laurel Road	0	0	0	0	0	0	0	No	No	No	No	No	No	Yes	No
173	Miller Hollow Road	6	0	0	0	0	0	0	No	Yes	No	No	No	No	No	No
174	Pebble Road	0	0	0	0	0	0	0	No	Yes	No	No	No	No	Yes	No

Site ID	Dumpsite	Tires	Appliances	Electronics	TVs	Furniture	Mattresses	Car Batteries	Car Parts	Bag Trash	Household Waste	Recyclables	Houshold Hazardous Waste	Clean Fill	Construction/ Demolition Waste	Yard Waste
Indiana County																
4	Big Two	50	3	0	2	2	0	0	Yes	No	No	Yes	No	No	No	No
5	Butterbaugh	60	5	2	0	10	3	0	Yes	Yes	Yes	Yes	No	No	No	No
91	Wolfe Road	0	10	0	0	3	0	0	No	No	No	Yes	No	No	Yes	No
92	North Elkin	5	20	0	0	0	0	0	No	No	Yes	Yes	No	No	No	No
93	Bosh Road	8	25	0	1	0	0	0	No	No	Yes	Yes	No	No	No	No
137	Fry Cemetery Road	200	100	0	0	150	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
son County																
76	Orchard Road	0	0	0	0	0	0	0	No	Yes	Yes	No	No	No	No	No
77	South Slate Road	0	0	0	0	0	0	0	No	Yes	No	No	No	No	No	No
78	Windy Whiz Road	20	1	0	0	2	0	0	No	Yes	Yes	No	No	No	No	No
79	Freedline	5	0	0	0	0	0	0	No	Yes	Yes	No	No	No	Yes	No

(Source: PA CleanWays, 2009; PA CleanWays, 2007a; PA CleanWays, 2007b)

APPENDIX F. INTEGRATED WATERBODY REPORT IMPAIRED WATERWAYS

TMDL Segment and Reason	Impairment	ID Date	TMDL Date
Eagle Run			
Aquatic Life (11950) - 2.38 miles			
Removal of Vegetation	Siltation	2006	2019
Eagle Run (Unt 47372)			
Aquatic Life (11950) - 1.72 miles			
Removal of Vegetation	Siltation	2006	2019
Glade Run (Unt 46201)			
Aquatic Life (3456) - 1.08 miles			
Abandoned Mine Drainage	Metals	2004	2017
Glade Run (Unt 46210)			
Aquatic Life (3463) - 1.62 miles			
Abandoned Mine Drainage	Metals	2004	2017
Glade Run (Unt 46211)			
Aquatic Life (3463) - 1.07 miles			
Abandoned Mine Drainage	Metals	2004	2017
Leisure Run			
Aquatic Life (4306) - 0.89 miles			
On site Wastewater	Organic Enrichment/Low D.O.	2004	2017
Little Mahoning Creek			
Aquatic Life (10030) - 0.63 miles			
Abandoned Mine Drainage	Metals	1998	2011
	pH	2002	2015
Aquatic Life (10031) - 6.31 miles			
Abandoned Mine Drainage	Metals	2002	2015
	pH	2002	2015
Little Mudlick Creek			
Aquatic Life (12798) - 1.66 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Little Mudlick Creek (Unt 47316)			
Aquatic Life (12798) - 0.42 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Aquatic Life (12065) - 2.58 miles			
Abandoned Mine Drainage	Metals	2006	2019
	Siltation	2006	2019
Channelization		2006	2019

TMDL Segment and Reason	Impairment	ID Date	TMDL Date
Mahoning Creek			
Aquatic Life (12065) - 2.58 miles			
Thermal Modifications		2006	2019
Removal of Vegetation	Siltation	2006	2019
Thermal Modifications		2006	2019
Urban Runoff/Storm Sewers	Nutrients	2006	2019
	Siltation	2006	2019
Aquatic Life (12067) - 1.14 miles			
Channelization	Siltation	2006	2019
Thermal Modifications		2006	2019
Removal of Vegetation	Siltation	2006	2019
Thermal Modifications		2006	2019
Road Runoff	Siltation	2006	2019
Aquatic Life (12304) - 2.16 miles			
Abandoned Mine Drainage	Metals	2006	2019
	Siltation	2006	2019
Mahoning Creek (Unt 47253)			
Aquatic Life (12776) - 0.51 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Mahoning Creek (Unt 47254)			
Aquatic Life (12777) - 2.24 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Mahoning Creek (Unt 47255)			
Aquatic Life (12777) - 0.37 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Mahoning Creek (Unt 47436)			
Aquatic Life (12805) - 2.15 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Mahoning Creek (Unt 47444)			
Aquatic Life (11941) - 0.65 miles			
Abandoned Mine Drainage	Metals	2006	2019
Mahoning Creek (Unt 47737)			
Aquatic Life (11973) - 1.17 miles			
Abandoned Mine Drainage	Metals	2006	2019
Surface Mining		2006	2019
Mahoning Creek (Unt 47738)			
Aquatic Life (11976) - 0.85 miles			
Abandoned Mine Drainage	Metals	2006	2019

TMDL Segment and Reason	Impairment	ID Date	TMDL Date
Mahoning Creek (Unt 47749)			
Aquatic Life (11976) - 0.73 miles			
Abandoned Mine Drainage	Metals	2006	2019
Mahoning Creek (Unt 47920)			
Aquatic Life (12307) - 1.03 miles			
On site Wastewater	Nutrients	2006	2019
	Pathogens	2006	2019
Mudlick Run			
Aquatic Life (10031) - 0.64 miles			
Abandoned Mine Drainage	Metals	2002	2015
	pH	2002	2015
North Branch Little Mahoning Creek			
Aquatic Life (11977) - 2.18 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Aquatic Life (11978) - 1.06 miles			
Abandoned Mine Drainage	Siltation	2006	2019
North Branch Little Mahoning Creek (Unt 47628)			
Aquatic Life (11977) - 1.53 miles			
Abandoned Mine Drainage	Siltation	2006	2019
North Branch Little Mahoning Creek (Unt 47629)			
Aquatic Life (11977) - 0.72 miles			
Abandoned Mine Drainage	Siltation	2006	2019
North Branch Little Mahoning Creek (Unt 47630)			
Aquatic Life (11977) - 1.14 miles			
Abandoned Mine Drainage	Siltation	2006	2019
North Branch Little Mahoning Creek (Unt 47631)			
Aquatic Life (11977) - 0.33 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Pine Run			
Aquatic Life (12793) - 5.27 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Pine Run (Unt 46280)			
Aquatic Life (4702) - 1.63 miles			
Abandoned Mine Drainage	Metals	2004	2017

TMDL Segment and Reason	Impairment	ID Date	TMDL Date
Pine Run (Unt 47348)			
Recreational (12803) - 0.41 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Pine Run (Unt 47349)			
Aquatic Life (12801) - 1.49 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Pine Run (Unt 47373)			
Aquatic Life (11950) - 0.73 miles			
Removal of Vegetation	Siltation	2006	2019
Ross Run			
Aquatic Life (12815) - 3.68 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47483)			
Aquatic Life (12815) - 0.36 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47484)			
Aquatic Life (12815) - 0.51 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47485)			
Aquatic Life (12815) - 0.92 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47486)			
Aquatic Life (12815) - 0.34 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47487)			
Aquatic Life (12815) - 0.33 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47488)			
Aquatic Life (12815) - 0.41 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47493)			
Aquatic Life (12815) - 0.52 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47494)			
Aquatic Life (12815) - 0.5 miles			
Grazing Related Agriculture	Siltation	2006	2019

TMDL Segment and Reason	Impairment	ID Date	TMDL Date
Ross Run (Unt 47495)			
Aquatic Life (12815) - 0.96 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47496)			
Aquatic Life (12815) - 0.39 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47497)			
Aquatic Life (12815) - 0.67 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47498)			
Aquatic Life (12815) - 0.41 miles			
Grazing Related Agriculture	Siltation	2006	2019
Ross Run (Unt 47499)			
Aquatic Life (12815) - 0.31 miles			
Grazing Related Agriculture	Siltation	2006	2019
South Branch South Fork Pine Creek (Unt 47210)			
Aquatic Life (8357) - 2.04 miles			
Agriculture	Nutrients	1998	2011
	Siltation	1998	2011
South Branch South Fork Pine Creek (Unt 47211)			
Aquatic Life (8357) - 0.7 miles			
Agriculture	Nutrients	1998	2011
	Siltation	1998	2011
South Branch South Fork Pine Creek (Unt 47212)			
Aquatic Life (8357) - 0.37 miles			
Agriculture	Nutrients	1998	2011
	Siltation	1998	2011
South Branch South Fork Pine Creek (Unt 47215)			
Aquatic Life (8357) - 0.39 miles			
Agriculture	Nutrients	1998	2011
	Siltation	1998	2011
South Branch South Fork Pine Creek (Unt 47216)			
Aquatic Life (8357) - 0.45 miles			
Agriculture	Nutrients	1998	2011
	Siltation	1998	2011

TMDL Segment and Reason	Impairment	ID Date	TMDL Date
South Fork Pine Creek (Unt 47161)			
Aquatic Life (4438) - 0.58 miles			
Abandoned Mine Drainage	Metals	2004	2017
South Fork Pine Creek (Unt 47165)			
Aquatic Life (4440) - 0.57 miles			
Abandoned Mine Drainage	Metals	2004	2017
Sugarcamp Run			
Aquatic Life (4203) - 1.02 miles			
Abandoned Mine Drainage	Metals	2004	2017
	Siltation	2004	2017
Aquatic Life (4205) - 1.41 miles			
Abandoned Mine Drainage	Metals	2004	2017
	pH	2004	2017
Aquatic Life (11941) - 1.83 miles			
Abandoned Mine Drainage	Metals	2006	2019
Aquatic Life (12800) - 2.73 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Sugarcamp Run (Unt 47347)			
Aquatic Life (12800) - 0.52 miles			
Abandoned Mine Drainage	Siltation	2006	2019
Sugarcamp Run (Unt 47696)			
Aquatic Life (11941) - 0.79 miles			
Abandoned Mine Drainage	Metals	2006	2019
Sugarcamp Run (Unt 47697)			
Aquatic Life (11941) - 1.03 miles			
Abandoned Mine Drainage	Metals	2006	2019

(Source: DEP, 2007a; DEP 2007b; DEP, 2008b)

APPENDIX G. LITTLE MAHONING CREEK WATERSHED VISUAL ASSESSMENT FORM

Evaluator's Names____ Date: ________________________

Sub-Watershed _____________________________ Stream Section Name ________________________________

Common Stream Name ________________________________ Reference Section Perfect Reach_______________

Weather Conditions Today _______________________________ Past 2-5 Days ___________________________

Land use within drainage (%): Grazing Pasture ______Forest _____ Residential _____ Industrial _____
Row Crop _____ Field _____ Conservation Reserve _____ Other _____

Dominant substrate (%): Boulder _____ Cobble _____ Gravel _____ Silt _____ Mud _____

Active Channel Width _____________ Invasive species Presence _______________

PLEASE DESCRIBE THE AREA THAT THE WATER FLOWS THROUGH: What type of forest? What type of farm? What type of residential?
PLEASE WRITE DOWN ANY GPS POINTS TAKEN AND WHY
SHOULD WATER SAMPLES BE TAKEN HERE? NEAR HERE?

Scoring Descriptions

Channel Condition

Natural channel; no structures, dikes. No evidence of down-Cutting or excessive lateral cutting.	Evidence of past channel alteration, but with significant recovery of channel and banks. Any dikes or levies are set back to provide access to an adequate flood plain.	Altered channel; <50% of the reach with riprap and/or channelization. Excess ***aggradation***; braided channel. Dikes or levees restrict flood plain width.	Channel is actively downcutting or widening. >50% of the reach with riprap or channelization. Dikes or levees prevent access to the flood plain.
10 9 8	7 6 5 4	3 2	1

Aggradation: *The process by which a stream's gradient steepens due to increased deposition of sediment.*
Keys: look for things like down cutting, lateral cutting, altered or widened sections, dykes, levees or other obstructions.

Riparian Zone

Natural Vegetation extends at least two active channel widths on each side.	Natural vegetation extends one active channel width on each side. Or If less than one width, covers entire flood plain.	Natural vegetation extends half of the active channel width on each side.	Natural vegetation extends a third of the active channel width on each side. Or Filtering function moderately compromised.	Natural vegetation less than a third of the active channel width on each side. Or Lack of regeneration. Or Filtering function severely compromised.
10 9	8 7 6	5 4	3 2	1

Keys: Related to ACTIVE channel width, an example would be a 5' wide stream. 10' = 2x active channel width.

Pool Variability

Even mix of large shallow, large deep, small shallow, small deep pools present.	Majority of pools large deep; very few shallow.	Shallow pools much more prevalent than deep.	Majority of pools small shallow, or absent.
10 9 8	7 6 5	4 3 2	1

Channel Sinuosity

The bends in the stream increase the stream length 3-4 times longer than if it was a straight line.	The bends in the stream increase the stream length 2 times longer than if it was a straight line.	The bends in the stream increase the stream length 1 times longer than if it was a straight line.	Evidence of Channel straightening, slight bends beginning to form	Channel straight; waterway has been channelized for a long distance.
10 9	8 7	6 5	4 3	2 1

Bank Stability

Banks are stable; at elevation of active flood plain; 33% or more of eroding surface area of banks in outside bends is protected by roots that extend to the base-flow elevation.	Moderately stable; at elevation of active flood plain; less than 33% of eroding surface area of banks in outside bends is protected by roots that extend to the base-flow elevation.	Moderately unstable; banks may be low, but typically are high (flooding occurs 1 year out of 5, or less frequently); outside bends are actively eroding (overhanging vegetation at top of bank, some mature trees falling into stream annually, some slope failures apparent).	Unstable; banks may be low, but typically are high; some straight reaches and inside edges of bends are actively eroding as well as outside bends (overhanging vegetation at top of bare bank, numerous mature trees falling into stream annually, numerous slope failures apparent).
10 9 8	7 6 5 4	3 2	1

Keys: **All** outside bends in streams erode; even the most stable streams may have 50% of its banks bare and eroding. A stable bank would be characterized by healthy vegetative cover, and/or a gentle slope. Unstable banks, on the other hand, would have little or no vegetative cover or a steep or vertical slope.

Water Appearance

Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks.	Occasionally cloudy; objects visible at depth 1.5 to 3 ft; may have slightly green color; no oil sheen on water surface.	Considerable cloudiness most of time; objects visible to depth 0.5 to 1.5 ft; slow sections may appear pea-green; bottom rocks or submerged objects covered with heavy green or olive-green film. Or Moderate odor of ammonia or rotten eggs.	Very turbid or muddy appearance most of the time; objects visible to depth <0.5 ft; slow moving water may be bright-green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface. Or Strong odor of chemicals, oil, sewage, other pollutants.
10 9 8	7 6 5 4	3 2	1

Keys: Remember to look at the water, not the substrate. If you dipped a glass in the water, what would the water look like?

Nutrient Enrichment

Clear water along entire reach; diverse aquatic plant community little algal growth present.	Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrates.	Greenish water along entire reach; abundant algal growth, especially during warmer months.	Pea green, gray or brown water along entire reach; severe algal blooms create thick algal mats in stream.
10 9 8	7 6 5 4	3 2	1

Keys: Looking for algae and other aquatic vegetation, some is good, but it should not be excessive.

Fish Barriers

No barriers.	Seasonal water withdrawals inhibit movement within the reach.	Drop structures, culverts, dams or diversions (<1ft drop) within the reach.	Drop structures, culverts, dams or diversions (>1ft drop) within 3 miles of reach.	Drop structures, culverts, dams or diversions (>1ft drop) within the reach.
10 9	8 7 6	5 4	3 2	1

Keys: You are looking for withdrawals, culverts, dams and diversions. Anything that is imposed or constructed by man that would impede fish passage.

Instream Fish Cover

>7 cover types available	6 to 7 cover types available	4 to 5 cover types available	2 to 3 cover types available	None to 1 cover type available
10 9	8 7 6	5 4	3 2	1

Cover types: Logs/large woody debris, deep pools, overhanging vegetation, boulders/cobble, riffles, undercut banks, thick root mats, dense macrophyte beds, isolated/backwater pools, other:_____________

Embeddedness

Gravel or cobble particles are <20% embedded.	Gravel or cobble particles are 20 to 30% embedded.	Gravel or cobble particles are 30 to 40% embedded.	Gravel or cobble particles are >40% embedded.	Completely embedded.
10 9	8 7 6	5 4	3 2	1

Keys: Embeddedness is defined as the degree to which objects in the stream bottom are surrounded by fine sediment. Only evaluate this item in **riffles & runs**. Measure the depth to which objects are buried by sediment. Be sure that you are looking at the entire reach, not just one riffle. To help better define embeddedness, picture a rock. If the average sediment in the stream covers the bottom 20% of the rock than you would check 20%. If the rock is covered 1/3rd of the way by sediment then it is 30% embedded.

Insect/invertebrate Habitat

At least 5 types of habitat available. Habitat is at a stage to allow full insect colonization (woody debris and logs not freshly fallen).	3 to 4 types of habitat. Some potential habitat exists, such as overhanging trees, which will provide habitat, but have not yet entered the stream.	1 to 2 types of habitat. The substrate is often disturbed, covered, or removed by high stream velocities and scour or by sediment deposition.	None to 1 type of habitat.
10 9 8	7 6 5 4	3 2	1

Cover types: Fine woody debris, submerged logs, leaf packs, undercut banks, cobble, boulders, coarse gravel, other: ___________

Canopy Cover
Keys: This pertains to waterways where channel is 50' or less.

Coldwater fishery

>75% of water surface shaded and upstream 2 to 3 miles generally well shaded.	> 50% shaded in reach. Or >75% in reach, but upstream 2 to 3 miles poorly shaded.	20 to 50% shaded.	<20% of water surface in reach shaded.
10 9 8	7 6 5 4	3 2	1

Warmwater fishery

25 to 90% of water surface shaded; mixture of conditions.	>90% shaded; full canopy; same shading condition throughout reach.	(Intentionally blank)	<25% water surface shaded in reach.
10 9 8	7 6 5 4		1

Sewage (if applicable)

(Intentionally blank)	Noticeable odor, excess plant growth and siltation.	Noticeable odor, excess plant growth. And Questionable pipe and black stream substrate.	Visible pipe with effluent, heavy odor.
	5 4	3 2	1

Manure Presence (if applicable)

(Intentionally blank)	Evidence of livestock access to riparian zone.	Occasional manure in stream or waste storage structure located on the flood plain.	Extensive amount of manure on banks or in stream. Or Untreated human waste discharge pipes present.
	5 4	3 2	1

Assessment Score		**Explanation of Score Given**
Channel condition	☐	______________________________
Riparian zone	☐	______________________________
Pool Variability	☐	______________________________
Channel Sinuosity	☐	______________________________
Bank stability	☐	______________________________
Water appearance	☐	______________________________
Nutrient enrichment	☐	______________________________
Fish barriers	☐	______________________________
In-stream fish cover	☐	______________________________
Embeddedness	☐	______________________________
Invertebrate habitat	☐	______________________________
Canopy Cover	☐	______________________________

Score only if applicable

Sewage ☐

Manure presence ☐

TOTAL SCORE: _______________
(Add all scores and divide by number of scores given)

< 6.0	= POOR
6.1 – 7.4	= FAIR
7.5 – 8.9	= GOOD
> 9.0	= EXCELLENT

Water Quality

In-Stream Habitat

Erosional	**% of Total**
Riffle	
Run	
Depositional	
Pool	
Edge	
Bar	
Backwater	

Local Non-Point Sources		
	no evidence	
	potential	
	obvious	

Local Watershed Erosion		
	None	
	Light	
	Moderate	
	Heavy	

APPENDIX H. SPECIES OF CONCERN

Plants

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status	Location by County		
							Armstrong	Indiana	Jefferson
Penstemon laevigatus	Beard-tongue	G5	S3	N	TU			x	
Baptisia australis	Blue False-indigo	G5	S2	N	PT		x	x	x
Astragalus canadensis	Canadian Milkvetch	G5	S2	N	TU			x	
Carex typhina	Cattail Sedge	G5	S2	PE	PT		x		
Trillium flexipes	Declined Trillium	G5	S2	TU	PT		x	x	
Poa languida	Drooping Bluegrass	G3G4Q	S2	TU	PT				x
Stenanthium gramineum	Featherbells	G4G5	S1S2	N	TU		x	x	x
Lonicera hirsuta	Hairy Honeysuckle	G4G5	S1	TU	PE				x
Erigenia bulbosa	Harbinger-of-spring	G5	S4	PT	PR		x		
Viburnum trilobum	Highbush-cranberry	G5T5	S3S4	TU	PR				x
Utricularia cornuta	Horned Bladderwort	G5	S2	N	PT		x		
Cardamine maxima	Large Toothwort	G5	S2	N	PT				x
Polymnia uvedalia	Leaf-cup	G4G5	S3	N	PR		x	x	
Asplenium pinnatifidum	Lobed Spleenwort	G4	S3	N	PR		x		
Salix petiolaris	Meadow Willow	G5	S4	TU	WATCH			x	x
Cimicifuga americana	Mountain Bugbane	G4	S3	PT	PR			x	
Stellaria borealis	Mountain Starwort	G5	S1S2	N	TU				x
Galium latifolium	Purple Bedstraw	G5	S3	N	TU		x		
Platanthera peramoena	Purple-fringeless Orchid	G5	S2	TU	PT		x	x	
Filipendula rubra	Queen-of-the-prairie	G4G5	S1S2	TU	TU		x	x	
Potamogeton richardsonii	Red-head Pondweed	G5	S3	PT	PR		x		
Helianthus microcephalus	Small Wood Sunflower	G5	S4	N	WATCH		x	x	x
Scirpus pedicellatus	Stalked Bulrush	G4	S1	PT	PT		x		
Pedicularis lanceolata	Swamp Lousewort	G5	S1S2	N	PE		x		
Lathyrus venosus	Veiny Pea	G5	S2	N	PE		x		
Symphyotrichum praealtum	Veiny-lined Aster	G5	S3	N	TU		x		x
Veratrum virginicum	Virginia Bunchflower	G5	S1	N	PE		x		

Plants (continued)

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status	Location by County Armstrong	Indiana	Jefferson
Rosa virginiana	Virginia Rose	G5	S1	TU	TU		x		
Strophostyles umbellata	Wild Bean	G5	S2	N	PE		x		
Phaseolus polystachios	Wild Kidney Bean	G5	S1S2	N	PE		x		

Vertebrates

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status	Location by County Armstrong	Indiana	Jefferson
Botaurus lentiginosus	American Bittern	G4	S1B	PE	PE				x
Haliaeetus leucocephalus	Bald Eagle	G5	S2B	PT	PT		x		x
Etheostoma camurum	Bluebreast Darter	G4	S2	PT	PT		x		
Percina copelandi	Channel Darter	G4	S2		PT		x		
Spiza americana	Dickcissel	G5	S2B	PE	PE				x
Heterodon platirhinos	Eastern Hognose Snake	G5	S3				x	x	
Myotis leibii	Eastern Small-footed Myotis	G3	S1B,S1N	PT	PT		x	x	
Hiodon alosoides	Goldeye	G5	S2?	PT	PT		x		
Ardea herodias	Great Blue Heron	G5	S3S4B,S4N				x	x	x
Cryptobranchus alleganiensis	Hellbender	G3G4	S3					x	x
Myotis sodalis	Indiana or Social Myotis	G2	SUB,S1N	PE	PE	LE	x		
Lampetra aepyptera	Least Brook Lamprey	G5	S3	PC	CR			x	
Asio otus	Long-eared Owl	G5	S2B,S2S3N		CU			x	
Percina macrocephala	Longhead Darter	G3	S2S3		PT		x		
Lepisosteus osseus	Longnose Gar	G5	S3		CR		x		
Hiodon tergisus	Mooneye	G5	S2S3	PT	PT		x	x	
Ichthyomyzon greeleyi	Mountain Brook Lamprey	G3G4	S2	PT	PT				x
Necturus maculosus	Mudpuppy	G5	S3S4				x	x	
Accipiter gentilis	Northern Goshawk	G5	S2S3B,S3N		CR				x
Myotis septentrionalis	Northern Myotis	G4	S3B,S3N		CR		x		
Ichthyomyzon bdellium	Ohio Lamprey	G3G4	S2S3	PC	CP				x
Podilymbus podiceps	Pied-billed Grebe	G5	S3B,S4N		CR		x		

Vertebrates (continued)

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status	Location by County Armstrong	Indiana	Jefferson
Regina septemvittata	Queen Snake	G5	S3				x	x	
Carpiodes carpio	River Carpsucker	G5	S1		CU		x		
Moxostoma carinatum	River Redhorse	G4	S3S4		CU		x		
Thamnophis brachystoma	Shorthead Garter Snake	G4	S3						x
Liochlorophis vernalis	Smooth Green Snake	G5	S3S4					x	
Porzana carolina	Sora	G5	S3B		CR		x	x	
Erimystax dissimilis	Streamline Chub	G4	S3				x		
Crotalus horridus	Timber Rattlesnake	G4	S3S4	PC	CA			x	
Rallus limicola	Virginia Rail	G5	S3B				x	x	
Glyptemys insculpta	Wood Turtle	G4	S3S4				x	x	

Invertebrates

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status	Location by County Armstrong	Indiana	Jefferson
Aeshna tuberculifera	Black-tipped Darner	G4	S2S3						x
Ellipsaria lineolata	Butterfly Mussel	G4	S1S2		CU		x		
Pleurobema clava	Clubshell	G2	S1S2	PE	PE	LE	x	x	
Elliptio crassidens	Elephant Ear	G5	SX		CU		x		
Alasmidonta marginata	Elktoe	G4	S4		N		x	x	
Cyprogenia stegaria	Fanshell	G1Q	SX		PX	LE	x		
Leptodea fragilis	Fragile Papershell	G5	S2		CR		x		
Gomphus viridifrons	Green-faced Clubtail	G3G4	S1				x		x
Gomphus descriptus	Harpoon Clubtail	G4	S1S2				x		x
Toxolasma parvus	Lilliput	G5	S1S2		PE		x		
Fusconaia subrotunda	Long-solid	G3	S1		PE		x	x	
Quadrula quadrula	Mapleleaf	G5	S1S2		PT		x		
Gomphus fraternus	Midland Clubtail	G5	S2S3						x
Quadrula metanevra	Monkeyface	G4	SX		PX		x		
Gomphus adelphus	Mustached Clubtail	G4	S3S4					x	x

Invertebrates (continued)

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status	Location by County		
							Armstrong	Indiana	Jefferson
Lanthus parvulus	Northern Pygmy Clubtail	G4	S3S4					x	x
Epioblasma torulosa rangiana	Northern Riffleshell	G2T2	S2	PE	PE	LE	x		
Boyeria grafiana	Ocellated Darner	G5	S3					x	x
Pleurobema cordatum	Ohio Pigtoe	G4	S1		PE		x		
Utterbackia imbecillis	Paper Pondshell	G5	S3S4		CU		x	x	
Quadrula pustulosa	Pimpleback	G5	S1		PX		x		
Potamilus alatus	Pink Heelsplitter	G5	S2		CR		x		
Lampsilis abrupta	Pink Mucket	G2	SX		PX	LE	x		
Tritogonia verrucosa	Pistolgrip Mussel	G4G5	S1		PE		x		
Cyclonaias tuberculata	Purple Wartyback	G5	SX		PX		x		
Pleurobema rubrum	Pyramid Pigtoe	G2G3	SX		PX		x		
Quadrula cylindrica	Rabbitsfoot	G3G4	S1	PE	PE		x		
Villosa iris	Rainbow Mussel	G5Q	S1		PE		x	x	
Gomphus quadricolor	Rapids Clubtail	G3G4	S1S2					x	x
Villosa fabalis	Rayed Bean Mussel	G2	S1S2		PE	C	x		
Leucorrhinia proxima	Red-waisted Whiteface	G5	S2						x
Pleurobema plenum	Rough Pigtoe	G1	SX		PX	LE	x		
Obovaria subrotunda	Round Hickorynut	G4	S1		PE		x	x	
Pleurobema sintoxia	Round Pigtoe	G4G5	S2		PE		x	x	
Gomphus rogersi	Sable Clubtail	G4	S1					x	x
Simpsonaias ambigua	Salamander Mussel	G3	S1?	PE	PT		x		
Plethobasus cyphyus	Sheepnose Mussel	G3	S1	PE	PE	C	x		
Epioblasma triquetra	Snuffbox	G3	S1	PE	PE		x	x	
Amblema plicata	Three-ridge	G5	S2S3		PT		x		
Enallagma divagans	Turquoise Bluet	G5	S3				x		
Fusconaia flava	Wabash Pigtoe	G5	S2		PE		x	x	
Lampsilis fasciola	Wavy-rayed Lampmussel	G5	S4		N		x	x	
Pieris virginiensis	West Virginia White	G3G4	S2S3				x	x	
Stylurus scudderi	Zebra Clubtail	G4	S1				x		x

Geologic Features

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status	Location by County Armstrong	Indiana	Jefferson
Meandering channels	Meandering Channels	GNR	SNR				x		
Erosional remnant	Erosional Remnant	GNR	SNR						x

Natural Communities

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status	Location by County Armstrong	Indiana	Jefferson
High-gradient clearwater creek	High-gradient Clearwater Creek	GNR	S3						x
Northern hardwood forest		GNR	S4				x		
Hemlock palustrine forest		GNR	S3					x	x
Big bluestem - indian grass river grassland		GNR	S3				x		

Basic Global Rank Codes and Definitions

Rank Code	Description	Definition
GX	Presumed Extinct	Believed to be extinct throughout its range. Not located despite intensive searches of historic sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
GH	Possibly Extinct	Known from only historical occurrences. Still some hope of rediscovery.
G1	Critically Imperiled	Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or stream miles (<10).
G2	Imperiled	Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or stream miles (10 to 50).
G3	Vulnerable	Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
G4	Apparently Secure	Uncommon but not rare, and usually widespread. Possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.
G5	Secure	Common, typically widespread and abundant. Typically with considerably more than 100 occurrences and more than 10,000 individuals.
G#G#	Range Rank	A numeric range rank (e.g., G2G3) is used to indicate uncertainty about the exact status of a taxon.

Basic Global Rank Codes and Definitions

Rank Code	Description	Definition
T	Infraspecific Taxon (trinomial)	The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A "T" subrank cannot imply the subspecies or variety is more abundant than the species= basic rank (e.g.., a G1T2 subrank should not occur). A population (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T rank; in such cases a Q is used after the T rank to denote the taxon's questionable taxonomic status.

Global Rank Qualifiers

Qualifier	Description	Definition
?	Inexact Numeric Rank	Denotes inexact numeric rank.
Q	Questionable Taxonomy	Taxonomic status is questionable; numeric rank may change with taxonomy.
C	Captive or Cultivated Only	Taxon at present is extant only in captivity or cultivation, or as a reintroduced population not yet established.

State Rank Codes and Definitions

Rank Code	Description	Definition
SX	Extirpated	Element is believed to be extirpated from the "state" (or province or other subnational unit).
SH	Historical	Element occurred historically in the state (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an element would become SH without such a 20-year delay if the only known occurrences in a state were destroyed or if it had been extensively and unsuccessfully looked for. Upon verification of an extant occurrence, SH-ranked elements would typically receive an S1 rank. The SH rank should be reserved for elements for which some effort has been made to relocate occurrences, rather than simply ranking all Elements not known from verified extant occurrences with this rank.

State Rank Codes and Definitions (continued)

Rank Code	Description	Definition
S1	Critically Imperiled	Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer occurrences or very few remaining individuals or acres.
S2	Imperiled	Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6 to 20 occurrences or few remaining individuals or acres.
S3	Vulnerable	Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences.
S4	Apparently Secure	Uncommon but not rare, and usually widespread in the state. Usually more than 100 occurrences.
S5	Secure	Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions.
S?	Unranked	State rank is not yet assessed.
SU	Unrankable	Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible, the most likely rank is assigned and a question mark added (e.g.., S2?) to express uncertainty, or a range rank (e.g.., S2S3) is used to delineate the limits (range) of uncertainty.
S#S#	Range Rank	A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the Element. Ranges cannot skip more than one rank (e.g.., SU should be used rather than S1S4).
HYB	Hybrid	Element represents an interspecific hybrid.
SE	Exotic	An exotic established in the state; may be native in nearby regions (e.g.., house finch or catalpa in eastern U.S.).
SE#	Exotic Numeric	An exotic established in the state that has been assigned a numeric rank to indicate its status, as with S1 through S5.
SA	Accidental	Accidental or casual in the state (i.e., infrequent and outside usual range). Includes species (usually birds or butterflies) recorded once or only a few times. A few of these species may have bred on the one or two occasions they were recorded. Examples include European strays or western birds on the East Coast and vice-versa.

State Rank Codes and Definitions (continued)

Rank Code	Description	Definition
SZ	Zero Occurrences	Not of practical conservation concern in the state because there are no definable occurrences, although the taxon is native and appears regularly in the state. This rank will generally be used for long distance migrants whose occurrences during their migrations have little or no conservation value for the migrant as they are typically too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. Typically, the SZ rank applies to a non-breeding population in the subnation -- for example, birds on migration. An SZ rank may in a few instances also apply to a breeding population, for example certain Lepidoptera which regularly die out every year with no significant return migration. Although the SZ rank typically applies to migrants, it should not be used indiscriminately. Just because a species is on migration does not mean it receives an SZ rank. SZ only applies when the migrants occur in an irregular, transitory, and dispersed manner.
SP	Potential	Potential that Element occurs in the state but no extant or historic occurrences reported.
SR	Reported	Element reported in the state but without a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports.
SRF	Reported Falsely	Element erroneously reported in the state (e.g., misidentified specimen) and the error has persisted in the literature
SSYN	Synonym	Element reported as occurring in the state, but state does not recognize the taxon; therefore the Element is not ranked by the state.
*		S rank has been assigned and is under review. Contact the individual state Natural Heritage program for assigned rank.
Not Provided		Species is known to occur in this state. Contact the individual state Natural Heritage program for assigned rank.

State Rank Qualifiers

Qualifier	Description	Definition
80	Breeding	Basic rank refers to the breeding population of the Element in the state.
N	Non-breeding	Basic rank refers to the non-breeding population of the Element in the state.
?	Inexact or Uncertain	Denotes inexact or uncertain numeric rank. For SE denotes uncertainty of exotic status. (The ? qualifies the character immediately preceding it in the SRANK.)
C	Captive or Cultivated	Element is presently extant in the state only in captivity or cultivation, or as a reintroduced population not yet established.
NOTE - A breeding status subrank is only used for species that have distinct breeding and/or non-breeding		

Pennsylvania State Status - Invertebrates

Status	Description	Definition
N		No current legal status but is under review for future listing.

Pennsylvania Status Definitions - Plants

Status	Description	Definition
PE	Pennsylvania Endangered	Plant species which are in danger of extinction throughout most of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.
PT	Pennsylvania Threatened	Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man.
PR	Pennsylvania Rare	Plant species, which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.
	Disjunct	Significantly separated from their main area of distribution
	Endemic	Confined to a specialized habitat.

Pennsylvania Status Definitions - Plants (continued)

Status	Description	Definition
PR	Limit of Range	At or near the periphery of their natural distribution
	Restricted	Found in specialized habitats or habitats infrequent in Pennsylvania.
PX	Pennsylvania Extirpated	Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.
PV	Pennsylvania Vulnerable	Plant species which are in danger of population decline within Commonwealth because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.
TU	Tentatively Undetermined	A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxanomic uncertainties, limited evidence within historical records, or insufficient data.
N		No current legal status exists, but is under review for future listing.

Pennsylvania State Status - Wild Birds and Mammals

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

Pennsylvania State Status - Wild Birds and Mammals (continued)

Status	Description	Definition
PT	Pennsylvania Threatened	Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".
N		No current legal status but is under review for future listing.

Pennsylvania State Status - Fish, Amphibians, Reptiles, and Aquatic Organisms

Status	Description	Definition
PE	Pennsylvania Endangered	All species declared by: 1) the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission, Executive Director to be threatened with extinction and appear on the Pennsylvania Endangered Species List published by the Pennsylvania Bulletin.
PT	Pennsylvania Threatened	All species declared by: 1) the Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens, and appear on a Threatened Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission Executive Director to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

Pennsylvania State Status - Wild Birds and Mammals (continued)

Status	Description	Definition
PC		Animals that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution or are at risk because of certain aspects of their biology.
N		No current legal status, but is under review for future listing.

Pennsylvania Biological Survey Suggested Status Definitions

Status	Description	Definition
PE	Pennsylvania Endangered	Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93 205 (87 Stat. 884), as amended.
PT	Pennsylvania Threatened	Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

Pennsylvania Biological Survey Suggested Status Definitions (continued)

Status	Description	Definition
PR	Pennsylvania Rare	Plant species which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.
	Disjunct	Significantly separated from their main area of distribution
	Endemic	Confined to a specialized habitat.
	Limit of Range	At or near the periphery of their natural distribution
CP	Candidate Proposed	Species comprising taxa for which the Pennsylvania Biological Survey (PBS) currently has substantial information on hand to support the biological appropriateness of proposing to list as Endangered or Threatened.
CA	Candidate at Risk	Species that although relatively abundant now are particularly vulnerable to certain types of exploitation or environmental modification.
CR	Candidate Rare	Species which exist only in one of a few restricted geographic areas or habitats within Pennsylvania, or they occur in low numbers over a relatively broad area of the Commonwealth.
CU	Condition Undetermined	Species for which there is insufficient data available to provide an adequate basis for their assignment to other classes or categories.
PX	Pennsylvania Extirpated	Species that have disappeared from Pennsylvania since 1600 but still exist elsewhere.
DL	Delisted	Species which were once listed but are now cited for delisting.
N		No current legal status, but is under study for future listing.

Federal Status Codes and Definitions

Status	Description	Definition
LE	Listed Endangered	A species which is in danger of extinction throughout all or a significant portion of its range.
LT	Listed Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
LELT	Listed Endangered in part of range; listed Threatened in the remaining part.	
PE	Proposed Endangered	Taxa proposed to be listed as endangered.

Federal Status Codes and Definitions (continued)

Status	Description	Definition
PT	Proposed Threatened	Taxa proposed to be listed as threatened
PEPT		Proposed Endangered in part of range; proposed Threatened in the remaining part.
C	Candidate for listing.	
E(S/A)		Treat as Endangered because of similarity of appearance.
T(S/A)		Treat as Threatened because of similarity of appearance.
XE	Essential Experimental population	
XN	Nonessential Experimental population	
"xy" (mixed status)		Status varies for different populations or parts of range.
"x" NL		Status varies for different populations or parts of range with at least one part not listed.

APPENDIX I. WILDLIFE LISTING

Common Name	***Scientific Name***
Amphibitans	
bullfrog	*Rana catesbeiana*
American toad	*Bufo americanus*
Appalachian seal salamander	*Desmognathus monticola monticola*
eastern gray treefrog	*Hyla versicolor*
eastern hellbender	*Cryptobranchus alleganiensis alleganiensis*
four-toed slamander	*Hemidactylium scutatum*
fowlers toad	*Bufo fowleri*
jefferson salamander	*Ambystoma jeffersonianum*
longtail salamander	*Eurycea longicauda*
marbled salamander	*Ambystoma opacum*
mountain chorus frog	*Pseudacris brachyphona*
mountain dusky salamander	*Desmognathus ochrophaeus*
mudpuppy	*Necturus maculosus*
northern two-lined salamander	*Eurycea bislineata*
northern dusky salamander	*Desmognathus fuscus*
northern green frog	*Rana clamitans*
northern leopard frog	*Rana pipiens*
northern red salamander	*Pseudotriton ruber ruber*
northern spring peeper	*Pseudacris crucifer*
northern spring salamander	*Gyrinophilus porphyriticus*
pickerel frog	*Rana palustris*
redback slamander	*Plethodon cinereus*
red-spotted newt	*Notophthalmus viridescens*
slimy salamander	*Plethodon glutinosus*
spotted salamander	*Ambystoma maculatum*
Wehrle's salamander	*Plethodon wehrlei*
wood frog	*Rana sylvatica*
Birds	
American bittern	*Botaurus lentiginosus*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Spinus tristis*
American robin	*Turdus migratorius*
American woodcock	*Scolopax minor*
bald eagle	*Haliaeetus leucocephalus*
Baltimore oriole	*Icterus galbula*
barn owl	*Tyto alba*
barred owl	*Strix varia*
black-capped chickadee	*Poecile atricapillus*
black-throated green warbler	*Dendroica virens*
blue jay	*Cyanocitta cristata*
blue-gray gnatcatcher	*Poliptila caerulea*

Birds (continued)

broad-winged hawk	*Buteo platypterus*
brown thrasther	*Toxostoma rufum*
brown-headed cowbird	*Molothrus ater*
Canada goose	*Branta canadensis*
Carolina chickadee	*Poecile carolinensis*
cedar waxwing	*Bombycillus cedrorum*
cerulean warbler	*Dendroica cerulea*
chestnut sided warbler	*Dendroica pensylvanica*
common grackle	*Quiscalus quiscula*
common yellow throat	*Geothlypis trichas*
Cooper's hawk	*Accipiter cooperil*
dark-eyed junco	*Junco hyemalis*
dickcissel	*Spiza americana*
downy wood pecker	*Picoides pubescens*
eastern bluebird	*Sialia sialis*
eastern screech owl	*Megascops asio*
eastern screech owl	*Otus asio*
great blue heron	*Ardea herodias*
great horned owl	*Bubo virginianus*
green heron	*Butorides virescens*
house finch	*Carpodacus mexicanus*
house wren	*Troglodytes aedon*
indigo bunting	*Passerina cyanea*
killdeer	*Charadrius vociferus*
long-eared owl	*Asio otus*
mallard duck	*Anas platyrhynchos*
mourning dove	*Zenaida macroura*
mourning warbler	*Oporonis philadelphia*
northern cardinal	*Cardinalis cardinalis*
northern flicker	*Colaptes auratus*
northern goshawk	*Accipiter gentillis*
northern mocking bird	*Mimus polyglottos*
northern saw-wheat owl	*Aegolius acadicus*
osprey	*Pandion haliaetus*
pied-billed grebe	*Podilymbus podiceps*
pileated wood pecker	*Dryocopus pileatus*
purple finsh	*Carpodacus purpureaus*
red-bellied wood pecker	*Melanerpes carolinus*
red-sholdered hawk	*Buteo lineatus*
red-tail hawk	*Buteo jamaicensis*
red-winged balck bird	*Agelaius phoeniceus*
ruby-throated hummingbird	*Archilochus colubris*
ruffed grouse	*Bonasa umbellus*
rusty blackbird	*Euphagus carolinus*
scarlet tanger	*Piranga olivacea*

Birds (continued)

song sparrow	*Melospiza melodia*
sora	*Porzana carolina*
Swainson's thrush	*Catharus ustulatus*
tree swallow	*Tachycineta bicolor*
tufted titmouse	*Baeolophus bicolor*
turkey vulture	*Cathartes aura*
Virginia rail	*Rallus limicola*
white breatesd nut hatch	*Sitta carolinensis*
white throated sparrow	*Zonotrichia albicollis*
wild turkey	*Meleagris gallopavo*
Wilson's Snipe	*Gallinago delicata*
wood duck	*Aix sponsa*
yellow-bellied sapsucker	*Sphyrapicus varius*

Fish

Lamprey: Family Petromyzontidae

American brook lamprey	*Lampetra appendix*
mountain brook lamprey	*Ichthyomyzon greeleyi*
Ohio lamprey	*Icthyomyzon bdellium*

Rocklings: Family Lotidae

burbot	*Lota lota*

Pikes: Family Esocidae

muskellunge	*Esox masquinongy*
northern pike	*Esox lucius*
tiger muskellunge	*Esox lucius cross Esox masquinongy*

Catfish: Family Ictaluridae

channel catfish	*Ictalurus punctatus*
brown bullhead	*Ameiurus nebulosus*

Minnows: Family Cyprinidae

bigmouth shiner	*Notropis dorsalis*
southern redbelly dace	*Phoxinus erythrogaster*
bigeye chub	*Hybopsis amblops*
blacknose dace	*Rhinichthys atratulus*
bluntnose minnow	*Pimephales notatus*
central stoneroller	*Campostoma anomalum*
common shiner	*Luxilus cornutus*
creek chub	*Semotilus atromaculatus*
emerald shiner	*Notropis atherinoides*
redside dace	*Clinostomus elongatus*
sand Shiner	*Notropis stamineus*
fallfish	*Semotilus corporalis*

Fish (continued)

Perches: Family Percidae

channel darter	*Percina copelandi*
longhead darter	*Percina macrocephala*
yellow perch	*Perca flavescens*
walleye	*Sander vitreus*
banded darter	*Etheostoma zonale*
fantail darter	*Etheostoma flabellare*
johnny darter	*Etheostoma nigrum*
logperch	*Percina caprodes*
greenside darter	*Etheostoma blennioides*

Trout: Family Salmonidae

brook trout	*Salvelinus fontinalis*
brown trout	*Salmo trutta*
rainbow trout	*Oncorhynchus mykiss*
golden rainbow trout	*Oncorhynchus mykiss var.*

Sunfish: Family Centrarchidae

black crappie	*Pomoxis nigromaculatus*
bluegill	*Lepomis macrochirus*
largemouth bass	*Micropterus salmoides*
pumpkin seed	*Lepomis gibbosus*
rock bass	*Ambloplites ruperstris*
small mouth bass	*Micropterus dolomieu*
white crappie	*Pomoxis annularis*

Suckers: Family Catostomidae

golden redhorse	*Moxostoma erythrurum*
northern hogsucker	*Hypentelium nigricans*
shortheaded redhorse	*Moxostoma macrolepidotum*
white sucker	*Catostomus commersoni*

Sculpins: Family Cottidae

mottled sculpin	*Cottus bairdii*
slimy sculpin	*Cottus cognatus*

Freshwater Mussels

butterfly mussel	*Ellipsaria lineolata*
clubshell	*Pleurobema clava*
creeper	*Strophitus undulatus*
elephant ear	*Elliptio crassidens*
elktoe mussel	*Alasmidonta marginata*
fanshell	*Cyprogenia stegaria*
fatmucket	*Lampsilis radiata luteola*
flutedshell mussel	*Lasmigona costata*

Freshwater Musselsb (continued)

fragile papershell	*Leptodea fragilis*
kidneyshell	*Ptychobranchus fasciolaris*
lilliput	*Toxolasma parvus*
long-solid	*Fusconaia subrotunda*
mapleleaf	*Quadrula quadrula*
monkeyface	*Quadrula metanevra*
northern riffleshell	*Epioblasma torulosa rangiana*
Ohio pigtoe	*Pleurobema cordatum*
paper pondshell	*Utterbackia imbecillis*
pimpleback	*Quadrula pustulosa*
pink heelsplitter	*Potamilus alatus*
pink mucket	*Lampsilis abrupta*
pistolgrip mussel	*Tritogonia verrucosa*
plain pocketbook mussel	*Lampsilis cardium*
purple wartyback	*Cyclonaias tuberculata*
pyramid pigtoe	*Pleurobema rubrum*
rabbitsfoot	*Quadrula cylindrica*
rainbow mussel	*Villosa iris*
rayed bean mussel	*Villosa fabalis*
rough pigtoe	*Pleurobema plenum*
round hickorynut	*Obovaria subrotunda*
round pigtoe	*Pleurobema sintoxia*
salamander mussel	*Simpsonaias ambigua*
sheepnose mussel	*Plethobasus cyphyus*
snuffbox	*Epioblasma triquetra*
spike mussel	*Elliptio dilatata*
three-ridge	*Amblema plicata*
Wabash pigtoe	*Fusconaia flava*
wavy-rayed lampmussel	*Lampsilis fasciola*

Mammals

American beaver	*Castor canadensis*
American black bear	*Ursus americanus*
American mink	*Mustela vison*
Appalachian cottontail	*Sylvilagus obscurus*
big brown bat	*Eptesicus fuscus*
coyote	*Canis latrans*
deer mouse	*Peromyscus maniculatus*
eastern chipmunk	*Tamias striatus*
eastern cottontail	*Sylvilagus floridanus*
eastern fox squirrel	*Sciurus niger*
eastern gray squirrel	*Sciurus carolinensis*
eastern pipistrel	*Pipistrellus subflavus*
eastern small-footed bat	*Myotis leibii*
eastern woodrat	*Neotoma floridana*

Mammals (continued)

evening bat	*Nycticeius humeralis*
gray fox	*Urocyon cinereoargenteus*
hairy-tailed mole	*Parascalops breweri*
hoary bat	*Lasiurus cinereus*
Indiana bat	*Myotis sodalis*
least shrew	*Cryptotis parva*
least weasel	*Mustela nivalis*
little brown bat	*Myotis lucifugus*
long-tailed shrew	*Sorex dispar*
long-tailed weasel	*Mustela frenata*
masked shrew	*Sorex cinereus*
meadow jumping mouse	*Zapus hudsonius*
meadow vole	*Microtus pennsylvanicus*
North American porcupine	*Erethizon dorasatum*
northern flying squirrel	*Glaucomys sabrinus*
northern myotis	*Myotis septentrionalis*
northern raccoon	*Procyon lotor*
northern river otter	*Lontra canadensis*
northern short-tailed shrew	*Blarina brevicauda*
pine vole	*Microtus pinetorum*
red bat	*Lasiurus borealis*
red fox	*vulpes vulpes*
red squirrel	*Tamiasciurus hudsonicus*
silver-haired bat	*Lasionycteris noctivagans*
smoky shrew	*Sorex fumeus*
snowshoe hare	*Lepus americanus*
southern bog lemming	*Synaptomys cooperi*
southern flying squirrel	*Claucomys volans*
star-nosed mole	*Condylura cristata*
striped skunk	*Mephitis mephitis*
Virginia opossum	*Didelphis virginiana*
water shrew	*Sorex palustris*
white-footed mouse	*Perocyscus leucopus*
whitetail deer	*Odocoileus virginianus*
woodchuck	*Marmota monax*
woodland jumping mouse	*Napaeozapus insignis*

Reptiles

black rat snake	*Elaphe obsoleta*
common snapping turtle	*Chelydraserpentina*
eastern box turtle	*Terrapene carolina*
eastern garter snake	*Thamnophis sirtalis*
eastern hognose snake	*Heterodon platirhinos*
eastern milk snake	*Lampropeltis triangulum*
eastern spiny softshell	*Apalone spinifera spinifera*

Reptiles (continued)

five-linked skink	*Eumeces fasciatus*
Kirtland's snake	*Clonophis kirtlandii*
midland painted turtel	*Chrysemys picta marginata*
mountain earth snake	*Virginia pulchra*
northern black racer	*Coluber constrictor constrictor*
northern brown snake	*Storeria dekayi dekayi*
northern copperhead	*Agkistrodon contortrix mokasen*
northern fence lizard	*Sceloporus undulatus hyacinthinus*
northern redbelly snake	*Storeria occipitomaculata occipitomaculata*
northern ringneck snake	*Diadophis punctatus edwardsii*
northern water snake	*Nerodia sipedon*
queen snake	*Regina septemvittata*
shorthead garter snake	*Thamnophis brachystoma*
smooth earth snake	*Virginia valeriae*
smooth green snake	*Opheodrys vernalis*
timber rattlesnake	*Crotalus horridus*
wood turtle	*Clemmys insculpta*

APPENDIX J. RECREATIONAL & HISTORICAL SITES

Parks	Size	Description
Dayton Ballfield	7 acres	Old baseball field converted into a little league field behind old Dayton school.
Dayton Elementary School		Playground, softball field, basketball court
Dayton Fairgrounds	107 acres	Grand stand, picnic area, race track, stage, camping area, show arena, dairy, barns
Dayton Fire Hall Park	1.4 acres	Playground, basketball court, tennis court, pavilion, recycling center
Dayton Grove Park	.5 acres	Playground, pavilion, benches, memorial
Greenwall Park	8.5 acres	Softball field, playground, pavilions, volleyball court, horseshoes, restrooms, and informal canoe access
Hemlock Lake	205 acres	Picnic shelters, restrooms, 60 acre lake,two boat launches, and hiking trails
Mahoning Elementary School		Playground, basketball court, open field
Mahoning Lake		Playground, picnic pavilions, restroom, volleyball court, horseshoes, grills, walking trails, scenic overlook, lake, opportunities for fishing, boating, hiking, and camping
Milton Loop Recreation Area		Part of Mahoning Lake provides picnic facilities and boat launch
Timblin Park		Large pavilion, playground, & ballfield
Sportsmen's Access		Canoe, kayak, car-top boat launch, and informational kiosk. No trailers permitted
Old Smicksburg Park		Passive park
Templeton Boat Launch and Armstrong Trail trailhead		Pennsyvlania Fish and Boat Commission Boat Launch and trailhead for Armstrong Trail
Templeton Community Park	4 acres	Baseball field, playground, picnic pavilion, grill, basketball court, tennis court, concession stand, bandstand

Golf Courses	Size	Description
White Oak Golf Course	2,743 yards	9-hole public course with a par of 34

Campground	Description
Milton Loop Campground	52 campsites, modern restrooms, sanitary disposal station located on
Little Mahoning Bible Camp	
Creekbend Campground	Showers, electric and water hook up, and dump station. Nearby hiking
Nautical Mile Campground and Marina at Templeton	Located along Armstrong Trail, the campground provides primitive opportunities as well as full-hook up. A shower house and boat launch
Laurel Lake Camp & Retreat Center	Church camp and retreat center with lodging, meeting rooms, swimming pool and bath house, canoeing, jet skiing, fishing,

Trails	Size	Description
Armstrong Trail		
Baker Trail		
Duck Hollow Trail		Located at Hemlock Lake
Fordham Trail-Rail trail in Perry Township		
Great Shamokin Path		
Jefferson County Multi-Use Trail		

Historical Sites	Date Listed	Location
John B. McCormick House	5/3/19747	Georgeville, Pa
Thomas Marshall House	4/22/1976	Dayton, Pa
Coldwell Cut Viaduct	6/22/1988	Mahoning Township
Bridge between Madison and Mahoning Township	6/22/1988	Deanville
Old Dayton High School - old orphanage historical value	not listed	Dayton, Pa
Gilgal Church	not listed	
Crawford 1 Schoolhouse	not listed	
John Schmick Museum	not listed	Smicksburg, Pa

State Game Lands	Size	Location
State Game Land 137 South Bethlehem	929 acres	South Bethlehem
State Game Lands 262 Hillsdale	443 acres	Hillsdale
State Game Lands 287 Templeton	1,167 acres	Templeton

Trout Approved Waters	County	Description
North Fork Pine Creek	Armstrong	
South Fork Pine Creek	Armstrong	
Scrubgrass Creek	Armstrong	
Little Mahoning Creek	Indiana	Intersection of T-836 and SR 1037 to McCormick Bridge
Mudlick Creek	Indiana	

Year Round Trout Approved Waters	County	Description
Mahoning Creek	Armstrong	Mahoning Creek Dam outflow downstream to confluence with Pine Run

APPENDIX K. INTERVIEW AND SURVEY QUESTIONS

Interview Questions

1. How has the area changed in the past 10 years in terms of…? Were these changes good, bad, indifferent?

2. How do the following meet the needs of the community? (Are the quantities sufficient, insufficient, or satisfactory? Are they in good condition or in need of repair/improvement?) Do you have any proposed solutions or management recommendations?

   a. Transportation –area roads, public transportation, availability or ease of using alternative transportation (biking, walking trails, etc.) to get around the area
   b. Infrastructure – water and sewer lines, communications (cell phone reception, Internet service, etc.)
   c. Employment opportunities
   d. Educational opportunities
   e. Land-use ordinances & zoning

3. Do the recreational opportunities currently meet the needs of the community and visitors? (Are there too many, not enough, or a sufficient number? What condition are they in? Are they easy to access?) Do you suggest any improvements or additions to the recreational opportunities throughout the area?

   a. Parks/Picnic Sites
   b. Hiking/Biking Trails
   c. Off- Road Vehicle Riding
   d. Scenic Vistas/Photography
   e. Wildlife/Bird Watching
   f. Hunting/Fishing
   g. Boating/Swimming
   h. Historical Sites/Structures
   i. Other
   j. Winter Recreation

4. What are some of the positive features of the watershed/area? (Please consider both ecology and social/community features in your answer, from water quality to economics.) What is one of the strongest or most attractive features/characteristic of the watershed area?

5. What impacts (positive or negative) are currently affecting the land, water, and biological resources? What positive/negative impacts are affecting the community character of the region? What impacts are affecting the local economy?

6. Do you have any specific projects or type of projects you would like to see identified in the plan? (Examples: Stream access locations for fishing/paddling; Erosion control projects; Trail development or linkages; Dirt and gravel road improvements; Restoration of a particular site or area affected by abandoned mines or mine refuse; Illegal dumpsites to be cleaned-up; Invasive plant infestations to control; Important natural areas to protect.)

7. What must the watershed conservation plan include to be successful?

8. Do you have any other concerns that we have not discussed?

9. Do you know of any other people we should ask to interview?

10. Do you have any questions or comments before we conclude this interview?

Survey Questions

Municipal Surveys

1.) Does your municipality have a comprehensive plan? YES or NO
If yes, what is the name of the plan(s) and when was it adopted?

2.) Does your municipality currently utilize zoning? YES or NO
Does your municipality currently utilizing subdivision ordinances? YES or NO
Does your municipality have floodplain ordinances? YES or NO

3.) Are there any municipal parks in your municipality? If yes, please list them?

4.) a. Does your municipality have any public water services in the project area? YES or NO
Supplier_______________________________

b. Do you foresee the need to upgrade or establish a public water supply in your municipality in the project area within the next ten years? YES or NO

5.) a. Does your municipality have any public sewage systems in the project area? YES or NO
Treatment System ____________________________

b. Do you foresee the need to upgrade or establish a public sewage system in your municipality in the project area within the next ten years? YES or NO

6.) Who provides emergency services, such as:

Police _____________________________________

Fire _______________________________________

EMS _______________________________________

7.) Is there anything unique, or well known about your municipality that you would like to have highlighted in the plan?

8.) Comments

Public Surveys

Residents & Visitors

Continued

* **Please use the following scale for the next three questions, each number can be used more than once.**

5 = Very Important
4 = Somewhat Important
3 = Neutral
2 = Not very Important
1 = Not Important

3. Please indicate the importance of the following watershed values.

_____ Attractive Natural Settings
_____ Community Activities
_____ Educational Opportunities
_____ New Business/Jobs
_____ Preserving History/Culture
_____ Recreation Opportunities
_____ Residential Development
_____ Water Quality
_____ Other ______________________________

4. Please indicate the importance of the following recreational activities in the region.

_____ ATV Riding
_____ Biking
_____ Bird/Wildlife Watching
_____ Boating
_____ Canoeing/Kayaking
_____ Fishing
_____ Hiking
_____ Horseback Riding
_____ Hunting
_____ Organized Sports
_____ Photography
_____ Picnicking
_____ Snowmobiles
_____ Swimming
_____ Visiting Public Parks
_____ Visiting Public Vistas
_____ Other ______________________________

Residents & Visitors

5. Please indicate the importance of addressing the following issues in this plan.

_____ Preserving Agricultural Lands
_____ ATV/Snowmobile Conflicts
_____ Providing ATV/Snowmobile Recreation Facilities
_____ Infrastructure (roads, water/sewage, etc.)
_____ Economic Development
_____ Environmental Education
_____ Erosion & Sedimentation
_____ Flooding
_____ Improving Forestry Techniques
_____ Historical & Cultural Heritage
_____ Illegal Dumping & Litter
_____ Invasive Species
_____ Mine Drainage/Mine Lands
_____ Storm Water Runoff
_____ Tourism
_____ Waste Sites/Hazardous Spills
_____ Water Quality
_____ Water Quantity
_____ Wildlife/Fisheries Habitats
_____ Other ______________________________

6. What are the top 3 services/amenities that are lacking within the region? (i.e. restaurants, public restrooms, gas stations, emergency services, etc.)

1. ______________________________
2. ______________________________
3. ______________________________

7. Other comments or concerns.

____
____
____
____
____

Thank you for completing this survey.

Return Instructions:
You may cut off and keep the informative panel with our contact information. Next, please refold the pamphlet, tape (do not staple), and place it in the mail with proper postage.

Lower Mahoning Creek Regional Watershed Conservation Plan

Complete a Survey and You Could Win!

Prize package includes donated items from local project partners

The goal of the Lower Mahoning Creek Regional Watershed Conservation Plan is to actively engage the public to address issues related to natural resources, socio-economics, recreation and culture; to encourage proper stewardship of land, water, and community resources; and to improve the quality of life throughout the region.

Residents

Only individuals with **permanent residence** within the project area (see map on left)

1. **In what county and municipality do you reside?**
County ________________________
Municipality ____________________

2. **Near what part of the Lower Mahoning region do you reside?**

◊ Mahoning Creek
◊ Little Mahoning Creek
◊ Pine Creek
◊ Don't Know
◊ Other _______________

3. **How long have you lived in the area?**

◊ Less than 1 year
◊ 1-10 years
◊ 11-20 years
◊ 21-30 years
◊ 31-40 years
◊ 41-50 years
◊ 51-60 years
◊ 60+ years

4. **How far do you travel to work?**

◊ Less than 1 mile
◊ 1-15 miles
◊ 16-30 miles
◊ 31-45 miles
◊ 46-60 miles
◊ N/A
◊ Farther _______________

Please continue with "Residents & Visitors" at far right

Visitors

Please Mark One

1. **Do you own property in the Mahoning region?**

◊ Yes
◊ No

2. **How far did you travel to visit?**

◊ Less than 1 mile
◊ 1-30 miles
◊ 31-60 miles
◊ 61-90 miles
◊ 91-120 miles
◊ 121-150 miles
◊ 151-180 miles
◊ Farther __________

3. **How long did you stay on this trip?**

◊ Less than one day
◊ 1-2 days
◊ 3-4 days
◊ 5-6 days
◊ One week
◊ A week and a half
◊ Two weeks
◊ Longer __________

4. **Approximately how much money did you spend?**

◊ Less than 100 dollars
◊ 100-500 dollars
◊ 500-1,000 dollars
◊ 1,000-2,000 dollars
◊ 2,000-3,000 dollars
◊ 3,000-5,000 dollars
◊ 5,000+ dollars

5. **What were your two biggest expenses?**

◊ Travel/Gas
◊ Food/Lodging
◊ Recreation/Supplies
◊ Souvenirs
◊ Others _______________

6. **What was your reason for visiting?**

◊ Business
◊ Family/Friends
◊ Passing through
◊ Recreation/Vacation
◊ Visiting
◊ Other __________

7. **How often do you visit?**

◊ First time
◊ Seasonal
◊ Yearly
◊ Occasionally (every 2-5 years)
◊ Every 5+ years

8. **Do you plan to return to this area?**

◊ Yes
◊ No

Demographics

(Optional)

1. **What is your gender?**

◊ Male
◊ Female

2. **What is your age?**

◊ 17 & under
◊ 18-25
◊ 26-45
◊ 46-65
◊ 66 & up

Residents & Visitors

1. **What do you think are the two most important land uses in the Mahoning region?**

◊ Agricultural
◊ Commercial
◊ Forested
◊ Other __________
◊ Industrial
◊ Recreation
◊ Residential

2. **Where did you obtain this survey?**

◊ Business/Restaurant
◊ Event __________
◊ State park/state forest
◊ Watershed group
◊ Website
◊ Other __________

Please continue with "Residents & Visitors" on reverse

* **If you would like to be entered to win a prize package from our project sponsors and receive project updates, please complete the information below. Entrees must be received by November 30, 2009.**

Name ______________________________
Address ______________________________
____
E-mail ______________________________
Home Phone ______________________________
Work Phone ______________________________

APPENDIX L. NATIVE PLANT GUIDE

Common Name(s)	*Scientific Name*	Dry Area Plant	Shady Area Plant	Shady Rain Garden Plant	Sunny Area Plant	Sunny Rain Garden Plant	Plant well suited for Banks	Cut Flower Garden Plant	Plant for near Lakes, Ponds or Streams	Soil Stabilizing Plant	Wet Area Plant	Plant for Wooded Areas	Deer Resistant Plant	Drought Tolerant Plant	Bee Attractant Plant	Bird Attractant Plant	Wildlife Attractant Plant	Butterfly Attractant Plant	Hummingbird Attractant Plant
balsam fir	*Abies balsamea*																X		
fraser fir	*Abies fraseri*																X		
box-elder	*Acer negundo*	X	X		X			X				X	X						
Norway maple	*Acer platanoides*																X		
red maple	*Acer rubrum*				X											X	X		
silver maple	*Acer saccharinum*		X	X		X	X		X			X							
sugar maple	*Acer saccharum*										X				X				
mountain maple	*Acer spicatum*			X	X	X		X	X		X		X						
maple	*Acer* spp											X					X		
common yarrow	*Achillea millefolium*				X														
monkshood	*Aconitum uncinatum*										X								
sweetflag	*Acorus americanus*	X			X											X			
doll's eyes, white bugbane, white baneberry	*Actaea pachypoda*		X		X	X						X							
black cohosh, black bugbane, black	*Actaea racemosa*											X	X			X			
red baneberry	*Actaea rubra*									X									
northern maidenhair fern, maidenhair fern	*Adiantum pedatum*				X														
bottlebrush buckeye	*Aesculus parviflora*				X														
red buckeye, buckeye	*Aesculus pavia*	X			X	X				X			X	X		X			
false foxglove	*Agalinis purpurea*											X	X						

Common Name(s)	***Scientific Name***	**Dry Area Plant**	**Shady Area Plant**	**Shady Rain Garden Plant**	**Sunny Area Plant**	**Sunny Rain Garden Plant**	**Plant well suited for Banks**	**Cut Flower Garden Plant**	**Plant for near Lakes, Ponds or Streams**	**Soil Stabilizing Plant**	**Wet Area Plant**	**Plant for Wooded Areas**	**Deer Resistant Plant**	**Drought Tolerant Plant**	**Bee Attractant Plant**	**Bird Attractant Plant**	**Wildlife Attractant Plant**	**Butterfly Attractant Plant**	**Hummingbird Attractant Plant**
blue giant hyssop, anise hyssop	*Agastache foeniculum*	X			X							X		X					
yellow giant hyssop	*Agastache nepetoides*		X																
giant purple hyssop	*Agastache scrophulariifolia*	X			X			X					X	X	X	X			
white snakeroot	*Ageratina altissima*												X						
small agrimony	*Agrimonia parviflora*				X	X					X					X			
red top	*Agrostis alba*	X			X														
hollyhock	*Alcea rosea*																X		
northern water plantain	*Alisma triviale*												X						
nodding onion, wild onion/leek	*Allium cernuum*									X									X
ramps, wild leeks	*Allium tricoccum*												X						
speckled alder	*Alnus rugosa*									X							X		
smooth alder	*Alnus serrulata*								X			X					X		
azalea	*Alnus serrulata*																X		
ragweed	*Ambrosia*																X		
downy serviceberry	*Amelanchier arborea*	X			X									X		X			
serviceberry, shadblow serviceberry, shadbush	*Amelanchier canadensis*														X			X	
allegheny serviceberry	*Amelanchier laevis*				X	X					X					X			
serviceberries, shadbush	*Amelanchier* spp.															X	X		
lead plant	*Amorpha canescens*			X	X		X		X			X				X			
Arkansas blue star flower	*Amsonia hubrectii*												X						
blue star, common blue star, eastern blue	*Amsonia tabernaemontana*						X					X						X	

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big bluestem grass, turkeyfoot	*Andropogon gerardii*	X	X		X	X					X	X	X			X	X		
little bluestem grass	*Andropogon scoparius*	X			X	X		X				X	X	X	X	X			
broom sedge	*Andropogon virginicus*				X								X				X		
meadow anemone, Canada anemone	*Anemone canadensis*		X									X							
pasque flower	*Anemone patens*		X		X	X		X	X		X	X	X			X			
wood anemone	*Anemone quinguefolia*												X			X			
thimbleweed, tall anemone	*Anemone virginiana*		X		X														
pussytoes, woman's tobacco, plantain-leaved pussytoes	*Antennaria plantaginifolia*		X																
wild columbine, eastern columbine, Canadian columbine, indianhemp	*Aquilegia canadensis*										X						X	X	X
wild sarsaparilla	*Aralia nudicaulis*				X	X			X		X								
spikenard	*Aralia racemosa*					X									X	X	X		
bearberry	*Arctostaphylos uva-ursil*				X														
redtop grass	*Argostis gigantean*	X	X	X	X								X						
jack-in-the-pulpit	*Arisaema triphyllum*					X													
dutchmans pipevine	*Aristolochia macrophylla*														X			X	
red chokeberry	*Aronia arbutifolia*				X														
black chokeberry	*Aronia melanocarpa*											X							
goatsbeard, bride's feathers	*Aruncus dioicus*									X									
wild ginger	*Asarum canadense*		X									X							
poke milkweed, tall milkweed	*Asclepias exaltata*		X								X		X					X	

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swamp milkweed, pink milkweed, white swamp milkweed	*Asclepias incarnata*	X																X	
purple milkweed	*Asclepias purpurascens*	X			X	X		X										X	
common milkweed	*Asclepias syriaca*		X											X			X	X	
butterflyweed, butterfly flower	*Asclepias tuberosa*					X					X					X		X	
whorled milkweed, horsetail milkweed	*Asclepias verticillata*		X				X					X						X	
pawpaw	*Asimina triloba*	X			X							X	X	X		X		X	
ebony spleenwort	*Asplenium platyneuron*				X	X		X					X	X					
blue wood aster, wood aster	*Aster cordifolius*					X					X		X		X			X	
white wood aster	*Aster divaricatus*	X	X								X	X						X	
heath aster	*Aster ericoides*				X						X							X	
smooth aster	*Aster laevis*	X						X					X						
dark leaf calico aster	*Aster lateriflorus*		X								X							X	
stiff-leaf aster, flaxleaf whitetop aster	*Aster linariifolius*										X			X					
big leaf aster	*Aster macrophyllus*		X		X				X										
New England aster	*Aster novae-angliae*				X						X		X			X	X	X	
New York aster	*Aster novi-belgii*					X					X							X	
aromatic aster	*Aster oblongifolius*		X									X	X					X	
purple-stemmed aster	*Aster puniceus*	X			X													X	
silky aster	*Aster sericeus*				X														
aster	*Aster* spp								X		X							X	
flat-topped aster	*Aster umbellatus*		X					X				X	X		X	X		X	

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lady fern	*Athyrium filix-femina*				X	X					X								
white wild indigo	*Baptisia alba*		X				X					X							
blue false indigo, wild indigo, false blue indigo	*Baptisia australis*												X					X	
cream wild indigo	*Baptisia leucophaea*		X										X			X			
dwarf wild indigo	*Baptisia minor*		X									X							
flare false indigo	*Baptisia solar*		X			X												X	
yellow wild indigo	*Baptisia sphaerocarpa*				X														
prairieblues wild indigo	*Baptisia starlite*		X									X	X	X		X		X	
yellow birch	*Betula alleghaniensis*																X		
birch	*Betula lenta*															X	X		
river birch	*Betula nigra*															X	X		
gray birch	*Betula populifolia*	X	X									X			X		X		
cross Vine	*Bignonia capreolata*	X			X			X					X	X		X			
boltonia, false aster	*Boltonia asteroides*	X			X														
sideoats grama	*Bouteloua curtipendula*												X				X		
bluejoint reedgrass	*Calamagrostis canadensis*	X	X		X								X						
American beautyberry	*Calicarpa americana*															X			
purple poppy mallow, winecups	*Callirhoe involucrata*							X											
bottlebrush	*Callistemon* spp.				X						X								
marsh marigold, marsh yellow marigold, cowslip	*Caltha palustris*				X	X	X				X		X		X				

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sweetshrub, Carolina allspice	*Calycanthus floridus*		X		X											X			
tall bellflower	*Campanula americana*				X														
creeping bellflower	*Campanula rapunculoides*	X	X		X	X						X	X			X		X	
trumpet vine, trumpet-creepe	*Campsis radicans*				X												X		
cut-leaf toothwort	*Cardamine concatenata*											X							
creek sedge	*Carex amphibola*											X			X				
appalachian sedge	*Carex appalachica*	X	X		X	X		X	X			X	X		X	X			
fringed sedge	*Carex crinita*	X	X		X			X				X							
bristleleaf sedge	*Carex eburnea*														X				
blue wood sedge	*Carex glaucoidea*														X				
gray's sedge	*Carex grayi*					X					X								
Ohio sedge	*Carex muskingumensis*								X										
Pennsylvania sedge	*Carex pensylvanica*				X	X					X								
plantainleaf sedge, seersucker sedge	*Carex plantaginea*				X														
silver sedge	*Carex platyphylla*					X					X								
broad-leaf sedge	*Carex siderosticha*	X			X								X	X					
sedges	*Carex spp.*				X												X		
owl-fruit sedge	*Carex stipata*				X											X			
upright sedge, tussock sedge	*Carex stricta*		X																
fox sedge	*Carex volpinoidea*		X		X					X			X				X		
American hornbeam, ironwood	*Carpinus caroliniana*		X		X		X					X	X		X				
hornbeam	*Carpinus* spp.				X													X	

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sweet pignut hickory	*Carya glabra*															X			
shagbark hickory	*Carya ovata*				X	X					X					X	X	X	
hickories	*Carya* spp.		X	X			X					X	X		X		X		
mockernut hickory	*Carya tomentosa*		X									X						X	
blue cohosh, papoose root	*Caulophyullum thalictroides*															X			
wild lilac or New Jersey tea	*Ceanothus americanus*				X													X	X
American bittersweet	*Celastrus scandens*		X	X	X	X			X		X	X	X				X	X	
hackberry, sugarberry	*Celtis occidentalis*	X			X				X		X		X				X	X	
buttonbush	*Cephalanthus occidentalis*		X		X	X		X	X		X		X	X		X	X		
eastern redbud	*Cercis canadensis*				X								X				X		
partridge pea	*Chamaecrista fasciculata*											X							
wild sensitive-plant	*Chamaecrista nictitans*				X			X						X					
atlantic white cedar	*Chamaecyparis thyoides*	X			X														
leatherleaf	*Chamaedaphne calyculata*	X																	
river oats, northern sea oats, indian woodoats	*Chasmanthium latifolium*		X										X			X			
white turtlehead	*Chelone glabra*															X			X
pink turtlehead	*Chelone lyonii*		X	X			X					X	X						
turtlehead	*Chelone* spp.	X			X	X		X	X		X		X		X				
fringetree	*Chionanthus virginicus*									X									
green-and-gold, gold star	*Chrysogonum virginianum*			X		X						X	X						
southern green and gold	*Chrysogonum virginianum var. australe*				X								X						

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Maryland golden aster, golden aster	*Chrysopsis mariana*		X								X	X	X						
hairy golden aster	*Chrysopsis villosa*											X							
chicory	*Cichorium intybus*		X		X	X				X			X	X		X			
mountain bugbane, American bugbane	*Cimicifuga americanus*	X	X					X	X					X					
fairy candles	*Cimicifuga racemosa*		X								X								
field thistle	*Cirsium discolort*		X									X	X			X			
spring beauty	*Claytonia virginica*	X	X				X						X		X			X	
virgin's bower, devil's darning needles, clematis	*Clematis virginiana*											X							
summersweet, sweet pepperbush	*Clethra alnifolia*	X			X														
bluebeard-lily, corn-lily	*Clintonia borealis*	X																	
blue-eyed mary	*Collinsia verna*		X		X	X			X		X	X	X			X		X	
sweet-fern	*Comptonia peregrina*		X									X	X			X			
blue mistflower	*Conoclinium coelestinum*											X							
sand coreopsis, lanceleaf tickseed	*Coreopsis lanceolata*										X							X	
passion tickseed	*Coreopsis limerock*												X					X	
prairie coreopsis	*Coreopsis palmata*		X		X	X			X		X	X	X			X			
tickseed	*Coreopsis pubescens*												X			X		X	
pink coreopsis, pink tickseed	*Coreopsis rosea*										X								
tickseed	*Coreopsis* spp.										X					X			
coreopsis, tall tickseed	*Coreopsis tripteris*		X				X		X			X	X		X				

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threadleaf coreopsis, threadleaf tickseed, whorled coreopsis	*Coreopsis verticillata*															X			
pagoda dogwood	*Cornus alternifolia*	X																	
silky dogwood	*Cornus amomum*	X			X								X				X		
flowering dogwood	*Cornus florida*												X				X		
swamp dogwood, stiff dogwood	*Cornus foemina*	X			X	X		X			X		X						
cornelian	*Cornus mas*																X		
gray dogwood, red panicled dogwood	*Cornus racemosa*		X									X	X			X	X		
red osier dogwood, redtwig dogwood	*Cornus sericea*	X	X				X				X	X	X	X		X	X		
dogwoods	*Cornus* spp.																X		
yellow harlequin	*Corydalis flavula*															X			
rock harlequin	*Corydalis sempervirens*															X			
American hazelnut, American filbert	*Corylus americana*															X			
cockspur hawthorn	*Crataegus crusgalli*															X			
Washington hawthrorn	*Crataegus phaenopyrum*	X			X											X			
dotted hawthorn	*Crataegus punctata*			X	X						X	X	X						
hawthorn	*Crataegus* spp.												X				X		
crocus	*Crocus* spp.																X		
orchard grass	*Dactylis glomerata*																X		
white prairie clover	*Dalea candida*		X		X	X		X	X		X	X	X		X				
tall larkspur	*Delphinium exaltatum*															X			
dwarf larkspur	*Delphinium tricorne*								X		X								

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hayscented fern	*Dennstaedtia punctilobula*							X											
hairgrass	*Deshampias flexuosa*		X				X					X	X						
sweet william	*Dianthus barbatus*				X	X										X			
squirrel corn	*Dicentra canadensis*	X										X				X			
dutchmans breeches	*Dicentra cucullaria*	X			X					X						X			
wild bleeding heart, turkeycorn, fringed bleeding heart	*Dicentra exemia*	X			X					X						X			
bush honeysuckle	*Diervilla lonicera*				X	X							X	X	X				
persimmon	*Diospyros virginiana*				X	X										X	X	X	
leatherwood	*Dirca palustris*				X	X					X		X			X			
shooting-star, American cowslips	*Dodecatheon meadia*	X													X				
parasol whitetop aster	*Doellingeria umbellata*				X						X								
goldie's wood fern	*Dryopteris goldiana*											X							
leather wood fern, marginal wood fern, evergreen wood fern, eastern wood fern	*Dryopteris marginalis*	X			X								X					X	
shield fern	*Dryopteris* spp.				X								X			X			
pale coneflower	*Echinacea pallida*											X	X						
yellow coneflower	*Echinacea paradoxa*					X							X						
purple coneflower	*Echinacea purpurea*			X	X	X							X		X	X	X		
coneflower	*Echinacea* spp.	X															X	X	
wild millet	*Echinochloa crus-galli*															X			
Canada wildrye	*Elymus canadensis*				X								X						

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bottlebrush grass	*Elymus hystrix*	X			X	X		X					X	X					
riverbank wild rye grass	*Elymus riparius*		X									X			X				
wild rye	*Elymus virginicus*	X																	
fireweed	*Epilobium angustifolium*				X														
horsetail	*Equisetum species*	X			X					X			X			X			
blue love grass	*Eragrostis elliottii*	X			X							X	X						
purple love grass, showy love grass	*Eragrostis spectabilis*										X							X	
daisy fleabane	*Erigeron strigosus*		X		X	X					X								
rattlesnake master	*Eryngium yuccifolium*				X	X		X			X	X	X			X		X	
trout lily, dogtooth violet, yellow trout lily, adder's tongue	*Erythronium americanum*																	X	
strawberry-bush	*Euonymus americanus*					X			X		X		X		X			X	
joe-pye weed, trumpetweed	*Eupatoriadelphus fistulosus*		X															X	
mistflower, blue mistflower, hardy ageratum	*Eupatorium coelestinum*				X	X		X			X		X		X			X	
little joe-pye weed	*Eupatorium dubium*				X	X					X		X		X	X		X	
hyssop-leaved boneset, thoroughwort	*Eupatorium hyssopifolium*	X			X			X						X				X	
gateway	*Eupatorium maculatum*											X							
spotted joe-pye weed	*Eupatorium maculatum*		X									X	X		X				
boneset, thoroughwort	*Eupatorium perfoliatum*												X			X			
purple joe-pyeweed, joe pye flower, sweetcented joe-pyeweed	*Eupatorium purpureum*		X		X	X							X			X			
snakeroot	*Eupatorium rugosm*		X			X					X		X						

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joe-pye-weed	*Eupatorium* spp.		X				X					X					X	X	
flowering spurge	*Euphorbia corollata*	X			X	X			X				X	X	X				
white wood aster	*Eurybia divaricata*				X							X	X		X			X	
flat-top goldentop	*Euthamia graminifolia*	X					X					X	X			*X*			
American beech	*Fagus grandiflora*		X			X		X	X			X	X				X		
beech	*Fagus* spp.	X															X		
queen-of-the-prairie	*Filipendula rubra*	X	X									X	X	X					
dwarf fothergilla	*Fothergilla gardenii*				X								X			X			
wild strawberry	*Fragaria virginiana*					X					X								
white ash	*Fraxinus americana*				X												X		
black ash	*Fraxinus nigra*															X			
green ash	*Fraxinus pennsylvanica*		X		X											X			
ash	*Fraxinus* spp.	X			X		X						X						
wandflower, beetleweed	*Galax urceolata*		X			X										X		X	
wintergreen, eastern teaberry	*Gaultheria procumbens*				X	X		X			X	X	X			X			
windflower	*Gaura lindheimeri*		X					X				X	X						
huckleberry	*Gaylussacia baccata*												X			X			
boxhuckleberry	*Gaylussacia brachycera*	X			X	X						X							
evening trumpet flower, Carolina jessamine	*Gelsemium sempervirens*		X		X						X	X				X			

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bottle gentian, closed gentian, blind gentian	*Gentiana clausa*				X	X										X			
wild geranium, wild cranesbill, wood geranium	*Geranium maculatum*				X													X	
cranesbill geranium	*Geranium sanguineum*																X		
prairie smoke	*Geum triflorum*	X			X	X		X					X			X		X	
American ipecac	*Gillenia stipulata*		X	X								X	X			X			
honey locust	*Gleditsia triacanthos*			X	X	X					X		X		X			X	
fowl mannagrass	*Glyceria striata*																X		
downy rattlesnake plantain	*Goodyera pubescens*		X									X						X	
Carolina silverbell	*Halesia caroliana*	X	X		X								X			X		X	
witchhazel, American witch hazel	*Hamamelis virginiana*				X											X		X	
english ivy	*Hedera helix*																X		
helen's flower; common sneezeweed, dog-tooth daisy	*Helenium autumnale*		X												X				
sneezeweed, purple-headed helen's flower	*Helenium flexuosum*		X		X	X					X		X			X		X	
swamp sunflower	*Helianthus angustifolius*	X			X	X							X		X	X		X	
thin-leaf sunflower	*Helianthus decapetalus*	X														X		X	
woodland sunflower	*Helianthus divaricatus*	X	X		X		X					X		X		X			
tall sunflower, giant sunflower	*Helianthus giganteus*		X									X	X						
small-headed sunflower	*Helianthus microcephalus*				X														
western sunflower	*Helianthus occidentalis*				X							X			X				
dwarf perennial sunflower	*Helianthus salicifolius*		X																

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sunflower	*Helianthus* spp.	X	X									X	X	X			X		
oxeye daisy, smooth oxeye, false sunflower	*Heliopsis helianthoides*	X			X								X			X		X	
swamp pink	*Helonias bullata*		X		X								X						
daylily	*Hemerocallis*																X		
roundlobe hepatica, sharplobe hepatica	*Hepatica acutiloba*	X																	
alumroot, coral bells	*Heuchera americana*		X									X							
hairy alum root	*Heuchera villosa*	X																	
shuttleworth's ginger	*Hexastylis shuttewortii*				X	X			X				X						
scarlet rose mallow	*Hibiscus coccenius*				X	X					X		X			X			
swamp rose mallow, marsh hibiscus	*Hibiscus moscheutos*			X					X		X	X	X				X		
rattlesnake weed	*Hieracium venosum*											X							
bluets	*Houstonia caerulea*				X						X								
wood hyacinth	*Hyacinthoides hispanica*																X		
wild hydrangea	*Hydrangea arborescens*				X											X			
oakleaf hydrangea	*Hydrangea quercifolia*		X																
goldenseal, yellow root	*Hydrastis canadensis*						X					X		X					
maple-leaved waterleaf, broad-leaved waterleaf	*Hydrophyllum canadense*										X		X						
Virginia waterleaf, eastern waterleaf	*Hydrophyllum virginianum*		X						X			X	X						
saint john's wort	*Hypericum calycinum*			X	X	X					X		X	X		X			
dense hypericum	*Hypericum densiflorum*		X			X							X			X			
shrubby saint john’s wort	*Hypericum prolificum*		X	X		X					X		X			X			

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great saint john's wort	*Hypericum pyramidatum*		X				X	X				X	X						
yellow star-grass	*Hypoxis hirsuta*		X	X	X				X					X		X			
inkberry	*Ilex glabra*				X	X											X		
American holly	*Ilex opaca*				X	X		X	X		X		X	X			X		
winterberry	*Ilex verticillata*						X					X	X				X		
jewelweed	*Impatiens capensis*														X				
pale jewelweed, touch-me-not	*Impatiens pallida*															X			
impatiens	*Impatiens* spp.																X		
crested iris	*Iris cristata*		X		X						X	X				X			
white crested iris	*Iris cristata alba*	X			X								X						
slender blue flag	*Iris prismatica*	X			X								X	X		X			
iris	*Iris* spp.																X		
blue flag iris, northern blue flag	*Iris versicolor*										X								
Virginia sweetspire, tassle-white	*Itea virginiana*	X			X						X			X		X			
twinleaf	*Jeffersonia diphylla*				X	X			X	X	X					X			
butternut	*Juglans cinerea*																X		
black walnut	*Juglans nigra*	X	X									X							
Canada rush	*Juncus canadensis*			X	X				X						X				
soft rush	*Juncus effusus*	X																	
eastern red cedar	*Juniperus virginiana*				X											X	X		
mountain laurel	*Kalmia latifolia*				X											X			
june grass	*Koehleria cristata*	X								X									

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false boneset	*Kuhnia eupatorioides*				X														
flatpea	*Lathyrus sylvestris*	X			X	X									X				
rice cutgrass	*Leersia oryzoides*					X							X			X	X		
round headed bush clover	*Lespedeza capitata*				X				X	X									
fetterbush	*Leucothoe racemosa*			X	X	X		X	X		X							X	
rough blazing star	*Liatris aspera*	X			X								X						
cylindrical blazing star	*Liatris cylindracea*				X	X					X		X			X			
meadow blazing star	*Liatris ligulistylis*		X	X								X	X					X	
appalachian blazing star	*Liatris microcephala*			X			X												
prarie blazing star	*Liatris pycnostachya*	X			X							X	X	X				X	
northern blazing star	*Liatris scariosa*														X				
dense blazing-star, gayfeather, spike gayfeather	*Liatris spicata*				X													X	X
blazing-star, gayfeather	*Liatris* spp.	X	X															X	
button blazing star, scaly blazing star, gayfeather	*Liatris squarrosa*											X							
wood lily	*Lilium philadelphicum*				X													X	
lily	*Lilium* spp.																X		
turk's cap lily	*Lilium superbum*				X	X					X		X			X			
Canada lily, wild yellow	*Lillium canadense*			X					X							X		X	
spicebush	*Lindera benzoin*														X				
sweetgum	*Liquidambar styraciflua*	X			X		X						X	X					
tuliptree	*Liriodendron tulipifera*															X			X

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cardinal flower, red cardinal flower	*Lobelia cardinalis*														X		X		X
beechwood blend	*Lobelia cardinalis x siphilitica*	X	X									X	X					X	X
indian tobacco	*Lobelia inflata*	X																	
great blue lobelia	*Lobelia siphilitica*							X											X
pale spiked lobelia	*Lobelia spicata*		X		X								X			X			
trumpet honeysuckle, coral honeysuckle	*Lonicera sempervirens*					X			X	X	X					X	X		X
birdsfoot trefoil	*Lotus corniculatus*																X		
seedbox	*Ludwigia alternifolia*	X			X	X		X			X		X			X			
wild lupine, indian beet, old maids bonnets, blue lupine, sundial lupine	*Lupinus perennis*	X		X		X									X				
hairy woodrush, woodrush	*Luzula acuminata*	X			X							X	X		X				
magnolia	*Magnolia* spp.		X													X			
sweetbay magnolia	*Magnolia virginiana*	X																	
Canada mayflower	*Maianthemum canadense*	X	X				X					X	X			X			
feathery false lily of valley	*Maianthemum racemosum*		X		X											X			
American crabapple	*Malus glaucescens*																X		
apple	*Malus* spp.																X		
barbara's buttons	*Marshallia grandiflora*				X								X			X		X	
ostrich fern	*Matteuccia struthiopteris*		X		X	X			X			X	X	X				X	
meehan's mint, creping ground mint	*Meehania cordata*											X						X	
Virginia bluebells	*Mertensia virginica*				X													X	

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sharpwing monkeyflower, winged monkey	*Mimulus alatus*		X									X	X						
monkey flower, square-stemmed monkey flower	*Mimulus ringens*															X		X	
partridgeberry	*Mitchella repens*				X														
bishops cap, mitrewort	*Mitella diphylla*		X		X						X			X					
basil balm	*Monarda clinopodia*	X			X														X
bee balm, oswego tea, bergamot, scarlet bee balm	*Monarda didyma*	X										X						X	X
wild bergamot, lavendar bergamot, bee balm	*Monarda fistulosa*		X	X	X	X				X	X		X	X		X			X
purple bergamot	*Monarda media*		X	X		X		X	X			X	X						X
spotted bee balm	*Monarda punctata*				X	X			X		X		X						
beebalm, monarda	*Monarda* spp.	X															X		X
red mulberry	*Morus rubra*				X			X									X		
pink muhly grass	*Muhlenbergia capillaris*					X							X						
bayberry, northern bayberry	*Myrica pennsylvanica*		X								X	X					X		
black gum, tupelo, sour gum	*Nyssa sylvatica*	X															X		
sharp-leaved aster, whorled aster	*Oclemena acuminatus*		X	X			X					X	X						
evening primrose, common evening	*Oenothera biennis*											X							
sundrops, fireworks	*Oenothera fruticosa*				X				X	X									
stiff goldenrod	*Oligoneuron rigidum*				X											X			
sensitive fern	*Onoclea sensibilis*															X			

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pricklypear, eastern pricklypear cactus, devil's tongue	*Opuntia humifusa*				X				X		X		X			X			
aniseroot	*Osmorhiza longistylis*	X			X	X	X					X	X	X					
cinnamon fern	*Osmunda cinnamomea*				X														
interrupted fern	*Osmunda claytoniana*				X	X			X		X		X		X				
royal fern	*Osmunda regalis*	X				X							X						
hop-hornbeam	*Ostrya virginiana*											X				X			
sourwood	*Oxydendrum arboreum*															X			
allegheny pachysandra, allegheny spurge	*Pachysandra procumbens*				X														
goldenragwort	*Packera aurea*		X					X											
peony	*Paeonia* spp.																X		
American ginseng	*Panax quinquefolius*				X											X			
atlantic costal panic grass	*Panicum amarulum*															X			
panic grass	*Panicum* spp.																X		
switch grass, panic grass	*Panicum virgatum (amarum)*				X	X											X		
wild quinine	*Parthenium integrifolium*	X	X																
Virginia creeper	*Parthenocissus quinquefolia*		X								X		X				X		
wild passion vine	*Passiflora incarnata*				X	X							X		X			X	
passionflower	*Passiflora* spp.		X															X	
arrow arum	*Peltandra virginica*																X		
beardtongue, foxglove, white beardtongue, talus slope penstemon	*Penstemon digitalis*											X							X

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hairy beardtongue	*Penstemon hirsutus*				X													X	X
small's beardtongue	*Penstemon smallii*	X	X						X			X	X						
beardstongue	*Penstemon* spp.		X																X
ditch stonecrop	*Penthorum sedoides*				X														
Carolina phlox	*Phlox carolina*															X			
woodland phlox, wild sweet william, meadow phlox, blue wood phlox	*Phlox divaricata*	X	X						X			X	X						
meadow phlox	*Phlox maculata*											X							
summer phlox, garden phlox, perennial phlox	*Phlox paniculata*															X			X
downy phlox	*Phlox pilosa*	X			X	X					X				X	X			X
phlox	*Phlox* spp.																X		
creeping phlox, summer phlox	*Phlox stolonifera*															X			
moss phlox, mountain phlox, moss pink	*Phlox subulata*												X						
ninebark	*Physocarpus opulifolius*				X	X					X			X		X			
obedient plant, false dragonhead	*Physostegia virginiana*			X					X			X	X						
pokeweed	*Phytolacca dodecandra*																X		
shortleaf pine	*Pinus echinata*				X	X					X				X				
pond pine	*Pinus palustris*						X					X			X				
pitch pine	*Pinus rigida*	X			X			X					X		X	X	X		
pines	*Pinus* spp.	X															X		
eastern white pine	*Pinus strobus*														X		X		
Virginia pine	*Pinus virginiana*							X											

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American sycamore	*Platanus occidentalis*		X								X	X							
Kentucky blue-grass	*Poa pratensis*																X		
roughstalk bluegrass	*Poa trivialis*										X								
mayapple, mandrake	*Podophyllum peltatum*		X					X				X	X				X		
greek valerian, jacob's ladder, greek valerian, spreading jacob's ladder	*Polemonium reptans*			X	X	X			X		X		X						
variegated native jacob's ladder	*Polemonium* spp.				X	X													
smooth solomon seal	*Polygonatum biflorum*				X														
solomon's seal, giant solomon's seal	*Polygonatum canaliculatum*		X		X				X		X		X						
downy solomon's seal	*Polygonatum pubescens*	X														X			
Pennsylvania smartweed	*Polygonum pensylvanicum*																X		
christmas fern	*Polystichum acrostichoides*															X			
tassel fern	*Polystichum polyblepherum*															X			
pickerelweed	*Pontederia cordata*															X		X	
aspen	*Populus* spp.																X		
bowman's root, indian physic, American ipecac	*Porteranthus trifoliata*															X			
long-leaf pondweed	*Potamogeton nodosus*																X		
sago pondweed	*Potamogeton pectinatus*																X		
prairie cinquefoil	*Potentilla arguta*				X														
bush cinquefoil, shrubby cinquefoil	*Potentilla fruticosa*				X	X					X					X			
Norwegian cinquefoil	*Potentilla norvegicia*	X			X								X	X		X			
three-toothed cinquefoil	*Potentilla tridentata*		X								X		X					X	

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common selfheal	*Prunella vulgaris*			X					X			X							
wild plum	*Prunus americana*	X										X							
pin cherry	*Prunus pensylvanica*		X											X					
black cherry, wild cherry	*Prunus serotina*				X					X	X					X	X		
cherries	*Prunus* spp.			X			X		X			X	X				X		
choke cherry	*Prunus virginiana*		X										X			X	X		
hoary mountain mint	*Pycnanthemum incanum*				X	X		X				X	X	X	X	X			
showy mountain mint, clustered mountain mint, mountain mint	*Pycnanthemum muticum*									X									
slenderleaf mountain mint	*Pycnanthemum tenuifolium*		X										X			X			
Virginia mountain mint	*Pycnanthemum virginianum*				X														
white oak	*Quercus alba*				X	X											X		
swamp oak, swamp white oak	*Quercus bicolor*	X			X		X						X		X		X		
scarlet oak	*Quercus coccinea*					X											X		
bur oak	*Quercus macrocarpa*	X																	
pin oak	*Quercus palustris*												X				X		
willow oak	*Quercus phellos*															X	X		
chestnut oak	*Quercus prinus*																X		
red oak	*Quercus rubra*				X	X		X	X		X		X			X	X		
oaks	*Quercus* spp.																X		
black oak	*Quercus velutina*															X			
prairie coneflower	*Ratibida pinnata*	X	X																
Maryland meadow beauty	*Rhexia mariana*				X										X				

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meadow beauty, handsome hairy	*Rhexia virginica*	X			X						X								
sweet azalea	*Rhododendron arborescens*					X					X								
rosebay rhododendron	*Rhododendron maximum*		X									X						X	
swamp azalea	*Rhododendron viscosum*	X			X								X	X		X			
rhododendron	*Rhododendron* spp.																X		
swamp azalea	*Rhododendron viscosum*	X			X								X	X		X			
rhododendron	*Rhododendron* spp.																X		
fragrant sumac	*Rhus aromatica*															X			
dwarf-winged sumac	*Rhus copalina*				X					X							X		
smooth sumac	*Rhus glabra*				X												X		
sumacs	*Rhus* spp.	X			X			X						X		X	X		
staghorn sumac	*Rhus typhina*		X									X					X		
pasture rose, Carolina rose	*Rosa Carolina*		X		X		X					X	X	X	X		X		
swamp rose	*Rosa palustris*					X							X				X	X	
rose	*Rosa* spp.																X		
Virginia rose	*Rosa virginiana*	X	X											X			X		
common blackberry	*Rubus allegheniensis*		X									X	X				X		
flowering raspberry	*Rubus odoratus*	X			X			X						X			X		
thimbleberry	*Rubus parviflorus*		X			X					X		X			X			
blackberry, raspberry	*Rubus* spp.																X		
eastern coneflower, organe coneflower	*Rudbeckia fulgida*		X																
black-eyed susan	*Rudbeckia hirta*		X	X					X		X	X	X			X			

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green-headed coneflower, cutleaf coneflower	*Rudbeckia lanciniata*											X							
great coneflower	*Rudbeckia maxima*														X				
sweet coneflower	*Rudbeckia subtomentosa*	X	X		X		X					X	X	X				X	
brown-eyed-susan, three lobed coneflower	*Rudbeckia triloba*		X										X			X			
Carolina wild petunia	*Ruellia caroliniensis*										X								
fringe-leaved petunia, hairy wild petunia, wild petunia	*Ruellia humilis*		X				X		X		X	X	X		X				
limestone petunia	*Ruellia strepens*	X			X														
pussy willow	*Salix discolor*		X				X					X	X	X					
sandbar willow	*Salix exigua*		X					X				X	X			X			
black willow	*Salix nigra*			X	X			X				X	X	X			X		
silky willow	*Salix sericea*									X	X				X		X		
willow	*Salix* spp.															X			
lyreleaf sage, purple knockout	*Salvia lyrata*				X											X			
elderberry, American elder, common elderberry	*Sambucus canadensis*	X	X		X		X	X				X	X	X	X	X	X		
red-berried elder	*Sambucus racemosa ssp. pubens*	X																X	
bloodroot	*Sanguinaria canadensis*		X																
swamp burnet	*Sanguisorba canadense*	X																	
sassafras	*Sassafras albidum*										X							X	
water dragon, swamp lily, lizards tail	*Saururus cernuus*	X			X							X							
swamp saxifrage	*Saxifraga pensylvanica*														X				
early saxifrage	*Saxifraga virginiensis*				X	X		X	X		X				X				

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little bluestem	*Schizachyrium scoparium*					X			X		X		X				X	X	
hardstem bullrush	*Scirpus acutus*		X		X												X		
black bullrush, green bullrush	*Scirpus atrovirens*		X									X							
wool grass, wool rush	*Scirpus cyperinus*				X														
three-square bullrush	*Scirpus pungens*											X					X		
softstem bullrush	*Scirpus tabermontanii*									X	X						X		
hoary skullcap, hyssop skullcap, skullcap	*Scutellaria incana*								X			X							
hyssop skullcap	*Scutellaria integrifolia*															X			
Allegheney skullcap	*Scutellaria serrata*				X	X			X		X								
sedum	*Sedum* spp.																X		
wild stonecrop, woodland stonecrop, stonecrop	*Sedum ternatum*															X			
golden ragwort, golden groundseal, squaw-weed	*Senecio aureus*											X						X	
northern wild senna, wild senna, American	*Senna hebecarpa*	X	X									X	X		X				
Maryland senna	*Senna marilandica*	X																	
bristlegrass	*Setaria* spp.																X		
wild pink, pink campion	*Silene caroliniana*				X	X				X			X			X		X	
royal catchfly	*Silene regia*	X																X	
starry campion	*Silene stellata*		X	X	X						X	X	X						
fire pink	*Silene virginica*		X									X	X						
compass plant	*Silphium laciniatum*												X						
cup plant	*Silphium perfoliatum*	X	X		X								X						

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prairie dock	*Silphium terebinthinaceum*														X				
whorled rosenweed	*Silphium trifoliatum*				X											X		X	
blue-eyed grass, select blue-eyed grass	*Sisyrinchium angustifolium*	X										X							
false solomon's seal	*Smilacina racemosa*						X					X						X	
greenbriar	*Smilax* spp.																X		
silverrod, white goldenrod	*Solidago bicolor*				X												X		
bluestem goldenrod, wreath goldenrod	*Solidago caesia*				X											X	X		
zigzag goldenrod	*Solidago flexicaulis*		X		X											X	X	X	
flat top goldenrod	*Solidago graminifolia*	X	X	X	X							X	X		X	X			
early goldenrod	*Solidago juncea*												X						
gray goldenrod	*Solidago nemoralis*				X														
anisescented goldenroad	*Solidago odora*		X				X												
roughleaf goldenrod	*Solidago patula*				X													X	
riddell's goldenrod	*Solidago reddellii*												X						
stiff goldenrod	*Solidago rigida*					X							X					X	
wrinkleleaf goldenrod, rough-stemmed goldenrod	*Solidago rugosa*				X												X		
seaside goldenrod	*Solidago sempervirens*												X						
blue-stemmed, grey, or showy goldenrod	*Solidago speciosa*			X			X					X							
short-pappus goldenrod, autumn goldenrod	*Solidago sphacelata*		X									X	X						
goldenrod	*Solidago* spp.	X			X								X				X	X	
American mountain ash	*Sorbus americana*																X		
indian grass	*Sorghastrum nutans*															X	X		

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American bur-reed	*Sparganium americanum*			X								X	X			X			
giant bur-reed	*Sparganium eurycarpum*									X							X		
prairie cord grass	*Spartina pectinata*		X	X							X	X	X		X	X			
indian pink	*Spigelia marilandica*				X				X		X								
meadowsweet	*Spiraea alba*		X									X							
steeplebush	*Spiraea tomentosa*	X																	X
nodding ladies tresses	*Spiranthes cernua*										X								
fragrant lady's tresses	*Spiranthes cernua var. odorata*	X			X									X	X			X	
lady's tresses orchid	*Spiranthes odorata*	X	X		X	X	X			X		X	X	X	X	X		X	
narrow-leaved meadowsweet	*Spirea alba*				X	X					X			X		X		X	
broad-leaved meadowsweet	*Spirea latifolia*		X																
tall dropseed, rough dropseed, meadow dropseed	*Sporobolus compositus*				X								X						
prairie dropseed	*Sporobolus heterolepis*															X		X	
American bladdernut	*Staphylea trifolia*															X			
porcupine grass	*Stipa spartea*				X											X			
stokes' aster	*Stokesia laevis*								X	X	X								
wood poppy, celandine poppy	*Stylophorum diphyllum*				X														
snowberry	*Symphoriacarops*	X			X							X		X					
coralberry	*Symphoricarpos orbiculatus*		X									X					X		
blue heart-leaved aster	*Symphotrichum cordifolium*				X											X			
crooked-stem aster	*Symphotrichum prenanthoides*				X											X		X	
purple-stemmed aster	*Symphotrichum puniceum*	X			X														

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short's aster	*Symphotrichum shortii*					X					X	X		X	X	X			
reclining aster	*Symphyotrichum ericoides*									X									
calico aster	*Symphyotrichum lateriflorum*														X				
white or frost aster	*Symphyotrichum porteri*											X	X						
skunk cabbage	*Symplocarpus foetidus*				X	X			X	X						X			
bald cypress	*Taxodium distichum*	X			X							X							
yew	*Taxus* spp.																X		
meadow rue	*Thalictrum aquilegifolium*																X		
early meadow rue	*Thalictrum dioicum*				X						X								
tall meadow rue	*Thalictrum pubescens*				X											X			
rue anemone	*Thalictrum thalictroides*										X								
New York fern	*Thelypteris noveboracensis*	X			X								X		X	X			
foamflower, creeping foamflower	*Tiarella cordifolia*					X													
American linden or basswood	*Tilia americana*					X											X		
Mexican sunflower	*Tithonia rotundifolia*																X		
poison ivy	*Toxicodendron radicans*																X		
Ohio spiderwort, spiderwort	*Tradescantia ohiensis*				X											X			
spiderwort, Virginia spiderwort, common spiderwort	*Tradescantia virginiana*				X														
tassel rue	*Trautvetteria caroliniensis*		X																
blue curls	*Trichostema dichotomum*	X	X		X		X			X			X	X					
purple-top	*Tridens flavus*		X		X											X			
red clover	*Trifolium pratense*																X		

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white dutch clover	*Trifolium repens*																X		
southern trillium	*Trillium cuneatum*	X										X							
purple trillium, red trillium, wake robin, stinking benjamin, squawroot	*Trillium erectum*				X							X	X			X		X	
declined trillium, white wake-robin, drooping trillium	*Trillium flexipes*															X			
showy trillium, large flowering trillium	*Trillium grandiflorum*	X	X		X		X						X	X					
yellow trillium, southern	*Trillium luteum*			X								X							
prairie trillium, bloody noses	*Trillium recurvatum*		X			X					X	X	X			X			
toadshade, toad trillium	*Trillium sessile*	X	X		X	X		X			X		X	X	X	X		X	
trillium	*Trillium* spp.				X				X	X							X		
spreading globeflower	*Trollius laxus*	X														X			
eastern hemlock	*Tsuga canadensis*				X											X	X		
hemlock	*Tsuga Carrière*																X		
tulip	*Tulipa* spp.																X		
showy merrybells, large-flowered bellwort, wild oats	*Uvularia grandiflora*		X															X	
bellwort, merrybells	*Uvularia perfoliata*	X		X	X	X										X		X	
wild oats	*Uvularia sessilifolia*				X								X						
lowbush blueberry	*Vaccinium angustifolium*				X								X				X		
highbush blueberry	*Vaccinium corymbosum*				X								X			X	X		
blueberries	*Vaccinium* spp.												X				X		
deerbery	*Vaccinium staminium*				X	X					X					X	X		

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regal lingonberry	*Vaccinium vitiis-idaea*										X								
wild celery	*Vallisneria Americana*																X		
purple vervain	*Verbena canadensis*				X					X	X					X			
blue vervain, simpler's joy, swamp verbena, blue verbena	*Verbena hastata*			X									X		X				
hoary vervain	*Verbena stricta*															X			
tall ironweed	*Vernonia gigantea*				X						X					X			
tawny ironweed, upland ironweed	*Vernonia glauca*											X							
New York ironweed, broadleaf ironweed	*Vernonia noveboracensis*												X						
culver's root	*Veronicastrum virginicum*															X			
giant ironweed	*Verononia gigantea*														X	X			
mapleleaf viburnum	*Viburnum acerifolium*		X													X			
witherod, wild raisin	*Viburnum cassinoides*				X								X						
arrowood viburnum, southern arrowwood	*Viburnum dentatum*		X														X		
nannyberry viburnum	*Viburnum lentago*										X								
possumhaw, witherod viburnum	*Viburnum nudum*		X									X							
blackhaw viburnum, black haw	*Viburnum prunifolium*												X			X	X		
viburnums	*Viburnum* spp.		X			X										X	X		
cranberry bush, highbush cranberry	*Viburnum trilobum*			X	X							X					X		
white violet, Canada violet	*Viola canadensis*					X					X	X	X				X	X	
marsh blue violet	*Viola cucullaria*																	X	
halberdleaf yellow violet	*Viola hastata*																	X	
labrador violet	*Viola labradorica*																	X	

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common blue birdfoot violet	*Viola pedata*																	**X**	
smooth yellow violet	*Viola pensylvanica*																	**X**	
downy yellow violet	*Viola pubescens*																	**X**	
long-spurred violet	*Viola rostrata*																**X**	**X**	
wild blue violet	*Viola sororia*																	**X**	
pansy	*Viola* spp.																**X**		
creamy violet	*Viola striata*																**X**	**X**	
grape, wild grape	*Vitis* spp.																**X**		
barren strawberry	*Waldsteinia fragarioides*																	**X**	
Virginia chain fern	*Woodwardia virginica*																	**X**	
yellow root	*Xanthorhiza simplicissima*																	**X**	
golden alexanders, zizia	*Zizia aurea*																	**X**	

APPENDIX M: ENHANCING FISH HABITAT

Habitat is defined as the place where an organism lives or is naturally found. Enhancing habitat in an aquatic ecosystem improves the over all health and quality of a given waterway. By doing so, it in turn benefits everyone who enjoys outdoor recreation weather it be fishing, boating, or just an outdoor enthusiast.

Aquatic habitat enhancement can be constructed in both streams and lakes and is designed to improve habitat for everything from fish to various reptiles. As well as having a wide range of organisms that habitat enhancement structures benefit there is also a diverse variety of artificial habitat purposes and designs that Pennsylvania Fish and Boat Commission (PFBC) has come up with to suit the needs of Pennsylvania's wildlife. In order to perform a Fish Habitat improvement project the proper permits must first be required from Pennsylvania's Department of Environmental Protection (PA DEP). Once the permits are acquired grants are applied for to provide funding.

The primary objective of artificial fish habitat is to use resources such as wood and rock rubble to increase the abundance of submerged native habitat using designs engineered to mimic Pennsylvania's naturally occurring resources. Artificial fish habitat also provides excellent fishing opportunities for anglers if they are aware of the locations of the structures.

PFBC offers Lake Habitat Improvement Maps for all the state and federal owned lakes where habitat improvement projects have been completed. These maps show the general shape of the lake and indicate where all man made structures are located along with how many are present and the depth of their location. If read correctly these maps provide a very efficient way for anglers to navigate the structures and ultimately find fish (PFBC[2]).

Habitat Enhancing Structures for Cover

Man-made aquatic habitat structures are designed to serve several different purposes for aquatic life, each one being necessary for a successful aquatic environment. One purpose for artificial habitat is to provide smaller prey fish with cover from predators where preexisting cover is nonexistent. Most needs for this type of habitat structure is in the early man made lakes that can be found scattered across Pennsylvania. This is because in earlier years when many lakes were being formed it was thought that the lake bottom should be bare, therefore all debris was cleared from the area leaving little to no cover remaining for aquatic organisms. There are many variations for this form of habitat that use all types of materials ranging from wooden poles to large sandstone rocks. Examples of this type of habitat structure are the Porcupine Crib, Porcupine Crib Jr., Post Stump, Post Stump Plus, Post Cluster, Post Cluster Plus, Rock Star, Vertical Plank Structure, Spider Hump, Stake Tree, Felled Shoreline Tree, and Rock Rubble Humps.

Porcupine Crib and Porcupine Crib Jr.

Porcupine Crib and Porcupine Crib Jr. are two habitat structures that are very alike in their design. They are constructed using 4ft. 2×2 pieces of rough timber, 8×8×16 concrete blocks, nails, and a nylon banding strap with steel buckle. The 4 ft. pieces of wood are nailed to one another while slowly steeping inward in the shape of a pyramid with the concrete blocks placed at the bottom for weights and the nylon banding strap used for added strength. Once completed the cribs are placed at the bottom of the lake at a minimum depth of about 10 ft. and are normally placed in clusters. Once submerged the Porcupine Crib and Crib Jr. form what serves as a wooden cage like structure with openings between the boards allowing smaller bait fish to swim in and out ultimately providing them with cover. At the same time the Porcupine Crib provides places for predatory fish to hunt due to the large amounts of bait fish that are drawn to them. Porcupine cribs serve as excellent areas for fishermen seeking various species of pan fish as well as the larger game fish species that are drawn in too feed on them (PFBC[1]).

Post Stump and Post Stump Plus

The Post Stump and Post Stump Plus have a simple design which involves nothing more that two to three 4ft. sections of 6 inch wide aquatic posts and are normally placed at a depth of about 4ft. of water. The Post Stump is made by pounding two sections the aquatic posts into the lake bottom until they are submerged about two feet below the surface. The two pieces of post can be placed straight up and down or at an angle depending on preference. The Post Stump Plus is constructed the same way as the plain Post Stump but involves a laterally positioned post that is bolted to the vertical posts underneath the waters surface for added cover. This Habitat structure is designed to benefit an array of aquatic organisms. The submerged posts act as artificial submerged stumps providing cover for predatory and prey fish alike. Being that this type of habitat structure is placed in shallower waters it creates fishing sites for anglers that are accessing the lakes from shore banks (PFBC[1]).

Post Cluster and Post Cluster Plus

The Post Cluster and Post Cluster Plus are very similar in design and purpose to the Post Stump and Post Stump Plus. This type of habitat is made with 8ft. long sections of 6 inch wide aquatic posts and normally involves the use of heavy equipment to build. The Post Cluster is placed in about 4ft. of water and is constructed by inserting the 8ft. sections of aquatic posts about two feet into the lakes bottom allowing the tops to protrude from the waters surface. The Post Cluster can include as many poles in each cluster as preferred and can be arranged in any shape that is desired. The Post Cluster Plus is constructed the same as The Post Cluster except it involves laterally positioned posts that are bolted to the vertical posts underneath the waters surface for added cover. Once completed the clusters of protruding posts replicate what acts as submerged woodland. This habitat structure is designed to benefit an array of aquatic organisms. As well as providing cover for fish of all sizes the exposed post above the surface of the water serve as excellent perch sites for fish hunting birds. Also the Post Clusters exposed portions tend to eventually attract aquatic plant growth such as lily pads which in turn attracts organisms like frogs and dragonflies that fish and other organisms can feed on. This type of habitat structure draws in all types of fish species thus providing favorable fishing for boating and shore fishermen alike. The post clusters also act as a barrier between the shore and open water by breaking up waves decreasing shore line erosion (PFBC[1]).

Rock Star

The Rock Star is a man made habitat structure that involves the use of both rough cut timber and sandstone rocks. To construct this type of structure you need seven tons of sand stone, seven eight ft. 2×6 sections of rough cut timber, and nails. A rock star consists of a two ton pile of sandstone encircled by five surrounding one ton piles of sandstone that is connected by five sections of 2×6 rough timber in the general shape of a star. The connecting pieces of rough cut timber should be buried in the rock piles and elevated from the lakes bottom for aquatic organisms to use for cover. After the star shaped structure is completed the last two sections of eight ft. 2×6 are nailed into the others that are already placed connecting any two of the pieces of boards for additional cover. These structures can be placed at any depth and are designed to provide cover for all types of aquatic organisms. Rock Stars can also double as spawning sites for some species of fish (PFBC[1]).

Vertical Plank Structure

The vertical Plank Structure is a wooden box designed to provide cover for large and small fish alike. The structure consists of 59 sections of rough cut timber that rang from 1×4×24 to 2×3×48, nine concrete blocks to allow it to sink to the bottom, and nails. Small conifer trees may also be placed in the box once built to add additional cover. This habitat structure is used much the same as the Porcupine crib.

Placement is normally at a minimum depth of 10ft. and more often then not they are placed in clusters. The main difference being the Vertical plank structure has openings that are much larger in size allowing larger fish and other aquatic organisms to enter them. If located the Vertical Plank structure is an excellent place for anglers to try their luck for not only does it provide cover for bait fish but larger sized fish as well (PFBC[1]).

Spider Hump and Rock Rubble Hump

The Rock Rubble Hump is the simplest artificial habitat structure there is as far as its general design is concerned. It consists of a pile of sandstone rock that stands anywhere from one to three ft. high and can be placed at any depth that is preferred. The Spider Hump is a more complex modification of the Rock Rubble Hump that is constructed using sandstone rocks, spikes, and 8ft. aquatic posts. A square is built with 8ft. posts then fastened down with spikes. Then 16 more evenly spaced posts are laid in the square and fastened down with all of the bottoms meeting in the center of the box. Once the posts are all placed three tons of rock is dumped onto the center of the structure to form a rock pile with wooden posts protruding providing excellent cover for all types of aquatic organisms. These habitat enhancement structures also provide excellent areas for fish species that prefer spawning in rocky areas (PFBC[1]).

Stake Tree

The Stake Tree is constructed using a five gallon plastic bucket, 2×2 wooden stakes (varying in length), and concrete. To create a Stake Tree simply arrange 6 to 8 wooden stakes in any random order in the bucket then pour in concrete to harden and hold them in place. When completed place it anywhere where it’s deep enough for it to become totally submerged and once placed it will replicate a submerged tree with branches. The Stake Tree can be placed in level or slightly steeping areas and in normally situated in groups of 10 to 30 structures or 50 to 60 per acre in a circular arrangement. These structures are excellent for attracting pan fish such as crappie and bluegill and are sure to provide fishing hot spots (PFBC[1]).

Felled Shoreline Tree

The Felled Shoreline Tree habitat enhancement uses trees surrounding a lake or other body of water, a chain saw, and a steel cable to create ideal aquatic habitat. A Felled Shoreline Tree is formed but cutting down a tree along the edge of a body of water and angling it so it falls into the water. Once cut down the tree is fastened to the stump that is remaining with the steel cable to keep it in place. Although this is already a naturally occurring process among aquatic ecosystems it speeds up the process and allows the person creating the habitat to place the downed trees in favorable locations. The Felled Shoreline Tree structure is to be placed where the tree will fall into water that has a steep droop off and has a minimum depth of 10ft. towards the where the top of the tree will fall. These structures provide habitat for fish of all species and sizes (PFBC[1]).

Habitat Enhancing Structures for Spawning and Nesting

Another purpose that Habitat enhancement structures are designed to improve is spawning and nesting sites available to aquatic organisms. There are several types of structures that are designed to provide nesting areas for specific types of fish species in Pennsylvania. These types of structures include the Black Bass Nesting Structure, Fathead Minnow Spawning Cover, and Channel Catfish Spawning Box. These three types of habitat structures all are designed to enable specific species of fish to reproduce efficiently buy building them the necessary habitat for each of their unique forms of breeding or nesting habits.

Black Bass Nesting Structure

The Black Bass Nesting Structure is built from wood, nails, and concrete blocks and when completed forms a table looking structure. It's constructed by building a base out of 4ft. pieces of 2×2 rough cut timber to place the concrete blocks in just as you would a porcupine box. Once the Blocks are in place for weights to make the structure sink to the bottom five 8ft. pieces of 1×8 rough cut timber are laid across the top with equal lengths of over hang on each side and nailed in place. The structures are placed in depths of about 5ft. and will provide ideal nesting sites for black bass species including the much sought after large mouth bass. The overhanging edges on opposing sides of the structure are about 14 inches from the bottom allowing bass to nest and lay their eggs underneath the cover it provides (PFBC[1]).

Fathead Minnow Spawning Cover

The Fathead Minnow Cover habitat structure is very simple to construct and consists of nothing more then a 2ft. long 1×8 with one end being pointed and the other flat. To build Fathead Minnow Spawning Cover you use a sledge to pound the piece of 1×8 into the bank of a lake or other body of water at a depth of 1 to 2ft. The structure is to be driven into the substrate 3 to 6in. at a slight upward angle. For ideal success the recommended density of this structure is six per acre. Like most other fish species Fathead Minnows spawn seasonally occurring during the month of June therefore the structures may be removed once the spawning time period has expired (PFBC[1]).

Channel Catfish Spawning Box

The Channel Catfish Spawning Box has one of the more complex structural designs, among the materials need to build this structure are 8ft. 1×8 boards, 16×16 concrete blocks, nails, and lag screws with washers. Using the boards a rectangle is constructed that is 32in. long 16in. wide and 10in. high. The box has a entrance hole 6in in diameter and two ½ in. air release holes on the top of the box towards the entrance hole. Two 16×16 concrete blocks are fastened to the bottom of the structure for anchors using the lag screws. Once completed the Channel Catfish Spawning Box is placed in 3 to 5ft. of water. When placed the structure will provide the Channel Catfish with a place to spawn or simply use for cover (PFBC[1]).

Habitat Enhancing Structures for Basking

These types of structures are designed primarily for reptile species and are essentially small floating dock like structures anchored down to provide organisms like turtles with an island refuge from the water. Basking structures benefit more then just the organisms that use them for retreat form the water. They also provide cover for fish just the same as a boat dock would. There is one main type of basking structure design in Pennsylvania and it's called the Turtle Basking Platform.

Turtle Basking Platform

The Turtle Basking Platform involves quite a variety of materials to construct. Materials needed to build this structure are 2ft. and 4ft. 1×8 rough cut lumber, 4ft. 4×4 rough cut lumber, various screws and bolts, stainless steel rope wire and cable clamp, PVC pipe and caps, sealer, conduit hangers, and 8×8×16 cement blocks. A 4ft. × 4ft. dock like structure is constructed form the rough cut timber and two capped PVC pipes serving as floats. The steel cables are then attached to opposing sides of the structure and the cement blocks are attached to the steel cables acting as anchors. These structures are placed in about 5ft. of water and can be placed alone or in clusters (PFBC[1]).

Habitat Enhancing Structures for Erosion Control

These types of structures are designed to eliminate shoreline erosion and act as wave deflectors. They also deplete the amount of sediment eroded into the water and create a buffer zone for nutrient saturation. This is accomplished by laying seeded jute matting above the banks where the habitat enhancement is constructed. Jute Matting will reinforce the shoreline and add plant growth to absorb nutrients. Along with the water quality benefits this type of habitat enhancement offers it also provides more desirable cover for fish that prefer shallow waters along the shoreline. Therefore these structures benefit anglers that fish from shore as well as the aquatic organisms that live there. There are two types of erosion controlling or deflecting habitat enhancement designs in Pennsylvania, the Saw-Toothed Deflector and the Stone Framed Deflector.

Saw-Toothed Deflector and Stone Framed Deflector

These two types of structures are not only very similar in design and appearance but involve the use of all the same materials. Both are constructed using large sandstone or limestone boulders to form an outline and smaller sandstone or limestone rocks to fill in the interior of the structures. Also pre-seeded jute matting is used in the construction of these structures along the shore where rock meets dirt for accelerated plant growth and bank stability. The Saw-Toothed Deflector uses the rocks to form an irregular pattern along the shore where erosion is occurring. The Stone Framed Deflector places rocks in a triangular pattern consisting of a 30 degree angle from shore that meets a 90 degree angle coming back towards shore. The long face of the triangle should be facing the direction in which the wind and waves are coming from. Stone Framed Deflectors extend further out into the lake then Saw-Toothed Deflector thus provide more availability in the relation to fish habitat. Along with the construction of these habitat structures riparian buffers are often put in place where stone deflectors are located (PFBC[1]).

Habitat Enhancement Structures for Streams

All of Pennsylvania's Rivers and streams are ever changing as the years go on. These changes develop naturally and can occur over the course of several years or just a couple days if flooding is sever enough. Changes among rivers and streams are caused by the systems natural urge to find equilibrium or the most stable direction of flow. This natural urge can cause the river or stream to wind back and forth and ultimately ruin the systems livability for more demanding aquatic organisms like trout. This is because constant bends and breaks in a running waterway causes it to become shallow, slow moving, and can in turn limit livable space for aquatic organisms. For this reason the Pennsylvania Fish and Boat Commission along with other conservation groups have developed ways to improve the course of a moving system while respecting the desired course of the waterway at the same time. These improvements often involve the use of heavy equipment and are constructed from natural materials such as wood and rock. A common solution that man made habitat enhancement structures provide for a moving aquatic ecosystems is straightening of its natural flow. By straightening the systems flow the river or stream will eventually move faster and deepen over the span of several years in turn providing more livable space and desirable habitat. Many of the created habitat structures also serve a double purpose for aquatic organisms by offering cover for them to hide amongst (Lutz, 2007).

There are various aquatic enhancements and habitat structures that are installed in Pennsylvania's streams and river systems. Sometimes they just involve stream bank stabilization or placement of woody debris for fish cover, but there are several man made habitat structures that involve quite elaborate designs and a lot of work to construct. All habitat structures require proper permits to build and place just as the habitat structures constructed for lakes. The most common types of structures that are constructed within streams are deflectors and Vanes. Both are mainly constructed to divert channel flow. There are also channel blocking structures that are made to block off side channels that drain from the main flow. And lastly there structures designed to provide habitat cover for aquatic organisms. These consist of Water Jacks, Cribs, and random rock or log structures (Lutz, 2007).

Channel Deflecting Structures

Deflectors are triangular structures of all different sizes that serve several purposes and can be constructed from all sorts of materials ranging from rocks to brush and even tree roots. One thing that a deflector does for a stream is adjust the main current back to the center of the waterway. While doing so the deflector narrows the channel of flow and collects substrate and debris along the bank below the structure which also deepens the waterway. Deflectors also provide some habitat cover for aquatic species such as fish. Another type of habitat structure designed for streams are Vanes. A Vane serves the same purpose as a Deflector and is constructed from basically the same materials. Types of Vane and Deflector structures include Saw-Toothed Deflectors, Stone Deflectors, Stone Deflector with Single Log, Log framed Deflector, Overhead Deflector, Log Faced Stone Deflector, Stacked Deflector, Brush Deflector, Root Wad Deflector, Single Log Vane, Single Log Vane with Root Wad, Multi-Log Vane, Rock Vane, Rock Vane with J Hook, Log Cross Vane, Rock Cross Vane.

Saw-Toothed Deflectors, Stone Deflectors, and Stone Deflector with Single Log

Saw-Toothed Deflectors are made form stone and are the simplest of the deflectors to construct. This habitat structure is made by dumping rock in the formation of triangles along the stream bank with a 30 degree angle facing the upstream end to center the current. They are to extend 5ft. out into the stream and are placed in groups of anywhere from three to as many needed. Stone Deflectors are built the same as the Saw-Toothed but tend to be larger and are placed alone instead of in groups. The Stone Deflector with Single Log is modified slightly from the others having a log buried in the rock pile that protrudes out from the tip of the deflector angling upstream against the flow. This is just to provide additional cover for fish and other aquatic organisms (PFBC[1]).

Log framed Deflector, Overhead Deflector, Log Faced Stone Deflector, and Stacked Deflector

The Log Framed Deflector is designed to server the same purpose as the Stone Deflector and is constructed the same way just with a triangular frame built from logs. The main log is placed along the face against the flow at a 30 degree angle and the brace log is put along the back side. The two logs are buried in the bank on the shore side and are pinned down at the tip with rebar. The Overhead Deflector is the same design but uses planking to fill in the deflector before the rock place as filler. As for the Log Faced Stone Deflector it's nothing more then a Stone Deflector one or two logs placed on the 30 degree face of the structure that diverts the current. The face log or logs are fastened to sill logs that are buried under the stone inside the structure. All three of these habitat enhancement structures are designed for current diversion and can double as cover for fish and other organisms like macro invertebrates (PFBC[1]).

Brush Deflector and Root Wad Deflector

The Brush Deflector is a type of deflector that has many benefits. It's constructed from wooded stakes and brushy debris. This type of deflector is built by pounding the stakes into the bottom of the stream leaving about 2×2ft. square spaces in between. The stakes should form a triangle pointing towards the middle of the stream and each stake should protrude about 6 inches from the streams surface. Once the stakes are in place the spaces between stakes are stuffed with bundles of brush until it's built up to above normal water level. This structure will eventually develop growth over of the brush pile and become land that can be walked on forming a permanent deflector. The Root Wad Deflector is simply a root wad or lower portion of a tree that is placed with the root mass in the water and the trunk buried within the streams bank. This habitat structure acts as a deflector for current but server more as a cover provider. Aquatic Organisms use the entangled mass of roots for cover from predators (PFBC[1]).

Single Log Vane, Single Log Vane with Root Wad, and Multi-Log Vane

The Single Log Vane and Single Log Vane with Root Wad are current deflecting structures and are designed to center the streams flow, prevent stream bank erosion, and provide cover for aquatic organisms. These habitat structures are constructed from logs and rock. A Single Log Vane is built by burying a log in the stream bank then pouring stone over the end that is stuck in the back to hold it in place. A larger stone is also placed behind the tip of the log in the stream for added strength. The log is to be pointed upstream against the flow at a 20 to 30 degree angle. Single Log Vane with Root Wad is the same structure with a root wad deflector added on the downstream side of the structure for added cover and current deflection. The Multi-Log Vane is another similar structure that is built the same as the single log vane but as the name states multiple logs are placed in the stream bank to protrude into the stream instead of a single log. This structure may be used when there are stronger currents or larger streams for added stability (PFBC[1]).

Rock Vane and Rock Vane with J Hook

The Rock Vane and Rock Vane with J Hook are two other vane structures that are constructed from only rock. A Rock Vane is built by making a line of larger stone out into the stream at a 90 degree angle. Then the upstream side of the structure is filled in with smaller rock forming a triangle. The Rock Vane with J Hook is the same structure just with a hook made from stone coming off the tip of the vane that curves downstream. These structures tend to deflect the current and form deep slow pools for aquatic habitat (PFBC[1]).

Log Cross Vane and Rock Cross Vane

The Log Cross Vane and Rock Cross Vane are designed to center flow and create a deepened pool with a fast moving current on the down stream end of the structure. These can form damming barriers in low water conditions but when water levels are normal to high the water is carried over the structure and cuts into the bottom forming deep holes that are desirable for anglers. These structures are nothing more then two vanes built on opposing sides of a stream with their tips meeting in the middle to be fastened down. Log Cross Vane being made up of two opposing Single Log Vanes and the Rock Cross Vane being made up of two opposing Rock Vanes (PFBC[1]).

Channel Blocking Structures

Channel blocking structures are habitat structures that are constructed to divert the flow of a stream back to its main channel. Over time streams can develop side channels from flooding that can deplete the amount of water as well as strength of current from the main channel. This can cause poor habitat for fish and other organisms that desire cool fast flowing waters and at the same time can impact the health of the stream. Channel blocking structures use natural materials to block these side channels off and correct the flow. There are two types of channel blocking structures these being the Stone Channel Block and The Log Frame Channel Block.

Stone Channel Block and Log Frame Channel Block

The Stone Channel Blocker is simply a wall build from piling rock to block off side channels. A pile of larger rock is dumped right where the side channel flows out then a layer of smaller rock and another layer of the larger rock. The rocks are piled slightly higher then the normal water level and should not be piled higher then the surrounding stream banks. The Log Framed Channel Blocker is built in the same way but involves log frame for added strength. The log frame consists of 2 logs placed across the side channel perpendicularly that are connecter by several brace logs that are fastened down with rebar. Once the frame is in place large rocks are poured over the edged and along the structures down stream face in the side channel. Then smaller filler rocks are dumped on to fill in the frame and other remaining space.

These structures keep the main flow of the stream going in the proper direction improving the overall quality of the stream (PFBC[1]).

Cover Providing Structures

There are several different variations of habitat structures that provide aquatic organisms with cover. The simplest forms of these structures are the Random Boulder Placement and the Half Log Structure. Both are quick and easy to construct and their soul purpose is to provide cover for organisms such as fish. Another type of habitat structure that is designed to provide cover is the cribbing structure. There are several different types of these structures including Bank Cover Cribbing, Bank Cover Cribbing with Root Wad, Mud Sill Cribbing, and Modified Mud Sill Cribbing all of which including the same basic design. These structures are designed to be placed along stream banks to allow fish and other organisms to swim under them for cover while also doubling as bank stabilizers.

Random Boulder Placement and Half Log Structure

Random Boulder structures are just as they sound. The Structures consist of boulders that are large enough to withstand flooding conditions being placed in the middle third of the wetted width of a stream. The boulders should protrude from the water's surface and should not be placed in a way that they would deflect the current of the stream towards the bank causing erosion. These habitat structures are very basic and easy to construct. The Half Log Structure consists of rebar, two 6 to 8 inch spacer logs, and a 3 to 4 foot long half log to be placed as the top. To construct this habitat structure the spacers and top are put in place and then fastened into place by pounding rebar through the top piece and spacer right into the stream bottom using preexisting drilled holes. The structure is to be placed parallel to the flow of the stream with the top slightly protruding from the water's surface. Both of these habitat structures are excellent for providing fish cover as well as cover for other aquatic organisms (PFBC[1]).

Brookie Water Jack and Water Jack

The Water Jack and Brookie Water Jack are similar structures that basically serve the same purpose. Both are designed to dam up and center stream flow eventually creating a deepened pool on the down stream side of the structure for organisms to live in. The Brookie Water Jack is smaller and a little simpler to construct because it is designed to be built in small fast moving streams that inhabit brook trout thus giving it the name. These structures are built from logs, rock, and a sheet of hemlock planking. A single log is placed across the stream and buried in the ground on both sides for strength. Then the sheet of planking is placed on the upstream face of the structure forcing the water to flow up and over. A notch is also to be cut in the middle of the sheet of planking so that water is still able to flow in low water conditions and when high will center the streams flow. On each side of the log along the bank rock deflectors are placed over the log to center the flow and add strength. The Basic Water Jack is a more elaborate habitat structure designed to be placed in larger streams yet is designed to serve the same purpose. It consists of the same materials the Brookie Water Jack does but it uses more logs. At the center two logs are placed along the stream perpendicular to the flow and another is placed up stream in the same way. Then the piece of wooden planking is placed over the logs at an upward steeping angle connection the gap to force the flow of water up and over the structure. Once this part is completed wing logs are placed along the sides forming structures similar to Log Framed Deflectors that keep the flow of the stream centered and the stream banks from eroding. The water jack structures provide deep pools of cold fast moving water for all sorts of aquatic organisms to thrive in. these structures also server as bank erosion controllers and channel deflecting structures. Overall they are very beneficial to a streams habitat and are very beneficial (PFBC[1]).

Bank Cover Cribbing and Bank Cover Cribbing with Root Wad

Cribbing structures are made from logs rock and planking boards. A Bank Cover Crib is constructed along the bank of the stream and is designed to act as an undercut bank for fish to hide under. This habitat structure is build by taking planking boards and driving them into the stream bank in a row to form a platform that extends out over the stream about 2 feet. With the platform in place a logs are fastened to the top and bottom of the platforms edge that hangs over the stream. The portions of the logs that extend further then the platform are buried in the ground for added support. Once there is a sturdy overhanging platform structure completed rocks are dumped over the plank platform to build it up to level with the stream bank. The Bank Cover Cribbing with Root Wad is build the same way as the Bank Cover Cribbing but has root wads protruding from under the structure for added cover. The root wads are buried in the stream bank and extend out from underneath the providing excellent habitat for aquatic organisms to hide amongst (PFBC[1]).

Mud Sill Cribbing and Modified Mud Sill Cribbing

The Mud Sill and Modified Mud Sill Cribbing are similar I design to Bank cover Cribbing structures. The Mud Sill Cribbing is built in 8ft. sections and is made from oak planking, logs, and rock. To construct this type of habitat structure you must first dig ditches in the stream bank for the logs to lie in. Once the logs have been laid a platform is built over the part of the structure that hangs over the stream using the oak planking. When the platform is completed rocks are dumped over the top of the structure at an angle leveling it off with the stream bank. The Modified Mud Sill Cribbing it constructed in the same fashion but instead of being designed so the current can freely flow underneath the structure the up stream and down stream ends of the structure are brought down all the way to the bottom of the stream just leaving an undercut that can be gotten under from the front. Also a log is placed protruding into the water on the downstream end of the structure to deflect the current back under the structure and create an undercut. These habitat structures are very efficient in creating cover for organisms like trout and other fish species serving as good fishing spots for anglers. The Mud Sill and Modified Mud Sill Cribbing structures also prevent stream bank erosion and provide bank stability (PFBC[1]).

References:

Lutz, K.J. (2007). *Habitat improvement for trout streams*. Retrieved August 24, 2010 from Pennsylvania Fish and Boat Commission website: http://fishandboat.com/water/streams/habitat_improve_trout.pdf.

Pennsylvania Fish and Boat Commission[1]. (n.d.).Habitat improvement. Retrieved August 24, 2010 from Pennsylvania Fish and Boat Commission website: http://fishandboat.com/habitat.htm.

Pennsylvania Fish and Boat Commission[2]. (n.d.). PFBC cooperative fish habitat management programs for lakes. Retrieved August 24, 2010 from Pennsylvania Fish and Boat Commission website: http://fishandboat.com/water/habitat/mgmt_plans/lake/intro_lake_hab.htm.

APPENDIX N. FUNDING SOURCES

Sponsoring Organization	Description / Restrictions	Contact
BMP		
State Conservation Commission-Dirt and Gravel Roads Maintenance	Available to local municipalities and state agencies for projects dealing with the BMPs for erosion and sedimentation control problems and fugitive dust in watersheds; dirt and gravel road jurisdiction required.	www.pacd.org
Community		
Pittsburgh Foundation	Economic, community development and the environment. Activities that increase employment, build strong neighborhoods, and promote civic engagement by all segments of the population. Funds for quality of life.	www.pittsburghfoundation.org
Energy		
DEP - Alternative Fuels	The Alternative Fuels Incentive Grants program continues to fund a considerable number of projects that use alternative fueled energy sources to reduce air pollution and our dependence on foreign oil. Alternative fuels include compressed natural gas	www.dep.state.pa.us
Environmental		
Beldon II Fund	Support environmental organizations working at the state-level. Some grants are made to regional and national organizations for efforts that support the work of state level groups.	www.beldon.org
Ben & Jerry's Foundation	Grant applications need to demonstrate that the project will lead to environmental change, address the root causes of environmental problems, and must help ameliorate an unjust or destructive situation by empowering constituents and facilitating leadership	www.benjerry.com
Eddie Bauer	Fund projects in certain local areas that support environmental goals such as clean rivers and streams or beautifying parks and school grounds. Must be 501(c) 3 and proposal should be kept between 2-3 pages.	www.eddiebauer.com

Sponsoring Organization	Description / Restrictions	Contact

Environmental (continued)

Howard Heinz Endowment	This program promotes environmental quality and sustainable development by supporting efforts to eliminate waste, harness the power of the market, and create a restorative economy. Should Promote sustainable urban design. Concentrated in Western Pennsylvania.	www.heinz.org
Raymond Proffitt Foundation	The foundation's purpose is to protect and restore the quality of the natural and human environment by informing and educating the general public about the impact of human endeavors upon the natural environment. The RPF strives to advance this understanding	www.rayproffitt.org
Surdna Foundation	The foundation's goal is to prevent damage to the environment and to promote more efficient, economically sound, environmentally beneficial, and equitable use of land and natural resources. Does not fund environmental education, sustainable agriculture, food production or toxic and hazardous waste.	www.surdna.org
Vira I Heinz Endowment	This program promotes environmental quality and sustainable development by supporting efforts to eliminate waste, harness the power of the market, and create a restorative economy. The program's goal is to promote sustainable urban design. Western Pennsylvania watersheds only.	www.heinz.org

Environmental/Watershed

EPA-Clean Water State Revolving Fund	May also contact: Beverly Reinhold (717) 783-6589. Infrastructure Investment Authority, Keystone Building 22 South Third Street, Harrisburg, PA 17101. email: breinhold@state.pa.us or Peter Slack, (717) 772-4054; DEP 400 Market Street, Harrisburg, PA 17105	(717) 772-4054
WREN - Conference/Training Scholarships	The activities funded must be educational and relate to drinking water source protection or watershed education. Applicant is required to provide a five percent match.	www.pa.lwv.org/wren
River Network Watershed Assistance Grants	Watershed projects and group start-ups.	www.rivernetwork.org
Foundation for Pennsylvania Watersheds	Provides funding to grassroots organizations and watershed associations for specific watershed remediation in Pennsylvania.	www.pennsylvaniawatersheds.org

Sponsoring Organization	Description / Restrictions	Contact

Environmental Education

Captain Planet	Supports hands-on environmental projects for children and youth to encourage innovative programs that empower children and youth around the world to work individually and collectively to solve environmental problems. Only for environmental education of children. Online only.	www.turner.com/cpf
DEP Environmental Education Grants	Open to schools, conservation districts, and non-profits. Open in summer, awarded in spring. Final application due dates vary. Application available online. Requires twenty percent match and reimbursement program.	www.dep.state.pa.us
Education Mini Projects Program	Small grants for Pennsylvania-based grassroots educational projects that address non-point source watershed concepts.	(717) 236-1006
Emerson Charitable Trust	Strong emphasis on cultural aspects and youth education, also science and education.	(314) 553-3722
EPA Environmental Education Grants Region III	Grants awarded to small non-profit groups for various projects in Region III.	(215) 566-5546
National Environmental Education and Training Foundation	To increase environmental awareness, environmental education, partnerships, etc. May also be reached at (202) 261-6464. Proposal deadlines: Jan. 1, March 1, July 15, and Sept. 1	(202) 833-2933
PACD - Mini Projects	The objectives of the Educational Mini-Project must promote the We All Live Downstream message by: stimulating an awareness of and interest in Pennsylvania's non-point source water pollution problems and solutions; salaries are not an approved expenditure	www.pacd.org
Project Wild	Project Wild is an interdisciplinary supplementary environmental and conservation program for educators of children in grades K-12. Small grants only.	www.projectwild.org
The Dunn Foundation	Promote the issues of the negative effect that sprawl, visual pollution, and poorly planned development have on the visual environment of communities and the resulting loss of quality of life. Encourage dialogue within and between communities. Do not fund property acquisition, capital improvement projects, capital campaigns, endowments, individuals, religious groups, or political organizations	www.dunnfoundation.org

Sponsoring Organization	Description / Restrictions	Contact
Environmental Education (continued)		
The Pathways to Nature Conservation Fund - National Fish and Wildlife Foundation	A partnership between the more than 270 Wild Birds Unlimited, Inc. franchises and the National Fish and Wildlife Foundation. The Pathways to Nature Conservation Fund offers grants to enhance environmental education activities and bird and wildlife viewing opportunities at significant sites.	www.nfwf.org
Water Resources Education Network - LWV	Funding to develop education programs for water issues facing communities. Local contact is shrerenehess@yourinter.net, Indiana PA, 724-465-2595. Must be 501(c)3	www.pa.lwv.org/wren
WREN - Opportunity Grants	The activities funded must be educational and relate to drinking water source protection or watershed education.	www.pa.lwv.org/wren
Environmental Justice		
EPA-Environmental Justice Small Grant Program	The program provides financial assistance to eligible affected local community-based organizations working on or planning to work on projects to address local environmental and/or public health concerns.	(202) 564-0152
Nathan Cummings Foundation	The foundation's purpose is to facilitate environmental justice and environmentally sustainable communities by supporting the accountability of corporations, governments, and other institutions for their environmental practices. Does not fund individuals, scholarships, or capital or endowment campaigns.	www.ncf.org
Norman Foundation	Support efforts that strengthen the ability of communities to determine their own economic, environmental, and social well-being, and that help people control those forces that affect their lives. Only fund in U.S. They do not fund individuals, universities, conferences, scholarships, research, films, media, arts projects, capital campaigns, fundraising drives, or direct social service programs.	www.normanfdn.org
Environmental Planning		
Coldwater Heritage Partnership	Grants for prioritizing watersheds in need of protection, for assessment of coldwater ecosystems, and for the development of watershed conservation plans.	(717) 787-2316

Sponsoring Organization	Description / Restrictions	Contact

Environmental Planning (continued)

DEP Nonpoint Source Control	Grants for planning and non-point source pollution control projects.	(717) 787-5259
DCNR - Community Conservation Partnership Program	Available to organizations that conserve and enhance river resources. Planning grants are available to identify significant natural and cultural resources, threats, concerns, and special opportunities, and the development of river	www.dcnr.state.pa.us
NRCS Watershed Surveys and Planning	Providing assistance for planning in water and coordinated water and related land resource programs in watersheds and river basins. Types of surveys and plans funded include watershed plans, river basin surveys and studies, flood hazard analyses, and floodplain studies.	www.nrcs.usda.gov

Flood Protection

DEP Flood Protection Grant Program	Open to communities that need to perform non-routine maintenance or improvements to already existing flood protection projects. Also applies to the purchase of specialized equipment. Open to communities that have flood protection projects that are deemed operable.	(717) 787-7432

General

Archer-Daniels-Midland Foundation	Proposals can be sent in letter form containing: 1) Description of the organization applying. 2) Description of the project/What funding would be used for. 3) A budget including how much is going to administrative costs. Emphasis is given to corporate operating locations.	www.admworld.com
Audrey Hillman Fisher Foundation, Inc.	Must refer to Application Procedures for more information. Preference given to southwestern Pennsylvania and central New Hampshire.	(412) 338-3466
Eureka Company	No specific interest, but, general focus is on social services, health, and the environment (wildlife, fisheries, habitat, and sustainable community development)	www.electrolux.se
Henry Hillman Foundation	Preference is given to organizations in the Pittsburgh/southwestern Pennsylvania area.	www.guidestar.org
Patagonia, Inc. Environmental Grants Program	Supports small grassroots organizations. Does not fund land acquisition.	www.patagonia.com

Sponsoring Organization	Description / Restrictions	Contact
General (continued)		
The Boeing Company	Provides contributions for capital campaigns, seed money (one-time grants) for new programs or projects that address community needs and priorities, and one-time grants to buy equipment, improve facilities, or enable special projects.	www.boeing.com/community
The Education Foundation for America	EFA's priorities include supporting the monitoring of the utility restructuring process as it impacts the environment, combating the growth of the "wise-use" movement, opposing large-scale live-stock confinement, and cutting federal "pollution." Letter limited to two pages.	www.efaw.org
The Prospect Hill Foundation	The foundation's environmental grant making concentrates on habitat and water protection in the northeastern region of the United States. Must have 501(c)3. The organization does not fund individuals, basic research, sectarian religious	http://fdncenter.org/grantmaker /prospecthill/
GIS		
DEP-GIS Software Grant	The grants consist of the latest commercial release of ArcView GIS software; several texts about utilizing GIS for environmental applications and land-use planning; CD-ROM containing spatial data about the commonwealth. Only issue 10 per quarter.	www.dep.state.pa.us
Habitat		
General Challenge Grant Program -National Fish and Wildlife Foundation	Requires non-federal match of 2:1. Address actions promoting fish and wildlife conservation and habitat; should involve conservation and community interest; leverage available funding and evaluate project outcomes.	www.nwf.org
Keep the Wild Alive (KWA) Species Recovery Fund	Fund on-the-ground projects that directly improve conditions for the endangered species highlighted in the KWA campaign. Current National Wildlife Federation employees are ineligible and applications must be submitted in English.	www.nwf.org/wildalive
Small Grants Program - National Fish and Wildlife Foundation	Address priority actions promoting fish and wildlife conservation and the habitats on which they depend; work proactively to involve other conservation and community interest; leverage available funding, and evaluate project outcomes. A 2:1 match of non-federal funds is required.	www.nwf.org

Sponsoring Organization	Description / Restrictions	Contact
Internship		
Office of Surface Mining Intern Program	Candidates must organize their work, work well with community groups and on their own, quickly internalize the requirements of acid mine drainage remediation and the national Clean Streams program, write well and enjoy public presentations. Academic credit. Can be undergraduate or graduate student. Positions available in AL, IL, IN, IA, KY, MD, MS, OH, OK, PA, TN, VA, WV. Must provide housing for interns.	(202) 208-2836
Land Protection		
DCNR Community Conservation Partnership Program	Conserve and enhance river resources by offering planning grants, technical assistance, implementation grants, development grants, and acquisition grants.	www.dcnr.state.pa.us
Lowes Charitable Foundation	Environmental initiatives that support the continued enhancement of the natural landscape, natural environment enhancers, and/or park improvement projects. Must apply online. Must be a 501(c)3.	www.lowes.com
Michael D. Ferguson Charitable Foundation	General environment, wildlife, fisheries, habitat, sustainable community, and development.	http://michaeldfergusonfoundation.com/
Nationals Parks Service - Land & Water Conservation Fund	Provide federal grants for land acquisition and conservation to federal and state agencies.	(303) 969-2500
The Wilderness Society	To preserve wilderness and wildlife, protect America's prime forest, parks, rivers, and shore lands, and foster an American land ethic. Alternate address Montana Regional Office, 105 West Main St., Suite E, Bozeman, MT 59715-4689	www.wilderness.org
Town Creek Foundation	Environmental issues of interest to the foundation include: 1) Preserving the ecological richness of our natural heritage, with a major focus on our federal public lands. 2) Promoting policies and practices to protect the land, estuaries, and coastal bays	www.towncreekfdn.org

Sponsoring Organization	Description / Restrictions	Contact
Loan		
Environmental Loan Fund	The loan can be used for membership development, creating and implementing a workplace giving program, cause-related marketing, donor development, special events, direct mail campaigns, mission related business enterprises, or capital campaign work.	www.envsc.org
Pennsylvania Infrastructure Investment Authority Drinking Water Loans	Must show water quality impact, must have qualified loan candidate. Loans to stormwater projects and non-point source projects. Interest is 1-2.8 percent over 20 years.	(717) 787-813
Multiple		
Acorn Foundation	Interested in small and innovative community-based projects which preserve and restore habitats supporting biological diversity and wildlife, and advocate for environmental justice. Does not fund the following: direct services, capital expenditure, construction or renovation programs, programs undertaken by tax-supported institutions or government initiatives, emergency funding, scholarship funds, or other individual aid.	www.commoncounsel.org/pages/foundation.html
Allegheny Foundation	The Allegheny Foundation concentrates its giving in the western Pennsylvania area and confines its grant awards to programs for historic preservation, civic development, and education. No event sponsoring. Does not fund individuals.	www.scaife.com
Anne & George Clapp Charitable & Educational Trust	Fields of interest include education, social services, youth and child welfare, and aging. Limited support for cultural programs, historic preservation, and conservation. Southwestern Pennsylvania only; grants are not made to individuals. No grants are made for medical research, research projects, filmmaking, conferences, or field trips.	(412) 234-1634
Charlotte and Donald Teast Foundation	Sustainable communities, arts, humanities, civic and public affairs, education, the environment, health, and social services.	(214) 373-6039
Ford Foundation	Interested in general/operating support, continuing support, endowment funds, program development, conferences/seminars, professorships, publication, seed money, fellowships, internships, research, technical assistance, consulting services, and program-related investments.	http://jefferson.village.virginia.edu/readings/ford.html

Multiple (continued)

Sponsoring Organization	Description / Restrictions	Contact
Max and Victoria Dreyfus Foundation	Consider support for museums, schools, educational and skill training projects, programs for youth, seniors, and the handicapped. Must be located in the U.S.	(914) 682-2008
National Fish and Wildlife Fund -Five Star Restoration Challenge	Projects must involve diverse partnerships of, ideally, five organizations that contribute funding, land, technical assistance, workforce support, and/or other in-kind services. Projects involving only research, monitoring, or planning are not eligible. No mitigation work	www.nfwf.org
National Parks Foundation	Education, training, preservation, and conservation. The grants that are available change often. See the website for current funding opportunities. Projects must connect with National Parks, be located on or next to National	www.nationalparks.org
Native Plant Conservation Initiative - National Fish and Wildlife Foundation	Through this initiative, grants of federal dollars will be provided to non-profit organizations and agencies at all levels of government to promote the conservation of native plants. There is a strong preference for "on-the-ground" projects that involve local communities and citizen volunteers in the restoration	www.nfwf.org
Public Welfare Foundation	The Public Welfare Foundation supports organizations that address human needs in disadvantaged communities, with strong emphasis on organizations that include service, advocacy and empowerment in their approach: service that remedies specific problems; advocacy that addresses those problems in a systemic way through changes in public policy; and strategies to empower	www.publicwelfare.org
Robert Shaw Charitable Foundation	Money to assist those organizations who work to enhance the educational, health and welfare, cultural, youth development, social welfare, and community development needs of the area. Only one grant per year will be	(724) 832-7578
Scaife Family Foundation	Grants awarded will support programs that strengthen families, address the health and welfare of women and children, or promote animal welfare. No event sponsorships, endowments, capital campaigns, renovations, or government agencies. No grants to individuals	www.scaife.com
The Lawrence Foundation	The mission of The Lawrence Foundation is to make a difference in the world by providing contributions and grants to organizations that are working to solve pressing educational, environmental, health, and other issues.	wwwthelawrencefoundation.org

Sponsoring Organization	Description / Restrictions	Contact

Multiple (continued)

The Max and Anna Levinson Foundation	Interested in the environment, including preservation of ecosystems and biological diversity, but also environmental justice, alternative energy, alternative agriculture, and toxics. Must have 501(c)3 status. Rarely fund organizations with budgets in excess of $500,000	www.levinsonfoundation.org
Turner Foundation	Supports activities to preserve the environment, conserve natural resources, protect wildlife, and develop and implement sound population policies. Interested in protecting rivers, lakes, wetlands, aquifers, oceans. Does not provide funding for buildings, land acquisition, endowments, start-up funds, films, books, magazines, or other specific media projects. Alternate Phone: 404-681-0172.	www.turnerfoundation.org

Natural Resources

Beneficia Foundation	Only applications for projects focusing on conservation of the environment or the arts will be considered. Beneficia has no geographic preferences, but favors requests for project support over general support and does not look favorably	www.beneficiafoundation.org
Canaan Valley Institute	Promotes the development and growth of local associations committed to improving or maintaining the natural resources of their watersheds in the Mid-	www.canaanvi.org
Charles A. and Anne Morrow Lindburgh Foundation	Grants awarded for the conservation of natural resources and water resource management. Grants are awarded to individuals for research and educational programs, not to organizations for institutional programs.	www.lindberghfoundation.org
Dana Corporation	Will consider funding air quality, environment, general, and water resources projects. Emphasis is given to areas where the corporation operates.	www.dana.com
Home Depot	Assistance is provided to non-profit organizations that direct effort toward protecting our natural systems. The grant program focuses on forestry and ecology, clean up, and recycling, green building design, and lead poisoning prevention	www.homedepot.com
W. Alton Jones Foundation, Inc.	The goals of the foundation are to build a sustainable world by developing new ways for humanity to interact responsibly with the planet's ecological systems, and build a secure world by eliminating the possibility of nuclear war by	www.wajones.com

Sponsoring Organization	Description / Restrictions	Contact

Natural Resources (continued)

Leo Model Foundation	Grants for habitat conservation, watershed conservation, and species preservation in the U.S.	(215) 546-8058
National Fish and Wildlife Fund Challenge Grants for Conservation	The foundation, in partnership with the NRCS and NACD (National Association of Conservation Districts) provides challenge grants. Primary goal of the program is to support model projects which positively engage private landowners.	www.nfwf.org
Rivers, Trails and Conservation Assistance Program	Grants to work with National Park Service to conserve land and river resources, and provides funding for various projects dealing with the conservation of these resources, including the development of trails and greenways.	(215) 597-1581
The River Restoration - NOAA	Submittal by email whenever possible. Encourage contact to discuss project prior to submitting application. Formal non-federal matches not required, but encouraged. Dam removal and fish passage. Available in northeast, Mid-Atlantic, and California	www.amrivers.org/feature/ restorationgrants.htm
The Watershed Protection and Flood Prevention Act	Plan development for natural resource concerns within a watershed area; cost sharing available to carry out plan.	(717) 782-4429
The William C. Kenney Watershed Protection Foundation	Protecting the remaining wild rivers of the west and ensuring the effectiveness of small environmental organizations.	www.kenneyfdn.org

Other

Charles Stewart Mott Foundation	The environmental program is devoted to reform of international lending and trade policies. Projects must be part of a national demonstration when out of the Flint, Michigan area.	www.mott.org
North American Fund for Environmental Cooperation	Funds community based projects in Canada, Mexico and the U.S. to enhance regional co-operation, prevent environmental and trade disputes, and to	(514) 350-4357
PA DEP Brownfields Inventory	Grantees will be paid $1,000 for each site registered into the PA Site finder. Municipalities and economic development agencies may apply for the grant by submitting an application.	(717) 783-7816
Retired and Senior Volunteer Program (RSVP)	Provides a variety of opportunities for people aged 55+ to volunteer in the management of trails, rivers, and open space. Grants can be used for staff	www.nationalservice.org/senior/index.html

Sponsoring Organization	Description / Restrictions	Contact
Plantings		
National 4-H Council	Grants are used to stimulate community tree planting and/or reforestation projects. Awarded to communities in support of on-going community planting/reforestation project or to stimulate new and creative youth-led projects. Organization must secure matching funds or in-kind contributions from other sources equal to the amount requested	www.fourhcouncil.edu
National Gardening Association	One hundred grants to be awarded to start-up programs involving children, and 300 will be awarded to established programs. Covers tools, seeds, plant materials, products, and educational resources. Grant restricted to programs involving children. There is a $10.00 administrative fee.	www.kidsgardening.com
Plant Material Centers	American Indian Liaison Resource Conservation and Community Assistance Division of USDA/NRCS. PMC select and grow plants that grow naturally and provide them to those people who wish to grow native plants.	(202) 720-8576
Remediation/Restoration		
Abandoned Mine Land Reclamation Program - Office of Surface Mining	Applications accepted anytime. Provides for the restoration of eligible lands and waters that have been mined, abandoned, or left inadequately restored. Two different grants are available. Protects land and corrects environmental damage caused by coal mining	www.osmre.gov
AMD Watershed Assessment - Bureau of Mining and Reclamation	Must be a municipality, municipal authority or incorporated non-profit. AMD projects only.	(717) 787-7007
American Canoe Association CFS Grants	For grassroots organizations to improve waterways. Cleanups, riparian corridor, and water quality monitoring projects. Very flexible as long as it is improving waterways and fish habitat. Can not be used to pay staff. However, it can be used to pay a contractor. Must use volunteer help	www.acnet.org
PA DEP - BAMR Abandoned Mine Reclamation Grants	Funds must be used for project development, design, construction, and directly related expenses. Site chosen must be located in a watershed or area with an approved rehabilitation plan . No administrative cost. Must be a municipality, municipal authority, or incorporated 501(c)3	(814) 472-1800
Bring Back the Natives - National Fish and Wildlife Foundation	Supports on-the-ground habitat restoration projects that benefit native aquatic species in their historic range.	www.nfwf.org

Remediation/Restoration (continued)

Sponsoring Organization	Description / Restrictions	Contact
Community Foundation	Projects related to abandoned mine drainage remediation, alkaline discharges, streambank preservation, removal of spoil piles, and other issues related to water quality are of interest to the foundation's board of advisors.	(814) 669-4847
EPA - Nonpoint Source Implementation Grants	Funds are provided to the state to carry out non-point source projects and programs pursuant to Section 319 of the Clean Water Act as amended by the Water Quality Act of 1987. Grants are awarded to a single agency in each state, designated by the governor. 40 percent non-federally funded match required. Only one administered to each state.	www.cfda.gov/static/p66460.htm
NOAA Fish Habitat Restoration Program	Financial assistance for community-based habitat restoration projects, to	www.habitat.noaa.gov
Office of Surface Mining Clean Stream Initiative	This grant is used to treat AMD. Design and administration is covered but the bulk of funding must go into construction. Must have funding partners. Applications available upon request. Review period takes 2.5-3 months, depending on eligibility. Must be a cooperative agreement.	(717) 782-2285
PA DEP -Stream Improvement Project Reimbursements	Provides assistance in an instance where a stream is posing a treat to structures, such as homes or businesses. Must pose threat to structure. Must be applied for by a conservation group or municipality.	(717) 783-7480
PA Fish and Boat Commission	Habitat improvement and technical assistance.	(814) 359-5158
Partnership with the U.S. Army Corps of Engineers	To foster cooperation on projects of mutual interest, such as fish and wildlife habitat restoration, non-structural flood control opportunities, wetland restoration, and endangered species protection.	www.nfwf.org
Pinellas County Environmental Foundation - National Fish and Wildlife Foundation	A partnership between Pinellas County and the National Fish and Wildlife Foundation. These two groups share the common goals of actively pursuing the protection, restoration and enhancement of fish and wildlife habitat, and developing creative and sustainable solutions to natural resource issues.	www.nfwf.org

Sponsoring Organization	Description / Restrictions	Contact
Research		
Conservation & Research Foundation at Connecticut College	The conservation and enlightened use of the earth's resources to encourage research to deepen the understanding of the intricate relationship between people and the environment. Will support higher education, individuals, museums, non-profits, and research. Unsolicited proposals are not accepted; however, letters of inquiry including a budget may be sent.	http://conservationresearch.wordpress.com/
USDA - Nutrient Science for Improved Watershed Management	Funds for integrated research in extension management of nutrients on a watershed level. Nutrients of interest are nitrogen and phosphorous. Please note that a research foundation maintained by a college or university is not eligible. These grants are for research	http://www.reeusda.gov/1700/funding/ourfund.htm
Stormwater Management		
DEP Stormwater Management Program	Watershed planning for stormwater control and implementation of programs at local levels.	(717) 772-4048
Streambank Fencing		
Ducks Unlimited - PA Stewardship Program	Provides strong incentives to landowners to create wooded stream buffers, create wider than minimum buffers, and fence cattle out of the stream. Grant is available for fencing and tree planting.	(814) 386-3458
Fish America Foundation	Grants awarded for streambank stabilization materials, instream habitat improvements, contracted heavy equipment, and stream morphology work. Match not required, but is highly recommended.	www.asafishing.org
Partners for Fish and Wildlife Program	The Partners for Fish and Wildlife Program provides technical and financial assistance to private landowners for habitat restoration on their lands. A variety of habitats can be restored to benefit Federal trust species (for example, migratory birds and fish and threatened and endangered species.) Normally the cost share is 50 percent (the Service and the landowner each pay half of the project costs), but the percentage is flexible. Services or labor can qualify for cost-sharing	(724) 938-4215
US Fish and Wildlife Service	Assists landowners in installation of high-tensile electric fence to exclude livestock from streams and wetlands. No buffer requirements.	www.fws.gov

Sponsoring Organization	Description / Restrictions	Contact
Streambank Fencing		
USDA Conservation Reserve Program	Statewide costshare program for creating stream buffers. A 40 percent practice incentive as well as a $10/acre incentive. Buffers of 35-180 feet per side of the stream. Land must have been pasture.	Regional USDA office (see Appendix P)
USDA - Environmental Quality Incentives Program	A statewide program based on environmental problems. It addresses all environmental problems on a farm. They fund BMPs.	Regional USDA office (see Appendix P)
USDA Project Grass	A co-operative effort of local farmers, conservation districts, with assistance from USDA, to improve agriculture productivity in southwestern Pennsylvania. For local contacts see information brochure on file. Contact: james.harrold@pasomerset.fsc.usda.gov	Regional USDA office (see Appendix P)
Technical Assistance		
Watershed Assistance Grants	Funding supports organizational development and capacity building for watershed partnerships with diverse membership. Match requested but not required. Non-profits, tribes, and local government only.	www.rivernetwork.org
Volunteers		
3M Foundation	3M sponsors a volunteer program called Community Action Retired Employee Service (CARES). Company favors projects that impact 3M communities. Alternate Phone: 612-737-3061	www.mmm.com
Wetlands		
U.S. Fish and Wildlife Service	For wetland Conservation projects. Must have 50 percent non-federal match in small-grant program with North American Wetlands Conservation Council.	www.fws.gov
Wetlands Reserve Program USDA Natural Resources Conservation Service	Restore and protect wetlands on private property; provide landowners with financial incentives to enhance wetlands in exchange for retiring marginal agricultural land.	Regional USDA office (see Appendix P)

APPENDIX O. USEFUL WEBSITES

Source	Data	Website
Project Area Characterisitics		
Bureau of Labor Statistics	Unemployment Rate	http://www.bls.gov/home.htm
Free Demographics	Population and Economic Data	http://www.freedemographics.com
Green Media Toolshed	Pollution in Your Community	http://www.scorecards.com
Natural Lands Trust	Conservation by Design	http://www.natlands.org
Pa. Department of Community and Economic	Zoning and Comprehensive Planning	http://www.elibrary.state.pa.us
Pa. Department of Education	School Report Cards	http://www.paprofiles.org
Smart Growth Partnership	Smart Growth	http://www.smartgrowth.org
United States Census Bureau	Population and Economic Data	http://www.census.gov
Land Resources		
Conservation Reserve Enhancement Program	Conservation Practices	http://www.creppa.org
Natural Resources Conservation Service	Soil Characteristics	http://www.nrcs.usda.gov/technical/efotg
Pa. Department of Environmental Protection	Permits, Violations	http://www.dep.state.pa.us/efacts/default.asp
Pa. Geological Survey	Environmental Geology	http://www.dcnr.state.pa.us/topogeo/pub/environmental.aspx
Pa. Geological Survey	Geological Characteristics	http://www.dcnr.state.pa.us/topogeo/index.aspx
Pa. Geological Survey	Mineral Resources	http://www.dcnr.state.pa.us/topogeo/pub/mineral.aspx
Pa. Geological Survey	Environmental Geology for Land Use Planning	http://www.dcnr.state.pa.us/topogeo/education/landuse/landuseplan.asp x
Pa. Spatial Data Access (PASDA)	Geographic Information System Data	http://www.pasda.psu.edu/
United States Environmental Protection Agency	Brownfields	http://www.epa.gov/brownfields
United States Environmental Protection Agency	Superfund	http://www.epa.gov/superfund
United States Environmental Protection Agency -	Enforcement and Compliance History	http://www.epa-echo.gov/echo/
United States Environmental Protection Agency - Envirofacts	Federal Permits, Violations, Wastesites	http://www.epa.gov/enviro/
Water Resources		
Center for Dirt & Gravel Road Studies		http://www.mri.psu.edu/centers/cdgrs/Index.html
Coldwater Heritage Partnership		http://www.coldwaterheritage.org/
Environmental Protection Agency	Surf Your Watershed	http://cfpub.epa.gov/surf/huc.cfm?huc_code=05030105
Federal Emergency Management Agency	National Flood Insurance Program	http://www.fema.gov/business/nfip/

Source	Data	Website
Water Resources (continued)		
Keystone Chapter Soil and Water Conservation Society		http://www.keystoneswcs.com/index.html
League of Women Voters	Groundwater Primer for Pa.ns	http://pa.lwv.org/wren/pubs/primer.html
Pa. American Water		http://www.amwater.com/awpr1/paaw/default.html
Pa. Department of Environmental Protection	Stormwater Management Program	http://www.depweb.state.pa.us/watershedmgmt/cwp/view.asp?a=1437&Q=518682&PM=1
Pa. Department of Environmental Protection	Water Resources Plan	http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/WaterResources/docs/WaterResourcesExecutiveSummary.htm
Pa. Department of Environmental Protection	Watershed Management	http://www.depweb.state.pa.us/watershedmgmt/site/default.asp
Pa. Department of Environmental Protection	State Water Planning Resource Center	http://www.dep.state.pa.us/dep/deputate/watermgt/wc/act220/default.ht
Pa. Fish and Boat Commission	Wild Trout Waters	http://www.fish.state.pa.us/classa98.htm
Pa. Geological Survey:	Water Resources Reports	http://www.dcnr.state.pa.us/topogeo/groundwater/gwlist.aspx
Pa. Geological Survey:	Geology of Groundwater in Pa.	http://www.dcnr.state.pa.us/topoeo/education/es3.pdf
Pa. Geological Survey:	Hydrogeologic and well-construction characteristics of the rocks of Pa.	http://www.dcnr.state.pa.us/topogeo/pub/w69recent.aspx
Pa. Geological Survey:	Pa. Groundwater Information System	http://www.dcnr.state.pa.us/topogeo/groundwater/PaGWIS/PaGWISMenu.asp?c=t
Pa. Trout	Wilderness Trout Streams	http://www.patrout.org/wildernesstroutstreams.htm
Stroud Water Research Center		http://www.stroudcenter.org/
U.S. Geological Survey	Water Resources Links	http://water.usgs.gov/lookup/getwatershed?05030105
United States Environmental Protection Agency	Water Quality Trading	http://www.epa.gov/owow/watershed/trading.htm
University of Pittsburgh	Regional Water Management Task Force	http://www.iop.pitt.edu/water/index.htm

Biological Resources

Biodiversity

Ecological Society of America	Biodiversity	http://www.esa.org/
NatureServe	Biodiversity	http://www.natureserve.org/
Pa. Biodiversity Partnership	Biodiversity	http://www.pabiodiversity.org/index.html
Pa. Biological Survey (PABS)	Biodiversity	http://alpha.dickinson.edu/prorg/pabs/index.htm
Pa. GAP Analysis Project	Biodiversity	http://www.orser.psu.edu/PAGAP/gappage.htm
Source	**Data**	**Website**

Biological Resources (continued)

Invasive Species

Aquatic Invasive Species of Pa.	Invasive Species	http://www.pserie.psu.edu/seagrant/ais/
Common Invasive Plant in Riparian Areas	Invasive Species	http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/streamreleaf/Docs/Invasive%20Plants.pdf
Invasive Plants of Pa.	Invasive Species	http://www.dcnr.state.pa.us/forestry/wildplant/invasive.aspx
Invasive Plants of the Eastern United States	Plant Invaders of Mid-Atlantic Natural Areas	http://www.invasive.org/eastern/midatlantic/intro.html
Invasive Species	Invasive Species	www.invasive.org
Invasive Species in Pa.	Invasive Species	http://www.biodiversitypartners.org/invasive/factsheets/PA.pdf
Mid-Atlantic Exotic Pest Plant Council		http://www.ma-eppc.org/
U.S. Department of Agriculture:	National Agricultural Library – Pa. Invasive Species Resources	http://www.invasivespeciesinfo.gov/unitedstates/pa.shtml

Native Plants and Landscaping

American Chestnut Foundation	Pa. Chapter	www.patacf.org
Arbor Day Foundation	Backyard Woods	http://www.arborday.org/backyardwoods/guide.cfm
Arbor Day Foundation	Tree City U.S.A.	http://www.arborday.org/programs/treeCityUSA.cfm
Carnegie Library of Pittsburgh	Books on Native Plants	http://www.carnegielibrary.org/subject/gardening/nativeplants.html
Ernst Conservation Seeds	Native Plant Sales and Landscaping Information	www.ernstseed.com
Pa. Department of Conservation and Natural Resources	Pa. Community Forests	http://www.dcnr.state.pa.us/forestry/pucfc/
Pa. Flora Database		http://www.paflora.org/Web3/Speciesbywatershed_search_form.asp
Pa. Native Plant Society	Useful Links and Information Regarding Native Plants	http://www.pawildflower.org/04_links/links.htm
Sylvania Natives	Native Plant Sales	www.sylvanianatives.com
U.S. Department of Energy	Energy Efficient Landscaping	http://www.eere.energy.gov/consumer/your_home/landscaping/index.cfm/mytopic=11910
Western Pa. Audubon Society	List of plants native to Allegheny County and surrounding region	http://www.aswp.org/files/allegheny_county_Pa._native_plants_aswp.pdf
Pa. Invertebrate Biodiversity Project		http://www.ento.psu.edu/home/frost/pinbiop/about.html
Pa. Natural Heritage Program		http://www.naturalheritage.state.pa.us/

Source	Data	Website
Biological Resources (continued)		
Wildlife		
U.S. Environmental Protection Agency	Ecoregions	http://www.epa.gov/wed/pages/ecoregions/reg3_eco.htm
Animal Rescue League of Western Pa.	Wildlife Rehabilitation	http://www.pawildlifecenter.org/about-pwc.htm
Audubon Society	Important Bird Areas	http://pa.audubon.org/iba/maps.html
Carnegie Museum of Natural History	2nd Pa. Breeding Bird Atlas	http://www.carnegiemnh.org/atlas/about_book.htm
Carnegie Museum of Natural History	Pa. Mammals	http://www.carnegiemnh.org/mammals/index.html
Field Guides		http://www.enature.com/fieldguides/index.asp
National Biological Information Infrastructure		http://www.nbii.gov/portal/server.pt
National Wildlife Federation		http://www.nwf.org/nationalwildlife/article.cfm?articleid=292&issueid=
North American Pollinator Protection Campaign		http://www.nappc.org/
Pa. Audubon		http://pa.audubon.org/
Pa. Biological Survey	Important Mammal Areas	http://www.pawildlife.org/imap.htm
Pa. Department of Conservation and Natural Resources	Endangered and Threatened Species of Pa.	http://www.dcnr.state.pa.us/wrcf/contents.aspx
Pa. Fish and Boat Commission	Pa. Fishes	http://www.fish.state.pa.us/pafish/fishhtms/chapindx.htm
Pa. Wildlife Federation		http://www.pawildlife.org/
Species Profiles		http://www.fcps.edu/StratfordLandingES/Ecology/mpages/organism_m
The Wildlife Society		http://joomla.wildlife.org/?CFID=13824013&CFTOKEN=85052420
Wildbird Recovery	Songbird Rehabilitation Center	http://www.stormpages.com/wildbird/index.html

Cultural Resources

National Parks Service	National Register of Historic Places	http://www.nps.gov/history/nr/research/nris.htm
PA Roots	Historical Information	http://www.pa-roots.com/
Pa. Department of Education	Environment and Ecology Standards	http://www.pde.state.pa.us/k12/lib/k12/envec.pdf
Pa. Fish and Boat Commission	Fishing Regulations	http://www.fish.state.pa.us/regs_fish.htm

APPENDIX P. RESOURCE GUIDE

Conservation Groups

American Chestnut Foundation
Penn State University
206 Forest Resources Lab
University Park, PA 16802
Website: www.acf.org

Armstrong County Herb and Garden Group
623 Woodlawn Road
Ford City, PA 16226
Phone: 724-763-9773

Armstrong County Hunting and Fishing Club
592 Pony Farm Road
Kittanning, PA 16201

Armstrong County Sportsmen and Conservation League
417 State Route 1031
Templeton, PA 16259
Phone: 724-545-7114
http://home.windstream.net/acscl

Armstrong Rails to Trails
P.O. Box 777
Kittanning, PA 16201
Phone: 724-543-4478
Fax: 724-543-1783
http://www.armstrongtrail.org/

Arrowhead Chapter Trout Unlimited
153 Doyle Road
Sarver, PA 16055
Phone: 724-295-2718
http://www.arrowheadtu.com/

Audubon Society of Western PA
614 Dorseyville Rd
Pittsburgh, PA 15238
Phone: 412-963-6100
Fax: 412-963-6761
Website: www.aswp.org

Cowanshannock Creek Watershed Association
P.O. Box 307
Rural Valley, PA 16249
http://www.cowanshannock.org/

Evergreen Conservancy
P.O. Box 0783
Indiana, PA 15701
Phone: 724-349-4333
www.evergreenconservancy.org

Indiana County Bow and Gun Club
P.O. Box 217
Shelocta, PA 15774
Phone: 724-726-1111

Indiana County Parks and Trails
1128 Blue Spruce Road
Indiana, PA 15701
Phone: 724-463-8636
Fax: 724-463-8740
www.indianacountyparks.org

Ken Sink Trout Unlimited
750 East Pike Road
Indiana, PA 15701
Phone: 724-459-3301
www.kensinktu.org

Kit-Han-Ne Chapter, National Wild Turkey Federation
174 Williamson Road
Templeton, PA 16259
Phone: 724-548-7746

Little Mahoning Creek Watershed Association
P.O. Box 83
Rochester Mills, PA 15771

PA Parks and Forests Foundation
105 North Front St., Suite 305
Harrisburg, PA 17101
Phone: 717-236-7644
Website: www.paparksandforests.org

Pine Creek Sportsmen Club
1169 State Route 1035
Templeton, PA 16259
Phone: 724-545-6384
http://home.windstream.net/
acscl/pinecreekhtml.htm

Conservation Groups (continued)

Pine Run Watershed Association
RD 1 Box 81-A
New Bethlehem, PA 16242

Rachel Carson Trails Conservancy
P. O. Box 35
Warrendale, PA 15086
Phone: 412-475-8881
http://www.rachelcarsontrails.org

Upper Mahoning Creek Watershed Association
McGees Mill Road
Box 1
Troutville, PA 15866

Western Pennsylvania Conservancy Watershed Conservation Program
40 West Main Street
Ridgway, PA 15853
Phone: 814-776-1114

Historical Societies

Armstrong County Historical Museum and Genealogical Society
300 North McKean Street
P.O. Box 735
Kittanning, PA 16201
Phone: 724-548-5707
http://armstrongcountyhistoricalsociety.org

Brady's Bend Historical Society
P. O. Box 451
East Brady, PA 16028
Phone: 725-526-5693
http://www.armstronghistory.org/bradysbend/index.php

Dayton Area Local History Society
Thomas Hindman Marshall House
107 North State Street
P.O. Box 447
Dayton, PA 16222
http://www.daytonpa.org/

The Historical and Genealogical Society of Indiana County
621 Wayne Avenue
Indiana, PA 15701-3072
Phone: 724-463-9600
Fax: 724-463-9899
http://www.rootsweb.ancestry.com/~paicgs/

Smicksburg Area Heritage Association
Kittanning Street
P.O. Box 89
Smicksburg, PA 16256
Phone: 814-257-8890

Regional Planning Commissions

North Central Regional Planning and Development Commission (Jefferson County)
651 Montmorenci Road
Ridgway, PA 15853
Phone: 814-773-3162
http://web2.ncentral.com/ncentral/index.html

Southwest Pennsylvania Commission (Indiana and Armstrong counties)
425 Sixth Avenue
Suite 2500
Pittsburgh, PA 15219
Phone: 412-391-5590
Fax: 412-391-9160
http://www.spc9.org/index.shtml

State Agencies

PA Department of Agriculture – Headquarters
2301 North Cameron Street
Harrisburg, PA 17110
Phone: 717-787-4737
www.agriculture.state.pa.us

PA Department of Agriculture – Region 4 (Armstrong & Indiana counties)
6 McIntyre Road
Gibsonia, PA 15044-9644
Phone: 724-443-1585
Fax: 724-443-8150
www.agriculture.state.pa.us

State Agencies (continued)

PA Department of Agriculture – Region 1 (Jefferson County)
13410 Dunham Road
Meadville, PA 16335-8346
Phone: 814-332-6890
Fax: 814-333-1431
www.agriculture.state.pa.us

PA Department of Conservation and Natural Resources – Headquarters
Rachel Carson State Office Building
P.O. Box 8767
400 Market Street
Harrisburg, PA 17105-8767
Phone: 717-787-2869
www.dcnr.state.pa.us

PA Department of Conservation and Natural Resources – Northwest Region (Jefferson County)
230 Chestnut Street
Meadville, PA 16335
Phone: 814-332-6190
www.dcnr.state.pa.us

PA Department of Conservation and Natural Resources – Southwest Region (Armstrong & Indiana counties)
1405 State Office Building
300 Liberty Avenue
Pittsburgh, PA 15222-1210
Phone: 412-880-0486
www.dcnr.state.pa.us

PA Department of Environmental Protection – Headquarters
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101
Phone: 717-783-2300
www.dep.state.pa.us

PA Department of Environmental Protection – Southwest Region (Armstrong, Indiana, & Jefferson counties)
400 Waterfront Drive
Pittsburgh, PA 15222
Phone: 412-442-4000
www.dep.state.pa.us

PA Department of Transportation
Penn DOT – Headquarters
Keystone Building
400 North Street
Harrisburg, PA 17120
Phone: 717-787-2838
www.dot.state.pa.us

PA Department of Transportation – Region 10-0 Office
2550 Oakland Avenue
Indiana, PA 15701
Phone: 724-357-2800
www.dot.state.pa.us

PA Fish and Boat Commission – Headquarters
1601 Elmerton Avenue
P.O. Box 67000
Harrisburg, PA 17106-7000
Phone: 717-705-7800
www.fish.state.pa.us

PA Fish and Boat Commission – Northcentral Region (Jefferson County) P.O. Box 5306
Pleasant Gap, PA 16823
Law Enforcement
Phone: 814-359-5250
Fax: 814-359-5254

PA Fish and Boat Commission – Northcentral Region (continued) Outreach & Education
Phone: 814-359-5193
Fax: 814-359-5153
www.fish.state.pa.us

PA Fish and Boat Commission – Southwest Region (Indiana & Armstrong counties)
236 Lake Road
Somerset, PA 15501
Law Enforcement
Phone: 814-445-8974
Fax: 814-445-3497
Outreach & Education
Phone: 814-443-9841
Fax: 814-445-3497
www.fish.state.pa.us

State Agencies (continued)

PA Game Commission – Headquarters
2001 Elmerton Avenue
Harrisburg, PA 17110-9797
Phone: 717-787-4250
www.pgc.state.pa.us

PA Game Commission – Northwest Region (Jefferson County)
P.O. Box 31
Franklin, PA 16323
Phone: 814-432-3188
www.pgc.state.pa.us

PA Game Commission – Southwest Region (Armstrong & Indiana counties)
4820 Route 711
Bolivar, PA 15923
Phone: 724-238-9523
www.pgc.state.pa.us

PA Geological Survey
400 Waterfront Drive
Pittsburgh, PA 15222
Phone: 412–442–4235
www.dcnr.state.pa.us/topogeo/index.aspx

PA Governor – Main Office
225 Main Capitol Building
Harrisburg, Pennsylvania 17120
Phone: 717-787-2500
Fax: 717-772-8284

PA Governor – Northwest Office (Jefferson County)
100 State Street, Suite 202
Erie, PA 16507
Phone: 814-878-5719
Fax: 814-455-3709
www.governor.state.pa.us

PA Governor – Southwest Office (Armstrong & Indiana counties)
14th Floor, State Office Bldg.
300 Liberty Avenue
Pittsburgh, PA 15222
Phone: 412-565-5700
Fax: 412-565-2445
www.governor.state.pa.us

PA State Conservation Commission
2301 North Cameron Street
Harrisburg, PA 17110
Phone: 717-787-8821
Fax: 717-705-3778
Website: www.pascc.state.pa.us

State Legislators

(Legislators in office 2010; see General Assembly website: www.legis.state.pa.us for current information)

House of Representatives – District 60
Hon. Jeffrey P. Pyle (2010)
289 Route 85 Highway
Home, PA 15747
Phone: 724-397-2961
Fax: 724-397-2964
http://www.legis.state.pa.us

House of Representatives – District 63
Hon. Donna Oberlander (2010)
373 State Route 1042, Suite A
Numine, PA 16244
Phone: 724-783-6166
Fax: 724-783-6177
http://www.legis.state.pa.us

House of Representatives – District 66
Hon. Samuel H. Smith
109 Indiana Street, Suite 3
Punxsutawney, PA 15767
Phone: 814-938-4225
Fax: 814-938-1950
http://www.legis.state.pa.us

State Senate – District 41
Hon. Donald C. White
618 Philadelphia Street
Indiana, PA 15701
Phone: 724-357-0151
http://www.legis.state.pa.us

Federal Agencies

U.S. Army Corps of Engineers – Headquarters
441 G. Street, NW
Washington, DC 20314-1000
Phone: 202-761-0011
www.usace.army.mil

Federal Agencies (continued)

U.S. Army Corps of Engineers – Pittsburgh District
2200 William S. Moorhead Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222-4186
Phone: 412-395-7500
Fax: 412-644-2811
http://www.lrp.usace.army.mil/

U.S. Army Corps of Engineers – Mahoning Creek Lake
145 Dam Site Road
RR1, Box 229
New Bethlehem, PA 16242
Phone: 814-257-8811

U.S. Department of Agriculture (USDA) – Headquarters
1400 Independence Ave., S.W.
Washington, DC 20250
Phone: 202-720-2791
www.usda.gov

USDA Animal and Plant Health Inspection Service (APHIS) – Pennsylvania Wildlife Services
P.O. Box 60827
Harrisburg, PA 17106
Phone: 717-236-9451
Fax: 717-236-9454
www.aphis.usda.gov

USDA Farm Service Agency
Pennsylvania State Farm Service Agency
1 Credit Union Place
Harrisburg, PA 17110
Phone: 717-237-2117
www.fsa.usda.gov

USDA Farm Service Agency
Armstrong County Farm Service Agency
Armsdale Administrative Building
124 Armsdale Road, Suite B2
Kittanning, PA 16201
Phone: 724-545-1022
Fax: 724-545-9012
www.fsa.usda.gov

USDA Farm Service Agency
Indiana County Farm Service Agency
1432 Route 286 Highway East
Indiana, PA 15701-1467
Phone: 724-463-8547
Fax: 724-463-1939
www.fsa.usda.gov

USDA Farm Service Agency
Clearfield County Farm Service Agency
(serving Jefferson County)
478 Jeffers Street, Building 3
Dubois, PA 15801-2438
Phone: 814-375-1297
Fax: 814-375-2435
www.fsa.usda.gov

USDA Natural Resources Conservation Service (NRCS) – Pennsylvania State Office
One Credit Union Place, Suite 340
Harrisburg, PA 17110
Phone: 717-237-2100
Fax: 717-237-2238
www.pa.nrcs.usda.gov

USDA-NRCS Kittanning Field Office
(Armstrong County)
Armsdale Administrative Building
124 Armsdale Road, Suite 3
Kittanning, PA 16201
Phone: 724-545-1022 ext. 3
Fax: 724-545-9012
www.pa.nrcs.usda.gov

USDA-NRCS Indiana Field Office
(Indiana County)
1432 Route 286 Highway East
Indiana, PA 15701-1467
Phone: 724-463-8547 ext. 3
Fax: 724-463-1939
www.pa.nrcs.usda.gov

USDA-NRCS DuBois Field Office
(Jefferson County)
478 Jeffers Street, Bldg. 3, Suite D
DuBois, PA 15801-2438
Phone: 814-375-2125 ext. 3
Fax: 814-375-2435
www.pa.nrcs.usda.gov

Federal Agencies (continued)

USDA NRCS Resource Conservation and Development Council – Penn's Corner (Armstrong & Indiana counties)
214 Donahoe Road, Suite C
Greensburg, PA 15601
Phone: 724-834-9063 ext. 116
www.parcd.org

USDA NRCS Resource Conservation and Development Council – Headwaters (Jefferson County)
478 Jeffers Street, Bldg. 3, Suite D
DuBois, PA 15801
Phone: 814-375-1372 ext. 4
www.headwaterspa.org

USDA-NRCS State Soil Survey Office
USDA-NRCS
Suite 340
One Credit Union Place
Harrisburg, PA 17110-2993
Edgar A. White, Jr., State Soil Scientist
Phone: 717-237-2207
http://soils.usda.gov/

USDA Rural Development
Butler Area Office (Armstrong & Indiana counties)
625 Evans City Road, Suite 101
Butler, PA 16001-8704
Phone: 724-482-4800 ext. 4
Fax: 724-482-9033
www.rurdev.usda.gov/pa

USDA Rural Development
Crawford Area Office (Jefferson County)
14699 N. Main Street, Extension
Meadville, PA 16335-9441
Phone: 814-336-6155 ext. 4
Fax: 814-337-0294
www.rurdev.usde.gov/pa

U.S. Department of Energy
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street
P.O. Box 3265
Harrisburg, PA 17105
www.puc.state.pa.us

U.S. Department of Energy
National Energy Technology Laboratory
Pittsburgh Research Center
626 Cochrans Mill Road, P.O. Box 10940
Pittsburgh, PA 15236
Phone: 412-386-6569
Fax: 412-386-5917
www.netl.doe.gov

U.S. Environmental Protection Agency – Headquarters
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
Phone: 202-272-0167
www.epa.gov

U.S. Environmental Protection Agency – Region 3 (DC, DE, MD, PA, VA, WV)
1650 Arch Street
Philadelphia, PA 19103
Phone: 215-814-5000
Fax: 215-814-5103
http://www.epa.gov/region03/

U.S. Fish and Wildlife Service
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, PA 16801
Phone: 814-234-4090
Fax: 814-234-0748
www.fws.gov

Armstrong County

Armstrong County Commissioners
450 Market Street
Kittanning, PA 16201
Phone: 724-548-3215
http://www.co.armstrong.pa.us/departments/elected-officials/commissioners

Armstrong County Conservation District
124 Armsdale Road
Kittanning, PA 16201
Phone: 724-548-3425
http://www.armstrongcd.org/

Armstrong County (continued)

Armstrong County Cooperative Extension
124 Armsdale Road, Suite 112
Armsdale Administration Bldg
Kittanning, PA 16201
Phone: 724-548-3447
http://armstrong.extension.psu.edu/

Armstrong County Planning and Development
402 Market Street
Kittanning, PA 16201
Phone: 724-548-3223
http://www.co.armstrong.pa.us/

Boggs Township
292 Mountain Trails Road
Templeton, PA 16259
Phone: 724-868-2546

Cowanshannock Township
P. O. Box 137
Numine, PA 16244
Phone: 724-783-6257

Dayton Borough
P. O. Box 396
Dayton, PA 16222
Phone: 814-257-9826

Madison Township
107 Lawsonham Road
Templeton, PA 16259
Phone: 724-868-2722

Mahoning Township
987 State Route 1025
New Bethlehem, PA 16242
Phone: 814-275-3059

Pine Township
P. O. Box 311
Templeton, PA 16259
Phone: 724-868-2922

Rayburn Township
142 McGregor Road
Kittanning, PA 16201
Phone: 724-548-7718

Redbank Township
409 Sugar Valley Road
Mayport, PA 16240
Phone: 814-365-5474

Valley Township
11521 State Route 85
Kittanning, PA 16201
Phone: 724-548-7046

Wayne Township
372 Boat Launch Road
Dayton, PA 16222
Phone: 814-257-8680

Indiana County

Banks Township
1870 Hemlock Lake Road
Rossiter, PA 15772-6004
Phone: 814-427-2112

Canoe Township
P. O. Box 355
Rossiter, PA 15772
Phone: 814-938-6383

East Mahoning Township
P. O. Box 164
Marion Center, PA 15759
Phone: 724-397-2260

Grant Township
100 East Run Road
Marion Center, PA 15759
Phone: 724-254-1530

Green Township
1492 Route 240 Highway
Commodore, PA 15729
Phone: 724-425-9355

Indiana County Commissioners
825 Philadelphia Street
Indiana, PA 15701
Phone: 724-465-3805
www.countyofindiana.org/commissioners

Indiana County (continued)

Indiana County Conservation District
625 Kolter Drive, Suite 8
Indiana, PA 15701-3571
Phone: 724-471-4751
Fax: 724-289-1506
http://iccdpa.org/

Indiana County Cooperative Extension
827 Water Street
Indiana, Pa 15701
Phone: 724-465-3880
http://indiana.extension.psu.edu/

Indiana County Office of Planning and Development
801 Water Street
Indiana, PA 15701
Phone: 724-465-3870
http://www.icopd.com/dev/index.php

Montgomery Township
1220 Cush Creek Road
Cherry Tree, PA 15724
Phone: 814-743-6513

North Mahoning Township
673 Mottarn Road
Rochester Mills, PA 15771
Phone: 724-286-9681

Smicksburg Borough
P. O. Box 90
Smicksburg, PA 16256
Phone: 814-257-8890

South Mahoning Township
244 Rossmoyne Road
Home, PA 15747
Phone: 724-397-9090

West Mahoning Township
P. O. Box 88
Smicksburg, PA 16256
Phone: 814-375-1095

Jefferson County

Jefferson County Commissioners
155 Main Street, County Courthouse Annex
Brookville, PA 15825
Phone: 814-849-1653

Jefferson County Conservation District
1514 Route 28
Brookville, PA 15825
Phone: 814-849-7463
www.jeffersonconservation.com/index.html

Jefferson County Cooperative Extension
Parker P Blood Block
180 Main Street
Brookville, PA 15825
Phone: 814-849-7361
http://jefferson.extension.psu.edu/

Jefferson County Department of Development
155 Main Street, 2nd Floor
Brookville, PA 15825
Phone: 814-849-3047
www.jeffersoncountypa.com/default.htm

Perry Township
P. O. Box 50
Hamilton, PA 15744
Phone: 814-938-2480

Porter Township
774 Nye Branch Road
Punxsutawney, PA 15767
Phone: 814-938-3273

Ringgold Township
2253 Ringgold Timblin Road
Ringgold, PA 15770
Phone: 814-365-5109

Timblin Borough
Timblin Borough Box M
Timblin, PA 15778
Phone: 814-256-3838

Tourism Affiliates

Armstrong County Historical Museum and Genealogical Society
300 North McKean Street
P.O. Box 735
Kittanning, PA 16201
Phone: 724-548-5707
www.armstrongcountyhistoricalsociety.org/

Armstrong County Tourist Bureau
125 Market Street
Kittanning, PA 16201
Phone: 724-543-4003
http://www.armstrongcounty.com/

Indiana County Tourist Bureau
2334 Oakland Ave, Suite 7
Indiana, PA 15701
Phone: 724-463-7505
Fax: 724-465-3819
http://www.visitindianacountypa.org/

PA Great Outdoors Visitors Bureau (Jefferson County)
175 Main Street
Brookville, PA 15825
Phone: 1-800-348-9393
http://www.visitpago.com/

Schools

Canoe-Grant Elementary School
4590 Richmond Road
Rochester Mills, PA 15771
Phone: 724-286-9615
http://mcasd.net/elem/index.html

Dayton Elementary
175 East Grant Avenue
Dayton, PA 16222
Phone: 814-257-8151
http://www.asd.k12.pa.us

Longview Elementary School
19466 Rt 119 Hwy North
Punxsutawney, PA 15767
Phone: 814-938-5118
http://www.punxsy.k12.pa.us

Mapleview Elementary School
9329 Route 536
Punxsutawney, PA 15767
Phone: 814-938-5119
http://www.punxsy.k12.pa.us

Marion Center High School
22820 Route 403 Hwy North
P.O. Box 209
Marion Center, PA 15759
Phone: 724-397-5551
http://mcasd.net/hs/index.html

Marion Center Middle School
22820 Route 403 Hwy North
P.O. Box 199
Marion Center, PA 15759
Phone: 724-397-5551
http://mcasd.net/ms/index.html

Punxsutawney High School
500 North Findley St
Punxsutawney, PA 15767
Phone: 814-938-5151
http://www.punxsy.k12.pa.us

Punxsutawney Middle School
465 Beyer Ave
Punxsutawney, PA 15757
Phone: 814-938-5151
http://www.punxsy.k12.pa.us

Rayne Elementary School
2535 Route 119 Hwy North
Home, PA 15747
Phone: 724-463-8615
http://mcasd.net/elem/index.html

Shannock Valley Elementary
Box 325
Rural Valley, PA 16249
Phone: 724-783-6991
http://www.asd.k12.pa.us

West Shamokin High School
178 Wolf Drive
Rural Valley, PA 16249
Phone: 724-783-7040
Fax: 724-783-6747
http://www.asd.k12.pa.us

Media/Outreach

Indiana Gazette
899 Water Street
Indiana, PA 15701
Phone/switchboard: 724-465-5555
Toll free: 800-262-3077
http://indianagazette.com/

Smicksburg/Dayton Advertising Co-op
P.O. Box 86
Smicksburg, PA 16256

APPENDIX Q. SUMMARY OF HYDRAULIC FRACTURE SOLUTIONS-MARCELLUS SHALE

TABLE 1

SUMMARY OF HYDRAULIC FRACTURE SOLUTIONS - MARCELLUS SHALE

Product Vendor	Application Sequence	Product Name	Hazardous Components (From MSDS)	Hazardous Ingredient Weight %	Pounds of hazardous ingredient / pound water	Gallons of Frac solution per stage	Concentration in Frac Solution (ppm)	EPA Risk Based Concentration - Residential Tapwater (ppm)
BJS	1	HCl	Hydrochloric Acid	8%	0.015834	2000	83.68	
		Cl-14	Propargyl Alcohol	5%	0.00004327	2000	0.23	0.073
			Methanol	68%	0.000588472	2000	3.11	18
		Ferrotrol 300L	Citric Acid	70%	0.0035	2000	18.50	
	2	XLW-32	Methanol	90%	0.001593	42000	176.79	18
			Boric Oxide	20%	0.000354	42000	39.29	
		GW-3LDF	Petroleum Distallate Blend	60%	0.00321	42000	356.24	
			Polysaccharide	60%	0.00321	42000	356.24	
		GBW-20C	no hazardous ingredients	0%	0	42000	0.00	
		BF-7L	Potassium Carbonate	100%	0.0005725	42000	63.53	
		GBW-15L	Sodium Chloride	14%	0.000154	42000	17.09	
	3	FRW-14	Hydrotreated light distillate	40%	0.000424	334000	374.20	
			Ethoxylated Alcohol	5%	0.000053	334000	46.77	
		Alpha 125	Glutaraldehyde	30%	0.0000798	334000	70.43	
Fractech	1	HCL	Hydrochloric Acid	8%	0.0168896	2000	89.26	
		40 HTL	Methanol	10%	0.0002	2000	1.06	18
		NE100	Methanol	5%	0.0000485	2000	0.26	18
		FE100L	no hazardous ingredients	0%	0	2000	0.00	
	2	HVG-04	no hazardous ingredients	0%	0	42000	0.00	
		B9	Potassium Hydroxide	20%	0.000206	42000	22.86	
		BXL-2	Potassium Hydroxide	10%	0.000117	42000	12.98	

SUMMARY OF HYDRAULIC FRACTURE SOLUTIONS - MARCELLUS SHALE

Product Vendor	Application Sequence	Product Name	Hazardous Components (From MSDS)	Hazardous Ingredient Weight %	Pounds of hazardous ingredient / pound water	Gallons of Frac solution per stage	Concentration in Frac Solution (ppm)	EPA Risk Based Concentration - Residential Tapwater (ppm)
	3	ICI-3240	Dazomet	24%	0.0000696	334000	61.42	
			Sodium Hydroxide	4%	0.0000116	334000	10.24	
		ICI-150	Glutaraldehyde	50%	0.00014125	334000	124.66	
			Methanol	5%	0.000014125	334000	12.47	18
		FRW-50	Diesel (use discontinued)	20%	0.000194	334000	171.21	
		FRW-25	no hazardous ingredients (used in place of FRW-50)	0%	0	334000	0.00	
Universal	1	Iron Check	no hazardous ingredients	0%	0	2000	0.00	
		HCl	Hydrochloric Acid	8%	0.0168896	2000	89.26	
	2	Unilink 8.5	Ethylene Glycol	40%	0.00111	42000	123.19	73
			Boric Acid	7%	0.00019425	42000	21.56	
		GBL-8x	n/a	0%	0	42000	0.00	
		Unigel 19XL	no hazardous ingredients (guar gum)	0%	0	42000	0.00	
	3	FRP-21	no hazardous ingredients	0%	0	334000	0.00	
		Bioclear 200	2,2-Dibromo-3-Nitrilopropionamide	20%	0.0000625	334000	55.16	
			Polyethylene Glycol Mixture	60%	0.0001875	334000	165.48	
Halliburton	1	HAI-OS	Methanol	60%	0.001068	2000	5.64	18
			Propargyl Alcohol	10%	0.000178	2000	0.94	0.073
		FE-1A	Acetic Acid	60%	0.001235042	2000	6.53	
			Acetic Anhydride	100%	0.002184454	2000	11.54	
		HCl	Hydrochloric Acid	8%	0.0168896	2000	89.26	
	2	K-34	Sodium Bicarbonate	100%	0.001271735	42000	141.13	
		BC 140	Monoethanolamine	30%	0.000523988	42000	58.15	
			Ethylene Glycol	30%	0.000566485	42000	62.87	73
			Boric Acid	30%	0.000608982	42000	67.58	
		Delta Frac 140	no hazardous ingredients	0%	0	42000	0.00	

SUMMARY OF HYDRAULIC FRACTURE SOLUTIONS - MARCELLUS SHALE								
Product Vendor	Application Sequence	Product Name	Hazardous Components (From MSDS)	Hazardous Ingredient Weight %	Pounds of hazardous ingredient / pound water	Gallons of Frac solution per stage	Concentration in Frac Solution (ppm)	EPA Risk Based Concentration - Residential Tapwater (ppm)
	3	FR-46	Ammonium Bisulfate	30%	0.000375	334000	330.95	
		Aldacide G	Glutaraldehyde	30%	0.0000798	334000	70.43	
Superior	1	AI-2	Glycol Ether (ethylene glycol monobutylether)	30%	0.000291	2000	1.54	18
			Propargyl Alcohol	30%	0.000291	2000	1.54	0.073
			Isopropyl Alcohol	30%	0.000291	2000	1.54	
			Proprietary Component	7%	0.0000679	2000	0.36	
		IC-100L	Cirtic Acid	100%	0.00154	2000	8.14	
		OB-Fe	Propylene Glycol	40%	0.000452	2000	2.39	730
			Ferrous Sulfate, Heptahydrate	30%	0.000339	2000	1.79	
		Super OW-3	Isopropyl Alcohol	40%	0.00018	2000	0.95	
			Methanol	13%	0.0000585	2000	0.31	18
		Super Pen 2000	Ethylhexanol	70%	0.000322	2000	1.70	
			Proprietary Component	30%	0.000138	2000	0.73	
		Super 100NE	Isopropyl Alcohol	30%	0.00015525	2000	0.82	
			Glycol Ethers	7%	0.00007245	2000	0.38	18
		HCl	Hydrochloric Acid	8%	0.0168896	2000	89.26	
	3	Bioclear 200	2,2-Dibromo-3-Nitrilopropionamide	20%	0.0000625	334000	55.16	
			Polyethylene Glycol Mixture	60%	0.0001875	334000	165.48	
		SAS-2	Hydrotreated Light Distillate	30%	0.000306	334000	270.06	
			Mineral Spirits	25%	0.000255	334000	225.05	
			Propylene Glycol	25%	0.000255	334000	225.05	730
			Ethoxylated Alcohols	4%	0.0000408	334000	36.01	

Source: http://www.dep.state.pa.us/dep/deputate/minres/oilgas/FractListing.pdf

Conservation Guidance for Landowners on Natural Gas Development
June 2010

Natural gas exploration and extraction activity have increased significantly across western Pennsylvania in recent years. Extraction of natural gas, much like any extractive activity, can have negative effects including serious environmental impacts. Western Pennsylvania Conservancy believes that conservation of the landscape and landowner management goals should be carefully considered prior to entering into a natural resource extraction lease agreement. Conservation features on the property that may need additional protection measures include but are not limited to the following: any water features such as streams, springs, seeps, and wetlands; steep slopes (generally those having a slope of 20% or greater); intact forests; wildlife habitat; native flora and fauna; natural vegetation and floodplain areas; recreational activities and scenic vistas.

It is important for the landowner to be aware of any potential negative impacts, as well as their rights as a landowner to control and guide any potential extractive use on their land. More specifically, in order to conserve the landscape, landowners should work with the land agent to carefully establish guidelines and develop an addendum to the lease agreement that permits recovery of this resource while at the same time promoting protection of ecologically-sensitive landscapes that include natural communities and species habitat.

Site visit

Upon request for a lease, the landowner should meet with the interested party and conduct a site visit on the property to identify potential impacts to the ecological resources on the land. This evaluation should consider:

- Conservation of natural communities, wildlife habitat, species of special concern
- Impacts to recreational opportunities and scenic vistas
- Degree of landscape fragmentation
- Potential effects upon hydrology, water quality, air and noise pollution
- Ability to significantly improve or restore degraded natural resources

The developer should use available data to locate plant and animal species of special concern (including without limitation searches or surveys the developer otherwise may be required to conduct pursuant to applicable environmental laws, or any searches or surveys conducted by a governmental entity). The site visit should occur prior to the start of seismic work. A seismic plan should be submitted to the landowner which includes a map showing all proposed seismic lines and test hole locations, as well as conservation values and features as identified in the site visit.

For Marcellus gas development, one well pad can now be used with directional drilling technology to extract natural gas from more than one square mile of shale that is located over a mile underground. Therefore, a landowner may decide to sign a lease but not allow any surface drilling or other infrastructure such as roads and pipelines on the property, but allow the gas to be extracted from another property nearby. This may result in lower payments from the developer, but it may better protect ecological resources on the property. The remainder of these conservation considerations focuses mostly on leases where drilling or other surface activities are permitted on the land owners' property.

If a significant gas source is found and a project moves forward, the developer should coordinate with the landowner as to the location of all proposed development including placement of a well or wells, access roads and pipelines and any other facility or equipment that will support the proposed operation. If the developer proceeds with extraction, the landowner should make sure the following details are addressed:

- Indicate parameters where no drilling is to occur;
- Identify maximum number of wells drilled per site;
- Require lease to include erosion and sediment control plan to be completed by developer and approved by the landowner prior to any earthmoving activity including well site clearing, well pad construction, pipeline construction and access road enhancement; and
- Require submission of a restoration and re-vegetation plan to be completed by developer and approved by landowner which identifies specific steps taken to minimize site disturbance, and addresses any alterations in the land associated with the extraction or transmission activities.

Lease Agreement

All new leases should obtain a comprehensive insurance provision, indemnification and hold harmless clause to protect the landowner against degradation of ecological resources. Leases with an insurance provision should be enforced by the landowner (i.e. both proof of insurance and the landowner listed on the policy as an additional insured). The landowner should also require a performance bond to ensure the developer meets the terms of the agreement. All activities and operations must be in accordance with the laws of the Commonwealth of Pennsylvania. The developer must obtain and follow the appropriate permit application process, and secure a performance bond to ensure parameters for drilling are met.

Specific recommendations for items to include in the addendum to the lease agreement:

Master Site Plan – The developer should submit a master site plan to the landowner which would include the following:

(a) a map or plat indicating the location of each and every well drilled or proposed for drilling;
(b) a map or plat indicating the location of each existing potable and non-potable water well;
(c) a map or plat indicating the location of each potable and non-potable water well drilled or to be drilled;
(d) a route map indicating the location of each pipeline laid or to be laid;
(e) a map or plat indicating the location of each existing road proposed for use;
(f) a map or plat indicating the location of each bridge, drain pipe or culvert pipe to be constructed;
(g) a plat, diagram and/or schematics indicating the location, design, construction of each slush pit to be constructed together with a corresponding maintenance plan for each such pit;
(h) a map or plat indicating the location of stream, creek, brook, or wetland together with the location of each proposed drilling site and proposed clearing site near each such stream, creek, brook, or wetland; and
(i) a map or plat that contains information regarding locations of plant and animal species of special concern, as well as locations of natural communities.

Erosion and Sedimentation Control Plan – This plan should include the following:
(a) existing topographic features of the site;
(b) contours, ditches and other excavations;
(c) water bars or diversion channels for surface runoff to prevent siltation;
(d) settling basins;
(e) spreading of gravel or shale on intercepting dips;
(f) installation of silt fences;
(g) stabilization of cut slopes;
(h) stabilization of highwalls; and
(i) restoration and revegetation of the property as described in a restoration and re-vegetation plan.

Wells – To reduce fragmentation and invasive plant pathways, the developer should locate wells closer to previously disturbed or developed footprint (such as landings, roads, barrow pits, pipelines and wells). Such wells should be camouflaged or screened with native plants to reduce aesthetic impacts.

Water – *Water quality and quantity should be carefully considered and monitored prior to and following the extraction activity.* The developer should not contaminate or pollute springs, brooks, streams, wetlands, vernal pools or other waters on the property. Any water well usage should be restricted to drilling processes only. Water well usage should not be used for frac, stimulation or completion processes. The developer or its contractors and subcontractors should not construct earthen dams across any stream to obtain a water supply for its operations. Developer should remove all water used in drilling and fracing processes from the property including water developed from the well. In addition, the developer must supply the landowner with a plan to address water source pollution in the event of a leak.

Well Plugging – At its own expense, developer should properly and effectively plug all wells on the leased premises before abandoning, in accordance with the regulations of the Department of Environmental Protection's Bureau of Oil and Gas Management and all applicable laws of the Commonwealth. A copy of the Certificate of Well Plugging showing the plugging procedure used and submitted to the Bureau of Oil and Gas Management should be supplied to the landowner for each well plugged and abandoned. Parameters should be established to determine acceptable production rates. If production falls below the rate and is determined to be uneconomic (i.e., not in paying quantities) to maintain and operate, then developer should (a) plug and abandon the well and (b) restore the well site and access road to the satisfaction of landowner within a specified timeframe.

At the end of production, whether or not oil or gas is produced, the developer is required to cover all costs to plug the wells (according to Section 601.210 of the Oil and Gas Act) and restore all disturbed acres. All wells no longer in use should be plugged by the operator(s).

Pipelines – Where possible, pipelines should be laid within the boundaries of existing roads or rights of way, such as existing pipelines and transmission lines. Developer should submit a route map for each pipeline to the landowner for review and approval as to location prior to the laying of any line. Developer should keep the pipeline and right-of-way in good repair and appearance.

Drilling – It is best to limit the number of wells and number of disturbed acres. It is recommended that a buffer area (e.g. 300 feet) be included for all water sources (rivers, creeks, streams, wetlands, etc.) to prohibit drilling in certain areas. Clearing on steep slopes (those greater than 20%) should also be restricted.

Pits – Developer should prevent access of wildlife to pits or excavations dug for Developer's operations by erecting and maintaining fences. Developer should have thirty (30) days from date of completion of a well to reclaim the pit. Pits must be lined with an impervious liner, not merely clay. When drilling is complete, pit liner and its contents should be properly disposed offsite. Developer should ensure that each slush pit will consist of two (2) compartments; one to contain fluids materials from the drilling operations and the second to contain surface runoff from the drilling site. Appropriate buffers should be established for pits as well.

Roads – All road locations and grades must be identified in the Master Site Plan. The landowner should limit the size of all new roads (e.g., determine an appropriate road width to be 20 feet). The location of drilling operations should be close to existing roads to prevent further fragmentation of the property. Developer should construct access roads to drilling sites along existing pipeline rights-of-way, provided that a ten percent

(10%) grade can be maintained, as described in the Erosion and Sedimentation Control Plan. Road drainage structures should conform to the Environmental Sensitive Maintenance Principles of Penn State's Center for Dirt and Gravel Roads program.

Erosion Sedimentation and Grading – Topsoil disturbed during construction shall be stored on uphill side of disturbed area, saved and put back during reclamation. Developer should regrade and refill to contour any areas of land cleared for construction and infrastructure placement within ten (10) working days following disturbance and should reseed according to the restoration and revegetation plan. Temporary seedling should be required, in addition to permanent revegetation. Gravel or shale should be spread on intercepting dips that become subject to erosion. Further, the developer should, at its own expense, secure, plant and maintain native species (consisting of grasses and/or trees or shrub seedlings) on all well sites, retired access roads, pipeline rights-of-way and other cleared areas.

Use of Department of Conservation and Natural Resources Gas Lease – The landowner may need to enter into a lease agreement that has more stringent terms than the standard lease agreement provided by the developer. WPC recommends using DCNR's 2007 gas lease as a guiding document.

Nothing in this document constitutes legal advice. Western Pennsylvania Conservancy recommends that any landowner considering entering into a natural gas lease agreement should obtain the advice of an attorney and a consultant specializing in natural gas leasing. In addition, many resources are available online that can provide basic information and education.

Penn State College of Agricultural Sciences Cooperative Extension:
http://extension.psu.edu/naturalgas/publications

DEP, Bureau of Oil and Gas Management, Marcellus Shale
http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/marcellus.htm

DEP, fact sheet *Landowners and Oil and Gas Leases in Pennsylvania*
http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-44185/5500-FS-DEP2834.pdf

DCNR, Marcellus Shale research in Pennsylvania
http://www.dcnr.state.pa.us/topogeo/oilandgas/marcellus.aspx