Pennsylvania's Watershed Regions

Great Lakes

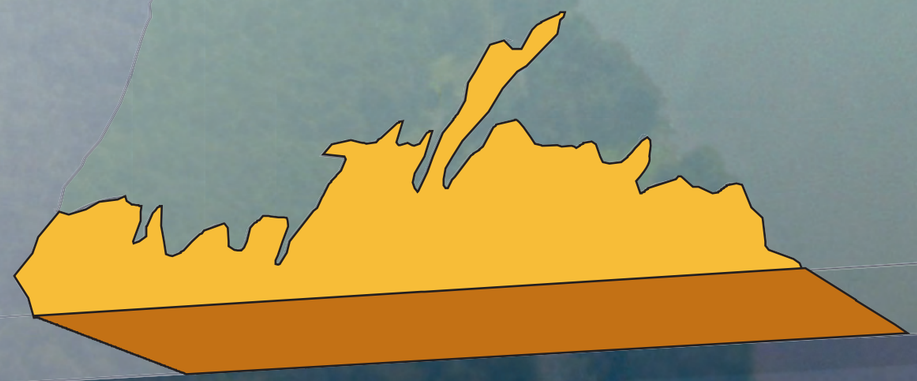
Upper/Middle
Susquehanna

Ohio

Lower
Susquehanna

Delaware

Potomac



Introduction

Marsh Creek covered bridge, Adams County. Photo courtesy of C. Dalpra.

Each of Pennsylvania's major drainage basins has an array of individual characteristics that distinguish it from other regions of the state.These include diverse geographic and geologic features as well as major differences in historical settlement, economic and land use patterns. To reflect these variations, six regional water resources committees were created by the Water Resources Planning Act to ensure that individual regional priorities were developed and highlighted in the plan. The priorities and actions of the Potomac Regional Water Resources Committee are significant and influence not only local streams and rivers, but also the Chesapeake Bay.

The committee members represent a broad range of interests in their region – business and industry, agriculture, local government and the environment. Each committee has identified and given consideration to a broad set of water resources issues and concerns specific to their region. The water resource management goals and objectives of the Potomac Regional Water Resources Committee include:

- Address land use planning by developing a strategy that allows growth and development while maintaining adequate water quantity and quality
- Develop land use programs that protect water quality and quantity and preserve the ecological integrity of groundwater and surface water, including springs, streams, lakes and wetlands
- Support a statewide inventory of waters to identify sources and quantity of quality water to meet human and ecological needs and encourage local municipal governments to do an inventory
- Develop, maintain and protect recreational water use and assess the in-stream and groundwater flow needs to support recreational water use
- Protect existing commercial agribusiness and industrial uses of water and allow opportunities for growth
- Protect stream habitat and groundwater recharge areas from the loss of native trees, shrubs and other vegetation along stream banks
- Increase compliance with existing regulations that minimize pollution and reduce erosion of stream banks and channels, and prevent impairment of groundwater recharge areas
- Promote nitrogen, phosphorus, etc. removal technologies and strategies at all effluent discharge points
- Minimize nutrient loading in water resources caused by nonpoint source pollution, such as septage applications and improper agricultural practices on agricultural fields
- Develop educational programs for the general public and elected officials to present the tools and information that support informed decisions about policies and actions for water resource and land use management
- Implement programs to train local elected and appointed officials on the use of comprehensive water conservation plans as a means to ensure adequate water resources for present and future needs
- Establish regulatory authority in the Potomac River Basin for reviewing and approving significant water withdrawals, i.e. 10,000 gallons per day (gpd) (similar to SRBC and DRBC requirements), including groundwater

The regional committee members will continue to work with DEP and other partners to make recommendations for attaining these goals.

The Potomac Region at a Glance

The Potomac River—nicknamed the "Nation's River" because it flows through the nation's capital—meanders 383 miles from Fairfax Stone, W. Va. to Point Lookout, Md. where it contributes the second largest amount of freshwater to the Chesapeake Bay. Although it comes within one or two miles of the southern Pennsylvania border, not one drop of water in the Potomac River flows through Pennsylvania. Pennsylvania is important to the watershed because many headwater streams that contribute to the Potomac or the Monocacy River form in one of seven counties in southcentral Pennsylvania.

The Potomac River's entire basin encompasses 14,670 square miles over four states—Pennsylvania, Virginia, Maryland and West Virginia—and the District of Columbia. The 1,584 square miles of Somerset, Bedford, Fulton, Franklin, Adams, Cumberland and Perry counties that drain into the Potomac River is only 3.5 percent of the state's land area, but accounts for 11 percent of the total basin. Approximately 5.35 million people live in the Potomac Region, 180,000 of them in Pennsylvania.

Potomac River Facts

European spelling of Native American name meaning "place where people trade" or "the place to which tribute is brought."

Basin Area:
- Total – 14,670 square miles
- Pennsylvania – 1,584 square miles

Headwaters: Fairfax Stone, W. Va.
Mouth: Chesapeake Bay, at Point Lookout, Md.
Potomac River Length:
- Total – 383 miles
- Pennsylvania – 0 miles

Introduction, continued

Major Tributaries (in Pennsylvania)

Wills Creek
Evitts Creek
Town Creek
Sideling Hill Creek
Tonoloway Creek
Licking Creek
Conococheague Creek
Antietam Creek
Toms Creek
Marsh Creek
Rock Creek

Populations Throughout the Region (2000 Census Estimate)

Chambersburg	17,862	McConnellsburg	1,073
Gettysburg	7,490	Hyndman	1,005
Littlestown	3,947	Wellersburg	176
Mercersburg	1,540		

Population and Future Projections

The maps on pages 238 and 239 show populations in the year 2000 and population projections for 2000 through 2030 for the Potomac Region. As illustrated in the Population 2000 Map, the western half of the region is rural while the more populated areas include Chambersburg, Gettysburg, Littlestown and the areas surrounding these communities. The highest populations of the region are found along Interstate 81, which is used as a corridor to Pennsylvania's capital region and Maryland, and along State Routes 30 and 15, which provide commuters with connections between the cities and towns of the region as well as those outside the region.

Generally, the populations in the eastern half of the region are expected to increase, with major population growth in Adams County. Population expansion in the areas around Adams and Franklin counties is occurring as individuals are choosing to leave the more populous areas of Maryland in search of quieter, less crowded neighborhoods. Adams County and Franklin County are serviced by several major highways, such as Interstate 81 and State Route 15. These highways provide easy access as well as quick commutes to the populated areas where many individuals may continue to work after relocating. Predictions for the western half of the region are that the population will either remain constant or slightly decrease with a noticeable population decline in the area along the Bedford/Somerset County border.

Watersheds in the Potomac Region

"Watershed" is a generic term used to identify an area of land that drains to a particular waterbody. Watersheds can vary in size, from the acreage that drains to a brook to a major river. For purposes of this atlas, watersheds are classified by a nested hierarchy based on landscape scale. A watershed is the land area that drains into a stream or river (or in some cases, two streams) and is the smallest in size in the classification hierarchy. Pennsylvania's original State Water Plan divided the commonwealth into 104 watersheds, ranging in size from approximately 100 to 1,000 square miles, named for the major streams of the watershed. A subbasin includes all of the watersheds that drain into a particular reach of a larger watercourse. A basin encompasses all of the subbasins that drain into a major waterway.

In Pennsylvania, there are six basins—Erie, Genesee, Ohio, Susquehanna, Potomac and Delaware—each with a different outlet. The Erie Basin empties into Lake Erie, the Genesee Basin contributes to Lake Ontario, the Ohio Basin drains into the Mississippi River, the Susquehanna Basin and Potomac Basin drain into the Chesapeake Bay, and the Delaware Basin drains into the Delaware Bay.

Did you know?

Although the Mason-Dixon Line is often thought of as the divider between Northern and Southern states during the Civil War, the line was actually created before the war, in 1763, when Charles Mason and Jeremiah Dixon were hired to settle a land dispute between the Calvert family of Maryland and the Penn family of Pennsylvania.

Monument on the site of Buchanan's Birthplace, Buchanan State Park, Franklin County.

Pennsylvania Memorial, Gettysburg National Military Park, Adams County.

Snowboarders at Whitetail Mountain Resort, Franklin County. Photo courtesy of Matt See.

Extreme Weather Conditions: Flash Floods

While most of the state of Pennsylvania is prone to flooding, a 1996 storm that hit Gettysburg exemplifies the term "flash flood."

Flash flood events generally occur when slow moving storms cause flooding in a particular area to the point that water rises at an extreme rate. Particularly, flash floods appear quickly with little notice, and heavy rainfall is concentrated in an area for a significant period of time.

On June 19, 1996, major flooding occurred in the Potomac Region. Rain poured down at such a rate that Gettysburg received nearly 11 inches of rainfall in just three hours. Nearly four feet of water overflowed from creeks and streams into the town, flooding businesses and homes. All major roads in the area were closed and more than 60 people were evacuated, including many water rescues. The Gettysburg mayor declared a disaster emergency after assessing the severity of the storm and its affect on the town. Damages from the storm surpassed $16 million in just Adams County.

A frontal event triggered unusually fierce storm clouds and significant rainfall, making the 1996 flood of Gettysburg a model flash flood in history.

A particular tract of land can belong in multiple watersheds, depending on the scale of the landscape. For example, in Fulton County, Barnetts Run is a tributary to Tonoloway Creek, which is a tributary to the Potomac River. The land that drains into Barnetts Run is part of the Licking – Tonoloway Creeks Watershed, which, in turn is part of the Potomac Subbasin/Basin. The Water Planning Area Map on the next page depicts the four watersheds found in the only Pennsylvania subbasin of the Potomac Basin.

Points of Interest in the Region

- Gettysburg National Military Park – Gettysburg, Adams County
- Eisenhower National Historic Site – Gettysburg, Adams County
- Natural and Wild Areas surrounding Buchanan State Forest (Sweet Root Natural Area, Pine Ridge Natural Area, Martin Hill Wild Area) – Bedford County
- US 30/Lincoln Highway Heritage Corridor, the first transcontinental highway in the U.S. – Fulton County
- Buchanan's Birthplace State Park – Cove Gap, Franklin County
- John McFadden Model Railroad Museum – Mercersburg, Franklin County

Land Cover (Percent of Watershed)

Forest	54.6%
Agriculture (crop/pasture)	35.8%
Developed	8.3%
Wetlands	<1%
Open Water	<1%
Barren (rock/sand/clay)	<1%

Regional Climate

The Potomac Basin experiences a moderate climate pattern, marked by cold winters and warm, humid summers. A majority of the region has a mean minimum temperature of 18 to 19 degrees Fahrenheit and a mean maximum temperature of 82 to 85 degrees Fahrenheit. Temperature regimes remain relatively constant throughout the region with the Somerset and Bedford County areas exhibiting the greatest variance between minimum and maximum average annual temperatures. Precipitation in the region is normally adequate to plentiful throughout the year. The region receives half of its precipitation during the growing season (with May being the wettest month). Winter precipitation consists of a mix of snow, freezing rain and rain. Average annual precipitation for the Potomac Region ranges between 34 and 49 inches—the eastern half of the region generally receives more precipitation than the western half. The area surrounding the Franklin/Adams County border receives the greatest amounts of precipitation, averaging between 42-43 inches up to 46-49 inches of precipitation per year.

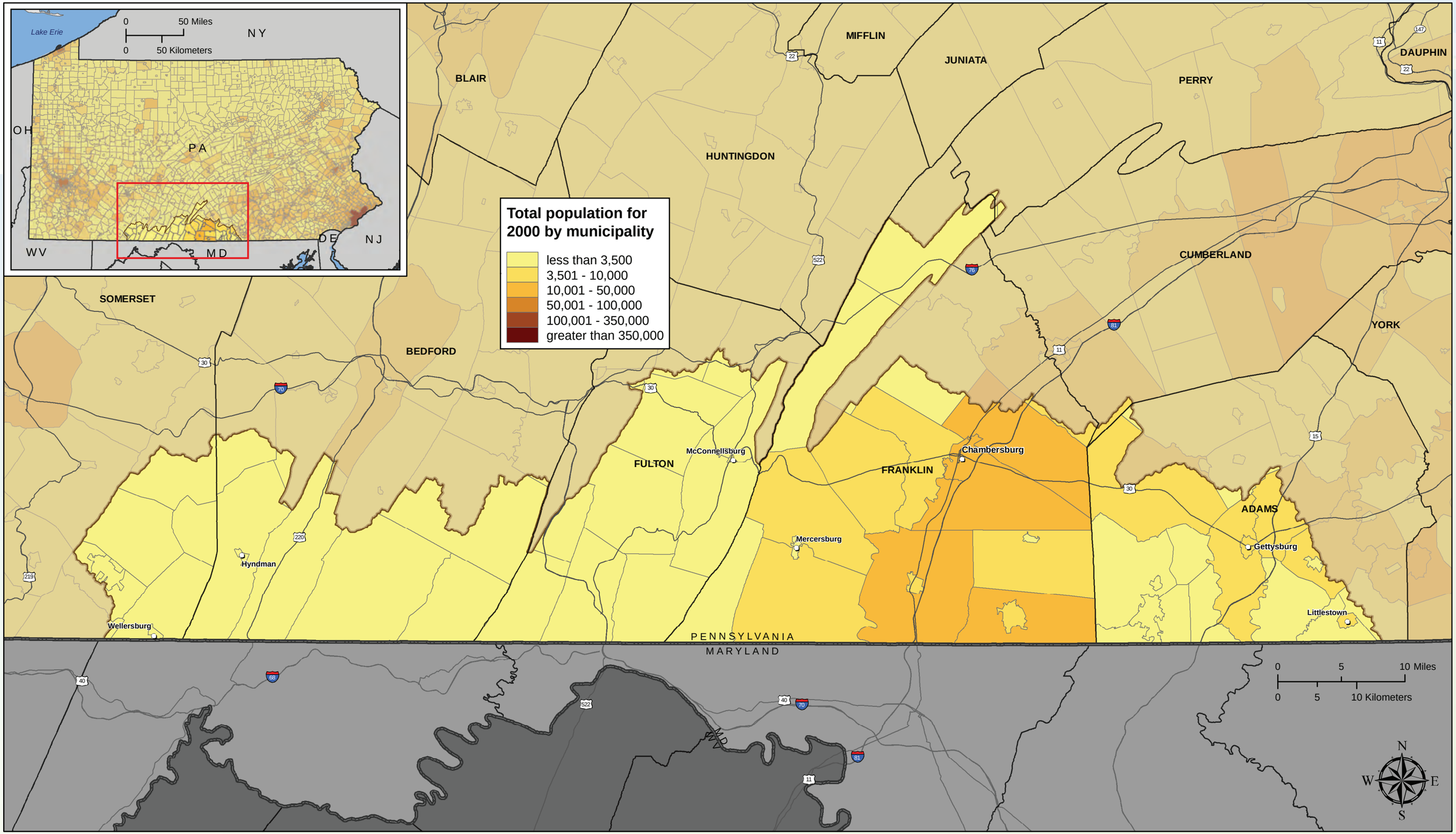
The maps on pages 242 to 244 show Annual Precipitation, Average Minimum Temperature and Average Maximum Temperature, averaged from 1971 to 2000, for the Potomac Region.

Regional Water Use

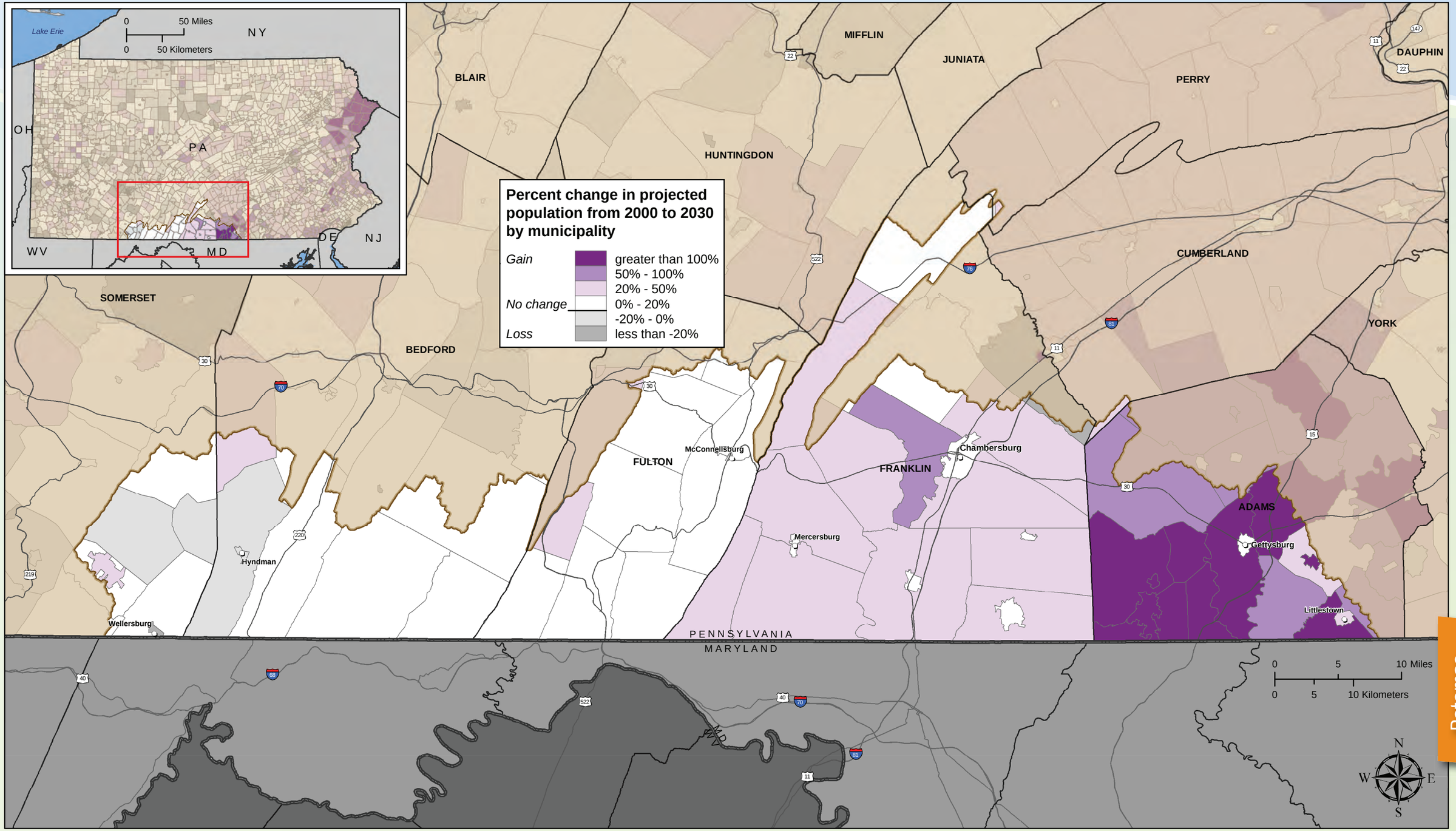
The demand for water throughout the region can be measured in part by compiling and mapping data contained in the registry of water users maintained by DEP. All public water supply agencies and hydropower facilities as well as anyone withdrawing more than 10,000 gallons of water per day are to register and report their usage to the DEP. There are no fees associated with registering and reporting.

Although this registry information does not account for all water demands of the region, it provides useful information to predict areas of higher and lower demand, as shown by the Registered Water Withdrawals Map on page 245. Consumptive water use, as defined by U.S. Geological Survey (USGS), is "that part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise

Population 2000



Population Projection



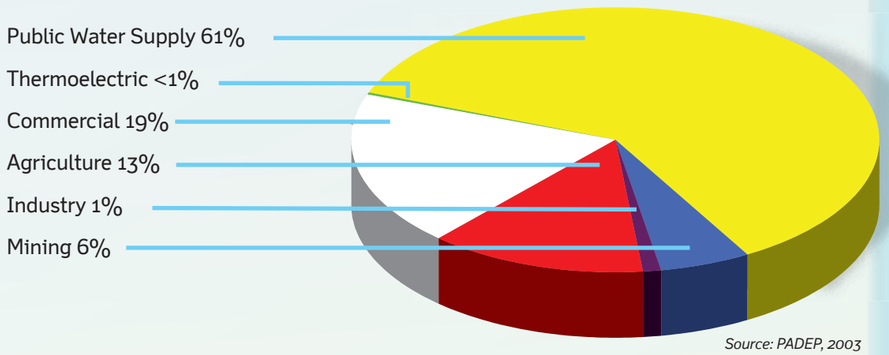
Potomac

Introduction, continued

removed from the immediate water environment." The amount of water consumed in a region becomes an important consideration for resource management during times of drought or water shortages. On the Registered Water Withdrawals Map, the pie chart within each subbasin depicts the percentage of each major sector of water use.

The pie chart below provides a breakdown of both consumptive and non-consumptive water users by sector for the Potomac Region. Approximately 61 percent of water is used by public water suppliers, 19 percent by commercial facilities, 13 percent by agriculture, six percent by mining, and one percent by industry and utility/ thermoelectric plants. This data is based on information available primarily from the registrations submitted to DEP in 2003.

Potomac River Basin Water Use



Source: PADEP, 2003

"[The Potomac is] frequented by otters, beavers, martens and sables. Neither better fish, more plenty, nor more variety for small fish had any of us ever seen in a place."

–Captain John Smith, 1608

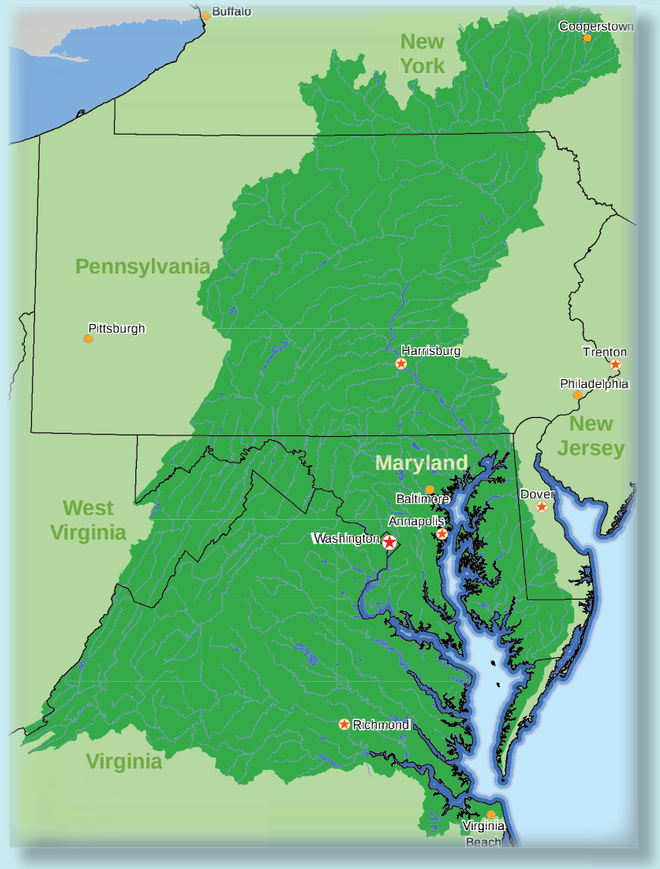
The Chesapeake Bay

The Chesapeake Bay Basin is made up of thousands of miles of rivers and streams that supply freshwater to the Chesapeake.

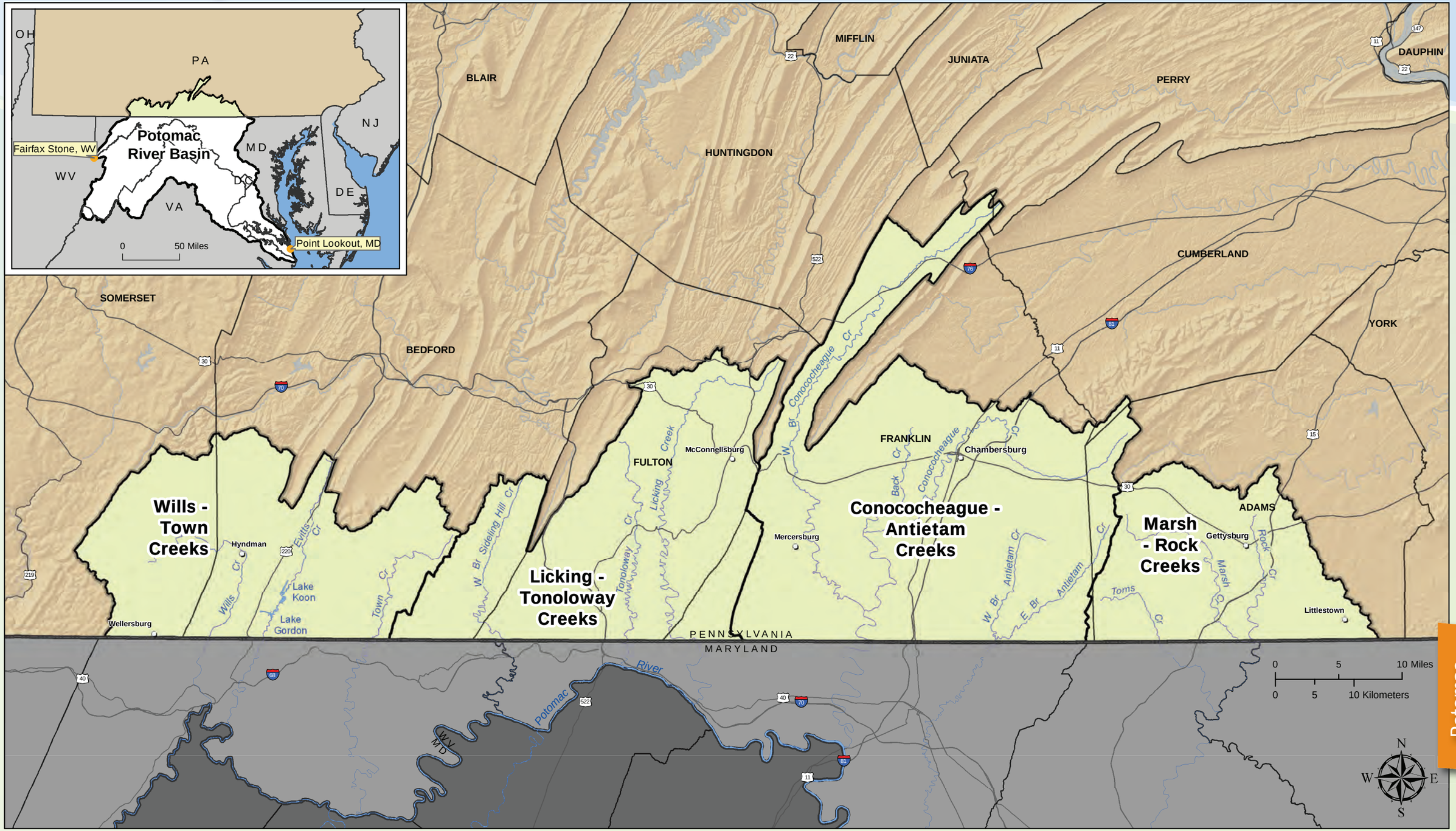
- The Chesapeake Bay Basin stretches from upstate New York to the Tidewater Region of Virginia. The drainage area covers 64,000 square miles or 41 million acres.
- Pennsylvania makes up more than one-third of the entire Chesapeake Bay Basin, more than any other state.
- About half of Pennsylvania (52 percent) lies within the Chesapeake Bay Basin.
- Within Pennsylvania's portion of the Chesapeake Bay Basin, the Susquehanna River drains 92 percent of the watershed and the Potomac River drains another seven percent. The remaining one percent of the watershed drains from the Elk Creek and Northeast River in Chester County, and Deer Creek and Gunpowder River in York County.
- Three million people, or about one-quarter of the entire Chesapeake Bay Basin population, live in Pennsylvania.

The Potomac River flows 383 miles from Fairfax Stone, W. Va. to Point Lookout, Md. and into the Chesapeake Bay. Although none of the river lies in Pennsylvania, the commonwealth provides headwater streams to the Potomac River.

- The Potomac River is the second largest source of freshwater to the Chesapeake Bay.
- Pennsylvania's Potomac Region does not include the river itself, but headwater streams flow into the Potomac at Harper's Ferry or into the Monocacy River, one of the larger tributaries of the Potomac.
- Almost 86 percent of the basin's population receives its drinking water from public water suppliers while 13 percent uses well water.

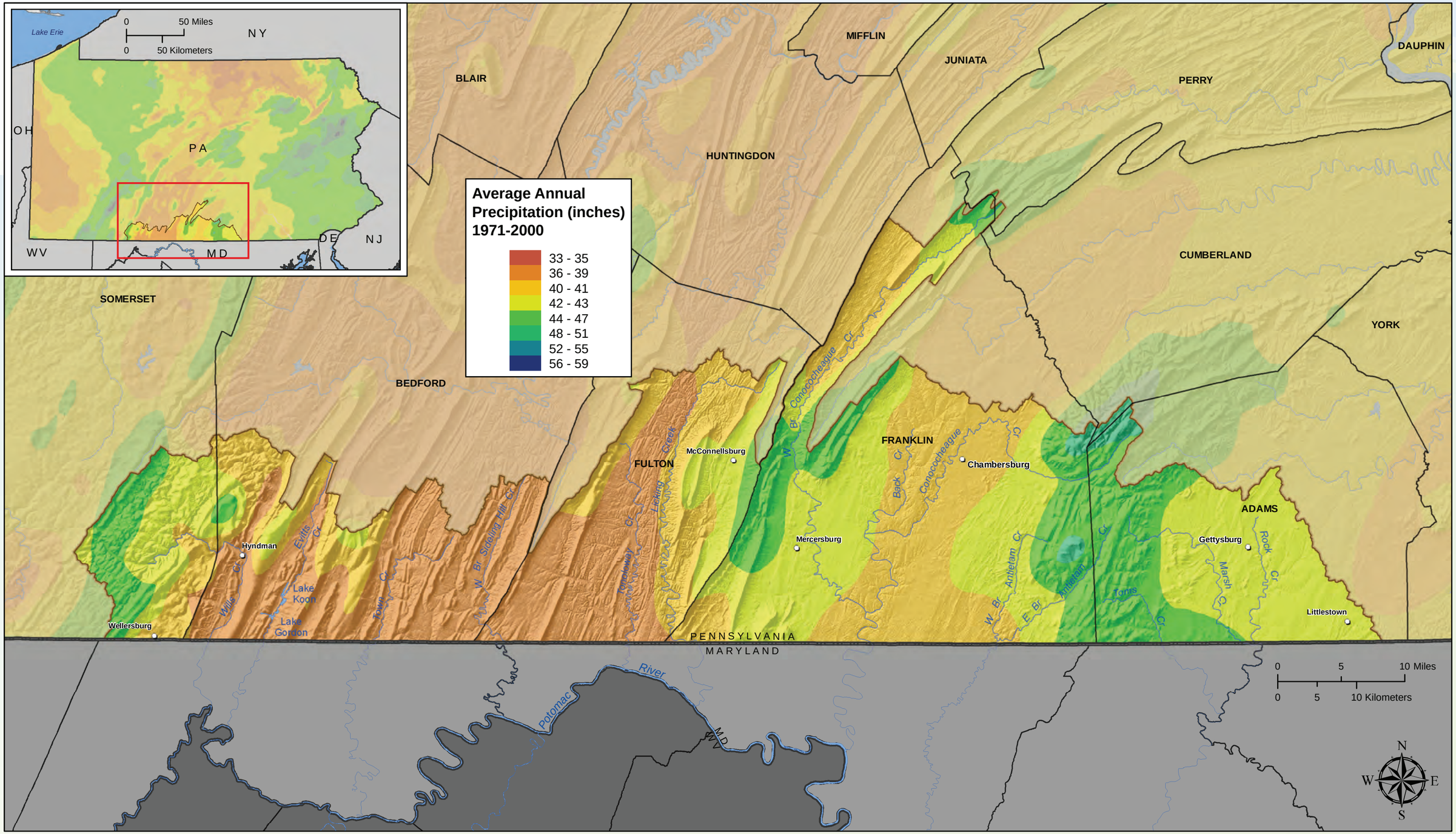


Water Planning Area

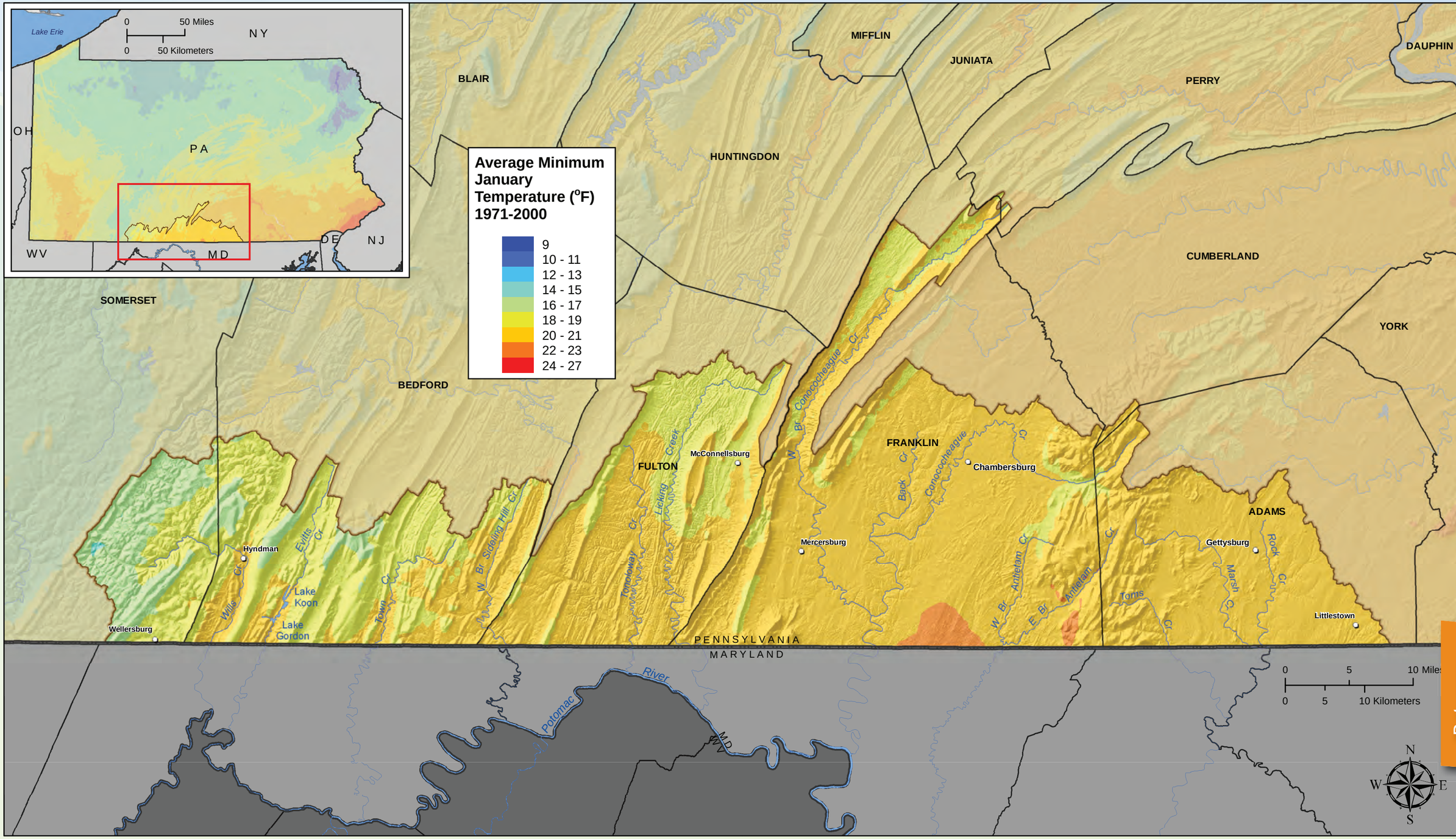


Watershed | Potomac River Subbasin | River/Stream | Waterbody | County Boundary | State Boundary | Major Roads | City/Town

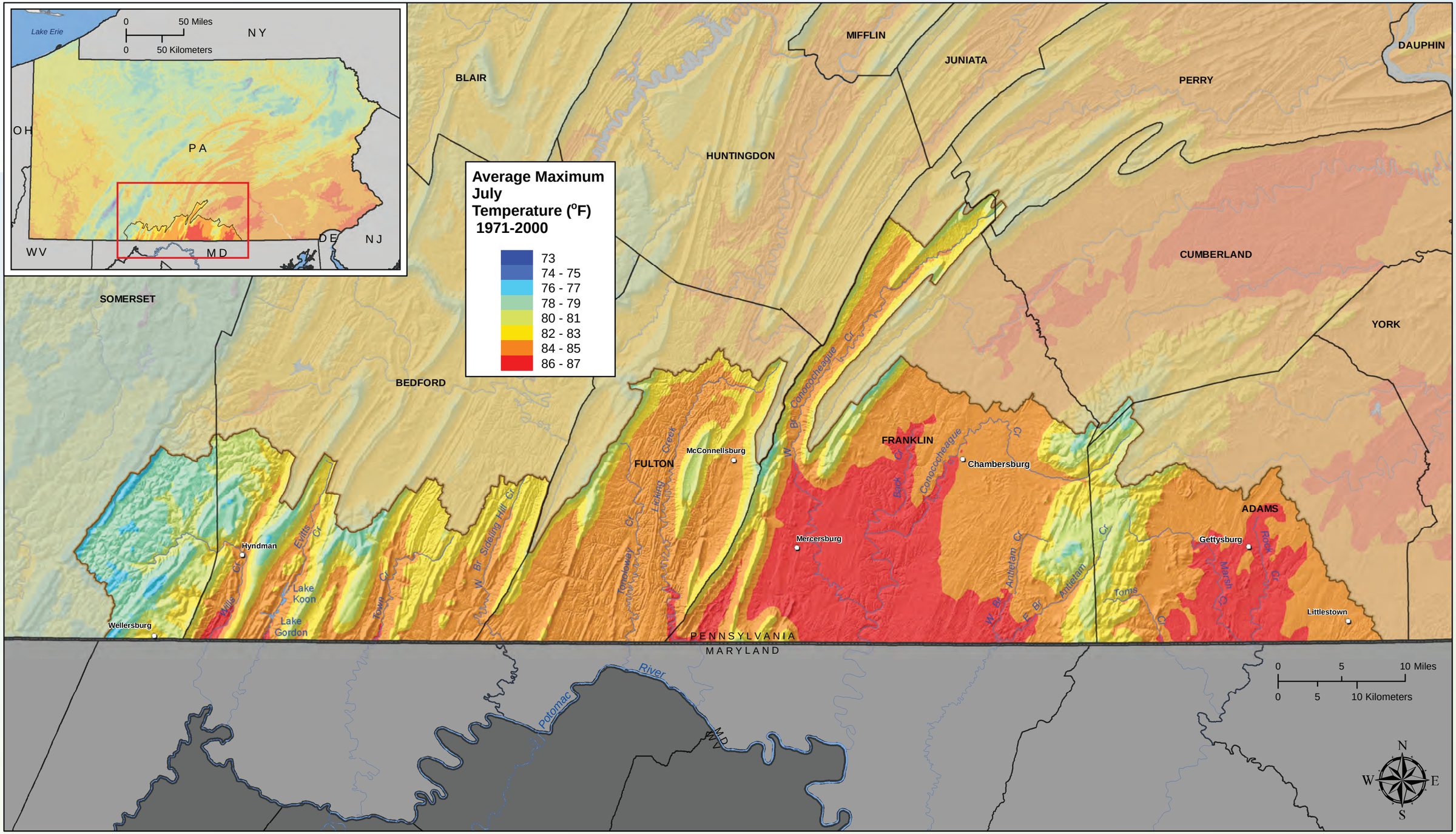
Precipitation



Average Minimum Temperature

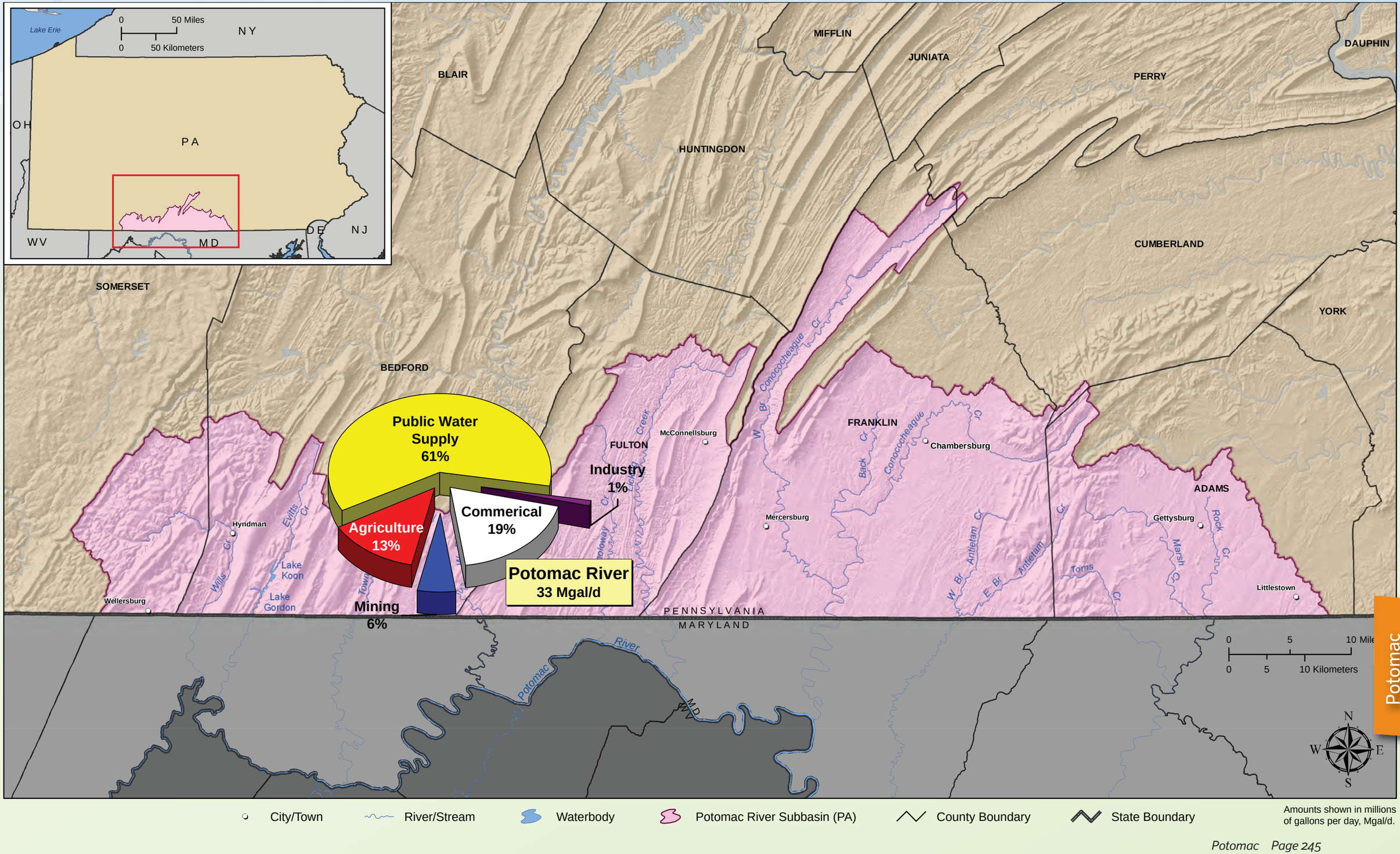


Average Maximum Temperature



River/Stream Waterbody County Boundary State Boundary City/Town

Registered Water Withdrawal



Potomac

Water Resources

Pennsylvania occupies nearly 11 percent of the land area drained by the Potomac River. The Potomac Region of Pennsylvania contains headwaters of the Potomac River, a federally recognized American Heritage River.

A map showing the larger streams, lakes and wetlands within the Potomac Region is provided on page 249. Streams and rivers can be classified according to their size based on a hierarchy of its tributaries. The hierarchy designates headwater streams as a first order stream. When two first order streams meet, the waterway becomes a second-order stream. When two second-order streams meet, the waterway becomes a third-order stream and so on. If a lower-order stream flows into a higher-order stream, the order designation does not change. For instance, if a first-order stream meets a second-order stream, the waterway designation remains second-order. For purposes of making the map readable, only higher order streams of the Potomac Region are shown in the Surface Waters Map.

Streams

Headwaters of the Potomac River in Pennsylvania include, from west to east, Wills Creek, Licking Creek, Conococheauge Creek and Marsh Run. Tributaries to Wills Creek include Hillegas Run, Shaffers Run and Brush Creek. Contributors to Licking Creek include Patterson Run, Cove Creek and Little Cove Creek. Streams feeding Conococheague Creek include Campbell Run, Rocky Spring Branch and Cold Spring Run. Tributaries to Marsh Run include Willoughby Run, Rock Creek and Littles Run.

These surface waters are part of the four watersheds in the Potomac Basin, which together make up the Potomac Region. These watersheds are shown on the Water Planning Area Map in the Potomac Region Introduction Section of this atlas.

Two U.S. Geological Survery (USGS) gaging stations that monitor peak stream flow conditions, water levels, discharge and water temperature are located in the Potomac Region. One gaging station is located on Wills Creek south of Hyndman, Bedford County, while the other is on Tonoloway Creek near Needmore, Fulton County.

Lakes and Dams

Several lakes and reservoirs exist within the Potomac Region. Most lakes throughout the region are created by dams, many of which have formed reservoirs for public water supply such as Lake Koon and Lake Gordon, which were both formed by the construction of the Thomas W. Koon Dam on Evitts Creek. The two lakes collectively provide drinking water for residents in Pennsylvania and Cumberland, Md.

Chambersburg Reservoir and Long Pine Run Reservoir, both located near Chambersburg in Franklin County, also provide drinking water for residents in and around the Chambersburg area. Both Koon and Gordon lakes provide recreational opportunities such as boating and fishing that are open for public access. Long Pine Run Reservoir offers limited public recreational opportunities as it is closed to most recreational activities.

In Fulton County, Meadow Grounds Lake, within State Gamelands 53, offers public fishing and boating, as well as hiking trails around its perimeter.

Wetlands

Wetlands are areas where water covers the soil or remains at or near the surface for an extended period of the year. These habitats provide a hydrologic link between land and water resources (either surface water, groundwater or both). Wetland types differ according to characteristics such as topography, climate, hydrology, water chemistry and vegetation.

The U.S. Fish and Wildlife Service (USFWS) provides information on the nation's wetlands and deepwater habitats—including location, type and status—through the National Wetlands Inventory (NWI). There are two general categories of wetlands: coastal (including estuaries) and inland (including rivers, lakes and riparian areas). The NWI classifies inland waters according to the amount and type of vegetation present:

- Open water (rivers and lakes)
- Emergent/herbaceous (marshes, wet meadows, fens)
- Scrub-shrub (swamps and bogs)
- Forested (swamps and bogs)

The Potomac River

Deemed the "Nation's River" because it flows through Washington D.C., the Potomac River flows for about 380 miles and measures nearly 11 miles wide where it meets the Chesapeake Bay at Point Lookout, Md. The river has tributaries in Pennsylvania, Virginia, West Virginia and Maryland.

The Potomac River serves as one of the nation's most historic and celebrated rivers. Named for the Algonquian tribe inhabiting the area, the Potomac has been home to the building of the nation's capitol in 1800 and many battles of the Civil War in Gettysburg and Antietam.

Today, many people flock to the battlefields near the Potomac to view reenactments of Civil War battles, along with the various recreational activities and attractions in the area. The Potomac Region has brought together various cultures throughout the basin, including coal miners, prestigious law makers and watermen in Virginia.

Over time, the river has faced many pollution issues. Mining and agricultural runoff, along with urban sewage have been issues of concern with the waters over time. Abraham Lincoln even noted that he would escape to the highlands to get away from the river's stench on summer nights and Lyndon Johnson once declared the river to be a "national disgrace." In the 1960s, restoration efforts were put into effect, with long-term efforts to reduce sewage pollution and bring back the beauty of the river. Since then, recreation on the river has come back. Concerns with the Potomac's flow into the Chesapeake have also been voiced, and many plans to monitor the river's sediment levels have been developed.

Fishing derby on Tom's Creek, Carroll Valley, Adams County. Photo courtesy of William Devlin.

Wetlands exist throughout the Potomac Region, typically forming in floodplains and adjacent areas of streams. Wetlands are prevalent in the areas of the Conococheague-Antietam Creeks Watershed. Several projects have been implemented to further increase the quality of the wetlands and surrounding streams. Also, several acres of a scrub/shrub wetland exist at the headwaters of Shobers Run in Bedford County. Restoration plans have been implemented to improve wildlife habitat, which will also aid in improving water quality to the stream itself.

Wetlands provide unique habitat to many species of plants and animals and also serve as natural filters for surface and groundwater supplies. Many wetlands in the region have the ability to eliminate contaminants such as nitrates and phosphorus as water flows through the wetland. The vegetation present in the wetland utilizes the excess waste, eliminating it from the water and reducing negative impacts to the environment. Wetlands also have the excellent ability to remove sediment from surface runoff. The vegetation plays a large role in reducing sediment as the sediment particles are captured and slowly removed as the water progresses through the wetland. These traits of wetlands have led some scientists to describe wetlands as "nature's kidneys." Wetlands of the Potomac Region are illustrated on the Surface Waters Map on page 249.

Special Protection Waters

Certain water bodies are designated special protection to prevent activities that could degrade water quality and therefore prevent these waters from meeting their uses. These special designations include federal or state Scenic/Recreational Rivers, High Quality and Exceptional Value Waters, and Class A Wild Trout Waters.

Scenic Rivers

Scenic rivers in Pennsylvania are designated for their exceptional aesthetic, pastoral or recreational value and must be maintained for these values. There are no scenic rivers in the Potomac Region. More detailed information about this program is included in the Statewide section of this atlas.

HQ and EV Waters

There are two types of special protection water classifications according to guidelines listed in Pennsylvania Code Title 25, Chapter 93 Water Quality Standards: High Quality (HQ) and Exceptional Value (EV). The Special Protection Waters Map on the next page shows the HQ and EV waters in the region.

- HQ waters are designated as such based on the water chemistry and the presence of a high quality aquatic community. Approximately 36 streams or stream sections are designated as HQ in the Potomac Region. A majority of these HQ streams are found in the forested Wills - Town Creeks Watershed.
- EV waters are designated based on water quality and are waters of substantial recreational or ecological significance. There are approximately eight streams or stream sections designated as EV in the Potomac Region. A majority of EV waters in the Potomac Region are found in the Licking – Tonoloway Creeks Watershed. Many waters are designated as EV based on the fact that they are classified as Class A Wild Trout Waters.

The classification of EV or HQ to a stream requires that new or expanded earth-disturbance does not degrade existing water quality. It is important to know that this does not mean that development will stop, but proposed projects will undergo a more detailed permit review by DEP and may result in meeting more stringent requirements to protect water quality.

Wild Trout Streams

Currently, the Pennsylvania Fish and Boat Commission reports that six waters in the Potomac Region are designated as Class A Wild Trout Waters. These waters support a population of naturally-produced trout of sufficient size and abundance to support a long-term and rewarding sport fishery. These streams are not stocked but are supported in full by the spawning of the wild trout populations, further illustrating their outstanding quality and protection they receive. Class A Wild Trout Waters include wild brook trout fisheries, wild brown trout fisheries, mixed wild brook/brown fisheries and wild rainbow trout fisheries.

The following Class A Wild Trout Waters list provides the county location, name of the water body and the type of trout found in the stream.

Somerset Two sections of Laurel Run (*brook trout*)

Franklin One section of West Branch Antietam Creek (*brook trout*)
Two sections of Broad Run (*brook trout*)
One section of Falling Spring Brook (*rainbow trout*)

Adams One section of East Branch Antietam Creek (*brook trout*)
One section of Carbaugh Run (*brook trout*)

The Special Protection Waters Map on the previous page 251 shows the locations of Class A Wild Trout Waters within the Potomac Region. For more information on wild trout streams in Pennsylvania, visit the Pennsylvania Fish and Boat Commission's Web site at www.fish.state.pa.us/.

Impaired Waters

Stream health assessments are complex and time consuming efforts put forth by many individuals. Assessments can include individual studies on the living organisms and habitat within and around the stream, studies on water chemistry and measurement of physical characteristics. There are also simple visual indicators one can look for to determine a stream's general health. Impaired streams may have eroded or undercut banks, low water clarity, foul odors, large amounts of algae or have deep deposition of sediments that cover

Water Resources, continued

Back Creek, Franklin County. Photo courtesy of J. Ducnuigeen.

larger rocks on the bottom of the stream. All of these results help determine overall stream health. Restoring impaired streams requires plenty of time and effort combined with the most recent water quality evaluations available.

The Pennsylvania Department of Environmental Protection (DEP), under Section 303(d) of the federal Clean Water Act, implements a program that assesses the water quality of state waters and identifies waterbodies that do not meet the standards for their designated uses. These designated uses—including aquatic life, recreation and drinking water—are characterized by the in-stream levels of parameters (e.g., dissolved oxygen, pH, metals, siltation, etc). If a waterbody does not meet the standards for its designated use, it is identified as "impaired" on the Pennsylvania Integrated Water Quality Monitoring and Assessment Report. This report also identifies the cause of the impairment, which may be one or more point sources (like industrial or sewage discharges) or nonpoint sources (like abandoned mine discharge or agricultural runoff).

Did you know?

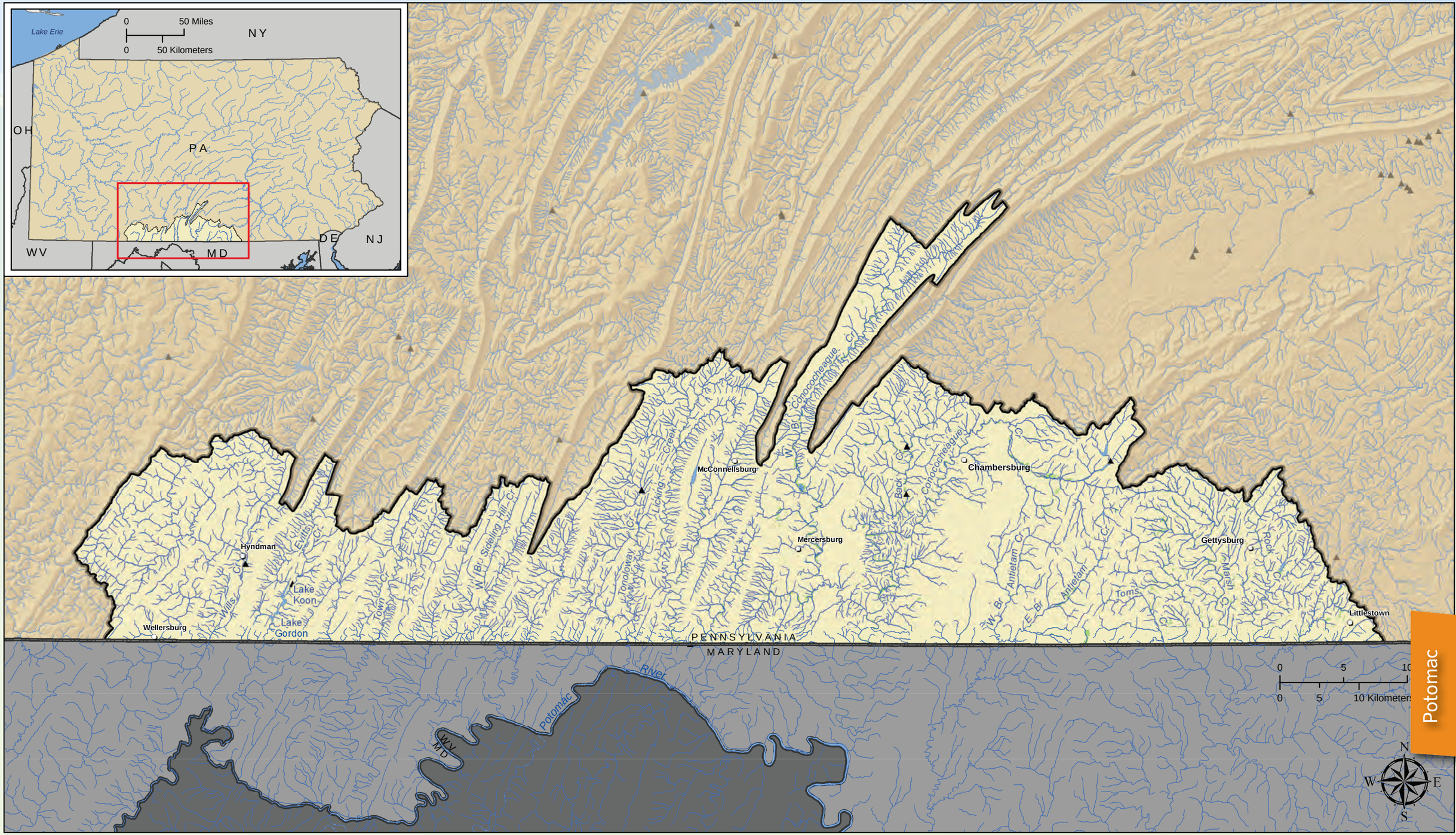
Thaddeus Stevens, a prominent 19th century abolitionist, attorney and politician spent part of his life living and working in Adams and Franklin counties. During his time in the region, Stevens helped secure free public schools for rural Pennsylvanians.

Did you know?

The Potomac River and its sister river in Japan, the Arakawa River, share a historic tie: the Arakawa River was the source of the cherry trees that grow along the Potomac in Washington, D.C.

Lousy Run surrounded by a forested riparian buffer, Adams County. Photo courtesy of Pat Naugle.

Surface Waters



Stream/River Lake, Pond or Reservoir Wetlands City/Town Stream Gauges State Boundary

Water Resources, continued

Muskrat Run, Adams County. Photo courtesy of J. Ducnuigeen.

Once impaired waters and their reasons for impairment are established, the state determines what conditions are necessary to return the water to the quality that meets its designated use. DEP and the United States Environmental Protection Agency (EPA) work in conjunction with other organizations, such as Pennsylvania State University, to develop a Total Maximum Daily Load (TMDL) for each impaired waterbody. A TMDL defines the allowable pollutant loads a waterbody can receive from point and nonpoint sources and still be able to maintain its designated water quality standards.

Conococheague-Antietam Creeks Watershed

The Conococheague-Antietam Creeks Watershed drains approximately 609 square miles in southern Franklin and Adams counties. The Conococheague Creek is the largest contributor to the watershed draining approximately 503 square miles.

The watershed's headwaters generally form in the rugged areas of Blue Mountain and South Mountain. The streams that originate in these mountainous regions have greater acidity until they flow through valley regions that are dominated by limestone, which neutralizes acid. Once reaching the valleys, the acidity is alleviated and the streams are buffered, supporting a greater abundance of aquatic life.

The largest contributors to degradation of the watershed are areas of development and agriculture. Development along the I-81 corridor is a factor resulting in increases of stormwater runoff, stream bank erosion and sedimentation. Agriculture in the region has existed for many years and contributes some pollution to the watershed, such as nutrient loading and sedimentation.

Restoration initiatives have been developed for the watershed to improve water quality and help restore the overall health of the area. Best management practices within the watershed include installing cattle crossings, wetland replacement and administering stormwater management programs.

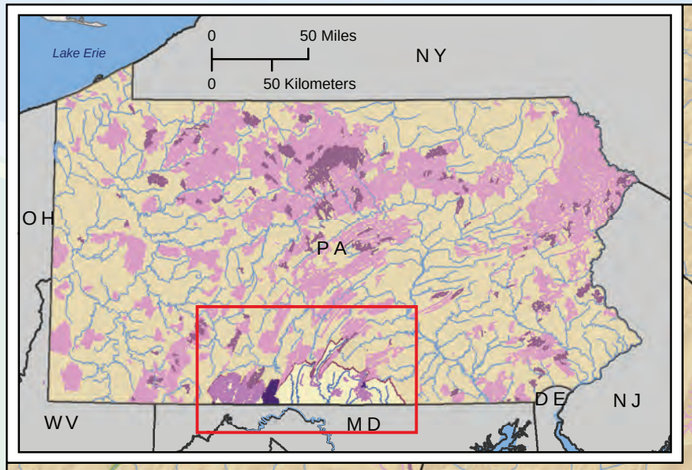
Although a majority of the Potomac Region's surface waters are healthy, several impaired streams exist within the region that require attention and best management practices, as seen in the Impaired Waters Map on page 252. Willoughby Run, a tributary of the Marsh Creek Watershed, and Rock Creek are two streams located in Adams County that suffer from degraded water quality. Like many streams and watersheds in the commonwealth, growing populations are creating new sources of nonpoint pollution. Problems that these streams and watersheds are facing include increases in stormwater which leads to stream bank erosion and siltation, loss of riparian buffers and turbid waters. The loss of riparian buffers creates waters with increased temperatures which in turn can lead to algae blooms. This ripple effect creates problems that will be felt their entire length to their confluence creating the Monocacy River located in Maryland.

In response to these concerns, several organizations such as the Watershed Alliance of Adams County (WAAC) have taken efforts to restore and protect these watersheds from further degradation. Monitoring sites, protocols and data collection sites have been set up by volunteers and professionals to increase public awareness of the water quality in the area. With their efforts, the watersheds have a first line of defense in protecting their water resources. For more information, visit the Marsh Creek Watershed Web site at www.marshcreekwatershed.org.

Stream Releaf Program

Pennsylvania DEP initiated the Stream Releaf Program in 1996 to restore streams and riparian areas in order to reduce and prevent stream bank erosion and sedimentation. The Stream Releaf Program has helped to create riparian buffers (vegetated areas along stream banks) along Big Cove Creek in Fulton County, East Branch Antietam Creek in Franklin County, and Marsh Creek in Adams County. These are just a few of approximately 322 projects found in the Stream Releaf database for this region. For more information on this program, see "Stream Releaf" under "DEP Programs" at www.depweb.state.pa.us.

Special Protection Water



BLAIR
MIFFLIN
JUNIATA
PERRY
DAUPHIN
HUNTINGDON
CUMBERLAND
SOMERSET
YORK
BEDFORD
FULTON
FRANKLIN
ADAMS
McConnellsburg
Chambersburg
Mercersburg
Gettysburg
Littlestown
Hyndman
Wellersburg
Lake Koon
Lake Gordon
Evitts Cr
Wills Cr
Town Cr
Licking Creek
Tonoloway Cr
W Br Conococheague Cr
Back Cr
Conococheague Cr
W Br Antietam Cr
E Br Antietam Cr
Toms Cr
Marsh Cr
Rock Cr
W Br Sideling Hill Cr
PENNSYLVANIA
MARYLAND
Potomac River
WV
MD
0
5
10 Kilometers
N
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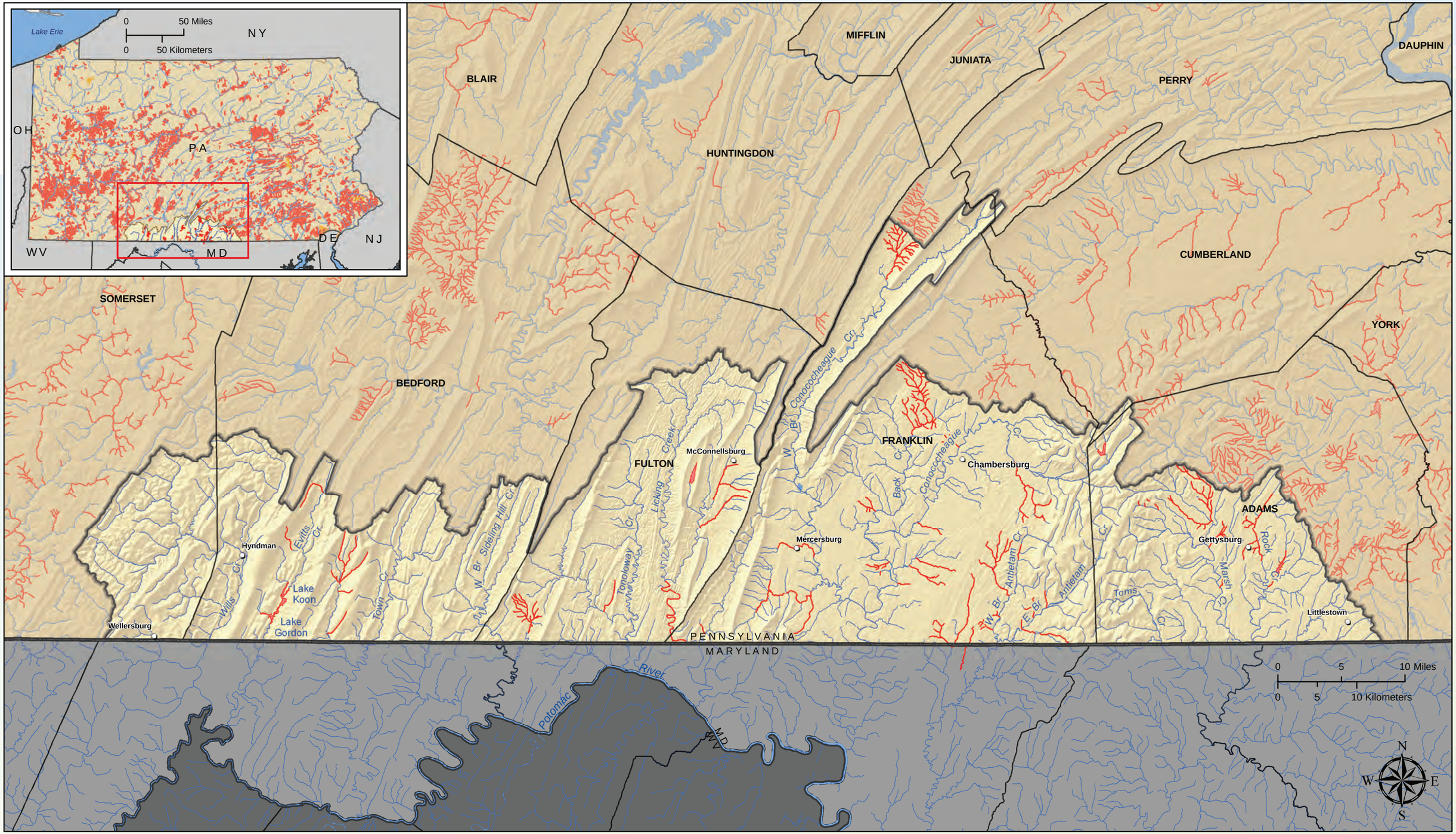
S
Potomac

Exceptional Value Stream (EV) · High Quality Stream (HQ) · Class A Wild Trout Stream · River/Stream · Waterbody · City/Town · County Boundary · State Boundary

Impaired Waters



Stormwater and Flooding

South Mountain and part of the Marsh Creek Watershed, Adams County. Photo courtesy of Pat Naugle.

Stormwater as a Resource

Stormwater runoff and flooding are natural events that have helped shape our watersheds and rivers. Human activities on the landscape routinely alter natural drainage patterns. Because of this, stormwater runoff is now being examined as to its effects on water quality, stream morphology, base flow and recharge. If not managed, these changes may increase localized flooding, stream bank erosion and loss of groundwater recharge. In addition to its physical impact on the environment, stormwater may carry a variety of pollutants.

By managing stormwater runoff as a resource rather than as a waste, a host of opportunities are available to protect the environment and complement water resource management. Since clean and abundant water is a vital resource, effective stormwater management provides for the protection and maintenance of the commonwealth's essential water resources. Stormwater management affects and involves all of the possible avenues precipitation might follow after falling to the ground: runoff from the surface of the land; groundwater by infiltrating (or soaking) into the ground; evapotranspiration by evaporating directly into the atmosphere or by transpiring through plant processes and then evaporating; or stored water for various uses.

Human activities that result in land development or changes in land cover, or land use, often dramatically affect the quantity and quality of stormwater runoff from the land surface. These changes can produce potentially harmful impacts on water resources, such as increases in damages from flooding; diminished stream flows and groundwater recharge; degradation of streams and stream channels from scour, erosion or deposition; and deterioration of water quality from pollution. These effects can be minimized, or avoided, through the careful preparation and implementation of comprehensive stormwater management plans and other planning or regulatory efforts.

Problems Associated with Stormwater and Flooding

Stormwater can have a detrimental effect on the agricultural lands, developed areas and the water quality of streams and rivers that flow through the 1,500-plus square miles of land that makes up the Potomac Region.

Flooding

Flooding is a localized temporary condition of partial or complete inundation of normally dry land from the overflow of streams or rivers. This potentially hazardous condition is generally the result of excessive precipitation. Generally, floods can be classified into two categories: flash floods, the product of heavy localized precipitation

Local Flooding Occurrence

Like all regions, flooding can create problems in the Potomac Region. In response to these problems, many local communities and municipalities have created flood control measures to help control flooding, such as reservoirs. Although the Potomac Region does not have any flood control measures managed and maintained by the U.S. Army Corps of Engineers, local regulating committees and township supervisors have taken on the responsibility of protecting their communities. Although these reservoirs and other emergency flood control measures exist in the region, occasionally heavy rains can overwhelm the flood controls.

Flood control measures and emergency reservoirs are now being augmented by improved stormwater management practices to prevent flooding. Flood mitigation measures are continually being refined by Pennsylvania and have helped reduce the overall impacts of major flood events. Flood hazards are also being addressed in Hazard Mitigation Plans that are being prepared by each county in the state. Also, the Pennsylvania Emergency Management Agency (PEMA) uses the Federal Emergency Management Agency's (FEMA) hazard identification tool, HAZUS, to assist counties and local communities in assessing flood risks and preparing mitigation plans. More information can be gathered by visiting the PEMA Web site at www.pema.state.pa.us.

Stormwater and Flooding, continued

in a short time period over a given location; and general floods, caused by precipitation over a longer time period over the river basin.

Flash floods can occur within a few minutes or several hours of heavy amounts of rainfall, rapid snow melt or from a sudden release of water held back by an ice jam. Flash floods can damage buildings and bridges, uproot trees and scour new drainage channels. Although flash flooding often occurs along small rural streams, it is also common in urban areas where much of the ground is covered by impervious surfaces. The impervious surfaces created by roads and buildings generate greater amounts of runoff than would typically occur over vegetated areas. As land is converted from fields and woodlands to impervious surfaces, it loses its ability to absorb rainfall. Urbanization greatly increases the quantity and velocity of runoff over what would occur naturally on vegetated and forested terrain. Fixed drainage channels in urban areas may be unable to contain the runoff that is generated by relatively small, but intense, rainfall events.

The severity of a flooding event is determined by a combination of river basin terrain, local thunderstorm movement, past soil moisture conditions and the degree of vegetative clearing. Abnormal weather patterns may also contribute to flooding of a local area.

Urban and Suburban Runoff

Stormwater runoff from developed areas in Pennsylvania is the third leading cause of stream impairment. Pollution in the Potomac Region can result from suburban development and impervious surface expansion, resulting in potential runoff of petroleum products, nutrients, etc. The trend of population spreading out from towns and cities into areas that were previously rural is expected to continue into the future.

These population changes can result in development and an increase in impervious surfaces (surfaces that water cannot drain through such as concrete pavement, asphalt and roofing materials). As impervious surfaces increase so can the amount of pollutant-carrying stormwater from new developed areas. Soils washed away from exposed building sites during construction also contribute to the excess sedimentation of streams.

Chambersburg in Franklin County is expected to continue to see development expanding outward. Stormwater runoff in this area affects water quality in the Conococheague Creek Watershed. Future land development can increase stormwater runoff and streambank erosion throughout the watershed and groundwater pollution. The general increase in population in Franklin County as well as Adams County has created concern that the new development will create impacts if intensive stormwater management techniques are not applied. This shift from agricultural runoff to urban runoff created from impervious surfaces such as parking lots and housing developments creates new issues that will need to be addressed.

Increased stormwater can cause sewer overflows in older towns that channel stormwater runoff to wastewater treatment facilities or worse yet, combined stormwater and wastewater can overflow into surface waters. Increased stormwater also destabilizes stream banks, disperses litter, distributes unnaturally warm water from developed surfaces into streams and reduces groundwater recharge.

Agricultural Runoff

Water quality degradation and impairment in the Potomac Region can also be caused by stormwater runoff from some agricultural lands. As stormwater flows over agricultural lands, it can wash away excess nutrients like nitrogen and phosphorous from commercial fertilizers and manure. Soils from plowed fields and unstable stream banks, sometimes exposed in part by grazing animals, can also be washed away with stormwater runoff. Excess nutrients, sediments and pollutants in this watershed not only impair Pennsylvania's waters but also the Chesapeake Bay.

Dennis Creek Streambank Restoration, Franklin County

The Dennis Creek Watershed originates in Hamilton Township, Franklin County, near Chambersburg in the pristine headwaters of the Kittatinny Mountain Ridge. Historically the land was forested but was cleared for use as fuel for the iron industry. Eventually the iron industry gave way to agriculture which now dominates land use in the area. Some agricultural practices have led to erosion problems, cattle waste pollution, overgrazing and unprotected streambanks.

DEP partnered with the Franklin County Watershed Association, an informal cooperative group of local citizens, to restore the Dennis Creek Watershed. The partnership started by constructing fencing to prevent cattle from directly entering streams or impacting stream banks. Fencing the streambanks alone led to immediate water quality improvements in the creek.

The partnership then worked on restoring riparian areas in the watershed by planting trees and native vegetation along streambanks that had been left with little to no vegetation from past land practices. DEP and the Dennis Creek Watershed Association also worked to restore wetlands in the watershed to control stormwater runoff. The final step in the Dennis Creek Watershed restoration project is maintaining the health of the watershed. This is being accomplished by implementing a water quality monitoring program that involves government agencies, school students and others in monitoring the health of the watershed.

Stormwater Association with Forestry

Forestry management techniques are also important to the protection of streams and creeks in the region. Timbering companies work hand in hand with agencies such as DEP, EPA, U.S. Army Corps of Engineers and the U.S. Forest Service to protect water resources. Strict permitting is required for stream crossings, wetland crossings and timbering near these resources. Timbering companies also are required to develop extensive erosion and sedimentation control plans for areas they plan to timber. Through these relationships between timbering companies and agencies, the timber business continues to thrive while protecting our water resources.

Karst Areas

Karst environments typically occur in areas where carbonate (limestone and dolomite) bedrock dominates the subsurface features. Natural breaks and fractures occur in carbonate bedrock which allows precipitation to infiltrate quite easily.

Water is a major reason for sinkhole collapses in Pennsylvania. Karst areas form over long periods of time as groundwater moves through breaks in the bedrock dissolving the rock and creating caverns and spaces below the surface. The spaces may be filled with soil material or may be open. A sinkhole forms as soil material is flushed through the underground spaces in the bedrock causing the surface to collapse. If more water is collected and redirected into a karst area this increases the potential for a sinkhole to occur.

The effects of stormwater on karst geology are of concern for the Potomac Region. Carbonate bedrock, which allows for sinkholes to form, is common throughout much of Franklin County and parts of Adams County. Conversely, the effects of sinkholes are a concern for groundwater quality. Water is naturally purified of contaminants as it passes through soil. Surface water that enters a sinkhole passes directly into existing groundwater supplies without any filtration, thereby contaminating groundwater resources.

Spotted Salamander

Stream Impairment and Stormwater

In the Potomac Region, water quality degradation of streams, rivers and groundwater has occurred in all counties found in the basin. The region is home to Conococheague, Antietam, Wills, Marsh, Licking and Evitts creeks watersheds. Several of these watersheds have high amounts of agricultural land and developed land like Conococheague-Antietam Creeks Watersheds.

In the Conococheague Creek Watershed in Franklin County, most new development is taking place around Chambersburg and along I-81. The Conococheague Creek Watershed is largely underlain with carbonate bedrock. Development in the area can alter the land's natural state and ability to absorb precipitation, which can concentrate stormwater runoff and accelerate the formation of sinkholes.

The Antietam Creek Watershed located in Franklin and Adams counties is experiencing similar stormwater problems as the Conococheague Creek. This watershed is also underlain with carbonate bedrock and has seen development growth occurring in the Waynesboro area and along I-81 north to Chambersburg.

In the western section of the Potomac Region, in Bedford County, Evitts Creek and its watershed flow into Koon and Gordon lakes. These lakes provide drinking water for 50,000 residents in the city of Cumberland, Md. located just over the Mason-Dixon Line. Land surrounding the Evitts Creek Watershed is primarily used for timbering and agricultural operations like dairy and cattle farming. Poorly managed timbering and agricultural practices in the past have contributed to stormwater runoff carrying excess nutrients and sediment into Evitts Creek, Koon Lake and Gordon Lake.

Throughout South Mountain and Michaux State Forest, vernal ponds (seasonal wetlands that often dry up by late summer) provide critical habitat for numerous species of protected, yet extremely vulnerable plants and animals.

Geology and Groundwater

The Potomac Region is the second smallest region in Pennsylvania found in sections of Somerset, Bedford, Fulton, Franklin, Cumberland, Perry and Adams counties. Geology and groundwater supplies vary throughout the region as different physiographic provinces are encountered.

Although the region is relatively small, it still contains three of the six major physiographic provinces found in the commonwealth. From west to east these provinces include the Appalachian Plateaus Province, Ridge and Valley Province and Piedmont Province. Within each province, differing bedrock regimes control groundwater aquifer recharge and groundwater supplies to residents in those areas. A discussion of these provinces and their origins is provided in the Overview Section and can be located on the map shown in that section.

Bedrock Geology

The varying provinces and bedrock regimes within the Potomac Region control groundwater supplies. In order to properly predict groundwater resources, an understanding of the relationship between bedrock geology and groundwater supply is needed. Aquifers within these provinces recharge at different rates depending on the bedrock geology. As the provinces transition throughout the region, the bedrock geology associated with the provinces changes as well.

The sandstone, shale, metamorphic and carbonate formations in the Potomac Region are consolidated rocks that comprise the majority of aquifers in the region. Groundwater is contained within and moves through fractures, spaces and partings in the consolidated rock. Aquifers exist here under two different conditions. Where water only partly fills the aquifer and is free to rise and fall, it is referred to as an unconfined aquifer or water table aquifer. Where water completely fills a rock unit and the aquifer is under a low-permeable feature or confining layer, this aquifer is said to be confined. This confining layer helps protect this kind of aquifer from contaminated water migrating from above.

The carbonate bedrock formations in this region are comprised of limestone and dolomite. Limestone bedrock formations in the region are prone to chemical dissolution, or dissolving, and form a landscape called “karst.” These voids may be filled with water, soil materials or air. Interconnected pathways can exist through the rock to allow water to be quickly transported in high volumes. If a contaminant reaches the void spaces, it easily enters the groundwater and can be transported extensive distances to other water supply or discharge areas. The creation of these interconnected voids in limestone bedrock can produce sinkholes, closed depressions and disappearing streams; common features of a karst environment. For more information on karst environments, see the Lower Susquehanna Region section of this atlas.

The connection between surface water and the aquifers that store and discharge groundwater is often misunderstood. The water table, which is the boundary below which all the spaces and cracks in the soil and bedrock are completely saturated, is often times a reflection of the surface topography. As the topography changes due to hills, mountains or valleys, the water table’s elevation and depth will often times change with it reflecting the changes occurring at the surface.

Streams, wetlands, springs or rivers will often form in areas where the water table intersects the land surface. These features form where the groundwater discharges from groundwater storage and becomes surface water. This discharge of groundwater into surface water is also known as base flow. Base flow can be thought of as the sustained low flow of a stream because it is supplied by the groundwater that is discharging from underground storage. Dry streambeds or springs that no longer supply water are a result of the water table being lower than the land surface.

Appalachian Plateaus Province

Beginning in the western area of the Potomac Region, a small portion of the Allegheny Front Section of the Appalachian Plateaus Province is found in the region. This area, which includes lands around Hyndman and Buffalo Mills, is characterized with small rounded hills that are separated with narrow valleys. This section commonly has erosion-resistant sandstone uplands, and lowlands consisting of sedimentary shale and siltstone bedrock. The Bedrock Geology Map on page 258 shows these bedrock formations of the Appalachian Plateaus Province.

Groundwater aquifer recharge will typically occur in the lowland areas where the sedimentary bedrock has a higher concentration of fractures than the slopes and highlands. These fractures allow for greater transport of precipitation and surface water into the aquifers. The lowland areas also contain deeper soil which will absorb water and allow it to slowly enter the aquifers.

The Great Valley

The Great Valley is one of the major landform features of eastern North America. It is made up of a chain of valley lowlands and is the central feature of the Appalachian Mountain system. This area stretches about 700 miles from Canada to Alabama and has been an important north-south route of travel since prehistoric times. In Pennsylvania, the Great Valley – also referred to as the Lehigh Valley, the Lebanon Valley and the Cumberland Valley – is cut by the Susquehanna and Schuylkill rivers.

Rocks that characterize this region include limestone, dolomite, slate, shale, sandstone, siltstone and some scattered metamorphic and igneous rocks. Many of the rocks in the Great Valley in Pennsylvania date from the Ordovician period, about 443 to 490 million years ago. Limestone and dolomite of this area has been extensively mined in the Great Valley in Pennsylvania for more than a century; many large quarries still operate. These carbonate rocks are used for a variety of purposes including crushed stone, cement manufacturing, fertilizers, paints, plastics and pharmaceuticals.

Overall land use in the Great Valley is about 75 percent agricultural, 15 percent forested, and 10 percent urban development. The prime agricultural soils have been farmed since settlers first arrived in the area. The Great Valley is a leading agricultural region for Pennsylvania. Dairy and livestock operations are the chief agricultural activities, but orchard produce and animal feed are also important contributors to the industry. The majority of Franklin County is within the Great Valley and is generally undeveloped, with 93 percent of the county devoted to agricultural uses and forested land. A significant amount of the development within Franklin County occurs along the major transportation routes of Interstate 81, U.S. Routes 11 and 30, and PA Route 16.

Ridge and Valley Province

The Ridge and Valley Province makes up the largest physiographic province in the Potomac Region. Chaneysville, McConnellsburg, Mercersburg, Chambersburg and surrounding areas are located within the physiographic province.

The ridges and valleys are a recognizable geographic feature found in Pennsylvania. The Appalachian Mountain chain, which makes up the Ridge and Valley Province, is a series of uplands and lowlands. The current topographic features of these uplands and lowlands are the end result of 65 million years of intense deformation and erosion.

The Ridge and Valley Province in the Potomac Region is comprised of sedimentary, carbonate, shale and sandstone bedrock. The upland areas are formed from tough, erosion-resistant sandstone bedrock, while the valleys and lowlands contain shale, siltstone and carbonate bedrock as shown on the Bedrock Geology Map.

Runoff caused by precipitation is likely to be directed to the lowland valleys where groundwater recharge occurs easier due to the large amount of fractures in the bedrock. Karst environments will occur in the carbonate-dominated areas of the Ridge and Valley Province. Lowland areas in Fulton and Franklin counties with carbonate bedrock have notable concentrations of karst features such as sinkholes, depressions and disappearing streams. The Karst Geology Map on page 259 illustrates karst features found in the Potomac Region. The callout box on the map shows a close up view of the frequency at which these features occur within the carbonate bedrock areas. Additional information of karst environments and its features can be found in the Lower Susquehanna Region section of this atlas.

Aquifer recharge occurs readily in the lowlands that contain sedimentary bedrock. Fractures and cracks in the rock encourage surface water infiltration, and deeper soils absorb precipitation and surface water.

Piedmont Province

As illustrated in the Bedrock Geology Map on the next page, significant variation occurs in the bedrock and consequently the groundwater regimes of the Piedmont Province in the Potomac Region. This physiographic province contains many different types of bedrock including carbonate, metamorphic, sandstone and shale. Carroll Valley, Gettysburg and their surrounding areas are located within the Piedmont Province.

The upland areas of the Piedmont Province are composed of mainly metamorphic and sandstone bedrock with some igneous features. Aquifer recharge is solely dependent on joints, which are cracks in the bedrock, and fractures found in these areas. Highland areas of relatively impermeable bedrock encourage precipitation runoff into the limestone and sedimentary bedrock valleys.

Lowland areas of the Piedmont Province are underlain with sedimentary and carbonate bedrock. Like all lowland areas, aquifer recharge is highly prevalent due to the high concentrations of fractures in the bedrock. Also, the soil mantle of the Piedmont Province's lowlands absorbs precipitation releasing it into the aquifer below.

Coal and Natural Gas Resources

The Potomac Region contains few coal and natural gas resources when compared to the other regions in the commonwealth. The only coal resources of the region are located in Somerset and Bedford counties. Georges Creek Coal Field is a coal field that contains low-volatile bituminous coal. The majority of the field itself resides in western Maryland while only a small northern portion is located in Pennsylvania.

Mining in the Georges Creek Field began in the early 1800s and was marketed via the arrival of transportation lines such as B&O and Pennsylvania railroads.

Bedford County is the only county in the region that contains natural gas fields and underground natural gas storage. Underground gas storage is performed by pumping natural gas into depleted natural gas reservoirs from past operations. Since they originally contained natural gas, operators have little concern about gas escaping because of the presence of natural confining layers surrounding the reservoir. Pennsylvania contains more underground storage facilities (49) than any other state in the U.S. Gas and gas storage fields occur in the southeastern areas of Bedford County along Route 26 south of Clearville.

Mineral Resources

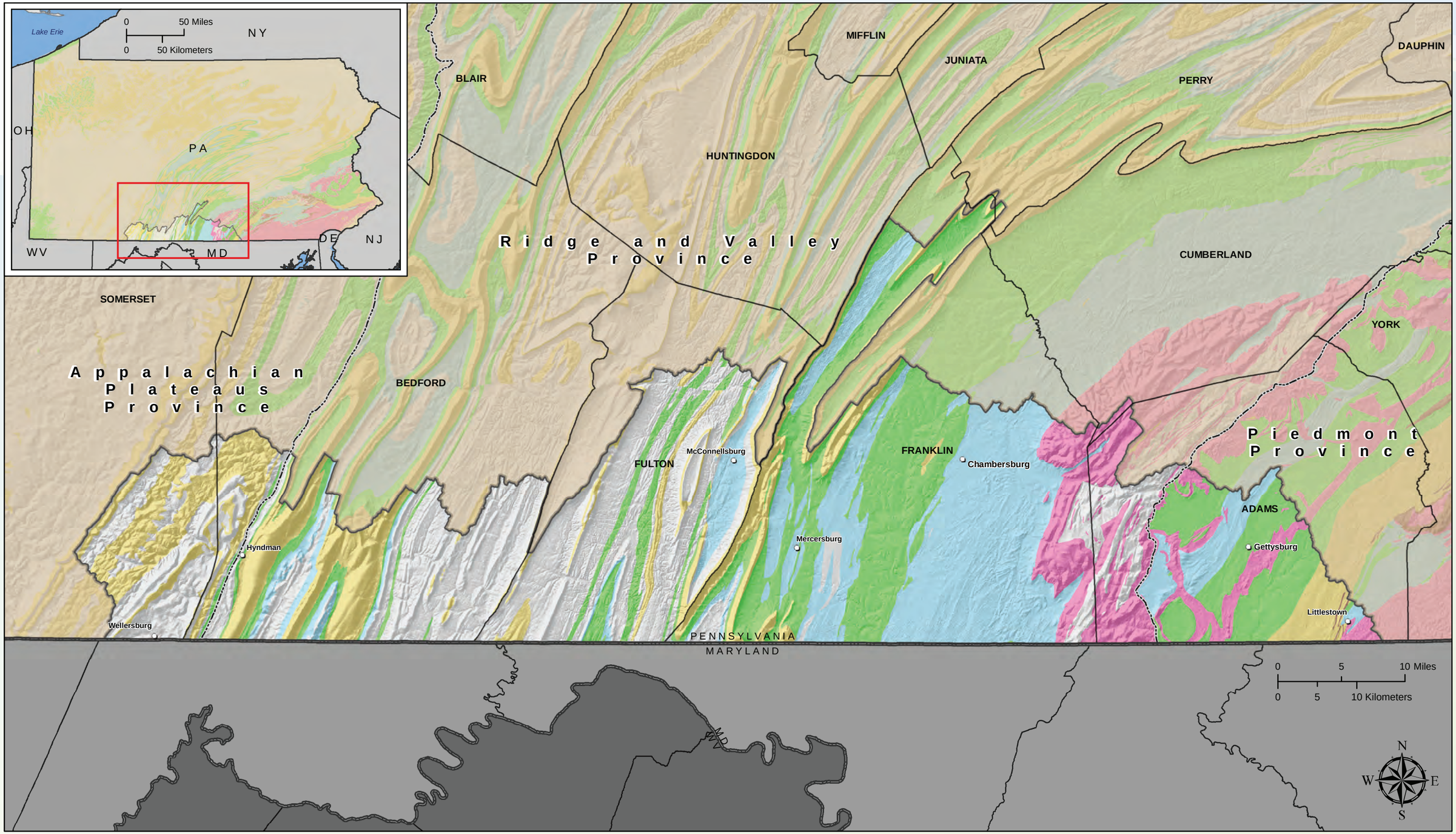
Mineral resources found within the Potomac Region occur throughout the region with larger operations in Franklin and Adams counties.

Crushed aggregate, most commonly limestone or dolomite, is produced from bedrock found in the Ridge and Valley Province of the Potomac Region. Crushed stone (aggregate) is an essential material used in road construction, concrete and asphalt plants and construction material manufacturing. Pennsylvania's crushed aggregate commodity is currently worth approximately $635 million per year.

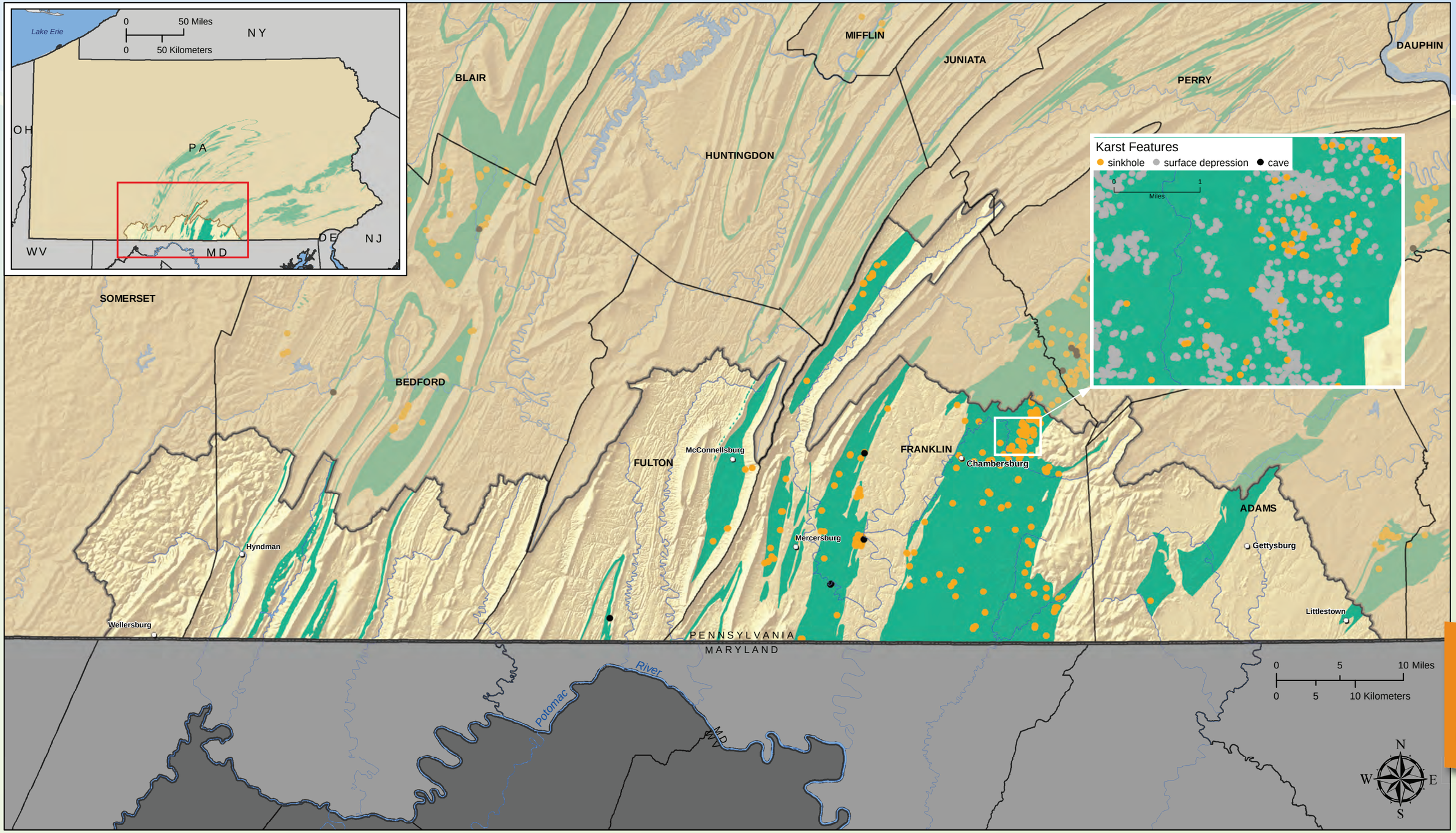
Another resource being extracted in the region is metabasalt. Metabasalt is a metamorphosed igneous rock used in the production of roofing granules for asphalt roofing shingles. Metabasalt is preferred because of several characteristics, including toughness and resistance to weathering. A large quarry in southwestern Adams County, located in the Ridge and Valley Province, is the primary producer.

Headwaters of the Conodoguinet Creek's west branch in the Ridge and Valley Province. View northeast from Route 30, Metal Township, Franklin County.

Bedrock Geology



Karst Geology



Karst Features
- Sinkhole
- Cave

Rock Type
- Carbonate

City/Town

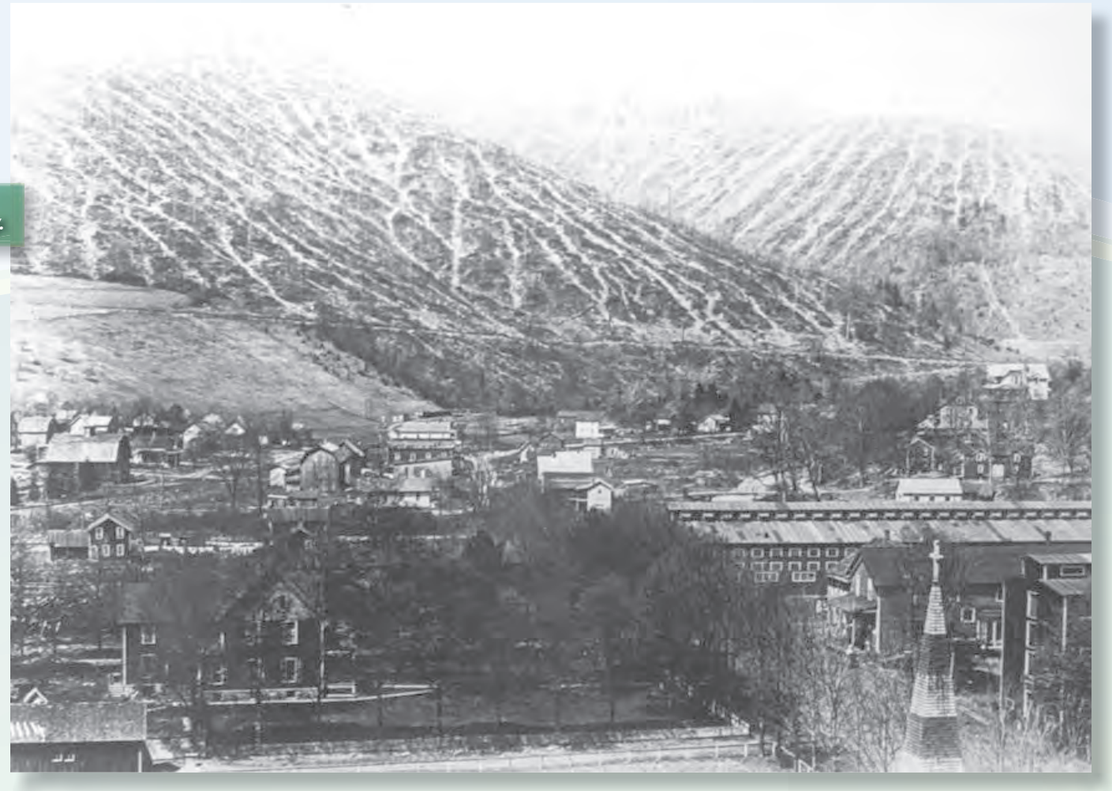
River/Stream

Waterbody

County Boundary

State Boundary

Land Use: Past and Present



Eroding skid trails and logged-over area. Photo courtesy of American Environmental Photographs, University of Chicago Library.

History of the Potomac Region

Studying the change in land use over time can offer insight into the development patterns that may influence the future landscape of an area.

Pennsylvania's Forests

Pennsylvania's water resources are closely tied to its forests. The vast forests of Penn's woods provided clean, pure water not only for Native Americans, but also for the state's founder, by acting as a natural filter. However, William Penn might not recognize his property today.

When colonists first arrived in the mid-Atlantic, more than 90 percent of the landscape was forested. By the mid-1800s, most of the region's trees had been cut down to clear land for cities, towns and farms or to provide lumber. Once dominated by virgin pine hemlock and chestnut forests, the forests regenerated into current day second-growth mixed deciduous and evergreen forests.

The post-colonial changes to the forest were significant. At one time, the predominant tree species in the mid-Atlantic deciduous forest was the American chestnut. Unfortunately, with the accidental introduction of a fungus (Endothia parasitica) to the area in 1904, most American chestnut fell to this disease. The fungus survives in stumps and saplings affecting any trees approaching maturity. The great oak-chestnut forests of the mid-Atlantic have been replaced by other forest types.

Early Settlement

The section lying between the Susquehanna and Potomac rivers has historically been known as the Cumberland Valley. Although Native American groups including the Delaware, Shawnee and Iroquois Confederacy used the area as a thoroughfare and hunting ground, there is no conclusive evidence they made their permanent residence in this region. A few Europeans began coming into the country in the 1730s and 1740s, but the Potomac Region of Pennsylvania remained largely unsettled by Europeans until after the French and Indian War. In 1750, Robert MacRay established a trading post in the area that would one day become Bedford County, but raids from hostile Native Americans pressured MacRay to abandon his Raystown outpost.

Following the defeat of the French at Montreal in 1760, the Cumberland Valley soon began to increase in population. Pioneers used the Forbes Road to settle in the lush valleys and timber-rich mountains. Many of the early settlers in the region were Scots-Irish and Scottish immigrants who pushed through the Cumberland Valley and then into central and western Pennsylvania. Other prominent groups included the English and Germans.

Did you know?

During the 1794 Whiskey Rebellion, President George Washington made Fort Bedford in Bedford County his headquarters. The Whiskey Rebellion was the result of an excise tax placed on all distilled spirits which angered western settlers.

Agriculture

The Potomac Region of Pennsylvania provided early farmers with fertile soils. Early colonial farmers initially concerned themselves with feeding their own families, not with producing quantities for sale. Early colonial agricultural practices depleted the soil. Farmers cleared the land and burned the trees or left them to rot. Principles of crop rotation and fertilization were not well understood, and soil fertility quickly declined. Early farmers let the land lie fallow (uncultivated) for up to seven years while other fields were farmed. Other settlers farmed their fields until the soil was exhausted and then moved to a new location. It was not until the 1790s that a crop rotation system alternating corn, wheat and clover was widely adopted.

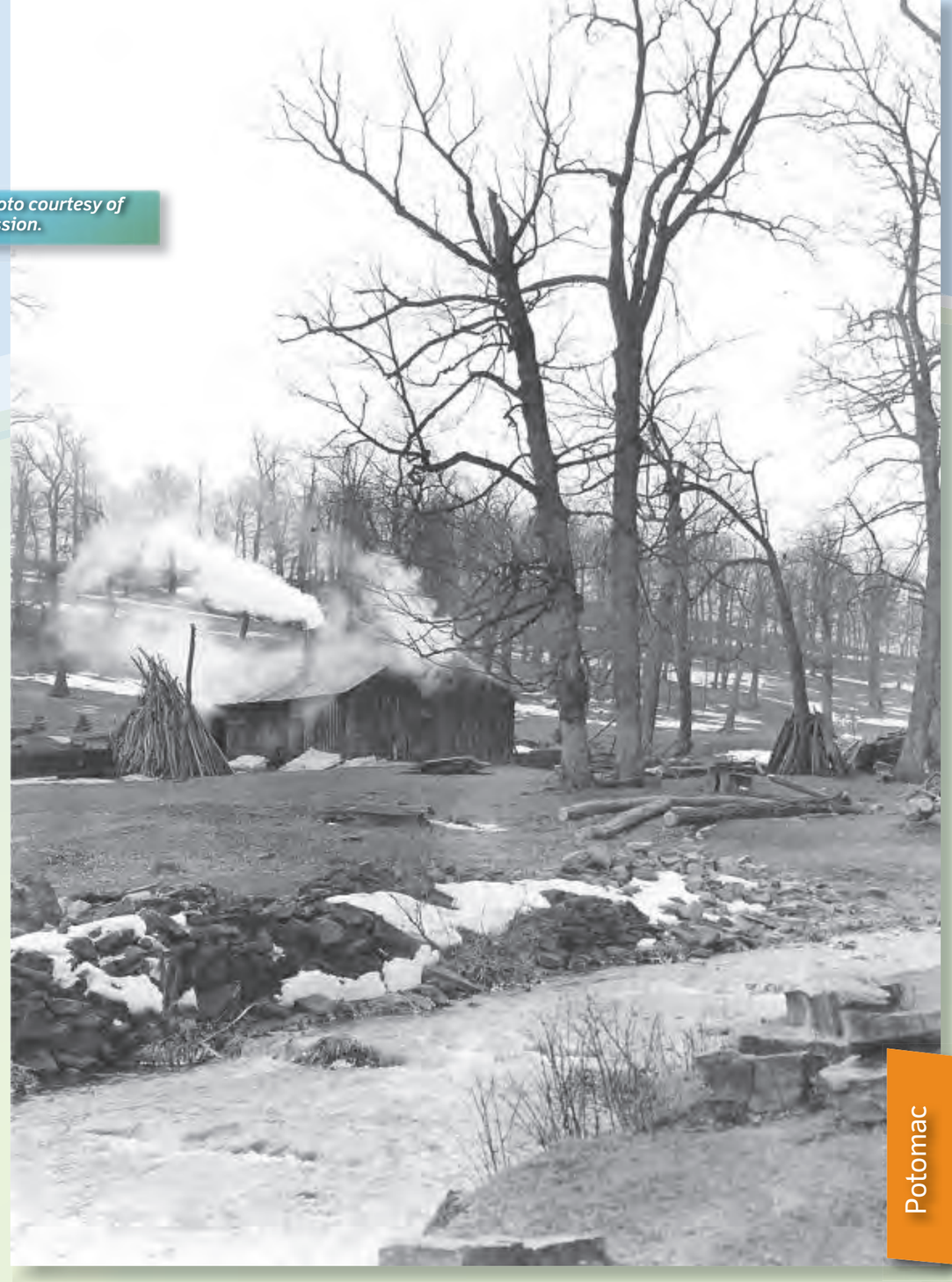
During the early 1800s, lime and gypsum fertilizer came into general use. A large portion of the Potomac Region is very rich in limestone. This limestone was burned in kilns and spread on the fields to increase fertility.

By the 1840s the Midwestern states could produce wheat at a cheaper price than Pennsylvania. The state ceased to be the grain belt of the nation, as it had been in the late-18th and early-19th centuries. A shift toward intensive agriculture, especially dairy farming, was made possible by mechanized farm equipment that was generally available by the 1850s. In the 20th century, technological advances in fertilizers and pesticides helped maintain high agricultural production.

Industry

The streams draining into the Potomac River supplied the water power for milling and manufacturing for early settlers. As with other areas of the state, early industries included logging, sawmills, grist mills and tanneries. The timber industry was an important one for the early inhabitants of the Potomac Region. Originally, the timber was used for lumber, but the forest also furnished fuel, potash, bark for tanning acid, wood for furniture and coopering, rifle stocks, shingles, household utensils, charcoal and other uses. Vast tracts of land were deforested. By the 1920s, the lumber was gone and the lumbermen moved to other states, leaving behind thousands of treeless acres that were subject to soil erosion, resulting in further degradation of the land and the silting of streams and rivers.

As the colonies pushed for independence, coal was discovered in Broad Top in Huntingdon County to the north. Bedford County possessed great quantities of iron ore. Iron foundries were established in the area after the American Revolution. The Mont Alto Iron Works first began operations in 1807-1808. In 1811, additional iron works were erected along East Antietam Creek. To



Somerset County maple syrup production. Photo courtesy of Pennsylvania Historical and Museum Commission.

reach markets, iron was hauled by wagon to the Potomac River at Williamsport, Md. to be taken downriver on flat boats. In later years, much of the iron was taken to Baltimore by wagon. Other furnaces included the Caledonia Iron Works (1837), Mount Pleasant Iron Works (1783), Carrick Furnace and Richmond Furnace.

Transportation

Early roads followed the Native American paths and were improved only to the point necessary to guide pack horses. Military necessity was the most common reason for road improvements in the pioneer days. When in 1759, the British removed the French from Fort Duquesne, a new road was cut to Raystown. A new garrison at Raystown was named Fort Bedford. The new road became known as the Forbes Road. This road originally began at Carlisle and ended at Pittsburgh. It was the first road to go into the western interior of the new nation. The Forbes Road is now part of U.S. Route 30 and the Pennsylvania Turnpike.

U.S. Route 30, also known as the Lincoln Highway, was the first road across America. The Lincoln Highway was originally promoted by Carl G. Fisher, who, in 1912, began seeking funding from friends in the automobile industry. Substantially completed by 1915, the Lincoln Highway was 3,389 miles long. The road inspired a movement for better roads in America for the new automobile.

Did you know?

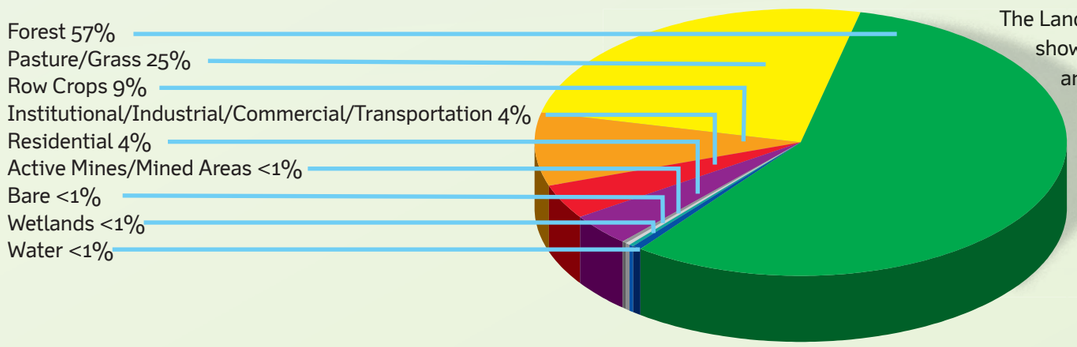
Gettysburg, in Adams County, will forever be famous for its three-day Civil War battle which took place in July 1863. An estimated 170,000 soldiers fought in the battle which ended with more than 40,000 killed, wounded or missing. The battle was the turning point in the struggle which ended in Northern victory in 1865.

The Cumberland Valley Railroad was the first railroad in this region. Chartered by the Legislature of Pennsylvania in 1831, it ran from Carlisle to Chambersburg in present-day Franklin County. In 1841 the Franklin Railroad connected the Cumberland Valley Railroad to Hagerstown, Md. By 1882, the Shenandoah Valley Railroad was opened from Hagerstown to a connection with the Norfolk & Western Railroad, at Roanoke, Va.

Land Use in the Potomac Region Today

As the pie chart on this page indicates, more than half of the land area in the Potomac Region consists of forestlands, particularly in the western portion of the region. Deciduous species make up the majority of the forest types throughout the region. Agricultural lands account for more than one-third of land use, and are prevalent in the eastern half of the region. Pasture and hay are a substantial part of the agricultural sector. In addition to McConnellsburg, Chambersburg and Gettysburg, developed areas are notable in southern Franklin and Adams counties. Commuters have developed the southern reaches of these two counties for its easy access to Maryland.

Potomac River Basin Land Use



The Land Cover Map on page 264 shows the various land uses and vegetative cover across the Potomac Region. Definitions for the land use categories used in the Land Cover Map are as follows:

Land Use: Past and Present, continued

Apple orchards, Adams County. Photo courtesy of Pennsylvania Historical and Museum Commission.

Development

Approximately 8 percent of the land in the Potomac Region is developed for residential, commercial and industrial use. Developed areas are categorized by the by the amount of land area covered by impervious surfaces:

- Developed, Open Space – less than 20 percent of the area is covered by impervious surfaces, mostly vegetation in the form of lawn grasses (e.g., golf courses, parks, single-family housing units and vegetation planted in developed settings for recreation, erosion control or aesthetic purposes)
- Developed, Low Intensity - 20 to 49 percent of the area is covered by impervious surfaces (e.g., single-family housing units)
- Developed, Medium Intensity – 50 to 79 percent of the area is covered by impervious surfaces (e.g., single-family housing units)
- Developed, High Intensity – 80 to 100 percent of the area is covered by impervious surfaces, where people live and work in high numbers (e.g., apartment complexes, row houses and commercial/industrial areas)

Forest

More than half of the land in the Potomac Region, 57 percent, is covered by forests. Forest lands are categorized by the type of trees that dominate the area:

- Deciduous Forest – greater than 20 percent of the area is dominated by trees that are taller than 5 meters and shed leaves in the autumn
- Evergreen Forest – greater than 20 percent of the area is dominated by trees taller than 5 meters and maintain their leaves all year round
- Mixed Forest – greater than 20 percent of the area is dominated by trees taller than 5 meters but are not dominated by deciduous or evergreen species

Agriculture

Approximately 34 percent of the land in the Potomac Region is used for farming. Agricultural lands are categorized by the type of crop that is cultivated:

- Pasture/Hay – 25 percent of the area is covered by grasses and legumes planted for livestock grazing or hay production
- Cultivated Crops – 9 percent of the area is covered by annual crops (e.g., soybeans, vegetables, tobacco, cotton), orchards and vineyards and/or all land that is actively being tilled

Other

Less than two percent of the land in the Potomac Region is covered by barren lands, open water, wetlands, shrub/scrub and grassland/herbaceous areas. These areas are categorized by the amount of land covered by vegetation (other than trees) and/or by water:

- Barren Land (Rock/Sand/Clay) – Areas of accumulated earthen material (e.g., bedrock, sand, glacial debris, strip mines, gravel pits) with less than 15 percent vegetation cover
- Open Water – all areas of open water with less than 25 percent of the area covered by vegetation or soil
- Wetlands – areas where the soil is periodically saturated or covered with water and greater than 20 percent of the area is covered with vegetation
- Shrub/Scrub – greater than 20 percent the area is dominated by shrubs and young trees smaller than 5 meters tall
- Grassland/Herbaceous – greater than 80 percent of the area is dominated by grasses and herbaceous vegetation

How Land Use Affects Water Resources

The various uses of land affect water in different ways, some better than others.

- Importance of Forested Areas to Water Supplies

  The Potomac River Basin drains into the Chesapeake Bay and is comprised of the Central Appalachian Ridge and Valley region. This mid-Atlantic region supports a mix of hardwood and coniferous forests. This region shares a balance of composition between the oak forests of exposed, dry, infertile sites and the richer moist mixed coniferous forests of the sheltered, fertile sites located in the cool moist uplands. Northern hardwoods such as sugar maple *(Acer saccharum)*, yellow birch *(Betula alleghaniensis)* and American beech *(Fagus grandifolia)* are characteristic, either forming a deciduous canopy or mixed with Eastern hemlock *(Tsuga canadensis)*, or in some cases Eastern white pine *(Pinus strobus)*. Other common and sometimes dominant trees include chestnut oak *(Quercus prinus)* and red oak *(Quercus rubra)*. Associated canopy species include tulip tree *(Liriodendron tulipifera)*, red maple *(Acer rubrum)*, pignut hickory *(Carya glabra)*, red hickory *(Carya ovalis)*, mockernut hickory *(Carya alba)*, American basswood *(Tilia americana)* and black birch *(Betula lenta)*. The tall shrub layer is characterized by American witchhazel *(Hamamelis virginiana)* and striped maple *(Acer pensylvanicum)*. The lower shrub layer is often patchy and contains a mixture of scrambling vines and highbush blueberry *(Vaccinium corymbosum)* plants. Forests comprise more than half of the region, with 50 percent deciduous species and five percent evergreen and mixed forest.

Forested areas are critical to the supply and quality of water resources.

The agricultural fruit belt region of western Adams County is inextricably linked to South Mountain rising to its west, as the groundwater is recharged from precipitation falling on the forested uplands. Photo courtesy of DCNR.

Tree canopies and the rich organic matter found in forest floors store, clean and slowly release the majority of water that replenishes groundwater and maintains streamflow. Areas of forested lands are reserves of clean groundwater, and forested areas are often good locations for municipalities to drill high-yield water wells.

Some forests are particularly effective at delivering water quality benefits. Wooded buffers along streams trap sediment and transform nutrients and other pollutants into less harmful forms. For example, properly managed woodlands can remove 90 percent of the nitrates in stormwater runoff given the right soil conditions.

With regard to drinking water, intact forests within wellhead protection areas play a vital role in protecting the amount and quality of water reaching public wells. In developed areas, urban forests are critical to reducing stormwater runoff from small storms.

Forests also protect local waterways by retaining nitrogen in air deposition. An oak/hickory forest retains an average of 90 percent of atmospheric deposition, while a spruce/fir forest retains 78 percent. In general, coniferous forests use less nitrogen than deciduous forests (a factor more of the soils than the tree itself). The exception is the Eastern hemlock forest, which is highly efficient at retaining nitrogen. Forests also sequester, or remove, carbon from the air helping to reduce the impact of carbon dioxide on global warming.

Some of the most important forests for water resource protection are the most threatened. Forests are vulnerable to development and other land uses that can fragment high quality forests and expose woodlands to invasive species. Parcelization is another threat – more people own forests than ever before but many own less than 10 acres. As larger tracts of forest land are subdivided, it is important that woodlot owners be educated about sustainable forest management practices.

On occasion, efforts to protect woodlands can be misguided and serve to diminish forest health. Under the Municipalities Planning Code, forestry, which includes timber harvesting, is a permitted use by right in all zoning districts. Concerns over forest regeneration and wildlife habitat have led to the adoption of local timber harvesting ordinances that, in some cases, are overly restrictive in prescribing timber harvesting practices. Local governments can benefit from knowledge of state regulations protecting against poor timber harvesting practices and advice from a professional forester when planning and adopting local ordinances.

Agriculture

Farmers usually rely on groundwater wells or springs to provide drinking water for both their families and livestock. Because groundwater is buried beneath the Earth's surface, it is sometimes thought that groundwater is protected from contamination. That is not the case. Activities on the land surface, including improper agricultural practices, can harm groundwater quality. Pollution by nitrate (a form of nitrogen), bacteria and pesticides can cause health problems for human beings and livestock when these contaminants pollute a water supply.

Animal manure, commercial fertilizers and pesticides can also pollute surface waters if they are misused or applied in excess of crop needs. Much of sediment pollution in streams comes from eroding and unprotected stream banks. Fencing stream banks and limiting livestock access with crossings promotes the establishment of a healthy vegetative cover. Forested vegetation along streams, called riparian forest buffers, helps stabilize stream banks in reducing erosion and collapse. These buffers can also help trap soils and pollutants that may otherwise run off of adjacent fields into the waterways.

Forestland and Farmland Conversion to Developed Land

Only about 9,600 of Pennsylvania's 58,000 farmers have sales of $100,000 or more. The cost to produce quality agriculture goods consumes nearly 85 percent of sales, leaving most farmers with a net farming income below $19,806, from which a 12.4 percent self-employment tax must be calculated. For a family of four, this net income is below the poverty level (based on 2006 figures). As a result, many farms in the commonwealth have been sold to housing developers in the past years. This movement is largely due to rising taxes and land prices, reflecting a high demand for land.

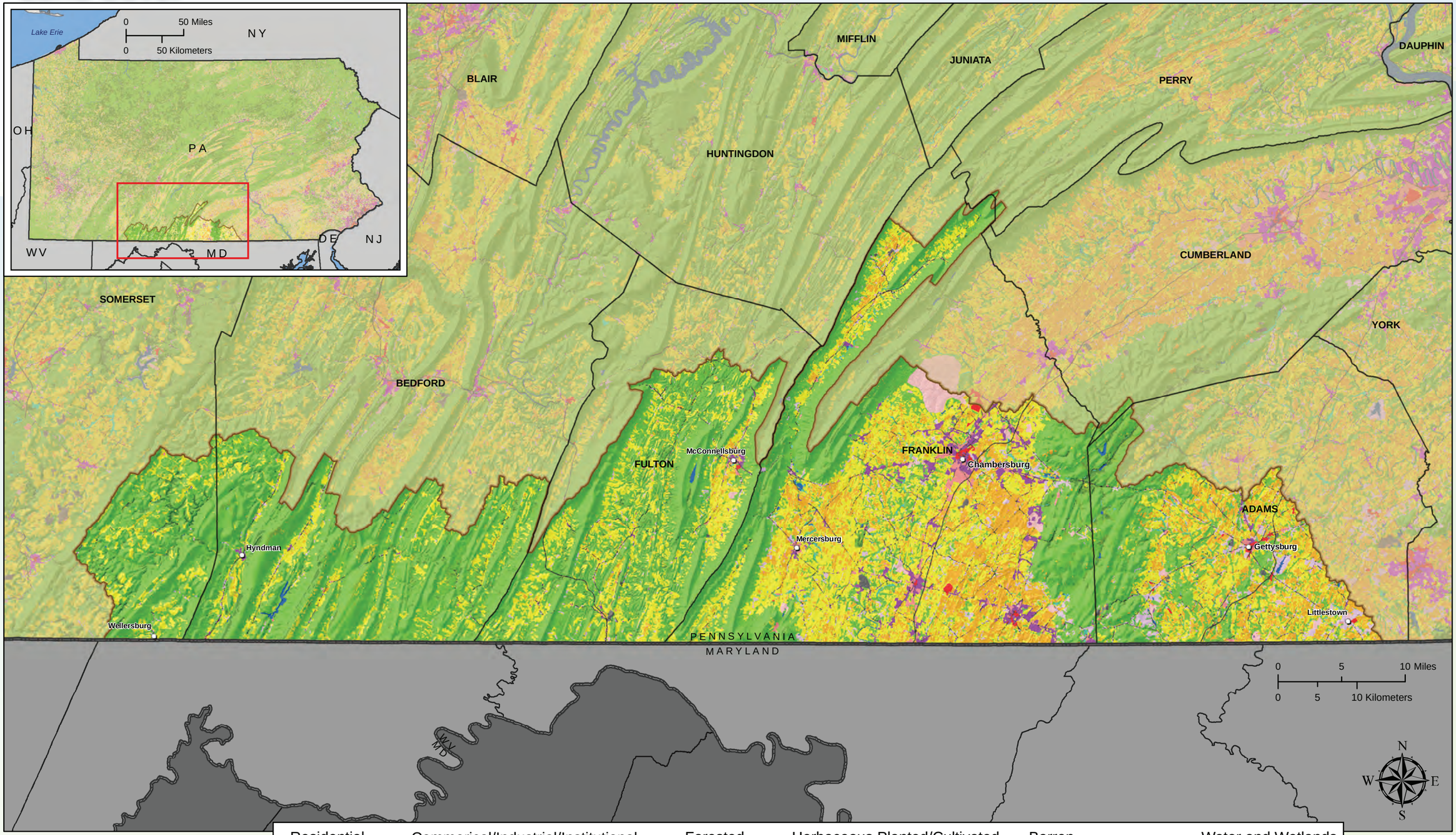
A map showing future population projections is presented earlier in the Potomac Region Introduction pages of this atlas. This map depicts a general trend of historically urban areas losing population while the areas surrounding towns and cities are gaining population. Many older towns and cities throughout Pennsylvania are currently losing population as people continue to settle in suburban and rural housing in areas that were once forest or farmland. During the 1990s, the total number of acres developed in Pennsylvania increased by 53.6 percent, while Pennsylvania's population grew by only 3.4 percent. The aerial photographs on page 265 illustrate the landscape changes that have occurred in the Potomac Region over time. Both photographs were taken in the area of Lake Heritage, Adams County. The 1937 photograph shows sparse houses among farm fields and orchards with a small tributary flowing along a rural road. The landscape is drastically different in the 2003 photograph. The small tributary has become Lake Heritage and the farm fields and orchards of 1937 were replaced with roads encircling the lake and connecting the numerous houses that have developed along the lakefront property.

The relationship between development patterns and water resources is complex. Since Pennsylvania recommends a watershed approach to managing water resources, it's critical that the local decision-making framework consider water resources and land uses within the entire watershed area when planning for growth and development.

A watershed approach broadens the geographic planning area beyond political boundaries and extends it to the hydrological boundaries of the watershed. Protecting and managing water resources at the broader watershed scale are likely to require inter-municipal cooperation.

Evaluating the percent of impervious cover in a watershed can be a useful indicator in planning future growth and development. Impervious surfaces, which prevent water from flowing through them and into the groundwater system, include roads, parking lots, rooftops, driveways and sidewalks. The Impervious Map on page 267 shows impervious surfaces based on land use/land cover in the Potomac Region. Areas of impervious cover are centered around cities and towns as well as corridors connecting these locations. Developed lands are more prominent in the eastern half of the Potomac Region, especially around I-81 which provides convenient access to Maryland.

Land Cover



- City/Town
- County Boundary
- State Boundary

Residential	Commerical/Industrial/Institutional	Forested	Herbaceous Planted/Cultivated	Barren	Water and Wetlands
Low Density	Low Density	Deciduous Forest	Row Crops	Bare	Water
Medium Density	Medium Density	Evergreen Forest	Pasture/Grass	Active Mines/Mined Areas	Forested Wetlands
High Density	High Density	Mixed Forest		Roads	Emergent Wetlands

Land Use: Past and Present, continued

Conservation Districts

Recognizing the need to support grassroots organizations and efforts, state legislators passed the Conservation District Law about 50 years ago. With this, county conservation districts were established. Bedford, Somerset, Fulton, Franklin, Cumberland and Adams counties all have their own conservation districts within the region.

Each conservation district is led by a board of directors made up of constituents from various occupations and backgrounds who volunteer their time to make a difference. These leaders explore their county's natural resources and determine the issues that need to be addressed to enhance and protect their communities, as well as preserve the land's natural beauty. Neighboring district board members often collaborate before taking action on projects that would make an impact across county lines.

Initiatives within the districts include environmental education, forest management, storm water management, floodplain management, dirt and gravel roads, nutrient management, Chesapeake Bay Program, abandoned mine reclamation, biosolids, stream encroachments and wetlands, agricultural preservation, erosion and sedimentation pollution control and wildlife management.

For more information on the conservation districts, visit: www.pacd.org or www.agriculture.state.pa.us

Research has shown a strong inverse relationship between the percent impervious cover and water quality and stream health. However, the location of impervious cover within a watershed is another variable that needs careful consideration. For example, in an attempt to protect water quality by limiting impervious cover, many local governments have mistakenly applied impervious cover thresholds to individual sites within a watershed by adopting low density zoning districts, thereby encouraging scattered low density development.

Used alone, low density development consumes more land and generates more stormwater runoff than the same number of homes accommodated under a higher density scenario in a given watershed. (See illustration on page 267.) In other words, when measured by the house, higher densities produce less stormwater runoff.

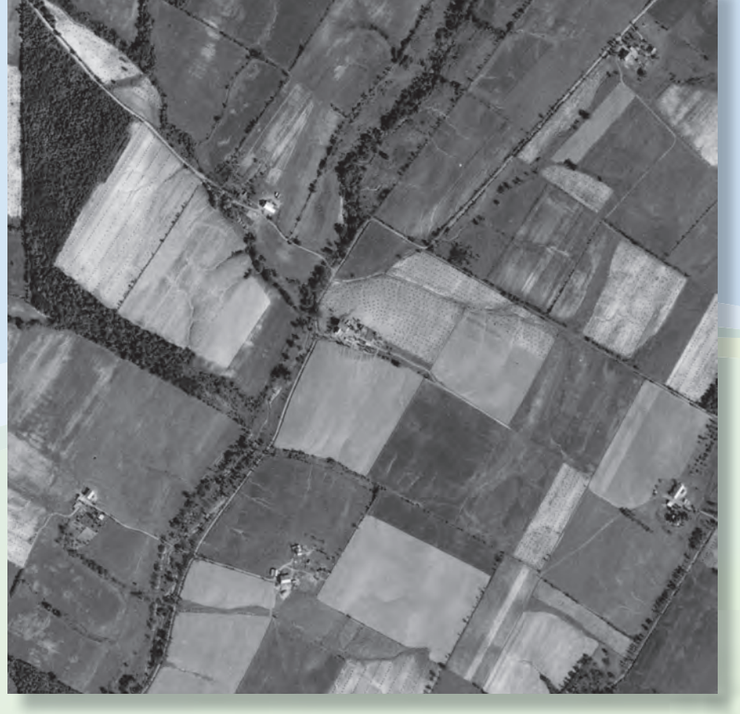
When runoff is measured by the acre, limiting density does minimize water quality impacts compared to higher-density scenarios. However, when measured by the house, higher densities produce less stormwater runoff. (Source: Protecting Water Resources with Higher-Density Development, EPA 2006)

Higher density development—more people on less land—can effectively protect water resources if it occurs within the framework of a more encompassing watershed strategy that considers other factors, such as the location of old and new development, preservation of critical natural lands and the use of site-specific stormwater management practices.

In some situations, low density development can be a tool to preserve agricultural and forest lands if it too reflects a watershed strategy and includes such elements as the protection of water supply protection areas, streamside buffers and floodplains or critical ecological habitats.

When planning for future growth that will be protective of water resources, it's important that local governments use a wide range of land use strategies, based on a sound understanding of local watershed hydrology, assessment of undeveloped lands and local housing and infrastructure needs.

For more information on smart growth techniques, EPA's Protecting Water Resources with Smart Growth provides an excellent overview of how communities have minimized the impacts of new development on water resources through effective planning policies and site-level practices. Visit www.epa.gov/smartgrowth.



Lake Heritage, Adams County. Top, 1937; above, 2003.

Land Use: Past and Present, continued

Land Use Planning for Water Resources

Planning for adequate supplies of clean water is just as important as planning for roads, businesses and schools. In recognition of this fact, the Municipalities Planning Code (MPC), the enabling state legislation that empowers local governments to plan and regulate land use, was amended in 2000 to require the inclusion of a plan for the reliable supply of water in the preparation of local comprehensive plans.

Nearly 1,200 municipalities have adopted comprehensive plans to guide future land uses. More importantly, the number of municipalities engaged in cooperative, multi-municipal planning (permitted under the MPC since 2000) is growing – 760 municipalities and counties were involved in 207 multi-municipal comprehensive plans in 2005.

Collaborative planning is essential to sound water use planning since water almost always crosses political boundaries. By planning at a watershed scale, local government leaders can take advantage of the many land use tools that are particularly useful in protecting the long term supply and quality of water.

For example, a multi-municipal approach provides for joint zoning ordinances. Instead of each municipal government providing for every land use, joint zoning allows neighboring governments an opportunity to integrate land uses. A joint overlay zone may protect a wellhead protection area that crosses municipal lines. An agricultural district may make more sense in one municipality where prime farmland dominates, while higher density development can be better accommodated in another municipality where the soils are less productive.

Many more land use planning tools, adopted jointly or individually, are at the disposal of local government officials who recognize the need to protect water resource lands and allow for growth and development. Examples include:

- Effective agricultural zoning
- Transfer of development rights
- Conservation easements on agricultural or forested land (purchased or donated)
- Overlay zones to protect wellhead protection areas, streamside buffers
- Green infrastructure planning
- Conservation subdivision or open space design
- Traditional neighborhood development
- Infill and redevelopment incentives
- Site-level development regulations that reduce impervious cover and infiltrate and/or treat stormwater runoff

All of these land use planning tools are most effective when applied within the framework of local watersheds. It is up to municipal governments to integrate watershed strategies in their comprehensive plans and development regulations in order to truly protect our most precious natural resource – water.

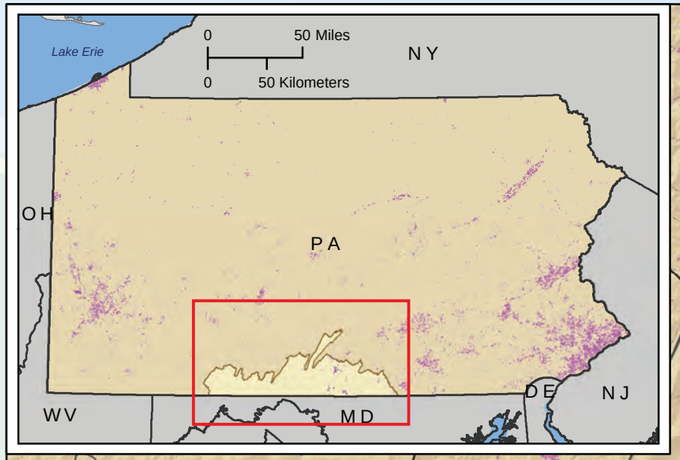
> "[It is] not uncommon to pull 4,000 shad or 300,000 herring in one seine haul. One haul of 450 rockfish with an average weight of 60 pounds was documented. Hundreds of sturgeon were captured on a single night near the US Arsenal in Washington."
>
> *Niles Weekly Register* ca. 1830s referring to the Potomac River

Average Annual Runoff - Lot Level Comparisons

Density of Houses/Acre	Impervious Cover (percent of total area)	Total Runoff (ft³ per year)	Runoff per House (ft³ per year)
8 houses on 8 acres	20%	149,600 (18,700 ft³/yr x 8 acres)	18,700
8 houses on 2 acres	38%	49,600 (24,800 ft³/yr x 2 acres)	6,200
8 houses on 1 acre	65%	39,600 (18,700 ft³/yr x 8 acres)	4,950

Back Creek, Franklin County. Photo courtesy of J. Ducnuigeen.

Impervious Cover



BLAIR
MIFFLIN
JUNIATA
PERRY
DAUPHIN
HUNTINGDON
CUMBERLAND
SOMERSET
BEDFORD
YORK
FULTON
McConnellsburg
Chambersburg
FRANKLIN
ADAMS
Mercersburg
Gettysburg
Littlestown
Hyndman
Wellersburg
PENNSYLVANIA
MARYLAND
WV
MD

0 5 10 Miles
0 5 10 Kilometers

N
W E
S

Potomac

City/Town
Major Roads
County Boundary
State Boundary
Roads
5 -30% impervious cover
31 - 75% impervious cover
>75% impervious cover

Water Supply and Wastewater Treatment

History of Water Supply and Wastewater Treatment in the Potomac Region

Historically, the Potomac Region offered settlers plentiful land and water resources. The region's water resources attracted the attention of many early settlers and colonists because they contained bountiful fish like shad and pristine drinking water. The Potomac Region also contained a great deal of forested land that would eventually become a major industry in the region. The region has seen industry like iron give way to agriculture which now dominates Franklin and Adams counties. Industries both past and present have had their effects on water quality in the region. Past agricultural practices have allowed for pesticides, herbicides and nutrient-laden sediment to migrate into surface and groundwater.

Did you know?

Founded in 1940, the Interstate Commission on the Potomac River Basin is the oldest of Pennsylvania's compact commissions (Pennsylvania joined in 1945).

The Potomac Region Today

It was because of past problems that Pennsylvania has worked hard with its neighbors to help restore the Potomac Basin to a healthy state. Today the Potomac Basin is responsible for supplying more than five million people throughout Pennsylvania and neighboring states with water for drinking and industrial use. Pennsylvania alone accounts for 1,584 square miles of the Potomac Basin's 14,670 square miles and 180,000 of the five million people in the region. The commonwealth is home to several major tributaries to the Potomac River such as Conococheague and Antietam creeks. Along with large tributaries to the Potomac River, Pennsylvania's portion of the Potomac Region also contains many groundwater resources, lakes, reservoirs, streams and rivers.

The Public Water Service Areas Map on the following page depicts population density throughout the Potomac Region in relation to areas served by public water suppliers. Each dot on the map represents 500 people living in the municipality (2000 Census). The dots are randomly placed within the municipality boundaries and do not represent the exact location of people living in a township, town or city. As the map shows, densely populated areas like Chambersburg, Gettysburg and McConnellsburg, represented by dots so close together that they form a solid color block, are generally served by public water supplies. The sources of public water supplies are groundwater, lakes, reservoirs, rivers and streams. Sparsely populated areas, where the dots are farther apart, are not included in the public supply service areas and residents must find private sources of water, such as residential wells that tap into groundwater, to meet their water needs.

Wastewater treatment service areas typically mimic those of public water service areas. Typically, public service areas are highly urbanized and cannot accommodate on lot private septic systems. Limited available open space and high concentrations of people nearly always require the need of public wastewater treatment.

Public Water Resources

Groundwater

In the Potomac Region, groundwater is used to supply some urban and suburban areas including Gettysburg in Adams County and Greencastle in Franklin County. In the region, private residences in rural areas also use groundwater as a source of drinking water.

Lakes and Reservoirs

The Potomac Region has lakes and reservoirs that provide drinking water, flood control and recreational use. Lakes throughout the region are maintained by state agencies like the Pennsylvania Fish and Boat Commission (FBC). Lakes, such as the 204-acre Meadow Grounds Lake in Fulton County, are maintained by the FBC. The Evitts Creek Water Co. owns the 268-acre Koon Lake and 120-acre Gordon Lake which supply water to the city of Cumberland, Md.

Rivers and Streams

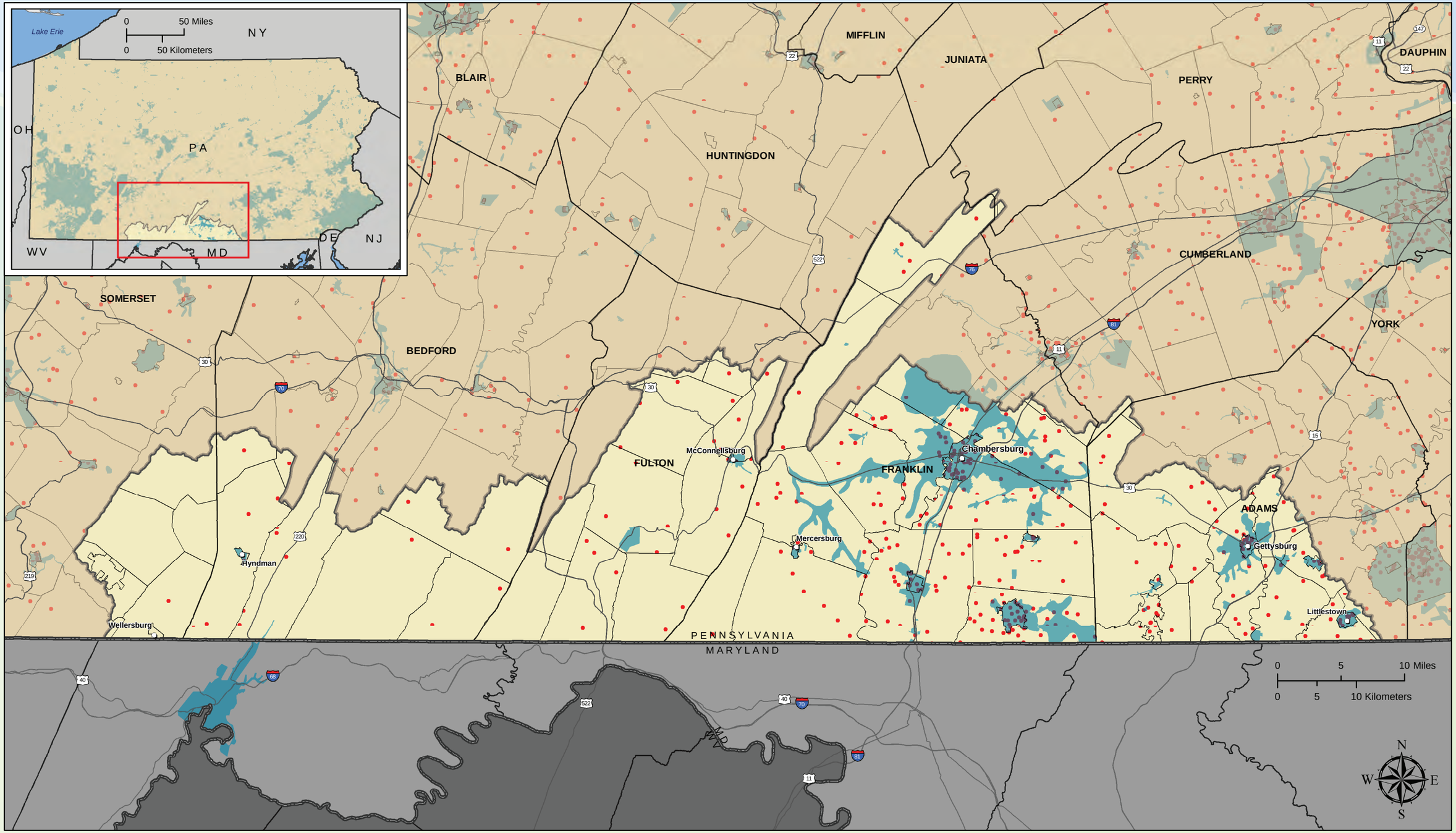
The 1,584 square miles of the Potomac Region contains many streams and rivers that are utilized for water supply and recreation. Antietam Creek and Rattlesnake Run in Franklin County are equipped with public water intakes that supply Waynesboro. Gettysburg in Adams County draws water from Marsh Creek, and Rock Spring supplies Centerville in Bedford County.

Drinking Water

Like all living organisms, humans need water to survive. Whether a person lives in a single family home in the country or a large metropolitan city, water supplies support daily life. Public drinking water may be supplied by a publicly-owned or privately-owned company while private drinking water is usually supplied by an on-site well. Depending on its source, water supplies

Pesticide spraying in Adams County orchard, 1890s.
Photo courtesy of Pennsylvania Historical and Museum Commission.

Public Water Service Area



City/Town

Major Roads

Public Water Service Area

Municipality Boundary

County Boundary

State Boundary

Population density for 2000 by municipality

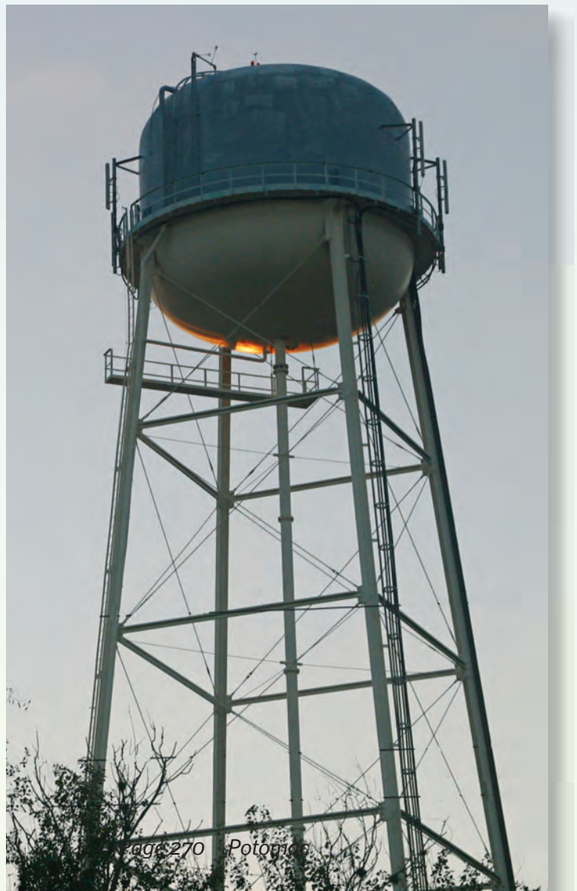
1 Dot = 500 People

Water Supply and Wastewater Treatment, continued

may require purification before human consumption. This purification is done to ensure that all harmful materials are extracted or minimized so not to adversely affect human beings.

Public Water Treatment

Water treatment for most urban and suburban centers involves a process of filtration, disinfection and distribution of purified water. The first process in filtration, coagulation, involves adding selected chemicals that stick to particles in the water and make them heavy. As the particles become heavy they drop to the bottom which is known as precipitation. Water is then filtered to remove the precipitate. During the filtering process, the water passes through layers of sand, gravel and charcoal that remove even smaller particles. Next, disinfection is accomplished by injecting chlorine or ozone into the filtered water. Chlorine is the most common form of disinfection because it has a residual effect, meaning it will remain in the water through the distribution system. Depending on where the source water to the aquifer comes from, groundwater resources may also require treatment for removal of organics and metals. The final aspect of water treatment is distribution in which the treated water is sent through piping systems to homes, businesses and industries or to a storage facility for later use.



Chambersburg Borough, the largest urban center in the Potomac Region, treats and purifies water from the East Branch of the Conococheague Creek. The 18.5 square mile watershed that feeds the East Branch is largely located in the Michaux State Forest. This has kept the public water supply to Chambersburg in near pristine condition. Other urban centers and cities in the Potomac Region like McConnellsburg, Gettysburg and Waynesboro use similar methods of water treatment.

Private Well Water Treatment

Rural areas, more common in the northern section of the Potomac Region, extract water from private wells. Homeowners with private wells have a variety of options for filtration and water softening systems that remove mineral particles from well water. The system selected usually depends on the amount of water a private residence uses per day as well as the most common types of contaminants necessary to filter from the water source. Fortunately for most private well users, little treatment is usually needed as a large portion of groundwater is unaffected by contaminants that typically affect surface water. Information on home water systems and contaminants can be obtained from the DEP, the EPA, Centers for Disease Control or the National Sanitation Foundation International. For more information on private well water management and protection, visit Penn State's Master Well Owner Network located at http://mwon.cas.psu.edu/.

Source Water Protection

Pennsylvania, like all other states in the U.S., is required to ensure that healthy drinking water is available for its citizens through compliance with the Safe Drinking Water Act (For more information visit www.epa.gov). Other federal and state laws, including the Water Resources Planning Act which prompted the creation of this atlas, lay the groundwork for water planning and protection. (Water laws and regulations are discussed in the Statewide Overview Section of this atlas.)

Since the Potomac Region supplies people with drinking water, protecting these resources has become paramount for the commonwealth. Groundwater, rivers and lakes in the region face potential contamination from a number of sources such as development, agriculture, old septic systems, waste disposal sites and abandoned mines. Pennsylvania state agencies are working with organizations in the Potomac Region to help assess the health of surface water and groundwater, identify point and nonpoint sources of pollution, prevent contamination, restore degraded waters, preserve pristine waters, increase public awareness of existing problems and help the public utilize best management practices.

Although federal and state level agencies are creating new policies, source water protection must literally begin at the source. Local governments – counties and municipalities – have the greatest opportunity to influence the future of Pennsylvania's water supply. By studying their water sources, identifying areas of concern or hazards that threaten those sources, developing water protection and conservation regulations, and implementing those regulations, local governments can protect water supplies for future generations. Many Pennsylvania counties in the Potomac Region are rising to this challenge.

- The Adams County Conservation District has created a Chesapeake Bay Tributary Strategy in order to combat excess nutrients in surface waters. The strategy focuses on increasing no-till farming practices and managing manure applications to agricultural lands. The strategy emphasizes the use of grass buffer strips and nutrient management programs to protect water quality.

- Franklin County's Conservation District has created a watershed program that is administered by a watershed specialist. The watershed specialist works with local organizations, citizens and municipalities to implement projects that improve local water quality. The program specialist also utilizes the Pennsylvania Growing Greener Grants to help farmers implement agricultural best management practices.

- The Adams County Water Supply and Wellhead Protection Plan was developed to address concerns for water conservation and protection. The addition of new industries coupled with rapid population increase has created strain on the available water sources. The purpose of the plan is to provide water conservation and protection assistance to several water supply systems and use those as examples for other municipalities in the county. Contact the Adams County Office of Planning and Development for specific details and obtain a copy of the water supply and wellhead protection plan.

Importance of Forested Areas to Water Supplies

Forested areas are critical to the water supply. Wetlands, vegetated areas and forests along streams act as natural filters of soils and pollutants. The importance of these vegetated areas along streams, known as riparian buffers, is largely overlooked. These areas, along with natural filtration, provide protection from erosion, allow excess water to be reabsorbed, and provide unique habitat to many plants and animals. Forests sequester carbon, helping to reduce the amount of carbon dioxide in the atmosphere. The forested areas that surround many streams and rivers also provide benefits to the waterways. Specifically, hemlocks are common residents of riparian areas that are beneficial by providing habitat and beneficial shade. Their dense canopies provide shade to streams which regulates stream temperatures providing an ideal ecosystem for many coldwater inhabitants, including brook trout. The loss of these hemlocks would be detrimental to many aquatic species as well as the species that live in and among the trees.

The map on the following page shows the region's forested areas. The Potomac Region supports hardwood forests including pine-oak and oak-hickory forests, as well as coniferous (that is, trees that produce cones and have needles such as pine trees) forests, including Eastern hemlock. This area is mainly comprised of deciduous (that is, trees with leaves that fall when autumn arrives) forest type, with 55 percent deciduous, and five percent coniferous and mixed forest types. The most densely forested areas of the region are found in the areas around Somerset, Bedford and Fulton counties as shown by the Forested Areas Map. More information about the Potomac Region's forests is provided in the Land Use: Past and Present pages of this Potomac Region section of the atlas.

Wastewater Treatment

Long before mankind appeared on the earth, natural biological processes had already found a means to deal with waste in streams. Once human beings began to evolve, they created small communities, towns and cities. As these population centers grew larger so did the amount of wastewater being generated by mankind. Natural biological processes were easily overwhelmed by humankind's high outputs of wastewater.

It was not uncommon for older cities to fall victim to outbreaks of disease caused by pathogenic, viral, bacterial or protozoan organisms from untreated wastewater contaminating drinking water supplies. This was exemplified in 19th century London, England's outbreaks of cholera that contaminated drinking water supplies and resulted in many deaths. It was because of harmful outbreaks like that in 19th century London that biologists, scientists and engineers developed methods for the treatment of wastewater.

When water leaves a private residence or business through a drain or toilet it travels to a septic tank or wastewater treatment facility. Wastewater treatment facilities follow a series of processes that screen, aerate and disinfect water before discharging it back into a stream or river or back into the groundwater supplies. The treatment process starts by screening any large debris from wastewater. The screened water is then aerated, which allows for natural biological processes to decay organic matter. Any solid material left in the tanks is then extracted and disposed of appropriately. The water is then disinfected, usually with chlorine, to kill any microorganisms that may be harmful to streams and rivers.

Public Wastewater Treatment

Pennsylvania has learned from history that discharging untreated sewage or industrial waste into the rivers and streams can have devastating results for its inhabitants and the natural environment. Just as high volume water purification facilities are needed to service urban centers and cities, so too are wastewater treatment facilities needed.

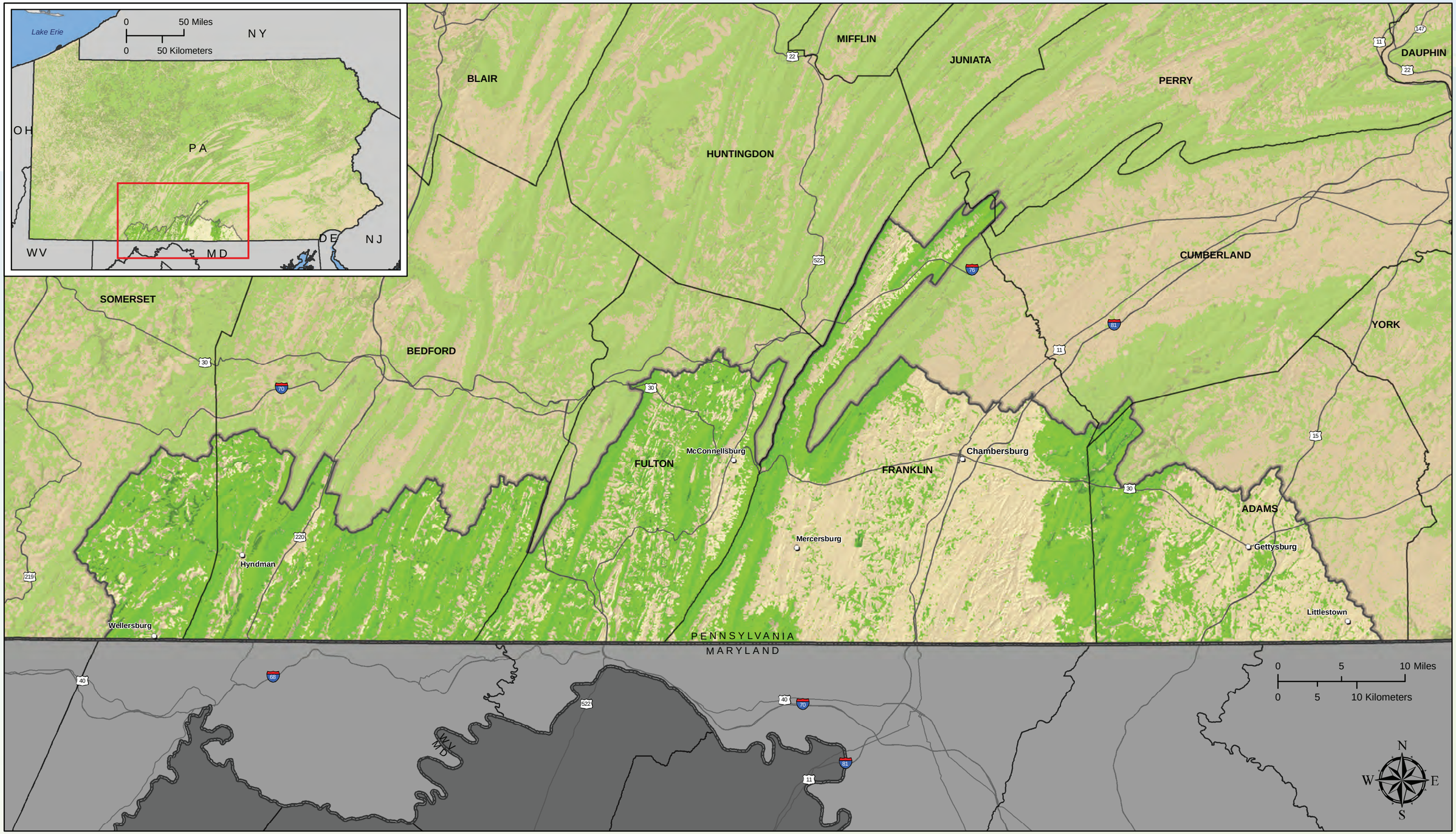
Private Wastewater Treatment

Private residences in some suburban and most rural areas of the Potomac Region commonly use private septic systems. Typical private septic systems allow for wastewater to flow to an underground tank. Once in the tank, heavy particles fall to the bottom while water can flow out of the top of a tank and into a drain field pipe. Once in the drain field pipe the remaining wastewater is dispersed into a drain field where it slowly permeates down through the soil.

Unfortunately, malfunctioning on-lot septic systems can be a significant source of groundwater pollution in these rural communities. DEP is continually searching for innovative technology that aids in the most effective way to reduce pollution from private septic systems. For more information on the latest technology, see www.depweb.state.pa.us under "DEP Programs–Wastewater Information."

Old Bedford Village, Bedford County.

Forested Areas



Water-Based Economy

The major industries of the Potomac Region include agriculture, manufacturing and recreation. All of these sectors rely on water—either directly or indirectly—to support their livelihood.

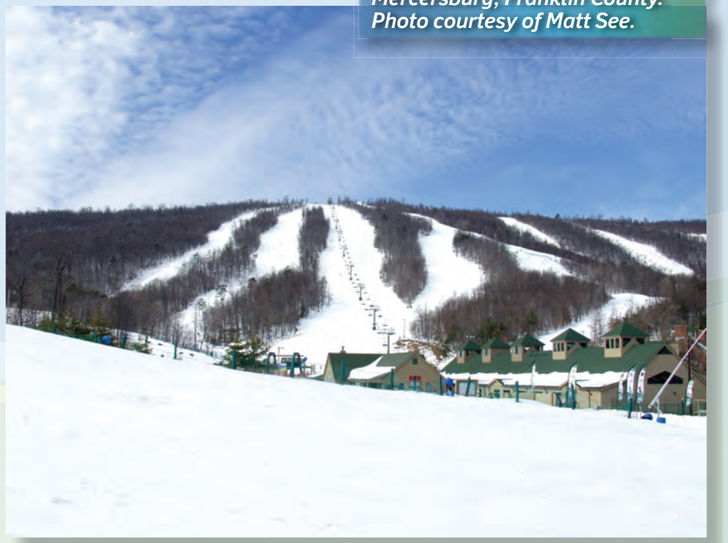
Agriculture

The Potomac Region is in the heart of the agriculture and dairy community in Pennsylvania. With three counties producing between 250 million to nearly 210 billion pounds of milk per year, it easily is considered one of the top dairy producing regions within the commonwealth. Within the region, Franklin County leads the way in dairy production, cattle herds and corn silage production. These factors add up to a region with a strong heritage in agriculture and subsequently a strong source of revenue.

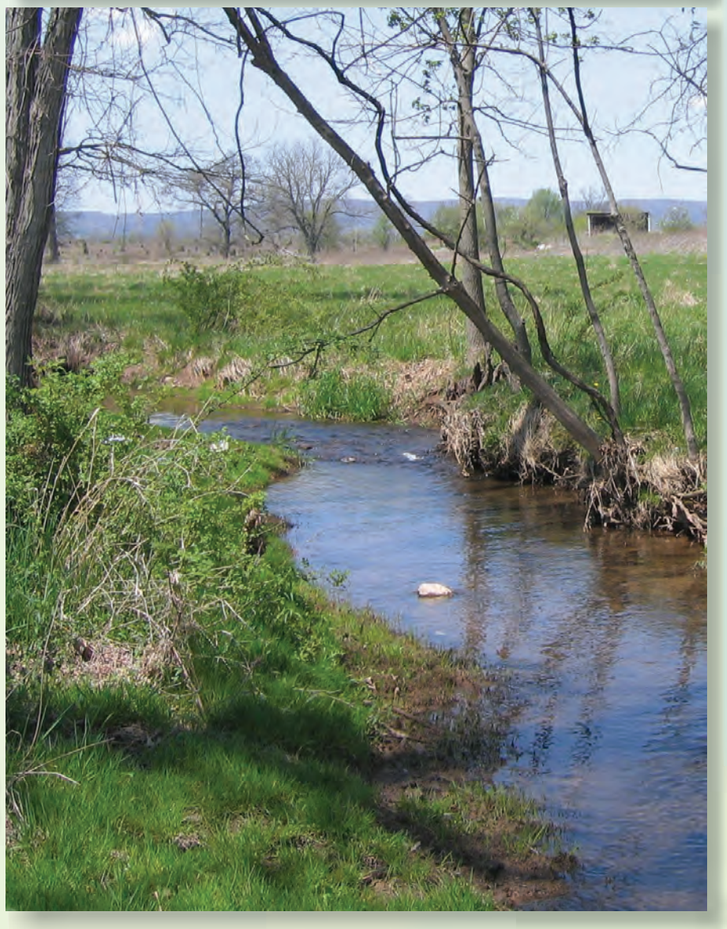
The region also boasts large production numbers of fruit tree produce and land used for forage purposes. Forage is land used for all hay and haylage, grass silage and greenchop. The productive and fertile limestone valleys that are present in the region help support such an abundance of agricultural produce. Many fruit orchards, such as apple tree orchards, are found throughout the region. Bedford, Franklin and Adams counties all contribute greatly to the fruit tree production within the region. Those three counties combined produce nearly 392 million pounds of apples per year. Adams County alone produces the greatest amount of apples in the state, producing nearly 291 million pounds per year.

Manufacturing

Although small compared to other regions in the state, the Potomac Region has several significant manufacturing industries within its geographical boundaries. Food production, metal manufacturing and apparel manufacturing are region leaders in production. The vast apple orchards and produce farms throughout the region help fuel the food production industry, such as Knouse Foods. Their plant in Chambersburg, Franklin County is a sole producer of one food – apple sauce. Knouse Foods also has another plant in the region located in Orrtanna, Adams County. Here, applesauce, apple juice and other bulk juices are packed and shipped.



Whitetail Mountain Resort Mercersburg, Franklin County. Photo courtesy of Matt See.



Muskrat Run, Adams County. Photo courtesy of J. Ducnuigeen.

State Forests of the Potomac Region

Michaux State Forest

Michaux State Forest is located in Adams, Cumberland and Franklin counties. It is named in honor of Andre Michaux, a French botanist, sent by the King and Queen of France in 1785 to gather plants for the Royal Gardens. He and his son, Francois Andre Michaux, are noted for discovering and identifying a host of flowers, shrubs and trees. The 85,000-acre forest produces a variety of wood products, but the most valuable resource is potable (drinking) water. Numerous local communities depend on its pure water for their municipal water supplies.

Michaux State Forest provides ample opportunities for recreational pursuits, including small game and deer hunting, fishing, camping, hiking, horseback riding, bicycling and snowmobiling. In addition, 130 miles of state forest roads are maintained for pleasure driving and sightseeing. The Appalachian Trail stretches diagonally across eastern Pennsylvania covering a distance of nearly 230 miles. Forty-five of these miles are located on state forest lands. About 40 miles are in the Michaux State Forest located just north of the Maryland state line. The remaining six miles are divided between the Weiser and Delaware state forests. Three state parks – Caledonia, Pine Grove Furnace and Mont Alto – are located within Michaux State Forest boundaries.

Buchanan State Forest

Located in the Allegheny Mountains, Buchanan State Forest is named in honor of James Buchanan, the 15th and only U.S. President from Pennsylvania. The area comprises 75,000 acres divided into several units located in Bedford, Fulton and Franklin counties. The forest was established as a direct result of the depletion of Pennsylvania's forests that took place during the mid- to late 1800s. Environmentalists such as Dr. Joseph Rothrock were concerned that the forests would not regrow unless they were managed properly.

Buchanan State Forest is rich with remnants from the American and Pennsylvanian past, including Buchanan's Birthplace Historical Park, pre-Civil War cemeteries, and German prisoner of war facilities from 1944. During the 1970s, youth groups, including the Youth Conservation Corps (YCC), Neighborhood Youth Corps and others, constructed foot trails, stream crossings, stream improvement devices, parking areas and outdoor learning stations within the forest. The improvements, covering approximately 40 acres of the tract, have helped to make the area more accessible and attractive to the public.

Today, recreational opportunities include multiple picnic areas, hiking and sightseeing. The 42-acre Cowans Gap Lake provides swimming, boating and fishing. The Redbud Valley, otherwise known as the Kerper Tract, is a 514-acre area that was cultivated by amateur naturalist Edmund Kerper, who purchased the property in 1934 and built a frame house with native materials. Today, the area is popular for birdwatchers and wildflower enthusiasts.

Water-Based Economy, continued

Large manufacturing firms are also headquartered out of the Potomac Region. Several industry leaders that produce mobile aerial platforms were originally developed within the region. These companies, like many others, have since branched throughout the nation and worldwide. Other manufacturing industries that produce wood cabinetry, furniture and veneer also found their home in the Potomac Region.

Electricity Generation

Although not solely water-based like other regions, electricity generation in the Potomac Region still depends on a dependable source of water. One plant in particular, the Hunterstown Generating Station operated by Reliant Energy located northeast of Gettysburg has managed to dramatically reduce water consumption. The generation station uses natural gas-fired turbines and has a capacity rating of 839 megawatts to serve consumers in the area.

Unlike many other generating stations, the Hunterstown plant uses an air-cooled condenser during the steam cycle, thus eliminating the need for vast amounts of water in typical wet cooling towers. It is estimated that this type of facility uses less than one-tenth of the normal amount of water consumed in generating facilities with water-cooled condensers.

Did you know?

The Star Theater, located in Mercersburg, Franklin County and built in 1912, was originally used by Franklin & Marshall College. During the Great Depression, canned goods were accepted by the theater for admission to help supply a local soup kitchen.

Adams County Apples

Scotch-Irish settlers established farms in the Biglerville area before 1740, followed later by German families which stimulated agriculture practices. Railroads accelerated fresh fruit shipping after 1880, and fruit processing after 1900. Today, the area is one of the most intensive fruit regions in the country, with nationally known processors and a variety of support industries. Pennsylvania ranks fifth in the nation for apple production. The commonwealth produces more than 13 million bushels of apples per year. Of the more than 500 million pounds of apples grown in the state, one quarter is sold fresh and the remaining three quarters are sold for processing products such as juices and sauces.

Within Adams County alone, close to 8 million bushels are produced, making it the top fruit producing county in the state. The county is nicknamed Apple Capital, USA, because it is one of the largest apple producers in the nation, with 20,000 acres dedicated to fruit production. The continued popularity and prominence of apples in Adams County has created the annual Apple Harvest Festival held every year during the first two weekends of October in Arendtsville. In Biglerville, the National Apple Museum provides historical background of the crop. The museum is owned and operated by the Biglerville Historical and Preservation Society. It opened in 1990 and resides in a restored Civil War-era barn.

Apple orchard in Adams County.

Miscellaneous Apple Facts

- There are 7,500 different apple varieties worldwide. This means that you could eat a different apple every day for more than 19 years, and never eat the same kind twice!
- Of the 2,500 apple varieties that grow in the U.S., only 100 are grown commercially.
- Apples float because 25 percent of their volume is air.
- The “Delicious” apple variety is the most widely grown variety in the United States.
- An apple tree has to grow four or five years before it will produce an apple.
- It takes nearly 40 apples to make one gallon of cider.
- The largest apple, according to the Guiness Book of World Records, weighed three pounds and two ounces.
- Bobbing for apples started as a Celtic New Year’s tradition to determine who you would marry.
- In ancient times, apples were thrown at weddings (instead of rice or birdseed, like today ... ouch!).
- It’s said that Isaac Newton thought of the “law of gravity” while sitting under an apple tree and having an apple fall on his head.
- The apple belongs to the rose family.

Caledonia State Park

Between Chambersburg and Gettysburg in Franklin County, Caledonia State Park is not only a recreational attraction, but also boasts rich historical roots. The park was named for Thaddeus Stevens' charcoal iron furnace, the Caledonia Furnace, that was built on site. Stevens was a member of the U.S. House of Representatives and was noted to be the father of the public school system in Pennsylvania. As the Civil War swept through the region, Confederate troops destroyed the furnace. Historians believe the destruction symbolized their disapproval of Stevens' views opposing slavery. Also, the park served as a field hospital during the Battle of Gettysburg in 1863. After being rebuilt and sold to the state, Caledonia State Park opened in 1903.

Today, Caledonia State Park is a huge attraction in the region for its many recreational activities. The park provides amenities for campers, including two campgrounds with showers, restroom facilities, fire pits and picnic tables. Also, cabins are available with modern conveniences.

Fishing, hunting and hiking are very popular in the park, along with summertime swimming and golfing. One of the most famous attractions in the park is the Totem Pole Playhouse that is a summer stock theater and puts on many plays. Actors including John Ritter, Sandy Dennis and Curtis Armstrong have worked with the resident company in the past.

Caldeonia State Park: Walking Dogs; Camping; The Pavilion

Recreation

Recreational opportunities in the Potomac Region are largely dominated by sport fishing, although ski resorts such as Ski Liberty and Richmond Hill also contribute to the economic wealth of the region. The following is a sample of some of the popular locations for recreational fishing:

- The 1,125 acres of Caledonia State Park (Franklin and Adams counties) are a popular destination for fishing. Anglers can catch a variety of trout species and some warm water game fish in the East Branch of the Conococheague Creek, Rocky Mountain Creek and Carbaugh Run.
- The Pennsylvania Fish and Boat Commission manages Meadow Grounds Lake (Fulton County) for boating and fishing activities. The 204-acre lake is located in state game lands and supports largemouth bass, pumpkinseed and walleye fishing.
- Falling Springs Branch Creek (Franklin County), near Chambersburg, attracts anglers for recreational fishing of trout and panfish. Falling Springs is a small, limestone tributary to Conococheague Creek, which is a wild trout habitat.
- Koon Lake (Bedford County) is a 268-acre impoundment owned by Evitts Creek Water Co., used to supply water to the city of Cumberland, Md. The lake supports both shoreline and boat fishing of trout, largemouth bass and panfish.

Did you know?

President Dwight D. Eisenhower and his wife, Mamie, retired to a farmhouse in Gettysburg. Although President Eisenhower retired from service to his country, he would continue to work, raising Angus cattle on his farm and serving on the University board at Gettysburg College. In 1967 Dwight and Mamie Eisenhower donated their home to the National Park Service.

Water-Based Economy, continued

- Gordon Lake (Bedford County) is located immediately south of Koon Lake. The 120-acre waterbody is owned by Evitts Creek Water Company and supplies water to the city of Cumberland, Md. The lake is also a local fishing spot for walleye, largemouth bass, muskellunge, pickerel and panfish.

For more information on state parks, see DCNR's "Pennsylvania State Parks" Web site: www.dcnr.state.pa.us/stateparks/index.aspx

For more information on recreational areas managed by the Pennsylvania Fish and Boat Commission, see the commission's "Boating Near You" Web site: www.fish.state.pa.us/boatinf.htm

Koon and Gordon Lakes

Located in Bedford County, both Koon and Gordon lakes provide premier fishing opportunities for anglers across the region. Fishing is very popular in Bedford County, and the two lakes bring in anglers from all over the northeast. Koon Lake covers 268 acres and Gordon Lake covers 120 acres, and both are owned by Evitts Creek Water Company and supply water to the city of Cumberland, Md.

Recent field reports indicated that both lakes deserve quality panfish reputations. Both Koon and Gordon lakes are popular for yellow perch, bluegills, brown bullheads and black crappie at considerable sizes. Anglers have enjoyed better access to the fish, as motorized boats are now permitted in the lakes. In addition, fishing is permitted on the shores and in the reservoir area, other than near the dam.

The Pennsylvania Fish and Boat Commission; Cumberland, Md. officials; and local anglers from Pennsylvania and Maryland are working together to provide increased angling opportunities on Koon Lake and Gordon Lake.

Whitetail Mountain Resort

Located in Mercersburg, Franklin County, Whitetail Mountain Resort has become a premier ski resort for vacationers and locals in recent years. Located near the Pennsylvania/Maryland border, the resort offers excellent skiing on its 19 trails. The highest vertical descent on the mountain measures in at 935 feet while the highest elevation of the resort is nearly 1,800 feet. Recent improvements on the mountain include a new enclosed Magic Carpet Conveyor Lift at the tubing facility, increased snow making capacities and Burton snowboard rental equipment. An onsite resort provides lodging at Liberty Mountain Hotel with luxury accommodations.

During the summer months, the resort offers golf and fly fishing amenities. Dusty Wissmath's Fly Fishing School is a wonderful resource for new anglers interested in learning the sport. Lessons are also available at the Whitetail Golf Resort, where many outings are planned each summer.

Whitetail Mountain Resort is affiliated with Snow Time Inc. which also owns Ski Liberty in Adams County, Ski Roundtop in York County and Ski Windham in New York.

Whitetail Ski Resort at night (top) and snowboarding at the resort (left). Photos courtesy of Matt See.