Chapter 4. *IMPACTS*

"Population, land use, development and redevelopment all impact our water resources. Water use, alteration and removal of natural features, and the resulting polluted runoff affect both the quantity and quality of water resources. Failure to properly plan development can create conflicts, increase costs, and diminish the quality and sustainability of our water resources." – State Water Plan

WESTMORELAND COUNTY COMPREHENSIVE PLAN

In 2016 Westmoreland County embarked on a new Comprehensive Plan "Reimagining Our Westmoreland". It will be a community driven road map detailing a long term vision and policy agenda for important quality of life issues like land use, housing, parks, infrastructure, transportation and more.

"Water touches all areas of life in Westmoreland County, drinking water to waste water treatment to recreation and industrial/commercial use; therefore the study of our water resources must also include stormwater and the water related issues of water use, flooding, and pollution."

-From Reimagining our Westmoreland, the County Comprehensive Plan

Photo by Westmoreland County

Ann Rudd Saxman Nature Park is a open space in the middle of a highly developed area near Greensburg.

GROWTH TRENDS AND WATER

According to “Reimagining Our Westmoreland”, development of housing, business, and industry has been shifting from downtown and already-developed areas to rural areas and suburban corridors, due in part to the following:

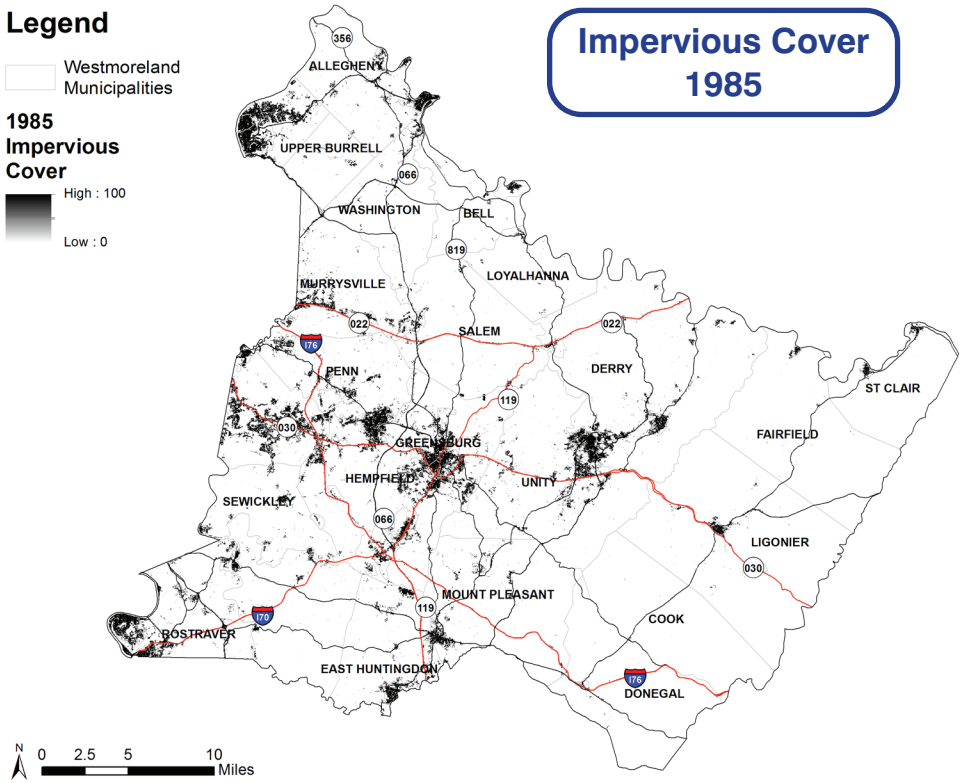
- Availability of large parcels of land
- Higher cost of demolishing and/or rehabilitating exiting structures as opposed to new construction on greenfield sites
- Consumer demand for easy-to-access sites that are close to major roadways and have plentiful parking

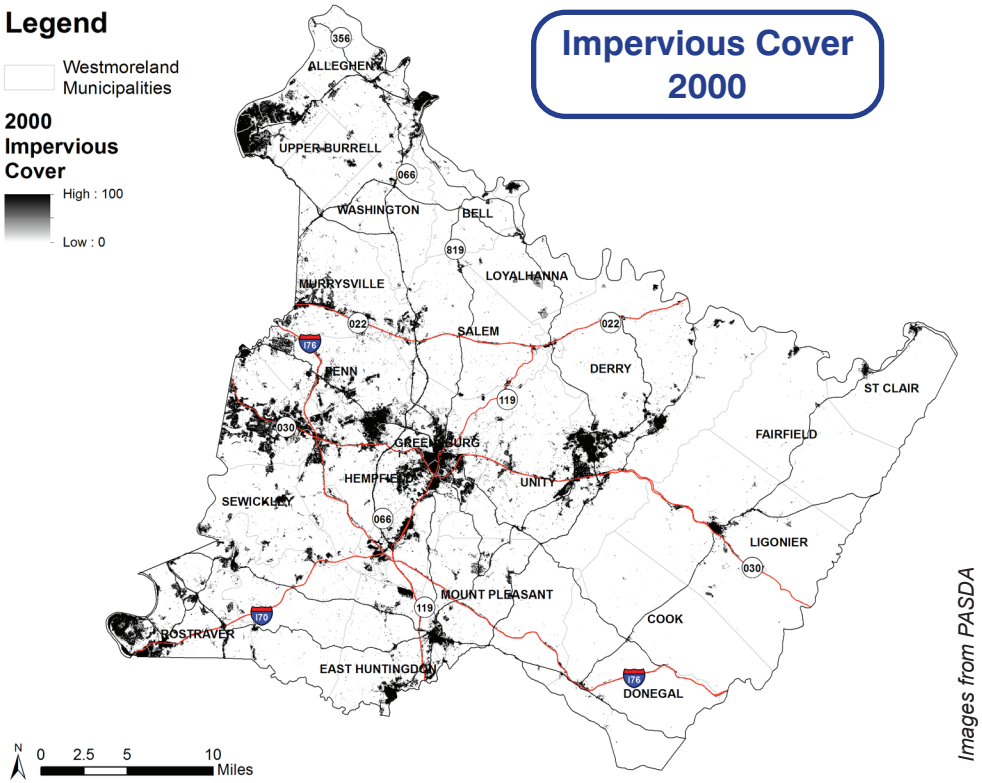
These development trends (many label them as ‘sprawl’) impact county water resources. One acre of parking lot can generate 27,225 gallons of runoff water in a one-inch rainstorm; this happens day or night, whether or not anyone is parked in the lot. Researchers at the University of California-Berkeley found that there are about 3.4 parking spaces available per car, nationwide. This means in our county, with approximately 250,000 personal vehicles registered, there may be as many as 850,000 parking spaces, all generating runoff in rainstorms and contributing pollutants such as oil, fluids, metals, and sediment to our waterways.

Our county’s system of roadways can be looked at the same way. If we assume that each of our county’s approximately 4,700 lane-miles of road are ten feet wide, this equals a paved area of 5,697 acres, or about 8.9 square miles. During a one-inch rainstorm, our roadways can generate 155 million gallons of runoff into our streams and waterbodies.

Photo by Pictometry

East Huntingdon Township: Commercial development along a transportation corridor. Notice the impervious coverage.





Images from PASDA

Runoff carrying pollutants from roads and parking lots is only one water-related issue facing our county. Our desire is that informed Westmoreland County citizens studying "Reimagining Our Westmoreland" and the Integrated Water Resources Plan will guide future development and redevelopment to reduce future impacts and even correct past impacts from unmanaged development, and promote sustainability in the county.

The following maps showing impervious cover across the county illustrate the concept of 'sprawl' or, the spreading of developed areas beyond what would historically have been necessary to support a certain population. Notice the change in impervious area from 1985 to 2000; the trend is sure to continue unless societal expectations change.

PHASE 1 ACT 167 PLAN

Phase 1 of the Act 167 Plan identified impacts to our water resources by referring to the PA Chapter 93 stream classifications for impaired waterways and their impairments, by noting existing dams and impoundments, and by tallying reported stormwater issues across the county.

During preparation of Phase 2 of the Act 167 Plan and the IWRP, the list of impacts to water resources grew to include water use by people including water supply and waste water treatment, flood hazard areas, obstructions, hydromodifications, impacts from resource extraction (oil & gas, coal and abandoned mine lands), and more.

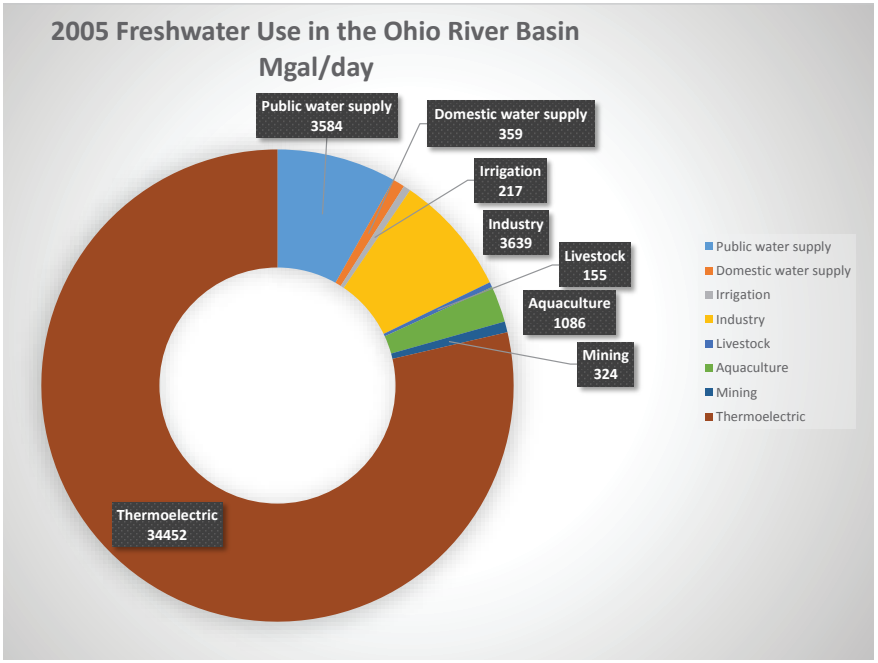
Learn more in the appendix for an exerpt of the Act 167 Phase 1 report or go to http://spcwater.org/pdf/acts/WestmorelandCounty/Westmoreland-County_Phase1_Act167.pdf

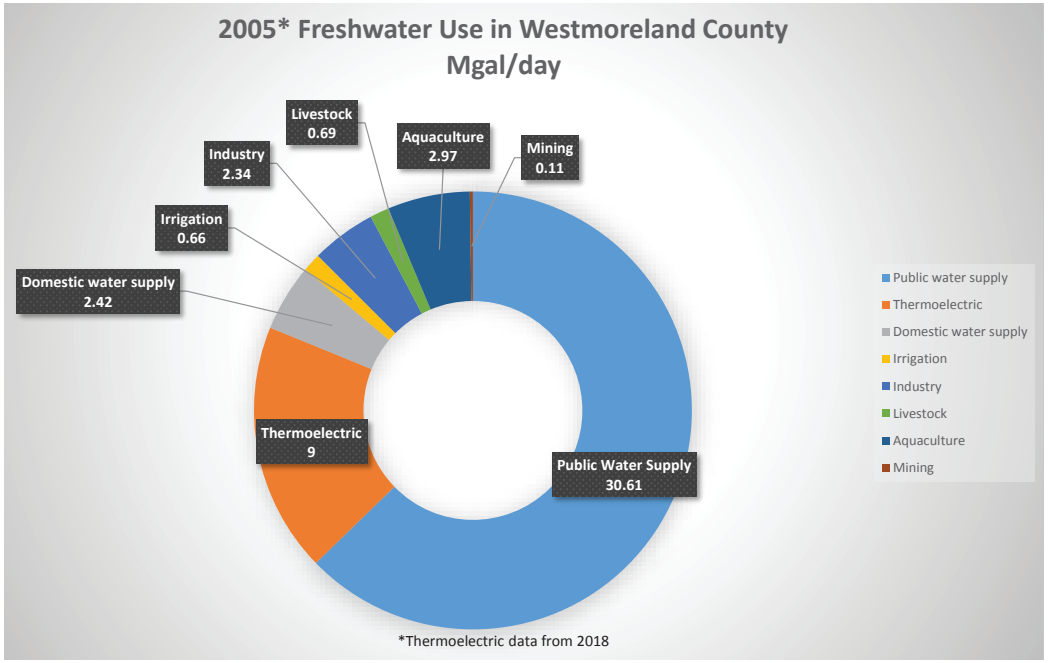
WATER USE

Water is used many different ways, including power generation, public water supply, industries, aquaculture, irrigation, livestock, mining, and firefighting. Without good clean water, our county would grind to a halt. And without our region's plentiful water, our cost of living would be higher, and our difficulty of living would increase. Anyone who has traveled to a place where "you can't drink the water" will understand, or as Ben Franklin said, "You won't know the worth of water until the well is dry." Much of the population in Westmoreland County is served with drinking water by various public sources. Most public water is from surface sources – rivers and creeks. In more rural areas, people rely on wells or springs to supply their homes with water.

There are two types of water use: consumptive use and withdrawal. Consumptive use is water which is removed from a watershed, making it unavailable for other uses. Consumptive uses include water used in the evapotranspiration process by growing plants, water used for bottling drinking products for sale in another region, and water evaporated by a power plant's cooling tower. Withdrawal is water which is taken from a source for a particular use. Withdrawal can be water piped from a stream to fill a fish pond and water taken from a river for drinking water which subsequently returns to the river through sewage treatment facilities.

In the Ohio River basin, consumptive use is dominated by water used in coal-fired power plants or thermoelectric use as shown in the following chart. The recently-opened Tenaska natural gas fired power plant in South Huntingdon Township will require nine million gallons of water daily for its operation, placing it into the 'thermoelectric' category of water use. Industry and public water supply, which are mostly withdrawals, are dominant in the Ohio River basin. In the Westmoreland water use chart, public water supply dominates. Domestic Water Supply on the chart refers to private sources like wells, and spring. Aquaculture primarily refers to fresh water where fish are stocked in a designated stream or lake.





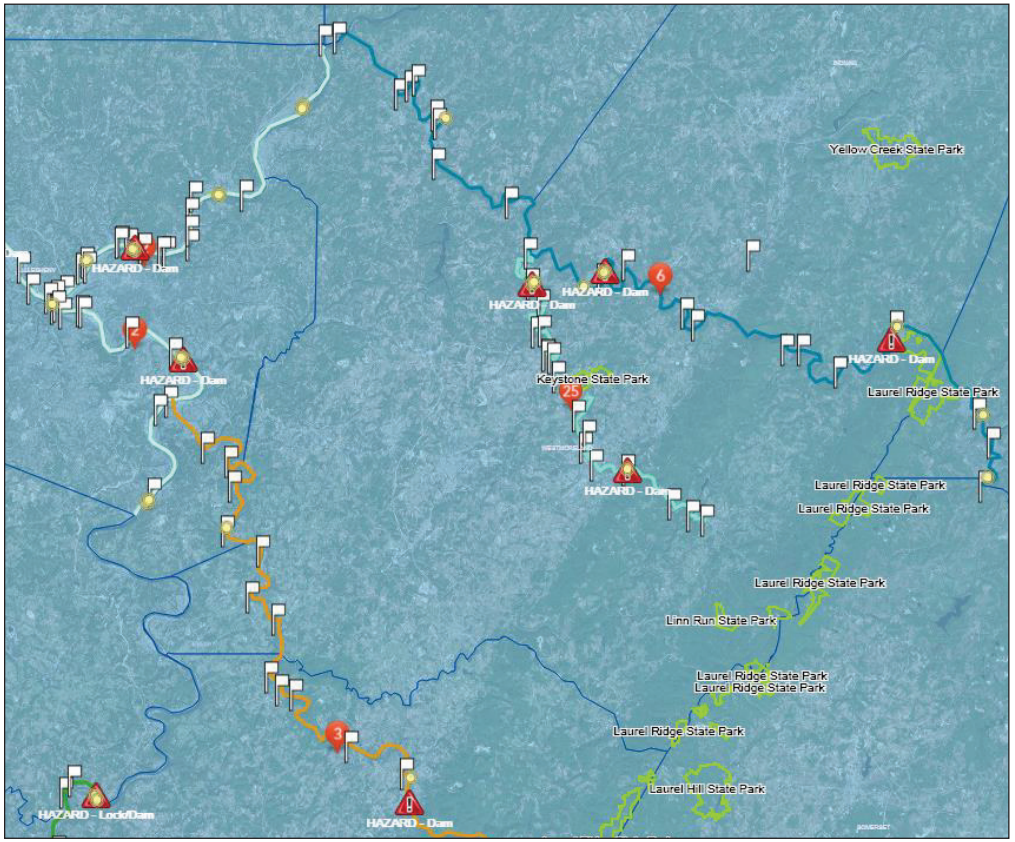
RECREATION AND WATER USE

The chart of water use in Westmoreland County doesn't specifically show recreation. Recreation includes designated water trails and access ramps to waterways and lakes for boating, fishing, swimming, and more. Many residents and visitors alike enjoy Westmoreland County's water resources.

The Army Corps of Engineers (ACOE) maintains the Loyalhanna Lake and Conemaugh Lake recreation areas for boating, fishing, hiking, and passive recreational activities. There are four state parks in Westmoreland County: Keystone which has a lake for fishing, boating and swimming; Linn Run which is a trout fishery; Laurel Ridge; and Laurel Summit. Forbes State Forest lies along Laurel Ridge at the eastern border of the county and protects the headwaters of several high quality and exceptional value streams; the unusual Spruce Flats Bog is found here too. Recreational boating and fishing also occurs on the Allegheny, Monongahela and Youghiogheny Rivers, which are accessible via boat ramps at various locations in the county.

Water trails are boat routes suitable for canoes, kayaks, and small motorized watercrafts. Like conventional trails, water trails are recreational corridors between specific locations, and are comprised of access points, boat launches, day use sites, and in some cases overnight camping areas. Each water trail is unique; a reflection of Pennsylvania's diverse geology, ecology and communities. In Westmoreland County, water trails are found on the Youghiogheny River, Loyalhanna Creek, Kiski-Conemaugh River, and Sewickley Creek.

Why is this important? Westmoreland County parks, open space, water bodies and waterways provide close-to-home recreation. Outdoor recreation like fishing and boating supports and contributes to a high quality of life for the residents of Westmoreland County and it attracts employers and families.



Water trails and access points in Westmoreland County

Legend

USGS Gauges

Hazards

Access Point

Water Trail Information

Youghiogheny River WT

Source - PA Fish and Boat Commission

Fishing class on Loyalhanna Creek

Photo by Mark Jackson

AGRICULTURE / AQUACULTURE AND WATER USE

Agriculture activities comprise 20% of Westmoreland County's land use. Locally sourced agricultural products such as grass-fed beef or organically grown vegetables command a prime price in local farmers markets. Availability of such locally-sourced products is one key factor in our quality of life and in attracting new residents to our county.

Many of the fresh fruits and vegetables found in our supermarkets, however, come in from all across the world. Farmland in places like Arizona or California must be irrigated to produce crops. Here in Westmoreland County, irrigation for field crops has historically been not necessary due to our abundant rainfall. However, some specialty crops such as vegetables are irrigated. Since agricultural operations use much water in their daily operations for crop production and sustaining livestock, agricultural use of water should be considered in any water plan.

Why is this important? Sustaining and growing the county's agricultural economy relies on the availability of clean water. Dairy cows can easily drink up to 50 gallons of water per day. Other livestock, like cattle, horses, pigs, and chickens all have to have a certain amount of fresh, clean water every day. That demand for water can become expensive if the farmer has to pay for the water. However, Westmoreland County is blessed with an abundance of natural springs where water seeps or flows out of the ground. A typical practice to enable farmers to water their livestock is to "develop" a spring and direct it to water troughs. To develop it simply means to carefully dig back into the hillside, find the source of the water, put in a gathering box under the ground, and lay a pipe to the water trough. The water will continually flow through the trough, which keeps it from freezing in the winter.

Water for agricultural irrigation is becoming much more important in Westmoreland County. There are a number of vegetable growers who supply local markets and consumers with quality vegetables from their farms and high tunnels (temporary plastic hoop greenhouses). Irrigation takes a tremendous amount of water – perhaps 20 inches of additional water on top of our regular rainfall, depending on the crop and whether there is a roof over the plants. It is estimated that there are over one thousand acres in the county that are now being irrigated, and this acreage will probably continue to increase because of market demand. Irrigation water is usually from surface sources, such as lakes, ponds, and streams because pumping that much water from below the ground surface is cost prohibitive.

Photo by Mark Jackson

Spring development for cows

Photo by Mark Jackson

Derry Township farmers Mike and Ina Bazley grow vegetables in a high tunnel and sell them at farmers markets.

Aquaculture is the raising of aquatic animals, the cultivation of aquatic plants for food, and the enhancement of production, such as regular stocking, feeding, and protection from predators. The 2012 USDA census of aquaculture lists Mammoth Park and its 24-acre fresh water lake as "stocked" by the PA Fish and Boat Commission (PFBC).

The goal of the PFBC since the late 1800s, is to promote high-quality streams, clean water, and good habitat, so that residents and visitors alike can enjoy recreational fishing and boating. The founding of the PFBC came about as a result of the noticeable impact of sediment from large-scale clearcut logging; a negative impact on our Commonwealth's streams so severe that the legislature in 1866 created the position of Commissioner of Fisheries. The PFBC annually stocks streams and lakes in Pennsylvania with cold water, warm water and cool water species throughout the year and maintains hatcheries.

In recent years the mission of the PFBC has expanded to include protection of endangered species, as the agency is one part of Pennsylvania's Natural Heritage Partnership, which curates the Pennsylvania Natural Diversity Inventory (PNDI), a statewide searchable index of endangered plants, animals, fish, amphibians, and invertebrates. Protecting these endangered species, many of which have a natural aquatic habitat and a water-dependent life cycle, helps to preserve our environment and the great diversity of life found in our state. Most persons obtaining a state permit for water-related construction activities (for example, a bridge across a stream) must use the PNDI search to discover possible impacts of their project on endangered species.

PA Fish and Boat Commission
2018 Statewide Summary of Trout Stocking

2018 Summary of Planned Adult Trout Stocking*						
Water	Number	Brook	Brown	Rainbow	Total	Trophy**
Streams	715	378,730	609,970	1,546,000	2,534,700	7,263
Lakes	126	93,940	31,880	498,880	624,700	1,320
Combined	841	472,670	641,850	2,044,880	3,159,400	8,583
Cooperative Nurseries (approximately)					1,241,927	
Total to be Stocked					4,401,327	

Westmoreland's Trout Stocked Lakes - open year round

- Keystone Lake
- Northmoreland Lake
- Twin Lakes Number One Reservoir (Lower Twin Lake)
- Twin Lakes Number Two Reservoir (Upper Twin Lake)

Fishing Derby at Mammoth Park lake – Westmoreland County Parks

Other Trout Stocked Lakes

- Mammoth Lake
- Indian Lake, North Huntingdon Township

Westmoreland's Trout Stocked Streams

- Turtle Creek
- Sewickley Creek
- Fourmile Run
- Mill Creek
- Hendricks Creek
- Shannon Run
- Long Run
- Jacobs Creek
- Linn Run
- Hannas Run
- Tubmill Creek
- Loyalhanna Creek

Why is this important? Fishing is one of the oldest and most common recreational activities in our county. Visit one of our county parks on a pleasant day and you will see the shorelines of the lakes lined with people fishing. Fishermen (and women and children) enjoy being outdoors and having a quiet place for recreation and communing with nature. In 2015 in PA, over 1.4 million people purchased some kind of fishing license and in Westmoreland County the figure was just over 38,000. Recently our county's ten-year average of boating registrations was over 10,000 out of over 328,000 statewide. These show that over ten percent of our county's citizens enjoy these pastimes, not an insignificant number! Preservation of our current good-quality streams and waterbodies, and restoration of our degraded waterbodies and streams, is of great importance to fishermen and county residents in general. Learn more at http://pfbc.maps.arcgis.com

Photo by Rob Cronauer

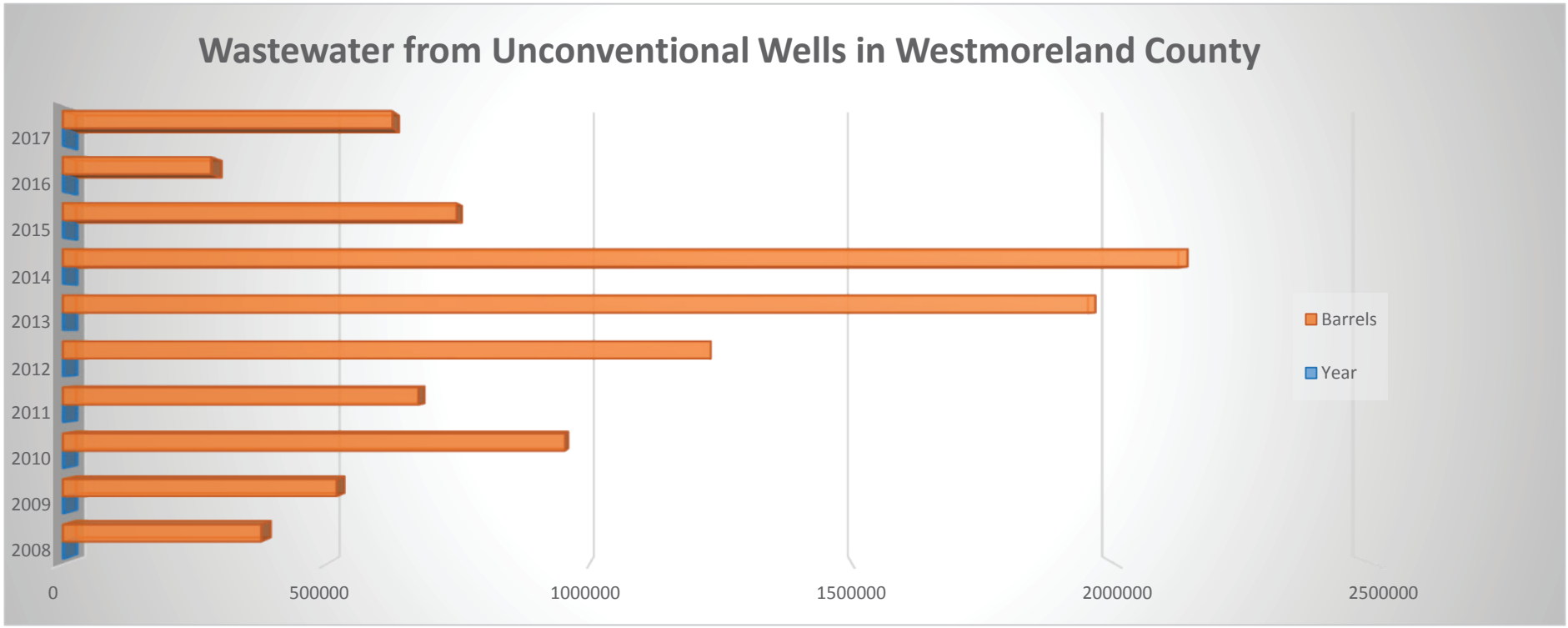
Westmoreland Conservation District Watershed Specialist Chelsea Walker collects data on fish populations in a stream in northwestern Westmoreland County.

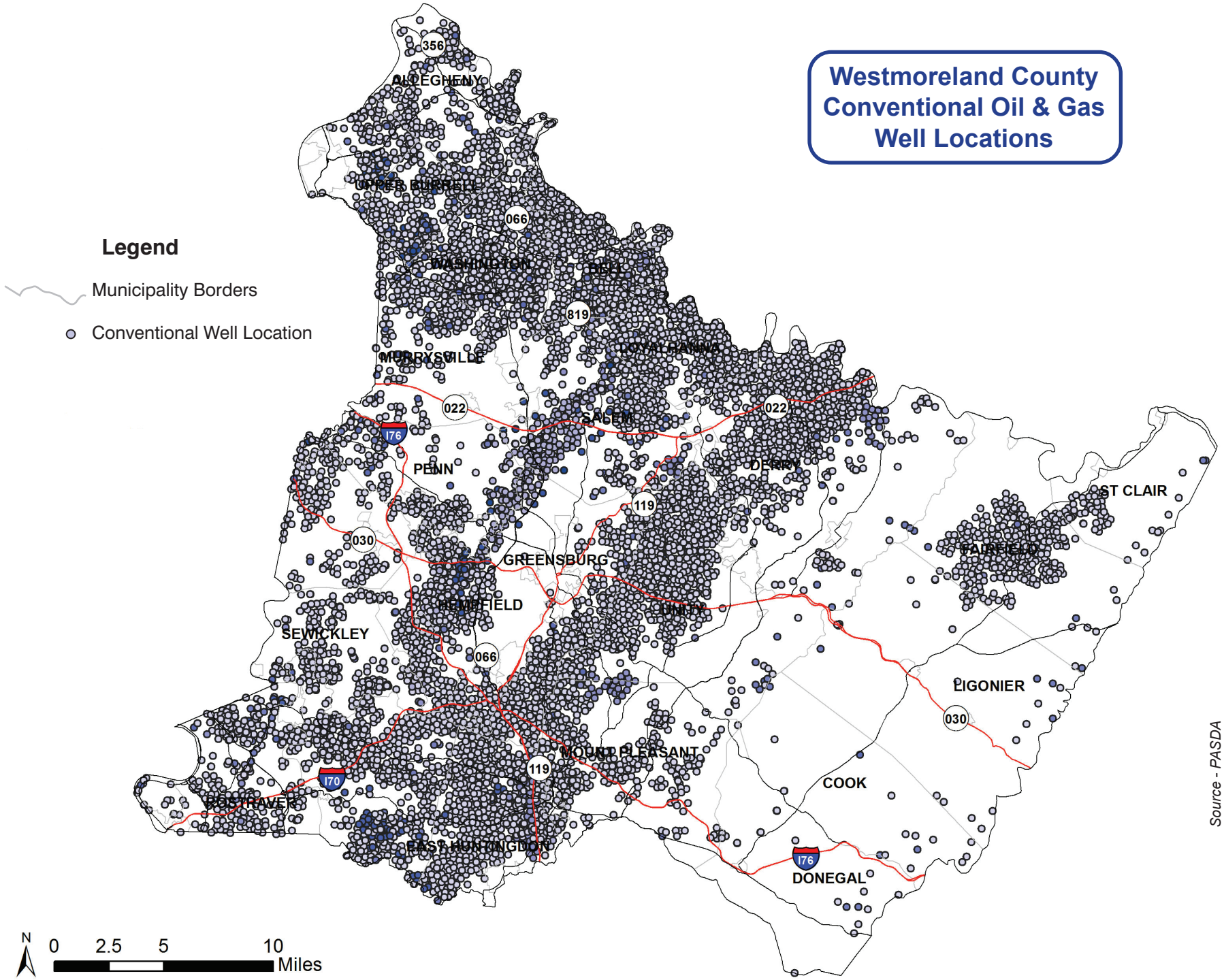
INDUSTRY, RESOURCE EXTRACTION AND WATER USE

Industrial and resource extraction operations have a potential to use great amounts of water. For example, the recently-constructed 940 megawatt natural gas-fired power plant near Smithton in South Huntingdon Township purchases about 9 million gallons of water daily from the Municipal Authority of Westmoreland County (MAWC) for steam generation and cooling purposes. This water is being withdrawn from the Youghiogheny River at Connellsville, treated, and sent to the power plant via a new 13-mile pipeline. The plant's cooling tower system will evaporate most of this, about 7.5 million gallons per day classified as a consumptive use, and about 1.5 million gallons per day will be treated and returned to the Youghiogheny River near Smithton.

Non-conventional gas extraction (mostly from the Marcellus Shale) can require large amounts of water for hydraulic fracturing, called "Fracking". A non-conventional gas well may require five million gallons of water to bring it to production of gas. The fracking water which returns to the surface contains metals, salts, and other chemicals and so it must be treated if it is to be released to waterways. Fracking water cannot be treated in a sewage treatment plant; it has too many salts and metals, and must be treated in a special system. Many gas drilling operations now reuse their fracking return water, saving the cost of disposing it. Conventional gas wells can impact water resources as well.

Why is this important? As industries grow and evolve, they must learn to use water sustainably so that it won't be harmed for future generations to use and enjoy. Industrial uses of water are generally subject to regulation and permitting by PA DEP; local sewer authorities have regulations about waste disposal as well. It is important for residents relying on well water to monitor their wells for quality and production if gas well drilling is nearby.

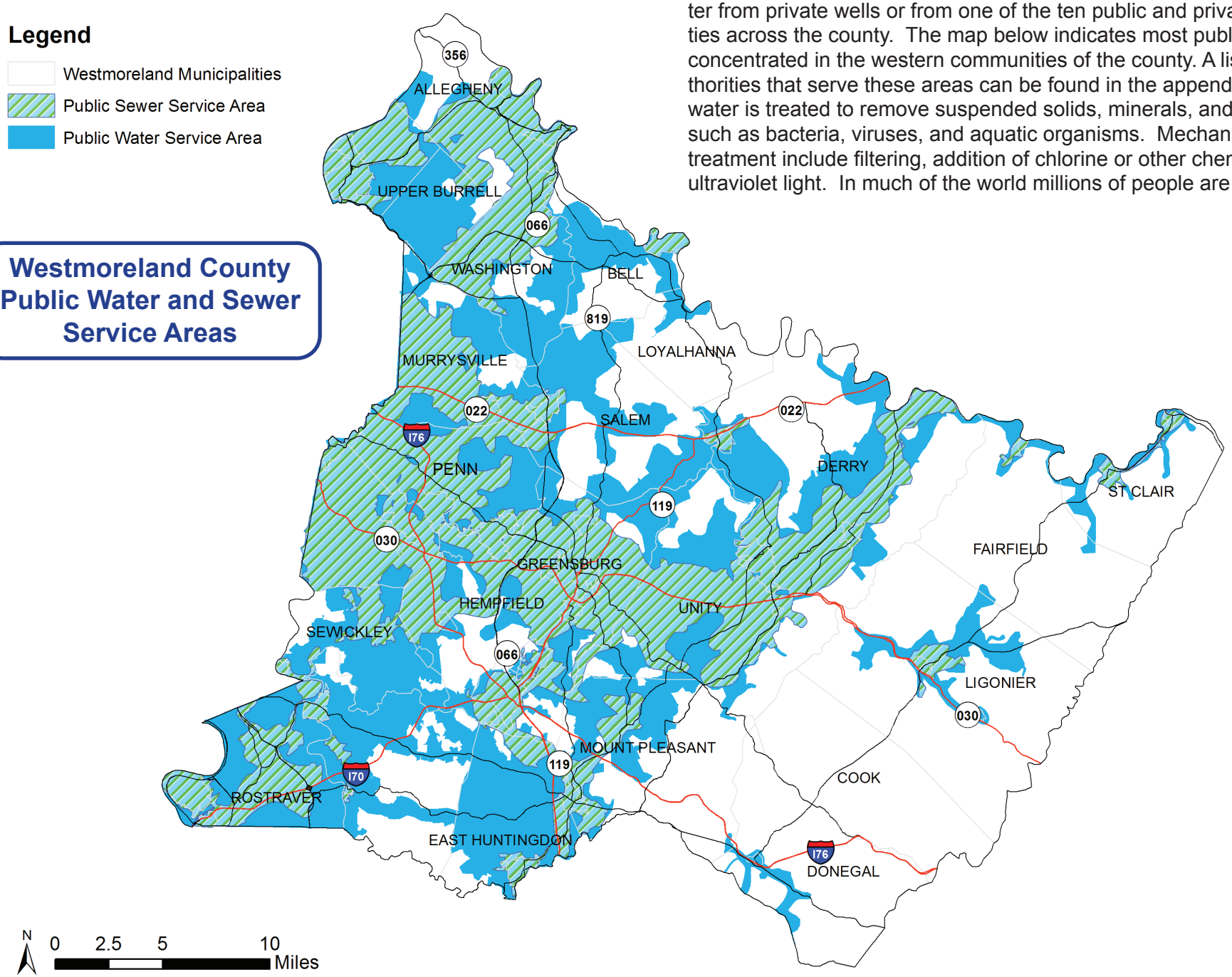



Westmoreland County
Conventional Oil & Gas
Well Locations
Legend
Municipality Borders
Conventional Well Location
356
ALLEGHENY
UPPER BURRELL
066
WASHINGTON
BELL
819
MURRYSVILLE
LOYALHANNA
022
I76
SALEM
PENN
DERRY
119
030
GREENSBURG
ST CLAIR
FAIRFIELD
HEMPFIELD
UNITY
SEWICKLEY
066
LIGONIER
030
MOUNT PLEASANT
119
I70
COOK
EAST HUNTINGDON
I76
DONEGAL
N
0
2.5
5
10
Miles
Source - PASDA

DRINKING WATER AND WATER USE

Westmoreland County residents and visitors can get their drinking water from private wells or from one of the ten public and private authorities across the county. The map below indicates most public service is concentrated in the western communities of the county. A list of authorities that serve these areas can be found in the appendix. Drinking water is treated to remove suspended solids, minerals, and pathogens such as bacteria, viruses, and aquatic organisms. Mechanisms of treatment include filtering, addition of chlorine or other chemicals, and ultraviolet light. In much of the world millions of people are sickened

Westmoreland County Public Water and Sewer Service Areas



Source - Westmoreland County Planning (2016)

and die annually from water-borne diseases; our safe drinking water here in the US and especially in Westmoreland County is to be treasured.

The growth of population or the expansion of developed areas increases the demand for drinking water. Although Westmoreland County's population is not growing, our various water authorities continually expand their service areas as demand by housing or commercial use spreads. Growth in developed areas can have a negative effect on drinking water supplies by increasing the runoff of pollutants into source water reservoirs. In a reservoir's watershed area, it is important that land development follow best management practices to control erosion and sedimentation of streams feeding the reservoir. It's also important that reservoir watershed areas be protected from pollutants such as human waste and chemicals. Each water supply must have a source water protection plan identifying potential pollutants and how to address them.

Why is this important? Safe, plentiful, inexpensive, and good-tasting drinking water is the key not only to good health but to economic development as well. One factor which regularly hinders development in Westmoreland County is the lack of city water. Wells in our county are often tainted by iron and are usually very slow producers due to geologic conditions. A well with a flow of only two to three gallons per minute is not unusual in our county.

Photo by MAWC

'Morning Glory' spillway and intake tower at Beaver Run Reservoir

WASTE WATER AND WATER USE

Westmoreland County residents and visitors may use private treatment facilities or the services of many of the 41 public and private authorities across the county for sewage treatment and disposal. Our public sewage treatment facilities treat an average of 65 million gallons each day. Most developed areas in the county are served by separate sanitary sewers and storm sewers. The sanitary sewers flow to a waste water treatment plant, where the sewage is treated to remove solid debris, fats and oils, and pathogens.

One problem faced in many of our county's older communities is that of combined sewers—a single pipe under the street which carries away wastewater from homes and businesses, and stormwater from hard

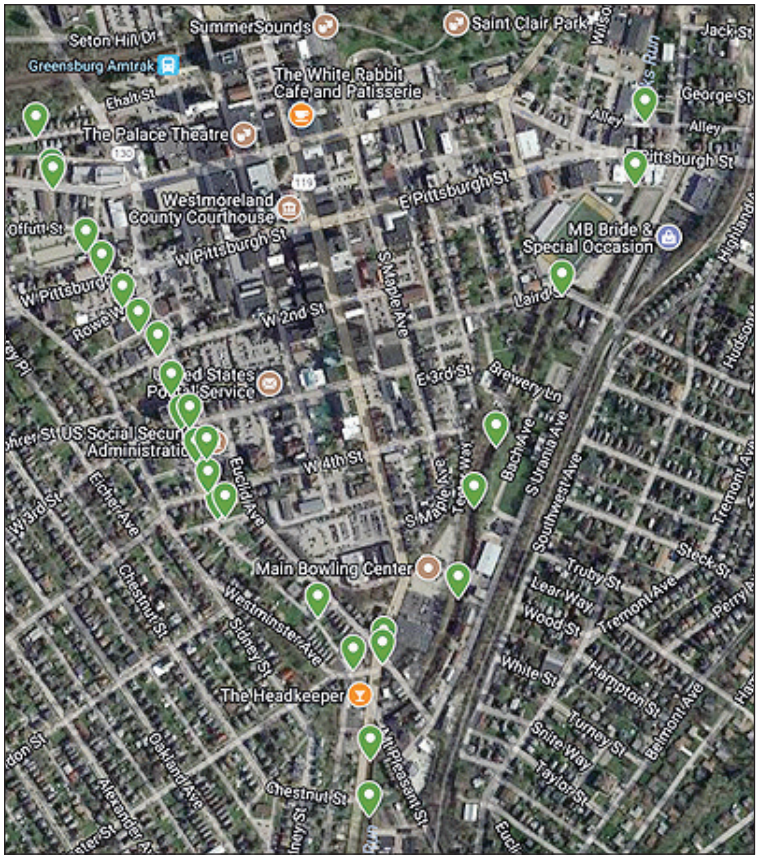


Image from Google, date from GGSA

Locations of CSO's in Greensburg along Jack's Run and Coal Tar Run

surfaces. These combined sewers can become overloaded during storms and overflow into our creeks and rivers, causing a pollution problem. In some areas, as little as ¼ inch of rain will cause an overload. Combined Sewer Overflows (CSO) can be handled by installing separate sewers in the community, storing excess flow in large tanks, and using green infrastructure practices to reduce stormwater runoff entering a combined system. Both Philadelphia and Pittsburgh are using green infrastructure to meet EPA-required CSO elimination goals.

Why is this important? Water-borne diseases kill 3.4 million people each year, according to the World Health Organization. Ninety percent of these deaths are children under the age of five. For the benefit of our county's future, good sewage treatment is of inestimable value. Many of our rural county residents do not have an adequate sewage treatment system. Our soils are not conducive to standard septic systems because of our high groundwater, tight clay soils, and shallow depth to bedrock. New homes in rural areas need to have expensive alternative systems built to treat sewage, and many older homes may discharge their effluent to a stream, a roadside ditch, or even into a coal mine. Sewer authorities are steadily expanding their service areas to reach some of the unserved population. For a list of public sewage treatment authorities and information regarding private septic systems, see the appendix.

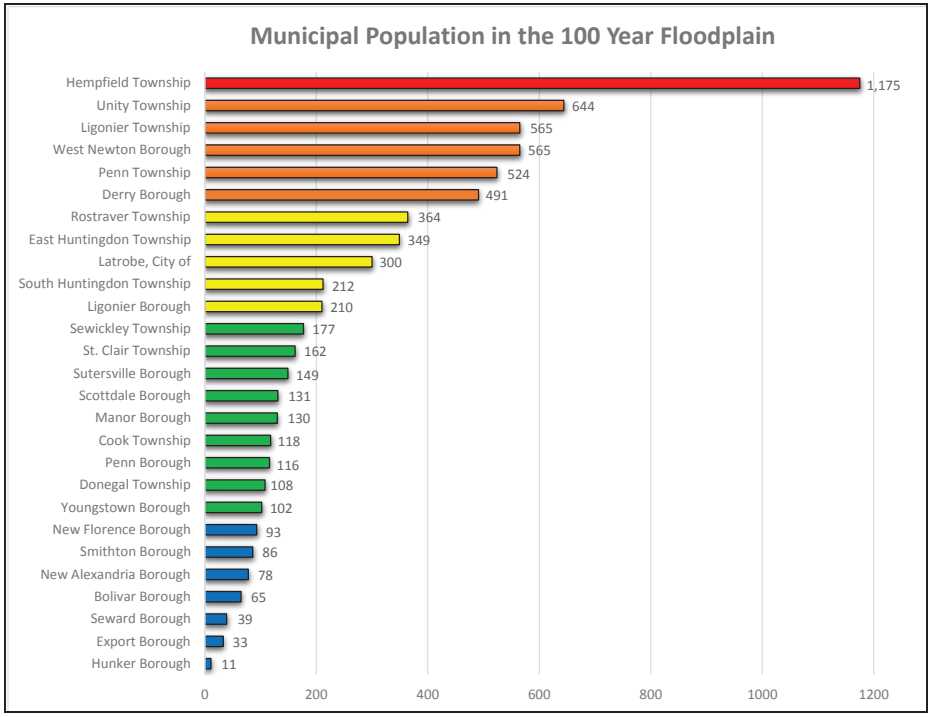
Image from Connect Explorer

Greater Greensburg Sewage Authority's treatment plant on Route 119 in Hempfield.

STORMWATER MANAGEMENT

Stormwater management is the practice of reducing runoff and improving the water quality of rain water or melted snow that runs off undeveloped or developed land. When stormwater is absorbed into the soil, it is naturally filtered and will replenish the ground water or create base flow in streams. In developed areas, impervious surfaces, such as paving and roof tops, prevent this from happening. Stormwater runoff picks up pollutants, volume and velocity leading to flooding, erosion and other hazardous conditions.

Areas most susceptible to flooding are those located in floodplains. Floodplains are the areas where water is stored or moves outside the natural banks of a waterway or waterbody. The Federal Emergency Management Agency (FEMA) was established by executive order in 1979 to coordinate in the preparation, prevention, mitigation, emergency response and recovery for domestic disasters, natural or man-made, including floods. FEMA maintains Flood Insurance Rate Maps (FIRMs) for the National Flood Insurance Program (NFIP) which identify the 100 year flood plain, the area where a there is only a 1% chance of flooding from a severe storm in any particular year. Local governments utilize the 100 year floodplain to set regulations for new development, and to determine plans for hazard mitigation in areas developed without regard to the location of floodplains.



Data from Westmoreland County 911

This chart shows municipalities with significant population living in the 100 year floodplain.

FLOOD HAZARD AREAS

Westmoreland County contains 1,025 square miles or 656,000 acres of land with over 31,000 acres or 5% of the county in the 100-year floodplain. Of the 365,169 county residents, 9,188 or 2.5% live in the 100 year floodplain. This puts at risk both lives and property.

In 2014, the county updated its hazard mitigation plan and the risk assessment for flooding. Floods are one of the most common hazards in the US and are the most prevalent type of natural disaster occurring in Pennsylvania. According to the Pennsylvania Environmental Management Agency (PEMA) both seasonal and flash floods have been the cause of millions of dollars in annual property damages, loss of lives, and disruption of economic activities.

The main flood types of concern for Westmoreland County are riverine, flash, ice jam, and stormwater floods.

Flash floods are a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, often beginning only minutes after a storm event. Urban areas, where a high percentage of the land is impervious, are more susceptible to flash floods, where rapid rises in water level and devastating flow velocities can become deadly and damaging.

Photo by WPXI TV

Stream, or riverine, flooding in Oakdale, PA, from Chartiers Creek.

Ice jam floods occur when an accumulation of ice acts as a natural dam restricting the flow of a body of water. Warm temperatures and heavy rains can cause snow to melt rapidly, rivers to swell and ice layers to break into large chunks. These chunks pile up near narrow passages and obstructions like dams and bridges, and can raise the water level enough to cause flooding. In Westmoreland County, both the Loyalhanna Creek and the Allegheny River experience ice jam flooding.

Stormwater flooding, or nuisance flooding, occurs in developed areas where inadequate infrastructure prevents rainwater from naturally reaching drainage channels. Instead, the water enters someone's basement, garage, or vegetable garden, causing localized but highly inconvenient and sometimes costly damage. Stormwater flooding is largely preventable by good design of land developments and good home construction practices.

Riverine floods are the most common and occur along a stream channel. These floods usually occur after prolonged heavy rains or snowmelt, are often slow rising, and generally develop over a period of hours or days. When a stream or river receives too much water, the excess water overflows its banks and inundates low lying areas.

FLOOD CONTROL FACILITIES

The Army Corps of Engineers (ACOE) operates two flood control facilities in Westmoreland County; the Conemaugh Dam and the Loyalhanna Dam. The county owns the Natural Resources Conservation Service (NRCS)-constructed Bridgeport Dam on the Jacobs Creek on the southern border of the county and the Acme Dam on Jacobs Creek between Donegal and Laurelville. The City of Jeannette owns the Bull Run Dam in Penn Township. Other flood control structures in the county include flood control channels, privately owned dams, and debris basins.

Photo by Rob Cronauer

The Westmoreland Conservation District helped build a debris basin in 2011 in New Kensington on Little Pucketa Creek to help control flooding of the Valley High School.

Flood control channels:

- Loyalhanna Creek in Latrobe
- McGee Run in Derry
- Turtle Creek in Export
- Jacks Run and tributaries in Greensburg area
- Jacobs Creek in Scottdale
- Little Pucketa Creek in New Kensington

Engineered flood control structures help prevent riverine floods that cause community-wide damage. However, they do not control the more frequent localized stormwater flooding that can cause expensive damage to homes and property. Low-impact development techniques and green infrastructure practices used in new and redevelopment can prevent stormwater flooding.

OBSTRUCTIONS AND ENCROACHMENTS

Obstructions and encroachments are structures or activities that may change the course, current, or cross section of a body of water or waterway. Examples include bridges, culverts, utilities, walls, weirs, dams, and fills. Our county contains countless obstructions—natural and man-made. Every road culvert, bridge, and streamside retaining wall contribute to impacting stream flow. Historically, people have obstructed and encroached upon streams without much thought of adverse effects. A too-small culvert will back up water and flood homes, a squeezed stream channel will become clogged with debris, and an undersized bridge will fail in a flood. Inadequate, poorly planned, or unmaintained obstructions and encroachments can cause an economic loss and even loss of life. Sometimes a once acceptable obstruction becomes a large concern. In many places, suburban sprawl has rendered previously adequate culverts inadequate by the increase of runoff caused by residential construction.

To help prevent these personal and economic losses, and to protect

our water resources, PA DEP has established a program of permitting for water obstructions and encroachments (see Chapter 3). Some permits are issued by PA DEP's Regional Office, and some are issued by the local conservation district. Over the last four years the Westmoreland Conservation District has reviewed and issued nearly 400 stream encroachment permits, and the number is steadily increasing each year. The purpose of these permits is to protect the environment and property.

Large dams are another kind of obstruction. There are many large dams in Westmoreland County for water supply, flood control, recreation, and for river navigation. Dams are permitted by PA DEP's Division of Dam Safety, and may meet the following criteria:

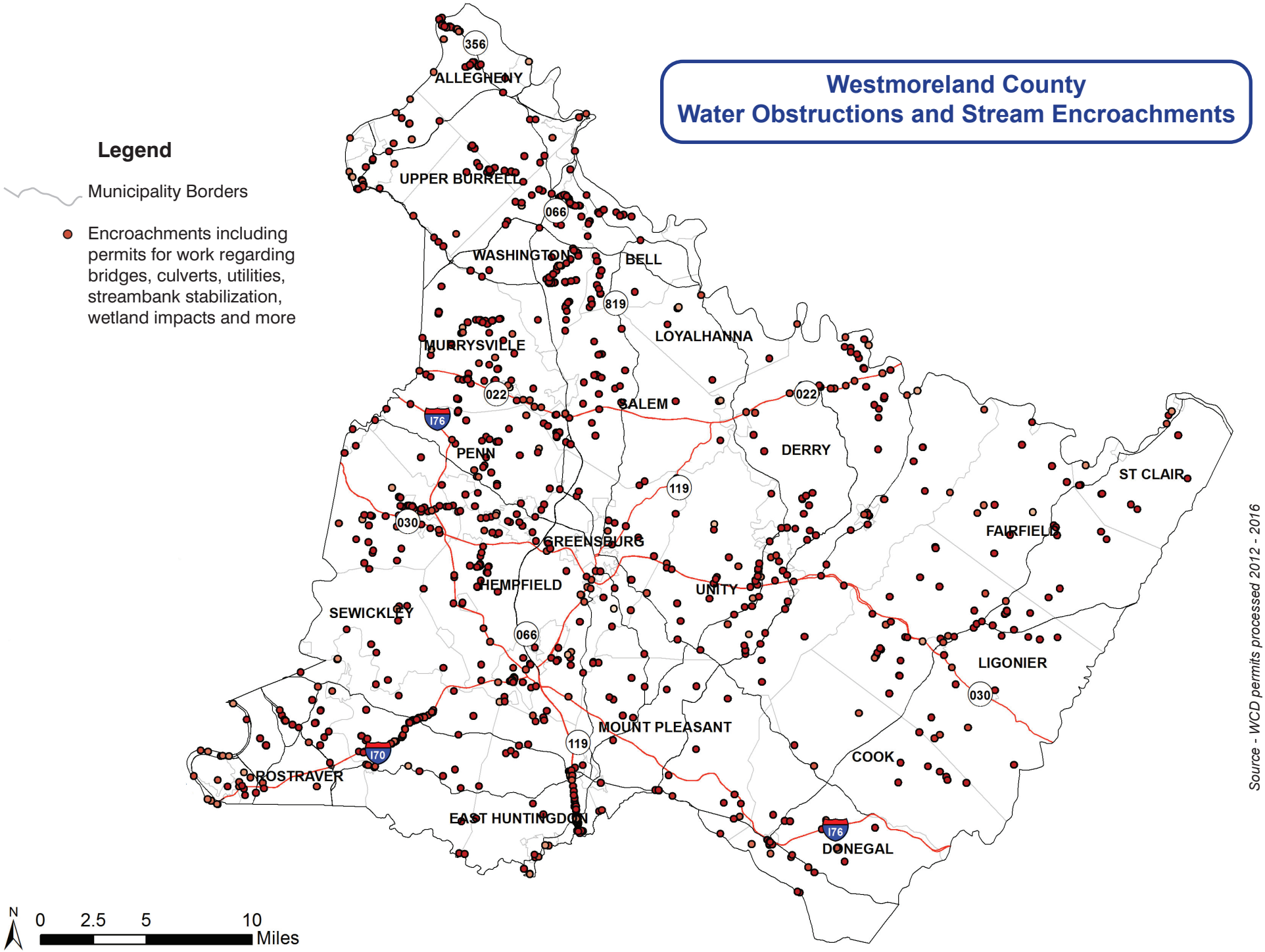
- Drainage area > 100 acres
- Embankment height above the original streambed of > 15 feet
- Storage capacity of > 50 acre-feet of water
- Construction of a dam which impacts wetlands

Each permitted dam must have an emergency action plan in case the dam starts to leak or overtop. Westmoreland County Emergency Management is the custodian of these plans.

Image from ACOE

Loyalhanna Dam on the Loyalhanna Creek was completed in 1942 and is managed by the U.S. Army Corps of Engineers.

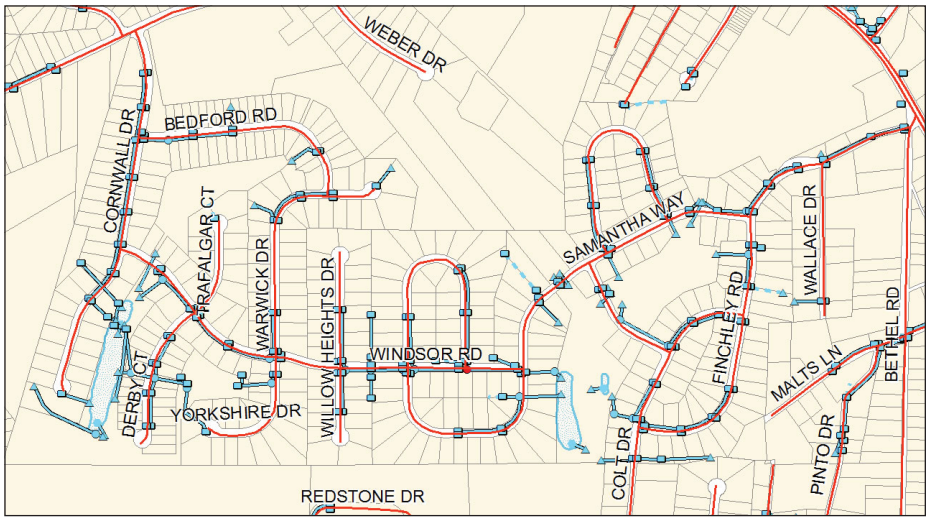
Westmoreland County
Water Obstructions and Stream Encroachments



Source - WCD permits processed 2012 - 2016

HYDROMODIFICATION

Hydromodification is the alteration of the natural flow of water through a landscape and often takes the form of channel modification or channelization. An example of this is a community's storm sewer system of inlets, pipes, culverts, and basic detention basins. Most of our county's communities have some kind of stormwater conveyance system similar to the example below of North Huntingdon Township's hydromodification mapping.



North Huntingdon Township hydromodification map

Source - North Huntingdon Township

In the natural condition, water flows across the land following the pattern of first, sheet flow; second, shallow flow; and last, channel flow. Sheet flow occurs high in a drainage area or a watershed, and is just a very thin layer of water feeling its way downslope through the roots of grasses and plants. Shallow flow may be an inch deep, slowly trickling downhill in rivulets. Channel flow forms where enough drainage area accumulates to the point where the flow has defined bed and bank. In a natural stream the water will move quickly in some places and slowly in others as it moves from pool to riffle to pool again, stepping its way down through the watershed.

Hydromodification changes the surface where water naturally sheets across. Grass or woodland soils are transferred to a hard paved surface into which nothing infiltrates and across which the water speeds towards a place of concentration like a street gutter. In a developed area, rainfall on the roof of a building rushes into the roof gutter and down the downspout to the sidewalk or a driveway, with no opportunity to soak into the ground. Making its way to the street, the water picks up speed and again has no opportunity to infiltrate naturally into the ground as it races downhill to a storm sewer. Once in the sewer system, the rushing water has nothing to hold it back or slow it down as it roars to the bottom of the system, where the onrush erodes the stream channel into which it dumps. If the natural stream has been channelized with concrete bottom and sides, the water picks up even more speed with nothing to slow it down or hold it back to allow time for natural infiltration.

The end result of hydromodification is that more water gets to where it is not wanted faster than it should, and carrying with it sediment and pollutants. This fast moving volume of water overloads streams, erodes and undercuts streambanks, deposits sediment and debris, and devastates the stream's natural habitat.

For many years regulations have mandated the use of detention ponds to help control runoff from land development. A conventional detention pond will help offset the effects of hydromodification, but only to a

Hydromodification: What's natural about this stream? Jack's Run in Southwest Greensburg

Photo by Alyssa Harden

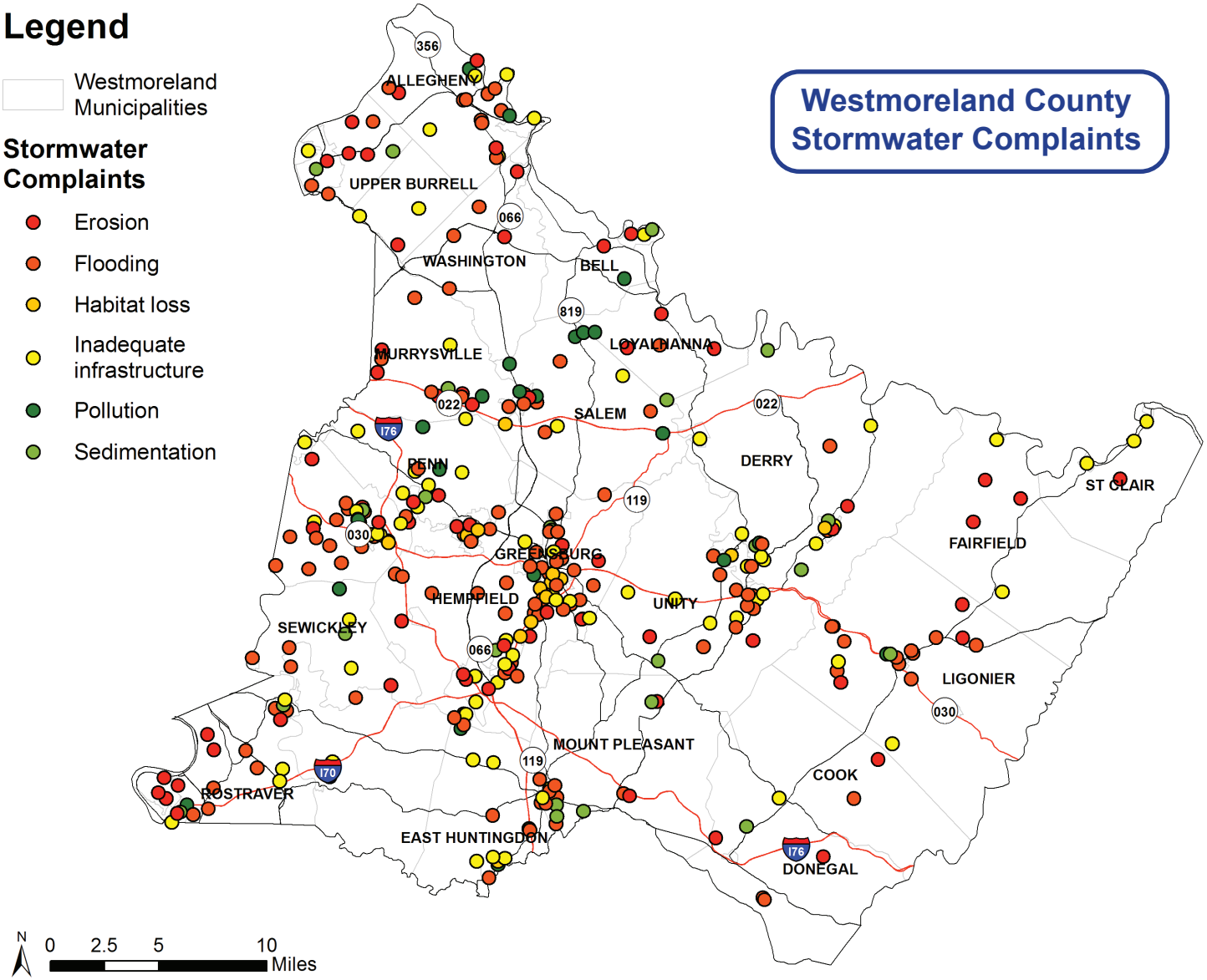
point. The detention pond will reduce the peak rate of flow, but in fact it doesn't reduce the volume of flow, and it may not improve the quality of runoff in an urbanized area. Streams feeding into detention ponds may fill the pond with sediment even if the runoff comes from a developed area. Streams receiving water from a detention pond may be eroded and have habitat loss due to prolonged steady releases from the pond. New scientific research shows that instead of using one single detention pond to control runoff from a project, it's better to distribute the stormwater controls across the development site to try to replicate natural hydrological conditions by managing the water where it falls.

Photo by Chris Droste

Stormwater detention ponds at the Tuscan Hills residential development.

STORMWATER MANAGEMENT ISSUES

Phase 1 of the Act 167 Plan identified the top three stormwater issues such as flooding, inadequate infrastructure, and water pollution from a total of seven categories of complaints which also included accelerated erosion, habitat loss or damage, sedimentation, or other issues. The map below is a combination of issues identified in Phase 1 and those identified during the IWRP process and Phase 2 of the Act 167 Plan. The problems recorded are more than just a pin on a map—each one represents a place where stormwater is causing harm to people or the environment.



Data from WCD logs 2014 - 2017 and Act 167 Phase I

Land development, while being one of the principal causes of stormwater problems, also can be designed and constructed to reduce or prevent problems. The best way to prevent land development activities from causing stormwater problems is for the developer to have a stormwater management plan, which shows how the proposed project will handle stormwater runoff.

PA Act 167 says that it is the "duty of persons engaged in the development of land…to assure that the maximum rate of stormwater runoff is no greater after development than prior to development activities… to manage the quantity, velocity, and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury."

Whether the stormwater plan is based on an Act 167 study or on standards outlined in a municipal ordinance, the goal is the same—to allow land development to take place without harming neighbors or the environment. For three decades the Westmoreland Conservation District has been reviewing stormwater management plans. As standards and approaches have changed, our reviews have changed, but our approach remains to treat stormwater as a valuable resource rather than as a waste material.

Recent individual site stormwater management plan reviews are enumerated by watershed in the following table:

WCD stormwater management plan reviews by watershed for recent years.

Watershed	2014	2015	2016	2017	TOTAL
Conemaugh River	1	5	10	2	**18**
Indian Creek	2	3	3	1	**9**
Jacobs Creek	9	8	15	9	**41**
Kiskiminetas River	24	21	13	18	**76**
Loyalhanna Creek	34	55	59	42	**190**
Monongahela River	6	1	1	5	**13**
Pucketa Creek/Plum Creek Allegheny River	9	6	7	12	**34**
Sewickley Creek	46	50	58	51	**205**
Turtle Creek	48	33	51	64	**196**
Youghiogheny River	13	9	15	17	**54**
TOTAL	**192**	**191**	**232**	**221**	**836**

Photo by Rob Cronauer

A heavy rain causes a large volume of stormwater runoff on Otterman Street in Greensburg, PA.

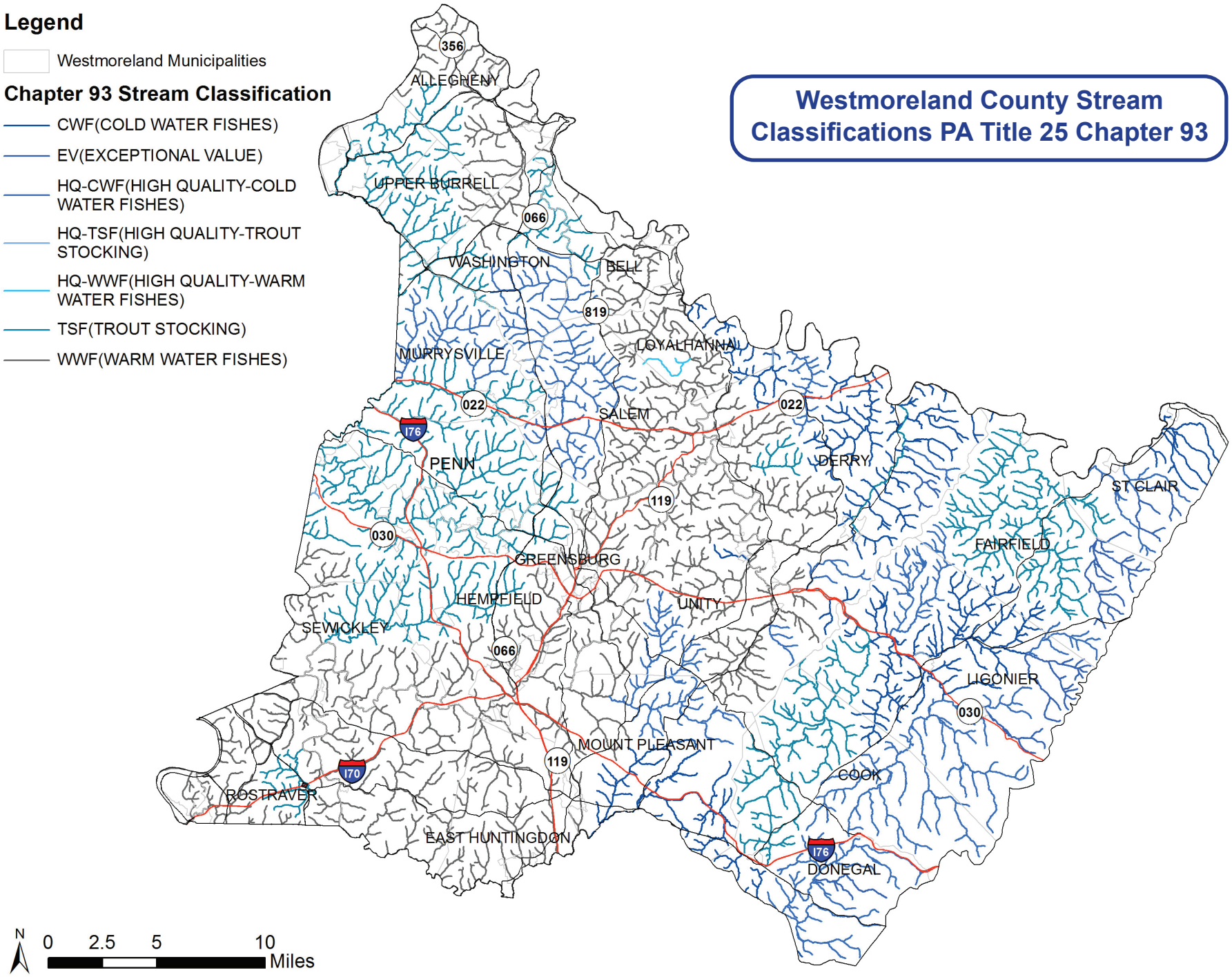
IMPAIRMENTS / POLLUTANTS

Water runoff from impervious areas can carry pollution from vehicles, yards, lawns, and farms to nearby waterways, which can potentially contaminate drinking water and harm aquatic wildlife. The Chesapeake Bay Foundation's research shows that one inch of rain falling on one acre of paved surface equals 27,000 gallons of polluted runoff. Nationally, polluted runoff is responsible for more than 38,000 miles of impaired rivers and streams, 948,000 acres of impaired lakes, and nearly 80,000 acres of impaired wetlands.

The PA Water Plan 2009 defines impaired waters as those with "eroded or undercut banks, low water clarity, foul odors, large amounts of algae, or have deep deposition of sediments that cover larger rocks on the bottom of the steam." The PA DEP under Section 303(d) of the Clean Water Act implemented a program that assesses the water quality of state waters and identifies waters that do not meet the standards for their designated uses. Designated uses such as aquatic life, recreation, and drinking water are characterized by the in-stream levels of parameters set by the state (dissolved oxygen, pH, metals, siltation, etc.).

If a water body or waterway does not meet the state standards for its designated use, it is considered 'impaired'; the reasons for its impairment are determined and listed on the PA Integrated Water Quality Monitoring and Assessment Report.

www.dep.pa.gov/business/water/cleanwater/waterquality/pages/default.aspx



Source - PA DEP

PA DEP, along with EPA and Penn State University, has determined what conditions are necessary to return the water to the quality that meets its designated use by developing a Total Maximum Daily Load (TMDL) for each impaired waterbody. A TMDL defines the allowable pollutant loads a waterbody can receive and still maintain its designated water quality standards.

On sites covered by an MS4 permit, pollutant control measures (best management practices) must be implemented to meet the following requirements dependent on stream classification:

- control metals and pH in stormwater discharges to impaired waters
- control pathogens (e.g. bacteria) in stormwater discharges to impaired waters
- control priority organic compounds (e.g., PCBs, Chlordane, etc.) in stormwater discharges to impaired waters
- control nutrients and/or sediment in stormwater discharges to impaired waters

Sediment in stormwater discharges harms aquatic life, clogs culverts and ditches, reduces the carrying capacity of a channel, and makes water difficult to treat for drinking.

Photo by Carnegie Mellon University

Sediment, by volume is the number one pollutant of Pennsylvania's waters, causes impairment at the Point in Pittsburgh where the Monongahela joins the Allegheny.

Causes of impairments to waters in Westmoreland County generally are abandoned mine discharge for metals and pH, malfunctioning septic systems and CSO's for pathogens, historical industrial activity for organic compounds, and agriculture and land development for nutrients and sediment. Stormwater carries with it other pollutants: according to the EPA and the Maryland Department of the Environment, the main pollutants sampled in Chesapeake Bay area runoff include: trash, soil, sediment, fecal bacteria, nutrients (nitrogen and phosphorus), oil and other petroleum products, pesticides and herbicides, road salt, and toxic metals including copper, lead and zinc.

Nature is able to address certain impairments, but as development increases, the natural ability of a watershed and its stream system to cleanse itself diminishes. Increased runoff prevents a natural area from absorbing nutrients like nitrogen and phosphorus, causing them to leave the landscape rather than be recycled back into the environment.

The Impervious Cover Model below, developed by the Center for Watershed Protection, shows a negative correlation between the amount of impervious surface and the level of stream quality. Watersheds having 10 percent or more of impervious surface begin to show stream degradation, illustrated by a decline in abundance and diversity of aquatic species. Watershed stressors such as untreated sewage and a lack of riparian buffers may increase degradation. When a watershed reaches 25% impervious cover, it reaches the point where aquatic habitat is completely lost due to impairment and pollutants.

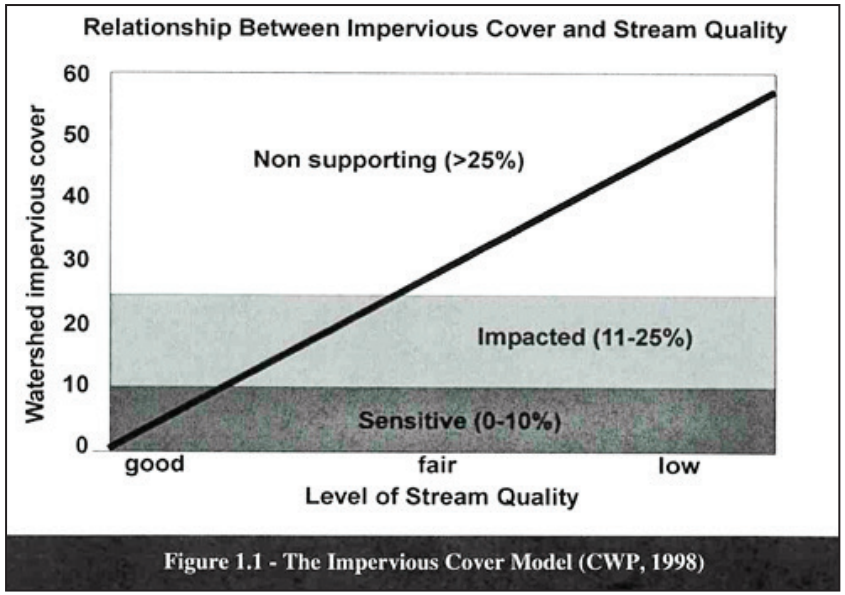


Figure 1.1 - The Impervious Cover Model (CWP, 1998)

Image from the Center for Watershed Protection

Because rainfall and snowmelt are not infiltrating into the groundwater system, normal stream baseflow is lower and aquifers may become depleted, leading to a dessicated streambed between rainstorms – one which cannot support aquatic life. Stormwater runoff from hard surfaces will contribute to thermal flashes, as the water coming from roofs and pavement is generally warmer than stormwater flowing over natural areas. Thermal pollution can negatively harm aquatic wildlife, which tend to tolerate very limited ranges of water temperature.

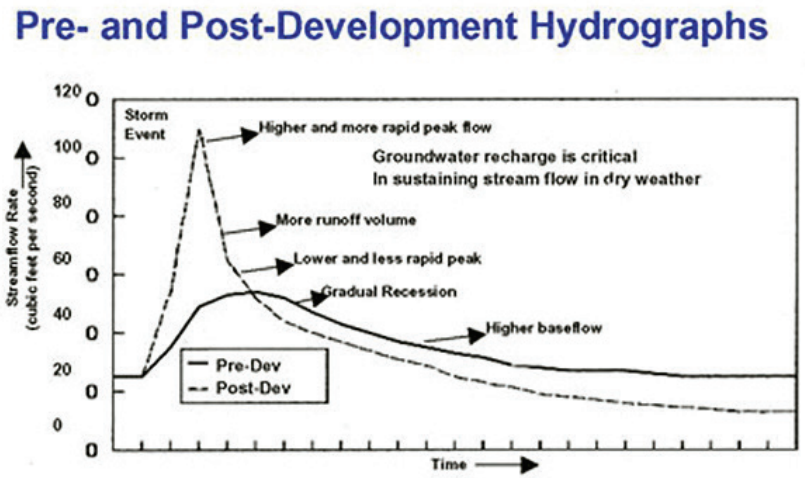


Image from the Center for Watershed Protection

Increases in impervious surface often decrease the amount of infiltration. Without infiltration, groundwater recharge rates will be reduced, and the stream base-flows will not be sustained at natural levels.

The above engineering illustration shows the effect of land development on peak flow in a stream. Before development, the storm-flow peak is low, and the base flow is higher in relation to the peak. After development, the peak flow is very high, and the base flow is lower, due to loss of groundwater. Engineers calculate flow rates for land development projects and then apply 'best management practices' to the development, such as detention ponds, vegetated swales, permeable pavements, and rain gardens, to try to reduce the peak flow to pre-development levels. *Source: EPA*

Designing site developments to handle changes in water quality will become more difficult in a changing climate. Climate change predictions for the northeastern United States indicate increases in precipitation as well as warmer winter months, which will feature more rain events than snow events. As a result, there will be more frequent, moderate runoff events. These runoff events will increase contaminant loads to waterways, particularly in the winter months when evapotranspiration and other biological processes are not as effective in managing stormwater runoff. *Source: USGS*

Uncontrolled runoff leads to flooding, erosion, and damaged roads and buildings. A quarter of flooding damage across the U.S. comes from uncontrolled suburban and urban stormwater runoff. Repeated flooding will cause property values to decline and diminish a community's tax base. *Source: Chesapeake Bay Foundation*

People may complain about the cost of stormwater management, but not having stormwater management costs money too, and harms property and the environment!

ABANDONED MINE DRAINAGE / ABANDONED MINE LANDS

In 1968, after more than a century of unregulated coal mining, Pennsylvania passed the Land and Water Conservation and Reclamation Act, the first act in the nation to address abandoned mine reclamation. It included a bond issue for abandoned mine reclamation and mine drainage abatement within the Commonwealth.

The abandoned mine reclamation portion of the act, known as "Operation Scarlift," is still administered by DEP. A central component of Operation Scarlift was identification and monitoring of acid mine drainage (AMD) discharges from abandoned deep mines throughout Pennsylvania. Data on flow and chemical composition of mine discharges were compiled and used to assess the magnitude of the AMD problem, and to estimate the costs for collecting and treating AMD discharges.

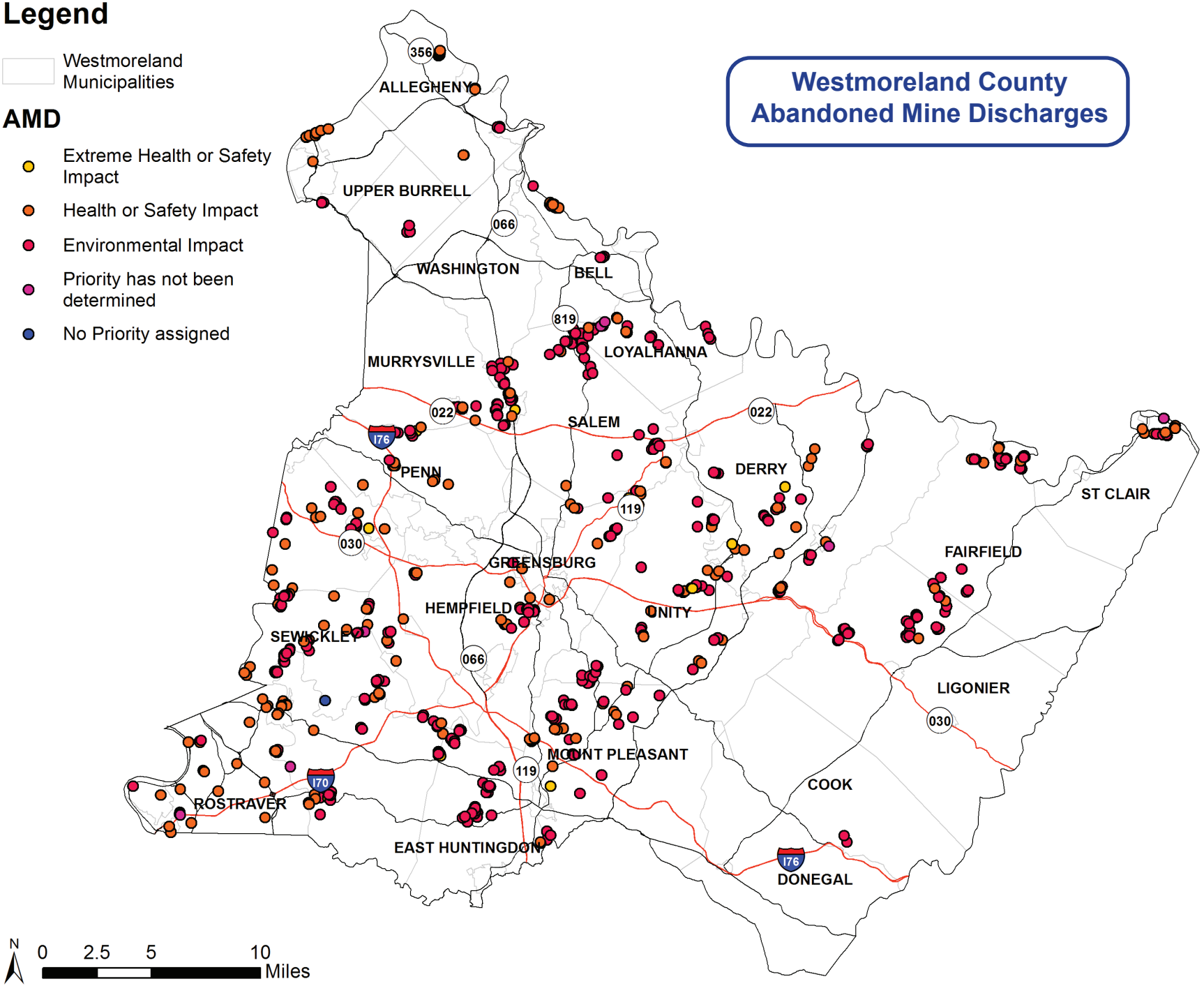
Numerous mine drainage watershed studies were produced by both department staff and by consultants between 1968 and 1982, and many of these remain the best descriptions and outlines of the AMD problems in the watersheds.

Learn more about the Scarlift Watershed Reports at Western Coalition for Abandoned Mine Reclamation's Abandoned Mine Reclamation Clearinghouse website. http://www.dep.pa.gov/business/landmining/abandonedminereclamation/operationscarlift/Pages/default.aspx

Why is this important? AMD in our county impacts 280 miles of streams, suffocating aquatic life. Orange streams might seem normal to many, but they aren't supposed to be that color.

Photo by Brandon Battistella

The abandoned mine drainage treatment site at Lowber, PA helps keep mine water pollutants such as iron oxide from entering the Sewickley Creek. The iron oxide settles out by passing from the old deep mine discharge through a series of settling ponds and a filtering wetland. The captured iron oxide is periodically harvested and sold for commercial uses such as stain pigment.


Legend
Westmoreland Municipalities
AMD
Extreme Health or Safety Impact
Health or Safety Impact
Environmental Impact
Priority has not been determined
No Priority assigned
Westmoreland County
Abandoned Mine Discharges
ALLEGHENY
UPPER BURRELL
WASHINGTON
BELL
LOYALHANNA
MURRYSVILLE
SALEM
PENN
DERRY
ST CLAIR
FAIRFIELD
GREENSBURG
HEMPFIELD
UNITY
SEWICKLEY
LIGONIER
MOUNT PLEASANT
COOK
ROSTRAVER
EAST HUNTINGDON
DONEGAL
356
066
819
022
I76
119
030
I70
N
0
2.5
5
10
Miles
Source - PASDA

FORESTRY AND TIMBER HARVESTING

"Sustainably managed forests make a vital contribution to Westmoreland County by providing economic, environmental and social benefits indispensable to the quality of life. A commitment to sustainable forest management means protecting water quality, soil, wildlife and unique resources; promoting human health and safety; and communicating the benefits of the practice of sustainable forestry." - from Sustainable Forestry Initiative

Westmoreland County's hardwoods are used both locally and domestically, and are exported overseas to make furniture. Timber harvesting may include 'clear-cutting' of an entire stand of trees, or some form of selective cutting where particular trees are harvested according to certain criteria such as diameter, age, type, quality, etc. Properly done, when managed by a professional forester, timber harvesting will allow the forest to regenerate itself, and can be done sustainably over the years. Timber harvesting does not harm water resources, especially if the workers follow appropriate standards and protect streams and wetlands they encounter. PA DCNR Bureau of Forestry has developed timber harvesting standards to protect water resources—this is especially important in stream headwaters areas on the timber-rich ridges in the eastern part of our county.

Timber harvesting operations conducted within Pennsylvania are regulated to minimize their impacts on soil and water resources and must be undertaken in accordance with Chapters 93, 102 and 105 of Pennsylvania's Title 25 Environmental Protection code (under the authority of the Clean Streams Law and enforced by the PA DEP) and the Federal Clean Water Act (enforced under the joint authority of the U.S. EPA, and the U.S. Army Corps of Engineers).

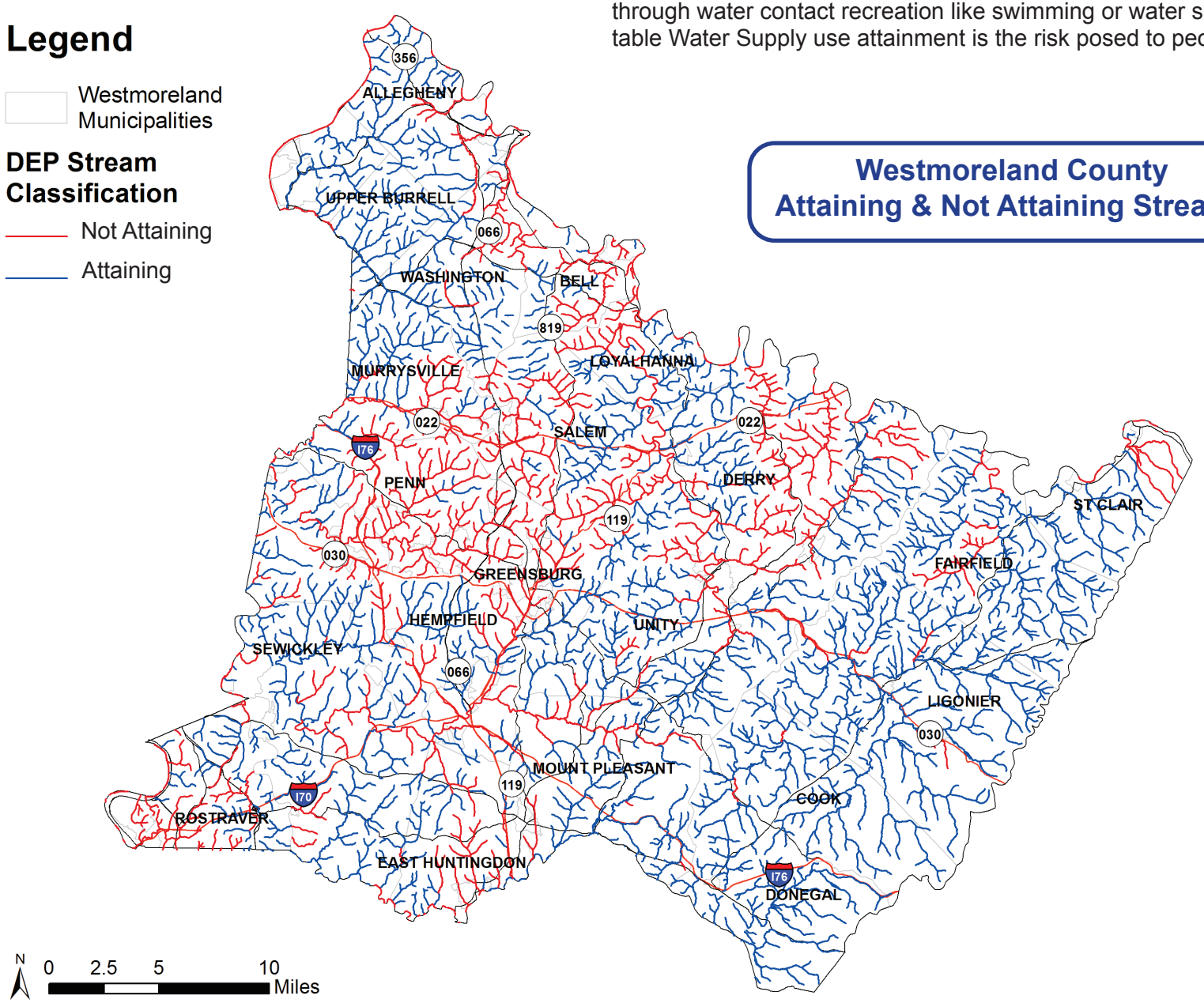
All timber harvesting operations in Pennsylvania must have an 'Erosion Control Plan for Timber Harvesting Operation' that has been approved by the Conservation District to minimize erosion and sediment pollution, considering such factors as topographic features, soils, and quantity of runoff, and is available onsite at the timber harvest site. PA DEP regional offices are responsible for enforcing the regulation and the program is delegated to the county conservation districts to administer.

Photo by Mark Jackson

Westmoreland Conservation District Forester Tony Quadro measures the diameter of a tree in a forest in Westmoreland County.

WESTMORELAND COUNTY STREAM CLASSIFICATIONS

PA DEP protects four stream uses: aquatic life, fish consumption, potable water supply, and recreation. The Aquatic Life use attainment is the integrity reflected in any component of the biological community (i.e. fish or fish food organisms). Fish Consumption use attainment is the risk posed to people by the consumption of aquatic organisms (ex. fish, shellfish, frogs, turtles, crayfish, etc.). Recreational use attainment is the risk associated with human recreation activities in or on a water body (i.e. exposure to bacteria and other disease causing organisms through water contact recreation like swimming or water skiing). Potable Water Supply use attainment is the risk posed to people by the



Source - PA DEP

ingestion of drinking water. The Chapter 93 stream classification list indicates segments that have been evaluated for attainment of those uses, and if a stream segment is not attaining any one of its four uses, it is considered impaired.

For more information, follow this link below:

https://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Some streams in Westmoreland County are classified as Exceptional Value—or, in layman's terms, the water is so good you could almost drink it! (but you should not). High Quality streams have a water chemistry that is great for supporting aquatic life: high level of dissolved oxygen, close to neutral pH, and low levels of nutrients, metals, pathogens, and other pollutants. A stream that classifies as Trout Stocking (TSF) means that if someone puts trout there, they will survive for a time, long enough for someone to catch them! Cold Water Fishes (CWF) indicates that the stream's temperature does not rise high in the summer, due to cool groundwater input into the stream and due to extensive shading of the stream by trees and shrubs. Fish prefer cold water because it holds more dissolved oxygen than warm water. In developed areas, most streams are classified as Warm Water Fishes (WWF). Such a stream might support 'low-quality' fish like carp, but it does not have the biological diversity or chemical purity of a higher-quality stream.

Photo by Stephen Simpson

Loyalhanna Creek

CLIMATE CHANGE

Changing climate patterns can impact how we mange stormwater and sustain our other water resources. Climate change has become a political issue, but in reality, the data should be approached scientifically and with engineering to effectively address the issue for the benefit of all.

In May 2017, the US Army Corps of Engineers (ACOE) partnered with NOAA to create a study titled 'Ohio River Basin – Formulating Climate Change Mitigation / Adaptation Strategies through Regional Collaboration with the Ohio River Basin Alliance'. The complete study can be found at http://www.corpsclimate.us/docs/USACE%20Ohio%20River%20Basin%20CC%20Report_MAY%202017.pdf

The report investigated potential climate change impacts to:

1. Ohio River Basin (ORB) infrastructure, including flood control, water supply, hydro-electric power production, and navigation; and
2. Terrestrial and aquatic ecosystems that are influenced by infrastructure components.

The climate change project modeled past conditions from 1951 to 2001 to calibrate the model for future periods. The project then modeled proposed future conditions. The predicted overall trend for the northeastern portion of the ORB (where Westmoreland County lies) over the next 30 to 80 years is warmer, wetter weather with a greater variability in weather systems as shown in the figures below. The mean, minimum, and maximum flows will still fall within historical ranges through the year 2040, after which flows will tend to increase. In certain locations in the ORB, autumn precipitation may decline and river flows may drop.

The ACOE study suggests that we will be getting wetter weather, warmer weather and less snow, but more individual and random intense storms. The study encourages climate preparedness and resilience especially regarding hydrologic analysis, because the various uses of water will be affected:

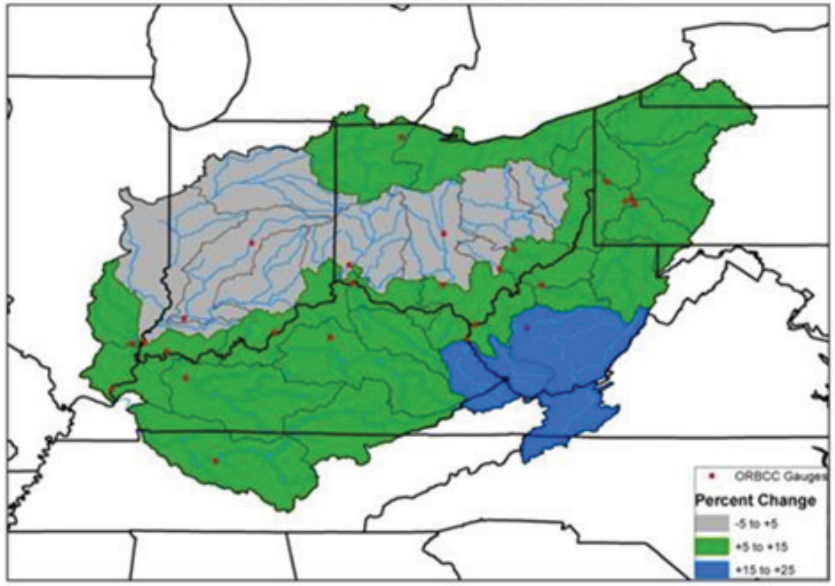
- Drinking water: plenty of water will still be available but it may be more muddy and require a higher level of treatment
- Sewage: flooding may impact treatment plants and higher precipitation will mean more incidences of Combined Sewer Overflow (CSO) and
- River transportation: higher flows may damage aging locks and dams and at certain times require river traffic to be shut down for fear of barges breaking away
- Agriculture: more rain and warmer temperatures can make plants grow better, but muddy fields make it difficult to plant and harvest crops, and erosion of farmland may increase
- Recreation: more water pollution and higher flows may make boating and swimming difficult
- Ecosystem: higher flows and warmer water temperatures in small streams will change the habitat for various species including the sensitive macroinvertebrates at the bottom of the aquatic food chain

Photo by Mark Jackson

Heavy rain covers an intersection.

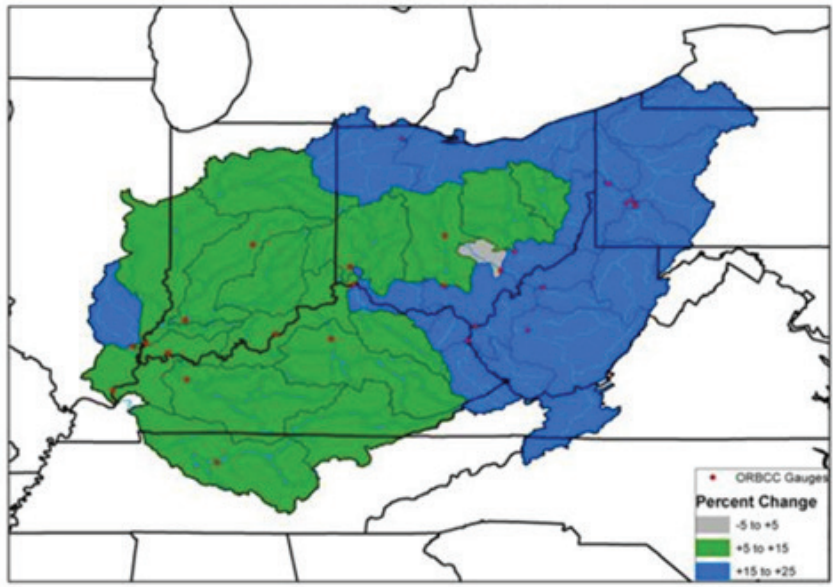
- Stormwater management: older storm drain systems will become inadequate, detention ponds will fill more frequently, and the use of alternative and green infrastructure practices like rain gardens, permeable pavement, and green roofs will become more important as we try to protect our small streams from flash flooding
- Flood control: the importance of regional flood control dams and channels will grow

The ACOE climate change study shows that water managers and especially stormwater management professionals have much work to do to protect the environment, life, and property in the next several decades.



Source - ACOE Study

Forecasted Percent Change in Annual Mean Streamflow (2011-2040)



Source - ACOE Study

Forecasted Percent Change in Annual Mean Streamflow (2041-2070)