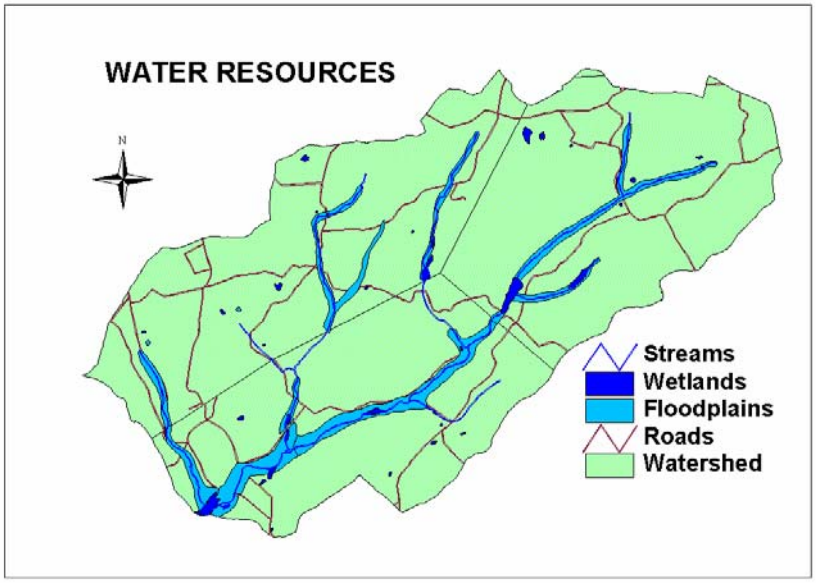
## WATER RESOURCES

Water features shown on the land use map are the streams, floodplains, and wetlands. The stream corridor includes the stream and adjacent land running along the stream. Stream characteristics and water quality are greatly dependent upon the natural features of this land, as well as the modifications that have occurred over time. The land closest to Pine Creek and its tributaries that is subject to periodical flooding during storms is the floodplain area. This land is usually flat and contains alluvial soils that may be wet a portion of the year. It often supports wetland vegetation that can serve as excellent areas for wildlife habitat. Floodplain areas vary with the topography and the size of the stream, increasing with stream order and drainage area. The Pine Creek floodplain varies in width from 25 to 100 feet or more. Much of the floodplain is wooded or features hydric soils with natural wetlands vegetation. The floodplain serves as a natural buffer area along the creek. This greatly aids in protecting the stream banks and absorbing the impacts of runoff and nutrient loading.




### Wetlands

Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support vegetation adapted for life in saturated soil conditions, including swamps, marshes, bogs and similar areas. Wetlands possess three essential characteristics: hydrophytic vegetation, hydric soils, and wetland hydrology. Wetland hydrology creates permanent or periodic inundation, or soil saturation to the surface, at least seasonally. The presence of water for a week or more during the growing season typically creates anaerobic conditions in the soil, which affect the types of plants that can grow and the types of soils that develop. Numerous factors influence the wetness of the area, including precipitation, groundwater discharge or periodic flooding.

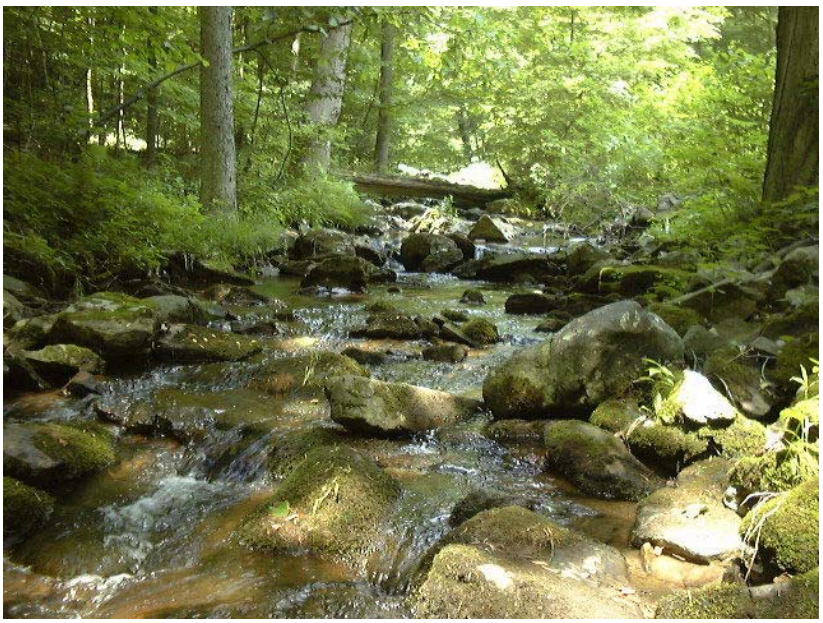
Wetlands have a variety of functions and uses. They can be extremely rich areas for plant growth and animal habitat, often serving as breeding places for many organisms. Wetlands also act as natural filters in removing pollutants such as bacteria and sediment from the water. Organisms living in the wetland consume the pollutants trapped by plants. In addition, wetlands help to control flooding by slowing and storing water generated during storm events. In this way

they help protect adjacent and downstream properties from flood damage. Pine Creek's wetlands are characterized by numerous small springs and seeps, derived from groundwater. Studies conducted at many of these wetlands areas have identified them as important habitat for both plant and animal species of concern. Accordingly wetlands should be preserved and maintained not only for their role in improving water quality and aiding flood control, but also as key areas to sustain biodiversity and protect rare and endangered species.

**Stream Description**

Pine Creek is 6.3 miles long and has a 12 square mile drainage basin. It joins Bieber Creek in northern Oley Township to form the Manatawny Creek. The main stem of Pine Creek originates from springs in a wooded wetland area near DeLong Road in District Township at an elevation of 980 feet. It flows in a southwesterly direction on a fairly straight course through deciduous woodland habitat, crossing under Baldy Hill Road and running parallel to Long Lane about 4.6 miles to its confluence with West Pine Creek east of Lobachsville at an elevation of 400 feet. Its bed is very rocky at places, and the stream forms divided channels as it flows through boulder fields. It travels along a narrow valley, almost entirely forested with the exception of scattered residential properties and several farm fields off Long Lane. Both sides of the stream are steeply sloped to an elevation of 1000-1,200 feet. There are many riffles and areas where the stream cascades over rocks. Below its confluence with West Pine Creek, it has a gentler slope and more open landscape, flowing through farmland and the village of Lobachsville. Nevertheless, the stream is shaded by wooded buffers, and much of this area consists of an extensive wetlands.

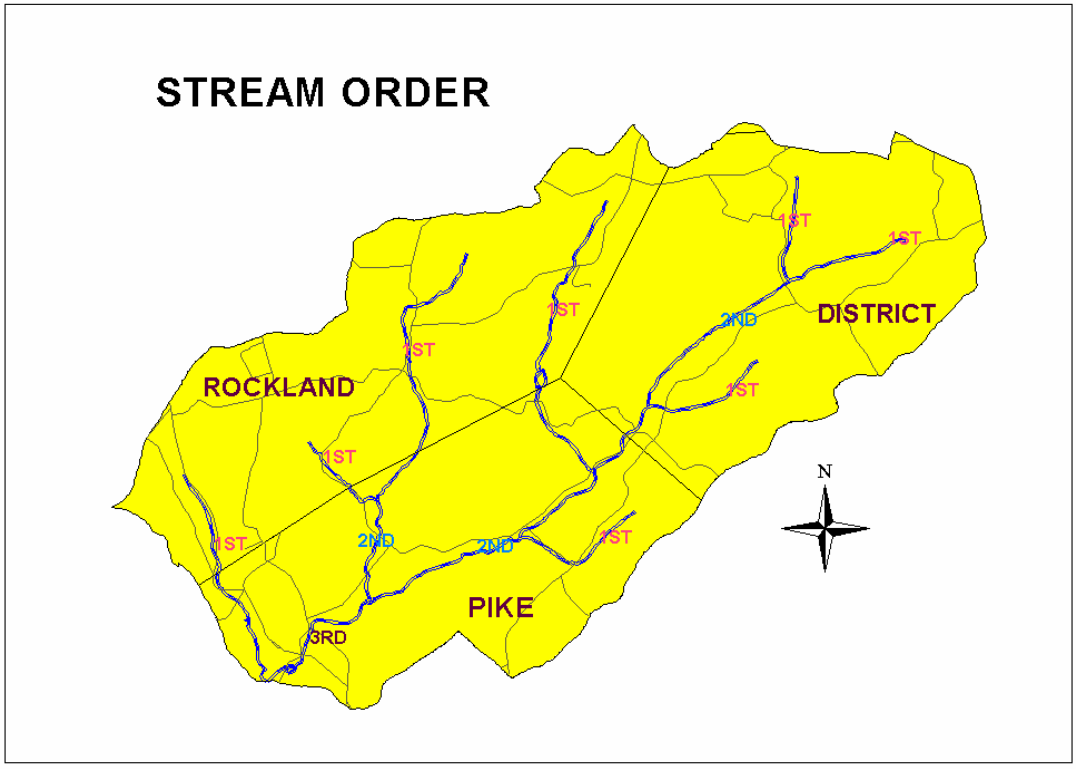
Pine Creek has six tributaries. Tributary #1 enters from the north just east of Baldy Hill Road. It is short and steep, descending from an elevation of 1,000 feet over about .7 mile. It has a rocky bed, and flows beneath large boulders over much of its course. Tributary # 2 enters from the southeast, flows for about 1.5 miles through woodland with some openings. It is fed from the southern slope of the ridge dividing Pine and Oysterville Creek watersheds, which contains many seeps. Tributary #3 is about 2 miles long, entering from the north. It originates in woodland near Five Points in Rockland Township, flows through wooded wetlands into a large pond with an earthen dam, thence into Pike Township where it follows a steep and extremely rocky downhill course to its confluence with Pine Creek at Long Lane. Tributary #4 enters from the south near Heilig School Road. It originates east of Mine Road and flows through woodland and wetland areas. Tributary #5 is West Pine Creek, a named tributary that flows through Rockland and Pike Townships.



It is 2.7 miles long, originating in highland woods and meadows, and following a rocky downhill course from Day Road to Ruppert School Road. It has two tributaries, which also are steep wooded streams. Tributary #6 enters from the north at Lobachsville, west of Long Lane. It runs parallel to Lobachsville Road through a steep wooded ravine into a wetlands area south of Boyer Road. It is 1.7 miles long

**First and Second Order Streams**

The Pine Creek watershed contains first, second, and third order streams, each with distinctive characteristics. The smallest streams, having no tributaries, are called first order streams. Two first-order streams join to form a second order stream. A third order stream is formed when two second order streams come together, and a fourth order stream is fed by at least two third order streams. Pine Creek begins as a first order stream, north of Baldy Hill Road. It continues as a second order stream from Baldy Hill Road to its confluence with the West Branch of Pine Creek north of Lobachsville. The remaining segment, through Lobachsville to Bieber Creek is a third order stream.



## Stream Classification

In Pennsylvania, streams or stream reaches are classified under water quality standards regulated by the Pennsylvania Department of Environmental Protection. There are five protected use designations awarded to streams that support the maintenance and propagation of fish species and suitable habitat for flora and fauna. These standards are specified in Chapter 93 of the Pennsylvania Code. As part of Chapter 93, stream reaches for protected uses are designated based upon specific water quality and biological conditions. They are defined as follows:

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

**WWF: Warm Water Fishery – Maintenance and/or propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.**

**CWF: Cold Water Fishery – Maintenance and/or propagation of fish species, including the family Salmonidae and additional flora and fauna, which are indigenous to a cold-water habitat.**

**HQ: High Quality Waters – A stream or watershed that has excellent quality waters and environmental or other features that require special water quality protection.**

**EV: Exceptional Value Waters – A stream or watershed that constitutes an outstanding national, State, regional, or local resource, such as waters of national, State, or county parks or forests, or waters which are used as a source of unfiltered potable water supply, or waters of wildlife refuge or State game lands, or waters which have been characterized by the Fish Commission as "Wilderness Trout Streams," and other waters of substantial recreational or ecological significance.**

The classifications HQ and EV are determined after a series of water quality assessments by DEP. As special protection waters, these streams are required to be maintained at their existing quality. Local government ordinances should incorporate good design techniques and buffer zones for the continued protection of the areas in these designated watersheds. Limiting erosion and sedimentation on construction sites, maintaining as much natural vegetation on the site as possible, maintaining buffers along stream banks and reducing the amount of impervious surfaces are suggested items that can be incorporated into local ordinances.

Pine Creek and the streams adjacent to Pine Creek are classified EV, at least for major portions of their length. This entire region constitutes a remarkable and unique headwaters resource area in Southeastern Pennsylvania. Maintaining existing quality in these waters will reap great benefits to the integrity of the ecosystem and the quality of life of those who live here. It is impossible to overestimate the value of abundant clean natural water, both in our streams and aquifers. Protecting these resources in a pristine state not only yields aesthetic benefits, but also lessens remediation costs and enhances property values.

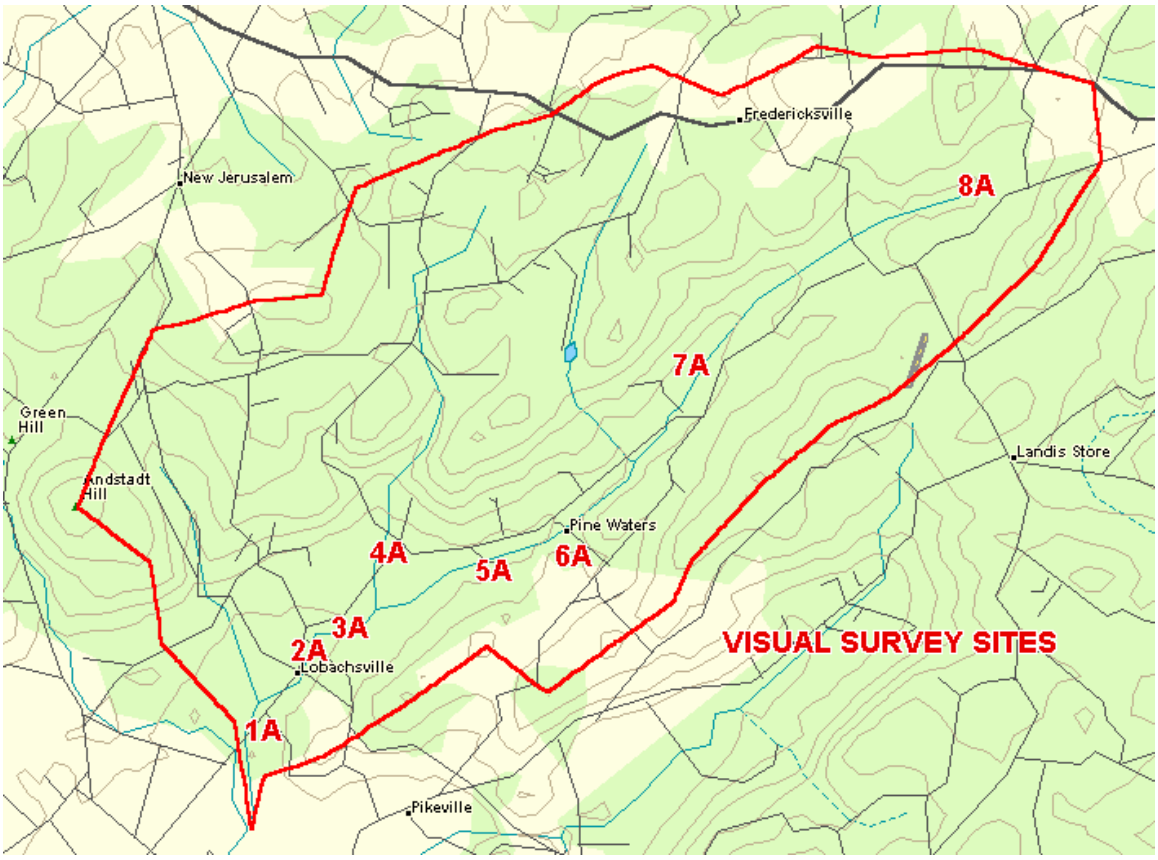
**Water Quality Assessment**

Biological monitoring of a stream serves to determine the relative health of the aquatic environment by determining the biodiversity of the habitat and the percentage of sensitive organisms that are found there. Bottom dwelling aquatic insects called benthic macroinvertebrate organisms are used as indicators of water quality. These insects as a group are wide ranging in their sensitivity to physical and chemical changes in their habitat. Ranking each kind of insect's sensitivity on a scale allows its use in interpreting the health of the stream. Indexes have been developed to rate a stream based on the pollution tolerance of its bug population, and to compare the numbers and varieties of types of invertebrates.

This photograph shows Susan Laubscher of the Penn State Cooperative Wetlands Center collecting "bugs" in Pine Creek near Bertolet Mill Road. Because of its EV ranking, Pine Creek has been the subject of continuing water quality assessments over the years.

**Methods**

From July 2001 through October 5, 2001 preliminary biosurveys utilizing visual survey techniques were conducted throughout the Pine Creek Watershed. The Pine Creek and its tributaries were walked and parameters such as habitat types, stream flow, water conditions, vegetation and stream bank composition were monitored. Methods followed EPA Volunteer Stream Monitoring Guidelines (EPA 841-B-97-003) and data sheets were produced from eight locations. (Sites 1A – 8A on following map) Macroinvertebrate samples were collected, and habitat assessments were performed at each sampling station.



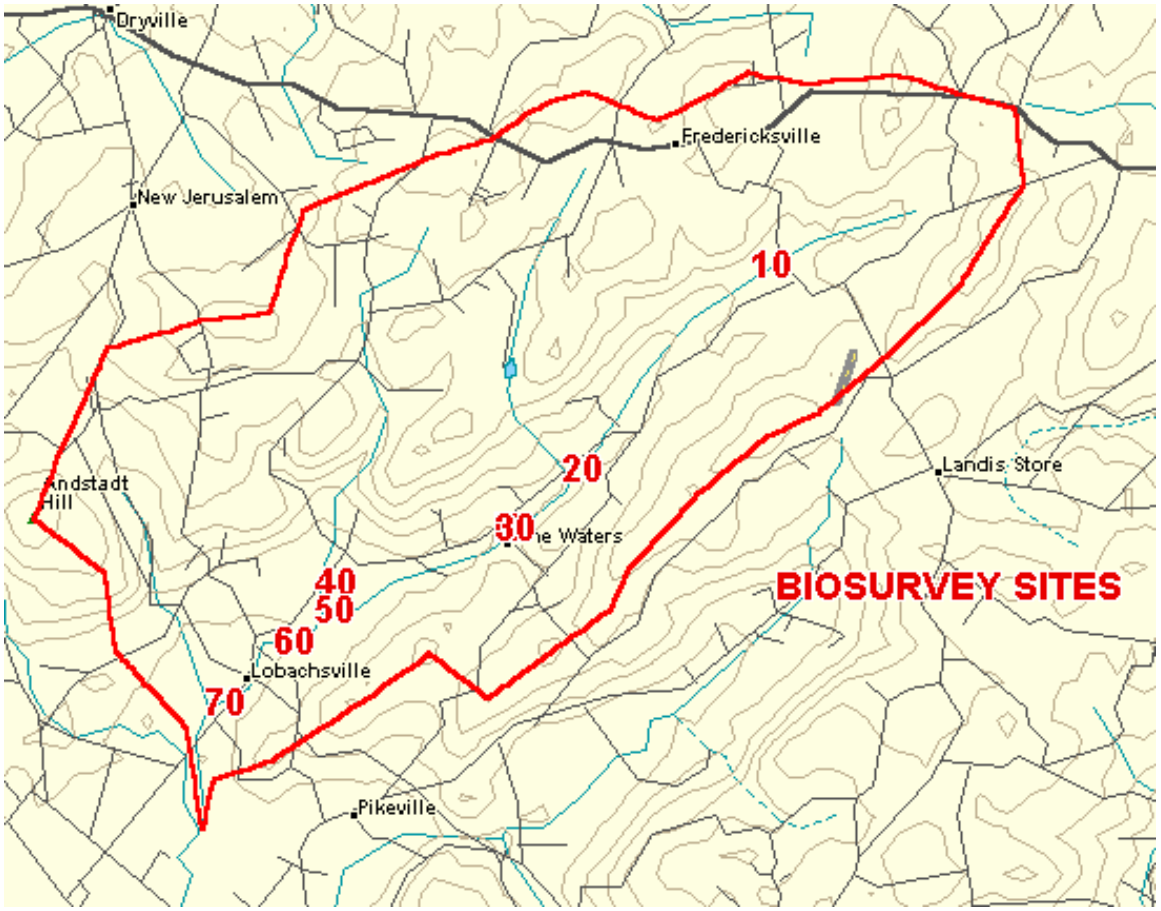

More intensive, qualitative biosurveys were conducted October 9 and 24, 2001, and April 11 and May 8, 2002. During these surveys environmental parameters were intensively measured at an additional seven sites along Pine Creek. (Sites 10 – 70 on map) These more intensive surveys focused on benthic macroinvertebrate populations and their associated habitats including riparian zones. Water chemistry measurements, including pH, conductivity, dissolved oxygen and temperature, were also performed at each station. Methods followed EPA Rapid Bioassessment Protocols. (Barbour et. al. 1999)

Benthic macroinvertebrates are bottom (benthic) organisms that are large enough to be seen with the naked eye (macro) and lack a backbone (invertebrate). Examples of benthic macroinvertebrates include insects in their larval or nymph forms, crayfish, clams, snails and worms. The populations of these organisms are useful indicators of localized conditions because of their limited migration patterns and their unique mode of life. Their broad range of trophic levels and pollution tolerances provide valuable data for interpreting stream quality. Macroinvertebrate population surveys combined with habitat assessments of riparian zones are useful indexes to evaluate stream quality and the corresponding watershed ecosystem health.

**Results and Discussion**

The stream and riparian assessment revealed a natural resource in overall excellent condition but with some emerging problems. Water chemistry values (pH, conductivity, dissolved oxygen, and temperatures) were all within normal range for each station and indicated no severe effects

from pollution. Physical habitat assessment scores less than 140 indicate stress to the system. Only stations 30 and 50 scored lower than 140, and both of these stations were chosen due to possible impacts from channelization and a pipeline crossing, respectively. Station 30 showed signs of severe bank erosion and lack of natural vegetation protection. Channelization disrupts a stream's natural flow regime and often produces these results. Station 50 had significant sediment deposition and a low frequency of riffles, probably due in part to a dam located downstream. Station 10 also had significant amounts of sediment deposition, possibly due to low flows, which may be inadequate to carry sediment downstream.




In the biological survey, all stations scored well for taxa richness and EPT taxa. Station 10 may appear to score low compared to the other stations; however, we must take into account the fact that this station is located in the headwaters of Pine Creek. Headwater streams, due to their small size, often have natural constraints on the macroinvertebrate community, which lowers taxa richness and the number of EPT taxa. The modified HBI (Hilsenhoff Biotic Index) scores all indicated good water quality. The increase at the downstream stations (60 & 70), although marginal, may indicate some influence from surrounding land use. Percent dominance values were excellent for stations 20, 30, 50, 60, and 70: stations 10 and 40 were in the range of fair (marginal) water quality. However, station 10 was dominated by the mayfly *Isonychia* and winter stoneflies (family Dapniidae), both of which have low tolerance values to pollution and

indicate high water quality. Station 40 was dominated by the mayfly *Paraleptophlebia,* which is also considered intolerant. Dominance by these particular taxa is probably due more to life cycles and seasonality than to anthropogenic impacts. The following chart shows the macroinvertebrate metric results from the Fall 2001 sampling:

| STATION | T0TAL INDIVID | TAXA RICHNESS | EPT TAXA | MODIFIED HBI | %DOMINANCE |
|---|---|---|---|---|---|
| 10 | 227 | 24 | 18 | 2.99 | 30 |
| 20 | 225 | 35 | 20 | 3.32 | 17.8 |
| 30 | 198 | 29 | 21 | 3.16 | 14.6 |
| 40 | 207 | 28 | 18 | 3.17 | 34.3 |
| 50 | 199 | 33 | 20 | 3.3 | 20.1 |
| 60 | 197 | 33 | 23 | 3.66 | 13.2 |
| 70 | 218 | 35 | 25 | 3.5 | 18.3 |

**Macroinvertebrate Survey**

- Taxa richness decreases with increasing disturbance
- EPT taxa decreases with increasing disturbance
- HBI values below 4.5 indicate excellent water quality
- Percent dominance measures the contribution of the dominant species to community abundance and increases with increasing disturbance.

Riparian assessments showed a relatively stable habitat but a decreased overall quality as you travel downstream to the mouth of Pine Creek. These conditions reflect the combination of natural stream evolution and cultural degradation. Human activities have resulted in loss of shade and increases in streambed sediment load from the area surrounding the Texas Eastern Pipeline downstream through Lobachsville and toward the mouth of the stream. Concurrently stream gradient declines in this area exacerbating the problem.

Areas of stream bank degradation near the Heilig School Road and Long Lane (SR1026) intersection were also identified and are currently being addressed in a stream bank stabilization project. This is a joint project being funded by a Growing Greener Grant administered by the Berks County Conservancy and carried out by the Tulpehocken Chapter of Trout Unlimited.

The Pine Creek's relatively undisturbed forest areas in the headwater and upstream portions of the watershed provide an influx of clean, cool water, which buffers some of these negative impacts encountered further downstream. It is therefore imperative that the upstream riparian buffers be preserved to ensure continuing water quality. In addition, it is suggested that riparian buffers be created, restored and protected where degradation has occurred.

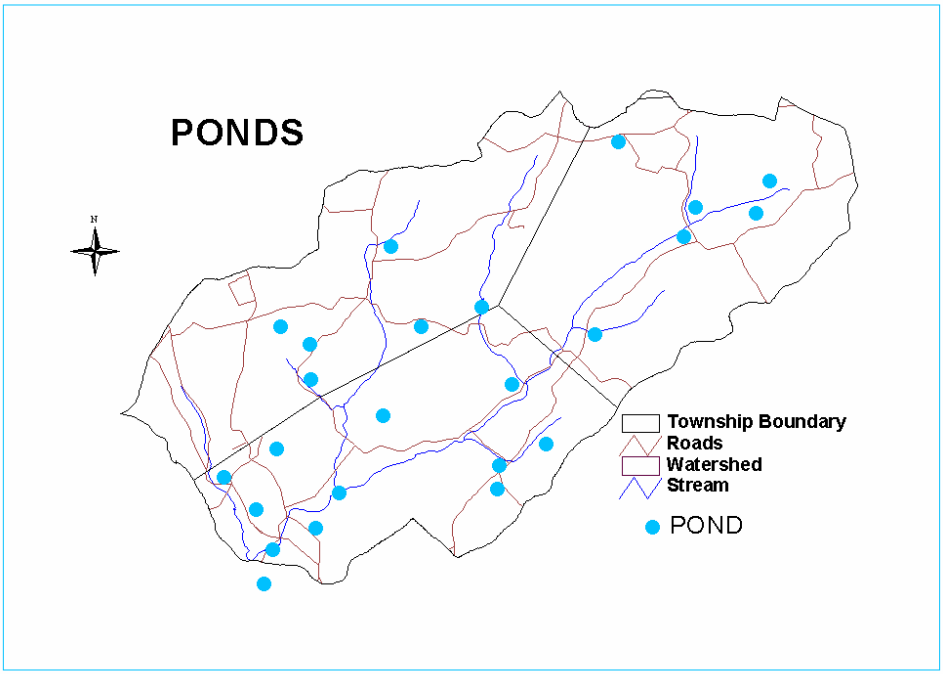
Also it is recommended that District, Pike, Rockland, and Oley Townships enact zoning regulations to facilitate protection of the watershed. These regulations should include watercourse and wetland buffer zones, conservation incentive programs, and funding and tax-relief programs providing landowner assistance.

**Ponds and Dams**

Lakes and ponds do not occur naturally in the watershed. Numerous privately owned small ponds range in size from <1 acre to >3 acres. Some of these were built as farm ponds or fish ponds and they furnish recreation and water supply for use in fire fighting, watering plants and crops, or watering livestock.

Some existing historic ponds were built for waterpower to run grist and saw mills. These mill ponds were connected to a stream by a system of races, a head race to carry water to the pond, and thence to the mill wheels or turbines, and a tail race that carried the water from the mill back to the stream at a lower level. These primitive waterpower systems were actually quite sophisticated, as they required intricate engineering to determine the exact place along the stream to start the millrace so it carried sufficient water and entered the mill at the right level to provide an adequate head and force to turn the waterwheels.

In addition to ponds, which are constructed as separate water bodies, there are also several dams, built across the stream to create an enlarged pool of water for recreation or for waterpower.




This map illustrates the approximate location of most ponds in the watershed. The Lobachsville Trout Hatchery pond (pictured on the next page) is shown at the lower left and appears to be outside the watershed boundary. This section of the watershed was not included in the PA GIS small watersheds coverage, and therefore is not mapped in this Plan, although the spring at this source is an important contributor to Pine Creek and the EV wetlands at this site.

**Point and Non-Point Sources of Pollution**

According to the National Pollutant Discharge Elimination System (NPDES) established as part of the Clean Water Act, the US EPA issues permits that allow discharges of regulated amounts of cooled effluent into water bodies. The EPA regulates and monitors the amount of effluent discharged by permit holders. The NPDES permit holder is responsible for maintaining and updating the permit on a regular basis. There are no NPDES permits in effect for Pine Creek or its tributaries.

**Non-Point Sources**

Pollution caused by erosion and runoff from agricultural, commercial and residential properties are non-point sources of stream degradation. Pollutants can be nutrients, such as nitrogen and phosphorus that are used in fertilizers used on cropland and lawns. Nutrients can also come from manure and mal-functioning sewage systems. Nutrient management practices can reduce these causes of pollution that produce excessive plant growth in streams and ponds.

The greatest non-point pollutant in Pine Creek, as well as other Berks County streams is sediment, small particles of soils or other insoluble materials washed into the stream after rain and storm incidents. Every significant rainfall induces runoff and erosion that results in muddy

stream conditions. Large storms and downpours that produce flooding can result in serious damage to the stream banks and the streambed. Although heavy rains cannot be prevented, stormwater controls can minimize the amount of sediment that enters the stream under normal conditions. Conservation best management practices on farms, erosion and sedimentation controls at all earth moving sites, detention basins in residential developments, use of streamside buffers of natural vegetation, and enactment and implementation of stormwater management ordinances are measures that address sediment loading in streams.

**Stormwater Damage**

The summer of 2001 had several severe storm events, which not only caused extensive flooding, but also washed out a vulnerable section of stream banks along the main stem near Heilig School Road. Undercut banks collapsed, sandbars shifted, islands were reconfigured and silt and stones washed into the field beside the stream. To remedy this situation, the property owners have applied to DEP for a *Water Obstruction and Encroachment Permit* for proposed stream bank restoration for the Pine Creek Watershed. The project consists of stream bank restoration along 1100 feet of the Pine Creek and its tributaries at the site.

The restoration work is a joint project between the Tulpehocken Chapter of Trout Unlimited, the Berks County Conservancy and the Pine Creek Valley Watershed Association. In addition to the bank stabilization effort, additional restoration activities will include aquatic habitat enhancement, improvement of sediment transport and establishing a riparian buffer through various plants and soil bioengineering practices. All of this work will be carried out by volunteers from Trout Unlimited, using Growing Greener Grant funding for plants and materials.

**Groundwater Quality**

Groundwater wells and springs furnish all the water for human uses in the Pine Creek Watershed. Yet groundwater is seldom tested by individual property owners or municipalities unless a health problem is suspected. Both groundwater quality and quantity are a concern to

local municipalities. Gaining greater understanding of groundwater resources is essential to informed land use planning decisions.

Contamination of groundwater by bacteria can result from agricultural wastes or wastewater from on-site disposal systems. When recharge water migrates through soil and rocks toward the ground-water reservoir, the bacteria it contains generally are filtered out. Under adverse conditions, however, bacteria-laden recharge water may flow into the water table with little reduction in the number of bacteria. This situation results a health hazard for private wells in a contaminated area.

**Groundwater supply**

Both natural and human factors affect groundwater quantity. The most important natural factors in a given region are precipitation, climate, and the type of geologic formations present. Ground water is present in and moves along and through bedding planes and joints, faults, and other fractures in the bedrock. Aquifer characteristics can be identified for different geological formations. Well yields depend upon the permeability, storage coefficient, areal extent of the aquifer, sources of induced recharge, the length of the well exposed to the aquifer and the well diameter. Topography also has a significant effect on well yield. Normally well yields are greater in valleys than in hilltop and hillside areas, where fewer fractures are present.

Precipitation and temperature influence the hydrologic cycle and determine how much water is present as groundwater, surface water, or atmospheric water vapor. Human factors include land use and water use. Wooded and natural vegetation areas provide optimum recharge areas for aquifers, while impervious cover and developed areas increase runoff to storm sewers and waterways, which can result with lowering of the groundwater. Although the underlying geology of a region can be helpful in predicting well yields and availability of groundwater, it is important to do actual groundwater studies to ascertain specific information that can assist a municipality in making land use planning decisions

The USGS conducted a Water Resources Study in Oley Township in 1981-82, which included data collected in the Pine Creek Watershed at Lobachsville. The study utilized volunteer assistance in reading stream gages, rain gages, and measuring water levels in monitoring wells. Daily readings were taken of the surface level of Pine Creek at a stream gage station on the upstream right side wing wall of the bridge at the intersection of Mill Road and Long Lane. The drainage area above this point was 9.7 square miles, and the mean discharge was calculated at 12.8 cubic feet per second. This discharge rate was comparable to that of Bieber Creek and Oysterville Creek, at gaging stations near the northern boundary of Oley Township. The ground water yield for the Pine Creek drainage basin was .91 cubic feet per second per square mile in 1982, based upon yields from a relatively large area. Individual well yields were not calculated outside of Oley Township. The study noted the seasonal nature of water levels. Levels of ground water generally start to decline in March or April and continue to decline until late fall. Even though precipitation is greater during the summer than the winter, less precipitation reaches the water table because large amounts are evaporated from the soil and transpired by vegetation. Natural annual fluctuations of water levels in wells generally range from 3 to 20 feet.