Executive Summary

Tulpehocken Creek Watershed Conservation Management Plan

August 2001

BERKS COUNTY CONSERVANCY

DCNR

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Executive Summary

This study addresses the Tulpehocken Creek watershed in its entirety, and is an update of the original 1995 Tulpehocken Creek Rivers Conservation Plan. The plan describes the watershed's resources, accomplishments in the watershed to date, and the major challenges that the resources are facing, or will face in the near future. This project was funded by the Pennsylvania Department of Conservation and Natural Resources Rivers Conservation Program.

The study area is approximately 140,000 acres (Please refer to Watershed Location Map) in which a large amount of research has been previously conducted. A Tulpehocken Creek Scenic River Study was completed in 1987. Prior to that time, the Berks County Conservancy organized a Citizens Advisory Committee composed of representatives from local municipalities in the study area, organizations with an interest in the stream, and property owners along the stream. The Conservancy, in cooperation with the Citizens Advisory Committee, generated information on the study area including a historical summary, land use characteristics, and natural resources. The information provided the supporting material used in the Tulpehocken Creek Scenic River Study.

Virtually all reaches of the Tulpehocken Creek have been studied by either Conservancy staff or other local, state, or federal agencies, organizations, and schools.

Blue Marsh Lake is receiving attention from the Conservancy and Albright College through an EPA 319 Clean Lakes Study. Dr. John Hall and Dr. Phillip Dougherty, both of Albright College, have been studying the lake for over ten years. Their data and recommendations can be found in the Clean Lake Study which is available at the offices of the Berks County Conservancy.

In January 1998 a federal project was approved which will exceed any previous initiative in the watershed. A Natural Resources Conservation Service Public Law 566 Plan was developed and is titled Tulpehocken Creek Watershed Protection Plan and Environmental Assessment. Total project costs are estimated at ~ $8.9 million and is being used to develop and implement improvement projects in the watershed.

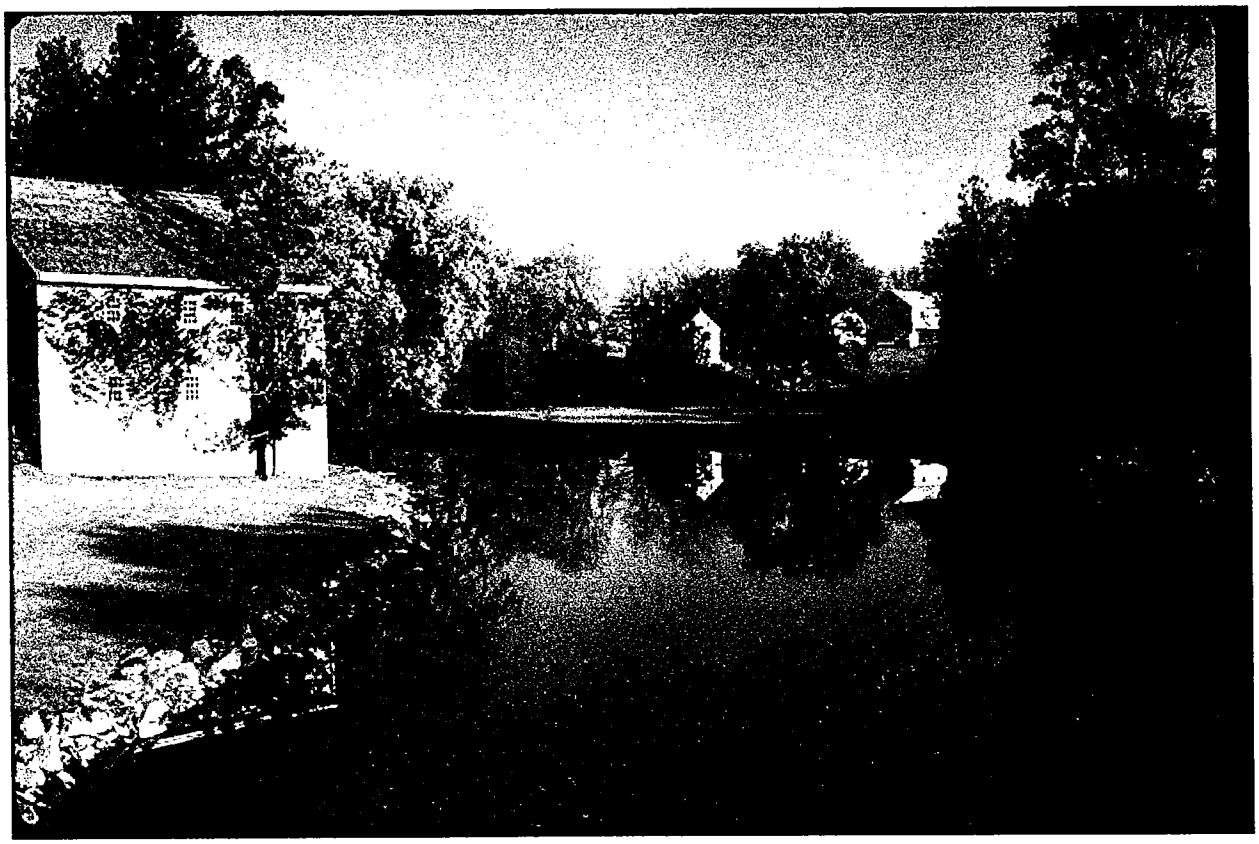
As a result of all this research, the Berks County Conservancy re-organized the previously mentioned Citizens Advisory Committee to include governmental agencies, non-profit and private organizations. This group of representatives from many respectable agencies and organizations is now called the Berks County Watershed Council. This cooperation has enabled us to implement the Rivers Conservation Plan for the benefit of the Tulpehocken Creek watershed.

The Berks County Conservancy will continue to manage this Rivers Conservation project. The Public Works Department in the City of Lebanon conducted the Geographic Information Systems (GIS) mapping for this project and we rely on comments and participation from members of the Berks County Watershed Council to assist us with the implementation phases of this project.

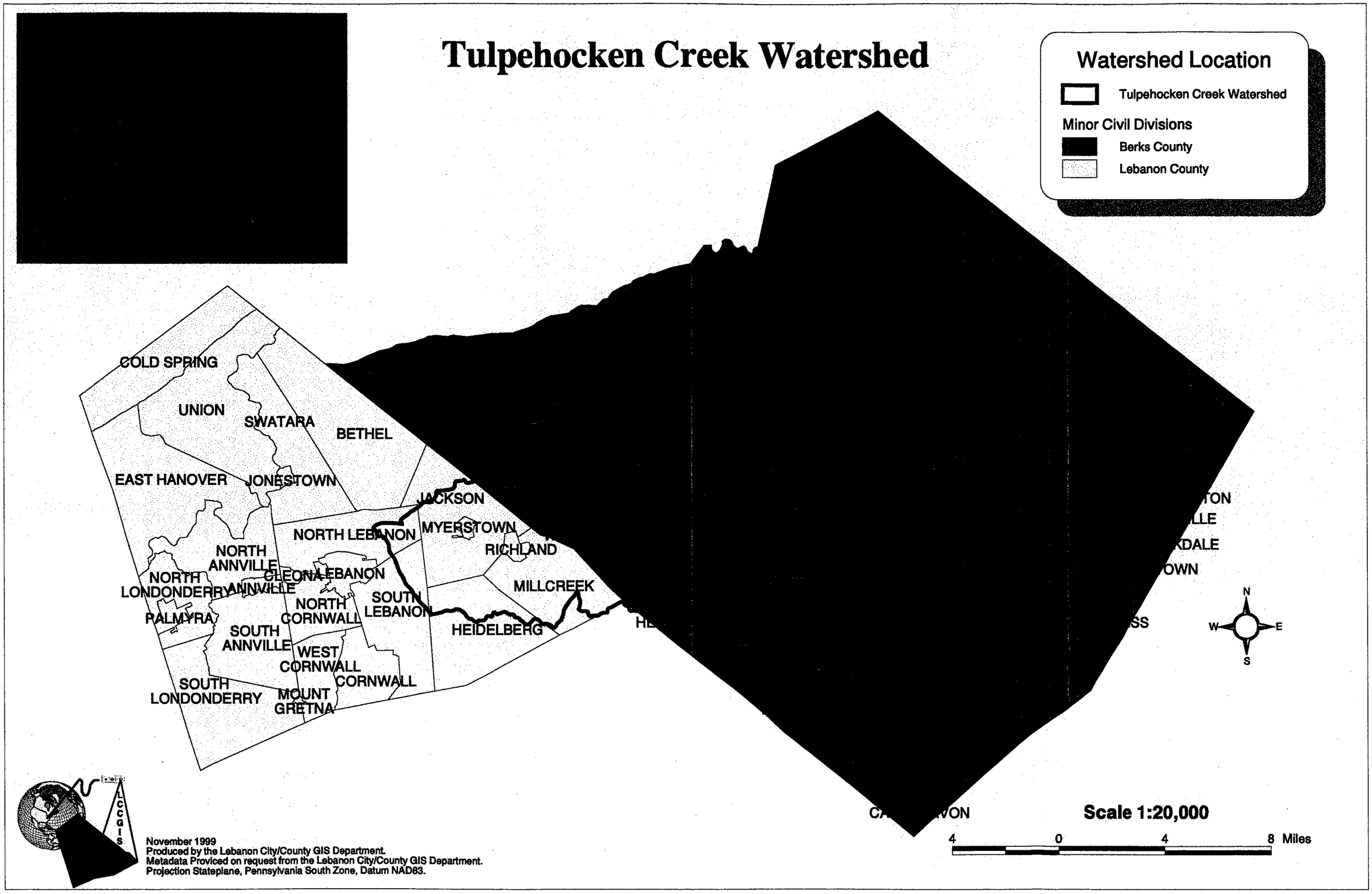
The development of the new Lebanon Valley Conservancy will further enhance our effectiveness to develop and implement management plans throughout the Tulpehocken Creek watershed.

The following Management Options are the piece of the overall Tulpehocken Creek Watershed Conservation Management Plan that we will encourage involved municipalities and organizations to review and consider in their overall planning process. The Management Options identify five goals and prioritize fourteen objectives that support the goals of the Tulpehocken Creek Watershed Conservation Management Plan.

Management Options



Tulpehocken Creek Watershed



November 1999
Produced by the Lebanon City/County GIS Department.
Metadata Provided on request from the Lebanon City/County GIS Department.
Projection Stateplane, Pennsylvania South Zone, Datum NAD83.

The goals and objectives presented in this plan are based on the data gathered, analyses performed, input received for this project, and on our previous experience within the Tulpehocken Creek watershed. Cooperation between private landowners, business and industry, non-profit organizations, educational and research institutions, and all governmental units within the watershed has been the success of the original Rivers Conservation Plan and the implementation of it. It is critical that this cooperation continues.

The twenty-seven municipalities listed in Table 2, in both Berks and Lebanon counties, will be included in all of the goals and objectives created for this Rivers Conservation Plan.

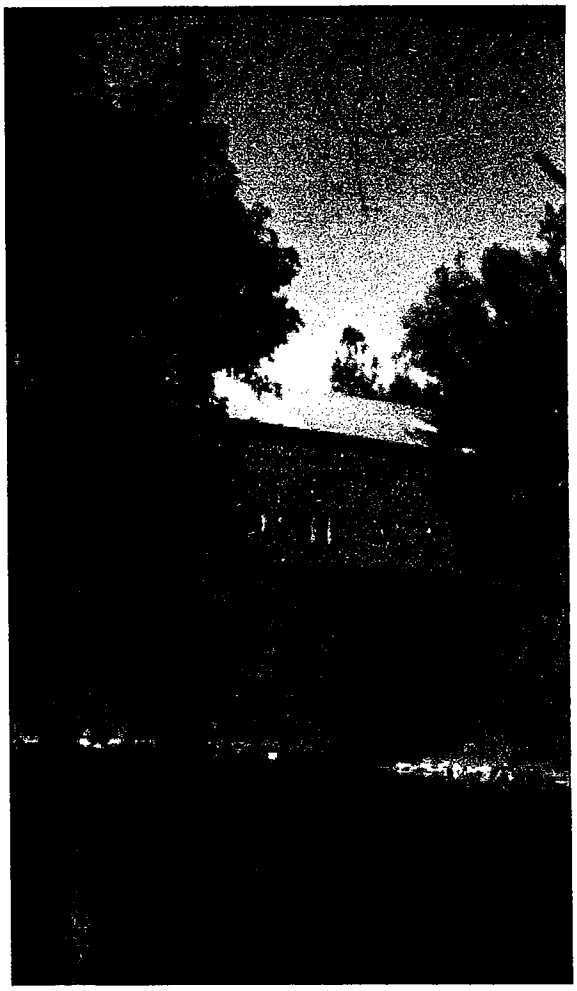
There are five goals that will continue to be considered during implementation phases of this project.

The goals are:

- **Improve water quality degraded as a result of agricultural activity**
- **Improve water quality degraded as a result of urban impacts**
- **Establish a continuous riparian corridor along the Tulpehocken Creek and its major tributaries**
- **Preserve the historical integrity of the Tulpehocken Creek watershed**
- **Provide education on a watershed basis**

As we progress with achieving our goals in the Tulpehocken Creek watershed, we are constantly promoting communication and cooperation throughout the watershed by providing a basis for merging common goals between *all* interested parties.

This watershed project has received statewide attention because of it's success and capability to be used as a model for other watershed projects. It's success is due to the outstanding partnerships that have taken place in Berks and Lebanon Counties. It is our hope that others will initiate similar partnerships in their own watersheds.



Wertz's Bridge, Tulpehocken Creek

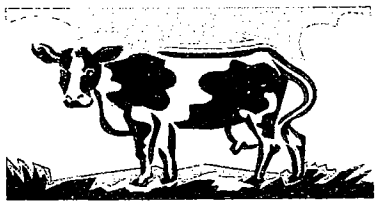
Goal: Improve water quality degraded as a result of agricultural activity

Due to the high level of agricultural activity within the watershed, it is imperative that we continue to seek to control nonpoint source pollution resulting from this activity. The majority of agriculture is concentrated in the portion of the watershed west of Blue Marsh Lake.

Large scale problems evolve as nutrients and sediment reach Blue Marsh Lake. The lake acts as a settling basin for the excess nutrients as well as the high sediment load, which in all probability may be accelerating the eutrophication process in the lake.

In order to reduce these effects, conservation plans must continue to be administered on agricultural properties in the Tulpehocken Creek watershed. Conservation plans are made-up of Best Management Practices designed to reduce soil erosion and reduce pollutants from entering the stream. Such practices include integrated crop management plans, stream bank fencing, conservation tillage, strip cropping, and establishment of riparian buffer zones.

There are professionals throughout the Commonwealth who can offer advice and services to help landowners install conservation plans and practices. County Conservation Districts can supply expert advice on such plans.



An example of a common and effective Best Management Practice is the installation of stream bank fencing to keep livestock out of the stream corridor. The fencing solves several problems created by livestock access. It will significantly reduce the levels of phosphates and nitrates in the stream that may have been elevated due to animal waste and runoff, and it allows the stream bank to restore itself by revegetation. This vegetation reduces the amount of pollutants entering the stream by slowing runoff and filtering sediment and associated nutrients. Streambank vegetation also protects sediment from the erosive force of the flow by reducing velocity and by the cohesive effects of root systems. The effects of livestock in the stream are most evident when a farming operation places the feedlot next to the stream, or the stream bi-sects the feedlot. In these areas there is no vegetation, and the completely exposed soil and waste directly enters the stream.

In January 1998 a federal project was approved which supplements the Rivers Conservation Program for the Tulpehocken Creek watershed. A Natural Resources Conservation Service Public Law 566 Plan was developed and is titled Tulpehocken Creek Watershed Protection Plan and Environmental Assessment. This new project exceeds any previous initiative in the watershed. The sponsors of the plan are Berks and Lebanon County Conservation Districts, Berks County Conservancy, and NRCS. The plan was drafted and reviewed by the project partners of the Tulpehocken Creek/Blue Marsh Lake Steering Committee. Approved federal funding is ~$5.9 million over a ten year implementation period. Total project cost is estimated at ~$8.9 million. The funds are being used to develop and implement improvement projects in the watershed.

The watershed project consists of accelerated land treatment systems for improved agricultural waste management, cropland resource management, and riparian area management. The plan also includes the acquisition of conservation easements and riverine fish and wildlife development features. The project will have substantial social, economic, and ecological benefits from improved surface and ground water quality, improved aquatic, wetland, and riparian habitat, and improved soil quality and sustainability. There are no significant adverse environmental impacts resulting from the project.

As of April 2001 $2,200,000 has been allocated to the installation of BMPs on over 45 properties in the Tulpehocken Creek watershed through this federal project.

The following objectives support the Goal: *Improve water quality degraded as a result of agricultural activity*

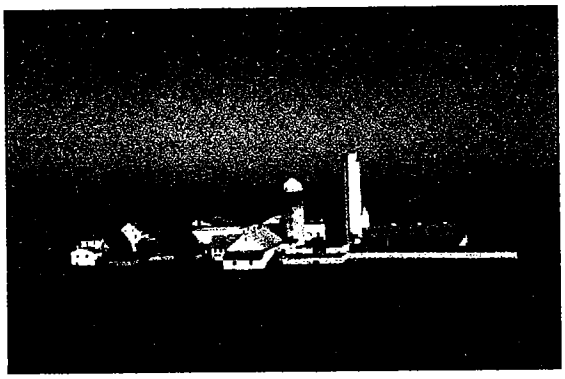
Objective: Provide educational materials and field trips to model farms to the agricultural community within the Tulpehocken Creek watershed

By developing model farms and organizing field trips to these farms, property owners can see Best Management Practices "on the ground", hopefully inducing them to do likewise. These site visits also give professionals in this field a chance to see their planning in action, and possibly provide them with ideas for improvement. The model farm program is recommended by the Penn State Cooperative Extension Service offices in both Berks and Lebanon counties. In addition to modeling effective Best Management Practices, we can disseminate information on new technologies (composting, biodigestion, etc..). Educational activities geared toward agricultural programs have "spread the word" and thus far made our programs a success, particularly in Marion and North Lebanon townships. All of our implementation programs need to begin by educating the general community about the optional programs in which they can participate.

Objective: Provide funding to promote the use of conservation plans, the implementation and monitoring of conservation plans, and farmland preservation programs

Supplemental funding will enable development and implementation of conservation plans on properties where farmers are willing to participate, but unable to afford these efforts. Best Management Practices encouraged through these plans include: animal waste management systems, terracing, diversions, waterway systems, stream protective vegetation or structures, and sediment retention or control structures. In addition, we will seek to educate and involve more farmers in integrated crop management which promotes the efficient use of pesticides and fertilizers in an environmental and economic manner.

Monitoring of farms in the watershed will answer our most commonly asked questions: How effective are certain Best Management Practices? Are farmers planning? Are farmers implementing the plans? Are those practices effective? This can be measured and quantified through testing, site inspection, and additional cooperation and communication with farmers. The Berks County Conservation District staff has recently grown to accommodate the needs of the agricultural programs in Berks County.



Farm in Marion Township, Berks County

Farmland protection and the implementation of Best Management Practices on these farms is a priority in both Berks and Lebanon counties. Working with one township at a time is a very effective approach to strengthen this land protection and implementation program. When you approach a community as a whole you tend to receive more participation rather than contacting one isolated landowner at a time. To date, township-wide projects that have been initiated through DCNR's Rivers Conservation Program include Marion Township in Berks County, and North Lebanon and Jackson Townships in Lebanon County. Marion Township has had farmland implementation projects in place since 1995, and North Lebanon and Jackson Townships since 1997. Direct one-to-one contact with landowner approval and discussion of the best available land protection strategy, which usually incorporates the

purchase or donation of conservation easements, are needed for successful land protection projects.

Future agricultural implementation projects in the Tulpehocken Creek watershed will focus on the municipalities west of Blue Marsh Lake which have not yet been addressed. Of priority are North Heidelberg, Lower Heidelberg, and Heidelberg Townships.

The Berks County Conservancy will coordinate efforts with the Berks and Lebanon County Conservation Districts, the Berks County Ag Land Preservation Office, the Berks County Planning Commission, and the Penn State Cooperative Extension to approach appropriate municipalities and landowners about land preservation techniques.

Goal: Improve water quality degraded as a result of urban impacts

Urban pressures are seen throughout a small portion of the Tulpehocken Creek watershed. Nonpoint sources of pollution in urban areas along the Tulpehocken Creek and its tributaries include individual septic systems, runoff from roads, lawns, and bank erosion. Individual septic systems are found in almost every community bordering the stream. It is unclear how much sewage is leaching into the groundwater and surface water of the Tulpehocken Creek watershed, however, it has been suggested that the amount of pollutants entering the stream from septic systems is thought to be significant enough to potentially negatively impact surface and groundwater.

Many urban areas do not have riparian buffer zones along the stream banks. The lack of vegetative cover de-stabilizes the banks creating severe erosion in some areas, allows runoff from roads and lawns to easily enter the stream, and allows for an increase in surface water temperature. The loss of the riparian buffer zone is further described later in this document.

Point sources of pollution include stormwater runoff pipes, discharge from sewage treatment plants, fisheries, schools, small businesses, etc.. There are twenty-three permitted discharges in the Tulpehocken Creek watershed. The following table lists the establishment name, the municipality and county in which it is located, and the receiving waters of the discharge.

Table 9. Name, municipality, county and receiving waters of each permitted discharge in the Tulpehocken Creek watershed (UNT = unnamed tributary).

Establishment Name	Municipality, County	Receiving Waters
Berks County Institution	Bern Twp, Berks	Plum Creek
Bernville Borough Authority	Bernville Borough, Berks	Northkill Creek
East Lebanon Elementary School	Millcreek Twp, Lebanon	Mill Creek
East Lebanon High School	Jackson Twp, Lebanon	UNT Tulpehocken Creek
Henne, Donald	Upper Tulpehocken Twp, Berks	UNT Little Northkill Creek
Leffler, Carlos R, Inc	Sinking Spring Borough, Berks	UNT Cacoosing Creek
McDurmott, Michael	Bern Twp, Berks	UNT Plum Creek
Myerstown Borough Sewer Authority	Myerstown Borough, Lebanon	Tulpehocken Creek
Myerstown Water Authority	Jackson Twp, Lebanon	UNT Tulpehocken Creek
North Heidelberg Sewer Co	Jefferson Twp, Berks	UNT Northkill Creek
Petroleum Prod Corp	Sinking Spring Borough, Berks	UNT Cacoosing Creek
Post Precision Castings Inc	Upper Tulpehocken Twp, Berks	UNT Jackson Creek
Quaker Alloy Castings Co	Myerstown Borough, Lebanon	Tulpehocken Creek

Reading Alloys Inc	South Heidelberg Twp, Berks	UNT Spring Creek
Reichart, Robert and Jeanet	Bern Twp, Berks	UNT Plum Creek
Robesonia/Wernersville Sewer Authority	Robesonia Borough, Berks	Spring Creek
Sinking Spring Borough Municipal Authority	Sinking Spring Borough, Berks	Cacoosing Creek
Spring Township Municipal Authority	Spring Twp, Berks	Cacoosing Creek
Stout, Royal C	Penn Twp, Berks	Tulpehocken Creek
Sun Pipeline Co	Spring Twp, Berks	Cacoosing Creek
Western Berks School Authority	Jefferson Twp, Berks	UNT Little Northkill Creek
Western Berks Water Authority	Lower Heidelberg Twp, Berks	Tulpehocken Creek
Womelsdorf Sewer Authority	Womelsdorf Borough, Berks	Tulpehocken Creek

(Source: PaDEP 1998)

The following objectives support the Goal: *Improve water quality degraded as a result of urban impacts*

Objective: Educate communities about the importance of septic system maintenance

Sewage concerns have been identified as a threat to both rational economic development and environmental protection. Most areas along the Tulpehocken Creek are served by individual systems, and these private septic systems have been identified as a probable cause of some pollution along this stream. Awareness of this issue is dangerously low in both Berks and Lebanon counties. Landowners simply do not know enough about the function of septic systems, operation and maintenance, replacement costs, alternative systems, or even how to get their water checked for pollutants. To address the issue of septic system maintenance we will need the cooperation of the Penn State Cooperative Extension and the Berks County Planning Department. We can incorporate workshops, or simply literature, pertaining to this issue into scheduled borough and township meetings, or into planned public meetings pertaining to the Tulpehocken Creek watershed.

The following municipalities have Municipal Act 537 Sewage Facilities Plans: Upper Bern Township, Spring Township, Bern Township, Centre Township, Sinking Spring Borough, Womelsdorf Borough, Robesonia Borough, and Wernersville Borough in Berks County and North Lebanon Township in Lebanon County. Two townships within the Tulpehocken Creek watershed are in the process of developing Act 537 plans; Heidelberg Township and South Heidelberg Township. (PaDEP 2001). Those municipalities within the Tulpehocken Creek watershed that are not listed either do not have a plan or the plan has not been updated within the past five years.

Objective: Educate municipal officials about zoning ordinances that protect surface water from urban nonpoint source pollution

The need for conservation zones along stream corridors will be addressed. Within these conservation zones, riparian corridors should be

established. These riparian corridors are beneficial in many ways, most importantly in urban areas where they filter contaminated runoff from lawns, parking lots, and roads before the runoff reaches any streams in the watershed. The stream should be recognized as the asset that it is, and incorporated into the overall outlook of each town in the Tulpehocken Creek watershed.

Retaining forests as open space and using riparian forest buffer corridors can be effective practices to integrate with stormwater planning in urbanizing areas. Forests can capture, absorb, and store amounts of rainfall 40 times greater than disturbed soils, like agricultural fields or construction sites, and 15 times more than grass turf or pasture. Capitalizing on this ability to reduce the amount of water available for stormwater runoff is a function that makes forests valuable as an "open space tool" for stormwater reduction. Fairfax County, VA, recently estimated that forests were providing almost $57 million in stormwater reduction benefits annually to local taxpayers.

Municipalities will be encouraged to follow environmentally sensitive practices throughout their jurisdictions. Examples of such practices include planting trees and/or vegetation that requires less mowing, decreasing the amount of road salts used, and decreasing or eliminating the use of pesticides and/or herbicides along the roads. These practices are usually of no extra cost to the municipality, in fact, they may lead to financial savings for the municipality.

A possible source of funding to assist municipalities in developing ordinances is PaDCED's Land Use Planning and Technical Assistance Program (LUPTAP) grant program of the Governor's Center for Local Government Services.

The Berks County Planning Commission is currently in the final stages of preparing an Act 167 Stormwater Management Project for the Tulpehocken Creek watershed. The purpose and benefit of the study and implementation plan is to provide all of the municipalities in the watershed (in compliance with the requirements of Pennsylvania Act 167) with an accurate and consistent implementation strategy and procedures for comprehensive stormwater management. Currently, not all of the municipalities in the watershed enforce stormwater management regulations, and for those that do, actual enforcement criteria vary (BCPC 1996). This project, along with various efforts in the watershed, will promote communication and cooperation between all involved municipalities. Once the Tulpehocken Stormwater Management Plan has been approved by the County Commissioners and PaDEP, then all involved municipalities will adopt the required regulations.

Goal: Establish a continuous riparian corridor along the Tulpehocken Creek and its major tributaries

Streams and rivers are a flowing transport system, providing aquatic connections between the atmosphere, land, and water. They are the vascular system of the terrestrial ecosystem. They carry both inorganic and organic materials, and they provide a complex set of habitats for many living organisms. Riparian corridors protect this system (USDAFS 1997).

Although reduction of nonpoint source pollution is a widely recognized function of riparian forest buffer systems, they also contribute significantly to other aspects of water quality and physical habitat. Habitat alterations, especially channel straightening and removal of riparian vegetation, continue to impair the ecological health of streams more often and for longer time periods than toxic chemicals. Studies in Pennsylvania consider loss of riparian forests in eastern North America to be one of the major causes of aquatic ecosystem degradation (USDAFS 1997). The following table displays the benefits of vegetation on aquatic ecology.

Table 10. Benefits of Vegetation on Aquatic Ecology

Vegetation	Benefits
Trees and shrubs overhanging the stream	➢ Shade lowers the water temperature, which improves the conditions for fish ➢ Source of large and fine plant debris ➢ Source of terrestrial insects that fish eat
Leaves, branches, and other debris in the stream	➢ Helps create pools and cover ➢ Provides food source and stable base for many stream aquatic organisms
Roots in the streambank	➢ Increases bank stability ➢ Creates overhanging bank cover
Stems and low-growing vegetation next to the watercourse	➢ Restarts movement of sediment, water, and debris floating in flood waters

Pressures from agriculture and residential development have led to a loss of the riparian corridor and habitat for wildlife especially along the Tulpehocken Creek and its tributaries upstream from Blue Marsh Lake. Farmers remove vegetation along streams to increase field size in order to receive the largest yield from their land, and also so livestock can access the stream as a source of water. Residential development has also led to the removal of the corridor. The removal of these riparian zones in the watershed has reduced the habitat for wildlife including small mammals, reptiles, aquatic species, and birds. The following are major reasons why riparian areas are so important to wildlife:

- Wildlife habitat is composed of cover, food, and "**water**".
- The greater availability of water to plants, frequently in combination with deeper soils, increases plant production and provides a suitable site for plants that could not occur in areas with inadequate water. This increases plant diversity.
- The shape of many riparian areas, particularly their linear meandering nature along streams, provides a great deal of productive edge.

- Riparian areas frequently produce more edge within a small area. In addition, along streams there are many layers of vegetation exposed in stair step structure. The stair step of vegetation of contrasting form (deciduous vs. coniferous, shrubs vs. trees) provides diverse nesting and feeding opportunities for wildlife.

- Riparian areas along intermittent and permanent streams and rivers provide travel routes for wildlife. These may serve as forested connectors between wooded habitats. Wildlife may use such habitat for cover to travel through otherwise unforested agricultural or urban areas.

(Source: USDAFS 1997)

A threat to wildlife downstream from Blue Marsh Lake that, for the most part, does have sufficient riparian buffer zones is the varying water level. The area around the confluence of the Cacoosing Creek, called Cacoosing Flats, is an especially affected area. This section of the Tulpehocken Creek was the focus of a PaDCNR Rivers Conservation implementation project in the watershed during Summer 1996. Approximately 1.25 miles of the Tulpehocken were restored with fiberlogs, tree plantings, stream deflectors, deer ladders, and fish habitat structures. The work was completed by the Tulpehocken Chapter of Trout Unlimited in an attempt to restore stream banks and improve aquatic habitats.

A continuous riparian corridor would provide residents with more recreational activites and opportunities. Recreational activities are an excellent way to involve local citizens and to promote awareness and protection of the watershed. The segment of the Tulpehocken Creek below the dam to the confluence in Reading at the Schuylkill River is heavily used for recreation such as fishing, biking, running/walking, and picnicking. Above the Blue Marsh dam the continuous riparian corridor ends, along with much of the recreation. Some of the municipalities, such as Myerstown, have parks along the stream, and several parks can be found along tributaries of Tulpehocken Creek. The watershed also contains several recreational areas, such as Sporting Clubs, which maintain the grounds for the use and benefit of the creek. However, there is room and the need for more recreational areas upstream from Blue Marsh Lake.

The following objectives support the Goal: *Establish a continuous riparian corridor along the Tulpehocken Creek and its major tributaries*

Objective: Continue to coordinate efforts between Berks and Lebanon County Conservation Districts and the Tulpehocken Chapter of Trout Unlimited to work with individual landowners to re-establish riparian vegetation

To date, four PaDCNR Rivers Conservation implementation projects have required the cooperation of these agencies. These projects (Cacoosing Flats, Marion Township, North Lebanon Township, and Furnace Creek) have all involved streambank restoration and the establishment of a riparian area. Marion and North Lebanon Township projects involved implementing Best Management Practices on farms as well. A common Best Management Practice is the installation of streambank fencing to limit livestock access to the creek, which in turn, allows vegetation along the streambank to re-establish itself. The Cacoosing Flats project involved planting more trees and shrubs in a riparian zone which was already established. The Furnace Creek project involves the establishment of recreational opportunities and a natural habitat educational area near the creek within the Borough of Robesonia, and the project is addressing flooding problems within the Borough of Robesonia and Heidelberg Township.

Streambank restoration project involving the placement of fiberlogs along the Tulpehocken Creek in Marion Township

We will continue pursuing similar projects with funds through the Rivers Conservation Program and through the federal NRCS PL566 program within the Tulpehocken Creek watershed. Fortunately, the Berks and Lebanon County Conservation Districts and the Penn State Cooperative Extension work with landowners in the watershed on a regular basis, and the Tulpehocken Chapter of Trout Unlimited is committed to the preservation of the Tulpehocken Creek watershed. Therefore, the development of a continuous riparian corridor along the Tulpehocken Creek and its major tributaries will occur through existing implementation projects and through new projects created by using federal NRCS PL566 funds and monies from other sources.

Objective: Promote diverse populations of native flora and fauna species in the Tulpehocken Creek watershed

The riparian corridor will act as the foundation for wildlife habitat. The attraction of wildlife to heavily utilized sections of the stream requires positive intervention to enable these species to find suitable homes and habitat. The installation of nesting boxes for birds, small mammals, and reptiles attracts wildlife and provides opportunity for community volunteer involvement. The nesting boxes can be constructed, installed, and monitored by local students and volunteers. Site locations within existing and newly established riparian corridor will include schools, municipal and county parks, and interested private landowners. It is critical that we create habitat where appropriate because we are losing so much of it to development in the watershed, and it is quite noticeable in declining populations of certain species.

Native warm-season grasses are prairie grasses that were present when our ancestors settled what was to become the Commonwealth of Pennsylvania. The four main grasses of tall-grass prairie habitat are switchgrass, big bluestem, little bluestem, and indiangrass.

Switchgrass near Blue Marsh Lake

These dense bunches of grass interspersed with open spaces between the bunches provide valuable nesting and foraging cover for upland game birds such as turkeys and pheasants, various waterfowl, and other ground-nesting grassland species like savannah sparrows. Probably one of the most important benefits of warm-season grasses is that, if left uncut, they remain upright throughout the winter, providing valuable cover for many animals at a time of year when most other plants have died or are dormant (PSU 1998).

Native wildflowers, trees, and shrubs provide food and cover for wildlife, aesthetic benefit for humans, and bank stabilization. From a recreational point of view, wildflowers planted in heavy traffic areas catch people's attention and may keep them attracted to the area.

New England aster, Wild columbine, and Black-eyed Susan

Wildflowers will be used where appropriate along with trees, shrubs, and grasses within the riparian corridor. Appendix B contains a chart that displays native plants used by common songbirds for food, cover, and nesting. Native plant species will be considered when we purchase materials for and encourage the re-establishment of the riparian corridor.

The control of noxious weeds and non-native invasive plants is a constant struggle in the watershed. Invasive or aggressive plant species are often easily established, but once established they expand beyond those areas for which they were intended. Invasive species are generally non-native species that can out-compete native species and reduce the diversity of natural plant communities. Invasive plant species can be dispersed by wildlife, livestock, and/or humans. Some examples of invasive species that may out-compete native plants in Pennsylvania are multiflora rose, Japanese honeysuckle, and purple loosestrife. Although some of these species provide benefits for wildlife, they can create problems and, in the long run, have limited value for most wildlife. Some species of invasive plants (e.g. multiflora rose) are classified as noxious weeds in Pennsylvania, and it is illegal to plant them (PSU 1998).

In an attempt to promote the use of native plants to individual homeowners, parks, and businesses across Berks County we have co-sponsored several events which have focused on *Creating Natural Habitats using Native Plants.* The workshops have focused on the following: average backyard habitats, woodlot management, golf course and park management, and school yard habitats. We will continue to co-sponsor such events as an effort to promote diverse native habitats as part of this conservation plan.

The overpopulation of resident Canada Geese continues to grow each year. Since the mid-1960's, the Canada Goose has wintered regularly as long as open water is available. If driven out by a hard freeze, it frequently returns as soon as the first thaw produces open water. High Berks County counts of this species include 18, 000 at Lake Ontelaunee March 11, 1990; 15,455 in 134 flocks over Hawk Mountain on October 14, 1969; and 10,000 at Blue Marsh Lake March 5, 1988 (Uhrich, et. al 1997). The US Army Corps of Engineers survey the summer flocks of *resident* Canada geese and show an average flock of 500 geese.

Geese tend to gather in areas where there is not a riparian buffer and the turf is well manicured. Goose droppings contain nearly 40 times the level of fecal coliform bacteria as human waste and have been directly responsible for an increased frequency of water pollution-related beach closures across Pennsylvania's State Parks (DCNR 1997). The Bureau of State Parks initiated a Goose-A-Way Program. It starts early in the year by watching for pairing geese which when sighted, become the focus of consistent harassment techniques including the use of noise-making devices. Beak-height waterfront fencing and the planting of shrubs make geese more cautious of coming ashore.

The Pennsylvania Game Commission has tried a variety of these techniques for controlling resident Canada Geese, particularly around Blue Marsh Lake. The US Army Corps of Engineers has obtained a permit from the Pennsylvania Game Commission to perform egg "addling" at Blue Marsh Lake. Each Spring, during the nesting season, Corps rangers attempt to locate Canada geese nesting sites, and when found, they "addle" the eggs and replace them. The "addling" aborts the embryo, but the goose continues to incubate the egg, unaware that it has been aborted. Egg addling has resulted in

an estimated average of 24-30 "addled" eggs per year. However, it appears the population of resident geese is still rising (USACE).

Tom Ridge, Governor of Pennsylvania, has initiated a program to re-establish buffers along our streams called Pennsylvania Stream Releaf. The Pennsylvania Department of Environmental Protection has led the initiative, along with the Department of Conservation and Natural Resources, and developed a plan for this program titled A Plan for Restoring and Conserving Buffers Along Pennsylvania's Streams. As we progress with our riparian corrdior goal for the Tulpehocken Creek watershed, the Berks County Conservancy will submit our data to PaDEP which will be added to the state-wide Stream Releaf database. The database can be accessed through PaDEP's website: www.dep.state.pa.us.

Objective: Improve the condition, access, and safety of established recreational areas within the Tulpehocken Creek watershed

Improvements to existing streamside recreational areas will include, but may not be limited to, bank stabilization and expansion. The established county park system below Blue Marsh Lake may be expanded as requested by local citizens, and as outlined in the Berks County's Open Space Plan with implementation by the county's Park and Recreation Department. This would tie-in nicely with our efforts in the Tulpehocken Creek watershed.

The installation of handicapped access docks will be a priority, particularly in heavily utilized areas surrounding the Tulpehocken Creek.

Safety concerns will be addressed in recreational areas, which will in turn, increase public use. Priority will be given to areas that currently have present safety dangers such as Stonecliffe Park and surrounding areas. The appropriate municipal officials and police departments will be contacted to emphasize the importance of monitoring these areas to keep them safe, and proper signs will be installed or replaced where needed.

Achieving this objective will require the cooperation of the Berks and Lebanon County Parks and Recreation Departments and appropriate municipalities and government officials. We will coordinate our efforts and share ideas to improve our recreational opportunities in the Tulpehocken Creek watershed.

Goal: Provide education on a watershed basis

Every goal in this plan involves education. The objectives in this section focus solely on educating *all* residents and municipalities of Berks County on the importance of preserving the Tulpehocken Creek watershed and how to do it.

Education throughout the entire watershed is essential to the success of any project. It is imperative that coordinated efforts be made with residents in agricultural, suburban and urban areas, commercial landowners, developers, public agencies, and youth to create awareness and induce actions that will benefit the Tulpehocken Creek and its tributaries. Educational programs will involve citizens at all learning levels. They need to understand how their actions affect the watershed environment, and how they can become involved in restoring and protecting this environment.

The Berks County Conservancy has had relations with a majority of the school districts in Berks County. Since the start of the Berks County Conservancy in 1974, the consistent hallmark of all our efforts has been education. We speak to many classes about water quality issues and we demonstrate monitoring techniques and activities in which students can participate to positively affect their watershed.

The following objectives support the Goal: *Provide education on a watershed basis*

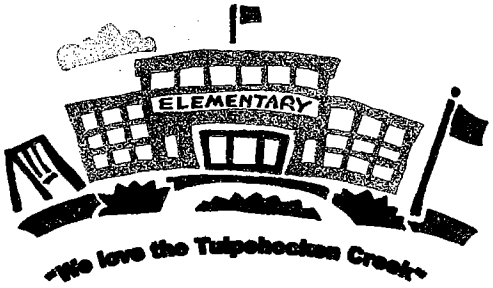
Objective: Cooperate with county agencies/organizations to educate landowners about land practices and preservation by developing one-on-one relationships

Successful projects begin with trust between the landowner and the involved agency or organization. The Berks and Lebanon County Conservation Districts, the Penn State Cooperative Extension, the Ag Land Preservation Boards, the Tulpehocken Chapter of Trout Unlimited, the Berks County Conservancy, and several other agencies and organizations have a good reputation with landowners across Berks County, particularly in the Tulpehocken Creek watershed.

To date, successful Best Management Practices such as streambank fencing, cattle crossings, storm water management systems, barnyard water management systems, and spring development systems are in place and some are modeled to interested landowners. Costs for each project depend upon the number and type of BMPs which are being installed. We will use already established projects to model the benefits of installing best management practices. More similar projects are planned within North Lebanon Township and surrounding municipalities in the Tulpehocken Creek watershed in both Berks and Lebanon counties.

Objective: Visit each school district in the watershed to increase awareness and appreciation for the natural, cultural, and recreational resources of the Tulpehocken Creek and its tributaries

There are seven Berks County public school districts in whole or in part of the Tulpehocken Creek watershed; Conrad Weiser Area, Hamburg Area, Schuylkill Valley, Tulpehocken Area, Wilson, and small portions of both Reading and Wyomissing districts. There are two Lebanon County public school districts in whole or in part of the Tulpehocken Creek watershed; Cornwall Area and East Lebanon County.



Each of these school districts will be visited by Berks County Conservancy staff. The purpose of the visits will be to inform students of all age levels about the Tulpehocken Creek watershed. The Berks County Conservancy received an environmental education grant from EPA, Region III, titled Watershed Awareness on a Local Level for the 1998-99 schoolyear. High schools across the county were visited and students learned of issues in their watersheds. The Tulpehocken Creek watershed was part of this project and several high school classes were visited. Over the next two years we will visit all grade levels of the school districts in the watershed to get the students aware of and involved with the Tulpehocken Creek watershed.

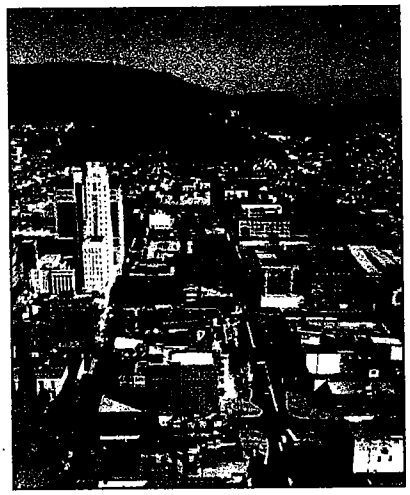
Objective: Provide education and information to municipalities throughout the Tulpehocken Creek watershed to encourage the development or amendment of ordinances to protect the resources of the Tulpehocken Creek watershed

Municipalities need to focus on developing standardized ordinances which reflect the importance of the Tulpehocken Creek and the rural nature of the watershed.

A prevailing problem in Berks and Lebanon Counties is urban sprawl. Berks County contains 76 municipalities, each growing in its own direction. The Tulpehocken Creek watershed is in danger due to its rural nature and, to what some envision as an, "ideal area" for new development along the Route 422 corridor. The Tulpehocken Creek watershed contains twenty-seven municipalities, and the differences in protection status are significant even among those municipalities committed to protection. Fragmented land use planning and controls are fueling an uncoordinated and costly pattern of growth here in Berks and Lebanon Counties, throughout southeastern Pennsylvania, and across much of the country.

As Berks County grows, we must preserve the character and identity of our community while guiding the creation of compatible new areas; protecting the environment; and encouraging diversity in the population, in housing, and in jobs. Future development must recognize and protect the unique character of Reading and the County's older communities, while carefully creating new neighborhoods which are innovative in design, sufficient in density, and compatible with their surroundings. Our use of land must balance ecological, agricultural, recreational, social, and economic uses (BGTP 1999).

The first step to controlling this sprawl is to change current zoning regulations in each municipality that has not addressed the issue of land and watershed protection. The need to educate residents, local officials and managers is paramount. Successful land and watershed protection and cooperation must start on a local level. A community's goals and visions are often expressed in a municipal comprehensive plan, as are general locations of future development. However, it is the zoning ordinance that legally prevails and ultimately determines future development possibilities. Zoning ordinances specify which land uses are permitted in each area and at what densities. This makes zoning the most important expression of municipal planning and land use policy (MCPC 1996).



City of Reading

Effective Agricultural Zoning can be a powerful tool when used in conjunction with the Agricultural Security Areas (Act 43) program, the Clean and Green (Act 319) program, and other agricultural preservation efforts. Effective Agricultural Zoning limits the amount of non-agricultural activities. To date, nineteen townships have developed effective agricultural zoning in Berks County totaling 108,684 acres. Seven of these townships have land all, or in part of, the Tulpehocken Creek watershed and the acreage in effective agricultural zoning of these townships totals 52,151 acres. The Berks County Planning Commission is providing funds for those townships who update or develop agricultural zoning through an Agricultural Zoning Incentive Program (AZIP).

Berks County established a Joint Planning Program in 1992 which is administered by the Planning Commission staff. The program has been very successful in Berks County and received state-wide attention in 1999. Several joint comprehensive planning efforts were initiated by the Berks County Planning Commission in the Tulpehocken Creek watershed. One completed effort, the Western Berks Joint Comprehensive Plan, includes five municipalities in western Berks County; Heidelberg Township, Marion Township, North Heidelberg Township, and the Boroughs of Robesonia and Womelsdorf.

A second completed joint planning effort, the Southwestern Berks Joint Comprehensive Plan, includes Lower Heidelberg Township, South Heidelberg Township, and the Borough of Wernersville. Adoption of this plan by all involved parties was anticipated by Summer 2000. However, during this time the General Assembly passed two important bills that amend the Municipalities Planning Code (MPC). These new laws - Act 67 and Act 68 allow municipalities and counties to jointly plan for development. The MPC amendments are extensive; many of these changes will help municipalities maintain their quality of life through the preservation of community character and the protection of natural and cultural resources while at the same time providing options to promote sound land use and growth in their region. The Southern Berks Joint Comprehensive Plan has been revised to include the changes in the new MPC and is the first in the Commonwealth of Pennsylvania to do so.

A Northern Berks Regional Joint Comprehensive Plan is currently in progress. This includes the following municipalities, some of which fall within the boundaries of the Tulpehocken Creek watershed; Upper Tulpehocken Township, Upper Bern Township, Tilden Township, Windsor Township, and the Boroughs of Hamburg and Strausstown.

Similar to the Joint Planning Program, a Joint Zoning Program was established in 1997. Municipalities must have a County sponsored joint comprehensive plan in place to be eligible for this program. Planning Commission staff will assist the municipalities throughout the joint zoning process. Currently there is a Joint Zoning Project in progress in the Tulpehocken Creek watershed which includes the townships of Heidelberg and North Heidelberg and the Boroughs of Robesonia and Womelsdorf.

In early 1999 another community planning effort was initiated called the Borough Showcase/ Route 422 Corridor Communities Project. Recognizing the need for proactive planning and having a commitment to truly make a difference in Berks County's Route 422 Corridor, a plan has been developed in cooperation with the corridor's municipalities, Skelly and Loy Inc., and Berks County. This effort will provide a model for municipalities throughout the Commonwealth and the nation by providing insights into the advantages and opportunities associated with joint municipal actions. The many results of these efforts have recently been completed, or are in progress, and include the following:

Phase 1:

- street sign replacement and updating
- gateway sign and development/banners
- tourist kiosks
- video of improvements
- engineering and project management

On September 17, 1999 the Pennsylvania State Association of Boroughs (PSAB) presented the

Robesonia Borough Showcase/422 Corridor Improvement Project. This event was the third showcase of PSAB's 21st Century Initiatives Project. Borough Showcases have resulted in successful partnerships that permitted the completion of the rebuilding of vital infrastructures within our communities. The following Berks County communities have signed resolutions to participate in this joint project (* = all or part of municipality is within the Tulpehocken Creek watershed):

- Womelsdorf Borough *
- Robesonia Borough *
- Marion Township *
- Heidelberg Township *
- Wernersville Borough *
- Sinking Spring Borough *
- Wyomissing Borough *
- Spring Township *
- Mount Penn Borough
- West Lawn Borough

This groundbreaking project involving intergovernmental cooperation and municipal partnership reflects commitment to bringing sustained prosperity and opportunity to the municipalities of Berks County, particularly in the Tulpehocken Creek watershed (PSAB 1999).

Unplanned growth in Berks County

The Berks County Conservancy supports the efforts of the Berks County Planning Commission and has committed to supporting the new Berks County Comprehensive Plan – *Berks Vision 2020.* We will also continue to encourage joint planning efforts in those municipalities which have not yet initiated such an effort.

An organization in Berks County, called Berks Growing Together Partnership, has addressed growth issues in Berks County over recent years. In September 1999 the Berks Growing Together Partnership officially merged with the Berks County Conservancy.

The Berks Growing Together Partnership is a coalition of individuals and organizations advocating sustainable growth for Berks County. The partnership supports a regional approach to land use and growth management, the revitalization of older communities, and the preservation of farmland and open space. This mission is incorporated into the Berks County Conservancy's overall mission and is a new focus of the organization.

This merger is promising for the future of the Tulpehocken Creek watershed, and Berks County as a whole.

Objective: Encourage the formation of local watershed associations in each sub-watershed of the Tulpehocken Creek watershed.

Numerous watershed associations are developing across Berks County. Watershed associations prove to be a successful way to gain the support of the local community and it provides the residents and students with opportunities for involvement. To date we are not aware of any established watershed associations within the Tulpehocken Creek watershed.

However, the Schuylkill Riverkeepers are currently considering facilitating the establishment of a Northkill Creek Watershed Association. This would be the first of its kind in this watershed. The Berks County Conservancy will continue to support the efforts of the Schuylkill Riverkeepers and encourage the formation of more watershed organizations in the Tulpehocken.

Examples of projects that watershed associations could conduct, and that this program could fund, are (but not limited to); clean-ups, stream restoration, creation of native natural habitat areas, educational stream walks, school visits, buffer establishment, and advocacy.

Goal: Preserve the historical integrity of the Tulpehocken Creek watershed

The Tulpehocken Creek watershed contains a wide variety of significant and unique cultural resources, many of which owe their existence to the Tulpehocken Creek. However, many of these resources are threatened, and could soon vanish from the watershed's landscape. Historic mills, bridges, farmsteads, churches, early industrial structures, and archeological sites may disappear or be substantially compromised by insensitive development. Currently, this is the biggest risk to both cultural and environmental resources within the watershed. Additional threats include neglect and lack of appreciation of the cultural value of these sites.

Kissinger's Church, Wyomissing - Lost to demolition in 1998

The following objectives support the Goal: *Preserve the historical integrity of the Tulpehocken Creek watershed*

Objective: Identify and officially recognize all Tulpehocken Creek watershed cultural resources.

A partial inventory of sites within the Tulpehocken Creek watershed was undertaken in the early 1980s. This project resulted in the listing of the Tulpehocken Creek Historic District on the National Register of Historic Places. The National Register of Historic Places is the Nation's official list of cultural resources worthy of preservation. It is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The District boundaries run parallel to the Creek from Bernville to the Lebanon-Berks County line and only include resources in immediate proximity to the Creek. A comprehensive survey should be made of all cultural resources within the watershed beyond the reconnaissance township survey completed in the 1980s. Previously surveyed sites should be re-evaluated and all sites should be documented with the aid of current technology and fieldwork practices.

The general watershed population is not sufficiently aware of the extent of the watershed's cultural resources. Greater public awareness of these resources and their significance will promote responsible stewardship. Official recognition through the Berks County Register of Historic Places or the National Register of Historic Places will encourage protection of the resources through municipal ordinances. National Register Sites and Districts have no restrictions placed on them, however the municipality could create restrictions. Tax incentives to individual homeowners and businesses located in National Historic Districts is a possible benefit in the near future. Heritage tourism programs can increase community awareness and pride of cultural resources while simultaneously stimulating local economies.

During the 1999-2000 schoolyear a historic survey project was completed in cooperation with the Borough of Robesonia and Conrad Weiser High School. The students, with direct assistance from the Berks County Conservancy, completed a photographic survey of the Borough of Robesonia as part of the school's community service program. This survey is the first part of a later National Register nomination for a Historic District in Robesonia. The second part of this survey will include creating boundaries for the historic district, and

eventually the students could play a role in writing the actual National Register nomination. This is one way to involve residents in a project that makes a difference in their own community. We will encourage other school districts within the Tulpehocken Creek watershed to run similar projects, of priority is Tulpehocken Area High School.

Objective: Promote preservation efforts of the Tulpehocken Creek watershed's cultural resources on a local government level.

Efforts to maintain the integrity of the watershed's cultural resources should be coordinated. Local zoning ordinances and planning guidelines should reflect the importance of both the environmental and cultural resources of the watershed and promote responsible stewardship of these sites on public and private levels.

Structures such as Kissinger's Church, pictured early in this section, are being lost throughout the watershed. One factor in the loss of Kissinger's Church was the lack of consideration given to the site's historic significance when application was made for a demolition permit. Municipalities must be made aware of the benefits of protecting cultural resources and encouraged to reflect the importance of significant sites in their ordinances, codes, and long-range planning.

Objective: Encourage private preservation efforts through education.

In addition to raising public awareness through identification and recognition efforts, programs must be undertaken to encourage residents of the watershed to protect privately-owned cultural resources. Such programs could include seminars and workshops on repairing, renovating, and maintaining historic structures; high school geography or civics class curricula based on planning and sprawl and its impact on historic landscapes; or restoration techniques training for industrial arts students in the building trades.

Each year the Berks County Conservancy sponsors a "Three Centuries in Berks Tour" of a different region of the county. These are self-guided tours that provide residents of Berks County with an opportunity to visit significant historic sites, and to meet the homeowner to learn about the renovation process. In 1999 the tour was held in western Berks County which included over twelve sites in the Tulpehocken Creek watershed.

Prioritized Objectives to meet the Goals of the Tulpehocken Creek Watershed Conservation Management Plan

- Provide education and information to municipalities throughout the Tulpehocken Creek watershed to encourage the development or amendment of ordinances to protect the resources of the Tulpehocken Creek watershed

- Provide funding to promote the use of conservation plans, the implementation and monitoring of conservation plans, and farmland preservation programs

- Continue to coordinate efforts between Berks and Lebanon County Conservation Districts, the Tulpehocken Chapter of Trout Unlimited, and interested agencies to work with individual landowners to re-establish riparian vegetation

- Visit each school district in the watershed to increase awareness and appreciation for the natural, cultural, and recreational resources of the Tulpehocken Creek and its tributaries

- Encourage the formation of local watershed associations in each sub-watershed of the Tulpehocken Creek watershed.

- Promote diverse populations of native flora and fauna species in the Tulpehocken Creek watershed

- Educate municipal officials about zoning ordinances that protect surface water from urban nonpoint source pollution

- Identify and officially recognize all Tulpehocken Creek watershed cultural resources

- Promote preservation efforts of the Tulpehocken Creek watershed's cultural resources on a local government level

- Cooperate with county agencies/organizations to educate landowners about land practices and preservation by developing one-on-one relationships

- Provide educational materials and field trips to model farms to the agricultural community within the Tulpehocken Creek watershed

- Educate communities about the importance of septic system maintenance

- Improve the condition, access, and safety of establish recreational areas within the Tulpehocken Creek watershed

- Encourage private preservation efforts through education

A Sample of Potential Projects Related to the Goals and Objectives of the Tulpehocken Creek Watershed Conservation Management Plan

- Develop a greenway and trail system from western Blue Marsh Dam to the Borough of Womelsdorf, and ultimately to the Tulpehocken Manor and/or Stracks Dam in Lebanon Co. in connection with the Union Canal Greenway Study initiative in Lebanon and Dauphin Counties.

- Conduct studies and develop management plans for sites that contain threatened and/or endangered species habitat (i.e. Stracks Dam).

- Develop land protection strategy to encourage the preservation of those critical properties that have not yet been permanently protected through conservation easements and/or acquisition.

- Partner with the Lebanon Valley Conservancy and Trout Unlimited on a stream restoration project in Lebanon County that will involve students and teachers from Jackson Elementary School.

- Contact all of the owners of Historic Sites that fall within the watershed and offer information and guidance for the preservation and recognition of the property.

- Hold a workshop for residents on Invasive Plants that explains how to identify such species and provides information on the methods of their removal.

- Visit each high school in the watershed by the close of the 2002-2003 school-year, and each elementary school by the close of the 2003-2004 school-year.

- Assist in the development of a Cacoosing Creek watershed organization and work with municipalities and landowners to increase awareness of stormwater management.

- Encourage, and assist where possible, the removal of Charming Forge Dam to restore the free-flowing Tulpehocken Creek.

- Complete the flood control, urban beautification, and recreation rehabilitation work in Myerstown Community Park.

- Accomplish a streambank stabilization project in two phases at Lyn-Lor Golf Course.

- Develop a Rivers Conservation Implementation project for Jefferson and North Heidelberg Townships that focuses on Best Management Practices.

- Work with the City of Reading to secure the protection of Stonecliffe Park, near the mouth of the Tulpehocken Creek.

- Encourage native natural habitat development on all properties that have received grant assistance and/or land protection from the Berks County Conservancy or other governmental entities.

- Continue stream restoration projects on Spring Creek (Class A Wild Trout Fishery).

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MANAGEMENT OPTIONS REPORT

As a reminder, the priority order identified for the 17 projects is as follows:

1. Trout Unlimited Bank and Channel Stabilization
2. Marion Township Farmland Conservation/Preservation
3. Amish Program
4. Blue Marsh Lake
5. Zoning Issues
6. Sewage Issues
7. Water Quality Testing and Monitoring
8. Education Programs (Model Farm)
9. Education Programs (Children and Youth)
10. Nesting Boxes
11. Canada Goose Control
12. Historic Information
13. Conservation Plans
14. Greenway Corridor Improvement
15. Cleanup
16. Monitoring Opportunities
17. Wildflower Plantings

Although it is difficult to fully prioritize these programs, since time, events, and circumstances do change; there is additional information not contained elsewhere in the report that may shed some light on when (and how) these items can be expected to happen.

•TROUT UNLIMITED BANK AND CHANNEL STABILIZATION--This project is ready to go and has been submitted as an implementation grant, approved by the Berks County Planning Commission. Trout Unlimited has checked all cost and manhour figures and continues to support the project. All work will be coordinated through Bill Semmel of the Berks County Parks and Recreation Department. All contacts should come through the Berks County Conservancy (Phoebe Hopkins or Joe

Hoffman) as the Board of Directors and officers of Trout Unlimited change regularly and they have no central office.

•MARION TOWNSHIP FARMLAND CONSERVATION/PRESERVATION--This project is also ready to go and has been submitted as an implementation grant, with eight farmers already having volunteered and approvals received from the Marion Township Board of Supervisors as well as the Berks County Planning Commission. This project will be administered by the Conservancy (Ann Orth) in cooperation with the Berks County Agricultural Center (Bernie Riley, Clyde Myers, Jack Schoenly).

•AMISH PROGRAM--his project is a high enough priority to go immediately in the first year but some factors prevent its prompt implementation. As you know, Amish society tends to be closed; suspicious and mistrustful of government, unwilling to accept grants or gifts, and slow to recognize or confide in outside helpers (even from non-profit organizations like the Conservancy). Compounding the problem are the differences even within the Amish sub-communities (some deal only through their area Bishop, others are more individual). Yet it is clear that in Lebanon County and western Berks County, Amish support is essential to secure real and lasting improvements to the Tulpehocken Creek. Here the Conservancy (Ann Orth, Joe Hoffman) proposes an education partnership with the Rivers Conservation Program of a technical assistance nature only (no grants) at least through spring 1996; at which time the program will be re-evaluated.

•BLUE MARSH LAKE--This program has been approved for funding by the Environmental Protection Agency but was subject to a funding freeze before work could begin. It has now been re-applied for under several additional sections of the Clean Water Act (Barb Lathrop is the DER contact person). Although the Berks County Planning Commission denied this proposal, both DER and EPA (as well as the participants: Western Berks Water Authority, Berks County Conservation District, Albright College and the Conservancy) felt the

proposal had as much merit as the Lake Ontelaunee study completed on Maiden Creek using this same program in the early 1990s. Since then, the US Army Corps of Engineers and Penn State University (Berks Campus) have joined in the project. Contacts are: WBWA-Oliver Smith; BCCD-Jack Schoenly; Albright-Prof. Daniel Daugherty; BCC-Joe Hoffman; Army Corps-Al Schoenebeck and PSU Berks-Stam Zervanos.

•ZONING ISSUES--The Conservancy will work through the Berks Growth Issues Forum to discuss these issues. BCC co-chairs with the Berks County Planning Department (Glenn Knoblauch) and has already scheduled two conferences and one breakfast that covered zoning issues in part or in full and reached over 500 people from at least 40 separate Berks County communities. Another seminar is scheduled for Friday, October 13. The Forum has videotapes which are loaned to municipalities on zoning matters. Community contacts will continue to increase protection of the stream corridor.

•SEWAGE ISSUES--This is also a project of the Berks Growth Issues Forum, who offered seminars at the second conference (June 1994) and contacts with Forum members (Greg Kohl, Carl D'Amico) on sewage issues. The denial of the permit for the Womelsdorf sludge-burning facility was an example of a recent success in this area. Much of the ability of the Conservancy to affect this issue depends on the review process of the Berks County Planning Department and DER. We wish to have a voice in these matters but the path is not as clear as with zoning.

•WATER QUALITY TESTING AND MONITORING--This is an ongoing Conservancy strength. Newest arrivals on the monitoring front are the Conrad Weiser School District (Cindy Murtaugh) who received a DER Environmental Education grant and Penn State-Berks (Stam Zervanos) which has six advanced placement students for the next year (started in May 1995) monitoring sites from Charming Forge westward. Dissolved oxygen, nitrate, phosphate, chlorine, ammonia nitrogen, alkalinity, temperature, and pH are the common

measurements. Macroinvertebrate studies are completed as we can. Studies for agricultural chemicals will likely have to wait abother year until we can amass the proper balance of trained workers, equipment and funding to accomplish the task.

•EDUCATION PROGRAMS (MODEL FARM)--This program may be undertaken by the Berks County Agricultural Center as part of their approach to getting best management practices funded along the Tulpehocken Creek. It is difficult to say right now which farm would be selected; likely it will be one of the eight farmers that has already signed up to work with the Conservancy. Its probable time frame is 1996 or maybe even 1997.

•EDUCATION PROGRAMS (CHILDREN AND YOUTH)--One of our expected 1996 grant proposals will be for the funding of a Tulpehocken Creek Scenic River Curriculum to be taught in schools. Similar to a program called the Little Lehigh Watershed Consortium run by the Wildlands Conservancy of Emmaus; this program would seek to incorporate comprehensive education along the stream throughout the various school districts in the watershed. As stated earlier, Conrad Weiser School District has already become a pioneer in those efforts.

•NESTING BOXES--Kathy Greenawalt, a Conservancy volunteer and resident along the Tulpehocken Creek, is starting to make several boxes for wood ducks, bluebirds, as well as suggesting habitat (plants) to attract butterflies to several specific areas in and along the stream. This project will probably be funded locally either through subscription or a grant, possibly from Metropolitan Edison or AT & T Telephone Pioneers.

•CANADA GOOSE CONTROL--This program is vitally important but nearly impossible at the present time. The last two states (Alabama and Mississipi) who have previously encouraged transport have rescinded those invitations; which means that there is no known point of drop-off for this species. Other methods including noise,

light and decoys have minimal long-term effects. We are keeping the project in the list due to its significance; but options are a lot less than one year ago.

•HISTORIC INFORMATION--The Conservancy has applied for a grant of $12,400 from the Sowers Estate; money which was supposed to go to a Photo Ecology Foundation that is now defunct. If that money is received, a portion will go toward organizing and updating the historic site surveys the Conservancy has already completed along the Tulpehocken Creek. This is the official Pennsylvania Historica;l and Museum Commission repository for all such information.

•CONSERVATION PLANS--Lori Sandman of the Berks County Agricultural Center has recently applied for a grant to fund these initiatives throughout the Tulpehocken Creek basin. Other than the normal process of farmer contact which goes on through the Soil Conservation Service on a regular basis and the Conservancy's pilot effort in Marion Township, thiese are the only efforts able to be made at this time.

•GREENWAY CORRIDOR IMPROVEMENT--The Conservancy has run into some opoposition on this proposal. An attempt to study placing a trail along the Cacoosing Creek in Lower Heiodelberg and Spring Townships was rejected overwhelmingly by resident farmers of the area. The negotiations for the connector between Blue Marsh Lake and the Grings Mill County Park continue; but it is not reasonable to expect implementation before 1996 or 1997. Individual park projects (such as Myerstown Park) have fallen through for the time being because of lack of funds.

•CLEANUP--While individual and small group cleanups continue regularly, this item was meant to encompass the more substantial removal of apopliance-size and industrial or commercial debris that is cluttering many of the roadsides and farmsteads. This requires a commitment of time and energy which the Conservancy, the Berks

Recycling Coalition, and others will want to make at some point but cannot afford to do (money or staff) at the present time.

•MONITORING OPPORTUNITIES--The Conservancy is working with its Volunteer Monitor Program (Barbara Breininger, Ann Orth) to ensure proper and frequent visitation of sites such as Charming Forge and other agricultural conservation easements already secured. To develop a moe comprehensive volunteer network requires an asemblage of talent that the Conservancy will consider but cannot commit to at this time.

•WILDFLOWER PLANTINGS--The demonstration project for this idea will be the Trout Unlimited bank stabilization project referred to earlier. The Conservancy has made great progress on suppliers (Kutztown University, Temple University, Brandywine Conservancy) and also with identification of which wildflowers belong in that area (Larry Lloyd, Deanna Witman). However, a thorough planting program would need to be the subject of a grant, perhaps in year three of this process or sooner if some contacts with the private sector turn out favorably.

If aditional information on each of these projects' current status is needed (since it changes frequently) please contact the Berks County Conservancy, 960 Old Mill Road., Wyomissing PA 19610 or phone (610) 372-4992 or fax (610) 372-2917.

INTRODUCTION

The Berks County Conservancy is a non-profit organization whose purpose is to preserve, protect, and enhance Berks County's significant natural, agricultural, and historic resources. The Conservancy has spent most of the past decade of time and resources to complete the Tulpehocken Creek Scenic River Study and to guide the process responsible for the Tulpehocken Creek being designated as a scenic river in 1992. In addition to the original studies, more work has been done over the past six months in order to generate additional information necessary to produce this strategic river management plan.

The Tulpehocken Creek Scenic River Study was completed in 1988. Prior to that time, the Berks County Conservancy organized a Citizen Advisory Committee composed of representatives from local municipalities in the study area, organizations with an interest in the stream and property owners along the stream. The Conservancy, in cooperation with the Citizen Advisory Committee, generated information on the study area including a historical summary, land use characteristics, natural resources, and water resources. The information provided the supporting material used in the Tulpehocken Creek Scenic River Study.

In 1994, the Conservancy built upon the existing study with a practicum cooperative through the Environmental Studies Department of Antioch New England Graduate School of Keene, NH. The practicum made possible water quality tests of the Tulpehocken Creek encompassing the first tests to incorporate the entire creek and its tributaries. (See Appendix A for a map of test sites and Appendix B for test results.) A comprehensive water quality report was written to analyze the test results and allow recommendations for future work to be made. (See Appendix C.) In addition to the water quality testing, physical inspections (stream walks), photography, and mapping as well as property owner lists and agency research for the Tulpehocken Creek were assembled. The

results were essential to make recommendations for an effective and current strategic river management plan.

To further assist the decision-making process, four large variable component multiple resource maps were created from topography maps so that five initial layers of varying information could be added. A detailed map of current zoning and land use patterns for the study area is included in this set of maps. Property ownership, agricultural, and hydrological maps were prepared as well. Research led to preparation of layers of acetate that are laid on top of each base map. Different combinations of acetate layers may be attached to the base maps to provide a thorough study of the Tulpehocken Creek's characteristics. The map series can be updated with additional characteristics at any future date.

As a result of that water quality testing, physical inspections, photography and mapping, the Berks County Conservancy is now in the position to re-organize the more recently created Tulpehocken Creek State Scenic River Task Force in addition to governmental agencies, non-profit and private organizations. This will enable us to implement the Strategic River Management Plan for the benefit of the Tulpehocken watershed.

The purpose of this particular Plan is to define actions detailed for the improvement of the Tulpehocken Creek. The Plan is to be viewed as a separate and unique Rivers Conservation Plan, borrowing from previous reports and studies, but meant to serve as a fresh start and approach to the problems of the Tulpehocken Creek as it enters the 21st century.

If the Plan results in grants or appropriations, obviously that would be beneficial. But the Plan is more meant to create and sustain dialogue concerning a valuable multi-faceted resource that two counties agree is vital to their citizens.

To achieve Scenic River status, a detailed resource inventory must be administered and the waterway must be found to possess one or more of the following: "outstanding, remarkable wild, scenic, recreational, geological, fishery and wildlife and/or vegetation, historical, cultural or scientific values." The Berks County Conservancy, a non-profit organization, worked in conjunction with the Bureau of State Scenic Rivers to provide the Tulpehocken Creek Scenic River Study that allowed the Tulpehocken Creek to achieve Scenic River status. Due to the cooperative effects of that study, the Berks County Conservancy has now become the host agency for the Tulpehocken Creek.

The Berks County Conservancy has recently received $14,000 in funding from State Senator Chip Brightbill of Pennsylvania and also the AT&T Pioneers to be applied to the Tulpehocken. A portion of the moneys will be used now for projects that are designed for stream improvement and which will be highly visible to the public. However, it was also this same sum of money that propelled research needed to write this proposal including covering supplies, miscellaneous expenses, and salaries.

The Tulpehocken Creek is located in Pennsylvania with its headwaters just northwest of Lebanon in Lebanon County. The Creek runs east until it reaches Reading in Berks County where it empties into the Schuylkill River, a main tributary to the Delaware River. The entire length of the Tulpehocken Creek's main corridor is estimated at 39.5 miles with 8.3 miles in Lebanon County and 31.2 miles in Berks County. Of the 39.5 miles, 28.8 miles well designated as a Scenic River. The river runs through a variety of land uses including flowing through several towns, across large portions of agricultural lands, and through a large reservoir constructed by the Army Corps of Engineers.

Virtually all areas of the Tulpehocken Creek have now been studied. The Tulpehocken Creek Scenic River Study conducted by the Berks County Conservancy and the Department of Environmental Resources was completed in 1988 and included such topics as general descriptions, historical summaries, land use characteristics, and inventories of natural and water resources. The study did not include water quality testing. Since

then, private and public organizations as well as this Strategic River Management Plan have done water quality testing on most stream segments.

The newest addition to the research team is the Berks Campus of the Pennsylvania State University and Dr. Stam Zervanos of their staff. Dr. Zervanos and the students are monitoring several sites northwest of Blue Marsh Lake using the Conservancy's water test kits and and more scientific kits that had fallen into disuse for several years. The AT & T Telephone Pioneers continue their research despite the transfer of most of the Pioneers' functions to Allentown and the Lehigh Valley metropolitan area.

The Plan will include an inventory of current data; an analysis of that data with a statement of problems and needs; recommendations including goals, objectives, strategies and priorities; and a management options report. Although the Plan will cover the entire area of the Tulpehocken Creek, it is understood that some sections were not included in the December 1992 scenic river designation.

These include:
3.4 miles from Ramona Road to the western boundary of the Sensenig property upstream from Flanagan Road in Jackson Township.

7.3 miles from the Heidelberg Country Club to the base of Blue Marsh Dam, known as the Blue Marsh Lake Greenway Link.

We are going to wait to petition for scenic river designation for these areas at this time. Perhaps the Rivers Conservation Program is a better fit for such segments anyway.

We invite questions and dialogue on our Tulpehocken Creek Initiative by calling the Berks County Conservancy at (610) 372-4992 or fax (610) 372-2917.

INVENTORY

Much of the original information on the Tulpehocken Creek can be gleaned from a 1992 study by the Soil Conservation Service, who has been interested in the farmers along the Tulpehocken Creek for many years.

Their description includes location (also found in the Introduction to this report); climate; population; soils; geology; groundwater; land use; agriculture (the predominant interest along the stream); surface water (including tributaries, protected uses, and designations); existing water quality information (including pollution documentation); and point source discharges.

Additional key information comes from the original Scenic River study done in the late 1980s. Information on history (particularly the extra data on the Union Canal which is a Lebanon County priority and accordingly a Conservancy priority as well); natural resources including more geology, soils, floodplain, minerals, and vegetation; and water resources (both ground and surface) does not change much over time.

This information also includes details on Blue Marsh Lake and Tulpehocken Creek Valley Park (also known as Grings Mill County Park) as well as Limestone Springs Fishing Preserve, Willow Springs, and the Borough of Myerstown park system which are very under-rated but useful Lebanon County park facilities.

The total of these two sections is 60 pages of inventory text on location, zoning and land use, topography, geology, soils, vegetation, history, culture, recreation, greenways, fisheries and water quality.

However, additional inventory information has been prepared to further elaborate on this considerable volume of work. The new 1994-1995 inventory updates include:

•10 pages of water quality testing research that presents the most complete current picture of stream conditions (pH, alkalinity, dissolved oxygen, nitrate, phosphate)

•15 pages of the most up-to-date listing of property owners along the Tulpehocken Creek based on the new Berks County tax maps and the updated editions in Lebanon County.

•21 pages of local zoning maps supplemented by the overlay series prepared by Susanne Wood in 1994.

It is expected that the inventory will continue to be upgraded over the next several years. Topics that deserve additional attention include:

•Zoning and land use revisions and progress toward creating and adopting a model ordinance package;

•Identification and protection of potential rare or endangered plants and animals;

•Update and better availability of the Conservancy's Historic Resources Site Survey;

•Developing the connecting link on the Tulpehocken Trail; and

•More comprehensive studies by the Pennsylvania Fish and Boat Commission and the Tulpehocken Chapter of Trout Unlimited.

LOCATION

The Tulpehocken Creek Watershed is located in the south-eastern part of Pennsylvania in Berks and Lebanon Counties. The main stem of the Tulpehocken Creek originates in the foothills just west of Myerstown in Lebanon County with smaller tributaries originating in the Blue Mountain to the north and South Mountain to the south. Tulpehocken Creek flows eastwardly through Lebanon and Berks Counties for 40 miles to join the Schuylkill River at Reading. The Schuylkill River flows through Reading in a south-easterly direction for 13 miles to the end of the watershed at Birdsboro. The total drainage area contains about 113 miles of streams in the watershed.

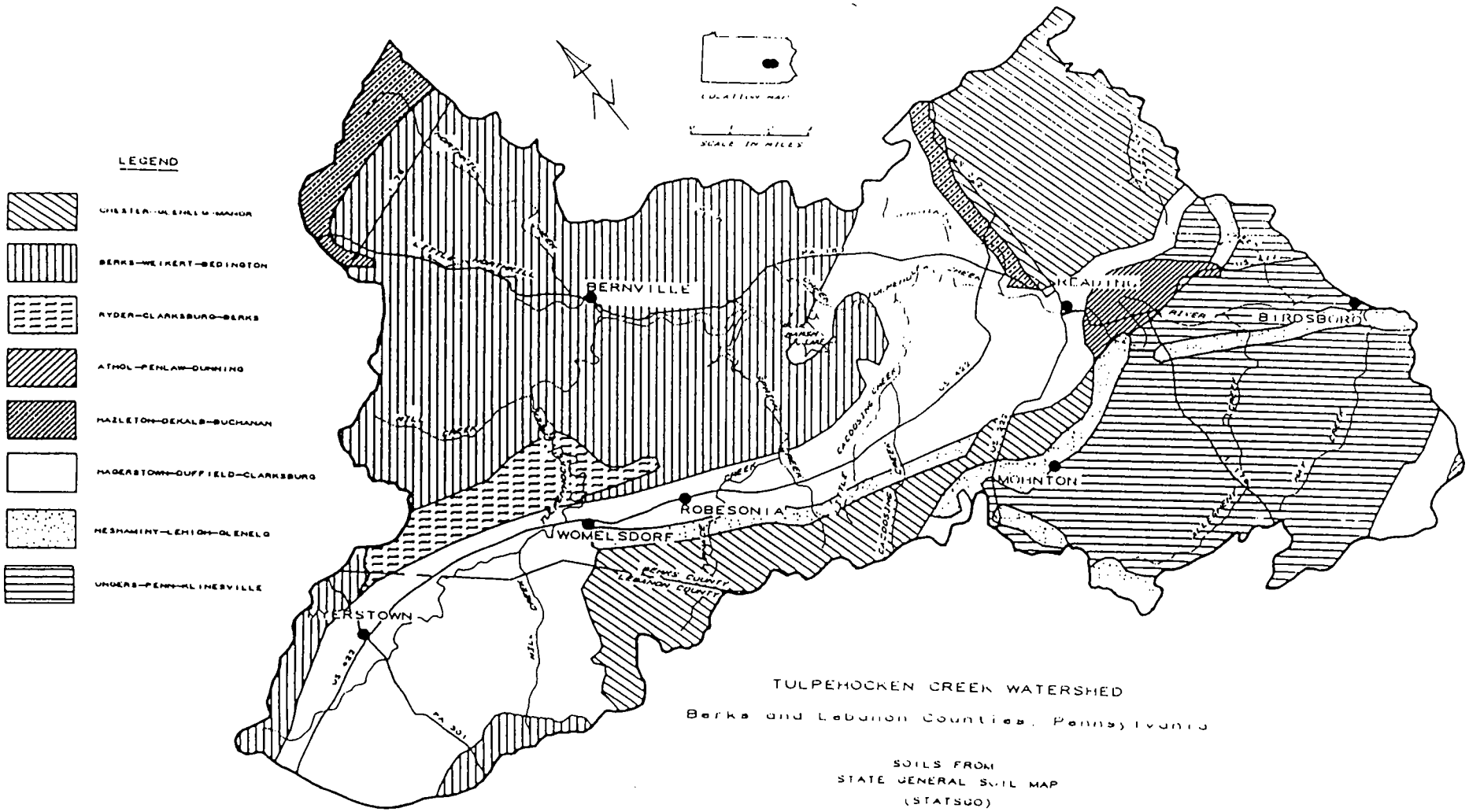
The watershed is located in the Water Resource Council's designated Hydrologic Unit 02040203. The study area is also designated as part of Subbasin-3 Watershed "C" in the State Water Plan. The drainage area is 352.7 square miles or 225,700 acres with 191,700 acres in Berks County and 34,000 acres in Lebanon County.

CLIMATE

The watershed has a humid, continental climate and moderate temperatures. The average annual precipitation is about 42 inches. The precipitation is fairly well distributed throughout the year. The seasonal snowfall is about 30 inches. Temperatures range from 0°F to 100°F. Summers are long with temperatures above 90°F for about 25 days. Winter temperatures average in the upper 30's. The average growing season is 176 days in Lebanon and 194 days in Berks.

POPULATION

The population in the watershed is approximately 217,800 people. The Lebanon County portion of the population accounts for about seven (7) percent of the population in the watershed. Fifty-nine (59) percent of the population is located in the numerous boroughs and City of Reading. Nearly seventy (70) percent of the population is found in the urban and built-up areas of the watershed. Over the last 20 years, the watershed has experienced slight shifts in population with modest growth occurring around the population centers.



TULPEHOCKEN CREEK WATERSHED

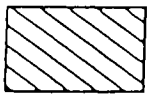
Berks and Lebanon Counties, Pennsylvania

SOILS FROM
STATE GENERAL SOIL MAP
(STATSGO)

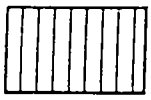
Figure 2

Source: Percent composition of mapping units can be obtained from STATSGO data base

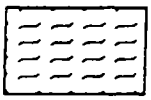
Soil Map Legend



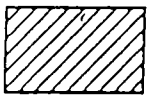
CHESTER-GLENELG-MANOR - This map unit consists of gently sloping to hilly soils formed in the Piedmont schists. The soils are dominantly well drained and very deep to moderately deep to bedrock. Areas are dominantly in cropland and hay and have high productivity.



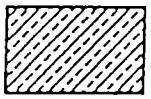
BERKS-WEIKERT-BEDINGTON - This map unit consists of steep to gently sloping soils on shale hills. The soils are shallow to deep and excessively drained to well drained. Areas of gently to moderately steep slopes are generally in cultivated crops and hay and have moderate productivity.



RYDER-CLARKSBURG-BERKS - This map unit consists of nearly level to strongly sloping areas of calcareous shales and siltstones. The soils are moderately deep to very deep and well drained to moderately well drained. Areas are dominantly cropland and hayland and have moderate to high productivity.

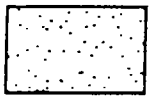


ATHOL-PENLAW-DUNNING - This map unit consists of nearly level to moderately sloping areas of red conglomerate. The soils are very deep to moderately deep and well drained to poorly drained. Areas are in cropland and hayland and have high to moderately high productivity.



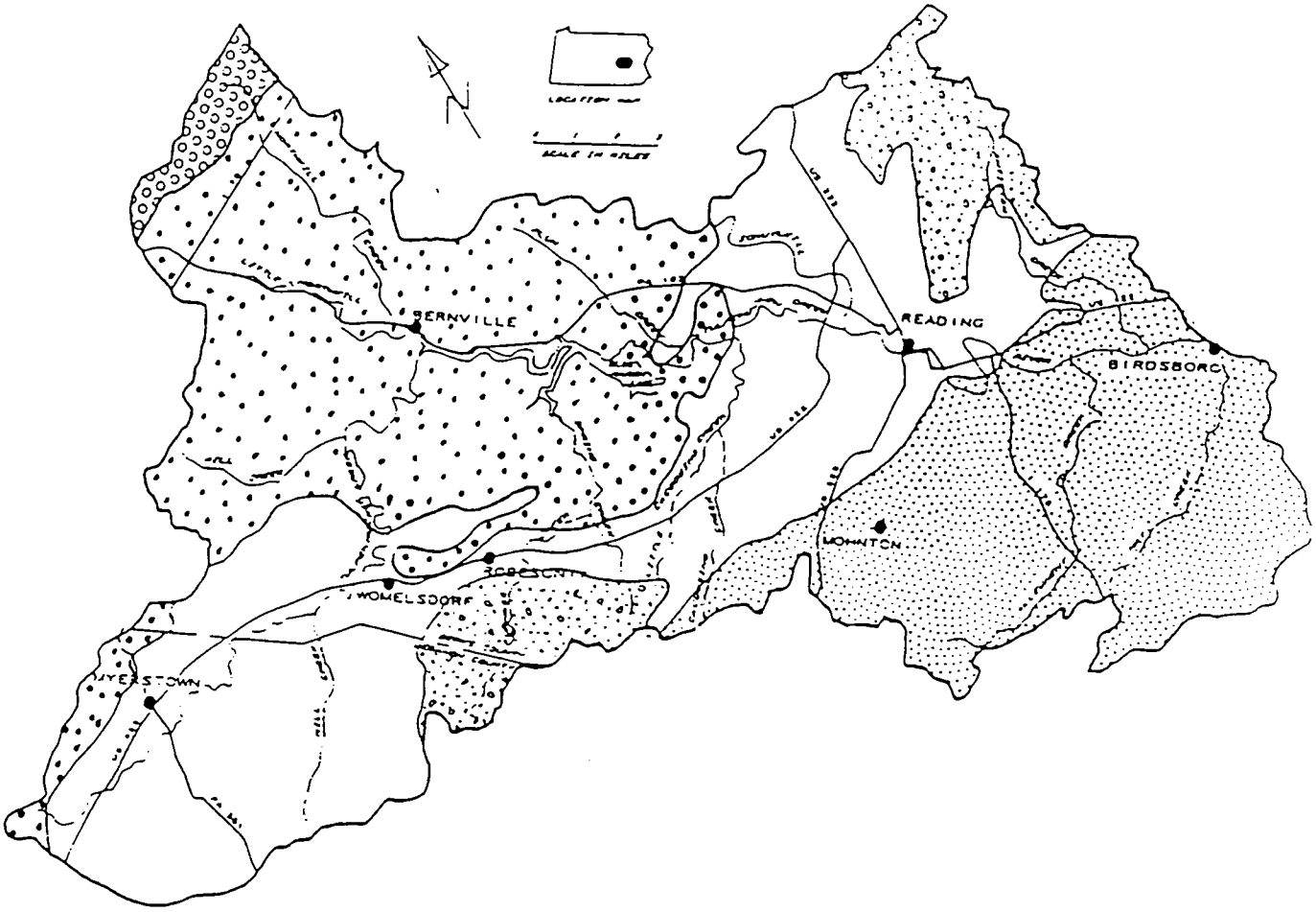
HAZLETON-DEKALB-BUCHANAN - This map unit consists of bouldery to very stony soils on very steep to sloping forested mountain ridges. The soils are well drained or excessively drained to moderately well drained and very deep. Areas are generally to steep and to stony for cultivation.

HAGERSTOWN-DUFFIELD-CLARKSBURG - This map unit consists of gently sloping to sloping soils in limestone valleys. The soil are dominantly well drained with minor areas of moderately well drained soils. Soils are very deep to deep. Areas are mostly in cultivated crops and have high productivity.



NESHAMINY-LEHIGH-GLENELG - This map unit consists of gently sloping to hilly and steep soils formed in a variety of non-acid crystalline rocks of the Piedmont. The soils are dominantly well drained with minor wet soils in drainage ways, lower slopes, and bottom lands. Soils are very deep to moderately deep and some steep areas and wooded areas are stony. Areas are dominantly in cropland and hay and have high productivity.

UNGERS-PENN-KLINESVILLE - This map unit consists of nearly level to moderately steep, very deep and moderately deep soils formed in reddish shale, sandstone and siltstone of the Triassic Basin. Soils are well drained to poorly drained. Areas are dominantly cropland and hay and have moderate productivity.



GEOLOGY LEGEND

- Sandstone, shale, mudstone conglomerate and diabase dikes and sheets
- Conglomerates, sandstone and interbeds of shale
- Shale, phyllitic shale with some limestone and graywacke sandstone
- Limestone and dolomite, with some interbedded sandstone and shale
- Granitic gniess and hornblende gneiss

TULPEHOCKEN CREEK WATERSHED
Berks & Lebanon Counties, Pennsylvania

GEOLOGY

FIGURE 3

folding, faulting, and gravity slides. The terrain consists mainly of a broad, gently-rolling valley underlain by easily erodible sedimentary rocks. This valley section is known as the Lebanon Valley Sequence and Hamburg Sequence of the Great Valley Section. The rolling terrain to the north is underlain by Ordovician Age shales (with some limestone and sandstones), known as the Hamburg Sequence. To the south, Ordovician and Cambrian Age limestones and dolomites (with interbeds of sandstone, shale, and quartzite), known as the Lebanon Valley Sequence, lie in a band between Myerstown and Reading.

Blue Mountain, along the northern watershed boundary, is underlain by resistant Silurian Age sandstones, conglomerates, and interbeds of shale. The Reading Prong Section which includes the Reading Hills and a small area south of Womelsdorf consists mostly of hornblende gneiss and granitic gneiss rocks which are metamorphic rocks of igneous origin. These Pre-cambian Age rocks have been folded, faulted, uplifted, and intruded with metadiabase dikes. These rocks are more resistant to weathering than other rocks in the watershed.

The hills in the southern part of the watershed in the Lowland Section, are underlain by reddish-brown Triassic Age sandstones, shales, mudstones, and quartz conglomerates. Diabase dikes and sheets have intruded these rocks and are more resistant to weathering than the rocks in the valley section.

Structurally, the carbonate rocks in the Lebanon Valley trend in a east-northeast strike direction. Younger formations crop out northward across the limestone valley while older beds overlie the younger ones as a result of overturned rocks. These beds appear as part of the overturned south limb of a recumbent synclinorium. The shales and sandstones to the north were, generally, thrust or gravity-slide slices stacked in their present location and then thrust as one single complex sheet.

The Tulpehocken Creek drains an area underlain by the highest percentage of carbonate rocks (36 percent) in the watershed. The largest reliable sustained water yields are available in this carbonate rock valley. Aquifers at median depth of 70 to 80 feet are capable of yielding an average of 640 gal/min/mi^2 in the carbonate Lebanon Valley. In comparison, Triassic sediments in the southern area yield only as much as 278 gal/min/mi^2 from shallow water-bearing zones.

GROUNDWATER

Groundwater resources in the watershed are considered good with nearly 70 percent of the water supply needs obtained from these sources. The demand for water use has grown steadily and it is projected that future water needs will come from groundwater supplies in this region. The primary uses of groundwater supplies go to rural domestic and public supplies and livestock with lesser demands coming from industry. Yields are controlled by geologic and topographic conditions.

Groundwater quality in the watershed is generally good. Natural sources of iron, manganese, hydrogen sulfide,and total dissolved solids occur in the aquifers. Hard water conditions resulting from calcium and magnesium minerals are a common problem in the carbonate aquifers. The sandstone, shale, and metamorphic rocks in the upland areas produce soft water and low pH tends to dissolve metal plumbing.

With median levels of 5.6 to 6.8 mg/l, there appears to be contamination of nitrates in the carbonate aquifers. Potential sources of this contamination in groundwater comes from on-lot septic systems, over-fertilization of croplands, and areas with concentrated manure. The carbonate aquifers are also susceptible to point source contamination from surface waters containing bacteria and pesticide chemicals entering sinkholes. In agriculture, these contaminates can be reduced by improved fertilizer, manure and pesticide management and by controlling contaminated surface water entering sinkhole areas.

Five groundwater basins (nos. 50-54) are delineated by DER in the watershed. Four of the basins are assigned a high priority based on the state-wide ranking for water use, ambient water quality, pollution sources, and pollution dispersion potential. Basin No. 50 is the only one not considered as a high priority.

LAND USE

Land use within the watershed is primarily devoted to agriculture (75 percent) except for numerous Boroughs including Bernville, Robesonia, Womelsdorf, Wyomissing, Wernersville, Sinking Springs, Birdsboro, and the City of Reading in Berks County, and Myerstown in Lebanon County. Federally-owned land within the watershed includes about 6,170 acres within the Blue Marsh Recreation Area containing the 1150-acre Blue Marsh Lake. This Corps of Engineer recreation facility is under cooperative agreement with the Berks Conservation District. About 2,900 acres of this Federally-owned land is leased by the Pennsylvania Game Commission for wildlife habitat management. In addition to

the Federally-owned land, the Pennsylvania Department of Environmental Resources, Bureau of State Parks manages about 500 acres of the French Creek State Park in Berks County. The Pennsylvania Game Commission manages over 9,800 acres of State Game Lands in the watershed for white-tailed deer and small game production. Local managed areas amount to less than 100 acres. Table 1 displays the land use in the watershed by county.

TABLE 1 - WATERSHED LAND USE BY COUNTY

COUNTY NAME	CROPLAND ACRES	WOODLAND ACRES	URBAN ACRES	PASTURE ACRES	TOTAL ACRES
Berks	80,600	43,600	53,600	13,900	191,700
Lebanon	23,100	4,500	2,700	3,700	34,000
Total	103,700	48,100	56,300	17,600	225,700

AGRICULTURE

The number of farm enterprises in the watershed is estimated at 400, of which 362 are livestock farms and 38 cash crop farms. Each operating farm contains an average of about 280 acres of cropland including rented farmland.

Crops grown include corn for both grain and silage, small grain both spring sown and fall sown, alfalfa, mixed hay, soybeans, vegetables and orchard crops. Tobacco is grown primarily by the Amish as a specialty crop on less than one percent of the cropland. The tobacco is concentrated in the area south of Myerstown in the subwatersheds of Prescott, Reistville, and Mill Creek in Lebanon County. These Amish farmers comprise about 30 percent of the livestock farms in these subwatersheds or 16 percent of the total farms in the watershed.

The typical rotations include two years of corn, one year of small grain, and two to four years of alfalfa-grass hay in shale soils and four years of corn and four years of alfalfa-grass hay on the limestone soils. Orchard crops such as apples, cherries, peaches, plums and pears are grown in the watershed. Table 2 displays the acres of cropland and percent by crop use in the watershed.

TABLE 2 - CROPLAND ACREAGE BY CROP USE

CROP	ACRES	PERCENT
Corn grain	41,200	40
Corn silage	7,900	7
Small grain	14,700	14
Soybeans	9,100	9
Alfalfa hay	14,600	14
Mixed hay	14,800	14
Vegetable	800	1
Orchard	600	1
TOTAL	103,700	100

Livestock are the major farming enterprises in the watershed. Livestock operations account for about 90 percent of the total farm operations in the watershed. Dairy and beef account for about 86 percent of the livestock operations. The other livestock operations are divided among poultry (4 percent), swine (4 percent), horses (3 percent), rabbits (1 percent), and sheep and goats (2 percent). Table 3 displays the livestock numbers and manure production by animal type.

TABLE 3 - LIVESTOCK POPULATION AND MANURE PRODUCTION BY ANIMAL TYPE

Livestock Operation	Number of Operations	Number of Animals	Animal Unit	Manure Production 1/
	(No.)	(No.)	(AU)	(T/Yr.)
Dairy	263	17,600	24,600	368,400
Young Dairy	3	8,500	6,000	89,000
Beef	45	3,200	3,200	35,000
Swine	16	22,500	2,900	20,800
Poultry	15	3,768,800	10,900	7,400
Sheep	7	400	30	200
Rabbits	1	29,000	120	1,300
Horses/Mules	12	700	700	5,700
TOTAL	362	3,850,700	48,450	527,800

Lebanon County accounts for about 64 percent of the livestock farms and 89 percent of the livestock. Nearly 64 percent of all the dairy and beef operations are located in Lebanon County, while nearly 80 percent of the poultry and 50 percent of the swine, sheep, and horse farms are in

1/ The Penn State Agronomy Guide 1991-92, (Table 18).

Lebanon county. These livestock operations are concentrated in the area south of Myerstown.

The nearly 528,000 tons of livestock and poultry waste generated each year represents a tremendous resource, if properly managed. Table 4 displays the total amount of nutrients produced by these animals each year. Over 85 percent of the animal waste nutrients are attributable to dairy and poultry.

TABLE 4 - TOTAL NUTRIENT PRODUCTION BY ANIMAL TYPE

Livestock Operation	N (Tons)	P_2O_5 (Tons)	K_2O (Tons)
Dairy	1843	738	1475
Young Dairy	445	178	356
Beef	193	123	175
Swine	243	191	191
Poultry	1814	1209	605
Sheep	3	1	2
Rabbits	22	32	15
Horses and Mules	35	14	26
Total	4598	2486	2845

SURFACE WATER

The Tulpehocken Watershed has 32 named streams which contribute flow to the Schuylkill River between Birdsboro and Ontelaunee, Pennsylvania. The named streams cover 92 percent of the drainage basin. The Tulpehocken Creek is a major tributary in the basin, representing about 62 percent of the area. Fifteen of the named streams comprise the majority of the drainage area to the 1150 acre Blue Marsh Lake. Table 5 lists all named streams beginning at Birdsboro on the Schuylkill River and progressing upstream.

Surface waters of the Tulpehocken Subbasin are protected under Chapter 93-Water Quality Standards of the Pennsylvania Department of Environmental Resources (DER), Rules and Regulations. Water quality criteria have been established for specific protected uses. Water uses protected throughout the basin are water supply (potable, livestock, irrigation, wildlife), warm water fishes, water contact sports, fishing, boating and aesthetics. Table 6 shows additional protected water uses for specific areas of the basin. (DER, 1989)

The Pennsylvania Fish Commission regulates fisheries throughout the Subbasin. Table 7 lists approved trout waters and special regulation waters.

TABLE 6 - ADDITIONAL PROTECTED WATER USES
STATE WATER PLAN SUBBASIN 3C
(Pa-DER, 1979)

Basin	Zone	Water Use Protected
Schuylkill River	Main stem, Ontelaunee to Birdsboro	Migratory Fish
Tulpehocken Creek	Headwaters to T-560 at Romano	Cold Water Fish
Tulpehocken Creek (except Northkill Cr)	T-560 to tailwaters of Blue Marsh Lake	Trout Stocking
Tributaries to Blue Marsh Lake (except Furnace Cr.)	----	Trout Stocking
Northkill Creek	Headwaters to I-78	Exceptional Value Waters
Northkill Creek	I-78 to mouth	Cold Water Fish
Furnace Creek	----	Cold Water Fish
Wyomissing Creek	----	Cold Water Fish
Angelica Creek	----	Cold Water Fish
Allegheny Creek	----	Cold Water Fish
Antietam Creek	----	Cold Water Fish
Hay Creek	----	Cold Water Fish

TABLE 7 - PENNSYLVANIA FISH COMMISSION DESIGNATIONS
STATE WATER PLAN SUBBASIN 3C.(PFC, 1991)

Waters	PFC Designation
Tulpehocken Creek 1/	Approved Trout Waters
Mill Creek (Lebanon County)	Approved Trout Waters
Northkill Creek	Approved Trout Waters
Spring Creek	Approved Trout Waters
Furnace Creek	Approved Trout Waters
Blue Marsh Lake	Conservation Lake
Tulpehocken Creek 2/	Delayed Harvest - Artificial Lures Only
Wyomissing Creek 3/	Approved Trout Waters
Angelica Lake	Approved Trout Waters
Antietam Creek	Approved Trout Waters
Antietam Lake	Approved Trout Waters
Hay Creek	Approved Trout Waters

1/ Headwaters to 1/2 mile below Charming Forge Dam.
2/ Downstream of Blue Marsh Dam (3.8 mile section).
3/ From headwaters to SR0222.

Portions of the Subbasin are protected under the Pennsylvania Scenic Rivers Act 283, as amended by Act 110. Designation requires a detailed study of the waterway and official action by the Commonwealth of Pennsylvania. Designated rivers are protected through cooperative and voluntary resource management. Table 8 summarizes the status of Scenic Rivers designations in the Subbasin.

Much of the Schuylkill River (124.8 miles) was designated through three actions of the Commonwealth, Act No.1978-33, Act No.1988-17, and a DER Secretarial Proclamation of July 1,1988. The portion of the Schuylkill within SWP Subbasin 3C, is protected under two categories. Upstream of Reading (at the Route 422 bridge over Fritz Island), through Ontelaunee, the Schuylkill is designated as Modified Recreational. Downstream of Reading, through Birdsboro, the designation is Recreational.

A Modified Recreational corridor is characterized by a substantial number of man-made modifications, is influenced and used by a high density population, and is comprised of recreational opportunities, public use facilities, and scenic, cultural and historical values which enhance the river environment. A Recreational corridor is characterized by moderate to extensive human activities and is comprised of historical, cultural, aesthetic and recreational values which enhance the river environment.

Tulpehocken Creek was evaluated and rated under the Scenic Rivers Act. The Tulpehocken received a rating of 1-A which signifies an immediate need for protection. A detailed study is presently being conducted.

TABLE 8 - PENNSYLVANIA SCENIC RIVERS ACT DESIGNATIONS STATE WATER PLAN SUBBASIN 3C. (BWRM, 1990)

Stream Segment	Type of Designation
Schuylkill River (Ontelaunee to Rt. 422 bridge, Reading)	Modified Recreational River
Schuylkill River (Rt. 422 bridge, Reading to Birdsboro)	Recreational River
Tulpehocken Creek	1-A Rating; under detailed study

Water quality in all or portions of 14 named streams and Blue Marsh Lake have been assessed by DER (BWQM, 1990). Eleven of the assessed streams and Blue Marsh Lake are within the Tulpehocken Creek watershed. In addition, the Schuylkill River, Bernhart Creek and Hay Creek were assessed. Water quality degradation was found in each of these streams with the exception of Manor Creek.

A total of 100 miles of stream are not fully attaining water quality standards. Nonpoint sources are impacting 78 miles. The primary cause of nonpoint pollution in assessed waters is agriculture. Non-agricultural nonpoint pollution is resulting from timber harvesting, development, urban runoff, acid rain and various other sources. Municipal Sewage Treatment Plants (STP) are the primary cause of point source pollution. Industrial discharges are also impacting some stream segments. Physical barriers are impacting migratory fishes in the Schuylkill River.

Nearly 38 stream miles are impaired by excessive nutrients, primarily from agriculture. Over 26 miles are impacted by high turbidity and suspended solids primarily from agriculture, timber harvesting and development. Municipal STP's are the principal source of low dissolved oxygen and high biochemical oxygen demand. Organic chemicals in fish tissue are impacting about nine miles of the Schuylkill River within the Basin. Other pollutants identified by the assessments include low pH, bacteria and pathogens, pesticides, and industrial chemicals.

EXISTING WATER QUALITY INFORMATION

Existing water quality information was reviewed to more clearly define problems and potential solutions in the Subbasin. The Pennsylvania Department of Environmental Resources (PaDER), U.S. Geological Survey and others have previously studied portions of the basin. The results of these studies are summarized in this section of the report.

Very little pesticide data was found. Most of the pesticide information was obtained from the U.S. Environmental Protection Agency computerized water quality data base (STORET). The banned pesticides chlordane, DDT or its metabolites, and dieldrin were found in the mud and sediments of each stream checked for these contaminants in the 1970's. These streams included the Schuylkill River, Allegheny Creek, Angelica Creek, Antietam Creek, Cacoosing Creek, Hay Creek, Heisters Creek, Licking Creek, Spring Creek, Tulpehocken Creek, and Wyomissing Creek. Aldrin was detected in Licking, Northkill, and Spring Creeks. The pesticide 2,4,5-T was detected at very low concentrations in the Schuylkill River.

Almost no testing is available for current-use pesticides. Diazinon and 2,4-D were detected at very low concentrations in 1979 in the Schuylkill River at Reading. Diazinon was also detected in Angelica Creek in 1979. Alachlor and Methoxychlor were identified in an unnamed tributary to Mill Creek (Lebanon County) in the early 1980's.

Most of the information reviewed for this report focused on surface water. The Schuylkill River and its minor tributaries will be discussed separately from the Tulpehocken Creek. The Tulpehocken Creek is a major tributary to the Schuylkill River. It is impounded by the 1150-acre Blue Marsh Lake a few miles upstream from the mouth of the Tulpehocken Creek. Information is, also, presented on state assessed stream segments, point source discharges, and groundwater quality.

Schuylkill River

The main stem of the Schuylkill River, from Ontelaunee to Birdsboro, is generally suitable as a warm water fishery. Degradation is resulting from several factors. Pollutant sources are many and varied. In this reach, point sources are an important cause of nutrients and BOD being discharged directly into the river. Nonpoint sources result in pesticide residues in fish tissue and additional nutrient loading.

Due to the size of the Schuylkill River drainage area upstream of the study area, pollutants from outside the area are significant. Mining in the headwaters and enrichment from the Lake Ontelaunee discharge are the principal sources of degradation from outside of the study area. Tulpehocken Creek, as well as urban and agricultural sources along the river corridor, are the primary sources of nutrients from nonpoint sources within the study area (Overdorff and Brown, 1985). Water quality has been assessed by the State in several of the streams impacting this reach of the Schuylkill River. Information is available for Hay Creek, an unnamed tributary, Bernhart Creek and Tulpehocken Creek and its tributaries.

Hay Creek, is impacted by excessive siltation (Boyer, 1988). Logging in the headwaters and housing developments lacking adequate erosion controls are the primary causes of the problem. Agricultural land erosion contributes to the siltation problem, but is less significant than the non-agricultural sources.

An unnamed tributary to the north, just upstream of Birdsboro, was found to be severely impacted. Leachate from a landfill was causing a variety of impairments (PaDER, 1976).

Bernhart Creek has industrial impacts. Boiler additives, metals, and solids discharged by two companies are impairing 0.8 miles of this creek (BWQM, 1990).

Tulpehocken Creek

Tulpehocken Creek is the largest tributary in the basin. Water quality data has been collected since about the 1940's. The U.S. Geological Survey studied the watershed, in cooperation with the U.S. Army Corps of Engineers, in the mid-70's prior to the Blue Marsh impoundment. Studies have been conducted for the Pennsylvania Department of Environmental Resources, since the dam's completion. These and other studies have determined that impairments in the Tulpehocken Creek include elevated nutrients, excessive siltation, low dissolved oxygen, and high bacteria levels. The principal causes of these impairments are agricultural activities and sewage treatment plant discharges.

The upper reaches of Tulpehocken Creek, to the Myerstown Sewage Treatment Plant discharge, are impacted by agricultural nonpoint source pollution (Barker, 1978; Bronner, 1980; BWQM, 1990). This segment has elevated levels of nitrate and total phosphorus and excessive siltation of the stream substrata. Livestock are contributing high densities of fecal coliform and fecal streptococci bacteria. Organic stimulated organisms are common. Aquatic macrophyte growths are stimulated.

Many of the tributaries to the Tulpehocken Creek are similarly impacted by agriculture (Barker, 1978; Bronner, 1980; Boyer, 1988; BWQM, 1990). Owl Creek, Mill Creek (Berks/Lebanon Counties) and Mill Creek (Berks County) have elevated levels of nutrients, fecal bacteria and turbidity. Substrata siltation is excessive. Benthic organisms are dominated by pollution tolerant and organic stimulated forms. An unnamed tributary to Mill Creek (Berks/Lebanon Counties) was also found to contain agricultural pollutants (Schott, 1982). The pesticides Alachlor and Methoxychlor were detected in samples collected from this stream. Nitrate levels were elevated.

Moderate agricultural impacts have been documented in the Little Northkill Creek, Spring Creek, and Hospital Creek. Little Northkill Creek had elevated nitrogen and phosphorus concentrations and excessive siltation as a result of agricultural activities (Bronner,1980). Similar, but less severe impacts were found for the Northkill Creek. In Spring Creek, high fecal coliform counts upstream of the Robesonia-Wernersville Sewage Treatment Plant were determined to be from agriculture (Boyer, 1988). Elevated nitrogen concentrations were attributed to agricultural sources in Hospital Creek (BWQM, 1990).

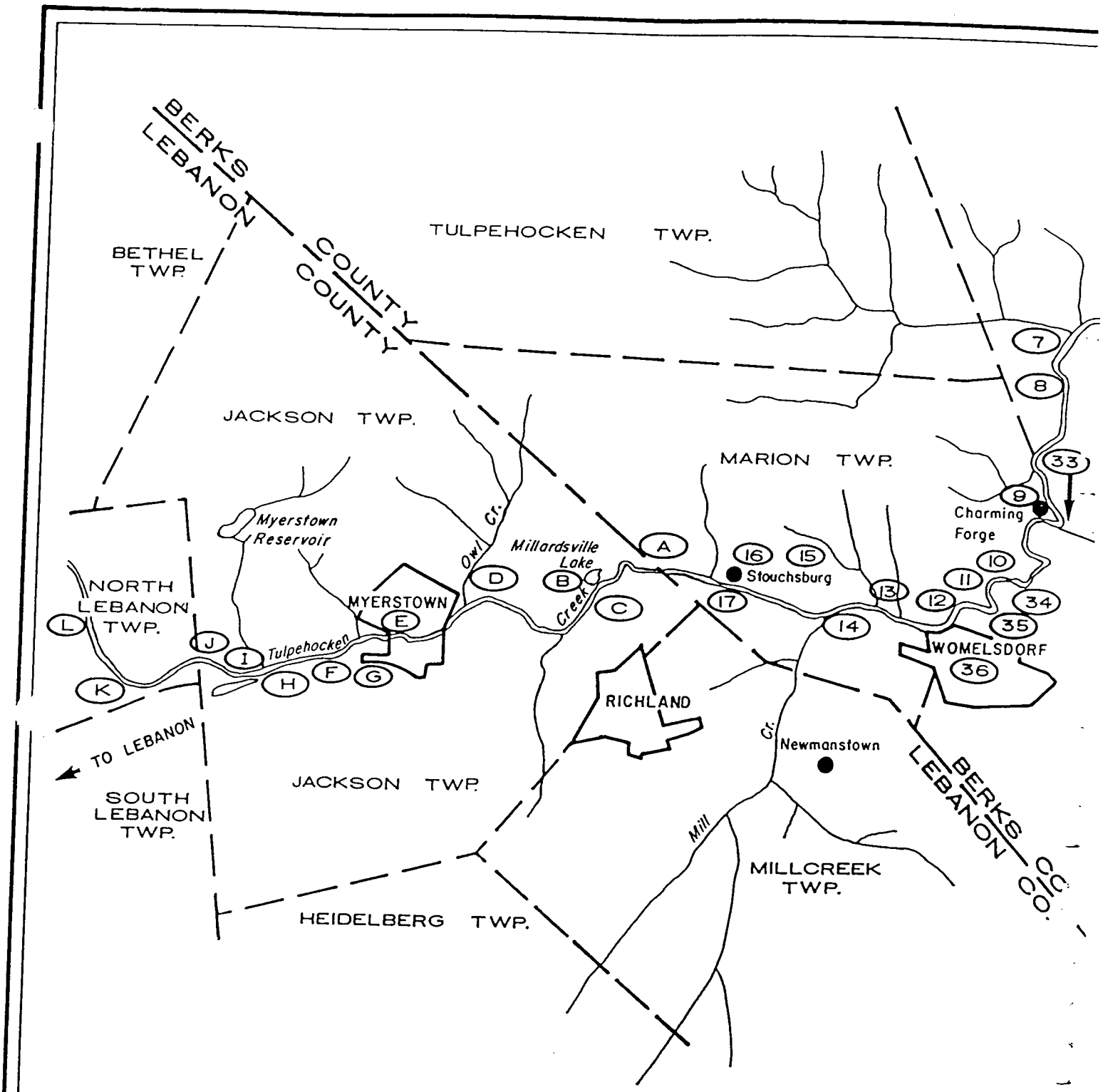
Point sources of pollution are also impacting portions of the Tulpehocken Creek watershed. Sewage treatment plant discharges enter the upper Tulpehocken Creek near Myerstown and the mid-Tulpehocken Creek near Womelsdorf. A 1980 study (Bronner, 1980) found distinctly increased levels of ammonia-nitrogen, total organic carbon, and fecal coliform bacteria downstream of the Myerstown discharge. Dilution and natural renovation reduced these impacts downstream. Biological effects of the discharge were localized. The Myerstown and Womelsdorf plants are currently operating within their discharge permits.

Mill Creek (Berks/Lebanon Counties) receives excessive discharges of BOD, phosphorus and suspended solids from the Fort Zeller Elementary School. These discharges are planned to be upgraded in the near future.

Northkill Creek receives effluent from the Bernville Sewage Treatment Plant. High levels of BOD and suspended solids are discharged at times, but the overall loads are low. The Heidelsburg Country Club discharges to the Northkill and the Tulpehocken High School discharges to the Little Northkill Creek. These discharges are relatively minor.

In Spring Creek, the Robesonia-Wernersville STP has created problems. High concentrations of bacteria, BOD, ammonia and suspended solids were documented (Boyer, 1988). Recently, these problems have been corrected.

Other point sources in the Tulpehocken Creek watershed include the Limestone Springs Trout Hatchery and several small

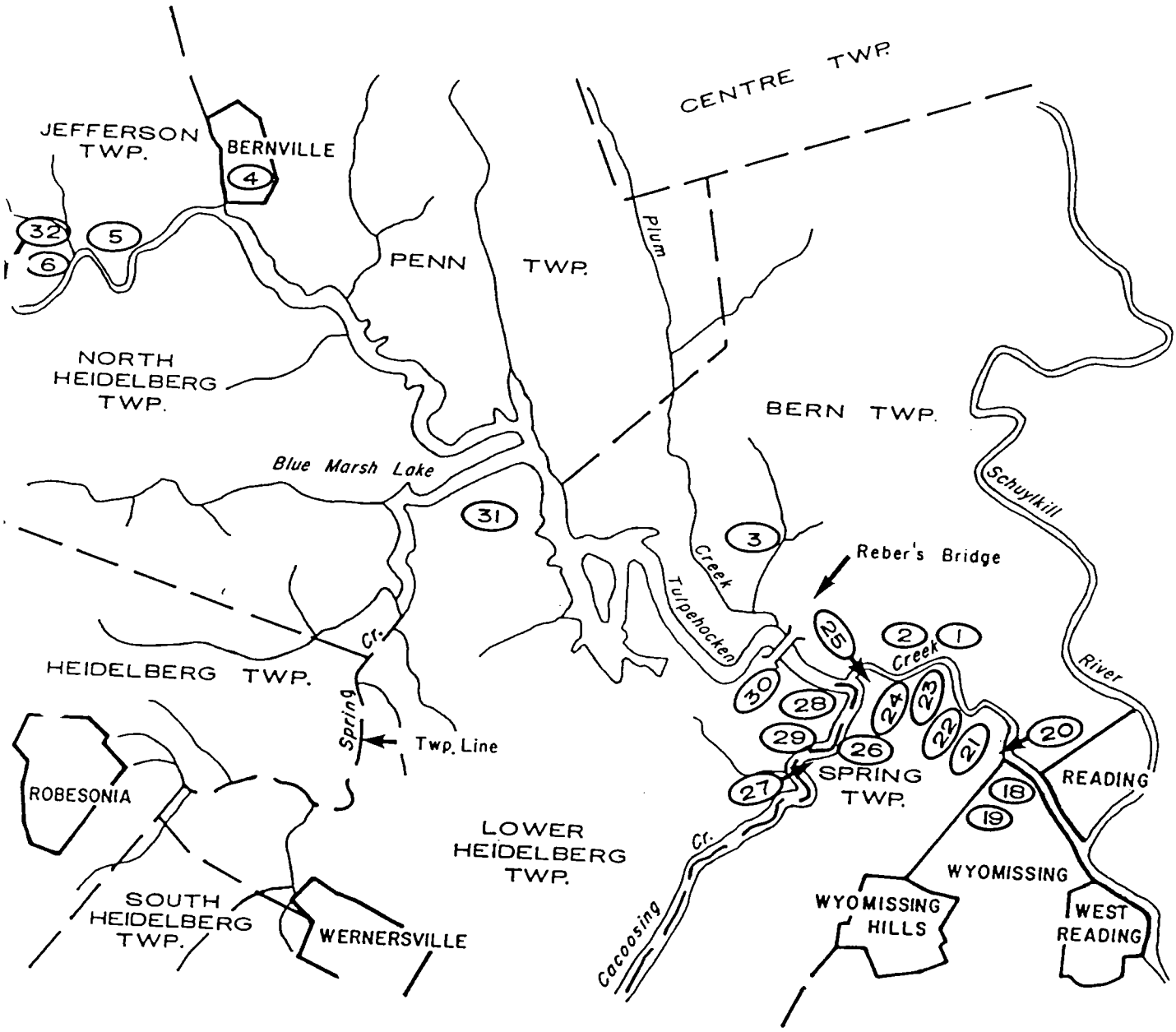


TULPEHOCKEN SC

N

SCALE IN MILES

1 0 1 2 3



NIC RIVER STUDY

HISTORICAL SITES TULPEHOCKEN CREEK AND SEGMENT OF CACOOSING CREEK

Map 5

LEGEND - MAP 6

Historic Sites in Myerstown Borough

LEGEND

1. Georgian/Germanic Herclerode-Meier house circa 1750 now being restored. Home of Isaac Meier, founder of Myerstown. On National Register.

2. Evangelical Theological Seminary. Founded in 1865.

3. Early (circa 1860) log store, now a grocery and news store.

4. Formerly a log house; cabinet maker, business started in 1834; oldest family establishment in borough.

5. 117 W. Main - home and business of Shulze, Governor of Pennsylvania in 1820's.

6. Old log house. Ney was a weaver of coverlets, starting in 1830.

7. Founded in 1867, with building dated 1875.

8. Known as Bowman building dated 1849, unique decorative iron grill on third floor.

9. Built in early 1850's and congregation organized in 1860.

10. First burial ground in Myerstown on site of First Lutheran Church founded 1813.

11. Typical of a number of bridges of limestone construction crossing Tulpehocken throughout its length.

12. Earlier house built circa 1760, present house bears a 1799 datestone. Family outstanding in politics, military, etc. since the Revolutionary War.

13. Grandson of early (1730) settler built this house. Unique architectural features.

14. 414 W. Main Avenue - a log tavern in the 1700's; Isaac Meier shot here in 1770.

15. A hotel before 1860.

16. A store before 1860; now a grocery store.

17. 102 S. Railroad Street - originally a log house. Used as residence by grandsons of Isaac Meier.

18. Built circa 1895; later became part of Albright College before it moved to Reading in 1929 (see (2) above). Now a retirement home.

19. Early example of French Mansard style architecture. Now a retirement home.

20. Built by grandson of Meier in the mid-1800's at the Union Canal. Sold in 1952.

21. Limestone house constructed before the Revolutionary War.

22. A grist mill, a powder mill, a gypsum mill and, at one time, a plaster mill. Earliest date for the

grist mill is 1742.

23. A picturesque bridge crossing.

24. Handsome limestone house.

25. Exact age unknown, on old road to Meier plantation before Reading-Harrisburg Turnpike constructed in 1850's.

26. A second generation house of Noecker could have been built in mid-1700's.

Stone Arch "S" Bridge

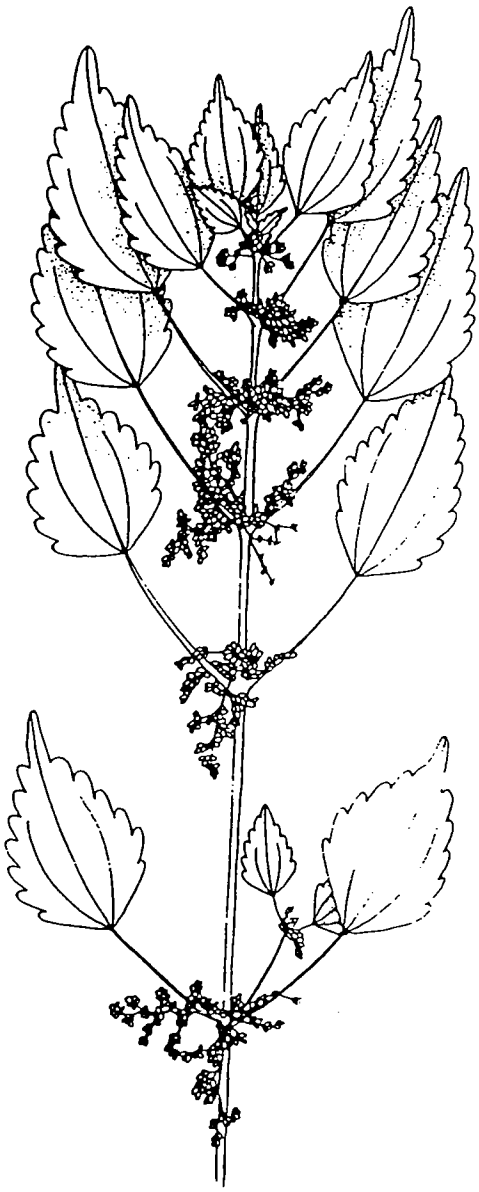
TULPEHOCKEN SCENIC RIVER STUDY

HISTORICAL SITES IN MYERSTOWN BOROUGH

ORIGINAL COURTESY OF MYERSTOWN BICENTENNIAL HISTORICAL COMMITTEE

Map 6

Finally, of special note is Map 7 and its Legend showing details of the Union Canal and bridge crossings of the Canal in Berks County. The map and accompanying data were prepared by George Meiser IX, the county's leading historian, and published in his Echoes of Scholla. Also according to Mrs. Mohn, there were numerous locks in Lebanon County - eleven alone between the Tulpehocken Manor and the Tulpehocken Manor Church. These are shown on Map 8.



Clearweed

LEGEND 8

UNION CANAL LOCKS, LOCATIONS, AND LOCKTENDERS IN BERKS COUNTY, PENNA

...compiled by Geo. M. Meiser, IX

Lock Number	Location of Lock	Early Period	1845	1853-1854	1858	1866	1876
17	at mill nr Long's Church	Wm. Hoegner	Fred Gansel	Fred Gansel	Michael Walters	Samuel Hoover	Mrs. S. Hoover
18	at Royer/Buckholder Mill	David Deiffenbach	Jacob Jones	John Sweitzer	John Robbold	Philip Witman	?
19	Stouchsburg west of Tulp. St.	David Deiffenbach	Wm. Spangler	Wm. Spangler	Wm. Spangler	John Goldman	Wm. Cooper
20	Stouchsburg -- east end	David Deiffenbach	Jacob German	Jacob German	John Emore	John Emore	Jacob German
21	at bridge (Mill Cr. & Tulp. Cr.)	David Deiffenbach	Conrad Spatz	Conrad Spatz	Longinus Schwar	Longinus Schwar	Longinus Schwar
22	close to old Reed's Church (razed)	Christopher Reed	John Goldman	John Goldman	John Allen	John Peiffer	Issac Mounce
23	opposite Kurtz house on Canal Rd.	John Kurtz	John Fisher	Henry Fisher	Henry Fisher	Henry Fisher	Henry Fisher
24	Womelsdorf -- at Mill Road	Patrick McBride	Issac Seibert	Issac Seibert	Franklin Kintzer	Geo. Staley	Geo. Staley
25	at bridge on Route 419	Robert Orr	Jacob Zerby	Jacob Zerby	Cyrus Good	Cyrus Good	Wm. Keller
26	on Godfried Fidler homestead	Robert Orr	Wm. Price	Wm. Price	Wm. Price	Wm. Price	Jon. Werner
27	Charming Forge	Obed Miller	Samual Moyer*	Samuel Moyer	Sam Moyerq	Sam Moyer	Sam Moyer
28	Charming Forge	Obed Miller	Samual Moyer	Samual Moyer	Edward Moyer	Edward Moyer	Edward Moyer
29	on Green Acres Farm	Jacob Werner	Jacob Werner	Jacob Werner	Jacob Werner**	Jacob Werner	Wm. Root
30	just north of Krick's Mill (gone)	Wm. Reed	Peter Anderson	Peter Anderson	Peter Anderson	Peter Anderson	H. Lengle
31	at former Cross Keys Hotel	Leonard Zerby	Adam Shower	Issac Shower	Adam Lengle	Adam Lengle	Adam Lengle
32	east of Sunday/Zerby Mill	Jacob Berntz (sic)	Adam Lengle	Adam Lengle	John Zechman	John Zechman	John Zechman
33	(difficult to describe/locate)	Geo. Moyer	George Moyer	Widow Moyer	John Moyer	John Moyer	Cyrus Moyer
34	behind Christmas Village	Paul Wenrich	Geo. Fessler	Geo. Himmelberger	Benneville Koch	Benneville Koch	Benneville Koch
35	west of Christ Little Tulp. Ch.	John Groff	Wm. Clay	Wm. Clay	Wm. Clay	John Grumas	Richard Burns
36	Bernville (at South Bernville	Benj. Kerchner	Abram Anders	Jon. Bartram	Geo. Staley	Enoch Burkert	Benj. Lins
37	at Upper Stout Mill (gone)	Mathias Stout	Mathias Stout	John Stout	Francis Petrey	Wm. Howe	Reuben Koch
38	just each of Upper Stout Mill	Mathias Stout	Wm. Shell	Henry Koch	Henry Koch	Henry Koch	Nathan Fromm
39	just east of Lower Stout Mill (gone)	Geo. Godshall	Mich. Zechman	Daniel Zechman	Daniel Zechman	Daniel Zechman	Lewis Zeller
40	East of iron bridge on Church Rd.	Isaac Wayne	Lawr. Hettinger	Lawr. Hettinger	Lawr. Hettinger	Lawr. Hettinger	Charles Gessler
41	west of for. Pleasant Valley Hotel	Wm. Spayd	Paul Meise	David Moyer	Isaac Hendricks	Isaac Ruth	Michael Speeicher
42	north of Pleasant Valley R. Mill	Peter Hedrick	Wm. Spayd	Geo. Stricker	Wm. Schweir	Elias Zerby	Lewis Werner
43	Blue Marsh	Matthias Werner	Jacob How	Jon. Kiebach	Jon. Kiebach	Jon. Keibach	James Hettinger
44	at Reber home near Palisades Rd.	Lawr. Hettinger	Geo. Stricker	Jacob Moyer	Jacob Moyer	Gabriel Spatz	Gabriel Spatz
45	west of Berks County Prison	John Lark	Matt. Werner	Matt. Werner	Matt. Werner	Matt. Werner	John Yoh
46	southwest of Reber's Bridge	Daniel Billman	Elijah Fisher	Elijah Fisher	Elijah Fisher	Elijah Fisher	Jesse Fisher
47	off Van Reed Rd.	Edward Ball	Jacob Grubb	Wm. Adies	Samuel Werner	Nathan Bohn	Joseph Werner
4	t. Van Reed Mill & Red Bridge	Issac Graff	Jon. Keibach	Levi Kiebach	Jacob Breidegam	John Moyer	Wm. Bohn
4	t. Gring's Mill & Kulp's Mill	Philip Wearheim	Daniel Reihn	John Herbach	John Herbach	Daniel Kershner	Daniel Reedy
50	opposite Gring's Mill (in park)	Peter Fisher	Fred Kendal	Jacob Diprey	John Wanner	John Wanner	Wm. Moyer
51	below Gring's Mill	Abraham Kissinger	Jacob Kissinger	Jacob Kissinger	Abraham Moyer	Abraham Moyer	James Strunk
52	nr Bushong's Cov. Bridge (gone)	John Moyer	Jacob Yeager	Jacob Yeager	Benneville Grim	John Gerhart	Jos. Weisenfort
53	just north of Penn St. Bridge	Joseph Good	Daniel Leinbach	***	John Power	Charles Frick	Nich. Thompson
54	south of Lancaster Ave. Bridge				Allen Rupp	David Miller	David Miller
54	(before 1850 flood was at "Mifflin's Arm" nr Route 724 & Valley Stream Rd at tip of Fritz's Island)	Jeremiah O'Connor	Thomas Swartz				

* Appears as *Meyer* and *Meyers* in some pay records.

** Appears as *Wanner* and *Wenner* in some pay records.

*** The 1850 flood did much damage to the lower section of the canal. In the early days of the Union Canal's existence, boats were locked out into the Schuylkill above the Penn St. Bridge. They crossed over to the Reading side and entered the Schuylkill Canal at the Guard Lock at the foot of Franklin Street. Lotz's Dam made the crossing at this point possible. Riffles, especially evident during periods of low water, mark the site of what remains of the dam breast -- opposite the Metropolitan Edison plant. See site "E" on page 44.

THIRTY-SEVEN BRIDGES CROSSING THE UNION CANAL IN BERKS COUNTY

Number 1 begins just west of Stouchburg in marion Township and #37 is the Lancaster Ave. Bridge crossing the Schuylkill River just north of the outlet Lock #54.

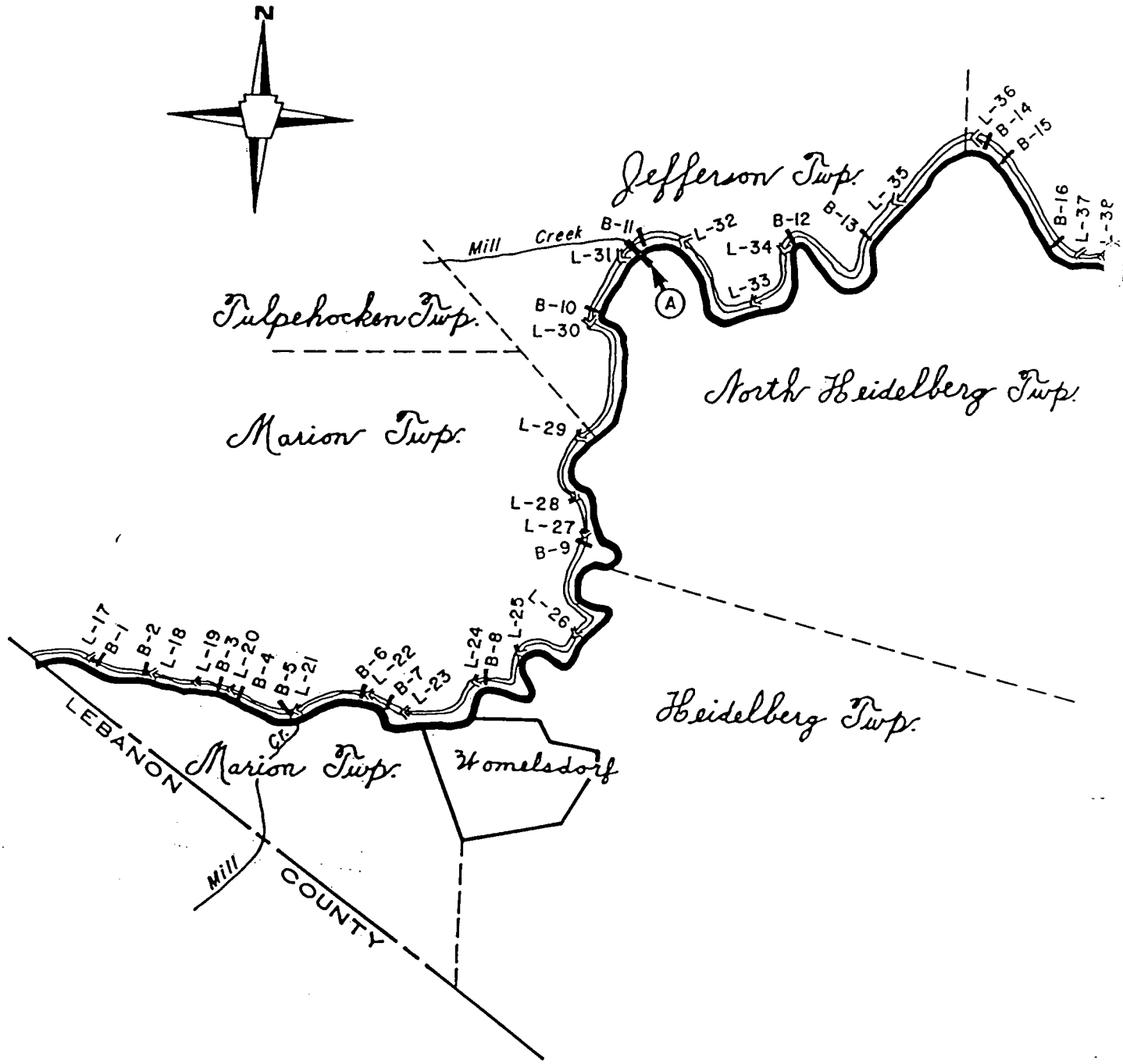
This listing, prepared to accompany the map shown above, was compiled in the latter days of the canal's existence. Spellings on this page and the one preceding are given as they appear in the records -- even though some are obivously incorrect

#

1 - Hershbert's Mill
2 - Royer's Mill
3 - Scharf's
4 - Graf's Farm
5 - on Turnpike Road
6 leid's Farm
7 - Kurtz's Farm
8 - at Lock #24
9 - Taylor's Forge (Road laid out 1789
10 - Krick's Mill (Road laid out 1818; Vol. 1; page 515)
11 - Richard's Mill (Road laid out 1787; Vol.; page 173)
12 - near Paul Wenrich's (Road laid out 1828; Vole. 3; page 61)
13 - near Christ Church (Road laid out 1847; Vol. 4; page 32)
14 - E. Staudt's
15 -
16 - Jared Staudt's Mill
17 - John Conrad's (Road laid out 1829; Vol. 3; page 95)
18 - near Deppen's (Road laid out 1826; Vol. 3; page 180)
19 - near Deppen's (Road laid out 1851; Vol. 4; page 557)
20 - near Deppen's (Road laid out 1846; Vol. 4; page 293)
21 - near Deppen's (Road laid out 1853; Vol. 3; page 43
22 - near J. D. Hiester's Mill (Road laid out 1790; Vol. 1; page 190)
23 - on the State Road (Road laid out 1821; Vol.
24 - below Lock #43 (Road laid out 1848; Vol. 4; page 570)
25 - at Lock #44 (Road laid out 1835; Vol. 3; page 528)
26 - below Lock #44 (road laid out 1835; Vol. 3; page 528)
27 - at Joseph Reber's Mill (Road laid out 1797; Vol. 1; page 287)
28 - Van Reed's (Road laid out 1857; Vol. 5; page 208)
29 -
30 - Winter's Mill (Road laid out 1796; Vol. 1; page 254)
31 -
32 - below Lock #50 (Road laid out 1827; Vol. 3; page 14)
33 - Guard Lock (Road laid out 1813; Vol. 1; page 352)
34 - Mouth of Tulpehocken Creek - County Bridge (Bushong's)
35 - on Turnpike Road at Reading - County Bridge (Penn Street)
36 - at Wyomissing Creek

Courtesy: Lebanon County Historical Society

Poling on the Canal



TULPEHOCKEN SC

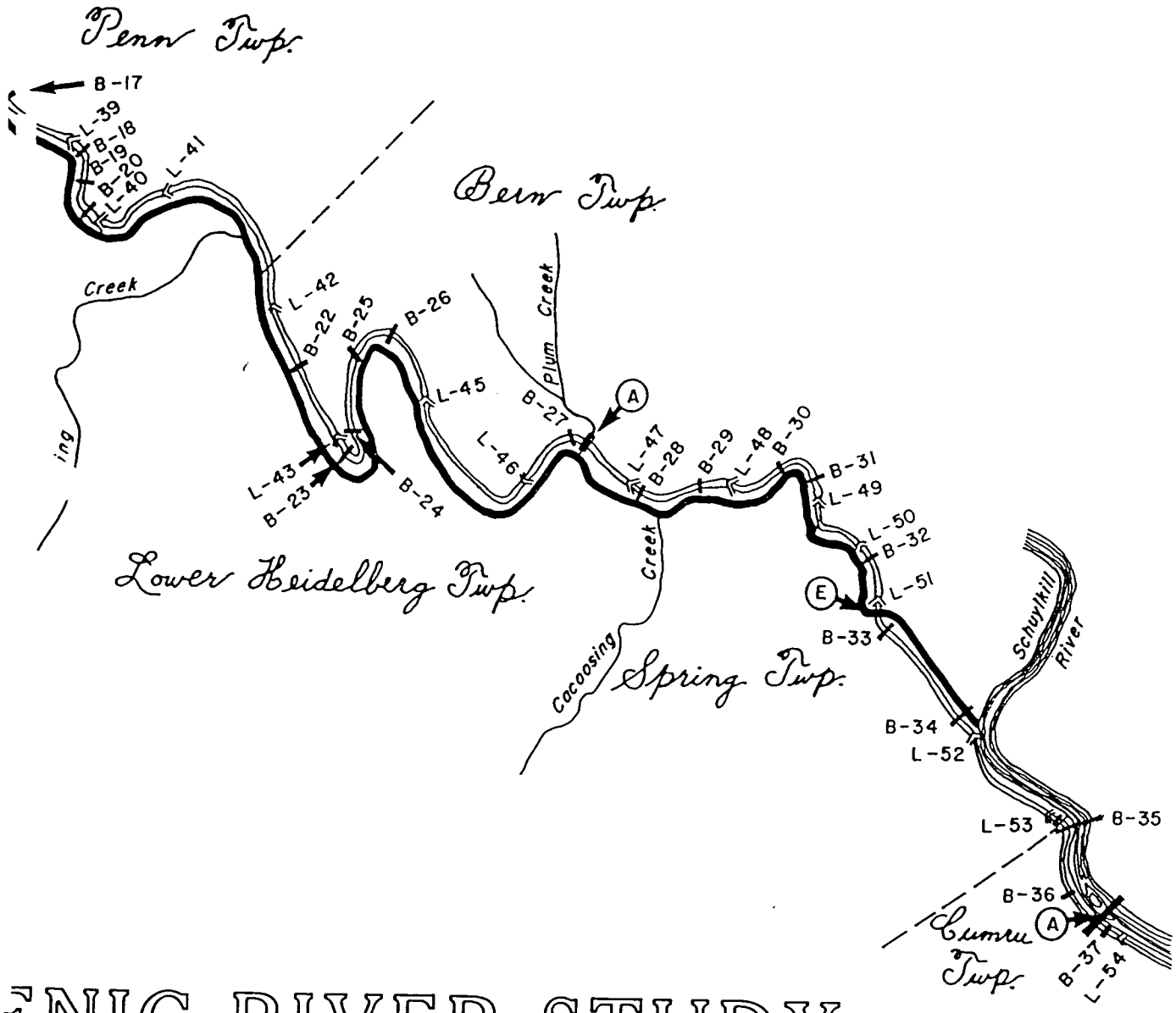
LEGEND

B - CANAL BRIDGE

L - CANAL LOCK

Ⓐ - AQUEDUCT

Ⓔ - AQUEDUCT (PRESENT BEFORE 1850)

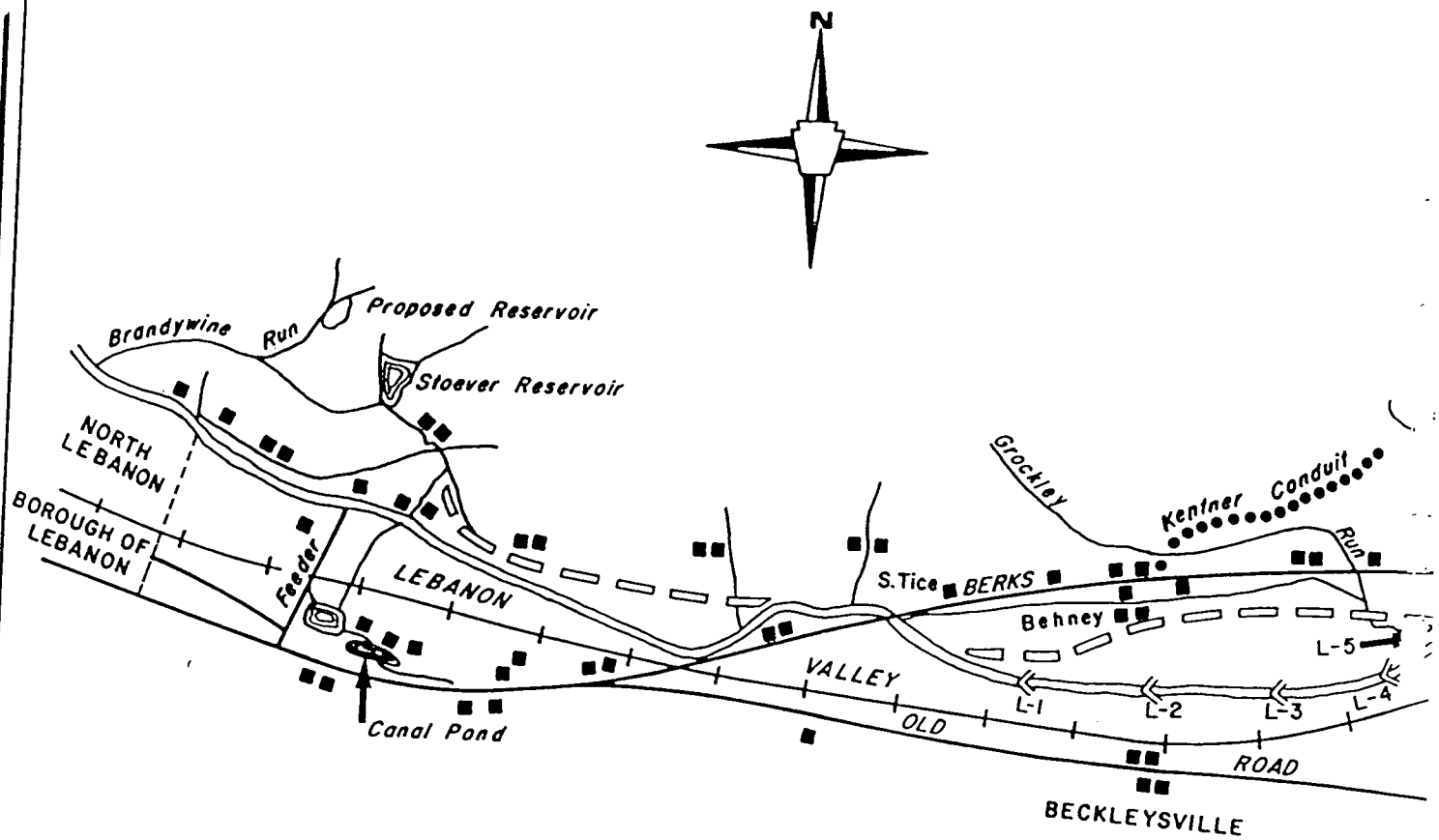


ENIC RIVER STUDY

UNION CANAL LOCKS AND LOCATIONS IN BERKS COUNTY

SOURCE: GEORGE M. MEISER, IV FROM DATA COMPILED BY D. S. ZACHARIAS

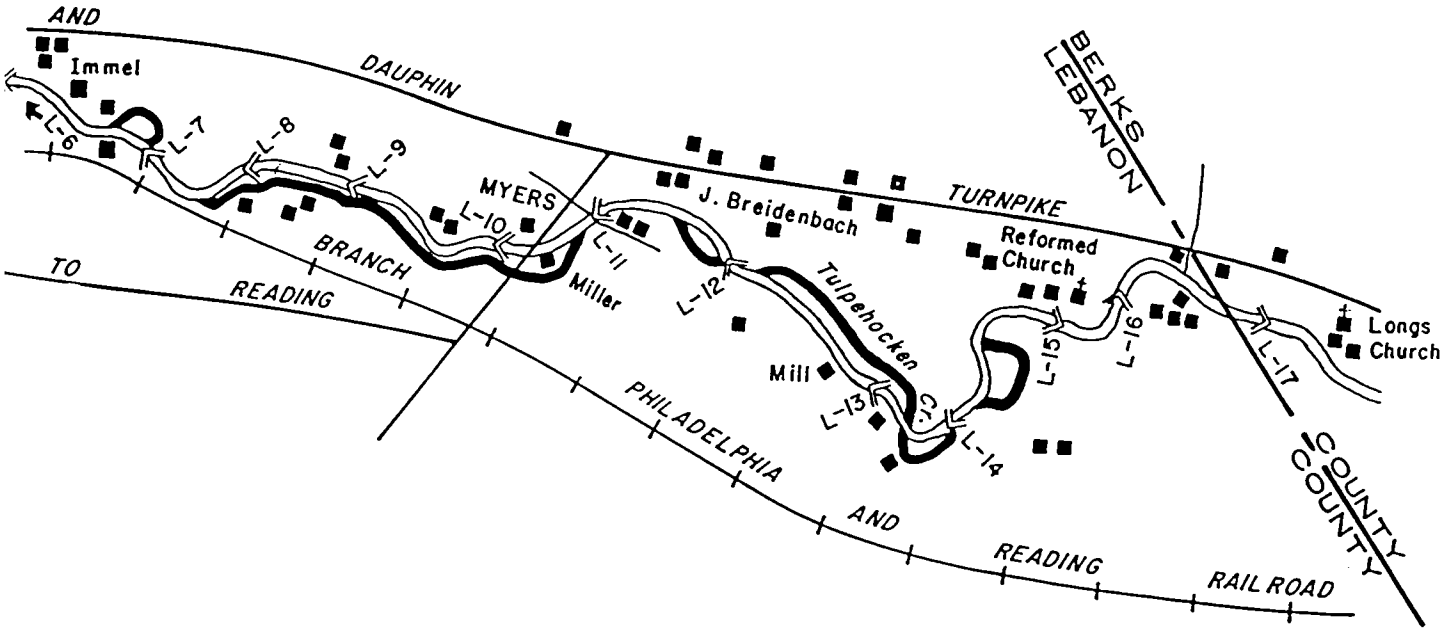
Map 7



TULPEHOCKEN SC

LEGEND

- CANAL
- ABANDONED CANAL
- CANAL LOCK
- FARMS / RESIDENCES
- CHURCHES

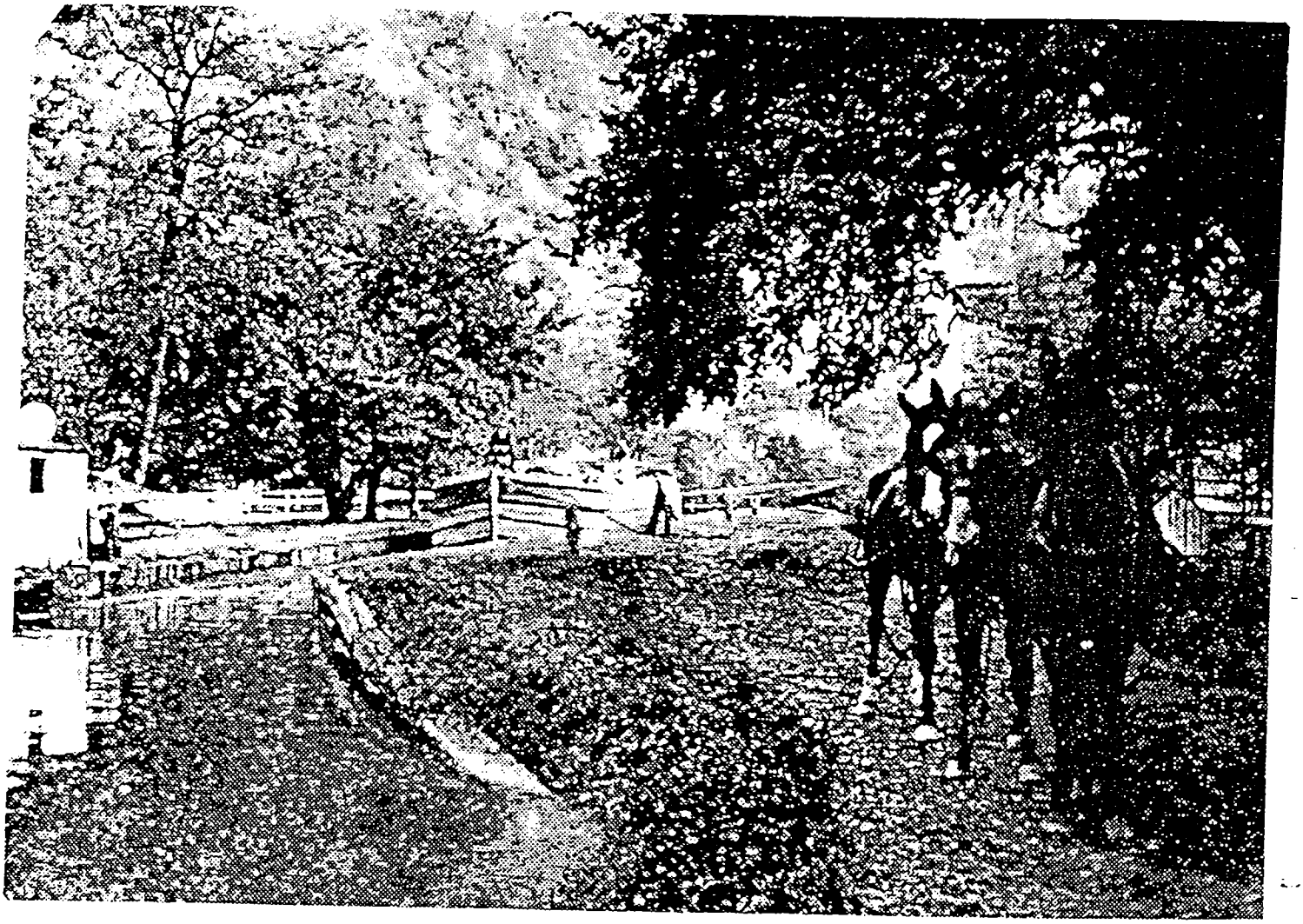


ENIC RIVER STUDY

LOCKS AND PHYSICAL FEATURES ON OR NEAR THE UNION CANAL IN LEBANON COUNTY

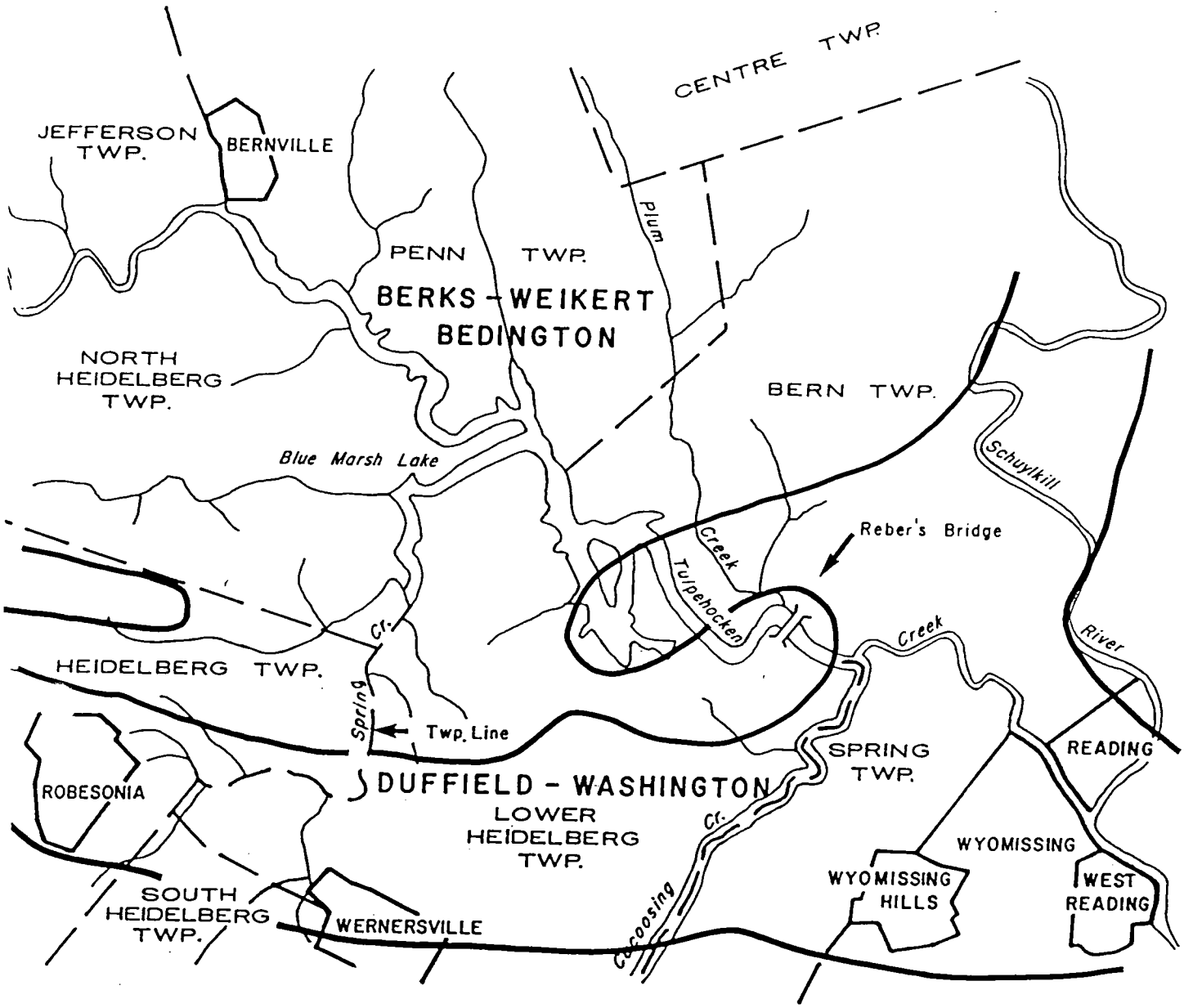
SOURCE DATA SUPPLIED BY LEBANON COUNTY HISTORICAL SOCIETY

Map 8



Courtesy: Lebanon County Historical Society

Mules pulling a boat
through a Union Canal Lock



NIC RIVER STUDY

GENERALIZED SOILS

Map 11

significant areas of spring flooding are the meadows in Marion Township and several low spots approaching Charming Forge. The Blue Marsh Dam helps prevent downstream flooding even though substantial flows enter the Creek from the Northkill, Spring and Cacoosing Creeks.

MINERAL RESOURCES

While minerals are not being mined or processed within the study corridor, the presence of limestone is of major importance throughout areas near the corridor. In Berks County, excavation of the Epler formation at the Brenneman quarry near the Cacoosing Creek continues. Shale or brick is produced by the Glen Gery Company from a quarry near the State Hill. Construction sand was produced in the late 19th century at the Gring quarry, from the Hardystone formation. Iron ores were formerly mined in the Berks County area during the 18th and 19th century, with magnetite iron produced as recently as 1905 and 1906 in the Wheatfield mine east of Fritztown. Presently, the predominant ore (limonite) is not considered very desirable in modern steel-making practice.

Geologic studies indicate that the area between the quarry pond at Millardsville and Annville which follows the

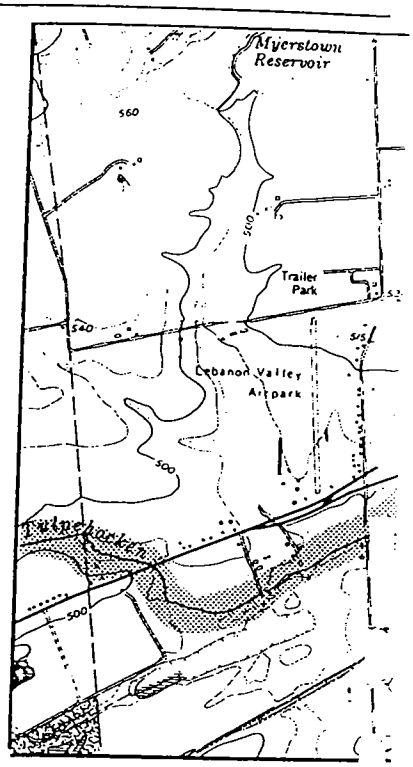
Cacoosing Creek

Tulpehocken merits further investigation, since limestone formations reach a maximum thickness of 250 feet in the Lebanon Valley. The studies also indicate that there are two mica prospects on the south side of South Mountain; as mica had been mined early in the 20th Century in two small mines there.

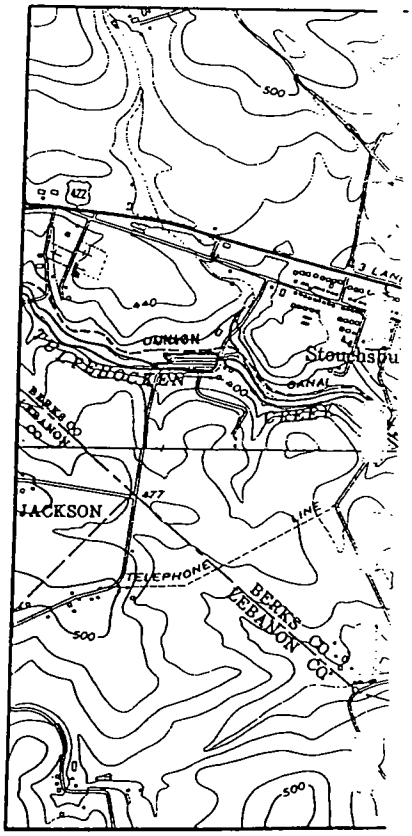
VEGETATION RESOURCES

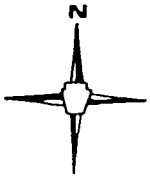
The study area and the creek corridor are characterized by farming up to the creek banks and farm woodlots of third and fourth growth deciduous bottomlands. According to the Fish and Wildlife Service National Wetlands Inventory, there are wetlands within the Blue Marsh recreation area and along the south bank of the Tulpehocken southwest of Bernville. These wetlands, together with the rural nature of the study area and corridor, combine to produce a diversity of natural communities that support wildlife and contribute to the aesthetic quality of the area. Information provided by the Pennsylvania Natural Diversity Inventory office, DER's Bureau of Forestry in Harrisburg indicates the corridor contains some species of special concern: the lesser clearweed (a small herbacious plant found near streams) and the white water crowfoot (of the buttercup family).

TULPEHOCKEN CREEK
LEBANON COUNTY

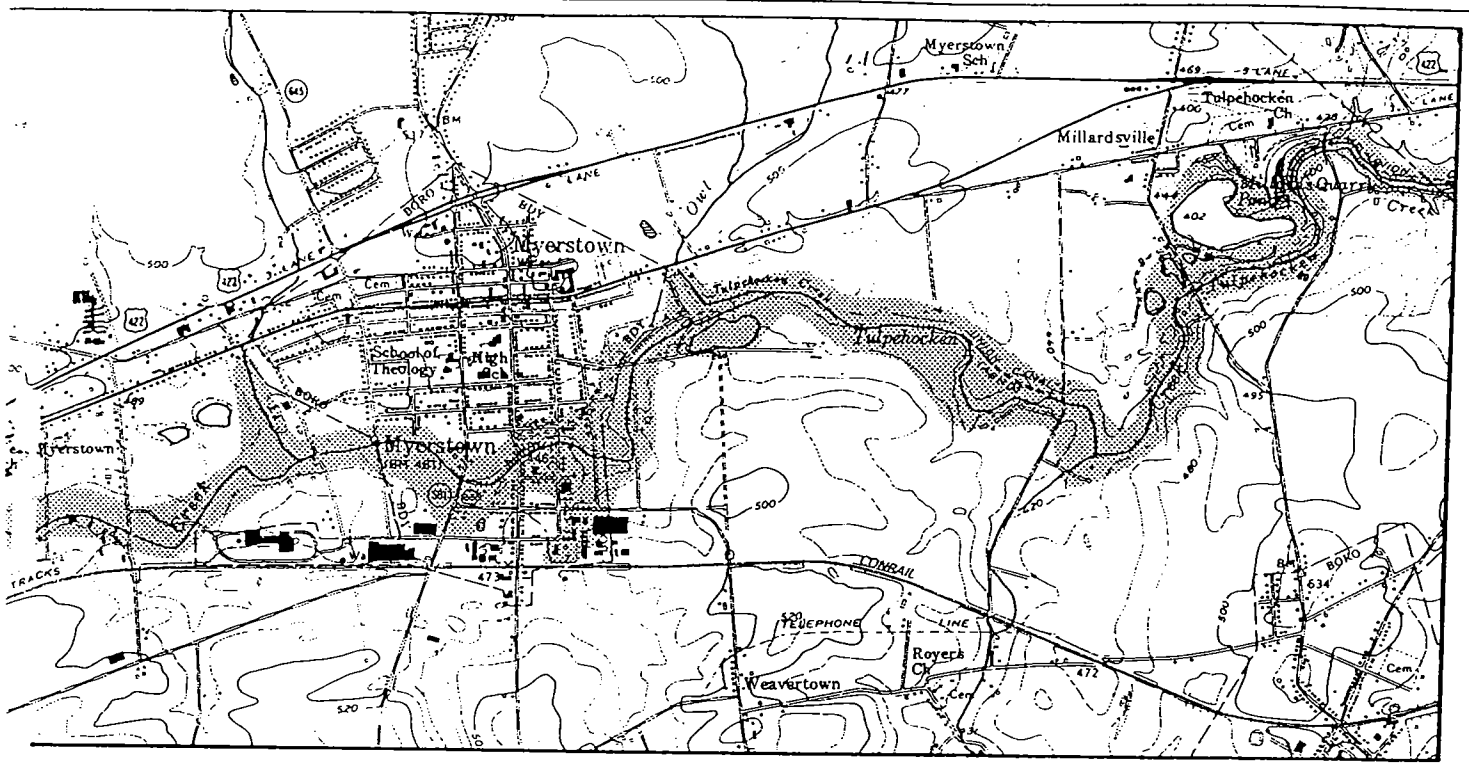


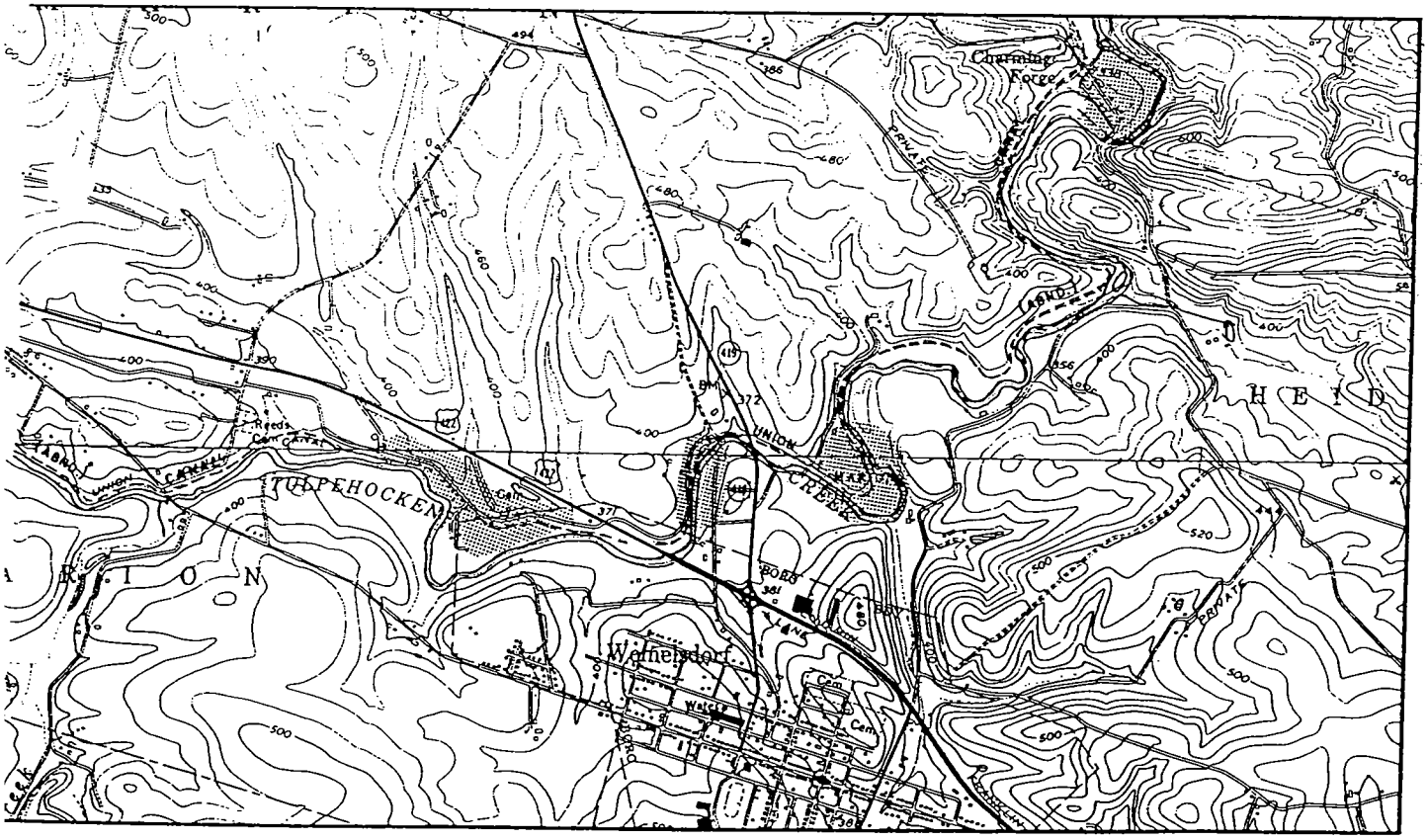
TULPEHOCKEN CREEK
BERKS COUNTY





TULPEHOCKEN SC





NIC RIVER STUDY

FLOOD PRONE AREAS

Map 12

III. Historical Summary of the Tulpehocken Creek Study Area

THE FIRST INHABITANTS

To the early Leni-Lenape Indians, the Tulpehocken was a region of approximately 270 square miles. It included the area just beyond the source of the Tulpehocken Creek in present day Lebanon County, and encompassed an area extending to the Cacoosing Creek near Reading in present day Berks County. These Indians were not migratory and grouped together when the environment provided ample food. Evidently, the Tulpehocken region had sufficient sustenance. Reports indicate there was a large Indian village near the confluence of the Mill Creek and Tulpehocken, west of Womelsdorf. In addition, the Allegheny Path from the Delaware to the Susquehanna at Harris Farm bisected the Tulpehocken (or Shamokin Trail) region near present day Womelsdorf.

One of the earliest references to the Tulpehocken region can be found in the Provincial Records of Pennsylvania. These records reveal that a French and Indian trader named Nicole was captured by a man named Martin, tied to a horse and delivered to Philadelphia by way of Peixtan (present Paxtang, a suburb of Harrisburg), TURPYHOCKEN and Manatawny. Although, the records do not specifically define the location of the Turpyhocken, it was an Indian town named by the Indians as "Land of Turtles".

THE COLONISTS ARRIVE

In the early 18th century, many Germans arrived as immigrants at Governor's Island in New York City and settled on Livingston Manor. By 1712 a number of these individuals reached the Schoharie Valley, about 160 miles north of New York City and 40 miles west of Albany. After farming for nearly a decade the settlers found they did not have title to their lands; a number left the valley in 1723 to search for lands which they could claim and legally hold to establish family farms or trades. Travelling down the Susquehanna River, they arrived safely at the mouth of Swatara Creek just south of present day Harrisburg. They followed the Swatara eastward to the source of a stream called the Tulpehocken. This group, and subsequent settlers from the Schoharie area, dispersed

along the banks of this waterway staking out claims wherever possible among the native Indians.

The settlers, joined by others, increased in numbers and caused the area to grow and prosper. Due to pressures from settlers and the influence of Conrad Weiser, who had settled in the area, officials of Lancaster County recognized the need for local government and in 1734 established Heidelberg Township. Records from 1749 indicate that some 12,000 immigrants had set ashore in Philadelphia and many had headed for the Tulpehocken area. It is surmised that early settlers spoke of the richness of its soils and helped establish its popularity.(1)

The colonists and Indians lived together for some time until events elsewhere brought on the French and Indian War in the period 1754 to 1763. Although there was never fighting on a major scale within the Tulpehocken region, there were a number of atrocities committed on local families by Indian raids. Because of threats to the settlers, six forts were built in or near the region to protect the settlers. In addition, a number of safe homes served as forts due to the number and suddeness of Indian attacks. One of these homes, Fort Zellers, is still standing near the Mill Creek at Newmanstown.

EARLY INDUSTRY AND COMMERCE

The Tulpehocken, Mill and Cacoosing Creeks were very important to the early pioneers as a source of power. Numerous mills--grist, saw, paper and fulling--sprang up along the banks of the Creeks. The first major industry was established in 1749 when the Tulpehocken forge was erected to process pig iron into wrought iron. Later, "Baron" Steigel purchased the forge and renamed it Charming Forge. Sometime later, furnaces to produce pig iron and other forges were built in the South Mountains on tributaries of the Tulpehocken.

Settlement and commerce were greatly enhanced when the old Tulpehocken Road (now US Route 422) was laid out in 1727. Running between Reading and Womelsdorf, the old road was replaced in 1817 with the Berks and Dauphin Turnpike and trade along this road flourished.

The most significant transportation development in the region was the construction and operation of the Union Canal. Proposed by George Washington as part of a larger network of canals and completed at its full length by 1828, it linked the Susquehanna River south of Harrisburg with the Schuylkill River at Reading. The Schuylkill Canal then provided the link necessary for transportation and trade from Reading to Philadelphia. For some 77 miles, the Union Canal followed the Swatara Creek to the vicinity of Lebanon and then on to Reading along the Tulpehocken. The canal boats carried lumber, coal, flour, whiskey and other merchandise from manufacturer to distributor and resulted in the growth of numerous businesses and trading centers (e.g. Myerstown, Womelsdorf, and Bernville) along its length. The canal's original narrow width restricted the size of the boats it could accommodate, and an expansion of the canal was completed in 1854. However, the additional tonnage and tolls collected from this expansion were insufficient to cover construction costs. Despite the help of lotteries and other subsidies, competition from the railroads which transported goods from Harrisburg, Reading and Philadelphia

(1) See Appendix 1 for a detailed account of early agricultural practices in the Tulpehocken/ Mill Creek area.

caused the canal to stop operations in 1884. The chief competition causing the demise of the canal was the Lebanon Valley Railroad, incorporated in 1836, and opened between Harrisburg, Lebanon and Reading in 1858.

THE 1900'S

The Tulpehocken region has been the result of steady and compatible growth rather than intensive development. A rural atmosphere of the sparsely settled communities in Berks and Lebanon Counties can still be found along the banks of the Tulpehocken Creek. Rolling farmlands, dense woodlands and picturesque hamlets and villages are familiar sights. Of most importance to the area has been the development of the Tulpehocken Creek in the 1960's and 1970's into a recreational center. The U.S. Army Corps of Engineers constructed the Blue Marsh Dam and Recreation Area. Downstream the Berks County Commissioners established the Tulpehocken Creek Valley Park. These facilities, while changing the character of the stream, provide flood protection, water supply and active and passive recreational facilities for thousands of county and regional residents.

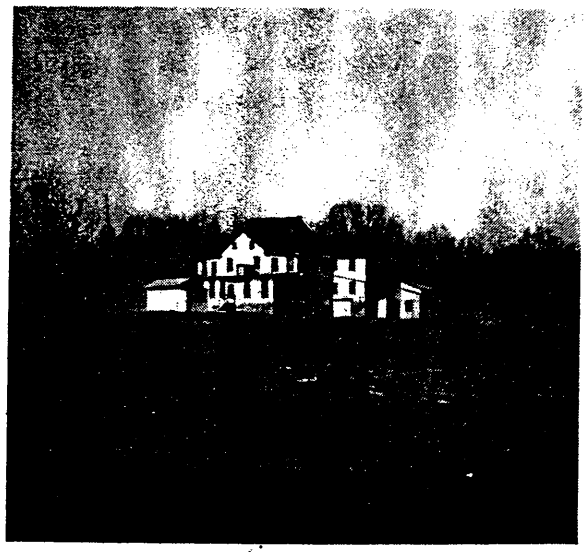
HERITAGE

Almost 275 years have passed since the first European settlers arrived in the Tulpehocken region. They made substantial contributions to the growth of the colonies and in so doing, left their legacy providing insight to the events and lifestyle that shaped the Tulpehocken region environment. A considerable number of buildings constructed during the settlement era are well preserved and remain as testimony to the historical value of the area.

There have been numerous surveys and studies of the area and these have been arranged in this study as follows:

Map 6 and its Legend outline the historical importance and location of buildings and sites along or near the Tulpehocken and a portion of the Cacoosing Creeks. The source of almost all of this information is surveys conducted in 1983-85 by the Berks County Conservancy under contracts with the Pennsylvania Historical and Museum Commission. These surveys were responsible for federal designation of the borough of Womelsdorf, the village of Stouchsburg and the Tulpehocken from near Bernville to the Lebanon County line as National Register Historic Districts.

Map 7 and its Legend also list similar information for the Tulpehocken region in Lebanon County. The Conservancy is indebted to Mrs. Viola Mohn, of Myerstown, for her expertise and help in identifying sites and making available her extensive library.



Gruber Wagon Works
- Heritage Center

LEGEND - MAP 5

Historic Sites Along the Tulpehocken and Cacoosing Creeks

BERKS COUNTY

Bern Township

1. Berks County Heritage Center - contains (a) the Gruber Wagon Works, built circa 1882, a National Historic Landmark, one of the most complete surviving examples of 19th century rural manufacturing; (b) C. Howard Hiester Canal Center, a converted barn housing the most extensive private canal collection in existence today; (c) Melcher Grist Mill, built circa 1888, rare and complete example of a water-powered farm mill; (d) Wertz's (Red) Covered Bridge, built circa 1867, on National Register as longest single-span covered bridge (204 feet) existing in Pennsylvania; (e) a park office/stone farmhouse built circa 1780; (f) the Deppen Cemetery - early Catholic burial ground, relocated from Mt. Pleasant area. Also nearby is Union Canal Lock #47E - restored lift lock with miter gates.

2. Union Canal Lock House - stuccoed German stone home built circa 1825, site of Lock 48.

3. Hiester Mansion - Federal style brick house, built circa 1815, home of a Governor of Pennsylvania.

Bernville Borough

4. A potential National Register Historic District.

Jefferson Township

5. Christ Little Tulpehocken Church - organized in 1729. Log church built circa 1730. Present Union Church 1809 with Old and New cemeteries.

6. Site of Lock 34. Stone house may have been Lock Tenders residence. Now site of "Christmas Village" - a Tourist Attraction.

7. Former Cross Keys Tavern - an inn during Canal era; summer kitchen, barn, outbuildings. Nearby is John Zerbe house, frame barn with root cellar in hillside. Dating from 1800-1820.

8. Original Lorentz Zerbe Homestead and site of Zerbe/Krick Gristmill - house constructed of materials from Christ Little Tulpehocken Church in 1806.

Marion Township

9. Charming Forge Mansion and Forge complex - 13 buildings used as homes or summer cottages. Dam, forge site, mill race cut by Hessians, canal locks nearby.

10. Former lock house along Union Canal at Lock 24 - three arch bridge over Tulpehocken Creek. Formerly on "Tulpehocken Path", the Sunbury Road, now relocated as Route 419. Lock stones used in bridge ramp when canal abandoned. Also a stone house and barn associated with underground railroad.

11. Philip Braun Homestead - settlement 1723. Log/stone home, farm buildings, cemetery.

12. 1753 Germanic stone home, barn, cemetery - Lock 23 across road.

13. Reed cemetery - 1727. Site of first church in western Berks County. Three churches built here.

14. "S" Bridge - stone arch near confluence of Mill Creek. Near site of early Reed Mill c. 1730.

15. Stouchsburg Historic District - nineteenth century canal - era village and cigar manufacturing center.

16. Frederick Reed Homestead, log cabin - 1766 Germanic stone house, stone barn. Canal bed in meadow.

17. Christ Lutheran Church - founded 1743. Rev. Henry Melchior Muhlenberg married Conrad Weiser's daughter here. The parsonage was the birthplace of Governor John A. Shulze, (1824-29).

Wyomissing Borough

18. Tulpehocken Farms - 1840-1860 Vernacular stone farmhouse.

19. Kissinger Union Church and Cemetery - 1852, potential National Register Historic District.

Spring Township

20. Vernacular stone farmhouse, built circa 1831 by W. M. Gring - now offices of Berks County Park and Recreation Department. Stone gristmill built c. 1811 by David Gring.

21. Vernacular stone farmhouse built circa 1803 - now owned by PA State University.

22. Vernacular stone farmhouse built circa 1803 - used as a residence.

23. Vernacular stone farmhouse built circa 1802 - used as a farmstead.

24. Vernacular stone farmhouse built circa 1820 by Henry Van Reed - used as a residence.

25. Vernacular farmhouse built circa 1773 by John Van Reed - used as a farmstead.

26. Vernacular farmhouse built circa 1800 - used as a residence.

27. Stone mill built between 1780-1820 - used as a residence.

Lower Heidelberg Township

28. Mansion House of Joshua Van Reed, owner of Van Reed Mill - intact Federal red brick farmhouse built circa 1834.

29. Stone farmhouse built circa 1853 - an active farm.

30. Reber Home - 1804 Georgian featured stone home.

31. Old Dry Road Farm - a farm complex of original log buildings and several moved from Blue Marsh Dam. Characteristic of an early Pa. Dutch farmstead.

North Heidelberg Township

32. Stone gristmill - Zerbe/Sunday. Operated by Lutz until 1957. Machinery intact, dam and race.

Brick house with addition, 1850.

33. Millers House, at Charming Forge - millers house nearby.

Heidleberg Township

34. Deppen Family Homestead 1780-1800 - early settlement, log house, stone barn, and former burial ground.

35. Braun gristmill - 1819 Federal style brick house, possibly inn along Sunbury Road. Mill rebuilt circa 1900 by Wagner and Emerick.

Womelsdorf Borough

36. The Borough is a National Register Historic District - architecture depicts development from 18th century log and stone houses to high style Victorian buildings.

LEBANON COUNTY

Jackson Township

A. Trinity Tulpehocken United Church of Christ, Parsonage and old cemetery - on old Route 422. First Reformed Church in North America; original church built before 1746.

B. In Millardsville, the Millardsville Tavern (now Danish Inn) - the lower story dates to early 1700's; upper part built around the Civil War.

C. The John Immell House - on the south bank of the Tulpehocken.

D. Breitenbach Complex - log barn, log house and first brick house in the area; a son of builder formed the first medical society in the United States. Only real fort in Myerstown area during French and Indian War (other limestone houses were used as forts when needed).

E. Rambler House - built circa 1741. Rambler was an early Whig politician.

F. The Immel House - datestone 1759. A son of Immel was a captain in the Revolutionary War, and his daughter married J. A. Shulze, an early Governor of Pennsylvania.

G. Chris Spengler House - built circa 1838. A lovely Georgian interior.

H. Christopher Lei House - one of only two known of early Germanic houses straddling arches. Part of Tulpehocken Manor Complex. Nearby is the Michael and Eva Lei house, a limestone manor house built circa 1769, which is on the National Register. Also in the complex is the Michael and George Spengler houses. The Michael Spengler house has the other rounded arch.

North Lebanon Township

I. Theiss Stone Cabin - 1744 datestone. Nearby is John Tise house, datestone 1796. Excellent example of farmstead with well-preserved limestone buildings.

J. Richard Boeshore Farmstead - Georgian farmhouse and large bank barn of limestone construction, c. 1800.

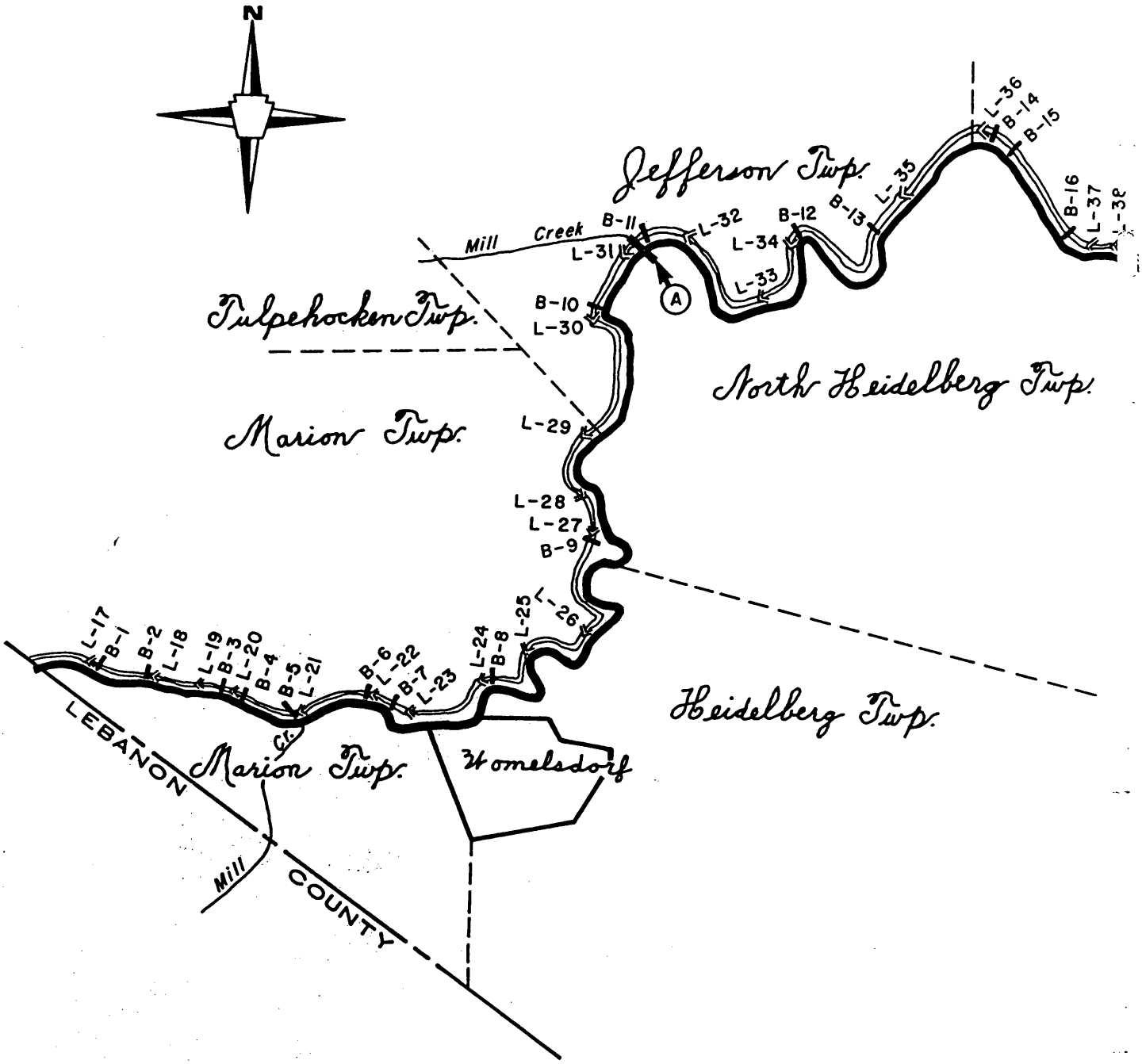
K. Schaeffer Farmstead - Brick

farmhouse and summer kitchen, dated 1861. Stone bank barn and family burial ground on property.

L.. (Early Schaeffer Homestead?) - Stone farmhouse and springhouse possibly dating from the late 18th century.

The borough of Myerstown in Lebanon County contains numerous historic buildings, some of which are located near the Tulpehocken as it winds its way thru the country-side. Map 6 and its Legend shows the Myerstown sites in some detail. This material is derived from a booklet prepared and distributed in 1976 by the Myerstown Bicentennial Historical Committee.

Charming Forge



TULPEHOCKEN SC

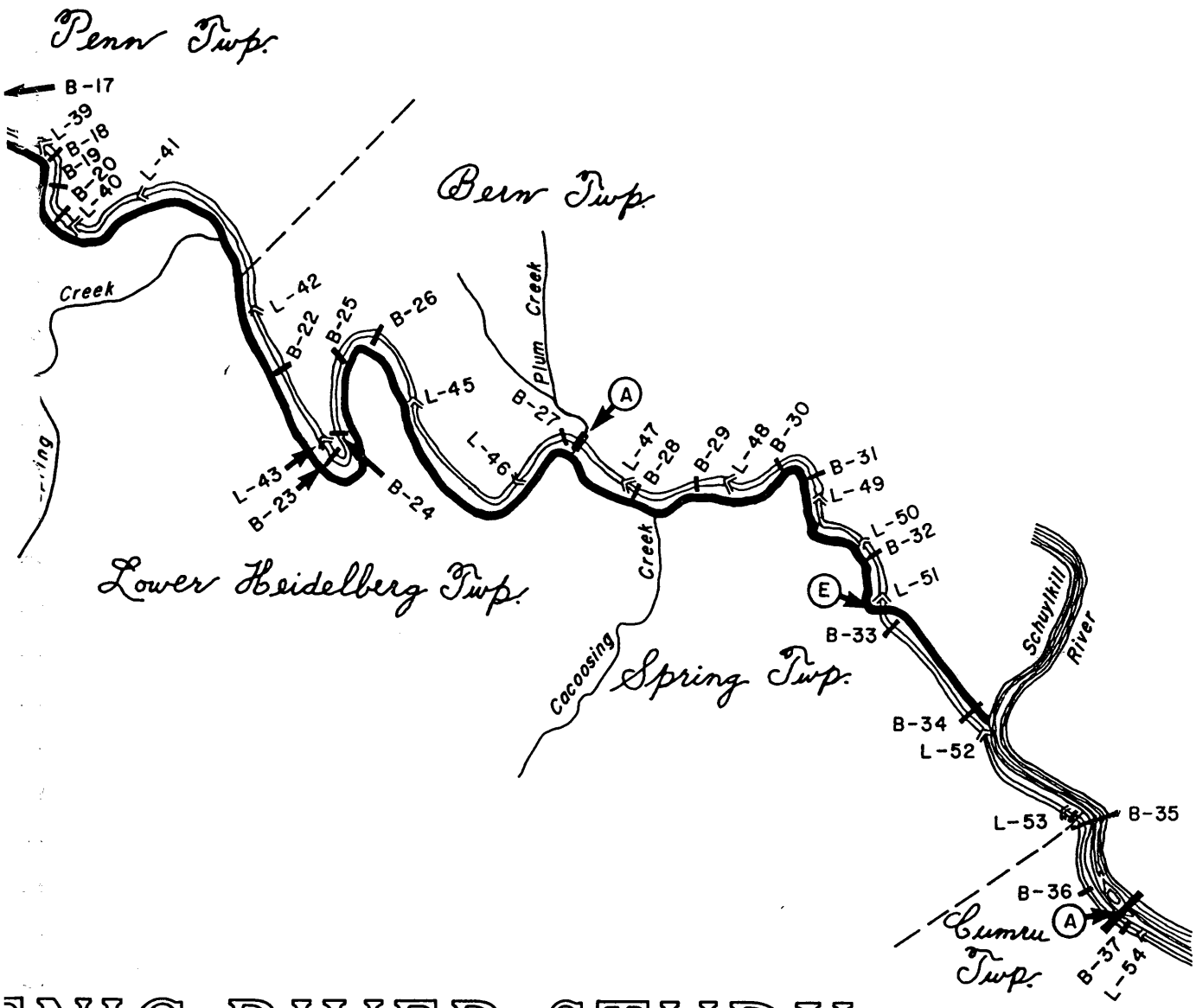
LEGEND

B - CANAL BRIDGE

L - CANAL LOCK

Ⓐ - AQUEDUCT

Ⓔ - AQUEDUCT (PRESENT BEFORE 1850)

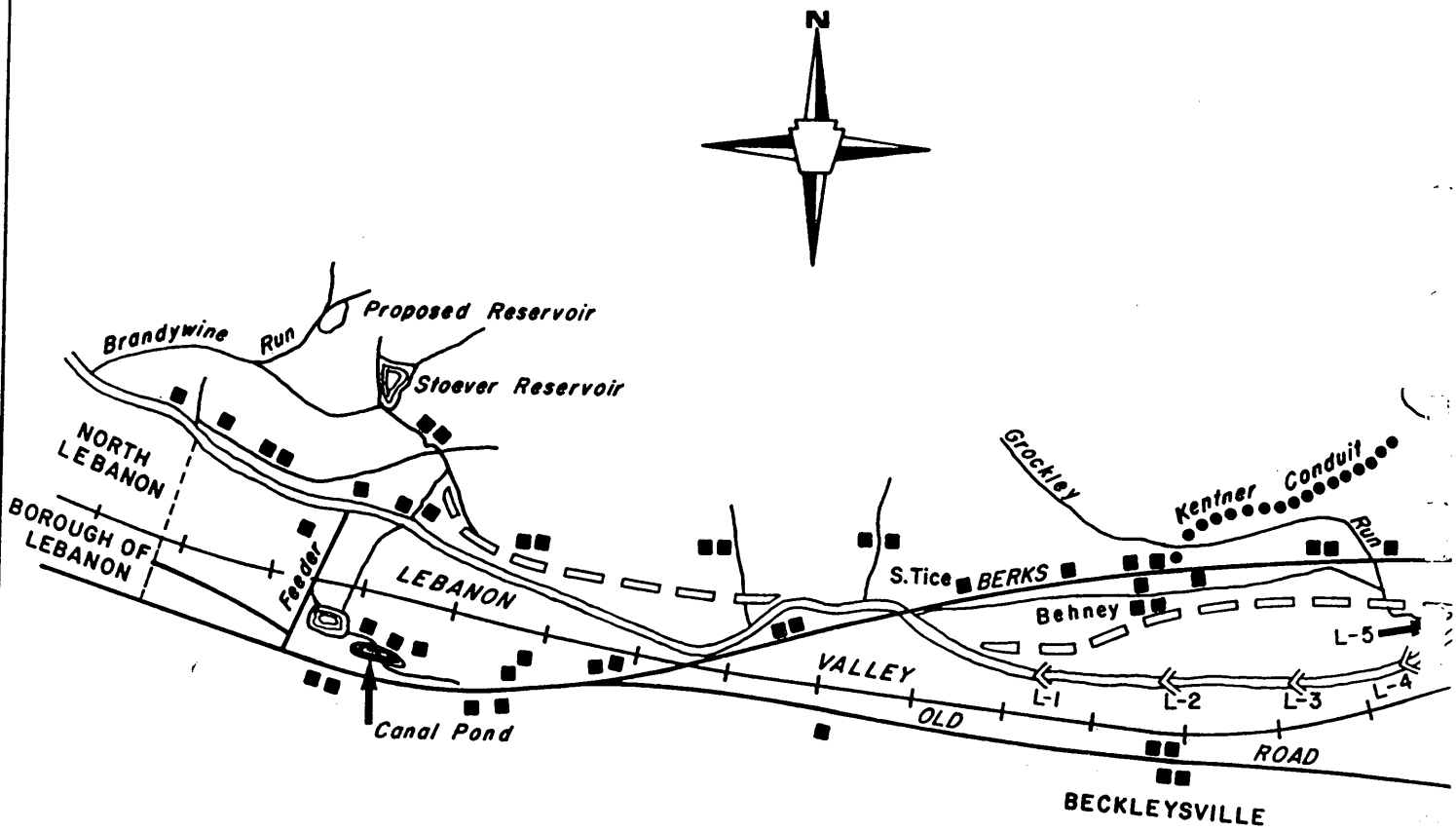


ENIC RIVER STUDY

UNION CANAL LOCKS AND LOCATIONS IN BERKS COUNTY

SOURCE: GEORGE M. MEISER, IV FROM DATA COMPILED BY D. S. ZACHARIAS

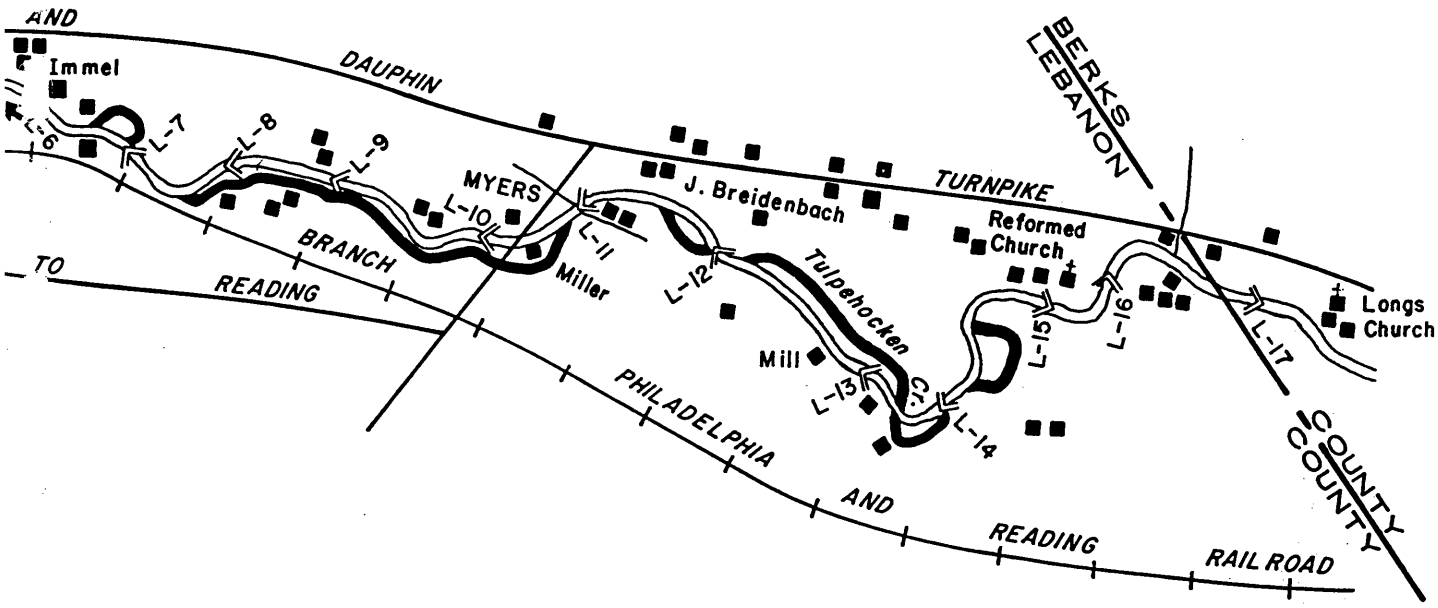
Map 7



TULPEHOCKEN SC

LEGEND

- CANAL
- ABANDONED CANAL
- CANAL LOCK
- FARMS / RESIDENCES
- CHURCHES



NIC RIVER STUDY

LOCKS AND PHYSICAL FEATURES ON OR NEAR THE UNION CANAL IN LEBANON COUNTY

SOURCE DATA SUPPLIED BY LEBANON COUNTY HISTORICAL SOCIETY

Map 8

Courtesy: Lebanon County Historical Society

Mules pulling a boat
through a Union Canal Lock

V. Natural Resources in the Tulpehocken Creek Study Area

GEOLOGIC SETTING

Most of Lebanon County is a broad, gently rolling valley, underlain by Middle Paleozoic shales and sandstones in the north, and Lower Paleozoic shales, limestones and dolomites in the Lebanon-Myerstown area. The geology is a very complex network of faults and folds--the carbonate rocks are part of the overturned south limit of a recumbent synclinorium. The shales and the sandstones to the north of the study area are lithotectnic units of the Hamburg sequence. Although some limestone does occur in the Hamburg sequence, the rocks are referred to as non-carbonate.

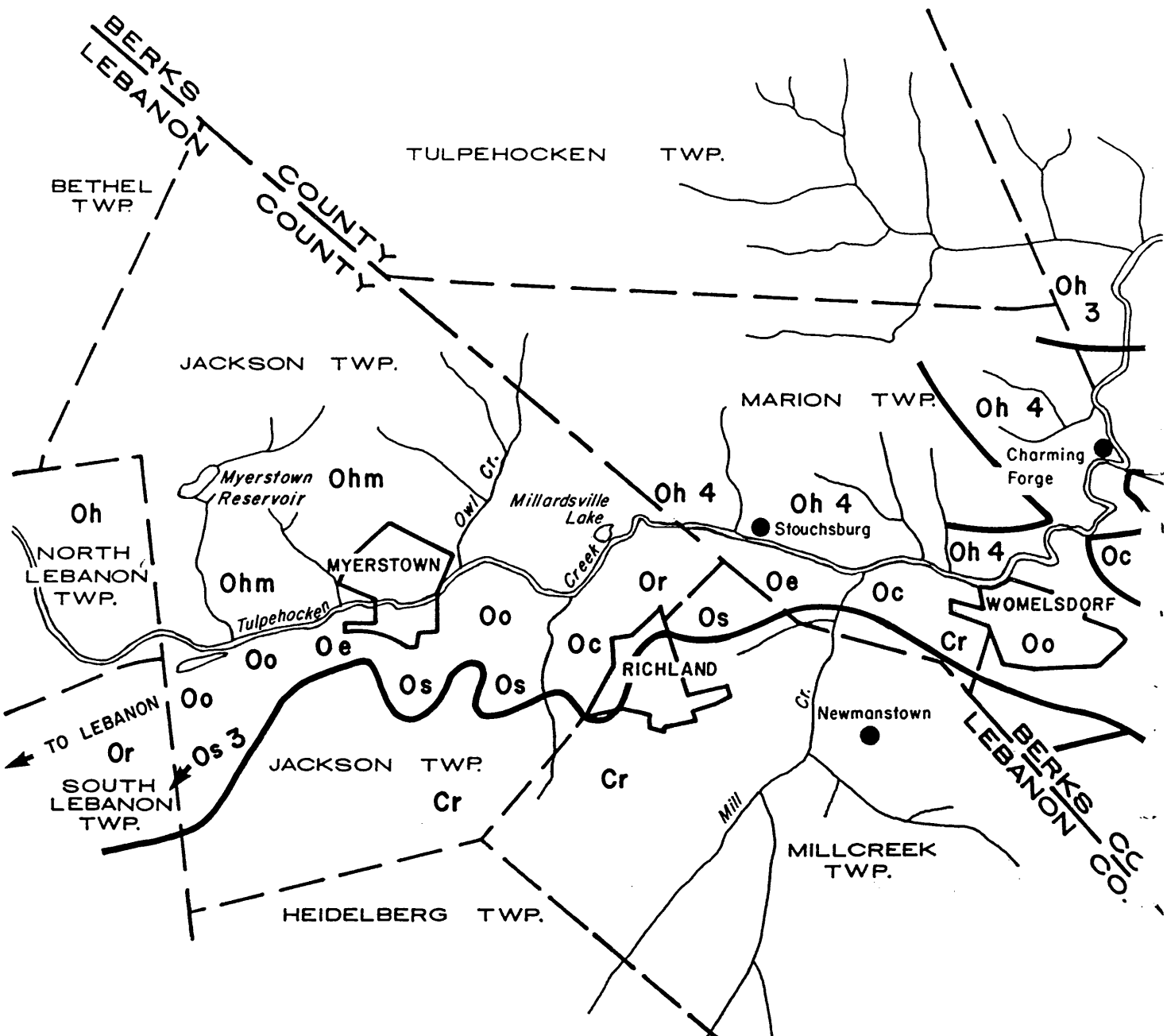
The carbonate valley referred to above is bounded on the south by the Furnace Hills, and by the South Mountain. Sandstone quartz conglomerate intruded by diabase dikes and sills form most of the Furnace Hills. Limestone conglomerate occurs locally near Schaefferstown.

Typical physiographic features are disappearing streams, sinkholes and larger collapsed areas. Large prosperous farms abound on thick fertile soil formed over limestone bedrock. A series of sinkholes and cavern entrances transect the Mill Creek from south of Newmanstown to Weissdale.

In Berks County, the shale terrain in the north drops somewhat abruptly to a generally rolling carbonate-floored valley. Despite lower mean elevations, the western part of the valley drains northward across the shale into the Tulpehocken by way of the Cacoosing Creek, Spring Creek and their tributaries

GEOLOGICAL DEVELOPMENT

Studies in regional sedimentology suggest that most of the rock units present in the Pennsylvania Appalachians formerly extended over this area. The youngest which have not been eroded away, are Ordovician shales about 450 million years old. Much of the erosion was apparently accomplished before the Triassic sediments were deposited, as the latter lie on rocks comparable in age to those presently exposed to the north. The lithology of the Triassic conglomerates, however, shows that somewhat younger rocks were the source. This indicates less erosion north of the basin than within it



TULPEHOCKEN SC

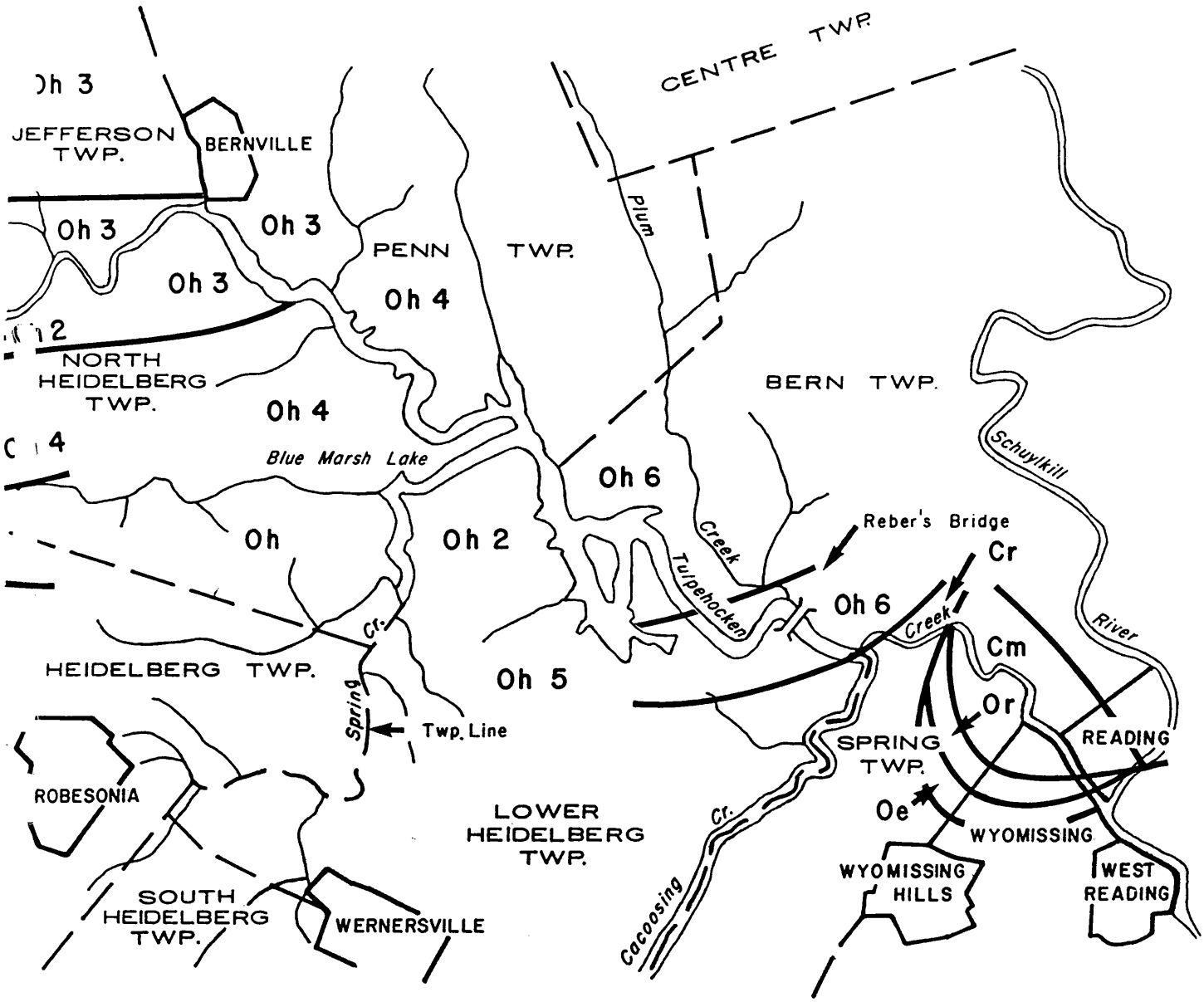
LEGEND

Oh 2	—	black shale and ribbon limestone
Oh 3	—	red siltstone and graywacke
Oh 4	—	siltstone, quartzite, limestone
Oh 5	—	shale or beds of limestone
Oh 6	—	siltstone, shale, graywacke
Oh	—	Hamburg Sequence
Oe	—	Epler Formation (limestone, dolomite)
Ohm	—	Hershey Formation (shaly limestone)
Oo	—	Ontelaunee Formation (dolomite/limestone)
Or	—	Rickenbach Formation (dolomite/limestone)
Os	—	Stonehenge Formation (limestone)
Cm	—	Millbach Formation (limestone/dolomite)
Cr	—	Richland Formation (dolomite/limestone)

N

SCALE IN MILES

1 0 1 2 3



NIC RIVER STUDY

LITHOTECHNIC UNITS

Map 10

prior to the Triassic deposition. This implies that the protobasin area was more elevated than the adjacent area during the erosional interval.

This Lower Paleozoic interval of mountain building is known as the Taconic orogeny and includes several distinct phases. While the carbonates of the Great Valley were still accumulating, shales and coarser clastics were being deposited southeast of the carbonate bank. These older shales are the source of the exotic material in the later shales. The arrival of the exotic, or allochthonous, material apparently occurred as a single complex unit, the Hamburg klippe, to its present neighborhood evidently preceded substantial deformation of the underlying rocks. In addition, the klippe itself evidently had a complex structural history prior to this deformation.

Subsequent to the emplacement of the Hamburg klippe, there was severe folding of the underlying rocks. Since no substantial interval was indicated, it is evident that the northward advance of basement folding provided the drive for the klippe. Folding of the Lower Paleozoic rocks and the basement was large scale and intense. The major structures produced were great recumbent folds which sheared off on their overturned limbs and carried detached cores of the basement gneisses northward. These great detached folds are known by the Alpine term, nappe. At least four or five of these great structures enter into the complex geological pattern of Southeastern Pennsylvania. They appear to be about 50 to 75 miles along strike and more than several miles wide. The three outcrops exposed along the northern edge of the belt of strong taconic deformation between the Delaware and Susquehanna Rivers show the more westerly nappe overriding the western end of its neighbor to the east.

The Hamburg klippe or sequence consists of those rocks in the Great Valley Shale belt which are in large part lithically distinct from typical shales and graywackes of the Martinsburg Formation. As noted on Map 11, seven or eight distinct tectonic levels have been recognized. While the age of the Hamburg sequence has not been established by evidence, all reasonably certain areas are Ordovician and probably post Canadian (lower Ordovician).

Other groups or formations represented on Map 10 include:

1. The Conococheague group includes the Schaefferstown, Millbach and Richland formations in the study area. The Millbach formation is found in eastern Lebanon County near Womelsdorf. In the western part of the corridor, there is more limestone than dolomite, but the dolomite begins to predominate as the formation moves east. The Richland formation is similar to the Millbach.

2. The Beekmanstown group includes Stonehenge, Rickenbach, Ontelaunee and Epler formations. The Epler formation is complex, with limestone more abundant than dolomite. The best exposures of the formation are evident throughout the Lebanon and Lehigh Valley sequence. Of particular note is its presence west of Womelsdorf. Both the Stonehenge and Rickenbach formations are present in the substructure of the corridor.

3. There are a number of formation products of some unconformity in the middle Ordovician period. The Myerstown and the Hershey formations are essentially limestone, with thin, very

dark shale embedded within the limestone. The Hershey is dark gray, impure, shaly limestone.

SOIL CHARACTERISTICS (SEE MAP 11)

Large portions of the Tulpehocken Creek valley are farmed, with farming practices generally employing a variety of soil conservation techniques to decrease the likelihood of severe erosion. According to the 1981 Lebanon County Soil Survey, the soils at or near the Tulpehocken, south of Route 422 in Jackson Township, Lebanon County, are Hagerstown silt loam; these soils are deep and well-drained. On the north side of Route 422, the Bedington-Berks soils although conductive to farming, have poor surface and subsurface drainage. The drainage constraints make the Bedington-Berks soils marginal for development.

The Berks County Soil Survey of 1963 indicates that a greater portion of the Tulpehocken--from the vicinity of Sunday's Mill east to the Blue Marsh Dam site--is found in the Berks/Weikert/Bedington association; shallow to deep, well-drained soils formed in material weathered mainly from silt and sandstone. East of the dam site to its confluence with the Schuylkill and west of Womelsdorf to the Lebanon County line the soil association is the Duffield/ Washington association, or deep well-drained, undulating soils formed in material weathered from limestone. There is a finger of the Ryder/Fogelsville association from Womelsdorf north along the Tulpehocken to Sunday's Mill. The association is likewise deep and well-drained silty soils that weathered from cement rock.

While the soils in the study area in both Lebanon and Berks are among the best for agriculture, there are limitations and restraints if used for other purposes. Within the Hagerstown/Duffield association there are sinkholes, solution channels and caverns in the bedrock, and a seasonal high water table. Groundwater contamination is a hazard for many users because of the caverns and solution channels.

The Berks/Weikert/Bedington series, while generally not as fertile as the Hagerstown series, poses similar constraints when used for other purposes. Shallow to moderate depth to bedrock, slope, and limited available water are the major limitations for most uses.

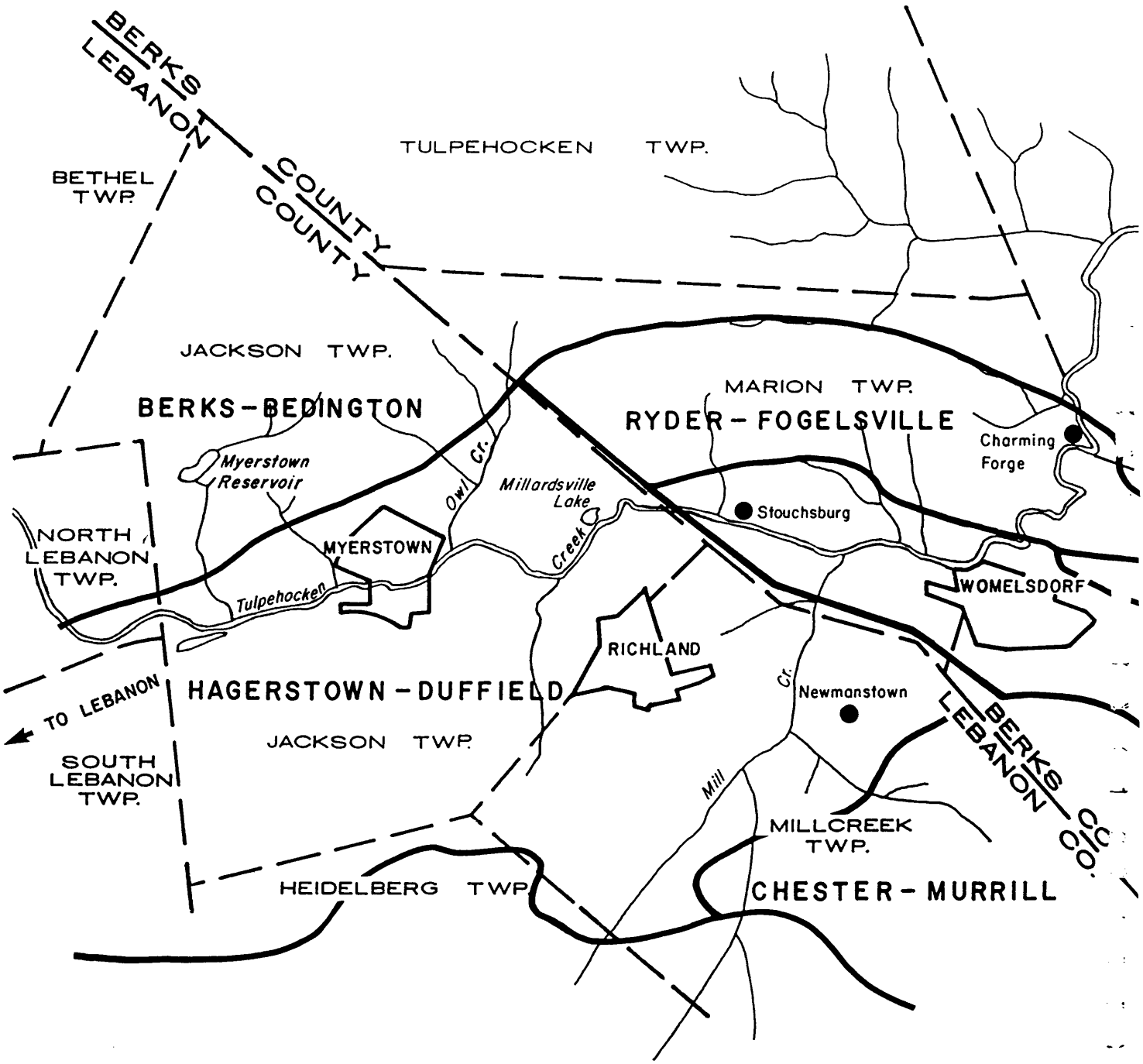
In Berks County, there is an association of Ryder/Fogelsville soils that have limitations similar to the Hagerstown soils: sinkholes and potential for groundwater contamination.

FLOOD HAZARDS/FLOODPLAIN (SEE MAP 12)

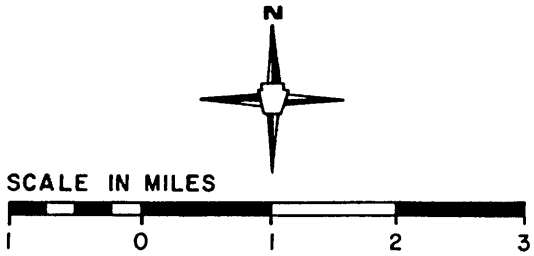
In Lebanon County, a major area of concern is Myerstown Borough where the September 1982 flood overflowed the Tulpehocken's banks to establish a 100-year flood line that includes small portions of Richland Avenue on the south and Center Avenue on the north. Local observers, however, report that stream flow is usually insufficient to pose flooding threats in the Borough.

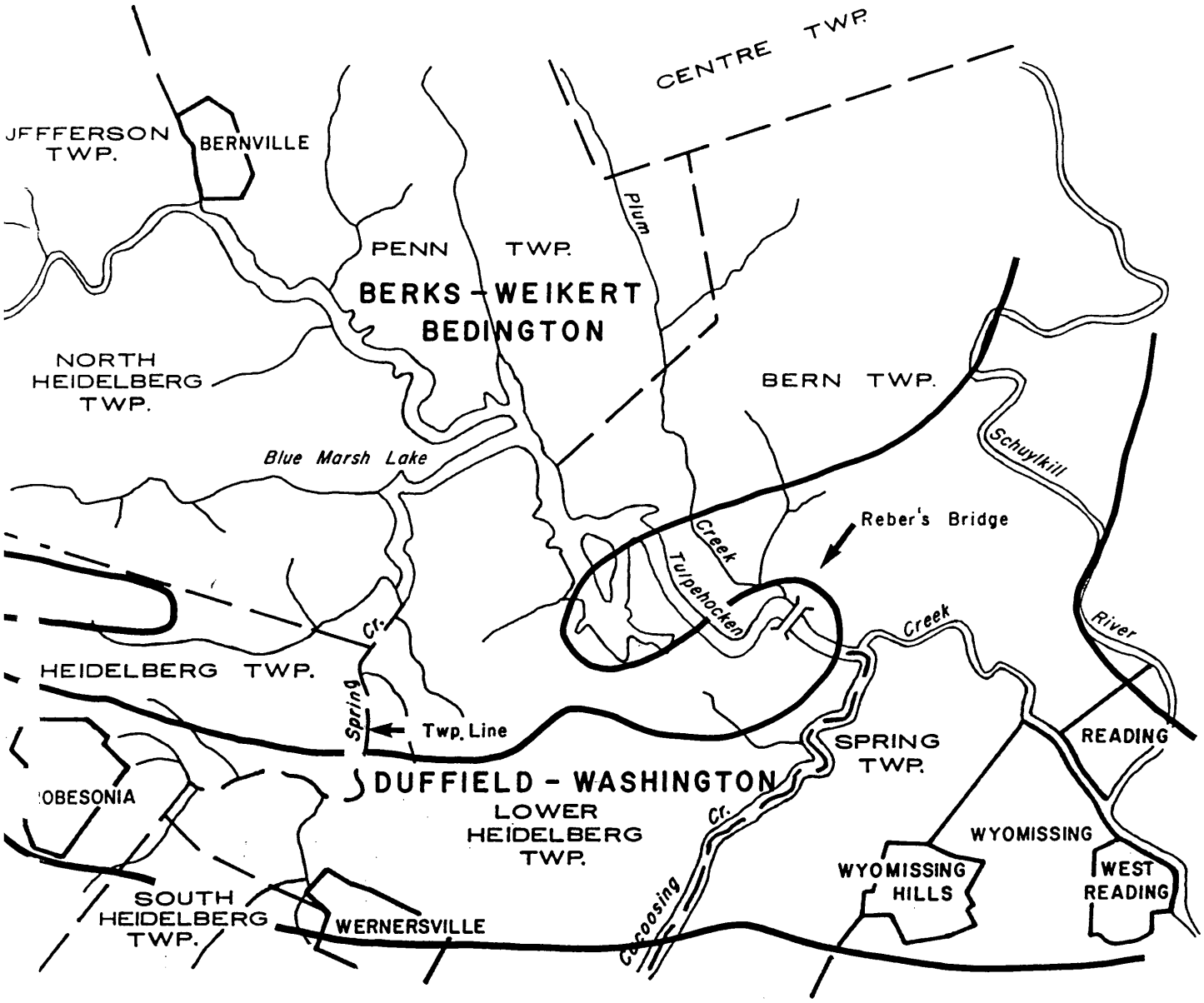
In Jackson Township, the flood insurance maps show normal spring flooding in meadows east and west of Myerstown. Township Routes 580 and 578 east of Myerstown and Routes 570, 573, 560 and 572 could also experience flooding.

Flood insurance maps show there are no areas along the Tulpehocken in Berks County where flood waters endanger a concentrated population. Several



TULPEHOCKEN SC





NIC RIVER STUDY

GENERALIZED SOILS

Map 11

significant areas of spring flooding are the meadows in Marion Township and several low spots approaching Charming Forge. The Blue Marsh Dam helps prevent downstream flooding even though substantial flows enter the Creek from the Northkill, Spring and Cacoosing Creeks.

MINERAL RESOURCES

While minerals are not being mined or processed within the study corridor, the presence of limestone is of major importance throughout areas near the corridor. In Berks County, excavation of the Epler formation at the Brenneman quarry near the Cacoosing Creek continues. Shale or brick is produced by the Glen Gery Company from a quarry near the State Hill. Construction sand was produced in the late 19th century at the Gring quarry, from the Hardystone formation. Iron ores were formerly mined in the Berks County area during the 18th and 19th century, with magnetite iron produced as recently as 1905 and 1906 in the Wheatfield mine east of Fritztown. Presently, the predominant ore (limonite) is not considered very desirable in modern steel-making practice.

Geologic studies indicate that the area between the quarry pond at Millardsville and Annville which follows the

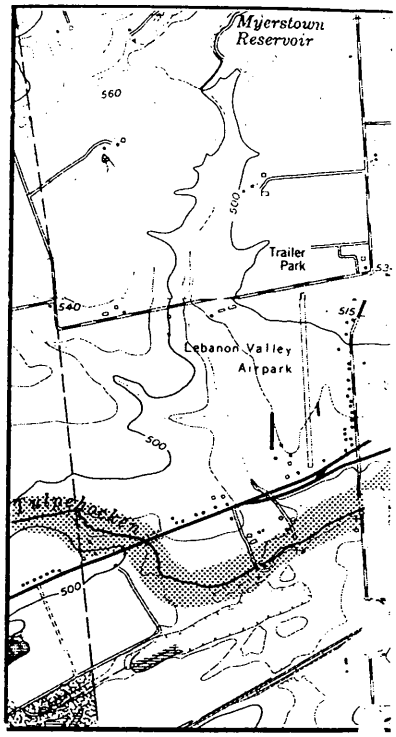
Cacoosing Creek

Tulpehocken merits further investigation, since limestone formations reach a maximum thickness of 250 feet in the Lebanon Valley. The studies also indicate that there are two mica prospects on the south side of South Mountain; as mica had been mined early in the 20th Century in two small mines there.

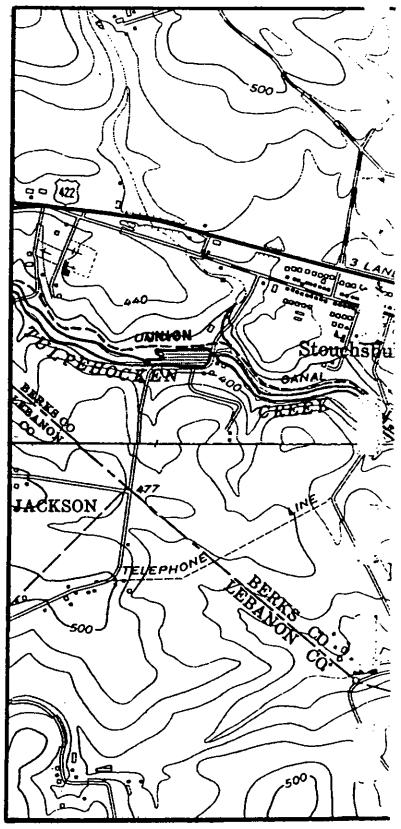
VEGETATION RESOURCES

The study area and the creek corridor are characterized by farming up to the creek banks and farm woodlots of third and fourth growth deciduous bottomlands. According to the Fish and Wildlife Service National Wetlands Inventory, there are wetlands within the Blue Marsh recreation area and along the south bank of the Tulpehocken southwest of Bernville. These wetlands, together with the rural nature of the study area and corridor, combine to produce a diversity of natural communities that support wildlife and contribute to the aesthetic quality of the area. Information provided by the Pennsylvania Natural Diversity Inventory office, DER's Bureau of Forestry in Harrisburg indicates the corridor contains some species of special concern: the lesser clearweed (a small herbacious plant found near streams) and the white water crowfoot (of the buttercup family).

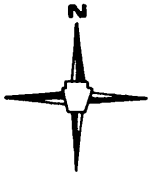
TULPEHOCKEN CREEK
LEBANON COUNTY

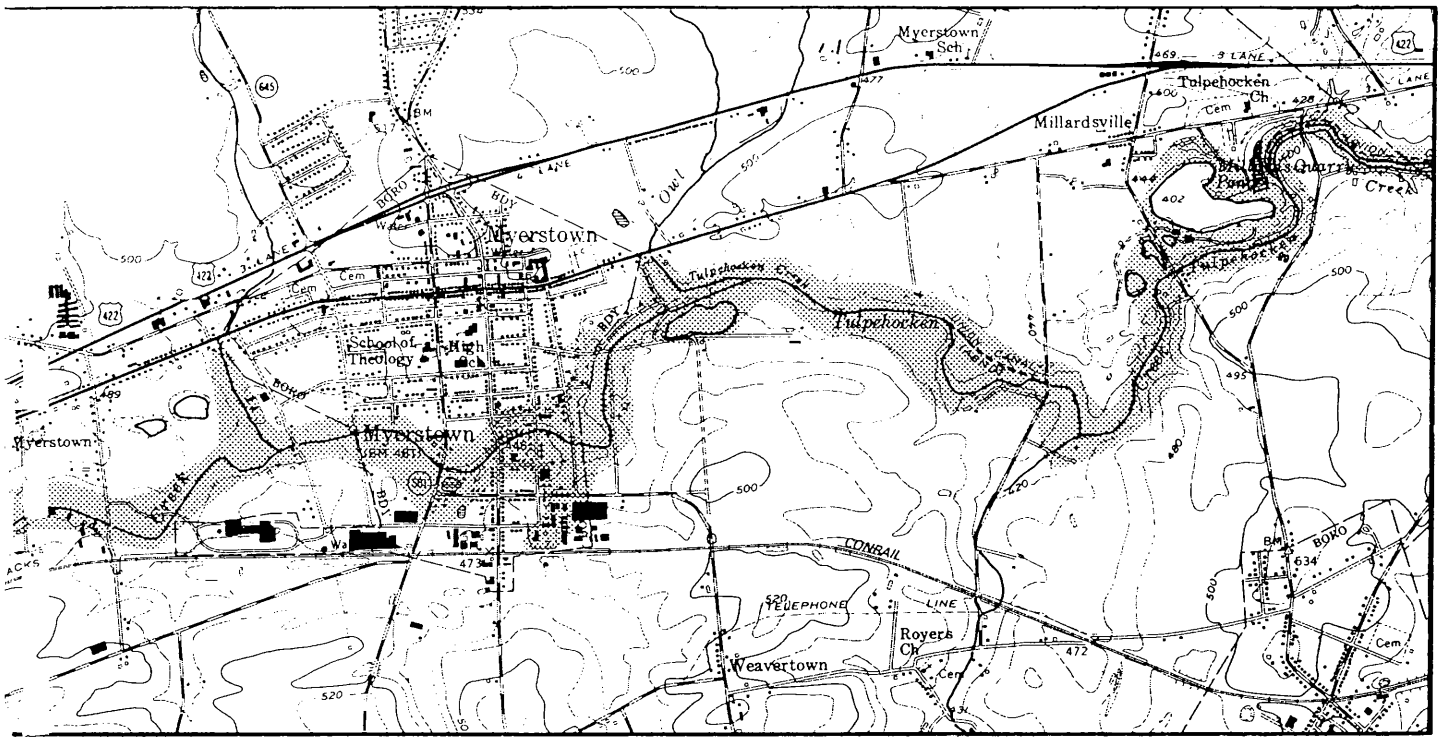


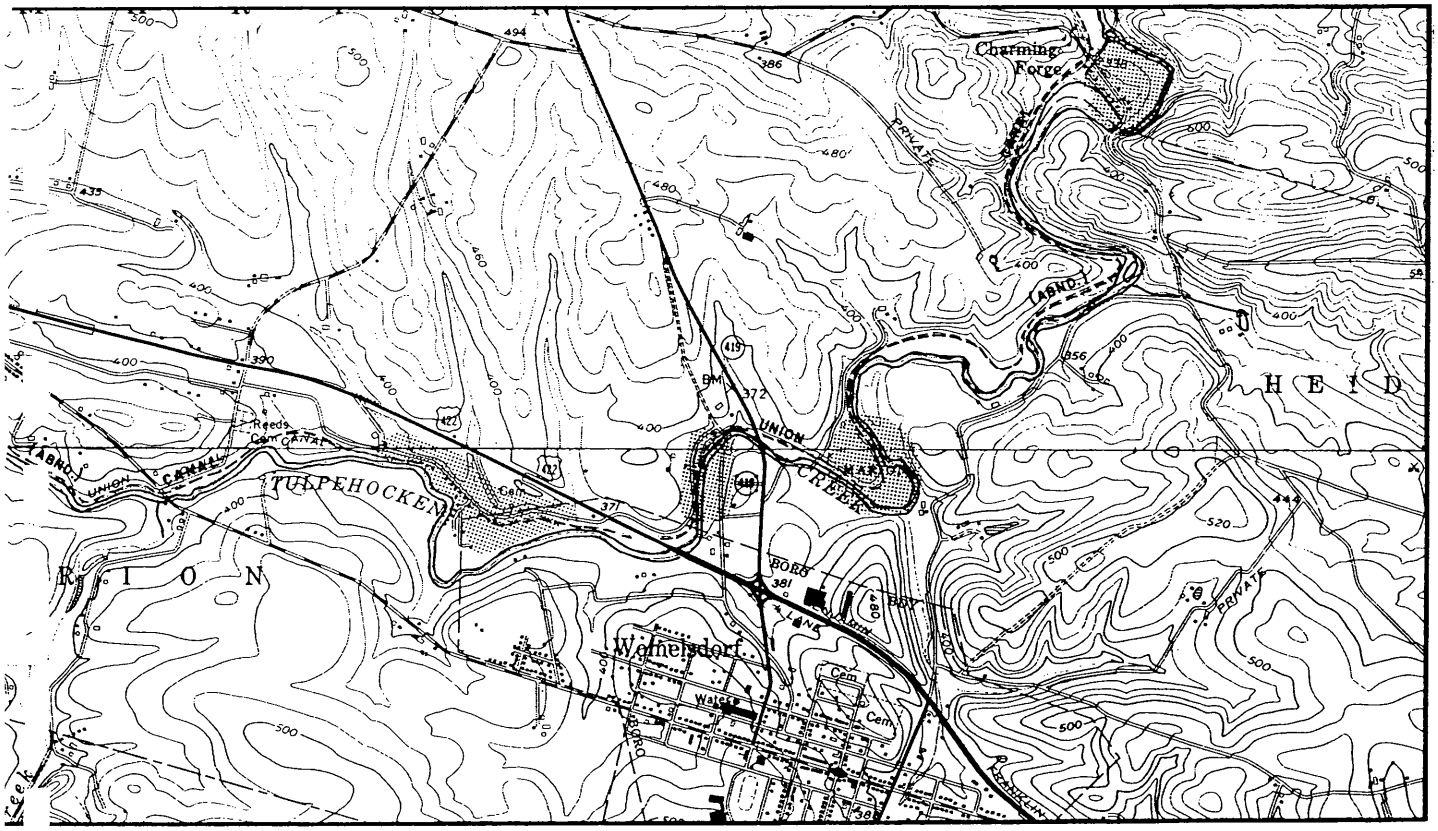
TULPEHOCKEN CREEK
BERKS COUNTY



TULPEHOCKEN SC







ENIC RIVER STUDY

FLOOD PRONE AREAS

Map 12

VI. Water Resources in the Tulpehocken Creek Study Area

DESCRIPTION OF THE WATERSHED

The Tulpehocken Creek watershed comprises an area of some 219 square miles in Berks and Lebanon Counties. The estimated average daily stream flow of surface water is 289 cubic feet per second. Numerous boroughs and townships are situated either entirely or partially within this watershed. In Berks County, these include the City of Reading and the boroughs of Bernville, Robesonia, Sinking Spring, Strausstown, Wernersville, Womelsdorf and Wyomissing; and the townships of Bern, Bethel, Centre, Heidelberg, Jefferson, Lower Heidelberg, Marion, North Heidelberg, Penn, South Heidelberg, Spring, Tulpehocken, Upper Bern and Upper Tulpehocken. In Lebanon County the Tulpehocken watershed includes all or part of Millcreek, Heidelberg, North Lebanon and Jackson Townships; and Myerstown Borough.

Agriculture is the dominant land use in the watershed. Over 50% of the land area in the watershed is devoted to some type of agricultural activity ranging from pasture or dairy land to crop farming.

Water supply within the watershed is principally obtained from private on-lot wells and springs. A few of the more densely settled communities, namely Bernville, Womelsdorf, Robesonia, Newmanstown and Myerstown are served by public water companies. In addition, the Western Berks Water Authority uses the Tulpehocken as its source of supply for more intensively developed portions of the suburbs west of Reading.

GROUNDWATER CHARACTERISTICS

The origin of all the groundwater contained within the rocks under the study area is precipitation. When the precipitation reaches the earth, three things can happen: (1) it may run off directly into streams as sheet or rill wash; (2) it may evaporate or be transpired by plants into the atmosphere; (3) it may soak into the soil and subsequently infiltrate into the voids and fractures of the rocks below.

After the water reaches the zone of saturation, where all the voids are full, it moves laterally, as well as downward, toward lower elevations. It may either come out at the surface as a spring or as

base flow into a stream, or it could remain in the aquifer at some depth.

Groundwater is contained in, and flows through, interconnecting voids in the rocks. These voids can be the spaces between the individual grains, known as primary porosity; or fractures or partings such as bedding surfaces, joints, faults or schistosity planes known as secondary porosity. It is secondary porosity that is most important in the Northeastern United States.

Table 5 summarizes the water-yielding capability of rocks found in Lebanon County. Of special note is that several rock units in the study area—the Millbach, Schaefferstown, Epler and Ontelaunee formations, and some of the limestone in the Hamburg sequence--report well yields that would indicate aquifers probably suitable for industrial and municipal supplies. But reported yields from the diabase and the South Mountain metamorphic rocks would require storage in order to meet minimum domestic supply needs.

Other factors affecting well yields are *lithology*, which points to Lebanon Valley carbonates as the largest reliable yields in the County; *geologic structure* (see above for discussion); *topography*, which has less of an effect in the gently rolling, central lowlands of the study area. Specific capacities reported for domestic wells within the Hamburg sequence are two to four times those reported for hilltop settings.

Groundwater characteristics in Berks County yields of 1,000 gallons per minute are possible in the better carbonate rock aquifers. High capacity wells may be located as little as 100 feet apart without causing excessive interference in areas of high transmissivity. Natural annual fluctuations of water level in wells generally range from 3 to 20 feet.

The Tulpehocken Creek drains an area underlain by the highest percentage of carbonate rocks (36%) and has the highest percentage of base runoff of the three gaging stations.

GROUNDWATER QUALITY

It has been estimated that 70% of Lebanon County's total water use is from groundwater. Groundwater in the Lebanon Valley carbonates is very hard, while the non-carbonate Hamburg sequence rocks yield moderately hard to hard water. However, in the southeast corner of the study area, the soft water from the granite rocks circulate into the water of the Lebanon Valley aquifers.

In terms of problems, there are excessive nitrate concentrations from crop fertilizers, cattle feedlots and barnyard wastes. In southern Lebanon County, supplies are easily contaminated by septic-tank effluent because groundwater circulation in diabase follows a shallow fracture system.

In Berks County, the quality of groundwater ranges from very hard to hard in the area of the stream in Marion, Heidelberg, South Heidelberg, Spring and Bern Townships; to moderately hard and hard in areas in North Heidelberg, Jefferson and Penn Townships. In terms of problems found in wells tested, while EPA indicated nitrate concentration limits were exceeded, these concentrations were not high enough to be considered hazardous to health. These nitrates are derived mostly from crop fertilizers, on-lot sewage disposal and barnyard wastes.

SURFACE WATER QUALITY

A 1980 aquatic biology investigation

TABLE 5
SUMMARY OF WATER-YIELDING CAPACITY OF ROCKS

Rock Unit	Type**	Specific Capacity* ((gal/min)/ft)				Reported Yield* (gal/min)			
		Number of Wells	25 Percent	50 Percent (Median)	75 Percent	Number of Wells	25 Percent	50 Percent (Median)	75 Percent
Diabase	D	6	.33	.03	.01	7	8.0	5.0	1.0
Hammer Creek Formation	D	38	.73	.36	.23	45	30.0	20.0	15.0
	N	19	3.10	.95	.50	26	175.0	60.0	35.0
Sherman Creek Member of Catskill Formation	D		-	-	-	4	32.5	13.0	4.5
Hellow Creeches thrust plate	D		-	-	-	21	12.0	5.0	1.5
Hamburg sequence, lithotectronic unit 8	N	5	17.50	12.00	1.50	15	350.0	50.0	15.0
Hamburg sequence, lithotectronic unit 6	D	4	1.18	.30	.05	28	20.0	12.0	8.0
Hamburg sequence, lithotectronic unit 4	D		-	-	-	13	22.5	15.0	8.5
Hamburg sequence, lithotectronic unit 3	D	3	-	.53	-	27	40.0	20.0	8.0
	N		-	-	-	4	115.0	58.0	6.0
Hamburg sequence, lithotectronic unit 2	D	3	-	.13	-	20	27.5	15.0	10.0
Hamburg sequence, lithotectronic unit 1	D	4	.17	.14	.09	18	25.5	15.0	7.5
	N	3	-	.93	-	6	60.0	17.5	12.0
Martinsburg Formation	D		-	-	-	6	40.0	17.5	15.0
Hershey Formation	D	4	.43	.29	.14	4	24.0	22.0	14.0
Annville Formation	N	3	-	.21	-	3	0.0	30.0	-
Onteluanee Formation	D		-	-	-	3	-	11.0	-
	N	6	180.00	60.00	14.00	11	600.0	200.0	75.0
Epler Formation	D	11	8.50	1.30	.16	7	25.0	11.0	3.0
	N		-	-	-	10	600.0	265.0	60.0
Rickenbach Formation	D		-	-	-	4	82.5	18.0	4.5
Stonehenge Formation	D	15	61.00	3.80	.49	-	-	-	-
	N	4	80.00	.20	.10	6	25.0	20.0	17.0
Richland Formation	D	21	19.00	2.40	.18	13	23.0	11.0	6.0
Millbach and Schaefferstown Formations, undivided	D	13	155.00	91.00	3.00	7	100.0	40.0	20.0
Snitz Creek Formation	D	13	9.00	1.40	.24	5	19.0	6.0	5.0
Buffalo Springs Formation	D	12	14.00	2.80	.20	4	11.0	10.0	6.0
	N	7	1.20	.76	.08	12	159.0	82.0	19.0
Leithsville Formation	N		-	-	-	3	-	100.0	-
Hornblend gneiss	D	3	-	.16	-	4	22.5	12.0	.03

* Value (specific capacity or reported yield) is exceeded by indicated percentage of wells

** D, domestic; N, nondomestic

of the Tulpehocken Creek basin conducted by the Pennsylvania Department of Environmental Resources concluded that generally good water quality conditions were observed throughout, with the predominant downstream persisting limitation being the influence of agricultural activities. The presence of industrial waste and treated sewage discharges in the Tulpehocken Creek were measurable at low levels in the Myerstown area, but these disappeared downstream due to dilution and natural renovation and their biological effects were likewise localized.

Four stations were located upstream from the Myerstown sewage treatment plant outfall in Lebanon County. Water quality was fair to good, with each station reflecting the effect of agricultural runoff in plant growth, elevated nutrient levels, excessive sediment and organic stimulated fauna. Small arsenic concentrations were noted downstream from Whitmoyer Laboratories.

Water quality improved from fair to good at four stations farther downstream until the effects of the Northkill Creek could be felt at Bernville At Bernville, water quality was found to be very good. Below Bernville, good quality persisted downstream at the Licking Creek and Spring Creek sampling stations and at the intake of the Western Berks Water Authority.

In general, better quality was observed in downstream segments and tributaries due to natural restorative properties of the stream and to dilution by waters having lower nitrate and phosphate concentrations from the Northkill Creek.[1]

In 1982, the Department of Environmental Resources issued its Water Quality Inventory for each stream within the Commonwealth. In it, the Tulpehocken basin from its headwaters to the Blue Marsh Dam is placed in category I; segments which have existing sewage discharges from sewerage systems including treatment plants, and are experiencing rates of growth at or above the statewide average in the segment's drainage area. Relevant pollutants from the creek's headwaters to the Blue Marsh dam are nitrates and phosphates; nitrates are found from the dam to the Creek's mouth. In fact, phosphorus limitations are being imposed on sewage treatment plants upstream of the Blue Marsh Dam. These limitations are expected to reduce nutrient loadings in the reservoir and slow the eutrophication process.

In summary, it should be noted that the water quality of the Tulpehocken and its tributaries has been studied intensively since the U.S. Army Corps of Engineers started planning the Blue Marsh impoundment. A 1973 U.S. Geological Survey's pre-impoundment survey to establish base-line water quality data suggested that the Basin is a highly fertile environment. This survey was followed by a Geological Survey in 1977 where it was determined that: (1) there was sufficient residual chlorine from major point sources (such as sewage treatment plants) to reduce the bacterial population to acceptable levels, and (2) there was sufficient retention time of the water in the lake to reduce bacteria densities from non-point sources to acceptable levels; the only exceptions were found at times following intense rainfall and runoff during normally low flow periods.

(1) Bureau of Water Quality, Pennsylvania DER, has indicated that it is proposing to reclassify the Northkill from Cold Water Fishery to Exceptional Value.

WATER USES IN THE AREA

The undeveloped scenic character of the Tulpehocken makes it ideal for a wide variety of outdoor recreational activities. The major uses are fishing, hunting and boating, but there are also a number of other uses, such as hiking and nature observation. These activities are enjoyed by many people generally without harm to the environment or local property owners.

Active water-oriented activities (boating, sailing, swimming, fishing, scuba diving) are to be found in two major activity centers: Millardsville Lake in Lebanon County and the Blue Marsh Dam reservoir and recreational area in Berks County.

For a summary of Park and Recreation Uses in the Tulpehocken Study Area, see Appendix 2.

THE BLUE MARSH LAKE

The U.S. Army Corps of Engineers maintains two boat launch sites and support facilities, a visitor center, a day use area with sandy beach and other facilities, two overlooks, a basin access area for fishing and several hiking trails. Camping and additional trails are planned for this area. In 1981, there were some 1,031,055 recreational visitors to the lake and of these about 95,000 visited the fishing basin.

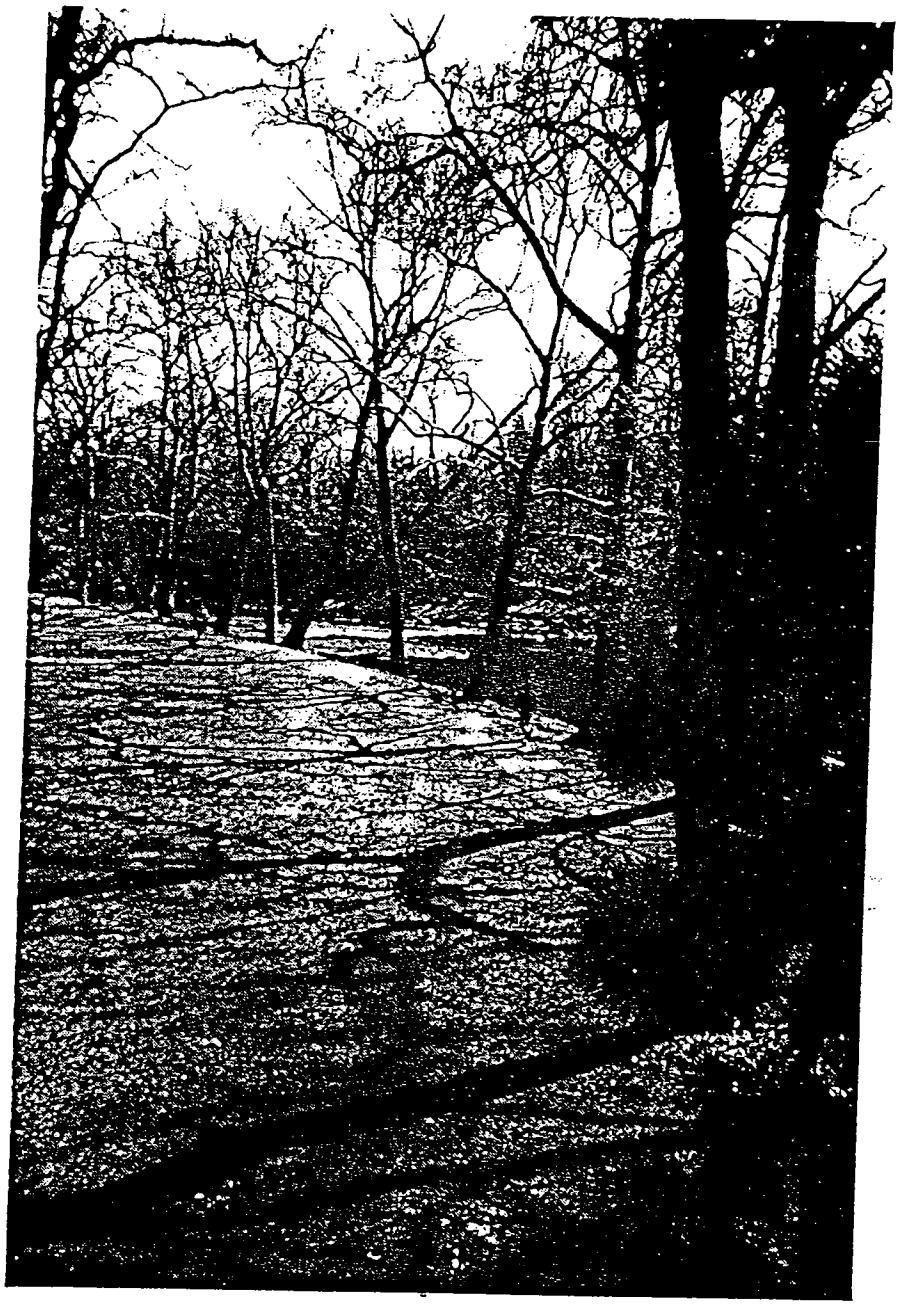
Boating is especially popular on the lake as it is the only lake in Southeastern Pennsylvania to accommodate boats with unlimited horsepower.

Fishing is one of the major recreational pursuits at the lake. In addition to the two boat launch sites provided by the Corps, the Pennsylvania Fish Commission maintains a third launch south of Bernville. Some 23 species of fish were found in 1980 and 1981 in the creek below the dam. A trout fishery has been developed extending about six kilometers downstream of the dam. This activity recognizes the exceptional quality of cold water fishing in this part of the Tulpehocken, a feature that draws fishermen from surrounding states.

Hunting is permitted adjacent to the lake. The Pennsylvania Game Commission manages 1,233 acres of Corps Blue Marsh Lake project lands adjacent to its 2,630 acres of Pa. Game Lands #280. These tracts are located on both sides of the impoundment upstream of the Blue Marsh dam. A large variety of bird species, particularly waterfowl, and mammal species occur in the lake's vicinity. Open lands in the area provide good habitat for rabbit, pheasant and doves. In the forested area, numerous woodland species can be found---squirrel, fox, raccoon, muskrat, deer and skunk. There are woodpeckers, bog turtles, occasional wild turkeys and various birds of prey, including hawks and owls. Appendix 3 lists some 23 amphibian species, 23 species of birds, 33 species of fish, 43 species of mammals and 23 species of reptiles likely to occur in the vicinity of the Tulpehocken, Mill and Cacoosing Creeks. At least 12 species are on the Federal and State list of endangered or threatened animals. These include the bog turtle, the eastern wood rat, the small footed myotis, and nine bird species.

THE BERKS COUNTY'S TULPEHOCKEN CREEK VALLEY PARK

Berks County's Tulpehocken Creek Park is to be found on both sides of the



Biking and Jogging
Along the Tulpehocken Creek

creek from Rebers Bridge downstream to a point near the confluence of the Tulpehocken with the Schuylkill River. It consists of (a) a five mile recreation trail used for hiking, jogging, biking, cross-country skiing, and birdwatching; (b) a recreation area (Stonecliff) within the City of Reading with numerous active recreation facilities; (c) a Leisure Area for senior citizens activities; (d) a multi-purpose Grings Mill area for active and passive recreation and meeting areas, and (e) the County Heritage Center/Red Bridge Recreation Area, featuring the National Register Gruber Wagon Works and Wertz's Covered Bridge, the Howard Heister collection of Union and Schuylkill Canal artifacts, etc. Fishing and boating is encouraged in this stream segment of the Tulpehocken Creek(1). Also Appendix 2.

It should be noted that the City of Reading has a biking and hiking trail from the Stonecliff area through the old Bushong Mill property to the Schuylkill River, completing public ownership of the banks of the creek.

(1) Appendix 4 is a letter from Micheal Kaufman, area fisheries manager of the Pa. Fish Commission, listing the Commission's present stocking program for the Tulpehocken and Mill Creeks. In a recent newspaper interview, Kauffman said that the Tulpehocken downstream from Blue Marsh Dam to Wyomissing is one of the top 35 stream sections for trout fishermen in the state. "It's definitely the best trout fishing available in Berks County and southeastern Pennsylvania."

RECREATION USES IN LEBANON COUNTY

Earlier it was noted that the Limestone Springs Fishing Preserve at Millardsville on the Tulpehocken is considered by its operators to be the most productive trout hatchery in Eastern United States. Through publications and by word of mouth, the prevailing spirit in the County is to maintain the Tulpehocken throughout its reaches as a preserve and prime fishing stream. As an example, the Jackson Township comprehensive plan recognizes the value of the Tulpehocken Creek by proposing its preservation for fishing and other recreational needs. More specifically, the plan notes that the Tulpehocken serves also as a link between two recreational sites--Calcite Quarry Pond and Millard Pond.

Lebanon County's Recreation and Open Space Plan notes that the Limestone Springs and adjacent Willow Springs complex, as outlined above, totals over 50 acres. Public ownership of park land along the Tulpehocken includes some eight acres known locally as the Myerstown Community Park. A semi-public facility--a six acre baseball complex the property of the Myerstown American Legion is located along the Tulpehocken Creek.

Results of Water Quality Testing

Water quality tests of the entire Tulpehocken Creek were recently taken between the dates of Friday, May 13, 1994, to Friday, May 20, 1994. The total number of sites where the tests were performed was 42 that includes sites on tributaries as well as the Tulpehocken Creek. The following is a list of the tests performed: air temperature, water temperature, pH, alkalinity, dissolved oxygen, nitrate, phosphate, chloride and ammonia nitrogen. In addition to the water quality testing, slides were taken and stream site evaluations were recorded at each site.

High levels of phosphorus and nitrates as well as a high sediment load was found to be characteristic in the portion of the stream from the headwaters to the upper reaches of Blue Marsh Lake. The primary cause for the pollution is agriculture that is overwhelmingly the highest form of land use. During the site evaluations it was found that near many testing sites, cows were viewed wading in the stream. Also, there is a general lack of vegetative cover due to the cows and farming practices that are leading to erosional problems. It was noted by speaking with the County Environmentalist and County Nutrient Management Specialist that many farms in the watershed do not utilize best management practices as prescribed to them such as nutrient management plans, strip cropping, conservation tillage or stream bank fencing.

In addition to agricultural practices, there is also erosional problems in urban areas. As noted above, the upper portion of the Tulpehocken suffers from a general lack a greenway corridor. Myerstown Park is a perfect example of an urban erosion problem due to a lack of vegetation. The Tulpehocken flows through the middle of the park and has two bridges crossing over it for both pedestrians and traffic. Without any vegetative cover to stabilize the banks, the creek is allowed to meander easily. As a result, the banks are scoured out and the bridges are becoming unstable as the soil around them is eroded. The stream is also scouring the soil around the few trees that exist. The township's

response to the problem was to erect concrete slabs to prevent the stream from meandering. The stream eroded the soil around the slabs and now there are several slabs either free standing or slumped down in the creek bed.

Another problem with the Myerstown Park is the current drainage system. Adjacent to the stream is a large manmade pond. There are several large drainage pipes emptying into the pond from source currently unknown. When the pond exceeds its capacity the excess water flows over a spillway that leads into the Tulpehocken Creek. At this point it is unclear what pollutants, if any, are added to the creek. The spillway cuts through a picnic area in the park. At present, signs are erected that state not to cross the spillway if water is running through it. It seems that the present drainage systems need to be rethought.

Two of the sites chosen for water quality testing above Blue Marsh Lake demonstrate the effects of excess nutrients and sedimentation. Both sites had dams that impounded the stream's water. The impounded water displays signs of eutrophication. At both sites the color of the water was pea green due to an overabundance of algae growth. The dissolved oxygen at one of the sites read 3 mg/l that is the equivalent to aquatic death. The other site was being treated for algae as traces of chlorine were found.

When the water from the Tulpehocken Creek reaches Blue Marsh, the effects are similar. Blue Marsh Lake acts as a settling basin for the excess nutrients as well as the high sediment load that may be accelerating the eutrophication process in the lake. "In another pre-impoundment study (Barker, 1977), annual input to the lake was estimated to be 1400 tons of nitrogen and 46 tons of phosphorus. Daily suspended sediment loads ranged from one to 8350 tons during the study period. (USDA, Soil Conservation Service, 1992)." "The state determined the trophic status of Blue Marsh using Carlson's Trophic State Index (TSI). Lakes with a TSI greater than 65 are considered eutrophic. Blue Marsh has a TSI of 65 (BWQM, 1990). The continuing inflow of nutrients will likely push the TSI into the eutropic category in the near future, as

predicted prior to and following impoundment in the mid-70's (USDA, Soil Conservation Service, 1992)."

The main source of pollutants to the lake is from the Tulpehocken Creek. Most of the tributaries that enter Blue Marsh had lower levels of nitrates, phosphates, and a low sediment load. The only exception to this would be the Licking Creek that did show high levels of the two nutrients. However, since the site chosen for testing was under a bridge and had a greasy texture to the water, it could be concluded that the source of the pollution was from the traffic on the road above.

The water coming out of the dam into the stilling basin is clear and the levels of phosphorus and nitrates were lowered as settling in the lake had occurred. At this point the stream has a greenway corridor that runs down to the confluence. With the installation of a trail between Blue Marsh and Reber's Bridge, a beautiful trail system with several park areas will exist from the stilling basin to the confluence. The trail is heavily used for hiking, biking and picnicking and fishing.

It appears that the main addition of pollution to the lower reaches of the stream come from industrial sources as well as sewage treatment plants. "Two tributaries which enter Tulpehocken Creek downstream of Blue Marsh Lake, Plum Creek and Cacoosing Creek, are impacted primarily by point sources. Agricultural impacts are documented upstream of the point discharges. Water quality in Plum Creek is generally good, except for a segment below a sewage treatment plant discharge. This segment was reported to have elevated concentrations of BOD, suspended solids, ammonia, nitrite, total phosphorus, chloride, and fecal coliform (USDA, 1992)." "Cacoosing Creek has poor quality water due to two sewage treatment plants and a paper mill discharge. Ammonia, nitrogen, phosphorus, and BOD are all elevated in the lower reach of the creek (Young, 1990) (USDA,1992)."

Throughout the lower reaches of the stream, nitrates and phosphates were high. The area is dominated by urban development outside the greenway corridor. Two major

highways run over the creek. At one of these overpasses the level of nitrates was over four times greater than any other level found in the stream. By the time the Tulpehocken reaches its confluence, the water is brown as it flows into the Schulykill River.

There are several other causes of source point pollution on the Tulpehocken Creek. "Sewage treatment plant discharges enter the upper Tulpehocken Creek near Myerstown and the mid-Tulpehocken Creek near Womelsdorf (USDA, 1992)." It was noted that these two plants were operating within their discharge permits. Likewise, the Bernville Sewage Treatment Plant discharges high levels of BOD and suspended solids but the overall loads area low (USDA, 1992).

Other sources of point source pollution would include the Fort Zeller Elementary School that releases BOD, phosphorus and suspended solids in the Mill Creek (Berks/Lebanon Counties). According to the 1992 study this was planned to be upgraded in the near future. "The Heidelsburg Country Club discharges to the Northkill and the Tulpehocken High School discharges to the Little Northkill Creek. These discharges are relatively minor (UDSA,1992)." Other point sources include the Limestone Springs Trout Hatchery and several small industrial discharges (USDA,1992).

Miscellaneous source of pollution on this upper part of the Tulpehocken Creek would include fish hatcheries. One hatchery could not be located but the area surrounding it suffered from low water quality with a high sediment load. Agricultural lands and a small trailer park also exist in the same area. It is unclear at this point the cause of the low water quality and should be further investigated. It was clear where the other hatchery was due to wire completely fencing it off and no fishing signs. Again the water quality was poor and a local fisherman complained of a strong odor coming from the hatchery.

During the water quality testing the air and water temperatures appeared normal and consistent for the time of year. The weather did vary over the testing period as rain occurred during the later part of the week. The rain in clearly reflected in the testing results. The sites that were tested during the drier part of the week had an average pH of

8.2. The day of the rain the average pH is 4.6. The day after the rain the pH was back up to about 6.2. The rain itself was not tested which would be the leading suspect in the sudden drop in pH. The reason for the quick rebound is the high levels of alkalinity found throughout the stream due primarily to limestone.

The remaining water quality indicators that were tested for are dissolved oxygen, chloride and ammonia nitrogen. The dissolved oxygen was higher in faster flowing areas and lower in slower moving waters. As noted above, the only dangerously low levels were found in the ponded areas above Blue Marsh. Only a few sites displayed having chloride or ammonia nitrogen and then only in minute traces. The sites were generally ponded area or slow moving water that may have been treated.

Property Owners Along the Tulpehocken

Berks County:

Map #	Acres	Owner	Address	Tax Map #	Pin #
1		Borough of Reading		530713	44-4444
2		City of Reading		530713	
3		Berks Co. Tulpehocken Park		530713	
4		County of Berks		439712	
5		County of Berks		439712	
6		County of Berks		439712	
7		County of Berks		439708	
8		County of Berks		439707	
9		County of Berks		439707	
10		County of Berks		439707	
11		County of Berks		439707	
12		County of Berks		439707	
13		County of Berks		439707	
14		County of Berks		439707	
15		County of Berks		439707	
16		County of Berks		439708	
17		County of Berks		439708	
18		County of Berks		439708	
19	76	Arrow International Inc.	PO Box 6306 Wyomissing, PA 19610	439815	53-1277
20		County of Berks		439708	

21		County of Berks		439708	
22		County of Berks		439708	
23		County of Berks		439708	
24		County of Berks		439708	
25		County of Berks		438804	
26		County of Berks		439803	
27		County of Berks		438804	
28		County of Berks		438804	
29		County of Berks		438804	
30		County of Berks		438804	
30.5	101	Richard & Joyce Greener	170 Rebers Bridge Sinking Springs, PA 19608	438804	51-4594
31		Army Corp of Engineers		438803	
32		Army Corp of Engineers		438803	
33		Army Corp of Engineers		438803	
34	2	Douglas & Karen Eisenhofer	RD1 Box 1151 Leesport, PA 19533	438803	32-8829
35		Army Corp of Engineers		438803	
36		Army Corp of Engineers		438803	
37	2	Clifford & Margaret Lewis	S. Water Road Sinking Springs, PA 19608	438803	14-8893
38	14	Western Berks Water Authority	c/o John Hoffert 529 Court Street Reading, PA 19601	438803	11-1466
39		Army Corp of Engineers		438803	
40		Army Corp of Engineers		437804	

41	Robert Curran, US Attorney	4042 US Courthouse 9th & Market Street Philadelphia, PA 19107	437804	94-8267
42	Army Corp of Engineers		437804	
43	Army Corp of Engineers		437802	
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94	PA State Game Commission	437903
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116	PA State Game Commission	436900
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136		Army Corp of Engineers		445000	
137		Army Corp of Engineers		445000	
138		Army Corp of Engineers		445000	
139	23	Heidelberg Investment Assoc.	PO Box 477 Bernville, PA 19506	445000	31-5575
140		Army Corp of Engineers		445000	
141	4	J.David & Mary Ann Bossard	970 Christmas Village Rd. Bernivlle, PA 19506	445000	20-1732
142	12	J.David & Mary Ann Bossard	970 Christmas Village Rd. Bernville, PA 19506	445000	10-5348
143	19	Heidelberg Investment Assoc.	PO Box 477	445000	20-7207
144	4	Walter & Sheila Stewart	RD4 Box 58A Bernville, PA 19506	435900	19-9952
145	112	Walter & Sheila Steward	RD4 Box 155 Bernville, PA 19506	435900	28-2862
146		Douglas & Marie Haring	443 Wroxham Drive Reading, PA 19610	434900	99-8096
147	11	Florence Schwartz	RD 4 Bernville, PA 19506	435900	18-5238
148	26	T.C.R. Packaging Inc.	806 Penn Ave. Sinking Springs, PA 19608	435900	17-6571
149	87	Charles & Patricia Minehart	RR2 Box 433 Bernville, PA 19506	434900	96-6647
150	80	Douglas & Marie Haring	443 Wroxham Drive Reading, PA 19610	434900	99-8096

151	42	Timothy Himmelberger & Michael Wenrich	RD1 Box 232 Robesonia, PA 19551	434900	88-8557
152	131	Koziars Christmas Village Inc.	782 Christmas Village Rd. Bernville, PA 19506	434900	79-3312
153	35	Curtis Himmelberger	40 Hunsicker Drive	434900	87-4509
154	189	Helene Fritz	652 Christmas Village Rd. Bernville, PA 19506	434900	58-2746
155	138	Roy & Mae Schrack	209 E. High Street	434900	36-2368
156	20	Terry Groff	PO Box 6902	434900	46-7900
157	180	Texas Eastern Transmission	Property Tax Dept. Houston, TX 77251-1642	434900	65-6730
158	138	Roy & Mae Schrack	209 E. High Street Womelsdorf, PA 19567	434900	36-2368
159	4	Billy & Carol Cipolla	RD2 Box 423A Bernville, PA 19506	434900	37-9715
160	2	Todd & Julie Anne Lynn	RD2 Box 423B Bernville, PA 19506	434900	38-8043
161	50	Paul & Jeanette Foose	RD2 Box 452 Bernville, PA 19506	434900	38-1684
162	119	David & Carol Batdorf	1638 Meadowlark Road Wyomissing, PA 19610	444000	30-6839
163	24	Leonard & Sally Blumberg	RD2 Box 419 Bernville, PA 19506	434900	19-4347
164	27	Kevin & Kimberly Murphy	RD2 Box 417 Bernville, PA 19506	434900	08-6924
165	7	Curtis & Susan Wallace	RD1 Box 422, Mill Road Womelsdorf, PA 19567	434900	08-6204
166	8	Anna Gassert	PO Box 134 Bernville, PA 19506	434900	97-6890

167	59	Thomas & Helen Handwerk	RD1 Box 46 Womelsdorf, PA 19567	434900	17-0708
168	3	Ronald & Mary George	RD1 Box 410 Womelsdorf, PA 19567	433900	97-4182
169	96	Jonathan & Tracy Bastian	364 Christmas Village Rd. Womelsdorf, PA 19567	433900	95-3943
170	12	Carol LaFollette & Marcia Laros	RD2 Box 422B Bernville, PA 19506	434900	17-5042
171	65	William & Kathryn Lutz	130 N. Wayne STreet Robesonia, PA 19551	434900	15-0138
172	89	Todd & Karen O'Neill	78 Forge Road Womelsdorf, PA 19567	433900	93-2744
173	46	Glyn Hook	RD1 Box 225 Robesonia, PA 19551	434900	13-5456
174	3	Kenneth Kreiser	RD1 Box 421 Womelsdorf, PA 19567	434900	03-6047
175	38	David & Annamae Gehret	RD1 Box 240A Robesonia, PA 19551	434900	01-8849
176	32	Elsie Wenner	105 Grandview Blvd. Wyomissing, PA 19609	434900	01-4316
177	32	Elsie Wenner	105 Grandview Blvd Wyomissing, PA 19609	434900	01-4316
177	4	Claude & Elsie Hartman	551 Basket Road	433900	91-0307
178		Richard & Frederica Heller	RD1 Box 336 Oley, PA 19547	433900	90-4595
179	18	Richard & Frederica Heller	RD1 Box 336	433900	90-2110
180	80	Pearl Sensenig	c/o Joan Sallade Womelsdorf, PA 19567	433800	88-0358
181	155	Arthur & Marguerite	RR1 Box 258	434800	17-3095

182	117	Glenn & Jane Siedel	RD2 Box 21 Womelsdorf, PA 19567	433800	93-8890
183	77	Ralph & Irene Miller	RD2 Box 20 Womelsdorf, PA 19567	433800	73-2863
184	5	Carlos & Kathleen Wiest	2312 Kay Court West Lawn, PA 19609	433800	76-4320
185	56	Roland & Carolyn Feeg	RD2 Box 7 Womelsdorf, PA 19567	433800	65-4849
186	135	Roland & Carolyn Feeg	RD2 Box 7 Womelsdorf, PA 19567	433800	53-6896
187	41	Roland & Carolyn Feeg	RD2 Box 7 Womelsdorf, PA 19567	433800	44-5712
188	18	Clark & Jane Hoover	RD1 Box 543 Womelsdorf, PA 19567	433800	44-2037
189	135	Floyd, Eugene, Neal & Carol Martin & Arlene Weaver	RD1 Box 541 Womelsdorf, PA 19567	433800	33-0933
190	1.4	James & Janice Murdough	RD1 Box 1544-A Womelsdorf, PA 19567	433800	41-7804
191	39	Roy & Virginia Zartman	PO Box 157 Womelsdorf, PA 19567	433800	11-8691
192	2	Russel & Joy Delp, Jr.	RD1 Box 532-E Womelsdorf, PA 19567	433800	11-0835
193	2	Blake & Beverly Brown	RD1 Box 532-A Womelsdorf, PA 19567	433800	01-6742
194	9	Eugene Wells	RD1 Box 113 Womelsdorf, PA 19567	433800	11-0110
195	109	Walter & Etta Wise	RD1 Box 114 Womelsdorf, PA 19567	433700	09-1826
196	.4	Terry & Patricia Boyer	RD1 Box 531 Womelsdorf, PA 19567	433800	02-5108
197		Brennan Brewer	RD1 Box 529 Womelsdorf, PA 19567	433800	02-5238

198		Casimir Nabozny, Jr.	RD1 Box 528B Womelsdorf, PA 19567	433800	02-5354
199		Kurt Fick, Sr.	PO Box 21 Womelsdorf, PA 19567	433800	02-5378
200	.3	Kurt Fick, Sr.	PO Box 21 Womelsdorf, PA 19567	433800	02-5493
201		Irvin & Stella Deppen	RD1 Box 527 Womelsdorf, PA 19567	433800	02-6557
202	.5	Robert & Mary Nagle	RR1 Box 519, Canal Rd. Womelsdorf, PA 19567	433800	02-5662
203	.5	Charles Manmiller & Lorraine Prince	RD1 Box 518, Canal Rd. Womelsdorf, PA 19567	433800	02-4676
204		Robert & Theodore Krick	8815 Lagrange Street Lorton, VA 22079	433800	02-3762
205	2	Robert & Theodore Krick	88815 Lagrange Street Lorton, VA 22079	433800	02-2971
206	25	Richard & Mary Jane Arbogast	RR1 Box 515A Womelsdorf, PA 19567	433800	02-1948
207	6	Robert & Mercedes Davis	210 E. Mansion Drive PO Box 171 Shillington, PA 19607	432800	94-3111
208	54	Larry & Nancy Weaver	RR1 Box 117-BB Womelsdorf, PA 19567	432800	92-4435
209	16	A. Kenneth Stoltzfus	RD1 Box 118 Womelsdorf, PA 19567	432800	82-2533
210	67	A.C. Klopp Co.	c/o Saveway 551 W. Penn Avenue Wernersville, PA 19565	432800	62-6938
211	77	Stephen & Philip Bennetch	RD1 Box 132 Womelsdorf, PA 19567	432803	42-6434
212	61	Susan Stum	35 Scharff Road Womelsdorf, PA 19567	432803	23-7095

213	52	Bruce & Jeana Webber	RD1 Box 166-A Richland, PA 17087	432803	12-1950
214	23	Marion Twp.Rod & Gun Club	44 S. Water Street Womelsdorf, PA 19567	432803	04-5244
215	39	Jack & Ethel Jean Bond	RD1 Box 165 Richland, PA 17087	432800	04-1976
216	200	Paul & Marilyn Sonnen	RD1 Box 6 Richland, PA 17087	431800	74-6495

Lebanon County:

Map #	Owner	Address	Tax Map #	Pin #
217	Anthony & Alice Oskam	201 Golf Road Myerstown, PA 17067	75	160
218	Lyn & Betty Jane Schaeffer	R1 Box 63 Richland, PA 17087	75	98
219	Melvin & Jane Nolt	160 Reilly Road Richland, PA 17087	75	165
220	Arthur & Alta Lehman	110 Reilly Road Richland, PA 17087	75	155
221	Elmer & Mary Ann Derr	R 1 Richland, PA 17087	75	152
222	Myron & Catherine Derr	150 Reilly Road Richland, PA 17087	75	150
223	Melvin & Jane Nolt	160 Reilly Road Richland, PA 17087	75	165
224	Quest Corp. Andrew Folmer	115 Stanley Drive Palmyra, PA 17087	75	120
225	Aaron & Verna Sensenig	260 Millardsville Road Richland, PA 17087	75	300
226	Carl & Noreen Sensenig	720 Tulpehocken Road Myerstown, PA 17067	75	401

227	Nelson & Eva Jane Martin	699 E. Lincoln Avenue Myerstown, PA 17067	75	403
228	Ivan & Ester Weiler	351 E. Mill Avenue Myerstown, PA 17067	75	402
229	Ivan & Esther Weiler	351 E. Mill Avenue Myerstown, PA 17067	74	420
230	David & Lovina Martin	70 Martin Road Myerstown, PA 17067	74	400
231	Lester & Pamela Strunk	500 E. Main Avenue Myerstown, PA 17067	74	408
232	Myerstown Borough Sewer Authority	Myerstown Borough Hall Myerstown, PA 17067	74	430
233	Jackson Township Lebanon County	60 N. Ramona Road Myerstown, PA 17067	74	440
234	Carl & Sheila Neuman	211 Quarry Drive Myerstown, PA 17067	74	560
235	Carl & Sheila Neuman	211 Quarry Drive Myerstown, PA 17067	74	560
236	Quaker Alloy, Inc.	S. Cherry & Richland Ave. Myerstown, PA 17067	74	520
237	Robert & Beverly Whitmer	1696 Hilltop Drive York, PA 17402	74 F	878
238	Robert & Beverly Whitmer	1696 Hilltop Drive York, PA 17402	74 F	870
239	Lee & Eleanor Davis	511 S. Cherry Street Myerstown, PA 17067	74 F	774
240	Jay & Crystal Zimmerman	515 S. Cherry Street Myerstown, PA 17067	74 F	776
241	Kohl Bros, Inc.	5 Muth Avenue Myerstown, PA 17067	74 F	800

242	Ada Straus	516 S. Railroad Street Myerstown, PA 17067	74 F	754
243	David & Robert Ebling	515 S. Railroad Street Myerstown, PA 17067	74 F	686
244	Boro of Myerstown	515 S. College Street Myerstown, PA 17067	74 F	680
245	Anthony Cikovic	525 S. College Street Myerstown, PA 17067	74 F	650
246	Boro of Myerstown	Myerstown Boro Hall Myerstown, PA 17067	74 F	660
247	Wengers Farm Machinery, Inc.	251 S. Race Street Myerstown, PA 17067	74 F	644
248	James & Mildred Condran	410 S. Goodwill Street Myerstown, PA 17067	74 F	630
249	Robert & Fern Patrick	200 W. Maple Avenue Myerstown, PA 17067	74 E	240
250	Unknown		Between 74 F & 59	
251	Ernest & Mary Hurst	435 S. Race Street Myerstown, PA 17067	59	30
252	Sterling Drug, Inc. c/o Eastman Kodak	343 State Street Rochester, NY 14650	59	29
253	Sterling Drug, Inc. c/o Eastman Kodak	343 State Street Rochester, NY 14650	59	34
253.5	Harold & Edith Grumbine	47 S. Fairlane Avenue Myerstown, PA 17067	59	40
254	Whitmoyer Laboratories Inc.	19 N. Railroad Street Myerstown, PA 17067	59	38
255	Graystone Group, Inc. c/o Diane Marlene Spang	46 E. Locust Street Lebanon, PA 17042	59	50
256	John & Elizabeth Zimmerman	50 S. Ramona Road Myerstown, PA 17067	59	60

257	Robert & Helen Russell	44 College Drive Jersey City, NJ 07305	59	56
258	Esther Nissly	624 W. Chesnut Street Lancaster, PA 17603	59	520
259	Lebanon Rock Inc.	Post Office Box 1531 Harrisburg, PA 17105	58	300
260	Kervin & Janet Zimmerman	1181 Miller Road Myerstown, PA 17067	58 A	400
261	Kervin & Janet Zimmerman	1181 Miller Road Myerstown, PA 17067	58 A	400
262	Richard & Kathryn Boeshore	100 Prescott Drive Lebanon, PA 17046	58	220
263	George Seyfert c/o Farmer's Trust Co.	Post Office Box 478 Lebanon, PA 17042	58	180
264	Arnold Acres, Inc.	R 2 Box 665 Lebanon, PA 17046	58	160
265	Arnold Farm, Inc.	RD 2 Lebanon, PA 17046	58	20
266	Christian & Florence Wolfersberger	544 E. Kercher Avenue Lebanon, PA 17046	72	542
267	Arnold Farm, Inc.	RD 2 Lebanon, PA 17046	72	548
268.5	Dene & Joan Light	625 E. Kercher Avenue Lebanon, PA 17046	72	510
268	Ray & Deborah Bishop	595 E. Kercher Avenue Lebanon, PA 17046	72	520
269	Richard & Kathryn Seyfert	704 N. 11th Avenue Lebanon, PA 17046	72	560

ANALYSIS

Based on the inventory information contained in the preceding section, the following problems and needs were identified.

•DEVELOPMENT PRESSURE AND FARMLAND PROTECTION

This remains the single largest factor affecting the water quality of the Tulpehocken Creek. To the degree that development replaces natural drainage with impervious surfaces, contributions to runoff and phosphate and nitrate pollution; to that degree is the Tulpehocken Creek in peril. While ordinances in the immediate corridor need some revision; watershed-wide ordinances need extensive attention.

Many methods have been outlined throughout this report and elsewhere concerning farmland protection. What needs to go hand-in-hand with land acquisition, conservation easements, and maintenance agreements, however, is a series of methods to preserve the profession of agriculture as we now know it. Financial protection is only part of that story.

Working on environmental-agricultural partnerships will take some time. Finding a model community to try a variety of approaches to preserve the profession of farming should be a principal element of this Plan; for farmers are the key for the foreseeable future to achieving protection along the stream.

•WATER QUALITY DIFFICULTIES

The results of the water quality testing showed high levels of phosphorus and nitrates, low dissolved oxygen at a few sites, and a high sediment load. Overall, the test parameters included pH, alkalinity, dissolved oxygen, nitrate, phosphate, chlorine, and ammonia nitrogen. On the other hand, tests for fecal coliform and fecal strep were not conducted. Similarly, the tests for various

pesticides and herbicides were not conducted. In an area where the known pollution is from agriculture and sewage treatment plants, it is imperative that the tests are geared to monitor pollutants that are likely to be at high levels. Adding more selective parameters would also help narrow down the source of pollution. For example, in one area where the water quality was poor, it could not be determined from the data whether the problem was caused by a fishery, agriculture, or a nearby trailer park. In this case, testing for fecal coliform and fecal strep may narrow down the source of pollution.

- ***Low Water Quality due to Agricultural Activity***

The Tulpehocken Creek watershed drains some 225,700 acres of Lebanon and Berks Counties. The major economic activity in the study area, and one that has been intensively practiced for the past 250 years, is agriculture. According to the Tulpehocken Creek Watershed Study done by both Berks and Lebanon Counties, 75% is used for agriculture excluding numerous boroughs. There are 362 farms with livestock populations. On these farms there are 26,100 dairy cows, 3,768,800 poultry animals, 22,500 swines and 29,000 rabbits.

The majority of agriculture is concentrated in the portion of the watershed upstream of Blue Marsh Lake. Pollution associated with agricultural practices are clearly reflected in water testing results through the levels of phosphate, nitrate, and sediment. High levels of phosphorus and nitrogen are found throughout the stream beginning approximately one mile from the headwaters all the way to the confluence. The level of phosphorus was exceedingly high in 80% of the water testing sites along the Tulpehocken and 92% of sites were high in nitrates. The sediment load carried by the stream is extremely high causing the water to run brown at times from one mile downstream of the headwaters through to Blue Marsh Lake.

Examples of the high levels of both nutrients and high sediment load can clearly be seen at dams or at the old Union Canal locks. In a couple of areas above Blue Marsh where the water becomes dammed, signs of eutrophication are evident. The color of the

water is pea soup green. Algal growth can be seen on rocks and throughout the water column as plant growth is stimulated by the increased level of nutrients. At the same time, the sediment load settles out as the water becomes slower behind the impoundment causing the stream to become shallower as layers of silt build up on the stream bed. At one of the impounded areas a dissolved oxygen test measured 3 mg/l. That is the equivalent of aquatic death for many desirable species.

Large scale problems evolve as the nutrients and sediment reach Blue Marsh Lake. Blue Marsh Lake acts as a settling basin for the excess nutrients as well as the high sediment load, which in all probability may be accelerating the eutrophication process in the lake. "In another pre-impoundment study (Barker, 1977), annual input to the lake was estimated to be 1400 tons of nitrogen and 46 tons of phosphorus. Daily suspended sediment loads ranged from one to 8350 tons during the study period. (USDA, Soil Conservation Service,1992)." "The state determined the trophic status of Blue Marsh using Carlson's Trophic State Index (TSI). Lakes with a TSI greater than 65 are considered eutrophic. Blue Marsh has a TSI of 65 (BWQM, 1990)." "The continuing inflow of nutrients will likely push the TSI into the eutrophic category in the near future, as predicted prior to and following impoundment in the mid-70's (USDA, Soil Conservation Service, 1992)."

Many agricultural practices contribute to the low water quality. Failure to administer conservation plans containing best management practices, the lack of nutrient management plans, and the removal of vegetation to the banks of the stream are a few practices that adversely affect water quality. An example of a best management practice contained in a conservation plan to increase water quality is stream bank fencing to keep livestock out of the stream corridor. Currently, intensive livestock operations allow the cattle direct access to the stream. Livestock or animal access creates two problems. Most obviously, the cattle urinate and defecate directly into the stream. The waste causes levels of phosphorus and nitrates to soar. Secondly, the cattle reduce vegetation along the stream

banks and also wear down the stream bank itself. The buffer zone of streamside vegetation can reduce pollution entering the stream, by slowing runoff and allowing sediment and associated nutrients to settle out. Streambank and bed vegetation protects sediment from the erosive force of the flow by reducing velocity and by the cohesive effect of root systems. The effects of cattle on the stream are most evident when a farming operation places the feedlot next to the stream or the stream bi-sects the feedlot. In these areas there is no vegetation. The completely exposed soil and waste directly enters the stream.

A general overview of the services offered by the County Conservation District and the Federal Natural Resources Conservation Service that will be discussed in this proposal are presented in Figure 1 and Figure 2.

Figure 2

County Conservation District

|

Nutrient Management Plan

Figure 1

Federal Natural Resources Conservation Service (NRCS)

|

Conservation Plans

|

Best Management Practices (BMP's)

| |

Agricultural Conservation Program (ACP) — Water Quality Plan Funding

| |

Permanent Vegetative Cover
Animal Waste Management System
Strip Cropping
Terraces
Cropland Protection
Contour Farming
Stream Protection
Permanent Cover / Critical Area
Sediment Retention / Control Structures
Manure Storage Facilities

Integrated Crop Management Plan (ICM)
Well Testing

Technically, in order for farms to qualify for NRCS Programs, a conservation plan is required. Conservation plans are made up of best management practices designed to reduce soil erosion and reduce pollutants from entering the stream. Such practices include integrated crop management plans, stream bank fencing, conservation tillage, strip cropping, and the re-establishment of riparian buffer zones that may have been removed to increase field space or for livestock purposes.

However, there is insufficient oversight capability to determine if the farms that have had the conservation plans prescribed to them are utilizing them and identifying which farms have never sought the plans. It was noted by speaking with the Berks County Environmentalist and Berks County's Natural Resources Conservation Service that many farms in the watershed do not fully utilize the conservation plans provided for them.

Legally, it is required that all farms have a conservation plan and implement it. However, unless a farmer is causing physical damage to someone else's property or someone reports undesirable activities, the farmer is generally left alone. If a farmer, who is not implementing a conservation plan, does cause damage to another person's property that farmer may face a lawsuit. For example, there was an instance of a farmer in Berks County who did not have a conservation plan, and had the equivalent of 60 to 70 wheelbarrows full of corn stalks runoff on to a neighbor's property, ripping up a series of posts that had been concreted in the ground. The farmer could potentially be liable for damages to that property owner if the owner decided to prosecute. Also, if a farmer is polluting a given area, DER may be notified and may begin imposing fines until the situation is corrected.

Nutrient management plans are offered at no charge through the County Conservation Districts. Both Berks and Lebanon Counties have nutrient management specialists who go out and write individual plans for farmers. The plan addresses manure and fertilizer applications based on soil testing and on-site evaluations. However, due to staffing problems the specialist are only able to reach a small percentage of the farms.

To compensate for the lack of nutrient management specialists, the Natural Resources Conservation Service (NRCS) has added integrated crop management (ICM) plans as a best management practice in a conservation plan. The ICM plans allow private consultants, who have been authorized by NRCS, to write the plans. The plans are a combination of a nutrient management plan and pesticide plan. The integrated crop management plans are more comprehensive than the nutrient management plans.

Many farmers in the Tulpehocken watershed do not have either a nutrient management plan or integrated crop management plan. In such cases, soil testing is either simply not done or is done by fertilizer manufacturers. The manufacturer then recommends amounts of fertilizers the farmer "should" be using and sells the product to them. Neither approach is a desirable method to achieve nutrient management.

Many best management practices in the conservation plan are eligible for cost sharing programs available through the Consolidated Farm Service Agency (CFSA), formerly the Agricultural Stabilization Conservation Service (ASCS). CFSA provides a percentage (that varies depending on the practice) of the total cost of selected best management practices through the Agricultural Conservation Program (ACP). The best management practice eligible for ACP include physical layout or structures. Funding is renewed each year for ACP.

The other best management practices are considered WQP-1 practices that are designed to reduce nonpoint source pollution modifying agricultural production systems and practices. A lump sum of money was given to the Natural Resources Conservation Services in each county in 1994. The money will not be renewed in 1995 and is expected to be used up by the end of 1994, after which, no funding will then be available for WQP-1 practices.

The conservation plans and nutrient management plans are designed to improve the water quality of the stream, but also to increase productivity and reduce expense for the farmer. Two leading reasons why farmers do not comply is a lack of funding on the

farmer's behalf (even with the cost sharing program) and the lack of education that explains the benefits of the practices to the farmers. The governmental agencies that write up the plans for these practices have little time to spend on education. Also the agencies are short staffed and do not have the extra time required to provide an education program. The farmers need to learn about benefits of the programs. Also, there are a substantial number of Amish and Mennonite farmers in the watershed that, due to their religious beliefs and practices, would require a culturally-sensitive approach for education prior to implementing a cost sharing program.

Each County in the watershed also has a Farmland Preservation Program. The program not only preserves the integrity of an area by limiting development but requires the farmers who participate to follow the conservation plans and nutrient management plans. This program does monitor participating farms every year to ensure compliance with both plans. If the plans are not being followed, legal actions can be taken such as paying back taxes that were lowered due to participation in the program, or additional fines and even lawsuits may be imposed. Again, many farmers do not even know the program exists let alone want to use it. The Farmland Preservation offices are understaffed and short of funding. Little is done to promote education and publicity due to this under staffing.

Many governmental agencies play a role in the agricultural community. The agencies include the Natural Resources Conservation Service, Conservation District, County Environmentalist, Agricultural Stabilization and Conservation Service, and Farmland Preservation. The watershed crosses County boundaries. Most of those agencies are found in each County. However, there is only one person who sometimes crosses the political boundary to work effectively in watershed management. The role of that individual is strictly limited. Both Counties do have agricultural centers where most of

the offices are located. However, communication between the agencies is very limited. The watershed desperately needs a person to organize and coordinate the activities of all agencies and provide education to effectively increase the efficiency of the overall system.

• *Low Water Quality due toUrban Impacts*

Urban pressures are seen throughout the watershed as the stream corridor passes through 14 municipalities of the 32 municipalities in the two counties of the watershed. Water quality is seriously degraded due to nonpoint and point source pollution. Nonpoint sources of pollution in urban areas along the Tulpehocken Creek include individual septic systems, runoff from roads, lawns, and bank erosion. Individual septic systems are found in almost every community bordering the stream. Private landowners use and maintain individual septic systems. It is unclear how much sewage is leaching into the ground water and the Tulpehocken Creek. Testing of well water on a periodic basis is not performed. It has been suggested that the pollutants entering the system from septic systems are as high as or higher than that amount of pollutants resulting from agricultural practices.

Many urban areas generally not have riparian buffer zones along the stream banks. Runoff from roads and lawns is able to easily enter the stream. The lack of vegetative cover also de-stabilizes the banks creating severe erosion in some areas. The loss of the riparian buffer zone is further described in the next section.

Point sources of pollution such as pipes, sewage treatment plants, fisheries, and discharges from trailer parks, schools and small businesses can be found throughout the watershed. Myerstown Park is an example of discharge from pipes entering the stream. At the park there is a large manmade pool adjacent to the stream. There are several large drainage pipes emptying into the pond from sources currently unknown. When the pond exceeds its capacity, the excess water flows over a spillway that leads into the Tulpehocken Creek. At this point it is unclear what pollutants, if any, are added to the creek. The spillway cuts through a picnic area in the park. Signs are currently erected that state not to

cross the spillway if water is running through it. The present location of the spillway also creates a potential safety hazard and needs to be rerouted. Other pipes empty into the stream through the watershed. The source of these pipes is unknown.

Many sewage treatment plants are impacting the Tulpehocken Creek. "Two tributaries which enter Tulpehocken Creek downstream of Blue Marsh Lake, Plum Creek and Cacoosing Creek, are impacted primarily by point sources. Water quality in Plum Creek is generally good, except for a segment below a sewage treatment plant discharge. This segment was reported to have elevated concentrations of BOD, suspended solids, ammonia, nitrite, total phosphorus, chloride, and fecal coliform. Cacoosing Creek has poor quality water due to two sewage treatment plants and a paper mill discharge. Ammonia, nitrogen, phosphorus, and BOD are all elevated in the lower reach of the creek (Young, 1990) Sewage treatment plant discharges enter the upper Tulpehocken Creek near Myerstown and the mid-Tulpehocken Creek near Womelsdorf (USDA, 1992)." It was noted that these two plants were operating within their discharge permits. Likewise, the Bernville Sewage Treatment Plant discharges high levels of BOD and suspended solids but the overall loads area low (USDA, 1992).

Several fisheries are under risk of polluting the stream. The surrounding areas of the stream suffer from low water quality with a high sediment load. In one such area, agricultural lands and a small trailer park also exist. The simplicity of the water quality testing done to date has made the cause of the low water quality unclear and should to be further investigated. Local fisherman complained of a strong odor coming from the hatcheries. The Limestone Springs Trout Hatchery is one such hatchery that has been known to emit small industrial discharges (USDA, 1992).

Other sources of point source pollution would include the area surrounding the Fort Zeller Elementary School that releases BOD, phosphorus and suspended solids in the Mill Creek (Berks/Lebanon Counties). According to the 1992 study, this was planned to be upgraded in the near future. "The Heidelberg Country Club discharges to the Northkill

and the Tulpehocken High School discharges to the Little Northkill Creek. These discharges are relatively minor (UDSA,1992)." Other point sources include several small industrial discharges (USDA,1992).

The lack of education is reflected in the zoning regulations that do not provide for a riparian buffer zone. None of the eleven municipalities above Blue Marsh Lake have zoning regulations that fully reflect the presence of a stream. Each community has a separate set of zoning regulations. Land surrounding the stream corridor varies from industrial, high, medium and low density residential, highway commercial, to agriculture. The development has allowed a riparian buffer zone only in secluded areas.

- *Loss of a greenway corridor*

The lack of a riparian buffer zone upstream of Blue Marsh Lake presents several problems. Storm water runoff carries the pollutants to the stream. The pollutants are a result of both agriculture and urban development. Agricultural pollutants include herbicides and pesticides applied to fields, soil from exposed areas, and manure from a variety of farm animals. Pollutants from traffic and lawn care products are only a few that result from urban areas. Second, the lack of vegetation de-stabilizes the banks resulting in erosion problems.

The removal of the greenway corridor also has its roots in both agriculture and urban development. Farmers remove vegetation along streams to increase field size in order to receive the largest yield from their land. Also, many farms allow animals access to the streams as a source of water. The animals generally over-graze the vegetation along the stream's banks. The weight of the animals and overuse of specific areas does not allow for new vegetation and eventually leaves the soil exposed. For example, the conditions where a feedlot exists along a stream are the worst.

- *Loss of Wildlife Habitat*

Pressures from agriculture and urban development have led to a loss of habitat especially along the Tulpehocken Creek corridor. As noted earlier, there is a lack of a greenway corridor above Blue Marsh Lake. The removal of the riparian buffer zone has reduced the habitat for many species including small mammals, waterfowl and birds. The vegetation also served as a cooling mechanism for the water. Cooler water holds more oxygen for the species that dwell in the stream. The warmer water that now exists makes it difficult for cold water species such as the native brown trout to live.

A threat to the lower part of the stream that does have a greenway corridor is the water releases from Blue Marsh Dam. Notably during spring rains, large volumes of water are released to control dam levels. The drastically varying water levels temporarily flush out the habitats downstream. The large releases are also causing extreme bank erosion that can be seen around the confluence of the Cacoosing Creek and the Tulpehocken Creek upstream along the Tulpehocken for approximately 1/2 mile to a small island. Over the past winter, severe erosion occurred due to the large snow pack and the large releases from Blue Marsh Dam. The stream is becoming shallower and therefore warmer, which may influence the dynamics of species The stream is currently designated as a cold water fishery and is stocked with trout. The trout may not be able to survive if the current conditions are allowed to worsen.

Canada Geese have made their nesting site 1/4 mile upstream along the Cacoosing from the confluence of the Cacoosing Creek and the Tulpehocken Creek The concentrated population of Geese has led to a reduced water quality. During winter and spring months, the water in the Cacoosing is brown and displays signs of accelerated levels of nitrates and phosphates. A relocation for some of the flock is needed to increase the water quality to keep the stream livable for other species.

- ***Improvements of Recreational Areas***

The area along the Tulpehocken from Blue Marsh Lake to the confluence in Reading is heavily used for recreation such as fishing, walking, and picnicking. Above this area the greenway corridor ends and so does the recreation. Many towns have only small parks that are in need of repair. At locations used for water quality testing, there were many fishermen usually accessing the stream usually by fishing illegally since there are very few public access points to the stream.

A different type of safety issue exists on the trail system below Blue Marsh Dam. A hiker was stranded in the middle of the stream on a Sunday as quickly rising water levels cut off the trail he was on from the mainland. Presently, there are no warning systems as to when the releases will be made or how large the releases will be.

As noted earlier, the releases from Blue Marsh Dam are causing extreme bank erosion and the stream in widening. Not only is this a threat to the trout population but is also cutting back the banks to the Berks County trail system. If the erosion is left untreated, the trails will eventually be undercut in more places than they already are.

- ***Education on a Watershed Basis.***

Education throughout the entire watershed is essential to the success of any watershed projects. At present, the only agencies providing some education within the watershed are the Penn State Extension Service and the Berks County Conservancy. It is imperative that coordinated efforts be made with agricultural community, suburban and urban areas, and in the schools to create awareness and induce actions that will benefit the stream. The educational programs need to be interactive and induce local citizens to want to participate.

The Berks County Conservancy has done planning on the Tulpehocken Creek for almost a decade. Implementation of the programs that will make substantial changes in the watershed and improve the health of the stream is now long overdue. The most important change, however, needs to be coordinated efforts and communication between all the agencies already involved in the creek, all the municipalities in the watershed, private land owners, schools and any other volunteer groups that have an interest in the creek. With the cooperation from all individuals, programs needed to address methods to increase water quality, decrease both nonpoint and point source pollution, restore wildlife habitat, improve recreational areas, preserve historical features, activate clean-up efforts, and institute educational programs that can be successfully carried out in a strategic river management plan.

STATEMENT OF GOALS

The goal of this grant proposal is to improve and preserve the natural and historical resources of the Tulpehocken watershed while providing recreational access. To achieve the goal, the river management plan will address methods to provide water quality monitoring, improve water quality degraded as a result of both agricultural and urban development, establish a greenway corridor, restore wildlife habitat, improve recreational areas, institute educational programs, preserve historical features, and activate clean-up efforts. Cooperation between municipalities, citizens, river support groups, governmental agencies, private industries, and nonprofit organizations is crucial to the success of the river management plan.

GOALS OF THE STRATEGIC RIVER MANAGEMENT PLAN:

- ***Produce water quality results for the watershed***

A goal of the strategic river management plan will be to produce water quality results for the Tulpehocken watershed. The water quality records will begin with the results given in this plan and will continue in future years. The consecutive years of results will provide a solid basis to make decisions within the watershed and will provide information as to sites that need immediate attention.

- ***Improve water quality degraded as a result of agricultural activity***

Due to the enormous amount of agriculture within the watershed, it is imperative that this Plan seeks to control the nonpoint source pollution resulting from this activity. Notably above Blue Marsh, runoff from fields and pastures and livestock with access to the stream need to be reduced to lower the levels of nutrients, sediments and herbicides/pesticides that currently enter the stream.

- *Improve water quality degraded as a result of urban impacts*

Individual communities need to reduce the amount of pollution from private septic systems, runoff from roads, lawns, and bank erosion. Riparian buffer zones need to be established or protected. The stream should be recognized as the asset that it is and incorporated into the overall outlook of each town.

Potential threats from point sources of pollution such as pipes, sewage treatment plants, fisheries, and discharges from trailer parks, schools and small businesses need to be identified. Checks on the emission of pollutants from these sources need to be implemented to identify short term or long term problems.

- *Establish a greenway corridor*

A goal of this Plan is to establish a greenway corridor along the entire Tulpehocken Creek and selected areas along tributaries. The effort will be concentrated upstream of Blue Marsh Lake since the lower section of the stream is already a park area with a buffer zone. The improvement of the greenway corridor will reduce pollutants from runoff from entering the stream as the stabilize stream banks and improve wildlife habitat.

- *Restore wildlife habitat*

The restoration of wildlife habitat will seek to increase the amount of wildlife habitat, increase the diversity of species and to raise the population of those species. The term species will apply to both plants and animals native to the Tulpehocken watershed.

- *Improve recreational areas*

Recreational areas will be improved by increasing the number of the areas as well as improving the existing conditions of current areas. New sites will be located above Blue Marsh Lake while existing areas downstream of Blue Marsh Lake will be expanded. All recreational areas in need of repairs will be addressed. The combination will increase recreational access for all communities within the Tulpehocken watershed.

- *Provide education on a watershed basis*

Educational programs will be implemented in the school systems and to all boroughs and townships within the watershed. The goal of the programs is to improve the health of the stream while providing education.

The initial goals in urban areas include changing zoning regulations that will reflect the presence of the stream and increase water quality by addressing pollution caused by sewage systems and runoff from lawns, roads, and storm water.

Education in the school systems will seek to be interactive. Students need to be aware of the presence of the stream and its watershed. They need to understand how their actions affect their environment and steps they can take to improve the health of the stream.

- ***Preserve the historical integrity of the watershed***

Historical sites need to be preserved and protected against general deterioration and change of ownership. When possible, repairs should be made to prolong the life of historical features. In times when a site does undergo a change in ownership, it is desirable for the new owner to maintain the historical feature. The combination of repairs and monitoring the change in ownership will help in preserving the historical integrity of the watershed.

- ***Clean-up trash / debris***

It will be the goal of this strategic river management plan to clean up the stream and its banks along the Tulpehocken Creek and its tributaries on a regular basis. The removal of trash will improve water quality, wildlife habitat, and the aesthetic value of the stream.

- ***Promote communication and cooperation throughout the watershed***

It is a goal of this river management plan to establish lasting ties between municipalities, citizens, river support groups, governmental agencies, private industries and nonprofit organizations. To realize long lasting positive effects of a river management plan, local groups need to communicate and work together over time. The strategic river

management plan will incorporate many groups and provide a basis for forging common goals between interested parties.

STATEMENT OF OBJECTIVES

The objectives outlined in this section, which are only briefly described here, are actions designed to meet the needs of the grant proposal. The following sections will provide a list of 17 detailed current strategies to meet the objectives. This listing of objectives is only to serve as a beginning point. In future years, more objectives may be aded as additional needs are identified.

The objectives listed in this section include:

•Set up a water quality testing program throughout the watershed

•Provide an integrated, comprehensive package to address problems on a watershed basis

•Control urban nonpoint and point sources of pollution

•Re-vegetate disturbed areas along the stream's corridor and preserve undisturbed areas to reduce non-point source pollution, stabilize stream banks, and improve wildlife habitat

•Maintain healthy populations of native plants and animals

•Increase the quantity, condition, and safety of recreational areas

•Provide education in the schools

•Monitor and preserve hisrorical sites

•Establish a cleanup program for the stream's corridor and its tributaries.

- *Set up a water quality testing program throughout the watershed*

It will be an objective of the strategic river management plan to institute a comprehensive water quality monitoring program throughout the watershed. Common chemical and physical measures of pollution including temperature, pH, alkalinity, dissolved oxygen, nitrate, phosphate, free and total chloride, and ammonia nitrogen will be the basic set of parameters to be tested for. The program will be designed to test the same sites a couple times a year, year after year to obtain a consistent record of water quality for the Tulpehocken Creek and its tributaries.

Problem areas such as those near sewage treatment plants, fisheries, and urban or agricultural areas with known pollution problems including those listed in the Tulpehocken Creek Watershed Report done by both Berks and Lebanon NRCS offices and Conservation Districts. Tests will include, but not be limited to, fecal coliform and fecal strep as well as various herbicides and pesticides. The addition of these tests to the set of common physical and chemical parameters will provide a clear picture of the water quality within the Tulpehocken watershed.

A water quality monitoring program will be established throughout the entire stream system. It will be the first of its kind in the Tulpehocken watershed and a pioneer in the entire region. The program will provide invaluable information on critical sites such as the point sources of pollution, clues as to the causes of pollution and, over time, reflect the improvements that have been incorporated in the watershed. It will follow a national computer model currently used by the Chesapeake Bay Foundation in Virginia, with improvements and modifications. Another goal of the monitoring program is to involve as many interested participants as possible such as students of all levels, river support groups, nonprofit organizations, and concerned citizens.

- *Provide an integrated comprehensive package to address problems on a watershed basis*

An objective of this Strategic River Management Plan is to provide an integrated comprehensive package that addresses agricultural problems on a watershed basis. The package would include providing funding to promote the use of conservation plans; providing education to the agricultural community to support conservation plans; providing culturally sensitive education to the Amish/Mennonite communities to support conservation plans; monitoring the implementation of conservation plans within the watershed; supporting the GIS in Lebanon County and establishing a GIS in Berks County; and promoting farmland preservation programs. The following is a list of boroughs and townships in both Berks and Lebanon Counties in the Tulpehocken Creek watershed that will be included in this objective:

Berks County

Reading City	Birdsboro Boro.
Robesonia Boro.	Wernersville Boro.
Womelsdorf Boro.	Bernville Boro.
Tulpehocken Twp.	Jefferson Twp.
Upper Tulpehocken Twp.	Marion Twp.
Bern Twp.	Spring Twp.
Upper Bern Twp.	Muhlenberg Twp.
Lower Heidelberg Twp.	Alsace Twp.
Penn Twp.	Lower Alsace Twp.
Centre Twp.	Exeter Twp.
N. Heidelberg Twp.	Robeson Twp.
Heidelberg Twp.	Brecknock Twp.
S. Heidelberg Twp.	Union Twp.

Lebanon County

Myerstown Boro.	Schaefferstown Boro.
Richland Boro.	Jackson Twp.
Millcreek Twp.	North Lebanon Twp.

The implementation of the agricultural integrated comprehesive package is designed to implement the use of best management practices throughout the watershed. The best

management practices are designed to significantly decrease the amount of nonpoint source pollution and thus increases the water quality of Tulpehocken Creek.

To compensate for the farmer's lack of funding in implementing conservation plans, this Plan will provide supplemental funding to the farmer for the installation of Best Management Practices (BMP's). A percentage of the cost of the BMP's incurred by the farmer will be re-funded to the farmer, therefore allowing enable more farmers to participate. The objective of the additional funding is to accelerate the use of the conservation plans.

Educational materials and seminars will be provided to the agricultural community within the watershed that will support the use of conservation plans and nutrient management plans. Benefits to the farmers for using both types of plans will be outlined and discussed. Visual demonstrations such as slides and field trips will be included whenever possible.

A portion of the education materials will be geared to more effectively reach the Amish/Mennonite communities. These educational programs will also support the use of conservation plans and nutrient management plans by outlining benefits and include visual demonstrations when possible.

To compliment the conservation plan and educational objectives, the implementation of the conservation plans will also be monitored. The monitoring will demonstrate which areas need to be targeted for future contact and education.

Another part of the integrated comprehensive package is tto promote the farmland preservation programs in both Berks and Lebanon Counties. The objective in Lebanon County is to get the program up and running. In Berks County, the objective is to support

the existing person who single-handedly runs the program by promoting education of the program and assisting of the on-site inspections.

- *Control urban nonpoint and point sources of pollution*

It will be an objective to control both urban nonpoint and source point pollution through education and site monitoring. To improve the water quality in urban areas, the strategic river management plan will reduce the nonpoint source pollution caused by septic systems, as well as runoff from roads, lawns and storm water through interactive education programs. Addressing sewage problems will play a large role in the community education. Communities will be encouraged to test their own well water. Alternatives to existing septic systems will be presented. Residents will learn the importance of septic system maintenance.

Model zoning ordinances will also be presented to the communities that will reflect the needs and concerns of the Tulpehocken watershed. Ideas such as the need for a conservation zone along the stream in which a greenway corridor may be established will be introduced.

Point source of pollution that are result from sewage treatment plants, fisheries, schools, small businesses, and trailer parks will be monitored. Pipes discharging into the stream system will be investigated and capped where applicable.

- ***Re-vegetate disturbed areas along the stream's corridor and preserve undisturbed areas to reduce nonpoint source pollution, stabilize stream banks, and improve wildlife habitat***

Continued progress toward establishing a full greenway corridor will be initiated. Educational programs will reinforce the importance of the riparian buffer zone in agricultural and urban areas. Within the agricultural conservation plans, provisions will be made for farmers to re-vegetate the stream's banks through cost sharing programs. In urban areas with the change in zoning regulations and conservation easements, space for a greenway corridor will be established. Through this grant, funding may be provided for

easements and to re-vegetate those spaces not covered under the agricultural conservation plans.

The riparian buffer zone will also act as the foundation for the wildlife habitat by providing for small mammals, waterfowl and birds. The vegetation will include shrubs and trees that will cool the water in order to allow a more diverse selection of species. For example, throughout the watershed, recreational fishing is extremely popular. Much of the Tulpehocken is currently stocked with trout. With the assistance of the Tulpehocken Chapter of Trout Unlimited, the trout habitats will be improved to increase the population of native trout.

- ***Maintain healthy populations of native plants and animals***

To improve the wildlife habitat, it will an objective of this Strategic River Management Plan to maintain healthy populations of plants and animals. Initally, this will be accomplised by providing nesting boxes, establishing wildflowers along the stream corridor and its tributaries, and reducing the pollution associated with concentrated populations of Canada Geese.

Bird populations will be encouraged by the addition of nesting boxes. Several species such as woodpeckers, wood ducks, owls, and kestrels can use the boxes that provide a safer location for the eggs and therefore a higher rate of survival.

It is an objective of the strategic river management plan to re-establish native wildflowers along the Tulpehocken Creek and its tributaries to enhance the natural aesthetics and improve wildlife habitat.

Species such as the Canada Goose will be discouraged. Very large flocks of geese find nesting sites and food sources on the Cacoosing Creek several hundred yards from the confluence with the Tulpehocken Creek. The large concentrations of geese are a major source of pollution to the stream.

- *Increase the quantity, condition, and safety of recreational areas*

To improve the quantity, condition and safety of recreational areas, several objectives will be employed. Areas above Blue Marsh Lake will be improved and increased. Park systems below Blue Marsh Lake will be expanded. Also, safely concerns will be addressed.

Recreational areas above Blue Marsh Lake will be improved and expanded. The objective is to increase the recreational access for citizens living in the upper portion of the watershed. Improvements may include, but not be limited to, such topics such as bank stabilization and expansion.

The established park system around and below Blue Marsh Lake will be expanded as requested by local citizens and as outlined in the Berks County's Open Space Plan and Recreation Plan.

Safety concerns will be addressed in recreational areas to increase the recreational use. Priority will be given to those areas currently with present dangers such as those areas falling within Reading City's limits and surrounding areas.

Controlling water releases from Blue Marsh will be addressed to provide safety for those utilizing the downstream recreational areas and to stabilize downstream habitat. A warning system needs to be upgraded to better insure that anyone using the trail will not be endangered by any sudden releases. Also, a more regular flow of water would allow species to develop individual habitats and have a better rate of survival. An agreement between the Army Corp. of Engineers and interested agencies and individuals needs to be reached. The agreement would better regulate the times for the releases and amounts of water to be released from Blue Marsh Dam.

- ***Provide education in the schools***

Educational programs will involve students at all learning levels. Students will be involved in water quality testing to monitor the Tulpehocken Creek. Lessons such as urban runoff, the importance of the greenway corridor, zoning, habitat restoration, and

agricultural practices will be taught so that students can understand concepts involved in river management.

- ***Monitor and preserve historical sites***

A monitoring program for all historical sites in the watershed will be established. It will include all sites listed in the Tulpehocken Creek Scenic River Study in addition to any sites discovered since the study seven years ago such as WPA and CCC sites. When it is appropriate, any changes in the sites will be reflected. The goal of this program is not only to keep a listing of historical sites but to reveal historical sites that are in need of repairs or are in danger of being sold and altered. Future years of the strategic river management plan may include resources needed to preserve the historical integrity of any site that are determined to be in danger.

- ***Establish a clean up program for the stream's corridor and its tributaries***

It is the intent of this river management plan to establish local clean-up efforts along the entire Tulpehocken Creek. The trash is mainly along major highways and an organized effort is therefore possible on a regular basis to remove the trash and keep the corridor clean for improved water quality, wildlife habitat and aesthetic value of the stream.

STATEMENT OF STRATEGIES

In the following pages, there will be detailed description of 17 strategies adopted in furtherance of the goals and objectives of this Strategic River Management Plan. Some of the strategies further multiple goals and objectives, in fact that is precisely their intent.

A strategy, prior to making it into this document, had to possess certain elemental characteristics. First, it had to be recognizable and evaluable. Second, it had to enjoy at least some measure of demonstrated public support and interest.

Third, the strategy had to be reflected, not only in this Plan, but in discussions among the Tulpehocken Creek State Scenic River Task Force. Finally, the strategy had to be consistent with the Berks County Comprehensive Plan.

A handful of objectives, such as acquiring additional staffing, improving GIS capabilities, and capping pipes in the watershed are not currently reflected in strategies because there is no consensus on how to proceed. As soon as that consensus is obtained, the strategy will be created and published in a future update. Nonetheless, we felt it important to include these ideas somewhere in the document in order to facilitate discussion of these issues.

Other proposals reflected in earlier drafts, such as Myerstown Park and the Cacoosing Creek trail, have been eliminated from this document because they cannot realistically be implemented in the face of municipal and community opposition.

Here, then, are the 17 strategies and their prioritization that should achieve the most immediate and recognizable improvements along the Tulpehocken Creek.

PRIORITIES

Priorities for implementation of the Strategic River Management Plan were established using the following parameters:

•Availability of immediate outside resources for action

•Proven track record of success

•Immediacy of need

•Greatest visual impression (sense of accomplishment)

•Broadest-based effect (serves largest group of users)

•Coordination with Berks County Conservancy programs

•Compatibility with Berks County Comprehensive Plan

•Location of action (on corridor, in watershed)

•Transferability to other areas (sites) in future years

•Ability to accomplish with existing staff

As a result of these parameters, the 17 projects described in the Strategic River Management Plan were prioritized as follows:

1. TROUT UNLIMITED BANK AND CHANNEL STABILIZATION--The junction of the Tulpehocken and Cacoosing Creeks is one of the primary areas of Grings Mill County Park and the immediate and powerful impact this physical work will have will be a catalyst for the entire program.

2. MARION TOWNSHIP FARMLAND CONSERVATION/PRESERVATION--This is the most cooperative Township with which the Conservancy has worked; the site of the Charming Forge acquisition; and an area identified through all our research as most in need of pollution prevention through agricultural protection strategies.

3. AMISH PROGRAM--0ne of the most compelling programs the Tulpehocken Creek has to offer; but will require some advance planning and legwork before being fully ready to implement.

4. BLUE MARSH LAKE--A critical program for the overall health of the watershed; however, funds for this program still appear likely through EPA Clean Lakes (either section 314 or 319) and so this may start under other auspices anyway.

5. ZONING ISSUES--This is the most significant planning issue in this watershed; however, it represents an ongoing effort of the Conservancy and will not have the dramatic, publicly visible effect some of the other programs will.

6. SEWAGE ISSUES--Probably, next to zoning, the most significant planning issue; it is already being covered through the Berks Growth Issues Forum and so the need for immediate intervention through this program is less acute.

7. WATER QUALITY TESTING AND MONITORING--Very important to the modernization and updating of the Plan, it represents our continued research arm of this project. The most critical area, however, is folded into the Marion Township project.

8. EDUCATION PROGRAMS (MODEL FARM)--Again, an important program to the overall success of this endeavor, however, it requires much more coordination with the Berks County Conservation District and the Berks County Agricultrural Program before it is fully ready for public attention and scrutiny.

9. EDUCATION PROGRAMS (CHILDREN AND YOUTH)--This effort has already begun through Conrad Weiser School District and will be expanded through normal Conservancy outreach as it is critical to our maintenance of our state sales tax exemption.

10. NESTING BOXES--This is an important project along the Tulpehocken Creek, however, it is more important along the Wyomissing Creek, Saucony Marsh, and Neversink Mountain, three other Conservancy projects and waiting for success rates on those projects is prudent before starting a much larger endeavor here.

11. CANADA GOOSE CONTROL--This is an important project that would normally rate higher except there are no currently willing "receptor" states now that Alabama and Mississippi no longer want shipments. Efforts now have to focus on private owners and preserves, a much more difficult and time-consuming process.

12. HISTORIC INFORMATION--Here the project is important but the shortages are serious: very little Pennsylvania Historical and Museum Commission funding; need to re-start recruitment and training of volunteers; and need for long-term commitment to this concept.

13. CONSERVATION PLANS--An important project already being accomplished by other sources; portions of this may surface in the specific Marion Township project; the rest of it needs a GIS capability that currently is not fully available.

14. GREENWAY CORRIDOR IMPROVEMENT--Riparian buffer zones are important to establish; but the ability to accomplish this in other than very select areas is not favorable right now. Owners feel greenways mean trails (which is why we are starting to use the term satreamways) and MUCH education is needed before proceeding with this work.

15. CLEANUP--Significant but ongoing; will not have the immediate effect of some other efforts; can be accomplished to some extent outside the confines of this program.

16. MONITORING OPPORTUNITIES--While portions of this will be addressed elsewhere (Marion Township, Blue Marsh) the larger part of this is an important research

project with significant transferability which just does not have the time, materials, staff or money to do right now. Once those issues can be worked out, expect this project to jump in ranking.

17. WILDFLOWER PLANTINGS--Again, portions will be done elsewhere (Trout Unlimited) but this is also a beautification program that must await better research on species; and also needs to await planning decisions on the fate of certain areas of the Tulpehocken Creek and watershed.

These projects are very difficult to prioritize after the first four or so. All have some importance and significance; and future updating of this Strategic River Management Plan may significantly alter their order.

What we have come to realize, however, is that the Tulpehocken Creek is both an opportunity and a controversy. We have the chance to make significant, on-ground improvements in the first year; but if we do not succeed, the consensus that now exists (grudgingly with some) may start to fragment.

The fear in this area is that framers are being unduly singled out as "responsible" for the problems of the Tulpehocken Creek and will be "coerced" into solving those problems to their financial detriment. Repeated re-assurances that such intentions are simply not there have gained at best a limited acceptance among some. That is why it is important that our programs in the early stages be totally voluntary; not solely farmer-related; and that they work, with a clear and visible impact to the community at large.

We learned this through the Tulpehocken Creek State Scenic River Task Force, through recent discussions with the Berks County Planning Commission related to the EPA Clean

Lakes Blue Marsh grant, and through the Conservancy's Land Preservation and Environmental Committees. Our efforts, therefore. must reflect currewnt opinions and realities if they are to be successful.

CONCLUSION: THE FUTURE STRATEGIC RIVER MANAGEMENT PROGRAM

The strategic river management plan was written with the intent that the programs within will be viable for at least the next three years. Below is an outline of future needs and how the Plan will be reviewed and updated.

AGRICULTURAL PROGRAMS

The agricultural programs need to be consistent and reliable over time to achieve their goals. Since there are 2,982 farms in the watershed; it is unrealistic to assume that any combination of strategies and programs will reach all intended beneficiaries in a short period of time.

Marion Township will likely achieve significant progress within one year. If we expand selectively (Jefferson, North Heidelberg, and Heidelberg) significant progress can be made each additional year. The program with the Amish and Mennonite communities should be ready to start by year two.

WILDLIFE AND RECREATION PROGRAMS

The Trout Unlimited and Blue Marsh Lake projects can achieve quick and noticeable successes early. Probably the Reading Greenway and nesting box programs can be instituted by year two. It is important to note that new projects not currently in the Plan will be identified as the result of continued research.

Developing a systematic strategy for parks and recreation in other areas of the watershed will be difficult, as we found out when resident landowners opposed a proposal to place trails along the Cacoosing Creek. Yet the effort must be made before the pace of development outstrips available services.

COMMUNITY EDUCATION PROGRAMS

All of the education programs need to be ongoing throughout the years of the Strategic River Management Plan. The goal of developing multi-community responsibility for a regional resource is extremely difficult to accomplish.

Education program needs vary so widely, by location, age, occupation, and interest; that realistically these items will remain in the Plan in some form for as long as there is a Plan or a Program.

PLAN UPDATING

The Tulpehocken Creek State Scenic River Task Force, which will be re-started for 1995 at the April 27 Marion Township meeting, will be the primary vehicle for plan updating, subject to research results the Conservancy and other groups obtain throughout the year.

Updating will include:

- Addition or deletion of programs
- Raising or lowering of priorities
- Measurement of goal, objective, and strategy achievement
- Revision in accordance with DER-mandated or locally suggested changes.

Assuming the grant application deadline remains the same, Plan revisions will be submitted by March 31 of each succeeding year.