An Executive Summary

Tinicum, Bridgeton, and Nockamixon Townships are located in Upper Bucks County, Pennsylvania. The Townships are within the Lower Delaware River Watershed. The predominantly rural municipalities are comprised of contiguous forests, striking scenic vistas, historic resources, tributaries, regional and local parks, state game land, and steeply sloping valleys. The Tinicum Creek and the its tributaries travel southeast, drain a sixteen thousand acre watershed, and eventually flow into the Delaware River. The development pressures and population growth experienced in the area are not as significant as middle and lower Bucks County municipalities, however there are pressures to develop open fields and woodlands into commercial and residential developments.

The Tinicum Creek Watershed contains some of the most pristine surface and groundwater resources in the region. The people living in the watershed obtain their drinking water from groundwater resources which are very much influenced by the quality of the surface water resources. Therefore, the three municipalities are particularly interested in preserving the quality of their creeks and streams. In recent years, Tinicum Township has partnered with local citizens and active environmental groups to legally protect both the Tinicum Creek through protective land use ordinances and through state-accepted water quality standards (Special Protection Waters Program). In fact, the Tinicum Creek has been a designated an Exceptional Value (EV) waterway since 1996 due to local efforts.

Tinicum Creek and its tributaries have also been included in the Lower Delaware River National Wild & Scenic Study and Management Plan (National Park Service, 1999). The purpose of the study is to determine whether this portion of the lower Delaware River is eligible and suitable for inclusion in the National Wild and Scenic Rivers System. The study classified Tinicum Creek as "scenic" and thus eligible and suitable for inclusion into the National Wild and Scenic Rivers System. The designation is still under consideration, with a September 2000 vote expected. If the designation is obtained, the Tinicum Creek and the lower Delaware River will receive permanent protection from federally licensed or assisted dams, diversions, channelization, and other water resource projects that would have direct and adverse effects upon the free-flowing condition of the water bodies. The three municipalities and active organizations in the Tinicum Watershed have supported the effort.

In 1996, the Tinicum Creek Watershed Association, and Tinicum Township submitted a grant application to the Pennsylvania Department of Environmental Resources (DER now DEP/DCNR) for a Rivers Conservation Planning grant to further protect this significant watershed. The application was supported by Nockamixon and Bridgeton Townships. The Keystone Rivers Conservation Planning Program was fairly new when the application was submitted. Time passed, Tinicum Township completed a good portion of GIS mapping for open space planning efforts, and a revised scope of work was submitted and approved by the Pennsylvania Department of

JAN 2001

Conservation and Natural Resources (DCNR) in 1999.

Through 1999 and 2000, Tinicum, Nockamixon, and Bridgeton Township staff, Planning Commissions, Environmental Advisory Councils, Princeton Hydro, LLC (Consultant), the Tinicum Conservancy, Tinicum Creek Watershed Association, Bridgeton-Nockamixon-Tinicum Groundwater Committee, and local citizens completed the necessary research, public outreach, mapping, data collection, and data analysis. The information gathered was necessary to create a watershed management plan with objective, realistic, and cost-effective management recommendations.

The Tinicum Creek and surrounding watershed were field surveyed using kayaks, and visual windshield surveys. GIS overlay analysis was also used to gather information. The length of the Tinicum as well as the Beaver and Rapp Creek Tributaries were assessed using these techniques. The field survey focused upon the visual health of the creek, streambanks, and riparian corridor. The watershed GIS overlay analysis focused upon current land use, zoning, existing water quality, projected land use changes, and the effects of development upon the EV classification of the Tinicum Creek. The assessment and mapping tasks resulted in the following positive conclusions:

- ✔ The creek corridor remains *very* scenic and virtually litter free.
- ✔ Federal, state, & local regulations provide extensive, multi-layered protection.
- ✔ In most cases, the creek and tributary corridors are currently well-buffered.
- ✔ Strong municipal, private, and citizen interest and involvement is evident in this watershed.
- ✔ Based on the EV classification of the Creek, the water quality is very good and sthere is community support to maintain the designated classification.

The assessment also identified the following areas that may require management attention:

- ✔ Several streambank areas are eroding.
- ✔ One bridge needs to be redesigned, while others need maintenance (e.g., remove debris).
- ✔ Sediment deposition may need to be removed in some places.
- ✔ In some instances, private landowners and other people are discharging pool water and grey water in some areas.
- ✔ There are creek crossings that are not paved and do not contain bridges.
- ✔ Uprooted trees are forming significant obstructions in areas.
- ✔ Stormwater discharge pipes may need maintenance or redesign for maximum water *quality* protection.
- ✔ From time-to-time private citizens and businesses remove water from the creek for reasons other than fire safety.
- ✔ Exceptional value water quality is easily degraded.
- ✔ Improved coordination is needed between the Township and agencies operating within the watershed (e.g., Pennsylvania Fish & Game, Pennsylvania Department of Transportation,

Bucks Conservation District).

- ✔ There is a geologic relationship between surface water and groundwater drinking sources.

To address the conservation, restoration, and management of the watershed, The Tinicum Creek Watershed, Rivers Conservation Management Plan contains the following goals:

- ✔ **GOAL 1: WATER QUALITY & WATER QUANTITY**
  Maintain existing *water quality & water quantity* in the Tinicum Creek and its tributaries.

- ✔ **GOAL 2: RIVER CORRIDOR AND RIPARIAN BUFFER PRESERVATION**
  Preserve and protect the river corridor and create and maintain an adequate, vegetated riparian buffer throughout the Tinicum Creek Watershed.

- ✔ **GOAL 3: SIGNIFICANT NATURAL & CULTURAL FEATURES**
  Protect and preserve the outstanding *natural, cultural, historical, and recreational resources* in the Tinicum Creek corridor and surrounding watershed.

- ✔ **GOAL 4: WATERSHED EDUCATION**
  Create and maintain an informed and pro-active citizenry throughout the Tinicum Creek Watershed.

- ✔ **GOAL 5: CAPITAL IMPROVEMENT PROGRAM**
  Provide reliable public and private funding to preserve, restore and maintain the Tinicum Creek Watershed.

The Tinicum Creek Watershed Management Plan (Section V) contains goals, policies and implementation strategies for all watershed partners. They are designed to achieve the goals set by the Advisory Committee, the public, and the partners developed during the planning process.

Acknowledgments

We would like to thank the following individuals and organizations for their interest in preserving the Tinicum Creek. We are thankful that they expressed their commitment by providing the time and expertise required to complete this plan.

The Pennsylvania Department of Conservation & Natural Resources

Mr. Terry L. Hough, Environmental Planner, Harrisburg Office
Mr. Jim Mays, DCNR Rivers Section, Harrisburg Office
Mr. Todd Stell, Southeast District Office, Harrisburg Office

Advisory Task Group Members

Mr. Damon Aherne, Tinicum Township Planning Commission, Chairman
Ms. Karen Budd, Tinicum Township Open Space Preservation Board
Dr. Marion Kyde, Environmental Advisory Board, Member &
Tinicum Conservancy, Trustee
Mr. John McFarland, Tinicum Creek Watershed Association
Mr. Michael Zavoda, Tinicum Township Environmental Advisory Board, Chairman
Michael A. Smith, President, Tinicum Creek Watershed Association
Dr. Robert B. Stanfield, Environmental Advisory Board &
Bridgeton-Nockamixon-Tinicum Groundwater Committee, Member
Bruce Wallace, Tinicum Creek Watershed Association
Ms. Linda Wieand, Tinicum Township Manager

Project Partners/Additional Project Support

The Brandywine Conservancy, John Theilacker, AICP, Senior Planner,
Shiela Flemming and Liza Rupp, Associate Planner
Bridgeton Township, Ms. Barbara H. Guth, Chair of Supervisors
The Bridgeton-Nockamixon-Tinicum Groundwater Committee
The Delaware River Greenway Partnership, James Amon, Chairman
National Park Service, Bill Sharp, Park & Recreation Planner
Nockamixon Township, Mr. John MacFarland, Chairman of the Supervisors
Elaine M. Gawronski, Nonmember Secretary & Treasurer of Supervisors
The Tinicum Conservancy

The Princeton Hydro, LLC Project Team

Stephen Souza, PhD, President
Mark Gallagher, Vice President
Geoff Goll, PE, Vice President
Suzanne Forbes, AICP, Project Manager,
Senior Environmental Planner
Fred Lubnow, PhD, Senior Scientist
Phil Perhamus, Senior Scientist

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Michael J. Blaner, Project Engineer
Christopher Borak, Project Scientist
Keithe Merl, GIS Technician
Christopher L. Mikalojczyk, Project
Scientist
Eric Swarts, Project Scientist
Joanne Thompson, Office Administrator

RESOLUTION NO. 2000 – 0913
TOWNSHIP OF TINICUM, BUCKS COUNTY, PENNSYLVANIA

Supporting The Tinicum Creek Watershed Plan and listing the Tinicum Creek and its tributaries, Rapp Creek and its tributaries and Beaver Creek and its tributaries on The Pennsylvania Conservation Registry.

WHEREAS, the Board of Supervisors of Tinicum Township recognizes the importance of conserving the Tinicum Creek Watershed to foster the quality of life in Tinicum Township, Bucks County, and;

WHEREAS, the Commonwealth of Pennsylvania, Department of Conservation and Natural Resources, Division of Conservation Partnerships (Pa. DCNR) has established a "Pennsylvania Conservation Registry" and;

WHEREAS, The Tinicum Creek Watershed Association And The Township Of Tinicum have completed The Tinicum Creek Watershed Plan for The Tinicum Creek Watershed which contains a number of conservation recommendations suitable for implementation development or acquisition in the Township of Tinicum, Bucks County and throughout the entire Tinicum Creek Watershed, and;

WHEREAS, The Tinicum Creek Watershed Plan has been reviewed and found acceptable by the Board of Supervisors of Tinicum Township, Bucks County and;

WHEREAS, The Township of Tinicum, Bucks County does endorse The Tinicum Creek Watershed Plan and will endeavor to take appropriate action to implement its recommendations.

NOW, THEREFORE, the Board of Supervisors of Tinicum Township, Bucks County approves the listing of rivers, river segments or tributaries listed above within its boundaries on the Pennsylvania Conservation Registry.

RESOLVED, this 13th the DAY OF September 2000.

Tinicum Township Board of Supervisors

Nicholas C. Forte

Nicholas C. Forte, Chairperson

Gary Pearson, Vice Chairperson

Boyce Budd, Chairperson

Attest: Linda Wieand
Township Manager

NOCKAMIXON TOWNSHIP
BOARD OF SUPERVISORS
589 Lake Warren Road
P.O. Box 100
Ferndale, PA 18921
(610) 847-5058
(610) 847-5812 Fax

RESOLUTION NO. 11-14-2000

A RESOLUTION OF THE BOARD OF SUPERVISORS OF NOCKAMIXON TOWNSHIP, BUCKS COUNTY, PA. SUPPORTING the Tinicum Creek Watershed Conservation Plan and listing Rapp Creek and Rapp Creek Tributaries, Beaver Creek amd Beaver Creek Tributaries, Tinicum Creek and Tinicum Creek Tributaries, and Little Tinicum Creek and Little Tinicum Creek Tributaries on the Pennsylvania Rivers Conservation Registry.

WHEREAS, The Nockamixon Township Board of Supervisors recognizes the importance of conserving the Tinicum Creek Watershed to foster the quality of life in Nockamixon Township, and

WHEREAS, The Commonwealth of Pennsylvania, Department of Conservation and Natural Resources, Division of Conservation Partnerships (PA DCNR), has established a "Pennsylvania Rivers Conservation Registry", and

WHEREAS, Princeton Hydro, LLC has completed a Tincium Creek Watershed Conservation Plan for Tinicum Creek Watershed which contains a number of conservation recommendations suitable for implementation development or acquisition in Nockamixon Township and throughout the entire Tinicum Creek Watershed, and

WHEREAS, The Tinicum Creek Watershed Conservation Plan has been reviewed and found acceptable by the Nockamixon Township Board of Supervisors, and

WHEREAS, The Nockamixon Board of Supervisors does endorse the Tinicum Creek Watershed Conservation Plan and will endeavor to take appropriate action to implement its recommendations.

NOW, THEREFORE, The Nockamixon Township Board of Supervisors approves the listing of rivers, river segments or tributaries listed above within its boundaries on the Pennsylvania Rivers Conservation Registry.

RESOLVED THIS 14TH DAY OF NOVEMBER, 2000.

NOCKAMIXON TOWNSHIP BOARD OF SUPERVISORS:

John R. MacFarland - Chairman

Henry J. Gawronski, Vice-Chairman

Scott K. Freeman, Member

Anne M. Lyons, Member

Albert M. Santopietro, Member

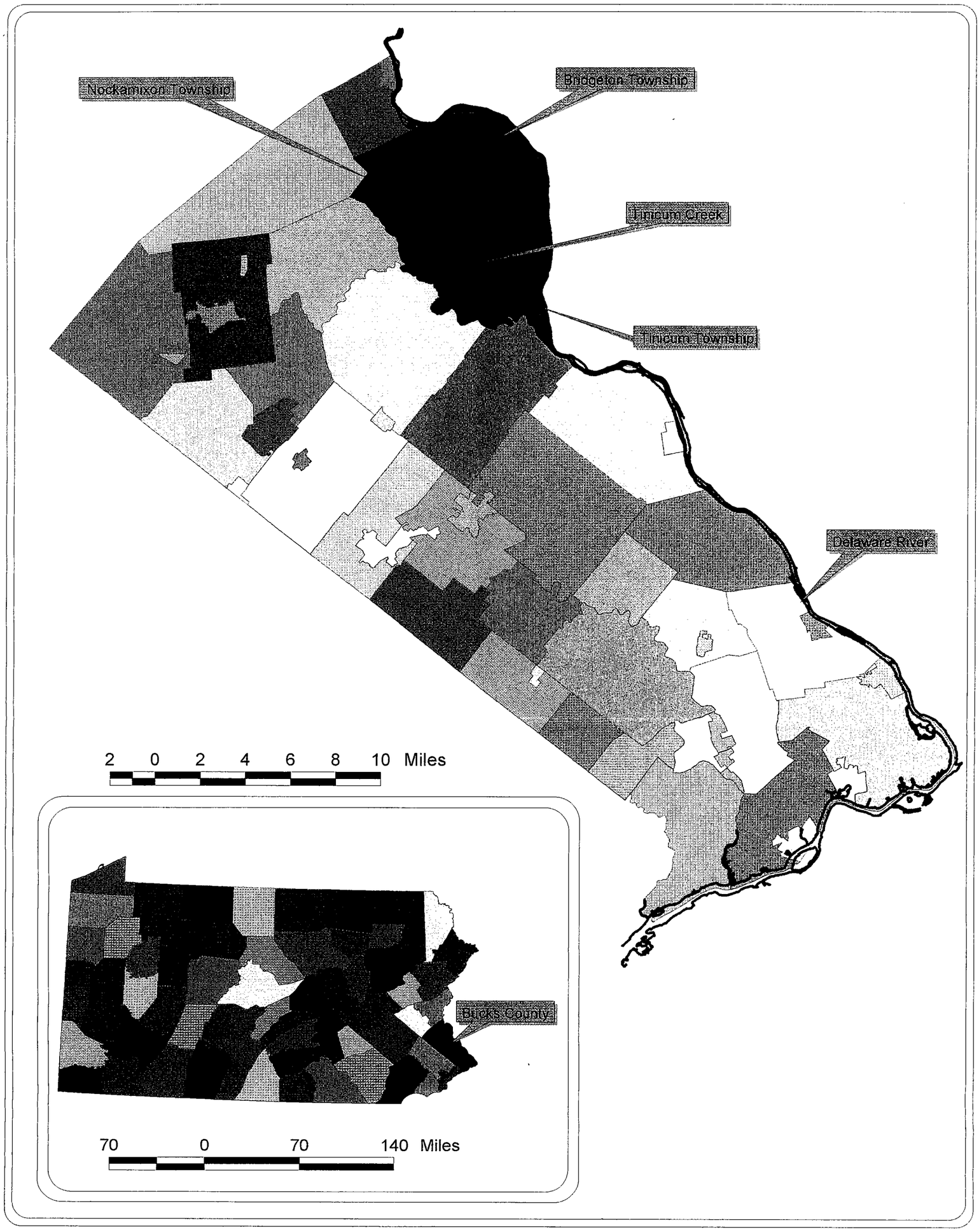
ATTEST: Elaine M. Gawronski

Elaine M. Gawronski, Secretary

Section One

The Tinicum Creek Watershed . . .

General Project Area Characteristics



The Tinicum Watershed Rivers Conservation Plan

N
W E
S

Map Scale: As Shown

Map Projection: Transverse Mercator (UTM)
Zone 18, North

Figure 1: The Tinicum Creek Watershed Bucks County, Pennsylvania

A GIS Mapping Partnership:
Brandywine Conservancy, Princeton Hydro, Tinicum Township, Watershed Associates, Bucks County Planning Commission and the World Wide Web

pH

A DCNR Keystone Conservation Project

DCNR

The Pennsylvania Department of Conservation and Natural Resources

Tom Ridge, Governor

John C. Oliver, Secretary

The Tinicum Creek Watershed is an Important Regional and Local Resource . . .

The Tinicum Creek is Located In the Delaware River Drainage Basin . .

The Tinicum Creek Rivers Conservation Watershed Area, Project Area Characteristics

The following section is intended to give a broad overview of the project area. More detailed information regarding biological, cultural, and land use is provided in later sections.

Project Area Characteristics ~

Tinicum, Bridgeton, and Nockamixon Townships are still quite rural. The three municipalities lie within an undeveloped region north of the Philadelphia metropolitan area, south of the Allentown-Bethlehem-Easton developed area, and west of the New York-New Jersey metropolitan region (See Figure 1, Page 1). The region is also located within the Delaware River Heritage Corridor, designated by the Federal government due to its environmental, historic, and cultural significance.

Watershed Area & Major Tributaries ~

The Tinicum Creek Watershed is a seventeen (17) square mile area. The watershed is an important regional and local natural, recreational, and economic resource. The area also contains state and county recreational land, habitat for both plant and animal species of special concern, National Landmarks, groundwater recharge area, and has been designated eligible for incorporation into the Federal Wild and Scenic Rivers System..

The Tinicum Creek flows for approximately twelve miles from the Rapp Creek & Beaver Creek tributaries in Nockamixon and Bridgeton Townships to the mouth of the Delaware River in Tinicum Township (See Figure 2, Page 4). The Creek descends a total of 480 feet along its southeasterly journey. The Tinicum Creek and the Rapp and Beaver Creek tributaries are located in the Delaware River Drainage Basin, and have been designated Exceptional Value (EV) waterways since 1996.

Vertical Cliffs of Red Shale create dramatic scenic amenities along the Tinicum Creek . . .

Red Shale is present throughout the Tinicum Creek Watershed. . .

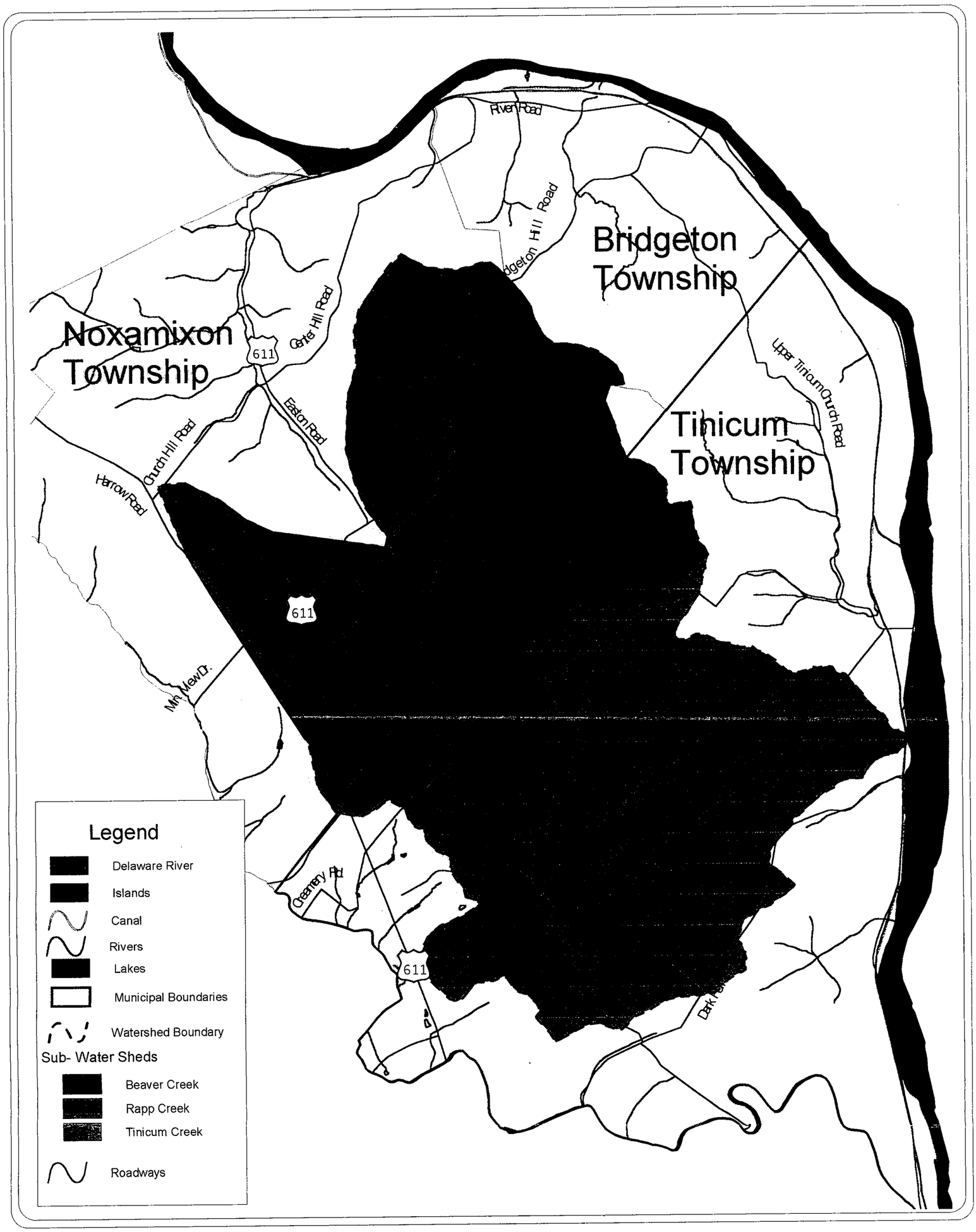
Topography & Geology ~

The Tinicum Creek Watershed area is comprised of some very steeply sloping creek valleys. In fact, the vast majority of the slopes within the Tinicum Creek and Tinicum Creek Corridor are greater than 25% (See Figure 3, Page 5). The Township lies within the Triassic lowlands of the Piedmont Physiographic Province.

The headwaters of Tinicum Creek (Rapp Creek & Beaver Creek) are found in Nockamixon and Tinicum Townships in the Diabase geological areas. Much of this area is within State Gameland #56. After meandering through this boulder-strewn, and wet forested area, the tributaries join the Tinicum Creek in Tinicum Township and flow in a southeasterly direction through the Brunswick Formation (siltstone, red shale, and mudstone). Vertical cliffs of red shale are exposed along the stream bed and within the Brunswick formation.

The geologic features of the area have supported quarry businesses throughout the regions history. In recent years, the area has become popular with rock climbers who flock to the area for the recreational challenge presented by the steep out croppings.

Below Frankenfield Road, the Creek bends in an easterly direction toward the Delaware River. The lower section of the Creek flows through the Locakatong Formation (shales and argillite), alternating through upland plateau and narrow ravines. From the tributary headwaters to the Delaware River, the Tinicum Creek descends a total of 480 feet.



The Tinicum Watershed Rivers Conservation Plan

0.5 0 0.5 1 1.5 2 Miles

N W E S

Map Scale: 1:55,000

Map Projection: Transverse Mercator (UTM) Zone 18, North

Figure 2: The Tinicum Creek Watershed

A GIS Mapping Partnership:
Brandywine Conservancy, Princeton Hydro, Tinicum Township, Watershed Associates, Bucks County Planning Commission and the World Wide Web

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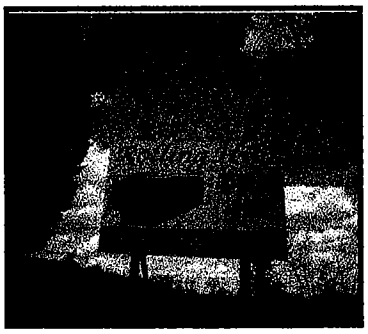
A DCNR Keystone Conservation Project

DCNR The Pennsylvania Department of Conservation and Natural Resources

Tom Ridge, Governor John C. Oliver, Secretary



Although developing at a relatively slow pace, the Tinicum Creek Watershed is experiencing development pressure . .

Land use ~

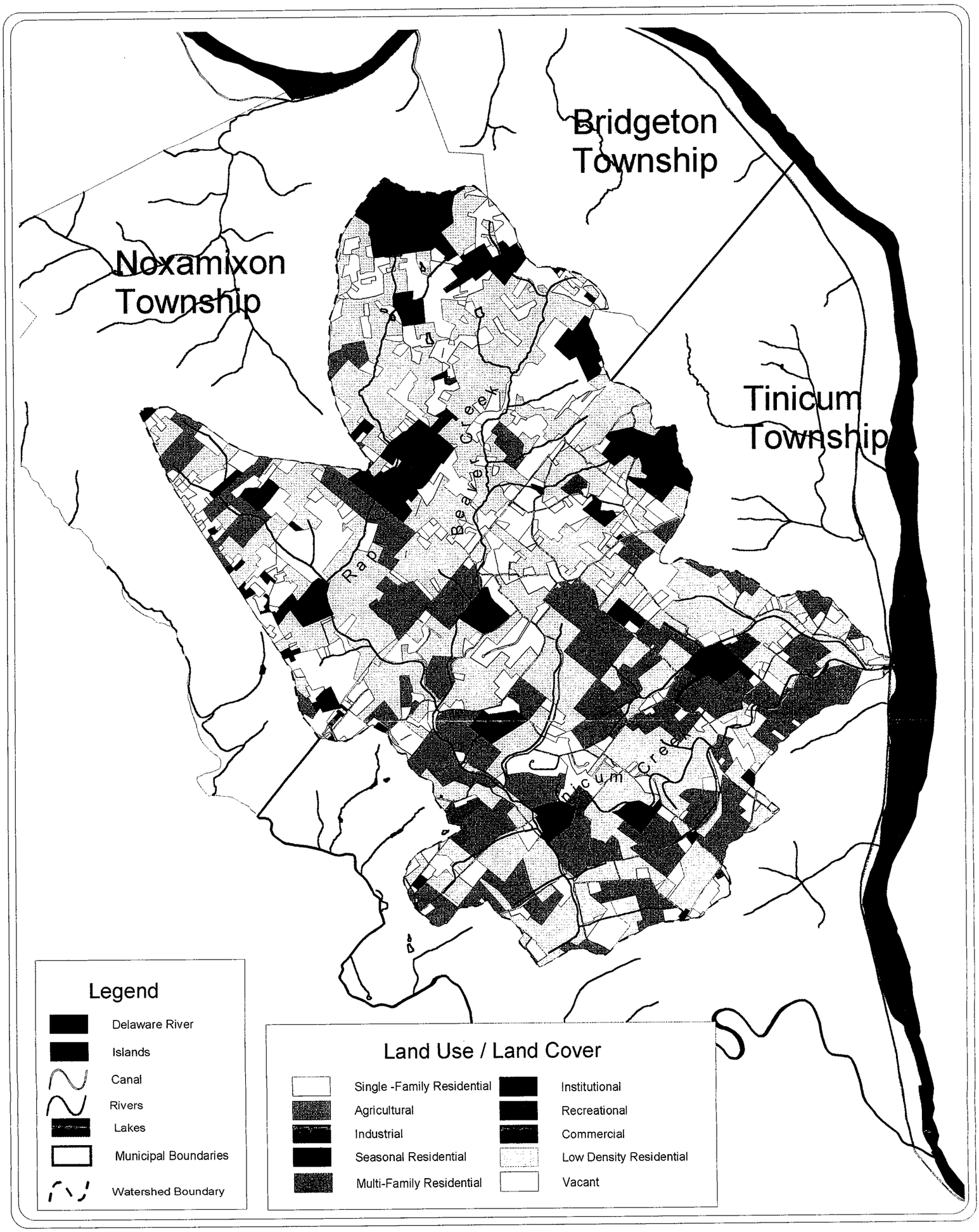
The watershed area for Tinicum Creek and its tributaries is approximately three (3) square miles. Land use within the watershed was initially evaluated using the Township Comprehensive plans and their zoning ordinances. GIS land use coverages were later obtained from Tinicum Township and the Bucks County Planning Commission. Digital GIS data is currently under development for Nockamixon and Bridgeton Townships, while coverages for Tinicum have recently been updated for the Tinicum Township Open Space Plan.

The 1990 land use coverages (for all three Townships) from Bucks County were used, because they differed little when compared with updated version developed for Tinicum. The GIS was later used to develop a land use map (See Figure 4, Page 7), and to calculate the percentage of land area associated with each land use in the Tinicum Creek Watershed. The table below illustrates land use percentages in the watershed area.

Table 1, Land Use, Tinicum Creek Watershed

LAND USE	ACREAGE (% Total)
AGRICULTURAL	21
COMMERCIAL	1
INDUSTRIAL	2
INSTITUTIONAL	1
MANUFACTURING	1
RECREATIONAL	7
RESIDENTIAL, LOW DENSITY	41
RESIDENTIAL, SEASONAL	1
RESIDENTIAL, SINGLE FAMILY	11
VACANT	14

Low density residential and agricultural are the most common land uses in the watershed . . .



The Tinicum Watershed Rivers Conservation Plan

0.5 0 0.5 1 1.5 2 Miles

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Map Scale: 1:55,000

Map Projection: Transverse Mercator (UTM) Zone 18, North

Figure 4: The Tinicum Creek Watershed Land Use/ Land Cover

A GIS Mapping Partnership:
Brandywine Conservancy, Princeton Hydro, Tinicum Township, Watershed Associates, Bucks County Planning Commission and the World Wide Web

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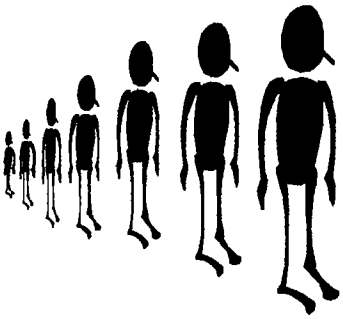
A DCNR Keystone Conservation Project

DCNR The Pennsylvania Department of Conservation and Natural Resources

Tom Ridge, Governor John C. Oliver, Secretary

The municipalities in the Tinicum Creek watershed have experienced a gradual land development and population increase since 1940 . . .



In terms of land development, the Tinicum Township Comprehensive Plan (Coughlin, Keene, and Associates, 1993) illustrates that between 1979 and 1990 the majority of subdivisions resulted in large lots of 10 acres or more. Similar trends were presented for Nockamixon and Bridgeton Townships. Bridgeton Township averages 4-5 homes per year.

Compared with trends for other municipalities within Bucks County, all three municipalities are developing at a relatively slow pace. Despite the comparatively light development trends noted, each municipality has experienced development pressure. Two recent examples in Tinicum Township include the Rolling Hills Development accessed from Headquarters Road (408 acres of land eventually containing 72 homes). and the Rushton proposed development on Dark Hollow Road (104 acre property). Route 611 in Nockamixon Township has several commercial properties under development and several single lots being developed in the Rapp and Beaver Creek Headwater areas.

Population Information ~

Population growth in any watershed will result in land use changes. The changes usually result in increased earth moving, additional homes, and increased impermeable surfaces (e.g., homes, parking lots, driveways). Increases in population will most likely affect the quantity and quality of surface water sources like the Tinicum Creek.

The Bucks County Planning Commission municipal population projections (1990-2020, See Appendix A) illustrate the following population trends for the three Tinicum Creek Watershed municipalities:

Table 2 , Population Projections for Municipalities in Watershed

Municipality	1990 Census	2000 (Middle)	2010 (Middle)	2020 (Middle)
Bridgeton	1, 378	1, 490	1, 600	1, 680
Nockamixon	3, 329	4, 000	4, 710	5, 510

Tinicum	4, 167	5, 230	6, 390	7, 390

The Delaware Valley Regional Planning Commission recently completed a municipal population forecast for the 54 Bucks County municipalities (See Appendix A). The Commission projects a population of 4, 630 people in 2000 and 7, 200 people in 2025, which represents a 55.5% population increase for Tinicum Township. Nockamixon Township will experience a 12.9 % increase and Bridgeton Township a 4.2 % increase as projected by the DVRPC population projections.

Tinicum Creek in several locations . . .

All three municipal Comprehensive Plans note that population density and population growth in each municipality is lower than the County average, but comparable to other municipalities in Northern Bucks (e.g., Durham, Bedminster Townships) .

Transportation & Designated Scenic Roadway Information ~

In terms of transportation, the only major arterial road in the Tinicum Creek Watershed is Route 611 with an average annualized traffic volume of 10, 510 vehicles per day in 1986 and an increase to 11, 343 in 1987. Minor arterials include route 32 (River Road), Route 113 (Bedminster Road), South Park Road, and the Frenchtown Bridge. River Road traverses the Delaware and Lehigh Navigational Canal. As the photo on the left illustrates, the Delaware Canal runs parallel to River Road (Route 32) in Tinicum Township and crosses over the Tinicum Creek in a raised aqueduct. Dark Hollow Road is considered

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Creek

a collector Road, and the remaining roads are considered local streets.

The Tinicum Creek is bounded by a collector road to the south (Wormansville Road), a minor arterial to the east (Route 32, River Road), several sub-collectors to the north, and a major arterial to the west (Route 611). Many of the local streets within the watershed remain unpaved, rural, and highly valued designated Scenic roadways. Designated Scenic roadways meander through wooden covered bridges, stone arch bridges and unpaved creek crossings. Tinicum Township has a designated Scenic Roads Ordinance providing that designated scenic roadways may not be paved with asphalt, widened or straightened. Recognizing the value of all scenic resources, Tinicum Township recently adopted a Designated Scenic Resources Overlay District. The majority of the Tinicum Creek Corridor is now considered a designated scenic resource and recognized in the Township Zoning Ordinance.

Employment Sources ~

There are manufacturing, tourist-based, retail, and service sector employment possibilities for residents. Many of them are located along the Route 611 corridor and Route 32 (River Road) corridors. However, less than 10% of the residents in the municipalities work in Tinicum, Nockamixon, and Bridgeton. Approximately 50% work in other parts of Bucks County, and the remainder work in surrounding metropolitan areas (Township Comprehensive Plans).

Cliffs
have formed where the
force of the creek
through time has cut
deeply into the rock . . .

Interestingly, there are a limited number of shopping centers, and industrial parks, however an shopping center located in Nockamixon on Route 611 will soon be developed. Bucks County Planning Commission projections indicate that employment within municipal boundaries will continue to be approximately 13% of the total population.

Significant Natural Resources

The more time one spends in the Tinicum Creek watershed, the more the *entire* watershed area appears outstanding and unique. The criss-crossing creeks and tributaries, open fields adjoining woodlands, dramatic cliffs, steep slopes, and park areas make for an outstanding and unique aesthetic experience!

Woodlands cover the cliffs, slopes and floodplains providing habitat for a variety of wildlife . . .

Recognizing the watersheds' natural significance, the National Park Service included the Tinicum Creek and its tributaries in the proposed National Wild and Scenic River Designation study for the Lower Delaware River. The study includes a listing of the unique vegetation, wildlife, and geologic features. Tinicum Township has created a Delaware River Wild and Scenic Overlay District requiring that all development be subject to conditional use approval from the Township. The value of the Tinicum Creek watershed is also recognized by the Commonwealth. The Creek was given a 1-A priority stream and a scenic waterway designation on January 11, 1990 by the Pennsylvania Department of Conservation and Natural Resources.

Exceptional Water Quality ~

The Pennsylvania Water Quality Standards (Title 25, Chapter 93) sets forth water quality standards for surface waters of the Commonwealth. The standards are also applied to wetlands. Each classification has an associated water quality criteria limiting the discharge of pollutants (e.g., treated sewage & industrial wastewater), More specifically, concentration limits for pollution parameters such as bacteria, pH, temperature, and other important parameters are regulated by the water quality standards. The classification given to the Tinicum Creek and the Rapp and Beaver Creek tributaries is an Exceptional Value (EV) designation.

exceptional value (EV) waterway. It is a resource with considerable ecological significance. . .

The EV Designation is the Most Highly Protected Water Quality Classification given to a surface water body in Pennsylvania . . .

The EV classification states that the Tinicum Creek is a "stream or watershed which constitutes an outstanding national, regional or local resource.... and is a water of substantial recreational or ecological significance". In terms of aquatic life, the CWF designation is intended for the protection and maintenance of cold water fish (e.g., salmon) and the vegetation and wildlife indigenous to cold water habitats. In essence, the Tinicum Creek has the most highly protected water quality classification.

Through the years, the Tinicum Creek Watershed Association, the Tinicum Conservancy, municipal officials from the three Townships,

Tinicum Creek, Notable Natural Features . . .

- ✔ Bottomland oak, mixed hardwood palustrine forest
- ✔ Rich hemlock, mixed hardwood forest
- ✔ Calcareous opening/cliff community
- ✔ Dry oak-heath forest
- ✔ Red oak -mixed hardwood forest
- ✔ Floodplain meadow
- ✔ Bedrock creek bed
- ✔ Sycamore-river birch-box elder floodplain forest
- ✔ River birch-sycamore floodplain scrub forest
- ✔ River beach bar community
- ✔ Yellow lamp mussel (*Lampsilis cariosa*)
- ✔ Seventy-six bird species including 11 rare breeders
- ✔ Locally rare plants
- ✔ Significant Wetlands, Beaver Creek Tributary
- ✔ Prime Agricultural & Locally Important Soils
- ✔ Farmland of Statewide Importance
- ✔ Approximately 20 contiguous properties, buildings, and covered bridges on the National Register Historic Places

and individuals in the region have worked to identify, assess, and protect regional water resources. Due to these efforts, the Tinicum Creek has obtained the Exceptional Value (EV) classification, despite the fact that Rapp Creek was seriously polluted in the 1960s by industrial wastes from a metals recovery plant ("The Revere Superfund & Boarhead Superfund Sites"). Changes in local regulations will help protect the Tinicum Creek. For instance, Tinicum Township has recently implemented an ordinance (e.g., Ordinance #123, Water Development Ordinance) designed to protect groundwater and surface water resources. The water quality analysis portion of the ordinances requires the developer to quantify expected increases in nitrogen concentrations that are expected from the additional sewage treatment facilities. Bridgeton requires setbacks from surface water resources, and Nockamixon Township includes protection for streams and water courses and lakes and ponds by requiring site capacity calculations for every development proposal.

Another effort to protect existing water quality was recently completed by Tinicum Township through a National Park Service grant. The nonpoint source pollution loading study for tributaries entering the Delaware Canal (Princeton Hydro, LLC, 2000) is an effort to plan for upcoming total maximum daily load (TMDL) state regulations. By quantifying baseline water quality data, threshold levels or limits of point source and nonpoint source pollution were established for the entire Township. The Township hopes to use the NPS loading limitations developed in the study to further refine zoning and land development ordinances. Eventually, a water quality study will then be required to accompany all land development and subdivision proposals presented for Township consideration. In addition, several municipalities in Upper Bucks County (e.g., Tinicum, Bedminster) are pursuing grant funding for volunteer water quality monitoring programs to obtain baseline data and to create a long-term water quality database.

The recently completed *Natural Areas Inventory of Bucks County*, Pennsylvania (Rhodes, Morris Arboretum, 1999) evaluates significant natural features based on biological, ecological, geological, and hydrological criteria. The inventory was undertaken to identify and prioritize the most significant remaining natural features in Bucks

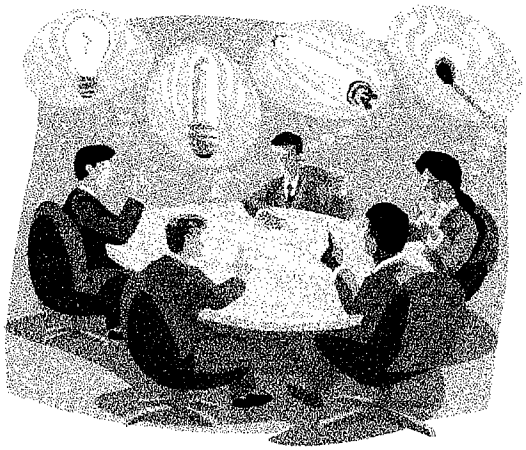
County. The Inventory describes the Tinicum creek valley in the following way:

The creek valley includes a diversity of plant communities including dry, south-facing cliffs, moist hemlock-dominated north-facing slopes, floodplain forests, and meadows. Plants which are locally rare include Hairy lip fern (Cheilanthes lanosa), Walking fern (Asplendium rhizophyllum), and Canadian yew (Taxus canadensis). Much of the creek bed is exposed bedrock which often occurs as step-like shelves and natural pavement. In the diabase region the creek is a boulder strewn series of pools and riffles. Creek inhabiting amphibians observed in our survey include Northern red salamander and Two-lined salamander. Bird diversity noted in recent studies includes 76 species of which 11 are rare breeders and two of special concern in Bucks County (Black-billed cuckoo and Purple martin). Yellow lamp mussel is present at the mouth of the creek.

Section Two

The Tinicum Creek Watershed . . .

Public Issues, Public Concerns, and the Public Participation & Planning Process



The Planning Process ~

The reason for undertaking the Tinicum Creek Watershed Rivers Conservation Plan was the areas' concern for maintaining the exceptional value (EV) water quality of the Tinicum Creek and its tributaries. Therefore, the primary aim of the Rivers Conservation planning effort was to generate public discussion on preserving this exceptional aquatic resouce. Since it is often difficult to gain widespread planning participation, several strategies for public involvement were implemented early in the planning process.

Public involvement strategies included the following:

A variety of strategies were used to initiate involvement and generate public discussion . . .

- ✔ **Public Notices** ~ Public notices were placed in local newspapers three weeks before the required public meetings.
- ✔ **Press Releases** ~ Press releases were provided to seven local and regional newspapers at three key stages of the project (e.g., commencement of assessment, completion of management plan, adoption of plan). Another will be released when the Tinicum Creek is successfully placed on the Pennsylvania Rivers Registry.
- ✔ **Meeting Invitations** ~ An invitation to the first public meeting was included with the plan questionnaire to solicit public involvement and support for the project.
- ✔ **Public Meetings** ~ The first public meeting was April 11. This meeting was an introduction to the project and included a power point presentation including photos of the river corridor, an overview of plan requirements, and an invitation to identify problem areas on a "unique and individual basis".

The second public meeting was a Board of Supervisors meeting on May 2, 2000. The Power point presentation along with draft assessment findings, GIS maps, GIS overlay analysis findings, and draft management recommendations were presented.

A third public meeting was to the Bridgeton-Nockamixon-Tinicum Townships' Joint Groundwater Committee on May 17, 2000. A similar agenda was presented along with additional information provided from the first two meetings. The final plan was adopted at a June 20th Board of Supervisors meeting and submitted to DCNR. (Public Comment is Provided in Appendix

The fourth public meeting was on July 11, 200 at a Board of Supervisors meeting in Bridgeton Township. A final meeting was to the Tinicum Township Board of Supervisors on September 12, 2000, whereby the plan was formally adopted and submitted to the DCNR.

Public information strategies included direct public participation, newsletter articles . . .

- ✔ **Questionnaires** ~ A questionnaire was provided to all municipal officials and appointed committee members (e.g., Planning Committee, Open Space Committee, Joint Groundwater Committee) as well as interested citizens attending the public meetings (See Appendix A).

- ✔ **Township Newsletter Articles** ~ One article was provided to the Tinicum Township summer newsletter. The same article was provided to Bridgeton and Nockamixon Townships. The newsletter article is included in Appendix A.

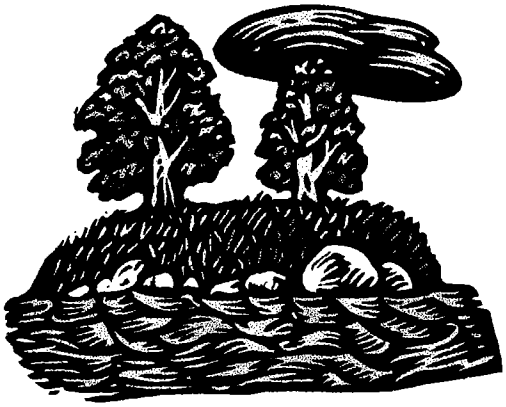
- ✔ **Volunteer Participation In Planning Tasks** ~ Members of various Township Committees and local conservancy groups helped with generating mailing lists, tallying questionnaire results, completing assessment sheets, attending meetings, completing field work, reviewing the draft plan, and providing review comments.

. . . Questionnaires, public meetings, and press releases.

Overall the community seemed very interested in preserving the Tinicum Creek Watershed and exploring traditional and innovative means of maintaining the water quality of the Creek and its' tributaries. A knowledgeable, interested, and pro-active public is key to efficiently and effectively implementing the conservation management plan. This particular community exhibits all three characteristics! The communities are in a very good position to implement the recommendations and best management practices (BMPs) listed in the management section of the plan (Section V).

Section Three

The Tinicum Creek Watershed . . .
A Creek Corridor Assessment



The River Corridor Assessment ~

✔ Gain first-hand knowledge of stream corridor and surrounding watershed

✔ Confirm GIS Mapping

✔ Take Photographs

✔ Identify and Confirm Significant natural and historical resources

✔ Identify location of eroded areas, litter problems and point source and nonpoint source pollution problem areas

The Tinicum Creek Corridor Field Assessment

A Creek Corridor Tour ~

In late April and early May a group comprised of the environmental consulting team and a few citizen volunteers completed a field assessment of the Tinicum Creek and Tributary corridor. Portions of the field assessment (Tinicum Creek from Geigel Hill Road to River Road) were completed using kayaks. Tributary areas (Rapp Creek, Beaver Creek, Little Tinicum, etc.) that were not "navigable" were assessed by foot and via windshield survey.

The following section of the plan is intended to provide the reader with a visual overview of the study area or a "sense of place". Subsequent sections will identify areas in need of restoration/management measures.

For assessment purposes, we identified three sections of the Tinicum Creek Corridor:

Section I ~ Rapp Creek & Rapp Creek Tributaries to Confluence with Beaver Creek

Section II ~ Beaver Creek & Beaver Creek Tributaries to Confluence With Rapp Creek

Section III ~ The Tinicum Creek & Tinicum Creek Tributaries from the Rapp and Beaver Creek Confluence to Municipal Road

Section IV - The Tinicum Creek, Little Tinicum Creek & Tributaries From Municipal Road to the Delaware River Confluence.

Each section was assessed to gain first-hand knowledge of the study area, to create a Power point presentation giving the audience a "sense of place" to better participate in the planning process, to confirm existing GIS mapping, to identify and confirm significant resources, and to identify areas in need of conservation management practices.

Visual Assessment of Rapp Creek Tributaries ~

✔ Headwater of Western Fork In Flat Land Comprising Agricultural and Residential Parcels
✔ Land in Watershed Area in 611 Corridor Under Development Pressure for Commercial Uses
✔ Eastern Fork Headwaters in State Gameland #56 Where Timbering Operations Take Place
✔ The Revere Superfund Site Is Located In This Subwatershed
✔ Tributary is Adjacent to Bucks County Quarry Where it Joins Eastern Fork.

Visual Assessment of Beaver Creek Tributaries ~

✔ Headwaters of Eastern and Western Forks Comprising Residential Areas Interspersed with Open Space and Parkland
✔ Land Along Cottage and Strocks Grove Road Under Some Development Pressure
✔ Eastern Fork in State Gamelands Where Timbering Operations Take Place
✔ Scenic Amenities Including Small Waterfalls, Boulders, White Water and Small Bridge Crossings With Scenic Views.
✔ Dirt and Gravel Roads are Present

Section I ~ Rapp Creek & Rapp Creek Tributaries to Confluence with Beaver Creek

There are two forks comprising the Rapp Creek Tributaries. Both forks originate in Nockamixon Township. The most western fork originates in a mixed agricultural residential area called Bucksville Manor. The tributary travels in a southeasterly direction crossing Route 611 and Quarry Road before joining the eastern fork at Quarry Road.

The eastern fork of Rapp Creek originates in Nockamixon Township at the State Gamelands #56 north of Warren Road. The tributary travels in a southwesterly direction crossing Lonely Cottage Road. It switches direction traveling in a southeasterly direction crossing Marienstein Road where it again meanders through additional State Gameland property. The two forks join at Quarry Road crossing the Tinicum Township border where the Rapp Creek joins Beaver Creek just above Geigel Hill Road. The majority of land surrounding the Rapp Creek Tributaries in Nockamixon Township is zoned Residential (R) and to a lesser degree Commercial (C) and Industrial. Land (Figure 4, page 7) consists primarily of low density residential uses.

Section II ~ Beaver Creek & Beaver Creek Tributaries to Confluence With Rapp Creek

There are two distinct forks comprising the Beaver Creek Tributaries. The western fork originates in Bridgeton Township flowing south through primarily residentially (R) zoned areas with low density residential uses. Crossing Lonely Cottage Drive and Strocks Grove Road in Tinicum Township, the western fork joins the eastern fork below Rock Ridge Road.

The eastern fork originates on State Gamelands in Tinicum Township. The unnamed tributary flows westerly crossing Tammany and Cafferty Roads before joining the eastern fork at just below Rock Ridge Road. The Beaver Creek continues its journey before joining the Rapp Creek at Geigel Hill Road. Area road names include Rock Ridge, Granite Way and Roaring Rocks– appropriate names describing the steep slopes, rocky boulders, small waterfalls, scenic views and

quickly flowing water that is present in the Beaver Creek sub watershed.

Visual Assessment of Tinicum Creek & Tributaries (Section III)~

✔ This Section Begins With Confluence of Rapp & Beaver Creeks At the Historic Animal Slaughterhouse Along Sheephole Road
✔ Gravel Roads Are Present In This Section As Well As Unpaved River Crossings
✔ Some Stormwater Outlets are Present In This Segment
✔ Several Bridges Are Present. Some Bridges May Need of Maintenance Others May Need to be Redesigned
✔ A Significant Number of Downed Trees From Storm Damage Have Created Obstructions
✔ Eroded Streambanks Are Present in the Main Stem and "Heany's Run"/ "Beaver Run".
✔ Scenic Amenities Include Steep Rock Outcrops, Healthy Riparian Buffers, and Significant Flora & Fauna
✔ Residential Homes Are Quite Close to the Creek in Some Locations
✔ The Rolling Hills Residential Development is Located In This Portion of the Project Area

Section III, Tinicum Creek from the Rapp & Beaver Creek Confluence to Municipal Road ~

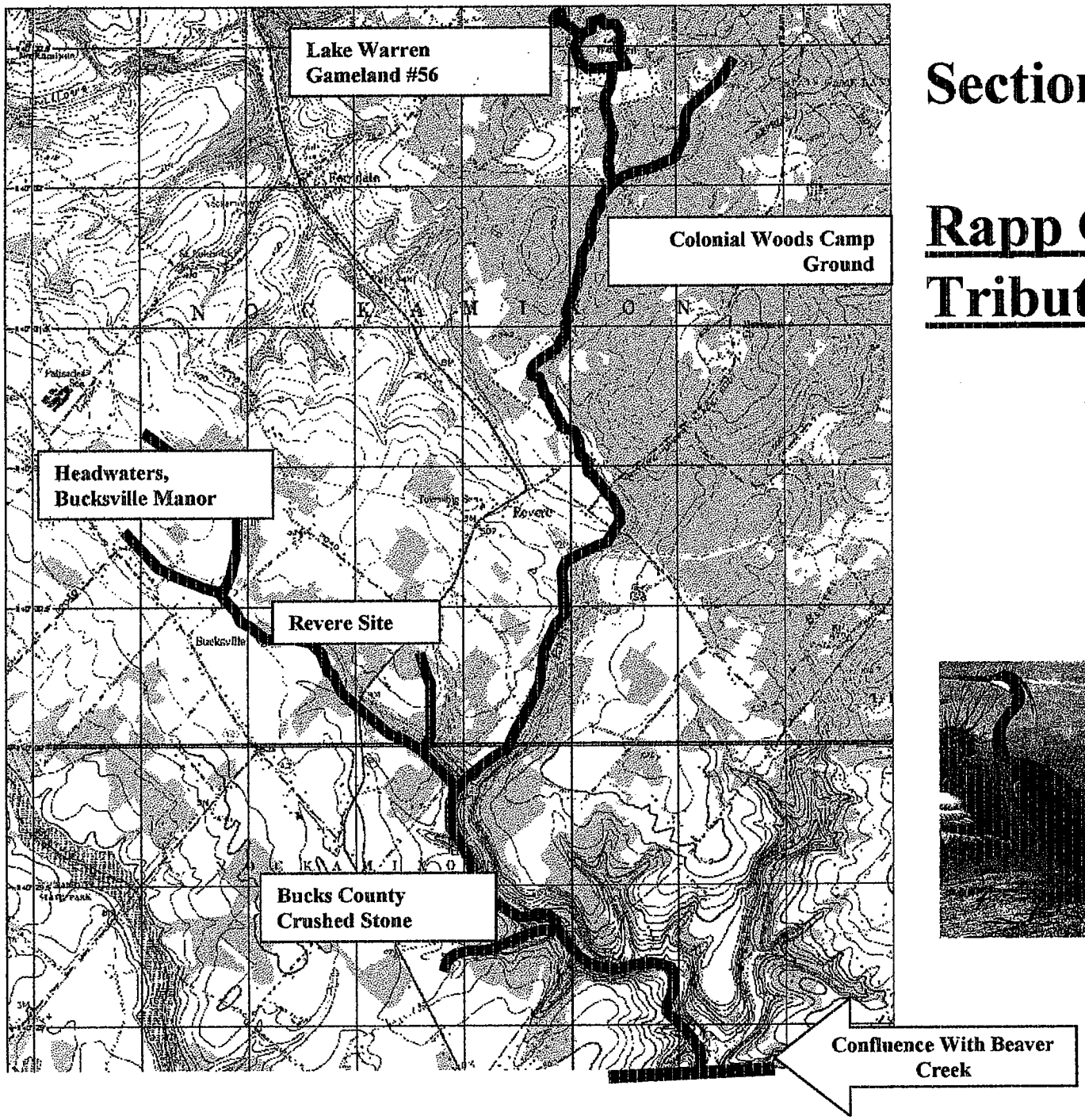
Section III of the Tinicum Creek is located entirely in Tinicum Township. The Creek meanders past gravel roads, under several bridge crossings, and is surrounding by large agricultural, residential, open space and wooded areas. An unnamed tributary (locally known as "Heaney's Run" or "Beaver Run") flows southwest and adjacent to Ridge Valley and Headquarters Road. The tributary joins the Tinicum Creek just below Sheep Hill Road.

This section of the creek makes an abrupt directional change just south of Frankenfield Road where it begins flowing in a northeasterly direction through densely wooded and steeply sloping geologic formations. Just west of Municipal Road, older homes were built quite close to the Creek. A few of them are well within the one-hundred year flood plain. The majority of land in this section is comprised of agricultural and low density residential land uses.

Section IV, The Tinicum Creek, The Little Tinicum Creek, and Tributaries from Municipal Road to the Delaware River Confluence ~

This portion of the creek is very scenic and contains a variety of scenic and natural amenities including the Frankenfield Covered Bridge, two small dams, and a series of geologic formations.

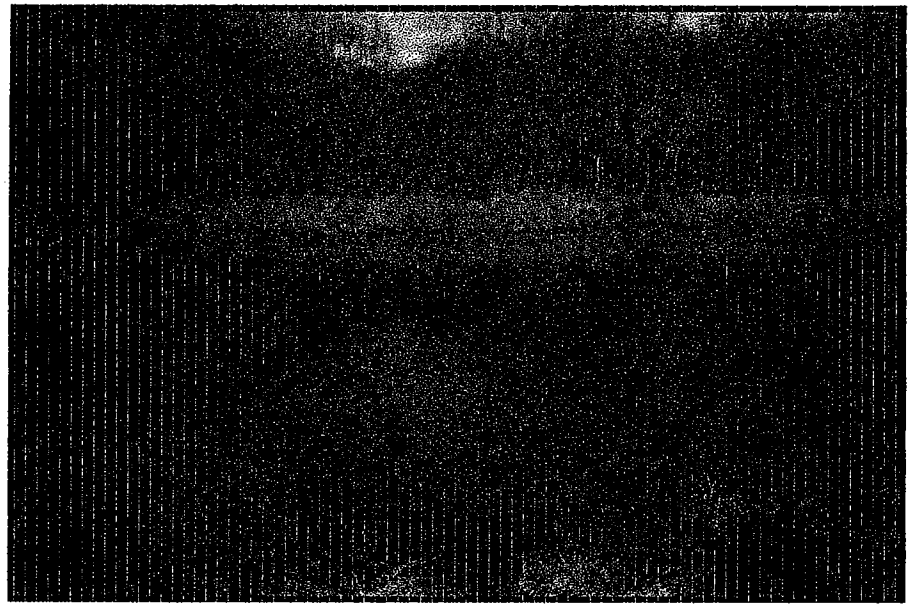
The Little Tinicum Tributary flows in an easterly direction and adjacent to Headquarters Road and Tinicum Creek Road. The narrow tributary makes the drive along the two roadways a very scenic and enjoyable experience. Residential development within the Little Tinicum subwatershed are evident. A rather expansive land development project, the Rolling Hills Residential Development, is taking place. The residential development will be accessed by Headquarters, Permanent School and Tettemer Roads.



Section I ~

Rapp Creek & Tributaries

State Gameland #56, Nockamixon Township



< =Pond at Lake Warren

<= Lake Warren

Colonial Woods Campground, Ponds

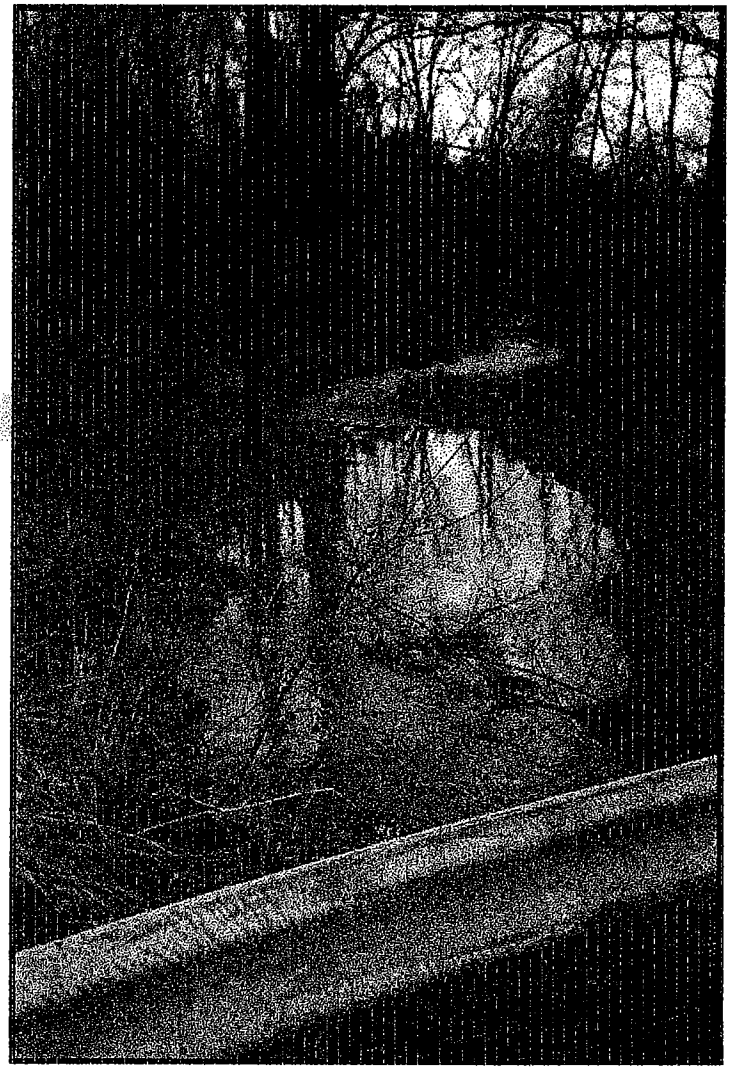
(Lonely Cottage Drive)

pH

Bucksville Manor Headwaters

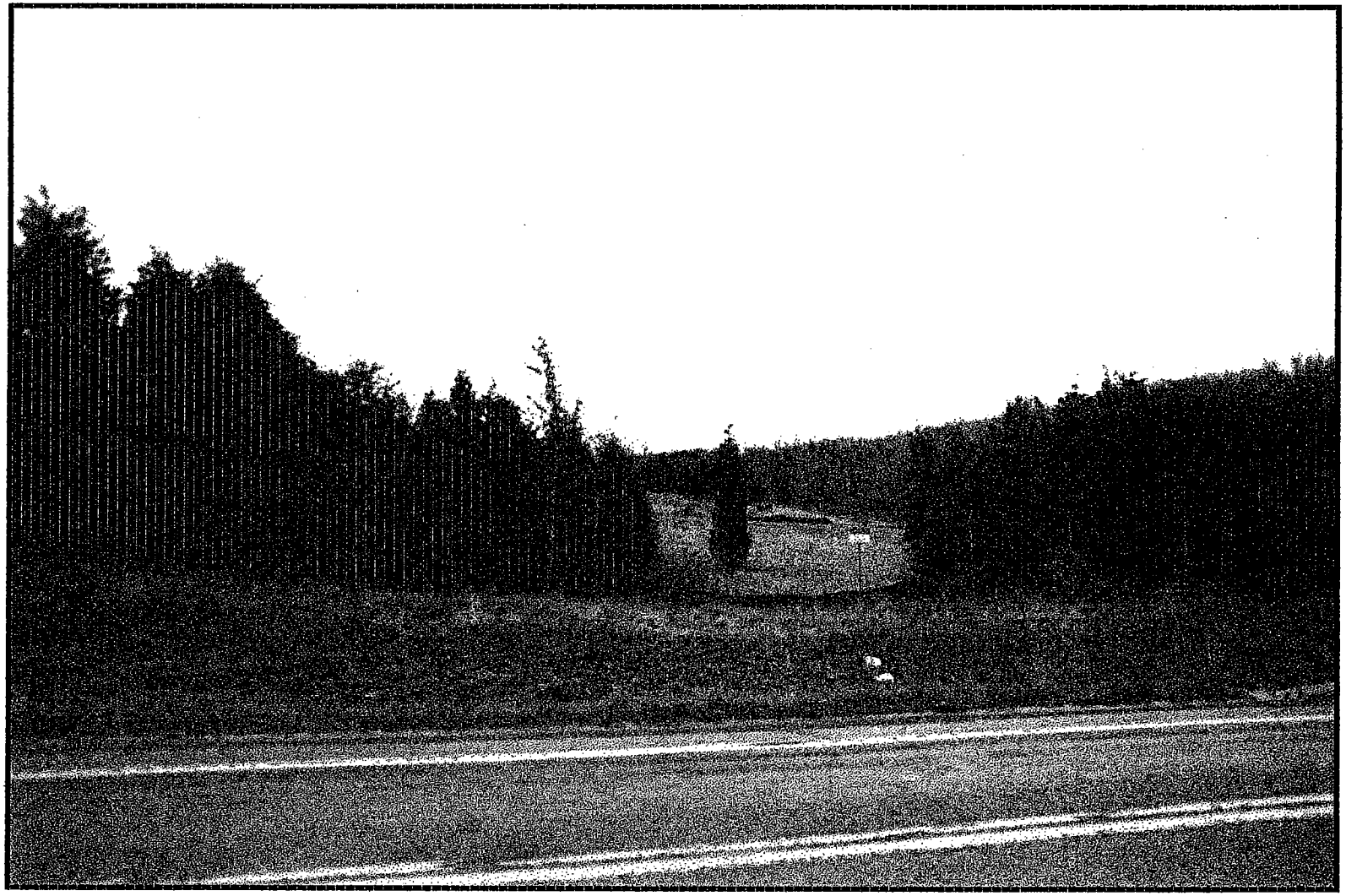
(William Road)

(East Park Road)



pH

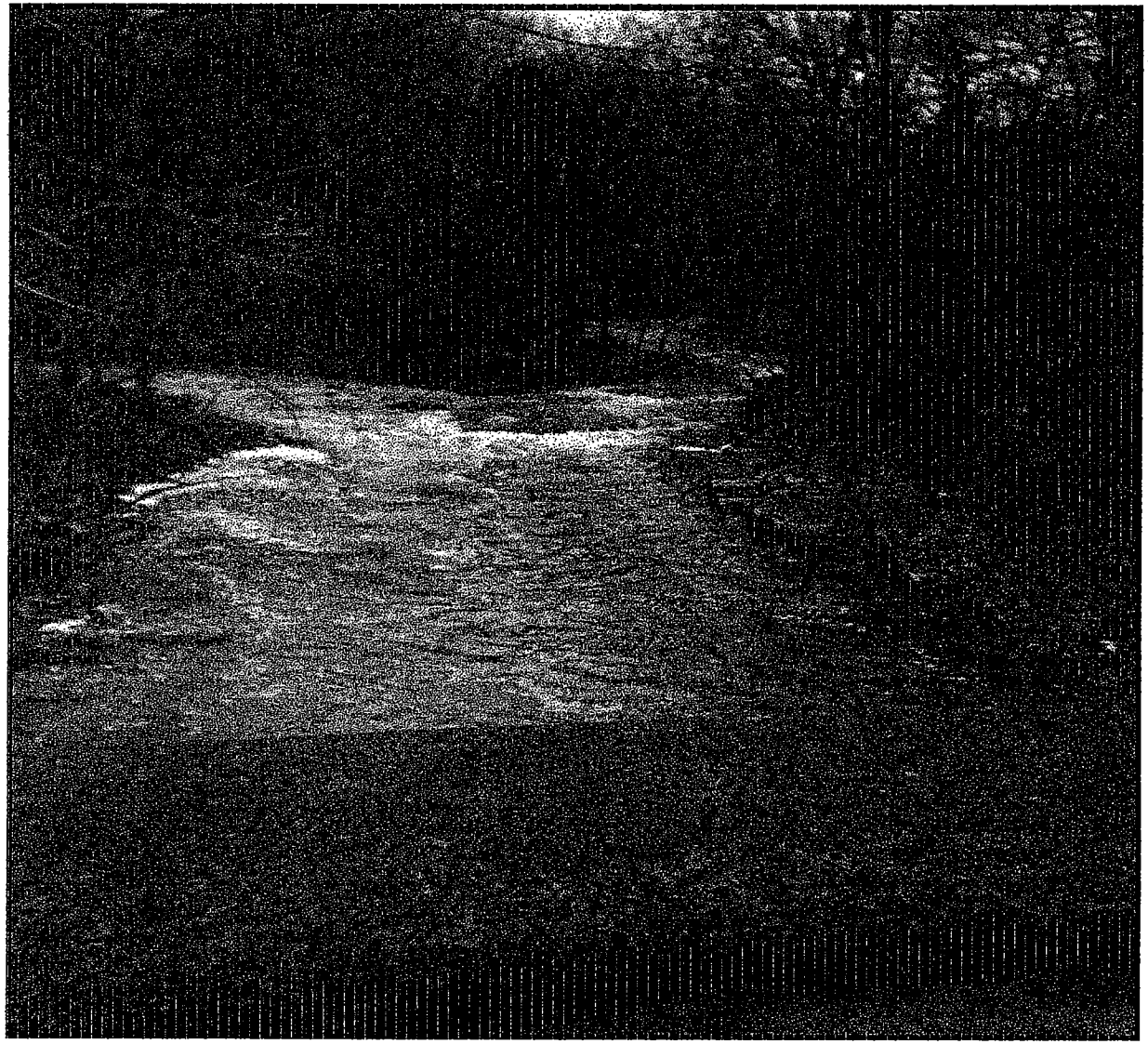
The Revere Site, Route 611, Nockamixon



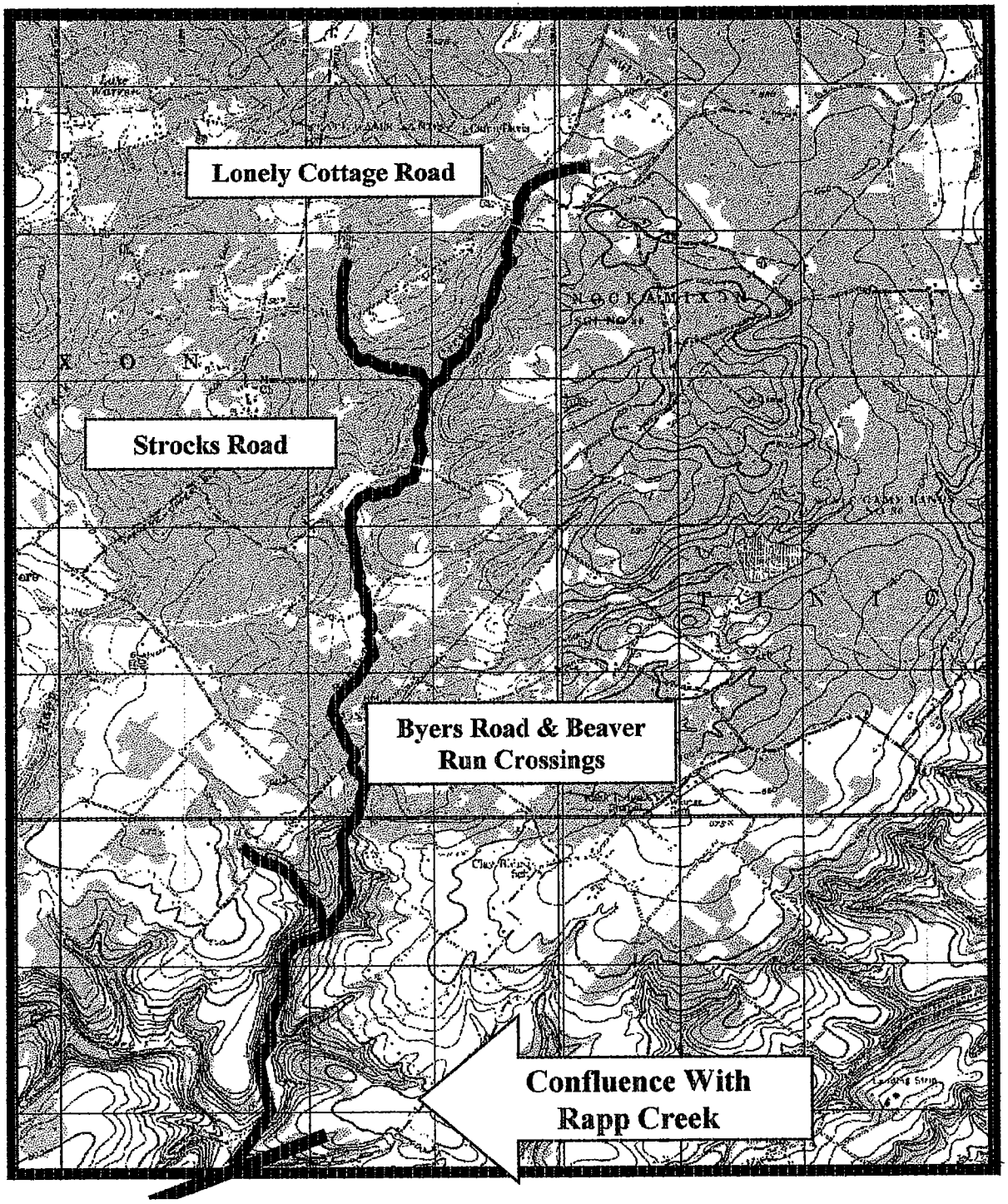
pH

Rapp Creek & Rapp Creek Tributary Confluence

(Quarry Road)

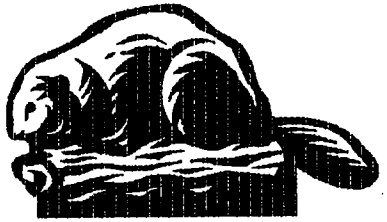


pH



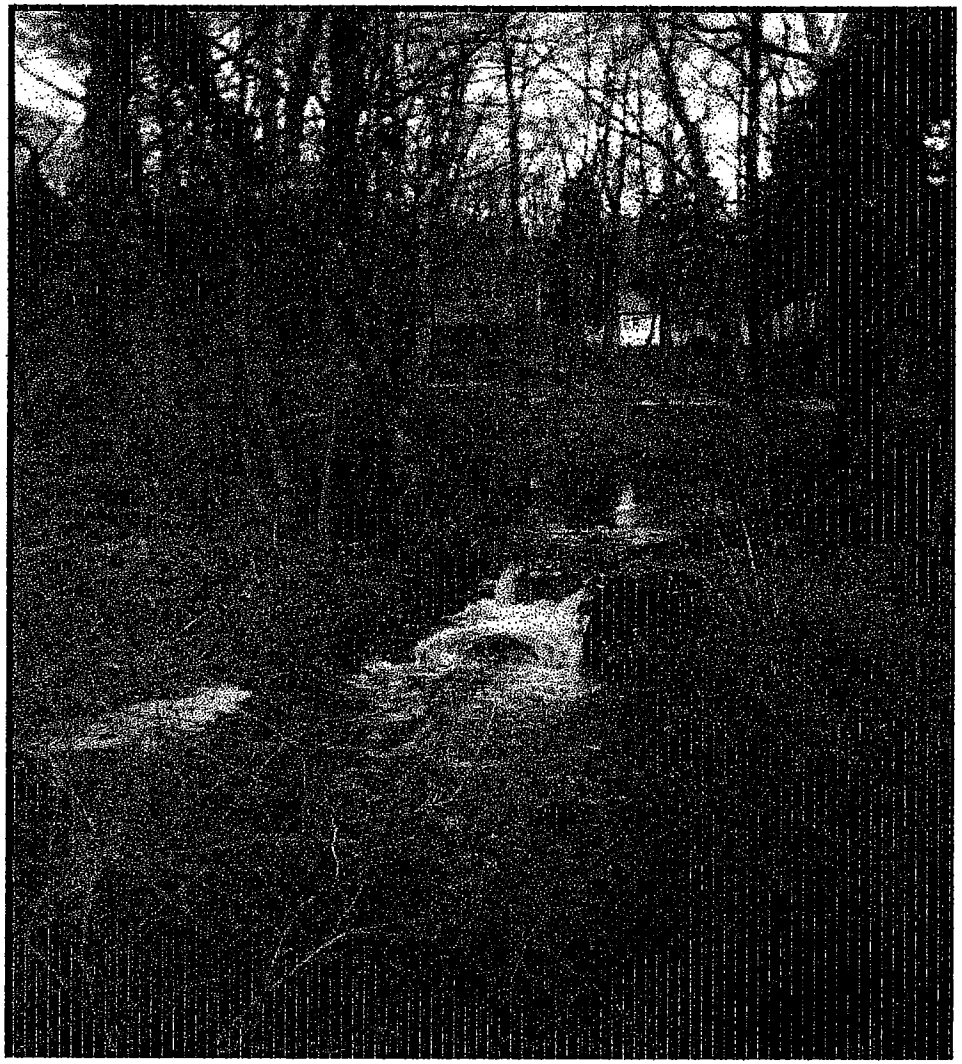
Section II ~

Beaver Creek & Tributaries



pH

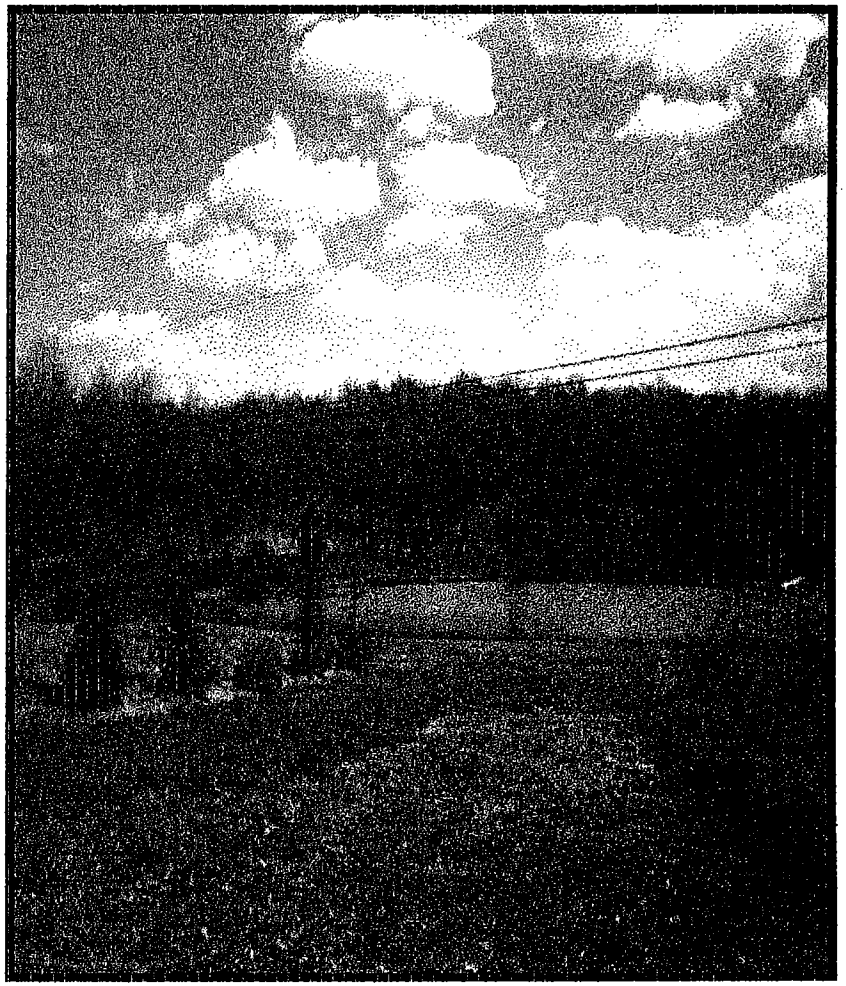
Beaver Creek Headwaters
(Lonely Cottage Road, Bridgeton)



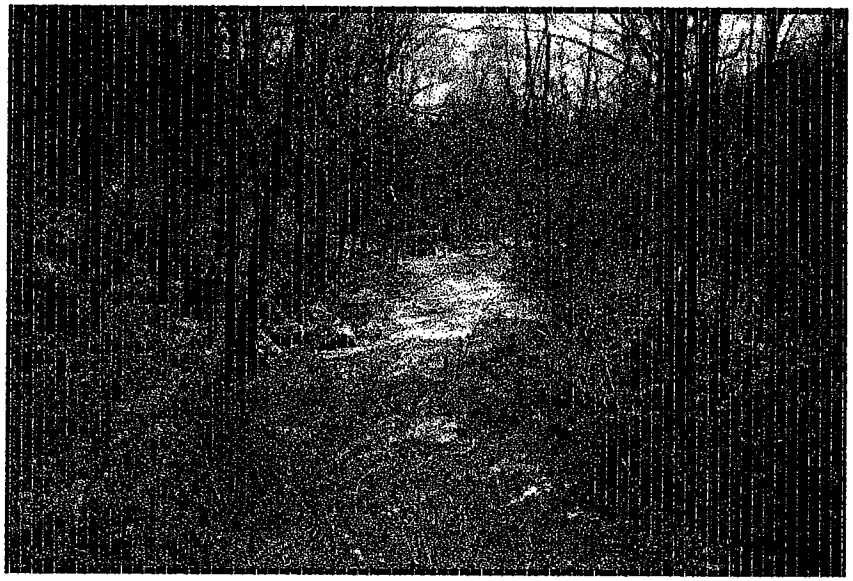
Beaver Creek , Nockamixon Township

(Crossing at Strocks Road)

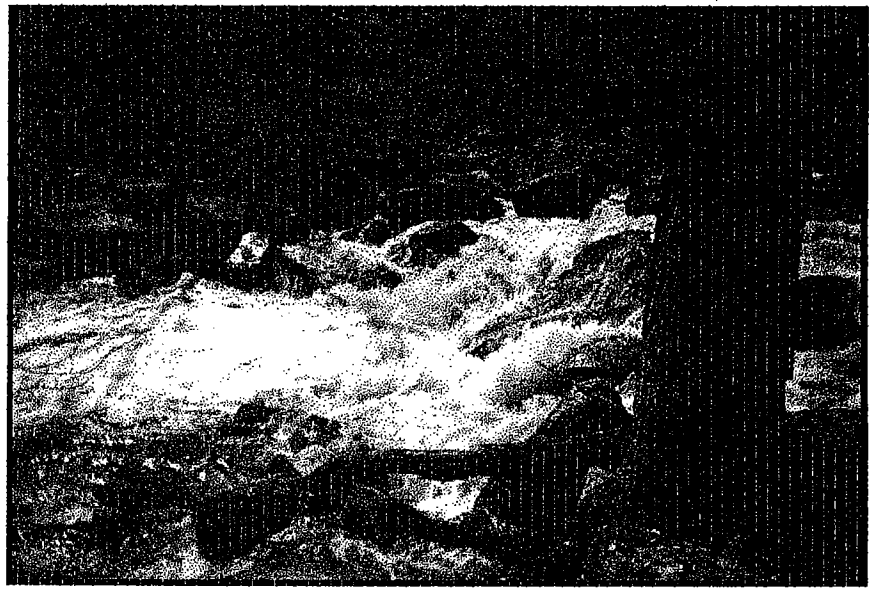
(Residential Ponds Strocks Road)



Beaver Creek, Tinicum Township



<= *Byers Road Crossing*

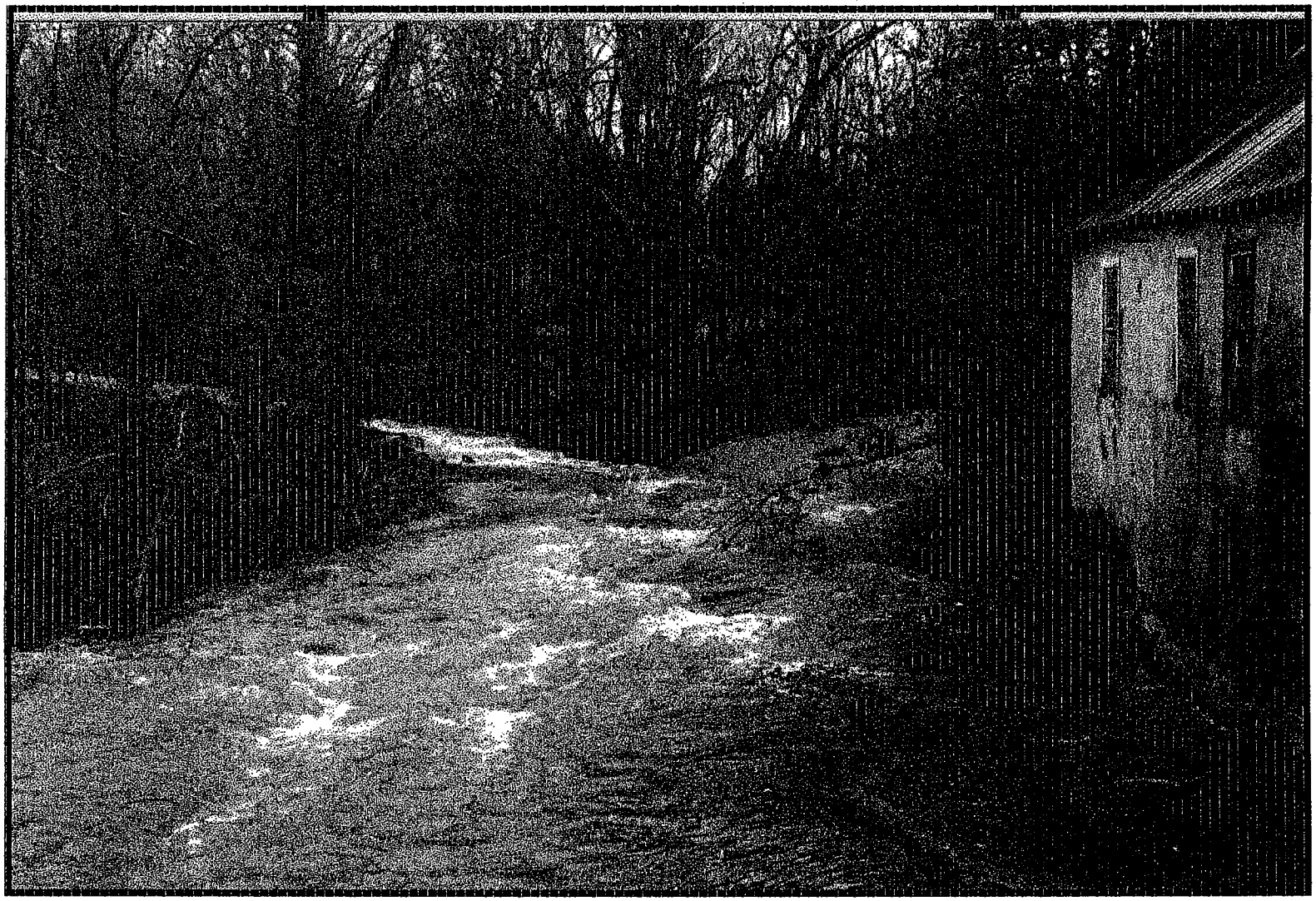


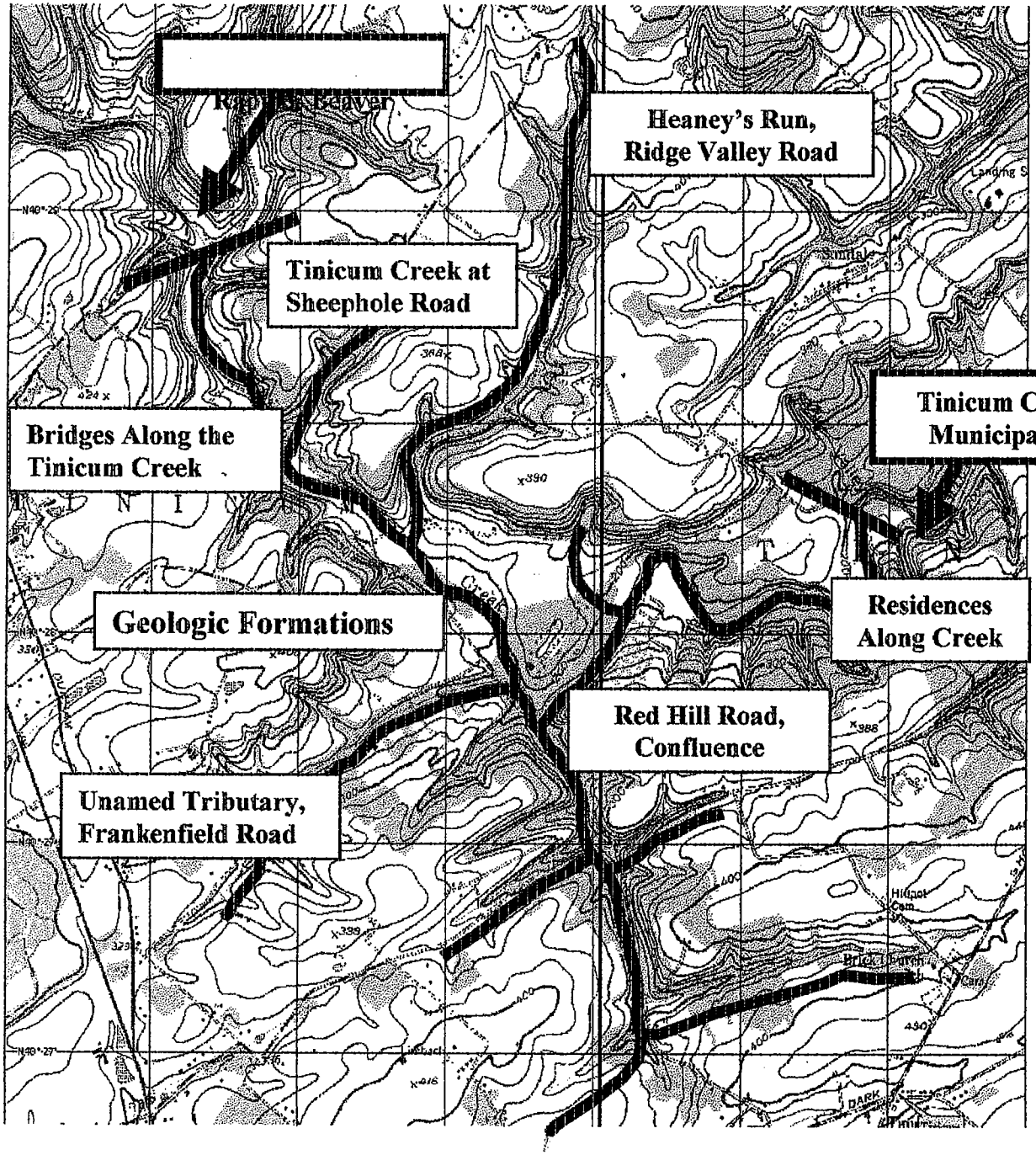
Beaver Run Road Crossing =>

pH

Rapp & Beaver Creek Confluence

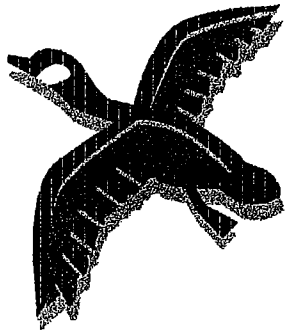
(Geigel Hill Road)





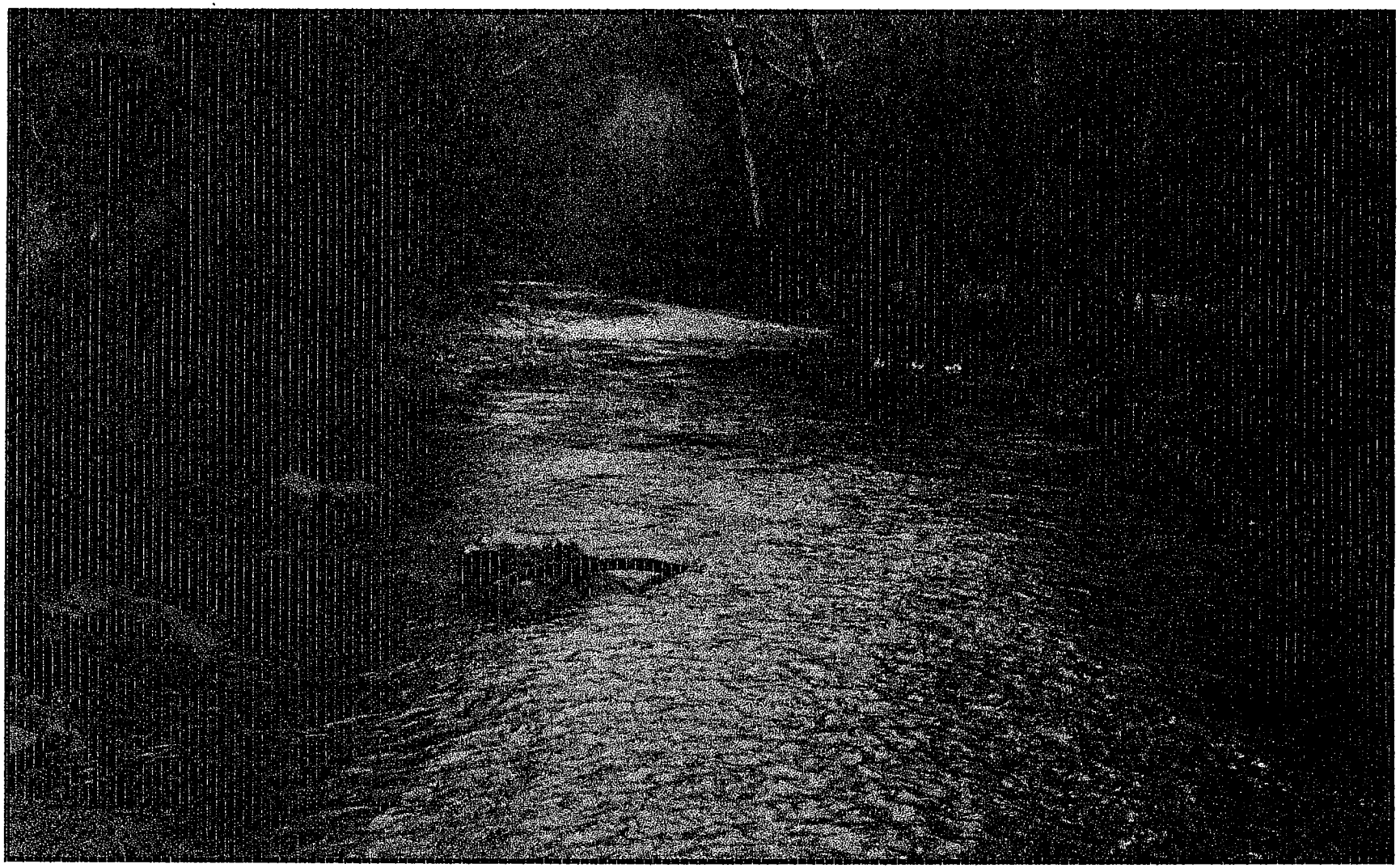
Section III ~

Tinicum Creek & Tributaries



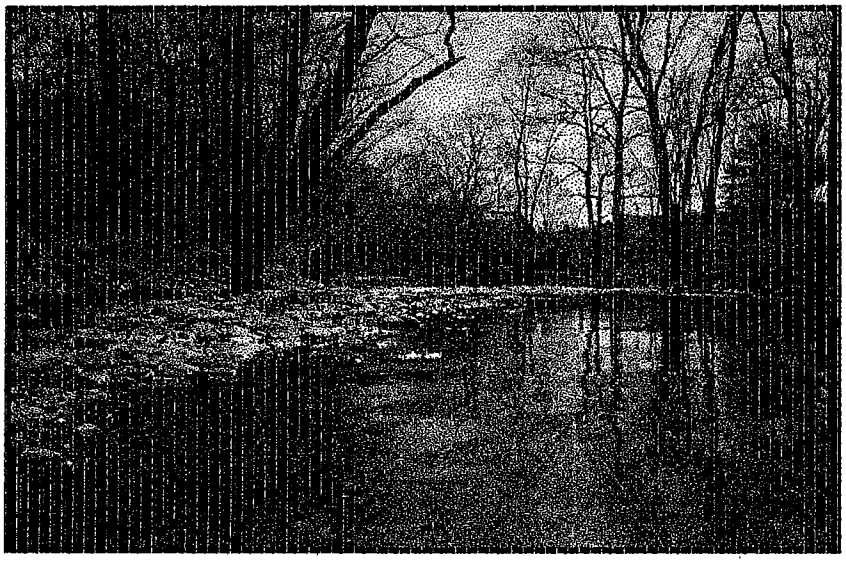
Tinicum Creek

(Along Sheephole Road)



pH

Bridges Spanning the Tinicum Creek



<= ***Bridge At Vagabond Park, Sheephole Road***

Bridge At Headquarters Road, Tinicum Township Stream Guage =>

Heaney's Run, Tinicum Creek

<= Ridge Valley Road

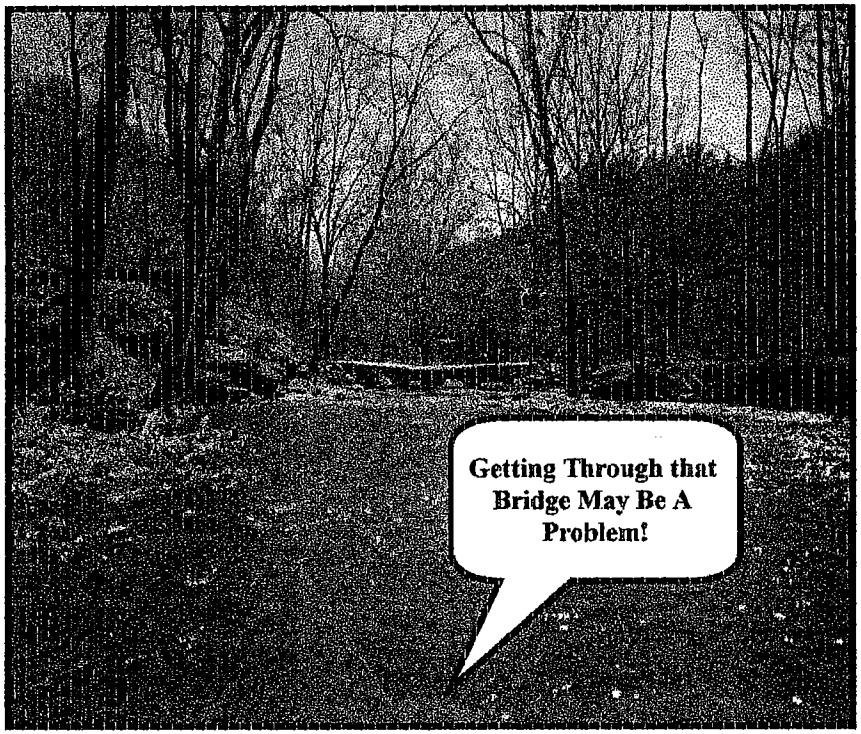
Confluence Below Headquarters Road =>

Geologic Formations

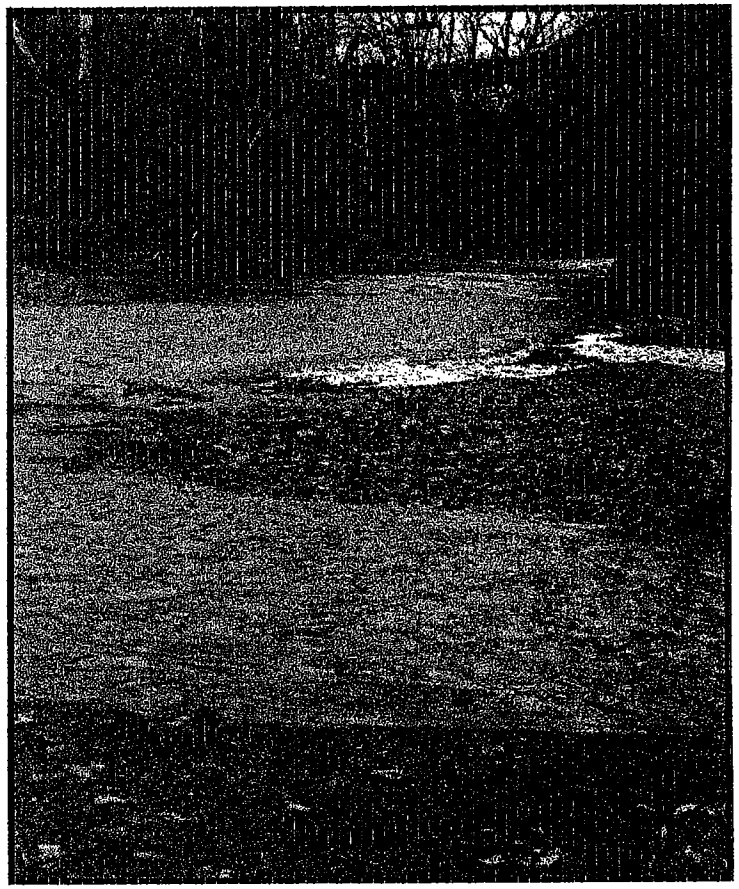
(Below Frankenfield Road)

pH

Tinicum Creek
(Red Hill Road)



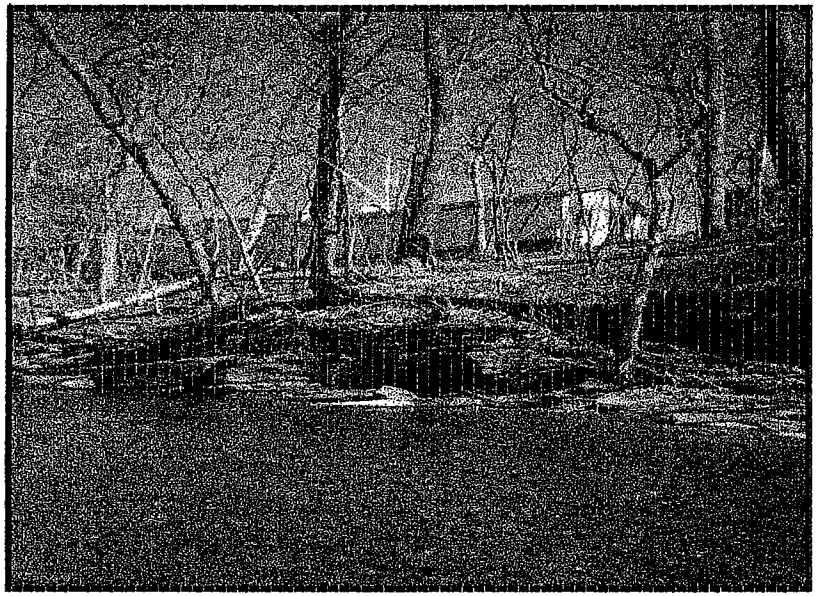
<= Bridge to Camp

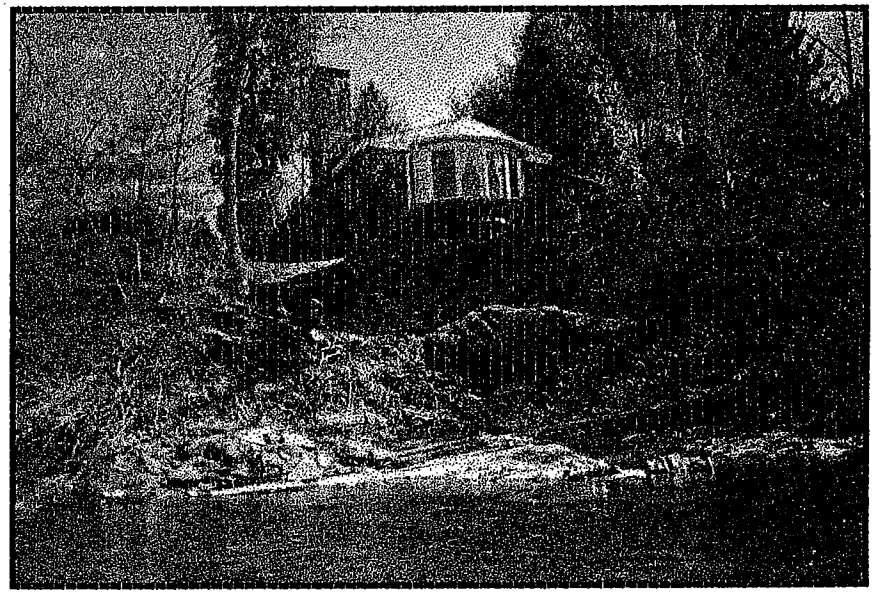


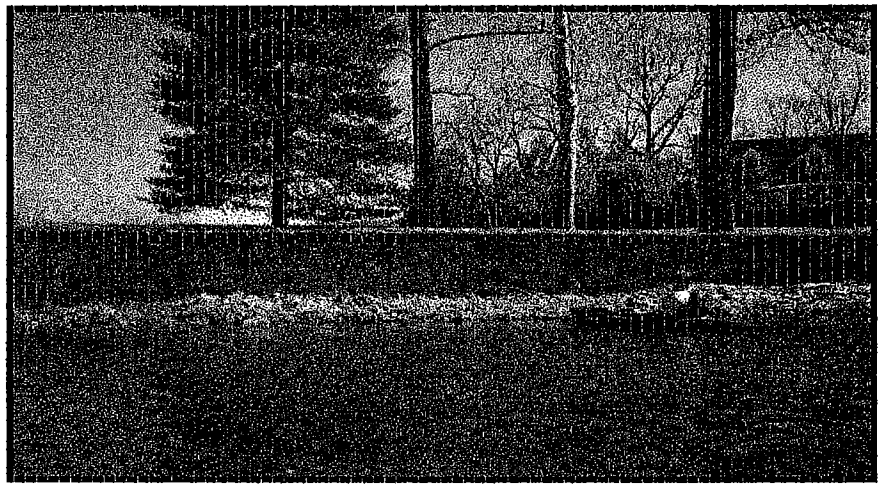
Confluence of Unamed Tributary & Tinicum Creek =>

Residential Homes Adjacent to Creek

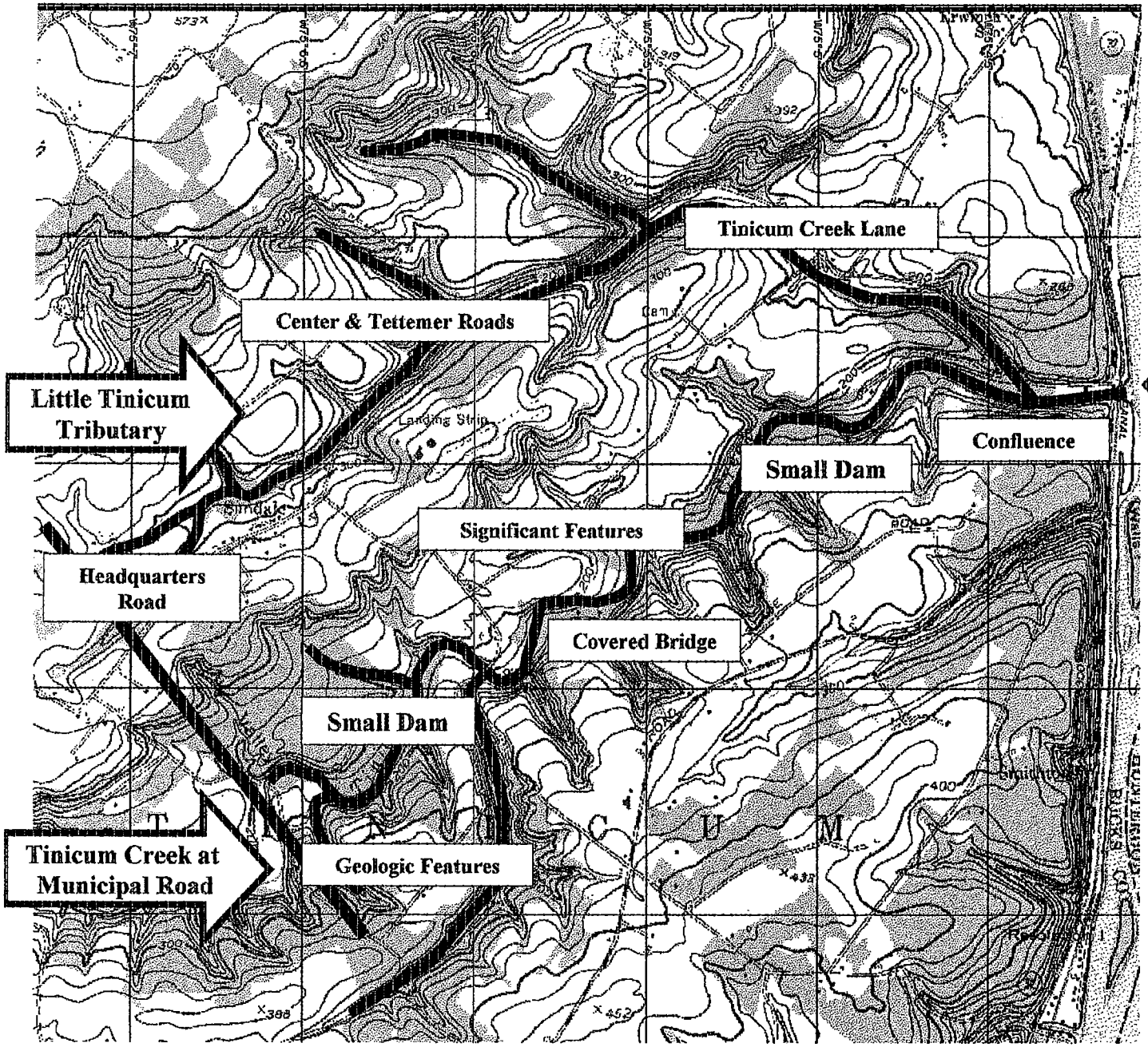
(Lily Valley Road)





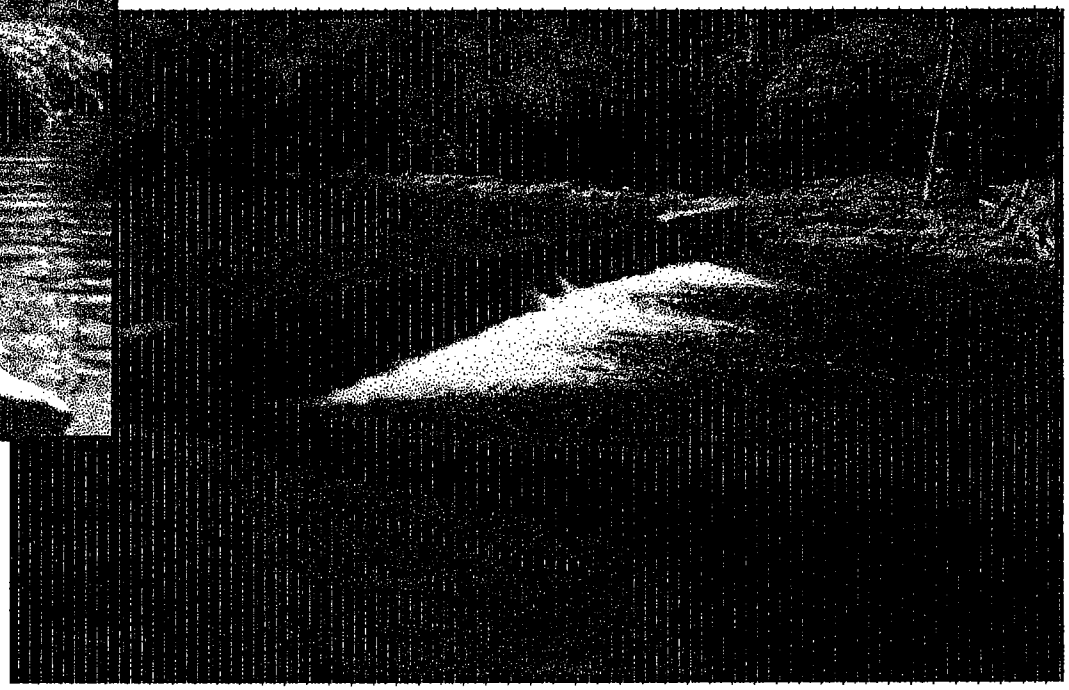


Section IV ~ Tinicum Creek & Tributaries



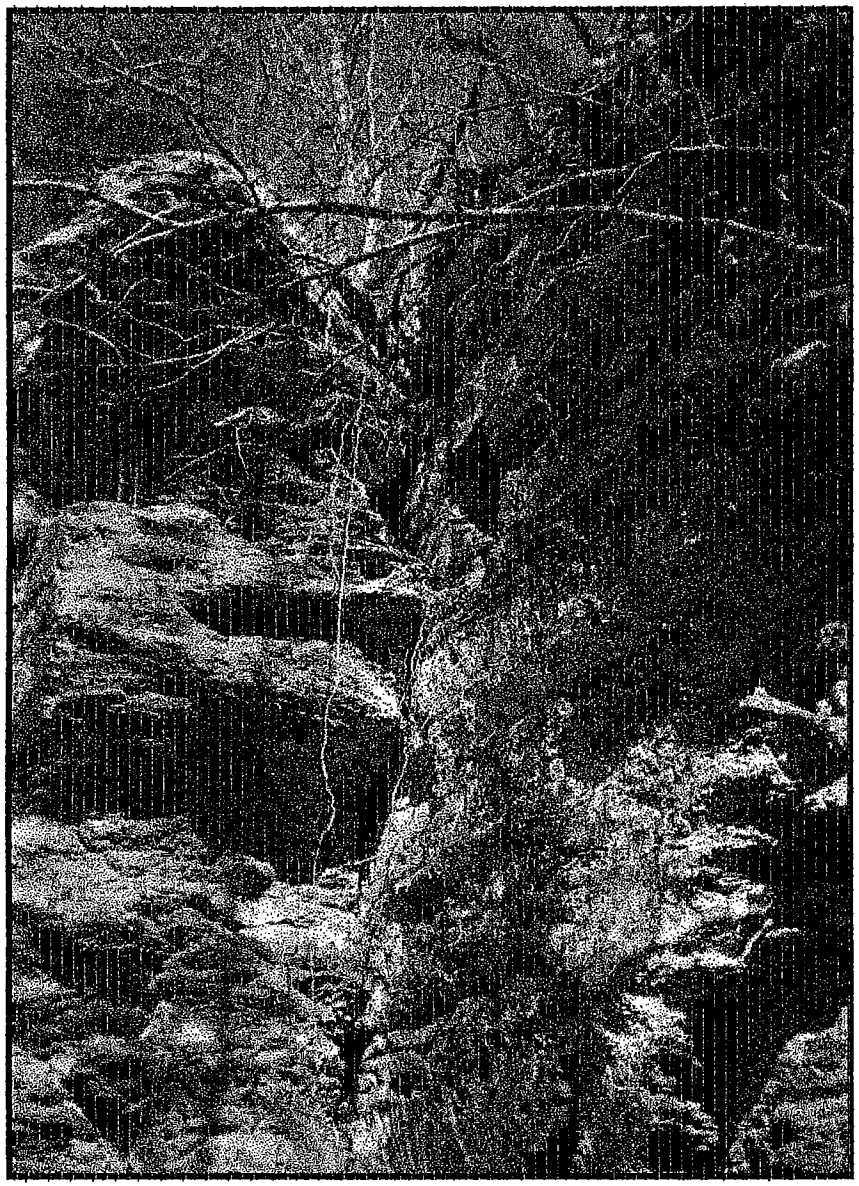
Tinicum Creek

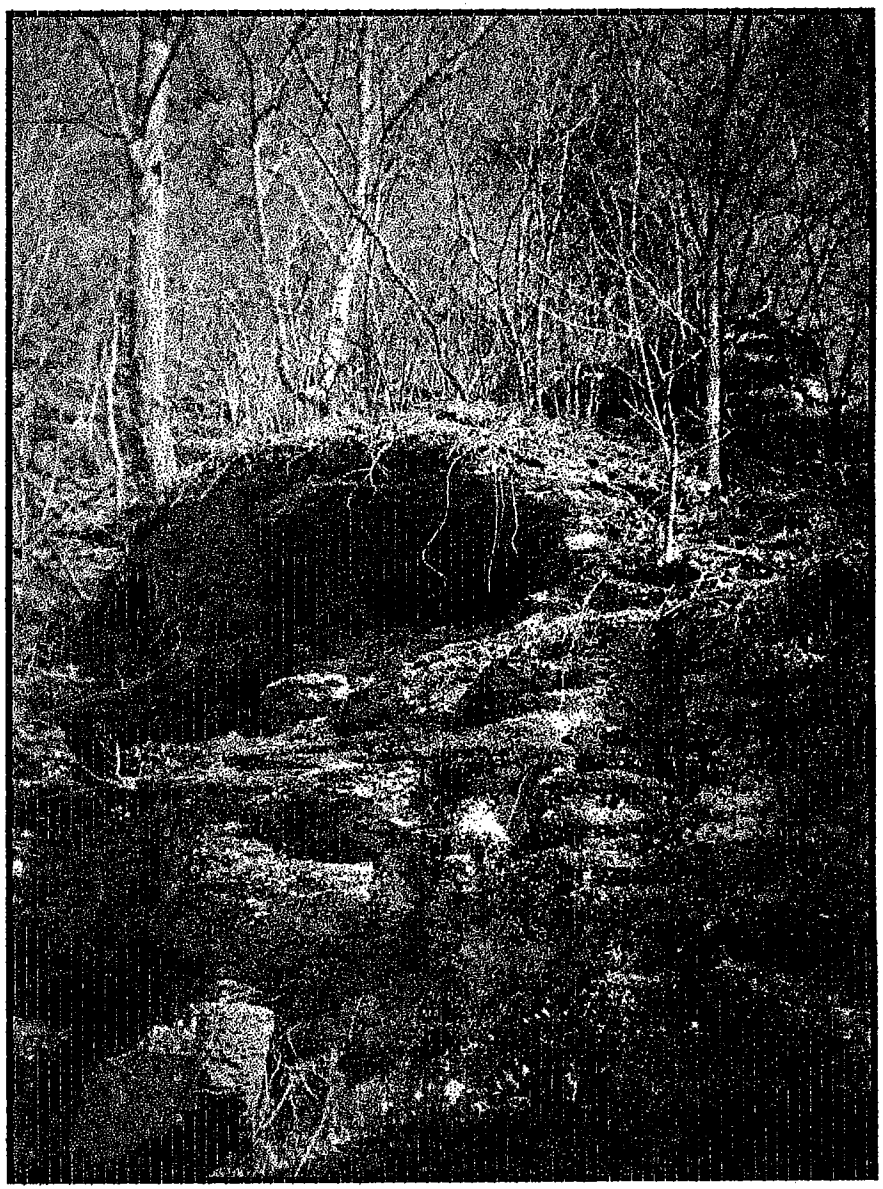
(Small Dam, East of Municipal Road)



Geologic Features, Tinicum Creek

(Below Municipal Road)

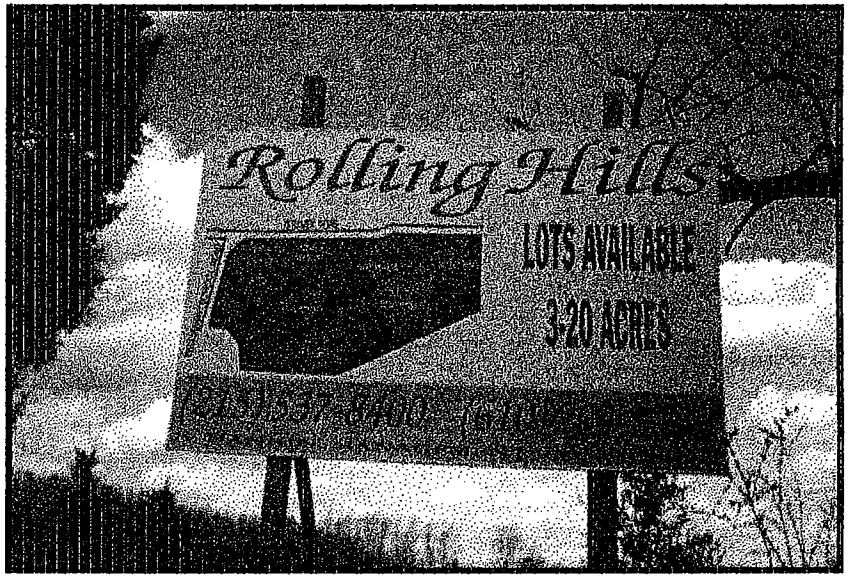




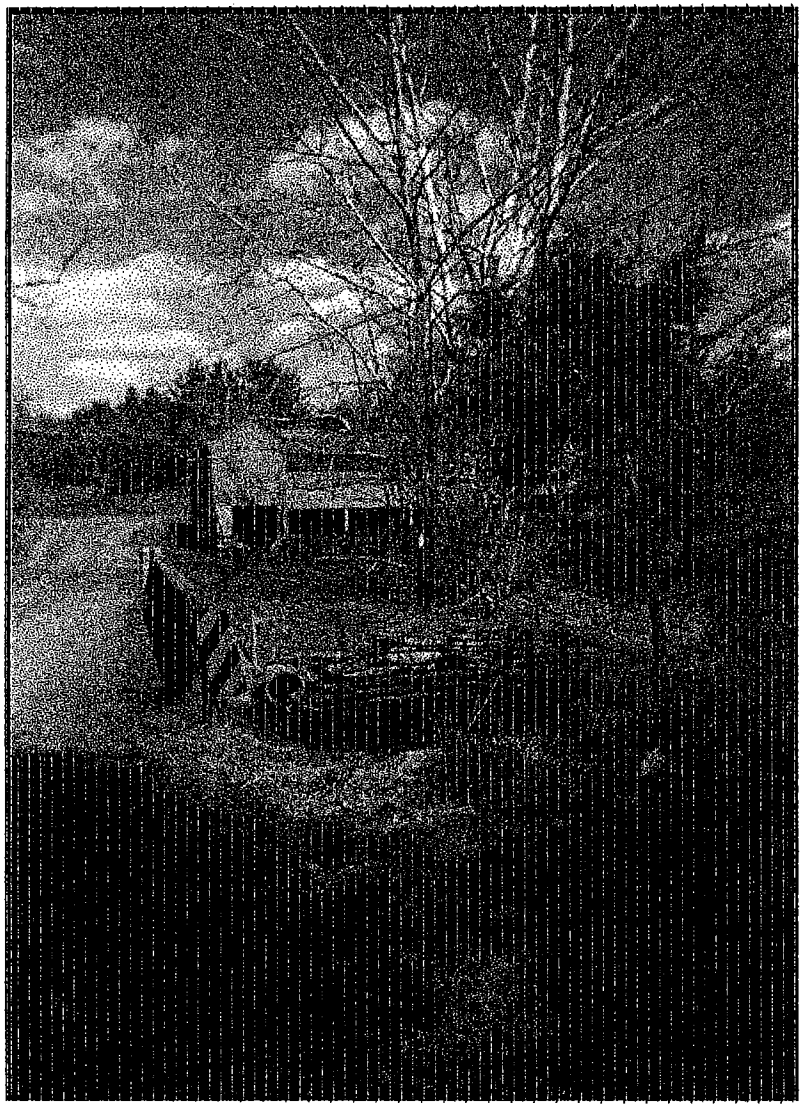
Tributaries to Little Tinicum

<= Center Road Tributary

Tettemer Road Properties =>



"Little Tinicum Creek"

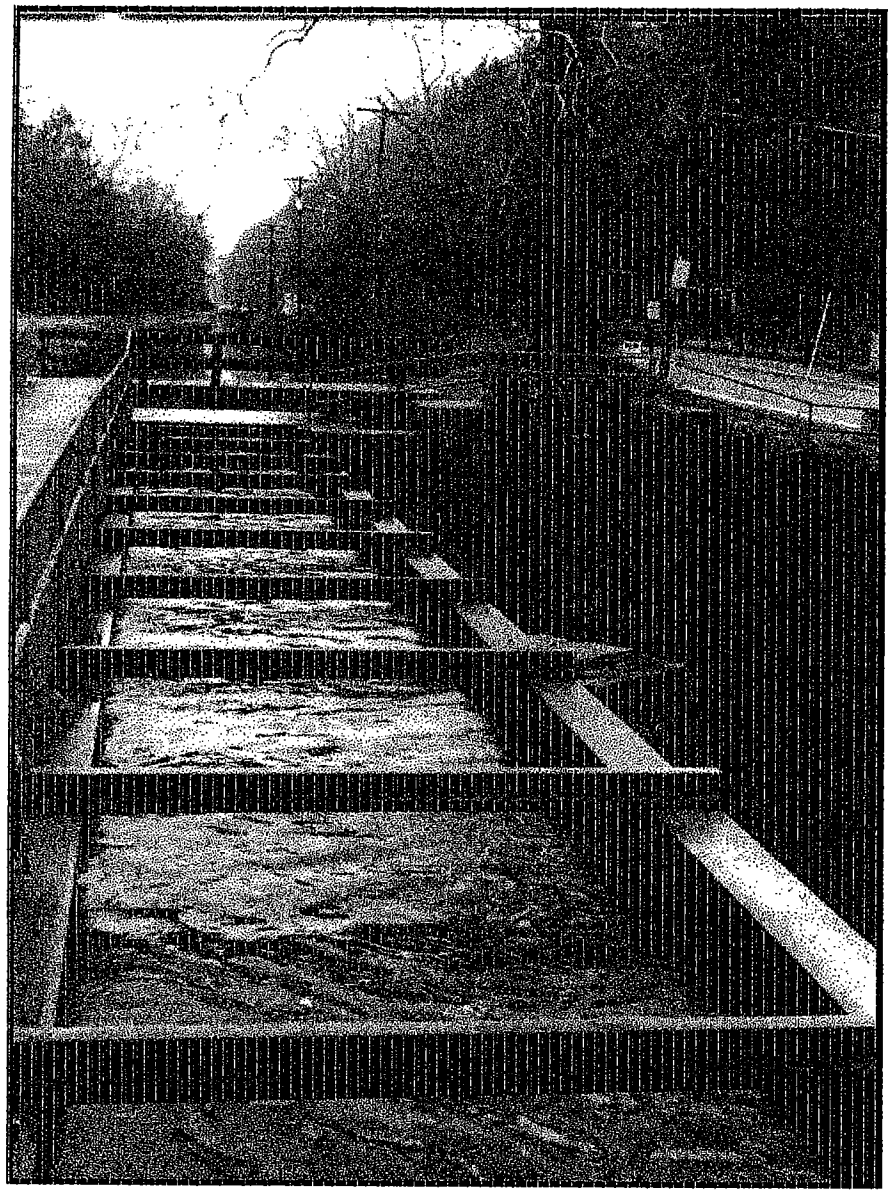


Tinicum Creek Road

<= Hollow Horn Road,
Lennox Craftsman Building

pH

The Delaware River Confluence



<= Delaware Canal Aqueduct

Confluence With Delaware River

The Delaware River

Preliminary Findings ~

The visual assessment was a worthwhile exercise as it provided the planning team with the information needed to obtain a "sense of place", to field check data, and to begin sharing findings with the Advisory Committee and the general public. The following is a list of preliminary findings based on the information gathered for Sections I & II of this plan as well as the visual assessment.

Some Positive Preliminary Findings

- ✔ Federal, state, regional, and municipal regulations provide extensive, multi-layered protection for this significant resource.
- ✔ The creek and tributary corridor remains *very* scenic and virtually litter-free.
- ✔ In most cases, the Tinicum Creek and Creek Tributary corridors are currently very well buffered.
- ✔ Community involvement in protection efforts is evident in this watershed.
- ✔ Based upon Exceptional Value (EV) classification and water testing, the water quality is very good.

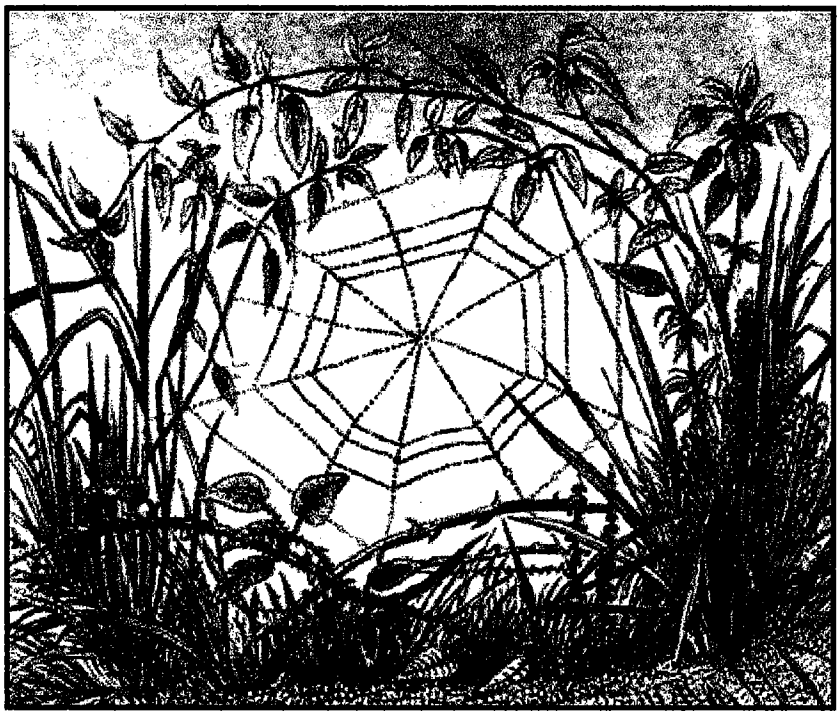
Additional Preliminary Findings

- ✔ Several streambank areas are eroding.
- ✔ There are several bridge crossings that have become obstructions due to bridge design or the buildup of "litter" (e.g, tree stumps).
- ✔ Sediment deposition is evident in areas of the creek corridor.
- ✔ Uprooted trees have formed significant obstructions in certain areas of the corridor.
- ✔ Unpaved roadway crossings exist in the creek corridor.
- ✔ There are stormwater discharge pipes along the creek and creek tributaries.
- ✔ Some landowners have applied streambank stabilization methods such as rock rip-rap and concrete walls to prevent streambank erosion.
- ✔ Roadways within the watershed are owned and maintained by a variety of entities.
- ✔ Residential and commercial development is taking place in the watershed.

The following sections describe the watershed in fuller detail.

SECTION FOUR ~

The Tinicum Creek Watershed . . . Significant Natural, Cultural, & Recreational Resources



A Listing of Soils in the Tinicum Creek Watershed . . .

- ✔ Abbottstown (AbB)
- ✔ Alluvial (Ae) *
- ✔ Bowmansville (Bo)*
- ✔ Doylestown (DoA, DoB)
- ✔ Klinesville (KlB, KlC, KlD)
- ✔ Lansdale (LDE, LDB)
- ✔ Lehigh (LhB)
- ✔ Mount Lucas (MoD)
- ✔ Neshaminy (NeB)
- ✔ Penn-Klinesville (PhB3, PKC3)
- ✔ Readington (RdB)
- ✔ Rowland (Ro)*
- ✔ Towhee (TOA)

* Floodplain/Alluvial Soils

Significant Natural Resources

Soil Characteristics & Soil limitations ~

The major soil associations in the Tinicum Creek Watershed include the *Abbottstown-Doylestown-Reaville Association,* and to a lesser degree, the *Penn-Klinesville Association.* The soil series within each sub-watershed are also listed in the soil coverage map (See Figure 5, Page 40). The Abbottstown Association soils are somewhat poorly drained, restricted in permeability, and have seasonal high water tables. Main limitations upon this association are high water table, restricted permeability, and limited depth to bedrock. The *Penn-Klinesville Association* is formed chiefly in material weathered from red shale and sandstone. Penn soils are moderately deep and well drained, while Klinesville soils are shallow and well drained. Found on upper slopes and hilltops, the main limitation upon the association is the shallow depth to bedrock. The Bucks County Soil Survey recommends thorough investigation before sites in the two associations are developed (USDA, 1975). A combination of Best Management Practices (BMPs) is also advisable when earth moving begins, the parcel is developed, and sewage disposal systems are operational.

The Palisades Area Wastewater Facilities Plan (BCPC, 1980) estimates that the majority of the three municipalities in the Tinicum Creek Watershed contain soils that are unsuitable for any type of on-site sewage disposal system. The Plan further states that Abbottstown, Doylestown, Reaville, and Towhee soils are not suitable for conventional sewage disposal systems (e.g., septic system). In addition, Klinesville, Penn, and Lehigh soils are considered suitable for alternative on-lot sewage systems. Other soils in the region are suitable for conventional on-lot systems.

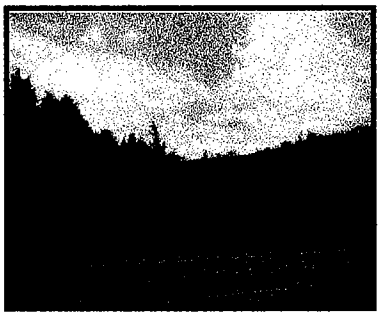
Tinicum Township is currently updating their Act 537 Wastewater Facilities Plan. The 537 plan will be completed in early 2001, and is expected to include a continuation of the use of on-lot disposal and treatment systems as well as a more pro-active on-lot maintenance program.

There are prime and locally important soils in the Tinicum Creek Watershed . . .

Prime Agricultural Soils ~

The Comprehensive Plans for the three municipalities note that the most fertile agricultural soils (*prime agricultural soils*) in the area are located in the floodplains along the Delaware River. However, there are pockets of Prime Agricultural Soils in the Sheep Hole Road (Tinicum Township) portion of the watershed and in headwater, floodplain and floodway areas. *Locally important soils* are located along Municipal Road and Headquarters Road and within the Tinicum Creek watershed. Additional *farmlands of statewide importance* are located throughout the Tinicum, Rapp and Beaver Creek watersheds. All three municipalities are involved in the movement to help protect significant agricultural areas.

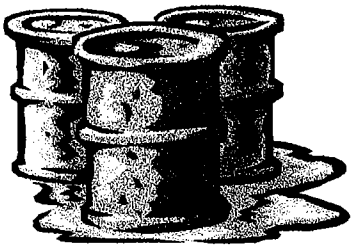
Within the Tinicum Creek and tributary corridor it is estimated that approximately 95% of the land is privately owned. However, the majority of land bordering the creek and creek tributaries has site constraints such as steep slopes, dense woodland, and alluvial floodplain soils. Due to the natural constraints present, and the protection techniques provided by the municipal zoning and subdivision ordinances (e.g., floodplain/floodfringe/floodway/floodplain soil protection, steep slope development standards, the corridor assessment illustrated that there are a limited number of homes and accessory structures (e.g., garages, storage units) currently encroaching upon the creek corridor. However, there are current exceptions noted in Section III of this Plan. Exceptions include several homes and structures within the 100 year floodplain (e.g., Lily Valley Road, Tinicum Township), and undeveloped parcels in zoning districts slotted for future development (e.g., 611 corridor & Quarry Road, Nockamixon Township, Little Tinicum Creek & Main Stem Tinicum, Tinicum Township). Development proposals in these areas should be carefully considered and viewed in light of their potential for additional nonpoint source pollution loadings to the Tinicum Creek.



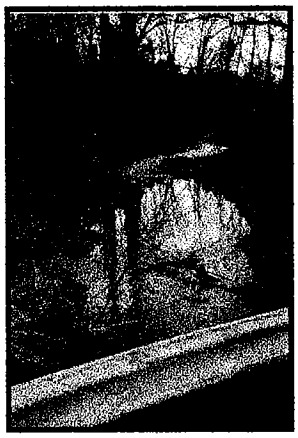
EPA Superfund Sites Are located in the watershed such as the Revere Site on Route 611 in Nockamixon Township . . .

Potential Hazard Areas ~

The United States Environmental Protection Agency (EPA), and the Pennsylvania Department of Environmental Protection (DEP) were contacted to augment local knowledge concerning active or closed "hazard areas". Areas of environmental concern included EPA



One EPA Superfund Site is Located in the Watershed Area, and a Second in an Adjoining Watershed . . .



Portions of the Rapp Creek are Adjacent to Bucks County Crushed Stone . .

Superfund Sites, RCRA Inspection Sites, CERCLA landfills and other areas.

The *Revere Chemical Company Superfund Site* is located on about ten acres off Route 611, and just north of Route 412 in Nockamixon Township. The plant recovered metals until the end of 1969 when it was closed by the Pennsylvania Department of Environmental Resources, because the operation was discharging contaminants into tributaries of the Rapp Creek. High concentrations of copper, chromium, and lead were found in both the south and east tributaries of Rapp Creek. Over two-thousand people living within three miles of the Revere site rely upon on-site private wells for drinking water. By 1984, twenty-two drums of waste chromic acid were removed as well as 30 cubic yards of sludge containing copper and chromium. The area has since been "capped " with a 40 ml plastic cover, and in June 1999, the cleanup was deemed "complete". On-site monitoring will continue for several years.

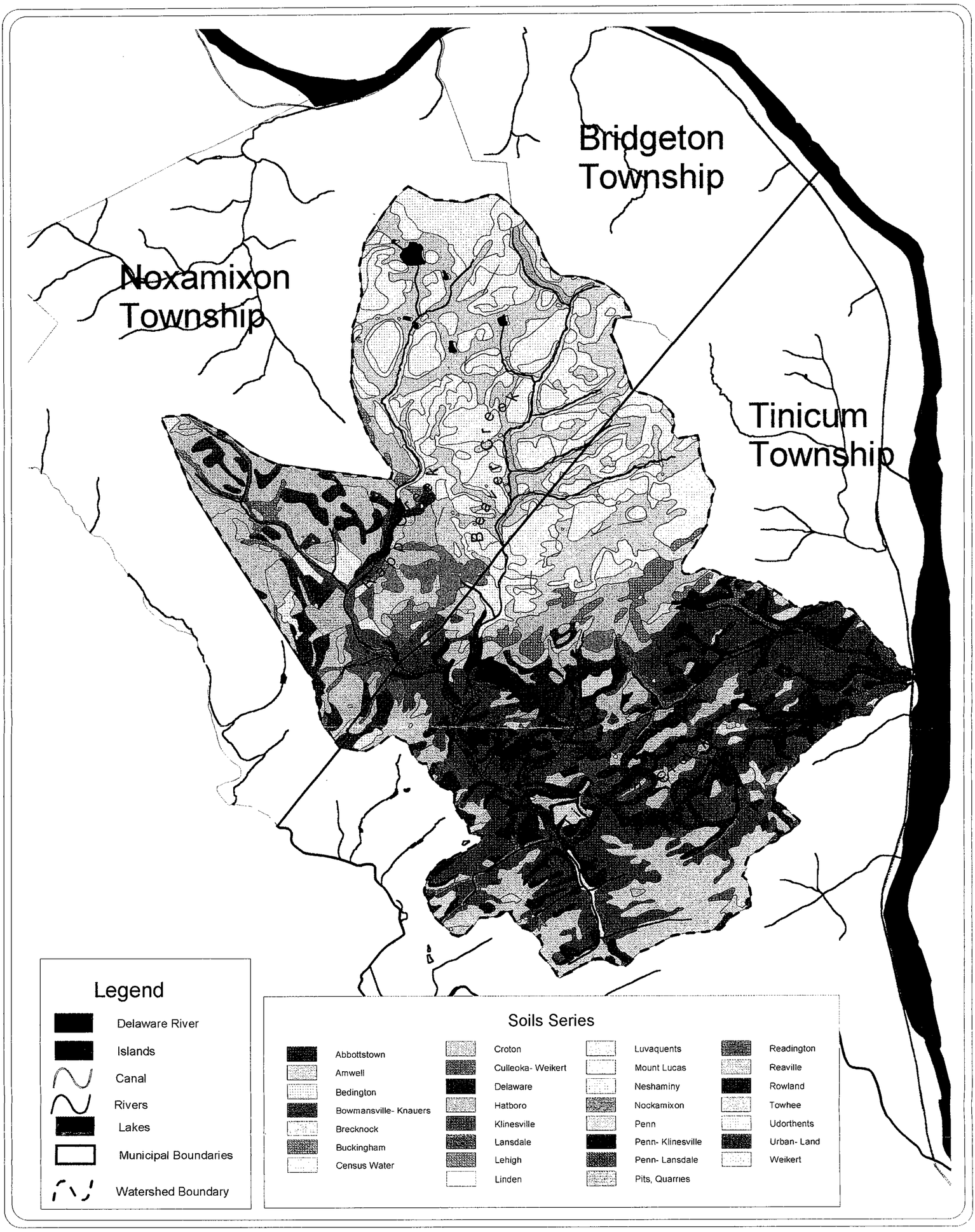
Although in the adjacent subwatershed, the *Boarhead Farm* Superfund site should be mentioned. The site, located on Lonely Cottage Drive in Bridgeton Township, was placed on the National Priorities List in 1988. Since that time, over 2, 500 buried drums and numerous leaking tank trucks containing volatile organic chemicals (VOC's) were removed from the site. Remediation plans are still under development, and include the excavation and removal of buried drums, contaminated soil, and the collection and treatment of contaminated water.

Also in the vicinity of Lonely Cottage Road in Bridgeton Township are two automobile junkyards. Nicks Used Auto Parts and Millers Junk yard are a local concern due to their proximity to the Beaver Creek and the presense of anti-freeze, oil, gasoline, and other chemicals.

Quarries & Sinkholes ~

Active and closed quarries are quite abundant in the Delaware River Valley from Erwinna to the northern boundary of the watershed.. Sand and gravel mining operations are common, because the region contains river terraces consisting of glacial outwash (e.g., sand and gravel). One such operation is *Bucks County Crushed Stone* Quarry. The Quarry is located along Rapp Creek in Ottsville. Another quarry, *Delaware Valley Quarry* is located on Route 32 (River Road) in

Lumberville. The closest carbonate area is the Durham Carbonate Valley located north of the project area. Therefore, land subsidence is not a problem in the watershed.



The Tinicum Watershed Rivers Conservation Plan

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N W E S

Map Scale: 1:55,000

Map Projection: Transverse Mercator (UTM) Zone 18, North

Figure 5: The Tinicum Creek Watershed Soil Series

A GIS Mapping Partnership:
Brandywine Conservancy, Princeton Hydro, Tinicum Township, Watershed Associates, Bucks County Planning Commission and the World Wide Web

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A DCNR Keystone Conservation Project

DCNR The Pennsylvania Department of Conservation and Natural Resources

Tom Ridge, Governor John C. Oliver, Secretary

Water Resources In the Tinicum Creek Watershed

The Rapp Creek Headwaters Originate in Nockamixon Township. Pictured Above is Lake Warren Pond off of Warren Road (State Gamelands #56) . . .

The following section of the plan includes a more in-depth discussion regarding surface and groundwater resources, in the Tinicum Creek Watershed (See Figure 6, page 53). Fortunately, the Township Zoning Ordinances and associated land development regulations recognize the importance of each resource. For instance, overlay zoning districts are in place in Tinicum Township, while Nockamixon and Bridgeton Township have implemented other resource protection strategies.

Tinicum Creek Tributaries ~

In addition to the main stem of the Tinicum Creek, four major tributaries include the Rapp Creek, Beaver Creek, Beaver Run/Heany's Run Tributary, and the Little Tinicum. Together they comprise over 100 miles of waterway! The western fork of the **Rapp Creek** begins in Nockamixon Township at Bucksville Manor, while the Eastern headwaters are located further north at State Gamelands #56 in Nockamixon.. The two tertiary tributaries join the secondary tributary to the Tinicum at Quarry Road and continue flowing in a southeast direction until joining the Beaver Creek Tributary at Giegel Hill Road in Tinicum Township. The combined total length of the Rapp Creek and its tributaries is approximately 26 miles. As previously discussed in Section I, Rapp Creek is considered a Special Protection water way, and has the protective Exceptional Value (EV) waterway classification.

The headwaters of Beaver Creek originate in Bridgeton Township on Lonely Cottage Road . . .

The majority of land use within the Rapp Creek subwatershed is low density residential (38%), followed by vacant (21%), agricultural (13%), recreational (11%), single family residential (10%), industrial (4%), and commercial (3%), and institutional (1%). The zoning of the majority of the subwatershed in Nockamixon Township is Residential (R), with smaller Industrial (I), Commercial (C), and Office (OSM) zoning districts. In Tinicum Township the Residential Agricultural (RA) zoning district is applied to the watershed surrounding Rapp Creek.

The **Beaver Creek** tributaries are approximately 25 miles long and meander through all three municipalities. Three tertiary tributaries originate east of Marienstein Road and south of Lake Warren Road in Nockamixon Township and Bridgeton Township. The tributaries flow

in a southwesterly direction until joining the Rapp Creek Tributary at Giegel Hill Road in Tinicum Township. Land use within the Beaver Creek subwatershed is predominantly low density residential (45%) followed by vacant (20%), single family residential (15%), recreational (11%), agricultural (6%), seasonal recreational (2%), and industrial/commercial (1%). Zoning in the Beaver Creek subwatershed is predominantly Resource Protected (RP) in Nockamixon Township and Bridgeton Townships and Residential Agriculture (RA) in Tinicum Township.

The **Little Tinicum Creek** is located entirely in Tinicum Township. The tributary is approximately 12 miles. It originates at the Tintinhill residence on Headquarters Road. The Little Tinicum tributary joins the Tinicum Creek just west of River Road before flowing into the Delaware River. The land surrounding the tributary is zoned Residential Agriculture (RA).

The Little Tinicum Tributary along Center Road . . .

Additional Surface Water Protection Efforts ~

In addition to some of the more traditional environmental performance standards provided by the municipal zoning districts, the Tinicum Township Zoning Ordinance also includes Floodway, Critical Recharge, Scenic Resource, Riparian Buffer, Watershed, and Delaware River Wild and Scenic Overlay Districts. The Overlay Districts are very protective of the Tinicum Creek Corridor. For instance, the Riparian Buffer Overlay District requires additional buffer area beyond the top of bank of all waterways, floodplains, and wetlands. The area may be maintained for yard area, but may not be used for buildings or structures. The exception is for driveway, road, and utility crossings. Crossings are allowable upon Township Conditional Use approval, however the landowner must prove that no other feasible alternative is available and that the least impact upon the natural topography and vegetation is incurred.

The Little Tinicum tributary along Tinicum Creek Road . . .

The Tinicum Creek Watershed Overlay District is intended to protect, preserve, and enhance the creek due to its Exceptional Value (EV) Water Quality and its Federal Wild & Scenic River Program status. All proposed development in the District is subject to Conditional Use approval. In addition, the applicant must also show that all proposed buildings and structures are located in areas having the least adverse impact on surface and groundwater resources. All septic tank

absorption areas must be located at least 150 feet from the top of bank of all waterways within the Tinicum Creek Watershed.

Floodplains, Wetlands, Lakes & Ponds ~

One-hundred year **floodplain** and floodway areas are evident along the Tinicum Creek and its tributaries (See Figure 6, page 44). Floodplains are subject to 100-year-recurrence-interval flooding, and serve a variety of functions. In terms of flood protection, floodplain areas serve to store water thereby easing rapid fluctuations of stream volume during rain events. Floodplain areas also trap sediment from stormwater runoff, so they serve water quality protection functions. In addition, floodplain areas serve as an "interface" between land and surface water habitat and are ecologically diverse. None of the three municipal zoning and subdivision ordinances allow intrusion on floodplains. As an additional precaution, the zoning ordinance for the municipalities protect floodplain soils, and limit intrusion upon the flood fringe. Tinicum Township requires a fifty foot setback for all structures from the edge of the floodway district.

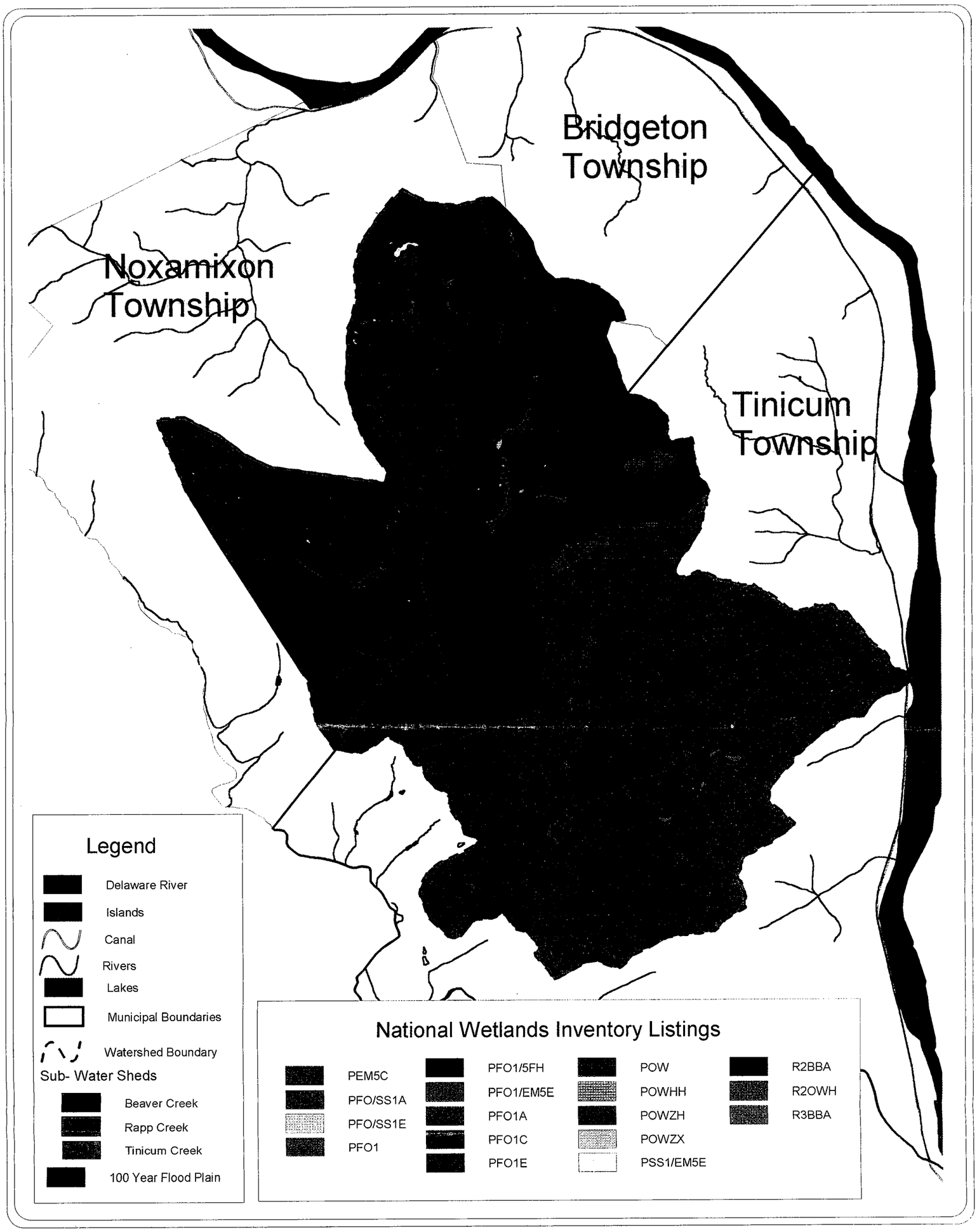
Several residential ponds are located in the Beaver Creek subwatershed along Lonely Cottage and Strocks Grove Roads

Wetland areas are saturated with water, support hydrophytic vegetation and contain hydric soils. Like floodplains, wetlands serve a variety of important functions. These valuable functions are due to their ability to store and slowly release large volumes of water. In terms of flood protection, wetland areas serve to store water thereby easing rapid fluctuations of stream volume during rain events. Wetlands also serve to filter pollutants from stormwater runoff. The majority of wetlands in the Tinicum Creek Watershed project area are *riverine* and to a lesser extent *palustrine*. They are noted on Figure 6 (page 44). Since wetlands are incompatible with development and serve a variety of functions, all three municipalities protect them. Nockamixon and Bridgeton Township prohibit development on wetlands (100%). Bridgeton Township requires a fifty foot setback from wetlands for all buildings. The Tinicum Townships zoning ordinance contains a wetlands and wetlands margin overlay district which requires a fifty foot wetland margin buffer. The fifty foot wetland buffer may not be altered, regraded or built upon.

Wetlands, Floodplains, Ponds and Lakes Serve a Variety of Valuable Functions . . .

Lakes and ponds moderate stream flows and provide wildlife habitat, and recreational resources. Lake Warren is the largest lake, and is located at the headwaters of Rapp Creek within State Gamelands #56. A chain of man-made ponds is present along Lonely cottage Drive, and

an unnamed pond is present at the headwaters of the western-most tributary to Beaver Creek. All municipal zoning ordinances are protective of lake and pond resources. Bridgeton and Tinicum do not allow intrusion upon a fifty foot buffer area around lakes and ponds.



The Tinicum Watershed Rivers Conservation Plan

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Map Scale: 1:55,000

Map Projection: Transverse Mercator (UTM) Zone 18, North

Figure 6: The Tinicum Creek Watershed Surface Water Resources

A GIS Mapping Partnership:
Brandywine Conservancy, Princeton Hydro, Tinicum Township, Watershed Associates, Bucks County Planning Commission and the World Wide Web

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A DCNR Keystone Conservation Project

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Tom Ridge, Governor John C. Oliver, Secretary

Water Protection Plans & Ordinances in the Watershed . . .

✔Lower Delaware River Stormwater Control (167) Plan

✔Comprehensive Plans

✔ Open Space Plans

✔ Zoning and Subdivision ordinances.

✔ Municipal Sewage Facilities Plans

✔Nockamixon Well Ordinance #62

✔ Tinicum Creek Watershed Rivers Conservation Plan

✔Tinicum Township NPS Control Study & Pollutant Loading Ordinance

✔ Hydrogeology & Groundwater Study (USGS)

✔ Bridgeton Water Impact Study Requirements (SALDO).

Tinicum Creek Watershed Water Quality ~

The Pennsylvania Water Quality Standards (Clean Streams Law, PA Code, Title 25, Chapter 93) requires that all surface water bodies be classified based upon use and water quality. As previously indicated, Tinicum Creek and its tributaries are classified as Exceptional Value (EV) waterways (§93.9 9e). EV waterways are classified based upon chemical and biological parameters (§93.4b.). Once classified, the exceptional water quality must be maintained and protected through the implementation of anti-degradation requirements (§ 93.4c.) intended to protect the Creek from point and nonpoint source pollution discharges. Water quality protection is commonly addressed through state regulatory programs. such as the Pennsylvania Nonpoint Discharge Elimination System (NPDES) permit program, Pennsylvania Stormwater Control Program (Act 167), and the Sewage Facilities Program (Act 537).

County-wide and municipal adoption of state regulations has taken place. For instance, the Bucks Conservation District works with the Pennsylvania Department of Environmental Protection (PADEP) to implement and enforce erosion and sediment control regulations at the local level. The *Lower Delaware Stormwater Control Plan* (Act 167, BCPC 1999) is a joint effort between PADEP, the Bucks County Planning Commission, and municipalities in the region to control the quantity of stormwater runoff from new development.

Historical water quality data from the Bucks County Planning Commission and the Bucks County Department of Health show the availability of consistently good drinking water although volume varies with location. According to studies in the early 1990s, the availability of safe drinking water from groundwater aquifers can be attributed to Tinicum Creeks high water quality. This is due to a geologic interaction between the Tinicum Creek and groundwater supplies (Tinicum Watershed Association & Coastal Environmental Services Inc. 1992). Apparently, degradation to the Tinicum Creek will have a direct effect upon drinking water quality throughout the watershed.

A USGS seepage study attempting to understand the interaction later stated that the majority (54 percent) of the Tinicum Creek Watershed is underlain by diabase of the early Jurassic age. Unlike sedimentary rocks where groundwater flows between the grains or bedding planes of the rock, diabase is considered relatively impervious to groundwater.

A List of Expressed* Surface water and Groundwater Quality Concerns . . .

✔ Increased Impervious Surfaces

✔ Inadequate Buffer

✔ On-Lot Disposal System Failure

✔ Pool Drainage

✔ Household Hazardous Waste

✔ Increased Stormwater Runoff & NPS Pollution

✔ Stormwater Quantity is Controlled not Quality

✔ Erosion & Sedimentation from Land Development Projects & Roadways

* Concerns were expressed during four public meetings for the Tinicum Creek Watershed Rivers Conservation Plan.

The USGS study concluded that all groundwater flow is through fractures, and nearly all groundwater storage is in the upper weathered zone. Some groundwater wells within the watershed bypass the diabase sill and extract from the underlying Triassic units. The remaining percentage of the Tinicum Creek Watershed is underlain by Triassic period sedimentary rocks, comprised predominantly of shales and siltstones. The groundwater system within these rocks can be visualized as a series of beds with a relatively high flow rate separated by beds with a relatively low flow rate. Beds within a formation are hydraulically connected by vertical joints and fractures that intersect one another at various angles throughout the formation. *This physical property of the formation permits surface water to permeate not only the unconfined surface aquifer, but the entire groundwater system.*

In 1997, the *Bucks County Water Supply Plan and Wellhead Protection Study* was completed and a groundwater pollution vulnerability map included (R.R. Hess, 1996). A "moderate to highly vulnerability" classification was given to the groundwater sources in the Tinicum Creek Watershed. The classification category was based upon the natural system of protection afforded bedrock aquifers. GIS overlay analysis was performed using physical features such as geology, soils, topography and hydrogeologic influences.

As previously discussed, some areas in the watershed have soils that are not suitable for conventional on-lot sewage facilities and only suitable for alternative systems (e.g., sand mounds). One example of a non-community system in the watershed is an industrial treatment facility, Cabot Corporation in Revere, with an NPDES permit allowing for daily releases of .017 MGD of untreated, non-contact cooling water. The permit is for discharges to the Rapp Creek. The *Palisades Area Sewage Facilities Plan* (Act 167, BCPC, 1980), is intended to control water quality degradation resulting from on-lot sewage treatment facilities. Two of the three municipalities have updated their 167 plans, Tinicum Township is beginning the process.

The municipalities have implemented, and in some cases augmented, state regulations by adopting local plans that recommend the implementation of Best Management Practices (BMPs) designed to protect surface and groundwater quality (See List of References) from non-point source pollution. Pertinent plans and ordinances are listed in the box on page 54.

A List of Expressed* Groundwater and Surface Water Quantity Concerns . . .

✔ New development is drawing the aquifer down faster than it is naturally replenished

✔ Surface water is removed for fire fighting, irrigation, and pesticide applications

✔ Water conservation is not practiced during non-drought years

* Concerns were expressed during four public meetings for the Tinicum Creek Watershed Rivers Conservation Plan.

Zoning, subdivision and land development, and stand-alone ordinances have also been implemented to maintain the Creek's EV water quality status. For instance, Tinicum Township has an ordinance requiring developers to submit information on the expected amount of nitrogen and phosphorus discharged from proposed residential on-lot disposal systems. Bridgeton Township has a hazardous waste storage ordinance, and Nockamixon Township requires developers to submit a water supply study proving adequate and potable drinking water for proposed development. Despite the multi-layered water quality regulations, residents and official still expressed surface and groundwater concerns. Recommendations regarding concerns will be addressed in the management plan (Section V).

Tinicum Creek Watershed Water Quantity ~

For many years the three municipalities within the Tinicum Creek watershed have relied entirely on individual on-site drinking water wells. The dependence is due in part to comparably low population densities, underlying geologic features, and associated unconfined groundwater aquifer yields. The headwater regions of the watershed are comprised of Diabase formations producing 200,000 - 300,000 gallons per minute (gpm). The geology south of the Rapp and Beaver Creek confluence is comprised of Lockatong & Brunswick formations from the Triassic epoch. The formations produce an average of 300,000 - 400,000 gpm (BCPC, Water Supply Inventory, 1992). The yields are adequate for on-site wells serving one or two households, but studies suggest that the flow and delivery pressure, is not sufficient or reliable enough for larger community systems. In addition, a market feasibility study was recently completed in Tinicum Township (ACOE & Miller Associates, 1996). The study concluded that a community drinking water facility would not be feasible or cost effective.

The Pennsylvania Safe Drinking Water Act (SDWA, 1986) primarily addresses the quality and quantity of drinking water for water systems serving more than twenty-five (25) people. The Act requires that public water suppliers obtain permits to ensure water quantity. However, permits are required only for new wells, surface water intakes, and substantial modifications to existing sources. In Bucks County, the Delaware River Basin Commission (DRBC) is responsible for community water system permits. In 1980, a Groundwater Protection Area was created by the DRBC (Regulation 80-18). However, the Tinicum Creek

Locally Rare & Special Concern Species ~
✔ Black-Billed Cuckoo
✔ Canadian Yew
✔ Hairy Lip Fern
✔ Northern Red Salamander
✔ Purple Martin
✔ Rare Bird Breeders
✔ Two-Lined Salamander
✔ Walking Fern
✔ Yellow Lamp Mussel

Threatened or Endangered Species~
✔ Small Flowered Crowfoot (Rare)
✔ Virginia False-Gromwell (Extirpated)

Significant Habitats~
✔ Headwater Forested Wetlands
✔ Migratory Bird Flyway
✔ Open Water
✔ Riparian

Invasive Species ~
✔ Honey Suckle Bush
✔ Japanese Knotweed
✔ Mile-A-Minute
✔ Multiflora Rose

Watershed is *not* within the protected area.

The laws previously described *do not* regulate individual wells nor do they regulate the negative effect of numerous individual wells upon groundwater aquifers. Pennsylvania municipalities, including the three in the Tinicum Watershed area, have historically relied upon state and local zoning regulations that indirectly protect groundwater and surface water quantity. Examples include zoning ordinance provisions addressing groundwater recharge and managing nonpoint source pollution (e.g., limiting impervious surfaces, requiring stormwater management facilities, prohibiting wetland, and surface water and floodplain disturbance). However, the municipalities are beginning to place more restrictions upon local developers. Local developers must now perform hydrogeolgic studies proving that an adequate amount of drinking water is available to accommodate additional homes and businesses.

In terms of recent study, the quantitative data suggests that maintaining groundwater quantity is also important to the Tinicum Creek. This is due, in part, to the conclusion that the average groundwater discharge to streams *is only* 20% of the average annual precipitation (USGS, 1994).

Biological Resources In the Tinicum Creek Watershed

For many years regional and local planning documents have noted the unique variety of biological resources in the Tinicum Creek watershed region of Bucks County. The biological variety is due to the physical diversity as well as changes in elevation, geology, climate, and aspects in the watershed.

The Delaware River Corridor Study (BCPC, 1982) notes the steeply sloping hills and cliffs adjacent to the Delaware, the mudflats, the corridor woodlands, and the terrestrial and aquatic wildlife. The corridor study designated a good part of the Tinicum Creek Watershed as an *area of special concern.* The *Bucks County Comprehensive Plan* (BCPC, 1993) and Natural Resource Plans (BCPC, 1999) note the geologic formations within the watershed area as well as the significant, rare, and unique status of the flora and fauna in the Tinicum Creek watershed.

In 1992 an extensive biological resource study was completed for the *Petition to Redesignate Tinicum Creek* (Tinicum Creek Watershed Association, Tectonic, & Coastal, 1992). A complete listing of biological species from the petition is included in Appendix B.

More recently, the *Lower Delaware River Scenic & Wild River Study* (National Park Service, 1999), and the *Natural Resource Inventory of Bucks County* (Rhodes, Morris Arboretum, 1999) again note the exceptional quality of the natural features, species, and habitats within the watershed. The inventory categorized the Tinicum Creek, from the confluence of Rapp and Beaver Creeks to the Delaware River, and the forested wetland headwater areas as a Priority 1 areas. Pennsylvania Natural Diversity Index (PNDI) status of existing watershed species is noted in the study. Significant species noted in the study are also listed in the box on page 57.

A follow up woodland vegetation study further delineated Tinicum Township woodlands (See Figure 7, Page 59), and now provides the Township with strategies to conserve them (Sullivan & Rhodes, Morris Arboretum, 2000).

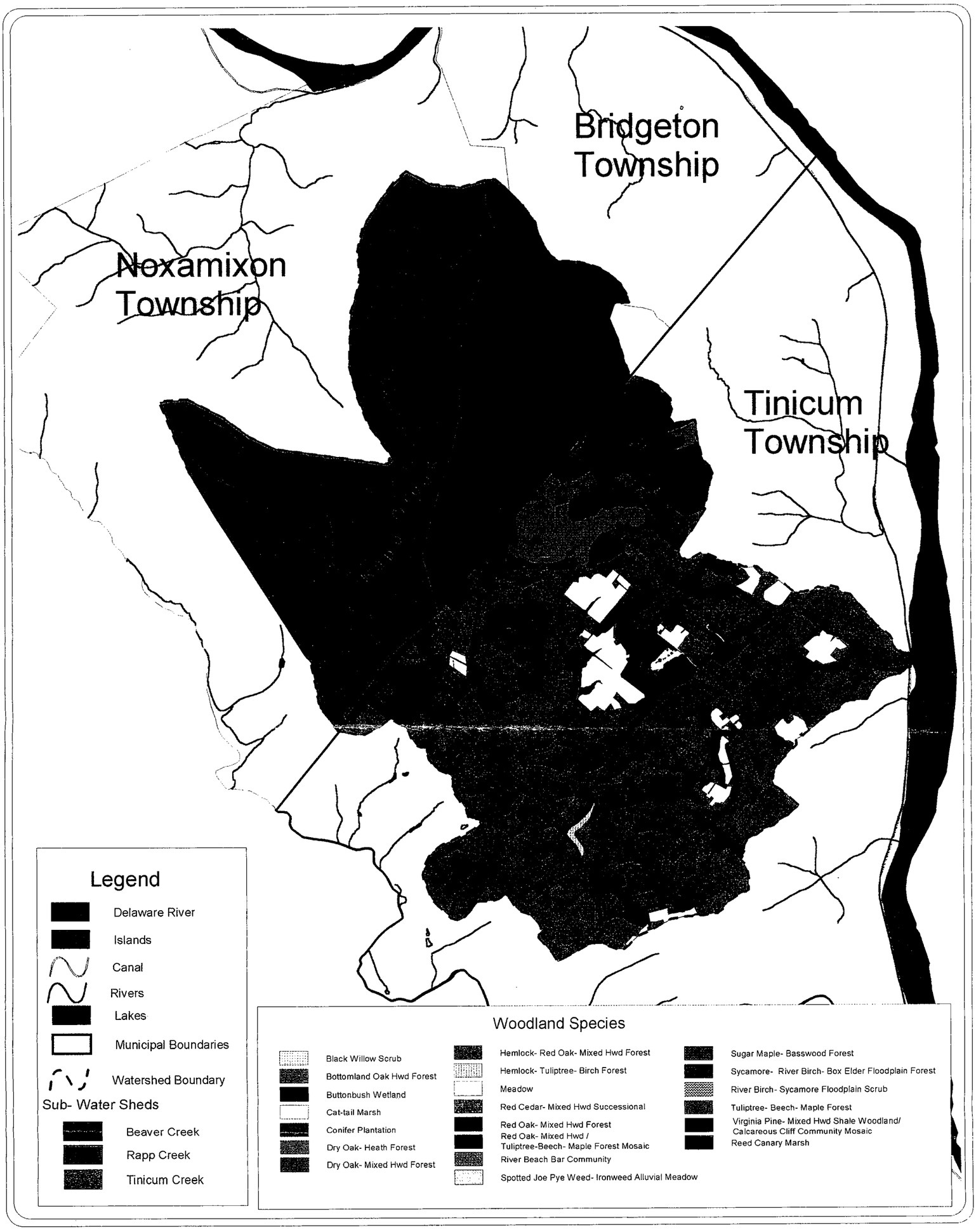
Several studies note the existence of significant flora and fauna in the Tinicum Creek Watershed . . .

Open Space Protection Efforts ~

In 1996 a report from the Bucks County Open Space Task Force was presented to the County Commissioners. The report recommended several policies to achieve preservation of open space in Bucks County.

A bond issue was successfully passed two years later to preserve farmland, provide for park and recreation areas and to protect unique natural and environmental features. The Bucks County Open Space Program requires that each municipality complete an open space plan before applying for preservation funding.

All three municipalities have completed or in the process of finalizing their municipal open space plans. At least ten properties currently under consideration are within the Tinicum Creek Corridor. Many more are located within the watershed. Funding for all properties is not available through the Bucks County Program. However, the municipalities are looking for other funding alternatives to preserve significant open space areas.



The Tinicum Watershed Rivers Conservation Plan

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N W E S

Map Scale: 1:55,000

Map Projection: Transverse Mercator (UTM) Zone 18, North

Figure 7: The Tinicum Creek Watershed Wood Land Species*

* Only coverages in Tinicum Township available.

A GIS Mapping Partnership:
Brandywine Conservancy, Princeton Hydro, Tinicum Township, Watershed Associates, Bucks County Planning Commission and the World Wide Web

A DCNR Keystone Conservation Project

The Pennsylvania Department of Conservation and Natural Resources

Tom Ridge, Governor — John C. Oliver, Secretary

Cultural & Historical Features

Archeologic & Historic Features ~

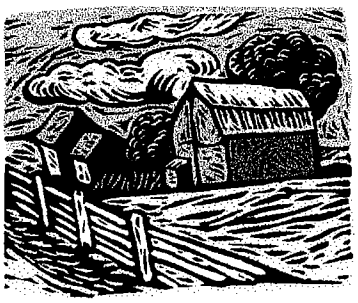
Settlers Arrived in the Tinicum Creek Watershed Area in the Early 1700's . . .

The name *Delaware* was applied to linguistically (Eastern Algonquian) and culturally similar bands of Lenni Lenape Native Americans occupying the Delaware River Valley at the beginning of the Seventeenth Century. In the Lenni Lenape tongue , Tinicum or *Mattenn nak-onck* means "along the edge of the island" and Nockamixon or *Nocha-miks-ing means* "at the place of three huts", or possibly "at the place of soil". Since the banks of the Tinicum Creek contain at least one undisturbed Indian rock shelter (dating from 3000 BC and used around 1000 AD), the Pennsylvania Historical Museum Commission has suggested there may be additional sites. They have suggested the need for additional study. Transitory hunting sites are also probable as argillite quarries, used to fashion stone tools, are located just three miles south of the Tinicum Creek. Native Americans would have traveled through Tinicum Creek to their permanent homes in the swamps or by the Delaware River.

Early Industry & Local Products Included Mills, Pottery Kilns, Baskets, Charcoal, and Farming Implements . . .

The well known story of the 1737 "Walking Purchase" took place in the Tinicum Watershed on what is now Headquarters Road. Local folklore includes Edward Marshall, a Tinicum resident buried in the township within the watershed, in the infamous story. According to the story the Walking Purchase was an effort by Thomas Penn, son of William Penn, to secure land from the Delaware Indians.

Marshall was accused by the tribe for cheating them and his wife, son, and daughter were murdered twenty years later. According to local documents, Marshall spent the majority of his life living at the Delaware River island located at the mouth of the Tinicum Creek. The island is now known as "Marshals Island".



Native Americans did not leave the region until approximately 1730. By that time there were a number of English and German settlers in the area. These early settlers transformed the area from wilderness to fertile farmland. Names common in what is now Tinicum, Bridgeton, and Nockamixon Townships included Steeper, Erwin, Heaney, Hoenig, Kolb, and Fretz. Common family names in Nockamixon & Bridgeton were Trauger and Kintner.

:ultural & Historical Sites in the Tinicum Creek Watershed . . .

- ✔ The Charles Rudy House, Sheephole Road
- ✔ Christian Frenz Home & Mill, Sheephole Road
- ✔ Elias Shull Mill, Tinicum Creek Delaware Canal Marker
- ✔ Erwinna Covered Bridge (PA Register)
- ✔ Frankenfield Coverd Bridge (PA & US Register)
- ✔ The Harrow Inn (PA Register)
- ✔ Headquarters Village, Ottsville
- ✔ John Williams Farm, Headquarters Road, (PA Register)
- ✔ Lewis Summers Farm, Headquarters Road (PA Register)
- ✔ Ridge Valley Historic District (National Register)
- ✔ Quarry Road/Beaver Run Road Bank Barn (PA Register)
- ✔ Quarry Road Stone Arch Bridge
- ✔ Red Hill Church & School (PA Register)
- ✔ Red Hill Village, Durham Road (National Register)
- ✔ Ridge Valley (PA Historic District)
- ✔ The Villages of Clay Ridge, Erwinna, Ferndale, Ottsville Revere, Smithtown, and Sundale

The first industry was the manufacturing of pottery as red clay was readily available. A local specialty was red tulipware from the Kinter, Herstine, Harin, and Singer potters kilns as well as baskets. Charcoal was also manufactured in the area and sold for cooking fuel. The historic components in the Comprehensive Plans of all three municipalities boast thousands of buildings, and hundreds of sites with historic and cultural merit. Many of the villages and historic structures still exist and are in good condition in this relatively undisturbed watershed. In Nockamixon Township the Villages of Ferndale and Revere are located in proximity to Rapp Creek on Route 611. Ferndale, known until 1880 as Rum Corner for its distillery, was noted for its thriving wheelwright, blacksmith, mining shoe factory, and creamery enterprises. Revere located south along Route 611 and is named for Paul Revere, the Revolutionary War hero.

Historic villages are located throughout the watershed. Including the Clay Ridge, Erwinna, Ottsville, Smithtown, and Sundale Villages. Clay Ridge is a small hamlet located on a clay soil ridge just east of Beaver Creek on Clay Ridge Road. The Rock Ridge Chapel is still maintained in its original condition. The historic village of Erwinna was originally know as London Ferry and named after the ferry operating there between 1699 and 1761. It was a boat building center servicing the needs of the Delaware Canal. The Erwinna Covered Bridge, the shortest in Bucks County, and several historic structures are still located in the village.

During the early 1700's, Scottish-Irish Presbyterians settled Ottsville. It is located west of the Tinicum Creek and just east of Route 611, and is one of the oldest villages in northern Bucks County. Known originally as "Red Hill, Ottsville boasted an inn for stage coaches traveling along Durham Road. The historic village of Smithtown, located on River Road, was named after a Quaker family. The Smith family was responsible for design improvements to the moldboard plow, and ran a farm implement business in Smithtown. Their most famous client was Thomas Jefferson. Sundale Village was once a meeting place for Township officials. Located on a hilltop overlooking the "Little Tinicum" Creek, the village now contains beautiful residential homes and the Van Sant Airport. The airport has been designated "rural" and still contains grassed runways for small planes and gliders.

Local citizens and officials feel the "original settlement pattern of this watershed remains remarkably intact". (See Appendix B).

Park & Recreational Opportunities & Sites in the Watershed . . .

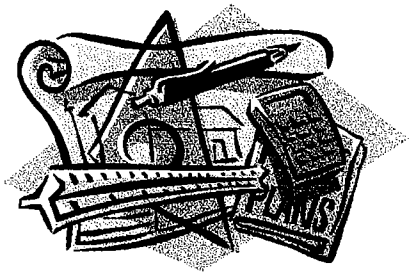
- ✔ Biking
- ✔ Boating
- ✔ Canoeing & Kayaking
- ✔ Covered Bridge Tours & Road Rallies
- ✔ Delaware Canal Park (Regional, County)
- ✔ Fishing & Hunting
- ✔ Hiking
- ✔ Little League Fields
- ✔ Picniking
- ✔ Play Lots
- ✔ Private Campgrounds
- ✔ Public and Private Schools
- ✔ State Gamelands #56 (Regional, State)
- ✔ Tinicum Parks (Regional County)

Recreational Resources ~

There are a number of park and recreational facilities in the Tinicum Creek Watershed. The existing park system provides a variety of passive and active recreational facilities. Throughout the seasons, people visit the watershed to experience the Delaware River, unique geologic features, locally unique flora & fauna, historic villages, historic structures, and covered bridges spanning the Tinicum Creek and its tributaries. The natural resource amenities present in the watershed create the perfect setting for the development of future, and the restoration of existing passive (e.g., nature trails) and active (e.g., sporting facilities) recreational areas.

If local citizens desire additional park areas and public access to the Tinicum Creek, information is certainly available to make intelligent decisions. In fact, Tinicum Township is currently seeking funding to create their first park and recreational plan. In addition, a 96 acre tract was just purchased along the Tinicum Creek by Bucks County for parkland. An additional 160 acres is under negotiation (See Article, Appendix A). A County park linking the Tinicum Creek and the Tohickon Creek has long been a County desire. The Tinicum Conservancy and other private groups currently own and are hoping to purchase additional easements along the Creek corridor. Open Space plans for all three municipalities have included properties along the Tinicum, Rapp and Beaver Creeks. The 1998 Bucks County Open Space Bond will provide some funding for property purchase.

Public meeting comments indicated that all three municipalities recognize the need to create recreational opportunities for their growing populations, and the requirement to do so based on accepted National Park and Recreation Association standards. The information provided in the aforementioned planning and research efforts (e.g., Natural Resource Inventory, USGS water study, Nonpoint Source pollutant loading study, Open space studies) provides a solid basis for choosing certain areas for recreational development and rejecting others. For instance, the decision to enhance an existing park or to locate creek access points or corridor hiking trails is dependent upon surrounding land use, land ownership, or protected habitats and natural features. In short, recreational amenities, both formal and informal, are desired by the municipalities. However, their development should not override the needs of current landowners and should protect existing significant natural, cultural, and aesthetic resources.



Section Five ~

The Tinicum Creek Watershed . . . Conservation Management Plan

Watershed Assessment Findings ~

- ✔ Existing regulations are protective.
- ✔ The creek corridor is scenic & litter-free.
- ✔ The creek corridor is well buffered in places and lacking buffering in others.
- ✔ Community involvement in conservation is strong.
- ✔ Two Superfund sites in watershed.
- ✔ Severe streambank erosion present.
- ✔ Obstructions are present.
- ✔ Stormwater discharge pipes are improperly sized and not treating quality.
- ✔ Development pressure is evident.
- ✔ Roadways maintained and repaired by several different entities.
- ✔ Agency regulations are inconsistently implemented.
- ✔ Partnerships are not formalized.
- ✔ Watershed-wide education lacking.

MANAGEMENT OPTIONS FOR THE TINICUM CREEK WATERSHED

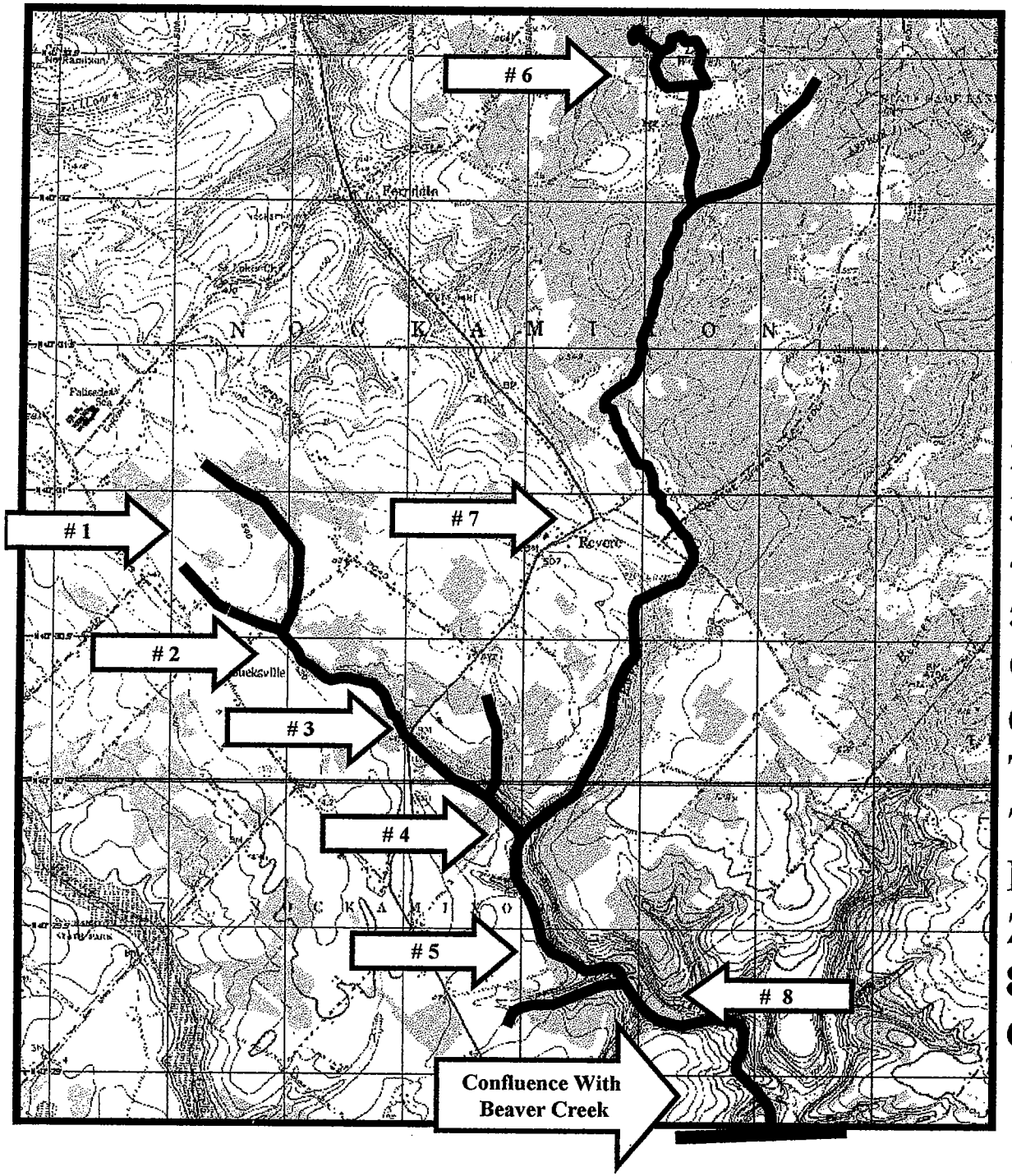
Identification of Areas Requiring Management Attention ~

One of the first *positive* preliminary findings was that citizens living in the Tinicum Creek watershed were very involved in activities involving river conservation and resource protection well before this project began. In fact, municipal officials, private citizens, municipal staff, and municipal advisory board members from all three municipalities donated their time and expertise toward completing questionnaires, returning interview phone calls, identifying problem areas, noting population growth areas, reviewing drafts, and attending meetings. This was a very positive finding, as rivers conservation efforts require partnerships, volunteers, and pro-active involvement.

Before participants and advisory board members were ready to formulate recommended management options, the following tasks were completed:

- ✔ Acquisition of Geographic Information System (GIS) data, coverages and coverage overlay analysis,
- ✔ Municipal planning and zoning research (e.g., plans, zoning, subdivision and land development ordinances, studies, stand alone ordinances, and interviews),
- ✔ Review of pertinent studies (see list of references),
- ✔ Stream corridor and watershed field assessment (windshield, foot, and kayak),
- ✔ Watershed assessment (field check GIS information),
- ✔ Creation of visual & interactive public presentations,
- ✔ Work sessions & public meetings,
- ✔ Preliminary field surveys of recommended restoration projects.

Maps and photos illustrating the location of "problem areas" are included in the following pages. A short section on stream dynamics and stream restoration options is also included. Finally, a comprehensive list of goals and objectives are included in the management plan (pages 70-88). For those interested, a complete

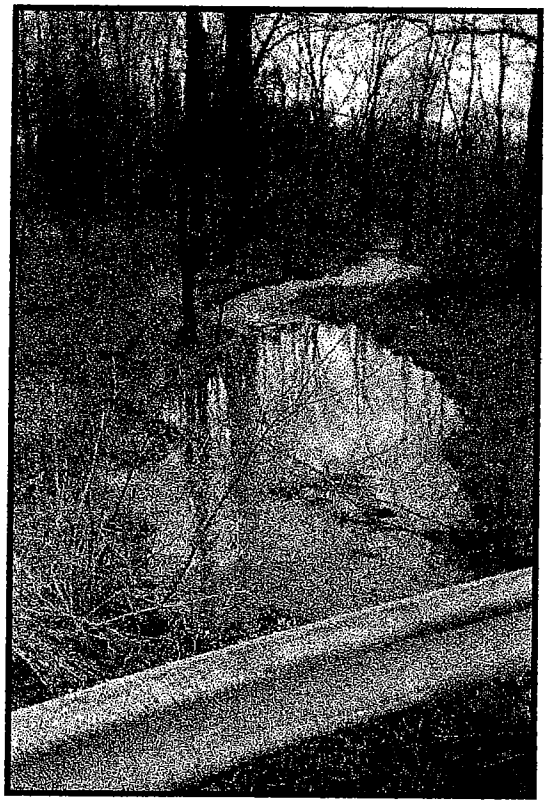


Rapp Creek & Tributaries

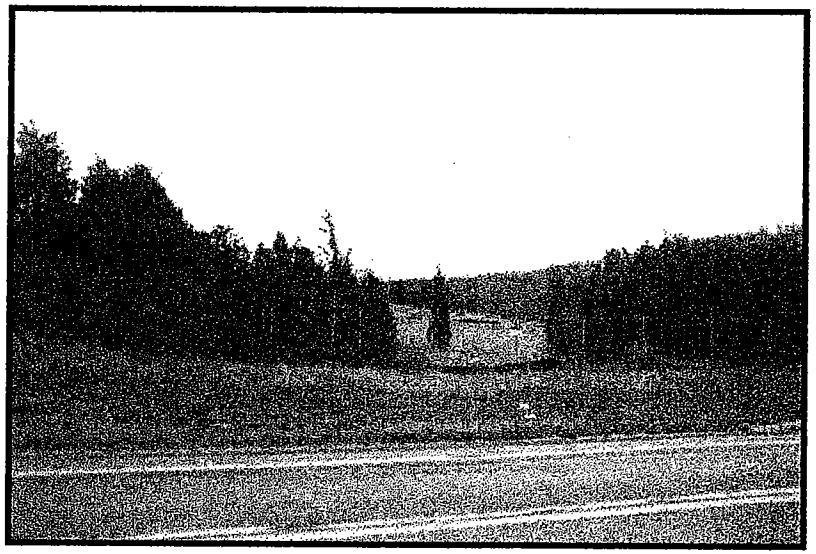
Areas that Need Management Attention (Section I)~

1. **Headwater Zoning Allows For Additional Development**
2. **Agricultural Runoff**
3. **Revere Superfund Site**
4. **Quarry Runoff**
5. **Tabor Road Stream Crossing**
6. **State Gameland Timbering Operations**
7. **Commercial Development Pressure, Some Industrial Zoning**
8. **Gravel Road /Stream Crossing, BunkerHill Road**

Rapp Creek & Tributaries
Areas that Need Management Attention (Section I)~



 # 2 AGRICULTURAL RUNOFF
Park Drive, Nockmixon



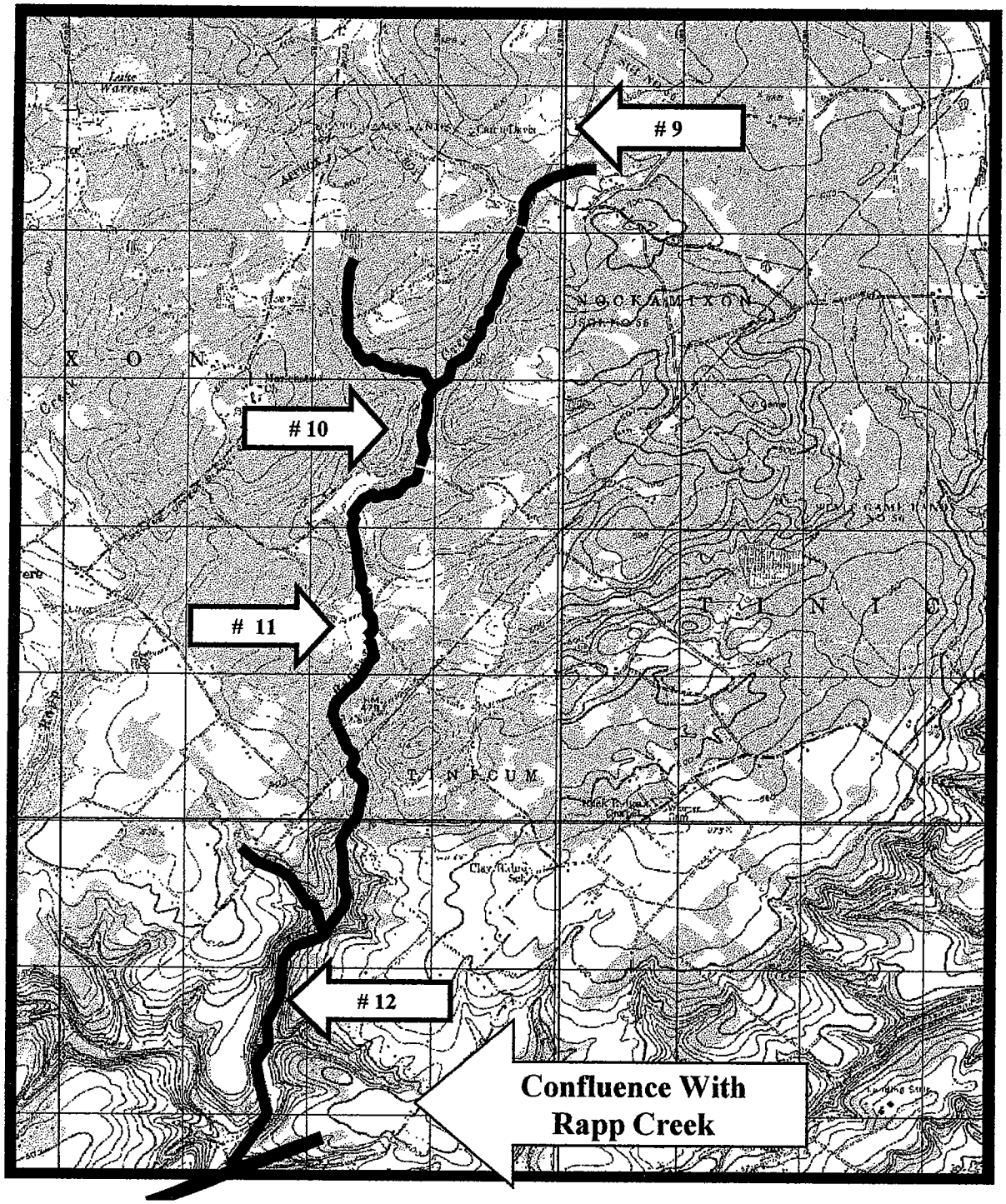
#3 SUPERFUND SITE, REVERE
Route 611, Nockamixon

Rapp Creek & Tributaries
Areas that Need Management Attention (Section I)~

 # 4 QUARRY RUNOFF
Quarry Road, Nockamixon

 # 6 TIMBERING OPERATIONS
State Gameland # 56, Nockamixon

pH



Beaver Creek & Tributaries

Areas That Need Management Attention (Section II)~

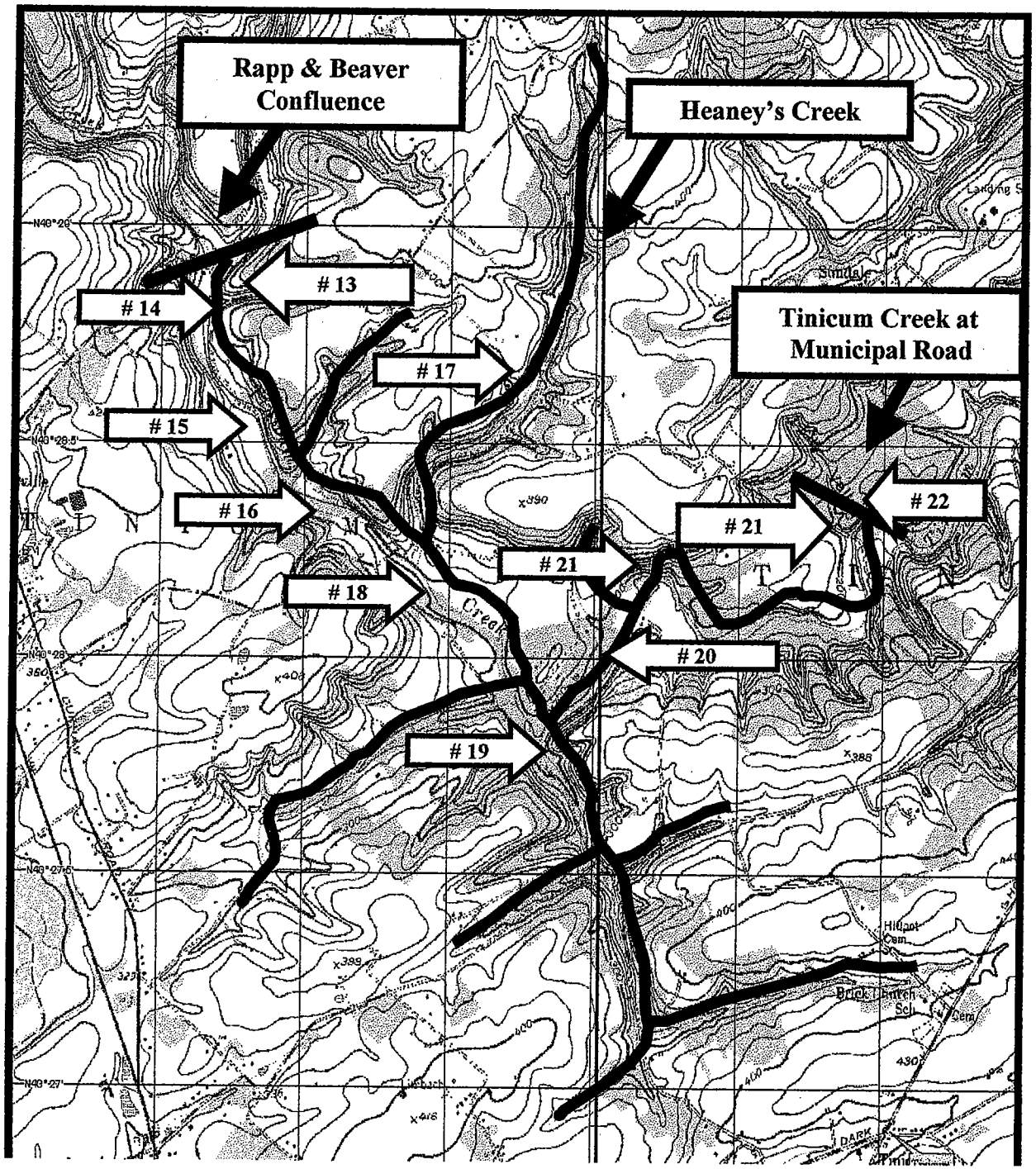
9. EPA Superfund Site, Boarhead Farms, & Two (2) Automobile Junkyards (Adjoining Watershed)

10. Some Residential Development Pressure, Strocks Road

11. Some Residential Development Pressure, Byers Road

12. Gravel Road StreamCrossing/ Bunker Hill

pH



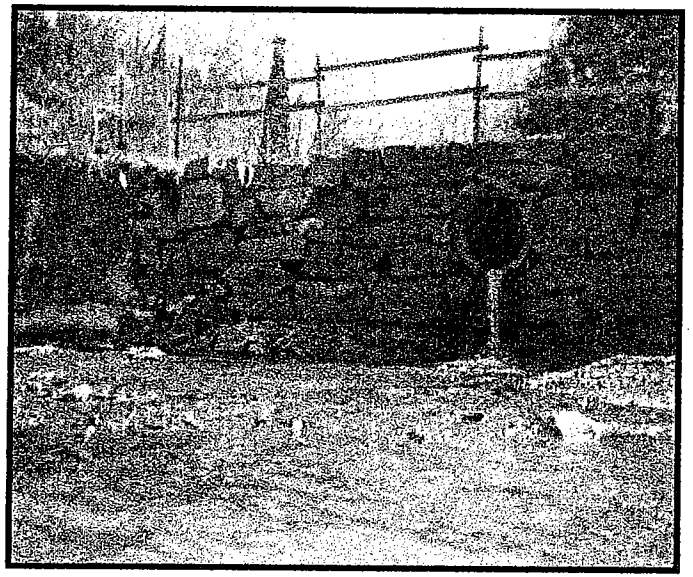
Tinicum Creek & Tributaries

Areas That Need Management Attention (Section III)~

13. Sheephole Road, Stormwater Outflow Pipe
14. Obstruction, Downed Trees, Sheephole Road
15. Eroded Streambank, Sheephole Road
16. Agricultural Runoff & Rock Rip-Rap
17. Eroded Streambank, Ridge Valley & Headquarters Road
18. Under Utilized Stream Gauge, Headquarters Road Bridge
19. Damaged Bridge/Obstruction
20. Eroded Streambank
21. Homes In Floodplain
22. Gravel Road Stream crossing, Municipal Road

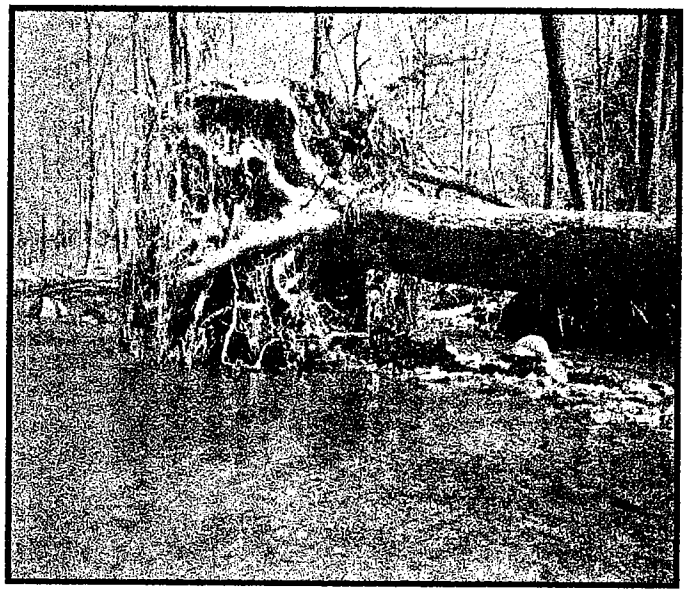
pH

Tinicum Creek & Tributaries
Areas That Need Management Attention (Section III)~

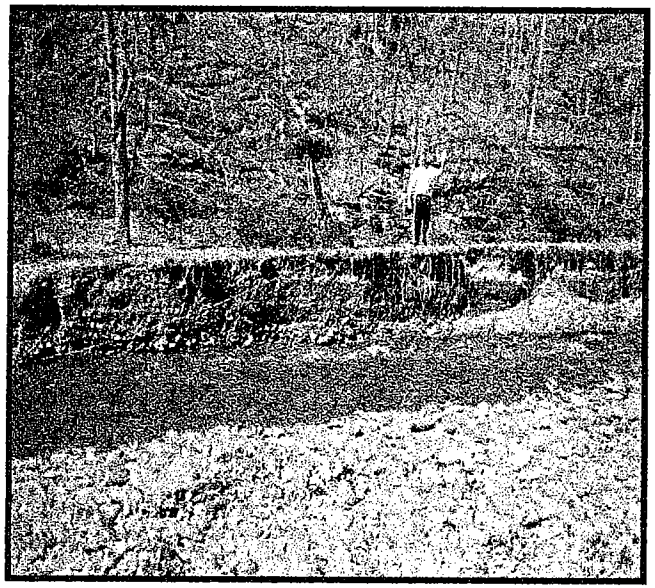


 # 13 STORMWATER OUTFLOW PIPE
Sheephole Road, Tinicum

TREE, OBSTRUCTION # 14
Sheephole Road, Tinicum



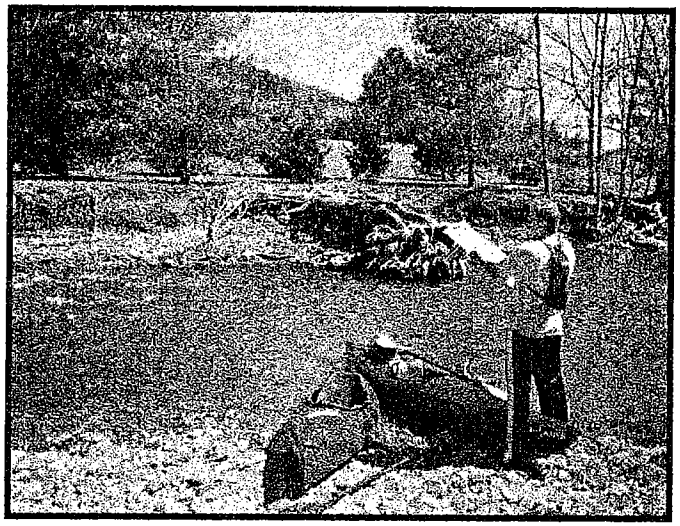
Tinicum Creek & Tributaries
Areas That Need Management Attention (Section III)~



#15 ERODED STREAMBANK
Sheephole Road, Tinicum

ERODED STREAMBANK #17
Headquarters Road, Tinicum

Tinicum Creek & Tributaries
Areas That Need Management Attention (Section III)~



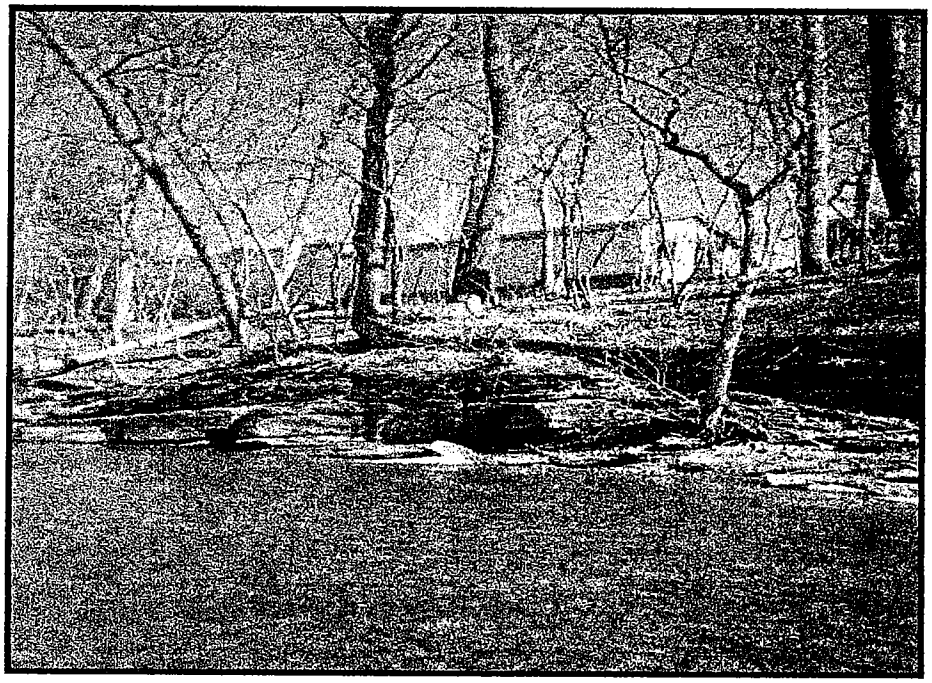
18 ERODED STREAMBANK,
Red Hill Road, Tinicum

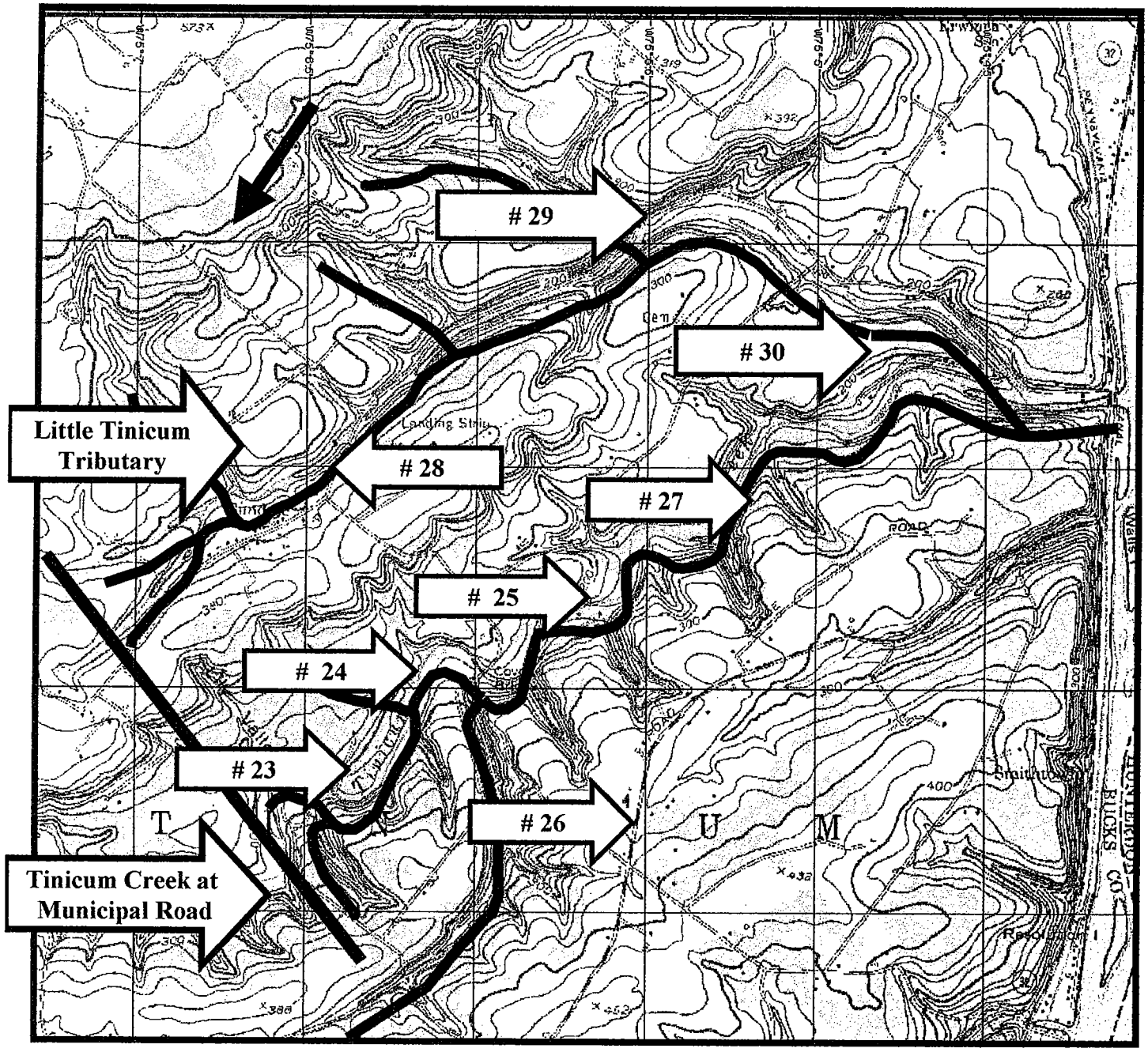
DAMAGED BRIDGE #19
Red Hill Road, Tinicum

pH

Tinicum Creek & Tributaries
Areas That Need Management Attention (Section III)~

HOME IN FLOODPLAIN # 21
Lily Valley Road , Tinicum





Tinicum Creek & Tributaries

Areas That Need Management Attention (Section IV)~

23. Bucks County Park Property (New Purchase)

24. Obstruction, Trees

25. Homes In Floodplain

26 Residential Development Pressure

27. Dams (Two)

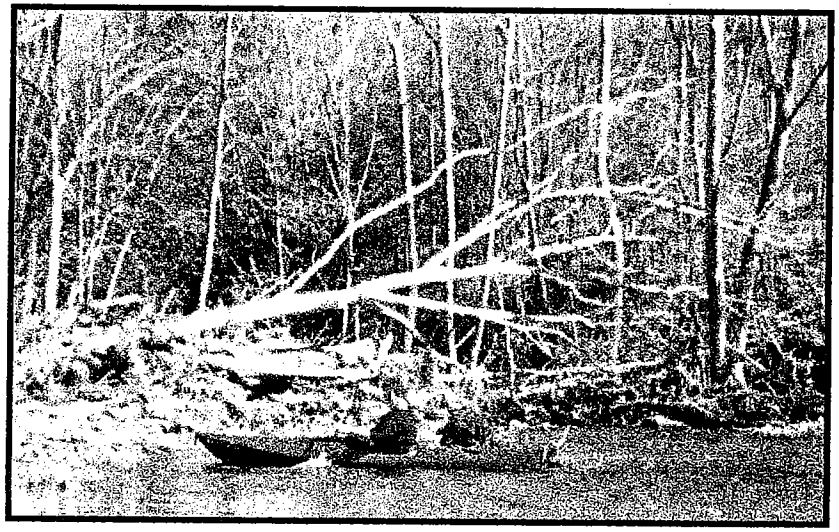
28. Roadway Runoff

29. Residential Development Pressure (Rolling Hills)

30. Stormwater Outflow Pipe

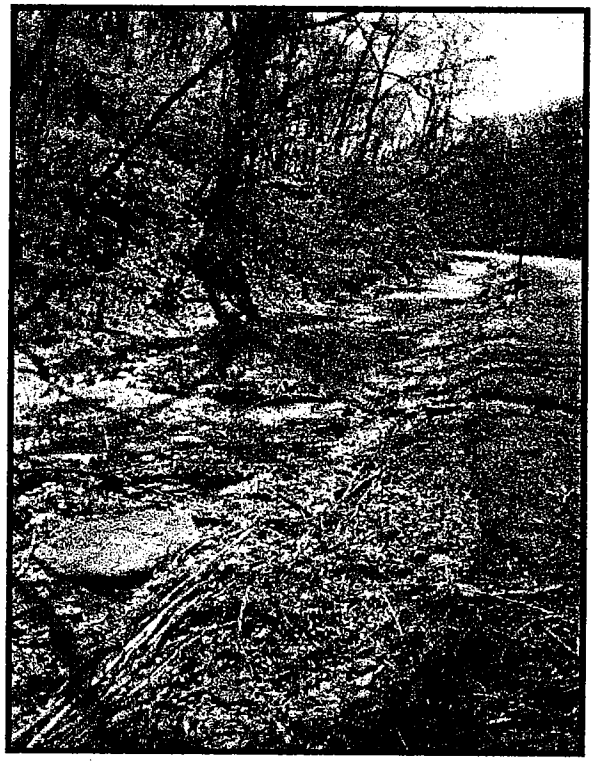
pH

Tinicum Creek & Tributaries
Areas That Need Management Attention (Section IV)~

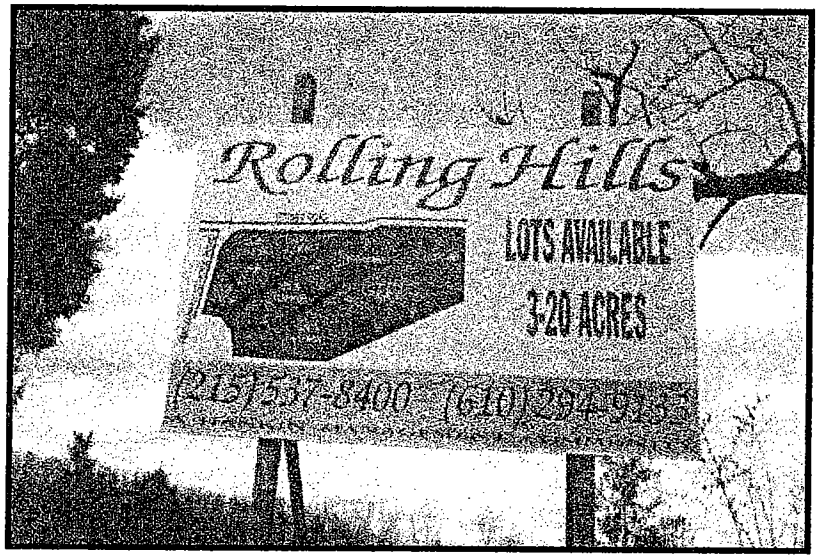


 # 24 OBSTRUCTIONS, TREES
Hollow Horn Road, Tinicum Township

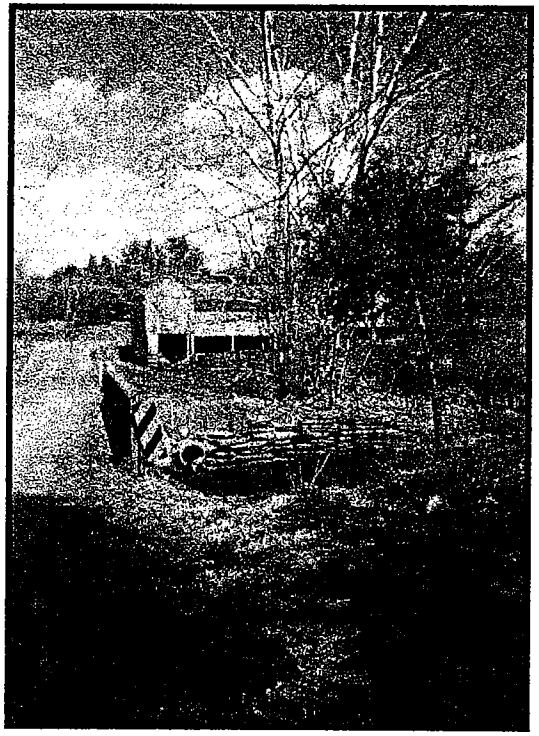
ROADWAY RUNOFF #28
Headquarters Road, Tinicum



Tinicum Creek & Tributaries
Areas That Need Management Attention (Section IV)~



 # 29 RESIDENTIAL DEVELOPMENT PRESSURE
Headquarters Road, Tinicum



STORMWATER DISCHARGE # 30
Hollow Horn Road, Tinicum

Watershed Protection & River Corridor Protection; A Multi-Disciplinary Regional Approach ~

Despite the array of positive findings in the Tinicum Creek Watershed, the plan advisory committee recognizes that conservation, management and restoration efforts are required to meet the five major goals included in the management plan. The plan advisory members and the watershed partners also recognize that implementing the management plan will require a multi-disciplinary effort involving the environmental science, political science, legal, planning, engineering, and education professions. More important, the watershed conservation effort will require the continuation of the hard work and perseverance already evident in this watershed. The partners also recognizes that continued success will require a stronger, regional partnership between regional environmental agencies, local government, municipal boards, and private organizations.

Stream Dynamics ~

Those involved in the planning effort understand that the Tinicum Creek and its tributaries are influenced by both natural and man-made dynamics. Although other portions of Bucks County have experienced much more development activity, those living in the area and attending public meetings have noticed a steady increase in residential and commercial development pressure. For instance, in the last ten to fifteen years, development in the Geigel Hill area of the watershed has resulted in increases in impervious surfaces (e.g., parking lots, homes, driveways and rooftops). Additional development is taking place or is currently proposed in other areas throughout the watershed.

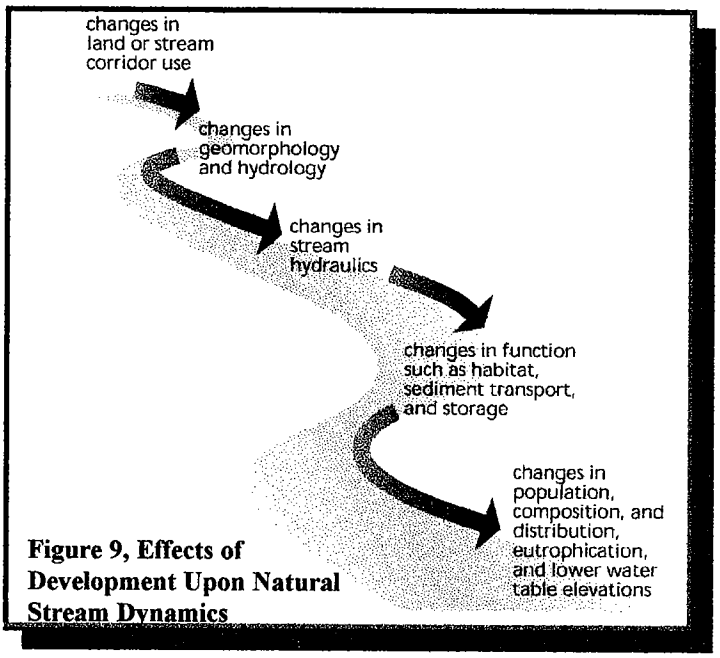


Figure 9, Effects of Development Upon Natural Stream Dynamics

Why are development trends important? Replacing open fields and wooded areas with impervious surfaces leads to decreased base flow, increased volumes of stormwater runoff, and increased peak flow and peak flow velocities. Due to development, (Route 611 corridor, and Sheephole, Headquarters, Red Hill Roads) impacts to the Tinicum Creek and its tributaries are evident and have included: scouring of stream beds and streambanks, increased sedimentation,

damage or loss of in-stream habitat, damage or loss of riparian habitat, increased turbidity, increased water temperature, and increased pollutant and nutrient loading.

Those living in the watershed have also noticed a correlation between development and road improvements implemented by the Pennsylvania Department of Transportation (PennDOT). PennDOT projects intended to accommodate increasing traffic have negatively impacted the Tinicum Creek. One example, of a project in conflict with recommendations included in this watershed management plan, is the replacement of vegetated ditches with impervious pavement along Geigel Hill Road. Again, the replacement of pervious soil and vegetation, with impervious surfaces results in negative impacts to the water resources in the Tinicum Creek Watershed.

To address the man-made problems identified in the corridor and watershed assessment, the project team created a list of general goals which are summarized in the following list:

- ✔ **Understand the hydrology of the watershed.**
- ✔ **Correct the causes of creek degradation rather than the symptoms.**
- ✔ **Use nature as the model to restore and maintain the creek corridor.**
- ✔ **Require Best Management Practices (BMPs) to promote recharge and minimize hydraulic variability.**
- ✔ **Integrate cultural, hydrologic, and mechanical restoration techniques in the Tinicum Creek Watershed, Rivers Conservation Management Plan**

Stream Restoration ~

Although a good portion of the creek corridor is still intact, some areas may need management attention. A natural stream corridor (Figure 8) is stable, dissipates energy, contains multiple habitats, is highly functional, and very resilient. In addition a transitional edge or buffer area is present throughout the corridor, however an adequate transitional buffer (Figures 9 –10) throughout the watershed is our ambition.

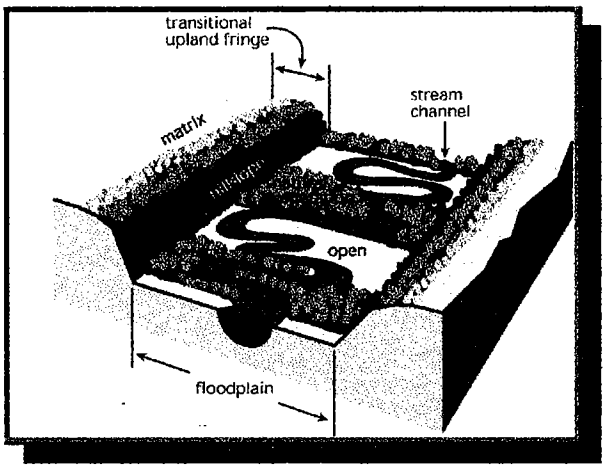


Figure 10~ Cross Section of a Natural Stream Corridor.

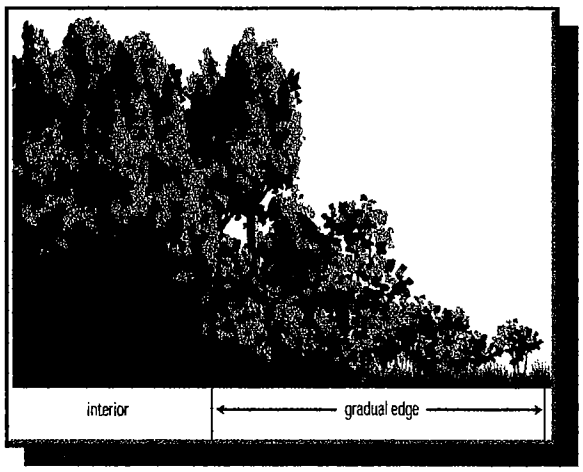


Figure 11 ~ The Transitional Edge Filters Pollution, Minimizes Erosive Energy, Stabilizes the Streambank, and Provides Habitat.

Some Conclusions ~

Recognizing the natural and man-made dynamics experienced in our watershed is a very important task. The local advisory committee also acknowledges that implementing protective ordinances, planning practices, individual projects, and cultivating an environmentally protective mind-set will require a long-term, multi-disciplinary approach. The Committee recognizes that the Pennsylvania Municipalities Planning Code (PA MPC), private property rights, environmental laws, and socio-political dynamics require approaches that balance opportunities for development as well as resource protection.

For example, maintaining the Exceptional Value (EV) waterway classification of the Tinicum Creek was the goal most frequently identified during the RCP planning process. Successful implementation may require amendments to existing zoning and subdivision ordinances that are acceptable to the three municipalities and their solicitors. Ordinance revisions should also provide local officials, developers, private landowners, engineers, biologists, and planners with a variety of alternatives that enable development while protecting significant natural and cultural resources.

Successfully implementing the recommendations included in the management plan will also require a comprehensive public education program and an educated citizenry. In conclusion, the Committee recognizes that time, effort, and money will be required to implement the Tinicum Creek Watershed, Rivers Conservation Plan. Implementation will be a long-term effort.

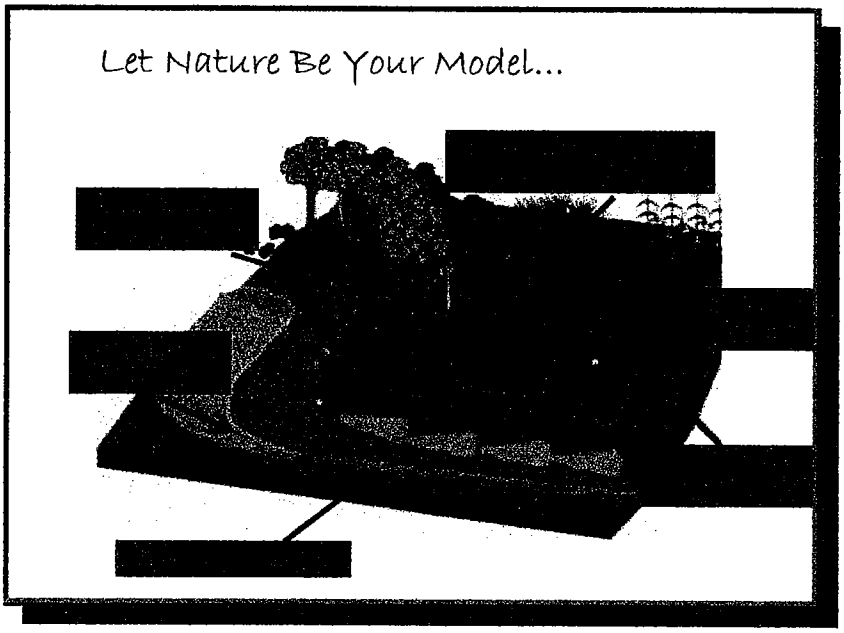


Figure 11, Using Nature As the Model to Restore and Maintain the Creek Corridor

Goals for the Tinicum Creek Watershed

The following goals were formulated by the local advisory committee and supported by public review comment.

Goal One ~ Water Quality & Water Quantity

Maintain existing water quality and water quantity in the Tinicum Creek and its tributaries.

Goal Two~ River Corridor and Riparian Buffer Preservation

Preserve and protect the river corridor and create and maintain an adequate vegetated riparian buffer throughout the Tinicum Creek watershed.

Goal Three ~ Significant Natural & Cultural Features

Preserve and manage outstanding natural, cultural, historical, and recreational resources in the Tinicum Creek corridor and surrounding watershed.

Goal Four ~ Watershed Education

Create and maintain an informed and pro-active citizenry throughout the Tinicum Creek Watershed.

Goal Five ~ Capital Improvement

Provide reliable public and private funding to preserve, restore, and manage the Tinicum Creek watershed and to obtain critical lands.

Water Quality & Water Quantity; A List of BMPs ~

- ✔ Bioretention
- ✔ Buffer Ordinance
- ✔ Conservation Plans
- ✔ Constructed Treatment Wetland
- ✔ Critical Area Planting
- ✔ Diversion
- ✔ Energy Dissipator
- ✔ Filter Bag
- ✔ Filter Strip
- ✔ Grass Swale
- ✔ Infiltration Trench & Dry Well
- ✔ Inlet Protection
- ✔ Interim Stabilization
- ✔ Lined Channel
- ✔ Outlet Stabilization Structure
- ✔ Permanent Vegetative Stabilization
- ✔ Permeable Paving System
- ✔ Ponds, Wet & Dry
- ✔ Portable Sediment Tank
- ✔ Protective Ordinances
- ✔ Stabilized Construction

Goal One ~ Water Quality & Water Quantity

Maintain existing water quality & water quantity in the Tinicum Creek and its' tributaries.

Ground Water & Surface Water Policies:

Recognizing the hydro-geologic relationship between surface and groundwater resources in the Tinicum Creek watershed, the following quality and quantity policies for all water resources are recommended for Bridgeton, Nockamixon, and Tinicum Townships officials and their public and private watershed partners:

- ✔ Maintain Exceptional Value (EV) surface water quality designation.
- ✔ Control existing and future point source and nonpoint source runoff.
- ✔ Require a combination of Best Management Practices (BMPs) that increase recharge and decrease pollutants in all proposed developments and projects throughout the watershed.
- ✔ Preserve, create, and maintain open space and riparian buffer zones throughout the watershed.
- ✔ Prohibit excessive earth disturbance and the creation of excessive impervious surfaces for all proposed developments in the watershed.
- ✔ Discourage development within steep slope, erosive, and aquatic buffer areas.

Implementation Techniques:

In order to achieve the previously stated policies, the following activities should take place:

- ✔ ***Develop a long-term surface and aquifer monitoring and conservation program.***
  - Perform follow up studies to USGS aquifer testing efforts.
  - Complete and apply EPA-funded wetland recharge studies.
  - Develop groundwater prediction models.
  - Design & implement water ordinances based on

Water Quality & Water Quantity, A List of BMPs (Continued) ~

✔ Streambank Stabilization
✔ Riparian Corridor Management
✔ Riparian Forested Buffer
✔ Rooftop Runoff Management
✔ Sand Filters, Closed & Opened
✔ Sediment Basin
✔ Sediment Trap
✔ Silt Curtain
✔ Silt Fence
✔ Slope Drain
✔ Stormwater Ordinance
✔ Temporary Stream Crossing
✔ Tree Preservation & Protection
✔ Trench Plug
✔ Water quality inlet
✔ Water resource protection ordinances
✔ Watershed-wide education

findings.

- Coordinate water ordinance review & implementation throughout the watershed.
- Implement appropriate recharge (e.g., created wetlands) and treatment (e.g., sand filters) BMPs in headwater and recharge areas.

✔ ***Improve system of placement, design, and maintenance of on-lot disposal systems (OLDS) in areas that are suitable and continue to prohibit OLDS in areas that are unsuitable.***

- Update municipal sewage facilities (Act 537) plans.
- Implement OLDS maintenance program.
- Require groundwater & surface water pollutant loading projections for systems in proposed developments.
- Allow alternative systems with proven treatment record.

✔ ***Implement stormwater ordinances and nonpoint source pollution reduction projects to reduce pollution loadings to the Tinicum Creek and its tributaries.***

- Adopt & implement management recommendations included in the Delaware River (North) Watershed Stormwater Management Plan (Act 167) & the PA Best Management Practice Handbook.
- Implement recommended model ordinance from the Act 167 plan or more stringent quantity and quality regulations.
- Require stormwater volume discharge & pollutant loading projections for systems in proposed developments.
- Redesign stormwater outflow pipes on the Tinicum Creek (e.g., Quarry Road, Sheephole Road, Hollow Horn Road) to ensure maximum quantity and quality protection.
- Consider best management practices (BMPs) designed to address creek crossings that are unpaved or without bridge crossings.

Stream Biological Restoration Techniques~

✔ Wattles
✔ Live Cuttings
✔ Bio-logs/coir fibre logs
✔ Jute Matting
✔ Brush Piles
✔ Brush & rock anchors

Stream Restoration

Works . . .

(Before)
(After)

- Direct the agricultural community to agencies (USDA/NRCS, Fish & Wildlife) providing cost-share programs to reduce agricultural runoff and to increase habitat.
- Seek interagency and inter-municipal resolutions that initiate watershed protection goals and plan review coordination.
- Continue municipal involvement and representation with the Bridgeton-Nockamixon-Tinicum Groundwater Management Committee.
- Obtain Pennsylvania Game Commission (Game land #56) land management plan and initiate project review involvement in timbering and other land management efforts.
- Seek more project review coordination with the Department of Transportation for infra-structural improvement and implementation of BMPs designed specifically for road maintenance projects in significant watersheds.
- Recommend that the agricultural community implement BMPs with help from USDA/NRCS and fish and wildlife funding programs.
- Redesign/retrofit existing stormwater facilities for maximum recharge *and* water quality treatment.
- Stabilize eroded streambank areas using traditional engineering and bio-engineering approaches.

✔ ***Implement nonpoint source pollution and groundwater recharge education program to increase understanding of water quality and water quantity protection issues.***

- The Groundwater Committee should advertise scientific study (e.g., hydrogeology, wetlands recharge) findings to Township officials, local citizens, and environmental organizations.
- The Tinicum Creek Watershed Association should implement a technical assistance program for private landowners in order to decrease nonpoint source pollution runoff and increase

Restoring Impacted Stream Corridors ~

Cultural Restoration. . .

Ordinances that restrict development, stormwater, or disturbance of stream channel, floodplain, riparian corridor

Hydrologic Restoration . . .

Minimize changes in stream hydrology or hydraulics (e.g. changes in base flow, storm surges, and wetted channel).

Mechanical Restoration . . .

Mitigation of stream impacts by means of bio-restoration techniques or traditional

water recharge in the watershed.

- Local landowners should be informed that discharging gray water or chlorinated pool water to the creek and creek tributaries will negatively effect water quality.

- Refer to goal three educational recommendations for additional educational recommendations.

Goal Two~ River Corridor and Riparian Buffer Preservation

Preserve and protect the river corridor and floodplain, and create and maintain an adequate vegetated riparian buffer throughout the Tinicum Creek watershed.

River Corridor and Riparian Buffer Policies:

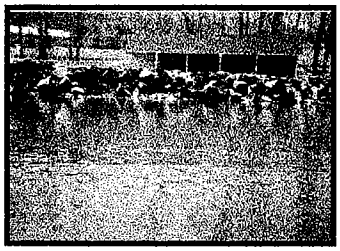
Floodplains are complex, dynamic systems with a variety of valuable functions. We have learned through trial and error that it is important to preserve floodplains and riparian buffers to accomplish the following: absorbtion and retention of flood waters, water quality improvement, protection of natural habitat, and the provision of recreational opportunities. The following riparian buffer policies and objectives are therefore recommended for Bridgeton, Nockamixon, and Tinicum Townships, private landowners, and environmental organizations in the Tinicum Creek watershed:

✔ ***In addition to the protection and enforcement of floodplain regulations; promote the protection, restoration, and maintenance of an adequate vegetated buffer area along the Tinicum Creek and its tributaries.***

✔ ***Encourage property owners to protect the river corridor and floodplain and to utilize land in ways that protect them.***

Implementation Techniques:

In order to achieve the previously stated policies, the following activities should take place:



✔ ***Continue to enforce floodplain (floodway & floodfringe) ordinance regulations and projects designed to reduce flood damage.***

- Update floodplain ordinances to protect property, life, and habitat.
- Require that development proposals identify floodway and floodfringe areas, and that they are field checked and delineated by a qualified expert.
- Consider implementing an additional setback of fifty feet from the identified edge of the floodway district for accessory structures and prohibiting utilities and other public facilities from floodway areas.
- Require increased buffer areas for all development proposals in proximity to the Tinicum Creek and Creek tributaries.
- Work with private landowners to remove obstructions presently identified in the stream corridor assessment (damaged bridges, over turned trees) and in the future.
- Coordinate with County and State to ensure sediments and other materials are removed from areas under their juristiction.

Areas In Our Watershed Requiring Streambank Restoration and Vegetated Buffers

✔ ***Restore and maintain vegetated buffer along the Tinicum Creek and its tributaries.***

- Complete an inventory identifying the width, vegetational make-up, and ownership of fifty foot buffer area along the Tinicum Creek and its tributaries.
- Implement a volunteer program to restore and maintain a fifty foot buffer area.
- Implement a program to identify and remove invasive species from the riparian corridor and surrounding watershed.
- Consider creating buffers or implementing appropriate BMPs on those tributaries lacking buffer areas and flowing in proximity to roadways (e.g., Headquarters, Ridge Valley, Red Hill, and Hollow Horn Roads)
- Work with Bucks County Department of Parks and Recreation to maintain buffer areas on newly purchased and existing recreational areas, and to place appropriate

Natural & Cultural Resource Protection Options ~
- ✔ Agricultural security areas
- ✔ Cultural & historic plan
- ✔ Conservation easements
- ✔ Critical recharge district
- ✔ Development districts
- ✔ Down zoning
- ✔ Environmental advisory councils (EACs)
- ✔ Environmental performance standards
- ✔ Environmental overlay zoning
- ✔ Floodplain management districts
- ✔ GIS mapping capabilities
- ✔ Historic commissions
- ✔ Historic districts
- ✔ Historic preservation overlay zoning
- ✔ Impact assessment
- ✔ Land banking
- ✔ Landscaping requirements

restrictions (e.g., conservation easements) upon acquired lands.

✔ ***Implement riparian buffer education program.***

- Implement a landowner education program providing technical and financial support, while addressing the importance of floodplains and a well-buffered creek corridor.

Goal Three ~ Significant Natural & Cultural Features

Preserve and manage outstanding natural, cultural, historical, and recreational resources in the Tinicum Creek corridor and surrounding watershed.

Natural & Cultural Preservation Policies:

The protection of woodlands, soils, steep slopes, geologic features, habitat, individual species, headwater areas, floodplains, and wetlands in the creek corridor and throughout the watershed is essential to maintain the ecological balance of the Tinicum Creek. Natural resource protection is required to protect surface and groundwater resources (see goal one). Protecting natural, scenic, and cultural resources creates an opportunity for people to commune with nature and an opportunity to learn more about our culture and traditions.

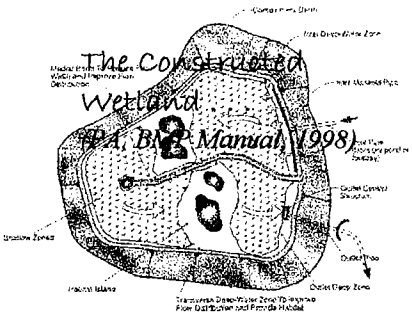
The following policy is recommended for Bridgeton, Nockamixon, and Tinicum Townships, and the environmental organizations presently involved in the Tinicum Creek watershed:

✔ ***Preserve, and maintain significant natural, scenic, cultural and historic resources in the Tinicum Creek Watershed***

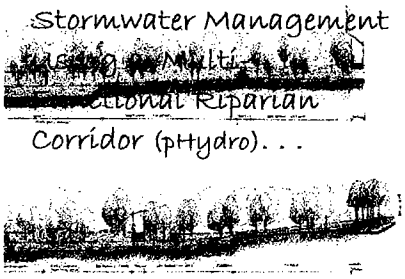
Natural and Cultural Resource Implementation Techniques:

✔ ***Update plans (comprehensive plans, functional plans), complete studies, and develop supporting ordinances that***

protect natural, cultural and historic resources in the Tinicum Creek Watershed.

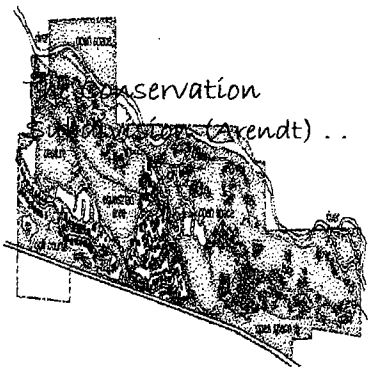


- Complete open space plans and gain approval from the Bucks County Open Space Board to obtain funding for open space acquisition.
- Develop or update historic preservation plans prescribing detailed protection strategy for historic areas.
- Take action to place historic structures and villages on National and State Historic Registers.
- Complete or update natural resource plans, and adopt ordinances and other measures (see box at left) protecting natural and cultural resources throughout the Tinicum Creek watershed.
- Identify all corridor areas with non-native, invasive plant species (e.g., Japanese Knotweed, mile-a-minute plant) and implement program for their removal.
- Obtain public and private funding to purchase land, easements, and development rights identified in rivers conservation, open space, natural resource, and cultural/historic preservation plans.



✔ ***Require Best Management Practices (BMPs) for all proposed developments in the Tinicum Creek Corridor and surrounding watershed.***

- Provide the PA Handbook of Best Management Practices to the municipal engineer, planning commission, environmental advisory Council, and others involved with reviewing development proposals.
- See list of BMPs on pages 71 to 72.



✔ ***Improve coordination with state and local agencies to prevent deterioration of natural and cultural resources in the watershed and to foster implementation of BMPs.***

- Seek interagency resolutions that initiate natural and cultural protection plans.
- Require the Pennsylvania Department of Transportation,

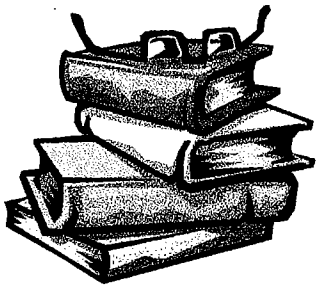
Education will help limit the negative impacts to the Tinicum Creek Watershed . . .

to implement BMP design standards to reduce nonpoint source pollution in this significant watershed.

- Seek more coordination with the Pennsylvania Department of Environmental Protection, Pennsylvania Department of Conservation & Natural Resources, PA Department of Historic and Cultural Resources, Bucks Conservation District and other agencies on development projects effecting natural and cultural resources.

✔ ***Increase understanding of natural and cultural resources in watershed***

- Priority resource area maps should be made available for all entities involved with development design reviews in each municipality. Maps should identify significant resources (e.g., wetlands, slopes soils, woodlands, farmland, greenways, historic features, groundwater recharge areas, endangered and threatened species)
- Refer also to educational recommendations listed in the following section.



Goal Four ~ Watershed Education

Create and maintain an informed and pro-active citizenry throughout the Tinicum Creek Watershed.

Watershed Education Policies:

We live in a complex, dynamic society. Individuals are surrounded by competing and conflicting views regarding the importance of protecting natural resources. However, more and more people realize that there is a need to balance the rate of development with the need for economic development. Although there are differing views regarding the extent to which the environment needs protection, the majority agree that we must limit negative environmental impacts.

In order to provide a better understanding about how individual actions and collective policy decisions impact the Tinicum Creek watershed, the following educational policy is recommended:

✔ ***Provide objective information to adults and children to***

Volunteer monitoring is one way to get adults involved in learning about watershed protection . . .

Reliable funding is required to implement the Tinicum Creek Watershed Management Plan . . .

cultivate and improve leadership, stewardship, and environmental decision-making throughout the watershed.

Watershed Education Implementation Techniques:

✔ ***Work with curriculum coordinators, teachers, and administrators in the Palisades School District and private school systems to incorporate watershed studies into the existing curriculum.***

- Obtain grant funding to incorporate information from this plan into existing science and social science curriculum.
- Develop a watershed tour and field work experiences for school-aged children in the Tinicum Creek watershed.
- Provide Power-Point presentations developed for this project to local schools for use in the classroom.
- Develop brochures for students regarding the importance of the Tinicum Creek Watershed and the natural and cultural processes effecting our water resources.
- Provide annual guided canoe/kayak trips for local schools.

✔ ***Work with adults to improve stewardship, throughout the watershed.***

- Obtain funding to develop a water quality and water quantity monitoring program to obtain long-term data base and to educate local citizens.
- Develop day-long seminar involving watershed tour, kayak/canoe trip, and written information about implementing residential BMPs.
- Include creek-related conservation story in each municipal newsletter released in the three municipalities.

- Develop brochure intended for landowners and focusing upon watershed conservation.
- See watershed education program section on page 73.

Funding Options ~

✔ Bucks County Open Space and Community Development Programs

✔ EPA, Nonpoint Source (319) Pollution and Environmental Education Grant Programs

✔ PADEP, 319, WRAP, Growing Greener, Environmental Education, Stormwater, Investment Loan, and Community and Economic Development Programs

✔ PADCNR, Keystone Rivers, Park, and Aquisition Programs

✔ PEC, Delaware River Estuary Grant Program

✔ William Penn & Dodge Foundation Programs

- See riparian corridor technical program recommendations on page 84.

Goal Five ~ Capital Improvement

Provide reliable public and private funding program to preserve, restore, and manage the Tinicum Creek watershed.

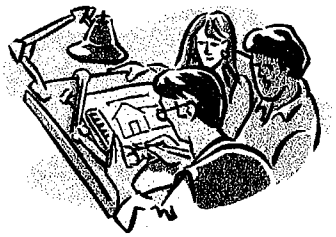
Capital Improvement Policy:

The recommendations and projects included in our management plan require funding and perhaps a Capital Improvements Program (CIP). A CIP is a multi-year schedule of publicly funded improvements. In this case, the improvements relate to the conservation, restoration, and management projects suggested throughout the Tinicum Creek Watershed, Rivers Conservation Plan (e.g., open space purchase, streambank restoration, watershed curriculum, revised functional plans and zoning ordinances, stormwater facility re-design, and buffer restoration program). Each recommended program has an associated labor and materials cost.

One option is grant funding from those programs listed on the left, but busy municipal officials, staff, volunteer committee members, and private environmental groups often overlook or do not have time to pursue grant opportunities.

Another option is to request funding or grant match funding through the annual municipal budget process. However, citizens and groups interested in implementing conservation and restoration management plans are not always the same group of people involved in developing and negotiating the annual municipal budget.

In order to ensure that the revenue required to implement our management plan is not less than what is needed, sporadic, or



non-existent, the following policy is recommended for Bridgeton, Nockamixon, and Tinicum Townships, and the citizens and environmental organizations presently involved in this watershed:

✔ ***Apply for and obtain funding for watershed projects from a variety of sources and on a continuous basis.***

Capital Improvement Plan Implementation Techniques:

✔ ***Obtain funding through public & private grant programs intended for environmental projects.***

- Create a list of prioritized projects, associated costs, and a time line for completing each project.
- Assign the responsibility of tracking grants to the municipal Environmental Advisory Committee or other appropriate body (e.g., Open Space, Park and Recreation, other).
- Obtain information and create a file for public and private grant opportunities, and grant application criteria.
- Apply for grants during the appropriate grant cycle.
- Participate in the annual municipal budget process to obtain additional funding for RCP projects.

Implementing the Tinicum Creek Watershed, Rivers Conservation Plan is a long-term project requiring coordination and an organized partnership.

In conclusion, the Advisory Committee and Planning team recognize that implementing the Tinicum Creek Watershed, Rivers Conservation Plan is a long-term project requiring coordination and an organized partnership. A special group of committed individuals and partners have already contributed a number of hours to complete this plan. The group feels that individuals are successful when they set goals and follow plans to achieve them, and that the same is true for successful communities.

It is better to prepare for growth and change, than to be forced to make quick decisions without the appropriate planning tools. The Tinicum Creek Watershed, Rivers Conservation Plan is one such planning tool.

Section 1302. The property is Tax Parcel 44-6-51 and is located at 315 Geigel Hill Road, Upper Black Eddy, PA. Hearing scheduled for Monday, August 21, 2000 at 7:00 p.m.

#8-2000 Property Owner K. Kyle Dury requests a Variance from the Tinicum Township Zoning Ordinance, Article VIII, Section 806 Subsection (d) 6 which prohibits stream discharge and spray irrigation sewage systems in the Critical Recharge Overlay Area and requests a variance from Subsection (e) 6 which prohibits stream discharge and spray irrigation systems in the Tinicum Creek Watershed Overlay District. Variance is requested to permit a spray irrigation system on Tax Parcel 44-15-1-2 located on Rope Walk Road and Center Road. Hearing continuance scheduled for Wednesday, September 27, 2000 at 7:00 p.m

10) MISCELLANEOUS:

Contract for Public Planning and Management Inc.:

Tinicum Township Police Pension Plan for the Year 2001:

Motion by , seconded by , to confirm the estimation of the MMO for the Tinicum Township Police of $20,571 for the year 2000.

Tinicum Township Non-Union employees Pension Plan for 2001:

Motion by , seconded by , to confirm the estimation of the MMO for the Tinicum Township Defined contribution of $16,537 for the year 2001.

11) ADJOURNMENT:

Motion by , seconded by , to adjourn the meeting at p.m. The next Meeting of the Supervisors is scheduled for Tuesday, October 3, 2000 at 7:45 p.m.

RESOLUTION NO. 2000-_____

_____
(Name of Borough or Township)

SUPPORTING THE_____ AND LISTING
(Name of Rivers Conservation Plan)

THE FOLLOWING _____
(rivers, river segments or tributaries included in the Watershed/corridor study) (in a Watershed Study, Tributaries included {named or unnamed} should be listed North to South on East side of river and North to South on West side of river).

ON THE PENNSYLVANIA RIVERS CONSERVATION REGISTRY.

WHEREAS, the _____
(Name of Borough Council or Township Supervisors)

recognizes the importance of conserving the _____
(Name of river corridor or watershed)

to foster the quality of life in _____, and
(Name of Borough or Township)

WHEREAS, the Commonwealth of Pennsylvania, Department of Conservation and Natural Resources, Division of Conservation Partnerships (PA DCNR), has established a "Pennsylvania Rivers Conservation Registry"; and

WHEREAS, _____ has
(Name of Grantee or Developer of Plan)

completed a _____ for
(Name of River Conservation Plan)

_____, which contains a number
(Name of river corridor or watershed)

of conservation recommendations suitable for implementation development or acquisition in _____
(Name of Borough or Township)

and throughout the entire _____, and
(Name of river study corridor or watershed)

WHEREAS, the _____ has been
(River Conservation Plan Title)

reviewed and found acceptable by the _____,
(Name of Borough Council or Township Supervisors)

and

WHEREAS, the _____ does
(Name of Borough or Township)

endorse the _____, and
(Name of River Conservation Plan)

will endeavor to take appropriate action to implement its recommendations.

NOW, THEREFORE, the _____ of
(Borough Council or Township Supervisors)

_____ approves the listing
(Name of Borough or Township)

of rivers, river segments or tributaries listed above within its boundaries on the Pennsylvania Rivers Conservation Registry.

RESOLVED THIS _____th DAY OF _____, 2000.
(day #) (month)

TOWNSHIP SUPERVISORS/BOROUGH COUNCIL

_____
Chairperson, Township Supervisor / Borough Council

_____
Supervisor / Council Person

_____
Supervisor / Council Person

_____
Supervisor / Council Person

_____
Supervisor / Council Person

Pennsylvania Department of Conservation and Natural Resources
Rachel Carson State Office Building
P.O. Box 8475
Harrisburg, PA 17105-8475
July 27, 2000

Bureau of Recreation and Conservation

(717) 783-2712

Ms. Linda Wieand
Tinicum Township
163 Municipal Road
Pipersville, PA 18942

RE: Tinicum Township (Bucks)
Tinicum Creek Watershed Conservation Plan
KEY-RCP-95-03

Dear Ms. Wieand:

I have reviewed the draft Tinicum Creek Watershed Rivers Conservation Plan submitted by Princeton Hydro, LLC to us on July 5, 2000. It is my pleasure to inform you that this current plan meets the requirements for listing on the Pennsylvania Rivers Registry. I want to commend Tinicum, Nockamixon and Bridgeton Townships and Princeton Hydro, LLC for the excellent work that you have done on the plan thus far.

The Plan still needs to finalized and the Township needs to petition the Department of Conservation and Natural Resources for listing on Pennsylvania Rivers Conservation Registry before the project is considered complete. While the overall plan meets the basic program requirements, I have some comments on items that should be addressed.

- Page 10 - last sentence - You need to indicate that Tinicum Creek was nominated as a 1-A priority stream in the Pennsylvania Scenic Rivers Inventory on January 11, 1990. Scenic Rivers Program functions are the responsibility of the Department of Conservation and Natural Resources, **not** the Department of Environmental Protection.

- Page 48 - last sentence, first paragraph - Biological Resources - Should the word aspect be pluralized as aspects?

- Biological Resources - Do you have any concerns regarding mammal species?

- Page 49 - Open Space Preservation - You should consider funding from Community Conservation Partnerships Acquisition Grants as administered by our Bureau within PA DCNR.

- Page 53 - Recreational Resources - You should consider funding from Community Conservation Partnerships Comprehensive Recreation, Park and Open Space Plan Grants as administered by our Bureau within PA DCNR.

- Management Options Section - Consider developing a more detailed list of specific areas where problems exist. It can be based on preliminary findings as identified on page 36. A more detailed list will allow the municipalities and others, such as the Tinicum Creek Conservancy, to build on your watershed efforts.

- Is there a need to address the issue of the two dams on Tinicum Creek within the Management Options section?

- Title of the Plan - The title of the final plan should be revised to read: The Tinicum Creek Watershed Conservation Plan. Drop the word Rivers from the title.

Congratulations on your development of an outstanding plan. I look forward to working with you on watershed conservation projects in the future. Should you have any other questions or comments, please contact me at the above telephone number.

Sincerely,

Terry L. Hough

Terry L. Hough
Environmental Planner
Grants Project Management Division

TLH:mk

cc: Suzanne Forbes, Princeton Hydro, LLC
Don Gephart/Todd Stell, Regional Advisor

SUSAN

DAV... Ahearns Comm... 8/29/00 (re send)

Comments to
The Tinicum Creek Watershed Rivers Conservation Plan

Page, Section	Comments
Acknowledgements	Please add under Advisory Task Members the following: Michael A. Smith – President, Tinicum Creek Watershed Association Bruce Wallace - Tinicum Creek Watershed Association John McFarland - Tinicum Creek Watershed Association
Acknowledgements	Please correct the spelling of "Savoda" to Zavoda
i, 3rd ¶	I believe the National W&S River issue is currently scheduled for a September vote. Greenwood's office could give you the actual legislative status, which should be included.
i, 4th ¶, 3rd sentence	Remove the coma after Keystone
ii, 2nd ¶	"wind shields" should be windshields
ii, bullets	add currently to "corridors are well-buffered" add to "Based on EV classification and water testing, the water quality is very good"
iii	Goal 1 – add "Maintain or improve existing water quality" Goal 2 – Need to discuss (and increase) the 50' buffer concept. I am aware of lots of references to suggest we need much higher to have a positive effect from buffers.
2, 3rd ¶	Watershed is greater than 3 miles ✓ over 17.
6, 1st ¶	Township Comprehensive Plans should be plural (Township's)
9, 4th ¶	route should be capitalized
9, 5th ¶	Add Designated in front of "scenic roads" to differentiate from those roads that are just scenic (not designated)
10, 3rd ¶	Correct "cris-crossing"
11, 1st ¶	Reference to classifications appears to be wrong – CWF is a small portion of watershed
12, 3rd ¶	Column on left states "ten rare breeders" while 3rd paragraph of text says "11 rare breeders"
Section II	NO PAGE NUMBERS, THEN NEXT SECTION STARTS @ 14 2ND page of Section II, 1st ¶ - note the composition of the Joint Groundwater Committee
15	Column on left has hanging text – "Dirt and Gravel Roads are"
27, 1st ¶	Name "unnamed tributary" as Beaver Run (make change on map titled Section III. Sentence with "unnamed tributary" is incomplete
36, bullets	add currently to "corridors are well-buffered" add to "Based on EV classification and water testing, the water quality is very good"

Page, Section	Comments
All of Part IV	Margin along left border is too close to border line and does not match prior formatting
38, 2nd ¶	remove extra comma after "development standards"
39, 3rd ¶	Reference to "Delaware Quarry" should be Delaware Valley Quarry and the sentence is incomplete
41, 1st ¶	add Tinicum Township Zoning Ordinances, reference can not be to other townships because it is not correct
41, 2nd ¶	add Beaver Run in lieu of "Unnamed Tributary"
42, left column	change "Lane" to Road
42, 3rd ¶	50' BUFFER ISSUE
43, 1ST ¶	"floodplains" should be floodways (check with Linda Wieand)
45, 2nd ¶	Check with Linda Wieand on reference to Lower Delaware Stormwater Control Plan – I recall that Tinicum had commenced with legal action over this plan because it was rather bad.
47, 2nd ¶	add reference to the US Army Corps study as it pertains to the fiscal analysis of the groundwater supply – it is not cost effective (or feasible) to provide a public water system
49, 2nd ¶	reference to PNDI status "noted in the box on the left" – there is no box to the left
52, 3rd ¶	"know" should be known
52, 4th ¶	"smith family" should be Smith family reference to Van Sant Airport should note it is a grass runway airport and I believe it has been classified by the State as a rural airport or something fancy to suggest it is rare and should be preserved.
Part V, 1st map	reference to "Timbering Operation" should note that the activity around Lake Warren was timbering on State Games Lands
67, 3rd ¶	a strong reference to the correlation of development and PennDOT should be provided – PennDOT has been performing shoulder and road "improvements" in anticipation of increasing traffic that conflict with BMP for the stream. Examples include their inept attempt to pave existing ditches along Geigel Hill Road. A strong statement about the need for PennDOT to have a maintenance program that reflects the presence of the watershed would be important
68, 2nd ¶	50' buffer again
69, 2nd ¶	??? – how can "maintaining" an EV status be a concern – is the worry that the State will take it away or that the attributes that made it an EV stream will be degraded?
70, Goal Two	50' buffer again
70. Goal Five	add acquisition of critical lands through fee simple purchase, easement or other methods

Page, Section	Comments
71, 1st bullet	??? – how can "maintaining" an EV status be a concern – is the worry that the State will take it away or that the attributes that made it an EV stream will be degraded?
73	add extensive discussion of PennDOT and their need to have standards that reflect the nature of the watershed (CHECK WITH LINDA WIEAND – there is a PennDOT reference that seems to require they follow different standards in "significant watersheds") add reference to existing funds available to farmers who provide buffers along streams (money is for lost planting area) – plan was established and I think run by the US Agriculture Department
74	numerous 50' buffer references
75, 1st sentence	"recommend" should be replaced with required
75	numerous 50' buffer references
75	add to Bucks County Department of Parks section the need for the County to place appropriate restrictions (conservation easements) upon the lands they acquire to ensure the preservation of the watershed's features. A discussion of possible inappropriate County uses should be provided
77	BMP bullet – Tinicum may already require this under recent changes
77	State and Local Agencies bullet – hit the PennDOT issue hard!
References	The references should include the Tinicum Creek Watershed Association's Scenic River Petition and study as well as the Tinicum Creek Watershed Association's EV Designation Petition and study The citation to Princeton Hydro and the Khydes is incorrect for the Tinicum Creek re-designation The Tohickon re-designation is misspelled as "Thicken" Once the PennDOT reference that seems to require they follow different standards in "significant watersheds") is found it should be included The US Army Corps study should be cited

7/25/00

Suzanne -

Every turned down page has either corrections, suggestions or questions. There are a few typos and words left out, probably a result of making several corrections on the computer. Overall, it looks wonderful. (It's a little discouraging, however, to learn how much needs to be done to repair this very pristine creek - what must others be like if Dunk has so much wrong with it?)

I think I did not get copies of all the supporting materials in the appendices, as some things that are referred to are missing. I'm going to assume they are available and present in the formal copies, since I know you will have checked for that!

In the overall context, the mistakes and omissions I've found are minor, but I'd be happy if you would make the corrections before sending the final official versions out. We want it to look as good as possible!

Thanks, Suzanne, for a great job!

Martie

Press Release– For Immediate Release **Date: 5/3/00**

Contacts – Linda Wieand, Tinicum Township Manager
(610) 294-9154 & Suzanne Forbes, Environmental Planner,
Princeton Hydro, LLC (609) 397-5335

Tinicum Creek Rivers Conservation Plan is Underway . . . .

The Tinicum Creek, Tinicum, PA

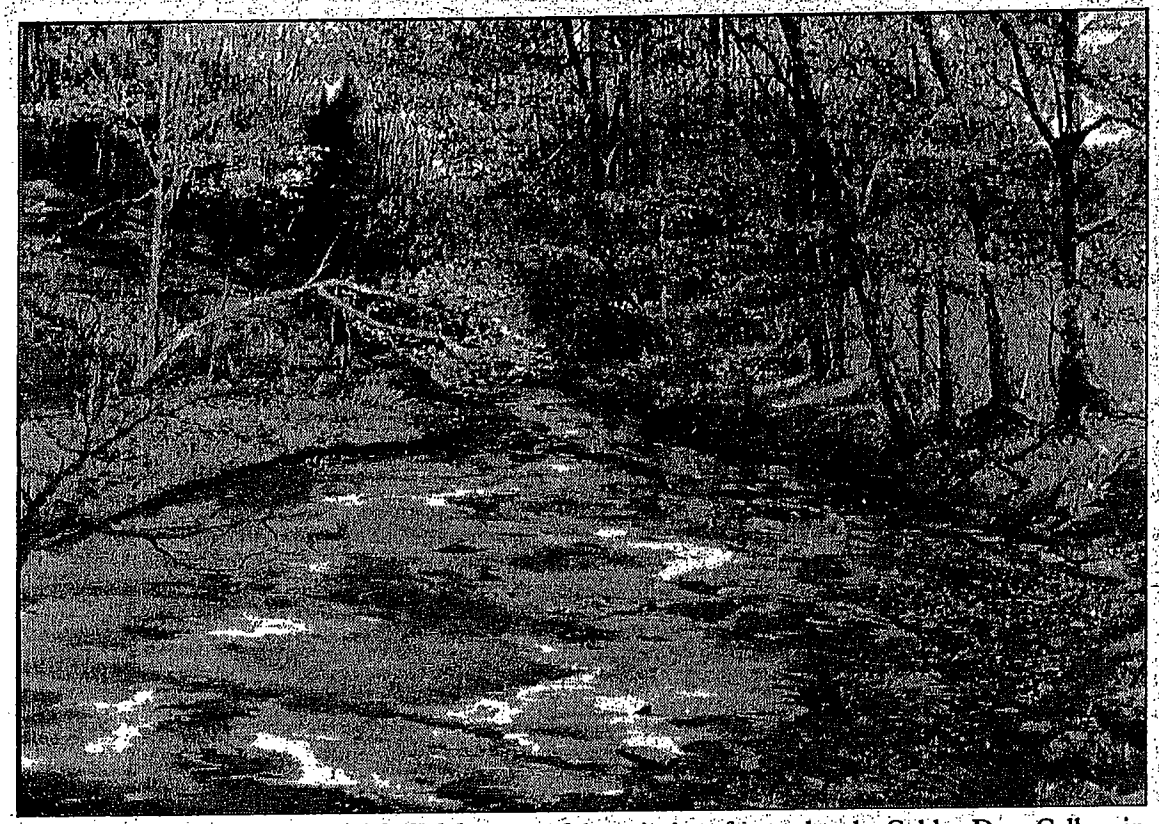
Tinicum Township is pleased to announce that work is well underway to complete the Tinicum Creek Watershed Rivers Conservation Plan (RCP). The planning effort, funded by the Pennsylvania Department of Conservation and Natural Resources (PADCNR), will include land resource information, GIS mapping, a watershed field assessment and a conservation management plan. The plan is intended to help protect open space and maintain the exceptional value (EV) water quality classification assigned to the Tinicum Creek by the Department of Environmental Protection.

Linda Wieand, Township Manager, commented that the "Tinicum Creek is such an important resource to our Township. The Creek runs through the center of our municipality and therefore greatly impacts the aesthetic appeal of our Town. So many of our residents as well as visitors to the area talk about the beauty of the creek and how they come here to relax and enjoy nature. Wieand added that, "The Bucks County Natural Resource Inventory classifies the Tinicum Creek watershed with the highest protection priority level (Priority 1). We feel the management plan resulting from the study will add one more level of protection to this very valuable and significant watershed resource".

Suzanne Forbes, from the environmental consulting firm Princeton Hydro in Lambertville, NJ will manage the project on behalf of the Township. Forbes said that , "The plan will be completed with the help of an advisory committee comprised of members from the Township Staff, Planning Commission, Environmental Advisory Board, Open Space Board, Tinicum Watershed Association, Tinicum Conservancy, and local citizens". She also mentioned that "Several volunteers have contacted her to help with the field assessment which will take place in late March before the trees leaf out. A unique twist is that field volunteers will be using kayaks to complete the assessment!"

Several public meetings are scheduled. The next meeting is scheduled for May 17, 2000, 7:30 PM at the Tinicum Township Municipal Building. This particular meeting is sponsored by the Regional Joint Groundwater Committee. All are welcome to attend and to share their comments and recommendations with the Plan Advisory Committee.

ARTS



"Along Tinicum Creek" by Patrick Walsh is one of the paintings featured at the Golden Door Gallery in New Hope. The exhibit is open to the public Tuesday to Saturday from 11 a.m. to 5 p.m. and Sunday from 1 to 5 p.m. Information: (215) 862-5529.

TINICUM TOWNSHIP OFFICE
163 Municipal Road (between Dark Hollow and Hollow Horn Roads)
Pipersville, PA 18947
Hours: Monday, Tuesday, Thursday, and Friday 9 a.m. – 5 p.m.
Wednesday 9 a.m. – 12 noon
Phone: 610-294-9154
Fax: 610-294-9889
Email: tinicum@epix.net

BOARD OF SUPERVISORS
Nicholas C. Forte, Chairperson
Gary Pearson, Vice-Chairperson
Boyce Budd, Member

TOWNSHIP MANAGER
Linda Wieand

TINICUM TOWNSHIP POLICE DEPARTMENT
Police Chief: James Sabath
165 Municipal Road,
Pipersville, PA 18947
Non-emergency: 610-294-9158
Emergency: 911
Bucks County Radio
Room: 610-982-5411

TINICUM TOWNSHIP ROAD DEPARTMENT
Roadmaster: Douglas Skelton
610-294-9153

ZONING ADMINISTRATOR
Peter Bent 610-294-8076

CONSTABLE
John Paul 215-766-7129

TAX COLLECTOR
Kim Hinrichs
366 Cafferty Road,
Pipersville, PA 18947
610-294-9669

TOWNSHIP MEETINGS
Please call the Township to hear the current list of meetings and request an agenda.

PRINTED ON RECYCLED PAPER

Welcome to the Newsletter

The last issue of our newsletter was published in June 1997. With volunteers Kate Barker and Barry Kessler in place (as editor and business manager, respectively) combined with a wealth of writers contributing their efforts, we were able to revive the newsletter this year. Our goal is to deliver a quarterly publication to the residents of Tinicum Township that keeps you apprised of township events, budget reports and general issues.

We hope you take the time to read through the newsletter and to make us aware of things you'd like to see in the upcoming issues. All comments and suggestions are welcome and valued.

Tinicum Township Open Space Committee Hard At Work

The Township's Open Space committee was formed by the Supervisors a year ago, and given an important list of tasks, all aimed at preserving our rural character:

- Completing an Open Space Plan so that we can apply for our share of Bucks County's open space bond issue funding
- Encouraging and supporting the giving of voluntary conservation easements, and making this process as easy as possible
- Considering methods of obtaining additional funding for open space
- Determining the most important open space to preserve

Three subcommittees or teams have been formed to pursue these tasks. One team is completing a draft version of the Open Space Plan. When the plan is done, it will be presented to the community and the Supervisors for comment, and then, if approved, sent to the County. After the county approves it, the Township will be eligible to apply for approximately $600,000 in County open space funding. While $600,000 sounds like a lot of money, it will not go very far toward preserving open space. A single farm can cost that much or more, and the Township still has to provide 25% matching funds.

With the enthusiastic support of the Supervisors, a second team has recently mailed to all property owners an easy-to-understand brochure, describing the benefits of voluntary conservation easements. The donation of conservation easements is an important way to preserve land, reduce estate taxes and provide the possibility of substantial tax benefits. Several committee members have either taken this step or are considering it and can answer questions about the process. Didn't receive a brochure? Norm MacArthur (610 294 1097) will be happy to send one to you.

The third team is looking for additional sources of money for open space, including other county programs, state grants, foundations, and more. Members are following up several promising leads. This subcommittee also helped provide letters of support for the Tinicum Conservancy's grant application for a Rivers Conservation Plan for the Tohickon Creek.

Why are we making this effort to preserve open space? Because the residents of Tinicum have indicated that this is exactly what they want. Responding to the 1989 Comprehensive Plan questionnaire, four out of five residents said that the township should actively pursue preservation of open space and since then support for open space preservation has clearly continued to increase. The Open Space Committee is hard at work responding to this mandate.

Our committee meetings are usually held on the fourth Monday of the month at 7:30 pm in the Township Building. We welcome visitors.

OUR TOWNS

County buys 96 acres on Tinicum Creek

The land cost $846,248. The county also is negotiating to purchase an adjacent tract of 160 acres. The area may be developed into a park.

By James F. Duffy
Staff Writer

DOYLESTOWN — In the future, county residents could have a pristine park to enjoy along the banks of the Tinicum Creek.

The county commissioners on Wednesday approved the purchase of 96.6 acres in Tinicum Township off Municipal Road for $846,248. The funding came from the county's open space bond and the property has been earmarked for parkland.

"It's a deep gorge area with steep slopes on the northern side and it is contiguous with other properties that are already being protected," said Bill Mitchell, executive director of the Bucks County Department of Parks and Recreation. "When you see the property, it's really what Bucks is all about. We're pleased to bring this piece of open space into the park system."

Mitchell said negotiations to purchase the land started more than three years ago.

"The property was being looked at by some other people," he said. "The owner knew we wanted to protect Tinicum Creek — we fell into (negotiations)."

The property owner, John C. Stephenson, will retain about 13.3 acres of the parcel, which totals about 110 acres.

"The part inside (the property) has a house and we were not desirous of purchasing a house — it was a real estate issue," he said.

Stephenson said he bought the property in 1986.

"When I bought the ground from Mrs. (Emma) Van Sant, I gave her my word that I would never develop it," he said. "I originally approached (the county) about having them purchase the development rights — it's been a long-term plan of the commissioners to preserve the land along the creek and I probably owned the largest tract. (Mitchell) later called me and asked if I would be interested in selling it."

Negotiations recently began on the 160-acre Van Sant tract, adjacent to the Van Sant Airport and also adjoining Stephenson's land, Mitchell said.

The parkland would not adjoin any existing county or state parks, though other nearby properties are protected from development through locally held conservation easements.

Mitchell said the property meets all of the criteria for parkland "when looking at areas of greater than 100 acres," although there are no plans at present to develop it.

The land would not be open to the public until it is developed at some point as a park.

Tinicum Township manager Linda Wieand said the property contains "some very valuable natural resources the township had already identified for protection," including watershed areas, forests and steep slopes.

"It will only be able to be used for conservation, recreation or parks," she said. "It's a very scenic and beautiful area of the township."

Stephenson called the location "truly unique" and said the sale worked out well for both himself and the county.

"With the cliffs, we are 300 feet in the air here. The view is tremendous," he said. "I think it's a spectacular piece of ground and now it will never change. It will be quite a park for generations to come."

5/7/00
Intel

Firms agree to help pay for cleanup

By Christina Hall
Staff Writer

BRIDGETON — Three companies allegedly responsible for some of the contamination at the Boarhead Farms Superfund site have agreed to pay for some of the cost of the $13 million cleanup of the 120-acre property.

Cytec Industries Inc., Ford Motor Co. and SPS Technologies Inc. filed a partial settlement with the U.S. Environmental Protection Agency last week in federal court in Philadelphia. The proposed settlement is subject to a 30-day public comment period and final court approval.

According to the EPA, the three companies contributed some of the hazardous substances found at the Lonely Cottage Road site, owned by Manfred DeRewal Sr. They are among several landowners and waste generators or transporters the EPA has identified as being potentially responsible parties.

"It's certainly good news. Funding from wherever will help," township Supervisor Wayne Brown said Friday. "The EPA funding is limited and needs to go to other sites. We didn't want funding too thin in our area, so this is good news that we have

5/28/00 Intel

Tapping water as a zoning tool

Townships are starting to tie zoning approval to availability of ground water.

By Mark E. Jolly
Staff Writer

Water is not only essential for life. It is becoming essential for zoning approval as well.

Several Bucks County municipalities are exploring a relatively unused portion of the state's 11-year-old municipal planning code that allows them to turn down a proposed development based on how it would impact local water supplies. Municipal officials see it as a way to protecting current residents' water supplies. Developers fear it could become just another tool to try and limit growth.

Tinicum Township has led the way toward ordinances tying development to the availability of local ground water, which municipalities

See **WATER**, *Page* **A 6**

Water

Continued from Page A 1

were empowered to do by a 1989 revision to the municipal planning code. May 16, supervisors rejected a proposed subdivision using their water development ordinance for the first time, although the law is more than two years old.

According to the township's hydrologist, the nine houses proposed for Edwin and Jean Rushton's 104-acre property off Dark Hollow Road would draw too much ground water, putting neighbors' wells at risk.

Tinicum is solely dependent on ground water for its water needs, and the underlying geology in many areas of the township is poor for producing water. As a result, township officials spent more than six years working out their water development ordinance, which requires well testing to assure sufficient safe water for past and future users.

"We have an ordinance to make sure we have adequate water supply before we grant a subdivision," Supervisor Gary Pearson said. "It is hard to put science into law, and we did our homework and a lot of studies before writing the ordinance."

David Gould, the Rushtons' lawyer, said the ordinance is flawed despite the time spent developing it and plans to challenge the township's rejection in county court. He maintains the township disregarded water recharge that would help sustain the aquifer below the Rushton property and says the testing methods established in the ordinance gives a skewed representation of what the actual water draw would be.

"Tinicum is focused more on creating an anti-development measure than they are on actually measuring whether the use on the site is going to be a problem," Gould said. His clients have had to pay "tens of thousands of dollars trying to satisfy an ordinance that is ultimately being applied in a way that no one could pass."

It is a safe bet several area municipalities will be watching Gould's case closely. Plumstead, Buckingham and Solebury are all exploring, at different levels of enthusiasm, enacting water-based development limits, either as zoning restrictions or well ordinances.

The Partnership for Land Use Management, a citizens' group led by David Mortimer, the chairman of Plumstead's planning commission, initiated a study of the Paunnacussing watershed last month, hoping to lay the foundation for water-based zoning that could protect that watershed, which crosses into all three of those north-central Bucks townships. Milford Township is also studying its aquifers but is waiting to see what they find before planning action.

Amleto Pucci, the hydrogeologist leading the partnership's study, has been involved with studying water issues for Bucks municipalities for years. He led the Ground Water Management Committee, which worked for 11 municipalities and produced a more than 50-page position paper on how to pursue ground water conservation.

According to Pucci, there are various reasons to attempt to hold development to a level supportable solely by ground water, for all uses from drinking and bathing to agricultural irrigation or other commercial use. Many of the supporters of water-based ordinances are environmentalists, and it is fairly easy to see why. Depleting ground water can deplete streams and wetlands in addition to drying up wells.

"The less you develop using a natural understanding of the ground water system, the more you're going to have to re-engineer the natural environment," Pucci said. "If you're developing within the ability of an area to accommodate growth, then there is no significant capital expenditure for

growth."

Mark McGuigan, director of the Greenspace Alliance of Southeastern Pennsylvania, illustrated why such re-engineering is problematic beyond the fiscal cost. He explained that protecting ground water stems from a relatively simple philosophical imperative: water resources should remain within their own watersheds.

Moving water around, as happens in Plumstead since most water is drawn from the ground but disposed of through Bucks County Water and Sewer Authority, can damage the plants and animals that depend upon certain streams and wetlands, even if those don't dry up.

McGuigan said a simple change in temperature or volume can be enough to do damage. A decreased flow in surface water can also mean higher concentrations of pollution and problems downstream. Even public water systems that draw from surface water could eventually pay a price if the headwaters are depleted.

"Optimally, what we would do is take water from one place and constantly put it back in the same system," he said. "It is important to support the headwater streams and that's one of the goals of water budgeting."

Though municipal officials and environmentalists tend to talk about water-based ordinances as ways to limit development, builders aren't necessarily opposed. Gould, who may well bring the first challenge to a water-based law in the county, admitted it can be necessary.

"There are aquifers that exist that have been exhausted," he said.

Bob Bender, a vice president at Heritage Building Group, also supported attempting to "balance" water systems as McGuigan described. As a municipal manager for 18 years before joining Heritage, however, Bender says he learned a lot more has to change than zoning to accomplish that. In essence, parts of the culture would have to adapt.

True balancing would require returning as much of the sewage water, after treatment, to the system as well, Bender pointed out, something that repulses many people.

Compounding the problem, residents' yards are usually graded to drain as quickly as possible after a storm, the exact opposite of what would be best to recharge ground water systems.

"The culture has been collect the water, pipe the water and dump the water as quickly as possible," Bender said. "This is a whole rethinking. It is a good idea; we certainly support it. But we don't support it if it is going to be used by municipal officials to try to thwart development."

The ecological impact isn't the only argument for ground water conservation, however, and isn't even the one municipal officials tend to cite when talking about their efforts. More often, it is the human costs that come up.

Solebury Supervisor Tom Caracio had his own well go dry in 1985 and said the experience is one impossible to understand without experiencing it.

"It could be weeks before you ever get your water restored. It substantially impacts your lifestyle," he said. "We had to go to a hotel; we had to eat all of our meals out. It is an impact that you don't comprehend or appreciate, until it happens."

In Solebury, Caracio said they have been successful in getting developers who have an impact on neighboring wells compensate most of those who lose their water. Likewise, Buckingham holds an escrow account from developers to pay for deepening any neighbors' wells that go dry.

Buckingham has fairly extensive requirements developers must fulfill to prove their wells will be sufficient and harmless to surrounding wells. Graham Orton, director of water and sewer for the township, said the township is interested in developing true water-based zoning if it can.

That is the direction Plumstead is looking as well, according to Supervisor Betsy Helsel. The township has already run into water quantity issues, especially during last year's drought. Helsel said she hopes to begin assembling an estimate of the township's available ground water in the next two or three months with an aim of starting to draft an ordinance in six.

"We are all dependent on ground water here," she said, which makes water-based zoning particularly attractive. "If we do it, we want it to be defensible."

One of the areas Tinicum looked for guidance did have true zoning based on ground water availability. Delaware Township in Hunterdon County, N.J., has a minimum three-acre zoning for building and increased that to six acres in certain regions where the water table is strapped.

And while several municipalities dependent on private wells would eventually like to see that work its way into law here as well, it promises to be a long process, largely through uncharted terrain.

"Pennsylvania is not as proactive in their land use as other states," said Damon Aherne, chairman of Tinicum's planning commission. "There is a natural limit to what the land can bear, but Pennsylvania has always been more interested in having growth than having common sense."

Despite the frustrations inherent in the state's provisions for water-based ordinances controlling development, many think such controls are not impossible. They just take plenty of data to back up the laws. Or so goes the theory. The outcome of the appeal of Tinicum's decision a couple of weeks ago may make it clearer what really is necessary.

"What these folks are doing is very cutting edge, you could say even in terms of the law," McGuigan said.

Staff photo by Donald R. Boorse

Robert B. Stanfield of the Smithtown Creek Watershed Association takes a walk by the creek in Tinicum.

Study backs upgrading creek status

Environmentalists want the Smithtown Creek deemed an "exceptional stream."

BY PATRICK LESTER
Staff Writer

TINICUM — Environmentalists here have been waging a five-year battle to get better water quality protections for a creek, only to have their request rejected by the state.

They're not giving up the fight.

The Smithtown Creek Watershed Association believes it now has the evidence it needs to convince the state Department of Environmental Protection to designate the Smithtown Creek an "exceptional value" waterway.

Bob Stanfield, who heads the organization, says he's hopeful the DEP's Environmental Quality Board will change its mind after a private firm hired to test the waterway determined the creek is worthy of the designation.

The special label, the state's highest quality rating, would help ensure the creek would not be degraded by discharges from developments and industries.

Once a creek is given that status, a developer looking to build within the area must go through a thorough permitting process to ensure no discharge will affect the quality of the stream.

The DEP has ruled that the creek should not be upgraded from its current trout stocking designation. The agency has done chemical and biological tests on the creek and compared it to similar streams in Berks and Chester counties.

The watershed group says the DEP should have compared the Smithtown to similar streams in the area, including the Tinicum, Beaver and Rapp creeks, which have been designated exceptional value waterways. The Smithtown, which is about a mile long, runs along Smithtown Road and into the Delaware River.

"They didn't think the creek was very good back then, and we challenged them," Stanfield said. Stanfield is vice chairman of the Tinicum Environmental Advisory Committee, which reviews subdivision, septic system and ground water plans submitted to the township.

His group decided to hire Princeton Hydro of Lambertville, N.J., to do an independent test of the stream.

Princeton Hydro, which studied other local creeks, determined that Smithtown Creek is worthy of an upgrade.

Researchers looked at the organisms that live in the stream and compared them to those in other local streams and also looked at the "physical attributes" of the waterway, including banks and the streambed.

"Our comparison was an effort to show that by using streams closer (to the Smithtown Creek), the results can be completely different," Mark Gallagher of Princeton Hydro said. "The one creek in Chester County and the other in Berks are just far enough away that there can be inherent differences that just make the comparison less objective or realistic."

When the DEP studies streams, it compares them to streams it already has data on, Gallagher said.

"They may not have data on the streams that they were encouraged to compare it to," he said. "That's just DEP trying to find time to do that. And I don't mean that in a bad way."

Gallagher's firm recently completed its study of the Smithtown Creek and sent a letter to the DEP outlining its arguments for upgrading the stream's status. Stanfield said he hasn't heard back yet.

Stanfield originally requested the study back in June 1995, and the DEP did its first review in February 1997 before rejecting the petition.

Now Stanfield is playing the waiting game again, and he has company locally.

Marion and Neil Kyde of the Tinicum Conservancy have been trying for about six years to have the Tohickon Creek upgraded to exceptional value. The Kydes' group also hired an independent group to test the water and has challenged the state's decision not to upgrade the Tohickon. They're still waiting for DEP's final decision.

The Tinicum Watershed Rivers Conservation Plan is Well Under Way

The Tinicum Creek Watershed Rivers Conservation Plan is a planning project funded through a grant from the Department of Conservation and Natural Resources (DCNR), Keystone Recreation program.

The Keystone grant was obtained the by the Tinicum Creek Watershed Association in an effort to learn more about the creek and to develop a variety of measures to protect the watershed. The watershed area includes the Tinicum Creek, Rapp Creek and Beaver Creek in Tinicum, Nockamixon, and Bridgeton Townships.

Linda Wieand, Township Manager, commented, "The Tinicum Creek is such an important resource to the three municipalities. So many of our residents and our visitors talk about the beauty of the creek and how they come here to relax and enjoy nature." Wieand added, "We feel the management plan resulting from the study will add one more level of protection to a very valuable and significant natural and cultural resource."

Tinicum's Environmental Advisory Council, Open Space Committee, Joint Municipal Groundwater Committee, and planning commissions and members of all three communities have been working with Suzanne Forbes, AICP, an environmental planner and scientist from Princeton Hydro, LLC, to develop the Tinicum Creek Watershed Rivers Conservation Plan.

During the last year, the planning team and the technical advisory committee have completed the Geographical Information System (GIS) mapping of the area. The maps are included in the Rivers Conservation Plan and identify the watershed boundary as well as topography, land use, soils, and surface water resources within the watershed. The separate maps have helped draw conclusions about the watershed.

In March and April, the field scientists from Princeton Hydro performed a river corridor assessment with the help of citizen volunteers. The visual assessment involved confirming GIS mapping, identifying significant natural and historical resources, taking photographs, and surveying areas that may need future management attention.

The field assessment resulted in the following positive findings:

- The Creek Corridor remains very scenic and virtually litter free.
- Federal, state and local regulations provide extensive protection.
- In most cases, the creek corridor remains very well buffered.
- There is extensive community and municipal interest and involvement in protection areas.

The following areas may need management attention in the future and will be included in the management plan:

- Several stream bank areas are eroding.
- In certain areas, bridges and overturned trees are forming obstructions to water flow.
- Sediment may need to be removed in certain places.
- Stormwater discharge pipes may need maintenance or redesign for maximum water quality protection.

Four meetings have taken place whereby the public has identified the following conservation goals:

1. Maintain the Exceptional Value Water Quality Status of the Tinicum, Rapp and Beaver Creeks
2. Conserve ground and surface water quantity
3. Preserve and protect significant natural features and open space in the River Corridor and in the surrounding watershed
4. Develop educational programs for the Tinicum Creek Watershed
5. Preserve and protect historical and cultural features within the watershed
6. Encourage compatible and passive recreational use of the River Corridor ways that are compatible with private landowners and natural resource amenities.

The three communities, technical advisory committee and the public have been reviewing and fine-tuning the draft plan. The draft plan was submitted to the Supervisors and DCNR at the beginning of July, 2000. We recently received a Congratulations on our "development of an outstanding plan" from DCNR, and they have informed us that the plan "meets the requirements for listing on the Pennsylvania Rivers Registry." DCNR also provided their recommendations for some minor revisions. The Tinicum Board of Supervisors will consider formal adoption of the plan during their public meeting on September 13, 2000 and encourages the public to attend this hearing.

Appendix B

Supporting Information,

Natural & Cultural Resources

Past Study Information
PA Historical Society Search

Commonwealth of Pennsylvania
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Post Office Box 1026
Harrisburg, Pennsylvania 17108-1026

April 7, 2000

Suzanne Forbes, AICP
Princeton Hydro, LLC
80 Lambert Lane
Lambertville, NJ 08530

TO EXPEDITE REVIEW USE
BHP REFERENCE NUMBER

Re: ER 00-1666-017-A
DCNR Keystone Rivers Conservation Plan:
Tinicum Creek Rivers Conservation Plan
Tinicum and Nockamixon Townships,
Bucks County, Pennsylvania

Dear Ms. Forbes:

The Bureau for Historic Preservation has reviewed the above named project under the authority of the Environmental Rights amendment, Article 1, Section 27 of the Pennsylvania Constitution and the Pennsylvania History Code, 37 Pa. Cons. Stat. Section 500 et seq. (1988). This review includes comments on the project's potential effect on both historic and archaeological resources.

Your request does not include sufficient information. We are unable to proceed with our review for cultural resources until the information on the attached form is provided.

Enclosed is a copy of the National Register listed and determined eligible resources (non-archaeological) for the Commonwealth, many of which may be in your project area. However, there are also many surveyed historic and archaeological resources identified. We recommend that you contact the Bureau for arrange to examine our maps and records, especially since the exact location of archaeological resources are protected.

If you need further information regarding archaeological resources please contact Mark Shaffer at (717) 772-0924. If you need further information concerning historic structures please consult Susan Zacher at (717) 783-9920.

Sincerely,

K. W. Carr

Kurt W. Carr, Chief
Division of Archaeology
and Protection

Enclosure
KWC/smz

Commonwealth of Pennsylvania
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Post Office Box 1026
Harrisburg, Pennsylvania 17108-1026

April 28, 2000

Suzanne Forbes, AICP
Princeton Hydro, LLC
80 Lambert Lane
Lambertville, NJ 08530

TO EXPEDITE REVIEW USE
BHP REFERENCE NUMBER
EXPEDITE REVIEW
BHP REFERENCE NUMBER

Re: File No. ER 2000-1215-017-B
COE Pennsylvania Water Obstruction & Encroachment Permit Application:
Proposed Retail Shop & Gasoline Station Development, Corner of Rt. 663 & AM Drive, Milford Twp., Bucks Co.

Dear Ms. Forbes:

The Bureau for Historic Preservation (the State Historic Preservation Office) has reviewed the above named project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended in 1980 and 1992, and the regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation. These requirements include consideration of the project's potential effect upon both historic and archaeological resources.

Thank you for submitting the additional information concerning the above referenced project.

Based on our survey files, which include both archaeological sites and standing structures, there are no National Register eligible or listed historic or archaeological resources in the area of this proposed project. Therefore, no historic properties will be affected by this project and your responsibility for consultation for this project is complete. Should you become aware, from any source, that historic or archaeological properties are located at or near the project site, please notify the Bureau for Historic Preservation at (717) 783-8946. If you need a **status only** of the reviewed project please call Tina Webber at (717) 705-4036.

Sincerely,

Kurt W. Carr, Chief
Division of Archaeology & Protection

Cc: COE, Philadelphia District

KWC/tmw

Botrychium virginianum	Rattlesnake Fern

Asteraceae/Compositeae

Hieracium aurantiacum	Orange hawkweed
Hieracium vulgatum	Yellow hawkweed
Tussilago farfara	Colts foot
Tragopogon pratensis	Yellow goats beard
Tragopogon porrifolius	Oyster plant
Lactuca canadensis	Wild lettuce
Cirsium discolor	Field thistle
Cirsium arvense	Canada thistle
Cichorium intybus	Chicory

Asteraceae

Solidago caesia	Blue stemmed goldenrod
Solidago patula	Rough leaved goldenrod
Solidago nemoralis	Gray goldenrod
Solidago gigantea	Late goldenrod
Solidago rugosa	Rough stemmed goldenrod
Solidago altissima	Tall goldenrod
Solidago canadensis	Canada goldenrod
Solidago graminifolia	Grass-leaved goldenrod
Aster divaricatus	Whitewood aster
Aster simplex	Panicled aster
Aster novae angliae	New England aster
Aster schreberi	~~Astor~~ schreber
Eupatorium rugosum	White snakeroot
Eupatorium perfoliatum	Boneset
Eupatorium maculatum	Spotted Joe Pye weed
Eupatorium fistulosum	Hollow Joe Pye weed
Erigeron philadelphicus	Common fleabane
Erigeron canadensis	Horseweed
Erigeron annuus	Daisy fleabane
Antennaria neglecta	Field pussytoes
Chrysanthemum leucanthemum	Ox-eye daisy
Taraxacum officinale	Dandelion
Rudbeckia hirta	Black-eyed susan
Rudbeckia laciniata	Thin-leaved coneflower
Tanacetum vulgare	Common tansy
Helianthus divaricatus	Woodland sunflower
Helianthus gigantens	Tall sunflower
Heliopsis helianthoides	Ox-eye
Actinomeris alternifolia	Wingstem
Sonchus asper	Spiney sow-thistle
Vernonia noveboracensis	New York ironweed
Arctium minus	Common burdock
Centaurea vochinensis	Tyrol knapweed
Centaurea maculosa	Spotted knapweed
Anaphalis margaritacea	Pearly everlasting
Gnaphalium obtusifolium	Sweet everlasting
Galinsoga ciliata	Galinsoga
Artemisia vulgare	Mugwort
Senecio aureus	Golden ragwort
Bidens polylepis	Tickseed sunflower
Ambrosia artemisiifolia	Common ragweed
Ambrosia trifida	Giant ragweed
Cichorium intybus	Chickory
Helenium autumnale	Sneezeweed
Achillea millefolium	Yarrow
Prenanthes trifoliata	Rattlesnake root

Hydrophyllaceae

Hydrophyllum virginicum	Virginia waterleaf

Menispermaceae

Menispermum canadense	Moonseed

GEOLOGY

The Tinicum Creek watershed lies entirely within the Triassic Lowlands Province. All of the rocks in this province are from the Mesozoic age, formed approximately 160 million years ago, before the Atlantic Ocean had opened; that is, while North America, Europe, and Africa were still together.

Sedimentary Triassic rocks in this area include the Brunswick, Lockatong, and Stockton, which are of continental origin, originating when inland valleys were filled with sediment-bearing lakes and rivers. These deposits are four to ten thousand feet thick. In the Tinicum Creek watershed, Brunswick (red shale) and Lockatong (argillite) are the prevailing sedimentary lithofacies. The Lockatong is similar to the Brunswick, though it is usually grey, with a silica binder or cement making the rock much harder and more durable.

Intruding into these rocks in northern Bucks County are diabase dikes and sills that are the remains of subterranean igneous intrusions. The upper tributaries of Tinicum Creek originate in such rocks in Nockamixon and upper Tinicum Townships, an area known as Coffman Hill or The Swamp.

"Ringing Rocks" is a 3 acre diabase boulder field on Coffman Hill where the rocks, when struck with a hammer, produce musical notes. More commonly, however, the diabase boulders are embedded in thick clay soils which hold water and frequently create wetlands despite the relatively high elevation and steep slopes.

At the edge of the diabase, where it is overlain by the Brunswick, there is a strip of baked shale or "hornfels," which was hardened and cracked by its proximity to the molten lava. This grey or darker red stone superficially resembles, but is not, argillite.

After the upper Tinicum, or Rapp, Creek leaves the diabase and hornfels, it cuts a valley that eventually becomes 200 feet deep through an area of Lockatong. In this area, the stream bed consists of a series of slightly inclined grey and red rock ledges, often so straight and square as to appear to be man made. This produces a long series of low rock waterfalls and pools that is extremely attractive.

Where Tabor Road fords the stream at the Tinicum Township border, the grey argillites give way to red shales, with the argillite continuing at ever higher levels in the cliffs along the stream. From there to the Delaware River, the stream bed is almost exclusively red shale or Brunswick rocks.

About three and a half miles downstream from Tabor Road there is an "elbow of capture;" the stream makes a sudden 90° left turn and heads east. At some time in the past, when the stream was approximately 120 feet higher than it now is, Tinicum Creek continued south, or straight ahead at this point. It ran on through a still-existing valley between Red Hill and Ervin Roads in Tinicum Township and then joined Tohickon Creek at what is now the Ralph Stover State Park. This valley should be studied for further information about this event.

Apparently, a small stream flowed through red shale directly into the Delaware along the course of the future lower Tinicum Creek, and as the water level of the Delaware dropped, the stream cut deeper. As this happened the source kept moving further inland by headwater erosion. Meanwhile, the old

recovered many years later by a friend of the family who found it being used in a stone wall. It is now in the possession of the finder's son, who still lives on the property.

From the time of his second visit to "Penn's Woods", William Penn had his eye on the area that is now Tinicum. In September of 1699 he instructed his surveyors to lay off that tract for himself and his children. The surveyors neglected to do so and the area became officially an Indian township, much to Penn's vexation. By 1730 there were a number of settlers in the township. Early settlers' names were Marshall, Collins, Haverford, Thatcher, Griffith, Hall, Willey and Ross. The Heaney, or Hoenig, family, along with Casper Kolb and Christian Fretz were among the early German settlers. In 1738 the settlers petitioned to form a township. The boundaries remain the same today.

These settlers transformed a wilderness of rocks, morasses and forests into well-cultivated fertile lands. The farms were well fenced with stones taken from the land during clearing. The process of clearing was known as a "frolic." When a frolic was proclaimed, the neighbors would gather soon after noon with axes, crow bars, picks and other tools, and with teams of horses with heavy wagons and sleds known as "stone sleds." All would go to work under the direction of the owner of the field. Rocks, trees and stumps were removed and fences built. At sundown everyone went to the farmhouse for whiskey, sumptuous food, singing and dancing.

In this way the virgin woods were cut down and the farms established. Log cabins were frequently replaced with sturdy stone farmhouses. Frame houses were rare and brick houses even rarer.

The London Company became the first large purchaser of land, owning a tract of 7,500 acres that covered the northern part of Tinicum. The London Company did not convey land to settlers but leased it, under the English manorial system, with a title to "improvements." When the London Company was dissolved by Act of Parliament in 1760, and trustees appointed to sell the land, it was surveyed in large tracts numbered consecutively. Much of it was purchased by representatives of families who had settled many years earlier on the adjoining "Dutch" or Streiper tract, to the south, which comprised nearly the entire balance of Tinicum Township. Arthur Erwin purchased fifteen hundred and sixty-eight acres. When comparing current tax maps of Tinicum Township with early maps of the London Company, the overall pattern of boundary lines is clearly similar.

The Indians didn't leave Nockamixon in large numbers until about 1730. Nutimus, legendary chief of the Munsee Clan of the Delawares, an herbalist doctor who could "cure all the ills flesh is heir to", was living in Nockamixon in 1734. He was said to have cured the bite of a rattlesnake and to have cured his own daughter after she was seized with hydrophobia. Nutimus is buried in Nockamixon.

The red clay of Nockamixon Township made pottery an industry in the seventeenth and eighteenth centuries. There was a time when "a person could stand at a certain point in Nockamixon and see the smoke curling from the flues of seven different potter's kilns" including those of Kintner, Herstine, Haring and Simon Singer. Their red tulipware was prized among the residents and throughout the neighboring areas.

On a dark night the fires in the charcoal makers' huts could be seen far and wide. Charcoal was a valued fuel for cooking and was manufactured within the watershed.

The stone arch bridge which carries Quarry Road over Tinicum Creek, is significant for its style and date of construction. Built in 1900, the bridge is somewhat unusual for the use of stone arch construction. Iron bridges and concrete arched bridges were the more common technology of the day. It is possible that the bridge was a substantial rebuilding of an earlier bridge. It may be eligible for the National Register as part of a thematic nomination with the other stone arch bridges in Nockamixon.

The Frankenfield Covered Bridge, one of several surviving covered bridges in Tinicum, crosses Tinicum Creek at Cafferty Road and is on the National Register.

There are too many dwellings and structures of architectural or historical significance to list here. The Bucks County Conservancy has done a "Windshield Survey" of many of them, listing their approximate age and eligibility for the National, Pennsylvania and County registers.

Ottsville, along the Durham Road, originally known as "Red Hill," is one of the oldest villages in the northern part of the county. This is where the earliest settlers founded their church. They were Scotch-Irish Presbyterians and the first Red Hill Church was log. The next stage of building was in 1766 when a stone church, with the stairway to the gallery on the outside, was erected. This was rebuilt in 1843 and stands today, remarkably preserved and on the National Register. The oldest gravestone in the yard is that of James Blair, who died in 1749, at the age of eighty-three.

The Sign of the Harrow Inn, built in 1740, began operating as an inn in 1744, and has been open ever since. Located on State Route 611, formerly Durham Road, it was a coach stop between Easton and Philadelphia. There is an interesting bit of folklore attached to this old place. Sometime in the early years of innkeeping, a woman drowned her child in the inn's well. Ever since then, people claim to have seen her, carrying her child in her arms, with the most recent sighting occurring just a few years ago.

There were inns operating in Ottsville and Sundale, a little village known as Headquarters in earlier times. This village retains most of its early buildings, including the inn, which is now a private home.

Further down Tinicum Creek at the juncture of Headquarters and Red Hill Roads is the substantial stone house built in the 1740's by a German Miller named Christian Fretz. Although the associated mill is no longer standing, it was built and functioning at a very early time during Tinicum's settlement period.

At the mouth of the Tinicum Creek stood the mill of Elias Shull. The site is marked on the 1830 survey of the Delaware Canal.

During the nineteen thirties and forties a number of well-known artists, playwrights, actors , actresses, directors and producers were in the area either as residents or as frequent visitors. On Sheephole Road, which winds along the Tinicum Creek, the late playwright and author John Wexley lived with his Viennese wife, Katharine. His works include the book, The Trial of Julius and Ethel Rosenberg, a play, "The Last Mile," and many screenplays, including "Angels With Dirty Faces." Their old house was a haven for the talented and famous, and included Spencer Tracy, John Steinbeck, Melvyn Douglas, John Huston, Elia Kazan, Miriam Hopkins and Claude Rains among its visitors.

Jackson Pollack, the abstract expressionist painter, lived and painted in a stone house, now a ruin, along Quarry Road in Nockamixon.

Princeton
Hydro, LLC
80 Lambert Lane
Lambertville, NJ 08530

March 30, 2000

Commonwealth of Pennsylvania
Pennsylvania Historical and
Kurt W. Carr, Chief Division of Archeology & Protection
Museum Commission
Bureau for Historic Preservation
Post Office Box 1026
Harrisburg, PA 17108-1026

Dear Mr. Carr:

We are requesting that the Bureau for Historic preservation review the attached information and provide us with a list of historic and archaeological features within our study area to include in the Tinicum Creek Rivers Conservation Plan. We will use the Division's information to formulate protective management policies for all significant features within the Tinicum Creek and Creek Tributary corridor.

- ✔ **County** - Bucks County, Pennsylvania
- ✔ **Municipality** - Tinicum & Nockamixon Townships
- ✔ **Location-** See attached project location map. The watershed covers approximately Tinicum Creek Watershed overlay district (Tinicum Township) as well as the Rapp & Beaver Creek Corridors (Nockamixon Township)
- ✔ **Proposed Development** - No proposed development. We are working on a DCNR Rivers Conservation Plan (RCP) which is funded through the Keystone program.

Thank you ahead of time for your time and effort. Please contact me if additional information is needed to complete your search.

Sincerely,

Suzanne Forbes

Suzanne Forbes, AICP
Project Scientist/Planner

cc: Tinicum Township, Linda Wieand, Manager
Project Team/Technical Advisory Committee
Correspondence Files

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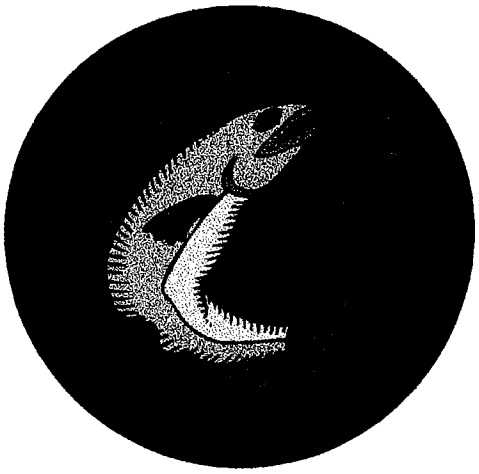
Appendix C

Supporting Information, Water Quality



Stream Monitoring Results, 1992

I. INTRODUCTION

Coastal Environmental Services, Inc. (Coastal) was retained by the Tinicum Creek Watershed Association to document stream quality within the watershed. This was accomplished through a water quality and biological monitoring program at important and representative streams within the watershed. Monitoring and data analysis was accomplished through a collective effort of trained volunteers, U.S. Geological Services and Coastal staff.

II. DESCRIPTION OF STREAM MONITORING PROGRAM

Water quality and benthic macroinvertebrate sampling was conducted at each of the following stations:

Station 1 -	Rapp Creek (just above Rapp Creek falls)
Station 2 -	Beaver Run (just below Beaver Run Road)
Station 3 -	Tinicum Creek (at Sheephole Road)
Station 4 -	Tinicum Creek (1000 feet upstream of the Municipal Road ford)
Station 5 -	Tinicum Creek (50 feet upstream from the confluence with Little Tinicum Creek.
Station 6 -	Little Tinicum Creek (50 feet upstream from the confluence with the Tinicum creek).
Station 7 -	Smithtown Creek

Water quality and flow data was collected on two dates 6 May and 21 August 1991 and were analyzed for pH, specific conductance, total solids, alkalinity, dissolved oxygen, and total nitrogen. Stream velocity was measured by at each station and was used together with stream channel width and depth measurements to yield instantaneous flow. Benthic macroinvertebrate sampling was conducted on _____ 1991 utilizing a standard 1 ft^2 Surber sampler.

III. RESULTS AND DISCUSSION

A. Water Quality

Although the water quality of the sampled streams (Table 1) exhibited considerable spatial variability, the data generally reflects conditions which would be expected in a stream not subjected to large anthropogenic stresses. In all cases, water quality met or exceeded water quality criteria specified in Pennsylvania Department of Environmental Resources (PA DER) Water Quality Standards (Chapter 93.7).

In general, sampled streams within the watershed are characterized by low flow (<1 cfs), moderate pH levels, relatively moderate to low nitrogen concentrations (<0.05 to 1.3 mg/l) and moderate to high dissolved oxygen concentrations (5.0 to 11.6 mg/l). A notable exception was encountered at Station #5 in Tinicum Creek, which exhibited a relatively high pH (9 su). It would appear that these relatively high pH values are associated with the photosynthetic utilization of CO_2 which tends to reduce CO_2 concentrations and leads to an increase in pH. High dissolved oxygen concentrations found in this station supports the presence of this high photosynthetic activity. (A similar, though somewhat less conspicuous relationship, is apparent at Station #4 in Tinicum Creek during the August sampling event).

Algal photosynthetic activity appears to strongly influence dissolved oxygen dynamics in Tinicum Creek as evidenced by high oxygen concentrations encountered at Station #5 and #6. It would also appear that, currently, the density of the algal population is limited by the quantity of nutrients available in the stream. Low nitrogen concentrations detected in these stations suggest that this nutrient is being utilized by algae. Algal populations may therefore be limited by the quantity of this essential nutrient.

While algal photosynthesis represents an important oxygen input to the stream, the seasonal die-away and decomposition of these populations can lead to a reduction in oxygen concentrations as a result of respiration. Increased nutrient loadings to these streams may result in a corresponding increase in algal populations which could eventually result in significant oxygen depletion of these waters. Under this scenario, the biological population of these streams would be negatively impacted.

B. Benthic Invertebrates

Benthic organisms are often used as environmental indicators (McErlean and Reed, 1981) because of their trophic level importance and because their limited mobility decreases their ability to avoid environmentally stressful conditions. The presence or absence of a benthic species may therefore suggest the degree to which ambient or historical water quality conditions permitted that species to colonize a particular habitat.

Streams with acceptable water quality and substrate conditions typically support a diverse macroinvertebrate community characterized by a significant number of organisms intolerant of

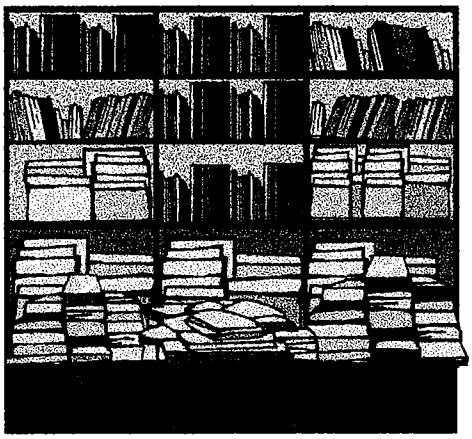
pollutional effects. In streams subject to point and non-point pollutant loading, the benthic community is typically characterized by low species diversity, high densities of a few organisms, and potential dominance by species capable of tolerating extreme conditions, such as low dissolved oxygen levels (Cole, 1974; Pearson and Rosenberg, 1978). Streams exposed to siltation and toxic chemical pollution may exhibit a reduced or total lack of benthic organisms.

Analysis of the benthic macroinvertebrate community indicate that the sampled streams are reflective of streams with good to high quality, subject to little or no impairment from anthropogenic sources. This is evidenced through the overall high diversity of the benthic community, substantial representation in the sensitive groups of Ephemeroptera, Plecoptera, and Trichoptera, and the high abundance of these sensitive groups in comparison to tolerant groups (Diptera). The one exception to this general characterization was station #6, which exhibited a lower ratio of sensitive to tolerant groups than the other stations. Differences observed at this station may be attributable to poor habitat, specially extremely low flow conditions present at this station, rather than water quality influences.

IV. SUMMARY/CONCLUSION

A limited water quality and biological monitoring program was implemented within representative streams within the Tinicum Creek Watershed. The objective of this monitoring effort was to provide data which could be utilized to define the overall quality of streams within the watershed survey. Based on the data collected in this monitoring program, the streams within the watershed can be characterized as good to excellent in quality with little evidence of anthropogenic stresses. The resiliency of the stream to withstand anthropogenic stress (e.g. increased nutrient loadings) appears to be low. First, the streams are characterized by low flow and therefore have little dilutional assimilative capacity. Second, the dynamics (e.g. dissolved oxygen concentrations) of some streams appear to be influenced by algal dynamics. This is important because, currently, it appears that algal concentrations may be nutrient limited. An increase in nutrient loading could result in a corresponding increase in algal densities which could eventually lead to a degradation in water quality and eventually to the degradation of the biological community of the stream.

A List of References



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