

Updated 12/2003

**Watershed Restoration Action Strategy (WRAS)
State Water Plan Subbasin 03J
Poquessing Creek and Pennypack Creek Watersheds
(Includes the Delaware River and Tacony/Frankford Creek)
Philadelphia, Montgomery and Bucks Counties**

Introduction

Subbasin 3J consists of 149 square miles of the Poquessing, Pennypack, and Tacony/Frankford Creeks and the Delaware River from the confluence of Neshaminy Creek to the confluence of the Schuylkill River. This small, highly urbanized subbasin consists of only 91 streams and 158 stream miles. Poquessing Creek forms part of the boundary between Philadelphia and Bucks County. The subbasin is included in **HUC Area 2040202**, Delaware River, a Category I, FY99/2000 Priority watershed in the Unified Watershed Assessment.

Geology/Soils:

The middle section of the basin is within the Northern Piedmont Ecoregion, Piedmont Uplands (64c), comprised of metamorphic and igneous rocks, mainly schist and mica of the Wissahickon Formation, and gneiss and hornblende. The topography is relatively level except for steep slopes in the ravines along major streams; slope ranging from 15 to 20 percent. The soils of Piedmont Uplands have a moderate rate of infiltration.

The northern portion of the watershed, mainly north of the Pennsylvania Turnpike, consists of the Northern Piedmont Ecoregion, Triassic Lowlands (64a), containing coarse gray sandstone, conglomerate, fine-grained red or brown sandstone and shale of the Stockton Formation. Low ridges associated with diabase dikes and sheets interrupt the low rolling topography. The soils of the Triassic Lowlands have slow infiltration rates and a high runoff potential.

The lower third of the watershed and areas along the Delaware River consists of unconsolidated sand and clay of the Middle Atlantic Coastal Plain Ecoregion, Delaware River Terraces and Uplands (63a). This is an area of low relief that was mainly marshes prior to settlement. Most of the coastal plain within Philadelphia has been drained or paved over, severely altering and impeding water infiltration rates, resulting in a very high runoff potential.

Only 13 named streams and 91 total streams flow through the subbasin, the smallest number for any subbasin in the state. The low number is partly due to the relatively small drainage area of the subbasin; however, many streams that formerly flowed on the surface no longer exist and are not included in the Pennsylvania Gazetteer of Streams. Streams in the uplands section of the subbasin were filled with ash in the early 1900's and houses were built over them. Drainage from these streams was diverted into storm sewers or other streams. During the late 1990's some houses built over the fill began to sink and homes had to be evacuated. In 1999, houses in a two-block area built over two filled streams, Wissanoming Creek and Little Wissanoming Creek, had to be demolished because creek water flowing under the ash fill undermined the houses.

Land Use:

This extremely urbanized subbasin includes two-thirds of the city of Philadelphia. Subbasin 03J is the second smallest in the state but has the highest population density, over 1.16 million. The population is projected to decrease slightly to 1.1 million by 2040 as people continue their move to the suburbs or out of the area. Most of the coastal plain land adjacent to the Delaware River in Philadelphia has been used as industrial warehouses, waste ponds, sewage treatment plants, and railroad yards. The U.S. Army and U.S. Air Force had warehouses along the Delaware River. Many of these buildings and warehouses were

abandoned and are crumbling or being torn down. Some of this area has seen a revival as upscale shops and restaurants in two areas along the river, Penn's Landing at the southern end and at the old U.S. Army arsenal near the Frankford section of Philadelphia. A drinking water intake and treatment plant operated by the city of Philadelphia is located along the Delaware River at Torresdale, near the upper end of the subbasin. A fish hatchery was located adjacent to the water plant. The high use I-95 parallels the Delaware River within ½ mile of its shore.

Natural/Recreational Resources:

The city-owned Poquessing, Pennypack, and Tacony Parks, part of the Fairmount Park Commission park system, provide riparian greenways and extensive natural areas within the highly urbanized subbasin. Portions of some smaller tributaries also have remaining riparian woodland parks. Cheltenham Township in Montgomery County has a 130-acre park on upper Tacony Creek, called Tookany Creek in Montgomery County. The entire length of Tacony/ Tookany Creek has a narrow riparian wooded buffer within township or city parks. An 8.8-mile long bike trail follows Pennypack Creek, starting at the upper end of the park and ending near the Delaware River. These parks also provide historical insights into the lives of the early inhabitants of the Philadelphia-lower Bucks County area, from the Native Americans through colonial times and the early industrial age.

DEP Chapter 93 High Quality (HQ) or Exceptional Value (EV) streams:

- None

Water Quality Impairment

This subbasin suffers from urbanization, resulting in point and nonpoint source pollution from urban/stormwater runoff, hydromodification, combined sewer overflows (CSO), heavy industry, and commercial and residential development. Even though the major streams have adjacent greenways, their water quality has been severely affected by runoff, habitat modification and extremely high water/flow fluctuations. Many of the greenways are narrow and severely eroded. The invasion of exotic plant species and soil compaction from intense recreational use has also taken their toll on streamside parklands. Japanese knotweed (fleeceflower) and multiflora rose are the most common exotic plants. The herbaceous knotweed has a shallow root system and does little to stabilize streambanks.

The lower few miles of Frankford Creek is ditched and flows partly through a cement channel. Many of the named tributaries to the Delaware River in the city have been buried or filled in and are now part of the storm sewer system. Sewers were laid in the streambeds to capture and divert stream flow into the sewer system. Smaller tributaries were added to the sewer system as spur lines. The sewers carry stream flow to the nearest large creek or river. The old streambeds and their floodplains were filled in, often with coal ash, cinders and incinerator waste. The steep slopes adjacent to the streams were filled in and houses were built over the old stream channels. In some cases the ground elevation over the old streambed is forty feet above the original stream level. Houses built over the old channels have settled over the years as the fill became saturated with water. Philadelphia has a total of 3,000 miles of sewer lines to maintain, many of which consist of old stream channels. A map of the buried streams can be found on the Philadelphia Inquirer web site in the July 11, 1999 issue, found at www.philly.com, under Archives.

Urbanization and paving can have a severe effect on stream aquatic life. Studies by the Maryland Department of Natural Resources indicated that a reduction in stream aquatic species diversity may begin with as little as 2% impervious cover. Maryland streams with above 15% impervious cover were rated fair to poor for aquatic species. When the impervious cover reached 25%, species diversity was significantly reduced. Riparian vegetation removal and paving affect both stream water temperature and habitat for aquatic species. Organisms most affected include many species of reptiles and amphibians, brook trout, and stoneflies. Stormwater runoff from paved areas can also wash out oil and grease and

other pollutants into streams. The paved areas also restrict replenishment of groundwater and contribute to flash flooding during storm events and extreme fluctuations in stream water levels. Extreme flow fluctuations cause difficulties in the attachment of bottom dwelling organisms to the stream substrate and cause a scouring of the substrate. Retention of riparian vegetation in unnamed headwater tributaries, known as first order streams, which may comprise as much as 50% of the streams in a watershed, can be especially critical to the protection of organisms in the downstream watershed.

The latest PA Department of Environmental Protection 303d and 305b lists include unnamed tributaries, not just the named tributaries as in previous lists. The causes of impairment of many streams in this subbasin are water flow variability or flow alterations due to urbanization and new residential development.

Flooding and extreme water level fluctuations are serious problems for most of the streams in the subbasin since the huge amount of paving blocks infiltration of rainwater and promote runoff after storm events. Urbanization has also caused severe water base flow depletion in many of the stream channels. After heavy rains, these same streams carry a very high volume of water. This extreme fluctuation in flow makes conditions very difficult for the colonization and survival of aquatic life, especially bottom dwelling macroinvertebrates. Pennypack Creek is one of the subbasin streams subject to high water level fluctuations, despite having a wide riparian buffer. Several pumping stations located in the subbasin adjacent to flood control dikes and levees were installed in an attempt to control flash flooding.

Monitoring/Evaluation

The subbasin was assessed under the DEP unassessed waters program in 1999 and 2000. Ninety-six percent of the subbasin was determined to be impaired. Out of a total of 142.7 assessed stream miles, only 6.0 miles were determined to be unimpaired. The headwaters of Pennypack Creek and 6 of its unnamed tributaries were the only stream segments attaining water quality standards. Impairments were due to water, flow and habitat alterations, water/flow fluctuations, and excessive algae growth from stormwater/urban runoff and small residential development. Less than one mile of an unnamed tributary to Pennypack Creek was impaired by agricultural runoff. The tidal portions of the streams that enter the Delaware River were not assessed.

Sources of Impairment for Assessed Streams in Subbasin 03J based on 303d List and data collected through October 2000.				
Protected Water Use	Source of Impairment	Miles Impaired	% Impaired of Total Miles	Data Source
Aquatic Life	Small Residential Runoff	58	37%	303d List
Aquatic Life	Urban Runoff /Storm Sewers	57	36%	303d List
Fishing	Fish Consumption Advisory	26	16%	303d List

DEP biologists use a modification of U.S. Environmental Protection Agency’s (U.S. EPA) Rapid Bioassessment Protocol II (RPB-II) as the primary mechanism to assess Pennsylvania’s unassessed waters. This method requires selecting stream sites that would reflect impacts from surrounding land uses that are representative of the stream segment being assessed. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment. The length of the stream segment assessed can vary between sites. Several factors are used to determine site location and how long a segment can be, including distinct changes in stream characteristics, surface geology, riparian land use,

and the pollutant causing impairment. A biological assessment is conducted at each site, using the modified RBP II method. Biological surveys include kick screen sampling of benthic macroinvertebrates, which are identified to family in the field, and habitat surveys. Benthic macroinvertebrates are the organisms, mainly aquatic insects, that live on the stream bottom. Since they are short-lived (most have a one-year life cycle) and relatively immobile, they reflect the chemical and physical characteristics of a stream and chronic pollution sources or stresses. Excessive scour, nutrients, and siltation from severe stormwater runoff cause extremely poor conditions for colonization by benthic macroinvertebrates in most of this subbasin.

Urban and suburban areas have a significant amount of land developed as impervious surface, such as pavement on the ground or rooftops of buildings, directly linked to streams through piping without stormwater controls. Areas that were developed more recently may have some stormwater controls that are designed to limit the rate of discharge during storms, yet the benefits of most such controls are limited. A wide variety of pollutants are deposited or placed on impervious areas and urban/suburban landscapes. These pollutants include animal feces, oil, fertilizers, pesticides, anti-freeze solution, soot, and trash. Such materials are carried into the streams with stormwater.

In addition to the pollutant load carried by the stormwater runoff from urban areas, the aquatic habitats that run through urban areas suffer from serious disruption of their structure and hydrodynamics. These disruptions include increased the frequency of bank-full storm events and overall storm flows, and decreasing dry-weather base flows in streams. The results include bank destabilization, increased sediment load, increased scour, increased substrate embeddedness, and increased sediment deposition. Channels can widen and/or deepen, causing a loss or alteration of aquatic habitat. All of these structural impacts adversely affect aquatic life. Such hydrologic modifications associated with stormwater are important causes of aquatic use impairment in this subbasin.

These aquatic habitat alterations cause such severe stress on the aquatic ecology, that they alone would be enough to exclude a significant number of native organisms. The severity of the impacts from habitat alterations and water/flow variability may have the effect of masking any more subtle water quality problems that may exist, such as the potential presence of low-level toxic inputs from the atmosphere, groundwater discharge, or stormwater runoff.

Combined Sewer Overflows (CSOs) are another important source of impairment in the subbasin, especially on the main stem of Frankford/Tacony Creek in Philadelphia County and the unassessed tidal portions of the watershed. Approximately 87 CSO outfalls are located in the subbasin: 11 CSO outfalls discharge into the impaired portion of the main stem of Frankford Creek, and twelve more CSO outfalls are found in the unassessed tidal portion. Five more CSO outfalls are found on the tidal segment of Pennypack Creek, and an additional 59 outfalls on the tidal Delaware Estuary, which is nominally part of this subbasin. These sources occasionally discharge sanitary sewage mixed with stormwater, and thus have the potential to contribute to stream impairment. The stream segments impacted by this source make up about 30 miles or 19% of the subbasin.

The flow rates and total volumes of water for the CSOs discharges are unknown. No reliable information is available about the water quality of the discharges. The only information available is the number of hours that the outfall discharged per storm event. Available data indicates that on average, each site discharges approximately ten hours per month, or 120 hours per year.

High rainfalls result in washing of raw or partly treated sewage from sewage treatment plants (STP's) in the subbasin. Some of it is inadvertent, some the result of deliberate bypassing to avoid "washout" of under designed plants. Similarly, in some watersheds, particularly in the City of Philadelphia, combined storm and sanitary sewer systems still exist. These overflow through

CSO outlets into streams and the Delaware River when the capacities of the sanitary interceptor sewers are exceeded.

Stormwater washes materials off roads, parking lots, and other areas with impervious or semi-impervious surfaces. These materials include oil, antifreeze, road salt, trash and other substances. These contaminants are washed into storm sewers and streams. In major flood events larger items, including storage tanks, drums and porta-potties have been washed into streams.

During construction and agricultural activities, heavy rainfall can wash soils into streams, causing stream sedimentation, choking the aquatic life. In addition, sedimentation raises the streambed, making it more likely that successive storm events will cause flooding. In some areas, however, rapid high water flows can scour the bed of a stream, displacing silt and stones.

Future threats to water quality

The same water quality issues will likely continue to affect the subbasin. As public awareness increases through the efforts of the many citizens groups and the Fairmount Park Commission, the potential for remediation and water quality improvement should increase.

Restoration Initiatives

Pennsylvania Growing Greener Grants:

- \$25,000 (FY2003) to Philadelphia Water Department, Office of Watersheds to restore Tacony Creek using natural channel design.
- \$100,000 (FY2003) to Township of Cheltenham for stream bank restoration on Tookany Creek.
- \$291,000 (FY2002) to City of Philadelphia for watershed protection through “Green Building” technology. This project will install runoff mitigation measures at the proposed Police Forensic Science Center, including construction of bio-swales; planting of native vegetation; incorporation of bio-filtration; bio-remediation and recharge strategies to minimize stormwater runoff.
- \$100,000 (FY2002) to the Pennsylvania Environmental Council to create a detailed design plan and document (Phase I) for the area of the Delaware Riverfront between Bridesburg and the Pennypack tidal flat (transected by the Tacony-Palmyra bridge).
- \$72,000 (FY2002) to the Fairmount Park Commission to provide public access and environmental education at a freshwater wetland, a tidal wetland, and a public water intake for pedestrians, bicycles and wheelchairs at the Pennypack Park section. Boardwalks, a bridge and interpretive signs will be provided at each location.
- \$42,000 (FY2002) to the Aubury Arboretum to redirect stormwater runoff from adjacent properties; remove obstructions to the flow from two natural springs; daylight a stretch of stream; enhance existing meadow and restore degraded areas with native plantings.
- \$30,000 (FY2001) to Horsham Township to stabilize streambanks, remove invasive species, and re-establish vegetation along 600' of the banks of Park Creek in Kohler Park.
- \$626,100 (FY2001) to the Fairmount Park Commission to support removal of exotic invasive plant species and replacing them with native plant species, to accompany restoration of a 900 foot by 70-foot area on the Meadow Lake shoreline.
- \$98,000 (FY2000) to Upper Southampton Township for 175 feet of streambank stabilization, 500 feet of riparian buffer, a 4.36-acre wetland, 800 feet of streamside bioretention restoration, and 2 acres of pond restoration to intercept and treat stormwater runoff in the highly urbanized Poquessing and Pennypack Creeks.
- \$9,640 (FY2000) to the Upper Southampton Township Natural Resources Advisory Board to organize a Southampton Creek Watershed Association using the Natural Resources Advisory Board's assistance to bring together citizens and local government to solve the problems of poor watershed management.

- \$19,970 (FY1999) to the New Kensington Community Development Corporation for urban watershed restoration initiatives.
- \$13,000 (FY1999) to Awbury Arboretum to implement a new watershed protection education initiative aimed primarily at reaching the area urban youth and community that live in the city of Philadelphia.
- \$120,000 (FY1999) to the Partnership for the Delaware Estuary to promote corporate, business and industrial participation in the reduction of nonpoint source pollution through restoration, enhancement and conservation or creation of wetlands.

U.S. Environmental Protection Agency (EPA) Clean Water Act Section 319 Grants:

- \$30,000 grant (FY2001) to Cheltenham Township for streambank restoration in their township owned park along Tookany (upper Tacony) Creek
- \$50,000 grant (FY1999) to Cheltenham Township for streambank restoration in their township owned park along Tookany (upper Tacony) Creek
- \$125,000 grant (FY1999) the Fairmount Park Commission for restoration of 1400 feet of streambank in their city owned park along Tacony Creek

Department of Conservation and Natural Resources (DCNR):

- Rivers Conservation Grant:
 - \$25,000 (1999) to Cheltenham Township and the Heritage Conservancy to develop a Tookany Creek River Conservation Plan
- Keystone Land Trust Program Grant:
 - \$200,000 to the Pennypack Ecological Restoration Trust to acquire 33 acres known as the Bethayres Woods along Pennypack Creek in Lower Moreland Township.

WREN Grants for Local Source Water Protection:

- 1999 Manayunk Canal Project in Philadelphia
- 1999 Belmont Water Intake Protection Project in Philadelphia

Pennsylvania Fish and Boat Commission Aquatic Resource Conservation Grants:

- \$5,000 (2000) to Cheltenham Township for streambank restoration on Tookany Creek.

Pennypack Ecological Restoration Trust:

- An active reforestation and ecological restoration program was begun in 1990 in their 683- acre natural area preserve in central Pennypack Creek watershed. Nearly 8,000 trees were planted as of summer 1999, including four riparian area projects. They also have ongoing programs to control non-native plant invasions. More information on their activities can be found on their website at <http://www.libertynet.org/pert>.

Public Outreach

Watershed Notebooks

DEP's website has a watershed notebook for each of its 104 State Water Plan watersheds. Each notebook provides a brief description of the watershed with supporting data and information on agency and citizen group activities. Each notebook is organized to allow networking by watershed groups and others by providing access to send and post information about projects and activities underway in the watershed. The notebooks also link to the Department's Watershed Idea Exchange, an open forum to discuss watershed issues. The website is www.dep.state.pa.us. Choose Subjects/Water Management/Watershed Conservation/Watershed and Nonpoint Source Management/Watershed Notebooks.

Citizen/Conservation Groups:

- Delaware Riverkeeper Network
- Concerned Citizens of the Delaware Valley
- The Heritage Conservancy
- Friends of High School Park (Tookany Creek)
- Glenside Green

- Wyncote Audubon Society
- Friends of Ralph Morgan Park
- Friends of Tacony Creek Park
- Community Resources
- William Penn Foundation
- Pennypack Ecological Restoration Trust
- Friends of Pennypack Park is an advocacy group formed in 1987 that is dedicated to the improvement of the park and the water quality of the Pennypack Creek. More information on their activities can be found on their website at <http://www.balford.com/fopp>.
- Mill Creek Council
- Friends of Poquessing Watershed, Inc. of Philadelphia and Bucks County, is dedicated to the conservation and beautification of Poquessing Creek and its environs. Their goals include increasing awareness of the watershed, improvement of water quality and environmental conditions of the creek and its wetlands, and creation of a passive linear trail for walking and wildlife appreciation. More information and links to other web sites on the history of northeast Philadelphia and lower Bucks County and other area citizens groups, parks and environmental centers can be found on their website at <http://www.friendsofpoquessing.org/>.
- Friends of Tookany (upper Tacony) Creek Park
- New Kensington Community Development Corporation

Water Quality Improvement Projects:

The Fairmount Park Commission, with the assistance of the Academy of Natural Science of Philadelphia (ANSP), developing a master plan for each of their parks. The ANSP has been conducting assessments of the plants and animals of terrestrial and aquatic habitats in the park. Major restoration plans include control of exotic species, increasing riparian buffers, reducing the amount of mowed areas, construction of new wetlands and expansion of existing wetlands, removing dams, reopening existing covered and channelized streams, stabilizing streambanks, and constructing berms and buffer strips to control stormwater runoff. More information on their activities can be found on their website at <http://www.nlreep.org/>.

Tacony/Frankford Creek

Tacony Creek Park was purchased by ordinance in 1915 by the City of Philadelphia. Park is a narrow strip of land containing 302 acres, 152 of which are designated natural lands. The park connects at the northern section to the Tookany Park corridor in Cheltenham Township, Montgomery County. In the southern section, below what is now Juniata Park, the Tacony Creek joins buried tributaries to form the Frankford Creek. Most of the tributary system of Tacony Creek in the park has been converted into storm sewers. The storm sewer outlet in Juniata Park now drains one-eighth of the surface area of the city of Philadelphia.

The Fairmount Park Commission is studying Tacony Creek Park as part of their Natural Lands Restoration and Environmental Education Program (NLREEP). They, along with the Patrick Center for Environmental Research at the Academy of Natural Sciences of Philadelphia, are developing the Tacony Creek Park Natural Lands Restoration Master Plan. Development of the master plan has had considerable community participation through public meetings and other activities. Youth from the City of Philadelphia have been helping to plant trees and remove trash in city parks. Through these activities inner city youth are becoming more aware of the natural world.

The Fairmount Park Commission is also restoring natural meadows. Meadows have been created or enhanced by restricting mowing to once a year. Less frequent mowing not only results in an increase in diversity of native plants, colonization by a variety of animal species and reduction in staff time and

money, but also helps decrease the amount of stormwater runoff. One of the newly created meadows is located in the Rising Sun Avenue portion of Tacony Creek Park.

Large-scale restoration projects have begun or are in the planning stage for Tacony Creek Park. Project will include construction of stormwater detention basins, repairing tributaries, and planting of riparian buffers. In the Juniata Park portion of Tacony Creek Park, 395 trees and 787 shrubs were planted on a 2 acre upland slope and 550 trees and 2268 shrubs were planted on another 7.1-acre area, and an infiltration trench was installed to alleviate stormwater damage. In a different area of the park, part of a 10-foot wide paved path and a footbridge were removed, and a 1.6-acre area was planted with 75 wetland shrubs and 1838 herbaceous wetland plants. The area of the park located between Rising Sun Avenue and the railroad has been the focal point for invasive species removal and native tree and shrub plantings.

The Philadelphia Water Department is spearheading a partnership developing a conservation plan for the Frankford/Tacony/Tookany Creek in Philadelphia and Montgomery County. The water department is planning to construct a self-guided tour spanning a distance of one mile.

Pennypack Creek watershed

The Fairmount Park Commission conducts many environmental education activities at their city parks. Programs involve hands on projects such as reforestation and aquatic invertebrate studies, litter clean up, and removal of non-native vegetation. These activities provide valuable lessons on the environment for inner city children. The Pennypack Environmental Center located on 100 acres of Pennypack Creek Park is a prime environmental education site.

In 1998, the Fairmount Park Commission undertook several initiatives to test various planning, design and management techniques on their parklands. Through these efforts, 50 community volunteers and students of two local high schools restored a 425-foot section of Pennypack Creek streambank. The streambank had eroded from stormwater runoff surges and lack of stabilizing vegetation. The banks were restored to a 3:1 slope armored with coir logs and netting, replanted with shrubs and native perennial grasses, and fenced to exclude deer. The restoration was successful; however, exotic plants had invaded the newly planted area within 6 months. Japanese knotweed eradication through various mechanical means was unsuccessful and herbicides had to be applied. The streambank remained stable for 15 months until flooding from Hurricane Floyd ripped out most of the structures and vegetation. Volunteers restored and replanted the banks in summer 2000. This project showed that streambank restoration projects should not be installed and ignored, and that regular follow-up maintenance and monitoring is the only way to ensure that a successful project will remain a success.

The Philadelphia Water Department (PWD) organized and held a public meeting at the Pennypack Environmental Education Center to explain the Rivers Conservation Plan process to interested citizens and stakeholders. PWD is leading the effort to develop the plan for the restoration of the Pennypack watershed. PWD plans to start a Pennypack Watershed Partnership to encourage local groups to work together on future projects benefiting the watershed.

The Center for Sustainable Communities at Temple University Ambler (CSC)

In July 2002, the CSC began a 30-month study of the Pennypack Creek watershed to tackle important issues related to the watershed. The study is being funded in part by a \$330,000 grant from the William Penn Foundation, headquartered in Philadelphia. Over the past 30 years, the Pennypack Creek watershed has undergone tremendous urbanization. The creek, which has swelled over its banks during devastating storms such as Hurricane Floyd, has become infamous with excessive flooding resulting in lives lost and millions of dollars in damage. The 56-square-mile Pennypack Creek watershed includes a population of about 640,000 people, according to the Philadelphia Water Department. In addition to the City of Philadelphia, the townships and boroughs located wholly or partially in the watershed include: Abington,

Bryn Athyn, Cheltenham, Hatboro, Horsham, Jenkintown, Lower Moreland, Rockledge, Upper Moreland, Upper Southampton, and Warminster.

The Pennypack Creek watershed has become a major stormwater problem area. The upper reaches of the Pennypack Creek have given way to 'mega-mall'-type development and all of the water runoff enters the creeks through storm sewers. The hydrology for the watershed has been changed and flood peaks have increased. Stormwater runoff in the upper watershed has flooded people downstream who thought they were safe. Storms like Hurricane Floyd and Tropical Storm Allison far exceeded the 100-year flood level. This study of potential hydrologic impacts on all of the municipalities in the watershed will help individual municipalities take actions that will not adversely affect the downstream municipalities.

The study will provide an updated set of floodplain maps, and undertake hydrologic and extensive Geographic Information Systems (GIS) mapping for the watershed. Standardized stormwater and floodplain ordinances and handbooks on best management practices will be developed. The study will provide the essential information for a stormwater plan for the Pennypack Creek. University experts will conduct water quality monitoring in addition to providing municipal officials with better technical information to implement open space and stream corridor protection plans. CSC will provide the research for the study; the individual municipalities will have the responsibility to implement the results. The study includes an extensive public information and involvement program, including a website to post study progress and provide opportunities for the public to comment on study proposals, and workshops for municipal officials and interested members of the public. More information is available on the Temple University Ambler website at www.csc.temple.edu/pennypack.

Anticipated short-term and long-term study outcomes include:

- Identification of at-risk houses located in floodplain areas that should be removed
- Preparation of new maps that will delineate extensive, accurate floodplain zones to help communities reduce the potential for flooding
- Analysis of existing stormwater facilities and recommendations to improve stormwater management
- Storm sampling to help pinpoint sources of pollution and assess how it can best be managed in order to enhance water quality
- Preparation of detailed GIS maps and identification of alternative open space and riparian corridor proposals
- Public comment and response to help guide decision-makers

When the plan is completed in 2004, the municipalities can explore their options and begin to protect and improve the environmental quality of the watershed through the implementation of stormwater and floodplain ordinances, water quality improvement measures, open space preservation, ecological restoration, and improved stormwater management

Funding Needs

The total dollars needed for addressing all nonpoint source problems in the watershed is undetermined. Stream assessments have been conducted and TMDLs will be developed for impaired waters in the subbasin. Watershed restoration plans developed for impaired waters will help determine what Best Management Practices (BMPs) are necessary to reduce pollution sources and provide estimates of restoration needs.

Funding sources available to support the development of site-specific implementation plans and remediation projects that address the sources of water quality impairment include the EPA Clean Water Act Section 319 grant program and the newer Pennsylvania funded Growing Greener program which target reductions in nonpoint source pollution. Pennsylvania has generally placed more emphasis on

funding projects slated for implementation on water bodies where TMDLs have been completed or where water quality impairments have been documented.

Restoration Needs

The problems and impairments associated with urbanization are difficult to correct due to the amount of paving for housing and business. Many of the old industrial sites within the city have been abandoned; 100's of run-down houses are torn down every year. These newly opened areas could be put into open space use as parks, community gardens, and stormwater retention basins which could help reduce water and flow fluctuations in the creeks. The potential exists for natural restoration of the corridors of streams such as Frankford Creek whose channel was ditched and cemented many years ago. The Awbury Arboretum Association received a Growing Greener grant in 2000 dedicated to increasing environmental awareness and restoration of Frankford Creek. Restoration efforts lead by the Fairmount Park Commission and Cheltenham Township are underway in the upper portion of the Frankford Creek system known as Tacony/ Tookany Creek.

Fully developed watersheds lead to specific problems associated with extreme runoff from rapid increases in storm flow and degraded riparian habitat. Invasive non-native plants such as purple loosestrife, Japanese knotweed, multiflora rose, and phragmites, are often the few plants that can survive such poor riparian habitat and harsh conditions. Not only is riparian vegetation diversity very low, but also the non-native plants often expose the stream to fully sunlight, which increases stream temperatures and prevent reestablishment of native woody species. The stream channels become deeply incised due to the extreme flow fluctuations. The banks become undercut and create further slippage of the banks and destruction of the riparian habitat. In other areas, the grass is mowed right up to the streambanks, which destroys riparian habitat and also allows sunlight to reach the stream and warm water temperatures.

Urban runoff is a profound social and structural problem which is very difficult to approach from a remedial point of view. The problem has a structural component, which can be traced to the way that American communities have traditionally provided for stormwater engineering. Reconfiguring existing structures may provide some benefit. Unfortunately, poorly designed projects may be implemented, at significant cost, without providing any net benefit. Some municipalities, community groups, and private landowners have begun to look for restoration project ideas to address this.

Pollutants may be addressed to some degree by modifying land-use practices, and thus limiting the quantity and type of polluting material that is deposited on the land. Such programs may be widely varied, depending on the pollutant to be targeted. Representative sampling of stormwater discharges would help to identify the specific chemical pollutants that seem to be the most prevalent in a given area. Some efforts under the existing NPDES program represent an attempt to address these issues. Philadelphia holds a NPDES permit under Phase I of EPA's Stormwater Regulations, and many of the smaller municipalities in the watershed will be required to obtain NPDES Stormwater Permits under Phase II of EPA's Stormwater Regulations. These permits may serve to motivate and empower municipalities to deliberately reduce the pollutant load in stormwater. Combined sewer overflows are also to some degree addressed through existing permitting. The City of Philadelphia is implementing a DEP-approved Long Term Control Plan for reducing the volume and frequency of discharges.

Potential Remediation Methods:

- Re-engineering of stormwater control and conveyance systems in established communities, to reduce the rate of discharge, increase groundwater recharge, and try to re-establish pre-development hydrodynamics.
- Restoration, where appropriate, of riparian structure and vegetation, to try to re-establish pre-development riparian and aquatic conditions.

- Monitoring in-stream water quality to assess the possible presence of toxic contaminants, whose impact may be masked by the fact that aquatic organisms are excluded due to habitat degradation.
- Monitoring the chemistry of stormwater, to assess what contaminants are present so that land-use practices may be targeted for pollution reduction.
- Monitoring the volume and/or water quality of CSO discharges to assess their actual impact.

References/Sources of information

- State Water Plan, Subbasin 3, Lower Delaware River. Department of Environmental Protection, July 1983
- USGS Topographic Maps
- 319 project proposals and summaries
- DEP: Watershed Notebooks, Unified Assessment Document, and information from databases.
- Map of Draft Level III and IV Ecoregions of Pennsylvania and the Blue Ridge Mountains, Ridge and Valley, and Central Appalachians of EPA Regions III
- From the Mountains to the Sea: The State of Maryland's Freshwater Streams. Maryland Department of Natural Resources and U. S. Environmental Protection Agency. EPA Publication EPA/903/R-99/023. 1999.
- Information from project proposals submitted to the Growing Greener and 319 grants programs.
- Baseline Assessment of the Condition of State Water Plan Watershed -(3J) Pennypack. 20001. Environmental Futures Team Assessment. DEP Southeast Regional Office.
- Newsletter and website of the Fairmount Park Commission's Natural Lands Restoration and Environmental Education Program.

Streams in Subbasin 03J: 303d/305b Listings

Stream	Stream Code	Drainage area square miles	<i>Miles Attained</i>	Miles Impaired	Causes/Sources
1-Delaware River	00002			<u>22.73</u>	<u>Fish consumption advisory for PCB and Chlordane</u>
2-Poquessing Creek & 5 UNTs	02468	21.6		14.71	Small residential runoff: Flow alterations, excessive algal growth, water/flow variability, habitat alterations
3-Black Lake Run	02478	0.86		0.74	Urban: Flow alterations, excessive algal growth, water/flow variability, habitat alterations
3-Byberry Creek & 3 UNTs	02470	7.48		7.76	Urban: Flow alterations, excessive algal growth, water/flow variability, habitat alterations
4-Walton Run & one UNT	02471	2.90		3.86	Urban: Flow alterations, excessive algal growth, water/flow variability, habitat alterations and Cause unknown
2-Pennypack Creek	02409	56.1	<i>2.55 Main stem; 3.45, 6 UNTs</i>	17.32 Main stem; 23.83, 22 UNTs 0.34 Main stem 0.77, one UNT	Small residential runoff & Urban: Flow alterations, excessive algal growth, water/flow variability, habitat alterations; Unknown causes; Municipal point source: Pathogens AG: Cause unknown & Urban
3-Southampton Creek & 6 UNTs	02450	6.13		8.43	Small residential runoff: Flow & habitat alterations, water/flow variability
3-Huntingdon Valley Creek & 2 UNTs	02440	3.89		4.59	Small residential runoff: Flow & habitat alterations, water/flow variability
3-Robinhood Brook	02430	3.79		1.01	Small residential runoff: Flow & habitat alterations, water/flow variability
4-Meadow Brook & 4 UNTs	02431	0.81		4.32	Small residential runoff: Flow & habitat alterations, water/flow variability

3-Rockledge Branch	02422	0.72		1.12	Small residential runoff: Flow & habitat alterations, water/flow variability
3-Sandy Run	02415	2.79		0.70	Small residential runoff: Flow & habitat alterations, water/flow variability
3-Wooden Bridge Run & 3 UNTs	02411	3.57		4.15	Small residential runoff: Flow & habitat alterations, water/flow variability
2-Frankford/ Taony (Tookany) Creeks & 8 UNTs	02389	37.0		18.36	Urban & Small residential runoff: Flow & habitat alterations, water/flow variability
3-Mill Run	02400	2.05		1.08	Urban: Flow alterations, water/flow variability, habitat alterations
3-Jenkintown Creek & 2 UNTs	02396	1.84		2.99	Urban: Flow & habitat alterations, flow variability
4-East Branch Jenkintown Creek	02398	0.52		0.61	Urban: Flow & habitat alterations, flow variability

Streams are listed in order from upstream to downstream. A stream with the number 2 is a tributary to a number 1 stream, 3's are tributaries to 2's, etc.

The subbasin was assessed under the DEP unassessed waters project in 1999.

Total miles listed as impaired or attained include unnamed tributaries (UNTs) where indicated.