Lower Neshaminy Creek Watershed Conservation Plan

Eight Arch Bridge over the Neshaminy

October 2004

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II. Rivers Conservation Plans

The Lower Neshaminy Creek Watershed Conservation Plan is a collaborative effort initiated under the Rivers Conservation Plans program, which was developed by the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) with the goal of "conserving and enhancing river resources through preparation and accomplishment of locally initiated plans" (PA DCNR).

The completed Rivers Conservation Plans (RCP) are listed on the Pennsylvania Rivers Registry, which "promotes river conservation and recognizes rivers or river segments in communities who have completed rivers conservation plans. The registry is also an avenue to endorse local initiatives by binding them together in a statewide recognition program. In order for a river to be placed on the registry, it must have an approved plan and local municipal support. Registry status must be achieved to qualify for implementation, development or acquisition grants"(PA DCNR).

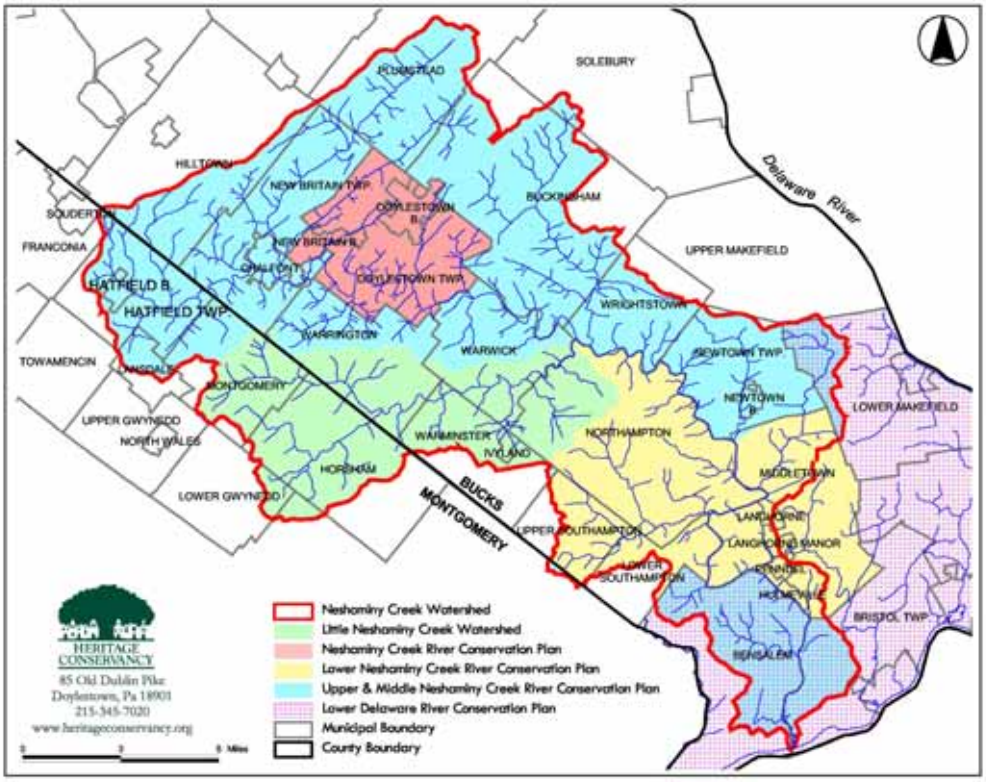
In 1997, the Doylestown Township Environmental Advisory Committee completed an RCP for the Neshaminy Creek in the vicinity of Doylestown Township. This plan was the fifth to be placed on the state rivers registry and the first to incorporate Geographic Information Systems (GIS) mapping.

The Delaware Riverkeeper completed an RCP for the Upper and Middle Neshaminy Creek Watershed in 2002. The Neshaminy Creek, from the Bensalem border to its confluence with the Delaware River, was included in the Lower Delaware RCP, which Heritage Conservancy completed in 1999. The Lower Neshaminy Creek Watershed Conservation Plan (LNWCP) will complete RCP coverage for the main stem Neshaminy Creek Watershed. The Little Neshaminy Creek RCP is scheduled for completion in 2006.

While the geographic areas and completion dates are different for the different Neshaminy Creek RCPs, the plans have many common goals and objectives. Efforts should be made to implement actions that span the different RCP areas in a comprehensive fashion that benefit the whole watershed.

Figure 1 - shows the areas of the Neshaminy Creek watershed that are covered by Rivers Conservation Plans.

Figure 1 - Neshaminy Creek River Conservation Plans



III. Steering Committee

A steering committee for the LNWCP was established in July 2002, and is comprised of watershed stakeholders, local, county and state governmental agencies, environmental groups and utilities. The purpose of the steering committee is to identify the important river related values and issues of concern to be included in the RCP, as well as proposing management options for the watershed.

The steering committee identified the RCP goals, which provided direction for the planning process. Representatives also provided critical assistance in the development of the plan. The committee reviewed draft plans, assisted in hosting, organizing and advertising public participation events, mailed and distributed plan questionnaires.

The steering committee has provided essential input for identifying management options and an implementation schedule for the RCP. Its members are:

- Lois Abbott, Langhorne Manor Borough
- Joe Amodei, Neshaminy Floodwater Association and Hulmeville Borough
- Terri Bentley, Bucks County Planning Commission
- Lola Biukians, Supervisor, Upper Southampton Township
- Chris Blaydon, Mayor, Langhorne Borough
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- Erich Wendel, Assistant Township Manager, Middletown Township
- Carol Zetterberg, Langhorne Open Space Inc.

IV. Plan Goals

The RCP goals were identified by the steering committee during the initial phases of the planning process. Goals reflecting the needs and desires of the local stakeholders and community were developed through facilitated discussion and consensus building. A set of objectives to support these goals was then developed by the steering committee, and is listed below.
(A prioritized list appears in Section XII of this report).

Water Quality

Protect and improve the water quality in the Neshaminy Creek Watershed to improve recreational opportunities, wildlife habitat and sources of drinking water.

Stormwater

Improve the way stormwater is managed in the watershed to reduce flooding, protect stream baseflow, and maintain the hydrologic balance.

Flood Damage

Reduce impacts from flooding on economic, historic and natural resources.

Important Resource Areas

Identify and protect the unique historical and scenic resources of the watershed.

Biological Resources, Wetlands and Recharge Areas

Promote the recharge of groundwater resources and protect floodplains, streambanks, wetlands, riparian, natural areas and areas of biological importance.

Parks and Recreation

Increase recreational opportunities, link greenways throughout the watershed and promote open space acquisition.

Education and Coordination

Educate the public, including builders, municipalities and residents, about reducing negative impacts from their activities, on floodplains and riparian areas.

V. Issues, Concerns and Constraints

The Lower Neshaminy Creek Watershed suffers from issues that are typical of post-World War II suburban development in the Delaware Valley. Flooding, streambank erosion, degraded water quality and loss of wildlife habitat are a direct result of the rapid urbanization of this region.

The Lower Neshaminy Creek Watershed has experienced serious periodic flooding, with millions of dollars in property damages caused by the Neshaminy Creek overflowing its banks since the flood of record in 1955. In September 1999, Hurricane Floyd caused the Neshaminy Creek to reach the 100-year flood stage, resulting in damage to hundreds of homes and businesses. The following summer a localized storm brought eight inches of rain to Upper and Lower Southampton in a period of three hours, damaging more homes and businesses.

The flooding issue is strongly related to the way stormwater is managed in the watershed. Development has increased the quantity of stormwater runoff as well as the velocity in which that water travels into streams. Detention basins, traditional stormwater controls implemented since the late 1970s, have reduced the peak discharges of stormwater into the watershed but have prolonged the discharge period.

This situation has resulted in receiving streams being subject to longer periods of bank full flows. New stormwater regulations address new construction only and will have little or no impact on current conditions which have resulted in historical flooding in the Lower Neshaminy Creek Watershed. Locally, the lower portion of the watershed, largely developed in the 1950s, has inadequate stormwater infrastructure to handle the 100-year storm. The county and federal government have begun buy-outs of the most susceptible properties, but a watershed wide review of the way land is developed and stormwater is managed will be the most successful method of reducing further loss of property.

Stormwater flows have also affected the aquatic habitat and stream morphology of the Neshaminy Creek. Increased velocity of stormwater flows, combined with the highly erodable soils found in the watershed, has resulted in severe streambank erosion and stream sedimentation. Banks of eight feet and more are not uncommon in the Lower Neshaminy Creek and some of its tributaries, and these eroding streambanks contribute sediment that forms silt islands and smothers aquatic habitat. Eroding streambanks are another source of property loss as home and business owners literally lose ground to the streams in the area.

Water quality in the Lower Neshaminy Creek is subject to a large variety of point and non-point sources of pollution. There are 15 municipal wastewater discharge points upstream from the study area. The region's sewer infrastructure runs parallel to and crosses under the creek throughout

the study area, adding the potential for inputs into the stream from leaks in the sewer infrastructure. The Pennsylvania Department of Environmental Protection (PA DEP) identifies sediment, nutrients and water flow variability as the sources of water quality impairment in this watershed. Improving water quality in this lower portion of the watershed will require the cooperation and coordination with upstream communities for both the management of municipal point source discharges, as well as better stormwater management to reduce nutrient and sediment inputs.

The current built environment in this region makes gains in natural and public open spaces very difficult. There are, however, many natural open areas within the RCP study area, and these represent islands of green in the built environment. Connections and greenways between these islands have the potential to improve the natural environment and physical well being of the region's residents. Greenways and corridors benefit wildlife by increasing the amount of available habitat. Development and acquisitions of these greenways will prove to be a challenge for future planning and implementation efforts.

Concern for open spaces cannot stop at land preservation and acquisition. Open spaces need to be managed both to prevent the proliferation of invasive plant species in these natural areas, and to ensure proper public use and access to recreational facilities in active use areas. Open spaces are also critical to support wildlife diversity and to promote the recharge of the region's groundwater resources.

The Lower Neshaminy Creek Watershed still maintains many important natural, cultural and historical resources. The area boasts five sites listed in the county's Natural Areas Inventory (NAI), four historic districts on the National Register of Historic Places, a nationally significant archaeological site, the most visited park in Bucks County, a potential Audubon Important Bird Area and many other resources.

Many of the issues, concerns and opportunities of this region are directly related to the Neshaminy Creek and the manner in which the land in the watershed has been developed. The region was not converted from pristine forest to bedroom communities overnight, nor will streambank erosion and flooding cease in the near future. Improvements to this region's natural, economic and built environment can be accomplished through good planning and cooperation among the various watershed stakeholders.

This RCP can bridge the goals and objectives of plans for both the upstream and downstream sections of the Neshaminy Creek watershed. This plan shares (among other goals), the goals of improving water quality, restoring riparian buffers and educating watershed residents with the Neshaminy, Upper and Middle Neshaminy and Lower Delaware RCPs. The completion of this plan and it's successful listing on the state River Registry has the potential to reenergize implementation efforts for these plans and can serve as a catalyst for cooperation between communities in the upper and lower

reaches of the Neshaminy Creek watershed. With the completion of the Little Neshaminy Creek RCP (the last section of the Neshaminy Creek watershed lacking an RCP), plans for the Neshaminy Creek Watershed should be reviewed to identify common themes and opportunities for implementation projects that will benefit the entire Neshaminy Creek watershed. A holistic watershed approach, that incorporates local solutions to watershed wide issues, may be the best strategy to conserve and reclaim this valuable resource.

VI. Project Area Characteristics

The study area encompasses 39.5 square miles (25,284 acres) of the Lower Neshaminy Creek Watershed that lie within the boundaries of Northampton, Middletown, Upper Southampton, Lower Southampton townships and Hulmeville, Langhorne, Langhorne Manor and Penndel boroughs in Bucks County. The study area includes 18.6 linear miles of the Neshaminy Creek and 51.6 miles of major tributaries as well as a small portion of the Queen Ann Creek watershed in Middletown Township. A map of the study area and sub-watersheds accompanies this report (**Map 1**). This area includes the last major section of the main stem Neshaminy Creek Watershed to receive an RCP.

The Neshaminy Creek, in this portion of Bucks County, generally flows in a southeasterly direction through gently sloping topography. The creek takes an almost ninety-degree turn westward along the Northampton-Middletown border. The creek takes another ninety-degree turn eastward when it reaches the Fall Line at the Bensalem Township border. This line marks the boundary between the Northern Piedmont and Middle Atlantic Coastal Plain physiographic regions.

The Lower Neshaminy Creek basin has a long history of human habitation. Peoples from prehistoric hunter-gatherers to modern suburbanites have found the region's mild climate, gentle topography and abundant water resources to be a hospitable place in which to live. Large scale, historic settlement of the region began with English Quakers in the late seventeenth century. Agriculture flourished in this area until the late 1940s, when most of this portion of the watershed was converted to housing as a first ring suburb of Philadelphia. Today, the majority of land-use in this study area is single family residential with pockets of commercial and industrial uses. Even though the majority of this watershed is developed, there are many important natural resources still present.

VII. Land Resources

Geology/Topography

The surficial geology and topography of this study area is detailed on the Geology and Topography maps that accompany this report (**Maps 2 & 3**).

Geology and topography exert great influence on the land uses and natural communities in a region. Regions with similar geologic and topographic characteristics are generally grouped into ecoregions or physiographic regions, and this study area includes portions of two physiographic regions: the Northern Piedmont and the Atlantic Coastal Plain.

The northern half of the study area lies within the Triassic Lowlands subsection of the Piedmont, with the Stockton formation being the predominant geologic formation. The Triassic Lowlands are characterized as a region of gentle rolling hills and ridges. The area of the watershed where the Neshaminy Creek takes a ninety-degree bend west indicates a transition into the Piedmont Uplands subsection.

The Piedmont Uplands are underlain by metamorphic geologic formations, mostly schist and gneiss, which are characterized by rounded hills and low ridges. A third subsection of the Northern Piedmont ecoregion, the Piedmont Lowlands, parallels the Fall Line and is underlain by a thin band of chickies quartz. The Fall Line separates the Northern Piedmont physiographic region to the north and west from the Atlantic Coastal Plain to the south and east.

The Atlantic Coastal Plain physiographic region is composed of unconsolidated sands and gravels deposited during the current Quaternary geologic period. The flat topography of the coastal plain contrasts with the gentle hills of the piedmont. There are very few unaltered natural areas left in the coastal plain in the Neshaminy Creek Watershed. Most of the land has been converted to human uses.

Elevations range from approximately 300 feet above sea level in the northern portion of the study area to approximately forty-feet above sea level at the Fall Line Running along the border between Middletown Township and Bensalem Township, the Fall Line continues east to bisect Langhorne Manor and Penndel Boroughs. The Fall Line can also be identified as the 40-foot elevation line on the topographic map and is identified in **Map 1**, the map of the study area. The Fall Line was so named because a series of falls on the Neshaminy Creek prevented early explorers from continuing further upstream by boat.

The *Bucks County Natural Resources Plan* identifies the Fall Line and a small pocket of Franklin Limestone in Lower Southampton as special geologic formations within the study area.

The following are descriptions of the characteristics of geologic formations in the study area. Descriptions are taken from *Engineering Characteristics of the Rocks of Pennsylvania,* and *Geology and Mineral Resources of Bucks County PA*. Table 1. details the surface geology statistics for the study area.

Chickies Formation

The main body of this formation is gray crystalline quartzite and light buff to white, feldspathic, sericitic quartz schists. This narrow band of quartzite extends westward across Bucks County from Morrisville. This formation has good surface drainage but groundwater yield is poor to moderate (~20 gallons / minute).

Felsic Gneiss, Pyroxene Bearing

This formation is a localized occurrence in the larger Baltimore Gneiss formation. This fine - grained granitic gneiss is resistant to weathering but shows good surface drainage, and median groundwater yields are below 20-gallons/minute.

Lockatong Formation

This formation is composed of dark gray to black argillite with occasional zones of limestone and black shale. This formation has good surface drainage but poor water yields (<35 gallons per minute).

Mafic Gneiss, Horneblende Bearing

This medium to fine - grained gneiss is highly resistant to weathering but shows good surface drainage. Median groundwater yields range from 20-36 gallons/minute at well-sited wells.

Metadiabase

This formation is composed of dark greenish to black diabase consisting of augite, feldspar and magnetite. It fractures in a blocky pattern, has good surface drainage but poor water yields (<5 gallons per minute).

Pennsauken and Bridgeton Formation

This formation consists of quartz, yellowish-brown gravel and yellowish-brown sands. The gravel, in some bodies, is granular in size and well sorted; other deposits range from pebbles to boulders. This is an important source of groundwater in southern Bucks County. Some wells yield >7,000 gallons/minute.

Stockton Formation

This formation is comprised of light colored sandstone, arkosic sandstone, and conglomerate sandstone. It also includes red to purplish-red sandstone, shale and mudstone. The formation is porous, permitting good surface drainage and good groundwater recharge. The Stockton formation usually provides a reliable supply of groundwater (~130 gallons / minute), and is suitable for agricultural and residential uses if density and coverage requirements are in place.

Stockton Conglomerate

A gray to reddish brown conglomerate, this fractures in a blocky pattern. The formation permits good surface drainage and is a good source of water. Wells are reported to yield 110 gallons per minute.

Wissahickon Formation

The Wissahickon Schist is composed of mica schist, gneiss and quartzite, in which the portions of mica, quartzite and feldspar vary from bed to bed. The formation is exposed where the Neshaminy Creek has cut through the overlying sediments of the Atlantic Coastal Plain.

Table 1 - Geologic Formations in Study Area

Formation	Acres	Percentage of Study Area
Stockton	**16,850**	**65%**
Felsic Gneiss	**4,615**	**18%**
Mafic Gneiss	**1,185**	**5%**
Stockton Conglomerate	**748**	**3%**
Pennsauken & Bridgeton	**720**	**3%**
Wissahickon	**681**	**3%**
Stockton Conglomerate	**748**	**3%**
Chickies	**480**	**2%**
Lockatong	**452**	**2%**
Metadiabase	**92**	**<1**

Source: PASDA

Soils

Soil characteristics are another physical attribute that affects the way that land is used and developed, as they are a factor in determining an area's suitability for farming, septic systems or the presence of drainage problems and erosion. Many municipalities will use soil characteristics to protect resources such as steep slopes and floodplains (see **Appendix A** for a matrix of municipal resource protection ordinances). The soils of this study area are generally in the Lansdale – Lawrenceville Association or the Urban Land - Chester Association. The Lansdale - Lawrenceville Association is comprised of moderately sloped, well-drained, upland soils, and the Urban Land – Chester Association is comprised of well-drained, nearly level, upland soils (Bucks County Soil Survey). The majority of land in this study area is classified as Urban Land, which is created when native soils are disturbed or destroyed by the construction process of homes, industry or active recreation

T he land use in this study area is overwhelmingly single family residential (43 percent) with pockets of open space and agricultural land uses.

facilities such as golf courses or ball fields. Soil characteristics of Urban Land are highly variable due to the highly disturbed nature of these soils.

Hydrologic Soil Groups (HSGs) are used by soil scientists to indicate the minimum rate of water infiltration obtained for bare soil after prolonged wetting. Soils are classified as A, B, C or D soils, with group A soils being well drained and suitable for septic systems and stormwater infiltration and group D soils being poorly drained or having a high seasonal water table. **Table 2.** indicates the infiltration rates of each soil group.

Table 2 - Hydrologic Soil Group Infiltration Rates

HSG	Infiltration Rate	Percentage of Watershed
A	**>0.3 in./hr.**	**1%**
B	**0.15-0.3 in./hr.**	**38%**
C	**0.05-0.15 in./hr.**	**18%**
D	**0-0.05 in./hr.**	**2%**
Urban Land	**Variable**	**41%**

Source: USDA Hydrology Handbook

A map of the Hydrologic Soil Groups is included with this report (**Map 4**). A matrix detailing the soil groups by name is included in **Appendix B,** and indicates five soils categories: soil depth, erosion potential, drainage potential, soil location, topography and hydrologic soil groupings. These categories indicate the potential limitations of these soils for land development and other anthropogenic uses.

Land Use

The land use in this study area is overwhelmingly single family residential (43 percent) with pockets of open space and agricultural land uses. Small areas of commercial land-uses dot the study area. The communities in this study area are considered "bedroom" communities for other commercial and industrial centers.

A map of land uses in the study area accompanies this report (**Map 5**). This map was generated by the analysis of aerial photos taken in 1995. The DVRPC is currently generating land use maps based on year 2000 aerial photos. **Table 3** indicates the acres and percentages of the study area in each particular land use.

Table 3 - Land Use Statistics

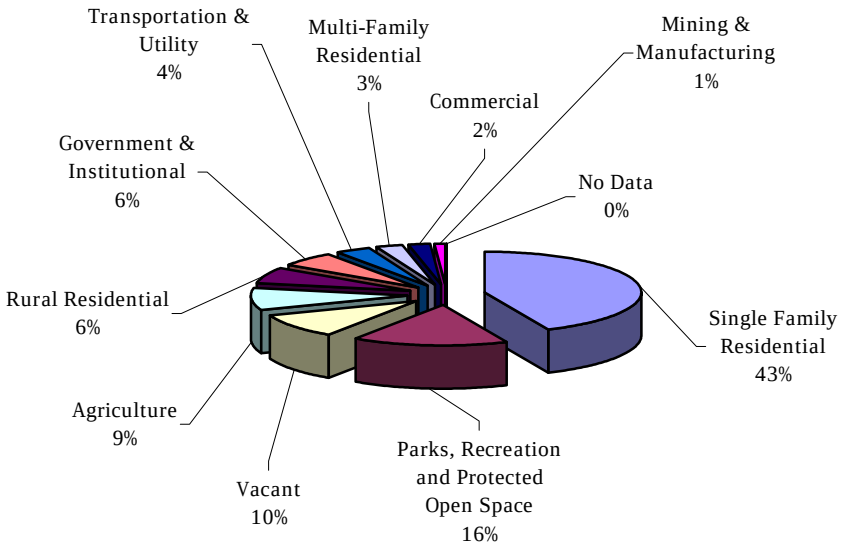
Description	Total Acres	Percent of Watershed
Single Family Residential	**9,459**	**43.4%**
Parks, Recreation and Protected Open Space	**3,508**	**16.1%**
Vacant	**2,098**	**9.6%**
Agriculture	**1,971**	**9.0%**
Rural Residential	**1,377**	**6.3%**
Government & Institutional	**1,268**	**5.8%**
Transportation & Utility	**807**	**3.7%**
Multi-Family Residential	**598**	**2.7%**
Commercial	**452**	**2.0%**
Mining & Manufacturing	**241**	**1.1%**
No Data	**23**	**0.1%**
Totals	**21,802**	**99.8%**

Source DVRPC

The majority of development in this area occurred prior to the implementation of stormwater management regulations enacted in 1978. Exceptions are large numbers of housing developments built in Northampton and Middletown townships in the 1980s. Subsequently, the majority of developments in this area have few, if any, stormwater Best Management Practices (BMPs) in place. Where BMPs are present, they are most likely detention basins intended to control peak run-off flows with little positive impact on water quality.

Since this study area is largely built-out, land use statistics closely resemble the generalized zoning for the study area. Zoning, or the land uses approved by local municipalities, should be periodically reviewed to ensure the best use for land is allowed by municipal ordinances. Mixed use and high-density developments offer gains in open space and stormwater management as older areas are redeveloped and community needs change. **Map 6** is the generalized Zoning Map of the study area.

Figure 2 - Land-use Breakdown



Source: DVRPC

Woodlots

Large parcels of wooded land provide habitat for wildlife, educational opportunities and places to retreat from the stress of everyday activities. These areas are important in replenishing groundwater resources and absorbing stormwater run-off. Wooded areas, especially those with public access, are an important but diminishing resource, and most of those in this study area are found within existing state, county or municipal parks. According to a Heritage Conservancy analysis of year 2000 aerial photos, there are approximately 3,900 acres of woodlands remaining in the study area.

Quarries

There is one quarry in the study area. The Delaware Quarries Inc. operates a small quarry on 13 acres in Middletown Township where they extract "Langhorne Stone" a mica-quartz building veneer. The quarry is operated as a surface mining operation. The quarry has a permit from DEP to discharge groundwater from the quarry into the Neshaminy Creek.

The quarry in the study area was located using the land use map and the DEP eFACTS database (www.dep.state.pa.us/efacts/).

Analysis

Stormwater

The Stockton, Stockton Conglomerate and Bridgetown/Pennsauken Formations (68 percent of the study area) permit good surface water drainage. Areas underlain by these geologic formations and which possess well-drained soils (HSG A & B soils; 39 percent of the study area) are candidate areas for infiltration stormwater BMPs. Infiltration BMPs will reduce stormwater run-off entering streams in the watershed and improve water quality by allowing the biota in the soils to process nutrients and some pollutants from stormwater. These areas may also be important areas for groundwater recharge, which in turn provides baseflow for the streams within the watershed. This study area's dependence on groundwater for drinking makes undisturbed recharge areas a protection priority as the population continues to grow. As the study area continues to be developed for housing, undisturbed native soils, which exhibit the best drainage potential, are becoming more rare.

The swath of the study area that is underlain by metamorphic geologic formations is generally not a good area for infiltration BMPs. In these areas, and where the predominant soils are HSG C, D and Urban Soils, other BMPs that improve water quality should be investigated. These BMPs are typically treatment ponds or wetlands that improve water quality with settling time and vegetation.

In 1997, the Bucks County Planning Commission (BCPC) released the *Lower Neshaminy Creek Watershed Water Quality and Stormwater Management Study*. This report assessed stormwater basins within the coastal plain municipalities of the Neshaminy Creek Watershed and offered recommendations of methods to retrofit those BMPs to improve water quality. The recommended BMPs and their benefits and drawbacks are detailed in **Appendix C**., which was taken from the BCPC report. This study should be revisited and used as a tool for improving stormwater management practices within the study area, and implementation of this study's recommendations should be considered.

Flood Damage

Disturbance of steep slopes and erodable soils should be managed within municipal ordinances to prevent greater sediment loading to the local watershed. Currently, all of the municipalities have ordinances that protect some percentage of natural cover on slopes greater than eight percent. Floodplain soils are also protected by ordinances in the study area municipalities, and enforcement and limiting of waivers to these ordinances is critical to protecting the watershed resources. **Appendix A**. details municipal resource protection ordinances.

Important Resource Areas

The Fall Line is an important natural and scenic resource in the region. The Fall Line provides scenic vistas and surficial expressions of this unique geology should be considered when developing preservation priorities. Control of non-native invasive species of plants is also critical in this area. The native vegetation that historically occupies this transition zone between the Atlantic Coastal Plain and the Piedmont Physiographic Region form unique biological communities and should be restored and protected on public lands.

The Fall Line coincidentally parallels a proposed greenway linkage along the Mill Creek from Churchville to Playwicki County Park.
Wooded land outside existing parkland should be targeted for preservation.

Education and Coordination

Single family residential is by far the largest land use category in the study area. By educating and engaging residents in resource protection activities, significant gains can be realized in protecting water quality and the natural resources of the watershed. The second largest land use category in the study area is classified as parks, recreation and open space. These public lands should be managed in an environmentally responsible manner, and should also serve as an example for the management of private property.

The following is a short list of possible programs/activities that can contribute to the environmental health of the region:

- Municipal rain barrel programs to reduce water run-off from residential properties.
- Municipal programming promoting management of open space for wildlife and water quality by reducing mown areas.
- Resident education about the importance of using native vegetation in home landscaping.
- Include non-point source pollution prevention education in school curricula.
- Homeowner education about mowing lawns along riparian areas especially along first order streams.
- Civic activities geared towards riparian restoration, invasive plant removal and habitat improvements on public lands.

Implementation of these educational efforts will also help the municipalities meet one or more of the minimum control measures required by the NPDES Phase II stormwater regulations.

Biological Resources, Wetlands and Recharge Areas

Due to this region's dependence on groundwater resources and its unique geology and soils, open space acquisition should support the Safe Drinking Water Act goals of protecting sources of drinking water. Wellhead

protection programs can identify areas of land that contribute to groundwater sources. These "zones of contribution" should be preserved for groundwater recharge and protected against possible sources of contamination, such as gas stations or certain industrial uses. Utilizing these lands for passive recreation and public open space will meet multiple land-use and resource protection goals. There is a lack of site-specific information regarding groundwater recharge potentials in this watershed, and this issue should be addressed.

VIII. Demographics

Demographic information was compiled using the U.S. Census Bureau's American Factfinder, and data is from the 2000 census. Information is included for entire municipalities, not just the portions of the municipalities falling within the Neshaminy Creek watershed. This situation leads to over-reporting of statistics for the study area, but still presents a valuable picture of the demographics of the study area.

Population

The total population of the municipalities within the study area is 124,786 people, which represents an increase of one percent from the 1990 census. Compared with the growth average for Bucks County (10.4 percent), this region is growing at a slower pace than the county as a whole. Most of the growth was within Northampton and Middletown townships, which coincidentally had the largest tracts of undeveloped land. The Southamptons, Penndel and Hulmeville lost population from 1990 to 2000. As first ring suburbs, municipalities within this region are beginning to face issues that fueled population declines in older boroughs and urban centers in previous decades. These issues, closely tied to the causes of suburban sprawl, include aging housing stock, federal subsidies for new construction and the desire for more private open space. DVRPC forecasts predict that Langhorne and Penndel boroughs will continue to lose population even while the rest of the region experiences growth. **Table 4.** details the population totals, population change and forecasts for the region.

Population projections for the next ten years predict growth rates from two to nine percent with Penndel Borough losing population (-0.8 percent). With the exception of Northampton and Middletown townships, growth within municipalities in the study area is likely to be in-fill and redevelopment. Population growth forecasts for Hulmeville, Langhorne and Langhorne Manor boroughs are atypical for older boroughs within the Commonwealth, most of which are losing population.

Population growth forecasts for Hulmeville, Langhorne and Langhorne Manor boroughs are atypical for older boroughs within the Commonwealth, most of which are losing population.

Table 4 - Population

Municipality	1990 Population	2000 Population	% Change	2010 Population Forecast	% Change
Hulmeville	**916**	**893**	**-2.5%**	**950**	**6.4%**
Langhorne	**1,361**	**1,981**	**45.6%**	**2,070**	**4.5%**
Langhorne Manor	**807**	**927**	**14.9%**	**980**	**5.7%**
Lower Southampton	**19,860**	**19,276**	**-2.9%**	**19,680**	**2.1%**
Middletown	**43,063**	**44,141**	**2.5%**	**47,870**	**8.4%**
Northampton	**35,406**	**39,345**	**11.1%**	**42,940**	**9.1%**
Penndel	**2,703**	**2,420**	**-10.5%**	**2,400**	**-0.8%**
Upper Southampton	**16,076**	**15,764**	**-2.0%**	**17,000**	**7.8%**
Total	**120,192**	**121,737**	**1.3%**	**133,890**	**10.0%**

Source: U.S. Census Bureau

Employment forecasts for the region exhibit a larger range of variation than do those for population. Employment figures for Langhorne Manor and Middletown are forecast to increase by more than 25 percent between 2000 and 2010, while employment figures for Langhorne Borough are forecast to decrease by 1.1 percent. Economic characteristics of the study area are detailed in **Table 5**. Employment figures for Bucks County are forecast to increase by nine percent. Unemployment figures for the study area range from one to three percent. These figures are close to but below the state unemployment rate of 3.5 percent.

Table 5 - Economic Characteristics

Municipality	% Unemployed	Median Household Income	Median House Value	% Families below poverty level
Hulmeville	**1.6%**	**$55,259.00**	**$148,000.00**	**0.8%**
Langhorne	**1.4%**	**$56,389.00**	**$172,220.00**	**2.6%**
Langhorne Manor	**2.2%**	**$67,500.00**	**$186,500.00**	**1.6%**
Lower Southampton	**2.0%**	**$57,011.00**	**$152,200.00**	**2.7%**
Middletown	**1.6%**	**$63,964.00**	**$155,000.00**	**2.1%**
Northampton	**1.5%**	**$82,655.00**	**$219,100.00**	**1.4%**
Penndel	**3.5%**	**$36,296.00**	**$132,900.00**	**2.4%**
Upper Southampton	**2.9%**	**$54,493.00**	**$175,800.00**	**1.5%**
Bucks County	**2.4%**	**$59,727.00**	**$163,200.00**	**3.1%**
Pennsylvania	**3.5%**	**$40,106.00**	**$97,000.00**	**7.8%**

Source: U.S. Census Bureau

Occupation statistics provide insight to the sources of economic health of the region. **Table 6.** details the percentages of people in each municipality in the respective occupational groups. Farming and forestry employment has virtually disappeared from this region, while the category of people who occupy professional or management positions form the largest percentage of residents in all municipalities except Penndel Borough. The largest percentage of Penndel residents appears to be employed in service occupations (23.6 percent).

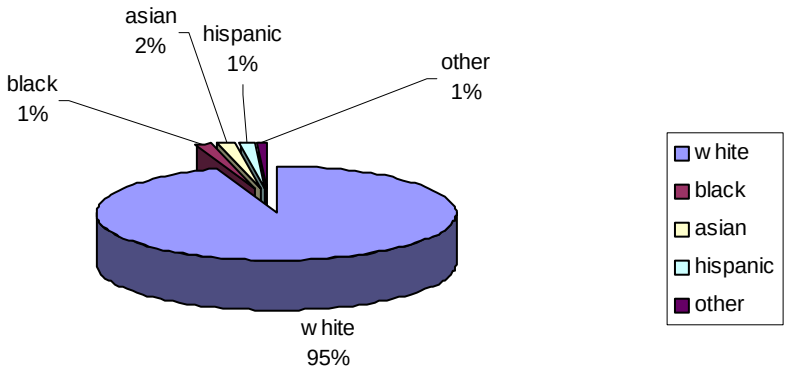
Table 6 - Occupation Statistics

Municipality	Management, Professional & Related	Service	Sales & Office	Farming, Fishing & Forestry	Construction, Extraction & Maintenance	Production, Transportation & Material Moving
Hulmeville	**33.1%**	**6.1%**	**25%**	**0%**	**18.9%**	**16.9%**
Langhorne	**45.5%**	**11.7%**	**27.3%**	**0.1%**	**7%**	**8.4%**
Langhorne Manor Borough	**48.4%**	**13.7%**	**25.1%**	**0%**	**4.8%**	**7.9%**
Lower Southampton	**33.8%**	**10.4%**	**33.4%**	**0%**	**12.9%**	**9.5%**
Middletown	**39.8%**	**10%**	**30.6%**	**0%**	**8.7%**	**10.9%**
Northampton	**47%**	**8.5%**	**31.6%**	**0.1%**	**5.8%**	**7%**
Penndel	**21%**	**23.6%**	**29%**	**0%**	**11.4%**	**15.1%**
Upper Southampton	**39.5%**	**8.5%**	**33.4%**	**0%**	**9.6%**	**9%**
Bucks County	**38.4%**	**10.7%**	**29.7%**	**0.2%**	**9%**	**12%**

Source: U.S. Census Bureau

Whites compose 95 percent of the population within the study area, followed by Asians at two percent, and blacks, Hispanics and others each composing one percent of the population, respectively. Langhorne Borough possesses the largest racial diversity with black or African Americans consisting of 15 percent of the population and Asians and Hispanics each consisting of one percent of the population. Racial makeup of the study area is less diverse than of Bucks County as a whole, where whites comprise 91.1 percent of the county population, followed by black or African Americans at 3.2 percent, Hispanic and Asians comprise 2.3 percent of the population each. **Figure 3.** details the percentages of major racial groups in the municipalities within the study area.

Figure 3 - Racial Make-up of Study Area



Source: U.S. Census Bureau

Table 7 - Racial Statistics

Municipality	White	Black	Hispanic	Asian	Other
Hulmeville	**887**	**0**	**1**	**3**	**2**
Langhorne	**1,587**	**300**	**20**	**72**	**2**
Langhorne Manor	**858**	**30**	**22**	**15**	**2**
Lower Southampton	**18,419**	**158**	**213**	**266**	**220**
Middletown	**41,004**	**893**	**993**	**779**	**472**
Northampton	**38,152**	**96**	**774**	**165**	**158**
Penndel	**2,199**	**90**	**20**	**92**	**19**
Upper Southampton	**15,227**	**101**	**87**	**221**	**128**
% of Population of Study Area	**94.86%**	**0.8%**	**0.7%**	**1.8%**	**1.0%**

Source: U.S. Census Bureau

Age characteristics of the study area are very similar to the county as a whole. The percentage of school age children under 17 years of age comprises 25.6 percent of the study area and 25.7 percent of the county population. This large segment of the population indicates a need for certain kinds of recreational facilities and programs as well as educational programs and opportunities. At the other end of the spectrum, the percentage of the population that is over 65 is 13.1 percent of the study area, as compared with 12.4 percent of the county as a whole. Recreational needs for the elderly population are clearly different from the under 17 population. This group also represents a segment of the population on a fixed income that may rely on public transportation and other municipal services to address quality of life issues. **Table 8.** details the specified age breakdown for each municipality. Upper Southampton has the highest portion of population over 65, at almost 20 percent

Table 8 - Age Characteristics

Municipality	Population under 17	% Population	Population over 65	% Population
Hulmeville	**212**	**23.7%**	**105**	**11.8%**
Langhorne	**519**	**26.2%**	**213**	**10.8%**
Langhorne Manor	**219**	**23.6%**	**122**	**13.2%**
Lower Southampton	**4,406**	**22.9%**	**2,762**	**14.3%**
Middletown	**11,565**	**26.2%**	**5,749**	**13.0%**
Northampton	**11,107**	**28.2%**	**3,929**	**10.0%**
Penndel	**519**	**21.4%**	**319**	**13.2%**
Upper Southampton	**3,401**	**21.6%**	**3,088**	**19.6%**
% of Population		**25.6%**		**13.1%**
% of Bucks County		**25.7%**		**12.4%**

Source: U.S. Census Bureau

Transportation

The vast majority of commuters over the age of 16 years that live in the study area utilize some form of automobile to get to work. Public transportation and walking is most utilized by residents of Langhorne and Penndel boroughs. **Table 9.** details the percentage of each municipality's population that utilizes each form of transportation to commute to work.

The mean travel time for commuters to get to work indicates that most of the people in the study area work outside of their communities. Northampton residents, on average, have longer commutes than do other residents of the study area. **Table 9.** also shows average commute time for each of the municipality's residents.

Major roads and railroads are included on the map of the study area (**Map 1**). The major transportation route that traverses the study area is the Pennsylvania Turnpike (Interstate 276). There is no interchange for the turnpike within the study area but interchanges at Willow Grove and Philadelphia provide access to this major route to New Jersey and western PA. Major routes that run from the northwest to the southeast connecting the study area with Montgomery County and Lower Bucks County include Street Road and County Line Road. Bristol and Almshouse Roads connect Central Bucks County and the study area, and Buck Road, Maple Avenue, Route 513 and Route 413 are the major arteries running southwest to northeast.

The study area is served by one regional rail line (SEPTA's R3), and three SEPTA bus lines (Route numbers 14, 24, 58). The rail line connects Trenton and Center City Philadelphia, and the bus lines connect portions of the study area with Northeast Philadelphia and the Frankford Transportation Center. Public transportation serves the four boroughs, portions of Upper and Lower Southampton and Middletown townships. Large areas of northern Middletown, Upper Southampton and Northampton are not accessible by public transportation.

The mean travel time for commuters to get to work indicates that most of the people in the study area work outside of their communities.

Table 9 - Transportation Statistics

Municipality	Car, Truck or Van -- Drove Alone	Car, Truck or Van -- Carpooled	Public Transportation	Walked	Other Means	Worked at Home	Mean Travel Time to Work (Minutes)
Hulmeville	**80.9%**	**9.4%**	**1.9%**	**3.4%**	**0%**	**4.3%**	**23.7**
Langhorne	**82.3%**	**5.5%**	**3.4%**	**4.7%**	**1.5%**	**2.6%**	**24.5**
Langhorne Manor Borough	**84.1%**	**5.7%**	**3.9%**	**2.0%**	**0.6%**	**3.7%**	**27.3**
Lower Southampton	**80.3%**	**10.1%**	**3.2%**	**1.8%**	**0.5%**	**4.0%**	**28.3**
Middletown	**85.5%**	**7.7%**	**2.7%**	**0.9%**	**0.4%**	**2.6%**	**26.5**
Northampton	**85.2%**	**6.6%**	**3.2%**	**0.6%**	**0.5%**	**4.0%**	**31.8**
Penndel	**70.3%**	**11.4%**	**3.1%**	**8.8%**	**1.7%**	**4.7%**	**21.8**
Upper Southampton	**84.2%**	**7.0%**	**3.6%**	**1%**	**0.6%**	**3.6%**	**28.7**
Bucks County	**83.0%**	**8.3%**	**2.8%**	**1.7%**	**0.6%**	**3.6%**	**28.6**

Source: U.S. Census Bureau

Analysis

Education and Coordination

Large segments of the population, 38 percent, are either under the age of 17 or over the age of 65. People in these age groups tend to be more dependent on other people, such as relatives, and on public transportation to meet their travel needs. Large areas of the study area are not served by public transportation, and most notably absent are services to the Bucks County Community College in Newtown, just outside of the study area, and the municipal senior activities centers.

Long commute times to work for these portions of the study area also seem to support the need for better public transportation.

Water Quality

Good public transportation not only serves the needs of transit dependent populations but also has environmental benefits, as a reduction of vehicles on the road affects air quality, and reductions of heavy metals and petroleum products from roads and highways improve water quality. Areas lacking population density for economically feasible public transportation may still benefit from car pool and shuttle services from central locations.

IX. Recreation and Open Space Facilities

Tyler State Park and three county parks, Core Creek, Churchville, and Playwicki, are found in the study area.

State and County Facilities

Tyler State Park and three county parks, Core Creek, Churchville, and Playwicki, are found in the study area. **Table 10.** details the recreational opportunities available at these parks, and they are also indicated on the Parks, Recreation and Open Space map (**Map 7**).

Table 10 - State and County Recreational Opportunities

Activity	Churchville Nature Center	Core Creek Park	Playwicki Park	Tyler Park
Ball Fields		x		
Biking		x		x
Boating		x		x
Disc Golf				x
Environmental Education	x			x
Fishing		x	x	x
Hiking	x	x	x	x
Horseback Riding		x		x
Ice Skating		x		
Picnicking	x	x	x	x
Playgrounds		x	x	
Tennis		x		
Wildlife/Bird Watching	x	x		x

Source: Bucks County Dept of Parks and Recreation & PA DCNR

Tyler State Park

Tyler State Park occupies 1,711 acres of land, 1,086 of which are within this study area. The land that became Tyler Park was purchased by Mr. and Mrs. George Tyler between 1919 and 1928. The state of Pennsylvania purchased the land in the 1970s with funds from the "Land and Water Conservation Reclamation Act", and in 1974, the park officially opened. In addition to recreational opportunities, the park is home to fine examples of early farm dwellings of rural Pennsylvania, some of which date to the early 1700s (PA DCNR). Approximately one quarter of the park remains in cultivation as a testament to the property's historical agricultural significance.

Tyler State Park boasts 10.5 miles of paved bicycle trails, four miles of gravel hiking trails and nine miles of bridle paths.

Core Creek County Park

Core Creek Park is comprised of 1,200 acres within Middletown Township. The park surrounds Lake Luxembourg, a PL-566 flood control reservoir, and contains trails for bicycle and horseback riding. Wildlife watching, boating and fishing are also popular activities at this park. Core Creek is the most heavily used of the county's parks, with 1992 attendance estimated at over 1.2 million visitors, and visitation is assumed to have surpassed 3.3 million in 2002. This park comprises a significant percentage of the open space in Middletown Township and the last remnants of agricultural land in the study area.

Churchville County Park

Churchville County Park is made up of 842 acres of noncontiguous land that surrounds the Churchville Reservoir. The reservoir and bordering land is owned by the Aqua America Water Company and serves as a supply reservoir for their treatment plant on the Neshaminy Creek in Middletown.

Churchville Park is home to the Churchville Nature Center (CNC), which is an important environmental education center in Lower Bucks County. Programs relating to wildlife, habitats and Native American cultures are offered, and the nature center maintains some trails within the park. Currently the Bucks County Department of Parks and Recreation is developing a Churchville Watershed Master Plan with funding from the PA DCNR. This plan will focus on the land immediately surrounding the reservoir, as well as investigating water quality within the greater Mill Creek Watershed.

Churchville Park and the surrounding area are listed as a Priority 2 site on the *Bucks County Natural Area Inventory.* This designation and its significance are discussed in the Natural Resources section of this plan.

Playwicki County Park

Playwicki Park is a linear park along the Neshaminy Creek within Middletown Township and Langhorne Borough. The park consists of 33 acres and forms an important corridor along the main branch of the stream. Facilities are indicated in **Table 9.** This park is a Priority 3 site listed in the *Bucks County Natural Area Inventory.*

Municipal Facilities

Municipal parks and open space are indicated on the Parks, Recreation and Open Space map that accompanies this report (**Map 7**). **Table 11.** identifies municipal and public recreation and open space within the townships and boroughs in the study area. Open spaces indicated on the following table are within the municipality and may be outside the boundaries of this study area.

Table 11 - Open Space - Recreation Statistics

Township	Park Or Recreation Property	Acres
Hulmeville	**Hulmeville Borough Park**	**0.4**
	Hulmeville School	**3.9**
	Township owned vacant lot	**1.0**
Total		**5.3**
Langhorne	**Langhorne Heritage Farm**	**7.5**
	Borough of Langhorne Firehouse	**0.5**
	Langhorne Memorial Association	**0.4**
	Woods Services	**0.1**
	Attleboro	**0.6**
	Maple Square	**0.4**
	Langhorne Methodist Church	**1.6**
	Country Club Estates	**0.2**
	Washington Village	**0.2**
	Mayor's Playground	**3.5**
Total		**15.0**
Langhorne Manor	**Woods School**	**7.0**
	Philadelphia College of Bible	**25.0**
Total		**32.0**
Lower Southampton	**Playwicki Farm**	**110.0**
	Dunlap Memorial field	**4.0**
	Elliot Memorial Field	**20.0**
	Neshaminy Recreation Center	**2.0**
	Towanka Elementary School	**39.0**
	Lower Southampton Elementary	**12.0**
	Poquessing Middle School/Ferber Elementary	**32.0**
	Assumption BVM	**9.0**
Total Acres		**228.0**
Middletown	**Beechwood Ave. Park**	**15.9**
	Cobalt Ridge	**0.5**
	Quincy Hollow	**0.5**
	Snowball Gate	**1.4**
	Upper Orchard	**0.5**
	Harris Park	**2.5**
	Middletown Country Club	**100.1**
	Periwinkle Park	**3.5**
	Polar St. Park	**13.1**
	Sunflower playground	**0.4**
	Twin Oaks Park	**18.0**
	Veterans Memorial Park	**7.5**
	Forsythia Crossing Park	**10**
	Middletown Community Park	**41.2**
	Pearl Buck Elementary	**15.0**
	Eisenhower	**13.9**
	Everitt Elementary	**17.0**
	Heckman School	**17.5**
	Hoover Elementary	**60.0**
	Maple Point HS	**87.6**
	Miller School	**17.0**

Township	Park Or Recreation Property	Acres
	Neshaminy HS	**212.0**
	Neshaminy JH	**40.0**
	Queen of the Universe Elementary	**4.7**
	Sandburg JH	**17.5**
	Schweitzer Elementary	**17.5**
Total acres		**717.3**
Northampton	**Township Recreation Complex**	**61.8**
	Hampton Estates Park	**16.4**
	Big Meadow Park	**31.9**
	Pheasant Road Park	**19.5**
	NAWC Land	**89.0**
	Morissey Land	**73.0**
	Holland Elementary	**16.7**
	Councils Rock JH	**68.0**
	Hillcrest Elementary	**20.0**
	Rolling Hills Elementary	**18.1**
	Richboro Elementary	**37.6**
	Council Rock JH at Richboro	**38.6**
	Churchville Elementary	**19.6**
Total Acres		**510.2**
Penndel	**Penndel Memorial Field**	**4.4**
Upper Southampton	**Stackpole Elementary**	**6.8**
	Klinger MS	**15.0**
	Township Community Center	**9.4**
	Schaeffer Sports Complex	**9.0**
	Tamanend Park	**104.0**
	Davis Elementary	**4.8**
	Shelmire School Site	**9.3**
Total Acres		**158.3**
Total Municipal and School District Recreation Space In Study Area		**1688**

Sources: Municipal Recreation and Open Space Plans

A matrix of municipal recreation facilities is included in **Appendix D**. of this report. This information was listed in the municipal open space and recreation plans

Bucks County Municipal Open Space Fund

In 1997, the Bucks County Commissioners passed a $59 million bond referendum to provide municipalities with funds to preserve open space and agricultural land. As a condition to receiving county open space funding, municipalities are required to complete local open space plans identifying important land in their municipality and provide a 25 percent match to the county funds (Bucks County Open Space Task Force).

Each of the municipalities within the study area has completed their open space plans. As of June 2003, the county has funded the preservation of 8,000 acres of open space and farmland throughout Bucks County, either through fee simple purchase, purchase of development rights or conservation easements. County allocations are determined by the municipality's land area

and population in addition to an $110,000 base allocation. **Table 12.** identifies each municipality's allocation and funds utilized to date.

Table 12 - Bucks County Municipal Open Space Funds

Municipality	Total County Funds Available	Total County Funds Allocated to Date
Hulmeville	**$125,941**	**$0**
Langhorne	**$132,631**	**$75,000**
Langhorne Manor	**$126,844**	**$126,844***
Lower Southampton	**$430,033**	**$385,478**
Middletown	**$875,000**	**$875,000**
Northampton	**$872,495**	**$872,495**
Penndel	**$148,012**	**$148,012**
Upper Southampton	**$383,914**	**$383,914**

Source: Bucks County Planning Commission

***** Langhorne Manor Borough transferred funds to Middletown Township in exchange for a conservation easement on the Langhorne Springwater Company property.

Upper Southampton Recreation Survey

In 2000, Upper Southampton Township conducted a survey of residents to determine the community's need for recreation facilities, with slightly more than three percent of the township's population responding to the survey. Five of the top ten responses for improved facilities related to trails, specifically including a desire for more hiking, bike and nature trails. Other responses included the need for skating areas, indoor pool and outdoor theaters as well as more playgrounds.

A noteworthy result of the survey is that due to Upper Southampton's high percentage (19.6 percent) of residents over the age of 65, more facilities for the aging may be needed.

Trails

Trails can serve as important alternatives to automobile travel, increase community open and green spaces and promote healthy lifestyles for residents. All of the existing trails within the study area are to be found within state, county and municipal park systems, although there are proposed trails throughout the study area.

The DVRPC identifies three potential trail pathways mentioned here, and they are indicated on the Parks, Recreation and Open Space map.

Mill Creek Link Parks

This potential off road multi-use trail would link Churchville Nature Center with Playwicki County Park and would follow the Ironworks and Mill creeks in Northampton, Upper and Lower Southampton townships. This linkage was identified as a first priority park linkage in the 1986 *Bucks County Park and Recreation Plan.* This trail is also being addressed in the Churchville Nature Center's Greenway Conservation Plan, which is currently in progress.

Neshaminy Creek Link Parks

This proposed off road multi-use trail would extend along the length of the Neshaminy Creek from Peace Valley Park in New Britain Township to Neshaminy Park in Bensalem Township. The section of the link park from Tyler State Park to Neshaminy State Park was identified as a first priority park linkage in the 1986 *Bucks County Park and Recreation Plan,* and the Bucks County Department of Parks and Recreation is currently addressing this priority.

Newtown Rail Trail

This proposed trail would follow the existing SEPTA right of way. The trail would connect the Pennypack Trail in Montgomery County to Newtown. In 2002, Upper Southampton Township formed a "rails to trails" task force to investigate the feasibility of opening the Newtown Rail Trail through Upper Southampton Township. The task force recommended "no further action" be taken in pursuit of this trail at the time of the study. The possibility of opening portions of this trail will be investigated further in the Churchville Nature Center's Greenway Conservation Plan.

Other Conserved Property

In addition, to state, county and municipally preserved land, there are 274 acres in this section of the Neshaminy Creek watershed that are permanently preserved by Heritage Conservancy through fee simple ownership or conservation easement. The location of these properties can be seen on the parks and open space map (**Map 7**).

Table 13 - Heritage Conservancy Preserved Land within the Study Area

Property	Municipality	Acres Preserved
Langhorne Springwater Co.	**Langhorne Manor Borough**	**69.7**
Jenk's Hall	**Middletown**	**2.6**
Bellwood	**Northampton**	**101.6**
Pheasant Valley	**Northampton**	**10.7**
Seven Families	**Northampton**	**17.6**
Pearson /Walker	**Northampton**	**17.0**
Heather Valley	**Northampton**	**13.5**
Bryn Gweled	**Upper Southampton**	**40.8**
Total		**273.5**

Source: Heritage Conservancy

Analysis

Parks and Recreation

Parks and protected open space account for approximately 16 percent of the study area, and open space is the second largest land use category in the study area. Important gains in open and recreational space should be focused on linking existing facilities and parkland through greenways, trails and pedestrian access from residential areas. The 1986 *Bucks County Parks and Recreation Plan* identifies potential regional greenway linkages, and these plans should be a priority for future open space gains, especially where the goals coincide with land identified in the NAI.

Access to the Neshaminy Creek and its tributaries for passive recreation, fishing and canoeing is another recreation priority for this region. Facilities for canoe launches on the Neshaminy Creek can help to increase awareness of river related issues and encourage better stewardship of the resource. Improved access to the stream for fishing will also encourage resource stewardship and draw more people to the creek.

The *Churchville Watershed Master Plan* is a good example of comprehensive resource management on a regional scope, and is a good first step to identifying the needs and direction for an important regional resource.

Aging populations within the study area require different recreational opportunities than the under 17 aged cohort. More passive recreation and organized activities are needed in this region to meet the needs of this group.

Stormwater

The new NPDES Phase II stormwater regulations require municipalities to utilize pollution prevention, municipal good housekeeping efforts and public education as minimum control measures to reduce non-point source pollution. Municipal parks and open spaces offer good opportunities for communities to utilize innovative stormwater BMPs and alternative parking lot materials for demonstration projects for new developments. Incorporating these BMPs into the recreational space for passive wildlife watching or education provide a return on the investment in these BMPs.

Pennswood Village, in Middletown Township, provides a good example of utilizing innovative stormwater BMPs as a community asset for stormwater management and source of passive recreation for its residents. This community installed treatment wetlands on its property to improve water quality of stormwater run-off. These treatment wetlands have attracted birds to the property, which the residents enjoy, and also serve as an educational opportunity for local school groups.

Flood Damage

Financing the buyouts of flood prone structures in the Lower Neshaminy Creek watershed is another important tool in supporting the proposed county greenway system, and offers opportunities to provide more river access for canoeing and fishing while reducing property loss due to flooding.

Biological Resources, Wetlands and Recharge Areas

Existing forested land and wetlands should also be a priority for preservation. These areas not only improve water quality in the watershed but also are rapidly disappearing within the study area. These areas are critical to preserving habitat for diverse wildlife populations.

X. Biological Resources

Natural biological diversity of a region is a function of the topographic, geologic and climatic conditions. The climate of this region is considered cool-temperate and receives an average of 42 inches of rainfall per year. The Neshaminy Creek crosses two physiographic regions (Piedmont and the Atlantic Coastal Plain) in the study area. These factors combined to create an environment in which biologic diversity flourished, and remnants of the area's rich biologic history can still be seen in parks and natural areas of the watershed today.

The land area that is included in the LNWCP was part of a land grant given to William Penn in late 1682. At this time, the land was completely forested, with the exception of pockets of land utilized by the Native American population for agriculture. Penn subdivided his land grant and agriculture spread throughout Bucks County with the influx of European settlers. Trade and market towns, such as Hulmeville, Churchville and Langhorne, arose to service these agricultural areas in the late 1600s and early 1700s. The next wave of development of the Lower Neshaminy Creek Watershed arrived with trolley cars bringing commuters from Philadelphia to Langhorne, Langhorne Manor and the town that is now Penndel Borough. Rapid suburbanization began after World War II with the need for housing for returning soldiers. The region was generally built up by the end of the 1960s, with the exception of Northampton and Middletown townships. Their turn came with the housing boom, which started in the 1970s and continues today.

Suburban development has contributed to habitat loss, which is a major factor in the decline of species diversity from pre European contact times. Other factors include competition from non-native invasive species and pollution or degradation of habitat.

Suburban development has contributed to habitat loss, which is a major factor in the decline of species diversity from pre European contact times

The federal and state governments established programs to protect species from extinction and extirpation (the removal of a species from an area). The 1973 Federal Endangered Species Act's goal was to protect plant and animal species, as well as the ecosystems on which they depend, from extinction. There are, however, no federally listed endangered species found within the study area.

At the state level, species protection falls under the jurisdiction of three governmental bodies: the DCNR Bureau of Forestry, the Pennsylvania Game Commission (PGC) and the Pennsylvania Fish and Boat Commission (FBC).

DCNR is responsible for the protection of plant species, the PGC is responsible for bird and mammals and the FBC has jurisdiction over fish, reptiles and amphibians.

Appendix E includes species listings of terrestrial and aquatic animals found in the study area. The appendix also includes a list of introduced and native vegetation found in the Neshaminy Creek watershed. The animal list was provided by the Churchville Nature Center and is representative of wildlife in the study area. The extensive vegetation list was provided by the

Pennsylvania Flora Project at the Morris Arboretum of the University of Pennsylvania.

Pennsylvania Natural Diversity Inventory

The Pennsylvania Natural Diversity Inventory (PNDI) is a cooperative project between the DCNR Bureau of Forestry, the Western Pennsylvania Conservancy and the Nature Conservancy. The purpose of the PNDI is to "identify and describe the Commonwealth's rarest and most significant ecological features. These features include plant and animal species of special concern, rare and exemplary natural communities, and outstanding geologic features"(PA DCNR). **Table 14.** lists the PNDI species and communities found within the Neshaminy Creek Watershed.

Table 14 - PNDI Species and Habitats Found in the Neshaminy Creek Watershed

Scientific Name	Common Name	State Rank	State Status
Alasmidonta varicosa	**Brook floater**	**S2**	
Amaranthus cannabinus	**Waterhemp ragweed**	**S3**	**PR**
Amelanchier canadensis	**Serviceberry**	**S?**	**N**
Andropogon gyrans	**Elliott's beardgrass**	**S3**	**N**
Baccharis halimifolia	**Eastern baccharis**	**S3**	**PR**
Bartonia paniculata	**Screw-stem**	**S3**	**N**
Bidens bidentoides	**Swamp beggar-ticks**	**S1**	**PT**
Bidens laevis	**Beggar-ticks**	**S3**	**N**
Coastal plain forest	**Coastal plain forest**	**S1**	
Cuscuta campestris	**Dodder**	**S2**	**N**
Cuscuta pentagona	**Field dodder**	**S3**	**N**
Echinochloa walteri	**Walter's barnyard-grass**	**S1**	**PE**
Eupatorium rotundifolium	**A eupatorium**	**S3**	**TU**
Falco peregrinus	**Peregrine falcon**	**S1B,S1N**	**PE**
Freshwater intertidal marsh	**Freshwater intertidal marsh**	**S1**	
Freshwater intertidal mudflat	**Freshwater intertidal mudflat**	**S1**	
Gasterosteus aculeatus	**Threespine stickleback**	**SA?**	**PE**
Glyceria obtusa	**Blunt manna-grass**	**S1**	**PE**
Heteranthera multiflora	**Multiflowered mud-plantain**	**S1**	**PE**
Ilex glabra	**Ink-berry**	**SX**	**PX**
Juncus filiformis	**Thread rush**	**S3**	**PR**
Leucothoe racemosa	**Swamp dog-hobble**	**S2S3**	**TU**
Lycopus rubellus	**Bugleweed**	**S1**	**PE**
Magnolia virginiana	**Sweet bay magnolia**	**S2**	**PE**
Pandion haliaetus	**Osprey**	**S2B**	**PT**
Panicum lucidum	**Shining panic-grass**	**S1**	**PE**
Panicum scoparium	**Velvety panic-grass**	**S1**	**PE**
Polygala cruciata	**Cross-leaved milkwort**	**S1**	**PE**
Pseudemys rubriventris	**Redbelly turtle**	**S2**	**CA**
Quercus falcata	**Southern red oak**	**S1**	**PE**
Quercus phellos	**Willow oak**	**S2**	**PE**
Sagittaria subulata	**Subulate arrowhead**	**S3**	**PR**
Schoenoplectus fluviatilis	**River bulrush**	**S3**	**PR**
Triplasis purpurea	**Purple sandgrass**	**S1**	**PE**
Vernonia glauca	**Tawny ironweed**	**S1**	**PE**
Woodwardia areolata	**Netted chainfern**	**S2**	**PT**
Zizania aquatica	**Indian wild rice**	**S3**	**PR**

Source: DCNR

Table 15. identifies the key to the PA DCNR state ranking system for PNDI species and ecosystems.

Table 15 - Key to State Ranking System

State Element Ranks	Implication	State Status	Implication
S1	**Critically Imperiled in the State (<5 Occurrences)**	**PE**	**PA Endangered**
S2	**Imperiled In The State (6-20 Occurrences)**	**PR**	**PA Rare**
S3	**Rare Or Uncommon in the State (21-100 Occurrences)**	**PT**	**PA Threatened**
S4	**Apparently Secure in the State**	**PX**	**PA Extirpated**
S5	**Demonstrably Secure in the State**	**CA**	**Candidate at Risk**
A	**Accidental in the State**	**N**	**No Current Legal Status**
B	**Breeding Population in the State**		
N	**Non-Breeding Population**		
X	**Believed to be Extirpated from State**		
?	**Uncertain Status**		

Source: PA DCNR

Bucks County Natural Areas Inventory

In 1999, the Commissioners of Bucks County engaged the Morris Arboretum to inventory the natural features of the county, and 240 individual sites were surveyed for the presence of unusual plants, animals, natural communities and geological and hydrological communities. The resulting document listed 115 sites that were prioritized at four levels of importance. Those levels were:

- Priority 1: sites of state and countywide importance based on the uniqueness or exceptionally high quality of the natural features they encompass.
- Priority 2: sites of county and sometimes statewide importance due to the quality and diversity of the resources they contain. The difference between Priority 1 and Priority 2 sites is one of degree.
- Priority 3: sites of local or countywide importance, includes sites with small or degraded occurrences of state listed rare species.
- Priority 4: sites with locally important biological or ecological resources, cases of small or remnant populations of rare species are included here.

There are six locations within the study area listed as significant in the *Natural Area Inventory of Bucks County*. Natural Area Inventory sites appear on the Natural Resources map (**Map 8**). A brief description of these locations follows.

Churchville County Park and Vicinity

Priority 2.

Located in Northampton Township, this site consists of the Churchville Reservoir and surrounding land. The reservoir, and much of the surrounding land, is owned by the Aqua America Water Company (AAWC). The county and township also own large blocks of land around the lake. These lands encompass a wide range of habitats, including stands of mixed oak forest, white and red pine, successional red maple forest, wetlands, grasslands and agricultural fields. High numbers and diversity of breeding birds make this location an important bird habitat in Bucks County. Unusual nesters include little green heron and Cooper's hawk. Species listing of birds, reptiles, amphibians, fish, mammals, and butterflies confirmed in the vicinity of Churchville Park are included in **Appendix E** of this report.

Notable features:

- PNDI Species:

Scientific Name	*Common Name*	State Rank	State Status
Pseudemys rubriventris	Redbelly turtle	S2	PT

- 89 species of birds including rare breeders

Neshaminy Creek Woods, Route 1 to Hulmeville Road

Priority 2.

This site consists of the floodplain on the south bank of the Neshaminy Creek for about two miles from Route 1 in Middletown Township to the Hulmeville Avenue Bridge in Bensalem Township. The floodplain has a diverse flora that includes Virginia bluebells (*Mertensia virginica).* This site is also notable for the outcrop of Chickies Quartzite along the north bank of the creek.

Notable features:

- Massive outcrop of Chickies quartz associated with Fall Line.
- Tulip tree-beech-maple forest
- Sycamore-river birch-box-elder floodplain forest

Playwicki Park & Neshaminy Creek Corridor to Route 413

Priority 3.

Located in Middletown Township, this linear stream corridor stretches two miles into Langhorne Borough. The corridor is notable for the presence of mature forest on the banks and adjacent upland areas as well as the presence of a rare parasitic flowering plant, smartweed dodder (*Cuscuta polygonorum*), in the alluvial floodplain deposits. Bank erosion is a concern for this section of the Neshaminy Creek.

Notable Features:

- PNDI Species:

Scientific Name	***Common Name***	State Rank	State Status
Cuscuta polygonorum	Smartweed Dodder	SU	

- Red oak mixed hardwood forest
- River beach bar community
- Sycamore-river birch-box-elder forest

Holly Avenue Woods

Priority 4.

This 10-acre site located in Middletown Township and Penndel Borough is a remnant of seasonally wet coastal plain forest, which contains a rare coastal plain shrub. The site is affected by invasive species.

Notable Features:

- PNDI Species:

Scientific Name	***Common Name***	State Rank	State Status
Leucothoe racemosa	Swamp dog-hobble	S2S3	PT

- Sweetgum-mixed oak coastal plain forest

Hulmeville Pennsylvania Avenue Forest

Priority 4.

This location in Hulmeville Borough and Middletown Township, contains a mature forest remnant and successional fields. The location boasts a good diversity of native species.

Notable Features:

- Red Oak mixed hardwood forest
- Early successional old fields

Langhorne Springwater Company Woods including Headwaters of Waterworks Run

Priority 4.

This 60-acre location in Langhorne Manor Borough and Middletown Township consists of continuous woods along the Waterworks Run (Chubb Run), and is dominated by a mature forest along the stream. A younger, tulip tree dominated forest is present below the pond on the site. Above Route 1, the forest is of the transitional coastal plain piedmont type. Vernal ponds, springs and seeps are also present at this location.

Notable Features:

- Creek and associated springs and seeps
- Vernal ponds and small lagoons which likely provide amphibian breeding habitat
- Red Oak mixed hardwood forest

- Tulip tree-beech-maple forest
- Sweetgum-mixed hardwood coastal plain forest
- Black Willow scrub /shrub wetland

Analysis

Important Resource Areas

Properties identified in the Natural Areas Inventory should not only be priorities for preservation but also for land management programs. Non-native invasive species are a chronic problem in disturbed natural areas, and require management strategies to prevent them from turning the region's natural areas into habitat deserts. Management tasks include removal of invasive species and planting of native vegetation. Goose and deer depredation on newly planted vegetation must be reduced to ensure the success of newly planted areas. Multiflora rose, bush honeysuckles, Oriental bittersweet, Norway maple, lesser celandine, Japanese stiltgrass, garlic mustard, invasive privets and Japanese knotweed are the most persistent non-native invaders of this region. Japanese knotweed poses a particularly difficult challenge and should be addressed before it spreads too far.

Education and Coordination

Volunteers and members of the public should be educated about invasive plants and enrolled in their removal. Long term strategies for cultivating native vegetation and habitats in the region's open space should be as high a priority as preserving the space in the first place.

XI. Water Resources

Water resources, including National Wetlands Inventory (NWI) wetlands, Federal Emergency Management Agency (FEMA) 100-year floodplains, sub-watershed basins are indicated on the Natural Resources map that accompanies this report (**Map 8.**).

The Neshaminy Creek is joined by two significant tributaries in the study area. The tributaries are Core Creek, which joins the Neshaminy at Bridgetown Pike in Middletown Township and Mill Creek, which joins the Neshaminy at Playwicki County Park in Middletown. The Mill Creek also has two significant tributaries, Ironworks Creek and Pine Run Creek. Ironworks Creek joins the Mill Creek at Buck Road in Northampton Township. Pine Run joins the Mill Creek just upstream from Playwicki Park. **Map 1.** delineates the major sub-watersheds of the study area.

The Neshaminy Creek Watershed is listed as a Category I Priority Watershed under the state's Unified Watershed Assessment program. Assessment results are based on biological and habitat surveys conducted by the PA DEP, and accordingly, the main stem of the Neshaminy Creek (in the study area) is considered impaired. Results reflect that the aquatic life present does not meet criteria established for expected species diversity and abundance.

The designated use for the Neshaminy Creek is a warm water fishery (WWF) with sections designated for use by migratory fishes (MF) such as the American eel. Core Creek, above lake Luxembourg is designated a cold water fishery (CWF) stream, however, the stream does not meet this designated use. Streams can also be designated High Quality (HQ) or Exceptional Value (EV). HQ and EV designations offer special provisions for water quality protection in land use regulations. None of the streams in the study area meet the criteria for these special protection designations. DEP determined that the major causes of impairment were excessive nutrients, water flow variability and sediment from a variety of point and non-point sources.

The Mill Creek Watershed in Upper and Lower Southampton and the Ironworks Creek watershed in Northampton, were not listed as impaired. DEP indicates that these stream reaches maintain a relatively high percentage of riparian vegetation. **Figure 4.** indicates the streams and tributaries to the Lower Neshaminy Creek that are impaired. **Table 16.** identifies the tributaries to the Neshaminy Creek in the study area as well as the total lengths of those tributaries, their designated use and the status of attainment of protected use. The table also details whether the streams are impaired and the causes of impairment.

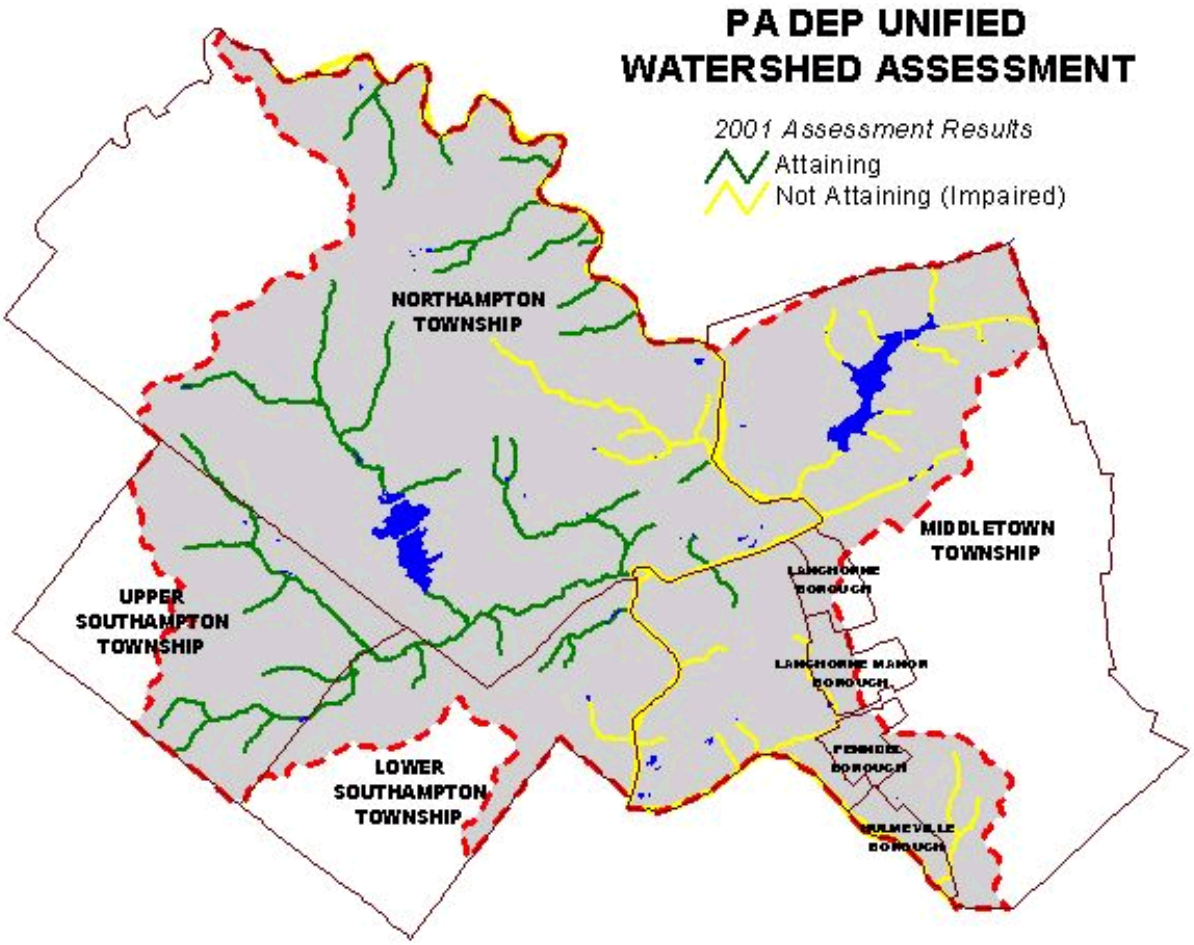
The Mill Creek Watershed in Upper and Lower Southampton and the Ironworks Creek watershed in Northampton, were not listed as impaired. DEP indicates that these stream reaches maintain a relatively high percentage of riparian vegetation.

Table 16 - Lower Neshaminy Stream Segments

Stream Name	Drainage Basin Mi^2	Total Length Mi	Designated Use	Miles Impaired	Miles Attained	Causes of Impairment
Main stem Neshaminy Creek	**29.23**	**18**	**MF, WWF**	**18**	**0**	**Siltation From Land Development; Siltation, Nutrients and Waterflow Variability from Urban Runoff and Municipal Point Sources; Siltation from Agriculture.**
Core Creek	**9.77**	**15.82**	**CWF, MF, WWF**	**15.82**	**0**	**Flow & Thermal Alterations and Siltation from Upstream Impoundment and Agriculture.**
Mill Creek	**17.40**	**13.44**	**MF, WWF**	**0**	**13.44**	
Ironworks Creek	**6.33**	**9.67**	**MF, WWF**	**0**	**9.67**	
Pine Run Creek	**2.66**	**4.16**	**MF, WWF**	**0**	**4.16**	

Source: PA DEP

Figure 4 - PA DEP 303d Listed Streams in the Study Area.



Source: PA DEP

Section 303d of the Clean Water Act required that states assess the quality of surface waters biannually. Streams considered impaired or not meeting their designated use are included on the "303d list". States must then prepare Total Maximum Daily Load (TMDL) plans for those streams' watersheds. The TMDL is designed to reduce the sources of impairments in the watershed by identifying specific causes of impairment and setting targets for the reduction of those inputs to the stream system.

In 2003, the PA DEP presented the draft findings for the TMDL for the Neshaminy Creek Watershed. The TMDL stated that the largest problem in the watershed is an increase in stream hydraulic energy of stream flows that cause erosion of stream banks and downstream sedimentation. Another result of increased hydraulic energy is that smaller storm events have gained the potential energy to wash away aquatic communities. Municipal point sources continue to be a source of nutrient input for the entire Neshaminy Creek Watershed. The report does state that due to the addition of tertiary treatment capacity and redirection of wastewater flows to regional treatment facilities, nutrient inputs from municipal wastewater treatment plants may not be the primary cause of nutrient enrichment of the Neshaminy Creek.

The TMDL can be viewed at http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/tmdl/NeshaminyCr_TMDL.pdf on the PA DEP website.

Lakes

There are two man-made lakes within the study area. They are Churchville Reservoir and Lake Luxembourg. Lake Luxembourg is part of the Neshaminy Basin Flood Control System built in the 1970s, Both Lakes are identified on Map 1. of the study area.

Churchville Reservoir

Churchville Reservoir is a 172-acre impoundment in Northampton Township, created by the damming of the Ironworks Creek and owned by the Aqua America Water Company. The lake serves as a floodwater impoundment, recreation area and provides supplemental flow to the AAWC drinking water treatment plant on the main stem of the Neshaminy Creek in Middletown.

Water quality and the trophic state of Churchville Reservoir are currently being studied, but historic data provided by Aqua America Water Company indicate that the lake is eutrophic. The lake does contribute to the wildlife habitat and species diversity of Churchville County Park that occupies land adjacent to the lake. Currently water quality and aquatic life surveys are being conducted by Princeton Hydro Incorporated as part of the Churchville Watershed Conservation Plan

Lake Luxembourg

Lake Luxembourg is a 174-acre lake that is surrounded by Core Creek County Park. Water quality in the lake is considered impaired and hypereutrophic, which indicates that the water quality in the lake is nutrient rich and oxygen poor. Along with the presence of a large gizzard shad population and lack of nursery habitat, this hypereutrophic state contributes to the poor condition of the fishery in the lake.

The lake is affected by excessive sediment loadings from adjacent and upstream land uses. A conservation pool located in the upstream portion of the lake was designed to hold 100 years of sediment while still maintaining full flood mitigation capacity. The conservation pool reached its 100-year sediment capacity within nine years after the damming of Core Creek (Princeton Hydro 2002).

Princeton Hydro completed a *Phase II Non-Point Source Pollution Implementation Project Report for the Core Creek Watershed* in 2002 and a *Final TMDL for Lake Luxembourg* in 1999 for the Bucks County Conservation District. The reports identify sediment loading from agriculture and construction activities as the major source of water quality impairment for the Core Creek Watershed.

The Princeton-Hydro report found that Lake Luxembourg is in a hypereutrophic state, meaning that the lake has a high level of biological productivity. Trophic states are a measurement of the biological productivity of a water body. Trophic states are measured using the Carlson Trophic State Index (TSI), which is comprised of three indices: Total Phosphorous (considered the limiting nutrient for algal growth), Chlorophyll α (an indication of algal biomass) and Secchi Depth (a measurement of water clarity).

Biological productivity is important because high productivity, indicated by high TSI values, can result in increased occurrences of low dissolved oxygen levels in the water, algal blooms and other aesthetic problems. Algae growth poses a problem for aquatic environments because although algae produces oxygen during daylight hours, algae consumes oxygen overnight. Large algal communities, therefore, can create anoxic conditions in a water body, essentially suffocating other aquatic organisms. The following tables, taken from the Princeton-Hydro report summarize the studies findings.

Table 17 - Trophic State Values

TSI Value	Trophic State	Biological Productivity
40-49	**Mesotrophic**	**Moderately Productive**
50-59	**Meso-Eutrophic**	**Moderately–Highly Productive**
60-69	**Eutrophic**	**Highly Productive**
>70	**Hyper-Eutrophic**	**Extremely Productive**

Source: Princeton Hydro

Table 18 - Summary of TSI Results for Lake Luxembourg

Monitoring Year	Phosphorous TSI	Chlorophyll TSI	Secchi TSI
1991-92	**79**	**71**	**75**
1996	**77**	**77**	**75**
1997	**78**	**67**	**69**
1998	**71**	**66**	**66**
1999	**70**	**72**	**78**
2000	**68**	**73**	**72**

Source: Princeton Hydro

Table 19 - Summary of Data from Lake Luxembourg TMDL

TMDL Model Scenario	Phosphorous TSI	Anticipated TP Concentration
Existing Conditions (1991-92)	**79**	**0.18 mg/l**
Baseline Conditions (Completely Forested Watershed)	**60**	**0.047 mg/l**
Targeted Conditions (1.2 Times Baseline Conditions)	**62**	**0.057 mg/l**

Source: Princeton Hydro

The report presented five recommendations to meet the TMDL for Lake Luxembourg. The recommendations are:

- Continue in-lake and watershed monitoring.
- Update land-use database and analyze current NPS loading model.
- Focus on immediate management options to reduce NPS loading into the lake.
- Re-design the conservation pool for water quality improvements.
- Implement public education programs and continue programs with Neshaminy Middle School.

Wetlands

Wetlands are areas that are seasonally or perennially wet. This situation can be due to replenishment of water from a groundwater source or the pooling of water due to poorly drained soils. Wetlands are often characterized by soil types, the presence of standing water for parts of the year and the plant communities that they support.

A unique landform, wetlands are often called bogs, swamps, marshes, seeps or springs. They provide habitats for wildlife, often serving as breeding areas for amphibians and fish, and can serve as important passive recreational areas for bird and wildlife viewing. Wetlands provide an additional benefit of improving water quality by filtering nutrients and other pollutants from the water. Wetlands can serve as a storage area for floodwaters and reduce the velocity of stormwater run-off. There are still several small wetlands, found along the creek corridor, remaining in the Lower Neshaminy Creek Watershed.

Wetlands in this watershed are included on the Natural Resources map that accompanies this report (**Map 8**). There are approximately 289 acres of

There are approximately 289 acres of wetlands within the study area, and were identified by the National Wetland Inventory.

wetlands within the study area, and were identified by the NWI, which is a service provided by the U.S. Fish and Wildlife Service. The NWI identifies wetlands from aerial photographs and is not field verified. As a result, data may be inaccurate or incomplete, and more formal verification is required for regulatory purposes.

Floodplains

Floodplains are the land areas adjacent to a stream channel that are subject to periodic inundation, and are usually categorized by the frequency of this inundation. For instance, a 100-year floodplain is that land area that has a one percent chance of being flooded in a given year.

One Hundred Year floodplains are commonly used to delineate land that has a significant risk of being inundated during any given year. The 100-year flood is the basis for regulations restricting development and construction activities in the floodplain. The 100-year floodplain is delineated on the Natural Resources map that accompanies this report (**Map 8**).

In order to qualify for the FEMA National Flood Insurance Program, communities must enact ordinances that regulate construction and certain human activities in floodplains in order to prevent loss of life and property due to flooding. Much of the development in this watershed occurred before regulations limiting development in floodplains were enacted. Historically, this watershed suffered from frequent flooding, as discussed in the following section of this report.

Riparian Buffers

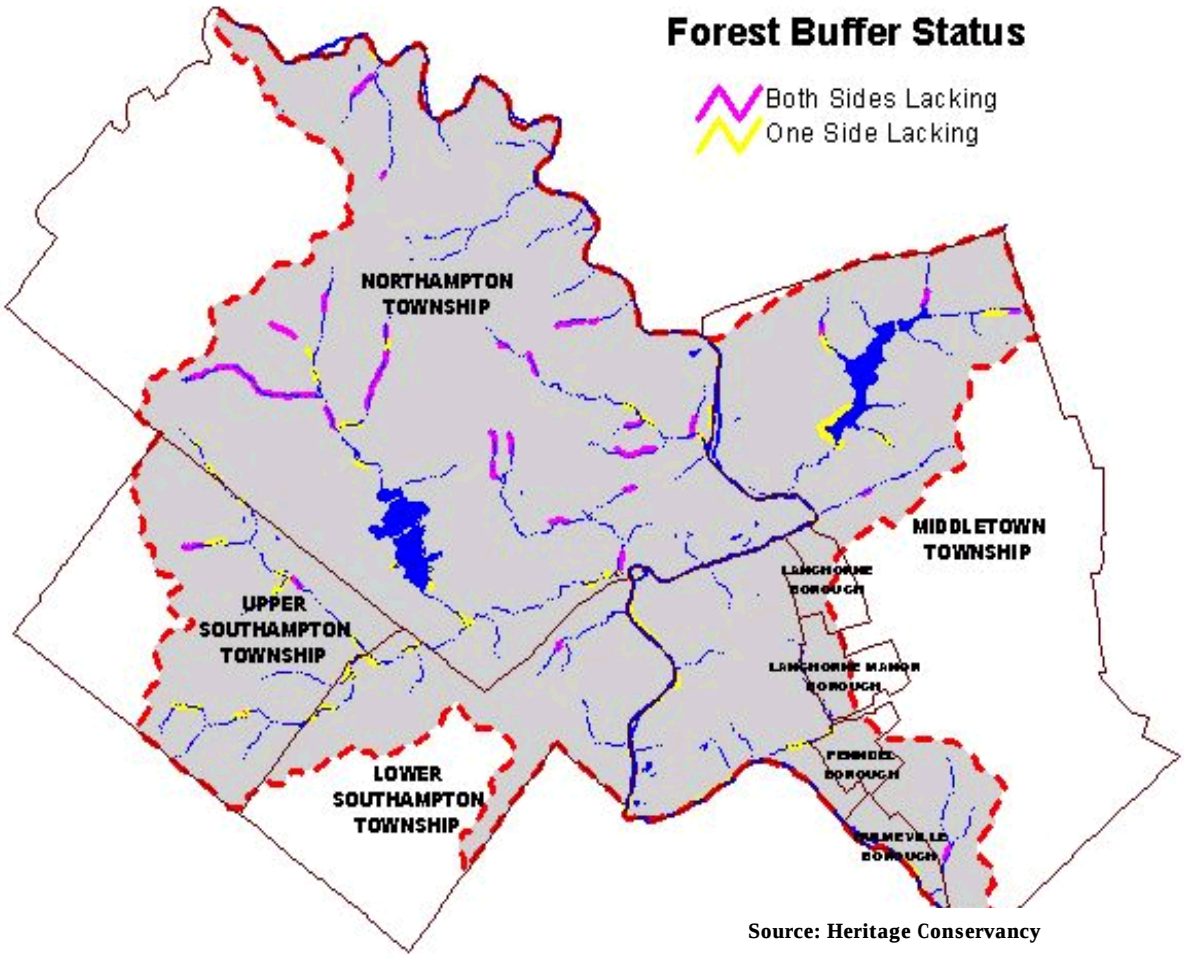
Riparian buffers are the areas of vegetation that grow along stream banks, serve as natural filters of stormwater and help to stabilize stream banks and reduce erosion. **Table 20.** reports the results of an assessment of riparian buffers in the study area (Heritage Conservancy 2001). For the purposes of this study, a forested buffer is defined as an area of trees that is 50 feet wide with at least 50 percent canopy cover. It should be noted that only forested buffers were indicated in this study and that meadow or wetland buffers were not included in the analysis. **Figure 5.** shows the results of the Riparian Buffer Assessment for the study area.

Table 20 - Forested Riparian Buffers

Stream	Miles Assessed	Total Miles Lacking Buffer	Percent Lacking Buffer
Neshaminy Creek Watershed	**409.0**	**86.7**	**21.2%**
Neshaminy Creek (Study Area)	**41.8**	**6.9**	**16.5%**
Ironworks Creek	**7.5**	**3.6**	**48.1%**
Pine Run	**4.1**	**1.2**	**28.8%**
Mill Creek	**13.2**	**2.8**	**21.1%**
Core Creek	**4.7**	**2.1**	**44.2%**

Source: Heritage Conservancy

Figure 5 - Riparian Forest Buffer Status



Source: Heritage Conservancy

Undeveloped floodplains and forested riparian buffers have many benefits for stream water quality, wildlife and recreation. Natural floodplains serve as storage areas for stormwater, allowing sediment to settle out of the water column and water to infiltrate back into the ground. This sediment often makes floodplain and alluvial soils very fertile. Forested floodplains and riparian corridors also serve as corridors between open spaces for wildlife to travel.

Vegetated riparian areas reduce in-stream temperatures and fallen vegetation can provide food and shelter for the organisms that live within the stream. Natural floodplain and riparian areas often provide access to a waterway for recreational activities such as fishing or nature watching.

Flooding

The Neshaminy Creek Watershed has a history of loss of property to flooding, with the 1955 flood of record causing an estimated $5,000,000 in property damages. These damages led to Bucks and Montgomery counties applying for federal assistance for watershed protection and flood prevention under Public Law 83-566. The *Neshaminy Creek Watershed Work Plan* was adopted by the U.S. Congress in 1967, and included provisions for ten flood-retarding structures to be built through out the watershed.

By 1982, eight of these structures had been built. One, the dam at Lake Luxembourg (Core Creek Park), is within this study area. In 1996, Montgomery County plan participants requested that a proposed dam on the Park Creek be removed from the watershed work plan, and construction plans for the tenth dam (Dark Hollow Dam) in Doylestown Township were revisited at this time. A steering committee, consisting of representatives from the watershed, the Natural Resource Conservation Service (NRCS), the county of Bucks and Bucks County Conservation District, was formed in 1997 to review the issue. In *The Neshaminy Creek Supplemental Watershed Work Plan No. 5*, released in 2001, the steering committee determined that the cost of constructing and maintaining the Dark Hollow Dam would exceed flood reduction benefits and supported a non-structural alternative to building the dam. The non-structural alternatives include:

- Establishing a flood warning system.
- Voluntary acquisition of houses that experienced greater than four feet of water on the first floor of the structure during a 100 year flood event; and would have a first floor elevation 12 feet above the lowest ground adjacent to the house, if elevated.
- Voluntary elevation of houses that experienced four feet or less of water above the first floor during the 100 year flood event, floodproofing measures are not possible and where elevation would result in first floor elevation less than twelve feet above the lowest ground adjacent to the house.

The majority of residents of the study area are served by public water and sewer utilities, although some still use private wells and septic systems.

- Voluntary floodproofing of houses that experience up to four feet of water above the first floor of the structure during the 100-year flood. Floodproofing would consist of a constructing a wall around the structure to a height at least 1 foot above the 100-year flood level.
- Continuation and enhancement of floodplain ordinances and flood insurance program.
- Continuation and enhancement of stormwater management.

Appendix F includes floodwater damage statistics for the Neshaminy Creek Watershed downstream from Dark Hollow Road to its confluence with the Delaware River, as well as estimated future conditions under the adopted watershed plan.

Water Supply

The majority of residents of the study area are served by public water and sewer utilities, although some still use private wells and septic systems. The public water utilities that service this area are local or county municipal authorities that rely on some groundwater and purchased surface water for supply. Northampton Township Municipal Authority, Upper Southampton Municipal Authority and Hulmeville Municipal Authority purchase water from the Bucks County Water and Sewer Authority (BCWSA), which resells water from the Philadelphia Water Department's Baxter water treatment plant in northeast Philadelphia. BCWSA services Lower Southampton and Middletown, and portions of Langhorne, Langhorne Manor and Penndel directly. The Lower Bucks County Joint Municipal Authority services portions of Middletown Township outside of this study area. **Table 21.** indicates the percentage of residents that utilize public water and sewer.

Table 21 - Percent of Study Area Served By Public Water and Sewer

Municipality	% On Public Water	% On Public Sewer
Hulmeville	**21.9**	**91.0**
Langhorne	**98.5**	**99.6**
Langhorne Manor	**97.3**	**17.3**
Lower Southampton	**77.2**	**97.6**
Middletown	**91.1**	**95.7**
Northampton	**71.5**	**89.8**
Penndel	**97.9**	**94.8**
Upper Southampton	**79.7**	**94.2**

Source BCPC Bucks County Continuum 1994

The whole study area lies within the Delaware River Basin Commission's Groundwater Protection Area of Southeastern Pennsylvania. Groundwater withdrawals, and reduced water infiltration into the water table due to increased development, led to reduced stream base flow in the Neshaminy Creek and the drying up of smaller headwater streams. This reduction in base flow negatively impacts aquatic life and reduces the ability of streams to assimilate pollutants and treated municipal waste. DRBC established the protection area in 1980 to reduce the impacts of increasing groundwater withdrawals in the region. In 1998, the DRBC developed numerical

withdrawal limits for wells within the Neshaminy Creek Watershed. Any well in the protected area that withdraws more than 10,000 gallons per day must be permitted by the DRBC.

BCWSA provides wholesale sewer service to the study area through the Neshaminy Interceptor Drainage Area. Wastewater from the study area is piped to Philadelphia and treated at the Northeast Wastewater Treatment Plant. As stated previously, there are sections of the study area that still have on-lot septic systems.

Discharges

There are no municipal wastewater discharges into the Neshaminy Creek Watershed within the study area, as the area's wastewater is treated within the city of Philadelphia and then discharged directly into the Delaware River. However, there are 15 municipal wastewater discharges upstream of the study area, and these discharges are indicated as a source of impairment for the main stem of the Neshaminy Creek in this stretch of the stream.

There are no municipal wastewater discharges into the Neshaminy Creek Watershed within the study area, as the area's wastewater is treated within the city of Philadelphia and then discharged directly into the Delaware River.

Aging and leaking sewer infrastructure is a concern for water quality within the watershed as the aforementioned interceptor line parallels the path of the stream for at least a portion of its route to the treatment facility.

The National Pollutant Discharge Elimination System (NPDES) is a federal permitting program designed to track and reduce the number of pollutants that are being discharged directly into the nation's waterways. The goal of the NPDES system is to restore waterways to a state where they can support historical uses such as fishing and swimming. There are two facilities with NPDES permits within the study area. **Table 22.** details the name of the discharging facility, NPDES permit number and standard industrial code where available. The locations are noted on the Watershed Issues and Constraints Map that accompanies this report **(Map 9**).

Table 22 - NPDES Permitted Dischargers within the Study Area.

Facility Name	NPDES Permit Number	Site Identification Code Description
Aqua America Water Company	**PA0011274**	**Water Supply**
Philmont Motor Company	**PAR600016**	**Motor Vehicle Parts**

Source: U.S. EPA

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Hazardous Waste Sites

The US Environmental Protection Agency (EPA) administers the Superfund program to identify and mitigate sites that, because of land uses in the past, present a danger to public health and the environment. When a potentially contaminated site is reported to the EPA, it is listed in the Comprehensive Environmental Response, Compensation, and Liability Information System

(CERCLIS). Through site investigation, the EPA will determine whether the site is listed on the National Priority List (NPL). Sites listed on the NPL become eligible for Superfund clean up.

There are four sites on the CERCLIS list within the study area; none of these sites in on the NPL, and according to the EPA's website, no federal remediation action is planned. This designation indicates that an entity other than the federal government is performing the remediation of the site or that the site contamination has already been addressed. **Table 23.** lists the CERCLIS hazardous waste sites within the study area. These waste sites are indicated on the Watershed Issues and Constraints **Map 9**.

Table 23 - CERCLIS Hazardous Waste Sites

Site Name	Location	Municipality
Langhorne Lead Site	**330 S. Bellevue Ave.**	**Langhorne**
Maple Ave. Dump Site	**500 E. Maple Ave.**	**Middletown**
SMDF	**Langhorne-Yardley & Township Line Roads.**	**Middletown**
Chinquipin Road Site	**Chinquipin Road**	**Northampton**

Source: U.S. EPA

Stormwater Planning and Regulations in the Watershed

According to the EPA, non-point source pollution, or pollution originating from diffuse sources, is the major problem affecting water quality in our nation's streams and waterways. Pollutants such as soil from erosion, nutrients from lawn and crop fertilizers and chemicals and heavy metals from roadways and parking lots are prime examples of non-point source pollution. Every time it rains, stormwater carries these and many more unnamed pollutants into a stream, creek or lake. In addition, the velocity of stormwater flows create other problems for stream system morphology. High velocity stormwater run-off scours stream channels and erodes stream banks often times stripping vegetation from stream banks. This eroded sediment is then deposited downstream when the water levels recede leaving sediment islands and debris blockages of bridges and culverts.

Act 167 Plan

In order to mitigate some of the effects of stormwater run-off, the Pennsylvania state legislature passed the Stormwater Management Act of 1978. Under this legislation, the Bucks County Planning Commission completed the Neshaminy Creek Stormwater Management Plan in 1992. This plan, while addressing issues of groundwater recharge and water quality impacts, emphasized the problem of peak stormwater flows. The Act 167 Plan for the Neshaminy Creek resulted in municipalities within the Bucks County portion of the watershed adopting the model stormwater ordinance set forth in the plan. The Act 167 plan set a standard for on-site stormwater

run-off for new construction in the watershed and identified reaches of the watershed where reduced stormwater flows would be required.

In short, post-construction peak storm water flows could be no greater than the flows from the site before it was developed. In portions of Northampton, Middletown and Upper Southampton townships, peak stormwater site discharge for new construction must equal 75 percent of pre-development run-off. The model ordinance recommended Best Management Practices (BMPs) that benefited water quality and groundwater recharge as well as peak flow attenuation. The Bucks County Planning Commission is currently updating the Act 167 Plan for the Neshaminy Creek Watershed, and the updated plan will address water quality aspects and groundwater recharge issues associated with stormwater management.

National Pollutant Discharge Elimination System (NPDES) and Phase II Stormwater Regulations

In 1972, the Clean Water Act prohibited the discharge of any pollutant into a water body of the United States without a permit. The NPDES program was designed to track the point sources of pollution and require the implementation of controls designed to reduce this pollution.

In 1987, the U.S. Congress amended the Clean Water Act to establish a national program for addressing stormwater discharges. The program was to be implemented in two phases. Phase I requires NPDES permits for municipal separate storm sewer systems (MS4s) for municipalities serving populations of 100,000 people or more. Phase I also regulated discharges from industrial point sources.

As of 2003, designated MS4s with populations of less than 100,000, within an urbanized area and meeting population density criteria (> 1000 persons/mi^2), are required to apply for NPDES permits to cover MS4's. Each municipality in this study area is a designated MS4., and they are required to submit plans to address six minimum control measures set forth by the state DEP. Minimum measures include:

- Public education and outreach.
- Public participation and involvement.
- Elicit discharge detection and elimination.
- Construction site runoff control.
- Pollution prevention.
- Good housekeeping for municipal operations.

At this time, the state is in the process of developing a model stormwater ordinance for municipalities to adopt to help meet the new permitting requirements.

Analysis

Water Quality

Water quality improvements in the Neshaminy Creek Watershed are dependant on preventing non-point source pollution. Education efforts both in school curricula and in municipal outreach programs will have benefits for water quality while helping to reduce NPS pollution.

Other gains in protecting water quality can be made by joining efforts of municipalities with drinking water utilities to protect sources of drinking water. Examples of these efforts would be the establishment of wellhead protection programs and sourcewater protection measures identified in a water supplier's Sourcewater Assessment Programs.

Ensuring recharge of groundwater aquifers will have the dual benefits of providing water quantity for municipal and private wells as well as increasing baseflow to tributary streams and creeks. Stream baseflow is comprised of groundwater flowing to the surface of the earth in a stream. Baseflow reduces pollutant concentrations that may be present in point source discharges and increases a water body's ability to assimilate nutrients and other potential contaminants. An absence of baseflow results in flashy streams that are composed entirely of wastewater plant discharges and stormwater run-off.

Stormwater

The Neshaminy Creek TMDL identifies increased stormwater hydraulic energy as the main problem affecting the health of the Neshaminy Creek Watershed. Reduction of stormflow energy will require a change in the way that stormwater is managed. Traditional detention basins reduce peak flows but prolong the duration of stormwater flows, and municipalities within the study area should actively participate in the revision of the Neshaminy Creek Act 167 Plan. Participation is reimbursable by the state and will insure that municipal concerns are addressed in the plan.

Stormwater basin retrofits should also be considered, wherever possible. BMPs that reduce discharge velocity while improving water quality with vegetative systems are a necessary first step to rehabilitating stream system morphology and meeting designated stream uses. Multiple funding sources and water quality protection programs should be accessed in the effort to finance stormwater basin retrofits. Examples are state revolving fund loans for improvements to infrastructure to protect sources of drinking water and the utilization of treatment wetlands and ponds as educational tools and community amenities. Support for the establishment of stormwater utilities, similar to programs in Florida and Georgia, will allow municipalities to finance sound stormwater management.

Flood Damage

Each municipality within the study area has restrictions on building within the floodplain. Strict enforcement of these ordinances is essential to prevent further loss of life and property due to flood events.

Important Resource Areas

The study area's dependence on groundwater for drinking makes identification of groundwater recharge areas essential. These areas should be identified and protected to ensure stream baseflow and the availability of groundwater for human use. A corollary of identifying recharge areas is developing wellhead protection plans for municipal wells and good land use practices for landowners with private wells. Integral to this strategy is the proper maintenance and management of septic and on-lot sewage disposal systems.

Education and Coordination

Existing programs and regulations should be addressed in a cooperative manner between drinking water, environmental and stormwater regulations. Coordination of efforts will reduce costs while improving message effectiveness.

XII. Archaeological and Historic Resources

Brief Overview

Prior to European settlement in the early 1600s, southern Bucks County was inhabited by the Lenape Indian tribe. The Lenape people, referred to as Delaware Indians by European Settlers, considered themselves the "original people". Lee Sultzman, in his History of the Delaware, indicates that there was a widespread belief among native peoples that the Lenape were the original tribe of Algonquin speaking peoples to inhabit the area.

The Unami band of Lenapes occupied the territory of Pennsylvania and New Jersey from Staten Island to just south of Philadelphia. The Unamis were not a politically cohesive group but shared common language and cultural characteristics.

First contact between the Lenape and Europeans occurred in the early 1600s. These early Swedish and Dutch explorers engaged in some trade with the natives, but first settlements remained close to the Delaware River. In 1664, the Dutch surrendered to the English the land that is now Lower Bucks County. In 1681, King Charles II of England granted William Penn 40,000 acres of land in the Delaware Valley as repayment for a debt owed to Penn's father. William Penn felt that the native Indian tribes should be justly compensated for these lands, and by 1683 had negotiated the purchase of all of the lands in this study area from the Lenape Indians.

With the establishment of Penn's colony, English settlers flocked to Bucks County establishing homesteads, plantations and towns. By 1700 the three townships of Middletown, Southampton and Northampton had formed, with the four boroughs in the study area incorporating out of Middletown Township in the 1800s.

Archaeological Resources

There are over 15 archaeological sites within the study area that have designated Pennsylvania Archaeological Site Survey (PASS) reports. Table 24. identifies PASS #'s and archaeologic period of significance of the sites. In order to protect the sites, site names and locations will not be identified. According to the Pennsylvania Historical and Museum Commission, other archaeological sites, which either have not been surveyed or discovered at this time, exist in the study area. This rich archaeological record attests to the region's breadth and depth in natural resources through historic and prehistoric times.

Table 24 - Archaeological Resources

PASS #	Historic Period	Artifacts of Significance	Culture
36 Bu 43	Late Archaic 3000-1000 BC	Projectile points	Native American
36 Bu 51	Archaic Period (6500-1000 BC)	Projectile Points, stone axes	Native American
36 Bu 57	Late Woodland (AD 1000-1550) and Contact Periods (AD 1550-1750)	Projectile points, glass bead, Bottle glass, Historic ceramics	Native American
36 Bu 58	Archaic Period (6500-1000 BC)	Projectile points	Native American
36 Bu 92	No available information		Native American
36 Bu 111	Date range unknown	1 hammerstone, lithic Chipping debris	Native American
36 Bu 140	Archaic Period (6500-1000 BC)	Projectile points	Native American
36 Bu 142	Archaic Period (6500-1000 BC)	Stone axe	Native American
36 Bu 143	Archaic Period (6500-1000 BC)	Stone axes	Native American
36 Bu 163		Hammerstones	Native American
36 Bu 173	Archaic (6500-1000 BC) through Late Woodland (AD 1000-1550) Periods and Historic Period(AD 1550-1750)	Projectile points, stone axes, Historic period smoking pipe fragments	Native American
36 Bu 202	Date range unknown	Lithic chipping debris	Native American
36 Bu 207	Revolutionary War Burial Ground	Graves of Revolutionary War casualties	Early American Republic
36 Bu 209	Historic school site	Slate Pencils, window glass, Building foundation	American Republic
36 Bu 214	Date range unknown	Lithic chipping debris	Native American

Source: PHMC

Playwicki Village

The Indian town of Playwicki is mentioned in the first treaty between William Penn and the local Lenape Indians. In 1993, archaeologists from Temple University began excavations of a historical contact period Native American village thought to be Playwicki Village. This site is significant because it reveals much about the culture of the Lenape Indians after European settlement, and there are very few post contact sites of this quality in the eastern United States.

The location of this resource or any other archaeological sites will not be identified in this report in order to protect those resources. Once taken out of context artifacts lose their ability to reveal good information about the cultures that utilized the objects. The richness of archaeological sites within this study area make investigation of undeveloped sites important before the resources and any context to the sites is lost to the bulldozer.

Historical Resources

Accompanying this report is a map of sites that are listed on the National Register of Historic Places (National Register) and the Bucks County Register of Historic places (**Map 10**.). The key to the map is included in Appendix G to this report. In 1966, Congress authorized the creation of the National Register, and administered by the National Parks Service, it serves as the nation's official list of cultural resources worthy of protection. In addition to the National Register, a list of Bucks County Historic sites has been maintained by Heritage Conservancy since 1975. The following section lists the important historical resources of each municipality in the study area and gives a brief history of the municipality.

Hulmeville Borough

Located along an important road between Trenton and Philadelphia, Hulmeville Borough arose as a significant milling and manufacturing village under the direction of John Hulme in the late 18th century. Manufacturing remained important to the village until around 1900. In the early 20th century, the area became a vacation destination for residents trying to escape the heat of Philadelphia in the summertime.

Hulmeville Borough was incorporated out of Middletown Township in 1872. The Hulmeville Historic Area forms the core of Hulmeville Borough, and this 33-acre village was listed on the National Register of Historic Places in 1986. Significant structures within the district include:

National Register Eligible

- The Edward Hicks House, 107 Green Street.
- Marek's Café, 1101 Bellevue Avenue.
- First Bank in Bucks County, 2 Water Street.
- Silas Barkley Mill, Trenton & Hulmeville Roads.
- Joshua Canby House, 200 Main Street.
- Johnson Hall, 3 Hulme Street.

Bucks County Register of Historic Places

- Isaac Hulme House 5 Green Street.

Langhorne Borough

Langhorne Borough emerged as an important commercial site at the crossroads of Bellevue Rd. and Maple Ave. in the early eighteenth century. This crossroads was a hub of coach transportation along the Bristol- Easton and Philadelphia-Trenton Roads. Langhorne was an important service center to farmers in the area until the 1870's when a reliable rail system, the Philadelphia & Bound Brook Railroad, allowed businessmen to commute to Philadelphia. The influx of new residents in the 1880s transformed this market town into a suburb of Philadelphia. This growth slowed after World War I until a new housing boom occurred in the area following World War II.

The Langhorne historic district occupies 185 acres focused around the original crossroads that formed the village center. The district includes homes built between 1738 and 1937 and was listed with the National Register of Historic Places in September 1987. Significant structures within the district include:

National Register

- Langhorne Library, 160 W. Maple Avenue.
- Joseph Richardson House, Bellevue & Maple Avenues.
- Tomlinson-Huddlestown House, 109 W. Maple Avenue.

National Register Eligible

- Hollywood Building of the Wood School, 236 S. Bellevue Avenue.

Bucks County Register of Historic Places

- Langhorne Hotel, Bellevue and Maple Avenues.
- George Walker House, 111 W. Maple Avenue.
- Jonathon Stackouse House, 139 W. Maple Avenue.
- Joseph Richardson House, Bellevue and Maple Avenues.
- Bethlehem African Methodist Episcopal Church, Pine and Flowers Streets.

Langhorne Manor Borough

Langhorne Manor Borough was formed from a core residential neighborhood populated by prominent residents of Langhorne and Philadelphia in the late 19th century. Originally known as Four Lanes End, Langhorne Manor Borough was incorporated in 1890 and named after the original owners of the land. Improvements in transportation in the late 19th century made Langhorne Manor a popular place of residence for Philadelphia businessmen. Originally these homes were very large and occupied lots of up to five acres, although many of these estates have since been converted into apartment buildings.

While there are no properties in the borough listed on the National Register of Historic Places, the borough does contain many potentially historic structures. Locally significant properties include:

Bucks County Register of Historic Places

- Samuel Linington House, 308 Gillam Avenue.
- Philadelphia College of Bible.
- Langhorne Spring Water District, along Hulmeville Ave.

Lower Southampton

Southampton was an agricultural community until the 1920s when easy access to Philadelphia transformed Lower Southampton into a residential suburban community. Responding to this growth, the township split into Upper and Lower Southampton in 1927. Lower Southampton has no properties on the National Register of Historic Places but lists these properties on the county register:

Bucks County Register of Historic Places

- Willett's Farm, 1547 Bustleton Pike.
- Buck Cemetery, Street Road & Fairview Avenue.
- Harding Cemetery, Street Road.
- Willett Knight House, 1409 Bustleton Pike.
- David Newport House, 526 Philmont Avenue.
- Vanartsdale–Snodgrass Farm Complex (Playwicki Farm), Bridgetown Pike.

Middletown Township

Middletown Township was so named because it was located midway between the Delaware River and agricultural communities further inland. Middletown was incorporated in 1682 and was part of the original Penn's Purchase. The township originally encompassed early manufacturing and commercial centers that eventually incorporated themselves into Hulmeville, Langhorne, Langhorne Manor, and Penndel boroughs in the late 1800s. Much of Middletown Township was rural and agricultural in nature until the housing boom of the mid 20th century. Levittown, the first of these planned suburban communities, typifies the growth in the township after World War II.

Middletown Township maintains a local registry of historic place that lists 113 properties as historically significant. The township also claims two extant buildings on the National Register of Historic Places and one that has since been demolished. Middletown has 12 additional properties that are eligible to be listed on the National Register.

National Register

- Edgemont, The Jenk's Homestead, Bridgetown Road.

- Beechwood, Rte. 213 & Flowers Mall.
- Harewood, demolished 1981.

National Register Eligible

- Boone Farm, 901 Langhorne-Newtown Road.
- John Buckman House 1567 Fulling Mill Road.
- Levi Buckman House, Route. 413.
- Wildman House, Langhorne Yardley Road.
- Harveson House, Tollgate Road.
- Jenks Hall, 295 Woodbourne Road.
- Daniel Larue house, 11424 Trenton Road.
- Maple Point School, Woodbourne Road.
- Thomas Stapler House, Newtown Pike.
- Trainer White Farm, Bridgetown Pike.
- Middletown Crossroads Hotel, 970 Durham Road.
- Wilson Tate House, Fulling Mill Road.

Bucks County Register of Historic Places

- Weinrich Tract, 1242 Brownsville Road.
- Middletown Friends Meetinghouse, 453 W. Maple Avenue.
- Joseph Richardson Farm, 878 Langhorne-Newtown Road.
- Bridgetown Tannery, 346 Bridgetown Pike.
- Subber Family Homestead, RD#1 Village Road.
- Pickering Farmhouse, Woodburne Road.
- Paxson Drake House, 1802 First Street.

Northampton

The area that is Northampton Township was part of William Penn's purchase of land from the Lenape Indians. The area was originally settled by English Quakers and later saw an influx of Dutch settlers in the Smoketown, now Churchville, section of the township. Northampton has a long history as an agricultural community with many mills along the Neshaminy Creek. The township's population began to grow in the late 1800's and again after World War II.

Northampton has four properties on the National Register of Historic Places and an historic district. Four other properties are listed as eligible for the National Register.

National Register

- Churchville Historic District.
- Hampton Hill, 1269 Second Street Pike.
- Twin trees Farm, 905 Second Street Pike.
- John Thompson House, 1925 Second Street Pike.

- Twining Ford Covered Bridge, Tyler State Park.
- Van Artsdalen Farm, 290 Foxcroft Drive.
- Willow Mill Complex, 559 Bustleton Pike.

National Register Eligible

- James Cornell Farm, Holland Road.
- Spring Garden Mills, Richboro Road.
- Hidden trail farm, 636 Almshouse Road.
- Willow Bank Farm, 130 Tanyard Road.

Bucks County Register of Historic Places

- Carrellton, 277 Bristol Road.
- Herzog's Corner, 569 Bustleton Pike.
- Feaster van Horn Cemetery, 115 Middle Holland Road.
- Shelmire Mill Tenement, 115 Middle Holland Road.
- Dr. Hugh Tombs Grist Mill, 1672 Chinquapin Road.
- Spring Brook, 400 Bridgetown Pike.
- Merry Dell Farm, 130 Merry Dell Road.
- David Krusen House, 191 Lower Holland Rd.

Penndel Borough

Penndel was incorporated as Attleboro in 1899, out of land that was Middletown Township. The town grew as a residential center in the 1880s with train service to Philadelphia. The formation of Penndel borough was centered around the Rumpf Hosiery mill, the town's major employer. The name of the borough was changed to South Langhorne in 1910 and then to Penndel in 1947. There are no properties in Penndel Borough listed on the county, state, or national register of historic places.

National Register Eligible

- Penndel Public School, 247 Hulmeville Avenue.

Upper Southampton Township

The area known as Southampton was part of William Penn's original purchase of land from the Lenape Indians in 1681. The township was founded by Quakers and recognized in 1703. In 1927, Southampton split, forming the townships of Upper and Lower Southampton. Upper Southampton remained a rural farming community until the 1950s, when a population boom resulted in its being almost completely developed by 1970. The village of Southampton forms the commercial core of the township.

National Register

- Southampton Baptist Church, Second Street Pike and Maple Avenue.

National Register Eligible

- 841 Street Road.

Bucks County Register of Historic Places

- Davisville Seminary, 10 Street Road.
- Gravel Hill Road Bridge over Mill Creek.
- Richard Leedom House 1255 Second Street Pike.

Analysis

Important Resource Areas

The study area is rich in historic and prehistoric resources. Where possible, historic resources should be preserved and strategies for adaptive reuse adopted. Education regarding prehistoric peoples and sites should be encouraged, especially regarding the important Playwicki Village site. Important historic areas should be priorities for flood and erosion mitigation projects.

Flood Damage

Measures should be taken to protect historic resources that are susceptible to flooding, particularly the Bridgetown, Hulmeville and Langhorne historic districts. As these resources help us to understand the growth and development of Bucks County and beyond, they have regional significance, and education to a broader audience should be used as a tool to garner support for future flood mitigation projects.

XIII. Stream Visual Assessments

On May 17, 2003, 16 members of the public met at Playwicki County Park to be trained in stream visual assessment techniques. Attendees were given stream visual assessment forms, which were modified versions of the Alabama Water Watch Visual Assessments. The purpose of the visual assessment was to enlist residents of the watershed to visit their local stream and report on the physical condition of the stream. Armed with maps, the assessment team indicated the presence of storm or sewer infrastructure, invasive plants, severe erosion, preserved natural areas or other notable physical characteristics of the stream stretch. Assessments were geared to give a general impression of the state of the streams in the watershed, and they also served the valuable purpose of getting residents into the creeks to witness firsthand the issues facing their local streams.

The visual assessment reports confirmed that the issues facing the Lower Neshaminy Watershed are typical of suburban watersheds. These assessments confirmed that erosion, invasive species, dumping of trash and yard waste is prevalent in local streams. The assessment teams also identified many important natural areas that are not well known along unnamed tributaries to the Neshaminy Creek. It is important to have these natural areas recognized so that they be conserved and enjoyed by the watershed's residents.

The assessment teams identified storm sewer infrastructure on their maps when applicable; this information may be helpful to the municipalities in the watershed when doing storm sewer infrastructure inventories that are required by the new NPDES Phase II stormwater regulations.

Results and recommendations of the visual assessment reports were included in the management options for the RCP. A matrix detailing the recommendations for each stream segment that was assessed is included in the Appendix to this report.

The visual assessments present a picture of a watershed in need of attention. Some issues, such as severe streambank erosion along the main stem Neshaminy Creek, are very large and will take years to address. Other opportunities, such as educating homeowners about not dumping their yard waste into the stream, can be addressed immediately. But these efforts need to be sustained for the Neshaminy Creek Watershed to reach its full potential.

The LNWCP steering committee would like to thank the following volunteers for their participation in the stream visual assessments of the Lower Neshaminy Creek Watershed:

Lois Abbott
Joe Amodei
Bob Beziat
Chris and Austino Blaydon
Estelle Brager
Lisa and Steve Buffardi
Walt DeWitt
Steve Donohue
Jim Edwards
Meredith Fischer
Kate Frietag
Kathy Horwatt
Frank Karwoski
Lysa Lepird
Bo McHale
Peg Mongillo
Regina Pena
Lionel Ruberg
Gretchen Schatschneider
Chris Steiber
Jeannette Sykes
Ray Walz
Rick Wendel
Christian Zetterberg

Stream Visual Assessment for Segment CC-1

Franklin Road to Tollgate Road
Tributary to Lake Luxembourg
Middletown Township

Weather: Clear
Assessment team: Erich Wendel
Date**:** 6/10/03

Notes:

Segment 1: County Road to Stone Meadow Farm

This segment is most likely a stormwater drainage area for the adjacent residential area. Stream is very small with silty bed (Photo 1). Water, when running, is clear with no aquatic life or algae. Vegetation on stream banks is grass / shrubs with multiflora rose, stilt grass and sumac present. There is a stand of Phragmites in the detention basin (Photos 2 & 3).

The stream is about two feet wide and six inches deep. The stream is channelized and fully exposed to the sun.

Segment 2: Stone Meadow Farm

This segment represents about 500 feet of stream as it flows across the Stone Meadow Farm. The water is clear and streambed is composed of boulders and gravel. The stream itself is fully shaded by thick vegetation. There are some green algae attached to the rocks in this segment. Fish are absent but amphibians were seen. The stream takes on a natural form in this section with some riffles present.

This segment is surrounded by open space and parkland. Silver maples are the dominant tree species. The detention basin mentioned in the previous segment has its outfall into this stream segment. A spring fed pond also releases water into this stream segment (Photo 4). At the end of this segment, the stream enters an underground pipe for approximately 100 feet.

Segment 3: Stone Meadow Farm downstream of underground pipe to Tollgate Road.

The stream enters a forested area in this segment (Photos 5 & 6). Very little erosion is present but the stream does widen to about eight to ten feet. The water slows in this low-lying segment before the stream enters Lake Luxembourg. The stream is fully shaded by a community of maples and oaks for up to 25 feet from the stream. Beyond 25 feet, the land use opens to fields.

Planning Implications

Stormwater

Small headwater streams are especially susceptible to the effects of large stormwater flows. Stomwater BMPs should be maintained or retrofitted where necessary to reduce stormwater velocities and improve water quality.

Invasive plants

Invasive plants such as phragmites and multiflora rose should be removed and replaced with native vegetation when possible.

Riparian buffer

Planting of a forested riparian buffer along this headwater stream would improve water quality, wildlife habitat and reduce erosion.

Segment CC-1 Photos

Photo 1. Ephemeral stream

Photo 2. Fields with invasive plants, Phragmites in detention basin

Photo 3. Multiflora rose

Photo 4. Pond outlet & detention basin outfall

Photo 5. Forested stream corridor

Photo 6. Forested stream corridor

Stream Visual Assessment for Segment CC-2

Basil to Silver Lake Road
Tributary to Lake Luxembourg
Middletown Township

Weather: Clear
Assessment team: Erich Wendel
Date: 5/30/03

Notes:

This segment is approximately 700 yards long and flows through residential and parkland uses (Photos 1&2). The stream is approximately six inches deep and composed of gravel boulders and bedrock. The right bank is forested and canopy fully shades the stream. The left bank is mowed to the edge and shows signs of erosion (Photo 3). Amphibians and abundant fish were observed in this segment. No algae were observed.

There are no pipe discharges in this stream segment but there are at least six private driveway bridges over the stream. Trash is present but not abundant (Photo 4). Streamside flora includes silver maple, oaks, crabapple and beech trees. Some multiflora rose is present.

This stream segment is felt to be in general good health. Volunteers noted the potential for stormwater run-off to affect this direct tributary to Lake Luxembourg.

Planning Implications

Homeowner education/lawn management

Homeowners should be encouraged to either plant or promote the growth of a riparian buffer. Currently the lawns are mown to the edge of the stream making the banks susceptible to erosion. Homeowners should be informed about the effects of NPS pollution and methods to improve water quality in the lake through good land use practices.

Segment CC-2 Photos

Photo 1. Stream flows through residential area

Photo 2. Driveways cross stream

Photo 3. Lawns mowed to edge of stream

Photo 4. Debris and trash

Stream Visual Assessment for Segment CC-3

Dam on lake Luxembourg to Bridgetown Pike
Core Creek
Middletown Township

Weather: Cloudy
Assessment team: Frank Karwoski and Ray Walz
Date: 6/14/03

Notes:

This stream segment stretches approximately 1.5 miles from the dam on Lake Luxembourg to Bridgetown Pike. The stretch is within Core Creek Park and flows under Park Road (Photo 1). Subsequently there is a good riparian forest on both banks of the stream with full canopy cover of the water. Forest continues for over 100 feet from the stream bank. The forest type is mixed deciduous trees (Photo 2).

The streambed is comprised of gravel, sand and boulders (Photo 3). Fish are moderately abundant and turtles and frogs were seen. Water clarity is good and no algae were present. The area also does not have litter or trash present. Erosion does not appear to be a problem in this stream segment.

Planning Implications

Forest management

This stream flows through an intact forest and subsequently appears to be a healthy habitat. Measures should be taken to ensure to quality of this habitat such as invasive plant management and forest management to prevent degradation of this resource.

Segment CC-3 Photos

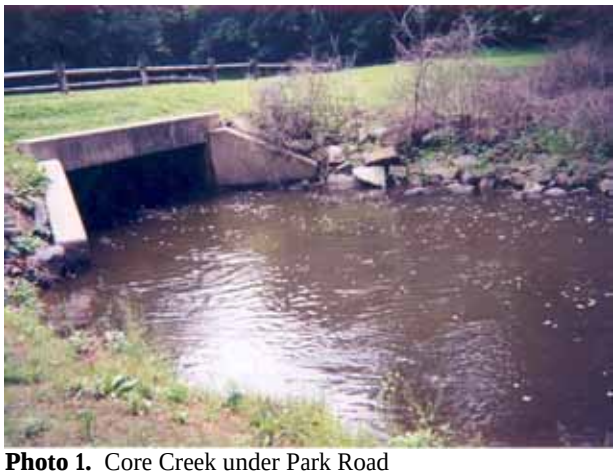


Photo 1. Core Creek under Park Road

Photo 2. Riffles in the stream

Photo 3. Stream flowing through forest

Photo 4. Stream under Bridgetown Pike

Stream Visual Assessment for Segment HU-1

Wilson Avenue to Main Street
Hulmeville Creek
Hulmeville Borough

Weather: Clear
Assessment team: Joe Amodei
Date: 6/28/03

Notes:

This stream segment flows through wooded and residential land uses. The water is clear and the streambed is composed of gravel and sediment (Photo 1). Dark green and brown algae are present in spots matted to the streambed and attached to rocks. Fish are moderately abundant but no reptiles or amphibians were seen. Stream banks have between 30-70 percent cover for up to 100 feet beyond stream edge (Photo 2.). Tree canopy covers an estimated 20-50 percent of the stream in this segment.

The stream shows signs of considerable erosion. The stream is approximately eight feet wide with six-foot high banks. Banks are actively slumping in places and debris has been dumped to stabilize banks (Photos 3&4). The stream does maintain a good riffle, run pool composition.

Invasive plant species are a special concern for this stream segment. Japanese knotweed is the dominant plant, with Japanese stiltgrass, multiflora rose and purple loosestrife are also present.

There is an abundance and variety of trash in this stream as well as many fallen trees and debris dams. Makeshift piping has bee installed to channel stream flow (Photo 5).

A fort or temporary shelter was noted in this stream segment (Photo 6).

Planning Implications

Stormwater

This stream segment suffers from active erosion due to upstream stormwater inflows. Stormwater velocities must be managed before restorations to this stream segment will become effective.

Restorations

There are many makeshift measures taken in this segment that are exacerbating the problems of this stream. Debris dumped on banks for stabilization contributes to downstream sedimentation. This stream is need of a comprehensive restoration plan.

Invasive species

Invasive plant species are abundant in this disturbed stretch of stream. These species should be removed as part of a comprehensive restoration strategy.

Segment HU-1 Photos

Photo 1. Sediment in streambed

Photo 2. Forested buffer and erosion

Photo 3. Slumping banks

Photo 4. Debris dumped on streambank

Photo 5. Makeshift piping

Photo 6. Temporary shelter?

Stream Visual Assessment for Segment I-1

Almshouse Road to Second Street Pike
Ironworks Creek
Northampton Township

Weather: Clear
Assessment team: Lisa and Steve Buffardi
Date: 8/4/03

Notes:

This stream segment was approximately 1,500 feet long. The stream runs through residential and commercial land uses that pipe stormwater into the stream (Photo 1). At the time of the assessment, the water was clear and no odors were present. The streambed consisted of gravel and sediment. Green and brown algae were present in spots attached to rocks.

The stream ranged from 1 to 15 feet wide with an average depth of 4 inches. There is riparian vegetation shading 70-100 percent of the stream channel. Beyond 25 feet from the stream bank, the vegetation thins. The dominant riparian vegetation is exotic honeysuckle and multiflora rose. The assessment team did not indicate the presence of native or woody vegetation. The stream is not channelized and shows good riffle-run-pool composition (Photo 2). No signs of erosion were present.

Two to three species of fish were noted on the assessment but no amphibians were seen. The assessment team noted abundant trash in the stream including appliances, sofas and typical trash. The team also witnessed pipes discharging odorless water into the stream (Photos 3&4).

Planning Implications

Discharges

Residents should be encouraged to redirect sump pump discharges to places where the water has an opportunity to seep back into the ground rather than discharging directly into the stream, adding volume during storm flow.

Trash and debris

This stream would benefit from clean-up programs both along the stream and along the roads that cross the stream.

Invasive species

Invasive plant species are a problem throughout the watershed and should be controlled wherever possible.

Segment I-1 Photos

Photo 1. Commercial parking lot stormwater discharge pipe.

Photo 2. Streambed composition and bank vegetation

Photo 3. Drain pipe for stormwater discharge.

Photo 4. Discharging storm sewer

Stream Visual Assessment for Segment M-1

Street Road to Bustleton Pike
Mill Creek
Lower Southampton Township

Weather: Cloudy
Assessment team: Jeannette Sykes and Estelle Brager
Date: 6/11/03

Notes:

Segment 1: 60 ft. length Street Road to downstream
The stream in this segment is bordered by commercial uses with a wooded riparian buffer (Photo 1). Water in the stream segment had a green color but no odor to it at the time of this assessment. The streambed in this segment consists of bedrock. There were no fish observed in the stream but a turtle was seen. Erosion is not an issue and the banks are completely vegetated with >30 percent vegetation cover from 20-100 feet back from the bank. Beech, Maple and Oak trees are the dominant tree species in this riparian forest buffer. Multiflora rose is present.

Woody debris forms the only obstruction to the stream in this segment. Litter such as bottles and cans are moderately abundant.

Segment 2: 450 ft. behind B&R Health club parking lot
This stream segment is characterized by an attractive woodlands behind the B&R Health Club (Photo 2). The water quality in this segment is clear and no odors or algae are present. No fish or amphibians were observed in this segment. The stream edge is approximately 30-70 percent covered by vegetation within 25 ft of the stream itself. Vegetative cover is <30 percent 25-100 feet from the stream. The streambed is mostly made up of boulders. There is severe erosion in this stream segment with the roots of some large beech trees exposed. The right bank appears to have been covered with soil fill. A sewer casement is exposed in this stream segment.

Tree composition is similar to the previous segment. Periwinkle is quite common on the right bank. Woody debris, bottles and cans are moderately abundant in this stream segment. There is a walking path on the right side of the stream behind the health club.

Segment 3: End of B&R Health club parking lot
This segment runs for approximately 20 ft. beyond the parking lot. The left bank of the stream is exposed and severely eroded (Photo 3.). Adjacent land uses are residential and condominiums.

Segment 4: End of health club to Bustleton Pike

This stream segment is surrounded by residential land uses. Streambed composition consists of gravel and boulders. Riparian vegetation covers between 30 –70 percent of each bank. Dominant tree types are sycamore, sweet gum, maple and dogwood but there is a bamboo infestation behind the condominiums on the left bank. Multiflora rose is present. This stream segment shows signs of severe erosion in the curves. Bristol Road is within the floodplain in the last 125 ft. of this segment. There were no fish, amphibians or algae observed in this stream segment and water clarity and odor were clear.

Planning implications

Stormwater management

Stormwater flows from adjacent parking lots should be managed using techniques that will reduce stormwater velocities and improve water quality. Measure such as vegetated parking islands and grassed pavers for overflow parking can have positive effects on the stream while improving aesthetics of the parking lot.

Streambank erosion

Improved stormwater management throughout the watershed will reduce damage from erosion such as the exposed sewer casement and eroding stream banks. Riparian property owners need to be educated about the damage done to stream quality by dumping of materials on stream banks to slow erosion.

Invasive plants

Multiflora rose appears to be the dominant invasive plant in this segment. Measures should be taken to replace the multiflora rose with native plants where possible. The bamboo infestation should be addressed before it spreads further. Invasive plant management is an issue for all of the riparian corridors in the Lower Neshaminy Creek Watershed.

Segment M-1 Photos

Photo 1. Riparian vegetation at Street & Stump Rds

Photo 2. Woodlands behind B&R health club

Photo 3. Severe erosion

Photo 4. Mill Creek approaching Bustleton Pk.

Stream Visual Assessment for Segment M-2

Street Road to Bustleton Pike
Mill Creek
Lower Southampton Township

Bustleton Pike to Bristol Road

Weather: Partly cloudy
Assessment team: Meredith Fischer
Date: 6/23/03

Notes:

Two branches of the Mill Creek come together in this segment. The southern branch flows behind some industrial land uses and the stream corridor in this section is not as wide as the mainstem of the Mill Creek (Photo1 & 2). There are also more discharge pipes in this section than in the main branch Mill Creek, both storm sewer discharges and pipes where the source was unidentified (Photos 3 &4). The stream is generally bordered by wooded floodplain with some wetland areas. Streambed composition consists of gravel and boulders with silt. Algae are present in spots attached to rocks. Fish are moderately abundant in this segment but there is an apparent lack of diversity of species (<3 Species observed). No amphibians were seen.

There is a good presence of riparian vegetation in most of this segment and the stream is fully shaded (Photos 5& 6). This stream segment does suffer from severe erosion especially on the curves of the creek (Photo 7). Banks can reach ten feet in height. Tree and shrub species include walnut, lady fern, arrowood, blackberry, and shining and smooth sumac. Invasive plants account for the majority of the vegetation with multiflora rose and honeysuckle dominating (Photos 5& 6). Garlic mustard, wine berry and periwinkle are also present.

The surrounding land uses are residential and industrial (Photo 8). There is moderate litter in the stream. There are numerous discharge pipes in this stream segment. One pipe was noted as discharging an orange liquid (Photo 3). The creek corridor behind industries suffers from erosion and degradation (Photos 9&10).

Sewer infrastructure follows the creek and the Mill Creek pumping station in located on Bristol Road (Photo 11).

Planning Implications

Discharges

There are many discharges within this stream segment. Sources and composition of effluent form these discharges should be identified as part of the NPDES Phase II stormwater regulations. The outfall discharging orange liquid should be investigated further.

Commercial land uses

Commercial and industrial property owners should be approached concerning the maintenance and management of their streamside property.

Sewer infrastructure

Sewer infrastructure parallels this stream. Sewer piping should be inventoried and monitored for leaks to protect water quality and aquatic habitat of this regionally important resource.

Erosion

Improved stormwater management is necessary to reduce stormwater velocities, which are at the root of this stream's erosion problems. Bank restorations may be successful in areas with the proper preparation and engineering. Soft or vegetative engineering techniques should be used wherever possible.

Segment M-2 Photos

Photo 1. S. Branch flowing under Bristol Rd.

Photo 2. Stream entering forested area.

Photo 3. Unidentified discharge

Photo 4. Storm sewer discharge

Photo 5. Vegetated Riparian zone S. branch

Photo 6. Vegetated riparian zone Mill Creek

Photo 7. Exposed stream banks

Photo 8. Residential area with manhole

Photo 9. Poorly maintained industrial lot

Photo 10. Erosion undermining fencing

Photo 11. Mill Creek pump Station

Stream Visual Assessment for Segment M-4

Cherry Blossom Road to Bristol Road
Mill Creek
Northampton Township

Weather: Clear
Assessment team: George Pickul
Date: 6/6/03

Notes:

This stream segment is a small headwater stream that flows through residential land uses and community open space (Photo 1). The water is clear and the streambed is composed of gravel and sediment. No algae or fish were seen. Stream banks have good cover for up to 100 feet beyond stream edge. Tree canopy covers an estimated 50-75 percent of the stream in this segment.

There are many PVC sump pump outflows in the residential area of this segment as well as storm sewer outfalls (Photo 2). Trash is moderately abundant. Litter is the main type. Multi flora rose and Japanese honeysuckle are present in this stretch. There are areas of severe bank undercutting in this section (Photos 3 & 4). There is a natural waterfall (Photos 5& 6) in this segment.

Planning Implications

Residential land uses

Riparian landowners should be educated about the benefits of refraining from mowing lawns to the stream's edge. Landowners should also be encouraged to direct sump pump discharges to areas where the water can infiltrate back into the ground instead of discharging directly into the stream.

Erosion

Erosion and severe bank undercutting of small streams is a result of high stormwater flow velocities. Reducing this impact of erosion will require better stormwater management in the watershed. Mitigation of severe erosion should be undertaken using soft or vegetative measures where practical. Homeowners should be discouraged from addressing erosion by dumping materials on the stream bank.

Segment M-4 Photos

Photo 1. Residential area

Photo 2. Storm sewer outfall

Photo 3. Attempt at erosion control

Photo 4. Severe stream bank erosion

Photo 5. Natural waterfall

Photo 6. Natural waterfall

Stream Visual Assessment for Segment M-5

Bridgetown Pike to Playwicki Park
Mill Creek
Northampton Township

Weather: Clear
Assessment team: Regina Pena
Date: 6/24/03

Notes:

This stream segment is approximately 1,000 feet in length. The stream in this segment is clear and no odor was present at the time of the assessment. Some green and brown algae are attached to the rocks at the bottom of the stream. No fish or amphibians were seen during this assessment. The streambed is composed of rocks and sediment. There does appear to be a riffle-run-pool morphology with deep runs accounting for ~65 percent of the stream length.

Riparian vegetation shades between 25-50 percent of the stream but stream banks are severely eroded (Photo 1). Streambank heights approach 12 feet, especially near the Mill Creek Confluence with the mainstem Neshaminy. Stream width approaches 40 feet near Playwicki Park (Photo 2). Channel depth in this segment is over 30 inches. Photos 3 & 4 reveal exposed roots and fallen trees caused by erosion. This condition is typical of this stream segment. Upstream stormwater flows carry large woody debris downstream.

Multi flora rose is the dominant plant in this area but there is a good amount of jewelweed. This segment is free from litter and trash from the surrounding residential land uses. The assessment team did note that illegal swimming is a use of the stream in this area.

Planning Implications

Erosion

Erosion in this stream segment is mostly undercutting of vegetated stream banks. This type of erosion is a product of high velocity stormwater flows. The best way to mitigate this type of erosion is through better stormwater management throughout the Mill Creek Watershed. Streambanks in this segment would require extensive restoration to prevent further undercutting and erosion.

Invasive species

Multiflora rose is the predominant invasive plant in this segment. Efforts to control this invasive plant should be undertaken, especially on public and park land.

Segment M-5 Photos

Photo 1. Severely eroded banks

Photo 2. Mill creek is wide as it approaches Playwicki

Photo 3. Tree lost to erosion

Photo 4. Fallen trees and roots in stream

Stream Visual Assessment for Segment Nesh-1

Mainstem Neshaminy Newtown-Richboro Rd to Playwicki
Neshaminy Creek
Northampton & Middletown Townships

Weather: Clear
Assessment team: Chris and Austino Blaydon
Date: 7/1/03

Notes:

This section was assessed by canoe. The assessment team started at Rt. 332 and canoed to Playwicki Park. The water was generally clear, with good riparian vegetation for large stretches of the stream corridor. Bridges, discharge pipes and abandoned automobiles were common on this stretch of the stream (Photos 1-3). Erosion does not seem excessive, although there are stream banks shored with rip-rap and stone (Photo 4). Tributary streams of various clarity and quality are also noted in the assessment.

Fish and amphibians were seen. Carp were noted. Japanese knotweed was indicted as a notable invasive plant present, particularly near the George School property and along the stream in Langhorne Borough. Brown and green algae were noted attached to rocks at the bottom of the streambed. Streambed composition varies from rock, gravel, and sediment to bedrock in some areas.

The stream is approximately 50 feet wide through out this section and approximately 4 feet deep (Photo 5). There is sewer infrastructure apparent through out this stream segment (Photo 6) and at least on pipe discharging directly into the stream.

There are numerous railroad and highway bridges across the stream. These bridges cause sediment to accumulate in the streambed and facilitate downstream bank erosion. The segment does not have an abundance of trash or large woody debris and construction materials are present (Photo 6).

Planning Implications

Erosion and Stormwater flows

This stream segment suffers from high velocity stormwater flows and some erosion. Addressing these issues will require watershed wide actions advocated by this plan.

Japanese knotweed

Japanese knotweed is beginning to dominate the riparian corridor along the mainstem of the Neshaminy Creek. A comprehensive eradication and

control strategy should be instigated to halt the advance of this invasive plant.

Sewer infrastructure

Sewer infrastructure parallels and crosses the stream throughout this segment. The condition of these pipes should be surveyed regularly to reduce interaction between the contents of the sanitary sewer and the stream.

Segment Nesh-1 Photos

Photo 1. Newtown-Richboro Road Bridge

Photo 2. Abandoned bridge abutment

Photo 3. Abandoned car in stream

Photo 4. Boulders stabilizing streambanks

Photo 5. View of stream corridor

Photo 6. Sewer infrastructure exposed and debris

Stream Visual Assessment for Segment Nesh-2

Railroad Bridge to Pennswood Village
Neshaminy Creek
Middletown Township

Weather: Clear
Assessment team: Lionel Ruberg
Date: 6/29/03

Notes:

Railroad Bridge to Pennswood Village 2,500 ft upstream from southern boundary of Pennswood Village property to Newtown Langhorne Road.

The Neshaminy Creek is approximately 50 feet wide with 2-8 foot banks in this stretch (Photo 1). There is good forest cover on both banks up to 100 feet from the stream's edge. Streambank erosion is not noted as severe.

Many fish and one large turtle were observed. Recreation and fishing were noted as uses of the stream in this section. Small areas of Multiflora rose and Japanese knotweed are present in the first 500 feet but there is a good population of tulip poplar and hickory. Knotweed becomes abundant in the next 2,000 feet of stream segment.

Stormwater discharge pipes were witnessed in this section of the Neshaminy Creek (Photo 2). There was very little trash in this stream segment.

Planning Implications

Pennswood Village Property

A stand of trees borders this stream segment on the Pennswood Village Community property. Efforts to facilitate the community's preservation of this forest should be facilitated.

Japanese Knotweed

Japanese knotweed is beginning to dominate the riparian corridor near the George School. This invasive should be removed and the area planted with native riparian vegetation

Segment Nesh-2 Photos

Photo 1. Dry weather discharge from storm water pipe

Photo 2. View of Neshaminy from Pennswood Village

Stream Visual Assessment for Segment Nesh-3

Mainstem Neshaminy along Langhorne Borough Border
Neshaminy Creek
Langhorne Borough

Weather: Clear
Assessment team: Kathy Horwatt & Sean Greene
Date: 8/1/03

Notes:

This section of the Neshaminy Creek is wooded on both banks. A good riparian forest exists. Water is clear and odorless. Fish were witnessed but no amphibians. Streambed composition is mostly rock and gravel.

The right bank suffers from severe erosion with banks over ten feet tall. Japanese knotweed, honeysuckle and multi flora rose are beginning to dominate the riparian area (Photo 1). Attempts to shore the banks with concrete are apparent (Photo 2).

The stream is approximately 50 feet wide through out this section and approximately 4 feet deep. There are sump and drainage pipes discharging directly into the stream (Photo 3).

A small tributary stream shows signs of degradation and erosion from high stormwater velocities from storm pipes from Rt. 413 (Photo 4).

There is an outcropping of bedrock in this stream segment that creates a small waterfall with deep-water pools. Kathy indicated that residents along this stream segment receive bottled drinking water from PECO in response to contaminated wells.

Planning Implications

Tributaries

Small tributaries are especially susceptible to damage from high velocity stormwater flows and carry tons of sediment to the Neshaminy Creek each year. Local stormwater management should include protection of the ephemeral streams.

Homeowner education

Riparian property owners should be encouraged to direct their sump pump discharge on to land where it has an opportunity to infiltrate back into the ground instead of discharging directly into the stream. Property owners should also be educated about invasive plant species and encouraged to remove them whenever possible

Segment Nesh-3 Photos

Photo 1: Japanese Knotweed along banks of creek

. Concrete pipes stabilizing streambank

Stream Visual Assessment for Segment P-1

Buck Road to Woodenbridge Road
Pine Run
Northampton Township

Weather: Clear
Assessment team: Peg Mongillo and Chris Steiber
Date: 8/20/03

Notes:

Segment 1: Buck Road to 1,125 feet downstream
This stream section flows through residential land uses with a wooded area on the left bank. There is a good riparian buffer on the left bank and residential lawns dominate the right bank. The stream is 10-12 feet wide with 3-5 foot banks. Erosion is more severe on the right bank where lawns are mowed to the edge of the stream (Photo 1). The streambed consists of sand, gravel, silt and boulders. Pools constitute 50 percent of the stream course with only approximately 20 percent being riffle area. Light green algae were present attached to rocks.

The assessment team indicated that the following native species were abundant: White Ash, Black Locust, Silky Dogwood, Boxelder, Jewelweed and Poison Ivy. Abundant invasive species included Multiflora Rose, Norway maple, privet, Lesser Celandine and Japanese Stiltgrass.

Fish were noted as moderately abundant in this stream segment and a good diversity of species were present (>3 species visible). No amphibians were seen in this segment.

The assessment team noted that litter was moderately abundant in this stream segment but there were areas where concrete was dumped to shore streambank erosion (Photo 2). No discharges were noted in the stream segment. A small tributary was determined to funnel stormwater into the stream. This tributary had severe streambank erosion.

Segment 2: End of wooded area on left bank to Woodenbridge Road. This segment is less wooded than the upstream segment and impact from residences is more evident. The stream itself is partially exposed (25-50 percent) to the sun and vegetation along the banks is mostly mown grass. The streambed is composed of gravel, silt and sand. Green algae are present in spots attached to rocks. The segment does have good riffle-run-pool composition and stream depth ranges from 6 inches to 4 feet in the pools.

Native woody vegetation includes Silky Dogwood and Red Maple. Privet and Fox Grape are the dominant invasive plant species. Stream banks show

signs of erosion and attempts to shore up the banks (Photo 3). Banks attain a height of 10 feet in some areas and exposed trees roots are common (Photo 4).

Fish are abundant in this segment and larger species were seen. No amphibians were noted by the assessment team.

There is very little litter in this stream segment but residents do dump yard waste and grass clippings along the stream bank (Photo 5). This stream segment is free of obstructions and woody debris.

Discharge pipes were identified but none were discharging at the time of the assessment.

Planning Implications

Residential land uses

Riparian landowners should be educated about the benefits of refraining from mowing lawns to the stream's edge. Landowners should also be discouraged from dumping yard waste and construction materials into the stream. Yard waste increases organic loading on the stream and construction materials dumped on stream banks ultimately are swept downstream exacerbating sedimentation and erosion. Homeowners should be informed about better methods to reduce erosion and to encourage infiltration of stormwater on their properties.

Erosion

Improved stormwater management is necessary to ultimately reduce erosion in this stream system. In the mean time, homeowners should be encouraged to use proper bio-technical techniques to protect their streamside property. Vegetative or soft engineering should be encouraged where possible.

Invasive species

Riparian property owners should be encouraged to utilize native plant species in landscaping their properties, especially in the riparian corridor.

Segment P-1 Photos

Photo 1. Residential lawns and erosion

Photo 4. Exposed roots due to severe erosion

Photo 2. Concrete and debris dumped to shore erosion.

Photo 5. Yard waste dumped into stream

Photo 3. Gabions stabilizing streambank

Stream Visual Assessment for Segment P-2

Woodenbridge Road to Fork in Stream
Pine Run
Northampton Township

Weather: Cloudy
Assessment team: Peg Mongillo and Jim Edwards
Date: 8/13/03

Notes:

Segment 1: Woodenbridge Road to Brookside Drive

This stream section was approximately 750 feet long. The stream runs through primarily residential land-uses (Photo 1). The streambed is mostly sand and sediment with some gravel. Algae were present in spots, mostly matted to the streambed but also attached to rocks.

The stream ranged from 10 to 12 feet wide with a depth of 1.5 feet in places. There is riparian vegetation shading 70-100 percent of the stream channel on the right bank and 50-75 percent on the left bank. The left bank shows some erosion and banks of 5 feet on the stream curves. Beyond 25 feet from the stream bank, the vegetation thins to less than 30 percent coverage. The stream exhibited good riffle-run-pool composition. This section exhibits good riparian vegetation but there are areas where lawns are mown to the stream edge. These areas exhibited signs of erosion (Photo 2). The assessment team indicated that the following native species were abundant: white ash, sweet gum, dogwood shrub, black willow, clearweed nettle and jewelweed. Abundant invasive species included multiflora rose, Norway maple, and Japanese stiltgrass.

Fish were noted as abundant in this stream segment and a good diversity of species were present (>3 species visible). No amphibians were seen in this segment.

The assessment team noted that litter was minimal in this stream segment but there were areas were residents dumped their yard waste (Photo 3). There are numerous obstructions in the stream including woody debris and two dams (Photo 4). Pipe outfalls discharging water were witnessed (Photo 5). A six-inch discharge at Woodenbridge Road had a hydrogen sulfide odor (Photo 6).

Segment 2: Brookside Drive to Fork in Pine Run

This segment is predominately wooded with good riparian vegetation on both banks. Residences are set back from the stream and this segment does not have the erosion characteristics of the upstream segment. Algae are present in spots attached to stream bottom. Streambed composition has

more gravel than upstream segment. Stream width is stable at 12 feet and the banks are sloping to a height of 5 feet. The stream segment exhibits good riffle-run-pool composition. Native vegetation is present in the riparian area. Abundant species include: black walnut, black willow, red maple and jewelweed. Abundant invasive plant species include: dodder, pokeweed and Japanese stiltgrass.

Aquatic life is abundant in this segment. Tadpoles, crayfish and many species of fish were witnessed.

Trash was more abundant than the upstream segment. It is mostly comprised of typical litter, bags, bottles and cans. Where the dam is in this segment, there is much woody debris, which helps create pools (Photo 7).

Sump pump and other stormwater discharge pipes were witnessed but none were discharging at the time of the assessment. Dumping of yard wastes is still an issue in this stream segment (Photo 8).

Planning Implications

Residential land uses

Riparian landowners should be educated about the benefits of refraining from mowing lawns to the stream's edge. Landowners should be encouraged to direct sump pump discharges to areas where the water can infiltrate back into the ground instead of discharging directly into the stream. This stream segment suffers from streamside landowners dumping their yard waste into the stream. This activity should be discouraged as it negatively affects stream water quality.

Erosion

Improved stormwater management is necessary to reduce stormwater velocities. Bank restorations may be successful in areas with the proper preparation and engineering. Soft or vegetative engineering techniques should be used wherever possible.

Trash and Debris

This stream would benefit from clean-up programs both along the stream and along the roads that cross the stream.

Segment P-2 Photos

Photo 1. Erosion and residential land use.

Photo 2. Severe erosion and debris dam.

Photo 3. Yard waste dumped into stream.

Photo 4. Dam across Pine Run

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Photo 5. Storm sewer outfall.

Photo 6. Storm sewer outfall at Woodenbridge Rd.

Photo 7. Breached concrete dam.

Photo 8. Yard waste dumped into stream.

Stream Visual Assessment for Segment UT 1

Joanne Road to St. Leonard's Road
Unnamed Tributary to Neshaminy Creek
Northampton Township

Weather: Cloudy and Rainy
Assessment team: Gretchen Schatschneider and Sean Greene
Date: 6/29/03

Notes:

Segment 1: Joanne Road to Bridge Road

This stream originates on township owned open space on the north side of Middle Holland Road. By the time the stream flows under Joanne Road, it is a small flowing stream. Assessments of this stream segment were done from road crossings as the stream flows through residential development.

Grass is mown to the edge of the stream with little riparian vegetation other than grass (Photo 1& 2). The water is clear. There were no fish or amphibians seen. Light green algae were present in spots. Trash from upstream storm flows is present.

Segment 2: Bridge Road to St. Leonard's Road

This segment represents about 400 feet of stream from Bridge Road down stream. In this segment, the stream flows through retirement community. Grass is managed to the edges of the stream with accompanying erosion present. There were some algae attached to the streambed but water clarity was good. There were no odors, fish or other aquatic life. There is less than 25 percent of the stream shaded by vegetation. The stream is approximately six feet wide and the banks range from four-five feet (Photo 3). There is some litter from upstream storm flow. A large elevated corridor crosses the stream.

Segment 3: Beginning of forest in retirement community to St. Leonard's Road.

The stream enters a forested riparian buffer on the retirement community property. The stream is composed of rock, gravel and boulders although some concrete blocks are present. The stream corridor is in a surprisingly natural state in this segment. Water clarity is good and there are no odors present. There are some algae attached to stream substrate. Fish are not as abundant as would be expected for a forested stream and there appear to be three different species present. The stream is not channelized and seems to have good riffle-run-pool sequencing.

The stream is about 50-75 percent shaded by vegetation. Streambank heights are approximately 3 feet on outside turns. Siltation islands are present. The

bridge at Old Jordan Rd (Photo 4) also shows some indication of causing downstream scouring.

Vegetation present included a good amount of skunk cabbage and jewelweed but also large stands of multiflora rose monoculture. Japanese honeysuckle and Virginia creeper are also present. Some stormwater infrastructure was witnessed but none had flow on this rainy day.

The stream has some obstructions in the form of small dams, roads and bridge crossings. There are natural woody debris blockages as well as small bedrock waterfalls (Photo 5).

Concrete blocks were the predominant litter, although litter from upstream storm flow was present. Signs of ATV use are present in the densely wooded corridor (Photo 6).

Planning Implications

Residential land uses

Riparian landowners should be educated about the benefits of refraining from mowing lawns to the stream's edge. Trees and shrubs along the banks of small headwater streams offer good protection for downstream conditions.

Homeowners should also be educated about NPS pollution and actions that the homeowner can take to reduce NPS pollution impacts on this stream.

Erosion

Erosion in this stream segment, while not severe, can be reduced by managing stormwater flows from the residential and institutional land uses in the headwaters of the stream. Measures such as retrofitting detention basins to reduce stormwater velocity and use of vegetated swales in the headwaters areas of this stream can protect it from severe erosion.

ATV Use

ATVs damage native vegetation, open habitat for invasive species and facilitate erosion. This stream segment flows through a relatively large tract of undisturbed habitat and should be protected from damage from illegal ATV use.

Forested land

There is a large forested tract of open space. This forest is largely unmanaged and used only by local residents. It should be protected as an important resource in the township and protected from degradation.

Invasive species

The forested portion of this stream segment is a valuable community amenity. A local group should be encouraged to work on removing existing invasive plants and preventing new invasives from getting a foothold in this forest.

Segment UT 1 Photos

Photo 1. Lawn mown to edge of creek

Photo 2. Lawn mown to edge of creek

Photo 3. Bank erosion

Photo 4. Bridge over Old Jordan Road

Photo 5. Bedrock waterfall

Photo 6. ATV damage to slope

XIV. Neshaminy Creek RCP Public Survey

A short public survey was developed for residents of the Lower Neshaminy Creek Watershed. The purpose of the survey was to increase awareness of the RCP process and to capture the input of people who may not have the opportunity to participate in the planning process through other scheduled public participation events. Survey results are not statistically significant due to the nature of the distribution of the survey, but are a valuable tool to capture a larger pool of input from stakeholders.

Surveys were distributed through mail by Hulmeville, Langhorne, and Langhorne Manor Boroughs and Middletown, Northampton, Lower Southampton and Upper Southampton townships. Copies of the surveys were also placed at the Southampton and Lower Southampton public libraries for distribution. The survey was accessible through Heritage Conservancy's website.

One thousand surveys were distributed in March 2003. Municipalities mailed between 50 and 150 surveys each, depending on municipality size and percentage of area within the watershed. Of those 1,000 surveys, 125 were returned to Heritage Conservancy and eight were filled out on their website.

On average, survey respondents have lived in their municipality for over 20 years and lived within the county for almost 30 years. The average age of respondents was 50 years of age. These numbers indicate that respondents have seen great changes in the nature of their municipalities and may be reflected in the rankings given to greatest watershed threats and needs questions that are posed in the survey. **Figure 24.** summarizes the municipality of respondents, average tenure in municipality, average tenure in Bucks County and average age of respondents.

Table 25 - Age and Tenure Characteristics of Respondents

Municipality	Number of Respondents	Average Age	Average Tenure in Municipality	Avg. Tenure in Bucks Co
Hulmeville	6	51	28	29
Langhorne	17	52	23	30
Langhorne Manor	12	50	19	30
Lower Southampton	8	55	32	36
Middletown	20	44	20	35
Northampton	14	50	15	24
Upper Southampton	42	53	21	25
Other	13	58	25	25
All Respondents	133	50	21	29

Eighty four percent of respondents indicted that they lived within 1 mile of the Neshaminy Creek or one of its major tributaries (112 of 133) with 41 percent (55) living along the creek. Fifty-six percent (74) of respondents visit the creek at least one time a month. Thirty-two percent (41) of respondents

answered that they have experienced some degree of property damage due to flooding from the Neshaminy Creek or one of its tributaries. These responses indicate that those surveyed have are familiar with the creek through either living near by or visiting it often.

Respondents indicated that they visited Tyler State Park (27 percent) most often, with Core Creek (24 percent) and Churchville Nature Center (23 percent) a close second and third. Thirteen percent of responses indicated that they visit Playwicki County Park most often and nine percent responded that they utilize other county or state parks most often. **Table 26**. summarizes these results.

Table 26 - Most visited parks

Park	% Indicating Most Visited Park	Total Responses
Tyler State Park	27%	50
Core Creek County Park	24%	46
Churchville Nature Center	23%	43
Playwicki County Park	13%	25
None	4%	8
Other	9%	16
Total	100%	188*

* Some surveys indicated more than one park.

Other local parks receiving mention included Tamanend Park in Upper Southampton and Playwicki Farm Park in Lower Southampton.

Hiking/biking was identified as the most popular activity for respondents with wildlife and bird watching ranked second. **Table 27.** summarizes the activities and percentage of respondents who participate in them.

Table 27 - Most Popular Activities.

Activity	% Participating	Total Responses
Hiking/Biking	33%	81
Wildlife/Birdwatching	20%	50
Nature programs	12%	30
Fishing	11%	27
Sports/Active Recreation	12%	29
Other	12%	30
Total	100%	247*

* Some surveys indicated more than one activity.
Other activities receiving mention were bike riding, picnicking and sailing.

When asked to rank the most important recreational need for the study area, respondents indicated the need for more passive recreational opportunities. Natural open spaces were ranked as the most important resources in the Lower Neshaminy Watershed and also as the highest priority for resources in need of improvement.

The highest number of responses indicated that municipal governments should seek grants to fund these improvements, followed by county government funding, special referendum taxes, special interest funding and users fees. **Table 28.** summarizes these responses.

Table 28 - Summary of responses to "Who should fund recreational improvements?"

Funder	% Indicating Funder	Total Responses
Municipal government seeking grants	34%	99
User fees	14%	40
Special referendum taxes	18%	52
County government funding	19%	55
Special interests / non-profits should fund	16%	46
Total	101%*	292**

*May not equal 100 percent due to rounding.
**Respondents indicated more than one funding source.

The survey is included in Appendix G of this report.
Other comments included from the surveys are listed below.

- "Equal access to trails should be provided for bikers not just horseback riders".
- "Creek needs to be dredged"(2)
- "Developers should pay a creek maintenance fee".
- "Houses were built in areas where they should not have after the flood of 1955".
- "Retention basins in established neighborhoods need to be improved".
- "Trails along the creek are a bad idea".

XV. Management Options

Management options for the Lower Neshaminy Creek Watershed Conservation Plan were developed based on the goals of the plan, input from public meetings and surveys, results of the stream visual assessments and resource inventory and concerns of the public and steering committee.

Management options are comprehensive in nature and most are relevant to all of the municipalities in the study area and the region as a whole. The steering committee prioritized the management options to give a sense of the projects that should be addressed first under each goal.

A matrix detailing the management options for this plan, potential project partners and the timeframe of expected project implementation are included in this section.

Prioritized Goals

Goal: Water Quality

Protect and improve the water quality in the Neshaminy Creek Watershed to improve recreational opportunities, wildlife habitat and sources of drinking water.

Prioritized objectives and actions

1) NPDES requirements
   a) Implement remediation and conservation design education
   b) Implement six minimum control measurements
      i) Public education and outreach
      ii) Public participation and involvement
      iii) Illicit discharge detection and elimination
      iv) Construction and site runoff control
      v) Post construction runoff control
      vi) Pollution prevention/good house keeping for municipal operations

2) Act 167 Management recommendation
   a) Adopt water quality goals per Act 167 plan

3) Protect drinking water sources
   a) Protect watershed as important source of drinking water
   b) Institute wellhead protection programs
   c) Reduce demand on water sources through residential water conservation programs
   d) Support efforts of local watershed groups to improve and protect water quality in the watershed

4) Water quality BMPs
   a) Implement naturalized stormwater BMPs to improve water quality

5) Sewer infrastructure
   a) Conduct sanitary sewer survey to determine locations of leaks, overflows, infiltration and inflow
   b) Repair and replace aging sewer infrastructure that adversely affects stream water quality
   c) Convene meeting of watershed municipalities, water utilities, wastewater utilities and DEP to explore cooperation meeting federal mandates.

6) Target locations for these actions include:
   a) Mill Creek between Street Road and Bustleton Pike, (L. Southampton)
   b) Neshaminy Creek Mainstem from Newtown-Richboro Road to Playwicki Park (Langhorne, Middletown and Northampton)
   c) Pine Run Creek from Woodenbridge Road to fork in stream (Northampton)

7) Churchville Reservoir and Lake Luxembourg
   a) Reduce sediment and nutrient loading on reservoirs and flood control lakes to improve drinking water quality, fishery and recreational opportunities
   b) Support Goose population control measures on lakes and watercourses

8) Water quality monitoring program
   a) Train, recruit and educate volunteer water quality monitors

Goal: Stormwater

Improve the way stormwater is managed in the watershed to reduce flooding, protect stream baseflow, and maintain the hydrologic balance.

Prioritized objectives and actions

1) Ordinances
   a) Update ordinances to support improved stormwater BMP design, construction, operation and maintenance
   b) Review municipal weed ordinances to eliminate conflicts with stormwater quality management goals

2) Stormwater management
   a) Support efforts to research requirements of establishing stormwater utility
   b) Coordinate stormwater management, conservation and preservation efforts between organizations and municipalities throughout the Neshaminy Creek Watershed
   c) Revisit 1997 Lower Neshaminy Watershed Water Quality and Stormwater Study

3) Best Management Practices (BMPs)
   a) Retrofit and/or naturalize BMPs where possible to promote infiltration and improvements in water quality
   b) Utilize treatment wetlands and innovative BMPs as educational tools for the public, municipalities and agencies
   c) Install innovative BMPs on pubic and school district land to be used as demonstration sites

4) School district property
   a) Conduct a professional assessment of school district stormwater management facilities
   b) Fund position at school district to address improved stormwater management, oversee implementation of assessment recommendations
   c) Create capital improvement policies at school districts that incorporate sound environmental and stormwater management practices

5) Vegetation
   a) Develop and implement residential, municipal and public education programs that address the benefits of naturalized land for water management and air quality
   b) Utilize urban tree canopy programs to encourage urban forestry in the watershed
   c) Increase the number of street trees in developed areas of the watershed

6) Stormwater flows
   a) Reduce residential stormwater run-off through promotion of rain barrels, rain gardens and homeowner education

Goal: Flood Damage

Reduce impacts from flooding on economic, historic and natural resources.

Prioritized objectives and actions

1) Flood prone properties
   a) Purchase flood prone properties for conversion to public open space.
   b) Ensure proper management of acquired land through property management plans
   c) Support park department staff person to address property management

2) Floodplains and wetlands
   a) Reduce exemptions to existing ordinances allowing encroachment and building in these areas
   b) Sponsor study to remap 100 year floodplain to account for upstream development as in Pennypack and Tacony creek watersheds

c) Strengthen existing ordinances that protect property in the stream corridor
d) Encourage protection of existing wetlands and natural floodplain areas through conservation easements

3) Zoning and building exemptions
   a) Provide training to zoning hearing boards regarding the cumulative effects of exemptions and increased impervious surface on the hydrologic cycle of the watershed
   b) Develop handbook for ZHBs educating them about cumulative impacts of impervious surfaces and offer recommendations of measures that can mitigate environmental damage

4) Debris and obstructions in stream
   a) Establish dialog with DEP, NRCS and ACE to create procedure for removal of obstructions

Goal: Important Resource Areas

Identify and protect the unique historical and scenic resources of the watershed.

Prioritized objectives and actions

1) Public open spaces
   a) Develop management plans for public open spaces and all park land
   b) Encourage naturalization of open spaces
   c) Create fund for purchase of trees, shrubs and meadows grasses to be used by municipalities, schools and organizations for re-vegetating open spaces

2) Reduce damage to natural areas
   a) Control invasive and exotic plants and animals
   b) Develop invasive species management study for watershed
   c) Institute measures to reduce damage from Canada Goose and White Tailed deer
   d) Control illegal ATV use on open spaces

   Target Areas for illegal ATV use are
   a) Forest adjacent to unnamed tributary to Neshaminy behind retirement community on St. Leonard's Road (Northampton)
   b) Open space along Neshaminy Creek in Langhorne Borough
   c) Bellwood preserve (Northampton)

3) Protect prioritized NAI sites
   a) Enact stricter resource protection regulations in designated NAI areas
   b) Protect NAI areas through acquisition or conservation easements

4) Link important resources
   a) Implement BCPC proposed greenway networks
   b) Develop trails, bike paths and greenways linking important natural and historic resources

5) Historic sites
   a) Maintain historic resources
   b) Update historic preservation ordinances
   c) Promote adaptive re-use of historic buildings

6) Education
   a) Create resource materials for use by municipalities regarding the benefits of using native vegetation in landscaping and residential gardens
   b) Encourage municipalities and school districts to adopt policy to use native vegetation in facility landscaping
   c) Install and maintain educational and regulatory signage in public open spaces

Goal: Biological Resources, Wetlands and Recharge Areas

Promote the recharge of groundwater resources and protect floodplains, streambanks, wetlands, riparian, natural areas and areas of biological importance.

Prioritized objectives and actions

1) Groundwater resources and stream baseflow
   a) Identify important groundwater recharge areas and protect as open space.

2) Riparian buffers
   a) Restore streambanks and riparian buffers along streams in the watershed

   The following areas should be targeted for riparian restorations
   a) Tributary to Lake Luxembourg, Franklin to Tollgate Roads (Middletown)
   b) Hulmeville Creek between Wilson Avenue and Mainstream (Hulmeville)
   c) Mill Creek behind B&R Health Club to Bustleton Pike (L Southampton)
   d) Mill Creek, Street Road to Bustleton Pike (L Southampton)
   e) Mill Creek, Bridgetown Pike to Playwicki Park (Northampton)
   f) Neshaminy Creek (Langhorne)
   g) Neshaminy Creek at Adventure Land Day Camp (Bensalem)
   h) Pine Run, Buck to Woodenbridge Road (Northampton)

3) Support goals of the Churchville Greenway Watershed master plan

a) Initiate cooperative projects to fulfill master plan goals and objectives

4) Promote good management practices on community open spaces
   a) Promote invasive plant and animal control, reduced mowing schedules, and other environmentally sound management practices for community held open spaces and common areas.
   b) Address illegal ATV in community open spaces
   c) Promote use of vegetated buffers around BMPs and ponds to discourage use by Canada Goose

5) Fisheries
   a) Improve fisheries in Churchville Reservoir Lake and Luxembourg

Goal: Parks and Recreation

Increase recreational opportunities, link greenways throughout the watershed and promote open space acquisition.

Prioritized objectives and actions

1) Municipal recreation facilities
   a) Maintain and improve playground and recreational facilities
   b) Increase passive recreation opportunities for residents through acquisition and management of natural open spaces
   c) Improve bike path and bike trail network through-out the watershed and park system

2) Environmental education
   a) Support CNC efforts to educate public and school children regarding environmental issues

3) Increase access to the creek for recreation
   a) ID potential public access points
   b) Acquire property / easements to increase public access

4) Canoe and kayak access points
   a) Identify and install canoe and kayak access points to the Neshaminy Creek
   b) Develop access points utilizing sound environmental design practices to serve as educational sites

5) Playwicki Farm Park
   a) Develop educational signage or programming informing public about important archaeological site

6) Promote connection of this park through Mill and Neshaminy Creek greenways
   a) Perform a gap analysis, acquire land, develop a trail network, restore wildlife habitats, develop environmental education programs and

encourage public participation in planning, acquisition, operations and maintenance

Goal: Education and Coordination

Educate the public, including builders, municipalities and residents, about reducing negative impacts from their activities, on floodplains and riparian areas.

Prioritized objectives and actions

1) Regulatory mandates
   a) Coordinate efforts between municipalities, water and wastewater utilities to cooperatively address SDWA, Act 167, NPDES Phase II and TMDL for Neshaminy Creek Watershed to capitalize on efforts

2) Promote integration of RCP with municipal comprehensive plans and ordinances watershed-wide

3) Review implementation of plan recommendations within five years
   a) Organize working group to encourage plan project implementation

4) Residents and homeowners
   a) Develop programs and materials educating homeowners about environmentally sensitive land use practices

5) Signage
   a) Post educational signage at stream crossings, naturalized areas, public open spaces and historical sites
   b) Pursue program to designate official names for unnamed tributaries to the Neshaminy Creek. Ensure that perennial streams are mapped

6) Sponsor regular trash and debris removal efforts

   The following areas should be targeted for this action
   a) Ironworks Creek Almshouse Road to Second Street Pike (Northampton)
   b) Mill Creek behind B&R Health Club to Bustleton Pike (L Southampton)
   c) Mill Creek Cherry Blossom to Bristol Road (Northampton)
   d) Neshaminy Creek Newtown–Richboro Road to Playwicki Park (Langhorne, Middletown and Northampton)
   e) Pine Run Brookside Drive to fork in stream
   f) Unnamed tributary to Neshaminy Joanne to Bridge Road (Northampton)

Table 29 – Management Options Matrix

Issues and Concerns	Conservation Actions	Primary Partners	Supporting Partners	*Projected Implementation*
1. **Water Quality Goal:** Protect and improve the water quality in the Neshaminy Creek Watershed to improve recreational opportunities, wildlife habitat and sources of drinking water.				
NPDES requirements	Implement remediation and conservation design education	Municipalities, DEP, BCCD	BCPC, HC	1-5 years
Act 167 Management recommendations	Adopt water quality goals per Act 167 plan	Municipalities, DEP	BCPC	1-2 years
Protect drinking water sources	• Protect watershed as important source of drinking water • Institute wellhead protection programs • Reduce demand on drinking water sources through residential water conservation programs • Support efforts of local watershed groups to improve and protect water quality in the watershed	Water utilities, municipalities, DEP	BCPC	2-5 years
Water Quality BMPs	• Implement Naturalized stormwater BMPs to improve water quality	Municipalities, PEC, HC, BCPC		ongoing
Sewer infrastructure	• Conduct sanitary sewer survey to determine locations of leaks, overflows, infiltration and inflow • Repair and replace aging sewer infrastructure that adversely affects stream water quality • Convene meeting of watershed municipalities, water utilities, wastewater utilities and DEP to explore cooperation meeting federal mandates.	Sewer utilities, municipalities, BCPC, BC, PEC,HC, Neshaminy Alliance	SDW revolving fund, PennVest, DCED	Ongoing
Lakes Springfield and Luxembourg	• Reduce sediment and nutrient loading on reservoirs and flood control lakes to improve drinking water quality, fishery and recreational opportunities • Support Goose population control measures on lakes and watercourses	BCCD, NRCS, municipalities,	DEP	Ongoing
0Water quality monitoring program	Train, recruit and educate volunteer water quality monitors	DRK, watershed associations		3-5 years
2. **Stormwater Goal:** Improve the way stormwater is managed in the watershed to reduce flooding, protect stream baseflow, and maintain the hydrologic balance.				
Ordinances	• Update ordinances to support better stormwater management • Review weed ordinance for conflicts with stormwater quality management goals	Municipalities, HC PEC, BCPC		1-2 years
Stormwater flows	• Reduce residential stormwater run-off through promotion of rain barrels, rain gardens and homeowner education	Municipalities, HC, BCPC, BCCD, PEC	DEP	1-2 years
Best Management Practices (BMPs)	• Retrofit and/or naturalize BMPs where possible to promote infiltration and improvements in water quality • Utilize treatment wetlands and innovative	Municipalities, HC, BCPC, BCCD, PEC	Consultants, DVRPC, Universities	1-5 years

Issues and Concerns	Conservation Actions	Primary Partners	Supporting Partners	*Projected Implementation*
	BMPs as educational tools for the public, municipalities and agencies • Install innovative BMPs on public and school district land to be used as demonstration sites			
School District Property	• Conduct a professional assessment of school district stormwater management facilities • Fund position at school district to address improved stormwater management, oversee implementation of assessment recommendations • Create capital improvement policies at school districts that incorporate sound environmental and stormwater management practices	Municipalities, BC, School Districts	BCPC, DEP	2-10 years
Vegetation	• Develop and implement residential, municipal and public education programs that address the benefits of naturalized land for water management and air quality • Utilize urban tree canopy programs to encourage urban forestry in the watershed • Increase the number of street trees in developed areas of the watershed	CNC, BCCD, HC, PEC, municipalities	DCNR, DEP, SEFRA	1-2 years
Stormwater management	• Support efforts to research requirements of establishing stormwater utility • Coordinate stormwater management, conservation and preservation efforts between organizations and municipalities throughout the Neshaminy Creek watershed • Revisit 1997 Lower Neshaminy Watershed Water Quality and Stormwater Study to implement recommendations	Municipalities, BCPC, Local Municipal Authorities, PEC, Neshaminy Alliance	State Legislators, DEP	Ongoing
3. Flood Damage Goal: Reduce impacts from flooding on economic, historic and natural resources				
Floodplains and wetlands	• Reduce exemptions to existing ordinances allowing encroachment and building in these areas • Sponsor study to remap 100 year floodplain to account for upstream development as in Pennypack and Tacony creek watersheds • Strengthen existing ordinances that protect property in the stream corridor • Encourage protection of existing wetlands and natural floodplain areas through conservation easements	Municipalities, BCPC, ACE, DEP, FEMA, PEMA		1-5 years
Debris and obstructions in the stream	• Establish dialog with DEP, NRCS and ACE to create procedure for removal of obstructions	ACE, DEP, municipalities, PAF&BC	State Legislators	1-2 years
Flood prone properties	• Purchase flood prone properties for conversion to public open space. • Ensure proper management of acquired land through property management plans • Support park department staff person to	BCDPR, BCCD, HC	NRCS, FEMA, PEMA	Ongoing

Issues and Concerns	Conservation Actions	Primary Partners	Supporting Partners	*Projected Implementation*
	address property management			
Zoning and building exemptions	• Provide training to zoning hearing boards regarding the cumulative effects of exemptions and increased impervious surface on the hydrologic cycle of the watershed • Develop handbook for ZHBs educating them about cumulative impacts of impervious surfaces and offer recommendations of measures that can mitigate environmental damage	HC, PEC, BCPC		2-4 years
4. Important Resource Areas Goal: Identify and protect the unique historical and scenic resources of the watershed.				
Public open spaces	• Develop management plans for public open spaces and all park land • Encourage naturalization of open spaces • Create fund for purchase of trees, shrubs and meadows grasses to be used by municipalities, schools and organizations for re-vegetating open spaces	BCDPR, CNC	HC, BCPC DCNR	2-6 years
Reduce damage to natural areas	• Control invasive and exotic plants and animals • Develop invasive species management study • Institute measures to reduce damage from Canada Goose and White Tailed deer • Control illegal ATV use on open spaces	BCDPR, BCCD, municipalities, HC, police departments	NRCS, DCNR, SEFRA	1-2 years
Protect prioritized NAI sites	• Enact stricter resource protection regulations in designated NAI areas • Protect NAI areas through acquisition or conservation easements	Municipalities, HC, BC, Land Trusts	DCNR	Ongoing
Link important resources	• Implement BCPC proposed greenway networks • Develop trails, bike paths and greenways linking important natural and historic resources	Municipalities, HC, BC, BCPC	DCNR, DVRPC	2-5 years
Historic sites	• Maintain historic resources • Update historic preservation ordinances • Promote adaptive re-use of historic buildings	Historical Societies, HC,	DCED, PHMC	1-5 years
Education	• Create resource materials for use by municipalities regarding the benefits of using native vegetation in landscaping and residential gardens • Encourage municipalities and school districts to adopt policy to use native vegetation in facility landscaping • Install and maintain educational and regulatory signage in public open spaces	CNC, BCDPR, municipalities, HC		1-2 years

Issues and Concerns	Conservation Actions	Primary Partners	Supporting Partners	*Projected Implementation*
5. Biological Resources, Wetlands and Recharge Areas Goal: Promote the recharge of groundwater resources and protect floodplains, streambanks, wetlands, riparian, natural areas and areas of biological importance.				
Groundwater resources and stream baseflow	Identify important groundwater recharge areas and protect as open space.	Municipalities, BCPC, HC		2-5 years
Riparian buffers	Restore streambanks and riparian buffers along streams in the watershed	BCCD,BCDPR,HC SWA, municipalities		Ongoing
Support goals of the Churchville Greenway Watershed master plan	Initiate cooperative projects to fulfill master plan goals and objectives	BCDPR,CNC,HC,BCCD, SWA		Ongoing
Promote good management practices on community open spaces	• Promote invasive plant and animal control, reduced mowing schedules, and other environmentally sound management practices for community held open spaces and common areas. • Address illegal ATV in community open spaces • Promote use of vegetated buffers around BMPs and ponds to discourage use by Canada Goose	BCCD, BCDPR,NRCS, PSCE, DCNR		1-5 years
Fisheries	Improve fisheries in Lakes Springfield and Luxembourg	PAFBC,BCDPR, TU		1-5 years
6. **Parks and Recreation Goal:** Increase recreational opportunities, link greenways throughout the watershed and promote open space acquisition.				
Municipal recreation facilities	• Maintain and improve playground and recreational facilities • Increase passive recreation opportunities for residents through acquisition and management of natural open spaces • Improve bike path and bike trail network through-out the watershed and park system	BCDPR, BC, CNC,	DVRPC,DCNR	2-5 years
Environmental education	Support CNC efforts to educate public and school children regarding environmental issues	CNC,BCDPR,DCNR, school districts		Ongoing
Increase access to the creek for recreation	ID potential public access points	Municipalities, HC	DCNR	2-5 years
Canoe and kayak access points	• Identify and install canoe and kayak access points to the Neshaminy Creek • Develop access points utilizing sound environmental design practices to serve as educational sites.	Municipalities, BCDPR,	DCNR	2-5 years
Playwicki Farm Park	Develop educational signage or programming informing public about important archaeological site.	LST,DCNR,	Temple University	1-2 years
Mill Creek and Neshaminy Creek Greenways	Perform a gap analysis, acquire land, develop a trail network, restore wildlife habitats, develop environmental education programs and encourage public participation in planning, acquisition, operations and maintenance.	Municipalities, HC, BC, BCPC	DCNR, DVRPC	1-5 years

Issues and Concerns	Conservation Actions	Primary Partners	Supporting Partners	*Projected Implementation*
7. Education and Coordination Goal: Educate the public, including builders, municipalities and residents, about reducing negative impacts from their activities, on floodplains and riparian areas.				
Regulatory mandates	Coordinate efforts between municipalities, water and wastewater utilities to cooperatively address SDWA, Act 167, NPDES Phase II and TMDL for Neshaminy Creek Watershed to capitalize on efforts	Municipalities, AAWC, BCWSA, LBJMA, upstream communities, Neshaminy Alliance	BCPC, HC, DEP, PEC	Ongoing
Review implementation of plan recommendations within five years of plan completion	Organize working group to encourage plan project implementation	Steering committee members, Neshaminy Alliance	HC, PEC Agencies	1-5 years
Residents and homeowners	Develop programs and materials educating homeowners about environmentally sensitive land use practices	Municipalities, DCNR, HC, Watershed Associations, PEC		1-2 years
Signage	Post educational signage at stream crossings, naturalized areas, public open spaces and historical sites. Ensure that perennial streams are mapped	CNC, BC HC, historical societies SWA		1 year
Sponsor trash and debris removal efforts	Organize volunteers and advocacy groups as well as municipalities to clean trash and debris from streams	Municipalities, CNC, HC, SWA		1 year

XVI. List of Abbreviations

AAWC	Aqua America Water Company
ATV	All Terrain Vehicle
ACOE	Army Corps of Engineers
BCPC	Bucks County Planning Commission
BCWSA	Bucks County Water and Sewer Authority
BMP	Best Management Practice
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CNC	Churchville Nature Center
CWF	Cold Water Fishery
DRBC	Delaware River Basin Commission
DVRPC	Delaware Valley Regional Planning Commission
EV	Exceptional Value
FEMA	Federal Emergency Management Agency
FBC	Pennsylvania Fish and Boat Commission
GIS	Geographic Information System
HQ	High Quality
HSG	Hydrologic Soil Group
LNWCP	Lower Neshaminy Watershed Conservation Plan
MF	Migratory Fishes
MS4	Municipal Separate Storm Sewer System
NAI	Natural Areas Inventory
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NPS	Non-Point Source
NWI	National Wetlands Inventory
PA DCNR	Pennsylvania Department of Conservation and Natural Resources
PA DEP	Pennsylvania Department of Environmental Protection
PASDA	Pennsylvania Spatial Data Access
PASS	Pennsylvania Archaeology Site Survey
PGC	Pennsylvania Game Commission
PNDI	Pennsylvania Natural Diversity Index
RCP	River Conservation Plan
SEPTA	Southeastern Pennsylvania Transportation Authority
TMDL	Total Maximum Daily Load
TSI	Trophic State Index

USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WWF	Warm Water Fishery

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Appendix A

Municipal Natural Resource Protection
Summary Ordinance Matrix

Municipal Natural Resource Protection Summary

Catagories		Middletown	Hulmeville	Northampton	Upper Southampton	Lower Southampton	Pendell	Langhorne	Langhorne Manor
	Location Recent Ordinances and Date Enacted	Zoning Ord. 1991 Updated 2000	Code of Ordinances 2002	Code of Northampton Township, 2001	S & LD 295	Zoning Ord. Updated 2000	Stormwater Management Ord. 1992	Zoning Ord. 8/95	Zoning Ord. 1996
Land Resources - Soils	Agricultural Security Area (acres)							Preserved Farm-Lojeski Tract	
	Restrictions on Prime Agricultural Soild								
	Agricultural Advisory Committee								
	Control Development on Restrictive Soils	100% OS on Floodplain Soils	100% OS on Floodplain Soils	100% OS on Alluvial Soils Where No Floodplain	100% OS on Floodplain Soils		100% OS on Floodplain Soils	100% OS on Floodplain Soils	100% OS on Floodplain Soils
Land Resources - Steep Slopes	Percent Protected on Slope 8-15% %Natural Cover	50%	60%		60%	60%	8+% slope, 60%	50%	50%
	Percent Protected on Slope 15-15% % Natural Cover	70%	70%	70%	70%	70%		60%	60%
	Percent Protected on Slope 25+% % Natural Cover	85%	85%	85%	85%	85%		75%	75%

Municipal Natural Resource Protection Summary

Catagories		Middletown	Hulmeville	Northampton	Upper Southampton	Lower Southampton	Pendell	Langhorne	Langhorne Manor
Location Recent Ordinances and Date Enacted		Zoning Ord. 1991 Updated 2000						Zoning Ord. 1995	Zoning Ord. 1996
Land Resources - Woodlands	Percent Protected for Open Space in Sensitive Areas	80%	60%	80%	Avoid development in wooded area		60% all areas	60%	60%
	Percent Protected for Open Space in Other Areas	50%		50%					
	Tree Protection Ordinance	Yes-100% in TPZ		Yes-100% in TPZ	Yes-100% in TPZ			Yes-100% in TPZ & Have Shade Tree Commission	Yes-100% in TPZ & Have Shade Tree Commission
Land Resources - Minerals	Quarry Operations Regulations Location	Quarry Regulations (Zoning Ord. 2003)							
Location Recent Ordinances and Date Enacted									
Water Re	Water Conservation Devices			Yes - on Fixtures		Yes - on Fixtures	Yes - on Fixtures		
	Well Drilling Ordinance			Yes-Construction Standards (Twp. Well Drilling Ord.)					
	Water Conservation Ordinance (Date enacted)			Yes		Yes			
	Low Density Zoning Near Supply								
	Drought contingency Plan								

Municipal Natural Resource Protection Summary

Catagories			Middletown	Hulmeville	Northampton	Upper Southampton	Lower Southampton	Pendell	Langhorne	Langhorne Manor
Wastewater Plan for Municipalities			Bucks County Sewage Facility Plan	Bucks County Sewage Facility Plan	Bucks County Sewage Facility Plan	Bucks County Sewage Facility Plan	Bucks County Sewage Facility Plan	Bucks County Sewage Facility Plan	Bucks County Sewage Facility Plan	Langhorne Manor Boro Sewer Facility Plan 1989
Water Resources - Water Quality	Wastwater Pre-treatment includes sewage treatment (plant and treatment level). All plants must also meet DEP regs.		Lower Bucks County Joint (M2) Secondary	N.E. Phila (M21) Secondary	N.E. Phila (M21) Secondary	Chapel Hill (M18) Territory, N.E. Phila (M21) Secondary	N.E. Phila (M21) Secondary	Chapel Hill (M18) Territory, N.E. Phila (M21) Secondary	N.E. Phila (M21) Secondary	
	Percent Proted for Open Space for Lake/Pond/ Watercourse		100%			100%		100%	100%	100%
	Percent Protected for Open Space for Lake/Pond/ Watercourse Margin (Margin in ft.)		80% (100ft.)	70% lake margins and 10% impervious surface; 80% pond and 10% impervious surface.					80% pond margin, 70% lake margin	80% (100 ft.)
	On-Lot Disposal System Management or Education Programs									
	Private Well Testing (Location for Criteria)			Yes						Yes - SLDO
	Watershed Location		Neshaminy & Delaware River South	Neshaminy	Little Neshaminy & Neshaminy	Neshaminy, Pennypack & Proquessing	Neshaminy, Pennypack & Proquessing	Neshaminy	Neshaminy & Delaware River South	Neshaminy & Delaware River South
	Prevent Industrial Contamination through		Yes	Yes	Yes	Yes-100% in TPZ	Yes	Yes	Yes	Yes
	Erosion and Sedimentation Control		Yes--SLDO 2000	Clean Stream Law	Yes--SLDO in Planning Code	Yes--SLDO 1992	Yes	Yes--SLDO	Yes--SLDO 2000	Yes - Ord. 1993-01-01
	Stormwater	Stormwater Runoff Equals Pre & Post development	Yes	Yes				Yes	Yes	Yes
		Stormwater Management Plans or Critera Location	Yes--SLDO 2000	Code of Ordinances 2002	Yes--Plan in Planning Code	Yes--SLDO 1992	Yes - Ord. #415,	Stormwater Management Ord. 1992	Yes - Ord. 1993 Neshaminy Creek Watershed	Yes - Ord. 1993 Neshaminy Creek Watershed

Municipal Natural Resource Protection Summary

Catagories			Middletown	Hulmeville	Northampton	Upper Southampton	Lower Southampton	Pendell	Langhorne	Langhorne Manor
Location Recent Ordinances and Date Enacted				Code of Ordinances 2002					Zoning Ord. 1995	Zoning Ord. 1996
Land/Interface Resources - Floodplains	Percent Protected for Development in 100-yr Floodplain (% OS)		100%	100%	100%	100%	100%	100%	100%	100%
	Limit Development on 100-yr Floodplain Fringe		100% fps	Yes						
	Wetlands	Percent Protedcted for Open Space in Wetland Areas	100%	100%	100%	100%		100%	100%	100%
		Percent Proteced for Open Space in Wetland Margins (ft.)	80% (100ft)	80% (100 ft.)	80%	80%			80%	80% (100 ft.)
Location recent Ordinances and Date Enacted										
Significant Natural Features-Wildlive	Critical Wildlife Habitat									
	Rare Plans Communities									
Geology	Geologic Features		Fall Line				Fall Line, Franklin Limestone	Fall Line		
	Restrictive Geologic Formation	Carbonate Geology Ordinance								
		Limit Development in Groundwater Areas								

Appendix B

Soil Types Matrix

Soil Types

Soil Series	Symbol(s)	HSG	Erosion potential	Drainage potential	Soil location	Topography
Abbotstown	AbB, AbC	C	slight to moderate	somewhat poorly drained	uplands	nearly level to sloping
Alton	AlA, AlB	A	slight to moderate	well drained	terraced out washes	nearly level to gently sloping
Amwell	AmA, AmB	C	moderate	slightly poorly drained	uplands	gently sloping
Bedington	BeB	B	slight to moderate	well drained	upland	nearly level to sloping
Bowmansville	Bo	B/D	low	poorly drained	floodplain	nearly level
Brownsburg	BsA, BsB, BsC	B	slight to severe	well drained	uplands	nearly level
Buckingham	BwB	C	slight to moderate	slightly poorly drained	uplands	nearly level to gently sloping
Chalfont	CbA, CbB	C	slight to moderate	slightly poorly drained	upland	nearly level to gently sloping
Chester	CeC	B	slight to high	well drained	uplands	nearly level to very steep
Culleoka	CyB, CyC	B	moderate to high	well drained	upland	gently sloping to moderately steep
Delaware	DaD	B	slight	well drained	floodplain terraces	nearly level
Doylestown	DdA, DdB	D	slight to moderate	poorly	upland	level to gently sloping
Duffield	DfB	B	moderate to high	well drained	upland	gently sloping to sloping
Duncannon	DuA	B	moderate to high	well drained	uplands	nearly level to gently sloping
Fluvaquent	Fl	C	slight	poorly drained	floodplain	nearly level
Fountainville	FoA, FoB	C	slight to moderate	moderately well drained	uplands	nearly level to gently sloping
Glennville	GrA, GrB	C	slight to moderate	moderately well drained	uplands	moderate sloping
Hatboro	Ha	D	slight	poorly drained	floodplain	nearly level
Klinesville	KlB, KlC,KlD	C	moderate to high	well drained	upland	gently sloping to

Soil Types

Soil Series	Symbol(s)	HSG	Erosion potential	Drainage potential	Soil location	Topography
						very steep
Lansdale	LaB, LaC, LaD, LdE	B	slight to high	well drained	uplands	nearly level to very steep
Lawrencville	LgB	C	slight to high	moderately well drained	uplands	gently sloping
Manor	MaB, MaC, MaD	B	moderate to high	well drained	uplands	gently sloping to very steep
Mattapex	MdA	C	slight	moderately well drained	coastal plain	nearly level
Othello	Ot	C/D*	none	poorly drained	floodplain terraces	nearly level
Penn	PeA, PeB, PeC, PeD	C	moderate to high	well drained	upland	gently sloping to very steep
Readington	RdB	C	slight to moderate	moderately well drained	uplands	nearly level to sloping
Reaville	RiC	C	severe	moderately well to slightly poorly drained	uplands	severe sloping
Rowland	Ro	C	low	moderately well drained	floodplain	nearly level
Steinsburg	StB, StC	B	moderate to high	well drained	upland	gently sloping to moderately sloping
Towhee	ToA	D	slight	poor	upland	gently sloping to gently sloping
Urban Land*	UlB, UlC, UdB, UdC	varies	characteristics variable	characteristics variable	variable	level
Urdothents	Ua, Ub, UfB, UdB	varies	low to moderate	moderately well to exceptionally well drained	uplands	nearly level to severe sloping
Weikert	WfD	B/D*	moderate to high	well drained	upland	gently sloping to moderately sloping

*indicates under drained/undrained conditions

Appendix C

Best Management Practices (BMPs)

Best Management Practices

This section provides information on the effectiveness, benefits, and relative costs of best management practices suitable for use in Bucks County. Table 1 describes constraints and restrictions for certain BMPs under various conditions. Table 2 describes the control benefits provided by various practices. Table 3 demonstrates BMP pollutant removal effectiveness. Table 4 shows the benefits, in addition to water quality control, of certain BMPs. Table 5 describes benefits related to general costs for a variety of BMPs. Table 6 presents the relative costs and feasibility factors for certain BMPs. These tables are meant as a guide. The benefits, limitations, and costs associated with installing BMPs vary depending on site characteristics such as hydrology, topography, size, and land use.

Table 1. Constraints on Treatment Practices

BMP	Slope	High Water Table	Close to Bedrock	Proximity to Foundations	Space Consumption	Maximum Depth Limitations	High Sediment Input	Thermal Impacts
Oil separator	●	●	■	■	●	○	○	●
Extended detention dry basin	●	●	■	●	○	●	■	●
Wet pond/Constructed wetland	●	●	■	●	○	○	■	○
Vegetated swale	■	○	■	■	●	●	○	●
Vegetated filter strip	■	■	■	■	●	●	○	●
Infiltration basin	■	○	○	■	■	○	○	●
Infiltration trench	○	○	○	○	●	○	○	●
Porous pavement	○	○	○	○	○	○	○	●
Urban forestry	●	■	●	■	●	●	●	●

● Generally not a restriction
■ Can be overcome with careful site design
○ May preclude the use of a BMP

Source: British Columbia Research Corp., 1992, cited in Horner et al., 1994.

Table 2. Comparative Quality Control Benefits Provided by Water Quality Control Practices

BMP	Peak Discharge Control			Volume Control	Groundwater Recharge/Low Flow Maintenance	Stream Bank Erosion Control
	2-Year Storm	10-Year Storm	100-Year Storm			
Oil separator	○	○	○	○	○	○
Extended detention dry basin	●	●	●	○	○	●
Wet pond	●	●	●	○	○	●
Constructed wetland	●	●	●	■	■	●
Vegetated swale/Filter strip/Urban forestry	■	○	○	■	■	○
Full infiltration basin	●	■	○	●	●	●
Combined infiltration-detention basin	●	●	●	●	●	●
Off-line infiltration basin	○	○	○	●	●	●
Full infiltration trench/Porous pavement	●	■	○	●	●	●

● Usually provided ○ Seldom or never provided ■ Sometimes provided with careful design

Source: British Columbia Research Corp., 1992, cited in Horner et al, 1994.

Table 3. Potential Pollutant Removal Effectiveness of Treatment Practices

BMP	Contaminant						
	Suspended solids	Oxygen Demand	Total Lead	Total Zinc	Total Phosphorus	Total Nitrogen	Bacteria
Oil separator	○	◆	◆	◆	◆	◆	◆
Extended detention dry basin	●	■	●	■	■	○	◆
Wet pond	●	■*	●	■	■*	○*	◆
Constructed wetland	●	●*	●	●	●*	●*	◆
Vegetated swale	●	○	●	■	○	○	◆
6-meter-wide turf filter strip	○	○	○	○	○	○	◆
30-meter wide forested filter strip	●	●	●	●	■	■	◆
Infiltration practices	●	●	●	●	●	■	●

● High potential for removal
■ Moderate potential for removal
○ Low potential for removal
◆ Insufficient knowledge

* May be subject to exports of nutrient-enriched and deoxygenated water

Source: British Columbia Research Corp., 1992, cited in Horner et al, 1994

Table 4. Potential and Auxiliary Benefits of Treatment Practices

BMP	Aquatic Habitat Creation	Wildlife Habitat Creation	No Temperature Increase	Landscape Enhancement and Aesthetics	Recreational Benefits	Public Safety	Community Acceptance
Oil separator	○	○	●	○	○	●	●
Extended detention dry basin	○	●	●	■	■	■	■
Wet pond	●	●	○	●	●	■	●
Constructed wetland	●	●	○	■	■	■	■
Vegetated swale	■	■	■	■	○	●	●
Vegetated filter strip	○	●	●	■	■	●	●
Infiltration basin	○	●	●	■	■	●	■
Infiltration trench	○	○	●	○	○	●	●
Porous pavement	○	○	●	○	○	●	●
Urban forestry	○	●	●	●	■	●	●

● Usually provided
■ Sometimes provided
○ Seldom provided

Source: British Columbia Research Corp., 1992, cited in Horner et al, 1994

Table 5. BMP Benefits and Costs

BMP	Beneficial For:	Beneficial with some Limitations for:	Advantages	Disadvantages	Pollutants Removed (Average % Efficiency)	General Cost
Extended detention - dry pond	· Flood control · Erosion control	· Water quality	· Provides peak flow control · Provides good particulate removal · Can serve larger developments · Usually does not release warm or anoxic water downstream · Provides excellent protection from downstream erosion · Can create wetland and meadow habitat when landscaped properly	· Removal rates for soluble pollutants are low · Not economical for drainage areas less than 10 acres · If not adequately maintained, can become an eyesore and health hazard · Improper design can lead to significant reduction in efficiency · Extremely large storms tend to "blow through" the system, reducing pollutant removal	· TSS (45%) · Phosphorus (25%) · Nitrogen (30%) · COD (20%) · Lead (50%) · Zinc (20%)	Construction $0.50/ft^3 Annual $0.30/ft^3
Wet pond	· Flood control · Erosion control	· Water quality	· Provides peak flow control · Cost-effective for larger, more intensely developed sites · Enhances aesthetics and can provide recreational benefits	· Not economical for drainage areas less than 10 acres · If not properly maintained, can become an eyesore and safety and health hazard · Requires considerable space · Not suitable for hydrologic soil groups A and B in the	· TSS (60%) · Phosphorus (45%) · Nitrogen (35%) · COD (40%) · Lead (75%) · Zinc (60%)	Construction (pond < 1 million ft^3) $0.50/ft^3 (Pond > 1 million ft^3) $0.25/ft^3 Annual $0.008 - 0.07/ ft^3

Table 5. (continued)

BMP	Beneficial For:	Beneficial with Some Limitations for:	Advantages	Disadvantages	Pollutants Removed (Average % Efficiency)	General Cost
Wet pond (cont.)			· Helps to prevent scour and resuspension of sediments · Provides good nutrient removal	NRCS classification unless the pond is lined or inappropriate soil are replaced with more appropriate soils · Possibility of release of warm and anoxic water, which may impact down-stream aquatic life		
Vegetated filter strip	· Water quality · Erosion control	· Flood control	· Low maintenance requirements · Can be used as part of the runoff conveyance system to provide runoff pretreatment · Can reduce particulate pollutant levels in areas where runoff velocity is low to moderate · Provides urban wildlife habitat · Economical	· Can concentrate water, which significantly reduces effectiveness · Ability to remove soluble pollutants highly variable · Limited feasibility in highly urbanized areas where runoff velocities are high and flow is concentrated · Requires periodic repair, regrading, and sediment removal to prevent channelization	· TSS (65%) · Phosphorus (40%) · Nitrogen (40%) · COD (40%) · Lead (45%) · Zinc (60%)	Construction *(existing vegetation)* $0/acre *(seeding)* $400/acre *(seed and mulch)* $150/acre *(sod)* $11,300/acre Annual - Natural Succession *(existing vegetation)* $100/acre *(seed)* $125/acre *(seed)*

Table 5. (continued)

BMP	Beneficial For:	Beneficial, with some Limitations for:	Advantages	Disadvantages	Pollutants Removed (Average % Efficiency)	General Cost
Vegetated filter strip (cont.)						$125/acre *(seed and mulch)* $200/acre *(sod)* $700/acre Annual - No Natural Succession *(existing vegetation)* $800/acre *(seed)* $825/acre *(seed and mulch)* $900/acre *(sod)* $1,400/acre
Grassed swale	· Erosion control	· Water quality · Flood control	· Requires minimal land area · Can be used as part of the runoff conveyance system to provide pretreatment · Can provide sufficient runoff control to replace curb-and-gutter in large-lot, single-family residential developments and on highway medians · Economical	· Low pollutant removal rates · Leaching from culverts and fertilized lawns may actually increase the presence of trace metals and nutrients	· TSS (60%) · Phosphorus (20%) · Nitrogen (10%) · COD (25%) · Lead (70%) · Zinc (60%)	Construction *(seed)* $6.50/lin ft *(sod)* $20/lin ft Annual *(seed)* $1/lin ft (sod) $2/lin ft

Table 5. (continued)

BMP	Beneficial For:	Beneficial with some limitations For:	Advantages	Disadvantages	Pollutants Removed (Average % efficiency)	General Cost
Constructed wetlands	· Flood control · Erosion control	· Water quality	· Can serve large developments; most cost-effective for larger, more intensely developed sites · Provides peak flow control · Enhances aesthetics and provides recreational benefits · Prevents shoreline erosion · Helps prevent scour and resuspension of solids · High pollutant removal potential	· Not economical for drainage areas less than 10 acres · Potential eyesore and health and safety hazard if not properly maintained · Requires large land area · Possible thermal and anoxic discharge, which could impact downstream aquatic life · May contribute to nutrient loadings during vegetation die-down periods	· TSS (65%) · Phosphorus (25%) · Nitrogen (20%) · COD (50%) · Lead (65%) · Zinc (35%)	Construction $50,000 to $100,000/acre (This is based on actual construction costs for a development in northern Delaware.)
Sand filter	· Water quality · Erosion control	· Flood control	· Provides high removal efficiencies of particulate · Requires minimal land area · Provides flexibility to retrofit existing small drainage areas · High removal of nutrients	· Not feasible for drainage areas greater than 5 acres · Only feasible in areas that are stabilized and highly impervious · Not effective as water quality control for intense storms	· TSS (80%) · Phosphorus 60%A) · Nitrogen (35%) · COD (55%) · Lead (80%) · Zinc (65%) · Oil and grease (75%)	Construction $5/ft³ Annual $0.10 - 0.80/ ft³

Table 5. (continued)

BMP	Beneficial For:	Beneficial with some limitations For:	Advantages	Disadvantages	Pollutants Removed (Average % efficiency)	General Cost
Oil/Grit separators	· Water quality · Erosion control	· Flood control	· Captures coarse-grain sediments and some hydrocarbons · Requires minimal land area · Flexibility to retrofit existing small drainage areas and applicable to most urban areas · Shows some capacity to trap trash, debris, and other floatables	· Not feasible for drainage areas greater than 1 acre · Minimal nutrient and organic matter removal · Not effective as water quality control for intense storms · Concern exists over the pollutant toxicity of trapped residuals · High maintenance requirements	· TSS (15%) · Phosphorus (5%) · Nitrogen (5%) · COD (5%) · Lead (15%) · Zinc (5%)	Construction $18,000/ drainage acre Annual $1,000/ drainage acre

Sources: MWCOG, 1992; Terrene Institute, 1994;USEPA, 1993, 1996 (draft).

Table 6. Relative Costs and Feasibility

BMP	Relative Cost	Feasibility Factors
Extended detention dry pond	Lowest-cost alternative in its size range	• Good if used in conjunction with pretreatment (e.g., sediment forebay, grassed swale) • Requires dedication of land that could otherwise be used for building • Viable option if downstream flooding is a concern
Wet pond	Moderate to high compared to alternatives; however, maintenance requirements tend to be less than with dry ponds	• Provides aesthetic benefits (which could be translated into economic benefits for developers) if creatively designed and properly maintained • Requires dedication of land that could otherwise be used for building • Viable option if downstream flooding is a concern
Vegetated filter strip	Low comparative cost	• For use in areas where land can be dedicated for stormwater runoff control • Better for new development than for retrofit in developed areas • Can be incorporated into the landscape of a development, adding aesthetic value
Grassed swale	Low compared to curb and gutter	• Requires some maintenance (mowing, cleaning trash) • More aesthetically pleasing than curb and gutter
Constructed wetlands	Marginally higher than wet ponds	• Provides habitat • Can be used as a selling point for developments • Requires some maintenance (more until wetlands become established) • Should be used in conjunction with other BMPs (e.g., sediment forebay, swales, etc.) to maximize wetland potential

Table 6. (Continued)

BMP	Relative Cost	Feasibility Factors
Sand filters	Comparatively high construction costs, requires regular maintenance	• Disposal of "dirty" sand can be a waste disposal issue because of contents of sand (hydrocarbons, heavy metals, etc.) • Good for use in areas where land is not available for ponds (e.g., retrofit areas) • High TSS removal rate is a definite benefit
Oil/Grit separators	High initial construction costs, requires regular maintenance	• Good for use in retrofit projects and areas where there is not a lot of land available

Sources: MWCOG, 1992; Terrene Institute, 1994; USEPA, 1993, 1996 (draft).

Appendix D

Recreational Facilities Matrix for
Lower Neshaminy Creek

Recreational Facilities in Lower Neshaminy Creek RCP Municipalities

Facility		Foot-Ball	Soccer	Open Field	Basket-Ball	Hockey	Skating	Senior Facility	Tennis	Picnic	Golf	Pool	Play-Grounds/ Tot Lot	Volley-Ball
Hulmeville														
Hulmeville School	x	x	x		x									
Langhorne														
Mayor s Playground													x	
Lower Southampton														
Playwicki Farm														
Dunlap Memorial Field	x				x									
Elliot Memorial Field	x		x		x				x				x	
Neshaminy Rec. Center				x				x						
Towanka Elementary School			x	x										
Lower Southampton Elementary				x									x	
Assumption BVM		x			x									
Middletown														
Beechwood Ave. Park	x													
Cobalt Ridge					x									

Recreational Facilities in Lower Neshaminy Creek RCP Municipalities

Facility	Baseball`	Football	Soccer	Open Field	Basket-Ball	Hockey	Skating	Senior Facility	Tennis	Picnic	Golf	Pool	Play-Grounds/ Tot Lot	Volley-Ball
Delaware Park	x			x	x				x	x			x	
Quincy Hollow					x									
Snowball Gate													x	
Upper Orchard					x								x	
Harris Park	x									x			x	
Middletown Country Club											x	x		
Periwinkle Park	x													
Poplar St. Park	x		x	x	x				x	x			x	
Sunflower Playground													x	
Twin Oaks Park	x		x	x						x			x	
Veterans Memorial Park	x				x				x	x			x	
Forsythia Crossing Park				x		x				x			x	
Middletown Community Park	x		x				x						x	
Tarreyton Estates				x									x	
Upper Orchard				x	x								x	
Eisenhower					x									

Recreational Facilities in Lower Neshaminy Creek RCP Municipalities

Facility	`	Foot-Ball	Soccer	Open Field	Basket-Ball	Hockey	Skating	Senior Facility	Tennis	Picnic	Golf	Pool	Play-Grounds/ Tot Lot	Volley-Ball
Everitt Elementary	x				x			x					x	
Heckman School					x									
Hoover Elementary														
Maple Point HS	x		x	x					x					
Miller School	x				x				x				x	
Neshaminy HS	x	x	x		x									x
Neshaminy JH		x			x									
Sandburg JH					x									x
Schweitzer Elementary	x												x	
Northampton														
Township Recreation Complex	x	x	x		x				x					
Hampton Estates Park	x													
Big Meadow Park	x		x											
Pheasant Road Park	x				x									
Holland Elementary	x													
Councils Rock JH	x	x	x	x										

Recreational Facilities in Lower Neshaminy Creek RCP Municipalities

Facility		Foot-Ball	Soccer	Open Field	Basket-Ball	Hockey	Skating	Senior Facility	Tennis	Picnic	Golf	Pool	Play-Grounds/ Tot Lot	Volley-Ball
Hillcrest Elementary					x									
Rolling Hills Elementary	x		x		x									
Richboro Elementary	x		x		x									
Council Rock JH at Richboro	x	x	x	x										x
Churchville Elementary	x				x				x					
Penndel	x	x	x	x									x	
Penndel Memorial Field	x	x							x					
Upper Southampton														
Stackpole Elementary					x									x
Klinger MS	x	x										x		x
Township Community Center		x			x							x		
Schaeffer Sports Complex	x	x	x		x			x	x	x				x
Tamanend Park	x	x	x	x				x		x				
Davis Elementary													x	
Shelmire School Site														

Appendix E

Listings of Birds, Fish, Reptiles, Amphibians,
Butterflies, Mammals and Vegetation
Compiled by Churchville Nature Center

Butterfly Species of the Lower Neshaminy Creek Watershed
Compiled by Churchville Nature Center

Pipevine Swallowtail
Black Swallowtail
Tiger Swallowtail
Spicebush Swallowtail
Cabbage White
Clouded Sulfur
Orange Sulphur
American Copper
Coral Hairstreak
Banded Hairstreak
Hickory Hairstreak
Striped Hairstreak
Red-banded Hairstreak
Juniper Hairstreak
Gray Hairstreak
Eastern Tailed-Blue
Spring Azure
Great Spangled Fritillary
Pearl Crescent
Question Mark
Eastern Comma
Mourning Cloak
American Lady
Painted Lady
Red Admiral
Common Buckeye
Red-Spotted Purple
Viceroy
Hackberry Emperor
Little Wood-Satyr
Appalachian Brown
Eyed Brown
Common Wood-Nymph
Monarch
Silver-Spotted Skipper
Juvenal's Dudkywing
Horace's Duskywing
Wild Indigo Duskywing
Common Checkered Skipper
Least Skipper
European Skipper
Pecks Skipper
Sachem
Northern Broken-Dash
Little Glassywing
Zabulon Skipper
Delaware Skipper
Dun Skipper

Churchville Nature Center and Reservoir Area
Nesting Bird Species
Compiled by Churchville Nature Center

Total Number ..... 93 species
Confirmed Nesters 61
Highly Probable Nesters 18
Possible Nesters 14

Confirmed

Green Backed Heron
Canada Goose
Wood Duck
Mallard Duck
Coopers Hawk
Red Tail Hawk
Kestrel
Ring Necked Pheasant
Killdeer
Rock Dove
Mourning Dover
Screech Owl
Great Horned Owl
Ruby Throated Hummingbird
Kingfisher
Red Bellied Woodpecker
Downy Woodpecker
Hairy Woodpecker
Flicker
Eastern Wood Pewee
Eastern Phoebe
Great Crested Flycatcher
Eastern Kingbird
Tree Swallow
Barn Swallow
Blue Jay
American Crow
Carolina Chickadee
Catbird
Mockingbird
Brown Thrasher
European Starling
White Eyed Vireo
Warbling Vireo
Red Eyed Vireo
Yellow Warbler
Ovenbird
Kentucky Warbler
Common Yellowthroat
Scarlet Tanager
Cardinal
Rose Breasted Grosbeak
Indigo Bunting
Towhee
Chipping Sparrow
Field Sparrow
Song Sparrow
Red Winged Blackbird
Cowbird
Baltimore Oriole
House Finch
American Goldfinch
Wood Thrush
American Robin
Swamp Sparrow
Tufted Titmouse
White Breasted Nuthatch
Brown Creeper
Carolina Wren
House Wren
Wood Thrush

Others

Great Blue Heron
Black Crowned Night Heron
Black Duck
Turkey Vulture
Black Vulture
Sharp Shinned Hawk
American Coot
Spotted Sandpiper
American Woodcock
Ring Billed Gull
Black Billed Cuckoo
Yellow Billed Cuckoo
Nighthawk
Chimney Swift
Willow Flycatcher
N. Rough-winged Swallow
Bank Swallow
Blue Gray Gnatcatcher
Veery
Cedar Waxwing
Blue Winged warbler
Black/White Warbler
American Redstart
Prothonotary Warbler
Louisiana Waterthrush
Yellow Br. Chat
Swamp Sparrow
Common Grackle
Eastern Meadowlark
Pine Warbler
Orchard Oriole
Broad Winged Hawk

Churchville Nature Center and Resevoir Area
Total Bird Species Sighted

Total Number 209

Red Throated Loon
Common Loon
Pied Billed Grebe
Horned Grebe
Red-Necked Grebe
Double Crested Cormorant
Greta Blue Heron
Great Egret
Green Backed Heron
Black Cr. Night Heron
Tri-colored Heron
Yellow Crowned Night Heron
Tundra Swan
Mute Swan
Greater W. Fronted Goose
Snow Goose
Brant
Canada Goose
Wood Duck
Green winged Teal
Amer. Black Duck
Mallard
Northern Pintail
Blue Winged Teal
Northern Shoveler
Gadwall
American Widgeon
Canvasback
Redhead Duck
Ring Necked Duck
Lessor Scaup
Oldsquaw
White Winged Scoter
Common Goldeneye
Bufflehead
Hooded Merganser
Common Merganser
Red Breasted Merganser
Ruddy Duck
Black Vulture
Turkey Vulture
Osprey
Bald Eagle
Northern Harrier
Sharp Shinned Hawk
Coopers Hawk
Red-Shouldered Hawk
Broad Winged Hawk
Red Tail Hawk
Rough-Legged Hawk
American Kestrel
Black Throated Green Warbler
Merlin
Peregrine Falcon
Ring Necked Pheasant
Ruffed Grouse
Wild Turkey
Northern Bobwhite
American Coot
Semi-palmated Plover
Killdeer
Greater Yellowlegs
Lessor Yellowlegs
Solitary Sandpiper
Spotted Sandpiper
Semipalmated Sandpiper
American Woodcock
Common Snipe
Laughing Gull
Bonopartes Gull
Ring Billed Gull
Herring Gull
Iceland Gull
Lesser Black Backed Gull
Greater B.B. Gull
Black Tern
Forsters Tern
Rock Dove
Mourning Dove
Black Billed Cuckoo
Yellow Billed Cuckoo
Eastern Screech Owl
Great Horned Owl
Barn Owl
Chimney Swift
Ruby Throated Hummingbird
Belted Kingfisher
Red Bellied Woodpecker
Yellow Bellied Sapsucker
Downy Woodpecker
Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Olive Sided Flycatcher
Eastern Wood Pewee
Yellow Bellied Flycatcher
Acadian Flycatcher
Willow Flycatcher
Least Flycatcher
Red-Winged Blackbird
Eastern Meadowlark
Eastern Phoebe
Great Crested Flycatcher
Eastern Kingbird
Purple Martin
Tree Swallow
N. Rough Winged Swallow
Bank Swallow
Barn Swallow
Blue Jay
American Crow
Common Nighthawk
Fish Crow
Black Capped Chickadee
Carolina Chickadee
Tufted Titmouse
Red Breasted Nuthatch
White Breasted Nuthatch
Brown Creeper
Carolina Wren
House Wren
Winter Wren
Golden Crowned Kinglet
Ruby Crowned kinglet
Blue Gray Gnatcatcher
Eastern Bluebird
Veery
Gray Cheeked Thrush
Swainson s Thrush
Wood Thrush
American Robin
Gray Catbird
Northern Mockingbird
Brown Thrasher
Cedar Waxwing
European Starling

White Eyed Vireo
Solitary Vireo
Yellow Throated Vireo
Warbling Vireo
Philadelphia Vireo
Red-Eyed Vireo
Blue Winged Warbler
Tennessee Warbler
Nashville Warbler
Northern Parula Warbler
Yellow Warbler
Chestnut Sided Warbler
Magnolia Warbler
Cap May Warbler
Black Throated Blue Warbler
Pine Warbler
Prairie Warbler
Palm Warbler
Bay Breasted Warbler
Blackpoll Warbler
Cerulean Warbler
Black and White Warbler
American Redstart
Prothonotary Warbler
Worm-Eating Warbler
Ovenbird
Northern Waterthrush
Loisiana Waterthrush
Kentucky Warbler
Common Yellowthroat
Hooded Warbler
Wilson s Warbler
Canada Warbler
Yellow Breasted Chat
Yellow Rumped Warbler
Scarlet Tanager
Northern Cardinal
Rose Breasted Grosbeak
Evening Grosbeak
Indigo Bunting
Rufous Sided Towhee
Amer. Tree Sparrow
Chipping Sparrow
Field Sparrow
Vesper Sparrow
Fox Sparrow
Swamp Sparrow
White Throated Sparrow
Dark-Eyed Junco
Common Grackle
Brown Headed Cowbird
Orchard Oriole
Baltimore Oriole
Purple Finch
House Finch
Pine Siskin
American Goldfinch
Willow Flycatcher
English Sparrow

Rare Sightings

Barnacle Goose
Sandhill Crane
Eurasian Widgeon
Loggerhead Shrike
Bairds Sandpiper
Whimbrel
Ruff
Red Knot
Stilt Sandpiper
Red-neck Phalorope
Sora Rail
Lark Bunting

Fish Species
Documented in Churchville Reservoir
Compiled by Churchville Nature Center

American Eel
Banded Sunfish
Black Bullhead
Black Crappie
Bluegill
Common Carp
Green Sunfish
Largemouth Bass
Pumkinseed Sunfish
Redear Sunfish
White Crappie
White Perch
White Sucker
Yellow Perch

Reptile and Amphibian Species
Documented in the Lower Neshaminy Watershed
Compiled by Churchville Nature Center

Salamanders
Spotted Salamander
Northern Dusky Salamander
Northern Two-lined Salamander
Long-tailed Salamander
Red-backed Salamander
Slimy Salamander
Northern Red Salamander

Frogs &Toads
American Toad
Fowlers Toad
Spring Peeper
Bullfrog
Green Frog
Pickerel Frog
Wood Frog
Gray Treefrog

Turtles
Spiny Softshell
Painted Turtle
Red-bellied Turtle
Red-eared Slider
Common Snapping Turtle
Common Musk Turtle
Eastern Box Turtle

Lizards
5-Lined Skink

Snakes
Black Racer
Eastern Milksnake
Eastern Ringneck Snake
Northern Water Snake
Northern Brown Snake
Eastern Garter Snake

Mammal Species of the Lower Neshaminy Watershed Compiled by Silver Lake Nature Center

Northern Short-tailed Shrew
Eastern Mole
Star-nosed Mole
Little Brown Bat
Big Brown Bat
Red Bat
Hoary Bat
Red Fox
Gray Fox
Raccoon
Virginia Oppossum
Eastern Cottontail
Woodchuck
Gray Squirrel
White-footed Mouse
Meadow Vole
Muskrat
Norway Rat
Meadow Jumping Mouse
Mink
Striped Skunk
White-tailed Deer

Native Plant Species of the Neshaminy Creek Watershed Compiled by the PA Flora Project at the Morris Arboretum of the University of Pennsylvania

Scientific Name	Common Name	Scientific Name	Common Name
Diphasiastrum digitatum	Deep-rooted running-pine	*Cuscuta gronovii v gronovii*	Common dodder
Huperzia lucidula	Shining firmoss	*Cuscuta polygonorum*	Smartweed dodder
Lycopodiella appressa	Appressed bog clubmoss	*Phlox maculata s maculata*	Wild sweet-william
Lycopodium dendroideum	Round-branch ground-pine	*Phlox paniculata*	Summer phlox
Lycopodium obscurum	Flat-branched ground-pine	*Phlox pilosa*	Downy phlox
Selaginella apoda	Meadow spikemoss	*Phlox subulata s subulata*	Moss-pink
Isoetes engelmannii	Engelmann's quillwort	*Polemonium reptans*	Spreading Jacob's-ladder
Equisetum arvense	Field horsetail	*Hydrophyllum virginianum*	Virginia waterleaf
Equisetum fluviatile	Water horsetail	*Cynoglossum virginianum*	Wild comfrey
Botrychium dissectum	Cut-leaved grape-fern	*Hackelia virginiana*	Beggar's-lice
Botrychium matricariifolium	Daisy-leaved moonwort	*Mertensia virginica*	Virginia bluebell
Botrychium oneidense	Blunt-lobed grape fern	*Myosotis laxa*	Wild forget-me-not
Botrychium virginianum	Rattlesnake fern	*Myosotis verna*	Spring forget-me-not
Osmunda cinnamomea	Cinnamon fern	*Phryma leptostachya*	Lopseed
Osmunda claytoniana	Interrupted fern	*Verbena hastata*	Blue vervain
Osmunda regalis v spectabilis	Royal fern	*Verbena hastata x urticifolia*	Vervain
Adiantum pedatum	Northern maidenhair	*Verbena simplex*	Narrow-leaved vervain
Cheilanthes lanosa	Hairy lip fern	*Verbena urticifolia v urticifolia*	White vervain
Polypodium virginianum	Common polypody	*Verbena urticifolia v leiocarpa*	White vervain
Dennstaedtia punctilobula	Hay-scented fern	*Agastache nepetoides*	Yellow giant-hyssop
Pteridium aquilinum v latiusculum	Northern bracken fern	*Agastache scrophulariifolia*	Purple giant-hyssop
Phegopteris hexagonoptera	Broad beech fern	*Collinsonia canadensis*	Horse balm
Thelypteris noveboracensis	New York fern	*Cunila origanoides*	Common dittany
Thelypteris palustris v pubescens	Marsh fern	*Hedeoma pulegioides*	American pennyroyal
Asplenium platyneuron	Ebony spleenwort	*Lycopus americanus*	Water-horehound
Asplenium rhizophyllum	Walking fern	*Lycopus uniflorus*	Bugleweed
Asplenium trichomanes	Maidenhair spleenwort	*Lycopus uniflorus x virginicus*	Water-horehound
Athyrium filix-femina v angustum	Lady fern	*Lycopus virginicus*	Bugleweed
Athyrium filix-femina v asplenioides	Southern lady fern	*Mentha arvensis*	Field mint
Cystopteris protrusa	Protruding bladder fern	*Monarda clinopodia*	Bee-balm
Cystopteris tenuis	Fragile fern	*Monarda fistulosa v mollis*	Horsemint
Deparia acrostichoides	Silvery glade fern	*Monarda media*	Bee-balm
Dryopteris campyloptera	Mountain wood fern	*Prunella vulgaris s lanceolata*	Heal-all
Dryopteris carthusiana	Spinulose wood fern	*Pycnanthemum incanum*	Mountain-mint
Dryopteris triploidea	Triploid hybrid wood fern	*Pycnanthemum muticum*	Mountain-mint
Dryopteris cristata	Crested shield fern	*Pycnanthemum tenuifolium*	Mountain-mint
Dryopteris goldiana	Goldie's wood fern	*Pycnanthemum torrei*	Torrey's mountain-mint
Dryopteris intermedia	Evergreen wood-ferm	*Pycnanthemum virginianum*	Mountain-mint
Dryopteris marginalis	Marginal wood fern	*Salvia lyrata*	Lyre-leaved sage
Onoclea sensibilis	Sensitive fern	*Scutellaria elliptica v elliptica*	Hairy skullcap
Polystichum acrostichoides	Christmas fern	*Scutellaria galericulata*	Common skullcap

Scientific Name	Common Name	Scientific Name	Common Name
Woodsia obtusa	Blunt-lobed woodsia	*Scutellaria integrifolia*	Hyssop skullcup
Woodwardia areolata	Netted chain fern	*Scutellaria lateriflora*	Mad-dog skullcap
Pinus pungens	Table-mountain pine	*Scutellaria nervosa*	Skullcap
Pinus rigida	Pitch pine	*Stachys tenuifolia*	Creeping hedge-nettle
Pinus strobus	Eastern white pine	*Teucrium canadense v virginicum*	Wild germander
Tsuga canadensis	Canada hemlock	*Trichostema dichotomum*	Blue-curls
Juniperus virginiana	Eastern red-cedar	*Callitriche heterophylla*	Water-starwort
Taxus canadensis	Canadian yew	*Callitriche palustris*	Water-starwort
Liriodendron tulipifera	Tuliptree	*Callitriche terrestris*	Water-starwort
Magnolia tripetala	Umbrella-tree	*Plantago rugelii*	Rugel's plantain
Magnolia virginiana	Sweet-bay magnolia	*Plantago virginica*	Dwarf plantain
Lindera benzoin	Spicebush	*Chionanthus virginicus*	Fringe-tree
Sassafras albidum	Sassafras	*Fraxinus americana v americana*	White ash
Saururus cernuus	Lizard's-tail	*Fraxinus americana v biltmoreana*	Biltmore ash
Aristolochia serpentaria	Virginia snakeroot	*Fraxinus nigra*	Black ash
Asarum canadense v canadense	Wild ginger	*Fraxinus pennsylvanica*	Red ash
Asarum canadense v reflexum	Short-lobed wild ginger	*Agalinis auriculata*	Eared false-foxglove
Nuphar lutea	Spatterdock	*Agalinis purpurea*	False-foxglove
Actaea pachypoda	Doll's-eyes	*Agalinis tenuifolia*	Slender false-foxglove
Anemone quinquefolia	Wood anemone	*Aureolaria flava v flava*	Yellow false-foxglove
Anemone virginiana	Tall anemone	*Aureolaria pedicularia*	Cut-leaf false-foxglove
Aquilegia canadensis	Wild columbine	*Aureolaria virginica*	Downy false-foxglove
Caltha palustris v palustris	Marsh-marigold	*Castilleja coccinea*	Indian paintbrush
Cimicifuga racemosa	Black snakeroot	*Chelone glabra*	Turtlehead
Clematis occidentalis	Purple clematis	*Gratiola aurea*	Goldenpert
Clematis virginiana	Virgin's-bower	*Gratiola neglecta*	Hedge hyssop
Hepatica nobilis v obtusa	Liverleaf	*Linaria canadensis*	Old-field toadflax
Hydrastis canadensis	Goldenseal	*Lindernia dubia v dubia*	False pimpernel
Ranunculus abortivus v abortivus	Small-flowered crowfoot	*Lindernia dubia v anagallidea*	False pimpernel
Ranunculus caricetorum	Marsh buttercup	*Mimulus alatus*	Winged monkey-flower
Ranunculus hispidus	Hairy buttercup	*Mimulus ringens*	Allegheny monkey-flower
Ranunculus micranthus	Small-flowered crowfoot	*Pedicularis canadensis*	Forest lousewort
Ranunculus pusillus	Low spearwort	*Penstemon digitalis*	Tall white beard-tongue
Ranunculus recurvatus	Hooked crowfoot	*Penstemon hirsutus*	Northeastern beard-tongue
Thalictrum dioicum	Early meadow-rue	*Scrophularia lanceolata*	Lanceleaf figwort
Thalictrum pubescens	Tall meadow-rue	*Scrophularia marilandica*	Eastern figwort
Thalictrum thalictroides	Rue anemone	*Veronica officinalis*	Common speedwell
Podophyllum peltatum	Mayapple	*Veronica peregrina s peregrina*	Neckweed
Menispermum canadense	Moonseed	*Veronica scutellata*	Marsh speedwell
Sanguinaria canadensis	Bloodroot	*Veronicastrum virginicum*	Culver's-root
Corydalis flavula	Yellow fumewort	*Conopholis americana*	Squaw-root
Dicentra cucullaria	Dutchman's-breeches	*Epifagus virginiana*	Beechdrops
Platanus occidentalis	Sycamore	*Orobanche uniflora*	Broom-rape
Hamamelis virginiana	Witch-hazel	*Campsis radicans*	Trumpet-vine
Celtis occidentalis v occidentalis	Hackberry	*Campanula americana*	Tall bellflower
Celtis occidentalis v canina	Dogberry	*Campanula aparinoides*	Marsh bellflower

Scientific Name	Common Name	Scientific Name	Common Name
Ulmus americana	American elm	*Campanula rotundifolia*	Harebell
Ulmus rubra	Red elm	*Lobelia cardinalis*	Cardinal-flower
Morus rubra	Red mulberry	*Lobelia inflata*	Indian-tobacco
Humulus lupulus	Brewer's hops	*Lobelia siphilitica*	Great blue lobelia
Boehmeria cylindrica v cylindrica	False nettle	*Lobelia spicata v spicata*	Spiked lobelia
Laportea canadensis	Wood-nettle	*Triodanis perfoliata v perfoliata*	Venus's looking-glass
Pilea pumila	Clearweed	*Cephalanthus occidentalis*	Buttonbush
Carya cordiformis	Bitternut hickory	*Diodia teres*	Rough buttonweed
Carya ovata	Shagbark hickory	*Galium aparine*	Bedstraw
Carya tomentosa	Mockernut hickory	*Galium asprellum*	Rough bedstraw
Juglans cinerea	Butternut	*Galium boreale*	Northern bedstraw
Juglans nigra	Black walnut	*Galium circaezans v circaezans*	Wild licorice
Comptonia peregrina	Sweet-fern	*Galium circaezans v hypomalacum*	Wild licorice
Myrica pensylvanica	Bayberry	*Galium lanceolatum*	Wild licorice
Castanea dentata	American chestnut	*Galium obtusum*	Cleavers
Castanea pumila	Chinquapin	*Galium pilosum*	Bedstraw
Fagus grandifolia	American beech	*Galium tinctorium*	Bedstraw
Quercus alba	White oak	*Galium triflorum*	Sweet-scented bedstraw
Quercus alba x montana	Saul oak	*Houstonia caerulea*	Bluets
Quercus bicolor	Swamp white oak	*Mitchella repens*	Partridge-berry
Quercus coccinea	Scarlet oak	*Diervilla lonicera*	Bush-honeysuckle
Quercus ilicifolia	Scrub oak	*Lonicera sempervirens*	Trumpet honeysuckle
Quercus marilandica	Blackjack oak	*Sambucus canadensis*	American elder
Quercus montana	Chestnut oak	*Symphoricarpos orbiculatus*	Coralberry
Quercus muhlenbergii	Yellow oak	*Triosteum aurantiacum v aurantiacum*	Wild-coffee
Quercus palustris	Pin oak	*Viburnum acerifolium*	Maple-leaved viburnum
Quercus phellos	Willow oak	*Viburnum cassinoides*	Witherod
Quercus prinoides	Dwarf chestnut oak	*Viburnum dentatum*	Southern arrow-wood
Quercus rubra	Northern red oak	*Viburnum lentago*	Nannyberry
Quercus stellata	Post oak	*Viburnum nudum*	Possum-haw
Quercus velutina	Black oak	*Viburnum prunifolium*	Black-haw
Alnus serrulata	Smooth alder	*Viburnum rafinesquianum*	Downy arrow-wood
Betula lenta	Black birch	*Viburnum recognitum*	Northern arrow-wood
Betula nigra	River birch	*Ambrosia artemisiifolia*	Common ragweed
Betula populifolia	Gray birch	*Ambrosia trifida*	Giant ragweed
Carpinus caroliniana	Hornbeam	*Anaphalis margaritacea*	Pearly everlasting
Corylus americana	American filbert	*Antennaria neglecta*	Overlooked pussytoe
Ostrya virginiana	Hop-hornbeam	*Antennaria howellii s neodioica*	Howell's pussytoe
Phytolacca americana	Pokeweed	*Antennaria parlinii s parlinii*	Parlin's pussytoe
Atriplex littoralis	Seashore orach	*Antennaria parlinii s fallax*	Parlin's pussytoe
Atriplex prostrata	Halberd-leaved orach	*Antennaria plantaginifolia*	Plantain-leaved pussytoe
Chenopodium album v missouriense	Lamb's quarters	*Aster cordifolius s cordifolius*	Blue wood aster
Chenopodium bushianum	Pigweed	*Aster cordifolius s laevigatus*	Smooth heart-leaved aster
Chenopodium capitatum	Indian-paint	*Aster divaricatus*	White wood aster
Chenopodium simplex	Maple-leaved goosefoot	*Aster dumosus*	Bushy aster

Scientific Name	Common Name	Scientific Name	Common Name
Amaranthus albus	Tumbleweed	*Aster ericoides s ericoides*	White heath aster
Amaranthus cannabinus	Salt-marsh water-hemp	*Aster fragilis*	Small white aster
Claytonia virginica	Spring-beauty	*Aster infirmus*	Flat-topped white aster
Cerastium arvense v arvense	Field chickweed	*Aster laevis v laevis*	Smooth blue aster
Cerastium nutans	Nodding chickweed	*Aster lanceolatus s simplex*	Simple aster
Paronychia canadensis	Forked chickweed	*Aster lateriflorus*	Calico aster
Paronychia fastigiata v fastigiata	Whitlow-wort	*Aster linariifolius*	Stiff-leaved aster
Sagina procumbens	Bird's-eye	*Aster macrophyllus*	Bigleaf aster
Silene antirrhina	Sleepy catchfly	*Aster novae-angliae*	New England aster
Silene stellata	Starry campion	*Aster patens v patens*	Late purple aster
Stellaria longifolia	Long-leaved stitchwort	*Aster paternus*	White-topped aster
Stellaria pubera	Great chickweed	*Aster phlogifolius*	Late purple aster
Polygonella articulata	Jointweed	*Aster pilosus v pilosus*	Heath aster
Polygonum amphibium v emersum	Water smartweed	*Aster prenanthoides*	Zig-zag aster
Polygonum arifolium	Halberd-leaf tearthumb	*Aster puniceus s puniceus*	Purple-stemmed aster
Polygonum erectum	Erect knotweed	*Aster schreberi*	Schreber's aster
Polygonum hydropiperoides v hydropiperoides	Mild water-pepper	*Aster solidagineus*	Narrow-leaved white-topped aster
Polygonum hydropiperoides v opelousanum	smartweed	*Aster undulatus*	Clasping heart-leaved aster
Polygonum pensylvanicum	Smartweed	*Bidens bidentoides*	Swamp beggar-ticks
Polygonum punctatum v punctatum	Dotted smartweed	*Bidens bipinnata*	Spanish needles
Polygonum punctatum v confertiflorum	Dotted smartweed	*Bidens cernua*	Bur-marigold
Polygonum sagittatum	Tearthumb	*Bidens comosa*	Beggar-ticks
Polygonum scandens v scandens	Climbing false-buckwheat	*Bidens connata*	Beggar-ticks
Polygonum scandens v cristatum	Climbing false-buckwheat	*Bidens frondosa*	Beggar-ticks
Polygonum tenue	Slender knotweed	*Bidens laevis*	Showy bur-marigold
Polygonum virginianum	Jumpseed	*Bidens vulgata*	Beggar-ticks
Elatine minima	Small waterwort	*Cacalia atriplicifolia*	Pale Indian-plantain
Hypericum canadense	Canadian St.John's-wort	*Cirsium altissimum*	Tall thistle
Hypericum dissimulatum	St.John's-wort	*Cirsium discolor*	Field thistle
Hypericum gentianoides	Orange-grass	*Cirsium pumilum*	Pasture thistle
Hypericum mutilum	Dwarf St. John's-wort	*Conyza canadensis v canadensis*	Horseweed
Hypericum punctatum	Spotted St. John's-wort	*Coreopsis tripteris*	Tall tickseed
Triadenum virginicum	Marsh St. John's-wort	*Eclipta prostata*	Yerba-de-tajo
Tilia americana v americana	Basswood	*Erechtites hieraciifolia*	Fireweed
Hibiscus moscheutos	Rose-mallow	*Erigeron annuus*	Daisy fleabane
Helianthemum canadense	Frostweed	*Erigeron philadelphicus*	Daisy fleabane
Helianthemum propinquum	Frostweed	*Erigeron pulchellus*	Robin's-plantain
Lechea pulchella	Pinweed	*Erigeron strigosus v strigosus*	Daisy fleabane
Lechea racemulosa	Pinweed	*Eupatorium coelestinum*	Mistflower
Lechea villosa	Pinweed	*Eupatorium fistulosum*	Joe-pye-weed
Viola affinis	LeConte's violet	*Eupatorium hyssopifolium*	Hyssop-leaved eupatorium
Viola blanda	Sweet white violet	*Eupatorium perfoliatum*	Boneset
Viola labradorica	American dog violet	*Eupatorium pilosum*	Ragged eupatorium
Viola cucullata	Blue marsh violet	*Eupatorium purpureum*	Joe-pye-weed

Scientific Name	Common Name	Scientific Name	Common Name
Viola cucullata x fimbriatula	Porter's violet	*Eupatorium rotundifolium v rotundifolium*	Round-leaved eupatorium
Viola pubescens v scabriuscula	Downy yellow violet	*Eupatorium rugosum*	White-snakeroot
Viola lanceolata v lanceolata	Lance-leaved violet	*Eupatorium sessilifolium*	Upland eupatorium
Viola macloskeyi s pallens	Sweet white violet	*Euthamia graminifolia v nuttallii*	Grass-leaved goldenrod
Viola palmata	Early blue violet	*Gnaphalium obtusifolium*	Fragrant cudweed
Viola pedata	Birdfoot violet	*Gnaphalium uliginosum*	Low cudweed
Viola brittoniana s brittoniana	Coast violet	*Helenium autumnale*	Common sneezeweed
Viola primulifolia	Primrose violet	*Helianthus decapetalus*	Thin-leaved sunflower
Viola pubescens	Downy yellow violet	*Helianthus divaricatus*	Rough sunflower
Viola rostrata	Long-spurred violet	*Helianthus giganteus*	Swamp sunflower
Viola sagittata v sagittata	Arrow-leaved violet	*Helianthus strumosus*	Rough-leaved sunflower
Viola sagittata v ovata	Ovate-leaved violet	*Hieracium gronovii*	Hawkweed
Viola sororia v sororia	Common blue violet	*Hieracium paniculatum*	Hawkweed
Viola striata	Striped violet	*Hieracium scabrum*	Hawkweed
Echinocystis lobata	Prickly cucumber	*Hieracium venosum*	Rattlesnake-weed
Sicyos angulatus	Bur cucumber	*Krigia biflora*	Dwarf dandelion
Populus grandidentata	Bigtooth aspen	*Krigia virginica*	Dwarf dandelion
Populus tremuloides	Quaking aspen	*Lactuca biennis*	Blue lettuce
Salix eriocephala	Daimond willow	*Lactuca canadensis v canadensis*	Wild lettuce
Salix humilis v humilis	Upland willow	*Lactuca canadensis v latifolia*	Wild lettuce
Salix myricoides v myricoides	Broad-leaved willow	*Lactuca canadensis v longifolia*	Wild lettuce
Salix nigra	Black willow	*Lactuca floridana v floridana*	Woodland lettuce
Salix sericea	Silky willow	*Prenanthes alba*	Rattlesnake-root
Arabis canadensis	Sicklepod	*Prenanthes altissima*	Rattlesnake-root
Arabis laevigata v laevigata	Smooth rockcress	*Prenanthes serpentaria*	Lion's-foot
Arabis lyrata	Lyre-leaved rockcress	*Prenanthes trifoliolata*	Gall-of-the-earth
Cardamine bulbosa	Bittercress	*Rudbeckia fulgida v fulgida*	Eastern coneflower
Cardamine concatenata	Toothwort	*Rudbeckia hirta v pulcherrima*	Black-eyed-susan
Cardamine parviflora v arenicola	Small-flowered bittercress	*Rudbeckia laciniata*	Cutleaf coneflower
Cardamine pensylvanica	Pennsylvania bittercress	*Rudbeckia triloba*	Three-lobed coneflower
Cardamine rotundifolia	Mountain watercress	*Senecio anonymus*	Appalachian groundsel
Lepidium virginicum	Poor-man's-pepper	*Senecio aureus*	Golden ragwort
Rorippa palustris s fernaldiana	Marsh watercress	*Senecio pauperculus*	Balsam ragwort
Clethra alnifolia	Sweet pepperbush	*Silphium trifoliatum v trifoliatum*	Whorled rosinweed
Epigaea repens	Trailing-arbutus	*Solidago arguta v arguta*	Forest goldenrod
Gaultheria procumbens	Teaberry	*Solidago bicolor*	Silver-rod
Gaylussacia baccata	Black huckleberry	*Solidago caesia v caesia*	Bluestem goldenrod
Gaylussacia frondosa	Dangleberry	*Solidago canadensis v hargeri*	Canada goldenrod
Kalmia angustifolia	Sheep laurel	*Solidago altissima*	Late goldenrod
Kalmia latifolia	Mountain laurel	*Solidago flexicaulis*	Zigzag goldenrod
Leucothoe racemosa	Fetter-bush	*Solidago gigantea v gigantea*	Smooth goldenrod
Lyonia ligustrina	Maleberry	*Solidago gigantea v serotina*	Smooth goldenrod
Lyonia mariana	Staggerbush	*Solidago juncea*	Early goldenrod
Rhododendron periclymenoides	Pinxter-flower	*Solidago nemoralis*	Gray goldenrod
Rhododendron viscosum	Swamp azalea	*Solidago puberula*	Downy goldenrod

Scientific Name	Common Name	Scientific Name	Common Name
Vaccinium corymbosum	Highbush blueberry	*Solidago rugosa v rugosa*	Wrinkle-leaf goldenrod
Vaccinium pallidum	Lowbush blueberry	*Solidago rugosa v aspera*	Wrinkle-leaf goldenrod
Vaccinium stamineum	Deerberry	*Solidago rugosa v sphagnophila*	Wrinkle-leaf goldenrod
Chimaphila maculata	Pipsissewa	*Solidago rugosa v villosa*	Wrinkle-leaf goldenrod
Chimaphila umbellata s cisatlantica	Pipsissewa	*Solidago ulmifolia v ulmifolia*	Elm-leaved goldenrod
Pyrola americana	Wild lily-of-the-valley	*Vernonia noveboracensis*	New York ironweed
Pyrola elliptica	Shinleaf	*Xanthium strumarium v canadense*	Common cocklebur
Monotropa hypopithys	Pinesap	*Xanthium strumarium v glabratum*	Common cocklebur
Monotropa uniflora	Indian-pipe	*Alisma subcordatum*	Broad-leaved water-plantain
Diospyros virginiana	Persimmon	*Sagittaria australis*	Appalachian arrowhead
Lysimachia ciliata	Fringed loosestrife	*Sagittaria calycina*	Long-lobed arrowhead
Lysimachia quadrifolia	Whorled loosestrife	*Sagittaria graminea v graminea*	Grass-leaved sagittaria
Lysimachia terrestris	Swamp-candles	*Sagittaria latifolia v latifolia*	Wapato
Samolus parviflorus	Water pimpernel	*Sagittaria latifolia v pubescens*	Wapato
Hydrangea arborescens	Sevenbark	*Sagittaria rigida*	Arrowhead
Ribes americanum	Wild black currant	*Elodea canadensis*	Ditch-moss
Sedum ternatum	Wild stonecrop	*Elodea nuttallii*	Waterweed
Chrysosplenium americanum	Golden saxifrage	*Vallisneria americana v americana*	Tape-grass
Heuchera americana	Alum-root	*Potamogeton amplifolius*	Bigleaf pondweed
Mitella diphylla	Bishop's-cap	*Potamogeton diversifolius*	Snailseed pondweed
Penthorum sedoides	Ditch stonecrop	*Potamogeton nodosus*	Longleaf pondweed
Saxifraga pensylvanica	Swamp saxifrage	*Potamogeton zosteriformis*	Flat-stemmed pondweed
Saxifraga virginiensis	Early saxifrage	*Arisaema dracontium*	Green-dragon
Agrimonia gryposepala	Agrimony	*Arisaema triphyllum s triphyllum*	Jack-in-the-pulpit
Agrimonia microcarpa	Small-fruited agrimony	*Arisaema triphyllum s pusillum*	Small jack-in-the-pulpit
Agrimonia parviflora	Southern agrimony	*Orontium aquaticum*	Goldenclub
Agrimonia pubescens	Downy agrimony	*Symplocarpus foetidus*	Skunk cabbage
Agrimonia striata	Roadside agrimony	*Lemna minor*	Duckweed
Amelanchier arborea	Shadbush	*Tradescantia virginiana*	Spiderwort
Amelanchier canadensis	Shadbush	*Juncus acuminatus*	Sharp-fruited rush
Amelanchier laevis	Smooth serviceberry	*Juncus biflorus*	Grass rush
Amelanchier obovalis	Coastal juneberry	*Juncus bufonius*	Toad rush
Aronia arbutifolia	Red chokeberry	*Juncus debilis*	Weak rush
Aronia melanocarpa	Black chokeberry	*Juncus dichotomus*	Forked rush
Crataegus coccinea	Red-fruited hawthorn	*Juncus effusus v solutus*	Soft rush
Crataegus crus-galli	Cockspur hawthorn	*Juncus marginatus v marginatus*	Grass-leaved rush
Crataegus uniflora	One-fruited hawthorn	*Juncus secundus*	Rush
Fragaria virginiana s virginiana	Wild strawberry	*Juncus tenuis v tenuis*	Path rush
Geum canadense v canadense	White avens	*Luzula echinata*	Common woodrush
Geum vernum	Spring avens	*Luzula multiflora*	Field woodrush
Geum virginianum	Cream-colored avens	*Bulbostylis capillaris*	Sandrush
Malus coronaria v coronaria	Sweet crabapple	*Carex abscondita*	Sedge
Physocarpus opulifolius	Ninebark	*Carex albicans*	Sedge
Potentilla canadensis	Cinquefoil	*Carex albolutescens*	Sedge
Potentilla norvegica s monspeliensis	Strawberry-weed	*Carex amphibola v rigida*	Sedge
Potentilla simplex	Old-field cinquefoil	*Carex annectens*	Sedge

Scientific Name	Common Name	Scientific Name	Common Name
Prunus americana	Wild plum	*Carex blanda*	Sedge
Prunus maritima	Beach plum	*Carex brevior*	Sedge
Prunus pensylvanica	Pin cherry	*Carex cephaloidea*	Sedge
Prunus serotina	Wild black cherry	*Carex cephalophora*	Sedge
Prunus virginiana	Choke cherry	*Carex communis*	Sedge
Rosa carolina v carolina	Pasture rose	*Carex conjuncta*	Sedge
Rosa palustris	Swamp rose	*Carex crinita v crinita*	Short hair sedge
Rosa virginiana	Wild rose	*Carex cristatella*	Sedge
Rubus enslenii	Southern dewberry	*Carex davisii*	Sedge
Rubus hispidus	Swamp dewberry	*Carex debilis v debilis*	Sedge
Rubus occidentalis	Black-cap	*Carex digitalis*	Sedge
Spiraea alba	Meadow-sweet	*Carex emmonsii*	Sedge
Spiraea latifolia	Meadow-sweet	*Carex emoryi*	Sedge
Waldsteinia fragarioides	Barren strawberry	*Carex festucacea*	Sedge
Amorpha fruticosa	False-indigo	*Carex glaucodea*	Sedge
Amphicarpaea bracteata	Hog peanut	*Carex gracilescens*	Sedge
Apios americana	Ground-nut	*Carex gracillima*	Sedge
Baptisia tinctoria	Wild indigo	*Carex grisea*	Sedge
Crotalaria sagittalis	Rattlebox	*Carex haydenii*	Cloud sedge
Desmodium canadense	Showy tick-trefoil	*Carex hirsutella*	Sedge
Desmodium ciliare	Tick-clover	*Carex hirtifolia*	Sedge
Desmodium cuspidatum	Tick-clover	*Carex laevivaginata*	Sedge
Desmodium glutinosum	Sticky tick-clover	*Carex laxiculmis v laxiculmis*	Sedge
Desmodium laevigatum	Smooth tick-clover	*Carex laxiflora*	Sedge
Desmodium marilandicum	Maryland tick-clover	*Carex leavenworthii*	Sedge
Desmodium nudiflorum	Naked-flowered tick-trefoil	*Carex lurida*	Sedge
Desmodium nuttallii	Nuttall's tick-trefoil	*Carex mesochorea*	Midland sedge
Desmodium paniculatum	Tick-trefoil	*Carex molesta*	Sedge
Desmodium perplexum	Tick-trefoil	*Carex muhlenbergii*	Sedge
Desmodium rotundifolium	Round-leaved tick-trefoil	*Carex normalis*	Sedge
Lespedeza capitata	Round-headed bush-clover	*Carex pedunculata*	Sedge
Lespedeza hirta	Bush-clover	*Carex pellita*	Sedge
Lespedeza intermedia	Bush-clover	*Carex pensylvanica*	Sedge
Lespedeza repens	Creeping bush-clover	*Carex prasina*	Sedge
Lespedeza stuevei	Tall bush-clover	*Carex radiata*	Sedge
Lespedeza violacea	Slender bush-clover	*Carex retroflexa*	Sedge
Lespedeza virginica	Slender bush-clover	*Carex rosea*	Sedge
Lupinus perennis	Blue lupine	*Carex scoparia*	Broom sedge
Robinia pseudoacacia	Black locust	*Carex sparganioides*	Sedge
Strophostyles helvola	Wild bean	*Carex sprengelii*	Sedge
Strophostyles umbellata	Wild bean	*Carex squarrosa*	Sedge
Tephrosia virginiana	Goat's-rue	*Carex stipata v stipata*	Sedge
Chamaecrista fasciculata	Partridge-pea	*Carex stricta*	Tussock sedge
Chamaecrista nictitans	Wild sensitive-plant	*Carex swanii*	Sedge
Gleditsia triacanthos	Honey-locust	*Carex tonsa v tonsa*	Sedge
Gymnocladus dioica	Kentucky coffee-tree	*Carex tribuloides*	Sedge

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Senna hebecarpa	Northern wild senna	*Carex trichocarpa*	Sedge
Ammannia coccinea	Tooth cup	*Carex umbellata*	Sedge
Cuphea viscosissima	Blue waxweed	*Carex virescens*	Sedge
Lythrum alatum	Winged loosestrife	*Carex vulpinoidea v vulpinoidea*	Sedge
Circaea lutetiana s canadensis	Enchanter's-nightshade	*Carex willdenovii*	Sedge
Epilobium angustifolium	Fireweed	*Cyperus bipartitus*	Umbrella sedge
Epilobium coloratum	Purple-leaved willow-herb	*Cyperus esculentus*	Yellow nutsedge
Gaura biennis	Gaura	*Cyperus lupulinus*	Umbrella sedge
Ludwigia alternifolia	False loosestrife	*Cyperus odoratus*	Umbrella sedge
Ludwigia palustris	Marsh-purslane	*Cyperus strigosus*	False nutsedge
Oenothera fruticosa s glauca	Sundrops	*Dulichium arundinaceum*	Three-way sedge
Oenothera laciniata	Cut-leaved evening-primrose	*Eleocharis acicularis*	Needle spike-rush
Oenothera parviflora v parviflora	Evening-primrose	*Eleocharis engelmannii*	Spike-rush
Oenothera perennis	Sundrops	*Eleocharis erythropoda*	Spike-rush
Oenothera pilosella	Sundrops	*Eleocharis obtusa v obtusa*	Wright's spike-rush
Rhexia mariana	Maryland meadow-beauty	*Eleocharis obtusa v peasei*	Spike-rush
Nyssa sylvatica	Sourgum	*Eleocharis olivacea*	Capitate spike-rush
Cornus alternifolia	Alternate-leaved dogwood	*Eleocharis palustris*	Creeping spike-rush
Cornus amomum s amomum	Kinnikinik	*Eleocharis parvula*	Dwarf spike-rush
Cornus florida	Flowering dogwood	*Eleocharis tenuis v tenuis*	Spike-rush
Cornus racemosa	Silky dogwood	*Eleocharis tenuis v pseudoptera*	Slender spike-rush
Comandra umbellata	Bastard toadflax	*Fimbristylis autumnalis*	Slender fimbry
Celastrus scandens	American bittersweet	*Rhynchospora capitellata*	Beak-rush
Euonymus americanus	Hearts-a-bursting	*Schoenoplectus fluviatilis*	River bulrush
Euonymus atropurpureus	Burning-bush	*Schoenoplectus smithii*	Smith's bulrush
Ilex verticillata	Winterberry	*Schoenoplectus tabernaemontani*	Great bulrush
Acalypha gracilens	Slender mercury	*Scirpus atrovirens*	Black bulrush
Acalypha rhomboidea	Three-seeded mercury	*Scirpus cyperinus*	Wool-grass
Acalypha virginica	Three-seeded mercury	*Scirpus georgianus*	Bulrush
Chamaesyce maculata	Spotted spurge	*Scirpus hattorianus*	Bulrush
Chamaesyce nutans	Eyebane	*Scirpus pendulus*	Bulrush
Chamaesyce vermiculata	Hairy spurge	*Trichophorum planifolium*	Club-rush
Ceanothus americanus	New Jersey tea	*Agrostis hyemalis*	Hairgrass
Parthenocissus quinquefolia	Virginia-creeper	*Agrostis perennans*	Autumn bent
Vitis aestivalis	Summer grape	*Agrostis scabra*	Fly-away grass
Vitis labrusca	Fox grape	*Alopecurus carolinianus*	Carolina foxtail
Vitis vulpina	Frost grape	*Andropogon gerardii*	Big bluestem
Linum medium v texanum	Yellow flax	*Andropogon glomeratus*	Broom-sedge
Linum virginianum	Slender yellow flax	*Andropogon gyrans*	Elliott's beardgrass
Polygala sanguinea	Field milkwort	*Andropogon virginicus*	Broom-sedge
Polygala verticillata v verticillata	Whorled milkwort	*Aristida dichotoma v dichotoma*	Povertygrass
Polygala verticillata v ambigua	Whorled milkwort	*Aristida oligantha*	Prairie threeawn
Staphylea trifolia	Bladdernut	*Bromus kalmii*	Bromegrass
Acer negundo	Box-elder	*Chasmanthium laxum*	Slender sea-oats
Acer rubrum v rubrum	Red maple	*Cinna arundinacea*	Wood reedgrass
Acer rubrum v trilobum	Trident red maple	*Critesion jubatum*	Foxtail-barley

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Acer saccharinum	Silver maple	*Danthonia compressa*	Northern oatgrass
Acer saccharum v saccharum	Sugar maple	*Danthonia spicata*	Poverty-grass
Rhus copallina v latifolia	Shining sumac	*Deschampsia flexuosa*	Common hairgrass
Rhus glabra	Smooth sumac	*Echinochloa muricata*	Barnyard-grass
Rhus typhina	Staghorn sumac	*Echinochloa walteri*	Walter's barnyard-grass
Toxicodendron radicans	Poison-ivy	*Elymus hystrix*	Bottlebrush-grass
Toxicodendron vernix	Poison sumac	*Elymus riparius*	Riverbank wild-rye
Oxalis dillenii s filipes	Southern yellow wood-sorrel	*Elymus villosus*	Wild-rye
Oxalis stricta	Common yellow wood-sorrel	*Elymus virginicus*	Virginia wild-rye
Oxalis violacea	Violet wood-sorrel	*Eragrostis capillaris*	Lacegrass
Geranium carolinianum	Wild geranium	*Eragrostis frankii*	Lovegrass
Geranium maculatum	Wood geranium	*Eragrostis pectinacea*	Carolina lovegrass
Floerkea proserpinacoides	False-mermaid	*Eragrostis spectabilis*	Purple lovegrass
Impatiens capensis	Jewelweed	*Festuca obtusa*	Nodding fescue
Impatiens pallida	Pale jewelweed	*Glyceria canadensis*	Rattlesnake mannagrass
Aralia nudicaulis	Wild sarsaparilla	*Glyceria septentrionalis*	Floating mannagrass
Aralia racemosa	Spikenard	*Glyceria striata*	Fowl mannagrass
Aralia spinosa	Hercules'-club	*Leersia virginica*	Cutgrass
Panax trifolium	Dwarf ginseng	*Leptoloma cognatum*	Fall witchgrass
Angelica venenosa	Deadly angelica	*Muhlenbergia frondosa*	Wirestem muhly
Chaerophyllum procumbens	Slender chervil	*Muhlenbergia schreberi*	Dropseed
Cicuta maculata v maculata	Beaver-poison	*Muhlenbergia sobolifera*	Creeping muhly
Cryptotaenia canadensis	Honewort	*Muhlenbergia sylvatica*	Muhly
Heracleum lanatum	Cow-parsnip	*Panicum acuminatum*	Panic grass
Hydrocotyle americana	Marsh pennywort	*Panicum anceps*	Panic grass
Hydrocotyle umbellata	Water pennywort	*Panicum boscii*	Panic grass
Osmorhiza claytonii	Sweet-cicely	*Panicum capillare*	Witchgrass
Osmorhiza longistylis	Anise root	*Panicum clandestinum*	Deer-tongue grass
Oxypolis rigidior	Cowbane	*Panicum columbianum*	Panic grass
Sanicula canadensis	Canadian sanicle	*Panicum commutatum*	Panic grass
Sanicula marilandica	Black snake root	*Panicum depauperatum*	Poverty panic grass
Sanicula trifoliata	Large-fruited sanicle	*Panicum dichotomiflorum*	Smooth panic grass
Sium suave	Water-parsnip	*Panicum dichotomum*	Panic grass
Thaspium trifoliatum v trifoliatum	Meadow-parsnip	*Panicum gattingeri*	Witchgrass
Zizia aptera	Golden-alexander	*Panicum latifolium*	Panic grass
Zizia aurea	Golden-alexander	*Panicum linearifolium*	Panic grass
Bartonia paniculata	Screwstem	*Panicum microcarpon*	Panic grass
Bartonia virginica	Bartonia	*Panicum oligosanthes*	Panic grass
Gentiana andrewsii v andrewsii	Bottle gentian	*Panicum philadelphicum*	Panic grass
Gentiana saponaria	Soapwort gentian	*Panicum polyanthes*	Panic grass
Gentianopsis crinita	Eastern fringed gentian	*Panicum rigidulum*	Panic grass
Obolaria virginica	Pennywort	*Panicum sphaerocarpon*	Panic grass
Sabatia angularis	Common marsh-pink	*Panicum stipitatum*	Panic grass
Apocynum androsaemifolium	Pink dogbane	*Panicum verrucosum*	Panic grass
Apocynum androsaemifolium x cannabinum	Dogbane	*Panicum virgatum*	Switchgrass

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Apocynum cannabinum v cannabinum	Indian-hemp	*Paspalum laeve v circulare*	Field beadgrass
Apocynum cannabinum v glaberrimum	Indian hemp	*Paspalum laeve v pilosum*	Field beadgrass
Apocynum cannabinum v hypericifolium	Indian hemp	*Paspalum setaceum v muhlenbergii*	Slender beadgrass
Asclepias exaltata	Poke milkweed	*Phalaris arundinacea*	Reed canary-grass
Asclepias incarnata s incarnata	Swamp milkweed	*Phragmites australis*	Common reed
Asclepias incarnata s pulchra	Swamp milkweed	*Poa autumnalis*	Autumn bluegrass
Asclepias purpurascens	Purple milkweed	*Poa cuspidata*	Bluegrass
Asclepias quadrifolia	Four-leaved milkweed	*Poa palustris*	Fowl bluegrass
Asclepias syriaca	Common milkweed	*Schizachyrium scoparium v scoparium*	Little bluestem
Asclepias tuberosa	Butterfly-weed	*Setaria geniculata*	Perennial foxtail
Asclepias variegata	White milkweed	*Sorghastrum nutans*	Indian-grass
Asclepias viridiflora	Green milkweed	*Sphenopholis nitida*	Wedgegrass
Physalis heterophylla	Clammy ground-cherry	*Sphenopholis obtusata v obtusata*	Prairie wedgegrass
Physalis pubescens v integrifolia	Hairy ground-cherry	*Sphenopholis obtusata v major*	Slender wedgegrass
Physalis subglabrata	Ground-cherry	*Sphenopholis pensylvanica*	Swamp-oats
Solanum carolinense	Horse-nettle	*Sporobolus vaginiflorus*	Poverty grass
Calystegia sepium	Hedge bindweed	*Tridens flavus*	Purpletop
Calystegia spithamaea s spithamaea	Low bindweed	*Triplasis purpurea*	Purple sandgrass
Ipomoea pandurata	Man-of-the-earth	*Vulpia octoflora v glauca*	Six-weeks fescue
Cuscuta campestris	Dodder	*Zizania aquatica v aquatica*	Wild-rice
Cuscuta compacta	Dodder	*Sparganium americanum*	Bur-reed
Sparganium eurycarpum	Bur-reed	*Polygonatum pubescens*	Solomon's-seal
Typha angustifolia	Narrow-leaved cat-tail	*Smilacina racemosa*	False solomon's-seal
Typha latifolia	Common cat-tail	*Trillium cernuum v cernuum*	Nodding trillium
Heteranthera multiflora	Mud-plantain	*Trillium cuneatum*	Huger's trillium
Heteranthera reniformis	Mud-plantain	*Uvularia perfoliata*	Bellwort
Pontederia cordata	Pickerel-weed	*Uvularia sessilifolia*	Bellwort
Allium canadense	Wild onion	*Veratrum viride*	False hellebore
Chamaelirium luteum	Devil's-bit	*Iris prismatica*	Slender blue flag
Erythronium americanum	Yellow trout-lily	*Sisyrinchium angustifolium*	Blue-eyed-grass
Hypoxis hirsuta	Yellow star-grass	*Sisyrinchium mucronatum*	Blue-eyed-grass
Lilium canadense s canadense	Canada lily	*Smilax glauca*	Catbrier
Lilium philadelphicum	Wood lily	*Smilax herbacea*	Carrion-flower
Lilium superbum	Turk's-cap lily	*Smilax pulverulenta*	Carrion-flower
Maianthemum canadense	Canada mayflower	*Smilax rotundifolia*	Catbrier
Medeola virginiana	Indian cucumber-root	*Dioscorea villosa*	Wild yam
Melanthium latifolium	Bunchflower	*Corallorhiza maculata*	Spotted coralroot
Polygonatum biflorum v biflorum	Solomon's-seal	*Cypripedium acaule*	Pink lady's-slipper
Polygonatum biflorum v commutatum	Solomon's-seal	*Galearis spectabilis*	Showy orchis
Sparganium eurycarpum	Bur-reed	*Goodyera pubescens*	Downy rattlesnake-plantain
Typha angustifolia	Narrow-leaved cat-tail	*Liparis liliifolia*	Lily-leaved twayblade
Platanthera lacera	Ragged fringed-orchid	*Platanthera clavellata*	Clubspur orchid

Introduced Plant Species of the Neshaminy Creek Watershed Compiled by the PA Flora Project at the Morris Arboretum of the University of Pennsylvania

Scientific Name	Common Name	Scientific Name	Common Name
Ginkgo biloba	Maidenhair tree	Petunia x hybrida	Petunia
Pinus sylvestris	Scots pine	Physalis alkekengi	Chinese-lantern
Aquilegia vulgaris	Columbine	Solanum dulcamara v dulcamara	Trailing nightshade
Clematis terniflora	Sweet autumn clematis	Solanum dulcamara v villosissimum	Trailing nightshade
Consolida ajacis	Garden larkspur	Solanum nigrum	Black nightshade
Helleborus viridis	Green hellebore	Solanum tuberosum	Potato
Ranunculus acris	Common meadow buttercup	Calystegia hederacea	Japanese bindweed
Ranunculus bulbosus	Bulbous buttercup	Convolvulus arvensis	Field bindweed
Ranunculus ficaria	Lesser celandine	Ipomoea batatas	Sweet potato
Ranunculus sceleratus	Celery-leaved crowfoot	Ipomoea hederacea	Ivy-leaved morning-glory
Berberis thunbergii	Japanese barberry	Ipomoea purpurea	Common morning-glory
Berberis vulgaris	European barberry	Buglossoides arvense	Bastard alkanet
Argemone mexicana	Mexican poppy	Cynoglossum officinale	Hound's-tongue
Chelidonium majus	Greater celandine	Echium vulgare	Viper's bugloss
Macleaya cordata	Plume-poppy	Myosotis scorpioides	Forget-me-not
Papaver orientale	Oriental poppy	Myosotis stricta	Forget-me-not
Papaver rhoeas	Corn poppy	Verbena bracteata	Prostrate vervain
Maclura pomifera	Osage-orange	Calamintha nepeta s glandulosa	Basil-thyme
Morus alba	White mulberry	Clinopodium vulgare	Wild basil
Humulus japonicus	Japanese hops	Glechoma hederacea	Gill-over-the-ground
Urtica dioica s dioica	Great nettle	Lamium album	Snowflake
Urtica urens	Dog nettle	Lamium amplexicaule	Henbit
Quercus robur	English oak	Lamium purpureum	Purple dead-nettle
Alnus glutinosa	Black alder	Leonurus cardiaca	Common motherwort
Beta vulgaris	Beet	Marrubium vulgare	Common horehound
Chenopodium album v album	Lamb's quarters	Melissa officinalis	Lemon-balm
Chenopodium ambrosioides	Mexican-tea	Mentha aquatica x spicata	Peppermint
Chenopodium berlandieri	Goosefoot	Mentha longifolia x suaveolens	Apple mint
Chenopodium botrys	Feather-geranium	Mentha spicata	Spearmint
Chenopodium glaucum	Oak-leaved goosefoot	Mentha spicata x suaveolens	Apple mint
Chenopodium murale	Nettle-leaved goosefoot	Moluccella laevis	Bells-of-Ireland
Cycloloma atriplicifolium	Winged pigweed	Nepeta cataria	Catnip
Kochia scoparia	Belvedere	Perilla frutescens	Perilla
Amaranthus blitoides	Prostrate pigwed	Prunella vulgaris s vulgaris	Heal-all
Amaranthus blitum	Amaranth	Thymus pulegioides	Creeping thyme
Amaranthus caudatus	Love-lies-bleeding	Callitriche stagnalis	Water-starwort
Amaranthus cruentus	Blood amaranth	Plantago aristata	Bristly plantain
Amaranthus hybridus	Pigweed	Plantago lanceolata	English plantain

Scientific Name	Common Name	Scientific Name	Common Name
Amaranthus powellii	Amaranth	Plantago major	Broad-leaved plantain
Amaranthus retroflexus	Green amaranth	Ligustrum amurense	Amur privet
Amaranthus spinosus	Spiny amaranth	Ligustrum obtusifolium	Obtuse-leaved privet
Celosia argentea	Celosia	Ligustrum ovalifolium	California privet
Froelichia gracilis	Cottonweed	Ligustrum vulgare	Common privet
Portulaca grandiflora	Moss-rose	Syringa vulgaris	Common lilac
Mollugo verticillata	Carpetweed	Antirrhinum majus	Snapdragon
Agrostemma githago	Corn cockle	Chaenorrhinum minus	Dwarf snapdragon
Arenaria serpyllifolia s leptoclados	Thyme-leaved sandwort	Cymbalaria muralis	Kenilworth-ivy
Cerastium fontanum s triviale	Common mouse-ear chickweed	Glossostigma diandrum	Mudmat
Cerastium glomeratum	Mouse-ear chickweed	Kickxia elatine	Cancerwort
Dianthus armeria	Deptford pink	Linaria genistifolia s dalmatica	Toadflax
Dianthus barbatus	Sweet-william	Linaria vulgaris	Butter-and-eggs
Gypsophila muralis	Baby's-breath	Melampyrum lineare v americanum	Cow-wheat
Lychnis coronaria	Rose-campion	Penstemon calycosus	Beard-tongue
Myosoton aquaticum	Giant chickweed	Verbascum blattaria	Moth mullein
Saponaria officinalis	Bouncing-bet	Verbascum thapsus	Common mullein
Scleranthus annuus	Knawel	Veronica arvensis	Corn speedwell
Silene latifolia	White campion	Veronica chamaedrys	Bird's-eye
Silene armeria	Garden catchfly	Veronica longifolia	Speedwell
Silene cserei	Campion	Veronica persica	Bird's-eye speedwell
Silene vulgaris	Bladder campion	Veronica serpyllifolia	Thyme-leaved speedwell
Spergula morisonii	Spurrey	Catalpa bignonioides	Catalpa
Stellaria alsine	Bog chickweed	Paulownia tomentosa	Empress-tree
Stellaria graminea	Lesser stitchwort	Campanula rapunculoides	Creeping bellflower
Stellaria media	Common chickweed	Lobelia chinensis	Chinese lobelia
Fagopyrum esculentum	Buckwheat	Galium mollugo	White bedstraw
Polygonum arenastrum	Doorweed	Galium pedemontanum	Bedstraw
Polygonum aviculare	Knotweed	Lonicera japonica v japonica	Japanese honeysuckle
Polygonum caespitosum v longisetum	Low smartweed	Lonicera japonica v chinensis	Japanese honeysuckle
Polygonum convolvulus	Black bindweed	Lonicera morrowii	Morrow's honeysuckle
Polygonum cuspidatum	Japanese knotweed	Lonicera tatarica	Tartarian honeysuckle
Polygonum hydropiper	Smartweed	Viburnum dilatatum	Linden viburnum
Polygonum lapathifolium	Dock-leaf smartweed	Viburnum opulus	Guelder-rose
Polygonum orientale	Kiss-me-over-the-garden-gate	Valeriana officinalis	Garden heliotrope
Polygonum perfoliatum	Mile-a-minute weed	Valerianella locusta	Corn-salad
Polygonum persicaria	Lady's-thumb	Dipsacus sylvestris	Teasel
Polygonum sachalinense	Giant knotweed	Achillea millefolium	Common yarrow
Rumex acetosella	Sheep sorrel	Anthemis arvensis	Corn chamomile
Rumex crispus	Curly dock	Anthemis cotula	Mayweed
Rumex obtusifolius	Bitter dock	Arctium minus	Common burdock
Rumex pulcher	Fiddle-dock	Artemisia vulgaris	Common mugwort
Rumex salicifolius	Willow-leaf dock	Bidens polylepis	Tickseed-sunflower

Scientific Name	Common Name	Scientific Name	Common Name
Hypericum perforatum	St. John's-wort	Centaurea calcitrapa	Purple star-thistle
Abutilon theophrastii	Butter-print	Centaurea cyanus	Bachelor's button
Alcea rosea	Hollyhock	Centaurea nigrescens	Knapweed
Callirhoe involucrata	Purple poppy-mallow	Chrysanthemum leucanthemum	Ox-eye daisy
Hibiscus syriacus	Rose-of-sharon	Chrysanthemum morifolium	Garden chrysanthemum
Hibiscus trionum	Flower-of-the-hour	Chrysanthemum parthenium	Feverfew
Malva moschata	Musk mallow	Cichorium endiva	Endive
Malva neglecta	Cheeses	Cichorium intybus	Blue chicory
Viola tricolor	Johnny-jump-up	Cirsium arvense v arvense	Canada thistle
Citrullus colocynthis	Watermelon	Cirsium arvense v integrifolium	Canada thistle
Cucumis melo	Muskmelon	Cirsium arvense v vestitum	Canada thistle
Cucumis sativus	Cucumber	Cirsium vulgare	Bull-thistle
Cucurbita pepo	Pumpkin	Conyza canadensis v pusilla	Fleabane
Populus alba	White poplar	Coreopsis lanceolata	Longstalk tickseed
Populus canescens	Gray poplar	Cosmos bipinnatus	Cosmos
Salix fragilis	Crack willow	Crepis capillaris	Hawk's-beard
Salix purpurea	Basket willow	Eupatorium serotinum	Late eupatorium
Cleome hasslerana	Spider-flower	Galinsoga quadriradiata	Quickweed
Alliaria petiolata	Garlic-mustard	Guizotia abyssinica	Ramtilla
Arabidopsis thaliana	Mouse-ear cress	Helenium flexuosum	Southern sneezeweed
Armoracia rusticana	Horseradish	Helianthus annuus	Common sunflower
Barbarea verna	Early wintercress	Helianthus laetiflorus	Showy sunflower
Barbarea vulgaris v vulgaris	Common wintercress	Helianthus mollis	Ashy sunflower
Barbarea vulgaris v arcuata	Wintercress	Helianthus tuberosus	Jerusalem artichoke
Brassica juncea	Brown mustard	Heterotheca subaxillaris	Camphorweed
Brassica nigra	Black mustard	Hieracium aurantiacum	Orange hawkweed
Brassica oleracea	Cabbage	Hieracium flagellare	Hawkweed
Brassica rapa s olifera	Field mustard	Hieracium piloselloides	King-devil
Camelina microcarpa	Small-fruited false-flax	Hieracium sabaudum	Hawkweed
Capsella bursa-pastoris	Shepherd's-purse	Ixeris stolonifera	Creeping lettuce
Cardamine hirsuta	Hairy bittercress	Lactuca sativa	Garden lettuce
Coincya monensis s recurvata	Coincya	Lactuca serriola	Prickly lettuce
Draba verna	Whitlow-grass	Leontodon taraxacoides	Hawkbit
Erucastrum gallicum	Dog-mustard	Matricaria matricarioides	Pineapple-weed
Erysimum cheiranthoides	Treacle-mustard	Picris hieracioides	Ox-tongue
Hesperis matronalis	Dame's-rocket	Senecio vulgaris	Common groundsel
Lepidium campestre	Fieldcress	Sonchus arvensis s uliginosus	Field sow-thistle
Lepidium densiflorum	Wild pepper-grass	Sonchus asper	Spiny-leaved sow-thistle
Lepidium heterophyllum	Pepper-grass	Sonchus oleraceus	Common sow-thistle
Lobularia maritima	Sweet alyssum	Tagetes erecta	African marigold
Nasturtium officinale	Watercress	Tagetes patula	French marigold
Raphanus raphanistrum	Wild radish	Tanacetum vulgare	Common tansy
Raphanus sativus	Garden radish	Taraxacum laevigatum	Red-seeded dandelion
Rorippa amphibia x sylvestris	Yellow cress	Taraxacum officinale	Common dandelion

Scientific Name	Common Name	Scientific Name	Common Name
Rorippa sylvestris	Creeping yellowcress	Tragopogon porrifolius	Oyster-plant
Sinapis alba	White-mustard	Tragopogon pratensis	Meadow salsify
Sinapis arvensis	Charlock	Zinnia elegans	Zinnia
Sisymbrium altissimum	Tumble-mustard	Potamogeton crispus	Curly pondweed
Sisymbrium officinale v leiocarpum	Bank cress	Najas minor	Waternymph
Thlaspi alliaceum	Garlic pennycress	Acorus calamus	Sweet flag
Thlaspi arvense	Field pennycress	Commelina communis v communis	Asiatic dayflower
Symplocos paniculata	Sapphire-berry	Commelina communis v ludens	Asiatic dayflower
Halesia carolina	Carolina silverbell	Carex spicata	Sedge
Anagallis arvensis	Scarlet pimpernel	Cyperus brevifolioides	Umbrella sedge
Lysimachia clethroides	Loosestrife	Aegilops cylindrica	Jointed goatgrass
Lysimachia nummularia	Creeping-charlie	Agrostis canina	Brown bent
Deutzia scabra	Deutzia	Agrostis capillaris	Rhode Island bent
Hydrangea paniculata	Peegee hydrangea	Agrostis gigantea	Redtop
Philadelphus coronarius	Mock-orange	Anthoxanthum odoratum	Sweet vernalgrass
Philadelphus pubescens	Mock-orange	Arrhenatherum elatius v elatius	Tall oatgrass
Ribes rubrum	Garden red currant	Arthraxon hispidus	Grass
Ribes uva-crispa v sativum	European garden gooseberry	Avena sativa	Oats
Sedum alboroseum	Garden orpine	Bromus commutatus	Hairy chess
Sedum sarmentosum	Orpine	Bromus hordeaceus	Soft chess
Sedum telephium	Garden orpine	Bromus inermis	Smooth brome
Crataegus phaenopyrum	Washington hawthorn	Bromus japonicus	Japanese chess
Duchesnea indica	Indian strawberry	Bromus racemosus	Soft chess
Geum aleppicum	Yellow avens	Bromus tectorum	Downy chess
Potentilla recta	Sulfur cinquefoil	Chloris verticillata	Windmill-grass
Potentilla reptans	Creeping cinquefoil	Critesion marinum s gussoneanum	Squirrel-tail
Prunus avium	Sweet cherry	Crypsis schoenoides	Grass
Prunus cerasus	Pie cherry	Cynodon dactylon	Bermudagrass
Prunus padus	European bird cherry	Dactylis glomerata	Orchardgrass
Prunus persica	Peach	Digitaria ciliaris	Southern crabgrass
Rhodotypos scandens	Jetbead	Digitaria ischaemum	Smooth crabgrass
Rosa eglanteria	Sweetbrier	Digitaria sanguinalis	Northern crabgrass
Rosa multiflora	Multiflora rose	Echinochloa crusgalli v crusgalli	Barnyard-grass
Rosa setigera	Prairie rose	Eleusine indica	Goosegrass
Rosa wichuraiana	Memorial rose	Elytrigia repens	Quackgrass
Rubus laciniatus	Cut-leaved blackberry	Eragrostis cilianensis	Stink grass
Rubus phoenicolasius	Wineberry	Eragrostis minor	Lovegrass
Spiraea japonica	Japanese spiraea	Eragrostis pilosa	India lovegrass
Kummerowia stipulacea	Korean-lespedeza	Festuca elatior	Fescue
Lathyrus latifolius	Perennial sweetpea	Festuca ovina	Sheep fescue
Lens culinaris	Lentil	Festuca rubra	Red fescue
Lotus corniculatus	Bird's-foot trefoil	Holcus lanatus	Velvetgrass
Medicago lupulina	Black medic	Hordeum vulgare	Barley

Scientific Name	Common Name	Scientific Name	Common Name
Medicago polymorpha	Bur-clover	Leptochloa filiformis	Red sprangletop
Medicago sativa	Alfalfa	Lolium multiflorum	Ryegrass
Melilotus alba	White sweet-clover	Lolium perenne	Perennial ryegrass
Melilotus officinalis	Yellow sweet-clover	Lolium temulentum	Darnel
Pisum sativum	Garden pea	Microstegium vimineum	Stiltgrass
Strophostyles leiosperma	Wild bean	Miscanthus sinensis v sinensis	Eulalia
Trifolium arvense	Rabbit's-foot clover	Panicum miliaceum	Broomcorn millet
Trifolium aureum	Large yellow hop-clover	Phalaris canariensis	Canary-grass
Trifolium campestre	Low hop-clover	Phalaris paradoxa	Canary-grass
Trifolium dubium	Little hop-clover	Phleum pratense	Timothy
Trifolium hybridum	Alsike clover	Poa annua	Annual bluegrass
Trifolium pratense	Red clover	Poa compressa	Canada bluegrass
Trifolium repens	White clover	Poa pratensis	Kentucky bluegrass
Trigonella procumbens	Fenugreek	Poa trivialis	Rough bluegrass
Vicia cracca	Canada pea	Polypogon monspeliensis	Beardgrass
Vicia sativa s nigra	Common vetch	Secale cereale	Rye
Vicia villosa s villosa	Hairy vetch	Setaria faberi	Giant foxtail
Vicia villosa s varia	Hairy vetch	Setaria italica	Foxtail millet
Myriophyllum aquaticum	Parrot's-feather	Setaria pumila	Yellow foxtail
Myriophyllum spicatum	Eurasian water-milfoil	Setaria verticillata v verticillata	Bristly foxtail
Lythrum hyssopifolia	Hyssop loosestrife	Setaria viridis v viridis	Green foxtail
Lythrum salicaria	Purple loosestrife	Sorghum halepense	Johnsongrass
Trapa natans	Water-chestnut	Taeniatherum caput-medusae	Grass
Celastrus orbiculatus	Oriental bittersweet	Triticum aestivum	Wheat
Euonymus alatus	Winged euonymous	Zea mays	Corn
Euonymus europaeus	European spindletree	Allium cepa	Onion
Euonymus hamiltonianus	Spindle-tree	Allium oleraceum	Field garlic
Ilex crenata	Japanese Holly	Allium vineale	Field garlic
Euphorbia cyparissias	Cypress spurge	Asparagus officinalis	Garden asparagus
Euphorbia marginata	Snow-on-the-mountain	Galanthus nivalis	Snowdrop
Rhamnus cathartica	Buckthorn	Hemerocallis fulva	Orange day-lily
Rhamnus frangula	Alder buckthorn	Hosta ventricosa	Blue plantain-lily
Ampelopsis brevipedunculata	Porcelain-berry	Lilium lancifolium	Tiger lily
Parthenocissus tricuspidata	Boston ivy	Muscari botryoides	Grape-hyacinth
Vitis labruscana	Fox grape	Narcissus pseudonarcissus	Daffodil
Vitis vinifera	European grape	Ornithogalum umbellatum	Star-of-Bethlehem
Linum usitatissimum	Common flax	Tulipa sylvestris	Dutch-lily
Aesculus hippocastanum	Horse-chestnut	Iris ensata	Japanese iris
Acer platanoides	Norway maple	Dioscorea batatas	Chinese yam
Acer pseudoplatanus	Sycamore maple	Aegopodium podagraria	Goutweed
Cotinus coggygria	Smoke-tree	Anethum graveolens	Dill
Ailanthus altissima	Tree-of-heaven	Ciclospermum leptophyllum	Marsh parsley
Phellodenron lavallei	Corktree	Daucus carota	Queen Anne's-lace
Erodium cicutarium	Red-stem filaree	Pastinaca sativa	Wild parsnip

Scientific Name	Common Name	Scientific Name	Common Name
Geranium sanguineum	Blood-red cranesbill	Buddleja davidii	Butterfly-bush
Geranium versicolor	Cranesbill	Centaurium pulchellum	Lesser centuary
Impatiens balsamina	Garden balsam	Vinca minor	Common periwinkle
Acanthopanax sieboldianus	Fiveleaf aralia	Capsicum annuum	Bell pepper
Lycopersicon esculentum	Tomato	Datura meteloides	Downy thorn-apple
Datura stramonium	Jimsonweed		

Appendix F

Floodwater Damage Statistics from
Neshaminy Creek Watershed Plan

Floodwater Damage Statistics from Neshaminy Creek Watershed Plan

Existing Conditions:

Statistics are calculated for Neshaminy Creek Watershed from Dark Hollow Road in Warwick Township to the creek's confluence with the Delaware River.

Damages in Dollars

Storm Frequency	Residential	Commercial	Road & Bridge	Totals
2 Year	$382,000	$78,000	$234,000	$694,000
10 Year	$2,613,000	$1,196,000	$568,000	$4,292,000
100 year	$9,002,000	$3,726,000	$663,000	$13,391,000
Average Annual Damage	$980,000	$363,000	$306,000	$1,649,000

Storm Frequencies and Flooding

Frequency	Damage to buildings	Maximum Flood Depth (feet) Houses/Businesses
2 year	88 houses, 6 businesses	9.0/6.9
10 year	241 houses, 29 businesses	10.6/10.6
100 year	392 houses, 56 businesses	15.8/15.8

Flood Prone Roadways

Frequency	Flooded Roadway
<1 year flood	Covered Bridge in Tyler State Park
<1 year flood	Bridgetown Pike
>1 year flood	Route 532
> 2 year flood	Worthington Mill Road
> 5 year flood	Brownsville Road
> 5 year flood	Route 332
> 10 year flood	State Road
> 10 year flood	New Falls Road
> 10 year flood	Old Lincoln Highway
> 10 year flood	Dark Hollow Road
> 25 year flood	Route 513
> 25 year flood	Route 232
>100 year flood	All others downstream of Dark Hollow Road and not listed

Estimated Future Conditions

Future conditions were projected to the year 2020. BCPC land use and population projections were used, as well as stormwater management criteria, and FEMA / PEMA hazard mitigation buyouts. Projections were based on NRCS Computer model (TR20) discharges.

Damages in Dollars

Storm Frequency	Residential	Commercial	Road & Bridge	Totals
2 Year	$246,000	$51,000	$211,000	$508,000
10 Year	$1,740,000	$1,057,000	$511,000	$3,308,000
100 year	$6,746,000	$3,467,000	$597,000	$10,810,000
Average Annual Damage	$668,000	$317,000	$276,000	$1,264,000

Storm Frequencies and Flooding

Frequency	Damage to buildings	Maximum Flood Depth (feet) Houses/Businesses
2 year	54 houses, 4 businesses	3.4/6.6
10 year	182 houses, 27 businesses	9.3/10.3
100 year	329 houses, 54 businesses	14.5/14.3

Appendix G

Key to Historical Resources

Key to Historic Resources

ID	ADDRESS	HISTORIC NAME	Listed on the National register
1	107 Green Street	The Frenier House	eligible
2	200 Main St.	Joshua C. Canby House (Clauss)	eligible
3	5 Green Street	Isaac Hulme House	
4	Bellevue And Maple Avenues	Langhorne Hotel	
5	109 W. Maple Ave.	Tomlinson-Huddleston House	nhr
6	111 W. Maple Avenue	George Walker House	
7	308 Gillam Avenue	Samuel Linington House	
8	1547 Bustleton Pike	The Willett's Farm	
9	1409 Bustleton Pike	Willett-Knight House	
10	878 Langhorne-Newtown Rd.	Joseph & Rebecca Richardson Farm	
11	346 Bridgetown Pike At Rt. 413	Bridgetown Tannery	
12	R.D.#1 Village Rd.	Elias A/K/A Subers Family Homestead	
13	1015 Hulmeville Road	Samuel H. Harrison House	
14	115 Middle Holland Road	Feaster-Van Horn Cemetery	
15	180 Buck Rd.	Roy Reinard, Jr. House	
16	1672 Chinquapin Road	Dr. Hugh Tombs Grist Mill	
17	400 Bridgetown Pike	Spring Brook	
18	130 Merry Dell Dr.	Merry Dell Farm	
19	Near Street & Woods Rd.	Stone Arch Bridge (Bucks Co. Bridge 293)	
20	Swamp Rd	"Tyler, George F. Mansion"	
21	Sackettsford Rd.		
22	Newton-Richboro Road	Spring Garden Mill	eligible
23	"Fulling Mill Road, S. Of Double Woods Rd"	Willson-Tate House	eligible
24	E Of Newtown Pike	"Stapler, Thomas W. House"	eligible
25	1567 Fulling Mill Road	"Buckman, John House"	
26	Rt 413	"Buckman, Levi House"	
27	905 Second Street Pikee	"Leedom, Richard House"	
28	"130 Tanyard Rd, (Sw Of Richboro)"	Willow Bank Farm	
29	72 Lempa Road	"Feaster, David House"	
30	1235 Buck Road	Edge Plain Floral Co.	
31	Lower Holland Road	Cornell Farm	
32	Lower Holland Road	"Krusen, David House"	
33	227 Bristol Rd.	Carrellton	
34	Buck & East Holland Roads	"Cornell, Adrian Farm"	
35	Second Street Pike	"Dungan, John House"	
36	Bridgetown Rd	"Hicks, George Farmstead"	
37	Buck Road	"Webster, John Farm"	
38	1448 Second Street Pike	Hogeland Farm Tenant House	
39	115 Millcreek Road		
40	Holland Road	"Fenton, Joseph House"	
41	Holland Road	"Cornell, James Farm"	eligible
42	Rocksville Rd.	"Thompson, Allen House"	
43	Rte 213 At Feasterville	Playwicki Farm	
44	910 Jeffrey Drive	"Fetter, Casper G. House"	
45	Buck Road	"Leffert, John Farm"	
46	45 Snowflake Road		
47	Tyler State Park	Twining Ford Covered Bridge	nhr
48	"Bridgetown Rd., N. Of Langhorne"	Edgemont (Jenks Homestead)	nhr
49	Ne Crnr Lr09052 & Worthingtn Ml Rd	Worthington Mill	
50	1925 Second St. Pike (Rt. 232)	"Thompson, John House"	nhr
51	S/S Silver Lake Rd	S/S Silver Lake Rd	

52	1269 2nd St. Pike	Hampton Hill	nhr
53	"Silver Lake & Banks Rds, T357"	Majka House	eligible
54	"Woodbourne Rd, Lr09027"	Village Farm	eligible
55	Tanyard Road		
56	"295a Woodbourne Rd, Lr09027"	Jenks Hall	eligible
57	"Tollgate Rd, T321"	Harveson House	eligible
58	905 Second St. Pike	Twin Trees Farm	nhr
59	Ne Cor. Woodbourne & Langhorne/Yardley Rds	Maple Point School	eligible
60	Se Corner Woodbourne & Langhorne/Yardley Rds	Tubbs Farmstead	
61	Langhorne/Yardley Rd	"Hammock Villa, Wildman House"	eligible
62	Woodbourne Rd Near Langhorne/Yardley Rds	"Hall, Richard H. & Marilyn A."	
63	Langhorne-Yarkley Rd Near Woodbourne Rd	"Styer, Thomas, Iii Property"	
64	1351 Woodbourne Rd	"Godzieba, John A. & Joanne J."	
65	1185 Buck Road	St. Leonard's Farm	
66	569 Bustleton Pike	Herzog's Corner	
67	"559, 569 Bustleton Pike"	Willow Mill Complex	eligible
68	Bustleton Pike	"Leedom, Richard House"	
69	"Bridgetown Pike, Off Lr09028"	Trainer/White Farm	eligible
70	"901 Langhorne-Newtown Rd, Rt 413"	Boone Farm	eligible
71	1598 Second Street Pike	"Cornell, Gilliam House & Store"	
72	1486 Second Street Pike	"Vansant, Richard Farm"	
73	1120 Bristol Road		
74	2nd St. Pike & Maple Ave.	Southhampton Baptist Church And Cemetery	nhr
75	1255 Second Street Pike	"Leedom, Richard House"	
76	1722 Bristol Road	"Tomlinson, Wilmer House"	
77	Chinquapin Road		
78	863 West Maple Drive		
79	1654 Bustleton Pike	Wynkoop-Plumley House	
80	"1242 Brownsville Rd, Langhorne"	"Waln, Nicholas House"	
81	1714 Bustleton Pike	"Slack, John House"	
82	1700 Street Road	Banes Farm	
83	970 Durham Rd	"Middletown Crossroads Hotel, Hotel Hellings"	
84	1124 Trenton Rd	"Larue, Daniel, Jr. House"	eligible
85	1032 Trenton Road	"Krosnodoriskie, John J. House"	
86	933 Trenton Rd	"Mcclelland, Richard K. House"	
87	2100 Durham Rd	"Hellings, Nathan Property"	
88	2132 Durham Road	"Mcclaren, Francis, House"	
89	2124 Durham Rd	"Rittenhouse, William David House"	
90	Bustleton Pike		
91	5 Churchville Lane	"Hillings, John House"	
92	Nw Corner Of Bellevue & Maple Aves.	Attleborough House	
93	139 W. Maple Ave.	"Stackhouse, John House"	
94	Bellevue & Maple Aves.	"Richardson, Joseph House"	nhr
95	160 W.Maple Ave	Langhorne Library	nhr
96	453 W. Maple Ave. In Langhorne	Middletown Monthly Meetinghouse	
97	107 Green St.	"Hicks, Edward House"	eligible
98	2 Water St	First Bank In Bucks County	eligible

Appendix H

Visual Assessment Results Matrix

Assessment Team	Stream Segment	Sub-watershed	Issues and Amenities	Recommendations
Erich Wendel	Franklin to Tollgate Road, Middletown Township Section CC-1	Core Creek	Issues • stormwater drainage area • invasive species; phragmites, stilt grass, multiflora rose • stream channel exposed to sun for much of length Amenities • spring fed pond • forested riparian buffer were stream enters Lake Luxembourg	• manage stormwater flows to reduce stormwater velocity and improve water quality • remove invasive plants when possible and replace with native vegetation • improve riparian buffer along the creek
Erich Wendel	Basil to Silver Lake Road, Middletown Township Section CC-2	Core Creek	Issues • residential lawns mowed to edge of stream Amenities • good forested buffer on right bank	• educate homeowners about NPS pollution and ways they can protect the stream as it flows through their property
Frank Karwoski and Ray Walz	Dam on Lake Luxembourg to Bridgetown Pike, Middletown Township Section CC-3	Core Creek	Amenities • stream flows through good forested riparian buffer in Core Creek Park	• implement good forestry and invasive plant management program to maintain quality of this forest habitat
Joe Amodei	Wilson Avenue to Main Street, Hulmeville Borough Section HU-1	Hulmeville Creek	Issues • stream suffers from severe bank erosion • construction materials dumped on banks for stabilization • invasive species; Japanese knotweed, Japanese stiltgrass, multiflora rose, purple	• manage stormwater flows to reduce stormwater velocity as part of comprehensive stream restoration process • remove makeshift and ineffective streambank stabilization efforts as these are creating additional problems • remove invasive plants when possible and replace with native vegetation

Assessment Team	Stream Segment	Sub-watershed	Issues and Amenities	Recommendations
			loosestrife • abundance of trash and debris in the stream Amenitites • good forest adjacent to the stream	
Lisa and Steve Buffardi	Almshouse Road to Second Street Pike, Northampton Township Section I-1	Ironworks Creek	Issues • numerous stormwater inputs into the stream • exotic honeysuckle and multiflora rose dominant riparian corridor • residents direct sump pump discharge into the stream • abundance of trash in the stream	• residents should be encouraged to direct sump pump discharge over land rather that discharging directly into the stream • hold stream clean-ups • remove invasive plants when possible and replace with native vegetation
Jeannette Sykes and Estelle Brager	Street Road to Bustleton Pike Section M-1	Mill Creek	Issues • streambanks shows signs of severe erosion on bends • moderate amounts of litter and trash • exposed sewer infrastructure Amenities • nice wooded riparian buffer • native trees; Beech, Maple Oak	• utilize BMP's to improve quality of stormwater runoff from commercial parking lots • reduce erosion throughout the watershed through better stormwater management • repair eroding streambanks using bioengineering techniques • remove invasive plants when possible and replace with native vegetation
Meredith Fischer	Street Road to Bustleton Pike Section M-2	Mill Creek	Issues • industrial and commercial land-uses discharge larges amounts of stormwater into this stream • exotic honeysuckle and multiflora rose dominate riparian corridor	• identify source and composition of discharge of orange liquid • map discharges into this stream stretch according to NPDES Phase II regulations • encourage riparian property owners to manage streamside property in environmentally sensitive manner

Assessment Team	Stream Segment	Sub-watershed	Issues and Amenities	Recommendations
			• streambank erosion is severe in places Amenities • good riparian vegetation along most of the stream length	• sewer infrastructure should be inventoried and monitored for failures and leaks • reduce erosion throughout the watershed through better stormwater management • repair eroding streambanks using bioengineering techniques
George Pickul	Cherry Blossom to Bristol Road, Northampton Township Section M-4	Mill Creek	Issues • residents direct sump pumps directly into creek • numerous stormwater outfalls • multiflora rose and Japanese honeysuckle Amenities • natural waterfall	• encourage residents to refrain from discharging sump pumps directly into the stream • educate riparian landowners about ways to reduce their impacts on the stream • utilize stormwater BMP's to reduce stormwater impacts on this headwater stream
Regina Pena	Bridgetown Pike to Playwicki Park, Northampton Township Section M-5	Mill Creek	Issues • severe streambank erosion • popular swimming area • multiflora rose Amenities • good riparian forest protected as county park	• comprehensive watershed management plan for Mill Creek to reduce erosion from storm events and repair eroded streambanks • institute program to remove invasive plants on public land an replace with native species
Chris and Austino Blaydon	Newtown-Richboro Road to Playwicki Park, Northampton and Middletown Townships Section Nesh-1	Mainstem Neshaminy Creek	Issues • Japanese knotweed is beginning to dominate riparian vegetation • large debris and litter are found in the stream after large storm events • many stormwater discharges Amenities • the stream has a good riparian	• implement better watershed wide stormwater management programs • institute programmatic elimination of Japanese knotweed on public land and replace with native vegetation • inventory and repair leaking sanitary sewer infrastructure along the stream

Assessment Team	Stream Segment	Sub-watershed	Issues and Amenities	Recommendations
			forest • good for canoeing and other recreation activities • many significant natural areas along creek	
Lionel Ruberg	Railroad Bridge to Pennswood Village, Middletown Township Section Nesh-2	Mainstem Neshaminy Creek	Issues • Japanese knotweed is beginning to dominate riparian vegetation • many stormwater discharges Amenities • good riparian forest behind Pennswood Village dominated by native trees	• facilitate preservation of Oak forest behind Pennswood village • institute programmatic elimination of Japanese knotweed and replace with native vegetation, especially on George School and Pennswood Village properties
Kathy Horwatt and Sean Greene	Length of Langhorne Borough border Section Nesh-3	Mainstem Neshaminy Creek	Issues • contaminated drinking water wells of homes along the creek • severe erosion of right bank • many sump pump and stormwater discharges • Japanese knotweed, Japanese honeysuckle and multiflora rose are abundant in riparian area Amenities • good riparian forest • stream has high recreational value in this section • small waterfall with deep pools	• discourage riparian landowners from discharging sump pumps directly into the stream • permanently protect open space along the creek in Langhorne Borough • protect intermittent tributaries through better stormwater management practices • remove invasive plants where possible and replace with native vegetation
Peg Mongillo and Chris Steiber	Buck to Woodenbridge Road,	Pine Run	Issues • lawns mown to edge of stream • areas of severe erosion	• educate homeowners about how there actions affect the stream ecosystem • discourage riparian landowners from

Assessment Team	Stream Segment	Sub-watershed	Issues and Amenities	Recommendations
	Northampton Township Section P-1		• debris dumped on streambank to arrest erosion Amenities • good riparian forest on left bank • abundant native species in riparian forest	dumping lawn waste into stream • encourage the use of native plants in residential landscaping
Peg Mongillo and Jim Edwards	Woodenbridge Road to fork in stream Section P-2	Pine Run	Issues • lawns mown to edge of stream • areas of severe erosion • lawn waste dumped into stream • discharge at Woodenbridge Road with rotten egg odor	• educate homeowners about how there actions affect the stream ecosystem • discourage riparian landowners from dumping lawn waste into stream • utilize bioengineering to repair eroding streambanks where possible • investigate source of odor at Woodenbridge Road
Gretchen Schatschneider and Sean Greene	Joanne to St. Leonard's Road, Northampton Township UT-1 & 2	Unnamed tributary to the Neshaminy Creek	Issues • lawns mown to edge of stream in headwaters area • ATV damage in forested area • multiflora rose and exotic honeysuckle are abundant Amenities • stream flows through mature forest • natural waterfall • large undisturbed natural area	• discourage landowners from mowing to edge of stream • name tributary to increase awareness of this resource • implement good forestry and invasive plant management program to maintain quality of this forest habitat

Appendix I
Public Survey

Opportunities for Involvement:
If you would like to participate in the River Conservation Plan process, or simply want to stay informed about the plan's progress, please provide the following information.

Name:_____
Address:_____
_____
City/State/Zip:_____
_____
Phone:_____
Email:_____

The Lower Neshaminy Creek River Conservation Plan is a collaborative effort between Heritage Conservancy, Bucks County Conservation District, Bucks County Planning Commission, Churchville Nature Center, Philadelphia Suburban Water Company, PA Department of Environmental Protection, USDA Natural Resource Conservation Service, Upper Southampton, Lower Southampton, Middletown, Northampton Townships and Hulmeville, Langhorne, and Langhorne Manor Boroughs.

The Lower Neshaminy Creek River Conservation Plan is funded by a grant from the PA Department of Conservation and Natural Resources, with matching funds and services provided by the project partners, Department of Community and Economic Development, PA Department of Environmental Protection and National Oceanic and Atmospheric Administration.

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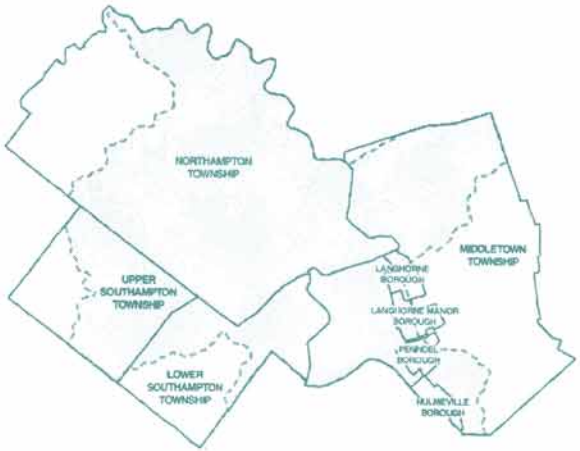
Preserving our Natural

Appendix I - Survey

HERITAGE CONSERVANCY
85 Old Dublin Pike
Doylestown, PA 18901

Lower Neshaminy Creek River Conservation Plan Public Survey



Public input is critical to a successful plan. If you live in or near the area indicated by the map above, please take a few minutes to return this postage paid survey.

Municipalities within the study area:

Lower Southampton	Hulmeville
Middletown	Langhorne
Northampton	Langhorne Manor
Upper Southampton	Penndel

Municipality in which you live:

_____

Age:_____

Length of residency within municipality:

_____

Within Bucks County:_____

How close do you live to the Neshaminy Creek or one of its tributaries?

Please check one.

❑ My residence is along the Neshaminy Creek or one of its tributaries.

❑ I live within 1 mile of the Neshaminy Creek or one of its tributaries.

❑ I live more than 1 mile from the Neshaminy Creek or one of its tributaries.

❑ I do not know how far I live from the Neshaminy Creek.

How often do you visit that creek?

❑ 1 time per week

❑ 1 time per month

❑ Every three months

❑ Rarely

❑ Never

If you live along the Neshaminy creek or a tributary, has your property ever been damaged by flooding?

❑ Yes

❑ No

Which state or county park do you visit most often?

❑ Tyler State Park

❑ Core Creek Park

❑ Churchville Nature Center

❑ Playwicki Park

❑ None

❑ Other_____

parks?

❑ Nature programs

❑ Fishing

❑ Hiking / biking

❑ Wildlife / birdwatching

❑ Sports / active recreation

❑ Other_____

Please rank from 1, being the lowest, to 5 being the highest what you think are the greatest threats to the Neshaminy Creek in lower Bucks County.

___ Stormwater runoff

___ Wastewater treatment plant discharges

___ Industry discharges

___ Agricultural runoff

___ Damage from flooding

___ Loss of wildlife habitat/streamside vegetation

___Other_____

Please rank from 1, being the lowest, to 5 being the highest what you think are the greatest recreation needs in the Neshaminy Creek Watershed in lower Bucks County.

___ More active recreation facilities, ball fields, basketball courts, skate parks

___More passive recreational opportunities, hik ing trails, bird/ wildlife watching opportunities

___Better access to the creek for canoeing, kayaking, boating

___Improve fishing through stocking/habitat restora-tion

___More opportunities for organized activities, teams, or recreation programs

___Other_____

being the highest what you think are the most important resources of the Neshaminy Creek watershed in Lower Bucks county.

___ Historical resources (Historically important buildings and districts)

___Natural open spaces (Undeveloped wood lots, wetlands and wild areas)

___Commercial and economic resources (Commercial and industrial ventures)

___Recreational opportunities (Parks, playing fields and trails)

___Agricultural resources (Farms, nurseries and agricultural production)

What resources would you like to see improved?

❑ Historical resources (Historically important buildings and districts)

❑ Natural open spaces (Undeveloped woodlots, wetlands and wild areas)

❑ Commercial and economic resources (Commercial and industrial ventures)

❑ Recreational resources (Parks, playing fields, and trails)

❑ Agricultural resources (Farms, nurseries, and agricultural production)

❑ Other_____

How do you feel the improvements that you indicated in the previous questions should be funded?

❑ Municipalities should pursue grant opportunities

❑ Special fees for people/groups who utilize those resources

❑ Special referendum taxes (an example is an open space referendum)

❑ County Government should fund

❑ Special interest organizations or non-profits should find funding

Appendix J
Public Meeting Notes

Lower Neshaminy Creek River Conservation Plan
Public Meeting Notes
March 03, 2004

The meeting began at 7:00 pm. Sign in sheet is attached.

The meeting began with an introduction and welcome by Sean Greene of the Heritage Conservancy. Sean explained that the purpose of the meeting was to present the draft Lower Neshaminy Creek RCP and receive public input and comment. Sean noted that the 30-day public review comment period began with this meeting. Following the introduction Sean gave a presentation on the major findings and goals of the Draft RCP. He began with an explanation of the River Conservation Plan (RCP) process and explanation of the project study area and various other RCPs in the Neshaminy Creek Watershed. The presentation also included a summary of the major resources within the study area. The goals of the plan as determined by the steering committee, were reviewed.

Following the presentation, Sean facilitated the public input session of the meeting. Condensed comments and concerns of the attendees are included below.

Comments and Concerns

General Comments

- Request that the League of Women Voters be added as a participant in the plan.
- Information provided on the grants available through the League of Women Voters for watershed related projects.
- Glad to see that debris removal is a recommendation in plan

Recreation Issues

- Several comments on plan's recommendations for trail development.
    - Plan does not specify location of trails, but rather supports trail and greenway development consistent with those appearing on County Open Space and DVRPC Plans.
    - County also has an existing greenway plan which identifies potential trails
    - Upper Southampton has an ad-hoc committee for rails to trails, but needs support from SEPTA to move forward.
    - Churchville Nature Center is also working on a Master Plan to include trails
    - Plan does endorse greenway linkages and that if in the plan helps provide funding for technical studies and acquisition.

- Comment that recreation and trails are not appropriate for river conservation plan, since people are biggest polluters. Inclusion clouds issues related to water quality.
    - DCNR requires that plan include recreation component because the plan's objectives cover a variety of river-related resources. Recreation is a quality of life issue and is integral in these types of plans.

Flooding and Dam Issues

- Many comments and personal reflections were offered regarding the impacts of flooding on individual homeowners and the changes within the creek. Several

property-owners explained the loss of property from increased velocity of waters along streams in backyards.

- Planting trees does not help because the roots are undercut and the trees end up falling into the creek. Many comments were made on how this problem has occurred over the past 15 years.
- Many observed the widening of the creek and the appearance of large sediment islands in the creek.
- Request was made to add recommendation to complete construction of the Dark Hollow Dam to help alleviate flooding.
    - Sean noted that this recommendation could not be included in the plan because it is inconsistent with the Neshaminy Watershed Work Plan (NRCS and County), which has eliminated the dam from its list of projects. DCNR requires that the RCP present recommendations consistent with State and County Plans.

- Funding for flooding issues is insufficient to address problem.
    - Plan does include recommendations to minimize problem such as recommending buyout of flood prone properties or by supporting better stormwater management to reduce flooding.

- Placing homes on pylons doesn't really address problems
- Although Dark Hollow Dam was rejected, problem still is not addressed. Need names to call about this.
- Several participants asked why flooding issues are not funded and why Dam is not being constructed? Also wanted to know why Dam issue is not studied in the RCP
    - Proposed Dark Hollow Dam is geographically out of this study area. Construction of Dam is addressed in Neshaminy Watershed Work Plan.

- Route 213 floods during storms and bridges go under water – effects emergency services and people don't realize that they are cut off from services. Issue is more about saving lives than saving money.

- Several comments were made regarding the problems with existing detention basins. Comment was also made that immediately following Hurricane Floyd, the detention basins at the Neshaminy Mall were empty…how could this happen? Why didn't this basin work? Who is responsible?
    - Plan includes recommendations to improve stormwater management. Northampton Township is currently working with Council Rock School District on a program to do this. Many water volumes are present even at the upper portion of the Neshaminy Watershed.
    - Under a new proposed bill currently under review by the Pennsylvania Legislature (House Bill #606), municipalities and counties would have the authority to acquire and manage stormwater BMPs.

- How will bank stabilization be implemented?
    - Broad recommendation in plan would help in funding requests for bank stabilization projects.

- Can an individual homeowner do riparian buffer restoration?
    - Yes. but some might need more than just vegetation, might need to be engineered. To receive grant funds, individual would need a sponsor with 501©3 status.

- Gretchen S. noted that BCCD can help individual owners with bioengineering projects, but prefers that request come to them via non-profit organization. Also noted that the CD receives many individual requests for grants.
- Southampton Watershed Organization sponsored buffer restorations.
- FEMA insurance provides up to $20,000 for homeowners to protect property from flooding. Should contact flood insurance company for information. Some projects require permits from State DEP and County CD. Recommended that entire length of property be addressed.

- Can the sediment islands be removed?
  - U.S. Army Corps of Engineers issues permits for sediment removal. The permitting process is long and very detailed. Efforts to remove these islands must be coordinated.
  - USACOE has been requested to re-evaluate hydrology in the Pennypack and Tookany Creek Watersheds. This would be a good approach in Neshaminy Creek watershed.

Integration and Coordination and Implementation

- How is plan integrated with all of the other plans in the watershed?
  - Each of the plans within the various Neshaminy Creek sub-watersheds reflect local concerns, but are not intended to conflict with other planning studies.
  - Kick-off meeting will be held on April 7th to create the Neshaminy Alliance whose purpose will be to coordinate efforts throughout the entire Neshaminy Creek Watershed and help implement some of the many reports and studies and recommendations that have been prepared for this area.

- Are specific entities named to help implement the plan?
  - Plan provides ideas for project partners. Implementation will depend on local citizens, watershed organizations and local government.

- Why have contractors or developers not come to these meetings? Is there a mechanism to include them?
  - Developers are welcome to participate in the planning process, but ultimately responsibility for type of development falls to the municipalities and their development process.

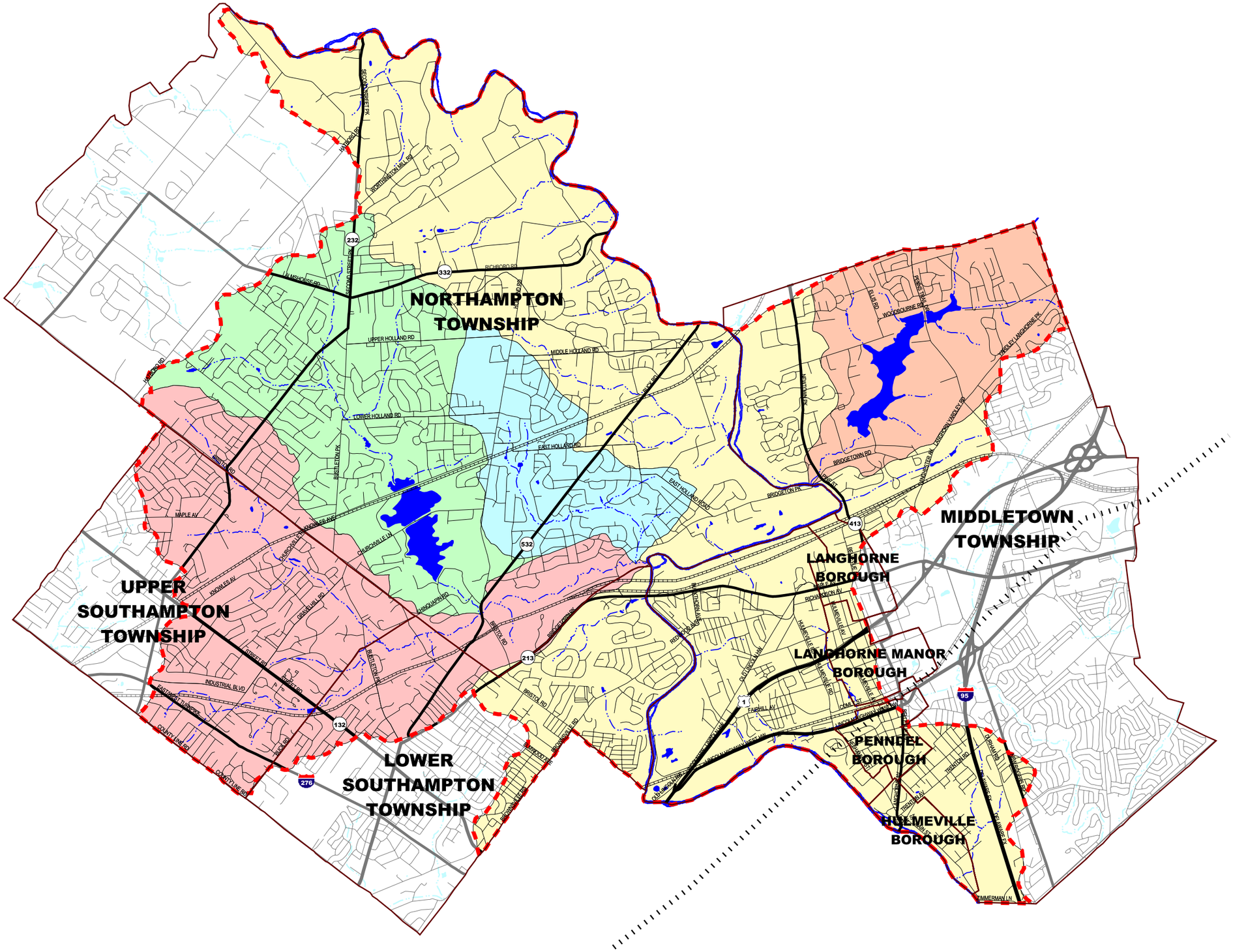
Sean thanked all participants for their input and comments.

Meeting concluded at 8:20 pm.

Maps

Lower Neshaminy Creek Watershed Conservation Plan

Map 1
Study Watersheds



Legend

Subwatersheds

- Neshaminy Creek
- Core Creek
- Mill Creek
- Pine Run
- Ironworks Creek

Key

- Watershed Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road
- Fall Line

Data Source

PA DEP, PennDOT, BLR Data, ADC-Greater Philadelphia Map Book

3000 0 3000 6000 Feet

July 2003

Prepared By:

HERITAGE CONSERVANCY

85 Old Dublin Pike
Doylestown, Pa 18901
215-345-7020
www.heritageconservancy.org

Funded in part by a grant from the Pennsylvania Department of Conservation and Natural Resources (DCNR).

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Lower Neshaminy Creek Watershed Conservation Plan

Map 2
Surficial Geology

Legend

- Fall Line
- Bryn Mawr Fm
- Chickies Fm
- Felsic Gneiss, Pyroxene bearing
- Lockatong Fm
- Mafic Gneiss, Hornblende bearing
- Metadiabase
- Pensauken and Bridgeton Fms Undiv
- Stockton Conglomerate
- Stockton Fm
- Wissahickon Fm (Oligioclase Mica Schist)

Key

- Watershed Boundary
- Sub-Basin Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road

Data Source

PA DEP, PennDOT, BLR Data, ADC-Greater Philadelphia Map Book, USDA-NRCS

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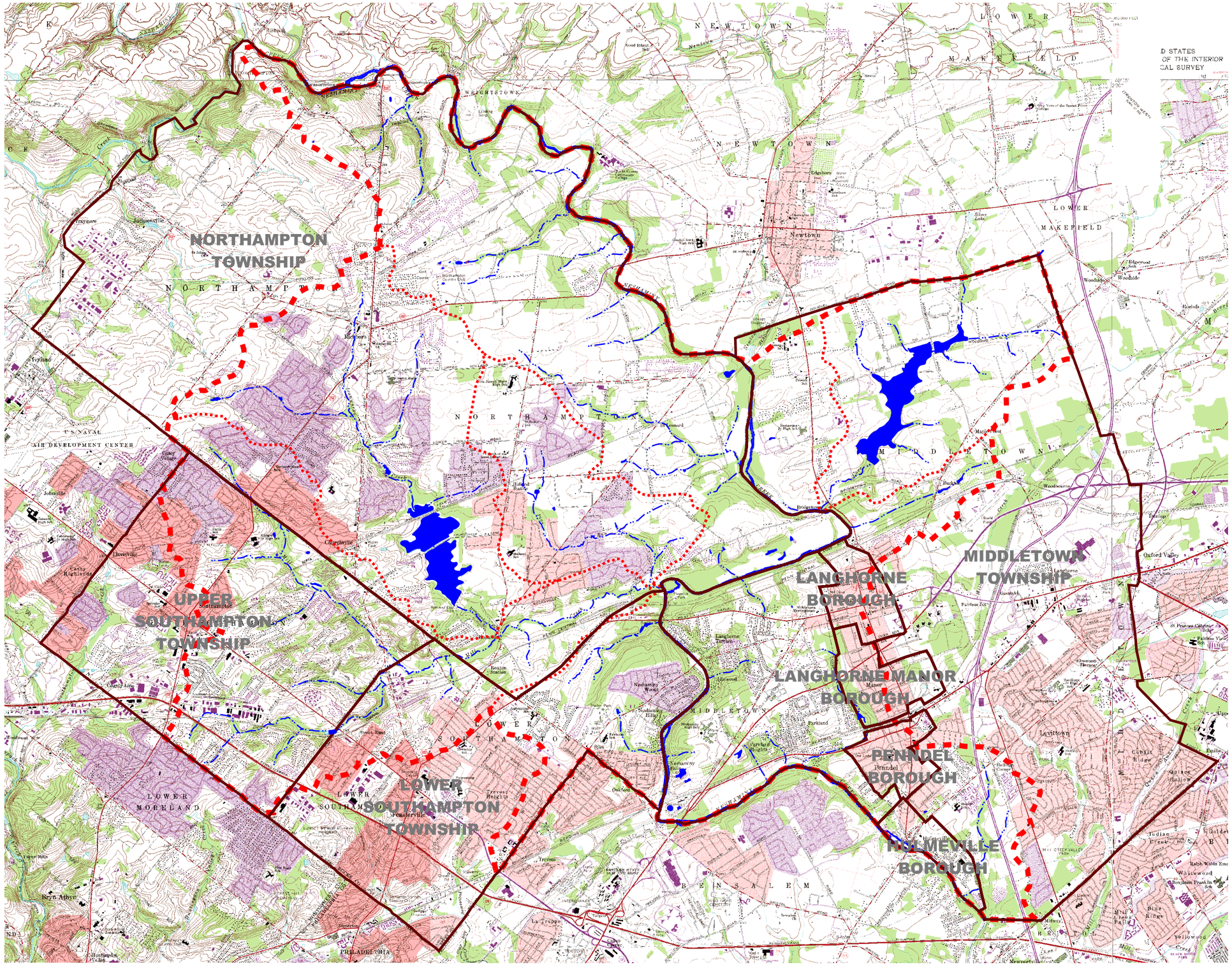
Lower Neshaminy Creek Watershed Conservation Plan

Map 3
Topography



Key

- Watershed Boundary
- Sub-Basin Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road

Data Source

PA DEP, PennDOT, BLR Data, ADC-Greater Philadelphia Map Book, USGS

3000 0 3000 6000 Feet

October 2004

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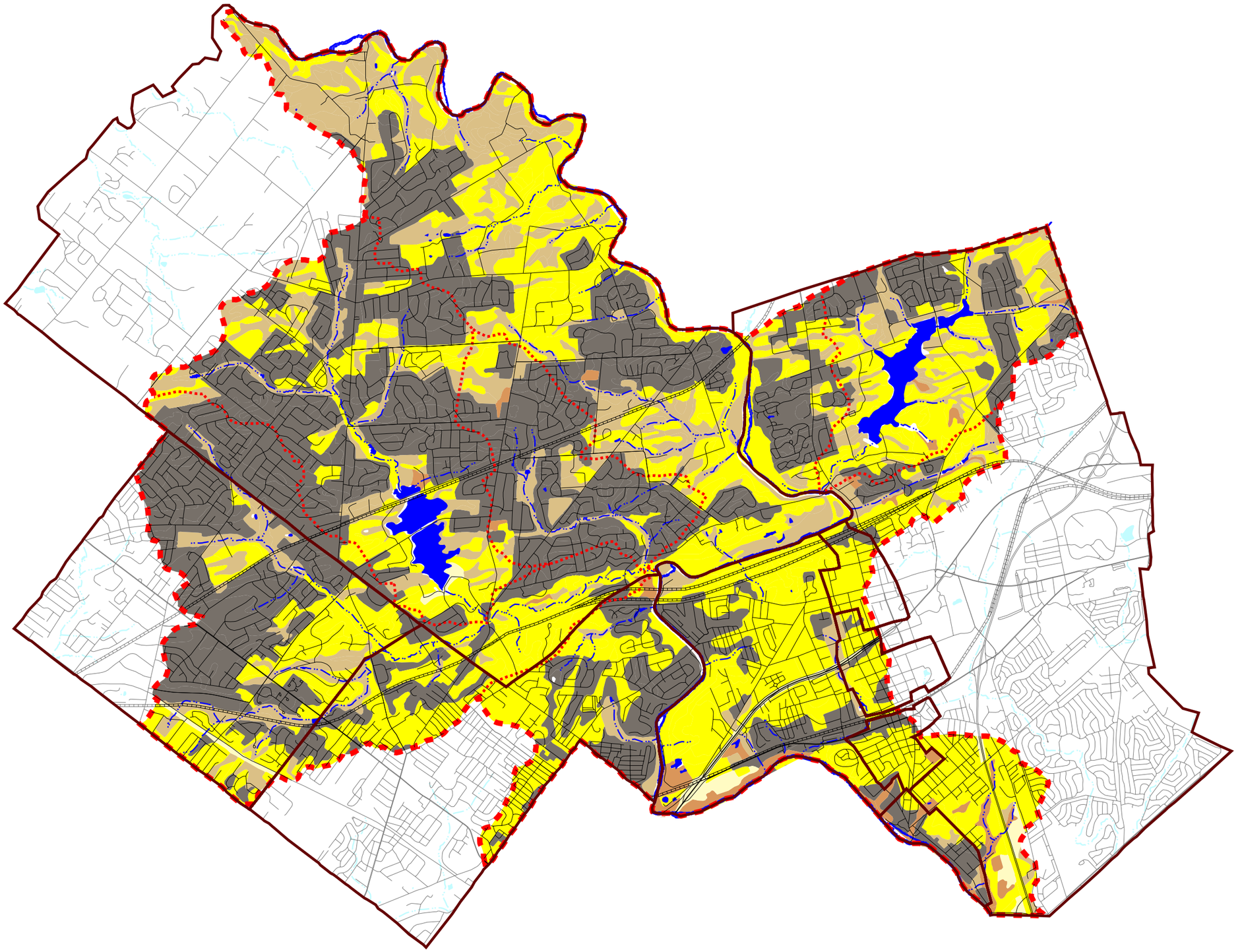
Lower Neshaminy Creek Watershed Conservation Plan

Map 4
Hydrologic Soil Groups



Legend

Infiltration Potential

- A = >0.3 inches/hour
- B = 0.15 - 0.3 inches/hour
- C = 0.05 - 0.15 inches/hour
- D = 0 - 0.05 inches/hour
- URBAN = variable

Key

- Watershed Boundary
- Sub-Basin Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road

Data Source

PA DEP, PennDOT, USDA-NRCS, Penn State University

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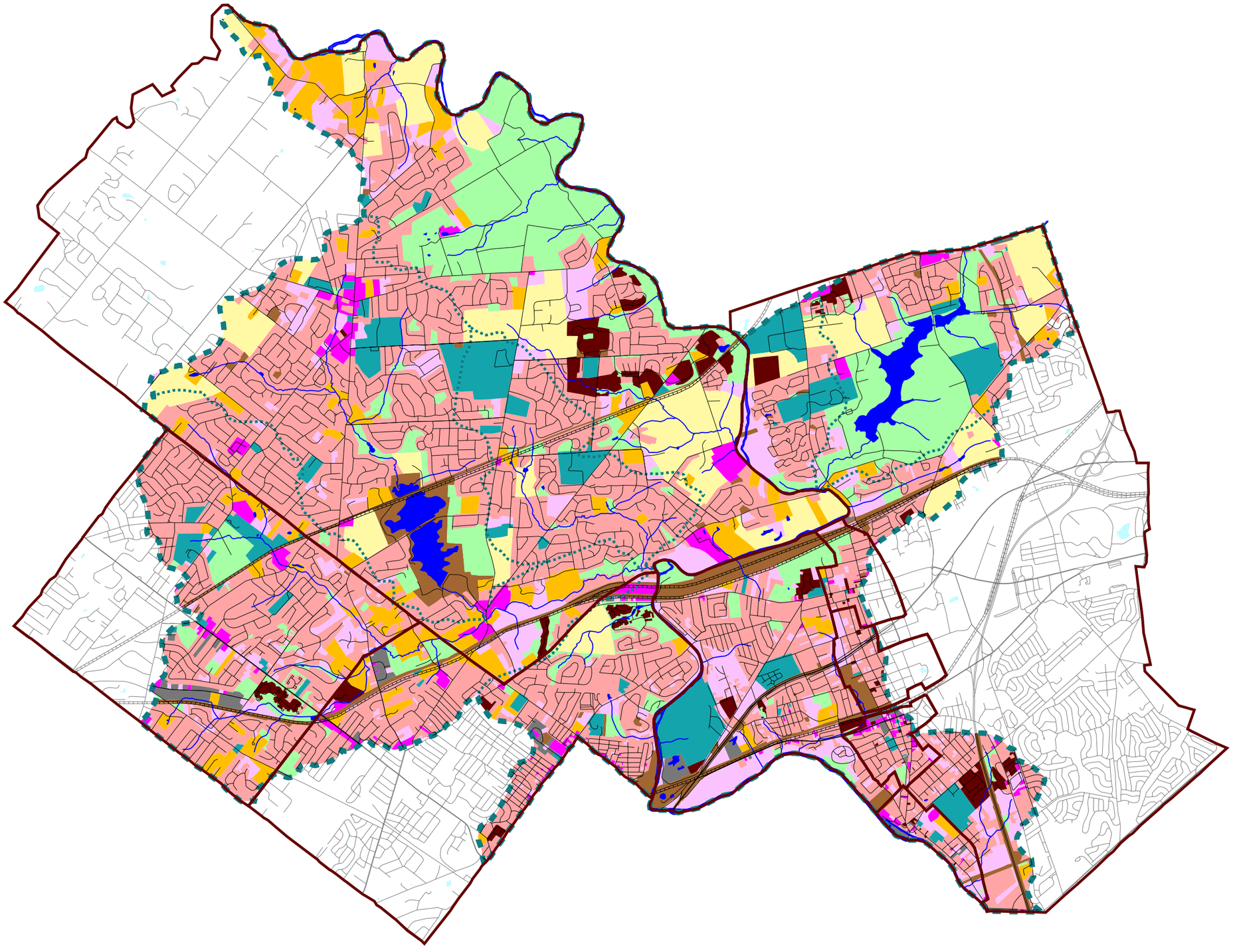
Lower Neshaminy Creek Watershed Conservation Plan

Map 5
Land Use



Legend

- AGRICULTURAL
- PARKS,REC, & PROTECTED OPEN SPACE
- MULTI-FAMILY RESIDENTIAL
- SINGLE-FAMILY RESIDENTIAL
- RURAL RESIDENTIAL
- COMMERCIAL
- MINING & MANUFACTURING
- GOVERNMENT & INSITUTIONAL
- TRANSPORTATION & UTILITIES
- VACANT

(DVRPC 1995)

Key

- Watershed Boundary
- Sub-Watershed Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road

Data Source

PA DEP, PennDOT, BLR Data, ADC-Greater Philadelphia Map Book, DVRPC

3000 0 3000 6000 Feet

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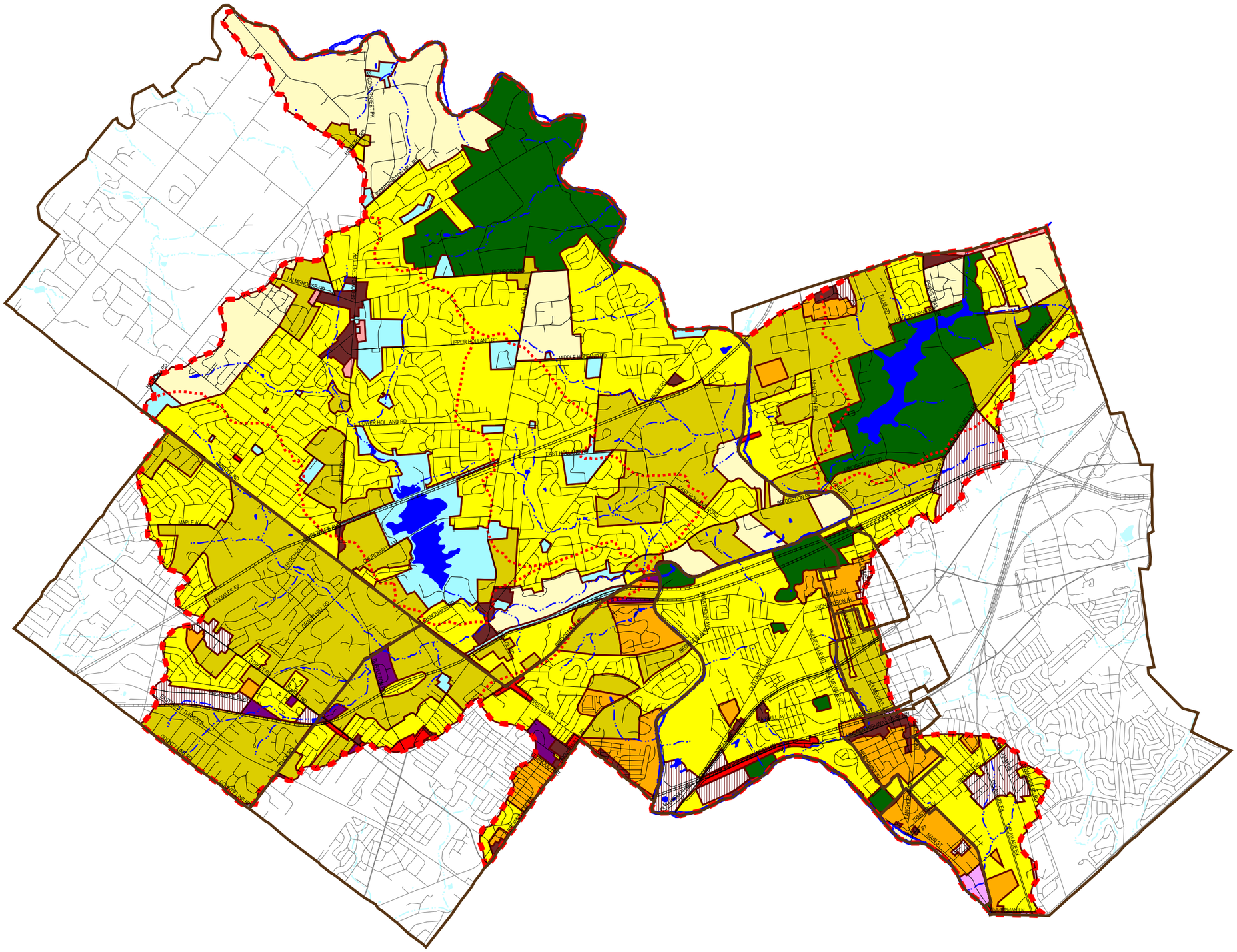
Lower Neshaminy Creek Watershed Conservation Plan

Map 6
Generalized Zoning



Legend

- OPEN SPACE
- RESIDENTIAL - <1 DU/AC
- RES - 1 DU/AC TO 2 DU/AC
- RES - 2 DU/AC TO 4 DU/AC
- RES - >4 DU/AC
- RETAIL
- OFFICE
- COMMERCIAL COMBINED
- LIGHT INDUSTRIAL
- HEAVY INDUSTRIAL
- INDUSTRIAL COMBINED
- MIXED USES
- INSTITUTIONAL
- EXTRACTION

(BCPC 1995)

Key

- Watershed Boundary
- Sub-Basin Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road

Data Source

PA DEP, PennDOT, Bucks County Planning Commission

3000 0 3000 6000 Feet

August 2003

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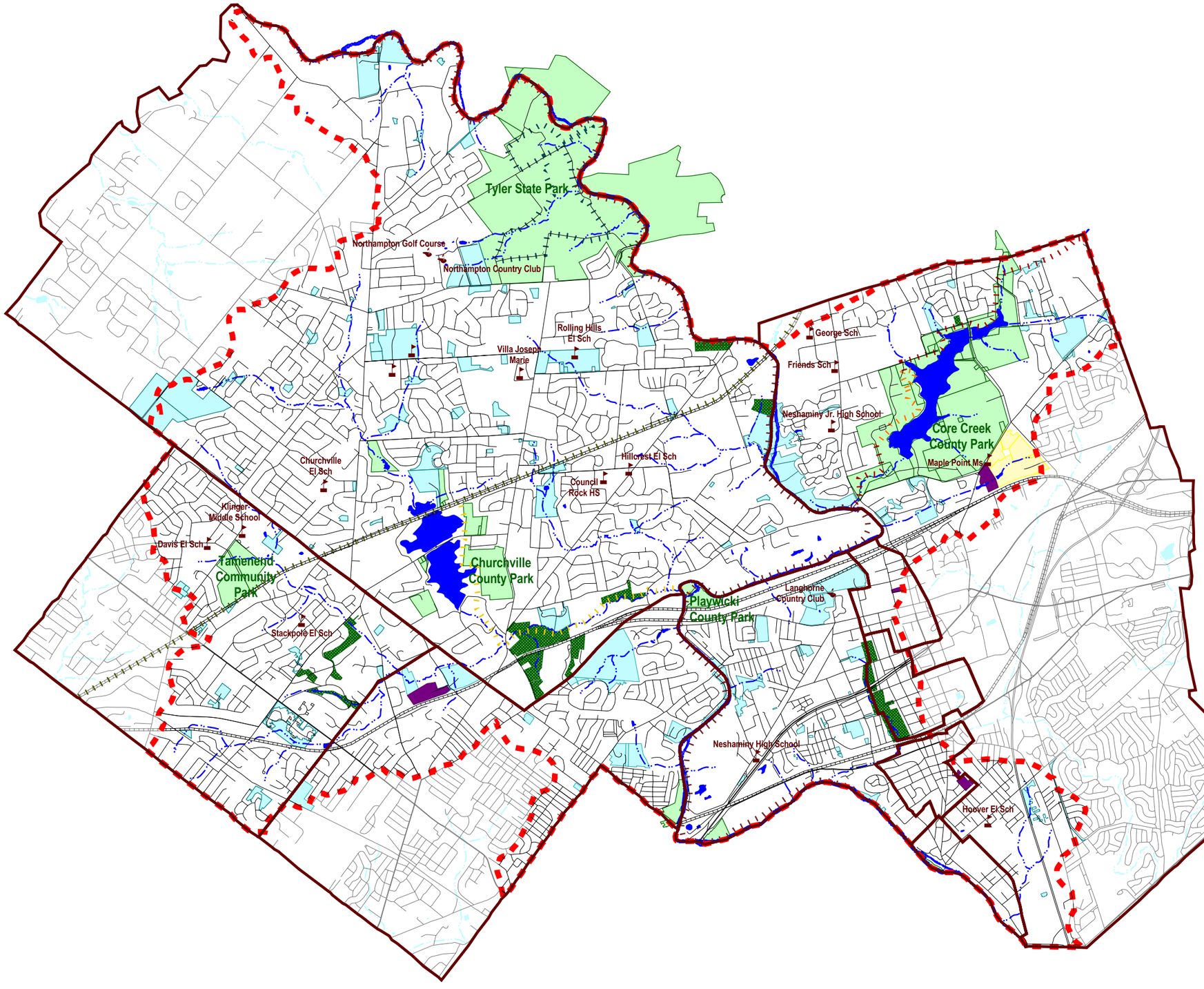
Lower Neshaminy Creek Watershed Conservation Plan

Map 7
Parks, Recreation & Open Space



Legend

- Golf Course
- School
- Park

Preserved Land

- Heritage Conservancy
- Municipally Owned/Preserved
- Bucks County Agricultural Preservation Program
- Bucks County Municipal Open Space Program

- Watershed Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road
- Core Creek County Park Trail
- Middletown / Lower Makefield Link Parks
- Mill Creek Greenway Trail
- Neshaminy Creek Greenway Trail
- Newtown Rail Trail
- Tyler State Park

Data Source

PA DEP, PennDOT, BLR Data, ADC-Greater Philadelphia Map Book, Heritage Conservancy, DVRPC

3000 0 3000 6000 Feet

July 2003

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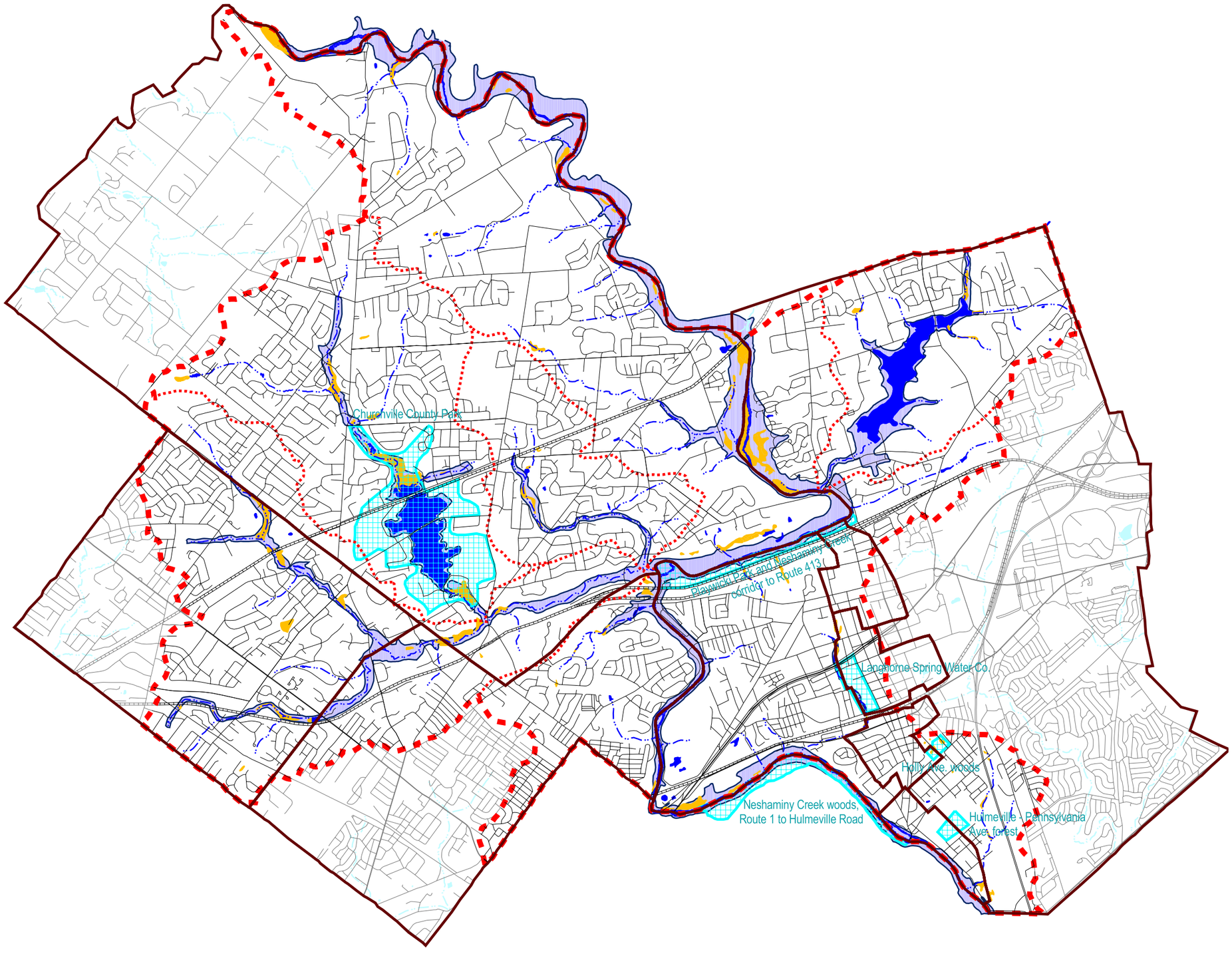
Lower Neshaminy Creek Watershed Conservation Plan

Map 8
Natural Resources



Legend

- Natural Areas Inventory Site
- National Wetland Inventory
- 100 Year Flood Plain

Key

- Watershed Boundary
- Sub-Basin Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road

Data Source

PA DEP, PennDOT, ADC-Greater Philadelphia Map Book, US FWS

3000 0 3000 6000 Feet

July 2003

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Lower Neshaminy Creek Watershed Conservation Plan

Map 9
Opportunities & Constraints

SMDF

Langhorne Lead Site

Maple Avenue Dump Site

Chinquipin Road Site

Pitmont Motor Company

Philadelphia Suburban Water Company

Legend

- Permitted Discharge (NPDES)
- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Site

Key

- Watershed Boundary
- Sub-Basin Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road

Data Source

PHMC, PA DEP, PennDOT, BLR Data, ADC-Greater Philadelphia Map Book, Heritage Conservancy

3000 0 3000 6000 Feet

July 2003

Prepared By:

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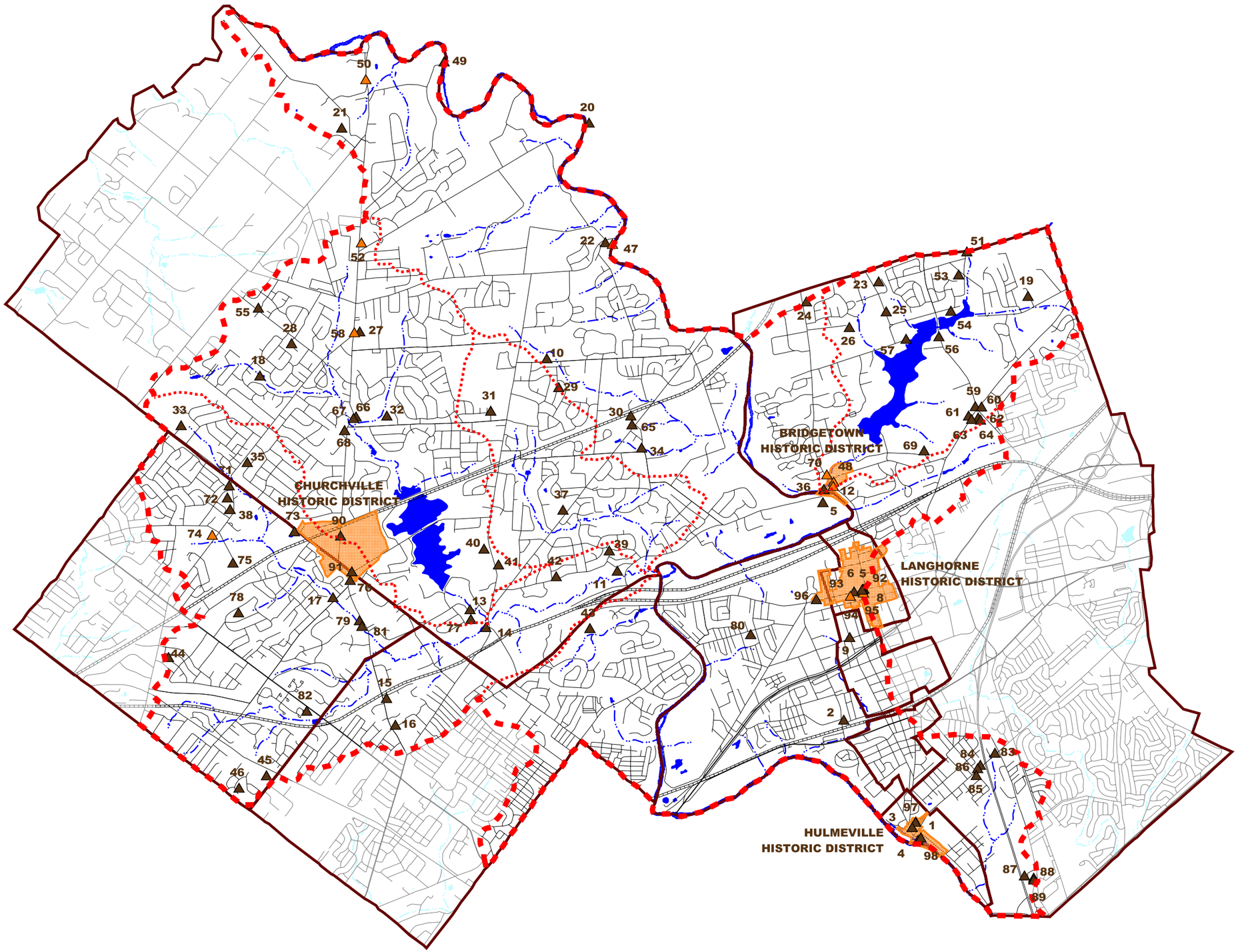
Funded in part by a grant from the Pennsylvania Department of Conservation and Natural Resources (DCNR).

DCNR

Lower Neshaminy Creek Watershed Conservation Plan

Map 10
Historic Resources



Legend

- Listed on the National Register of Historic Places
- Locally Significant Historic Structure
- National Register Historic District

Key

- Watershed Boundary
- Sub-Basin Boundary
- Municipal Boundary
- Stream
- Rail Line
- Road

Data Source

PHMC, PA DEP, PennDOT, BLR Data, ADC-Greater Philadelphia Map Book, Heritage Conservancy

3000 0 3000 6000 Feet

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DCNR