5. PENNYPACK PARK MASTER PLAN

Fairmount Park System

Natural Lands Restoration

Master Plan

Mainstem of Pennypack Creek.

5.A. TASKS ASSOCIATED WITH RESTORATION ACTIVITIES

5.A.1. Introduction

The project to prepare a natural lands restoration master plan for Pennypack Park began in October 1997. Numerous site visits were conducted in Pennypack Park with the Fairmount Park Commission (FPC) District #5 Manager and staff, community members, Natural Lands Restoration and Environmental Education Program (NLREEP) and ANSP staff. Informal meetings at the Park's district office were held to solicit information and opinions, and ANSP participated in the NLREEP Technical Advisory Committee (TAC) meetings in March and October 1998. These meetings were used to solicit ideas and develop contacts with other environmental scientists and land managers. A meeting was also held with ANSP, NLREEP and FPC engineering staff to discuss completed and planned projects in, or affecting, the natural lands in Pennypack Park. A variety of informal contacts, such as speaking at meetings of Friends groups and other clubs and discussions during field visits provided additional input.

ANSP, NLREEP and the Philadelphia Water Department (PWD) set up a program of quarterly meetings to discuss various issues of joint interest. These meetings are valuable in obtaining information useful in planning restoration and in developing concepts for cooperative programs. As a result of these meetings, PWD staff reviewed the list of priority stream restoration sites proposed for the Pennypack Park.

5.A.2. Community Meetings

As part of the planning process, NLREEP held two community meetings and conducted a community mapping initiative to solicit citizen attitudes and information on park use and conditions. ANSP participated in these activities and used information from them in planning restoration activities.

The first meeting on the restoration of the natural lands of Pennypack Park, held on 8 November 1999, introduced interested community members to NLREEP and the project. The goals of NLREEP were identified and the ANSP was introduced as the consulting team hired to assess the natural areas of the park and recommend areas to be restored. At this initial meeting, the existing conditions of the park were summarized, based on ANSP's year-long study of natural conditions. Slides of the fauna and flora were shown and natural areas of high quality were identified. Current environmental problems in the park were identified and explained, and the types of restoration activities which were being considered to address these were discussed. The initial list of proposed restoration activity and a draft map of restoration sites were distributed. The sites were categorized into habitat types and their function in the environment was explained to the public. After the ANSP presentation, ANSP team members met with residents to gain information about how they use the park, to obtain feedback on proposed restoration activities and to solicit suggestions for additional sites or activities. These comments from the participants were noted and used in the final nomination process.

The final meeting with community members concerned about the Pennypack Park, held on 7 February 2000, focused on the recommended high priority restoration sites. The sites proposed for restoration were summarized, and pictures were shown depicting areas to receive restoration. The team also commented on what the sites might look like after the restoration work was completed. Slides of comparable restorations were shown. ANSP took the final comments from the public and made necessary adjustments to the restoration site nomination list. At this point the list was finalized and delivered to NLREEP.

5.A.3. Community Mapping

In an effort to further involve community members in the restoration planning process, and to augment the technical information about the park system's natural environments prepared by the ANSP, NLREEP undertook a "community mapping" initiative in Pennypack Park. The idea of community mapping was to actively engage residents of the neighborhoods adjacent to Pennypack Park in helping FPC staff and the ANSP team members better understand how the park is used, both currently and historically. The purposes of the community mapping initiative were:

- To increase the effectiveness of restoration activities within the park.
- To increase the FPC staff awareness of the community's use of the park.
- To increase the community's understanding of the park's natural areas.
- To better inform decision-making about which restoration activities should occur and where.

The community mapping initiative, which divided Pennypack Park into 12 sections and was led by FPC staff, occurred in the fall of 1999 and involved interested neighbors. Participants noted human impacts on the park by mapping 15 key indicators of use, such as trash, graffiti and invasive vegetation. During the mapping initiative, community members also noted other positive and negative uses of Pennypack Park. Specific results of the community mapping initiatives were provided to the ANSP to aid in the selection of potential restoration sites and activities. A general overview of the way the park is used, as determined by the mapping exercises, was shared with community members at the public meetings about natural lands restoration activities in Pennypack Park.

5.B. PENNYPACK ASSESSMENT AND RESTORATION PLANNING

5.B.1. Executive Summary

Pennypack Park is part of District 5 of the Fairmount Park system, which includes Tacony Creek Park, Poquessing Creek Park, and street trees in the northeastern part of the city. Pennypack Park today comprises about 1,750 nearly contiguous acres of open space of which about 74% (1,300) acres have been designated natural lands. The park is a long strip of land stretching eight miles from its northern boundary at Fox Chase Farm at the Montgomery County line to the mouth of the Pennypack Creek at the Delaware River. Parts of Pennypack Park were purchased in 1905, with subsequent acquisitions through the first quarter of the 20th century, so that by 1929 the park contained most of its current area (Cantor 1990). The original section stopped south of Pine Road. More recent additions include Fox Chase Farm, the fields south of Verree Road and west of Tabor Road, and areas along Wooden Bridge Run. Pennypack Park offers a wide variety of recreational opportunities from sports fields to walking, biking and horse back riding trails. In addition, the Pennypack Environmental Center and Fox Chase Farm provide educational programming for individuals and groups.

Holmesburg Dam, 1916.

The land use history of Northeast Philadelphia has determined the present conditions of the soil and vegetation in Pennypack Park, as much of this land was

used for agricultural purposes until the early 20th century. The mouth of the Pennypack was first settled by Swedes in the mid-17th century, and settlement and clearing increased with English settlement in the late 17th century. Early settlement was clustered around Holmesburg. Because of its location at the head of tide, Holmesburg provided water power and was a hub for water and overland transportation. A number of mills existed in the valley by the late 17th century, and several of these became major commercial operations by the mid-19th century. The existing dams in the park are remnants of these mill operations. Many of the impoundments were larger when the mills were in use, and a number of dams and millponds on the main Pennypack and on tributaries have disappeared. Mills and farming were the primary land uses throughout the 19th century. Along the uplands, the countryside was dotted by farmstead and wood lots with little else. Mid-19th century maps show the countryside with few woods, with the remaining woods located primarily along the riparian corridors. Development increased through the late 19th and early 20th centuries, with construction of major roads and grids of smaller streets. However, the Pennypack was one of the last watersheds in the city to be developed, and it was not fully built upon until after World War II. The various stages of development have had profound effects on the park. Sedimentation from early clearing was deposited on the floodplain of the Pennypack. Increased imperviousness and decreased infiltration into ground water increased peak flows and decreased base flows, drying up many springs and seeps in the valley. These impacts led to incision and widening of stream channels, reducing the regular inundation of floodplains. Impoundments blocked river channels and changed sedimentation patterns above and below the dams. Forest cutting, understory grazing, and fragmentation have reduced forest biodiversity.

Currently, much of the park is wooded, with relatively even-aged stands dominated by tulip poplar (*Liriodendron tulipifera*) and American beech (*Fagus grandifolia*) on slopes, and box elder (*Acer negundo*) in the floodplain. However, vegetation within the park is still relatively high in diversity, and several species were found only or mainly in Pennypack Park. In particular, there are a few small areas of relatively old woods which were not farmed or clearcut for timber, such as on steep slopes, that still remain rich in vegetative diversity. However, deer populations are dense in Pennypack Park and have lead to heavy browsing of shrubs and herbs, and an absence or rarity of saplings of preferred tree species. Reduced vegetative diversity has been linked with over browsing by deer and reducing deer populations will be necessary to achieve long-term increases in the abundance and diversity of native plant species.

Deer are not the only factor posing a problem for the biodiversity of Pennypack Park. The building of structures (railroads, highways, buildings, trails) has had a negative impact on the health of the ecosystems of the Pennypack. Although streams and floodplains have been greatly affected by changes in hydrology, the park still contains a number of small wetlands along the main creek and its tributaries. Pennypack Creek is tidal almost to Frankford Avenue, and the tidal area contains ecologically significant intertidal freshwater marsh habitat.

Faunal assessments showed the importance of intact, high quality habitat on native biodiversity, with different faunal groups responding to different aspects of habitat quality. Some groups, such as land snails, have shown major losses of native biodiversity (with a loss of about 25% to 50% of the native species) and increase in exotic species. However, one species, known only from the Wissahickon, Pennypack and Schuylkill River, was found within Pennypack Park. The native species have probably been affected by habitat loss and changes in soil chemistry. Decreases in native diversity of reptiles and amphibians is probably even greater, although the historical record is relatively poor. These species have probably been most affected by habitat fragmentation and loss (especially wetlands and fields). One state-listed threatened species (the red-bellied turtle) was found. Several wetland-dependent amphibians, which have become rare in the Fairmount Park system, were also found. The extent of woods in the park provides habitat for a variety of woodland

birds, and the Pennypack is second only to the Wissahickon in breeding diversity of birds (excluding widespread urban/suburban species). However, several woodland species were uncommon or rare in Pennypack Park. This can be attributed to the loss of the shrub and herbaceous layer due to deer browsing. Most of the native fish species of the upper Pennypack and the small tributaries are still present, although several species have probably been extirpated from the drainage. There has been a loss of species using small wetlands and ditches near the mouth of the Pennypack, and a decrease in some fishes in the tidal river. However, the mouth of the Pennypack Creek, including the constructed wetland, is used by anadromous fish such as striped bass and white perch. Studies of benthic macroinvertebrates and craneflies showed a few high quality stream sites, especially Three Springs Hollow, one of the best streams in the entire Fairmount Park system. The cranefly inventory also showed high quality forest sites, such as near the environmental center, and wetland sites along Three Springs Hollow, and near Rhawn Street, Rockledge Run and Sedden's Run. The inventory of Lepidoptera (butterflies, moths and skippers) noted the importance of the meadows, such as the Tabor meadow and the meadow adjacent to Three Springs Hollow, to some grass-feeding taxa.

Ninety-five percent of the Pennypack Creek watershed lies outside of the park boundaries and sixty-one percent of this watershed is classified as urban land cover. This means that most of the water being contributed to the creek is not controlled by the park. There are approximately 18.3 miles of river/stream within the park boundaries, including 10.8 miles of the mainstem Pennypack Creek and many small tributaries that flow directly into the creek. The mainstem Pennypack Creek was not included in the stream assessment (streamwalk/SQI) since the majority of the Pennypack Creek's drainage area is outside the park and restoration activities within the park would have little impact on the overall ecological health of Pennypack Creek. Most of the Pennypack Creek tributaries within the park have significant watershed areas outside the park. These watersheds are highly urbanized, leading to rapid runoff during storms, which increases peak flows and reduces base flows during non-storm periods. As a result, channels in the stream show widening and incision which are typical results of increased storm flows.

A Stream Quality Index (SQI) was developed to reflect the condition of distinct stream reaches throughout the Fairmount Park system. The SQI is based on three important characteristics: 1) stream geomorphology; 2) aquatic habitat; and 3) riparian or stream-side condition. Of a total of 77 reaches in Pennypack Park, all but one were rated as impaired (49.5%) or moderately impaired (49.5%). None of the stream reaches was classified as slightly or non-impaired. One reach, on the tributary in Fox Chase Farm, was categorized as severely impaired.

A number of restoration activities is recommended to enhance the natural lands of Pennypack Park. Based on the size, diversity and condition of different types of natural lands in the park, major objectives for restoration should be:

- Enhancement of forest flora and fauna. The presence of some relatively old patches of woods, often surrounded by younger patches, provides potential for large, nearly continuous woods, including upland, slope, seep and floodplain components. Control of deer browsing will be essential to enhance shrub and herbaceous layers of woods and allow for regeneration of canopy tree species. Without control of the deer population, deer enclosures could provide for the preservation of small areas. Activities to enhance forests include control of invasive plants, planting of native species, erosion control, and enlargement of forest areas. With reduced deer numbers and control of invasive plants, continued maturation of young woods can be expected. Shrub and herbaceous planting can increase the native biodiversity of the woods, including the re-introduction of species locally extirpated from the park. Reduction of the amount of mowed lawn and management of forest edges will also enhance park forests.

- Preservation and enhancement of the various types of wetlands. Pennypack Park contains a variety of wetland types, preserving perhaps the greatest diversity of wetland flora in the city, as well as supporting numerous animals. Enhancement by control of invasive plants and control of hydrology will be valuable.
- Maintenance of the early successional habitats. Pennypack Park contains several areas of old fields and meadows, providing an increasingly uncommon habitat in the city. These should be maintained by mowing, burning or cutting to promote native species.
- Protection and enhancement of high quality sites. Various activities should be undertaken to ensure the preservation of high quality sites, such as the forest, wetlands and stream at Three Springs Hollow; the wetland, creek and woods at Rhawn Street; the woods and wetlands in the park around Verree Road, and the intertidal wetlands at the mouth of the Pennypack Creek.
- Amelioration of impacts of human use of the park. Control of storm water runoff from roads, bridges and other impervious surfaces which lead to gullying and sedimentation in streams, control of trail erosion on slopes and banks, improvement of trail crossings, closure of some rogue trails, construction of durable access points for anglers and other users, reduction in dumping, and management of forest edges will help sustain the natural lands of Pennypack Park.
- Enhancement of tributary streams and the mainstem Pennypack Creek. Modification of the three dams on the mainstem Pennypack (Rhawn Street, Verree Road, and Roosevelt Boulevard dams) is recommended, pending more detailed feasibility studies. Dams are non-natural elements that have significant effects on stream ecosystems. Potential effects include sedimentation in backwaters and reduction of sediment supply in downstream reaches, stream warming, and blockage of stream channels to migrations of organisms. However, restoration can have a significant impact on the many smaller streams that are affected by localized impacts, including lack of riparian forest, invasive plants, road drainage, poorly designed culverts, debris dumps, and trail/stream crossings.

Restoration activities at various sites were prioritized on the basis of expected ecological benefits, likelihood of success, estimates of implementation costs, site constraints and other site-specific factors. Descriptions of sites with high priority restoration activities are presented in the following sections and maps. Restoration activities are proposed throughout the park. Activities are clustered in different areas, where they can enhance each other.

A number of activities are recommended in Fox Chase Farm, where current farming practices impact land and streams. Activities include increasing riparian buffers, installation of deer enclosures, replanting, and construction of a stream crossing for cattle.

The upper end of the park (above Bustleton Avenue) contains some high quality canopy woods, streams and a number of good wetlands. These sites should be monitored and protected. Parts of the area are impacted by deer and invasive plants. Invasive control, especially along forest edges and riparian zones, and edge management is recommended at a number of sites within this area. Replanting of shrubs and herbaceous plants in sites with mature canopy coverage is recommended once deer numbers are reduced. Improved riparian management along several tributaries, such as along Rockledge and Sedden's runs, and along the mainstem is also recommended, since these areas are affected by mowing, gully erosion from road or trail runoff, and/or trampling. Modification of the Verree Road dam to restore upstream-downstream connection and normal channel form is recommended. It is recommended that part of the mowed field in the bend of the creek above Verree Road be released and maintained as a wetland/floodplain area. If the

Verree Road parking lot is moved to the north side of the road, wetland expansion on the north side can be used to control parking lot runoff, and the wetland on the south side of Verree Road can be enhanced. Several old fields near the railroad and south of Verree Road provide uncommon early successional habitat for the park. These should be actively maintained as meadows and old fields. Several areas where road or trail erosion is severe should be addressed in the trail management plan. Several large log dumps compromise good quality forest, and the dumps should be removed or reduced in size.

The park lands between Bustleton and Holme avenues are generally narrower and more disturbed, with significant park edge effects, such as yard waste and other dumping, slope erosion, Norway maple and other invasive plants. Deer browsing is also a major problem in this section. Release of mowed areas to enlarge natural lands is recommended in several places in this section. The dam above Roosevelt Avenue creates overflow problems which affects the trail and side wall of the creek. Modification of the dam to ameliorate these problems and restore natural stream function would be ecologically beneficial, although the presence of sewer line crossings above the dam may make it difficult to remove. There are several other restoration projects on tributaries in this reach involving trail crossing and storm flow problems.

The section between Holme Avenue and the lower Rhawn Street crossing has many of the same problems as the upstream section. The Holme-Rhawn section is notable for containing several floodplain wetlands, including the large Rhawn Street wetland, which is ecologically significant. This section also contains several good quality tributaries, although many are affected by poorly designed trail crossings. Enhancement of the woods and wetlands by invasive control and replanting is recommended, though most replanting should be deferred until deer populations are reduced. This area is heavily used, and improving trail crossings of creeks, closing rogue trails, and improving major trails are recommended in several places. Control of gully erosion on slopes is also recommended in several places. Modification of the Rhawn Street dam is recommended, which will benefit the main channel of the Pennypack Creek.

The section of park from Rhawn Street to State Road is narrow and highly disturbed. Invasive control and replanting is recommended at several sites, with most replanting deferred until deer numbers are reduced. Several mowed areas could be released to increase the amount of natural land. Trash removal is recommended in several sites, as well.

The mouth of the Pennypack Creek is ecologically very significant. The natural land along the west bank has been modified extensively by creation of an intertidal wetland, with associated impacts on the surrounding area. Monitoring of this area is recommended to determine the success of the revegetation of the wetland and surrounding uplands. It is likely that supplemental planting will be beneficial in this wetland. Control of invasive plants and replanting may become necessary in the area surrounding the wetlands. Access to the site needs to be modified to allow beneficial uses of the area without opening it to dumping and other disturbances.

Like the Wissahickon, Pennypack Park contains an almost continuous band of natural lands, from preserves in Montgomery County to the mouth of the creek at the Delaware River. The park spans the boundary between the Piedmont and the Coastal Plain, and includes a diversity of forests, wetlands and meadows. The recommended restoration activities will enhance these lands and thereby improve their value to the park users and the city.

5.B.2. **Introduction**

Pennypack Park is part of District 5 of the Fairmount Park system, which includes Tacony Creek Park, Poquessing Creek Park, and street trees in the northeastern part of the city. Pennypack Park today comprises about 1,750 nearly contiguous acres of open space of which about 1,300 acres

have been designated natural lands. The park is a long strip of land stretching eight miles from its northern boundary at Fox Chase Farm at the Montgomery County line to the mouth of the Pennypack Creek at the Delaware River. Parts of Pennypack Park were purchased in 1905, with subsequent acquisitions through the first quarter of the 20th century, so that by 1929 the park contained most of its current area (Cantor 1990). The original section stopped south of Pine Road. More recent additions include Fox Chase Farm, the fields south of Verree Road and west of Tabor Road, and areas along Wooden Bridge Run.

Fox Chase Farm, Winter 2000.

Pennypack Park offers a wide variety of recreational opportunities from sports fields to walking, biking and horse back riding. In addition, Fox Chase Farm, an interpretive farm owned by Fairmount Park, but leased to, and managed by, the School District of Philadelphia, offers a hands-on agricultural program to children of Philadelphia. A farmer carries out the daily site operations and the administration is handled by the school district. The Pennypack Environmental Center, located east of the creek and north of Verree Road, was one of the first of its kind in the country (Klein 1984). Portions of the park have also been devoted to other uses, such as the police stables north of Krewstown Road and the prison near the mouth of the creek.

The park presents a recent landscape which has a much older history. Human settlement began with the ancestors of the Lenape Indians, who perfected a woodlands culture based on a combination of farming and hunting-gathering. The Pennypack landscape was described by the first European settlers as an unbroken wilderness, although it probably reflected patterns of burning and farming by Native Americans. A more detailed description of the forests encountered by the early settlers is found in Volume I, Section 4.B.

European settlement in the Pennypack valley began with the Dutch and Swedes who, in the first quarter of the 17th century, founded trading posts along the Delaware River from Delaware Bay to Burlington Island. By 1650, the mouth of the Pennypack Creek was settled and ferry transportation was available, linking the mouth to the adjacent side of New Jersey (FP settlement map-vertical file). In 1687, settlement up the creek began and the second grist mill in Pennsylvania was constructed at Verreeville (where Verree Road now crosses the creek). Beginning in the mid-17th century, Swedish and Finn settlers began building mills along the Pennypack Creek.

By 1681, the English had gained political control of the Delaware Valley and settlement by a large number of immigrants interested more in farming than trade with the Indians began in earnest. A plantation system developed in the countryside, connected to the mouth of the Pennypack Creek, where goods and products could be sent to the growing city.

The Pennypack Creek is tidal from its mouth almost to Frankford Avenue, where natural falls (at the geologic fall line) stop tidewater. Holmesburg, located just above the fall line, became an early center of commerce and trade. Holmesburg provided an easy creek crossing at low tide, and at high tide water travel was used to link people and the plantation produce to the city. The crossing marked an old Indian trail, which was used by settlers. By 1697, travel was so busy in the area that a stone bridge (the Frankford bridge, which is still in use) was constructed. North-south routes linked Philadelphia and the lower, western part of the Delaware Valley to Princeton and New York (Cantor 1990). Holmesburg got its name from Thomas Holme, who was granted over 1,600 acres by William Penn which he developed into a plantation. A number of mills were sited on the lower Pennypack Creek, fueled by water funneled into races by a dam built over the natural falls just above the Frankford Avenue bridge. By the close of the 18th century, the lower Pennypack Creek sported a cotton factory, a saw mill and a grist mill (Cantor 1990). By 1800 there were over 30 milling

operations on the creek (Sommer 1963). What began in the 18th century turned into large industrial complexes by the mid-19th century (see Ellet's 1839 map, Fig. 5.B.1). For instance, the Rowland Shovel Works, located near the mouth of Wooden Bridge Run, opened its doors in 1826 with eight employees (Cantor 1990) and expanded and stayed in business until 1920. The Pennypack Print Works, located above the present lower Rhawn Street crossing, grew and expanded, while the La Grange Company for the manufacture of art supplies and calico also employed numerous people. Incidently, La Grange Company started raising silk worms and imported mulberry trees to feed the worms. Upstream at Verreeville Mills, a community grew from a small grist mill in the 17th century to a small milling town, with a number of buildings from that period still standing near the Pennypack Environmental Center.

The agricultural development of the watershed led to increases in sediment erosion in the uplands, with deposition on the floodplain of park streams. Hydrology changed as immediate storm flow runoff increased at the expense of infiltration to ground water. The decrease in stream base flows following clearing was recognized very early (e.g., Kalm 1770), and the decrease in the number of springs in Pennypack Park following more intense development was also noted (Fowler 1916, McNeil 1963). With dams came impoundment ponds and races which cut the stream banks, and areas along the floodplain were filled to house mills and out buildings, which further disrupted the natural system. Even after dams are removed, it may take a long time for erosion of the former impoundment to recreate a more natural channel form. In the early industrial period, the city seemed to care little about such environmental degradation until the water supply was threatened, and then this awareness came slowly.

Traces of the industrial development and agricultural land use are apparent in the park today. Open meadows relating to agricultural uses are found throughout the park, while evidence of the dams and races can be found throughout the stream valley.

Mills and farming were the primary land uses throughout the 19th century (Bromley 1863). Rural farmsteads were juxtaposed alongside milling sites which ran the length of the Pennypack Creek. Along the uplands, the countryside was dotted by farmsteads and wood lots. By 1863, Smedley (1863; Figs. 5.B.2 through 5.B.4) shows the countryside with little woods, primarily along the riparian corridors, suggesting that most of the arable, drainable land was in cultivation. The map also shows a well developed road system leading to Holmesburg and other roads running east and west connecting the farms to the river and the city.

Between 1863 and 1894 (Fig. 5.B.5), the Pennypack stream valley developed dramatically. The area was designed on city maps, including roads extending the rigid geometry of the city to the countryside now poised for development. It was during the mid 19th century that part of lower Dublin Township became part of the City of Philadelphia and the stage was set for the expansion and development of the agricultural lands as an extension of the city. At the mouth of the Pennypack Creek, a new landscape emerged. Channels or ditches, along with dikes approximately 20-30 feet in width, were constructed near the river's edge. It is presently unclear how these structures functioned in the industrial landscape. However, it is clear that by 1896 the mouth of the Pennypack Creek was developed and was no longer primarily agricultural. The upper reaches were ready for expansion of the city. Nonetheless, the Pennypack Creek was one of the last of the Philadelphia watersheds to be developed, remaining a rural landscape well into the 20th century (Bromley 1910). In the early 20th century, some farms were turned into country estates, but much of the land remained open. Aerial and ground photographs (Miller et al. 1983) from 1910-1930 show new roads being laid out into open farmlands with a few clusters of new developments. Even by 1940, the Pennypack valley was not fully developed (Miller et al. 1983).

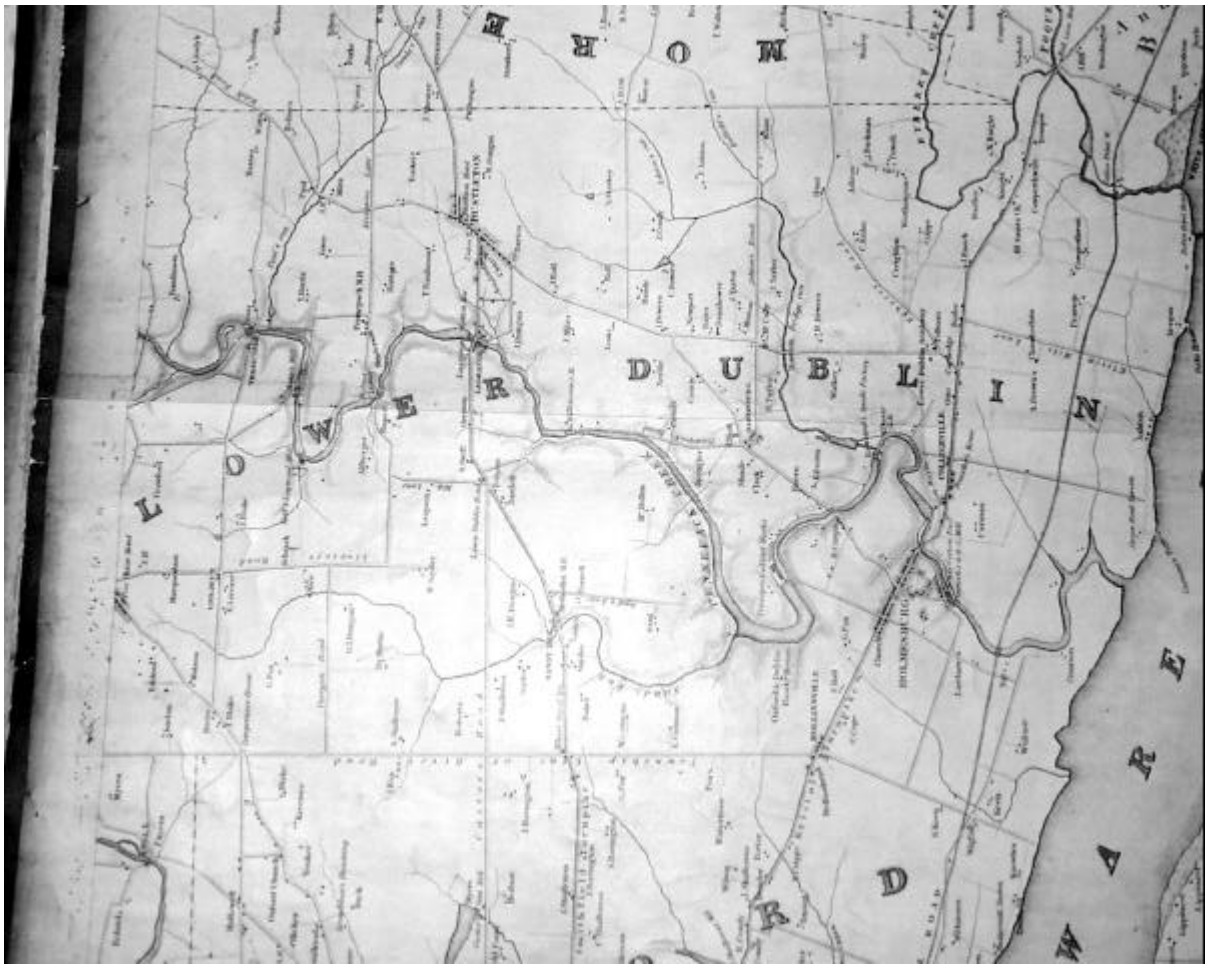


Figure 5.B.1. Other than the numerous mill sites along Pennypack Creek, in 1839 the stream valley remained rural (Ellet Map, 1839).

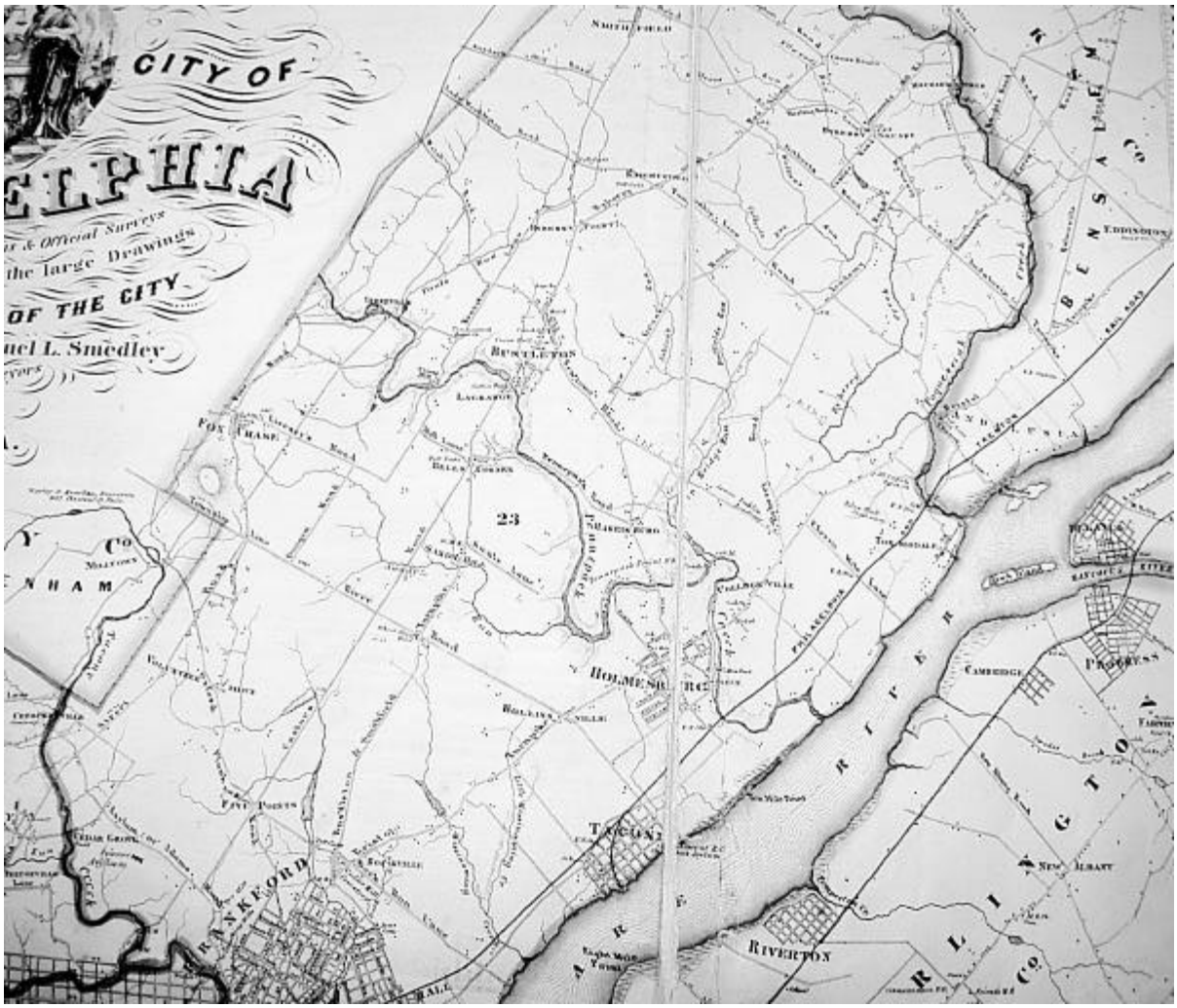


Figure 5.B.2. The Smedley map of 1863 shows the Pennypack Creek and tributaries with numerous industrial sites.

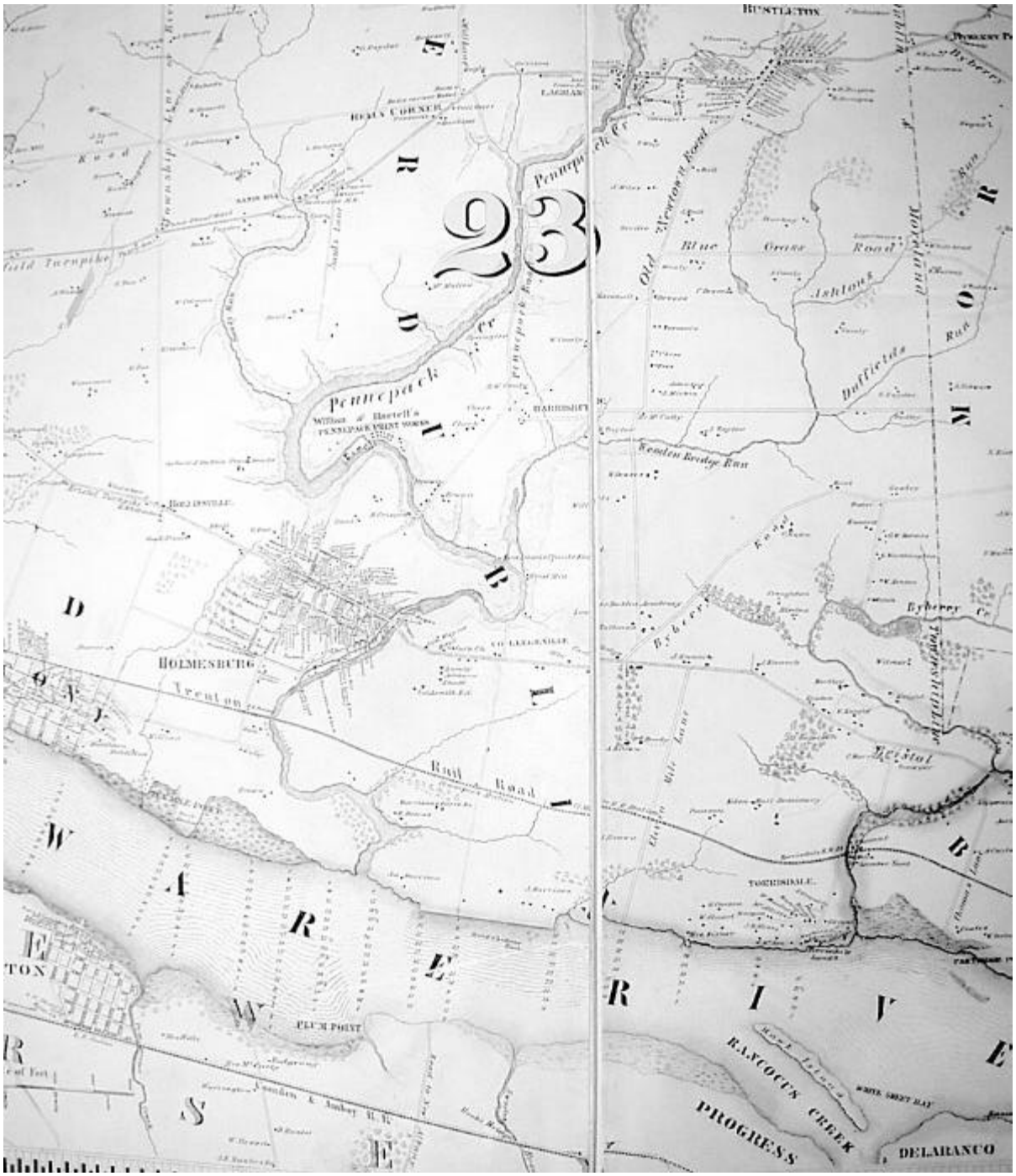


Figure 5.B.3. Detail of the Smedley map of 1863 showing the mouth of Pennypack Creek.

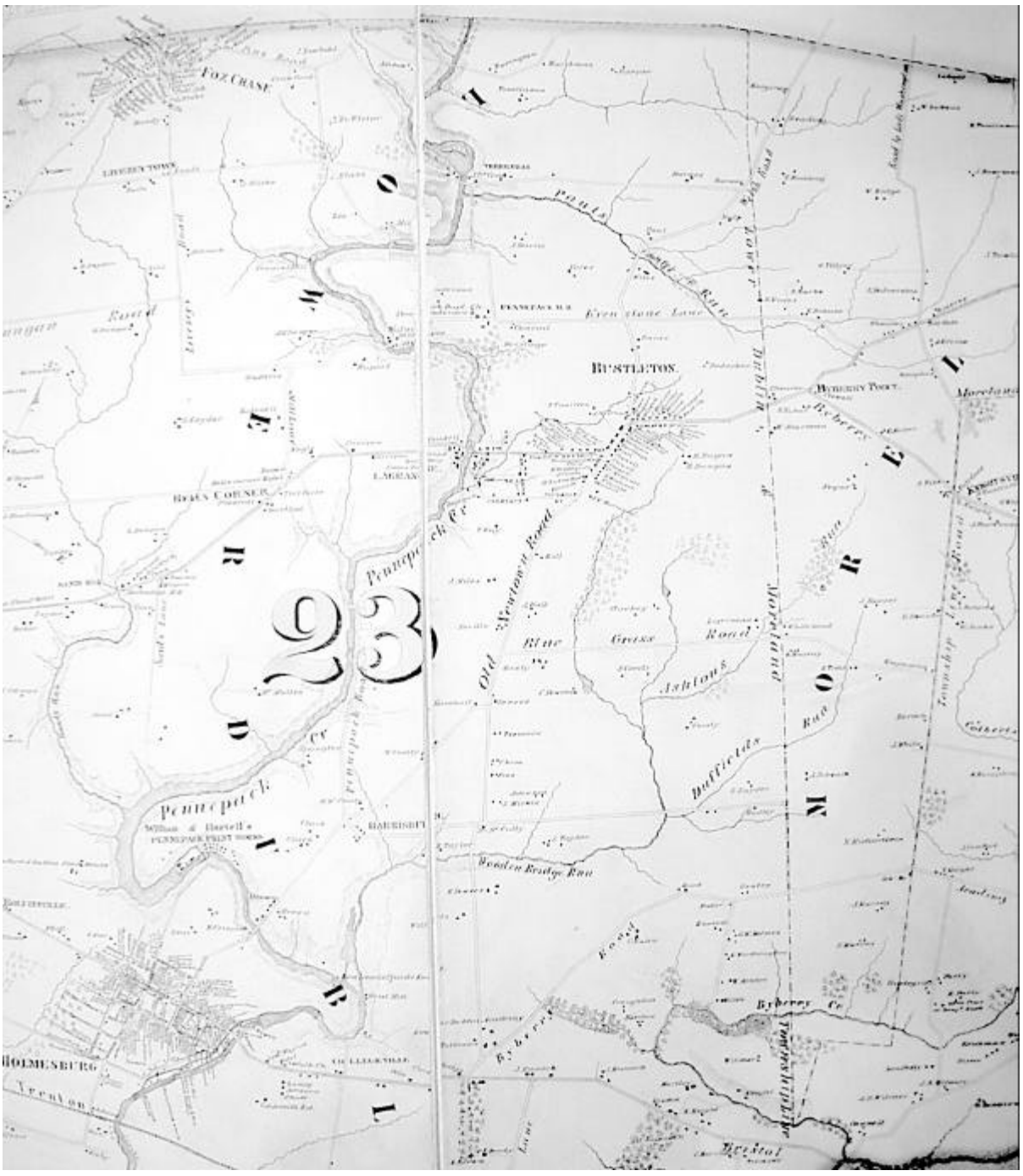


Figure 5.B.4. Detail of the Smedley map of 1863 showing the upper portion of Pennypack Creek in Philadelphia.

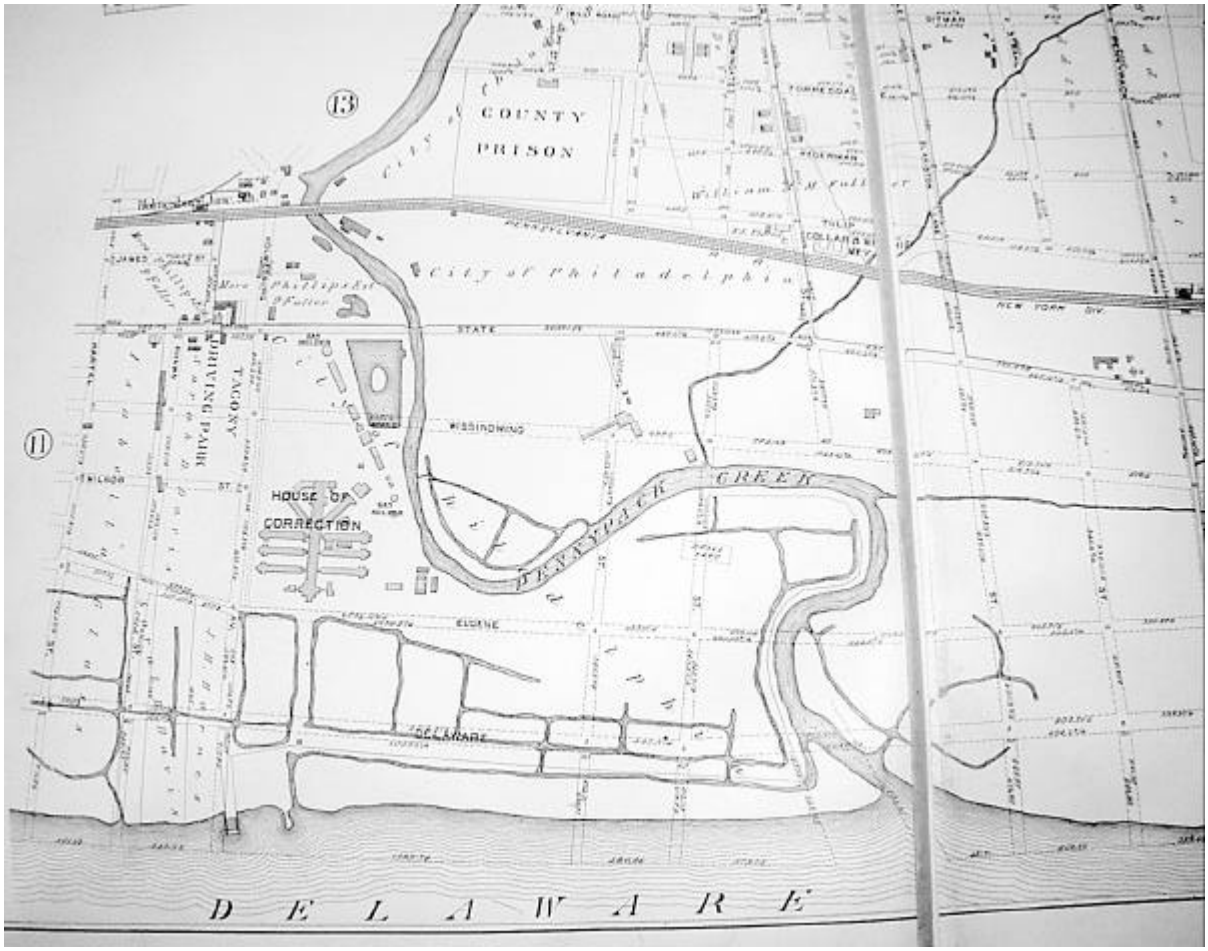


Figure 5.B.5. The Bromley map of 1894 shows that the mouth of Pennypack Creek began to develop dramatically at the turn of the century.

By 1910 the city was interested in securing additional lands for the park system and protecting the stream valley. Charles Leavitt developed a plan presented in a report to Jesse Vogdes, Chief Engineer to the Park and the Commissioners. By 1916, the Commissioners had secured 1,260 acres of land in the Pennypack (Leavitt 1916). In Leavitt's plan, he notes a park needs to be developed because "suburban conditions are rapidly changing in this vicinity." He implied that land must be put aside for public use to meet the changing needs of an expanding city.

The plan of 1916 presented to the Commissioners shows a proposed landscape. Although many of the suggestions were not undertaken, such as the construction of a dam at the mouth of the Pennypack to stop the awful smells at low tide, the plan does afford a glimpse of the landscape when the park was founded. In 1916 much of the land was pasture or field. This is substantiated by the photo scrapbook in the possession of the park which shows over 70 views of the land purchased for the park and by later aerial photographs (Miller et. al 1983). Small patches of large woods run along the creek and are today the better forests in the Pennypack Park. Large forests existed at Grant Avenue, along the creek on either side of Rockledge Run, and a fringe of forest also ran along the slope on the other side of the creek. A large forest was also present along Tabor Road at the slope south of the Verree Road parking lot, and ran to the other side of the creek to Bloomfield Avenue. A large patch ran from Solly Street west along the creek almost to Bloomfield Avenue, along the right bank of Sedden's Run and on the right slope of Pennypack to Krewstown Road, and began again across the street and ran on both sides of Krewstown Road west of the Pennypack Creek. On the east side of the Pennypack, there was a large patch of woods at Three Springs Hollow. There was also a patch of woods between Large Avenue and Lexington and the Pennypack, the west bank woods above Roosevelt Boulevard. Further downstream, there were narrow strips of woods along the slopes or along the creek, especially on the west side from Sandy Run to Holme Avenue. Notably, there were few woods along the east side of the creek from Holme Avenue to Bustleton Avenue.

The plan envisioned many pathways winding through woods and meadows. Many open meadows are shown on the plan. Interestingly, the author of the plan mentioned how important the beauty and use of meadows were to the park. Conflict between natural lands and sports fields was specifically mentioned. Discussing a meadow east of Rhawn Street which was used as a ballfield, the plan opines:

> Although baseball is the most popular sport in the country and is enjoyed equally well by boys and men, yet it seems selfish to permit 18 people to occupy several acres of land for several hours to the exclusion of all other sports. For may years there will be sufficient open meadow in the Park for the enjoyment of baseball without inconvenience to the general public, but looking to the future, it does not seem wise to establish definitely part of the plan for more than 2 ball fields. It is wise for the Commissioners to secure land outside the Park limits, should the need for more ball ground become increasingly apparent.

The plan included a number of small impoundments. These apparently included some new impoundments, some enlargements of existing mill ponds and the dredging of some of the relict mill ponds. The plan discussed the value of these for skating and canoeing in the park. Wetlands were viewed negatively, and impoundment, dredging and filling to create ponds and dry ground were advocated. It is unclear how much of the plan was realized. Many of the dams and road realignments, were not implemented. Some of the recreational facilities, such as the ball field at the bend in the creek above Verree Road, are still mowed open space. Other open areas are now in forest regrowth.

Thus, the forest, meadows and woods which make up the present Pennypack Park is not an old pristine system but one rebounding from a variety of industrial and agricultural uses. The channels and floodplain of the Pennypack Creek and most of the smaller streams are affected by agricultural development and construction in the watershed, and many bear the marks of impoundment and

building of bridges, roads or structures along the banks. These continue to be affected by the changes in hydrology created by development. Patches of old growth woods remain, but much of the woods are less than 100 years old. A variety of successional stages are apparent, from a few fire-maintained meadows, to old fields in some of the most recently acquired lands, to young tulip poplar forest, to some relatively old growth woods. Succession will continue to change these areas. However, the rate and nature of change are now affected by an overabundant deer population which limits regeneration of many species, the influx of invasive species from edges and the surrounding city, and by human use of the park. The residual effects of soil disturbance and changes in hydrology and fire regime will also affect the nature of succession. Many species were probably lost from the area as it was fragmented into small woodland patches. While most canopy tree species are still present and available for regeneration, some shrub and herb species may require reintroduction. The challenge of restoration of Pennypack Park is to encourage the natural succession of some areas, retain some high diversity areas in early successional stages, and sustain the human use of the park.

5.B.3. Existing Conditions Inventory and Assessment

5.B.3.1. Introduction

Existing and new information collected as part of the 1998 inventory are discussed in Chapter 4 of Volume I. The comparison of information among parks provides strong evidence for pervasive disturbance throughout the Fairmount Park system, as well as individual differences among parks. In this section, more site-specific information on conditions in Pennypack Park is presented. This section focuses on condition and disturbance of vegetation of the park, faunal occurrence, and condition of stream channels as determined by the 1998 streamwalk. This information formed the basis for selecting restoration sites and specifying activities to be done at these sites.

5.B.3.2. Vegetation and Flora

Pennypack Park was surveyed as part of the 1998 assessment by the Academy of Natural Sciences of Philadelphia, and the results of that assessment, as well as suggested restoration activities for the natural lands based on existing conditions and land use history, are provided in the following text. This information supplements the vegetation classification maps (Section 5.F.3) and list of plant species recorded in the park (Appendix A-1.1). Sites visited in Pennypack Park represent a variety of habitat types, including forests, non-forested areas such as meadows and edges, wetlands, and riparian zones.

Three Springs Hollow.

Pennypack Park, located in northeast Philadelphia, consists of approximately 1,750 nearly contiguous acres, of which about 74% is natural land, 19% is designed/built land and 7% water. The land use history of northeast Philadelphia has determined the present conditions of the soil and vegetation in Pennypack Park, as much of this land was used for agricultural purposes until the early 20th century. Much of the park is wooded, with relatively even-aged stands dominated by tulip poplar (*Liriodendron tulipifera*) and American beech (*Fagus grandifolia*) on slopes, and box elder (*Acer negundo*) in the floodplain. However, there is still a relatively high diversity of vegetation within the park, and several species were found to occur only, or mainly, in Pennypack Park. In particular, a few small areas that historically were not farmed or clearcut for timber, such as the steep slopes, remain rich in vegetative diversity. However, deer populations are dense in Pennypack Park, as indicated by the browse line, the abundance of signs (tracks, deer beds, etc.) and numerous sightings. Vegetation throughout the park shows signs of the damage caused by deer browse. Vegetation damage includes heavy browsing of shrubs and herbs, and absence or rarity of saplings of preferred tree species. Reduced vegetative diversity has been linked with over-browsing by deer. Reducing deer

populations will be necessary to achieve long-term increases in the abundance and diversity of native plant species.

Deer are not the only factor posing a problem for the biodiversity of Pennypack Park. The building of structures (railroads, highways, buildings, trails) has also had a negative impact on the health of the park ecosystems. Although streams and floodplains have been greatly affected by changes in hydrology, the park still contains a number of small wetlands along the main creek and tributaries. Pennypack Creek is tidal almost to Frankford Avenue, and the tidal area contains ecologically significant intertidal freshwater marsh habitat. The Pennypack Creek, especially the upper part, was once noted for hemlock stands along the creek. These have virtually disappeared, although there are a few small stands.

The land north of Pine Road is part of Fox Chase Farm and is used by school groups from around the city for educational purposes. Most of the area is grazed by cattle. While this land use has served to educate the community, the farming activities impact the land and streams in this section. The small stream which runs through the farm is mowed up to the edge of the water, and the animals are permitted to graze in this area. The dominant vegetation in this riparian zone is multiflora rose. Kentucky bluegrass (*Poa pratensis*), orchard grass (*Dactylus glomerata*), and sweet vernal grass (*Anthoxanthum odoratum*) were common throughout the farm. The dearth of vegetation along the streambank has caused erosion of the banks and incising of the stream. Communications with the farm staff regarding feasible restoration activities at the site have begun and should be continued.

The area between Pine and Verree roads comprises disturbed riparian zones, maintained recreational land, a large forest, small wetlands and disturbed edges. The riparian zone in this section of the park is in disrepair as much of it is mowed, and it is used heavily for fishing and other recreational activities. The banks along the channel are eroding due to overuse and lack of stabilizing vegetation, and large canopy gaps are present. The shrub layer is dominated by spicebush (*Lindera benzoin*) and multiflora rose, and ragweed (*Ambrosia artemisiifolia*), mugwort (*Artemisia vulgaris*) and stinging nettles (*Urtica dioica*) are present in the herbaceous layer. Canada geese (*Branta canadensis*) are common in this area, particularly in the open mowed field along the right bank of the creek, and trash dumping presents a problem along the length of the riparian zone. The dominant canopy community types in the upland forests are tulip poplar/beech and beech/oak (*Quercus* spp.)/tulip poplar. Dogwood species (*Cornus* spp.) and spicebush are the most common shrub layer species in the upland community and the herbaceous layer, where present, is comprised of hay-scented fern (*Dennstaedtia punctilobula*) and a few spring ephemerals such as trout lily (*Erythronium americanum*), spring beauty (*Claytonia virginica*) and wild ginger (*Asarum canadense*, mainly on slopes on the east bank). The main wetland is a sedge-rush-grass wetland, and also contains species such as Canada thistle (*Cirsium arvense*), sensitive fern (*Onoclea sensibilis*), burdock (*Arctium minus*) and milkweed (*Asclepias syriaca*) in the herbaceous layer, and several planted red maples (*Acer rubrum*) in the shrub layer. Small skunk-cabbage (*Symplocarpus foetidus*) wetlands are also present. Edges of woods are highly disturbed, and the predominant species found in edge habitats include Japanese honeysuckle (*Lonicera japonica*), poison ivy (*Toxicodendron radicans*), oriental bittersweet (*Celastrus orbiculatus*), grape species (*Vitis* spp.) multiflora rose, wineberry (*Rubus phoenicolasius*) and Tree-of-heaven (*Ailanthus altissima*). The edges, which are often located next to roads and trails, are also heavily impacted by the accumulation of trash. The prevalence of exotics in these habitats reduces the value of edges to wildlife and may negatively impact the interior of adjacent woods. Recommended restoration activities in these sites include control of exotic species, planting to develop herbaceous, shrub, or wooded buffer zones on the edges, and development of hedgerows (e.g., by conifers) to shade forest interiors. Trail restoration activities should also be undertaken, such as on the slopes on the east (left) bank behind the environmental center.

The forests in the area between Verree and Krewstown roads are similar in community composition to those woods north of Verree Road. Erosion and gullying by storm water runoff are beginning to pose a threat to the interior of the woods. This situation is exacerbated by the lack of vegetation along steep slopes. Several of the woods on the slopes in this area are rich in diversity of canopy trees, as they were not recently farmed or maintained as recreational land. Large American beech, mixed hickory (*Carya* spp.) and mixed oak species are common on slopes on both sides of the creek, especially in the northern part on both banks, along the right bank of Sedden's Run, and in a narrow band on the right bank. The herbaceous and shrub layer are sparse in this area, but despite the heavy deer browse, several musclewood (*Carpinus caroliniana*), bladder-nut (*Staphylea trifolia*) and witch-hazel (*Hamamelis virginiana*) specimens were observed in the understory . Spring ephemerals, including trout lily, dwarf ginseng (*Panax trifolius*) and cut-leaved toothwort (*Cardamine laciniata*) are present on these slopes. A variety of ferns is present as well, particularly on the right bank slopes. The riparian zone along this section of the creek is dominated by tulip poplar, sycamore (*Platanus occidentalis*), and box elder. The shrub layer has some dense patches of Japanese knotweed (*Polygonum cuspidatum*) and Norway maple (*Acer platanoides*) saplings, and the ground cover is composed of garlic mustard (*Alliaria petiolata*), lesser celandine (*Ranunculus ficaria*), stinging nettle and goutweed (*Aegopodim podigraria*). There is an abundance of grape vines along the riparian zone, often associated with edges and canopy gaps. This area is used for fishing and recreational activities, which, in association with the lack of stabilizing vegetation, may be causing the erosion along the banks of the creek. A skunk-cabbage wetland is located south of Verree Road, on the right bank of the Pennypack Creek. This is a relatively healthy wetland habitat with red maple and red ash (*Fraxinus pennsylvanica*) in the canopy and southern arrowwood (*Viburnum dentatum*) and spicebush in the shrub layer. Herbs common in this wetland are spring beauty, sensitive fern and jack-in-the-pulpit (*Arisaema triphyllum*). However, several aggressive, exotic species were also observed growing in this forested wetland including mile-a-minute (*Polygonum perfoliatum*), garlic mustard and Japanese stilt grass (*Microstegium vimineum*). Several other wetlands exist in this area, including a large skunk cabbage wetland on a tributary of Sedden's Run, a sedge-grass wetland in an overflow channel north of Sedden's Run, and several skunk cabbage wetlands on the east side of the creek. There are several old fields on the west (right) bank along the railroad line. These contain species such as bluestem grass (*Andropogon* and/or *Schizachyrium*), milkweed, yarrow (*Achillea millefolium*), fragrant cudweed (*Gnaphalium obtusifolium*), Canada thistle, goldenrod species (*Solidago* spp.), deer tongue grass (*Panicum clandestinum*), garlic mustard, asparagus (*Asparagus officinalis*) and blackberry (*Rubus allegheniensis*). One of these fields appears to be maintained as an open meadow by fires, which may come from sparks from the railroad or from burning. Habitats such as these are rare in the park and should be maintained or protected when they are found. Maintaining land as meadows can be done by infrequent mowing and removal of woody species from the site. A police facility is located in this area of the park and the slopes and ridge-top behind the buildings are used as a dump for logs and other waste. There is another large log dump area on the floodplain on the north (left) bank above Krewstown Road, and this area has a number of old roads. These dumps compromise large forest areas within the park and should be removed or reduced in size. The vegetation in this area is relatively young and contains many invasive species.

The riparian zones in the park between Krewstown Road and Bustleton Avenue are thin and show signs of erosion. The macadam pathway, which runs along the right bank of the creek, has decreased the width of the riparian zone and, in many areas, there is only a few feet between the trail and the creek. The dominant canopy community in the riparian zones is a tulip poplar, sycamore, red ash, box elder association. Other species, such as shagbark hickory (*Carya ovata*) and basswood (*Tilia americana*), were also present within the floodplain. The shrub layer is dominated by spicebush, and the exotic species wineberry and Japanese knotweed are patchy along the creek bank.

The herbaceous layer is composed of lesser celandine, garlic mustard, false nettle (*Boehmeria cylindrica*), goutweed, and jack-in-the-pulpit. Japanese honeysuckle was found covering the ground as well as invading the canopy. There are several small skunk cabbage seeps in the floodplain at the base of the slopes. The non-forested areas in this section of the park are old fields which appear to be routinely burned, such as on the east bank near Three Springs Hollow. The burning may be initiated by vandals or could also be the result of sparking from the railroad tracks. Species typically found in these old field habitats include mixed grasses, goldenrod species, aster species (*Aster* spp.), Japanese barberry (*Berberis thunbergii*), blackberry, indian hemp (*Apocynum cannabinum*) and milkweed. Early successional tree species such as red ash, black locust (*Robinia pseudoacacia*) and various cherry species (*Prunus* spp.) have also been observed on the edges of the open fields. Fields located closer to the edge of the park and adjacent to roads have become targets for human disturbance and invasion by exotic species. Mile-a-minute was found in these fields, as were grape vines. The woods between Krewstown Road and Bustleton Avenue are mainly tulip poplar/sycamore dominated. Some early successional species, such as red ash and various species of cherry, are patchy throughout the woods. A mixed oak, hickory and American beech community association was also found abundantly in these woods. Several sweet cherry (*Prunus avium*) and mockernut hickory (*Carya tomentosa*) individuals were observed in the northeast edge of the Three Springs Hollow woods. The Three Springs Hollow woods is apparently one of the larger section of old woods. The shrub layer of the forested uplands in this section of the park lacks diversity due to deer browsing and is dominated by the native spicebush and the non-native species, wineberry and amur honeysuckle (*Lonicera maackii*). The herbaceous layer hosts species such as the native plants sensitive fern, lady fern (*Athyrium filix-femina*), Christmas fern (*Polystichum acrostichoides*), smooth yellow violet (*Viola eriocarpa*), jack-in-the-pulpit, wild ginger, and anise-root (*Osmorhiza longistylis*) and the non-native plant species garlic mustard, stinging nettle, Japanese stilt grass and lesser celandine. A majority of the wooded edges in this section of the park is highly disturbed, with the dominant vegetation consisting of woody vines and non-native shrubs. However, one high quality edge habitat which should be protected from invasive species exists north of Bustleton Avenue and to the west of Winchester Avenue. Wineberry and multiflora rose dominate the outermost edge of the woods, but large American beech, shagbark hickory, sycamore, red oak (*Quercus rubra*), white oak (*Quercus alba*) and chestnut oak (*Quercus montana*) can be found in the canopy layer of this edge habitat. Proper edge management, including weeding of exotic species and replanting of natives, removal of yard waste and trash and erosion control will aid in the native regeneration of this area.

Between Bustleton Avenue and Roosevelt Boulevard, the slope forest on the right bank of the creek is a mixed oak, mixed hickory, American beech vegetation community. Some of these woods are relatively old, based on earlier maps and photographs. Red ash and black cherry *(Prunus serotina*) were also observed at patchy locations throughout the area. A few stands of the exotic tree-of-heaven were also present along the more disturbed parts of the slope. The shrub layer on the slope was absent and six deer were sighted at this location the day the vegetation assessment was performed. Garlic mustard, lesser celandine, and chickweed (*Stellaria media*) were found to be common species in the herbaceous layer. Grape vines are present in the canopy gaps in the wood, although restoration efforts have already begun and the efforts of vine cutting are evident. Southeast of Benton Avenue is a small wetland, which is dominated by common reed (*Phragmites australis*). Skunk-cabbage was also observed in patches in the wetland. Woody vegetation included sycamore, silver maple (*Acer saccharinum*) and red ash. Vegetation in both the herbaceous and shrub layer is scarce and deer pose a threat to the native vegetation of this wetland. There is a small old field located off of Old Newtown Road, which is overrun with exotic species, namely porcelain-berry (*Ampelopsis brevipedunculata*) and mile-a-minute.

The forests from Roosevelt Boulevard to Holme Avenue are severely impacted by deer. On one site visit, seven deer were noted browsing the woods on the slope located west of Axe Factory

Road and north of Holme Avenue. Tulip poplar and red maple dominate the canopy and black cherry, flowering dogwood (*Cornus florida*), and red ash are scattered throughout the woods. The understory is completely dominated by spicebush and a deer browse line is very obvious. The non-native species garlic mustard, wineberry and Japanese honeysuckle are invading the forest from the edge of the road. The forest south of the Axe Factory tributary is composed of a red maple, red oak, silver maple canopy. There is little cover in the shrub layer and the dominant species are spicebush and wineberry. Issues such as yard waste dumping, deer overbrowsing and exotic species in the edge pose a threat to the stability of this forest. There are several small parcels of land along the edge of the woods in this area which are currently being maintained, but are not actively used for recreational purposes. These areas should be mowed infrequently and native tree species should be planted to help fill in the gaps along the edge of the woods. Any planting activity performed in an area with a high density of deer should be enclosed to prevent further damage to new plantings.

The slopes located south of Winchester Avenue, between Welsh Road and Rhawn Street are badly eroded, and exotic species are occupying this habitat. Norway maple and tree-of-heaven are beginning to invade the native canopy, which is composed of red oak, black walnut (*Juglans nigra*) and American beech. The shrub layer at this site is represented by the native spicebush and ornamental species such as Amur honeysuckle, boxwood (*Schaefferia frutescens*), and Norway maple saplings. The herbaceous layer is lacking at this site, as it is heavily populated by deer. Erosion, caused by storm water runoff and the lack of stabilizing vegetation along the slopes, has caused a large gully at this site. Trash and yard waste dumping are aiding in the erosion problems along the slope. The debris should be removed and the slope needs to be stabilized with native vegetation, which is protected from deer. A small floodplain, located north of Rhawn Street, on the right bank of the mainstem, is dominated by the exotic tree sycamore maple (*Acer pseudoplatanus*). A large gully is present, which may have been caused by storm water runoff from the adjacent parking lot.

In the area between Rhawn Street and Ryan Avenue, south of Lexington Avenue, there is a small parcel of woods (about 1.5 acres) which has not been as severely impacted by deer browse as other woods in the park. The vertical diversity and species diversity of trees at this site is high in comparison to other wooded areas of Pennypack Park. The canopy contains American beech, tulip poplar, red ash, red oak, white oak and sycamore. The understory is represented by musclewood and American beech saplings. The herbaceous layer is lacking diversity, as is typical of a heavily browsed area, and the two species noted were jewelweed (*Impatiens capensis*) and sensitive fern. The slopes south of Lexington Avenue show signs of disturbance from yard waste dumping and the soil is badly eroded. Norway maple is common along the edge of this slope, as are Amur honeysuckle, poison ivy and grape vines. The interior of the woods is a tulip poplar and American beech community with spicebush and paw paw (*Asminsa triloba*) dominant in the shrub layer. This is the largest stand of pawpaw found in the park, and it does not appear to be a target of deer damage. This is a large shrub/small tree that typically occurs along moist, rich woodlands. The right bank of the Pennypack Creek supports a narrow riparian zone which supports a tulip poplar, red ash canopy and a box elder, spicebush understory. Several black walnuts were also noted at this site. However, the overall vegetative diversity was extremely low. The only herbaceous plants found at this location were stinging nettle and garlic mustard. There are several small skunk cabbage wetlands along the right bank which arise from seeps in the slope. There is a large wetland located on the left bank of the creek, where lizard-tail (*Saururus cernuus*), which is rare in the park, is present. The riparian zone on this side of the creek is comprised of a box elder, red ash community with spicebush existing as the only shrub cover and goutweed, stinging nettle and skunk-cabbage found in patches in the herbaceous layer. Many deer and deer beds were seen throughout this floodplain. The lack of vegetation due to deer browsing is the main disturbance at this site, but trash dumping and patches of grape vines, which have started to invade the area, also pose a threat. An old field, south of Lexington Avenue and east of Ryan Avenue was recorded as a highly disturbed open area dominated

by Japanese stilt grass. Raspberry (*Rubus occidentalis*) and blackberry were found abundantly in the shrub layer. On the right bank below the Sandy Run tributary there are several wetlands, containing skunk cabbage, reed canary grass (*Phalaris arundinacea*) and moneywort (*Lysimachia nummularia*) in the herbaceous layer.

The woods along Sandy Run between Ryan Avenue and Roosevelt Boulevard are highly disturbed, with extensive trampling and waste along the slopes and severe storm water impacts in the floodplain. The Philadelphia Water Department has suggested damming Sandy Run to create a wetland for storm water control.

Between Welsh Road and Frankford Avenue there is a large wooded area composed of a tulip poplar, red ash, black cherry, sycamore and Norway maple canopy and a wineberry, spicebush and multiflora shrub layer. The damage from deer here is severe and Japanese honeysuckle, greenbriar (*Smilax rotundifolia*), and garlic mustard are covering the ground. These woods are heavily used by local high school students and many rogue trails are causing erosion and gullying along the slopes, which support American beech, red maple and mixed oaks. The right bank riparian zone is extremely narrow and hosts species which are forming a dense thicket, such as greenbriar, wineberry, multiflora, Japanese honeysuckle and grape vine. Further south, oriental bittersweet is dominant along the floodplain and can be seen in the canopy trees. Trash dumping and general overuse of the area, especially in the vicinity of the Frankford dam, are causing more disturbance to an already compromised ecosystem. The managed land on the left bank should be released from an active management regime, as it currently serves no recreational purpose.

The woods located between Frankford and Torresdale avenues are thin and highly disturbed. Along the left bank, north of Torresdale Avenue, there is a large maintained area adjacent to a ball field and other recreational facilities. This area could be released from a strict management regime to serve as a tall grass buffer. There is a small stand of Eastern hemlock (*Tsuga canadensis*) on the left bank of the Pennypack Creek, south of Frankford Avenue. The woods in this area have been disturbed by the adjacent construction of a housing development in the early 1990s.

The Pennypack Creek becomes tidal a little below Frankford Avenue and supports an intertidal marsh flora below State Road. A band of the emergent plant spatterdock (*Nuphar advena*) on both banks widens into a large patch at the mouth of the creek. The parkland at the mouth of the Pennypack has been modified extensively in the last few years. Most of the western part has been graded and is now maintained as soccer fields and open, mowed parkland. A wetland has been constructed in the eastern part, along with a mound built from the material excavated from the wetland. Vegetative regrowth in this area should be monitored, and invasive control and planting should be done where necessary to encourage native wetland, field and forest flora. These, in turn, can be very important for supporting a variety of wildlife, including fishes, other aquatic organisms, and breeding and migratory birds. There is a small wetland-old field complex in the southwest part of the park, intertidal mudflats along the Delaware River and mouth of the Pennypack Creek. These were not surveyed in the 1998 assessment. However, flats such as these are extremely significant sites for rare plants in the Delaware Estuary.

5.B.3.3. **Community Mapping Results**

The community mapping initiative in Pennypack Park focused largely on how people use, or disabuse, this urban park. Over 500 items were mapped throughout the 12 sections of the park. Participants noted many positive features of Pennypack Park, including the large expanses of forest, the ability of the park to accommodate numerous uses (ball playing, picnicking, sledding) and the diversity of wildlife. Also positively noted were the presence of the Pennypack Environmental Center and the groups of dedicated volunteers who work to maintain the park.

One of the negative features mapped is the presence of trash within the park. Due to the efforts of volunteers, park staff and responsible users, Pennypack Park is generally clean. The trash that does occur is usually present in smaller amounts generated from picnics and special events. Some dump sites were also mapped throughout the park. These locations were generally contractor dumping, although some home owners appear to be depositing yard waste in the park. Although there are multiple storm and sanitary sewer lines and manholes throughout the park, the mapping initiative found only one instance of visible pollution in the stream, one location of a damaged sewer outlet and two instances of distinctive sewer odors, but no evidence of broken lines.

Party sites were found throughout Pennypack Park. Most of the sites were generators of litter, although some were located near existing trash receptacles. Many of the sites were found in remote areas, away from heavily-used portions of the park. Railroad lines that run through, or adjacent to, the park appear to be preferable locations for party sites. Locations of invasive plant material were also mapped. These invasive plants often out compete native plants, can take over a section of the park and severely limit biodiversity. Invasive plant species commonly found in the park include Japanese knotweed, purple loosestrife, multiflora rose, Oriental bittersweet and honeysuckle. Participants also mapped portions of the Pennypack trail system. Due to its large size, Pennypack Park contains an extensive network of official and rogue trails. FPC staff is currently working with a consultant on a comprehensive trail master plan for Pennypack Park.

Graffiti was found throughout the park, on signs, bridges, trees and buildings. Fortunately, through the combined efforts of the Friends of Pennypack Park, park staff and other volunteers, graffiti is generally removed as quickly as it is discovered. Abandoned cars are not a major problem in Pennypack Park. The community mapping exercise found only one abandoned in the entire park. Approximately 20 fire locations were documented during the mapping process. Many of the locations were associated with party sites, but others appear to be random acts of vandalism. Fires, when appropriately managed and controlled, can be beneficial for the park's ecosystems. Uncontrolled, however, they can lead to great damage to the park and the possible loss of plant, animal and human life.

There was evidence of all-terrain vehicle (ATV) use in the park. However, this use has fortunately not yet severely impacted the park's natural areas. Evidence of ATV use was found at Wooden Bridge Run and was heard in the vicinity of Sandy Run. Perception of safety was one of the major indicators mapped. Participants noted approximately 20 locations that were considered dangerous. These areas included, among others, open sink holes, missing or cut fence and erosion gullies. Other inappropriate park uses noted include the feeding of wild animals, dogs off of their leashes, swimming and evidence of dirt bike track construction. The community mapping participants also noted the damage being done to the park's natural areas by the overabundance of deer.

In summary, the community mapping initiative undertaken in Pennypack Park provided valuable information about park uses that aided in the selection of natural lands restoration sites.

5.B.3.4. **Fauna**

The following sections provide specific information on the fauna of Pennypack Park, as indicated by the ANSP 1998 inventory and other sources of information. This information is important in determining links between disturbance, vegetation, and fauna, which are used to select restoration sites and activities. The information also indicates significant sites which need to be protected because of faunal occurrence.

Photo courtesy of Vireo.

Baltimore Orioles breed in Pennypack Park.

Birds. Pennypack Park was surveyed for birds on 7 June 1997 and 2, 3, 4 and 18 June 1998. The park is most similar in geology and habitat to the Wissahickon, and its bird life reflects this similarity. The upper sections of the park are the widest and most forested. However, it is also in this area where we find some of the Fairmount Park system's only shrublands (along Verree Road) and a small bluestem grassland (just west of the Conrail rail line at Krewstown Road).

Overall, the 1998 bird census of Pennypack Park provides clear data that the park is second only to Wissahickon in its diversity of breeding birds. Many of the same birds are present in both areas, although for various reasons, it appears that the diversity and abundance are higher in the Wissahickon. The park's size, especially its narrowness in many sections, appears to limit the abundance of quite a few of the species that were common in the much larger, and wider, Wissahickon. The 1998 census yielded a total of 55 probable breeders. A total of 337 individuals of the indicator species was observed during the survey (see Appendix A-2.2 in Volume III).

Most notable amongst the differences with the Wissahickon is the complete absence of Ovenbirds and fewer Veeries than expected at Pennypack Park. Differences such as these may be due to extremely heavy deer browse. There is a general lack of understory, lack of ground cover, and a pervasiveness of vines and honeysuckle in certain areas of Pennypack Park. Such conditions are not favorable to Ovenbirds, are likely to prevent other ground-nesters from using the park, and are less favorable to other forest specialists.

The mouth of Pennypack Creek.

During a preliminary visit to the park land along the Delaware River at the mouth of Pennypack Creek in 1997, prior to a wetlands creation project and very soon after the reclamation of land for a new recreation area, numerous interesting species were observed that are now apparently absent. These were Red-tailed Hawk, Osprey, Ring-necked Pheasant, Yellow Warbler, and Orchard Oriole in the eastern part of the site (the area now containing the constructed wetland) and Killdeer, Spotted Sandpiper, Bank Swallow, Tree Swallow and other interesting species in the new recreational area. While restoration of the wetlands may attract now-absent species, the mouth of the Pennypack in 1998 was less attractive to birds than the shrub/edge habitat that existed prior to the wetlands and recreation projects. Observations in the constructed wetland in the spring of 1999 indicated use by migratory shorebirds. Many of the shrubs and trees that had been providing cover in the recreation area have died or have been eliminated. With our knowledge about the historical importance of the wetlands at the mouth of the Pennypack Creek, monitoring of use of this area by migratory and breeding birds and efforts to improve the area are important.

Mollusks. Next to the Wissahickon, Pennypack Park has the best remaining native snail fauna in the Fairmount Park system, although the native fauna has been reduced. Historically, 10 native species of land mollusks were recorded from Pennypack Park, and 2 others, recorded from Bustleton and Valley Falls, may have also occurred in the park. Four of the ten native species were recorded in the 1998 survey (see Volume I). Three other native species were found in the 1998 survey, including two species of the family Succineidae which are found near wetlands. One of these, *Novisuccinea ovalis*, was formerly common in the Philadelphia area, but was found only at one site along Rockledge Creek. The other, *Succinea* sp. C, was found along Pennypack Creek near Rhawn Street. This species is currently known only from a few sites in the Pennypack, Wissahickon and lower Schuylkill drainages.

Four exotic species were found in Pennypack Park (see Volume I), only one of which had been recorded previously in the park.

Herpetofauna. Surprisingly few historical records of reptiles and amphibians from Pennypack Park were located (Appendix Table 9.1). Only 13 species (4 salamanders, 4 frogs, 2 turtles and 3 snakes) were reported. Given the range of habitats historically present in the park, virtually all of the local species (Appendix Table 9.1) could have occurred within the park.

Current information was provided by the assessments from 1998, the 1999 BioBlitz environmental festival, and by other observations during the 1998-2000 period. These assessments recorded 13 species (Appendix Table 9.2). These were mainly widespread species (redback and twolined salamanders, green frog, bullfrog, and snapping and painted turtles, northern water snake, Eastern garter snake and brown snake). Spring peepers were heard calling from the Rhawn Street wetland, and there are recent reports of peepers in wetlands above Verree Road. This species has become rare in the park. The red-bellied turtle was noted in the creek near Roosevelt Boulevard; this species is restricted to the southeastern corner of the state and is listed as threatened within the state. The introduced redeared slider was also recorded. The red salamander, pickerel frog and American toad have been recorded in the past, but were not found in this survey. However, the American toad reports are from the last few years, and it may still occur in the park.

Terrestrial Insects. Craneflies were sampled by light traps and sweep net samples at 13 sites in Pennypack Park in 1998. These collections are discussed in Volume I and summarized here. Different species of craneflies use different habitats, and the collections provide insight into habitat quality. Eight of the samples (Table 5.B.1) were comprehensive and allowed classification of stream, marsh/swamp, forest and meadow habitat quality. These results are generally consistent with

Table 5.B.1. Quality of habitats in Pennypack Park for craneflies, based on light trap and sweep samples.

Locality	ID	Stream	Marsh/ Swamp	Forest	Meadow	Notes
Rhawn Street woods	CF20	Poor	Excellent	Fair	None	
Three Springs Hollow	CF23	Excellent	Excellent	Good	None	open vernal and shaded seep wetlands
Krewstown Trib.	CF24	Good	Good	Fair	None	
Tabor meadow	CF26	None	None	Not rated	Poor	
Sedden's Run, and nearby woods and marshes	CF27	Poor	Excellent	Fair	None	
North of environmental center	CF28/29	Poor	None	Excellent	None	
Ballard Run	CF31	Poor	None	Good	None	
Rockledge Run	CF32	Poor	Excellent	Good	None	

the benthic macroinvertebrate, streamwalk and vegetation sampling. Three Springs Hollow was notable for the diversity of species characteristic of stream, vernal pond, and shaded seep wetlands, and provided good forest habitat, as well. The areas around Rhawn Street (which contain the large lizard-tail wetland), Rockledge Run (which has a nearby skunk cabbage wetland) and Sedden's Run (which has a large skunk cabbage-false hellebore wetland) also provided excellent marsh and swamp habitat. Except for the Three Springs Hollow and Krewstown Road tributaries, stream habitat quality was poor. The forest north of the environmental center was rated excellent quality for forest craneflies. No good meadow habitat was found within Pennypack Park.

Cranefly species were rated in terms of rarity, based on ongoing assessments of the craneflies of Pennsylvania. A number of species was collected which are found primarily in the southeastern part of the state, making their occurrence in the Fairmount Park system particularly important. Other species are widespread, but rare in the state. Seven of these local species and fourteen rare species were collected in Pennypack Park (Table 5.B.2). Three Springs Hollow and the Rhawn Street wetland area had the highest number of these species, although some of these were recorded at other sites, especially around Rockledge Run, Sedden's Run and the Krewstown tributary.

Benthic Invertebrates. Benthic macroinvertebrate communities in Pennypack Park were assessed in two ways. A cursory examination of rocks was done as part of the streamwalk. The results of this examination were incorporated into the stream quality index (SQI). The second type was a detailed, quantitative examination of invertebrates dislodged from a known area of stream bottom. These results are presented in Volume I, Section 4.E.8 and are summarized here. Quantitative samples were taken at 11 sites, including 1 in the mainstem Pennypack Creek, and in 10 of the larger tributaries. Tributaries included disturbed sites, such as Sandy Run and Fox Chase Run, and sites in less impacted forest, such as Three Springs Hollow, and tributaries 12/13 (right bank above Roosevelt Road).

The benthic macroinvertebrate data show the relationship between watershed disturbance, hydrology and biodiversity. The Three Spring Hollow site is clearly the highest quality site in Pennypack Park sampled by several criteria, including number of taxa, diversity, number of mayfly, stonefly and caddisfly taxa (EPT), and pollution tolerance scores (Appendix Tables A-7.1 to A-8.11). This site also had the highest number of taxa, diversity and number of EPT taxa of any of the sites sampled throughout the park system. This stream arises within the park and has numerous seeps indicating subsurface inputs of water. Most of the other creeks (Ballard Creek, Sedden's Run, Paul's Run, Wooden Bridge Run, Slater's run and Rockledge Run), which arise outside the park and are affected by urban/suburban storm flows are intermediate in macroinvertebrate community quality. Rankings among different criteria are not always concordant for these sites. For example, Paul's Run has moderately high diversity, but its taxa have a high pollution-tolerance rating, while Slater's Run shows the opposite pattern. Tributaries 12/13 showed the most discordant pattern. They had a relatively low total abundance, high number of taxa, and generally had pollution-intolerant taxa. However, they had only one EPT taxa. These tributaries are largely within the park and are located in one of the older patches of woods. However, they do receive drainage from the city. Sandy Run and the tributary at Fox Chase Farm had the most impaired macroinvertebrate communities, with low diversity, low evenness (i.e., dominance by a few taxa), none or only one EPT taxa, and high pollution-tolerance scores.

The proportion of different feeding groups of macroinvertebrates in the samples was calculated. As noted in Volume I, these trophic structures indicate disturbance at sites throughout the park. Shredders, which shred leaves and other coarse material, were rare or absent at all sites. Since this group normally represents a major pathway of forest production into stream systems, this indicates a major shift in stream biological function. The rarity of this group probably reflects low retention time of leaves; i.e., leaves are carried downstream quickly by storm flows. Similarly,

Table 5.B.2. Occurrence of significant cranefly taxa in Pennypack Park sites in the 1998 inventory. Codes for significance are 0 (common within range), 1 (uncommon; significant occurrence), and 2 (very significant). Codes for rarity are R (species found throughout PA but rare) and SE (species confined in PA to southeastern part).

Scientific Name	Significance	Rarity	Rhawn St	Trib 12/13	Three Springs	Krewstown trib	Tabor meadow	Sedden's area	Pennypack Env Center		Rockledge
			CF20	CF21	CF23	CF24	CF26	CF27	CF28	CF29	CF32
			light trap	sweep	light trap	sweep	light trap	sweep	light trap	sweep	sweep
Brachypremna dispellens	2	SE		X		X		X	X		
Dicranota cayuga	1	SE				X					
Dicranota eucera	1	SE			X						
Erioptera chlorophylla	1	R			X						
Erioptera megophthalma	2	R			X						
Erioptera needhami	2	R			X			X			X
Erioptera parva	2	R	X						X		X
Hexatoma albitarsis	1	SE						X			
Limnophila sp.	2	R						X			X
Limonia bryanti	2	R	X		X						
Limonia canadensis	2	R	X								
Limonia diversa	2	SE	X								
Limonia divisa	2	R				X				X	
Limonia domestica	0	SE	X		X						
Limonia globithorax	2	R			X						
Limonia longipennis	2	R					X				
Limonia tristigma	2	R			X					X	
Nephrotoma urocera	2	SE				X			X		
Pilaria imbecilla	1	R									X
Tipula oropezoides	1	R									X
Tipula spenceriana	1	R	X								
Number of rare species			4	0	6	1	1	2	1	2	5
Number of local (SE) species			2	1	2	3	0	2	2	0	0

scrapers, which scrape algae and associated organic matter from rocks and logs, and predators were also rare or absent. Filterers were variable, but tended to be more abundant in some of the less disturbed streams. Gatherers and collectors, which are more generalized in feeding habits, were predominant in most samples. The proportion of gatherers tended to increase with disturbance.

Fish. There are several sources of information on fishes of Pennypack Park. Henry Weed Fowler, a curator of fishes at the Academy of Natural Sciences of Philadelphia (ANSP) who lived in Holmesburg, collected fishes in the area in the period around 1898-1930. He (Fowler 1916) summarized fish occurrence in the nontidal creek, tidal creek, Delaware River and in ponds and ditches near the river (Table 5.B.3, see Appendix Table A-5.5 for scientific names of fishes). ANSP has a number of Fowler's specimens, although only 15 of the 38 species he reported from the Pennypack Creek are represented by specimens. Fifteen species are documented by these early records (Table 5.B.3). Most species are reported from the main creek, while 12 are documented from Sandy Run and 7 from what he called Willit's Run (based on his description, this may actually have been Wooden Bridge Run). Fowler noted 24 species in the creek above the dams. Most of these are widespread native stream species. These also include some introduced sport and aquarium fish: common carp, brook trout, bluegill, largemouth bass, smallmouth bass, and possibly chain pickerel. The chain pickerel is native to the region, but Fowler stated that the species was introduced to the Pennypack. He considered most of the introduced species to be uncommon. Five species (creek chubsucker, redfin pickerel, tadpole madtom, bridle shiner and golden shiner) are typical of vegetated streams. All of these have become less common in the region in recent years (Fairchild et al. 1998), although the golden shiner is still widespread. Fowler also reported the margined madtom, a riffle species which is not now present in most local streams.

More recent records come from the Pennsylvania Fish Commission and others (Table 5.B.4); these range from the mouth of the river (a few samples) to the vicinity of Lorimer Park, outside the city limits. Twenty-five species were recorded in these samples, two of which (Eastern silvery minnow and mummichog) were probably collected in tidal waters. The recent samples include some introduced species (brown trout, yellow bullhead, green sunfish, rock bass) and native stream species (longnose dace, spotfin shiner) not recorded earlier. The redfin pickerel (which Fowler noted as abundant) was collected at three sites in 1983. This species has become increasingly rare in the area. The records do not indicate a clear pattern of distribution within the creek, and there is not enough data to indicate recent temporal trends in fishes. For the 1998-1999 assessment, collecting was concentrated in the tributaries and near the mouth of the Pennypack Creek (Appendix Table A-6.4). Twenty-nine species were collected, with the increase from the earlier assessments reflecting capture of introduced species (rainbow trout, fathead minnow) and river fish (striped bass, white perch, gizzard shad) from the tidal part of the creek. The tributary collections were compared with collections from other streams in the region (Volume I and Appendix Table A-6.5). Considering tributary size, Rockledge, Paul's and Wooden Bridge runs had average or above-average species richness. This indicates that even though these streams are affected by storm water runoff, they are able to support native fish communities. However, the richness in these samples partly reflects the proximity of the park portions of these tributaries to the mainstem Pennypack Creek, which may act as a source fauna for fish. Sandy Run had virtually no fish (a few individuals of one species were captured) during the assessment. It was sampled following diversion of water from the creek to the sewage treatment system in order to control wastes from illegal storm-sanitary sewer connections, so the run had little flow at the time of sampling.

The collections after 1980 may be compared with the historical records. The fallfish, bridle shiner, golden shiner, and creek chubsucker (said by Fowler to be abundant) were recorded before 1931, but were not found in the more recent samples. Several other species noted by Fowler, but not represented by samples—the yellow perch (said to be widespread but not abundant), tadpole and

Table 5.B.3. Records of fishes of Pennypack prior to 1931, from Fowler (1916) and ANSP archived specimens. (Bust. = Bustleton; Holm. = Holmesburg; Rowl. = Rowlands.)

	Pennypack Creek from Fowler (1916)	Adjacent Delaware River from Fowler (1916)	Trib	Pennypack Creek				Pennypack Creek, Sandy Run		Sandy Run	Willet's Trib	Willits Run
			at Bust.	above Bust.	at Bust.	above Holm.	at Holm.	Holm.	Holm.		Rowl.	Rowl.
Brown bullhead	Common	Common					2			1		
American eel	Abundant	Abundant								1		
White sucker	Very abundant						8		1	6		1
Satinfin shiner	Very abundant						26		1	6	1	1
Creek chubsucker	Very abundant						6			3	1	1
Redfin pickerel	Very abundant						2					
Chain pickerel	Introduced; a few caught											
Eastern mud minnow		Locally abundant in pools and ditches										
Tesselated darter	Very abundant				1		10			2	1	2
Redbreast sunfish	Very abundant, mostly above tide				1		4			1		1
Bluegill		Several seen										
Pumpkin-seed	Abundant	Abundant					1					
Common shiner	Very abundant; occ. In tidal portion			1		1	16		1	6		
Bridle shiner	Common in creek and tidal creek						8		1	1		1
Spottail shiner	Common in larger streams	Common										
Golden shiner	Abundant in quiet water	Abundant in quiet water		1			11			2		1
Swallowtail shiner	Rare						1					
Blacknose dace	Very common brooks and small streams		1				5	1	1	9		
Creek chub	Creek, brooks and springs											
Fallfish	creek and spring-brooks, sometimes tidal						6			4		
Sea lamprey	A few adults	Abundant										
Atlantic sturgeon	Young in tidal river; now rare	Adults formerly common										
Shortnose sturgeon		Several seen										
Longnose gar	Reported c. 1898	Several reported										
Alewife	Formerly abundant in tidal reach; young in tidal ditches	Common										
Blueback herring		Present										
American shad	Several reported in tidal portion	Present										

Table 5.B.3 (continued). Records of fishes of Pennypack prior to 1931, from Fowler (1916) and ANSP archived specimens. (Bust. = Bustleton; Holm. = Holmesburg; Rowl. = Rowlands.)

	Pennypack Creek from Fowler (1916)	Adjacent Delaware River from Fowler (1916)	Trib	Pennypack Creek				Pennypack Creek, Sandy Run		Sandy Run	Willet's Trib	Willits Run
			at Bust.	above Bust.	at Bust.	above Holm.	at Holm.	Holm.	Holm.		Rowl.	Rowl.
Menhaden	Some in tidal portion	Juveniles reported										
Gizzard shad	Irregular	Irregular										
Brook trout	Introduced, apparently unsuccessfully											
American smelt		Small numbers										
Eastern silvery minnow	Sometimes in tidal portion	Common										
Common carp	Large ones in creek											
Goldfish		Ditches and sloughs										
White catfish	Occasional in tidal	Frequent										
Tadpole madtom	Local	Small numbers in estuaries along the river										
Margined madtom	Rare											
Mummichog	Abundant tidal	Abundant										
Banded killifish	Abundant	Abundant										
Four-spined stickleback		Extremely abundant in weedy bayous, tidal inlets, ponds and ditches										
Pirateperch		Occasional in tidal estuaries										
Bluespotted sunfish		Locally common in ponds and ditches										
Banded sunfish		Rare in ponds and ditches										
Smallmouth bass	A few seen											
Largemouth bass	A few seen											
Yellow perch	Widespread, uncommon	[probably present]										
Striped bass	Mouth of creek	Present										
White perch	Common in tidal	Common										
Hogchoker		Reported										

Table 5.B.4. Records of fishes from Pennypack Creek after 1941, from records of the PA Fish Commission and ANSP archived specimens. (N = native; I = introduced; L = probably incomplete sampling; M = moderate efficiency (intensive seining); H = high efficiency (shocking); s = emphasis on sport fish (some other species may not have been identified); h = identification of all fish; t = tidal river only.

Scientific Name		**Status**	**1941**	**1983**	**1981**	**1983**	**1983**	**1983**	**1995**	**1981**	**1998-1999**
	Rivermile		**0**	**1.94**		**5.13**	**7.03**	**8.36**	**10.69**	**Wooden Bridge**	
	Approximate location		**"tidal"**	**Frankford**	**Rhawn**	**Roosevelt**	**Krewstown**	**Verree**	**Lorimer**		
Dorosoma cepedianum	Gizzard shad	N									t
Ictalurus punctatus	Channel catfish	I sport									t
Ameiurus catus	White catfish	N									t
Ameiurus natalis	Yellow bullhead	I							x		
Ameiurus nebulosus	Brown bullhead	N				x	x				
Anguilla rostrata	American eel	N catad		x		x	x	x	x		x
Carassius auritus	Goldfish	I				x					
Catostomus commersoni	White sucker	N		x	x	x	x	x	x	x	x
Cyprinella analostana	Satinfin shiner	N	x		x				x		x
Cyprinella spiloptera	Spotfin shiner	N		x	x		x	x			x
Cyprinus carpio	Common carp	I				x		x			t
Esox americanus	Redfin pickerel	N				x	x	x			
Etheostoma olmstedi	Tesselated darter	N		x	x	x	x	x	x		x
Fundulus diaphanus	Banded killifish	N		x	x	x	x	x	x		x
Fundulus heteroclitus	Mummichog	N		x						x	x
Hybognathus regius	Eastern silvery minnow	N	x	x							t
Ambloplites rupestris	Rock bass	I sport									t
Lepomis auritus	Redbreast sunfish	N sport		x	x	x	x	x	x		x
Lepomis cyanellus	Green sunfish	I		x		x			x		x
Lepomis gibbosus	Pumpkinseed	N sport		x		x	x		x		x
Lepomis macrochirus	Bluegill	I sport				x					
Luxilus cornutus	Common shiner	N	x						x		x
Micropterus dolomieu	Smallmouth bass	I sport									x
Micropterus salmoides	Largemouth bass	I sport		x		x			x		t
Morone americanus	White perch	N sport									t
Morone saxatilis	Striped bass	N sport									t
Notropis hudsonius	Spottail shiner	N		x	x	x	x	x	x		x
Notropis procne	Swallowtail shiner	N			x				x		x
Pimephales promelas	Fathead minnow	I									x
Rhinichthys atratulus	Blacknose dace	N		x	x	x	x	x	x		x
Rhinichthys cataractae	Longnose dace	N				x					x
Onchorhynchus mykiss	Rainbow trout	Stocked									x
Salmo trutta	Brown trout	Stocked							x		x
Semotilus atromaculatus	Creek chub	N			x		x	x	x		x
Probable sampling efficiency			L	Hs	Mh	Hs	Hs	Hs	Hs	Lh	
Number of species			3	13	10	16	12	11	16	2	

margined madtoms (said to be rare), and brook trout (said to be introduced with little success)—were also not found. Two native species, the longnose dace and spotfin shiner, were not recorded in the earlier samples. The mummichog was reported in the nontidal parts of the stream, while historically it was limited to tidal waters. The longnose dace may be hard to catch by seining and may have been missed. The spotfin shiner has apparently expanded its range in this region (Horwitz 1982). A number of introduced species have become established or more common as well, based on the recent samples. Many of the species Fowler reported from the tidal portion of the creek were found in the 1998-1999 samples. However, none of the river herrings (American shad, alewife or blueback herring), the sea lamprey or the sturgeons were found in the recent assessment.

Fowler noted the presence of several species in the ditches near the Delaware River. These species were probably originally found in wetlands along the river, and were also able to inhabit the artificial ditches dug along the shore (see Section 5.B.2 and Fig. 5.B.3). The loss of the these species is primarily due to filling of these ditches and wetlands. While some of these species still occur in remaining wetlands along the Delaware River in Pennsylvania, they are absent from most remaining areas. They may be restricted from many sites by introduced sunfish, such as the bluegill.

5.B.3.5. **Stormwater/Streams**

Ninety-five percent of the Pennypack Creek watershed lies outside of the park boundaries and sixty-one percent of this watershed is classified as urban land cover. This means that most of the water being contributed to the Creek is not controlled by the park. There are approximately 18.3 miles of river/stream within the park boundaries, including 10.8 miles of the mainstem Pennypack Creek and many small tributaries that flow directly into the creek. The mainstem Pennypack Creek was not included in the stream assessment (streamwalk/SQI) since the majority of the Creek's drainage area is outside the park and restoration activities within the park would have little impact on the overall ecological health of the Pennypack Creek. However, three intact dams exist on the mainstem as it flows through the park, each of which are addressed in the recommended restoration activities.

A stream in Pennypack Park impacted by stormwater.

Most of the Pennypack Creek tributaries within the park have significant watershed areas outside the park. These watersheds are highly urbanized. When a watershed is developed or urbanized, the supply of water and sediment to stream channels changes dramatically. Peak discharges and runoff volumes increase as water quickly runs off of paved surfaces. Less water infiltrates into the ground, and so less water reaches the stream through the groundwater, thus reducing the amount of water during low flow periods. Stream channels in suburban and urban areas respond to these changes in several ways. Increased storm discharges promote channel erosion, which results in increased channel size and decreased channel roughness (see Appendix B-5; Pizzuto et al. 2000). As the stream incises, the floodplain becomes progressively more isolated, the water table is lowered and floodwaters are less able to interact with the riparian or streamside ecosystem. Scour also causes reduced development of pool/riffle topography that provides important habitat for aquatic organisms. These changes often lead to stream instability which is characterized by abrupt, episodic, and progressive changes in the stream geometry. Unstable channels can destroy property, damage structures, reduce water quality, diminish aquatic (and terrestrial) habitat, and degrade aesthetic quality.

Few restoration activities are proposed for the larger tributaries since these activities within the park have little ecological benefit. However, restoration can have a significant impact on the many smaller streams that are affected by localized impacts, including lack of riparian forest, invasive plants, road drainage, poorly designed culverts, debris dumps, and trail/stream crossings.

About 74% of Pennypack Park consists of natural lands, which are those areas that are not mowed or managed on a regular basis. However, many trails run throughout this park that are used for recreational activities and there are several sites where the trail/stream intersections are negatively impacting the stream. At these stream crossings, the most common problems are erosion and scour due to improperly designed bridges, or clogged culverts/pipes where the trail goes over or through the stream. In most of these instances, unclogging or removing the pipes and building span walkways across the stream to reduce the impact these crossings have on small streams is recommended.

The dams on mainstem Pennypack Creek include: Rhawn Street dam, Verree Road dam, and the Roosevelt Boulevard dam. These are non-natural elements that have significant effects on stream ecosystems. Potential effects include sedimentation in backwaters and reduction of sediment supply in downstream reaches, stream warming, and blockage of stream channels to migrations of organisms. Under present conditions, these dams have little water storage capacity, and the net effects of oxygen depletion in backwaters and aeration at spillways is unknown. Those dams that have started to collapse should not be repaired to their original structure. All three dams are recommended for modification or removal. However, removing the Roosevelt Boulevard dam may not be an option due to a nearby underground sewer line.

Gullies form when stormwater channelizes and causes hillslopes to erode. In Pennypack Park, stormwater runoff from street intersections and neighborhood runoff are contributing to the formation of gullies at several locations. These gullies carry large flows that are contributing significant amounts of sediments to Pennypack Creek and its tributaries. It is recommended that the stormwater drains be checked at certain locations and other methods investigated to detain and divert storm runoff to avoid further erosion and deepening of the gullies.

Daylighting refers to the excavation and restoration of a stream that has been buried in an underground culvert, covering, or pipe. When a stream is underground, it does not function as a stream. By daylighting a stream, it is reborn and can support aquatic life. Two sites have been identified in Pennypack Park where daylighting would benefit the health of the streams.

In addition to the physical, water quantity-related problems, several tributaries in Pennypack Park have severely degraded water quality. Although water quality is not specifically addressed by this restoration plan, it did arise as an issue for this park. A source of sewage to the streams arises due to cross-connections caused by faulty plumbing. Cross-connections result when the household sewage drain is inadvertently or intentionally connected to the storm drain instead of the sanitary sewer system, resulting in untreated wastewater reaching the stream during dry periods, as well as during storms. The Philadelphia Water Department has an ongoing program to locate and fix cross-connection problems. Sandy Run had major cross-connection problems, and the Philadelphia Water Department has diverted the flows until the cross-connections can be found and corrected.

A Stream Quality Index (SQI) was developed to reflect the condition of distinct stream reaches throughout the Fairmount Park system. The SQI is based on three important characteristics: 1) stream geomorphology; 2) aquatic habitat; and 3) riparian or stream-side condition. A detailed methodology is provided in Section 5.C.4.1 of Volume I.

The resulting index allows for a comparison of the condition of any stream in the Fairmount Park system. Stream geomorphology, aquatic habitat, and riparian condition were weighted evenly and the final scores ranged from 0 to 300 representing bad to good, respectively. The resulting scores were divided into equal categories representing stream quality (Table 5.B.5). In addition, the

Table 5.B.5. Stream Quality Index categories and results.*

Stream Quality	Stream Quality Index Range	Number and % of Reaches - Fairmount Park System	Number and % of Reaches - Pennypack Creek Park
Severely Impaired	0 to 75	11 (3%)	1 (1%)
Impaired	76 to 150	164 (38%)	38 (49.5%)
Moderately Impaired	151 to 225	248 (58%)	38 (49.5%)
Slightly or Non-impaired	226 to 300	3 (1%)	0 (0%)
Totals	0 to 300	426 (100%)	77 (100%)

* This index and the number of stream reaches does not include FDR Park.

resulting SQIs for Pennypack Park stream reaches are presented visually in Steam Quality maps in Volume II, Section 5.F.

Of a total of 77 reaches in Pennypack Park, all but 1 are impaired (49.5%) or moderately impaired (49.5%). None of the stream reaches was classified as slightly or non-impaired. One reach on the stream that flows through Fox Chase Farm was categorized as severely impaired. Because of the number of streams in Pennypack (34 including the mainstem Pennypack), the following discussion has been broken down into 3 sections according to geography. In the following discussions, names have been given to apparently unnamed streams based on nearby street names.

Fox Chase Farm to Krewstown Road. The streams in the northern portion of Pennypack Park include (from north to south): Fox Chase Run, Ballard Run, Rockledge Brook, Paul's Run, Verree Creek (Tributary 2), Hower Creek (Tributary 1), Tabor Creek (Tributary 6), Slater's Run, Sedden's Creek, and Tustin Creek, which is a tributary to Sedden's Creek (Tributary 3). This portion of the park includes three streams that are entirely in the impaired SQI category: Fox Chase Run, Hower Creek (Tributary 1), and Tabor Creek (Tributary 6), with Fox Chase Run having one reach that is severely impaired. The remaining streams have an SQI of moderately impaired to impaired.

Fox Chase Run flows through an educational farm in the park. The stream is being impacted by cattle trampling in the stream and on the stream's banks. In addition, the benthic macroinvertebrate (aquatic insect) survey suggests that nutrient runoff (most likely from animal wastes) is a water quality issue in this stream. A minimal riparian buffer of about 5 feet currently exists on each side of the stream. A restoration activity is recommended to fence the cattle out of the stream channel entirely or install a cattle crossing to prevent degradation of the stream channel and bank erosion. In addition, it is recommended that the forested buffer along this stream be increased to at least 35 feet.

Rockledge Brook begins as moderately impaired but becomes impaired as it nears the mainstem Pennypack. Near its confluence with Pennypack Creek, the left bank is currently being mowed to the edge of the stream, preventing riparian forest vegetation from taking root and stabilizing the stream banks. In addition, there is a new housing development along which a small tributary leading down to Rockledge Brook has been buried in a pipe. This small tributary has been recommended for daylighting or re-reouting (S20.01) for the 100 meters where it is underground to help restore the natural flow of the tributary and provide habitat for aquatic life.

No restoration activities are recommended for Paul's Run (moderately impaired) or Verree Creek (Tributary 2) (impaired). Much of the Paul's Run watershed is outside the park and restoration activities within the park would not significantly improve the aquatic ecosystem without first

addressing water quality and quantity problems originating outside the park. Verree Creek (Tributary 2) runs next to an open field and the surrounding forest is heavily disturbed with invasive species. The stream is adjacent to a wetland area and downslope of a horse trail.

Hower Creek (Tributary 1) was found to be impaired. It starts with a culvert in a managed area and has gray water (an indicator of sewage). In addition, there is trash dumping in the stream, and it flows through a culvert just before its confluence with the Pennypack to allow for a trail crossing. The trail crossing is in good condition and should be maintained. Trash removal is recommended for this stream.

Slater's Run has standing water with some sewage in it at the top of the stream below a culvert. The streamside vegetation is overgrown with Japanese knotweed and erosion is occurring. It has an SQI of moderately impaired to impaired and overall has low restoration potential.

Sedden's Creek is a large tributary that is heavily impacted by increased stormflows caused by urbanization in the watershed outside the park. The creek has an SQI rating of moderately impaired to impaired. The macroinvertebrate analysis indicates that habitat restoration will not significantly improve the diversity of benthic communities in this stream until water quality and quantity issues are addressed. However, Sedden's Tributary 1, which has an SQI of moderately impaired to impaired, has some good quality skunk cabbage wetlands, but is in need of protection and monitoring, as well as trash removal. The stream has an inactive floodplain but a new floodplain seems to be forming in the channel. The surrounding forest is moderately disturbed. Tributary 3, which is also a tributary to Sedden's Creek, starts as a nice spring out of bedrock with a wetland area. Along its length are numerous streamside skunk cabbage wetland areas. The stream is moderately impaired and has been recommended for protect/monitor as well as 5-10 yards of daylighting (30.01) where it goes underground just before reaching Sedden's Creek.

Finally, within this upper portion of the park, the modification of the Verree Road dam is recommended, e.g., by removing the middle of the dam to restore the obstruction. Removal of the obstruction created by the dam will improve the health of the mainstem Pennypack Creek.

Krewstown Road to Roosevelt Boulevard. The streams in the middle portion of the park include (from north to south): Krewstown Creek (Tributary 15), Agusta Creek (Tributary 5), Three Springs, Tremont Creek (Tributary 4), Horrocks Creek (Tributary 12), Benton Brook (Tributary 13), and Shriners Run (Tributary 14). No restoration activities are recommended for Tremont Creek (Tributary 4), Agusta Creek (Tributary 5), Horrocks Creek (Tributary 12), and Benton Brook (Tributary 13) since they are heavily impacted by urban runoff from outside the park and have signs of raw sewage contributions. However, Shriners Run (Tributary 14), Krewstown Creek (Tributary 15), and Three Springs were all classified as moderately impaired and have restoration potential.

Krewstown Creek (Tributary 15) is a small stream (about a 1.5-foot wide channel) and was found to have a healthy benthic macroinvertebrate community. This stream is recommended for protect/monitor status. However, there is a trail/stream crossing issue where all-terrain vehicles are being driven across the stream. Control of all-terrain vehicle access and trash removal is being recommended for this site (S30.02). Finally, correction of an erosion gully that is occurring due to stormwater runoff from Krewstown Road (S30.03) is recommended.

While Three Springs has signs of sewage contamination and there is evidence of deer damage in the adjacent forest, it is surrounded by skunk cabbage and small wetlands. This area was found to be good salamander habitat, had a very good macroinvertebrate community and is recommended for protect/monitor status. In addition, the stream health should be improved through additional native plantings in the riparian zone once deer are controlled.

Shriners Run (Tributary 14) is only moderately impaired and has stream/trail erosion issues. It is recommended that a spanning walkway replace the existing culvert to prevent further damage to this stream.

Also in this section of the park, the Roosevelt Boulevard dam is recommended for removal or modification. In addition to the typical impacts caused by dams in streams, such as altered sediment supply, stream warming, low dissolved oxygen, and fish blockage, erosion below the dam along a trail is resulting from overbank flow around the dam during high flows (S50.03). However, a sewer line crosses the Pennypack Creek just upstream of this dam and more information is needed to ensure that the sewer line would not be affected by dam removal or modification.

Roosevelt Boulevard to the State Road. The streams in the bottom portion of the park include (from north to south): Bluegrass Creek (Tributary 11), Axe Factory Tributary, Albion Creek (Tributary 10), Loney Creek (Tributary 9), Sandy Run, Meehan Creek (Tributary 8), Winchester Creek (Tributary 7), Wooden Bridge Run, and Willits Run. Several of the streams in the lower portion of Pennypack Park are in fairly healthy condition and slated for protect/monitor status (Winchester and Loney creeks). Other streams in this portion of the park are in poor health, but restoration activities have been identified. And, finally, many of the streams in this portion of the park are in terrible shape (sewage and stormwater impacts) and no restoration activities are recommended (Axe Factory, Sandy Run, and Wooden Bridge Run).

Winchester Creek (Tributary 7) begins as a groundwater seep with native wetland species surrounded by a nice forest. The watershed for this stream is mostly within the park and it is, therefore, not impacted by urban stormwater runoff. Unfortunately, some trash and yard waste dumping is occurring. Along with protect/monitor restoration activity being recommended for this stream, a spanning walkway is recommended where the trail crossing this stream is currently clogged and causing a disruption to the stream hydrology and sediment transport.

Loney Creek (Tributary 9) is a small, moderately impaired stream worth protecting and monitoring as a restoration site. A spanning walkway or bridge is recommended where this stream meets the trail to prevent negative impacts (S80.02). There is a nice wetland just above the trail along this stream. An additional restoration activity for this stream is the prevention and repair of a gully forming at the intersection of Lexington Avenue and Rhawn Street (S80.01). Another gully at this road intersection which is eroding towards the mainstem Pennypack Creek is also recommended for prevention and repair (V70.06).

Albion Creek (Tributary 10) and Bluegrass Creek (Tributary 11) are in poor condition but have been recommended for stormwater outfall repair and riparian forest restoration, respectively. Albion Creek (Tributary 10) is head-cutting and incising, creating 15-foot banks as a result of stormwater runoff. The head-cutting has undermined the stormwater outfall near Winchester Avenue, the outfall structure has crumbled, and there is a huge drop from the culvert to the stream bottom. A structural repair and energy dissipation at this outfall is recommended. Bluegrass Creek (Tributary 11) is impaired and the stream channel and banks are lined with concrete. This is a typical urban stream with very low flows and high stormflows. Bank regrading and riparian forest widening is recommended at the top of this reach near Winchester Avenue and Bluegrass Road.

Meehan Creek (Tributary 8) is a very small stream (approximately 20 feet in length and 1 foot across) that starts as a groundwater seep. A trail cuts across the stream and a spanning walkway is recommended to prevent further impacts on the stream. Willits Run flows through the park for a short distance before entering Pennypack Creek and is recommended for trash removal.

Within the lower part of the park, removal or modification of the Rhawn Street dam is recommended. This restoration activity would allow fish to move upstream from the Delaware River to the upper Pennypack Creek.

5.C. APPLICATION OF RESTORATION GOALS

5.C.1. Overview

Pennypack Park is almost continuous from the mouth of the creek to the city border, where it connects with park land outside the City of Philadelphia. About 74% of the park is natural land, and the 1,300 acres of natural land make it second only to the Wissahickon in natural land in the park system. The lands are predominantly forested, with a mix of floodplain, slope and upland forests. However, the uplands also contain bluestem meadows and shrubby old fields. The park also has a variety of wetlands, including skunk cabbage seeps, different kinds of marshes, and intertidal wetlands at the mouth of the creek.

Most park lands were incorporated in the early 20th century, with some more recent additions. Much of the park was farmed prior to incorporation, so the majority of the forest is recent regrowth. As a result, much of the forested lands are relatively even-aged and dominated by a few tree species, although the overall tree diversity of the park is high. Overall, shrub and herbaceous diversity is also relatively high over the entire park, but many sites have either little understory or few species. This pattern probably reflects severe effects of deer browsing, as well as the former agricultural use of large areas.

Many tributaries of the Pennypack Creek arise in urban areas outside the park and are affected by storm water runoff. Almost all were rated as impaired or slightly impaired (see 5.B.3.5). Slope and trail erosion are also severe in many places.

A number of restoration activities are recommended to enhance the natural lands of Pennypack Park. Based on the size, diversity and condition of different types of natural lands in the park, major objectives for restoration should be:

- Enhancement of forest flora and fauna. The presence of some relatively old patches of woods, often surrounded by younger patches, provides potential for large, nearly continuous woods, including upland, slope, seep and floodplain components. Control of deer browsing will be essential to enhance shrub and herbaceous layers of woods and allow for regeneration of canopy tree species. Without control of the deer population, deer exclosures could provide for the preservation of small areas. Activities to enhance forests include control of invasive plants, planting of native species, erosion control, and enlargement of forest areas. With reduced deer numbers and control of invasive plants, continued maturation of young woods can be expected. Shrub and herbaceous planting can increase the native biodiversity of the woods, including the re-introduction of species locally extirpated from the park. Reduction of the amount of mowed lawn and management of forest edges will also enhance park forests.
- Preservation and enhancement of the various types of wetlands. The park contains a variety of wetland types, preserving perhaps the greatest diversity of wetland flora in the city, as well as supporting numerous animals. Enhancement by control of invasive plants and control of hydrology will be valuable.
- Maintenance of the early successional habitats. Pennypack Park contains several areas of old fields and meadows, providing an increasingly uncommon habitat in the city. These should be maintained by mowing, burning or cutting to promote native species.
- Protection and enhancement of high quality sites. Various activities should ensure the preservation of high quality sites, such as the forest, wetlands and stream at Three Springs Hollow; the wetland, creek and woods at Rhawn Street; the woods and wetlands in the park around Verree Road; and the intertidal wetlands at the mouth of the Pennypack Creek.

- Amelioration of impacts of human use of the park. Control of gullying along slopes at the edge of the park, control of trail erosion on slopes and banks, improvement of trail crossings, closure of some rogue trails, construction of durable access points for anglers and other users, reduction in dumping, and management of forest edges will help sustain the natural lands of the park.
- Enhancement of tributary streams and the mainstem Pennypack Creek. Modification of the three dams on the mainstem Pennypack (Rhawn Street, Verree Road, and Roosevelt Boulevard dams) is recommended, pending more detailed feasibility studies. Dams are non-natural elements that have significant effects on stream ecosystems. Potential effects include sedimentation in backwaters and reduction of sediment supply in downstream reaches, stream warming, and blockage of stream channels to migrations of organisms. However, restoration can have a significant impact on the many smaller streams that are affected by localized impacts, including lack of riparian forest, invasive plants, road drainage, poorly designed culverts, debris dumps, and trail/stream crossings.

5.C.2. General Restoration Activities

5.C.2.1. Exotic Control

A habitat type that is becoming increasingly common in the Fairmount Park system is the exotic-dominated forest, shrubland and riparian zone. Exotic species are defined as those species which have been intentionally or accidentally introduced into an area outside its natural range. These species are most frequently found in open areas—forest edges, canopy gaps, along streambanks and riparian zones—but also occur in the herbaceous and shrub layer in forests with native canopy species and on disturbed slopes. Exotic species that were found invading natural lands in Pennypack Park during the 1998 survey are included in Appendix A-1.1 in Volume III. Exotic species of concern out-compete native plants for resources and can become very aggressive. The control of these species applies to all areas of the park system, since exotic species are well established in each of the parks surveyed. The control of exotic species can be labor-intensive, and volunteer help can be effective. However, volunteer control may not be effective at some sites, such as those with poor access, or for techniques such as herbicide application. The method of control is dependent upon the species involved and can include cutting, burning, herbiciding and/or covering the area with plastic (DeLoach 1997, FNPCI 1998). Replanting of native species is highly recommended in areas where exotic removal has taken place, in order to increase shade and decrease reestablishment of exotics. However, exotic control is valuable even where planting is not feasible immediately, to prevent further spread into adjacent areas. This is particularly important around areas with restoration plantings. In the list of restoration activities, exotic/invasive control refers to control without planting.

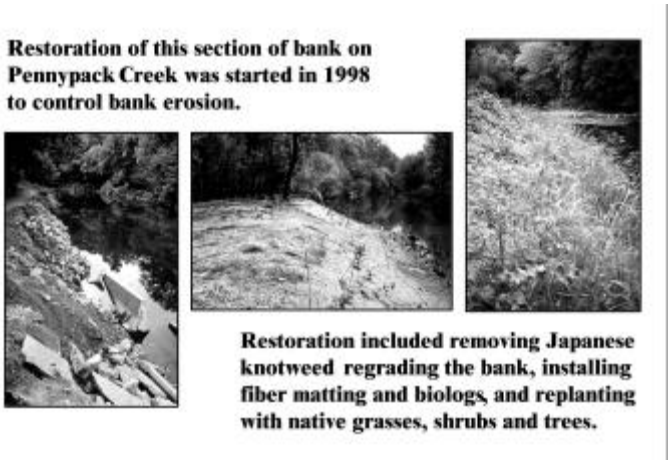
Exotic trees thrive on the edge of the woods and can out compete native species.

Sites where exotic control has been initiated must be monitored following control. New shoots of exotic growth should be pulled to prevent further invasion. Due to the aggressive nature of most exotic species, it is essential that monitoring activities be well-planned and followed. Repeated application of control measures may be necessary for some species.

5.C.2.2. **Planting**

Debris in Ballard Run.

Planting of native trees, shrubs or herbaceous species is a primary restoration technique for different habitats throughout Pennypack Park. While natural regeneration can provide new growth in many situations, planting can provide more rapid development of shade to reduce growth of exotics, more rapid cover to reduce erosion, and provide species which are unable to colonize the site. Typically, planting is done in sites that have been cleared of exotics. In the classification of restoration activities, it is assumed that control of exotics will be necessary prior to planting in most cases. Planting is also recommended to restore vegetation as part of erosion control on slopes (see Section 5.C.3.3), to counteract browsing damage by deer, and following control of other disturbances.



Stream bank restoration and planting in Pennypack Park.

Selection of plants should be based on the habitat conditions of the site. A list of native species which are suitable for the Fairmount Park system and the habitat requirements and resource demands for each are given in Appendix C-1 in Volume III. Selection of the type of stock to use (e.g., seeds, plugs, size of tree, bare root or balled root) will depend on the species to be planted, site conditions (e.g., risk of deer damage), site access and other logistical issues (Sauer 1998). Fencing, tubes or planting large stock may be necessary in Pennypack Park where deer browsing is a problem. Soil preparation, e.g., tilling and mulching, may be desirable to improve planting success and reduce weeds. Follow-up maintenance, such as watering and weeding, can also increase planting success.

In the categorization of restoration activities, planting is designated where it is the primary restoration activity. Planting is also routinely part of other restoration activities, such as gully repair and wetland creation. *Forest planting* involves planting a mix of trees, shrubs and herbaceous plants and is appropriate on newly cleared areas. *Tree planting* is recommended to increase representation of specific tree species in existing forests or canopy gaps in forests, to establish riparian woods on unforested flood plains, to provide shade and cover to control exotics to and reduce erosion. *Shrub planting* may be done to improve understory conditions and introduce specific species of shrubs. *Herbaceous planting* is recommended for establishment of meadows and to improve understory diversity in areas where herbaceous diversity has been reduced.

5.C.2.3. **Trash**

In the Fairmount Park system, trash includes a wide and varied array of items. It can range from litter in the form of garbage to dumping of used automobiles and large appliances. There are established dump sites within the natural lands of Pennypack Park. If an area appears to be a dump, it will seem an acceptable place to dispose of unwanted household appliances, yard waste and vehicles and the boundaries of these sites will eventually expand into natural lands. Piling of waste is not only unsightly, but it also compromises ecosystem integrity. Soils will become covered and/or compacted in the area, which will prevent growth of vegetation. Canopy gaps are also created which opens the area to sunlight, providing sites for exotic plant species which thrive in disturbed soils and full sun. Yard waste, containing seeds and root fragments of invasive plants, also adds to the

presence of exotic species. The first step in this activity is to block access to such sites, such as by controlling access with permanent structures at points of entry. Cleanup can be an opportunity for volunteer groups, if the cleanup does not require heavy machinery or dangerous equipment. Removal of all debris from the site and proper disposal off site is required. Since the area will most likely be inundated with exotic species, replanting of natives should not begin until the exotics are removed and disposed of off site. Tilling the soil should not be done since an exotic seed bank will be present and this could cause regrowth of exotic species. The soil should not be left exposed or unplanted as this provides aggressive species with the opportunity to invade the area. The site should be replanted with native species that are appropriate for the habitat type which would have naturally occurred in the area. This type of restoration, as with other heavily disturbed areas, needs to be monitored consistently. Any exotics that may grow back must be killed in order to ensure the success of the native plantings.

5.C.3. Habitat-Specific Restoration Activities

5.C.3.1. Forested Uplands

Forested uplands have been fragmented in recent years by adjacent construction activities, overall development and park landscaping. Forest regrowth is occurring on some formerly cleared or mowed areas. These sites may show long term effects of the earlier disturbance, and they may be vulnerable to exotic species. Not only does the forested upland habitat type support plants and animals, it also acts as a buffer for storm water runoff and prevents slope erosion.

Both natural and anthropogenic influences on forested uplands have affected the stability of the Pennypack Park woods. In areas where trash dumping and encroachment of recreational activities are issues, the wooded areas become fragmented, creating open habitat for exotic, aggressive plants, including trees such as Norway maple and vines. Although the canopy in these areas may persist, there will not be any regrowth of the understory and herbaceous layer once exotic species become established. There are a number of sites in Pennypack with these conditions, such as the edge at the Pine Street Recreation area, the edges of the stables and dumps on the east side north of Krewstown Road, and along mown upland edges throughout the park.

Woods near Lexington Avenue.

Restoration in forested uplands is recommended to increase biodiversity of forested flora and fauna. In addition to exotic control, replanting and trash removal, the following activities can be included as restoration actions in the forested upland habitat: protection of high quality areas, repairing gullies and increasing forest area by decreasing the area that is currently mowed or managed, and replanting.

Protection and monitoring are activities that should be performed at sites which are presently considered high quality woods. Protect/monitor (referred to as protect/enhance in chapters 1 and 2) includes monitoring the site for any evidence of exotic species, trash or other disturbances. The goal of the protect/monitor recommendation is to recognize the area as a high quality site and to protect it from development or degradation. For example, a patch of persimmon trees, which are rare in the park system, is present on the north side of Krewstown Road (V30.14) and should be protected and monitored.

Repairing gullies, which are usually caused by storm water runoff and vehicle damage, helps to protect the forest from further erosion and allows native plants to regenerate. Control of the source of erosion will be necessary, followed by filling the gully with clean soil and replanting with native tree saplings and shrubs. This soil should not be obtained from another site within the park because

it may contain root fragments and seeds of non-native species. Stabilizing slopes by regrading or placing berms at the top to control storm water runoff is usually necessary. Gullies are present in many places in Pennypack Park, especially in the area below the Roosevelt Boulevard. For example, gullies on either side of the intersection of Rhawn and Lexington streets affect good quality woods and wetlands.

Releasing mowed areas can be done simply by mowing the area less frequently. This creates a tall grass buffer adjacent to forested areas, which aids in erosion control. Over time, if exotics are controlled, succession will occur and a forested area will be present in an area that was formerly turf grass. For example, restoration site V60.02, located between Roosevelt Boulevard and Holme Avenue off of Walnut Hill Street, is a maintained lawn which should be released from maintenance. Releasing the area would help control slope erosion as well as adding natural lands to the park.

The benefits of restoration in forested areas include creating habitat and increasing biodiversity, since small patches of woods do not provide suitable habitat for many animal species. Replanting or removal of exotics in any area requires monitoring of the site. Restoration areas should be protected from vandalism by barriers and community members should be made aware of the restoration and the expected outcomes so they can participate in the monitoring efforts.

5.C.3.2. **Non-forested Uplands/Meadows**

Non-forested uplands restoration includes lands which are not wetlands, forests or riparian zones. More specifically, non-forested uplands includes edges of forests, where invasive and exotic plants can dominate, meadow habitats, where herbaceous plants and forbs are dominant, and managed (e.g., mowed) lands which are no longer actively used.

Forest edges in Pennypack Park, such as the one located at the intersection of Bloomfield Avenue and Pine Road (V20.11), are often highly disturbed, as they are typically small and linear and are adjacent to lawns, highways and structures which are often targets for trash dumping and vandalism. These areas are susceptible to invasion by exotic species, which are able to thrive in a broad range of habitat types with varying environmental conditions, especially in unshaded areas. Edges are examples of places where exotics can outcompete native species for available resources, since natives are less tolerant of disturbances. This poses a problem, since the edge of a forest acts as a buffer for the interior of the woods. If the perimeter of the woods hosts exotics and fragmentation of wooded areas continues, the interior of the forest will be negatively impacted, as the seed source for exotics is present. However, if the edge is managed effectively, it can serve as a first line of defense against disturbance in healthy stands of forest. Well-managed edge habitats can also provide foraging areas for some woodland species (e.g., butterflies feeding on flowers) and habitat for a variety of species. Common species presently found along the edge of wooded areas in Pennypack Park include non-natives such as tree-of-heaven (*Ailanthus altissima*), princess tree (*Paulownia tomentosa*), Norway maple (*Acer platanoides*), paper mulberry (*Broussonetia papyrifera*), white mulberry (*Morus alba*), multiflora rose (*Rosa multiflora*), wineberry (*Rubus phoenicolasius*), Japanese stilt grass *(Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), oriental bittersweet (*Celastrus orbiculatus*), and natives such as box elder (*Acer negundo*), grape vines (*Vitis* spp.) and poison ivy (*Toxicodendron radicans*). The exotic invasive vine, mile-a-minute (*Polygonum perfoliatum*), is spreading within the park, mainly along edges.

A meadow near Krewstown Road.

Meadows are an under-represented habitat type in the Philadelphia area. Where present, they can support a wide variety of bird species and invertebrates which may otherwise be absent from an

urban setting. These sites are open and are often located near major roads or trails making them accessible to vandals. In order to preserve this habitat type in the landscape, we must take an active role in maintaining lands as open meadows and preventing them from succeeding into wooded areas or being destroyed by vandalism. In Pennypack Park, an example of a natural meadow can be found between Verree Road and Bustleton Avenue, along the railroad corridor, in the vicinity of Three-Springs Hollow (V40.03). Species present in this area include goldenrods and asters as well as exotics such as Japanese barberry and wineberry. It is recommended that this site be managed as a meadow by possibly burning in the spring.

In an undisturbed area, succession is a natural process in which one group of species replaces another group over a given period of time, following fire or some other natural disaster, which acts as a catalyst. Following the disturbance, grasses, along with annual and some perennial herbaceous plants, will typically be the first community type to become reestablished in the landscape. Perennial herbaceous species will increase over time, followed by replacement woody species such as shrubs and small trees. These, in turn, will be replaced by large trees, including large specimens of some mid-successional species such as tulip poplar, plus late successional species. Eventually, if no other disturbance occurs, a closed canopy will result. In areas of disturbance, where land was used for agriculture or development and where fire has been suppressed, the natural process of succession has been interrupted and exotic plants have outcompeted native species. Exotic species occur frequently in areas of high soil fertility, such as abandoned agricultural fields and disturbed areas. The vegetative community composition is dependent upon the level of disturbance and the length of time that the area has lacked a management regime. It is currently not known whether these exotic-dominated old fields will eventually be replaced by late successional stages with more native species, or whether the exotics can arrest or greatly delay successional patterns.

Non-native forbs such as goutweed (*Aegopodium pedagraria*), garlic-mustard (*Alliaria petiolata*), Canada thistle (*Cirsium arvense)*, purple loosestrife (*Lythrum salicaria*) and lesser celandine (*Ranunculus ficaria*), as well as non-native grasses such as Japanese stilt grass (*Microstegium vimineum*) and Kentucky bluegrass (*Poa pratensis*) take advantage of these open habitats and will outcompete native mustards (*Brassi cceaea*), milkweed (*Asclepias syriaca*), butterflyweed (*Aeslepias tuberosa*), composites (asters, goldenrods, etc.), native grasses such as bluestems, rushes, and sedges.

Areas which are not presently used for recreation, but are being mowed, could be managed as meadows by mowing infrequently and possibly burning the area to promote plant diversity. Replanting of these areas is also recommended to establish native species and deter exotic species.

Restoration Activities. The actions recommended as part of the restoration plans for non-forested uplands are grouped and described according to their functions in the following paragraphs.

Protection of natural lands is the first step in restoring and maintaining native biodiversity. High quality meadows and forest edges need to be protected from exotic invasion and should also be monitored to ensure against future disturbance. Other types of activities include control of invasive plants, replanting, management to maintain meadows (prevent forest succession), trash removal, control of access, and storm water management. Activities which are similar to those in other habitats are discussed elsewhere in this document.

Protection:

Protect/Monitor- This action is recommended for meadows and edges that presently support native plant and animal species and do not appear to be disturbed. These sites are shown on the Restoration Sites Map in Section 5.F and should be protected from any human impact. They should also be monitored for human disturbance and invasion by exotic species.

Active Management:

Edge Management- The recommendation for edges is to remove the exotic vegetation and replant the area with more appropriate native species. It is also recommended that trash be removed from these areas and gullies be repaired. Gullies lead to erosion and create niches which can only be suitable for exotics. Because edges are located next to roads and developments, gullies caused by storm water runoff are abundant in these areas. It is recommended that the basic storm water runoff issue be addressed and the gullies repaired, as they will have an effect on the interior of the forest if left alone. Conifers (e.g., red-cedar) may be planted along edges to shade the forest.

Release/Widen- This action is recommended for lands that are currently mowed, but are not actively being used for recreational purposes. Depending on the adjacent land uses, and visual aesthetics, different management regimes may be used for released areas. Infrequent mowing of an area will promote the growth of native plant species and prevent succession by trees and shrubs. Any decrease in the frequency of mowing can increase the height and diversity of vegetation and increase water retention. Mowing only once a year will suppress trees, but allow herbaceous cover. These areas can act as buffers to woods, wetlands and riparian zones. Alternately, mowing may be stopped and the area may be planted with trees or shrubs or allowed to revert to forest. Monitoring for invasion by exotic species should be done in release areas. Planting release sites is advisable to reduce open space for exotics. Once areas are released, management options are similar to those for the following activity, meadow management.

Meadow Management- This is recommended to maintain existing meadow sites. The action promotes the protection of established meadows by seasonal mowing, burning, or tree removal. Meadow management encompasses the removal of exotics and the replanting of natives, prescribed burning, preferably in the spring and managed mowing to be performed once a year. Trees can be hand-cut or girdled to prevent forest succession. This can be done by volunteers and in areas inaccessible to mowers. These activities can enhance existing meadows. These meadows will provide habitat for native fauna and will protect adjacent slopes and forests from the negative impacts of storm water runoff. A management plan for maintaining an area as a meadow must be drafted and followed throughout the year or the area will once again become inundated with exotic species and trash. Barriers and signs should be place around the restored area to make community members and users of the park aware of the many benefits of open meadow habitats and to avoid the perception that these areas have been abandoned.

Replanting and Exotics Control:

Invasive/Exotic Control- This action is recommended in those areas where there are local invasive/exotic issues, the removal of which would promote native vegetation regrowth. This does not include any replanting. For example, this is recommended to reduce the spread of mile-a-minute. Invasive/exotic control in sites adjacent to planted restoration sites may help reduce the spread of invasives into the planted sites.

Remove Exotics/Replant Natives (forest, trees, shrubs or herbs)-This action implies that once the exotic plants are removed from an area, the area be planted with appropriate native species. This differs from the *invasive/exotic* control action as it includes replanting of native as part of the activity. Herbaceous plants can be established by seeding or transplanting plugs. While the former may be less expensive, the latter is apt to be more successful, especially when competing with exotics species. In general, replanting following invasive control is preferable to simple control, if there are sufficient resources for purchase, planting and maintenance of plantings.

Remove Structure/Replant Natives- Where an obsolete manmade structure is impeding the growth of native species, it is suggested that this structure be removed and native plants be established in its place.

Storm Water:

Gully Repair- Concentrated storm water runoff leads to erosion, which in turn can lead to gullies. Meadows and herbaceous borders can slow down storm water runoff and increase infiltration, reducing storm water problems. Thus, meadow management can be an important part of storm water management, especially in landscaped areas where woods are not desired. It is recommended that the storm water be redirected into a wetland or a tall grass buffer to prevent gullying of the landscape. The gully should then be filled in with soil and replanted with native vegetation to stabilize the soil.

5.C.3.3. **Slopes**

Many of the slopes in Pennypack Park and the other park sections have been severely eroded due to overuse by trail users (including hikers, horses, mountain bikes, and motorized vehicles), trash dumping and storm water runoff from adjacent lawns and streets. Activities which disturb the soil aid in eroding the slopes, which will make them unstable and unable to support vegetation. The lack of cover further increases erosion. Storm water runoff exacerbates the problem and creates gullies along the slopes, which serve as obstacle courses for all terrain vehicles (ATVs). Even where slopes are not denuded, the sequence of intermittent storm water runoff and drying may favor invasive species such as Japanese knotweed and *Phragmites australis*.

An example of a riparian zone in Sedden's Run.

As part of the restoration recommendations for slopes, activities include regrading some of the highly impacted slopes, replanting with native species, repairing gullies, controlling erosion, and removing trash and exotics. For example, these activities would be beneficial for the slopes located behind the Pennypack Environmental Center (V20.08). Planting a native meadow at the top of the slope to help control water runoff during storm events, as was described previously, is also recommended. Placing berms at the top of the slope will also aid in decreasing the velocity of the storm water which flows down the slopes toward the stream. This will not only prevent further erosion of the slopes but will decrease the amount of silt that reaches the creek and tributaries. Slope erosion can be prevented by brush bundles, logs, and water bars, which slow, pond and disperse concentrated downslope flows. These can be implemented by volunteers in sites where mechanical access would create further problems. Since some types may attract use (e.g., waterbars used as trails, logs used for sitting) and exacerbate slope erosion, these should be designed to be unobtrusive.

Forest on a slope near Krewstown Road.

5.C.3.4. **Riparian Zones**

Riparian zones are areas adjacent to a body of water which are influenced at least periodically by flooding (Mitsch 1993). They serve as ecotones between aquatic and terrestrial communities and are important areas for animal refuge and migration. Plant communities of riparian zones are usually diverse due to the gradients in moisture. Riparian areas are valuable to people because they can slow the flow of water during a storm event and prevent flooding.

In the Pennypack Park, the areas adjacent to the creeks have been used by the public as picnic areas, bike trails, and fishing points. The natural vegetation of these riparian zones has been altered in such a way that they are no longer able to function as they should.

The restoration activities for riparian zones in this project include removing invasive species, regrading the banks where necessary and replanting with native forest corridors at least 35 feet in width (if feasible) to serve as a functional riparian zone. An example of a disturbed riparian zone is the floodplain located east of Tabor Road, along Sedden's Run (V30.06). The banks are eroded, threatening the trail along the north side, and the exotic species Japanese knotweed is found growing along the banks.

5.C.3.5. **Wetlands**

Wetlands are defined as transitional lands between aquatic and terrestrial habitats where saturation with water leads to characteristic soil types and plant and animal communities. Wetlands are biologically rich, and development and potential impacts on wetlands are regulated by the Federal government under the Clean Water Act. According to the U.S. Fish and Wildlife Service (FWS), the following three criteria must be met in order for an area to be considered a wetland for regulatory purposes: 1) the land must be dominated by hydrophytic vegetation; 2) the soils must be categorized as hydric; and 3) the land must be saturated with water for some time during the growing season. There are other biological, physical and chemical factors such as light, temperature, and man-induced disturbances which alter the community composition and overall biodiversity of wetlands.

Wetlands are classified into the following five systems by the FWS; Marine, Estuarine, Lacustrine, Riverine and Palustrine. These systems are partly distinguished from one another based on their level of tidal influence and also the amount of salinity present from the ocean. Marine systems have saltwater, tidal flows. Estuarine systems are tidal systems with a mix of fresh water and oceanic water producing brackish conditions (this definition is more restrictive than the standard ecological definition, which considers freshwater tidal systems as estuarine as well). Lacustrine wetland systems are defined as permanently flooded lakes, ponds and reservoirs. These areas may be deep and may experience considerable wave action. Riverine systems are defined as wetlands which are contained within a natural or manmade channel. Palustrine systems are defined as vegetated wetlands less than two meters deep which have no tidal influence.

The majority of wetlands found in Pennypack Park can be classified as palustrine wetlands, according to the FWS classification system. Larger wetlands in the park (apparent on the aerial photographs used to develop the vegetation maps) are identified on the Vegetation Classification maps. Wetlands can be broadly categorized as swamps, marshes, or open water areas. Swamps are defined as areas with a woody canopy, while marshes are unshaded and dominated by herbaceous vegetation. These types may be further categorized on the basis of vegetation cover, which is strongly controlled by the depth and frequency of inundation with water. Marshes were categorized as cattail (*Typha* sp.) marsh, *Phragmites* marsh, intertidal marsh, sedge/rush/grass marshes, and wet meadows. These types roughly follow a gradient from deeper and more frequent inundation to less frequent inundation. The most common wetland types found during this survey were *Phragmites* marsh, cattail marshes, and skunk cabbage seeps. Tidal wetlands are found at the mouth of the Pennypack Creek where the Delaware River meets the creek. These wetlands support a variety of plant species (Table 5.C.1), most of them specific to tidal marshes. Only a few sedge/rush/grass marshes large enough to be mapped were encountered in the survey, although there are small patches of these scattered throughout the park. Wetlands that have been filled or altered as a result of urbanization are common in Pennypack Park. Some areas with wetland hydrology may be maintained as lawns by mowing, as is the case with the open lawn area along the right bank of the Pennypack Creek in the

A wetlands near Lexington Avenue.

bend above the Verree dam (V20.03). Table 5.C.2 illustrates the types of wetlands in the park, the functions of such a habitat type, the restoration recommendations, and the benefits of restoration.

It is especially important to promote and highlight the ecological importance of wetlands in urban settings. Wetlands can provide a number of environmental benefits, including reduction of storm flows by water storage, supply of water during low flow conditions, purification of water by storage or removal of nutrients and other substances, and support of a variety of plants and animals. The small tributaries in Pennypack Park which feed into larger creeks could benefit from the water purification function that wetlands provide. Wetlands also support numerous plant and animal species that may otherwise be absent from an urban setting. For example, lizard-tail, which was found in the Rhawn Street wetland, was not found elsewhere in Pennypack Park. Riparian forests exist along the floodplains of the main creeks and some of the small tributaries. Depending on hydrology, some of these floodplain forests could be classed as wetlands, depending on their soils and degree of inundation. Because of the gradation in these characters, the vegetation survey did not distinguish wetland and non-wetland floodplain forests, except where there were marked differences in vegetation, such as the presence of herbaceous wetland plants and/or standing water.

Hydrology. This factor is often the most difficult to quantify in the field. However, it is the most critical since the presence or absence of water determines whether soils will be hydric and vegetation hydrophytic. Water can originate from various sources including, but not limited to storm water runoff, precipitation, headwater or backwater flooding, tidal influence and groundwater. These sources can operate independently, but in many cases wetlands are controlled by a combination of hydrologic factors. Topography, soil type and vegetative cover are all factors that have been shown

Table 5.C.1. Potential flora of intertidal Philadelphia wetlands based on historic records and the present flora of other tidal habitats in the Delaware Estuary. Species recorded during the 1998-1999 assessment period are noted with an *.

Submerged and Floating Aquatics

Elodea nuttallii (Nuttall's Waterweed)
Callitriche heterophylla (Water Starwort)
Najas flexilis (Northern Water-Nymph)
Najas gracillima (Slender Water-Nymph)
Potamogeton epihydrus (Ribbonleaf Pondweed)
Potamogeton natans (Floating Pondweed)
Potamogeton pectinatus (Sago Pondweed)
Potamogeton perfoliatus (Redhead Pondweed)
Potamogeton pusillus (Small Pondweed)
Potamogeton spirillus (Snailseed Pondweed)
Ranunculus longirostris (Beaked White Water Crowfoot)
Vallisneria americana (Wild Celery)

Herbaceous Emergents of Tidal Shores (S) and Marshes (M)

Acorus calamus (Sweet Flag)—M
Aeschynomene virginica (Sensitive Joint-vetch)—S
Amaranthus cannabinus (Water Hemp)—M
Alisma subcordatum (Southern Water-Plantain)—M
Ambrosia trifida (Giant Ragweed)—M
Asclepias incarnata (Swamp Milkweed)—M*
Aster lanceolatus (Eastern Lined Aster)—M
Aster puniceus (Bristly Aster)—M
Bidens bidentoides (Southern Estuarine Beggar-ticks)—S
Bidens coronata (Tickseed Sunflower)—M
Bidens frondosa (Beggar-ticks)—S,M
Bidens laevis (Bur Marigold)—S,M
Cardamine pensylvanica (Pennsylvania Bittercress)—S
Carex hyalinolepis (Shore-Line Sedge)—S
Cyperus engelmannii (Engelmann's Flatsedge)—S,M
Cyperus bipartitus (River-Shore Umbrella Sedge)—S
Cyperus brevifolioides (Umbrella Sedge)—S
Cyperus polystachyos (Many-Spiked Flatsedge)—S,M
Cyperus odoratus (Flatsedge)—S,M*
Echinochloa walteri(Walter's Barnyard Grass)—S*
Elatine americana (Waterwort)—S
Eleocharis erythropoda (Red-Based Spike-Rush)—S
Eleocharis obtusa (Obtuse Spike-Rush)—S

Table 5.C.1 (continued). Potential flora of intertidal Philadelphia wetlands based on historic records and the present flora of other tidal habitats in the Delaware Estuary. Species recorded during the 1998-1999 assessment period are noted with an *.

Herbaceous Emergents of Tidal Shores (S) and Marshes (M)

Eleocharis palustris (Creeping Spike-Rush)—S,M
Eleocharis quadrangulata (Four-Angled Spike-Rush)—S
Eriocaulon parkeri (Parker's Pipewort)—S
Eryngium aquaticum (Marsh Eryngo)—M
Gratiola neglecta (Hedge-Hyssop)—S
Helenium autumnale (Common Sneezeweed)—S
Heteranthera multiflora (Multiflowered Mud-Plantain)—S,M*
Heteranthera reniformis (Common Mud-Plantain)—S,M
Hibiscus moscheutos (Rose Mallow)—M*
Impatiens capensis (Jewelweed)—M*
Isoetes riparia (Riverbank Quillwort)—S
Juncus acuminatus (Sharp-Fruited Rush)—S
Leersia oryzoides (Rice Cutgrass)—M*
Limosella australis (Awl-Shaped Mudwort)—S
Lindernia dubia (False Pimpernel)—S
Lobelia cardinalis (Cardinal Flower)—M
Ludwigia palustris (Common Water-Purslane)—S
Lycopus americanus (Water Horehound)—S,M
Mikania scandens (Climbing Hempweed)—M
Nelumbo lutea (American Lotus)—S
Nuphar lutea (Spatterdock)—S,M*
Orontium aquaticum (Goldenclub)—S
Peltandra virginica (Arrow Arum)—S,M
Pilea pumila (Clearweed)—M
Polygonum amphibium (Water Smartweed)—S
Polygonum arifolium (Halberd-Leaved Tearthumb)—M
Polygonum punctatum (Dotted Smartweed)—S,M
Polygonum sagittatum (Arrow-Leaved Tearthumb)—M
Pontederia cordata (Pickerel-weed)—S,M
Rorippa palustris (Yellow Watercress)—S
Rumex altissimus (Tall Dock)—S
Sagittaria calycina (Hooded Arrowhead)—S
Sagittaria graminea (Grass-Leaved Arrowhead)—S
Sagittaria latifolia (Common Arrowhead)—S,M
Sagittaria rigida (Sessile-Fruited Arrowhead)—S
Sagittaria subulata (Subulate-Leaved Arrowhead)—S
Schoenoplectus fluviatilis (River Bulrush)—S,M
Schoenoplectus pungens (Common Threesquare)—S*

Table 5.C.1 (continued). Potential flora of intertidal Philadelphia wetlands based on historic records and the present flora of other tidal habitats in the Delaware Estuary. Species recorded during the 1998-1999 assessment period are noted with an *.

Herbaceous Emergents of Tidal Shores (S) and Marshes (M)
Schoenoplectus smithii (Smith's Bulrush)—S
Schoenoplectus tabernaemontani (Softstem Bulrush)—S,M
Sium suave (Water Parsnip)—M
Sparganium eurycarpum (Giant Bur Reed)—M
Typha angustifolia (Narrowleaf Cattail)—M
Typha x *glauca* (Hybrid Cattail)—M
Typha latifolia (Common Cattail)—M*
Zizania aquatica (Southern Wild Rice)—S,M

to affect the hydrology of a wetland. The frequency and length of time of saturation or flooding is highly dependent upon the position of the wetland in the landscape and the land use history of the area. If a wetland is located in a floodplain area or riparian zone, it may stay wet for a longer period of time than a wetland whose elevation is far above the floodplain. Manmade structures, such as dams and natural obstacles can also alter the water holding capacity of a wetland. Soils and vegetation in turn also affect the amount of water that can be held by a wetland. Clay soils, for example, hold water for a much longer period of time than do sandy or loamy soils, due to the fact that they absorb and release water at a much slower rate. In general, more densely vegetated wetlands are able to hold more water because plant cover slows water flow. Some of the most common field indicators of hydrology include the following: recorded data (i.e., USGS gage data), water marks on vegetation, sediment marks on vegetation, standing water, drift lines, hummocking, which is indicated by the ground having a series of small elevated areas which are often vegetated with mosses or sedges, and visual observation of ground saturation, which can be observed by digging a pit in the soil.

The natural hydrology of the Pennypack Creek has been severely altered by development in the watershed and the construction of roads, dams, railroads, and other manmade structures in the channel and floodplain. Historically, the source of water for many wetlands in the park was storm runoff, subsurface flows associated with creeks or rivers, or flows from springs. Development has altered hydrology by increasing the magnitude of peak flows and decreasing base flows.

Sedimentation and incision in floodplains and channels of many of these creeks, and decreases in base flows and groundwater flows, have severely decreased sources of water for adjacent wetlands. Smaller tributaries which have not been as severely affected by urbanization are capable of providing water to sustain wetlands. Examples of wetlands which are fed by small tributaries include one on Sedden's tributary (V30.07) and the Rhawn Street wetland (V80.06). Tidal flow as well as the flow of springs, lakes and channels are also factors that influence or drive hydrology of the wetlands found within the park. Seeps and springs are found throughout the park, often on slopes of ravines, such as north of Bustleton Road. There are no known natural lakes within Pennypack Park.

Structure/Type of Wetland. Wetlands not only depend on the presence of water, but are also affected by the amount and periodicity of wetting, which is important to consider in regard to restoration and planning activities. The amount of water will determine the floral and faunal composition on the site and the overall functioning of the wetland. Water flow data can usually be obtained by a gage station or by placing monitoring wells in the area. Classification criteria for

Table 5.C.2. Classification of wetland types in the Fairmount Park system, with relative importance of various types of benefits and major restoration activities.

	Type and Vegetation	Hydrology	Functions					Potential Restoration Activities	Abundance in FPC
			Storm water Retention	Source at Base Flow	Water Quality	Floral Biodiversity	Faunal Biodiversity		
Open Water									
	Permanent pond	Permanent standing water	Depends on basin capacity	Yes	Yes	Submerged macrophytes, algae	Important to fish and other groups.	Enlargement, habitat improvement, dredging, nutrient control; faunal or floral reintroduction	Small, artificial ponds
	Vernal pond	Seasonal standing water	Variable	Late winter and spring	Variable	Variable	Spawning sites for some reptiles, amphibians, and other groups	Controlling hydrology to produce specific requirements; faunal or floral reintroduction	Rare or absent
Marsh									
	Intertidal	Fluctuating saturation	Little	No	Yes	Variable; supports regionally rare species	Important for fish, birds, other groups	Controlling hydrology	Local
	Phragmites	Variable	Tolerant of occasional inundation	No	?	Low	?	Invasive control and replanting	Fairly common
	Cattail	Permanent, shallow standing water	Tolerant of occasional inundation	Yes	Yes	Low-moderate	Important for some groups	Enlargement, habitat enhancement, exotic control	Fairly common

Table 5.C.2 (continued). Classification of wetland types in the Fairmount Park system, with relative importance of various types of benefits and major restoration activities.

	Type and Vegetation	Hydrology	Functions					Potential Restoration Activities	Abundance in FPC
			Storm water Retention	Source at Base Flow	Water Quality	Floral Biodiversity	Faunal Biodiversity		
	Sedge-Grass-Rush	Seasonally saturated soil	Intolerant of long periods of standing water; locally small sites with little storage capacity	Yes	Yes	High	Important for some habitat specialists	Enlargement, habitat enhancement, exotic control, floral reintroduction	Some very small patches
	Exotic (Japanese knotweed, lesser celandine)	Variable	Variable	Variable	?	Low	Probably low	Exotic control and replanting	Common
Swamp or Marsh									
	Skunk cabbage	Permanently wet soil	Intolerant of long periods of standing water and storm flows	Yes	Yes	Moderate	Important for some habitat specialists	Maintain hydrology, promote forest cover	Common, mostly small seeps

Table 5.C.2 (continued). Classification of wetland types in the Fairmount Park system, with relative importance of various types of benefits and major restoration activities.

	Type and Vegetation	Hydrology	Functions					Potential Restoration Activities	Abundance in FPC
			Storm water Retention	Source at Base Flow	Water Quality	Floral Biodiversity	Faunal Biodiversity		
Swamp									
	Large tree dominated: Silver maple, red maple sycamore, box elder, ash, etc.	Intermittently wet soil	Tolerant of short periods of inundation	Yes	Yes	Moderate-High	Important for many groups; depends on amount of standing water, etc.	Maintain hydrology, exotic control and replanting, control erosion, sedimentation	Common on floodplains; gradation with non wetland floodplain forests
	Shrub dominated: alder, buttonbush	Intermittently wet soil	Tolerant of short periods of inundation	Yes	Yes	Can support uncommon species	Important for some habitat specialists	Maintain hydrology, exotic control and replanting, control erosion, sedimentation	Absent?
	Misc.: e.g., lizardtail	Intermittently wet soil	Tolerant of short periods of inundation	Yes	Yes	Can support uncommon species	Important for some habitat specialists	Maintain hydrology, exotic control and replanting, control erosion, sedimentation	Rare (e.g., Rhawn Street wetland)

hydrologic zones, based on the frequency and duration of inundation or saturation of the soil during the growing season, have been developed by federal agencies and implemented by wetlands scientists. Classifications range from zone 1, areas which are labeled "permanently inundated" to zone 6, which are "intermittently or never inundated." Table 5.C.3 presents a classification system for non-tidal areas.

Table 5.C.3. USFWS Classification of wetland types on the basis of frequency of inundation.

Zone	Classification	Duration	Comments
1	Permanently inundated	100%	Inundation <6.6. ft. mean water depth
2	Semipermanently to nearly permanently inundated or saturated	>75%-<100%	Inundation $\leq$ 6.6 ft mean water depth
3	Regularly inundated or saturated	>25%-75%	
4	Seasonally inundated or saturated	>12.5%-25%	
5	Irregularly inundated or saturated	$\geq$5%-12.5%	Many areas with this characteristic are not wetlands
6	Intermittently or never inundated or saturated		Areas with this characteristic are not wetlands.

U.S. Army Corps of Engineers, Wetland Delineation Manual, 1987.

Soil Chemistry and Composition. Soil composition and chemistry strongly affect the types of flora and fauna that can be found in a wetland. Hydric soils are defined as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, July 13, 1994). Anaerobic conditions refer to the effect of microbial activity in wet soils which causes a depletion of oxygen. Decomposition is generally slow in these oxygen-depleted areas, and partially decomposed plant materials tend to accumulate in areas of little water movement. Soils that result from this process are called histosols. In areas of rapid or frequent water movement, the organic layer of the soil is washed away, leaving behind sand, silt and clay. The effects of anaerobic conditions include the accumulation of organic matter, the accumulation or loss of iron, manganese, sulfur, or carbon compounds. Hydric soils can be identified in both wet or dry times of the year based on the characteristic morphologies of the above processes, such as oxidized root channels. Another indicator of a hydric soil is the strong odor of hydrogen sulfide gas. However, this indicator cannot be depended upon for all areas, as it only occurs in very wet sites which contain sulfur.

Wetland Chemistry. The community composition of wetland vegetation is strongly affected by pH and associated chemical variables. Acid wetlands created by microbial processes affecting plant decomposition, are described as having a pH of less than 5.5. Circumneutral wetlands are defined as those with a pH ranging from 5.5-7.4, and alkaline sites, which are generally created by limestone or similar rock in the drainage or groundwater, have a pH of 7.4 or greater. Based on historical plant occurrence, some acidic wetlands may have occurred within Philadelphia. However, the wetlands now present in the park system are typically circumneutral.

Vegetation. Hydrophytic vegetation includes plants that are adapted morphologically to grow in wet conditions. They are found in areas that are, at the least, periodically deficient in oxygen as a result of excess water. These plants have adapted morphological, physiological and reproductive

characteristics to the wet conditions in which they grow. Plants lacking morphological, physiological, and/or reproductive adaptations for wet conditions cannot grow, effectively compete, reproduce, and/or persist in areas that are subject to prolonged inundation or saturated soils. Morphological adaptations to vegetation in wet areas include, but are not limited to, the following: buttressed tree trunks, shallow root systems, floating leaves, and multiple trunks. These adaptations aid the plants in nutrient uptake, buoyancy, and support, and are indicative of a wet area. Physiological adaptations are essential for plants that are subject to the anaerobic conditions of wetlands. Adaptations such as these are not easily quantified in the field since they involve biochemical processes. Prolonged viability of seeds and flood-tolerant seedlings are several reproductive adaptations which plants in wet conditions must also possess.

Wetland delineations are made by determining the dominant wetland vegetation and are no longer based solely on the presence or absence of indicator species. For example, an area which is dominated by upland species but has several wetland plant individuals would not meet the hydrophytic vegetation criteria which must be satisfied in order for an area to be considered a wetland.

Wetland Functions. Wetlands are often targets for destruction since they can be easily drained or filled for agricultural purposes or development. The benefits of wetlands are sometimes not obvious and these biologically diverse ecosystems can therefore be regarded as waste areas or areas that attract mosquitoes and pests. Wetland functions are defined as the biological, chemical and physical processes of the wetland, many of which provide direct benefits to human beings. Wetlands play an integral part in the purification of water. They act as a sink for nutrients and metals and can filter the water of sediments and organic matter. They may serve as sites for transformation of nutrients (e.g., from organic nitrogen to inorganic nitrogen gas which is released to the atmosphere) or storage of nutrients. These processes improve overall water quality and provides clean drinking water. Wetlands can process subsurface flows, such as flow into the wetland from the adjacent watershed, as well as riverine flows that flood the wetlands. Wetlands are also involved in the process of water storage. They store rain water either from direct precipitation or from storm water runoff which is then slowly released from the wetland. Some of the values associated with this function include flood protection and erosion control. Wetlands are areas of high biological productivity, serve as breeding grounds for many aquatic species, and provide wildlife with refugia and food sources. Many species depend on wetlands, so that regional biodiversity depends on wetlands. These areas are also significant to the commercial fisheries industry as they are critical habitat types for many fish species.

The benefits provided by wetlands will vary with type, size and other site-specific factors. Different types of wetlands will differ in the relative importance of different benefits (Table 5.C.2). For example, the ability to reduce storm peaks by water holding will depend on the storage capacity relative to the size of the storm flow. Areas that have saturated soils (including ponds, swamps and marshes with standing water) require topography or structures (berms, etc.) that allow ponding of storm water. Since some of the wetland vegetation cannot tolerate long periods of inundation, large areas would be necessary to store significant quantities of water. Furthermore, storm flows may carry sediments which would be deposited into these wetlands. While this can be considered as a type of filtration, these sediments may fill in wetlands unless there is periodic maintenance of the wetland. Similarly, the purification functions of wetlands depend on their size relative to inputs. Because of these factors, wetlands along the Pennypack Creek may not be able to provide large storm water retention or purification benefits of storm water in the creek. Wetlands along tributaries and seeps such as the Benton Avenue wetland (V40.11) and the Verree Road wetland (V20.0), may be more effective for these functions.

Relevance to Restoration. Although wetlands were once abundant in the Pennypack watershed, in particular in the tidal Delaware River area, these areas have since been filled and/or drained for development. To preserve and restore the natural landscape in the area, special emphasis must be placed on wetlands. This includes preserving them from further destruction, implementing

actions to aid them in proper functioning and working to replace lost wetlands. As part of this project, wetlands have been identified in the park boundaries and recommendations have been made for the protection and/or restoration of these lands. Recommendations are based on the size and condition of the existing wetland, the ecological benefits of enlarging or creating a wetland and the feasibility of long-term monitoring, and cost associated issues. For example, a wetland located along a large stream would need to be large and deep in order to store the overflow from the stream as well as storm water. This could prove to be an extremely expensive project, and may not prove to be as beneficial as removing exotics and trash from several existing wetlands. The actions recommended as part of the restoration plans are grouped and described according to their functions in the following text.

Development and urbanization have lead to the destruction of tidal wetlands, which were once abundant along the Delaware River, and intertidal wetlands which existed in the wooded areas of Philadelphia. Protection of the few remaining wetlands in Pennypack Park is critical to many species of plants and animals. For many aquatic species, these wetlands acts as refugia, without which the species would not survive in this area. The overall level of biodiversity in the Philadelphia region is dependent on the protection of natural lands in the city. Wetlands have proven to be lands of high productivity and diversity, and it is essential that their ecological significance is understood.

Restoration Activities Recommended in Wetlands. Areas of Pennypack Park that have already been mapped and verified by ground-truthing as wetlands are sites that should be protected and monitored to ensure against future development in the area. These sites are shown on Map 5.F.6 to raise public awareness of the existence and importance of wetlands. Protection and monitoring is recommended for wetlands where little disturbance is evident.

A variety of active restoration activities are recommended for wetlands. Many of these are analogous to activities in other habitats. These include activities designed to reduce damage to wetlands by controlling access or improving trails and structures associated with access, enhancing wetland vegetation, improving hydrology, and enhancing native fauna.

Access:

The following actions address the need for increased or decreased access to an area of the park. Where restoration sites occur on or near sites that are heavily impacted by humans and or deer, structures such as exclosures must be installed to protect the existing vegetation and/or the new plantings from the effects of trampling and herbivory.

1. *Access platforms*. This action refers to installation of structures to reduce trampling of vegetation and soils of a wetland, while providing access to a recreation spot, creek bank, etc. These platforms should be constructed out of a material that is difficult to destroy so that they require little maintenance and do not need to be replaced repeatedly.
2. *Structural Improvement*. If there is an obvious structure, such as a dam or parking lot that is impeding water from reaching the wetland, and it is feasible, it is suggested that these structures be removed to restore the natural hydrology of the area.
3. *Trail Improvement*. This is suggested for wetlands that have become part of the trail or have taken part of the trail due to water overflow.
4. *Control Access*. This action is recommended for high quality wetlands that are functioning properly and are providing habitat for plants and animals suited to wet conditions. Since this habitat type is rare in the Fairmount Park system, wetlands need to be protected when they are found providing high value functions. Controlling public access limits the destruction. This could be done by placing a physical barrier, such as a fence, around the wetland.
5. *Deer Exclosures*. Where deer browsing is a problem, barriers to deer are suggested where wetland creation is recommended and also on lands that need to be protected and enhanced. If replanting is suggested in these areas, fencing is recommended to protect the plantings. Because of the cost of building and maintaining fencing, the need for exclosures

would limit the amount of area restored, and exclosures should not be considered a long-term solution to browsing problems in the parks.

Replanting and Exotics Control:

Wetlands can be especially prone to invasion of exotic plants, and several actions are suggested to promote native vegetation and control exotics. Some of the more common problematic species found in the park include: Japanese knotweed (*Polygonum cuspidatum*), Japanese hops (*Humulus japonica*), lesser celandine (*Ranunculus ficaria*), common reed (*Phragmites australis*), Japanese stilt grass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*) and oriental bittersweet (*Celastrus orbiculatus*). Examples of wetlands in Pennypack Park where such species are commonplace include the wetland along the right bank of the creek, east of Benton Avenue (V50.02), where *Phragmites* is found. On the left bank of the Creek, east of Welsh Road, along Winthrop Avenue, there is another wetland which is being invaded by exotic species such as multiflora rose, wineberry and Japanese honeysuckle (V100.03) When attempting to rid an area of exotics, species-specific removal methods need to be researched. Aggressive exotics have demonstrated their ability to grow in a wide variety of habitats under different conditions. Care should be taken when removing these plants from a site to ensure that every part of the plant is removed and disposed of off-site. To promote native vegetation and decrease the incidence of exotics, replanting the area with appropriate native species after exotics have been removed is recommended. The general recommendations for replanting address those areas in which the native vegetation is sparse due to some factor other than exotic species, such as manmade structures and herbivory.

1. *Invasive/Exotic Control*-This action is recommended in those areas where there are minor invasive/exotic issues, the removal of which would promote native vegetation regrowth. This action does not include replanting.
2. *Remove Exotics/Replant Natives*-In areas where wetland vegetation is sparse due to the dominance by exotic species, it is recommended that exotics be removed and native wetland species be planted. Removal of exotic species from a wetland and replanting of natives that are appropriate to the region will promote wetlands which are able to support native fauna. This may aid in increasing the level of biodiversity in the area and will promote succession.
3. *Replant Native Herbaceous Plants*-This is recommended in areas where the shrub and canopy layers are well established, but the herbaceous layer is sparse due to human disturbance or impacts from deer browsing.
4. *Replant Native Shrubs*-In wetlands where the herbaceous and canopy layers are well established, but the shrub layer is sparse due to human disturbance or impacts from deer browsing, replanting of native shrubs is recommended. This adds vertical diversity to the wetland and promotes understory growth.
5. *Replant Native Trees*-This is recommended in areas that have large canopy gaps due to exotic vines or dead standing trees. If deer browsing is an issue in the area of replanting, it is suggested that large trees be planted to avoid further damage.

Storm Water/Channel Actions:

Hydrological or topographical modifications are suggested to enhance the water filtering and holding functions of the wetland and to promote high biological productivity.

1. *Berms*-Vegetated mounds that act as dikes which are placed in the path of the storm water runoff can be used to promote infiltration and decrease flow velocities. Berms promote the greater infiltration of rainwater into the ground, thereby decreasing storm water runoff and reducing erosion and the occurrence of gullies.
2. *Regrade Banks*-Streambanks which are unstable would benefit by regrading to decrease their slopes. Many of the problems which cause unstable streambanks are caused by

upstream impacts and would require solutions which are not contained within the scope of this project.

Creation/Expansion:

Suggestions for increasing wetland acreage are provided, such as expanding existing wetlands by changing management techniques and creating new wetlands where they do not currently exist.

1. *Release/Widen* - A simple management technique that could enhance wetland activity is to mow less frequently in areas adjacent to wetlands. Some mowed areas may have wetland hydrology and may support wetland vegetation if frequent mowing is stopped. Mowed grass does not function as well as tall grasses and meadow forbs do in erosion protection. Where appropriate, open fields located next to wetlands should be mowed as infrequently as possible. Allowing natural vegetation to grow in a maintained area increases habitat for wetland species. Where usage is not high, these areas should be taken out of the active management regime, since they would then support diverse wetland plants and serve as refugia for animal species.
2. *Wetland Creation/Expansion*- This is recommended in areas that once existed as wetlands or appear to have the hydrology and soils that could support hydrophytic vegetation and are typical of a wetland. To ensure success, the hydrology, soil characteristics and vegetation present need to be examined carefully to determine the appropriate depth and area needed to sustain a healthy wetland. This also requires replanting of the wetland with appropriate native wetland species. Some existing wetlands may be enlarged where the surrounding area could be restored to contain appropriate hydrology and vegetation.

5.C.3.6. **Channel**

Proposed restorations were classified as “channel” type if the activity is intended to restore a stream within its channel or along its banks. The types of “channel” restoration actions include: protect/monitor, trash removal, bank stabilization/regrade/riparian, modify channel, infiltration/berms, detention basin, daylighting, dam modification, dam removal, structural improvements (trails and stormwater), gully repair and prevention, and fish reintroduction. A given restoration site may involve one or more of these actions, depending on site-specific conditions (Volume II, Section 5.E). The overriding objective for channel restoration is to improve in-stream habitat to a more natural state. As discussed in the Restoration Goals, reference streams in rural southeast Pennsylvania served as models of how Fairmount Park system streams should "naturally" function.

Protect/Monitor. A site designated as protect/monitor is either a stream in very good condition or a stream feature of exceptional value, such as a waterfall. These streams and features should be protected from future destruction or stresses, such as increased stormwater flow. Highlighting these areas as restoration sites is meant to monitor their role as important, sensitive areas. These sites should be maintained and enhanced with garbage clean-up and graffiti removal when necessary. Signs should be posted to inform the public of the site’s significance. Maintenance and signs should increase the public’s appreciation and understanding of these areas. This is consistent with the goal of increasing public awareness of the scenic, inspirational, and spiritual values of streams.

Verree Dam.

Trash Removal. The dumping of trash is a problem throughout the park system. Not only is it unsightly and disheartening for park users, trash accumulation in stream channels can be especially

problematic. Piles of debris can create dams, altering a stream's normal flow path and causing an unstable channel. Major dumping can cause streams to become almost entirely buried and unable to support aquatic life. Sites identified as needing trash removal are generally those with severe dumping. At these sites, removing the debris and preventing future accumulation of debris is recommended. Barriers should be installed at all existing or potential access points on the park edges to prevent further dumping.

Bank Stabilization/Regrade/Riparian. Stream sites selected for this action are those with unstable streambanks that actually require regrading and/or bioengineering techniques. The purpose of this type of action is to locally stabilize the streambank, thus decreasing erosion and the sediment flux downstream. A bank stabilization project can include regrading the streambank to a lower slope, securing bioengineering (natural) materials to the bare bank, and planting native herbs, shrubs or trees to establish a forested stream-side or riparian buffer. In some cases, only replanting of riparian forest may be sufficient to stabilize stream banks. The sites where riparian replanting that does not require regrading or engineered stabilization are also very beneficial to stream ecosystems but are defined as "vegetation" restoration sites.

Modify Channel. This is an umbrella term which includes any type of in-stream modification of channel grade or shape. This activity has been recommended in streams that are severely unstable or in highly-erodible gullies. When it is evident that erosion is occurring in the bottom of a channel, further incision can be prevented by making changes within the channel. Options include installing check dams or natural rock falls to prevent the headcutting of the bottom of the channel. This type of channel modification aims to prevent destructive erosion by providing some stability, but not to be so stable as to inhibit the dynamic nature of the stream channel.

Infiltration/Berms. This action promotes infiltration of rainwater into the ground, thereby reducing stormwater runoff and improving groundwater recharge. These projects might include the installation of an infiltration trench or the building of berms (dike-like vegetated mounds) perpendicular to the path of stormwater runoff. An infiltration trench is installed by digging out a deep trench, replacing the soil with a more pervious substrate, and replanting the surface. These measures would be used in areas where there is excessive stormwater runoff, usually from a paved or mowed surface, causing gullies and increased erosion. The trenches or berms placed in the path of runoff promotes increased infiltration/decreased runoff and decreased flow velocities, resulting in reduced erosion further downslope.

Detention Basin. This action includes the installation of wet or dry ponds to detain stormwater runoff. These basins can help reduce peak flows during storm events, but do not alter the overall volume of runoff. Elevated peak flows can be very destructive to a stream channel, causing incision, eroding banks, and the loss of stream habitat. Where feasible, a detention basin would be placed at the source of excessive runoff, such as a paved parking lot, or near the stream, but should not be placed within the stream's channel. Stormwater runoff would be directed into the detention basin where it is slowly released into the stream system. Besides the reduction in peak flows, detention basins can be designed to provide wetland and pond habitat, if constructed to hold a permanent pool. A detention basin is not an easy restoration option. It is expensive and it requires a large amount of space, as well as future maintenance.

Daylighting. Numerous streams have been placed underground to allow for the development of Philadelphia. Many of these underground streams extend into the park. Daylighting refers to the excavation and restoration of a stream that has been buried in an underground culvert, covering, or pipe. When a stream is underground, it does not function as a stream. By daylighting a stream it can again support stream life. Most of these underground streams still flow due to groundwater sources and drain into the larger creeks, such as the Pennypack. The flows from these underground streams may provide important contributions to the flows in these larger creeks during low-flow or drought periods. Unfortunately, many of these underground streams also receive raw sewage due to combined sewer overflows during storm events and due to incorrectly connected sewage pipes from homes. Therefore, before daylighting a stream, sewage contributions must be considered and eliminated.

Dam Modification/Dam Removal. These actions are intended to improve stream conditions that are impaired by dams. As detailed in the restoration goals, dams have damaging effects on streams. Dams block the passage of fish and other aquatic organisms and cause backwaters that are warm and can become depleted of oxygen. A dam on a stream is analogous to a clogged artery. Many Fairmount Park system dams are falling apart and are a safety hazard as well. Based on ecological benefits, it is recommended that all dams be removed, but this is not feasible for all dam sites. Complete removal may not be desired for historical reasons; leaving a portion of the dam may be desirable in these cases. When dam removal is not possible, a dam modification is recommended, which involves creating one or more V-shaped notches in the top of the dam to allow for better movement of water, sediment, and organisms. Dam removal involves the use of large machinery to remove the manmade elements. Some dams may have underlying bedrock or rock falls, which would remain as a natural waterfall. Mud flats adjacent to the banks would be planted with native vegetation and some bank stabilization measures may be required after demolition. Removing these abandoned dams will serve as a long-term benefit to the stream and will require little to no future maintenance.

Structural Improvement to Stream Channels. These actions seek to address problems caused by malfunctioning or obstructive structures in or near streams. A main problem with any structure in a stream is that streams are dynamic, while the structure was most certainly constructed to remain static. As a stream moves, transports sediment and acts in its dynamic nature, these structures get in the way and cause problems such as scouring, drastic erosion, and sediment trapping. Stormwater structures such as culverts, pipes, and manholes were found to have become obstructions in streams. These structures also block the flow of debris and garbage in the stream, causing piles of debris that are unsightly and may cause local erosion problems. Any plan to improve a Philadelphia Water Department (PWD) structure will have to be a joint effort between FPC and PWD. Stream crossings on trails can sometimes have a negative impact on the stream. Many times bridges and stream crossings can cause local erosion problems. In addition, many clogged or failed culverts create unstable stream channels, streambank erosion or damage due to constant trampling. The clogged culverts prevent the natural stream flow patterns and cause the stream to back up so that it overflows the trail at times. Any trail improvement related to stream crossings will have to be coordinated with the trails consultants. Improvements might include constructing bridges or better culvert systems and diverting or changing trail routes.

Gully Repair and Prevention. This activity is similar to repairing gullies in the forested uplands, but is specifically meant for repairing/preventing gullies that connect directly to stream channels, thereby contributing excess sediment. In general, these gullies are formed by concentrated storm runoff due to roads, trails, or improperly design stormwater outfalls. Repair of these gullies can range from placing structures within the gullies to prevent them from getting worse to correcting the source of the concentrated flows and actually filling in the gullies. In large gullies, where prevention of the high flows is not practical or too expensive, installing check dams, energy dissipation structures, or controlled drop structures may be recommended to prevent the gully from enlarging. However, if it is possible to actually control or prevent the concentrated flows, the recommendation may be for installing berms or detention basins, filling in the gully with soil, and replanting the area with native vegetation.

Fish Habitat Enhancement Techniques. A number of devices have been developed to improve habitat for certain fish, typically trout (e.g., Hunt 1993). These are usually aimed at providing cover, deep holes, etc.; many, such as current deflectors or small check dams, are designed to direct currents to scour out holes. Such structures need to be sturdy enough to withstand storm flows. By redirecting flow (e.g., current deflectors), narrowing channels (e.g., instream boulders or logs), or armoring parts of banks, there is a risk that some installations may increase erosion above or below the installation. These projects may be implemented by volunteers, and organizations and agencies (e.g., Trout Unlimited, Pennsylvania Fish and Boat Commission) may assist in planning and installation. In keeping with restoration goals, enhancement of watershed or riparian conditions is expected to create

sufficient habitat, so that watershed management is preferable where feasible. However, these installations may be desirable in sites where watershed improvement is not feasible, or to further improve habitat in good quality streams.

Cover for fish may be provided in pond and lake habitats, as well (D'Itri 1985). Such installations can be as simple as addition of trees, or may involve more complicated artificial structures. These structures can provide attachment sites for algae and invertebrates, spawning sites for organisms (species which attach eggs to hard surfaces or which guard nests in crevices), and cover for both forage fish and predators.

5.C.3.7. **Faunal Monitoring, Introduction and Management**

Most of the restoration activities are expected to affect park fauna by improving habitat for terrestrial and aquatic animals. Some activities directly involve fauna. These include some types of monitoring and introductions.

Deer Monitoring. Deer monitoring is critical for restoration planning and implementation in Pennypack Park. The effects of deer on vegetation in Wissahickon Park were estimated over the 1994-1996 period (Natural Resource Consultants 1996). The FPC reviewed the information on deer and public hearings were held concerning deer impacts and possible remedies. Reduction of the deer population in the Wissahickon was started in late winter of 1999. The assessment of vegetation in Pennypack Park showed impacts as great or greater than those in the Wissahickon. Observations of deer and deer sign also indicate a large population in Pennypack Park. As a result, control of deer is recommended in Pennypack Park.

The nature of the deer monitoring which could be implemented depends on the goals of the monitoring. For example, estimation of population density may be valuable in planning direct deer management, while estimation of damage may be more relevant to restoration planning. In order to aid restoration planning, ANSP reviewed information on possible approaches to monitoring, developed a protocol for monitoring deer damage, and tested this protocol in the Wissahickon in February 1999.

This information is summarized in Appendix C-2. The results and conclusions of the study may be summarized as follows:

Monitoring of browse/grazing damage was considered to be the most relevant approach for the objectives of natural lands restoration. It was concluded that census methods were too expensive to implement for routine monitoring, and counts based on indicators such as pellet counts and tracks were difficult to relate to deer density or deer damage.

The protocol was based on monitoring browse damage to shrubs and trees with twigs accessible to deer. This allowed monitoring in winter when herbs were not evident. The addition of herbaceous monitoring (e.g., of preferred spring ephemerals like may apple) would be valuable for spring monitoring.

The protocol was practical and could be implemented. There was some subjectivity in distinguishing browsed twigs from other sources of twig damage, but this was not thought to invalidate the protocol. However, false identification of browse could be more of a problem in areas with low frequencies of deer browse. In the future, testing in areas with little or no damage, such as within enclosures, would be useful to determine frequencies of other types of twig damage.

Twig damage may reflect browsing over a relatively long period of time because old cut twigs may still be evident. This is a disadvantage in assessing short-term rates of damage. However, it would be an advantage for monitoring areas with low deer densities, where deer damage may be sporadic.

The rates of browsing on any given plant species probably varies with deer density. Nonpreferred species may suffer little damage at low densities, but be browsed at high densities. Deer browsing is likely to affect recruitment of shrubs and saplings, so that species occurrence is not independent of deer density. For example, preferred species may be eliminated in areas of moderate

deer density, leaving nonpreferred species with relatively low browse rates. In areas with lower deer densities, preferred species may be present, but browsed. Thus, interpretation of browse results needs to consider the frequency of damage by species and the frequency of occurrence of different plant species.

Deer monitoring and management is ongoing by a variety of groups in the region. Contacts with these groups would be valuable in setting up monitoring programs. Personnel with the U.S. Forest Service in Warren, PA (David DeCalesta and Susan Stout) and with the U.S. National Park Service in Gettysburg, PA (Herbert Frost) have been identified as sources of information on deer and deer monitoring (Community Resources, pers. comm.).

Other Monitoring. While the faunal inventory for this study and other monitoring programs provided a great deal of information on faunal occurrence and abundance, sampling was limited in time and space. Additional monitoring can be valuable in determining occurrence of uncommon species, trends in species, and response to restoration. The assessment for this study demonstrated decreases in the native fauna in many groups and increases in exotic species in some groups. Sampling of other taxonomic groups would provide additional information on the park fauna. Monitoring programs can be linked to environmental education activities, to park special events and to more thorough scientific collection.

Faunal monitoring would be particularly valuable as part of some restoration activities. Where feasible, baseline and post-restoration monitoring should be defined as part of restoration planning, although in some cases, funding constraints may preclude monitoring. Monitoring of virtually any taxonomic group would be valuable, but certain groups would be particularly informative for different types of restoration, such as butterflies for meadow and edge management; aquatic macroinvertebrates for wetland creation and restoration, and stream channel restoration; reptiles and amphibians for wetland creation and restoration; fishes for dam removal and restoration in larger wetlands and streams; birds for woodland restorations, meadow restoration, and exotic control; and terrestrial invertebrates such as land snails and slugs, ants and earthworms for woodland restoration.

Faunal Introductions. Re-introduction of animal species can restore the natural biodiversity of an area. However, there are some ecological risks to re-introductions which need to be considered. These risks are outlined in the project goals (Section 1.C). Where major restoration of vegetation is done, faunal re-introductions should typically be undertaken after successful establishment of the vegetation. Many organisms which are mobile or have mobile dispersal stages will colonize restored sites. However, introduction may be necessary for less mobile and habitat-restricted species or for species locally extirpated from an area. For example, reintroduction may be especially appropriate for some species of fish, amphibians (e.g., frogs or salamanders which reproduce in small ponds), or butterflies (see Volume I, Section 4.E.5).

Fish:

Natural colonization of fish to a site is expected where there is an aquatic connection to a source fauna. Introduction is appropriate to stock new, isolated ponds, to restore species extirpated from the colonizing source, and to develop migratory stocks imprinted on the site.

Introduction should be made from local sources, so that issues concerning disease and genetic differentiation are insignificant. Also, nearby source material makes introduction logistically easy. Introduction would need approval from the Pennsylvania Fish and Boat Commission. In addition, collection of fish would be best done under a scientific collecting permit in order to use efficient collecting techniques and to collect enough fish. Introduction could probably be done successfully at various times during the year, but would probably be easiest and most successful in early to mid-spring. At that time, holding and transporting of fish would be safer, since lower water temperatures reduces risks of handling mortality. The source and receiving water should be at similar temperatures, easing acclimation. Introduction at this time would also allow spawning during the first year. The specifics of stocking, such as methods of capture, holding, number, size and stage to stock, would depend on the species involved.

Larger wetland restoration sites (e.g., about one or more acres) with permanent water of a foot or more in depth would be able to support fish. These would provide an opportunity for introduction of fishes which were historically found in regional wetlands and are still present in some sites. The Eastern mudminnow and bluespotted sunfish would be good candidates for such programs. Stocking protocols would be similar to those defined for the stream fish, except that smaller numbers of specimens would probably be introduced, because of the more closed nature of the wetlands and to decrease impacts on source populations. Such introductions would be best done after establishment of aquatic vegetation within the wetlands. Stocking of smaller wetlands is not recommended, since these would support fewer fish individuals, would have a smaller likelihood of long term success, and would be more valuable as breeding sites for amphibians which can be adversely affected by fish predation in breeding ponds.

The three-spined stickleback (*Gasterosteus aculeatus*) is a small, partly anadromous species which has become rare in Pennsylvania. It is known to inhabit some small tidal ponds (e.g., in Delaware County). Reintroduction of this species into existing ponds or new ponds near the mouth of the Pennypack Creek may be feasible, if these have a tidal connection.

Re-establishment of migratory stocks could be an important benefit of dam removal or water quality improvements. Some migratory species return to their natal waterbody (they are "imprinted" to their birthplace during early life) to spawn. As a result, re-establishment of a stock may be prevented by lack of imprinted fish, and stocking of eggs or larvae may be necessary to produce fish that will return to a site. This strategy has been successful for American shad, which are closely imprinted on their natal river, and is being used on the Schuylkill River. However, it is likely that such stocking would not be necessary for species likely to benefit from the restoration and habitat improvements on streams and ponds outside the Schuylkill River. Anadromous or migratory species likely to use these smaller streams include alewife and blueback herring, gizzard shad, white perch, striped bass, and white catfish. These species are not as closely tied to their natal site as American shad and may be expected to establish themselves through Delaware River populations, if suitable sites are created.

Amphibians:

A number of frogs and salamanders are resident in ponds and wetlands and may be unable to recolonize new or enhanced sites because of the isolation of these sites. Several species, such as American toad (*Bufo americanus*) and spring peeper (*Hyla crucifer*), reproduce in ponds and use adjacent habitats such as marshes and woods. These species are present, but local in the Fairmount Park system (e.g., in the Pennypack and Wissahickon), and would be good candidates for introduction at additional sites. Reproduction of these species is most successful in temporary ponds, such as vernal ponds, and other fishless sites. Another candidate is the Coastal Plain leopard frog (*Rana utricularia*). In Pennsylvania, this species has been much reduced in abundance because of development of the Coastal Plain; however, it does occur in the area at the Tinicum marsh. The leopard frog is resident in ponds and marshes, and could be introduced to appropriate wetlands near the mouth of the Pennypack Creek.

Canada Goose Monitoring and Management. Historically, the Canada goose (*Branta canadensis*) was a common migrant and rare wintering bird in the region. The number of wintering birds increased at least through the 1970s (Hess et al. 2000). This is attributed to changes in migratory patterns, with reduction in migration distances as birds started wintering farther north. This shift apparently started in the 1930s. In recent years, there has been a decline in the number of migratory geese (Hess et al. 2000, Walsh et al. 1999). The Canada goose has also become a common breeding bird, breeding in a variety of open sites, including parks, golf courses, and refuges. Local breeding started in the 1930s in the mid-Atlantic, but populations have expanded greatly in recent years. The timing and origin of breeding birds is not well-documented. Potential sources of breeding birds include escapes from wildfowl collections (Walsh et al. 1999), wounded or pinioned birds kept as decoys to attract wild birds (Hess et al. 2000), and birds introduced at wildlife management areas to restore populations of the subspecies *B. canadensis maxima* (Brauning et al. 2000). This

subspecies (the giant Canada goose) formerly bred in the midwest and was thought extinct until rediscovered in the 1960s. In the Philadelphia area, breeding birds are resident year-round. Resident birds are joined by large numbers of birds in the winter. The origin of these birds is not well known; they could include Arctic nesters, migrants from New England or the northern mid-Atlantic (i.e., derivatives from the new breeding populations), or some locally-bred birds making local movements. Small numbers of snow geese (*B. chen*) and brant (*B. branta*), which breed in the Arctic, are found in winter in the city, such as in FDR Park and along the Schuylkill River, indicating that the park populations may contain long distance migratory birds.

Canada geese are most common in large, open areas, although they are increasingly able to use small lawns and marshes. In Pennypack Park, Canada geese are most common at the mowed field in the bend of the creek above Verree Road and near the mouth of the creek.

With their spread into urban and suburban areas, Canada geese have been considered a nuisance in some cases. Aggressiveness by breeding birds and accumulation of droppings are common concerns, but human health risks resulting from bacterial contamination of droppings and ecological effects may be more serious. Geese graze field, wetland and aquatic plants, and they contribute to nutrient enrichment of resting areas. However, the magnitude and effects of nutrient enrichment in local systems are not documented. The relative contributions of resident birds with the larger numbers of migratory birds is also unknown.

Various techniques have been used to manage concentrations of geese. These include various means of scaring birds (dogs, etc.), shaking eggs, and habitat management to reduce open fields and access to water. Many of the vegetation and storm water restoration techniques recommended for NLREEP, particularly reduction in the amount of mowed area and planting of riparian zones, may reduce suitability for geese. Fencing may also be used to restrict access to water. This has been implemented by the Philadelphia Water Department in partnership with NLREEP, along the Schuylkill River near the Belmont water intakes. Regionally, shifts in hunting seasons have been made to increase the harvest of resident birds and decrease the harvest of migratory birds.

As a migratory species, Canada geese are protected by federal laws and international treaty; geese are managed by the federal government,, for example, through hunting regulations (season and limits) and maintenance of waterfowl refuges. Therefore, management actions should be coordinated with other agencies. Migratory geese are considered an important resource whose apparent decline has been of concern. Therefore, control of nonresident birds (migrating and wintering birds) is not recommended. Given uncertainties on the relative effects of breeding and wintering birds, there is not enough information to justify active control of breeding geese. However, habitat management techniques, which are consistent with other NLREEP goals, may be an effective approach to reducing goose impacts in the park.

5.C.3.8. **Floral Re-introduction**

Comparisons of the vegetation/floral assessment of this study with historical information on plants of the Pennypack indicate changes in the flora of the area. Re-introduction of some species may be appropriate where current conditions can support the species, where stock is available and where transplanting and establishment are feasible. Types of species which are particularly suitable are forest species which may have been lost during earlier deforestation and forest grazing, meadow species which may be maintained in managed meadows, and wetland species. Virtually all of the historically recorded tree species are still present, and most candidate species are herbaceous or shrubs. Some species may be re-introduced in deer exclosures, but re-introduction would be most successful after deer populations are reduced.

Primary sources for historical information were the herbarium records at ANSP. Localities in or near the current Pennypack Park were considered relevant, such as the many older records from “Holmesburg” which were probably from the area that is now part of the park. Species for which there are a number of records are considered the best candidates, since they were less likely to have

depended on unusual conditions at a few sites which may no longer be present. In addition, McNeil (1963) summarized records from Louis Hand's surveys of Pennypack Park.

Possible species for re-introduction based on the historical occurrence and absence from the current inventory include:

Trees/shrubs:

Speckled alder (*Alnus serrulata*)

Chokeberry (*Aronia prunifolia* and/or *A. arbutifolia*)

Red-cedar (*Juniperus virginiana*)

Spring ephemeral herbaceous plants of woodlands and wetlands:

Liverleaf (*Hepatica nobilis*)

Canada mayflower (*Maianthemum canadense*)

Wild columbine (*Aquilegia canadensis*)

Bloodroot (*Sanguinaria canadensis*)

Dutchman's breeches (*Dicentra cucullaria*)

Green-dragon (*Arisaema draconitum*)

Cranesbill and wild geranium (*Geranium carolinianum* and *G. maculatum*)

Summer or autumn blooming herbaceous plants of wetlands and wet meadows:

Swamp milkweed (*Asclepias incarnata*)

Butterflyweed (*Asclepias tuberosa*)

Joe-pye weeds (*Eupatorium dubium* and *E. fistulosum*)

Great lobelia (*Lobelia siphilitica*)

Turk's cap lily (*Lilium superbuum*)

Mountain mints (*Pycnanthemum muticum, P. verticillatum* and *P. virginianum*)

Summer or autumn blooming herbaceous plants of meadows:

Round-leaved boneset (*E. rotundifolium*)

Beard-tongue (*Penstemon digitalis*)

False foxglove (*Agalinis purpurea)*

Some other species probably no longer present, but which would be more difficult to re-introduce (less likely to become established, difficult to obtain stock, etc.) include:

Grape ferns (*Botrychium dissectum* and *B. virginianum)*

Trailing arbutus (*Epigaea repens*)

Meadow bottle gentian (*Gentiana clausa*).

Some other species would probably be very difficult to locate, establish and maintain, and are poor candidates for re-introduction, although they are part of the historic flora:

Grape ferns (*Botrychium matricariaefolium, B. multifidum* and *B. simplex*)

Ragged-fringed orchid (*Platanthera lacera*)

Large twayblade and Loesel's twayblade (*Liparis liliifolia* and *L. loeseli*)

Green adder's mouth orchid (*Malaxis unifolia*)

Autumn coral-root (*Coralliorhiza odontorhiza)*

Ladies-tresses orchids (*Spiranthes cernua, S. lacera,* and *S. vernalis*).

A number of other species probably occurred in the park but are not documented by herbarium specimens (cf. Rhoads and Klein 1993, Wherry 1968, Appendix A-1.1). Some of these would probably be good candidates for introduction to the park.

5.D.1. Restoration Site Overview

Restoration activities at various sites were prioritized on the basis of expected ecological benefits, likelihood of success, estimated implementation costs, site constraints and other site-specific factors (Table 5.D.1). Descriptions of sites with high priority restoration activities are presented in Section 5.E and mapped in Section 5.F.6. For Pennypack Park, virtually all restoration activities involving planting would be affected by deer at their current population level. Restoration prioritization was done under the assumption that deer numbers will eventually be reduced. Restoration activities which should not be implemented until such reduction are noted by a "HD" priority. Following deer control, some exotic species may increase along with native species. Therefore, monitoring of restored sites and controlling exotics is recommended along with replanting for a number of sites. This action is referred to as monitor plantings/control exotics as needed. Some planting can be done even at current deer levels, but these will be limited in extent because of the greater expense. For example, large (e.g., about 8-10 feet) sapling trees may planted to establish canopy species. Because of the greater initial cost of larger stock, greater difficulty in handling and greater maintenance to achieve high survival, extensive planting of large saplings is not recommended. Deer exclosures can also be used to protect new plantings. However, exclosures are not a solution to deer problems, because of the high absolute cost for large exclosures, the high relative cost for small or elongate exclosures, and the need for maintenance. Small deer exclosures are recommended in some sites as an interim activity to maintain floral diversity and demonstrate effects of deer. Exclosures are recommended in areas with good quality canopy in high use areas (near main trails, Fox Chase Farm, and the Pennypack Environmental Center). Activities which can be undertaken immediately include some of the erosion and gully control measures, such as physical water holding devices and water bars), release of mown areas, and control of invasive plants (especially control of mile-a-minute, oriental bittersweet and other vines or rapidly spreading invasives). However, long-term control of established invasives may be difficult where replanting is desired to prevent re-establishment. In these cases, planting should include species not preferred by deer, enclosures would have to be used, or control would have to be sustained until replanting can be done.

Restoration activities are proposed throughout the park. Activities are clustered in different areas, where different activities can enhance each other.

A number of activities are recommended for Fox Chase Farm, where current farming practices impact lands and streams. Activities include increasing riparian buffers, installation of deer enclosures, replanting, and construction of a stream crossing for cattle.

The upper end of the park (above Bustleton Avenue) contains some high quality canopy woods, streams and a number of good wetlands. These sites should be monitored and protected. Parts of the area are impacted by deer and invasive plants. Invasive control, especially along forest edges and riparian zones, and edge management is recommended at a number of sites within this area. Replanting of shrubs and herbaceous plants in sites with mature canopies is recommended once deer numbers are reduced. Improved riparian management along several tributaries, such as along Rockledge and Sedden's runs, and along the creek is also recommended, since these areas are affected by mowing, gully erosion from road or trail runoff, and/or trampling by anglers and other users. Modification of the Verree dam to restore upstream-downstream connection and normal channel form is recommended. It is recommended that part of the mowed field in the bend of the creek above Verree Road be released and maintained as a wetland/floodplain area. If the Verree Road parking lot is moved to the north side of the road, wetland expansion on the north side can be used to control parking lot runoff, and the wetland on the south side can be enhanced. Several old fields near the railroad and south of Verree Road provide uncommon early successional habitat for the park. These should be actively maintained as meadows and old fields. Several areas where road

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
S11	Channel	Lower Cobbs Creek	Lower Cobbs Creek	L	
		Action		**Priority**	
		Trash Removal		L	
S20.01	Channel	Rockledge Brook	S. of Pine Road; near new residential development	HC	0.06
		Action		**Priority**	
		Daylighting		L	
		Structural Improvement (SW)		L	
		Coordinate with other agencies		HC	
S20.02	Channel	Fox Chase Run	Fox Chase Farm	H	0.94
		Action		**Priority**	
		Structural Improvement (Trails)		H	
S20.03	Channel	Verree Road Dam	North Verree Road	H	0.07
		Action		**Priority**	
		Dam Modification		H	
S20.04	Channel	Ballard Run	S. of Pine Road, W. of Cargill Road	L	0.07
		Action		**Priority**	
		Trash Removal		L	
S20.05	Channel	Ballard Run	Culvert under Bloomfield Avenue	H	0.09
		Action		**Priority**	
		Trash Removal		H	
		Bank Stabilization/Regrade		H	
		Structural Improvement (SW)		H	
		Coordinate with other agencies		HC	
S30.01	Channel	Tustin Creek, a trib. to Sedden's Creek (Trib. 3)	E. of Tabor Ave., S. of Verree Ave.	H	2.43
		Action		**Priority**	
		Daylighting		H	
		Protect/Monitor		HP	
S30.02	Channel	Krewstown Creek (Trib. 15)	W. of Krewstown Road, E. of Railroad Bridge	HP	1.46
		Action		**Priority**	
		Protect/Monitor		HP	
		Control ATV/Dirt Bike Access		HT	
S30.03	Channel	Krewstown Creek (Trib. 15)	W. of Krewstown Road	H	0.18
		Action		**Priority**	
		Gully Repair and Prevention		H	
		Coordinate with other agencies		HC	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
S30.04	Channel	Hower Creek (Trib. 1)	Near Rising Sun Ave. and Hower Lane	HV	0.45
		Action	**Priority**		
		Trash Removal	HV		
S30.05	Channel	Tributary 1 of Sedden's Run	near Tabor Road access to park	HP	2.19
		Action	**Priority**		
		Protect/Monitor	HP		
		Trash Removal	HV		
S40.01	Channel	Three Springs	South of railroad and Krewstown Road	HP	4.36
		Action	**Priority**		
		Protect/Monitor	HP		
S50.01	Channel	Dam on Pennypack just north of Roosevelt Blvd.	Just north of Roosevelt Blvd.	HC	0.12
		Action	**Priority**		
		Dam Modification	HC		
S50.02	Channel	Shriners Run (Trib. 14) and Pennypack Creek	Just north of Roosevelt Blvd; West of Pennypack Ck	HC	0.86
		Action	**Priority**		
		Coordinate with other agencies	HC		
		Structural Improvement (Trails)	HT		
S50.03	Channel	Mainstem Pennypack	South of Roosevelt Boulevard Dam	HC	0.22
		Action	**Priority**		
		Coordinate with other agencies	HC		
		Structural Improvement (Trails)	HT		
S60.01	Riparian Zone	Bluegrass Creek (Trib. 11)	Just S. of Roosevelt Blvd; W. of Bluegrass Rd.	H	0.36
		Action	**Priority**		
		Structural Improvement	H		
		Regrade	H		
		Replant Native Forest Species	HV		
S70.01	Channel	Winchester Creek (Trib. 7)	S. of Winchester Ave., E. of Holmehurst Ave.	HVD	0.33
		Action	**Priority**		
		Protect/Monitor	HP		
		Trash Removal	HV		
		Invasive-Exotic Control	HD		
S70.02	Channel	Winchester Creek (Trib. 7)	S. of Winchester Ave., E. of Holmehurst Ave.	H	0.09
		Action	**Priority**		
		Structural Improvement (Trails)	H		

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
S70.03	Riparian Zone	Winchester Creek (Trib. 7)	S. of Winchester Ave., E. of Holmehurst Ave.	HD	0.07
		Action	**Priority**		
		Replant Native Shrubs	HD		
S70.04	Channel	Winchester Creek (Trib. 7)	S. of Winchester Ave., E. of Holmehurst Ave.	H	0.05
		Action	**Priority**		
		Structural Improvement (Trails)	H		
S70.05	Channel	Albion Creek (Trib. 10)	W. of Winchester Ave., NW. of Holmehurst Ave.	L	0.18
		Action	**Priority**		
		Structural Improvement (SW)	L		
S80.01	Channel	Loney Creek (Trib. 9)	SE of intersection of Lexington Ave. and Rhawn St.	HC	0.21
		Action	**Priority**		
		Gully Repair and Prevention	HC		
S80.02	Channel	Loney Creek (Trib. 9)	S. of intersection of Lexington Ave. and Rhawn St.	H	0.13
		Action	**Priority**		
		Protect/Monitor	HP		
		Structural Improvement (Trails)	H		
S80.03	Channel	Rhawn Street dam	Just south of Rhawn Street	H	0.11
		Action	**Priority**		
		Dam Modification	H		
S80.04	Channel	Meehan Creek (Trib. 8)	South of Rhawn Street	H	0.01
		Action	**Priority**		
		Structural Improvement (Trails)	H		
S90.01*	Channel	Pennypack current deflector (no mapped polygon)	Uncertain, between Roosevelt and upper Rhawn	HC	
		Action	**Priority**		
		Structural Improvement (SW)	HC		
S100.01	Channel	Willits Run	Willits Road	HV	0.21
		Action	**Priority**		
		Trash Removal	HV		
V10.0*	Non-Forested Upland	Fox Chase Farm Sites (no mapped polygon)	North of Pine Road	H	
		Action	**Priority**		
		Invasive-Exotic Control	H		
		Release/Mow Infrequently	H		

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V10.01	Riparian Zone	Fox Chase Farm Riparian Zone	Tributary in Fox Chase, North of Pine Road	H	0.74
		Action		**Priority**	
		Structural Improvement		H	
		Release/Widen		M	
V10.02	Riparian Zone	Fox Chase Tributary Restored Area	Fox Chase Farm Tributary	H	3.01
		Action		**Priority**	
		Release/Widen		H	
		Structural Improvement		H	
		Remove Exotics/Replant Native Shrubs		HV	
V10.04	Forested Upland	Fox Chase Woodlot	Fox Chase Farm Property	H	0.88
		Action		**Priority**	
		Deer Exclosures/Replant Native Forest Species		H	
V10.05	Forested Upland	Fox Chase Woods	Northwest of the Manor House	H	1.44
		Action		**Priority**	
		Deer Exclosures/Replant Native Forest Species		H	
		Replant Native Forest Species		H	
V20.01	Forested Upland	Pine Road Sugar Bush	Along Pine Road across from Fox Chase Farm	H	17.84
		Action		**Priority**	
		Invasive-Exotic Control		H	
		Replant Native Trees		H	
V20.02	Wetland	Verree Road Wetland	West bank of Pennypack, North of Verree	H	1.67
		Action		**Priority**	
		Release/Widen		H	
		Wetland creation/expansion		H	
		Remove Exotics/Replant Native Wetland Species		HD	
V20.03	Wetland	Goose Pond Meadow	West bank Pennypack in bend above Verree Dam	H	5.09
		Action		**Priority**	
		Invasive-Exotic Control		H	
		Wetland Creation		H	
		Berms		H	
		Structure Building (Boardwalk)		L	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V20.04	Forested Upland	Woods north of Verree	S. of Creek and N. of Verree Rd. at Dam	H	23.81
		Action		**Priority**	
		Slope Stabilization		H	
		Protect/Monitor		HP	
		Replant Native Trees		HD	
V20.05	Forested Upland	Pennypack Environmental Center	Left bank of Pennypack, North of Verree	H	4.47
		Action		**Priority**	
		Release/Widen		H	
		Monitor plantings/Control Exotics as Needed		H	
		Remove Exotics/Replant Native Forest Species		HV	
		Replant Native Trees		HV	
		Deer Exclosures/Replant Native Understory Species		L	
		Replant Native Herbs		HD	
V20.06	Forested Upland	Verree Wetland Woods	Northwest of Verree Road	H	4.30
		Action		**Priority**	
		Edge Management		H	
		Replant Native Forest Species		HD	
V20.07	Riparian Zone	Right bank of Pennypack, north of Verree Dam	West side of Pennypack Creek above Verree Dam	H	0.85
		Action		**Priority**	
		Regrade		H	
		Structural Improvement		H	
		Replant Native Forest Species		HD	
		Trail Improvement		HT	
V20.08	Slope	Environmental Center Slopes	Left Bank of the Pennypack, Behind EC	H	3.68
		Action		**Priority**	
		Erosion Control		H	
		Deer Exclosures/Replant Native Forest Species		H	
		Replant Native Shrubs		HD	
V20.09	Riparian Zone	Veree Road Riparian Zone	Right Bank of the Pennypack, North of Veree Rd.	L	0.38
		Action		**Priority**	
		Replant Native Forest Species		L	
		Bank Stabilization		L	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V20.10	Forested Upland	Verree Street Woods	North of Verree, South of Pine Road	HD	21.60
		Action		**Priority**	
		Deer Exclosures/Replant Native Forest Species		L	
		Slope Stabilization		L	
		Replant Native Shrubs		HD	
		Replant Native Herbs		HD	
V20.11	Non-Forested Upland	Bloomfield and Pine Forest Edge	Intersection of Bloomfield and Pine	HT	8.76
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		L	
		Replant Native Forest Species		L	
		Invasive-Exotic Control		L	
		Trail Improvement		HT	
V20.12	Non-Forested Upland	Bloomfield Oldfield	Intersection of Pine Rd. and Bloomfield Rd.	H	0.88
		Action		**Priority**	
		Meadow Management		H	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		HV	
		Remove Exotics/Replant Native Shrubs		M	
		Release/Mow Infrequently		L	
V20.13	Riparian Zone	Pine St. Park Riparian Zone	Right Bank of the Pennypack, opposite Ballard Run	H	0.65
		Action		**Priority**	
		Deer Exclosures/Replant Native Forest Species		H	
		Replant Native Forest Species		H	
		Release/Widen		H	
V20.14	Riparian Zone	Rockledge Brook Riparian Zone	Rockledge Brook	H	0.42
		Action		**Priority**	
		Release/Widen		H	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		HV	
		Replant Native Forest Species		HD	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V20.15	Riparian Zone	Rockledge Brook Riparian Zone (lower)	S. of Pine Road, W. of Picnic Area	H	1.73
		Action		**Priority**	
		Release/Widen		H	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		HV	
		Replant Native Forest Species		M	
		Trail Improvement		HT	
V30.01	Wetland	Verree Rd. Southeast Wetland	Right bank Pennypack below (S and E) of Verree	HD	1.50
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		HV	
		Structure Building (Boardwalk)		L	
		Replant Native Wetland Species		HD	
V30.02	Non-Forested Upland	North Verree-Tustin Old Field	South of Verree , west side of creek	H	14.47
		Action		**Priority**	
		Meadow Management		H	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		HV	
		Replant Native Shrubs		HD	
V30.03	Non-Forested Upland	South Verree and Tustin Old Field	Verree Rd and Tustin St.	HD	19.73
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		HD	
		Remove Exotics/Replant Native Meadow Species		HD	
V30.04	Slope	Tustin St. Sloped Forest	West side of creek below Verree	H	28.30
		Action		**Priority**	
		Deer Exclosures/Replant Native Forest Species		H	
		Invasive-Exotic Control		H	
		Monitor plantings/Control Exotics as Needed		L	
		Replant Native Trees		L	
		Replant Native Shrubs		L	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V30.05	Riparian Zone	Strahle Terrace Riparian Zone	North of Sedden's Run	HD	1.98
		Action		**Priority**	
		Deer Exclosures/Replant Native Forest Species		L	
		Invasive-Exotic Control		L	
		Monitor plantings/Control Exotics as Needed		HD	
		Remove Exotics/Replant Native Forest Species		HD	
V30.06	Riparian Zone	Sedden's Run	East of Tabor Road	HV	1.09
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		HV	
		Replant Native Forest Species		HV	
		Invasive-Exotic Control		HV	
		Structural Improvement		M	
V30.07	Wetland	Wetland on Sedden's tributary	Right bank tributary of Sedden's Run	HP	1.61
		Action		**Priority**	
		Protect/Monitor		HP	
		Replant Native Shrubs		M	
		Deer Exclosures/Replant Native Wetland Species		M	
V30.08	Slope	Krewstown Forest Seeps	Forest above railroad and Krewstown Road	H	1.07
		Action		**Priority**	
		Deer Exclosures/Replant Native Forest Species		H	
		Monitor plantings/Control Exotics as Needed		HD	
		Replant Native Herbs		HD	
		Trail Improvement		HT	
V30.09	Non-Forested Upland	Krewstown Old Field	Old field along railroad, above Krewstown Road	H	10.12
		Action		**Priority**	
		Protect/Monitor		HP	
		Meadow Management		H	
		Invasive-Exotic Control		HV	
V30.10	Slope	Krewstown Sloped Forest	Slopes north of railroad and Krewstown Road	H	36.98
		Action		**Priority**	
		Erosion Control		H	
		Replant Native Shrubs		L	
		Deer Exclosures/Replant Native Forest Species		L	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V30.11	Non-Forested Upland	Krewstown Forest/old field	Adjacent to RR Bridge	H	1.37
		Action		**Priority**	
		Meadow Management		MC	
		Gully Repair		H	
		Replant Native Trees		HD	
		Trail Improvement		HT	
V30.12	Non-Forested Upland	Tustin Street Forest	Corner of Tustin St. and Verree Rd.	M	2.59
		Action		**Priority**	
		Release/Mow Infrequently		M	
		Replant Native Trees		M	
V30.13	Riparian Zone	Verree Rd. East Floodplain	Verree Rd. near EC	HD	2.87
		Action		**Priority**	
		Meadow Management		L	
		Remove Exotics/Replant Native Forest Species		HD	
		Monitor plantings/Control Exotics as Needed		HD	
V30.14	Forested Upland	Persimmon Patch	NW of Krewstown Road	HP	4.09
		Action		**Priority**	
		Protect/Monitor		HP	
		Replant Native Shrubs		L	
		Replant Native Herbs		L	
V30.15	Wetland	Police facility Wetland	Left bank of creek, West of Krewstown Rd.	HV	0.63
		Action		**Priority**	
		Protect/Monitor		HP	
		Invasive-Exotic Control		HV	
		Replant Native Shrubs		M	
		Monitor plantings/Control Exotics as Needed		M	
		Replant Native Herbs		M	
V30.16	Slope	Martin's Run (Bloomfield Rd.) Woods	Adjacent to Environmental Center	HPD	2.30
		Action		**Priority**	
		Protect/Monitor		HP	
		Remove Exotics/Replant Native Forest Species		HD	
		Replant Native Herbs		HD	
		Monitor plantings/Control Exotics as Needed		HD	
		Replant Native Shrubs		HD	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V30.18	Wetland	Tabor Woods Wetland	North of Krewstown, East of Tabor	M	0.57
		Action		**Priority**	
		Remove Exotics/Replant Native Wetland Species		M	
		Wetland Creation		M	
		Invasive-Exotic Control		M	
		Monitor plantings/Control Exotics as Needed		M	
V30.19	Slope	Rising Sun Ave. Sloped Forest	West of Rising Sun Ave. North of Krewstown Rd.	HC	56.88
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		H	
		Protect/Monitor		HP	
		Invasive-Exotic Control		HV	
		Trash Removal		HC	
		Release/Widen		HC	
		Replant Native Trees		HD	
V40.01	Forested Upland	Krewstown dump	Old quarry south of Krewstown, west of creek	H	0.37
		Action		**Priority**	
		Trash Removal		H	
		Replant Native Forest Species		L	
		Replant Native Trees		L	
V40.02	Riparian Zone	Three-springs Hollow	South of railroad and Krewstown	HD	4.36
		Action		**Priority**	
		Remove Exotics/Replant Native Forest Species		M	
		Deer Exclosures/Replant Native Forest Species		M	
		Replant Native Herbs		HD	
		Monitor plantings/Control Exotics as Needed		HD	
V40.03	Non-Forested Upland	Three-spring Hollow Old Field	Edge of railroad at top of slope	H	0.94
		Action		**Priority**	
		Meadow Management		H	
		Replant Native Herbs		M	
		Monitor plantings/Control Exotics as Needed		L	
		Deer Exclosures/Replant Native Meadow Species		L	
		Invasive-Exotic Control		L	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V40.04	Non-Forested Upland	Three-springs Hollow, NE edge	NE edge of woods	H	2.62
		Action		**Priority**	
		Meadow Management		H	
		Edge Management		H	
		Invasive-Exotic Control		HV	
V40.05	Forested Upland	Winchester Avenue Woods	South of Winchester, West of Bustleton Ave.	HVD	1.25
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		HV	
		Edge Management		M	
		Protect/Monitor		M	
		Replant Native Forest Species		HD	
V40.06	Riparian Zone	Algon Avenue Riparian Zone	North of Algon, Right bank of Pennypack Creek	HVD	1.50
		Action		**Priority**	
		Release/Widen		H	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		HV	
		Remove Exotics/Replant Native Forest Species		HD	
V40.07	Non-Forested Upland	Bustleton Avenue Edge	West of Buselton, North of Benton Ave.	M	1.33
		Action		**Priority**	
		Edge Management		M	
		Invasive-Exotic Control		M	
V40.08	Slope	Algon Ave Sloped Woods	Left bank of Creek, N of Algon Ave.	HP	34.41
		Action		**Priority**	
		Protect/Monitor		HP	
		Remove Exotics/Replant Native Forest Species		M	
		Deer Exclosures/Replant Native Forest Species		L	
V40.09	Slope	Three-Spring Hollow woods	S of Krewstown, N of Algon Ave.	HD	19.87
		Action		**Priority**	
		Deer Exclosures/Replant Native Understory Species		L	
		Monitor plantings/Control Exotics as Needed		HD	
		Replant Native Trees		HD	
		Replant Native Herbs		HD	
		Replant Native Shrubs		HD	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V40.10	Riparian Zone	Algon Ave. Flood Plain	Northwest of Bustleton Ave.	H	6.84
		Action		**Priority**	
		Gully Repair		H	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		M	
		Replant Native Forest Species		M	
		Deer Exclosures/Replant Native Forest Species		L	
V40.11	Wetland	Benton Ave. Wetlands	Algon Ave Wetland	L	0.71
		Action		**Priority**	
		Replant Native Herbs		L	
		Replant Native Shrubs		L	
V40.12	Forested Upland	Algon Avenue Gully	North of Algon, South of Krewstown	HT	0.20
		Action		**Priority**	
		Trail Improvement		HT	
V50.01	Slope	Benton Avenue Slopes	East of Benton Avenue, right bank of Creek	L	15.41
		Action		**Priority**	
		Erosion Control		L	
		Replant Native Trees		L	
		Replant Native Shrubs		L	
		Monitor plantings/Control Exotics as Needed		L	
		Invasive-Exotic Control		L	
V50.02	Wetland	Benton Avenue Wetland	East of Benton Avenue, right bank of Creek	HPD	1.21
		Action		**Priority**	
		Protect/Monitor		HP	
		Remove Exotics/Replant Native Herbs		HD	
		Monitor plantings/Control Exotics as Needed		HD	
V50.03	Forested Upland	Bradford Street Forest	North of Roosevelt Blvd. , West of Bradford St.	M	0.78
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		M	
		Remove Exotics/Replant Native Forest Species		M	
		Invasive-Exotic Control		L	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V50.04	Riparian Zone	Winchester Ave Shrubland	West of Winchester, Left bank of the Pennypack	H	0.25
		Action		**Priority**	
		Structural Improvement		H	
		Gully Repair		H	
		Replant Native Forest Species		HD	
V50.05	Riparian Zone	Old Newtown Road Riparian Zone	West of Winchester, Left bank of the Pennypack	M	0.17
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		M	
		Replant Native Forest Species		M	
		Invasive-Exotic Control		M	
V50.06	Non-Forested Upland	Large Street Trail Crossings	North east of Horrocks Street	HT	1.84
		Action		**Priority**	
		Trail Improvement		HT	
V60.01	Riparian Zone	Winchester Riparian Zone	Just S. of Roosevelt Blvd; W. of Bluegrass Rd.	H	2.10
		Action		**Priority**	
		Release/Widen		H	
		Replant Native Forest Species		HD	
		Monitor plantings/Control Exotics as Needed		HD	
V60.02	Non-Forested Upland	Walnut Hill Mowed Field	Walnut Hill Street	H	1.69
		Action		**Priority**	
		Edge Management		H	
		Release/Mow Infrequently		H	
		Meadow Management		H	
V60.03	Forested Upland	Axe Factory Road Woods	Winchester Ave. and Axe Factory Road	L	9.64
		Action		**Priority**	
		Protect/Monitor		L	
		Replant Native Shrubs		L	
V60.04	Forested Upland	Dewees Street Woods	Left Bank of creek, West of Winchester Ave.	HD	33.41
		Action		**Priority**	
		Protect/Monitor		L	
		Monitor plantings/Control Exotics as Needed		HD	
		Replant Native Shrubs		HD	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V70.01	Wetland	Lexington Avenue Wetland	North of Rhawn, East of Lexington Avenue	HD	0.32
		Action		**Priority**	
		Replant Native Shrubs		HD	
		Replant Native Herbs		HD	
		Monitor plantings/Control Exotics as Needed		HD	
V70.02	Wetland	Winchester Avenue Wetland	South of Winchester, East of Holmehurst	M	3.00
		Action		**Priority**	
		Remove Exotics/Replant Native Wetland Species		M	
		Structure Building (Boardwalk)		L	
V70.03	Riparian Zone	Rhawn Street Meadow	North of Rhawn, East of Holmehurst	M	0.83
		Action		**Priority**	
		Remove Exotics/Replant Native Forest Species		M	
		Release/Widen		M	
		Meadow Management		M	
V70.04	Slope	Winchester Avenue Slopes	South of Winchester, West of Welsh Road	H	6.17
		Action		**Priority**	
		Structural Improvement		H	
		Monitor plantings/Control Exotics as Needed		L	
		Remove Exotics/Replant Native Forest Species		L	
		Erosion Control		L	
		Deer Exclosures/Replant Native Forest Species		L	
		Replant Native Shrubs		L	
		Replant Native Trees		L	
V70.05	Slope	Lexington Ave Slopes	Lexington and Rhawn Streets.	HV	7.07
		Action		**Priority**	
		Trash Removal		HV	
		Edge Tree/Shrub Planting		L	
V70.06	Slope	Lexington Ave Slopes	Lexington and Rhawn Streets	HC	0.49
		Action		**Priority**	
		Gully Repair and Prevention		HC	
V80.01	Riparian Zone	Lexington Avenue Floodplain	Southeast of Lexington Ave.	L	2.35
		Action		**Priority**	
		Regrade		L	
		Replant Native Forest Species		L	
		Deer Exclosures/Replant Native Forest Species		L	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V80.02	Forested Upland	Lexington Avenue Oak Forest	South of Rhawn, East of Lexington Ave.	HPD	1.48
		Action		**Priority**	
		Protect/Monitor		HP	
		Monitor plantings/Control Exotics as Needed		HD	
		Remove Exotics/Replant Native Forest Species		HD	
V80.03	Forested Upland	Lexington Avenue Woods	West of Rhawn Street to Ryan Ave.	H	15.58
		Action		**Priority**	
		Slope Stabilization		H	
		Faunal Introduction		M	
		Edge Management		L	
		Replant Native Trees		HD	
V80.04	Wetland	Ryan Avenue Wet Meadow	East of Ryan Avenue, South of Lexington	HV	1.01
		Action		**Priority**	
		Invasive-Exotic Control		HV	
		Monitor plantings/Control Exotics as Needed		M	
		Replant Native Shrubs		M	
		Deer Exclosures/Replant Native Wetland Species		L	
V80.05	Riparian Zone	Pennypack Earth Day Site	South of Rhawn Street Park	HVD	0.97
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		H	
		Invasive-Exotic Control		HV	
		Replant Native Forest Species		HD	
V80.06	Wetland	Earth Day Wetland	Adjacent to Earth Day Stream Site	H	4.46
		Action		**Priority**	
		Structure Building (Boardwalk)		LT	
		Protect/Monitor		HP	
		Deer Exclosures/Replant Native Wetland Species		H	
		Replant Native Herbs		L	
		Trail Improvement		HT	
V80.07	Wetland	Lexington and Rhawn Wetland	South of Rhawn Street	HP	0.59
		Action		**Priority**	
		Protect/Monitor		HP	
		Deer Exclosures/Replant Native Wetland Species		M	
		Replant Native Herbs		M	
		Replant Native Shrubs		M	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V80.08	Wetland	Rowland Ave. Wetland	Northwest of Roland Ave.	H	3.04
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		H	
		Deer Exclosures/Replant Native Wetland Species		H	
		Invasive-Exotic Control		M	
		Structural Improvement		HC	
		Remove Exotics/Replant Native Wetland Species		HD	
V90.0	Wetland	Ryan Avenue West Wetland	West of Ryan Avenue, East of Roosevelt Blvd.	HC	2.06
		Action		**Priority**	
		Invasive-Exotic Control		L	
		Replant Native Herbs		L	
		Monitor plantings/Control Exotics as Needed		L	
		Wetland Creation		HC	
V100.01	Forested Upland	Solly Avenue Woods	East of Welsh Rd. At Solly and Hess Sts.	HC	21.89
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		M	
		Invasive-Exotic Control		M	
		Trash Removal		M	
		Replant Native Forest Species		M	
		Coordinate with other agencies		HC	
V100.02	Riparian Zone	Father Judge Riparian Zone	West of Convent Ave., East of Father Judge H.S.	M	9.62
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		M	
		Monitor plantings/Control Exotics as Needed		M	
		Remove Exotics/Replant Native Forest Species		M	
		Replant Native Forest Species		L	
V100.03	Wetland	Winthrop Avenue Wetland	Left Bank of Creek, East of Welsh Rd.	H	0.74
		Action		**Priority**	
		Invasive-Exotic Control		H	
		Remove Exotics/Replant Native Shrubs		HD	
		Remove Exotics/Replant Native Herbs		HD	
		Monitor plantings/Control Exotics as Needed		HD	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V100.04	Riparian Zone	Winthrop Riparian Zone	Left Bank, East of Welsh Rd.	HD	3.97
		Action		**Priority**	
		Deer Exclosures/Replant Native Forest Species		H	
		Trash Removal		HV	
		Remove Exotics/Replant Native Forest Species		HD	
		Monitor plantings/Control Exotics as Needed		HD	
V100.05	Wetland	Draper Street Wetland	East of Welsh Rd., West of RR tracks	L	0.42
		Action		**Priority**	
		Protect/Monitor		L	
V110.01	Non-Forested Upland	Frankford hemlock grove	East bank, south of Frankford, w of Enfield	L	1.89
		Action		**Priority**	
		Spray Program		L	
V110.02	Forested Upland	Torresdale edge	Above Torresdale. East side of Pennypack.	H	1.23
		Action		**Priority**	
		Replant Native Trees		H	
		Monitor plantings/Control Exotics as Needed		H	
		Release/Widen		H	
		Replant Native Herbs		M	
V110.03	Forested Upland	Frankford Ave. Waterfalls Forest	North of Frankford, Left bank of Pennypack	HV	1.59
		Action		**Priority**	
		Remove Exotics/Replant Native Trees		HV	
		Remove Exotics/Replant Native Shrubs		HV	
		Trash Removal		HV	
		Monitor plantings/Control Exotics as Needed		HV	
V120.0*	Wetland	Mouth of the Pennypack (no mapped polygon)	west bank in bend of Pennypack Creek at mouth	H	
		Action		**Priority**	
		Replant Native Shrubs		H	
		Structural Improvement		H	
		Replant Native Herbs		H	
V120.01	Wetland	Created wetland	Mouth of the Pennypack	H	12.38
		Action		**Priority**	
		Structural Improvement		H	
		Replant Native Herbs		H	

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Site ID	Restoration Type	Site Name	Location	Priority	Acreage
V120.02	Slope	Trash mound slopes	Mouth of the Pennypack	H	4.98
		Action		**Priority**	
		Invasive-Exotic Control		H	
		Replant Native Forest Species		H	
		Monitor plantings/Control Exotics as Needed		H	
V120.03	Forested Upland	Mouth of Pennypack, east half	Mouth of Pennypack	H	8.59
		Action		**Priority**	
		Structural Improvement		H	
		Replant Native Forest Species		L	
		Structural Improvement		HC	
		Trail Improvement		HT	
V120.04	Wetland	Pennypack Wetland	East section of the park	M	0.27
		Action		**Priority**	
		Monitor plantings/Control Exotics as Needed		M	
		Invasive-Exotic Control		M	
		Protect/Monitor		M	
		Replant Native Shrubs		M	
		Replant Native Trees		M	
V120.05	Non-Forested Upland	Mouth of Pennypack Old Field	Mouth of Pennypack	H	4.10
		Action		**Priority**	
		Protect/Monitor		HP	
		Meadow Management		H	
		Replant Native Herbs		M	
V130.0*	Park Wide	Pennypack Pk. Deer Control (no mapped polygon)	Park wide	H	
		Action		**Priority**	
		Control Deer		H	
		Deer Monitoring		H	
V130.01*	Park Wide	Park Wide (no mapped polygon)	Park wide	HD	
		Action		**Priority**	
		Floral Reintroduction		HD	
V130.02*	Park Wide	Release/buffer zone protection (no mapped polygon)	Park wide	H	
		Action		**Priority**	
		Structural Improvement (protect trees)		H	
		Mow Infrequently to Increase Woods		H	

or trail erosion is severe should be addressed in the trail management plan. Reduction or removal of log dumps on the east side of the creek is also recommended.

The park lands between Bustleton and Holme avenues are generally narrower and more disturbed, with significant park edge effects, such as yard waste and other dumping, slope erosion, Norway maple and other invasive plants. Deer browsing is also a major problem in this section.

Release of mowed areas to enlarge natural lands is recommended in several places in this section. The dam above Roosevelt Avenue creates overflow problems which affects the trail and side wall of the creek. Modification of the dam to ameliorate these problems and restore natural stream function would be ecologically beneficial, although the presence of sewer line crossings above the dam may make it difficult to remove the dam. There are several other restoration projects on tributaries in this reach, involving trail crossing and storm flow problems.

The section between Holme Avenue and the lower Rhawn Street crossing has many of the same problems as the upstream section. The Holme-Rhawn section is notable for containing several floodplain wetlands, including the large “Rhawn Street” wetland which is ecologically significant. This section also contains several good quality tributaries, although many are affected by poorly designed trail crossings. Enhancement of woods and wetlands by invasive control and replanting is recommended, though most replanting should be deferred until deer populations are reduced. This area is heavily used and improving trail crossings of creeks and closing rogue trails and improving major trails are recommended in several places. Control of gully erosion on slopes is a recommended in several places. Modification of the Rhawn Street dam is recommended, which will benefit the main channel of the Pennypack Creek.

The section from Rhawn Avenue to State Road is narrow and highly disturbed. Invasive control and replanting is recommended in several sites, with most replanting deferred until deer numbers are reduced. Several mowed areas could be released to increase the amount of natural land. Trash removal is recommended in several sites, as well.

The mouth of the Pennypack Creek is ecologically very significant. The natural land along the west bank has been modified extensively by the creation of an intertidal wetland, with associated impacts on the surrounding area. Monitoring of this area is recommended to determine revegetation of the wetland and surrounding uplands. It is likely that supplemental planting will be beneficial in the wetland. Control of invasive plants and replanting may become necessary in the area surrounding the wetlands. Access to the site needs to be modified to allow beneficial uses of the site without opening it to dumping and other disturbances. A greenway trail along the Delaware River has been proposed; this trail would go through the park at the mouth of Pennypack Creek. Overall, this trail could increase open lands along the river, provide means for ecological enhancement and provide access to important natural areas. However, design and maintenance will need to address potential problems such as providing access for dumping, destruction of natural vegetation, and encouragement of invasive plants.

Pennypack Park contains an almost continuous band of natural lands, from preserves in Montgomery County to the mouth of the creek at the Delaware River. This spans the boundary between Piedmont and the Coastal Plain, and includes a diversity of forests, wetlands and meadows. The recommended restoration activities will enhance these lands and thereby enhance their value to the park users and the city.

5.D.2. General Recommendations for Future Activities

The prior section described specific activities that are recommended for implementation in Pennypack Park. In addition to these, a number of other related activities are also recommended. These relate to overall operations in the park, particularly those involving management of the borders between the designed and natural lands. Some of these are outside the direct purview of NLREEP and should be implemented in cooperation with other groups.

- Damage done to the natural lands by trash dumping is a major problem. Exercising control, through methods such as passive blocking of access points as well as patrolling and/or enforcement of regulations, is necessary to minimize or eliminate the damage.
- Non-native plantings in landscaped areas are often a source of invasion by these plants. An increased use of native plants in landscape settings and avoidance of particularly invasive species, such as Norway maple, is recommended in order to avoid this infiltration of non-native landscapes.
- Decreasing the frequency of mowing can result in taller grass and other vegetation which increases water retention and provides better habitat. Implementation of a decreased mowing schedule in places where this does not interfere with other uses is recommended. However, monitoring of the areas of less frequent mowing should be done to ensure that they are not colonized by exotic plants.
- Exotic species occur in both landscaped areas and natural lands. However, exotic species are often patchy in occurrence and may be controlled if addressed early. Occurrence of the species should be monitored throughout the parks.
- Dumping of large quantities of logs, leaves and other horticultural waste is damaging and should be controlled. However, logs can be used in woods to increase soil fungus, decrease surface runoff, provide animal habitat and restrict access. Mulch can be used in restoration plantings to improve soil and decrease unwanted plants. Methods of making these materials available for restoration can improve the success of the restoration initiative, while reducing the storage needs for these materials.

5.D.3. Suggested Implementation Schedule

Costs per acre for implementation of the various restoration activities were estimated and used to calculate the restoration costs for the recommended activities at the recommended sites. These estimates indicate that most or all of the high priority options would be achievable under NLREEP funding and other grants which were submitted for restoration work. As a result, no attempt was made to further develop an implementation schedule, i.e., to prioritize sites among the high priority sites. Scheduling would depend on optimal times for performing various restoration activities and logistics involved in scheduling volunteers, contracting for commercial work, and making links with other agencies. Some particular considerations for implementation are:

- Some types of restoration, particularly control of invasives, will often require several treatments. Scheduling should allow for multiple treatments at optimal times.
- Scheduling should be done to optimize effectiveness. For example, control of exotics which spread by seed, such as garlic mustard, mile-a-minute, and possibly Japanese knotweed, should be done before seed set. Planting of most species is best done in spring or fall to minimize stress on newly planted material. Some species will have particular requirements, necessitating a more specific planting season.
- Scheduling should be done to minimize impacts of implementation. For example, stream bank stabilization in the spring may increase chances of washout by storms and effects on spawning fishes.
- The recommended stream restoration projects include wetland creation and dam removal, which are relatively expensive and need a longer lead time for planning and review. These should be implemented early to allow implementation and modification of other schedules if changes in these projects significantly change costs.
- Since many restoration projects are clustered, scheduling is important to avoid impacts on already completed projects and to increase efficiency of implementation.

- A maintenance schedule should be developed for different types of restorations. For replanting activities, several maintenance visits should be made during the first planting season to water new stock, control any invading unwanted plants, and, if necessary, plant additional material. For projects done early in the NLREEP funding period, additional visits will be possible in one or more seasons after planting, when control of invasives and other corrective activities can be done. These maintenance activities are expected to be inexpensive relative to the initial investment in restoration and can greatly increase probability of success and provide information to improve subsequent restoration work.
- Scheduling should allow for implementation of baseline and post-restoration monitoring programs. If such monitoring is not done by NLREEP, scheduling and notification should be done to give outside groups an opportunity to develop monitoring programs.

5.E. RESTORATION SITE ASSESSMENTS

The individual restoration site assessments for Pennypack Park are presented on pages II-510 through II-609. The high priority sites are also shown on the Restoration Sites maps in Volume II, Section 5.F.6. The key to codes used in the restoration site assessments is given below.

Option priorities:

HP High priority to protect/monitor

HV High priority, can be immediately implemented by volunteers

HC High priority; coordination with other agencies should be sought to deal with large complex projects, joint responsibilities or regulatory issues.

H High priority, single action for site or multiple, equivalent actions for site

M Moderate priority

L Low priority

HD High priority action dependent on control of deer populations; restoration should not be done until deer populations are reduced.

HVD High priority; some activities can be immediately implemented by volunteers, while others should not be started until deer populations are reduced.

HPD High priority site for protection and monitoring; in addition, specific restoration activities are recommended once deer populations are reduced.

HT High priority trail work, which should be addressed as part of trail restoration planning.

Site Use constraints:

P Near playground, main paths, etc., where safety a potential issue

OM Ongoing mowing

D Likely ongoing disturbance

Fairmount Park Restoration Sites

Pennypack Park

Park: PP **Restoration Site ID:** S20.01 **Site Name:** Rockledge Brook

Location: S. of Pine Road; near new residential development

General Location: Pine to Verree

Disturbance/Condition: Underground Stream

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.06

Site Priority: HC **Location Criteria:** Isolated

Description:

Rockledge Brook is in pretty good condition for an urban stream but starts to get more impaired as it nears its confluence with the Pennypack. In this reach, Rockledge Brook has large eroded banks. There is a new housing development along which a small tributary leading down to Rockledge Brook has been led through a pipe. This stream could be daylighted to help restore the natural flow of the tributary and provide habitat for aquatic life. There is approximately 100 meters to daylight.

Tom Witmer has questioned whether this culvert drains a natural stream, or only drains a detention pond for the development. He says there appears to be an old channel nearby. Re-routing part of the basin outflow into this may be the best option to enhance natural processes. This option could allow most storm water discharge to flow through the pipe, maintaining drainage and preventing erosion of the natural channel. Any actions at this site should be coordinated with the engineers who built the existing structure.

Restoration Options:

ID	Action	Priority	Proportion
A	Daylighting	L	100%
B	Structural Improvement (SW)	L	100%
C	Coordinate with other agencies	HC	100%

Park: PP **Restoration Site ID:** S20.02 **Site Name:** Fox Chase Run

Location: Fox Chase Farm

General Location: Fox Chase and North of Pine

Disturbance/Condition: Erosion/Scour

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.94

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

The stream is being impacted by cattle trampling in the stream and on the stream's banks. A minimal riparian buffer of about 5 feet currently exists on each side of the stream. A restoration activity is recommended to fence the cattle out of the stream channel entirely. If this is infeasible, a cattle crossing should be installed to prevent degradation of the stream channel and bank erosion. In addition, a vegetation restoration recommendation (V10.02) for this site is to increase the buffer along this stream to at least 35 feet. All restoration will need to be done in coordination with the staff of the Farm.

Restoration Options:

ID	Action	Priority	Proportion
A	Structural Improvement (Trails)	H	100%

Park: PP **Restoration Site ID:** S20.03 **Site Name:** Verree Road Dam

Location: North Verree Road

General Location: Pine to Verree

Disturbance/Condition: Dam

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.07

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

Dam removal or modification is recommended. Dams are detrimental to a stream's ecosystem. Those dams that have started to collapse should not be repaired to their original structure. Removing or modifying the dam will allow for the natural dynamics of water, sediment, flora, and fauna.

Restoration Options:

ID	Action	Priority	Proportion
A	Dam Modification	H	100%

Park: PP **Restoration Site ID:** S20.05 **Site Name:** Ballard Run

Location: Culvert under Bloomfield Avenue

General Location: Pine to Verree

Disturbance/Condition: SW Structure Malfunction/Problem

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.09

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

The culvert for Ballard Run under Bloomfield Avenue is causing major problems with the stream channel in the park. The problem is twofold: 1) at low flows, the culvert is probably too big and 2) at high flows, the culvert is too small and forces large stormflows to concentrate in the channel, when historically these higher flows would be up on the floodplain. The solution, albeit an expensive one, is to install three squash (i.e., approximately elliptical) culverts. The lower culvert is sized for normal low flows and the upper two culverts transfer flood flow up onto the floodplains where they belong. This culvert system would also require a rebuilding of the blown-out channel and floodplain directly downstream of Bloomfield Avenue.

Coordination with the City Streets Department or the Penn DOT should be sought to modify the culvert so as to dissipate energy as the high flows exit the culvert into the park.

Restoration Options:

ID	Action	Priority	Proportion
D	Bank Stabilization/Regrade	H	100%
A	Structural Improvement (SW)	H	100%
B	Trash Removal	H	100%
C	Coordinate with other agencies	HC	100%

Park: PP **Restoration Site ID:** S30.01 **Site Name:** Tustin Creek, a trib. to Sedden's Creek (Trib. 3)

Location: E. of Tabor Ave., S. of Verree Ave.

General Location: Verree to Bustleton

Disturbance/Condition: Underground Stream

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 2.43

Site Priority: H **Location Criteria:** Near other restorations

Description:

There is a large wetland at the top of this small stream. The wetland should be protected and monitored, along with the stream, which exists entirely within the park boundaries. The stream is fed into a pipe about 5-10 yards before it reaches Seddens Creek. It is recommended that the underground portion of the stream is daylighted so that the natural stream ecosystem can be restored. The daylighting option will have to be weighed against the negative ecological effects that will happen while getting equipment into and out of the site, so that there is a minimal impact on the surrounding vegetation.

Restoration Options:

ID	Action	Priority	Proportion
A	Daylighting	H	1%
B	Protect/Monitor	HP	100%

Park: PP **Restoration Site ID:** S30.02 **Site Name:** Krewstown Creek (Trib. 15)

Location: W. of Krewstown Road, E. of Railroad Bridge

General Location: Verree to Bustleton

Disturbance/Condition: Vehicle Damage

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 1.46

Site Priority: HP **Location Criteria:** Near other restorations

Description:

There is a small amount of water in this stream whose banks have not been eroded to any great extent. There is a problem with all-terrain vehicles tearing up the ground. The vehicle trail goes over the stream while the stream is fed through a small pipe that is clogged. It is recommended that the use of all-terrain vehicles in this area be stopped. Relocation of Krewstown Road has been proposed by the Streets Department. This relocation would greatly affect the tributary. Undeveloped land in the headwaters of the tributary are slated for new housing. The new housing development is planned to have detention basins, but effects on the lower tributary may occur.

Restoration Options:

ID	Action	Priority	Proportion
B	Protect/Monitor	HP	100%
A	Control ATV/Dirt Bike Access	HT	100%

Park: PP **Restoration Site ID:** S30.03 **Site Name:** Krewstown Creek (Trib. 15)

Location: W. of Krewstown Road

General Location: Verree to Bustleton

Disturbance/Condition: Erosion/Scour

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.18

Site Priority: H **Location Criteria:** Near other restorations

Description:

There is a gully in need of repair that is off of Krewstown Road and leads down to the stream. Erosion control is recommended here. Modification of this site could involve installing check dams and should involve coordination with the City Streets Department. Relocation of Krewstown Road has been proposed by the Streets Department. This relocation would greatly affect the tributary. Undeveloped land in the headwaters of the tributary are slated for new housing. The new housing development is planned to have detention basins, but effects on the lower tributary may occur.

Restoration Options:

ID	Action	Priority	Proportion
A	Gully Repair and Prevention	H	3%
B	Coordinate with other agencies	HC	100%

Park: PP **Restoration Site ID:** S30.04 **Site Name:** Hower Creek (Trib. 1)

Location: Near Rising Sun Ave. and Hower Lane

General Location: Verree to Bustleton

Disturbance/Condition: Trash Dumping

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.45

Site Priority: HV **Location Criteria:** Affects ecolog. Significant site

Description:

The stream starts with a culvert, and the top half of the stream runs through a managed area with gray water (an indicator of sewage). There is trash dumping in the stream, and it flows through a culvert just before its confluence with the Pennypack to allow for a trail crossing. The trail crossing is in good condition and should be maintained. Trash removal is recommended for this stream.

Restoration Options:

ID	Action	Priority	Proportion
B	Trash Removal	HV	100%

Park: PP **Restoration Site ID:** S30.05 **Site Name:** Tributary 1 of Sedden's Run

Location: near Tabor Road access to park

General Location: Verree to Bustleton

Disturbance/Condition: None/Minimal

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 2.19

Site Priority: HP **Location Criteria:** Affects ecolog. Significant site

Description:

This stream has some high quality skunk cabbage wetlands, but is in need of protection and monitoring as well as trash removal. The stream has an inactive floodplain but a new floodplain seems to be forming in the channel.

Restoration Options:

ID	Action	Priority	Proportion
A	Protect/Monitor	HP	100%
B	Trash Removal	HV	100%

Park:PP **Restoration Site ID:** S40.01 **Site Name:** Three Springs

Location: South of railroad and Krewstown Road

General Location: Verree to Bustleton

Disturbance/Condition: None/Minimal

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 4.36

Site Priority: HP **Location Criteria:** Affects ecolog. Significant site

Description:

While Three Springs has a sewer smell at times and there is evidence of deer damage in the surrounding forest, it is scattered with skunk cabbage patches and small wetlands. This stream had one of the highest quality macroinvertebrate faunas of any site surveyed in the park. This area was found to be good salamander habitat and is recommended for protection and monitoring. In addition, riparian plantings are recommended once deer are controlled (site V40.02).

Restoration Options:

ID	Action	Priority	Proportion
A	Protect/Monitor	HP	100%

Park: PP **Restoration Site ID:** S50.01 **Site Name:** Dam on Pennypack just north of Roosevelt Blvd.

Location: Just north of Roosevelt Blvd.

General Location: Bustleton to Roosevelt Blvd

Disturbance/Condition: Dam

Restoration Category Stream

Restoration Type: Channel **Constraints:** May not be visable

Acreage: 0.12

Site Priority: HC **Location Criteria:** Affects ecolog. Significant site

Description:

It is recommended that the dam on the Pennypack be removed or modified. Overflow from the dam goes over the west bank and contributes to trail erosion and deterioration of the stone wall along the creek. Dams are detrimental to a stream's ecosystem. Those dams that have started to collapse should not be repaired to their original structure. Removing the dam will allow for the natural dynamics of water, sediment, flora, and fauna.

A sewer line crosses Pennypack Creek just upstream of the dam. More information is needed to be sure that dam removal will not impact the sewer line.

Restoration Options:

ID	Action	Priority	Proportion
B	Dam Modification	HC	100%

Park: PP **Restoration Site ID:** S50.02 **Site Name:** Shriners Run (Trib. 14) and Pennypack Creek

Location: Just north of Roosevelt Blvd; West of Pennypack Ck

General Location: Bustleton to Roosevelt Blvd

Disturbance/Condition: Erosion/Scour

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.86

Site Priority: HC **Location Criteria:** Near other cultural resources

Description:

Tributary 14 is flooding at times of high flow and eroding the trail as it flows towards the Pennypack. The trail has started to erode into the stream. It is recommended that a spanning walkway be installed for the trail so that it does not continue to erode in times of high flow. Also at the top of the stream is a construction/development site where there is a detention basin to store runoff. It should be determined if the water from the detention basin is being led to this tributary. This project needs to be coordinated with dam removal or other options to control overflowing of the trail around the dam during storms.

Restoration Options:

ID	Action	Priority	Proportion
B	Coordinate with other agencies	HC	100%
A	Structural Improvement (Trails)	HT	100%

Park: PP **Restoration Site ID:** S50.03 **Site Name:** Mainstem Pennypack

Location: South of Roosevelt Boulevard Dam

General Location: Bustleton to Roosevelt Blvd

Disturbance/Condition: Erosion/Scour

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.22

Site Priority: HC **Location Criteria:** Near other cultural resources

Description:

About 20 yards downstream of Tributary 14, the mainstem Pennypack Creek is eroding the wall along the right bank, and a hole is forming beneath the wall. There is a steep slope alongside the other side of the trail. A restoration action to consider is a spanning walkway for the trail to bridge the eroding streambanks.

At the community meeting, it was stated that the erosion below the dam results from overbank flow around the dam at high flows, and that this will not be fixed unless the dam is removed. There is a recommendation to remove the dam that is just upstream of this restoration site. This would affect the erosion that is occurring along the trail and so should be coordinated with the dam removal, if it occurs.

Restoration Options:

ID	Action	Priority	Proportion
B	Coordinate with other agencies	HC	100%
A	Structural Improvement (Trails)	HT	100%

Park: PP **Restoration Site ID:** S60.01 **Site Name:** Bluegrass Creek (Trib. 11)

Location: Just S. of Roosevelt Blvd; W. of Bluegrass Rd.

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Slope Erosion

Restoration Category Stream

Restoration Type: Riparian Zone **Constraints:**

Acreage: 0.36

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This is a typical urban stream that has very low baseflow with many sediment deposits. The streambed and banks are lined with concrete but the concrete is being dislodged. The floodplain should be increased at the top of the stream reach near the intersection of Winchester Avenue and Bluegrass Road so that in times of high flow, the water will flow out into the floodplain instead of incising the channel further. It is recommended that the riparian buffer be increased at this stream so that it can help control stormwater impacts. Regrading of the right bank for the first 20 yards of the stream is recommended.

There is an FPC building next to this tributary and a driveway alongside it. After the first 30 yards of stream, there is only about 5-10 yards between the stream and the pavement; therefore, the riparian buffer area is restricted to the first 20 yards of stream.

Restoration Options:

ID	Action	Priority	Proportion
C	Regrade	H	100%
B	Structural Improvement	H	100%
A	Replant Native Forest Species	HV	100%

Park: PP **Restoration Site ID:** S70.01 **Site Name:** Winchester Creek (Trib. 7)

Location: S. of Winchester Ave., E. of Holmehurst Ave.

General Location: Holme to Lower Rhawn

Disturbance/Condition: None/Minimal

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.33

Site Priority: HVD **Location Criteria:** Affects ecolog. Significant site

Description:

This is a nice stream that starts out as a groundwater seep with an abundant collection of wetland plant species (e.g., false nettle) and stable banks. This stream is in very good condition. We observed minimal amounts of trash and yard waste dumping in the stream. The stream should be protected in the following ways: 1) Do not alter the hydrology and 2) Maintain trash removal and invasive/exotic control.

Restoration Options:

ID	Action	Priority	Proportion
A	Protect/Monitor	HP	100%
B	Trash Removal	HV	100%
C	Invasive-Exotic Control	HD	100%

Park: PP **Restoration Site ID:** S70.02 **Site Name:** Winchester Creek (Trib. 7)

Location: S. of Winchester Ave., E. of Holmehurst Ave.

General Location: Holme to Lower Rhawn

Disturbance/Condition: Erosion/Scour

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.09

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

There is a trail crossing at this site where a concrete bridge is falling apart and concrete blocks are resting in the stream beneath it. Part of the trail crossing is blocking the stream flow. It is recommended that a span walkway be installed and the old bridge taken out so that the stream is not hindered by this structure. In addition, all of the concrete within and near the stream bed should be removed. The rest of the stream should be protected.

Restoration Options:

ID	Action	Priority	Proportion
A	Structural Improvement (Trails)	H	100%

Park: PP **Restoration Site ID:** S70.03 **Site Name:** Winchester Creek (Trib. 7)

Location: S. of Winchester Ave., E. of Holmehurst Ave.

General Location: Holme to Lower Rhawn

Disturbance/Condition: Erosion/Scour

Restoration Category Stream

Restoration Type: Riparian Zone **Constraints:**

Acreage: 0.07

Site Priority: HD **Location Criteria:** Near other restorations

Description:

There are steep stream banks and an incised channel along the stream adjacent to the parking lot. Evidence of deer damage and invasive plant species are present. It is recommended that native riparian vegetation is planted to help restore the riparian buffer along the stream and control stormwater runoff that may be coming from the parking lot.

Restoration Options:

ID	Action	Priority	Proportion
A	Replant Native Shrubs	HD	100%

Park: PP **Restoration Site ID:** S70.04 **Site Name:** Winchester Creek (Trib. 7)

Location: S. of Winchester Ave., E. of Holmehurst Ave.

General Location: Holme to Lower Rhawn

Disturbance/Condition: Trail Crossing (culvert, bridge, etc.)

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.05

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

The pipe that is clogged where Tributary 7 meets the Pennypack should be removed and a bridge should be installed over the stream. This will allow the stream flow to reach the Pennypack Creek unobstructed.

Restoration Options:

ID	Action	Priority	Proportion
A	Structural Improvement (Trails)	H	100%

Park: PP **Restoration Site ID:** S80.01 **Site Name:** Loney Creek (Trib. 9)

Location: SE of intersection of Lexington Ave. and Rhawn St.

General Location: Holme to Lower Rhawn

Disturbance/Condition: Erosion/Scour

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.21

Site Priority: HC **Location Criteria:** Near other restorations

Description:

There is an erosion gully off of Lexington Avenue that stops at Tributary 9 that should be repaired. The gully has probably formed from stormwater runoff from Lexington Avenue. There is another gully across Rhawn St. (V70.06) that has also formed most probably from stormwater and it is suggested that these two sites be looked at simultaneously. This should be coordinated with the Streets Department.

Restoration Options:

ID	Action	Priority	Proportion
A	Gully Repair and Prevention	HC	100%

Park: PP **Restoration Site ID:** S80.02 **Site Name:** Loney Creek (Trib. 9)

Location: S. of intersection of Lexington Ave. and Rhawn St.

General Location: Holme to Lower Rhawn

Disturbance/Condition: Trail Crossing (culvert, bridge, etc.)

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.13

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

This is a small, moderately impaired stream worth protecting and monitoring. A spanning walkway or bridge is recommended where this stream meets the trail to prevent negative impacts. There is a wetland just above the trail along this stream.

Restoration Options:

ID	Action	Priority	Proportion
B	Protect/Monitor	HP	100%
A	Structural Improvement (Trails)	H	100%

Park: PP **Restoration Site ID:** S80.03 **Site Name:** Rhawn Street dam

Location: Just south of Rhawn Street

General Location:

Disturbance/Condition: Dam

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.11

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

The dam creates a long impoundment. There was erosion around and through the left side during the Hurricane Floyd storm. Because of the historical association of the Dam with the mill complex (portions of the millrace are still visible), complete removal is not recommended. Instead, removal of the center portion, leaving the ends in place, would provide ecological benefits while maintaining the basic structure of the dam.

Restoration Options:

ID	Action	Priority	Proportion
B	Dam Modification	H	100%

Park: PP **Restoration Site ID:** S80.04 **Site Name:** Meehan Creek (Trib. 8)

Location: South of Rhawn Street

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Erosion/Scour

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.01

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This is a very small stream (approximately 20 ft in length and 1 ft across) that starts as a groundwater seep. A trail cuts across the stream, and a spanning walkway is recommended to prevent further impacts on the stream.

Restoration Options:

ID	Action	Priority	Proportion
A	Structural Improvement (Trails)	H	75%

Park: PP **Restoration Site ID:** S90.01* **Site Name:** Pennypack current deflector (no mapped polygon)

Location: Uncertain, between Roosevelt and upper Rhawn

General Location: Roosevelt Blvd to Holme

Disturbance/Condition:

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage:

Site Priority: HC **Location Criteria:** No distinctive

Description:

There is no mapped polygon for this site. This section of stream has relatively low habitat diversity. In particular, it has few deep pools. At a community meeting, it was suggested that one or more devices be installed to improve habitat. Current deflectors to channel current, creating a chute and eddy, are a possible design. The Pennsylvania Fish and Boat Commission (PFBC) has assisted in planning and implementation of such devices.

While increasing pool/drop structure may have positive effects on aquatic organisms (especially fish), there are several potential problems with these devices. They would be subject to storm flows, including floating trees and other debris, so their stability is uncertain. Given the low gradient of this stream section and apparent amount of sedimentation, the ability to create fast chutes and deep runs and pools is uncertain. There is also a potential for increasing stream erosion at the upstream or downstream ends.

Because of these potential problems, installation is not recommended as a high priority. However, discussions with and possible site visit by the PFBC is recommended to determine feasibility and likelihood of success of different types of structures.

Restoration Options:

ID	Action	Priority	Proportion
A	Structural Improvement (SW)	HC	100%

Park: PP **Restoration Site ID:** S100.01 **Site Name:** Willits Run

Location: Willits Road

General Location:

Disturbance/Condition:

Restoration Category Stream

Restoration Type: Channel **Constraints:**

Acreage: 0.21

Site Priority: HV **Location Criteria:** No distinctive

Description:

This stream runs under a railroad bridge and has a small drop structure on it near the confluence with the Pennypack. The debris and litter in the stream should be removed, as well as the fallen tree across the stream. This stream runs under a railroad bridge and has a 4 foot drop structure on it near the confluence with the Pennypack. There are 2 intact sewerheads in the stream and along the banks. The one sewer is about 15 feet high and is not aesthetically pleasing. There is also a fallen tree across the stream just above the drop structure. It is recommended that the debris should be cleaned out of the stream and the fallen tree removed.

Restoration Options:

ID	Action	Priority	Proportion
A	Trash Removal	HV	100%

Park: PP **Restoration Site ID:** V10.0* **Site Name:** Fox Chase Farm Sites (no mapped polygon)

Location: North of Pine Road

General Location: Fox Chase and North of Pine

Disturbance/Condition: Mowed/No Riparian Zone

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:**

Acreage:

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

This page describes restoration suggestions for the whole farm and includes vegetation restoration sites V10.01, V10.02, V10.04 and V10.05 and therefore, has no mapped polygon. The proportion of work to be performed describes the percentage of work that is to be done on all four of these site combined.

Restoration Options:

ID	Action	Priority	Proportion
B	Invasive-Exotic Control	H	30%
A	Release/Mow Infrequently	H	100%

Park:PP **Restoration Site ID:** V10.01 **Site Name:** Fox Chase Farm Riparian Zone

Location: Tributary in Fox Chase, North of Pine Road

General Location: Fox Chase and North of Pine

Disturbance/Condition: Mowed/No Riparian Zone

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:** Possible conflicts with agriculture

Acreage: 0.74

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

The small stream that runs through the farm property would benefit by increasing the width of riparian zone vegetation and installing a fence which keeps the livestock out of direct contact with the water. Animal manure is also an issue on site. Procedures to keep animal waste from reaching the stream are strongly suggested. We understand a connection to the sewer is planned for the swine herd. This will need to be done in coordination with the staff of the Farm.

The part of the stream located west of the road is heavily impacted by farm animals. Because of the need for grazing space, the farmer does not feel that he could sacrifice any more land in this area for the benefit of widening the riparian zone.

At the community meeting, it was suggested that a wider riparian zone (at least 35 ft) be implemented here.

Restoration Options:

ID	Action	Priority	Proportion
B	Structural Improvement	H	100%
A	Release/Widen	M	100%

Park: PP **Restoration Site ID:** V10.02 **Site Name:** Fox Chase Tributary Restored Area

Location: Fox Chase Farm Tributary

General Location: Fox Chase and North of Pine

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 3.01

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

To the east of the main road, there have been some improvements made in widening the existing riparian zone vegetation. However, there are some areas that are only five feet wide. The riparian zone should be at least thirty-five feet wide. There are many large gullies along the banks of the stream and the dominant shrub is multiflora rose. This exotic could be removed with the help of Lincoln High School students and a more suitable native riparian shrub could be planted. The farmer told us that the SCS (now NRCS) had discussed installing sediment traps to stop sediment transport. This is something that needs to be discussed further with an engineer.

Install a cattle ford to stop erosion.

Restoration Options:

ID	Action	Priority	Proportion
A	Release/Widen	H	15%
B	Structural Improvement	H	1%
C	Remove Exotics/Replant Native Shrubs	HV	30%

Park: PP **Restoration Site ID:** V10.04 **Site Name:** Fox Chase Woodlot

Location: Fox Chase Farm Property

General Location: Fox Chase and North of Pine

Disturbance/Condition: Deer Damage

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 0.88

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

This is a small area to the north of the tributary in which the livestock do not graze. One or several deer exclosures should be placed around existing woods to observe the effects of herbivory on the forest trees.Native trees and shrubs should be planted within the exclosure(s). This project could be maintained by the farm staff and the students. The area is used by numerous birds and increasing the number of native shrubs and trees and excluding the deer would provide these birds and other wildlife with beneficial habitat.

Restoration Options:

ID	Action	Priority	Proportion
A	Deer Exclosures/Replant Native Forest Species	H	50%

Park: PP **Restoration Site ID:** V10.05 **Site Name:** Fox Chase Woods

Location: Northwest of the Manor House

General Location: Fox Chase and North of Pine

Disturbance/Condition: Deer Damage

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 1.44

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

This parcel of woods is not used by the Fox Chase Farm, and it was suggested by staff that deer exclosures be built and the interior replanted with natives to increase bird habitat on and around the Fox Chase Farm.

Restoration Options:

ID	Action	Priority	Proportion
A	Deer Exclosures/Replant Native Forest Species	H	100%
B	Replant Native Forest Species	H	100%

Park:PP **Restoration Site ID:** V20.01 **Site Name:** Pine Road Sugar Bush

Location: Along Pine Road across from Fox Chase Farm

General Location: Pine to Verree

Disturbance/Condition: Disturbed Forest

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:** Likely ongoing disturbance

Acreage: 17.84

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

The mile-a-minute which is growing in the shrubby edge along the maintained park must be removed. Cut Norway maples and plant more sugar maples, turning this area into a sugar bush which can then be used by the adjoining farm program. This area seems to be damaged by deer browse. Before any planting is implemented, the deer must be controlled or fencing needs to be put in place. The use of tree guards around each planted tree is an alternative to fencing.

Restoration Options:

ID	Action	Priority	Proportion
A	Invasive-Exotic Control	H	100%
B	Replant Native Trees	H	10%

Park: PP **Restoration Site ID:** V20.02 **Site Name:** Verree Road Wetland

Location: West bank of Pennypack, North of Verree

General Location: Pine to Verree

Disturbance/Condition: Maintained Lawn/Mowed Field

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 1.67

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

Currently, this area is mowed. It is on the Pennypack floodplain and would likely support wetland vegetation if unmowed. The parking lot on the south side of Verree Road may be moved to the west edge of this area. If so, runoff from the parking lot could be routed into this area, providing storage for storm water runoff and a water source which could enhance wetland plants. Excavation of the surface to lower its elevation or construction of berms to hold runoff may also enhance water storage cabability.

Restoration Options:

ID	Action	Priority	Proportion
C	Release/Widen	H	100%
A	Wetland creation/expansion	H	65%
B	Remove Exotics/Replant Native Wetland Species	HD	100%

Park: PP **Restoration Site ID:** V20.03 **Site Name:** Goose Pond Meadow

Location: West bank Pennypack in bend above Verree Dam

General Location: Pine to Verree

Disturbance/Condition: Filled/Drained Pond or Wetland

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 5.09

Site Priority: H **Location Criteria:** Near environmental Center

Description:

Currently, a large area in the bend of Pennypack Creek above the Verree Dam is mowed. 19th Century maps show this area to be part of the impoundment from the Verree Dam during active use of the mill. The meadow may have been partly filled subsequently. The center of this area is low and is frequently wet. There is a skunk cabbage wetland in the unmowed area to the northwest of the mowed field, and it is likely that the area would support wetland vegetation if mowing were stopped. High flows from Hurricane Floyd deposited sand along the river bank, but sand was not evident in the middle of the field

There are several options for wetland creation here. If mowing were stopped, the site may support wet meadow vegetation without further site work. Greater water storage could be provided by construction of berms around the perimeter and/or excavation of some of the surface. Construction of inflow and outflow channels may be built to deliver water from the creek. Siltation of the wetland would be a concern. However, if much flood sediment is deposited at the edges of the channel, siltation rates may be low within the basin.

The resultant plant communities would depend on site hydrology and depth of the wetland. Planting of appropriate native species and follow-up control of any invasives would be desirable.

Parts of the existing mowed area would be retained, to support picnic activities, fishing, etc. Depending on the size and depth of the wetland, a boardwalk could provide access to the wetland.

At the community meeting, it was noted that this area appears to have become wetter in recent years. Breeding of American toads (which breed in fishless pools) has been noted in the area. Concerns about mosquitoes were raised at the community meeting; it was suggested that permanent standing water might increase mosquito problems.

Restoration Options:

ID	Action	Priority	Proportion
D	Berms	H	100%
B	Invasive-Exotic Control	H	100%
A	Wetland Creation	H	100%
C	Structure Building (Boardwalk)	L	100%

Park: PP **Restoration Site ID:** V20.04 **Site Name:** Woods north of Verree

Location: S. of Creek and N. of Verree Rd. at Dam

General Location: Pine to Verree

Disturbance/Condition: None/Minimal

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 23.81

Site Priority: H **Location Criteria:** Near other restorations

Description:

These woods should be protected as they are relatively undisturbed. Oaks and hickories should be planted to help maintain this area and to push for a late successional forest.

There are erosion problems on the slopes which could begin to impact a relatively good woods and a native herbaceous layer. These could be addressed by brush bundles and similar devices installed by volunteers.

At the community meeting, concerns were raised about human safety due to falling trees or tree limbs in this area.

Restoration Options:

ID	Action	Priority	Proportion
C	Protect/Monitor	HP	100%
B	Slope Stabilization	H	10%
A	Replant Native Trees	HD	10%

Park: PP **Restoration Site ID:** V20.05 **Site Name:** Pennypack Environmental Center

Location: Left bank of Pennypack, North of Verree

General Location: Pine to Verree

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 4.47

Site Priority: H **Location Criteria:** Near environmental Center

Description:

The environmental center presents a number of opportunities for restoration which could be used for demonstrative purposes.

The open field parking area can be redesigned to include a herbaceous border, the woods can be planted, possibly with deer exclosures, and the slope leading to the creek can be repaired using a variety of techniques. The plantings for this area will be coordinated with Peter Kurtz. The exotic species should be removed from the area before any replanting takes place. Once natives are replanted, they should be monitored and any exotics which grow back should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
F	Monitor plantings/Control Exotics as Needed	H	100%
D	Release/Widen	H	15%
A	Remove Exotics/Replant Native Forest Species	HV	100%
B	Replant Native Trees	HV	10%
C	Deer Exclosures/Replant Native Understory Species	L	5%
E	Replant Native Herbs	HD	25%

Park: PP **Restoration Site ID:** V20.06 **Site Name:** Verree Wetland Woods

Location: Northwest of Verree Road

General Location: Pine to Verree

Disturbance/Condition:

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 4.30

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This site appears to include formerly mowed areas that are reverting to woods; there is a border of logs between this area and the mowed area to the east.

The recommendation is to buffer the woods from the proposed parking lot area by planting native trees and shrubs on the edge of the woods. Removal of exotics on the edge of the woods is also suggested.

The construction of the proposed parking lot must not impact the woods adjacent to the site. Pervious materials are recommended for the building of the lot. The area may need to be regraded so that the drainage from the lot is directed toward the wetland.

Restoration Options:

ID	Action	Priority	Proportion
B	Edge Management	H	15%
A	Replant Native Forest Species	HD	10%

Park: PP **Restoration Site ID:** V20.07 **Site Name:** Right bank of Pennypack, north of Verree Dam

Location: West side of Pennypack Creek above Verree Dam

General Location: Pine to Verree

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 0.85

Site Priority: H **Location Criteria:**

Description:

Stabilize riparian corridor and make provisions to accommodate fishing (e.g., stone platforms). Where fishing activities do not take place at this site, native forest species should be planted to aid in bank stabilization.

Remove asphalt and regrade stream bank assuring access for fishing. There may be a need for a better designed trail to reach the fishing area, to protect the bank from human impact.

Restoration Options:

ID	Action	Priority	Proportion
D	Regrade	H	10%
A	Structural Improvement	H	100%
C	Replant Native Forest Species	HD	25%
B	Trail Improvement	HT	100%

Park: PP **Restoration Site ID:** V20.08 **Site Name:** Environmental Center Slopes

Location: Left Bank of the Pennypack, Behind EC

General Location: Pine to Verree

Disturbance/Condition: Slope Erosion

Restoration Category Vegetation

Restoration Type: Slope **Constraints:**

Acreage: 3.68

Site Priority: H **Location Criteria:** Near environmental Center

Description:

The recommendation is to stabilize the slopes by planting shrubs. The deer must be controlled in this area before any planting takes place. The site must also be monitored after planting and a deer exclosure should be constructed.

Restoration Options:

ID	Action	Priority	Proportion
A	Deer Exclosures/Replant Native Forest Species	H	5%
B	Erosion Control	H	25%
C	Replant Native Shrubs	HD	75%

Park: PP **Restoration Site ID:** V20.10 **Site Name:** Verree Street Woods

Location: North of Verree, South of Pine Road

General Location: Pine to Verree

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 21.60

Site Priority: HD **Location Criteria:**

Description:

This site is typical of the Pennypack wooded areas. It has been heavily disturbed by deer, as is indicated by the lack of understory and herbaceous layer. The dominant shrub is spicebush, and the areas of the forest which lie on slopes are badly eroding. In order to successfully meet the objectives of vegetation restoration, the deer must be controlled. Planting in an area such as this would be a futile effort. Replant the understory when the deer are controlled. Deer exclosures may be another option.

Restoration Options:

ID	Action	Priority	Proportion
A	Deer Exclosures/Replant Native Forest Species	L	5%
B	Slope Stabilization	L	15%
D	Replant Native Herbs	HD	10%
C	Replant Native Shrubs	HD	10%

Park: PP **Restoration Site ID:** V20.11 **Site Name:** Bloomfield and Pine Forest Edge

Location: Intersection of Bloomfield and Pine

General Location: Pine to Verree

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:** Ongoing disturbance

Acreage: 8.76

Site Priority: HT **Location Criteria:** Near other restorations

Description:

Box elder is the main tree in the forest. The edge of this forest is highly disturbed. Trails are eroding and exotic honeysuckle and oriental bittersweet are evident. Edge management and exotic control are recommended for this site. The south facing slope of this area has large stands of native wild ginger (Asarum canadense).

Restoration Options:

ID	Action	Priority	Proportion
B	Invasive-Exotic Control	L	100%
D	Monitor plantings/Control Exotics as Needed	L	15%
A	Replant Native Forest Species	L	15%
C	Trail Improvement	HT	10%

Park: PP **Restoration Site ID:** V20.12 **Site Name:** Bloomfield Oldfield

Location: Intersection of Pine Rd. and Bloomfield Rd.

General Location: Pine to Verree

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:**

Acreage: 0.88

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

This site is an old field that is presently supporting a mix of native and exotic species. The recommendation is to remove the exotics and plant low shrubs to improve wildlife habitat. Once natives are replanted, they should be monitored, and exotics should be removed routinely. Old field areas should be treated according to a site-specific management plan. Periodic mowing is recommended to maintain the area as an old field. In open areas where exotic species are an issue, a controlled burn may be more effective for maintaining meadow, but burning may not be feasible.

Restoration Options:

ID	Action	Priority	Proportion
A	Meadow Management	H	100%
E	Monitor plantings/Control Exotics as Needed	H	100%
B	Invasive-Exotic Control	HV	100%
D	Remove Exotics/Replant Native Shrubs	M	10%
C	Release/Mow Infrequently	L	10%

Park: PP **Restoration Site ID:** V20.13 **Site Name:** Pine St. Park Riparian Zone

Location: Right Bank of the Pennypack, opposite Ballard Run

General Location: Pine to Verree

Disturbance/Condition: Mowed/No Riparian Zone

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:** Currently Mowed

Acreage: 0.65

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

This site is located on the right (west) bank of the mainstem, opposite Ballard Run. The area adjacent to this riparian zone is used for recreation but does not need to be mowed as frequently as it is currently being maintained. The recommendation is to release at least 35' of the mowed area and replant the riparian zone with native trees and shrubs.

Restoration Options:

ID	Action	Priority	Proportion
C	Deer Exclosures/Replant Native Forest Species	H	10%
A	Release/Widen	H	25%
B	Replant Native Forest Species	H	10%

Park: PP **Restoration Site ID:** V20.14 **Site Name:** Rockledge Brook Riparian Zone

Location: Rockledge Brook

General Location: Pine to Verree

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 0.42

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This area is mowed right to the edge of Rockledge Brook. The recommendation is to widen the riparian zone and replant native shrub and tree species to restore function to the riparian zone, buffer the stream channel and provide wildlife habitat. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
D	Monitor plantings/Control Exotics as Needed	H	100%
C	Release/Widen	H	100%
A	Invasive-Exotic Control	HV	100%
B	Replant Native Forest Species	HD	100%

Park: PP **Restoration Site ID:** V20.15 **Site Name:** Rockledge Brook Riparian Zone (lower)

Location: S. of Pine Road, W. of Picnic Area

General Location: Pine to Verree

Disturbance/Condition: Mowed/No Riparian Zone

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 1.73

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This stream would benefit by increasing the buffer alongside the picnic area. Currently, the riparian zone is being mowed up to the left bank of the stream. Riparian forest species should be planted to help increase the buffer. The plantings should be monitored to control exotics, especially after deer are controlled. There are some trail issues here that should be investigated by the trails consultants.

Restoration Options:

ID	Action	Priority	Proportion
E	Monitor plantings/Control Exotics as Needed	H	80%
A	Release/Widen	H	20%
C	Invasive-Exotic Control	HV	80%
B	Replant Native Forest Species	M	15%
D	Trail Improvement	HT	10%

Park:PP **Restoration Site ID:** V30.01 **Site Name:** Verree Rd. Southeast Wetland

Location: Right bank Pennypack below (S and E) of Verree

General Location: Verree to Bustleton

Disturbance/Condition: None/Minimal

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 1.50

Site Priority: HD **Location Criteria:** Affects ecolog. Significant site

Description:

This site has stands of skunk cabbage, as well as sensitive fern, sedges, grasses and other herbs. There are scattered trees, including box elder. The wetland should be protected from the negative impacts of the adjacent parking lot. The recommendation is to plant native wetland shrubs and herbs such as buttonbush and Carex stricta after deer numbers are reduced. The surrounding floodplain forest should be planted with floodplain trees such as red maple (see site V30.19). Once natives are replanted, they should be monitored and exotics should be removed routinely.

There was a small amount of mile-a-minute here that needs to be removed. Stinging nettle, garlic mustard and other exotics occur along the edge, and lesser celandine is present within the wetland. There are plans to move the parking area across the street, which would lessen the disturbance on the site.

Restoration Options:

ID	Action	Priority	Proportion
D	Monitor plantings/Control Exotics as Needed	H	100%
C	Invasive-Exotic Control	HV	100%
B	Structure Building (Boardwalk)	L	100%
A	Replant Native Wetland Species	HD	40%

Park:PP **Restoration Site ID:** V30.02 **Site Name:** North Verree-Tustin Old Field

Location: South of Verree , west side of creek

General Location: Verree to Bustleton

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:** Deer Browse

Acreage: 14.47

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

The recommendation for this area is to manage it as a meadow by periodic mowing or possibly by seasonal burning. Removal of multiflora rose and replanting of native shrubs is also recommended after deer numbers are reduced. Once natives are replanted, they should be monitored and exotics should be removed routinely. The area is also heavily impacted by deer and fencing must be installed if any restoration efforts are to take place at this site at current population levels.

Restoration Options:

ID	Action	Priority	Proportion
B	Meadow Management	H	25%
D	Monitor plantings/Control Exotics as Needed	H	100%
A	Invasive-Exotic Control	HV	100%
C	Replant Native Shrubs	HD	25%

Park: PP **Restoration Site ID:** V30.03 **Site Name:** South Verree and Tustin Old Field

Location: Verree Rd and Tustin St.

General Location: Verree to Bustleton

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:** Deer Browse

Acreage: 19.73

Site Priority: HD **Location Criteria:** Affects ecolog. Significant site

Description:

This site encompasses a large old field and an early successional woods, which are adjacent to a forest on a steep slope. Multiflora rose is dominant in much of the area. This site can be enhanced by controlling the multiflora rose and planting mid successional species such as black cherry, sumac, silky dogwood, and low bush blueberry in the old field section of the site. Plantings will differ depending on the habitat type that exists in the different areas of the site. Planting should be done after deer numbers are reduced, and followup monitoring for exotics should be done.

Restoration Options:

ID	Action	Priority	Proportion
C	Monitor plantings/Control Exotics as Needed	HD	20%
B	Remove Exotics/Replant Native Meadow Species	HD	20%

Park: PP **Restoration Site ID:** V30.04 **Site Name:** Tustin St. Sloped Forest

Location: West side of creek below Verree

General Location: Verree to Bustleton

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Slope **Constraints:** Deer Browse

Acreage: 28.30

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

The recommendation for this site is to remove the Norway maples and replant oaks and hickories. The understory is open as this area is heavily browsed by deer. It is suggested that the understory be planted with native shrubs such as witch-hazel and maple-leaf viburnum and small trees. Once natives are replanted, they should be monitored, and exotics should be removed routinely. Extensive replanting can only be done on the site after deer are controlled. However, planting of small areas within deer exclosures will be valuable in maintaining native flora prior to deer control. The exotic species should also be removed.

Restoration Options:

ID	Action	Priority	Proportion
D	Deer Exclosures/Replant Native Forest Species	H	4%
C	Invasive-Exotic Control	H	100%
E	Monitor plantings/Control Exotics as Needed	L	35%
B	Replant Native Shrubs	L	15%
A	Replant Native Trees	L	20%

Park: PP **Restoration Site ID:** V30.05 **Site Name:** Strahle Terrace Riparian Zone

Location: North of Sedden's Run

General Location: Verree to Bustleton

Disturbance/Condition: Disturbed Forest

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:** Ongoing disturbance

Acreage: 1.98

Site Priority: HD **Location Criteria:** Affects ecolog. Significant site

Description:

This area includes slopes and immediate flood plain along the creek. Revegetation of the site and removal of Japanese knotweed would be desirable. Once natives are replanted, they should be monitored, and exotics should be removed routinely. However, the deer problem is very noticeable at this location, and exclosures would be needed if replanting is to be done prior to deer control.

Restoration Options:

ID	Action	Priority	Proportion
C	Deer Exclosures/Replant Native Forest Species	L	100%
B	Invasive-Exotic Control	L	100%
D	Monitor plantings/Control Exotics as Needed	HD	15%
A	Remove Exotics/Replant Native Forest Species	HD	15%

Park: PP **Restoration Site ID:** V30.06 **Site Name:** Sedden's Run

Location: East of Tabor Road

General Location: Verree to Bustleton

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 1.09

Site Priority: HV **Location Criteria:** Affects ecolog. Significant site

Description:

The banks of Sedden's Run are eroded, threatening the trail along the left (north) side. There is a sewer line paralleling the run, which might also be affected by erosion. Because of high storm water inputs, performing work at this site may be difficult. There is little room for regrading for stabilization, so armoring might be the primary option for stabilization. Control of Japanese knotweed and replanting with native riparian species will enhance vegetation. Once natives are replanted, they should be monitored and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
B	Invasive-Exotic Control	HV	90%
D	Monitor plantings/Control Exotics as Needed	HV	100%
A	Replant Native Forest Species	HV	10%
C	Structural Improvement	M	10%

Park: PP **Restoration Site ID:** V30.07 **Site Name:** Wetland on Sedden's tributary

Location: Right bank tributary of Sedden's Run

General Location: Verree to Bustleton

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 1.61

Site Priority: HP **Location Criteria:** Affects ecolog. Significant site

Description:

This relatively large wetland contains stands of skunk cabbage and false hellebore, and the site should be protected. Planting of shrubs could increase vegetative diversity, but is of lower priority, given its existing condition.

Restoration Options:

ID	Action	Priority	Proportion
A	Protect/Monitor	HP	100%
C	Deer Exclosures/Replant Native Wetland Species	M	100%
B	Replant Native Shrubs	M	25%

Park: PP **Restoration Site ID:** V30.08 **Site Name:** Krewstown Forest Seeps

Location: Forest above railroad and Krewstown Road

General Location: Verree to Bustleton

Disturbance/Condition: None/Minimal

Restoration Category Vegetation

Restoration Type: Slope **Constraints:** Deer Browse

Acreage: 1.07

Site Priority: H **Location Criteria:** Near other restorations

Description:

Small seeps run down the slope and present an opportunity for planting. Deer must be managed before any planting takes place.

The trail runs directly down the slope and creates erosion.

Restoration Options:

ID	Action	Priority	Proportion
B	Deer Exclosures/Replant Native Forest Species	H	15%
D	Monitor plantings/Control Exotics as Needed	HD	15%
A	Replant Native Herbs	HD	10%
C	Trail Improvement	HT	50%

Park: PP **Restoration Site ID:** V30.09 **Site Name:** Krewstown Old Field

Location: Old field along railroad, above Krewstown Road

General Location: Verree to Bustleton

Disturbance/Condition: None/Minimal

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:**

Acreage: 10.12

Site Priority: H **Location Criteria:** Near other restorations

Description:

This field contains bluestem and other native herbs. Meadow management should be done to maintain this area as meadow habitat. Control of exotics will enhance native diversity. Should fire be used in the park this site may be a good opportunity for a controlled burn. There is a substantial amount of native herbs which need to be protected from disturbance. Vehicular access will cause damage if not prohibited from the area.

Restoration Options:

ID	Action	Priority	Proportion
C	Meadow Management	H	25%
B	Protect/Monitor	HP	100%
A	Invasive-Exotic Control	HV	15%

Park: PP **Restoration Site ID:** V30.10 **Site Name:** Krewstown Sloped Forest

Location: Slopes north of railroad and Krewstown Road

General Location: Verree to Bustleton

Disturbance/Condition: Slope Erosion

Restoration Category Vegetation

Restoration Type: Slope **Constraints:** Deer Browse

Acreage: 36.98

Site Priority: H **Location Criteria:** Near other restorations

Description:

The forest contains a canopy of oaks and beech and small trees including ironwood and witch-hazel. This area is heavily browsed by deer, as is evident by the lack of understory, and exclosures should be placed around any new plantings. This wooded area is heavily used, and slope and gully erosion is a problem. Erosion control (brush dams on slopes, etc.) should be done on the slopes. These devices could be installed by volunteers where needed. In the long term, restoration of understory (following deer control) will be important in controlling erosion.

Restoration Options:

ID	Action	Priority	Proportion
B	Erosion Control	H	5%
D	Deer Exclosures/Replant Native Forest Species	L	100%
A	Replant Native Shrubs	L	5%

Park: PP **Restoration Site ID:** V30.11 **Site Name:** Krewstown Forest/old field

Location: Adjacent to RR Bridge

General Location: Verree to Bustleton

Disturbance/Condition: Erosion/Scour

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:**

Acreage: 1.37

Site Priority: H **Location Criteria:** Near other restorations

Description:

There is an old field at the top of the slope, under the powerline. The northern edge of the site includes low forest on the upper end of the slope.

An old road runs to the top of the slope on the west side of the railroad bridge. The road is eroding and beginning to impact the forest. Narrowing the road by planting the edges and controlling the storm water to stop the erosion would lessen impacts. The road may still be used, e.g., for power line maintenance.

The old field has different vegetation than the larger field (V30.09) to the SW. This may reflect burning of the larger meadow. It is not known whether the NE old field (V30.11) is herbicided as part of power line maintenance. Prescribed burning could improve the vegetation of the field. Maintenance should be coordinated with PECO.

Restoration Options:

ID	Action	Priority	Proportion
D	Meadow Management	MC	100%
B	Gully Repair	H	20%
A	Replant Native Trees	HD	15%
C	Trail Improvement	HT	40%

Park: PP **Restoration Site ID:** V30.13 **Site Name:** Verree Rd. East Floodplain

Location: Verree Rd. near EC

General Location: Verree to Bustleton

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 2.87

Site Priority: HD **Location Criteria:** Near other restorations

Description:

This site grades into the skunk cabbage wetland (V30.01). Together, these sites can support high plant diversity. Currently, there are a variety of exotic plants, including multiflora rose, stinging nettle, lesser celandine and garlic mustard. The site has scattered trees, including some recently planted saplings. The site should be planted with native floodplain trees, such as red maple in the interior and black walnut on the edge. Herb and shrub planting may also be desirable, especially at the edge of the wetland.

If the parking lot is mowed, the area now occupied by the parking lot should be restored as part of this site. Restoration would require removal of gravel, addition of soil, and replanting.

Restoration Options:

ID	Action	Priority	Proportion
A	Meadow Management	L	100%
C	Monitor plantings/Control Exotics as Needed	HD	30%
B	Remove Exotics/Replant Native Forest Species	HD	30%

Park: PP **Restoration Site ID:** V30.14 **Site Name:** Persimmon Patch

Location: NW of Krewstown Road

General Location: Verree to Bustleton

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:** Deer Browse

Acreage: 4.09

Site Priority: HP **Location Criteria:** Near other restorations

Description:

There is a small stand of persimmon trees on the slope behind the parking lot. The persimmon is rare in the park and should be protected. The mapped polygon includes part of the slope to the north (west) of the railroad bridge. There are a few persimmon trees on this part of the slope, but it is highly disturbed, and of lower priority for protection than the main stand.

Restoration Options:

ID	Action	Priority	Proportion
A	Protect/Monitor	HP	100%
C	Replant Native Herbs	L	10%
B	Replant Native Shrubs	L	10%

Park: PP **Restoration Site ID:** V30.15 **Site Name:** Police facility Wetland

Location: Left bank of creek, West of Krewstown Rd.

General Location: Verree to Bustleton

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 0.63

Site Priority: HV **Location Criteria:**

Description:

This wetland appears to be an old river oxbow and contains standing water. Control of exotics (e.g., stinging nettle, lesser celandine and Japanese honeysuckle) and replanting of natives would enhance the site. Once natives are replanted, they should be monitored and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
D	Protect/Monitor	HP	100%
A	Invasive-Exotic Control	HV	100%
E	Monitor plantings/Control Exotics as Needed	M	100%
B	Replant Native Herbs	M	100%
C	Replant Native Shrubs	M	100%

Park: PP **Restoration Site ID:** V30.16 **Site Name:** Martin's Run (Bloomfield Rd.) Woods

Location: Adjacent to Environmental Center

General Location:

Disturbance/Condition: Deer Damage

Restoration Category Vegetation

Restoration Type: Slope **Constraints:**

Acreage: 2.30

Site Priority: HPD **Location Criteria:**

Description:

The beech forest is in reasonably good shape, and an understory planting would help stabilize the slopes. Planting should not occur until after deer are controlled. Trash should be removed from the slopes before replanting. Old roads and fields at the east edge of the site have exotics (garlic mustard, etc.) which would need to be controlled prior to planting. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
C	Protect/Monitor	HP	100%
E	Monitor plantings/Control Exotics as Needed	HD	50%
D	Remove Exotics/Replant Native Forest Species	HD	10%
B	Replant Native Herbs	HD	20%
A	Replant Native Shrubs	HD	20%

Park: PP **Restoration Site ID:** V30.19 **Site Name:** Rising Sun Ave. Sloped Forest

Location: West of Rising Sun Ave. North of Krewstown Rd.

General Location:

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Slope **Constraints:**

Acreage: 56.88

Site Priority: HC **Location Criteria:**

Description:

The forest contains a mix of forest types, including beech, beech/tulip poplar, and mixed oak/beech/tulip poplar/hickory woods. There are sections with relatively old trees. The slopes support several spring ephemerals (e.g., trout lily, cut-leaved toothwort, spring beauty, dwarf ginseng, violets, jack-in-the pulpit). The woods also contain several areas of wooded wetland, mainly on either side of the small tributary below Martin's Creek and along the trail leading up to Rising Sun Road. However, the forest shows signs of extensive deer browsing, with little regeneration of many trees, low diversity of shrubs, and a relatively sparse herbaceous layer. A planting would enhance this woods but should not occur until after deer are controlled.

Control of exotic plants (e.g., multiflora rose, wineberry, garlic mustard, lesser celandine) would enhance the site. Some exotics may become more common if deer are controlled, so monitoring and control of exotics should follow planting.

The upper edge (along the top of the slope) and the eastern edge (near Krewstown Road) of the site borders large dump areas. Exotic plants are common along these edges. Reduction of the area of the dump sites and restoration of these areas should be done, if possible. This would need to be coordinated with park maintenance staff.

Restoration Options:

ID	Action	Priority	Proportion
F	Monitor plantings/Control Exotics as Needed	H	1%
A	Protect/Monitor	HP	100%
B	Invasive-Exotic Control	HV	1%
D	Release/Widen	HC	5%
E	Trash Removal	HC	5%
C	Replant Native Trees	HD	1%

Park: PP **Restoration Site ID:** V40.01 **Site Name:** Krewstown dump

Location: Old quarry south of Krewstown, west of creek

General Location: Verree to Bustleton

Disturbance/Condition: Trash Dumping

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:** Ongoing Disturbance

Acreage: 0.37

Site Priority: H **Location Criteria:** Near other restorations

Description:

A dump is located within a "hollow" that appears to be an old quarry. Many appliances and much large trash was present at the initial site visit. Once this debris is removed, the area could be replanted to aid in the process of native plant regeneration in the old dump, although this is lower priority than the trash removal.

Restoration Options:

ID	Action	Priority	Proportion
A	Trash Removal	H	100%
C	Replant Native Forest Species	L	10%
B	Replant Native Trees	L	10%

Park: PP **Restoration Site ID:** V40.02 **Site Name:** Three-springs Hollow

Location: South of railroad and Krewstown

General Location: Verree to Bustleton

Disturbance/Condition: Disturbed Forest

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:** Deer Browse

Acreage: 4.36

Site Priority: HD **Location Criteria:** Affects ecolog. Significant site

Description:

The stream is one of the highest quality streams in Fairmount Park. Enhancement of riparian vegetation would further enhance the stream. However, planting should not be done until deer are controlled. Replanting in deer exclosures is not recommended, because of the limited area which could be planted.

Restoration Options:

ID	Action	Priority	Proportion
A	Deer Exclosures/Replant Native Forest Species	M	100%
C	Remove Exotics/Replant Native Forest Species	M	10%
D	Monitor plantings/Control Exotics as Needed	HD	25%
B	Replant Native Herbs	HD	25%

Park: PP **Restoration Site ID:** V40.03 **Site Name:** Three-spring Hollow Old Field

Location: Edge of railroad at top of slope

General Location: Verree to Bustleton

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:**

Acreage: 0.94

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This small meadow contains bluestem grass and other herbs. A site-specific management plan needs to be developed for this old field. Periodic mowing (or burning) and replanting of native herbaceous species may be required to remove exotics and to maintain native meadow vegetation. Once natives are replanted, they should be monitored and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
C	Meadow Management	H	100%
B	Replant Native Herbs	M	10%
D	Deer Exclosures/Replant Native Meadow Species	L	100%
A	Invasive-Exotic Control	L	100%
E	Monitor plantings/Control Exotics as Needed	L	100%

Park: PP **Restoration Site ID:** V40.04 **Site Name:** Three-springs Hollow, NE edge

Location: NE edge of woods

General Location: Verree to Bustleton

Disturbance/Condition: None/Minimal

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:** Deer Browse

Acreage: 2.62

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

Management of the edge can maintain herbaceous cover along the edge of the woods and buffer the woods and high quality stream. Some planting has been done in this area, and continued volunteer maintenance of this site should be encouraged.

Restoration Options:

ID	Action	Priority	Proportion
A	Edge Management	H	10%
B	Meadow Management	H	20%
C	Invasive-Exotic Control	HV	100%

Park: PP **Restoration Site ID:** V40.05 **Site Name:** Winchester Avenue Woods

Location: South of Winchester, West of Bustleton Ave.

General Location: Verree to Bustleton

Disturbance/Condition: None/Minimal

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:** Ongoing disturbance

Acreage: 1.25

Site Priority: HVD **Location Criteria:** Isolated

Description:

Invasive plants such as garlic mustard, stilt grass, wineberry, mile-a-minute and tree-of-heaven are encroaching on this good quality forest from the edge. The recommendation is to protect the woods from the managed area by controlling exotics and replanting uplands forest. Replanting should only be done after deer are controlled. Once natives are replanted, they should be monitored and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
E	Monitor plantings/Control Exotics as Needed	H	10%
C	Invasive-Exotic Control	HV	100%
B	Edge Management	M	10%
A	Protect/Monitor	M	100%
D	Replant Native Forest Species	HD	10%

Park:PP **Restoration Site ID:** V40.06 **Site Name:** Algon Avenue Riparian Zone

Location: North of Algon, Right bank of Pennypack Creek

General Location: Verree to Bustleton

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 1.50

Site Priority: HVD **Location Criteria:** Near other restorations

Description:

The area along the path contains open areas that could be released to woods. Japanese knotweed grows in a narrow band between the path and creek. Control of Japanese knotweed and increase in wooded area are recommended. After deer are controlled, control of vines and replanting with native forest species would enhance this site. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
D	Monitor plantings/Control Exotics as Needed	H	15%
A	Release/Widen	H	10%
C	Invasive-Exotic Control	HV	10%
B	Remove Exotics/Replant Native Forest Species	HD	5%

Park: PP **Restoration Site ID:** V40.08 **Site Name:** Algon Ave Sloped Woods

Location: Left bank of Creek, N of Algon Ave.

General Location: Verree to Bustleton

Disturbance/Condition: Slope Erosion

Restoration Category Vegetation

Restoration Type: Slope **Constraints:**

Acreage: 34.41

Site Priority: HP **Location Criteria:**

Description:

This is a large site with a range of conditions. Exotics are dense in a ravine on the west end. However, a quality oak woods is present on the knoll of the slope located near the west end of the site. There is also evidence of considerable deer browsing at this site.

Restoration Options:

ID	Action	Priority	Proportion
A	Protect/Monitor	HP	5%
B	Remove Exotics/Replant Native Forest Species	M	10%
C	Deer Exclosures/Replant Native Forest Species	L	5%

Park: PP **Restoration Site ID:** V40.09 **Site Name:** Three-Spring Hollow woods

Location: S of Krewstown, N of Algon Ave.

General Location: Verree to Bustleton

Disturbance/Condition: Deer Damage

Restoration Category Vegetation

Restoration Type: Slope **Constraints:**

Acreage: 19.87

Site Priority: HD **Location Criteria:** Affects ecolog. Significant site

Description:

A high-quality stream flows through this site. There is a mix of young and near mature trees (mature trees mainly down-slope). There is extensive deer browse. Replanting is recommended if deer are controlled.

Restoration Options:

ID	Action	Priority	Proportion
D	Deer Exclosures/Replant Native Understory Species	L	2%
E	Monitor plantings/Control Exotics as Needed	HD	10%
C	Replant Native Herbs	HD	5%
B	Replant Native Shrubs	HD	5%
A	Replant Native Trees	HD	2%

Park: PP **Restoration Site ID:** V40.10 **Site Name:** Algon Ave. Flood Plain

Location: Northwest of Bustleton Ave.

General Location: Verree to Bustleton

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 6.84

Site Priority: H **Location Criteria:** No distinctive

Description:

The recommendation for this site is to fill in and replant the gully which runs from the slope to the main stem of the Pennypack at the northern edge of the site. Removal of exotics and replanting native species is also recommended. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
D	Gully Repair	H	5%
E	Monitor plantings/Control Exotics as Needed	H	10%
A	Invasive-Exotic Control	M	100%
B	Replant Native Forest Species	M	10%
C	Deer Exclosures/Replant Native Forest Species	L	2%

Park:PP **Restoration Site ID:** V40.12 **Site Name:** Algon Avenue Gully

Location: North of Algon, South of Krewstown

General Location: Verree to Bustleton

Disturbance/Condition: Trail Gully

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 0.20

Site Priority: HT **Location Criteria:**

Description:

The trail drops off the slope at the end of old train/trolley line. There is extensive erosion on the trail here.

Restoration Options:

ID	Action	Priority	Proportion
A	Trail Improvement	HT	100%

Park: PP **Restoration Site ID:** V50.02 **Site Name:** Benton Avenue Wetland

Location: East of Benton Avenue, right bank of Creek

General Location: Verree to Bustleton

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 1.21

Site Priority: HPD **Location Criteria:** Affects ecolog. Significant site

Description:

The recommendation for this site is to remove exotics and replant native wetland species after the deer are controlled. The wetland is adjacent to a disturbed floodplain with little understory. Vines were moving into the canopy, and deer were seen during a site visit.

At the community meeting, Roland Williams noted that American toads use this wetland. This suggests relatively high quality, justifying a higher priority for restoration and a need to protect and monitor the wetland.

Restoration Options:

ID	Action	Priority	Proportion
B	Protect/Monitor	HP	50%
D	Monitor plantings/Control Exotics as Needed	HD	20%
C	Remove Exotics/Replant Native Herbs	HD	10%

Park: PP **Restoration Site ID:** V50.04 **Site Name:** Winchester Ave Shrubland

Location: West of Winchester, Left bank of the Pennypack

General Location: Bustleton to Roosevelt Blvd

Disturbance/Condition: Trail Gully

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 0.25

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

Old Bustleton Road deadends by the church and runoff from the road channels down the slope in gullies on either side of the old bridge abutment. Runoff from the top of the slope needs to be redirected. There is also gullying along the trail at the edge of the creek. The bridge abutment would provide a good viewing spot; installation of a safety railing is recommended. The slopes leading to the floodplain are steep and eroding. There is little understory in the flood plain forest. Repairing the gullies and replanting with forest species is recommended.

Restoration Options:

ID	Action	Priority	Proportion
A	Gully Repair	H	15%
C	Structural Improvement	H	100%
B	Replant Native Forest Species	HD	10%

Park: PP **Restoration Site ID:** V50.06 **Site Name:** Large Street Trail Crossings

Location: North east of Horrocks Street

General Location: Bustleton to Roosevelt Blvd

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:**

Acreage: 1.84

Site Priority: HT **Location Criteria:** No distinctive

Description:

Trails parallel and cross the creek and create erosion problems.

Restoration Options:

ID	Action	Priority	Proportion
C	Trail Improvement	HT	100%

Park: PP **Restoration Site ID:** V60.01 **Site Name:** Winchester Riparian Zone

Location: Just S. of Roosevelt Blvd; W. of Bluegrass Rd.

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Mowed/No Riparian Zone

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 2.10

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

The riparian corridor is eroding and storm flows are causing damage at the intersection of the pathway before it enters the Pennypack. If the storm flow problem can be addressed, the riparian zone should be replanted with appropriate tree, herb and shrub species. The deer problem also needs to be resolved before any restoration effors take place in this area.

Restoration Options:

ID	Action	Priority	Proportion
B	Release/Widen	H	50%
D	Monitor plantings/Control Exotics as Needed	HD	60%
C	Replant Native Forest Species	HD	10%

Park: PP **Restoration Site ID:** V60.02 **Site Name:** Walnut Hill Mowed Field

Location: Walnut Hill Street

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Maintained Lawn/Mowed Field

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:**

Acreage: 1.69

Site Priority: H **Location Criteria:** Near other restorations

Description:

There appears to be no reason for the area to be mowed. The recommendation is to release this area of mowed lawn adjacent to houses, replant with herbaceous vegetation and manage the site as a meadow.

Restoration Options:

ID	Action	Priority	Proportion
B	Edge Management	H	15%
C	Meadow Management	H	25%
A	Release/Mow Infrequently	H	100%

Park: PP **Restoration Site ID:** V60.04 **Site Name:** Dewees Street Woods

Location: Left Bank of creek, West of Winchester Ave.

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Deer Damage

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 33.41

Site Priority: HD **Location Criteria:** Affects ecolog. Significant site

Description:

This site is a forested plateau, which is a rare habitat type in the Fairmount Park System. The understory is heavily browsed and could be enhanced by plantings once the deer are controlled. Followup monitoring to ensure that the area is not invaded by exotics is recommended. The area should be protected from development.

Restoration Options:

ID	Action	Priority	Proportion
A	Protect/Monitor	L	100%
C	Monitor plantings/Control Exotics as Needed	HD	10%
B	Replant Native Shrubs	HD	10%

Park: PP **Restoration Site ID:** V70.01 **Site Name:** Lexington Avenue Wetland

Location: North of Rhawn, East of Lexington Avenue

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 0.32

Site Priority: HD **Location Criteria:** Affects ecolog. Significant site

Description:

The dominant canopy species is tulip poplar. Black walnut, sycamore, black cherry and box elder are also present. The wetland contains grasses, water starwort, touch-me-not, and poison ivy, as well as exotics such as lesser celandine and garlic mustand. Deer appear to be bedding in this site. The recommendation is to replant native wetland species once deer are controlled. Since this is off the side of the main pathway, this would be a good site for signage and education.

Restoration Options:

ID	Action	Priority	Proportion
C	Monitor plantings/Control Exotics as Needed	HD	40%
B	Replant Native Herbs	HD	20%
A	Replant Native Shrubs	HD	20%

Park: PP **Restoration Site ID:** V70.04 **Site Name:** Winchester Avenue Slopes

Location: South of Winchester, West of Welsh Road

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Trash Dumping

Restoration Category Vegetation

Restoration Type: Slope **Constraints:**

Acreage: 6.17

Site Priority: H **Location Criteria:** Near other restorations

Description:

There are Norway maples and Ailanthus along the edge. Yard waste and other trash are currently being dumped over the guard rail, which is contributing to the erosion along the slope. The understory lacks diversity as deer are overpopulated in the area. Restoration attemps would most likely be unsuccessful due to these ongoing disturbances, and replanting and erosion control actions are therefore considered low priority. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

Toward the west end of the site, there is a forty foot drop from the slope to the forest below. Presently, this is fenced off with an old four foot metal fence. This should be replaced with a more permanent type of structure to increase visitor safety and reduce trampling.

Restoration Options:

ID	Action	Priority	Proportion
F	Structural Improvement	H	10%
D	Deer Exclosures/Replant Native Forest Species	L	5%
C	Erosion Control	L	15%
G	Monitor plantings/Control Exotics as Needed	L	55%
B	Remove Exotics/Replant Native Forest Species	L	25%
E	Replant Native Shrubs	L	20%
A	Replant Native Trees	L	10%

Park: PP **Restoration Site ID:** V70.05 **Site Name:** Lexington Ave Slopes

Location: Lexington and Rhawn Streets.

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Trash Dumping

Restoration Category Vegetation

Restoration Type: Slope **Constraints:**

Acreage: 7.07

Site Priority: HV **Location Criteria:**

Description:

The slope is badly eroded and would benefit from native plantings along the edge of the site. These plantings will aid in retaining and slowing down storm water which would otherwise flow down the slope and cause further erosion. Trash dumping is a major problem which could be addressed by volunteers.

Restoration Options:

ID	Action	Priority	Proportion
A	Trash Removal	HV	100%
B	Edge Tree/Shrub Planting	L	15%

Park: PP **Restoration Site ID:** V70.06 **Site Name:** Lexington Ave Slopes

Location: Lexington and Rhawn Streets

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Channel Gully

Restoration Category Vegetation

Restoration Type: Slope **Constraints:**

Acreage: 0.49

Site Priority: HC **Location Criteria:**

Description:

There is an erosion gully that has formed, probably due to stormwater runoff from Lexington Avenue and Rhawn Streets. This gully should be repaired. It may be possible to channel the stormwater runoff from the streets into the wetland (V70.1). There is another gully that has formed off of Lexington Avenue south of Rhawn St. (S80.01) probably due to similar stormwater runoff problems. These two sites should be managed together, along with V70.05. Restoration should be coordinated with the Streets Department, since street runoff is the primary cause of the problem.

Restoration Options:

ID	Action	Priority	Proportion
A	Gully Repair and Prevention	HC	100%

Park: PP **Restoration Site ID:** V80.02 **Site Name:** Lexington Avenue Oak Forest

Location: South of Rhawn, East of Lexington Ave.

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: None/Minimal

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 1.48

Site Priority: HPD **Location Criteria:** Near other restorations

Description:

The canopy is dominated by American beech, white oak, red oak, tulip poplar and sycamore. The understory is sparse and lacks diversity. The dominant species are hornbeam (ironwood), ash, and wineberry. The exotic shrub should be removed and the area planted once the deer are controlled. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
A	Protect/Monitor	HP	100%
D	Monitor plantings/Control Exotics as Needed	HD	100%
B	Remove Exotics/Replant Native Forest Species	HD	100%

Park:PP **Restoration Site ID:** V80.03 **Site Name:** Lexington Avenue Woods

Location: West of Rhawn Street to Ryan Ave.

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 15.58

Site Priority: H **Location Criteria:** Near other restorations

Description:

The slopes on the edge of the forest have been impacted by trash dumping and erosion. The forest has been heavily impacted by deer browsing and exotic vegetation. The recommendation for the slopes is stabilization and edge management, which includes the removal of Norway maple, grape vines, yard waste and other trash as well as placing woody debris along the slope to help slow down erosion. The forest lacks overall vegetative diversity due to deer browsing. The recommendation is to replant native trees. However, this should not be done until deer are controlled. There is a large stand of paw paw (possibly 3/4 of an acre) that the deer do not appear to be browsing.

This is a possible site for re-introduction of zebra swallowtail, which feeds on pawpaw.

Restoration Options:

ID	Action	Priority	Proportion
D	Slope Stabilization	H	10%
C	Faunal Introduction	M	25%
A	Edge Management	L	25%
B	Replant Native Trees	HD	10%

Park: PP **Restoration Site ID:** V80.04 **Site Name:** Ryan Avenue Wet Meadow

Location: East of Ryan Avenue, South of Lexington

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:** Deer Browse

Acreage: 1.01

Site Priority: HV **Location Criteria:** Near other restorations

Description:

This site grades from old field along the northern edge to wet meadow at the south end. It has a mix of native grasses, sedges and herbs, and exotic plants such as multiflora rose. Invasive control and replanting is recommended. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
A	Invasive-Exotic Control	HV	10%
D	Monitor plantings/Control Exotics as Needed	M	10%
C	Replant Native Shrubs	M	10%
B	Deer Exclosures/Replant Native Wetland Species	L	100%

Park: PP **Restoration Site ID:** V80.05 **Site Name:** Pennypack Earth Day Site

Location: South of Rhawn Street Park

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 0.97

Site Priority: HVD **Location Criteria:** Near other cultural resources

Description:

Stream bank stabilization and replanting were done at this site in 1998. Continued efforts to control exotics (especially Japanese knotweed and hops) and replanting of native plants is recommended. Once natives are replanted, they should be monitored and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
C	Monitor plantings/Control Exotics as Needed	H	25%
A	Invasive-Exotic Control	HV	100%
B	Replant Native Forest Species	HD	25%

Park: PP **Restoration Site ID:** V80.06 **Site Name:** Earth Day Wetland

Location: Adjacent to Earth Day Stream Site

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Deer Damage

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 4.46

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This site is near the stream bank restoration site. It was highlighted as a significant site in the 1983 Master Plan. It contains large stands of lizard's tail, which was not found elsewhere in the park.

At the community meeting, it was noted that the amount of water in the wetland seems to be decreasing over the last few decades. It was suggested that the size be increased, e.g., by routing nearby runoff into the wetland or by damming or raising the level of the outlet drains. This is currently not recommended, as this may alter and disturb the existing plant communities in the wetland.

There is a trail across the wetland which threatens wetland vegetation. Construction of a boardwalk across the wetland could channel traffic and reduce damage. However, concerns were raised at the community building about building a boardwalk over the wetland. It was felt that this would increase access and habitat destruction, and that maintenance of the boardwalk would be difficult. The rogue trail across the wetland was said to be relatively recent, dating from dry periods when it could be easily crossed. Concerns about maintenance of the boardwalk were also raised. It was suggested that trail routing to avoid the wetland entirely would be better.

Currently, there is no signage directing visitors from the parking lot at the top of the slope down to the bike path. Better signage along entry points and along the main trail and blocking access to the rogue trail across the wetland could reduce access and damage to the wetland.

Deer damage is extensive in the area around the wetland. Because of its visibility, planting within deer exclosures is recommended at this site.

Restoration Options:

ID	Action	Priority	Proportion
B	Structure Building (Boardwalk)	LT	1%
D	Deer Exclosures/Replant Native Wetland Species	H	10%
E	Protect/Monitor	HP	100%
A	Replant Native Herbs	L	30%
C	Trail Improvement	HT	3%

Park: PP **Restoration Site ID:** V80.07 **Site Name:** Lexington and Rhawn Wetland

Location: South of Rhawn Street

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 0.59

Site Priority: HP **Location Criteria:**

Description:

This site consists of a relatively large seep along Tributary 9. The slopes contain a diversity of canopy trees. The seep contains a mix of skunk cabbage, jewelweed and watercress in wetter areas, with various other herbs along the edges.

Restoration Options:

ID	Action	Priority	Proportion
D	Protect/Monitor	HP	100%
C	Deer Exclosures/Replant Native Wetland Species	M	2%
B	Replant Native Herbs	M	25%
A	Replant Native Shrubs	M	15%

Park: PP **Restoration Site ID:** V80.08 **Site Name:** Rowland Ave. Wetland

Location: Northwest of Roland Ave.

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Deer Damage

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 3.04

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This site consists of a pair of wet areas on either side of a small tributary. The wetlands contain large stands of skunk cabbage along the Pennypack side, and shallow pools along the base of the slope (adjacent to the main trail). Vegetation includes a mixture of grasses, sedges, skunk cabbage and moneywort in wetter areas, and stinging nettle, lesser celandine and spring beauty in drier areas. Box elder is the most common tree, and spicebush is the most common shrub. This wetland could be enhanced by invasive control and planting. Once natives are replanted, they should be monitored and exotics should be removed routinely.

At the community meeting, it was suggested that the small stream could provide additional water to these wetlands. The tributary runs between the main wetland areas. The stream channel is incised, but there is little difference in elevation between the top of the bank and the wetlands. Therefore, storm water flow could probably be diverted into the wetlands with little effort. At a minimum, a channel could be dug into the top of the channel banks, which would divert storm flows above that level. More complicated structures may reduce channel erosion. It is recommended that this option be studied in more detail, e.g., to determine storm flow levels in the tributary.

Restoration Options:

ID	Action	Priority	Proportion
C	Deer Exclosures/Replant Native Wetland Species	H	10%
F	Monitor plantings/Control Exotics as Needed	H	25%
B	Invasive-Exotic Control	M	100%
E	Structural Improvement	HC	10%
A	Remove Exotics/Replant Native Wetland Species	HD	25%

Park: PP **Restoration Site ID:** V90.0 **Site Name:** Ryan Avenue West Wetland

Location: West of Ryan Avenue, East of Roosevelt Blvd.

General Location: Roosevelt Blvd to Holme

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 2.06

Site Priority: HC **Location Criteria:** Affects ecolog. Significant site

Description:

Construction of a wetland here could control some storm water. The Philadelphia Water Department (PWD) is interested in creating a wetland here. Further discussion between the PWD and the park is encouraged. PWD has discussed damming Sandy Run at Ryan Avenue and using much of the upstream floodplain as a backwater for the wetland. Given the amount of storm flow in the creek, it may be difficult to create such an inline impoundment that would support wetland vegetation and provide water storage. An alternative would be to construct a wetland on the left bank which would be filled by overflow from the stream. While this would hold less water, it would provide more stable habitat for wetland vegetation.

Restoration Options:

ID	Action	Priority	Proportion
A	Invasive-Exotic Control	L	100%
D	Monitor plantings/Control Exotics as Needed	L	20%
B	Replant Native Herbs	L	20%
C	Wetland Creation	HC	30%

Park: PP **Restoration Site ID:** V100.01 **Site Name:** Solly Avenue Woods

Location: East of Welsh Rd. At Solly and Hess Sts.

General Location: Lower Rhawn to Torresdale

Disturbance/Condition: Lack of understory/herbaceous layer

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 21.89

Site Priority: HC **Location Criteria:**

Description:

The disturbances in this forest are a combination of deer damage, trash and yard waste dumping, exotic vegetation and trail damage. The recommendation is to manage the edge by removing exotics, replanting native forest species and limiting access to dumping. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

This area is used heavily by local high school students from Father Judge. There are many rogue trails in the woods, and the damage to the understory caused by the deer is severe. If the deer are not culled and/or if fencing around plantings is not an option, this area would not be a high priority for restoration. Volunteers could remove the trash and yard waste that has been dumped along the edge of the woods. This could be coordinated with Father Judge as a community service project.

The edge community is represented by Norway maple, tulip poplar and black cherry in the canopy, with the shrub layer primarily occupied by wineberry and spicebush. Japanese honeysuckle covers the ground layer and is beginning to invade the canopy.

Restoration Options:

ID	Action	Priority	Proportion
C	Invasive-Exotic Control	M	100%
E	Monitor plantings/Control Exotics as Needed	M	100%
A	Replant Native Forest Species	M	10%
B	Trash Removal	M	100%
D	Coordinate with other agencies	HC	100%

Park: PP **Restoration Site ID:** V100.03 **Site Name:** Winthrop Avenue Wetland

Location: Left Bank of Creek, East of Welsh Rd.

General Location: Lower Rhawn to Torresdale

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 0.74

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

Exotic vines, multiflora rose and wineberry were observed at the site. The exotics need to be removed, and the area should be replanted with native wetland plant species. Once natives are replanted, they should be monitored, and exotics should be removed routinely. Deer exclosures are necessary if replanting is performed before deer numbers are reduced.

Restoration Options:

ID	Action	Priority	Proportion
A	Invasive-Exotic Control	H	100%
D	Monitor plantings/Control Exotics as Needed	HD	100%
C	Remove Exotics/Replant Native Herbs	HD	10%
B	Remove Exotics/Replant Native Shrubs	HD	10%

Park: PP **Restoration Site ID:** V100.04 **Site Name:** Winthrop Riparian Zone

Location: Left Bank, East of Welsh Rd.

General Location: Lower Rhawn to Torresdale

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Riparian Zone **Constraints:**

Acreage: 3.97

Site Priority: HD **Location Criteria:** No distinctive

Description:

This area would benefit from a general clean-up of trash in the channel. The riparian zone should be replanted, and deer exclosures are recommended around new plantings.

Restoration Options:

ID	Action	Priority	Proportion
C	Deer Exclosures/Replant Native Forest Species	H	100%
A	Trash Removal	HV	25%
D	Monitor plantings/Control Exotics as Needed	HD	50%
B	Remove Exotics/Replant Native Forest Species	HD	50%

Park: PP **Restoration Site ID:** V110.02 **Site Name:** Torresdale edge

Location: Above Torresdale. East side of Pennypack.

General Location: Lower Rhawn to Torresdale

Disturbance/Condition: Maintained Lawn/Mowed Field

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:** Presently mowed

Acreage: 1.23

Site Priority: H **Location Criteria:** Area with few other restoration opportunities

Description:

Release mowed area and plant native herbs and trees.

Restoration Options:

ID	Action	Priority	Proportion
D	Monitor plantings/Control Exotics as Needed	H	20%
A	Release/Widen	H	20%
B	Replant Native Trees	H	10%
C	Replant Native Herbs	M	10%

Park: PP **Restoration Site ID:** V110.03 **Site Name:** Frankford Ave. Waterfalls Forest

Location: North of Frankford, Left bank of Pennypack

General Location: Lower Rhawn to Torresdale

Disturbance/Condition: Trash Dumping

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:**

Acreage: 1.59

Site Priority: HV **Location Criteria:**

Description:

The recommendation is to clean up trash along the banks and remove the vines that are beginning to take control of the floodplain forest. When the vines are removed, native trees and shrubs should be replanted and monitored, and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
D	Monitor plantings/Control Exotics as Needed	HV	100%
C	Remove Exotics/Replant Native Shrubs	HV	50%
B	Remove Exotics/Replant Native Trees	HV	50%
A	Trash Removal	HV	100%

Park: PP **Restoration Site ID:** V120.0* **Site Name:** Mouth of the Pennypack (no mapped polygon)

Location: west bank in bend of Pennypack Creek at mouth

General Location: Torresdale to mouth

Disturbance/Condition: Filled/Drained Pond or Wetland

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:** Portions not accessible to the public

Acreage:

Site Priority: H **Location Criteria:** Affects ecolog. Significant site

Description:

This summary describes the mouth of the Pennypack and does not have an associated mapped polygon. The mouth of the Pennypack is a rare type of environment for Fairmount Park and is of great regional importance as well. There are a variety of possible enhancement activities discussed in accompanying specific site recommendations, which include the replanting of native herbs and shrubs and improved access to the site. Access to the constructed wetland and to the stream is a complicated issue and needs to be coordinated with the prison.

Restoration Options:

ID	Action	Priority	Proportion
A	Replant Native Herbs	H	
C	Replant Native Shrubs	H	
B	Structural Improvement	H	

Park: PP **Restoration Site ID:** V120.01 **Site Name:** Created wetland

Location: Mouth of the Pennypack

General Location: Torresdale to mouth

Disturbance/Condition: Disturbed Floodplain

Restoration Category Vegetation

Restoration Type: Wetland **Constraints:**

Acreage: 12.38

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

This is a wetland which was constructed as part of a mitigation plan. Various wetland herbs and shrubs were planted in 1998. However, the overall density of plants was relatively low in May, 1999, particularly in the lower end. Planting additional herbs within the intertidal zone or on the island in the wetland to replace planted material which hasn't survived and to expand the planted area would enhance the area. In addition, installation of artificial cover (e.g., trees) in the lower part can enhance habitat quality for aquatic organisms.

Restoration Options:

ID	Action	Priority	Proportion
A	Replant Native Herbs	H	20%
B	Structural Improvement	H	1%

Park: PP **Restoration Site ID:** V120.02 **Site Name:** Trash mound slopes

Location: Mouth of the Pennypack

General Location: Torresdale to mouth

Disturbance/Condition: Trash Dumping

Restoration Category Vegetation

Restoration Type: Slope **Constraints:** Limited access

Acreage: 4.98

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

Remove exotics to favor regeneration of native plants. Plant the slopes which are constructed to cover the landfill. Once natives are replanted, they should be monitored, and exotics should be removed routinely.

Restoration Options:

ID	Action	Priority	Proportion
A	Invasive-Exotic Control	H	20%
C	Monitor plantings/Control Exotics as Needed	H	20%
B	Replant Native Forest Species	H	20%

Park: PP **Restoration Site ID:** V120.03 **Site Name:** Mouth of Pennypack, east half

Location: Mouth of Pennypack

General Location: Torresdale to mouth

Disturbance/Condition: Disturbed Forest

Restoration Category Vegetation

Restoration Type: Forested Upland **Constraints:** Limited access

Acreage: 8.59

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

The wetland and associated land are a major resource. Access is limited, since it must be through the prison. Unlimited access would likely be a problem for the prison and may affect wildlife use of the wetland. However, a change in fencing allowing occasional access by groups would allow subsequent restoration, natural lands maintenance, environmental education and monitoring. This could be done by building a gate in the existing fence from the soccer fields. If necessary, additional fencing could be added to limit access to parts of the area (probably the northern part).

Additional planting of the non-wetland parts of the mitigation site could increase native diversity. This is a lower priority until the natural growth in the area is determined.

At the community meeting, construction of a tower or platform to allow overview of the wetland area was suggested. This could conflict with the prison management, so this option would need to be reviewed with the prison before any decision could be made. This is labeled as a HC (High priority for coordination) priority.

At the community meeting, it was suggested that a trail be built in the vicinity of the wetland and mouth of Pennypack. A trail could be built in conjunction with a gate.

Restoration Options:

ID	Action	Priority	Proportion
A	Structural Improvement	H	10%
B	Replant Native Forest Species	L	100%
C	Structural Improvement	HC	10%
D	Trail Improvement	HT	5%

Park: PP **Restoration Site ID:** V120.05 **Site Name:** Mouth of Pennypack Old Field

Location: Mouth of Pennypack

General Location: Torresdale to mouth

Disturbance/Condition: Invasive/Exotic Vegetation

Restoration Category Vegetation

Restoration Type: Non-Forested Upland **Constraints:**

Acreage: 4.10

Site Priority: H **Location Criteria:** Near other cultural resources

Description:

Manage the old field as a meadow. Augmenting diversity with plantings would be valuable but is of lower priority. Protect from recreational development.

Restoration Options:

ID	Action	Priority	Proportion
A	Meadow Management	H	100%
C	Protect/Monitor	HP	100%
B	Replant Native Herbs	M	10%

Park: PP **Restoration Site ID:** V130.0* **Site Name:** Pennypack Pk. Deer Control (no mapped polygon

Location: Park wide

General Location: Park wide

Disturbance/Condition: Deer Damage

Restoration Category Vegetation

Restoration Type: Park Wide **Constraints:**

Acreage:

Site Priority: H **Location Criteria:**

Description:

Deer cause extensive damage throughout the park, with the possible exception of the mouth. Control is necessary for extensive restoration to be done. This is a general recommendation for the whole park and is not represented by a polygon on the maps.

Restoration Options:

ID	Action	Priority	Proportion
A	Control Deer	H	100%
B	Deer Monitoring	H	100%

Park: PP **Restoration Site ID:** V130.01* **Site Name:** Park Wide (no mapped polygon)

Location: Park wide

General Location: Park wide

Disturbance/Condition:

Restoration Category

Restoration Type: Park Wide **Constraints:**

Acreage:

Site Priority: HD **Location Criteria:**

Description:

This is a general recommendation and there is no mapped polygon. Some of the planting sites are good opportunities for planting locally extirpated or endangered species. Species and possible locations will be spelled out in the master plan.

Restoration Options:

ID	Action	Priority	Proportion
A	Floral Reintroduction	HD	

Park: PP **Restoration Site ID:** V130.02* **Site Name:** Release/buffer zone protection (no mapped polygo

Location: Park wide

General Location: Park wide

Disturbance/Condition: Maintained Lawn/Mowed Field

Restoration Category Vegetation

Restoration Type: Park Wide **Constraints:**

Acreage:

Site Priority: H **Location Criteria:**

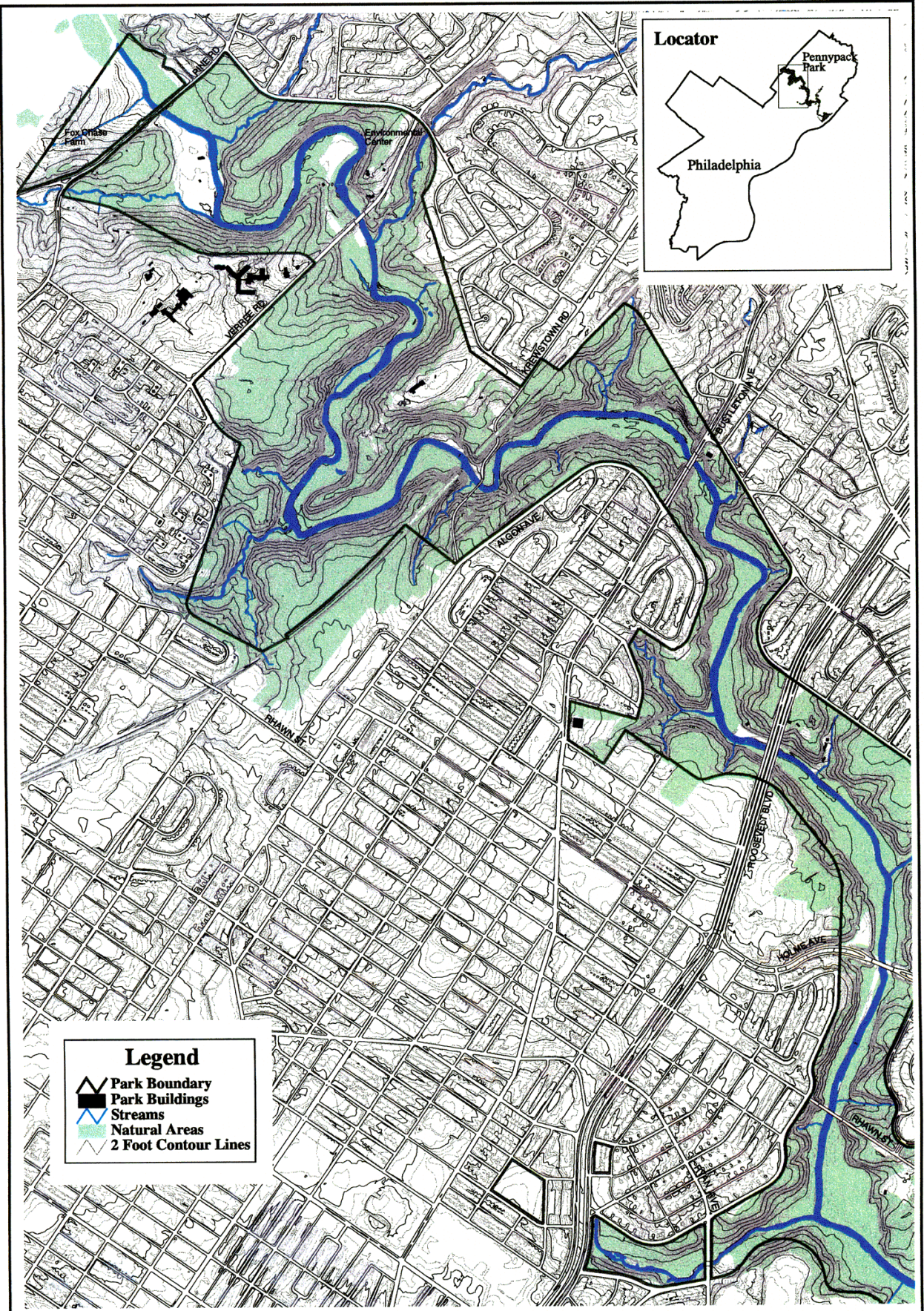
Description:

This is a general recommendation to release mowed areas, where possible, and there is no mapped polygon associated with this site. Specific sites are identified for release from mowing, where this would benefit natural areas and retention as mowed area is not needed. Release could be done at other sites as well, with subsequent maintenance as woods or meadow buffer zones. This was suggested as a general recommendation at the community meeting. Deployment of barriers (mulch, barrriers, trees) to protect plantings at edges from mowing was also suggested.

Restoration Options:

ID	Action	Priority	Proportion
A	Mow Infrequently to Increase Woods	H	100%
B	Structural Improvement (protect trees)	H	100%

The Master Plan Maps for Pennypack Park follow.



PENNYPACK PARK
Natural Lands Restoration Master Plan
PARK BASE MAP

Map 1 of 2

FAIRMOUNT P·A·R·K COMMISSION

N

500 0 500 Feet

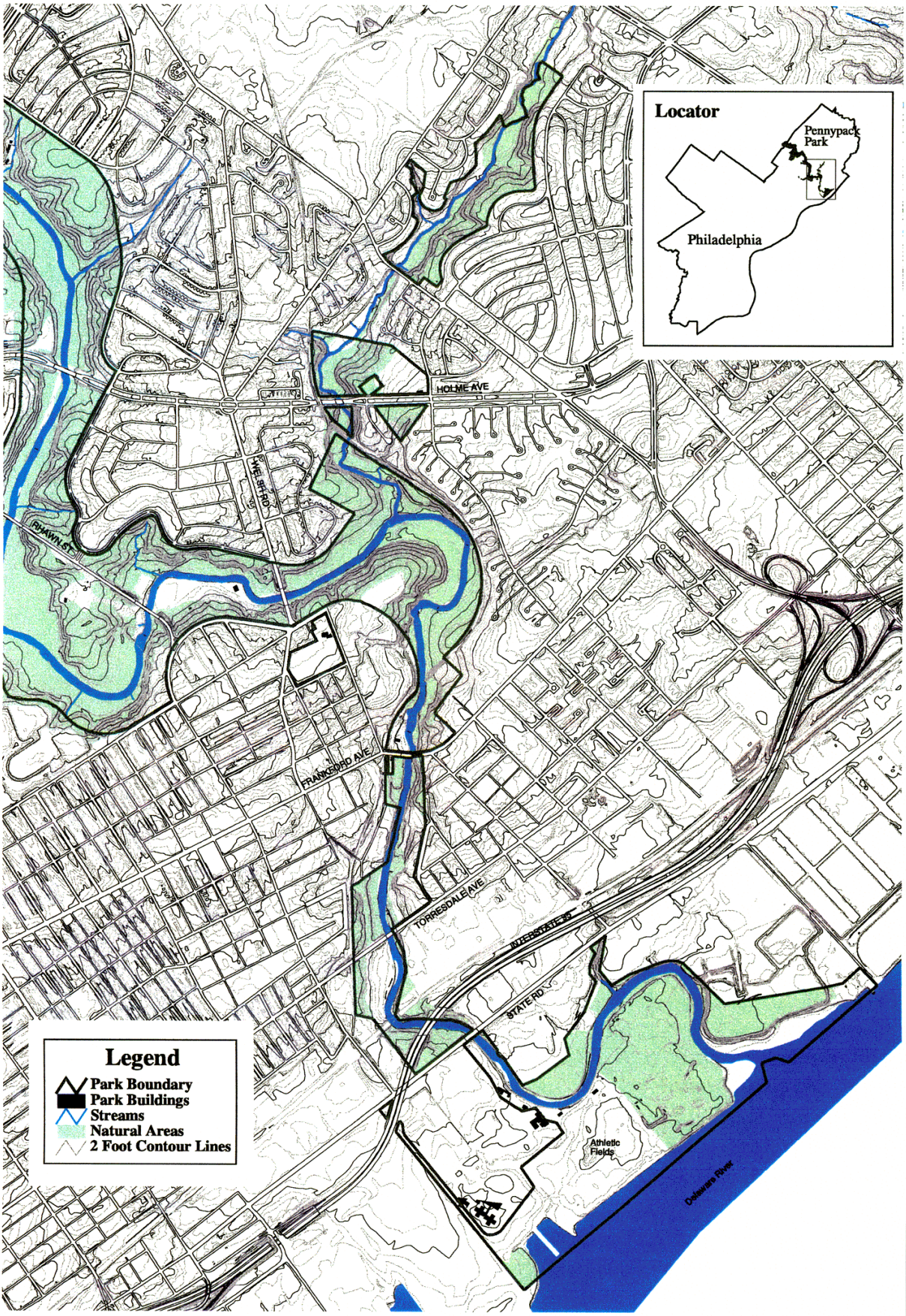
1 inch = 1250 feet

Prepared for: Fairmount Park Commission
Natural Lands Restoration and Environmental Education Program

Prepared by: THE ACADEMY OF NATURAL SCIENCES
Patrick Center for Environmental Research

Date: June 2000

Base Map Data: Roads from Phila. Water Department Digital Data Set
Park Boundaries from the Phila. Planning Commission with updates by PCER
Hydrology from the Phila. Water Department Digital Data Set with updates from PCER



PENNYPACK PARK
Natural Lands Restoration Master Plan
PARK BASE MAP

Map 2 of 2

FAIRMOUNT PARK COMMISSION

N

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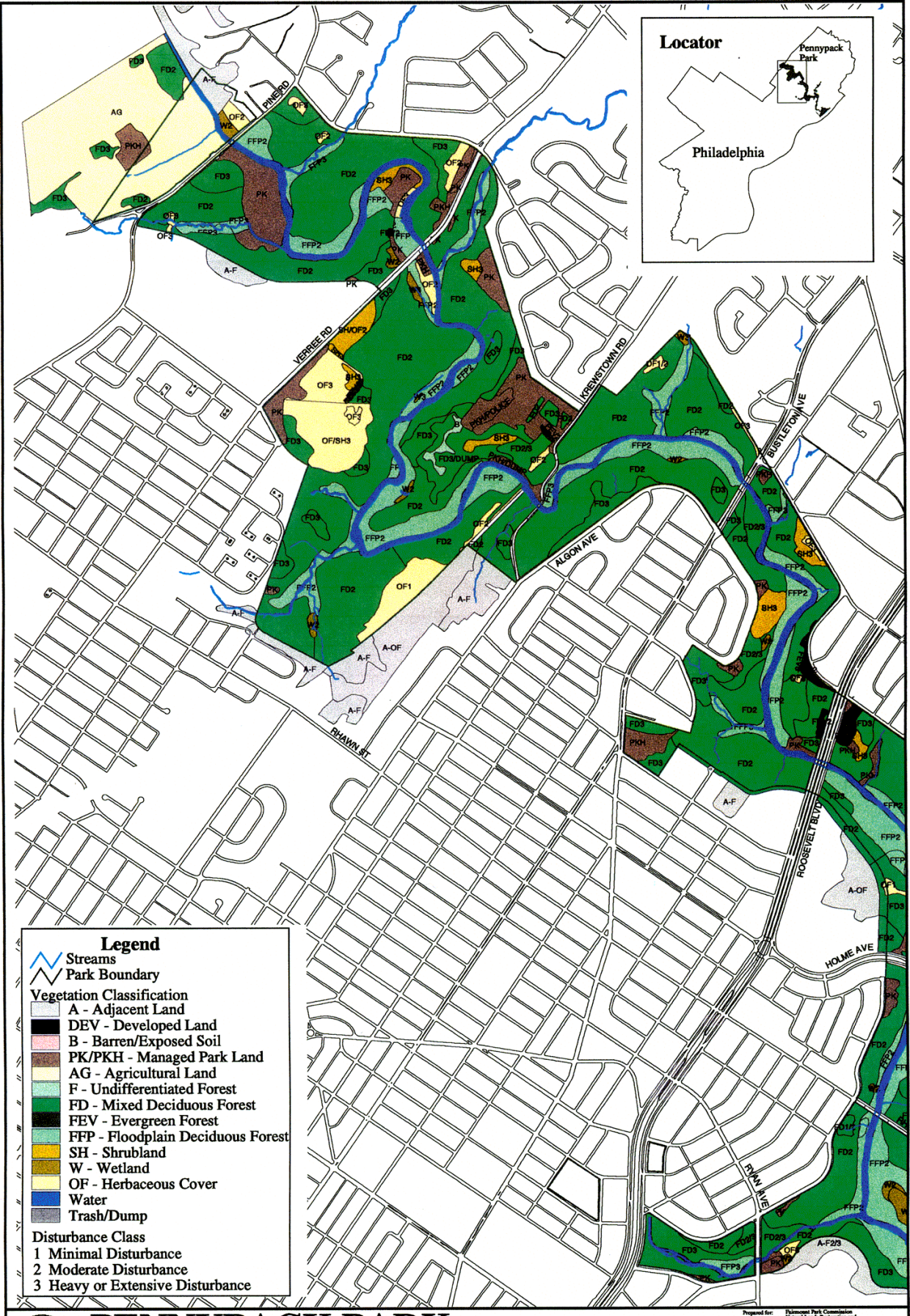

PENNYPACK PARK
Natural Lands Restoration Master Plan
VEGETATION CLASSIFICATION
Map 1 of 2

FAIRMOUNT PARK COMMISSION

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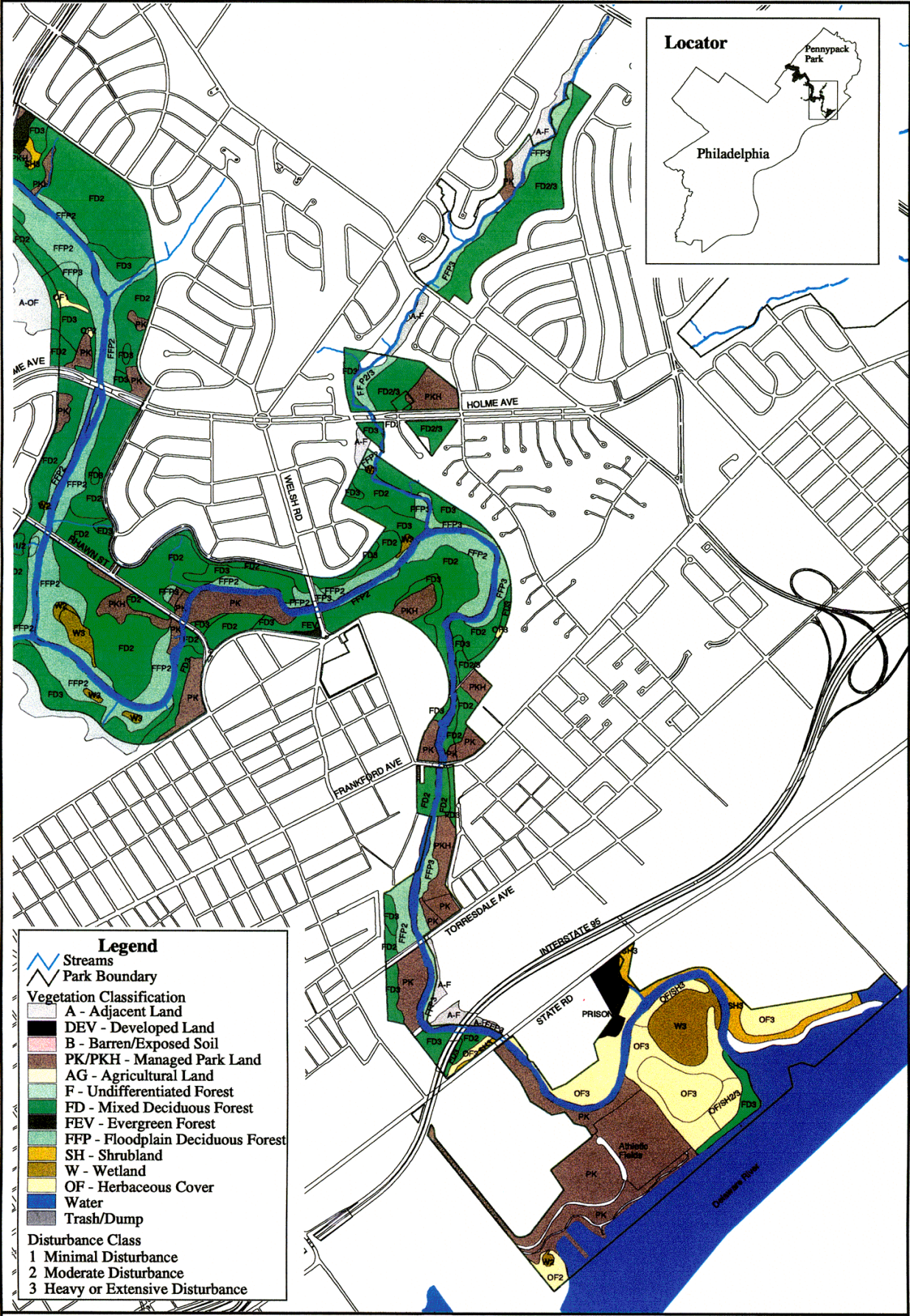

PENNYPACK PARK
Natural Lands Restoration Master Plan
VEGETATION CLASSIFICATION
Map 2 of 2

FAIRMOUNT P·A·R·K COMMISSION

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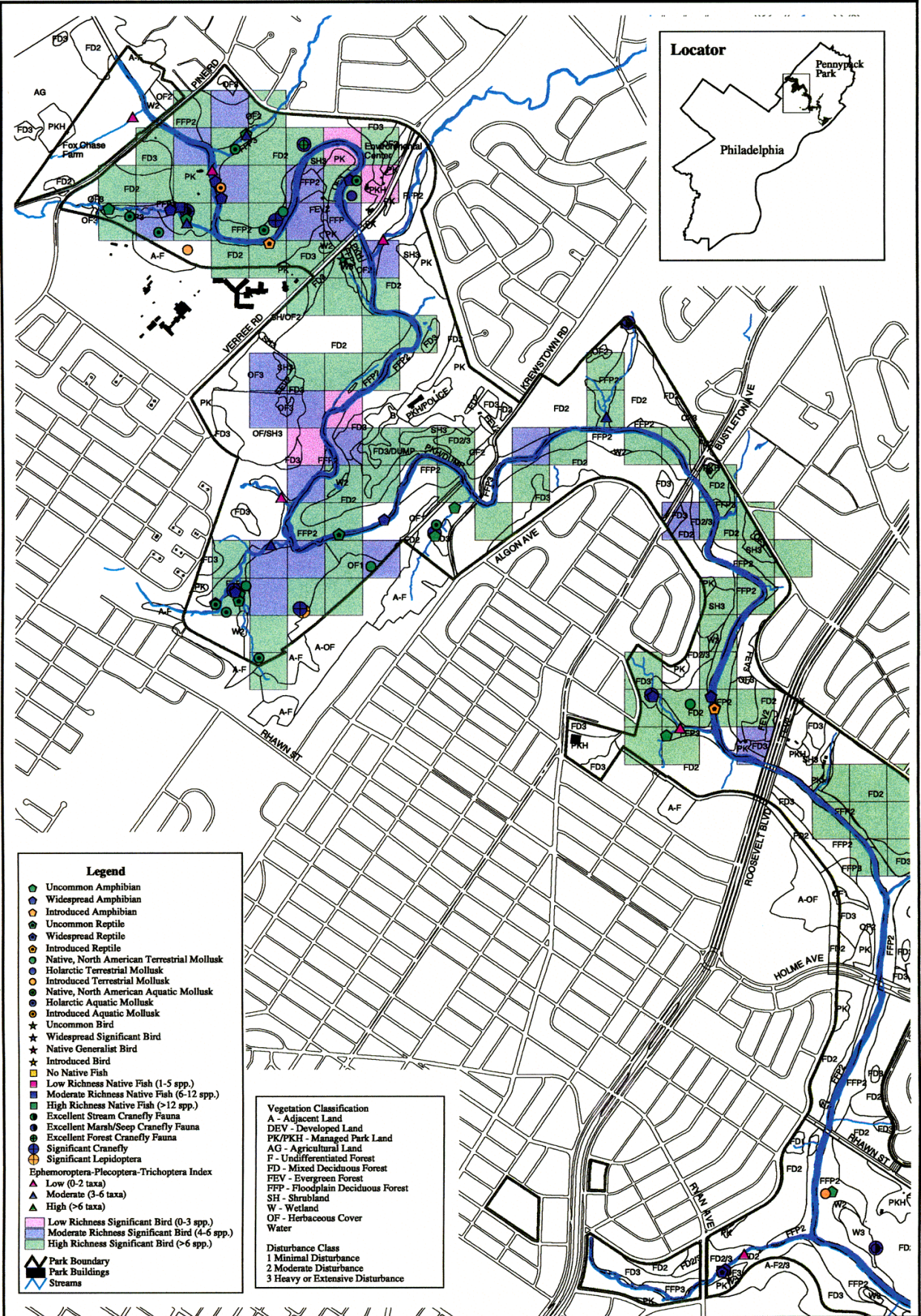

PENNYPACK PARK
Natural Lands Restoration Master Plan
HABITAT QUALITY
Map 1 of 2

FAIRMOUNT P·A·R·K COMMISSION

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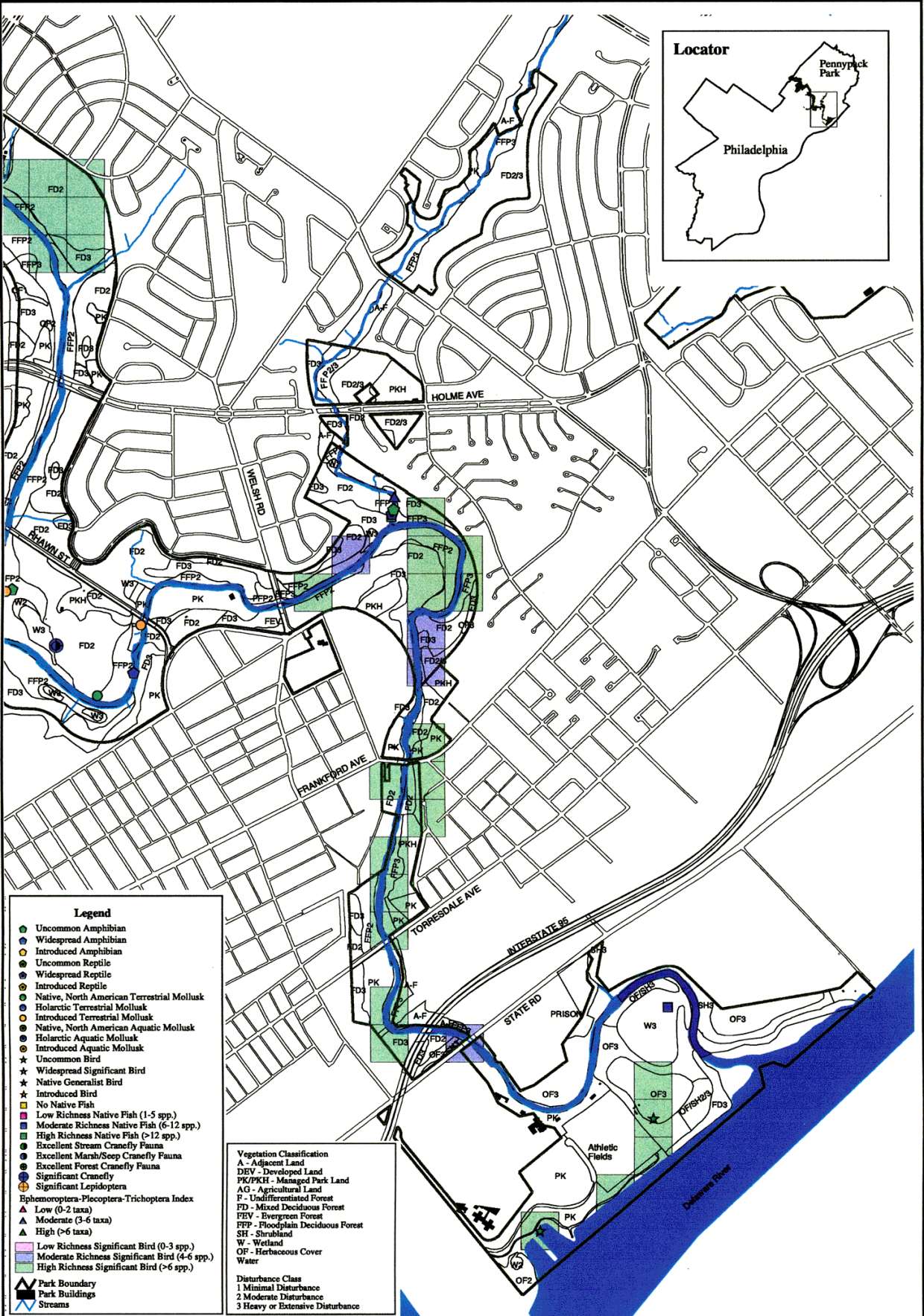

PENNYPACK PARK
Natural Lands Restoration Master Plan
HABITAT QUALITY
Map 2 of 2

FAIRMOUNT P·A·R·K COMMISSION

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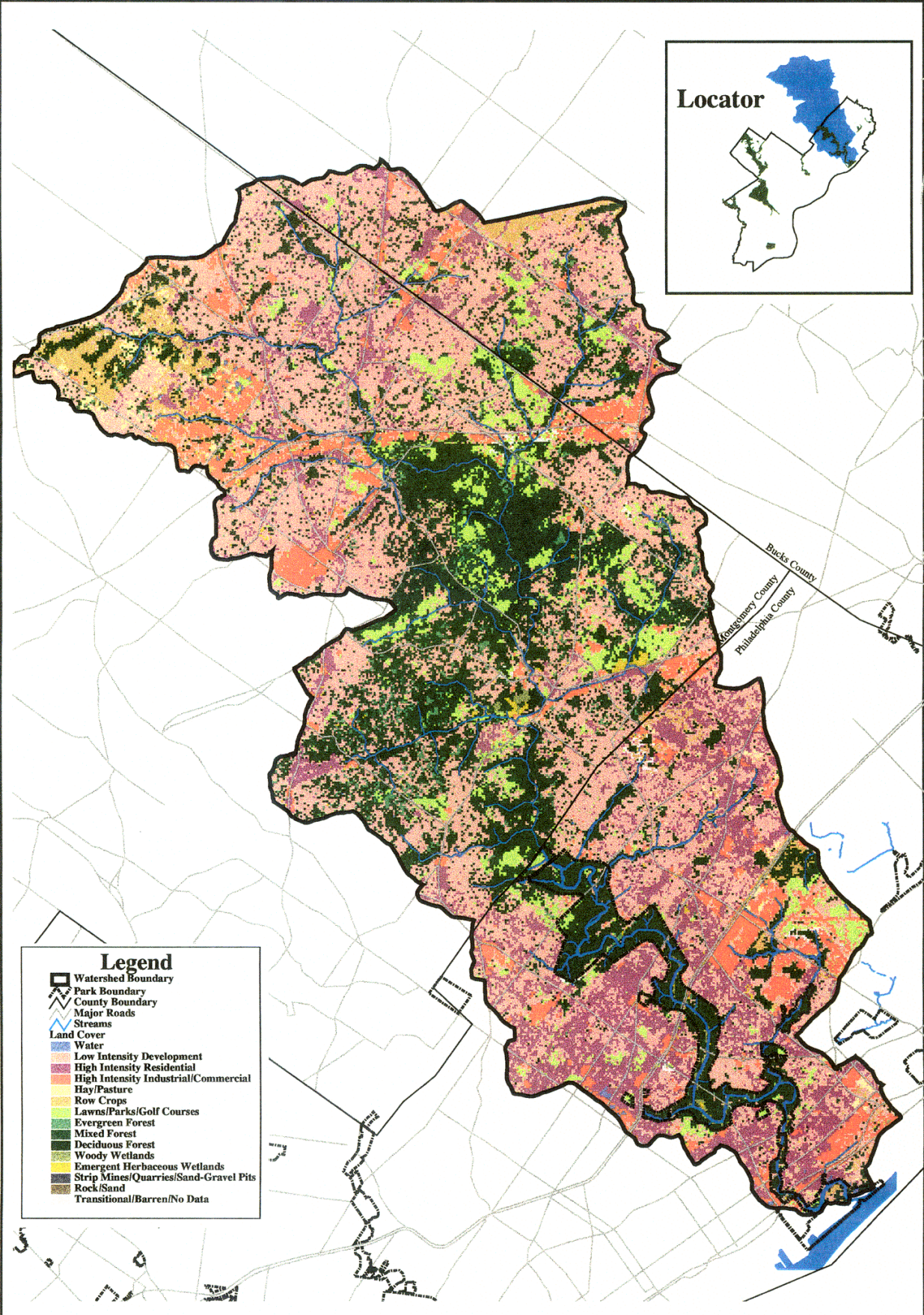

PENNYPACK PARK
Natural Lands Restoration Master Plan
WATERSHED MAP

FAIRMOUNT PARK COMMISSION

N

3000 0 3000 Feet

1 inch = 5750 feet

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Natural Lands Restoration and Environmental Education Program

Prepared by: THE ACADEMY OF NATURAL SCIENCES
Patrick Center for Environmental Research

Date: June 2000

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PENNYPACK PARK
Natural Lands Restoration Master Plan
STREAM QUALITY
Map 1 of 2

FAIRMOUNT P·A·R·K COMMISSION

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Natural Lands Restoration and Environmental Education Program

Prepared by: THE ACADEMY OF NATURAL SCIENCES
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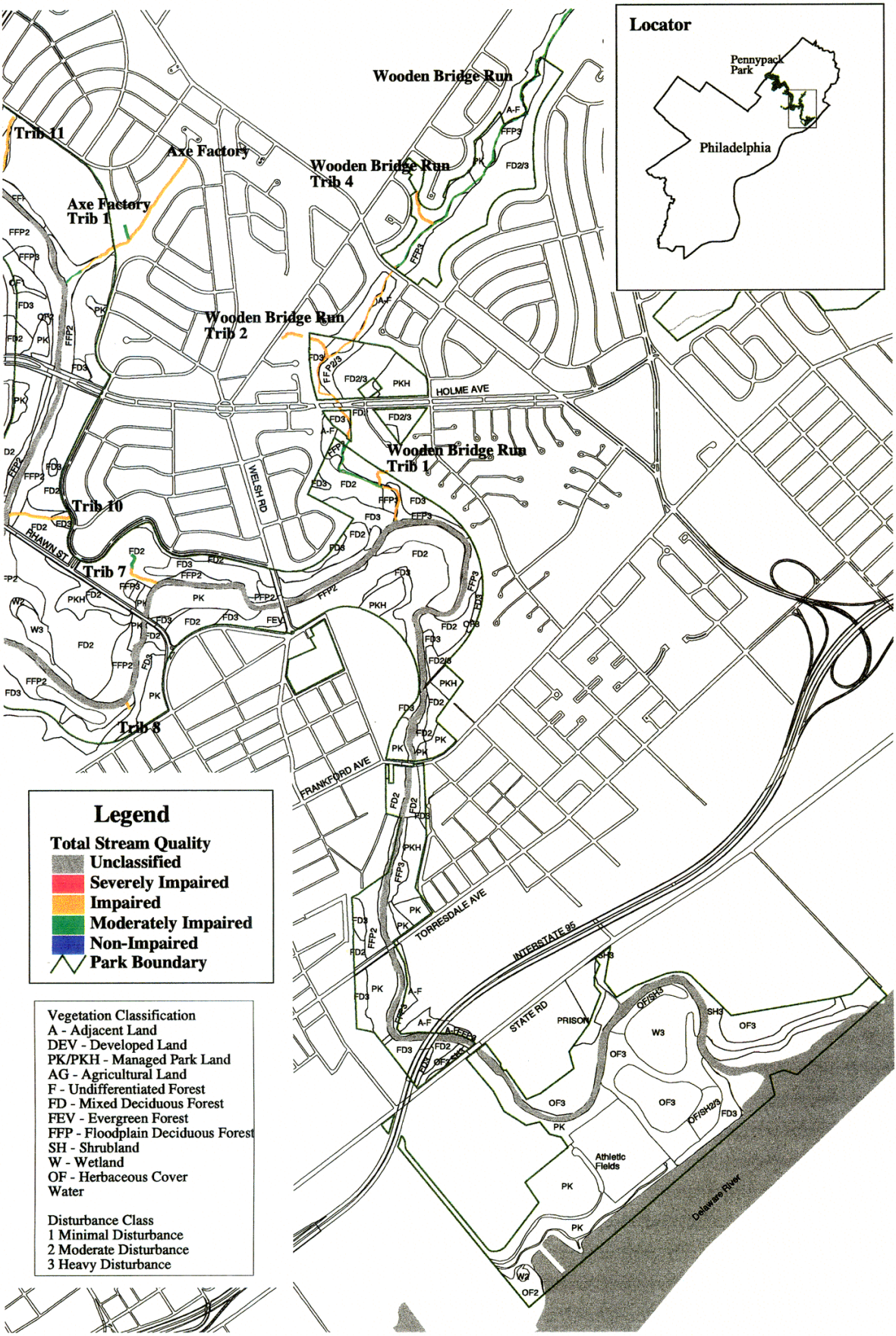

PENNYPACK PARK
Natural Lands Restoration Master Plan
STREAM QUALITY
Map 2 of 2

FAIRMOUNT P·A·R·K COMMISSION

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Prepared by: The Academy of Natural Sciences, Patrick Center for Environmental Research

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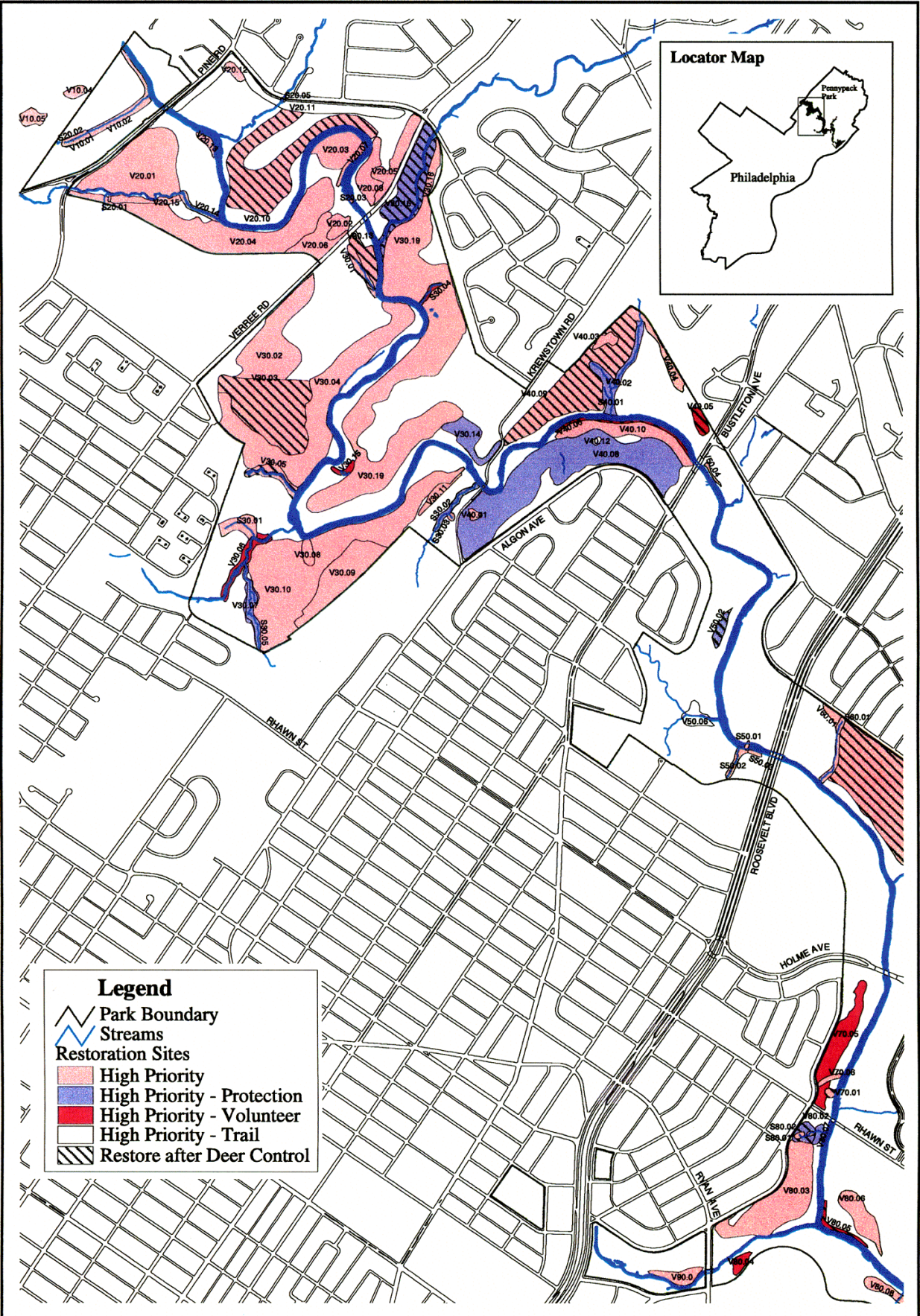

PENNYPACK PARK
Natural Lands Restoration Master Plan
RESTORATION SITES
Map 1 of 2

FAIRMOUNT PARK COMMISSION

N

500 0 500 Feet

1 inch = 1250 feet

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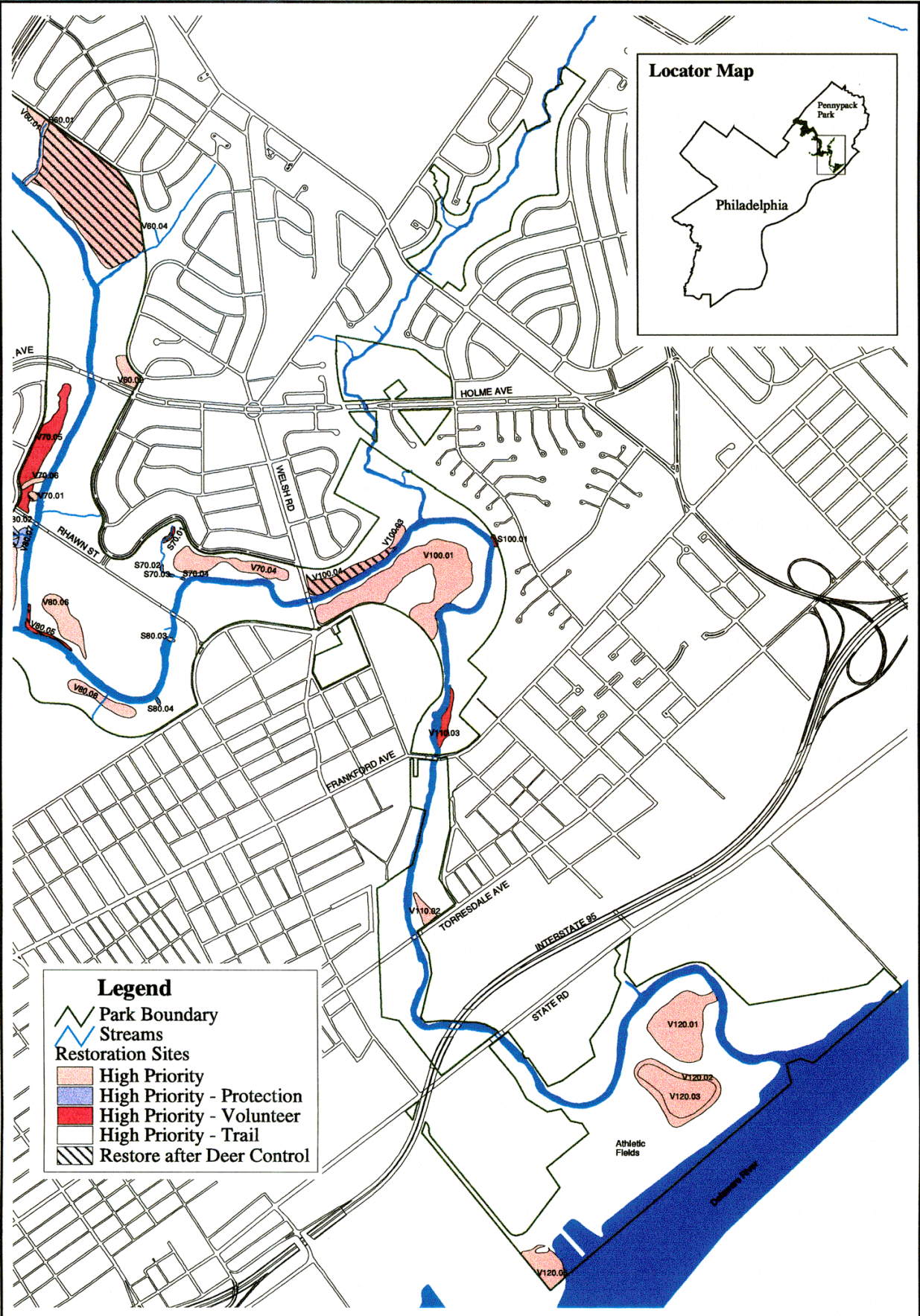

PENNYPACK PARK
Natural Lands Restoration Master Plan
RESTORATION SITES
Map 2 of 2

FAIRMOUNT P·A·R·K COMMISSION

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