

MELLON BIOLOGICAL SERVICES

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MASTER PLAN
FOR
FIVE-MILE WOODS PRESERVE
LOWER MAKEFIELD TOWNSHIP
PENNSYLVANIA

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INTRODUCTION

Five-Mile Woods is located in the southwest corner of Lower Makefield Township with some spillover into Falls Township, Bucks County, Pennsylvania. The woods is bounded on the north by Big Oak Road and on the south by the Route 1 bypass. On the west, the woods borders Independence Square with a small private boundary near Big Oak Road. The northern third of the eastern boundary is adjacent to Cambridge Estates, while the southern portion borders the Guzikowski property.

The total are of Five-Mile Woods is approximately 230 acres, of which better than 90% is wooded, with the remainder made up of fields, bogs and marshes. The woods straddles the fall line and has special botanical significance due largely to the coastal plain influence, which is very limited in Pennsylvania and subject to tremendous developmental pressures where it does occur. This coastal plain influence is displayed primarily as very strongly acid soils and a very high water table with the associated flora.

Since one of the primary reasons for preserving the area is to protect the unique ecological character of the woods, this master plan will examine the physical, biological and ecological components of the woods and make recommendations on the preservation, management and public use to best preserve this unique natural area.

FIVE-MILE WOODS

Headquarters

Big Oak Road

Cambridge Estates

Queen Anne Creek



Independence Square

Guzikowski Property

Ridge

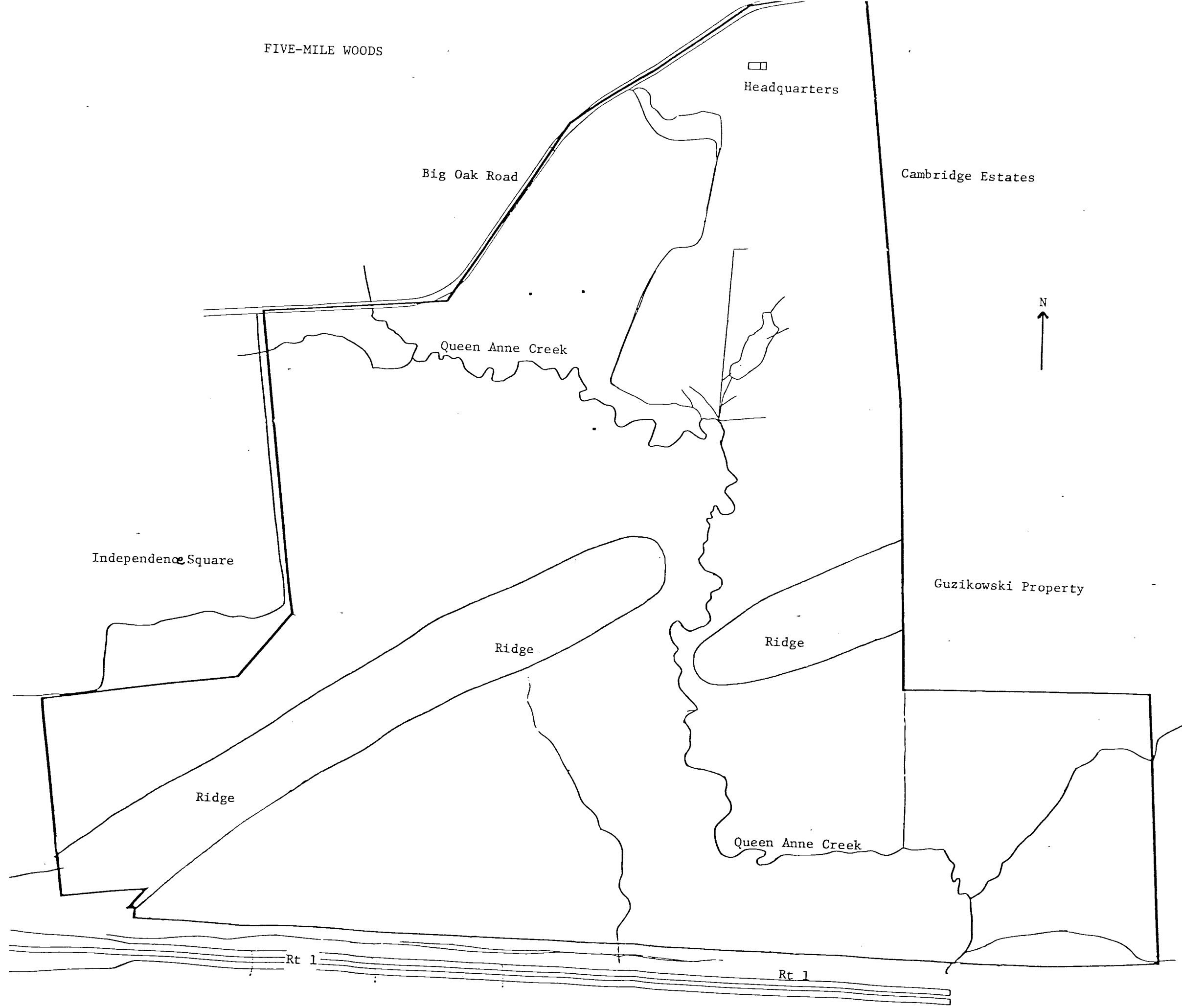
Ridge

Ridge

Queen Anne Creek

Rt 1

Rt 1



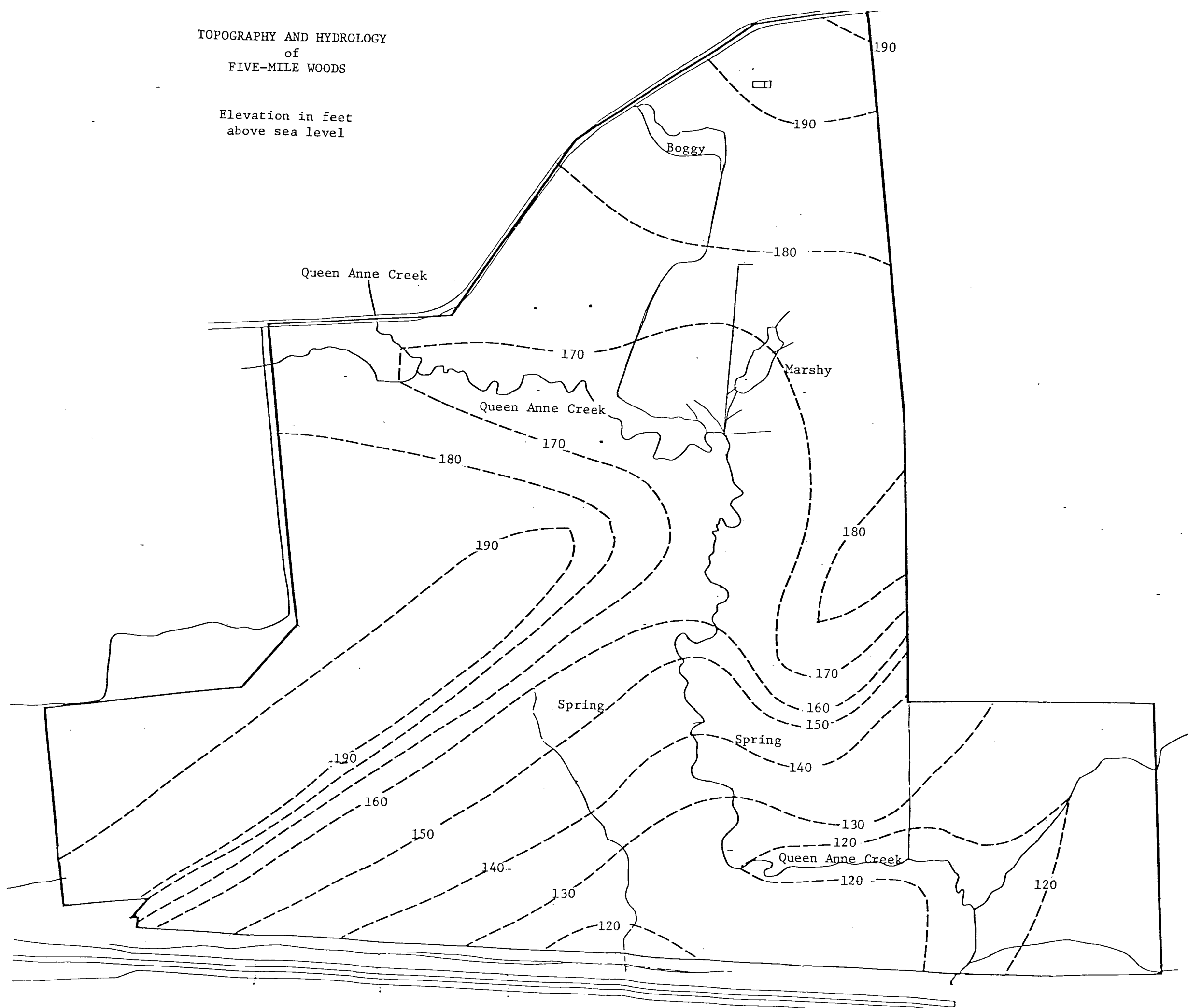
PHYSICAL COMPONENTS

TOPOGRAPHY

Five Mile Woods consists of two gently sloping terraces separated by a ridge running east-northeast to west-southwest. The higher terrace on the north side of the ridge ranges from an elevation of 160 feet above sea level to 190 feet above sea level. The terrace below the ridge (south) ranges from 120 feet where Queen Anne Creek leaves the preserve to 160 feet at the base of the ridge. The ridge reaches a maximum elevation of 200 feet and has a rather broad, level top. The ridge enters the preserve at the southwest corner of the preserve and leaves about half way between the north and south borders on the east. It is bisected by Queen Anne Creek, which enters the preserve along the north border in the northwest section. It leaves the preserve along the south border in the southeast section. Slopes throughout the preserve are gentle, ranging from zero to eight degrees except along the ridge where slopes range up to 25 degrees.

TOPOGRAPHY AND HYDROLOGY
of
FIVE-MILE WOODS

Elevation in feet
above sea level



GEOLOGY

Five Mile Woods straddles a ridge of Lower Cambrian Chickies Quartzite running diagonally across the property from northeast to southwest. Extending north of the ridge for approximately one mile is a formation of Pre-Cambrian Baltimore Gneiss overlain by Pre-Illinoian Deposits, while extending to the south is Wissahickon Schist overlain with Illinoian Gravel Outwash. Following are descriptions of each formation as described by the Geology and Mineral Resources of Bucks County, Pennsylvania published by the Pennsylvania Geological Survey and the Commonwealth of Pennsylvania in 1959:

Baltimore Gneiss - Baltimore Gneiss is a granitoid, schistose or gneissose rock ranging in composition from a granite to an amphibolite and from light gray to black depending on the amount of injected material. The principal minerals are hornblende and plagioclase, but biotite is common, pyroxene occurs locally and in more felsic rocks, quartz and potash feldspar appear. Accessory minerals are magnetite, epidote, zircon, pyrite and locally euhedral sphene. Alterations of original minerals are as follows according to Armstrong (1941, p. 675): Pyroxene to hornblende and quartz, hornblende to biotite, plagioclase becomes more sodic (andesine to oligoclase), potash feldspar replaces plagioclase, and quartz, potash feldspar and plagioclase have replaced hornblende and biotite.

A sedimentary origin for the Baltimore Gneiss was proposed by Mathews (1904). Williams and Darton (1892)... suggested that [it] was originally sedimentary and igneous rocks. Armstrong (1941) stated that the "mafic rocks are probably of igneous origins" but her evidence is restricted to the intrusive gabbro in the Van Artsdalen Quarry and a lack of evidence for the development of the amphibolite by alteration of a carbonate rock. Although the mafic rocks in Baltimore Gneiss are probably igneous in origin, this theory has not been conclusively proven.

Wissahickon Schist - Wissahickon Schist is composed of mica schist, gneiss and quartzite in which the proportions of mica, quartz and feldspar vary from bed to bed. Individual layers and lenses range in thickness from about one inch to several feet. These are apparently sedimentary in origin (Weiss 1949 p. 1696) though metamorphism has developed thinner bands within the layers. The chief minerals in the Wissahickon Schist in Bucks County are quartz, plagioclase (mostly oligoclase), and micas. Common accessory minerals are garnet, staurolite, sillimanite, magnetite, apatite, zircon, sphene, and ilmenite (?) flakes.

Sandstone, arkose and shale, the original sediments of the Wissahickon Schist (Weiss, 1949 p. 1697), were recrystallized without addition of material by regional metamorphism which increased in intensity from northwest to southeast. Zones of metamorphism, characterized by index minerals; developed with increasing intensity to the east and southeast [Five Mile Woods is located along the northwest border of Wissahickon Schist.]

Lower Cambrian Chickies Quartzite - The main body of Chickies quartzite is gray crystalline quartzite and light buff to white feldspathic, sericitic quartz schist. At its base the Hellam Conglomerate member contains elongated blue quartz pebbles questionably said to come from Baltimore Gneiss to the north. Cleavage is parallel to bedding. A thickness of 1300 feet was assigned to these steeply south-dipping strata.

The age and correlation of Chickies Quartzite in the Langhorne area depend on lithology and cannot be proved paleontologically. Scolithus, is the only organic remains reported. To the west the age of Chickies Quartzite has been determined as early Cambrian. Lithologically, it is little different from Chickies Quartzite with basal Hellam Conglomerate from the type locality at Chickies Rock above the Susquehanna River.

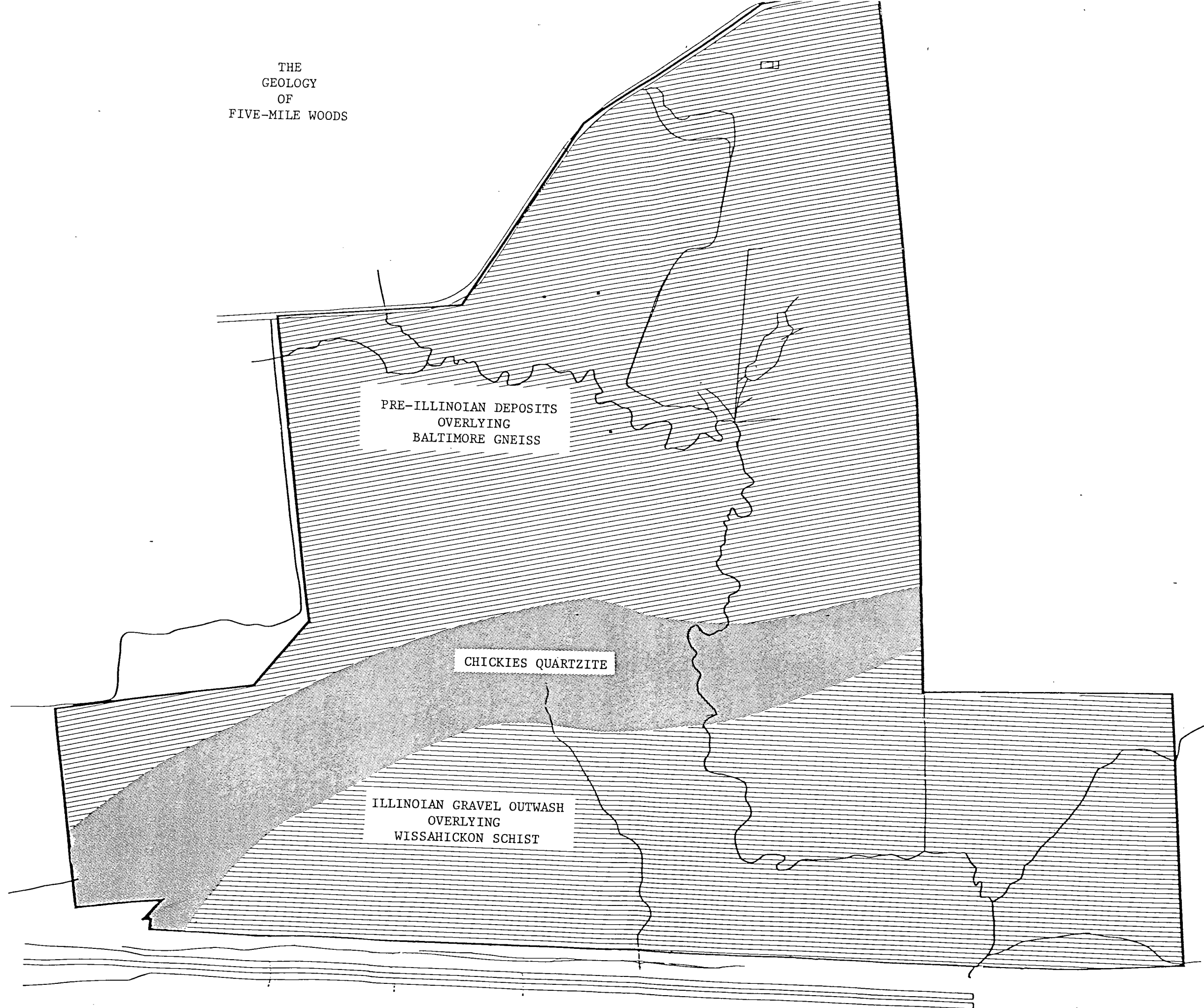
Although the formation supports a low, fairly continuous ridge, exposures are poor. At the northern, lower contact, Chickies Quartzite rests unconformably on

the Pre-Cambrian Baltimore Gneiss. The upper contact along the southern border of the Chickies Quartzite is interpreted as a thrust fault, regardless of whether the metamorphic rocks to the south are Pre-Cambrian or Lower Paleozoic. The total absence of Cambrian Limestone which normally overlies Chickies Quartzite elsewhere is significant. It is unlikely that the limestone is absent through lack of deposition, when it is known to have a thickness of several hundred feet in the Buckingham area and to reappear above the Chickies Quartzite west of the Langhorne area.

Pre-Illinoian Deposits - The earliest Pleistocene deposits recognized in Bucks County consists of scattered boulders, thin bodies of silty gravel, and scattered pebbles and cobblestones mixed with Wisconsin loess and fragments of frost-shattered rock. These deposits occur on a rock bench 180 to 200 feet above sea level. They consist largely of pebbles of quartz, quartzite, sandstone and chert similar to those in conglomerate of Stockton Lithofacies. ... a gravel is exposed in the railroad cut at Dunlop [1/2 mile southwest of Five Mile Woods], five miles west of Morrisville. Here, beneath a thin podsolized silt loam, lies yellow-brown, compact, jointed, pebbly sand. The pebbles, consisting of milky quartz, gray, white and pink quartzite, and gray sandstones, are well rounded and could not have been derived from underlying rock. However, the angular fragments of quartz and schistose quartzite in this deposit are probably of local derivation.

Illinoian Gravel Outwash - Deposits of reddish-brown poorly-sorted, compact, clayey, and silty gravel occur extensively on the valley walls in the vicinity of Morrisville. A typical exposure of this gravel is exposed along the Trenton Cut-off of the Pennsylvania Railroad, two miles southwest of Morrisville. At this locality a thin deposit of Wisconsin loess lies upon compact, rubified Illinoian sand and gravel. A pebble sample shows that the gravel has an unusually high proportion of quartz pebbles, owing either to a severe period of weathering of Stockton Lithofacies immediately preceding the Illinoian glacial stage, or to some, as yet unrecognized, source of local contamination.

THE
GEOLOGY
OF
FIVE-MILE WOODS



PRE-ILLINOIAN DEPOSITS
OVERLYING
BALTIMORE GNEISS

CHICKIES QUARTZITE

ILLINOIAN GRAVEL OUTWASH
OVERLYING
WISSAHICKON SCHIST

SOIL

Much of the unique character of Five Mile Woods is directly attributable to the soil. The "Coastal Plain influence" is actually 90% characteristic soils and 10% climate, thus much of the uniqueness of the woods could be altered if the soils were significantly changed. In the past, the soils in the preserve exhibited a great deal of homogeneity both chemically and physically. However, both these characteristics have been altered to varying degrees by human activity.

The soils originated from four geologic formations; Baltimore gneiss, Chickies quartzite, Wissahickon schist and Pre-Illinoian and Illinoian outwashes (the outwashes are riverine deposits laid down around the time of the Illinoian glacier.) Physically, the soils are primarily medium to fine textured, with some layers of sand and gravel in the glacial outwashes. The top layer of organic soil has either been lost to erosion, reduced to less than three inches or plowed into the subsoil during farming, while the subsoil below the plow layer has been relatively unchanged. Permeability ranges from moderately rapid on some high areas, to slow in low wet areas. (This is to be expected, since clays and silts are often carried off the uplands during heavy rains, only to be deposited in low quiet depressions.) Time of permeability for many soils is quite long and are listed in table 1.

Chemically, the soils have undergone tremendous changes in some areas and very little change in other areas. Originally, the soils were very low in soluble bases (calcium, potassium, sodium and magnesium) and thus were extremely acid. This characteristic is expected from the parent material, since Chickies quartzite ground water mineral content shows one of the lowest soluble base contents of any rock in the country, Baltimore gneiss and Wissahickon schist are also quite low and low soluble base contents is to be expected from riverine deposits that spent long periods of time under water. The high ground water also contributes to the low pH, since the soluble bases are easily dissolved and leached downward into the

water table.

A typical soil sample taken before human activity significantly changed the soil would probably have been similar to a sample taken in section C2A1. In the sample, there was a thin layer of extremely acid organic topsoil, overlaying a very strongly acid, bright yellow, sandy-silty-loamy subsoil layer. (In the past, the organic layer was probably much thicker and lower areas often display much more clay in the subsoil layer). At the seasonally high water table level, the soil was mottled yellow, rust and gray, while below the permanent water table level the soil was gray.

The sample was sent to the Merkle Laboratory at the College of Agriculture at Pennsylvania State University for chemical analysis. The results showed a 4.2 pH reading and a 5.6 buffer pH. The cation exchange capacity was 18.5, which merely indicates the soil can not hold great quantities of soluble bases. As is expected in areas of extremely low pH readings, the percent saturation of the bases was extremely low with readings of 0.4% for potassium, 10.7% for calcium and 0.9% for magnesium. This base saturation of 12% is extremely low compared to typical readings of 25% at pH 5.0, 50% at pH 5.5 and 75% saturation at pH 6.0. It should also be pointed out that as the percentage saturation of bases drops, not only are less bases present in the soil, but they are also much more **tightly** held by the soil. Thus, it becomes obvious that minor changes in the pH trends can indicate major changes in soluble base availability, which is one of the primary limiting factors in Five Mile Woods. (It should be noted that pH typically varies from 1/2 to 1 pH point over the course of a year in any soil, therefore, monitoring should concentrate on annual trends not individual readings.)

Given this soil profile, early farmers were forced to fertilize heavily if they hoped to produce any commercial crops. The result is heavily fertilized areas that are similar to the piedmont intermixed with highly acid native coastal plain soils. The pH varies from 4.0 in undisturbed areas to 6.0 in currently farmed fields.

ESTIMATES AND CALCULATIONS ON SOIL PERMEABILITY

Depth of layer	Available water capacity "/"of soil	Permeability "/hour	Rain to fill layer	Time to fill layer Hours	Time for one inch of water to be absorbed Hours	Approximate % of water shed above ridge
Ca 0-14	0.18	2.00	2.52	7.0	2.8	10%
14-33	0.10	0.20	1.90	95.0	50.0	
33-60	0.08	0.63	2.16	135.0	62.5	
Total			6.58	237.0		
Ce 0-12	0.12	2.00	1.44	6.0	4.1	10%
12-45	0.10	2.00	3.30	16.5	5.0	
45-60	0.08	6.30	1.20	2.4	6.3	
Total			5.94	24.9		
Do 0-11	0.16	0.63	1.76	17.5	9.9	20%
11-32	0.08	0.20	1.68	105.0	62.5	
32-53	0.08	0.20	1.68	105.0	62.5	
Total			5.12	227.5		
Ho 0-9	0.16	2.00	1.44	4.5	3.1	5%
9-42	0.10	0.63	3.30	52.4	15.9	
42-50	0.10	0.63	0.80	12.7	15.9	
Total			5.54	69.6		
Lg 0-25	0.18	6.30	4.50	4.0	0.9	10%
25-47	0.10	0.63	2.20	34.9	15.9	
47-72	0.18	0.63	4.50	39.7	8.8	
Total			11.20	78.6		
Ma 0-10	0.14	6.30	1.40	1.6	1.1	10%
10-19	0.12	6.30	1.08	1.4	1.3	
19-60	0.06	6.30	2.46	6.5	2.6	
Total			4.94	9.5		
Ur 0-10	0.16	2.00	1.60	5.0	3.1	35%
10-39	0.08	0.20	2.32	145.0	62.5	
39-50	0.08	0.20	0.88	55.0	62.5	
Total			4.88	205.0		

Column one shows the depth in inches of the layers of soil in each soil type. "Available Moisture Capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crops."¹ "Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates do not take into account lateral seepage or such transient soil features as plowpans and surface crust."² Permeability is measured in inches per hour. Rain to fill the layer estimates the amount of water needed to fill each layer and is calculated by multiplying the number of inches in each layer by the Available Moisture Capacity. Time To Fill The Layer is the amount of time water must sit on the surface for the soil layer to be completely filled with water. It is calculated by dividing the number of inches of soil by the maximum permeability rate. This will give a minimum time necessary to fill each layer with water. The next to last column gives the rate at which one inch of water is absorbed into the layer. It is calculated by dividing one inch of water by the Available Water Capacity, giving the number of inches of soil needed to absorb one inch of water. This figure is then divided by the permeability to determine the length of time necessary for one inch of water to be absorbed. (Since absorption downward can proceed no faster than the slowest layer above, permeability rates that are lower in higher soil levels are used in lower soil layers.) Again, the Maximum figure for Available Moisture Capacity was used so that the results

^{1&2} Soil Survey of Bucks and Philadelphia Counties Pennsylvania issued by the Soil Conservation Service in July 1975.

represent the minimum length of time water must sit on the surface for one inch to be absorbed.

Following are brief descriptions of the soil types found in Five Mile Woods as described by the Soil Conservation Services' Soil Survey of Bucks and Philadelphia Counties, Pennsylvania issued July 1975:

Chalfont silt-loam, 0 to 3 percent slope, (CaA). Consists of deep, somewhat poorly drained soils of uplands, with firm slowly permeable silt-loam subsoil. The water table rises to within 12 inches of the surface during parts of the winter months. Building limitations are severe due to the high water table.

Chester silt-loam, 3 to 8 percent slope, (CeB). Consists of deep well drained soils of uplands. These soils are on the sides and tops of ridges and are formed in loamy material chiefly weathered from gneiss and schist. Building limitations slight.

Doylestown silt-loam, 0 to 3 percent slope, (DoA). Deep poorly drained soils of uplands, with firm, slowly permeable silt-loam subsoil. The surface layer is ponded at times and the water table is at or very near the surface during wet seasons. Building limitations are severe, due to the high water table.

Fallsington silt-loam, 0 to 3 percent slope, (Fa). Deep poorly drained soils on terraces, with gravelly, sandy, clay loam subsoil with moderate permeability. The water table generally rises to or very near the surface during the wet season. Severe building limitations due to high water table.

Howell silt-loam, 0 to 3 percent slope, (HoA). Deep, well drained soils on terraces. Subsoil is silty, clay loam with moderately slow permeability. Building limitations slight.

Lawrenceville silt-loam, 0 to 3 percent slope, (LgA). Deep, moderately well drained soil soils of uplands. The subsoil is firm to very firm silt-loam with moderately slow permeability. The water table generally rises to with 18 to 36 inches of the surface during the wet season. Building limitations are moderate due to seasonally high water table. Note: It should be noted that the descriptions for the soil types are general descriptions and local variations are to be expected. The two areas of Lawrenceville soils in Five Mile Woods are examples of local variations. In these

areas the water table is rarely more than one foot below the surface and is often within inches during the wet season. Therefore, building restrictions should be considered severe.

Manor loam, 8 to 15 percent slope, (MaC) and 15 to 25 percent slope, (MaD). Deep, well drained soils on uplands. Subsoil is channery, sandy loam with moderately rapid permeability. Road building limitations are severe due to slope.

Marsh, (Mh). Refers to areas where runoff collects. Soil profiles are too varied to generalize. Obviously, building limitations are severe.

Urbana silt-loam, 0 to 3 percent slope, (UrA) and 3 to 8 percent slope, (UrB).

Deep, moderately well drained to somewhat poorly drained soils on uplands. The subsoil is silty, clay-loam to silty, clay-loam fragipan with slow permeability. The water table rises to within 12 to 24 inches of the surface during wet seasons.

Road building limitations are moderate. However, much of the Urbana soils of Five Mile Woods has a seasonal high water table of less than six inches, which puts severe limitations on all road construction.

Woodstown silt-loam, 0 to 5 percent slope, (WoA). Deep, moderately well drained soils on terraces. Subsoil is silt-loam, gravelly sandy-clay loam, and sandy clay loam, with moderate permeability and a water table that rises to within 18 inches of the surface during wet seasons. Road construction limitations are moderate due to a seasonally high water table.

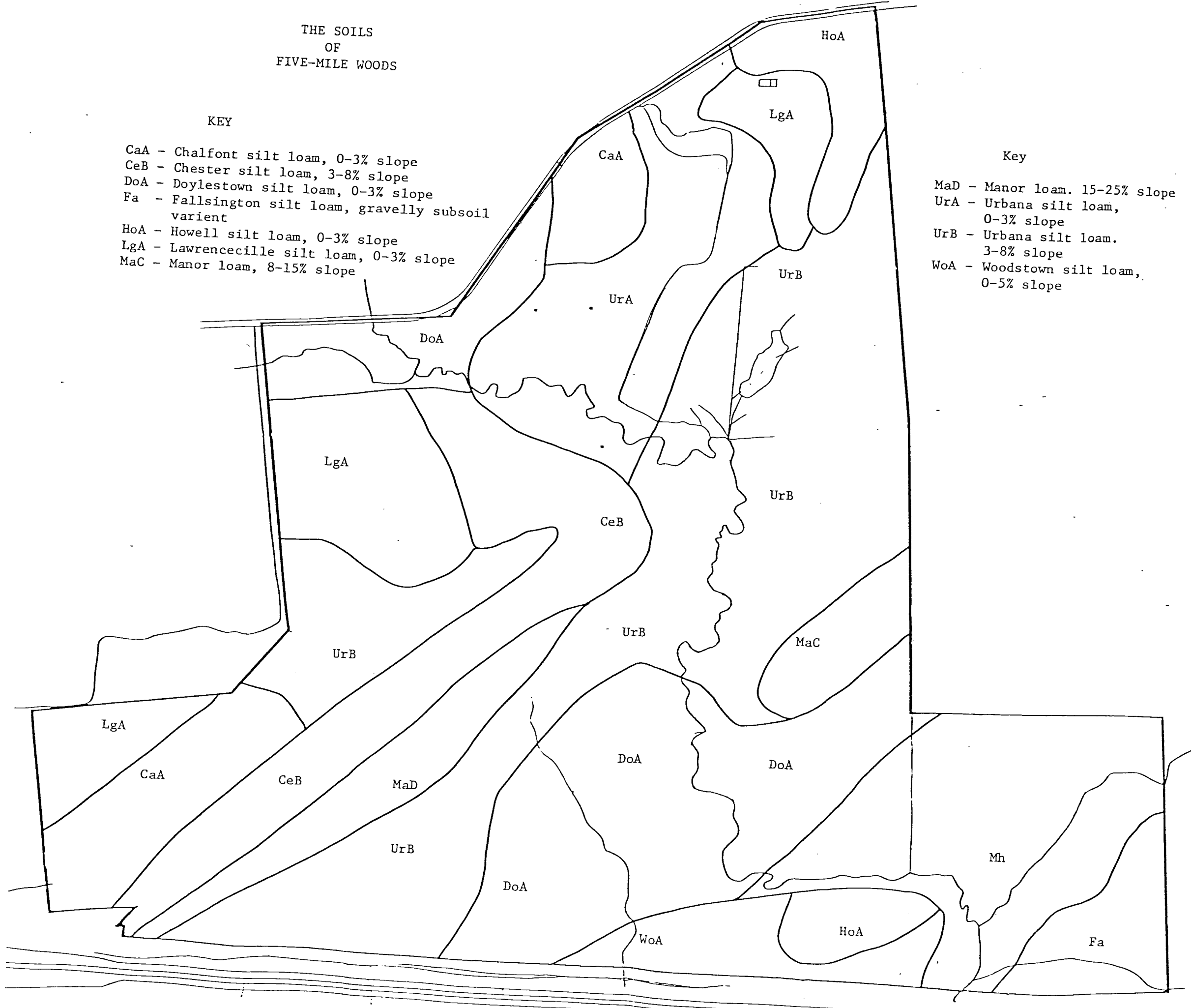
THE SOILS
OF
FIVE-MILE WOODS

KEY

- CaA - Chalfont silt loam, 0-3% slope
- CeB - Chester silt loam, 3-8% slope
- DoA - Doylestown silt loam, 0-3% slope
- Fa - Fallsington silt loam, gravelly subsoil
variant
- HoA - Howell silt loam, 0-3% slope
- LgA - Lawrenceville silt loam, 0-3% slope
- MaC - Manor loam, 8-15% slope

Key

- MaD - Manor loam, 15-25% slope
- UrA - Urbana silt loam,
0-3% slope
- UrB - Urbana silt loam,
3-8% slope
- WoA - Woodstown silt loam,
0-5% slope



HYDROLOGY

Five Mile Woods lies entirely in the watershed of the Queen Anne Creek, except for a small section northeast of the headquarters that drains into Rock Run in the Martins Creek watershed. The headwaters of the creek are less than one mile north of the preserve. Two main tributaries and numerous small streamlets feed the creek in the preserve. The first tributary enters the preserve from the west about 200 feet south of Big Oak Road and meets the creek about 450 feet west of the boundary. The drainage area is less than 100 acres. The second main tributary meets Queen Anne Creek about 200 feet north of the southern border and flows from the Guzikowski property to the east. The streamlets are the result of numerous springs scattered throughout the property. These springs are dependent on the seasonally fluctuating water table, thus during wet seasons the entire woods is quite wet, while extensive drying can occur during periods of drought.

Although flood waters entering the preserve from upstream do have an effect on the flora growing on the flood plain, of Queen Anne Creek, the present and potential effects on Five Mile Woods are rather limited. Flood plains are, by definition, areas that are periodically flooded and plants that have adapted to flood plains, obviously have adapted to this flooding. The only adverse effect the creek seems to have on the woods appears to be the addition of nutrients to the flood plain, which tends to raise the pH and thus favor a different group of plants. Since much of this nutrient enrichment comes from road salts and farm fertilizers and since the nutrients will increase with the development of the watershed, controlling these nutrients seems unlikely. However, since the creek only directly influences the flood plain and since the flood plain has been enriched for years, the adverse effects on the preserve should be limited and no loss of plant species should occur (however, some weed plants like stilt grass will probably increase on the flood plain.)

Much more important than the surface water of Queen Anne Creek, is the ground

water of the preserve and its origins. Five Mile Woods is normally a very wet area. The seasonally high water table is rarely more than one foot from the surface, except on the ridge. There are numerous small springs that feed two small ponds near the headquarters, a small marsh area south of the headquarters, two small streams at the base of the ridge and numerous low seepage areas throughout the preserve. Since so many of the unique plants of Five Mile Woods are dependent on this high water table and the excellent quality of the water, the obvious question concerns the source of the ground water. Studying the Topographic and Hydrologic Map (map #3) of this area we see the only possible source of water on this "plateau" is rain fall absorbed by the soil. However, checking the Soils map and chart #1 shows that the soils of the watershed tend to be moderately slowly to slowly permeable, thus replenishment of the natural ground water reservoir is dependent on rainfall being slowly absorbed by the soils. The length of time required for one inch of rain to be absorbed by the soil varies considerably from one soil type to another and also on the amount and depth of water already present in the soil. However, generally speaking, water must stand on the surface for considerable periods of time for absorption to occur.

Lateral movement of water in the water table is generally considered to be limited and slow. However, it is significant since much of the spring and seepage water below the ridge originates above the ridge.

BIOLOGICAL COMPONENTS

BOTANY

The botanical excellence of Five Mile Woods has long been appreciated by local botanists. In recent years, this haven for coastal plain species has become even more important due to the development of most of the coastal plain in Pennsylvania. Thus, a number of rare and unusual plants found in Five Mile Woods are becoming even rarer in Pennsylvania as similar habitats are lost to development. Some of these species may even be lost in Five Mile Woods if proper habitat management is not instituted.

Following is a list of approximately 200 species that have been observed in the preserve and their status. Nomenclature follows the eighth edition of Gray's Manual of Botany by M. L. Fernald.

HERBACEOUS PLANTS

- | | |
|--|---|
| Ground Pine | <i>Lycopodium obscurum</i> L. |
| Locally abundant in moist and wet woods. | |
| Ground Cedar | <i>Lycopodium complanatum</i> v. <i>flabelliforme</i> |
| Locally abundant in moist and wet second growth and young forests. | |
| Cut-leaved Grape Fern | <i>Botrychium dissectum</i> Spreng. |
| Scattered throughout young woodlands. The typical variety, <i>forma obliquum</i> and <i>forma oneidense</i> are all present. | |
| Rattlesnake Fern | <i>Botrychium virginianum</i> (L) Sw. |
| Scattered below the ridge, primarily in areas with relatively high pH. | |
| Royal Fern | <i>Osmunda regalis</i> L. |
| Locally common in wet acid swamps. | |
| Cinnamon Fern | <i>Osmunda cinnamomea</i> L. |
| Locally abundant in wet areas. | |
| Sensitive Fern | <i>Onoclea sensibilis</i> L. |
| Scattered throughout, where ever adequate sunlight exists. | |
| Marsh Fern | <i>Dryopteris thelypteris</i> (L.) Gray |
| Limited to wet areas. | |
| New York Fern | <i>Dryopteris novaboracensis</i> (L.) Gray |
| Locally abundant in woodlands. | |

- Broad-beech Fern *Dryopteris hexagonoptera* (Michx.) Christens.
Limited to C2M4. A somewhat surprising species for this highly acid area.
- Christmas Fern *Polystichum acrostichoides* (Michx.) Schott
Locally common in wooded areas with a pH higher than 5.0.
- Hay-scented Fern *Dennstaedtia punctilobula* (Michx.) Moore
Locally abundant, usually in drier, sunnier woodlands.
- Lady Fern *Athyrium filix-femina* (L.) Roth
Locally common in moist to wet woods.
- Net-vein Chain Fern *Woodwardia areolata* (L.) Moore
Restricted to C2M4 and thus threatened by neighboring development. However, since most of the woods favor this species, it should be re-established throughout the woods.
- Bracken *Pteridium aquilinum* (L.) Kuhn
Limited to somewhat dry soils in open areas.
- Bur-reed *Sparganium* sp.
Located in the southeast section of Queen Anne Creek.
- Water Millet *Echinochloa pungens* (Poir.) Rydb.
Abundant in area F4S1.
- Little Blue Stem Grass *Andropogon scoparius* Michx.
Abundant in old fields.
- Broomsedge *Andropogon virginicus* v. *abbreviatus* (Hack.)
Fern & Grisc.
Very locally common in moist and wet areas.
- Wool Grass *Scirpus rubricosus* Fern.
Rather common in wet areas.
- Sedge *Carex folliculata* L.
Scattered in wet wooded areas.
- Jack-in-the-pulpit *Arisaema triphyllum* (L.) Schott
Scattered in wet and moist woodlands. This includes forma *pusillum* (Peck) Fern.
- Skunk Cabbage *Symplocarpus foetidus* (L.) Nutt.
Locally abundant in wet areas.
- Asian Dayflower *Commelina communis* L.
Scattered in disturbed areas.
- Soft Rush *Juncus effusus* L.
Common in wetter, sunnier areas.
- Woodrush *Luzula* sp.
Scattered throughout the woods.
- White Hellebore *Veratrum viride* Ait.
Small colony in section M4S1.

- Wild Oats *Uvularia sessilifolia* L.
Locally abundant in wet and moist woods.
- Field Garlic *Allium vineale* L.
Locally abundant in disturbed areas.
- Common Orange Day-lily *Hemerocallis fulva* L.
Locally escaped to form small colonies.
- Turk's Cap Lily *Lilium superbum* L.
Locally abundant, but due to a lack of adequate light the plants rarely bloom.
Most of the plants will probably be lost as the canopy thickens.
- Erythronium americanum* Ker. Trout-lily
Locally abundant in moist and wet woods.
- Solomon's Plume *Smilacina racemosa* (L.) Desf.
Scattered throughout the woods.
- Canada Mayflower *Maianthemum canadense* Desf.
Locally abundant in moist and wet woods.
- Solomon's Seal *Polygonatum biflorum* (Walt.) Ell.
Scattered throughout moist areas.
- Indian Cucumber Root *Medeola virginiana* L.
Common in moist and wet woodlands.
- Common Greenbriar *Smilax rotundifolia* L.
Locally abundant in wooded areas.
- Pink Lady's Slipper *Cypripedium acaule* Ait.
Scattered throughout the woods.
- Whorled Pagonia *Isotria verticillata* (Willd.) Raf.
Widely scattered in the woods.
- Rattlesnake Plantain *Goodyera pubescens* (Willd.) R.Br.
Widely scattered in wooded areas.
- Arrow-leaved Tearthumb *Polygonum sagittatum* L.
Scattered in wet areas.
- Halberd-leaved Tearthumb *Polygonum arifolium* L.
Scattered in wet areas.
- Spring Beauty *Claytonia virginica* L.
Locally abundant, usually in areas with a pH higher than 4.5.
- Kidney-leaved Buttercup *Ranunculus abortivus* L.
Scattered in disturbed areas.
- Tall Meadow-rue *Thalictrum polygamum* Muhl.
Scattered throughout moist and wet areas.
- Wood Anemone *Anemone quinquefolia* L.
Scattered in moist areas.

White Baneberry Scattered in M5A2. Probably adventive.	<i>Actaea pachypoda</i> Ell.
May Apple Locally abundant in areas with a pH higher than 4.5.	<i>Podophyllum peltatum</i> L.
Wild Strawberry Scattered in old fields.	<i>Fragaria virginiana</i> Duchesne
Dewberry Scattered in old fields and young second growth.	<i>Rubus</i> sp.
Blackberry Locally abundant in old fields.	<i>Rubus</i> sp.
Spotted Jewelweed Locally abundant in damp areas.	<i>Impatiens capensis</i> Meerb.
Slender St. Johns-wort Rather common in old fields.	<i>Hypericum canadense</i> L.
Marsh Violet Locally abundant in wet woods.	<i>Viola cucullata</i> Ait.
Seedbox Scattered in moist old fields.	<i>Ludwigia alternifolia</i> L.
Evening Primrose Common in old fields.	<i>Oenothera biennis</i> L.
Sundrops Rare in old fields.	<i>Oenothera fruticosa</i> L.
Enchanter's Nightshade Common throughout.	<i>Circaea quadrisulcata</i> (Maxim.) Franch. & Sav.
Wild Sarsapilla Locally abundant on the ridge.	<i>Aralia nudicaulis</i> L.
Dwarf Ginseng Uncommon in wet woodlands. This is not the species used for medicinal purposes.	<i>Panax trifolius</i> L.
Queen Anne's Lace Common in fields.	<i>Daucus carota</i> L.
Striped Wintergreen Locally common in drier mature woods with limited leaf cover.	<i>Chimaphila maculata</i> (L.) Pursh.
Indian-pipe Scattered throughout.	<i>Monotropa uniflora</i> L.
Soapwort Gentian Rare. Will probably be lost unless succession is managed for an acid old field habitat with limited competition.	<i>Gentiana saponaria</i> L.

Bartonia Scattered in wet areas.	<i>Bartonia virginica</i> (L.) BSP.
Screw stem Scattered in acid wet areas.	<i>Bartonia paniculata</i> (Michx.) Muhl.
Indian Hemp Scattered in old fields.	<i>Apocynum cannabinum</i> L.
Swamp Milkweed Scattered in open wet areas.	<i>Asclepias incarnata</i> L.
Common Milkweed A few scattered plants in disturbed areas with higher pH.	<i>Asclepias syriaca</i> L.
White Vervain Scattered in disturbed areas.	<i>Verbena urticifolia</i> L.
Blue Vervain Scattered in old fields.	<i>Verbena hastata</i> L.
Heal-all Scattered throughout.	<i>Prunella vulgaris</i> L.
Bee-balm Probably introduced. Found only in rich soil of M5A2.	<i>Monarda didyma</i> L.
White Turtlehead Scattered throughout in wet areas.	<i>Chelone glabra</i> L.
Purple Gerardia Local in old fields.	<i>Gerardia purpurea</i> L.
Beech-drops Abundant under beech trees. A pale yellow form (forma pallida) is also locally abundant.	<i>Epifagus virginiana</i> (L.) Bart.
Partridge-berry Scattered throughout the woods.	<i>Mitchella repens</i> L.
Cardinal Flower Uncommon in moist areas.	<i>Lobelia cardinalis</i> L.
Ironweed Scattered in open wet and moist areas.	<i>Vernonia novaboracensis</i> (L.) Michx.
Joe-pye-weed Scattered throughout.	<i>Eupatorium fistulosum</i> Barratt
Boneset Scattered in wet areas.	<i>Eupatorium perfoliatum</i> L.
White Snakeroot Uncommon in wooded areas.	<i>Eupatorium rugosum</i> Houtt.
Silver rod Common in drier old fields.	<i>Solidago bicolor</i> L.

Early Goldenrod Common in drier open areas.	<i>Solidago juncea</i> Ait.
Gray Goldenrod Locally abundant in dry, old fields.	<i>Solidago nemoralis</i> Ait.
Rough Goldenrod Common in fields.	<i>Solidago rugosa</i> Ait.
Canada Goldenrod Rather common in old fields.	<i>Solidago canadensis</i> L.
Grass-leaved Goldenrod Locally abundant in fields.	<i>Solidago graminifolia</i> (L.) Salisb.
White Wood Aster Scattered in wooded areas.	<i>Aster divaricatus</i> L.
Blue Wood Aster Scattered throughout.	<i>Aster cordifolius</i> L.
Swamp Aster Occasional in open wet areas.	<i>Aster puniceus</i> L.
Hairy Aster Locally abundant in fields.	<i>Aster pilosus</i> Willd.
Small White Aster Locally abundant in wet old fields.	<i>Aster vimineus</i> Lam.
Calico Aster Rather common in old fields.	<i>Aster lateriflorus</i> (L.) Britt.
Tall White Aster Scattered in old fields.	<i>Aster simplex</i> Willd.
Common Ragweed Common in old fields.	<i>Ambrosia artemisiifolia</i> L.
Stick-tights Abundant in F4W1. Scattered in open wet areas.	<i>Bidens polylepis</i> Blake
Common Yarrow Common in drier fields.	<i>Achillea millefolium</i> L.
Field Thistle Scattered in fields.	<i>Cirsium discolor</i> (Muhl.) Spreng.
Canada Thistle Introduced. Common in old farm fields.	<i>Cirsium arvense</i> (L.) Scop.
Gall-of-the-earth Widely scattered in wooded areas.	<i>Prenanthes trifoliata</i> (Cass.) Fern.
Rough Hawkweed Occasional in wooded areas.	<i>Hieracium scabrum</i> Michx.

SHRUBS

- Bayberry *Myrica pensylvanica* Loisel.
Introduced. Scattered in old fields and second growth.
- American Hazelnut *Corylus americana* Walt.
Restricted to the forest edge of M2M6.
- Spicebush *Lindera benzoin* (L.) Blume
Locally abundant in woodlands with a pH above 4.8.
- Meadow-sweet *Spirea latifolia* (Ait.) Borkh.
Scattered in old fields.
- Red Chokeberry *Pyrus arbutifolia* (L.) L.f.
Locally abundant in old fields and young forests.
- Multiflora Rose *Rosa multiflora* Thunb.
Introduced. Locally abundant in old fields.
- Marsh Rose *Rosa palustris* Marsh.
Locally abundant in wet areas.
- Staghorn Sumac *Rhus typhina* L.
Scattered in old fields.
- Poison Ivy *Rhus radicans* L.
Scattered in old fields and young woods, usually in areas with rather high pH.
- Winterberry *Ilex verticillata* (L.) Gray
Scattered throughout the woods.
- Smooth Winterberry *Ilex laevigata* (Pursh) Gray
Widely scattered in moist areas.
- Strawberry Bush *Euonymus americana* L.
Widely scattered small specimens in wooded areas.
- Virginia Creeper *Parthenocissus quinquefolia* (L.) Planch.
Scattered throughout.
- Grape *Vitis* sp.
Scattered mainly in areas with higher pH.
- Silky Dogwood *Cornus amomum* Mill.
Common along edge of F4S1.
- Sweet Pepperbush *Clethra alnifolia* L.
Locally abundant in moist and wet areas.
- Pinxter-bloom Azalea *Rhododendron nudiflorum* (L.) Torr.
Common on moist wooded sites.
- Swamp Azalea *Rhododendron viscosum* (L.) Torr.
Common in wetter woods.

- Maleberry *Lyonia ligustrina* (L.) DC
Locally abundant in wet situations.
- Fetterbush *Leucothoe racemosa* (L.) Gray
Common in wet locations.
- Dangleberry *Gaylussacia frondosa* (L.) T.&G.
Occasional in drier, wooded situations.
- Black Huckleberry *Gaylussacia baccata* (Wang.) K. Koch
Locally common on drier wooded sites.
- Deerberry *Vaccinium stamineum* L.
Occasional on the ridge.
- Low Bush Blueberry *Vaccinium vacillans* Torr.
Locally common on drier sites. Late low bush blueberry is very similar to this species except it has serrated leaves, rather than entire leaves. It should be looked for and in fact has been reported. Unfortunately, all the plants examined were of *V. vacillans* rather than *V. angustifolium* and since *V. angustifolium* is much rarer in this area and easily confused, it is not included as being found in Five Mile Woods.
- High-bush Blueberry *Vaccinium corymbosum* L.
Locally abundant in moist areas.
- Japanese Honeysuckle *Lonicera Japonica* Thunb.
This species is over running a few high pH areas. As shade and pH increase, This species will lose its competitive edge and colonies will decline.
- Swamp Haw *Viburnum nudum* L.
Locally common in wet wooded areas.
- Southern Arrow-wood *Viburnum dentatum* L.
Abundant in moist strongly acid areas.
- Viburnum *Viburnum dilatatum* Thunb.
Introduced. One specimen is near Big Oak Road in section C2A1. The scarlet berries are distinctive in fall and winter.
- Maple-leaved Viburnum *Viburnum acerifolium* L.
Abundant on drier woodland soils.
- Common Elderberry *Sambucus canadensis* L.
Scattered throughout.
- TREES
- Red Cedar *Juniperus virginiana* L.
A few young individuals are restricted to F3A1 and F3A2. This is probably an introduced species that will die out as soils acidify.
- Willow *Salix* sp.
Scattered plants in F4S1 and F4W1.
- Shagbark Hickory *Carya ovata* (Mill.) K.Koch
Scattered throughout the moist and drier areas.

- Black Birch *Betula lenta* L.
Common on moist soils, becoming abundant and often co-dominant on moderate soils.
- Gray Birch *Betula populifolia* Marsh.
Scattered throughout old fields and second growth.
- Beech *Fagus grandifolia* Ehrh.
The dominant or co-dominant tree in most of the extreme acid mature and climax habitats. Becomes less common on soils with higher pH.
- American Chestnut *Castanea dentata* (marsh.) Borkh.
Young sprouts and suckers of up to 15 feet tall persist from old stumps on drier soils.
- White Oak *Quercus alba* L.
Common throughout and often a co-dominant.
- Swamp-white Oak *Quercus bicolor* Willd.
A few individuals are scattered throughout the woods in wet areas.
- Red Oak *Quercus rubra* L.
Common throughout.
- Pin Oak *Quercus palustris* Muenchh.
Common in wetter areas.
- Scarlet Oak *Quercus coccinea* Muenchh.
Scattered in drier woods.
- Black Oak *Quercus velutina* Lam.
Common throughout.
- Willow Oak *Quercus phellos*
Reported, but not verified. Should be looked for in moist and wet woods.
- American Elm *Ulmus americana* L.
Scattered throughout.
- Umbrella Magnolia *Magnolia tripetala* L.
Introduced. Scattered along the base of the ridge in sections M2M6 and S2M3.
- Tulip tree *Liriodendron tulipifera* L.
Locally abundant. Increases as pH rises.
- White Sassafras *Sassafras albidum* (Nutt.) Nees
Scattered throughout.
- Witch-hazel *Hamamelis virginiana* L.
Scattered through drier areas.
- Sweet Gum *Liquidambar styraciflua* L.
Locally abundant pioneer tree, with mature trees scattered throughout.
- Apple *Pyrus malus* L.
Introduced. Some trees still remain in an old orchard in section O3M1.

Crab Apple Common in old fields.	<i>Pyrus</i> sp.
Black Cherry Scattered in old fields and edges.	<i>Prunus serotina</i> Ehrh.
Sour Cherry Introduced. A few trees remain in the old orchard in O3M1.	<i>Prunus cerasus</i> L.
Black Locust Introduced. A small grove is in S3M1.	<i>Robinia psuedo-acacia</i> L.
Red Maple Locally abundant, usually on wetter soils.	<i>Acer rubrum</i> L.
Silver Maple Widely scattered, usually in disturbed or wet areas.	<i>Acer saccharinum</i> L.
Sour Gum Common throughout.	<i>Nyssa sylvatica</i> Marsh.
Flowering Dogwood Scattered throughout.	<i>Cornus florida</i> L.
Persimmon Occasional in the less acid old field and edge areas.	<i>Diospyros virginiana</i> L.
White Ash Scattered throughout.	<i>Fraxinus americana</i> L.

MAMMALS

Opossum Common resident.	<i>Didelphis marsupialis</i>
Least Shrew Possible resident.	<i>Cryptotis parva</i>
Short-tailed Shrew Probably a common resident.	<i>Blarina brevicauda</i>
Starnose Mole Possible resident.	<i>Condylura cristata</i>
Eastern Mole Probable resident.	<i>Scalopus aquaticus</i>
Bat Rather common resident.	<i>Myotis</i> sp.
Raccoon Common resident.	<i>Procyon lotor</i>
Long-tailed Weasel Secretive, but probably present.	<i>Mustela frenata</i>
Striped Skunk Probably a rather common resident.	<i>Mephitis mephitis</i>
Red Fox Although previously reported, no evidence was found for it presently residing in the Woods. However, since this is a widely ranging species, it will probably occur in the future as a visitor.	<i>Vulpes fulva</i>
Gray Fox Less common than the red fox and unreported in the woods. However, it may visit the preserve in the future.	<i>Urocyon cinereoargenteus</i>
Eastern Gray Squirrel Rather common resident.	<i>Sciurus carolinensis</i>
White-footed Mouse Probable common resident.	<i>Peromyscus leucopus</i>
Meadow Vole Probable resident.	<i>Microtus pennsylvanicus</i>
Muskrat Uncommon visitor to Queen Anne Creek.	<i>Ondatra zibethica</i>
Eastern Cottontail Common resident.	<i>Sylvilagus floridanus</i>
Whitetail Deer Rather common resident. With increased development on adjacent lands, the deer population will become increasingly dependent on the Preserve for food. If damage to the plants becomes too great, steps should be taken to reduce the deer population.	<i>Odocoileus virginianus</i>

HERPETOLOGY

REPTILES

Northern Water Snake Probable visitor to the Queen Anne Creek.	<i>Natrix sipedon sipedon</i>
Eastern Garter Snake Probable resident.	<i>Thamnophis sirtalis sirtalis</i>
Black Rat Snake Rather common resident.	<i>Elaphe obsoleta obsoleta</i>
Eastern Painted Turtle Probably an uncommon visitor.	<i>Chrysemys picta picta</i>
Spotted Turtle Uncommon resident.	<i>Clemmys guttata</i>
Bog Turtle An endangered species and very secretive. Reported from the Queen Anne Creek watershed, although never found in the preserve. However, due to its secretive habits, it may be an undetected resident.	<i>Clemmys muhlenbergi</i>
Box Turtle Common resident.	<i>Terrapene carolina carolina</i>

AMPHIBIANS

American Toad Common resident.	<i>Bufo terrestris americanus</i>
Fowler's Toad Possible resident.	<i>Bufo woodhousei fowleri</i>
Green Frog Rather common resident.	<i>Rana clamitans melanota</i>
New Jersey Chorus Frog Common resident in F4S1. In Pennsylvania found only on the coastal plain.	<i>Pseudacris nigrita kalmi</i>
Northern Spring Peeper Common resident in F4S1.	<i>Hyla crucifer crucifer</i>
Eastern Wood Frog Uncommon resident.	<i>Rana sylvatica sylvatica</i>
Northern Red Salamander Uncommon resident.	<i>Pseudotriton ruber ruber</i>
Spotted Salamander Uncommon resident.	<i>Ambystoma maculatum</i>

ORNITHOLOGY

Regionally, Five Mile Woods is an average birding area, however on a local basis, the preserve is one of the best birding areas in Lower Makefield Township. It is a good area for migrating woodland species and breeding summer residents, an average area for winter landbird visitors and a poor area for waterbirds. The two most important features concerning the birds of Five Mile Woods are the increased importance of the woods as an "island sanctuary" for migrants passing over the expanding suburban sprawl and the presents of a small number of scientifically interesting, potential breeding species. These include the Hooded Warbler, which presently is rare or absent as a breeding species in Bucks County, but which was observed singing during June 1979; the Northern Waterthrush, Worm-eating Warbler and the Acadian Flycatcher, all of which are unusual or absent breeders in this area, but which showed indications of possibly breeding and the Black-capped and Carolina Chickadees, both of which were present during the breeding season, suggesting the possibility of hybridization.

Following is a list of 119 species which are probably somewhat regular within the preserve (at least 98 have already been observed), and their status:

Canada Goose	<i>Branta canadensis</i>
Occasionally observed flying over the preserve during migration and winter.	
Mallard	<i>Anas platyrhynchos</i>
An erratic visitor that may attempt to nest.	
Green Heron	<i>Botaurus lentiginosus</i>
Uncommon summer visitor.	
Turkey Vulture	<i>Cathartes aura</i>
Uncommon visitor.	
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Uncommon migrant and winter visitor.	
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Rather common winter resident that may attempt to nest.	
Broad-winged Hawk	<i>Buteo platypterus</i>
Uncommon migrant and possible summer resident.	

Osprey An occassional migrant observed flying over the preserve.	<i>Pandion haliaetus</i>
American Kestrel Uncommon visitor and possible resident.	<i>Falco sparverius</i>
Ring-necked Pheasant Rather common resident in old fields.	<i>Phasianus colchicus</i>
Killdeer Uncommon visitor observed flying over the preserve.	<i>Charadrius vociferus</i>
American Woodcock Rather common migrant in wet second growth, that may nest in the preserve.	<i>Philohela minor</i>
Ring-billed Gull Winter visitor uncommonly seen flying over the preserve.	<i>Larus delawarensis</i>
Herring Gull Winter visitor uncommonly seen flying over the preserve.	<i>Larus argentatus</i>
Mourning Dove Abundant permanent resident.	<i>Zenaida macroura</i>
Yellow-billed Cuckoo Uncommon summer resident.	<i>Coccyzus americanus</i>
Black-billed Cuckoo Uncommon migrant.	<i>Coccyzus erythrophthalmus</i>
Great Horned Owl Uncommon permanent resident.	<i>Bubo virginianus</i>
Common Nighthawk Uncommon fall migrant.	<i>Chordeiles minor</i>
Chimney Swift Common summer visitor and possible breeding resident.	<i>Chaetura pelagica</i>
Ruby-throated Hummingbird Uncommon migrant. May be a breeding summer resident.	<i>Archilochus lolubris</i>
Common Flicker Rather common summer resident. Occassional in winter.	<i>Colaptes auratus</i>
Red-bellied Woodpecker Common permanent resident.	<i>Melanerpes carolinus</i>
Yellow-bellied Sapsucker Occassional migrant and winter visitor.	<i>Sphyrapicus varius</i>
Downy Woodpecker Common permanent residents.	<i>Picoides pubescens</i>
Hairy Woodpecker Uncommon permanent resident.	<i>Picoides villosus</i>

Eastern Kingbird Uncommon migrant and summer visitor.	Tyrannus tyrannus
Great Crested Flycatcher Uncommon summer resident.	Myiarchus crinitus
Eastern Phoebe Uncommon summer resident.	Sayornis phoebe
Acadian Flycatcher Uncommon migrant and summer visitor (or resident?).	Empidonax virescens
Eastern Wood Pewee Uncommon summer resident.	Contopus virens
Barn Swallow Uncommon migrant and summer visitor.	Hirundo rustica
Blue Jay Uncommon permanent resident.	Cyanocitta cristata
American Crow Common permanent resident.	Corvus brachyrhynchos
Fish Crow Uncommon visitor.	Corvus ossifragus
Black-capped Chickadee Uncommon summer resident. Common winter resident. May breed or even hybridize with the Carolina Chickadee.	Parus atricapillus
Carolina Chickadee Common summer resident. Uncommon winter resident.	Parus carolinensis
Tufted Titmouse Common permanent resident.	Parus bicolor
White-breasted Nuthatch Uncommon permanent resident.	Sitta carolinensis
Red-breasted Nuthatch Occasional migrant and winter resident.	Sitta canadensis
Brown Creeper Uncommon migrant and winter resident.	Certhia familiaris
House Wren Uncommon migrant and possible summer resident.	Troglodytes aedon
Winter Wren Uncommon and secretive migrant and winter visitor.	Troglodytes troglodytes
Carolina Wren Uncommon permanent resident.	Thryothorus ludovicianus

Northern Mockingbird One resident pair near the headquarters. Uncommon elsewhere.	<i>Mimus polyglottos</i>
Gray Catbird Common summer resident in old fields. Rare winter visitor.	<i>Dumetella carolinensis</i>
Brown Thrasher Rather common summer resident in young second growth. Rare in winter.	<i>Toxostoma rufum</i>
American Robin Very common summer resident and occasional winter visitor.	<i>Turdus migratorius</i>
Wood Thrush Common summer resident.	<i>Hylocichla mustelina</i>
Hermit Thrush Common migrant and occasional winter resident.	<i>Catharus guttatus</i>
Swainson's Thrush Rather common migrant.	<i>Catharus ustulatus</i>
Gray-cheeked Thrush Uncommon migrant.	<i>Catharus minimus</i>
Veery Common migrant and summer resident.	<i>Catharus fuscescens</i>
Blue-gray Gnatcatcher Uncommon migrant and possible breeding resident.	<i>Polioptila caerulea</i>
Golden-crowned Kinglet Uncommon migrant and winter visitor.	<i>Regulus satrapa</i>
Ruby-crowned Kinglet Common migrant and occasional winter visitor.	<i>Regulus calendula</i>
Cedar Waxwing Erratic. Common to absent in winter and migration.	<i>Bombycilla cedrorum</i>
European Starling Rather common permanent resident.	<i>Sternus vulgaris</i>
White-eyed Vireo Uncommon migrant and possible summer resident.	<i>Vireo griseus</i>
Yellow-throated Vireo Uncommon migrant and possible summer resident.	<i>Vireo flavifrons</i>
Solitary Vireo Uncommon migrant.	<i>Vireo solitarius</i>
Red-eyed Vireo Rather common summer resident.	<i>Vireo olivaceus</i>
Warbling Vireo Uncommon migrant and possible summer resident.	<i>Vireo gilvus</i>

Black-and-white Warbler Common migrant and an uncommon summer resident.	<i>Mniotilta varia</i>
Worm-eating Warbler Uncommon spring migrant and possible summer resident. Most southbound birds leave by the end of August.	<i>Helminthos vermivorus</i>
Blue-winged Warbler Uncommon migrant.	<i>Vermivora pinus</i>
Tennessee Warbler Rather common migrant.	<i>Vermivora peregrina</i>
Nashville Warbler Uncommon migrant.	<i>Vermivora ruficapilla</i>
Northern Parula Warbler Common migrant.	<i>Parula americana</i>
Yellow Warbler Common migrant and summer resident in open, wet areas.	<i>Dendroica petechia</i>
Magnolia Warbler Common migrant.	<i>Dendroica magnolia</i>
Cape May Warbler Uncommon migrant.	<i>Dendroica tigrina</i>
Black-throated-blue Warbler Uncommon migrant.	<i>Dendroica caerulescens</i>
Yellow-rumped Warbler Periodically abundant during migration. Occasional in winter.	<i>Dendroica coronata</i>
Black-throated-green Warbler Common migrant.	<i>Dendroica virens</i>
Blackburnian Warbler Uncommon migrant.	<i>Dendroica fusca</i>
Chestnut-sided Warbler Uncommon migrant.	<i>Dendroica pensylvanica</i>
Bay-breasted Warbler Uncommon migrant.	<i>Dendroica castanea</i>
Blackpoll Warbler Rather common migrant.	<i>Dendroica striata</i>
Pine Warbler Occasional migrant.	<i>Dendroica pinus</i>
Prairie Warbler Occasional migrant.	<i>Dendroica discolor</i>

Palm Warbler Uncommon migrant (migrates north in april).	<i>Dendroica palmarum</i>
Ovenbird Very common summer resident.	<i>Seiurus aurocapillus</i>
Northern Waterthrush Rather common migrant in wooded swampy areas.	<i>Seiurus noveboracensis</i>
Louisiana Waterthrush Rather common migrant along Queen Anne Creek.	<i>Seiurus motacilla</i> Possible summer resident.
Kentucky Warbler Uncommon summer resident.	<i>Oporornis formosus</i>
Common Yellowthroat Common summer resident.	<i>Geothlypis trichas</i>
Hooded Warbler Uncommon migrant. Possible summer breeding resident.	<i>Wilsonia citrina</i>
Wilson's Warbler Uncommon migrant in wet scrubby areas.	<i>Wilsonia pusilla</i>
Canada Warbler Uncommon migrant.	<i>Wilsonia canadensis</i>
American Redstart Abundant migrant and possible uncommon summer breeding resident.	<i>Setophaga ruticilla</i>
House Sparrow Common resident near the headquarters. Uncommon elsewhere.	<i>Passer domesticus</i>
Red-winged Blackbird Rather common migrant. Uncommon winter and summer resident.	<i>Agelaius phoeniceus</i>
Orchard Oriole Uncommon migrant and possible summer resident.	<i>Icterus Icterus spurius</i>
Northern Oriole Rather common summer resident.	<i>Icterus galbula</i>
Rusty Blackbird Rather uncommon migrant.	<i>Euphagus carolinus</i>
Common Grackle Common permanent resident often seen in large flocks in the non-breeding seasons.	<i>Quiscalus quiscalus</i>
Brown-headed Cowbird Uncommon permanent resident.	<i>Molothrus ater</i>
Scarlet Tanager Common summer resident.	<i>Paranga loivcea</i>
Northern Cardinal Common permanent resident.	<i>Cardinalis cardinalis</i>

Rose-breasted Grosbeak Rather common migrant and possible summer breeding resident.	<i>Pheucticus ludovicianus</i>
Indigo Bunting Rather common summer resident.	<i>Passerina cyanea</i>
Evening Grosbeak Occasional winter visitor.	<i>Hesperiphona vespertina</i>
Purple Finch Uncommon migrant and winter resident.	<i>Carpodacus purpureus</i>
House Finch Increasingly common permanent resident.	<i>Carpodacus mexicanus</i>
Common Redpoll Rare winter visitor in old fields and in birch trees.	<i>Carduelis flammea</i>
Pine Siskin Occasional winter visitor.	<i>Carduelis pinus</i>
Goldfinch Common permanent resident.	<i>Carduelis tristis</i>
Rufous-sided Towhee Common summer resident and migrant. Occasional winter visitor.	<i>Pipilo erythrophthalmus</i>
Dark-eyed Junco Common winter resident.	<i>Junco hyemalis</i>
American Tree Sparrow Uncommon winter visitor.	<i>Spizella arborea</i>
Chipping Sparrow Rather common summer resident near the headquarters.	<i>Spizella passerina</i>
Field Sparrow Common summer resident in old fields. May move out as habitats change.	<i>Spizella pusilla</i>
White-crowned Sparrow Occasional migrant.	<i>Zonotrichia leucophrys</i>
White-throated Sparrow Common migrant and winter resident.	<i>Zonotrichia albicollis</i>
Fox Sparrow Rather common migrant.	<i>Passerella iliaca</i>
Lincoln's Sparrow Occasional and very secretive migrant.	<i>Melospiza lincolni</i>
Swamp Sparrow Uncommon migrant and winter resident.	<i>Melospiza georgiana</i>
Song Sparrow Common permanent resident.	<i>Melospiza melodia</i>

ECOLOGICAL COMPONENTS

ECOLOGICAL COMPONENTS

Each habitat in Five Mile Woods was identified, analyzed for its inherent importance and potential problems and recommendations were made on habitat management. A habitat sheet was prepared for each area.

Each habitat is identified by a four (occasionally five) character code. The first character refers to the stage of succession: F- field. Open area dominated by herbaceous vegetation (includes ponds, marshes and bogs). ⁰ - Old field. Dominated by shrubby vegetation. S - Second growth. Young trees up to four inches in diameter at breast height (DBH). M - Mature forest. Trees primarily from four to 12 inches DBH. C - Climax forest. Trees primarily over 12 inches DBH.

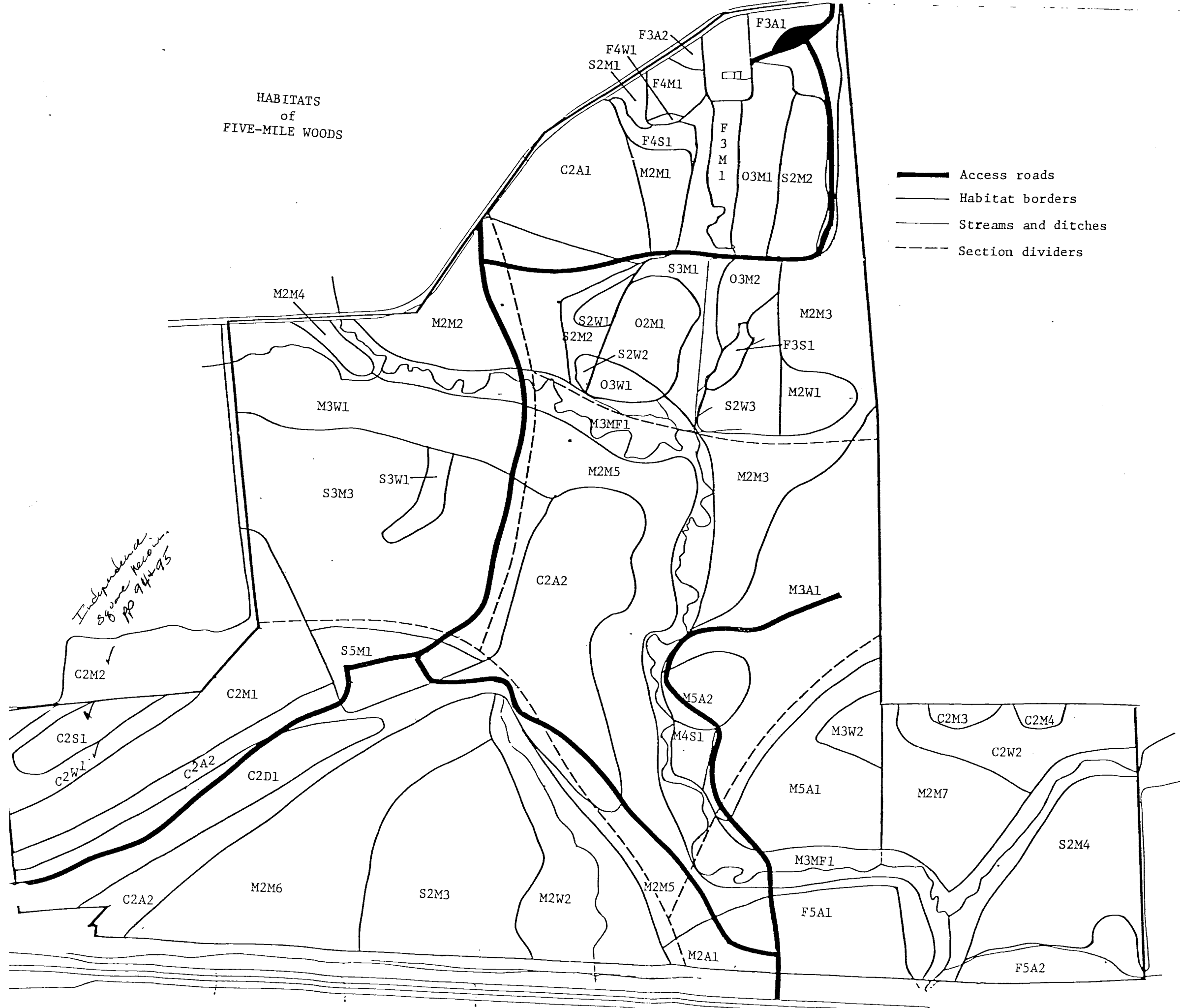
The second character describes the acidity of the soil: 1. - Very extremely acid. pH less than 4.0. 2. - Extremely acid. pH between 4.0 and 4.5. 3. - Very strongly acid. pH 4.6 to 5.0. 4. - Strongly acid. pH 5.1 to 5.5. 5. - Medium acid. pH 5.6 to 6.0. The third character is used to describe moisture in the soil; S - Standing water. More than two inches of water. W - Wet. Water line not obvious. Walking in the habitat will result in wet feet. M - Moist. The soles of the shoes will be wet. A - Average moisture. A moderate amount of moisture is in the soil so it rarely dries out. D - Dry. Subject to frequent drying of the soil. Little moisture present.

The fourth character is usually a number. If it is the letter "F", it means the habitat lies in a flood plain. The last number which usually follows the moisture reading refers to the number of that specific habitat. Thus, there may be three mature, strongly acid, wet forest habitats (M4W). They would be numbered M4W1, M4W2 and M4W3. The letters following the habitat number indicate the section of the preserve the habitat is in. (C-Central, NE-Northeast, etc.)

The location refers to the USGS 7 1/2" topographic map on which Five Mile Woods is located. All other headings should be self-explanatory.

HABITATS
of
FIVE-MILE WOODS

- Access roads
- Habitat borders
- Streams and ditches
- - - Section dividers



*Independence
Swamp Reclaim
PO 94-95*

HABITATS

Habitat: F3S1 Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Primarily an herbaceous marsh with two islands of shrubs.

Soils: Very strongly acid muck.

Moisture: Very high. 2" below the surface to 10" above the surface.

Topography: Very slightly sloping southward from a spring at the north end.

Dominant Plants:

Trees: None.

Shrubs: Two islands of Marsh Rose (*Rosa palustris*).

Herbs: Stilt Grass.

Significant Animals: A red salamander and some egg masses were found in the spring.
The area is also good for migrating birds in the late fall.

Critical Factors: The entire area is vulnerable to nutrient pollution primarily from the ground water. Apparently this is already somewhat of a problem, since the dominant grass (stilt grass) is typically a species of higher pH disturbed areas. Careful water chemistry monitoring should be carried out.

Habitat Management: No management is presently necessary due to the very high water table which will limit successional forces. However, if the water table drops permanently, a re-evaluation will have to be made. Water chemistry and water levels should be monitored.

Comments:

HABITATS

Habitat: F3M1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Old field with some shrubs and trees invading primarily on drier sites.

Soils: Very strongly acid yellow silty-clay with little or no organic layer.

Moisture: Quite moist with a high water table. Wet areas exist in the northeast and southwest corners.

Topography: Nearly level, a "ridge" runs northwest-southeast through the area.

Dominant Plants:

Trees: Scattered sweet gum and tulip trees.

Shrubs: Scattered meadowsweet and multiflora rose.

Herbs: Small white aster, blackberry, early goldenrod little blue stem grass.

Significant Animals:

Critical Factors: Both the northeast and southwest corners should be protected from off-trail use due to their very high water table.

Habitat Management: Annual late winter or early spring cutting. (This should be done while the ground is still frozen).

Comments:

HABITATS,

Habitat: F3A1 F3A2 NE Location: Trenton West, N.J.
Tract: Five Mile Woods Master Number: 811
Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township
Successional Stage: Transition from old field to a shrubby field, however this area should not be permitted to successionaly proceed passed this present stage.

Soils: Very strongly acid yellow silty-caly with little or no surface organic layer.

Moisture: Moderate. No apparent moisture problems. Mottling greater than two feet below the surface.

Topography: Gradually sloping.

Dominant Plants:

Trees: Scattered crabapples.

Shrubs: Scattered multiflora rose, and arrow-wood.

Herbs: Hairy Aster, Little blue stem grass, queen anne's lace blackberry and early and gray-steemed goldenrods.

Significant Animals:

Critical Factors: None.

Habitat Management: Annual late winter mowing. Permit a representative collection of shrubs to remain in the field and a couple crab apple trees, but prevent increased invasion by woody plants with annual mowing.

Comments: This area east of the headquarters should be maintained as an herbaceous old field, whereas the area west of the headquarters should be maintained as a shrubby old field.

HABITATS

Habitat: F4S1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Two small marshy ponds.

Soils: Strongly acid clay muck.

Moisture: Standing water usually present, but may dry during prolonged droughts.

Topography: Low wet depressions that were apparently man-made. The area was probably quite wet and unacceptable for farming, so to facilitate drainage a pond and drainage ditch were created with a bulldozer. Since then the drainage ditch has silted in and the only evidence of the bulldozer is the numerous hummocks.

Dominant Plants:

Trees: Some red maples and sour gums are invading the hummocks.

Shrubs: High bush blue berry, seet pepperbush, silky dogwood.

Herbs: Soft rush, silt grass, water millet.

Significant Animals: This is the best area for frogs in the preserve. Peepers chorus frogs, green frogs and wood frogs are all found here during the breeding season.

Critical Factors: The entire area is vulnerable to changing salt levels and compaction from off-trail use.

Habitat Management: A monitoring system should be created for the water level and chemistry. The populations of amphibians and plants should also be monitored to detect any early indications of a changing environment. The area is presently in a delicate balance between acid bog and fresh water marsh. If the salt levels increase significantly, many of the acid loving plants will be lost to competition, while if (cont)

Comments: (continued from H.M.) - a salt berm is constructed to limit salts from Big Oak Road, the area will gradually increase in acidity with the possible loss of the area as a breeding grounds for frogs.

Since this is the only area of significant amphibian breeding in the preserve,

(continued on back)

HABITATS

Habitat: F4W1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Open field.

Soils: Strongly acid grayish-brown clay-muck.

Moisture: Typically wet, with water table very near surface. Occasional dries out to moderately moist during droughts.

Topography: Very slightly sloping toward section F4S1.

Dominant Plants:

Trees: None.

Shrubs: Scattered willows and silky dogwoods.

Herbs: Stick-tights.

Significant Animals:

Critical Factors: Wet soil limitations for off-trail use.

Habitat Management: Annual elimination of selected woody material. This area should be maintained as an open habitat. Normal high water will prevent most woody species from invading the area, but during years of drought trees may begin to move in and should be eliminated before they establish a foot hold.

Comments:

HABITATS

Habitat: F4M1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Old field.

Soils: Strongly acid yellow silty-clay.

Moisture: Varying gradually from wet at the south end to moderate at the northend.
Water table is 6" to 18" below the surface.

Topography: Gently sloping downward from north to south.

Dominant Plants:

Trees: Scattered crab apples are invading the field.

Shrubs: Scattered fatterbush, arrowwood and high bush blueberry.

Herbs: Little blue stem grass and blackberry.

Significant Animals:

Critical Factors: None.

Habitat Management: Selective annual cutting in early spring leaving many shrubs, but eliminating trees.

Comments:

HABITATS

Habitat: F5A1 F5A2 SE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Open agricultural fields.

Soils: Medium acid yellow silty clay. The relatively high pH is probably due to the current agricultural use and thus the annual fertilization the area has been receiving. This should drop by about 1.5 pH points in the coming years.

Moisture: F5A1 - Moderate. F5A2 - Moderate to moist. Evaporation is high on open agricultural soils, thus as natural vegetation invades the field more water should be held by each area and the moisture readings will increase.

Topography: Slightly sloping to level.

Dominant Plants:

Trees: None.

Shrubs: None.

Herbs: Soy beans. Rough aster, black berry and rough and canada goldenrod are dominant along the edges.

Significant Animals:

Critical Factors: None.

Habitat Management: Annual mowing. F5A2 - Allow to proceed with normal succession.

Comments:

HABITATS

Habitat: 02M1 03W1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Old shrubby field in the north east to very young second growth in the southwest.

Soils: 02M1 - Extremely acid yellow silty clay. 03W1 - Very strongly acid dark clay-loam, due primarily to high water table.

Moisture: 02M1 - A moist area with a high seasonal water table (2"-10"). 03W1 - Water table fluctuates from 3 inches below the surface to 3 inches above the surface.

Topography: Gently sloping north to south.

Dominant Plants:

Trees: Red maples and sweet gum.

Shrubs: High bush blueberry, fetterbush, maleberry and chokeberry.

Herbs: Little blue stem grass, soft rush and wool grass.

Significant Animals:

Critical Factors: This area can provide the best extremely acid moist, open area in the preserve. Thus, permitting natural succession to take its course is the primary threat to this area.

Habitat Management: Annual cutting of trees.

Comments: This is the ideal place to create an open acid bog which will maintain the diversity presently being lost to succession. See recommendations.

HABITATS

Habitat: 03M1 NE

Location: Trenton West, N.J.

Tract: Five Mile Woods

Master Number: 811

Dates: 1/80 - 3/81

Sponsor: Lower Makefield Township

Successional Stage: This area is an old orchard that fits into the old shrubby field category better than any other, but really is primarily a "junk" area of introduced species.

Soils: Very strongly acid clay-loam.

Moisture: Rather moist. Water table over one foot below the surface.

Topography: Gently sloping north to south.

Dominant Plants:

Trees: Apple, cherry and silver maple.

Shrubs: Multiflora rose and honeysuckle.

Herbs: Blackberry

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments: This is an area only an ecologist could love. It is an old orchard that has grown up with such exotic species as multiflora rose and Japanese honeysuckle, probably due to the "better" soil present during orchard use. Since then, many of the fertilized nutrients have been leached out of the soil and the pH has been

(continued on back)

HABITATS

Habitat: 03M2 Ne Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: The area varies from herbaceous old field to young second growth.

Soils: Very strongly acid yellow clay.

Moisture: Moist with a very high water table (1" to 6").

Topography: Practically level, but a small "ridge" runs north to south through the middle.

Dominant Plants:

Trees: Sweet gum and gray birch.

Shrubs: High bush blueberry.

Herbs: Little blue stem grass.

Significant Animals:

Critical Factors: Prevent succession.

Habitat Management: Selective annual cutting to keep the area open. Cutting should be limited to trees and selective shrubs.

Comments:

HABITATS

Habitat: S2W1 S2W2 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Second growth.

Soils: Extremely acid clay.

Moisture: Seasonally high water table (1").

Topography: Slightly concave.

Dominant Plants:

Trees: Red maple and sweet gum.

Shrubs: Chokeberry, High bush blueberry, fetterbush and maleberry.

Herbs: Sphagnum.

Significant Animals: Excellent for migrating warblers.

Critical Factors: Very sensitive to soil disturbance.

Habitat Management: None.

Comments: Potentially a good botanical area that should be avoided.

HABITATS

Habitat: S2W3 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Varies from old shrubby field to a young forest.

Soils: Extremely acid humus above clay.

Moisture: Very wet. Water table 0"-6" below the surface.

Topography: Nearly level.

Dominant Plants:

Trees: Sweet gum, pin oak and red maple.

Shrubs: High bush blueberry, fetterbush and maleberry.

Herbs: Ground pine.

Significant Animals:

Critical Factors: Herb layer extremely sensitive to off-trail use.

Habitat Management: Selective cutting to maintain a partially open character.

Comments: This area is an excellent wet acid woodland habitat.

HABITATS

Habitat: S2M1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Second growth.

Soils: Extremely acid loamy clay.

Moisture: Quite moist. Water table varies from near the surface near F4S1 to about 12".

Topography: Moderately sloping from northeast to southwest.

Dominant Plants:

Trees: Red Maple.

Shrubs: Scattered high bush blueberry.

Herbs: Blackberry.

Significant Animals:

Critical Factors: The area does not appear to be greatly influenced by salts from Big Oak Road, but these should be monitored.

Habitat Management: Monitor the salt levels.

Comments:

HABITATS

Habitat: S2M2 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Second growth.

Soils: Extremely acid clay loam.

Moisture: Quite moist, with a high water table (3" to 10").

Topography: Somewhat higher than neighboring wet habitats with a slight north to south slope.

Dominant Plants:

Trees: Red maple, sweet gum and pin oak.

Shrubs: High bush blueberry and red chokeberry.

Herbs: Ground pine.

Significant Animals:

Critical Factors: The moist soil is very sensitive to off-trail use.

Habitat Management: None.

Comments:

HABITATS

Habitat: S2M3 M2M6 SW

Location: Trenton West, N.J.

Tract: Five Mile Woods

Master Number: 811

Dates: 1/80 - 3/81

Sponsor: Lower Makefield Township

Successional Stage: Varies from shrubby second growth to mature forest. Apparently part of the area was logged and logging practices varied from areas of clear-cut to areas of selective cutting to areas with no apparent recent cutting.

Soils: Extremely acid clay-humus, but varies to strongly acid in places.

Moisture: Quite varied from moderate to small seepage areas of quite wet soils, giving a rather mottled effect.

Topography: Gently sloping away from the ridge.

Dominant Plants:

Trees: Variable. Beech, oak tulip and black birch share the dominance. A couple stands of aspen suggest localized areas of higher pH.

Shrubs: High bush blueberry, sweet pepperbush and arrow-wood.

Herbs: Ground pine, ground cedar, lady fern and New York fern.

Significant Animals:

Critical Factors: Reduced ground water flow and noise from Route 1 are the two primary areas of concern. See recommendations for more details.

Habitat Management: None.

Comments: This is a large variable area that possesses old fields to mature forests and extremely acid soils to probably medium acid soils, which vary from moderate moisture to wet. Since all the variations are rather randomly distributed throughout this area, the best classification for the area is to divide it into two sections with a rather nebulous border separating them.

HABITATS

Habitat: S2M4 SE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Second growth.

Soils: Extremely acid to strongly acid yellow clayey-silt.

Moisture: Moist, with some seasonally wet areas toward M3MF1.

Topography: Slightly sloping from the southeast toward M3MF1.

Dominant Plants:

Trees: Red maple and sweet gum.

Shrubs: High bush blueberry, arrow-wood, spicebush and poison Ivy.

Herbs: Ground cedar, white woodland aster and solomon's plume.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments: This is an excellent area for an off-trail educational use area. There is little of ecological or biological importance and the soil should permit this type of activity.

HABITATS

Habitat: S3W1 NW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Young second growth.

Soils: Very strongly acid loamy-clay.

Moisture: The area is a seasonally wet seepage area.

Topography: Drains south to north.

Dominant Plants:

Trees: Red maple and sweet gum.

Shrubs: High bush blueberry.

Herbs: Ground cedar.

Significant Animals:

Critical Factors: The primary threat to the area is permitting succession to continue, thus reducing the diversity of the area. Off-trail use is also a threat.

Habitat Management: Selectively clearing most trees within thirty feet of the seepage area, thus producing a woodland glade with diversity.

Comments:

HABITATS

Habitat: S3M1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Second growth.

Soils: Somewhat variable from strongly acid, humusy-clay to very strongly acid silty clay. The higher pH area being in the area of skunk cabbage.

Moisture: Primarily moist, with the water table 6" to 12" below the surface, with some wet areas.

Topography: Gradually sloping from north to south.

Dominant Plants:

Trees: Variable. Red maple and sweet gum, with one grove of black locust.

Shrubs: High bush blueberry and arrow-wood.

Herbs: Canada Mayflower (lower end) and blackberry.

Significant Animals:

Critical Factors: Skunk cabbage depression is sensitive to off-trail use.

Habitat Management: None.

Comments:

HABITATS

Habitat: S3M1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Second growth.

Soils: Very strongly acid loamy-clay.

Moisture: Rather moist to moderately moist.

Topography: Gently sloping from north to south.

Dominant Plants:

Trees: Sweet gum and red maple.

Shrubs: Limited.

Herbs: Limited.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments: This area is well suited for off-trail educational uses. There is nothing of unusual importance and the soil can tolerate the compaction.

HABITATS

Habitat: S3M3 NW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Second growth.

Soils: Very strongly acid loamy-clay. The pH tends to rise toward habitat S5M1, probably due to past fertilization of the field.

Moisture: Generally moist, but scattered wet areas are found throughout.

Topography: Gently sloping from south to north.

Dominant Plants:

Trees: Sweet gum and red maple.

Shrubs: High bush blueberry.

Herbs: Ground cedar.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments:

HABITATS

Habitat: S5M1 SW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Second growth.

Soils: Medium acid loamy soil. Probably a remnant from earlier agricultural uses.

Moisture: Moist to moderate.

Topography: Very slight slope from south to north.

Dominant Plants:

Trees: Aspen

Shrubs: Japanese honeysuckle.

Herbs:

Significant Animals:

Critical Factors: None.

Habitat Management: none.

Comments:

HABITATS

Habitat: M2W1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus overlaying clayey-silt.

Moisture: Very wet, with some areas having standing water most of the year.

Topography: Level.

Dominant Plants:

Trees: Pin oak, sweet gum and red maple.

Shrubs: High bush blueberry.

Herbs: None.

Significant Animals:

Critical Factors: Due to the wet soils, off-trail use must be controled. There should be a monitoring system developed to determine changes in water levels and chemistry.

Habitat Management: Develop a monitoring system for water level and chemical changes.

Comments: This is anexcellent wooded swamp area.

HABITATS

Habitat: M2W2 SW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus overlaying clay.

Moisture: Wet with areas of seasonal standing water.

Topography: Gently sloping north to south.

Dominant Plants:

Trees: Red Maple, tulip, white oak.

Shrubs: Arrow-wood.

Herbs: Lady fern.

Significant Animals:

Critical Factors: Off-trail use should be controlled. Significant lowering of the water table or chemical contamination of the water table would both have tremendous negative results on the vegetation. See recommendations.

Habitat Management: None.

Comments:

HABITATS

Habitat: M2M1 Ne Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus over clay.

Moisture: Moist. Water table 6"-12" below the surface.

Topography: Slight dome, sloping downward to the north, east and south. A small ditch marks the western border.

Dominant Plants:

Trees: Sweet gum, red maple and tulip.

Shrubs: High bush blueberry and arrow-wood.

Herbs: Ground pine, ground cedar, greenbriar and canada mayflower.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments:

HABITATS

Habitat: M2M2 M2M4 NW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus over silty-clay.

Moisture: Moist, with some seasonal wet areas.

Topography: Gently sloping from north to south.

Dominant Plants:

Trees: Red, black and white oak and beech.

Shrubs: High bush blueberry and arrow-wood.

Herbs: Canada mayflower.

Significant Animals:

Critical Factors: Noise from Big Oak Road (see recommendations).

Habitat Management: None.

Comments:

HABITATS

Habitat: M2M3 NE & C Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus overlaying silty-clay.

Moisture: Varies from isolated wet areas to rather moderate.

Topography: Slightly higher in the east and north.

Dominant Plants:

Trees: Beech, white oak, sweet gum and tulip.

Shrubs: High bush blueberry and arrow-wood.

Herbs: New York fern and lady fern.

Significant Animals:

Critical Factors: If the recommendation for an access road through this area is accepted, great care must be given to the exact location and to the construction to prevent damage to this fragile area.

Habitat Management: None.

Comments:

HABITATS

Habitat: M2M4 M2M2 Nw Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus over silty-clay.

Moisture: Moist, with some seasonal wet areas.

Topography: Gently sloping from north to south.

Dominant Plants:

Trees: Red, black and white oak and beech.

Shrubs: High bush blueberry and arrow-wood.

Herbs: Canada mayflower.

Significant Animals:

Critical Factors: Noise from Big Oak Road (see recommendations).

Habitat Management: None.

Comments:

HABITATS

Habitat: M2M5 C Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus overlaying silty-clay.

Moisture: Moist to moderate with a few isolated, seasonally wet areas.

Topography: Gently sloping toward M3MF1 in the northern 1/3. Moderately sloping north to south and toward M3MF1 in the middle section. Gently sloping toward M3MF1 and M2W2 in the south section.

Dominant Plants:

Trees: Beech, tulip and red, white and black oaks.

Shrubs: Arrow-wood.

Herbs: Limited. Canada mayflower.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments:

HABITATS

Habitat: M2M6 S2M3 SW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Varies from shrubby second growth to mature forest. Apparently part of the area was logged and logging practices varied from areas of clear-cut to areas of selective cutting to areas with no apparent recent cutting.

Soils: Extremely acid clay-humus, but varies to strongly acid in places.

Moisture: Quite varied from moderate to small seepage areas of quite wet soils, giving a rather mottled effect.

Topography: Gently sloping away from the ridge.

Dominant Plants:

Trees: Variable. Beech, oak tulip and black birch share the dominance. A couple stands of aspen suggest localized areas of higher pH.

Shrubs: High bush blueberry, sweet pepperbush and arrow-wood.

Herbs: Ground pine, ground cedar, lady fern and New York fern.

Significant Animals:

Critical Factors: Reduced ground water flow and noise from Route 1 are the two primary areas of concern. See recommendations for more details.

Habitat Management: None.

Comments: This is a large variable area that possesses old fields to mature forests and extremely acid soils to probably medium acid soils, which vary from moderate moisture to wet. Since all the variations are rather randomly distributed throughout this area, the best classification for the area is to divide it into two sections with a rather nebulous border separating them.

HABITATS

Habitat: M2M7 SE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus overlaying clay.

Moisture: Moist, with isolated wet areas.

Topography: A low dome.

Dominant Plants:

Trees: Sour gum, sweet gum, red maple and tulip.

Shrubs: Sweet pepperbush, and arrow-wood.

Herbs: New York fern, lady fern, ground pine and Canada mayflower.

Significant Animals:

Critical Factors: Off-trail use should be restricted.

Habitat Management: None.

Comments:

HABITATS

Habitat: M2A1 SE

Location: Trenton West, N.J.

Tract: Five Mile Woods

Master Number: 811

Dates: 1/80 - 3/81

Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Extremely acid humus, overlaying clay.

Moisture: Moderate.

Topography: Gently sloping downward toward the northwest.

Dominant Plants:

Trees: Tulip, white oak and sweet gum.

Shrubs: Maple-leaved Viburnum and greenbriar.

Herbs: White woodland aster.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments:

HABITATS

Habitat: M3W1 NW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Very strongly acid humus overlaying silty-clay.

Moisture: Highly variable, from seasonally standing water to moist conditions.

Topography: Slopes gently toward Queen Anne Creek.

Dominant Plants:

Trees: Sweet gum and white oak.

Shrubs: Spicebush.

Herbs: Canada mayflower, spring beauty and wild oats.

Significant Animals:

Critical Factors: Off trail use. Noise - see recommendations on noise. Enrichment and loss of groundwater due to development - see soil and water recommendations.

Habitat Management: Monitor water levels and chemistry.

Comments: This is a prime example of an area's soil pH being elevated by agricultural uses of an adjoining area. As recently as 25 years ago S3M3, S3W1 and S5M1 were all part of an agricultural field. Since that time the field's pH has dropped from about 6.0 necessary for agricultural uses, to about 5.5 in the drier portions to about 4.5 in the wetter areas. Since this habitat was directly effected by the (cont. on back)

HABITATS

Habitat: M3W2 SE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Very strongly acid humus overlaying clay.

Moisture: Variable. Areas of wet and even seasonally standing water are intermixed with ridges of moist ground.

Topography: Generally rolling low ridges in an overall depression with its outlet to the southwest.

Dominant Plants:

Trees: Sweet gum and tulip.

Shrubs: Sweet pepperbush and Swamp haw.

Herbs: Cinnamon and royal ferns and marsh violet.

Significant Animals:

Critical Factors: Two threats presently exist. First, if construction changes the present groundwater flow, the springs could dry up. If this happens many of the unusual plants of this area will be lost. Second, if the ground water's chemistry changes significantly, the effect will also be a change in vegetation. See water recommendations.

Habitat Management: Monitor the water chemistry, water table, soil chemistry and successional changes.

Comments: This is an excellent wooded swampy area which has the best stand of swamp haw and marsh violets in the preserve. The precise reason for their presents in this habitat rather than the shrubs and herbs common in other similar habitats is not presently clear. The answer probably lies in the soil and water chemistry.

HABITATS

Habitat: M3MF1 NW, C,SE. Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Very strongly acid silt-loam.

Moisture: Generally moist with scattered wet areas. Subject to flooding during heavy rains.

Topography: Rather level.

Dominant Plants:

Trees: Red maple, tulip and sweet gum.

Shrubs: Arrow-wood, spicebush and elderberry. Variable.

Herbs: Wild oats, Canada mayflower stilt grass and tall meadow rue.

Significant Animals:

Critical Factors: With the future development of the watershed north of Big Oak Road, lawn fertilization and liming will create higher nutrient levels and pH in Queen Anne Creek, which in turn will be deposited on this flood plain habitat in future years. Thus this area will gradually become more basic and a corresponding change will occur in the vegetation. Fortunately, the change does not (cont)

Habitat Management: None. One potential project to "clean up" the debris in Queen Anne Creek will only hasten the movement of water out of the preserve and is precisely the opposite plan needed to retain water. Therefore it should not be carried out.

Comments:

HABITATS

Habitat: M3A1 C Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Very strongly acid to extremely acid humus overlaying yellow silty-clay.

Moisture: Moderate, with one small moist area near the east boundary.

Topography: This area straddles the ridge. The northern third of the area slopes moderately downward toward the north. The middle third is the rather flat top of the ridge, while the southern third drops abruptly from the top of the ridge with a moderately sloping tail to the southwest.

Dominant Plants:

Trees: Oak throughout, with a beech co-dominant in the areas of extreme acidity and a tulip co-dominant in areas of very strongly acid soil.

Shrubs: Maple-leaved viburnum.

Herbs: May apple.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments:

HABITATS

Habitat: M4S1 C Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature forest.

Soils: Strongly acid silt-loam overlaying clay.

Moisture: A spring and feeder stream make up the primary part of this habitat and usually have standing water. The high ground in this area is actually representative of habitat M3A1 and further information can be found under that habitat.

Topography: Gently sloping from the spring to Queen Anne Creek.

Dominant Plants:

Trees: Oak and beech.

Shrubs:

Herbs: Skunk cabbage and white hellebore.

Significant Animals: This may be a good area for breeding salamanders.

Critical Factors: If the water table drops, this area could dry up considerably.
See recommendations for water.

Habitat Management: None.

Comments:

HABITATS

Habitat: M5A1 SE

Location: Trenton West, N.J.

Tract: Five Mile Woods

Master Number: 811

Dates: 1/80 - 3/81

Sponsor: Lower Makefield Township

Successional Stage: Rather young mature forest (probably not more than 40 years old).

Soils: Medium acid silt-loam overlaying strongly acid silty-clay. This area and M5A2 are fascinating areas. They are the least acid areas of the preserve (except for F5A1 and F5A2, which are still being farmed and fertilized) and are much less acid than any other wooded area.

Moisture: Moderate.

Topography: Somewhat dome like, except for the northern portion that slopes of the ridge.

Dominant Plants:

Trees: Tulip and sweet gum.

Shrubs: Spicebush and Japanese honeysuckle.

Herbs: Spring beauty.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments: This is a prime example of a higher drier soil's ability to maintain rather high pH values while neighboring lower wet soils (M3W2) undergo intense acidification. Both of these areas were part of the same farm field that was probably cultivated as recently as fifty years ago. The eventual acidification of this area (cont. on back)

HABITATS

Habitat: M5A2 C Location: Trenton West, N.J.
Tract: Five Mile Woods Master Number: 811
Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township
Successional Stage: Mature forest with an opening of shrubs tangled with grape vines.

Soils: Medium acid silt-loam overlaying strongly acid silt-clay (see M5A1).

Moisture: Moderate.

Topography: Rather abrupt south facing slope.

Dominant Plants:

Trees: Tulip.

Shrubs: Spicebush and grape vine.

Herbs: Christmas fern, doll's eyes, bergamot and stilt grass.

Significant Animals:

Critical Factors: Off-trail use should be restricted.

Habitat Management: None.

Comments: The ruins, if they can be made safe, can provide an excellent starting point for educational programs on the interaction between man and his environment.

HABITATS

Habitat: C2S1 SW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Rather open climax forest.

Soils: Extremely acid humus overlaying extremely acid clay.

Moisture: Primarily standing water with occasional wet or moist hummocks. May dry out to a moist condition during years of drought.

Topography: A natural depression with no outlet.

Dominant Plants:

Trees: White oak, sweet gum and sour gum.

Shrubs: Sweet pepperbush, swamp azalea and fetterbush.

Herbs: No dominants.

Significant Animals:

Critical Factors: See soil and water recommendations.

Habitat Management: None.

Comments: This is the best wooded bog in the preserve. The area includes the best stands of sweet pepperbush, swamp azalea, fetterbush, maleberry and swamp white oak. With continued study, more excellent plants and animals may be found in this area.

HABITATS

Habitat: C2W1 SW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Climax forest.

Soils: Extremely acid humus overlaying extremely acid silty-clay.

Moisture: Wet, although drying out to moderate during severe drought.

Topography: Gently sloping toward C2S1.

Dominant Plants:

Trees: Sour gum, white and black oaks.

Shrubs: Sweet pepperbush, swamp azalea, and fetter bush.

Herbs: Indian cucumber root, and canada mayflower.

Significant Animals:

Critical Factors: See recommendations - Soil and water.

Habitat Management: None.

Comments: See C2S1.

HABITATS

Habitat: C2W2 SE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature to climax forest.

Soils: Very strongly acid humus overlaying silty-sandy clay.

Moisture: Very wet, with areas of moist soil. May dry to moderate during periods of prolonged drought.

Topography: A shallow depression draining south.

Dominant Plants:

Trees: Sweet gum, white and pin oaks.

Shrubs: High bush blueberry and swamp haw.

Herbs: Cinnamon and royal fern.

Significant Animals:

Critical Factors: See recommendations - water and soil. Off trail use.

Habitat Management: None.

Comments:

HABITATS

Habitat: C2M1 C2M2 SW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Climax forest.

Soils: Extremely acid humus overlaying extremely acid silty-clay.

Moisture: Moist with some wet areas.

Topography: Gently sloping downward toward C2W1.

Dominant Plants:

Trees: Beech, black birch, red and black oaks.

Shrubs: Sweet pepperbush and arrow-wood.

Herbs: Canada mayflower.

Significant Animals:

Critical Factors: See water and soil recommendations.

Habitat Management: None.

Comments:

HABITATS

Habitat: C2M3 C2M4 SE

Location: Trenton West, N.J.

Tract: Five Mile Woods

Master Number: 811

Dates: 1/80 - 3/81

Sponsor: Lower Makefield Township

Successional Stage: This is a small area of climax forest. This area holds some of the oldest trees in the preserve.

Soils: Extremely acid humus overlaying extremely acid clayey-silt loam.

Moisture: Moist to wet.

Topography: Slightly sloping downward toward C2W2.

Dominant Plants:

Trees: Beech and black oak.

Shrubs: High bush blueberry.

Herbs: Beech drops and Canada mayflower.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments:

HABITATS

Habitat: C2A1 NE Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Climax forest.

Soils: Extremely acid humus overlaying extremely acid silt-loam.

Moisture: Moderate with isolated wet areas.

Topography: Slightly sloping toward the south.

Dominant Plants:

Trees: White oak and beech.

Shrubs: Arrow-wood, high bush blueberry and pinxterbloom azalea.

Herbs: White woodland aster, and beech drops.

Significant Animals:

Critical Factors: A fifteen foot zone of dead and stunted shrubs line the edge of Big Oak Road. This may be due to automotive air pollution. If so, and if traffic levels increase with increased development, the damage may begin to effect plants deeper into the woods. Since this is a special area botanically, the precise cause and the potential damage should be carefully monitored.

Habitat Management: See above.

Comments:

HABITATS

Habitat: C2A2 C, SW. Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Mature to climax forest, with some rather open areas.

Soils: Extremely acid to very strongly acid humus overlaying very strongly acid clayey-silt loam.

Moisture: Moderate.

Topography: Variable. Steep sloping on the south side of the ridge, mildly sloping on the north side and gently sloping on the top of the ridge.

Dominant Plants:

Trees: Oak with beech in extremely acid areas and tulip in strongly acid areas.

Shrubs: Maple-leaved viburnum.

Herbs: White wood aster and blackberry.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments:

HABITATS

Habitat: C2D1 SW Location: Trenton West, N.J.

Tract: Five Mile Woods Master Number: 811

Dates: 1/80 - 3/81 Sponsor: Lower Makefield Township

Successional Stage: Climax forest.

Soils: Extremely acid humus overlaying extremely acid clayey-silt loam.

Moisture: Dry.

Topography: Rather flat ridge top.

Dominant Plants:

Trees: Beech, black oak, black birch, red oak and tulip.

Shrubs: Maple-leaved viburnum, high and low bush blueberry.

Herbs: Bracken, hay-scented fern, wild sarsparilla, and white woodland aster.

Significant Animals:

Critical Factors: None.

Habitat Management: None.

Comments:

RECOMMENATIONS

PRESERVATION

FENCING

I

Fencing should be the top priority for the Preserve, since the area cannot be properly managed unless it is first controlled. Presently, unlimited access provides snowmobilers, motorcyclists, wood cutters, horseback riders, and troublemakers not only easy access to the Preserve, but also easy exit. Therefore, public access and parking should be limited to the headquarters area where Preserve regulations will be posted.

A five-foot fence similar to those used by Penndot to line limited access highways should be constructed along the border of the entire Preserve and accompanied by no trespassing and no parking signs along Big Oak Road and Rt. 1. No fence will prevent the individual who is determined to climb it from entering the Preserve. However, horses, motor vehicles, and "innocent" wanderers will be excluded and anyone found in the Preserve disobeying the rules can hardly plead ignorance.

In high visibility areas, shrubs can be planted along the fence and it is also possible to use a split rail fence in front of the wire fence. Along Big Oak Road in front of the headquarters, a three-foot fence, coupled with a split rail fence, would be adequate and aesthetically acceptable.

Prior to construction of the fence, the boundaries of the Preserve should be surveyed to determine their precise locations, since the apparent east boundary below the ridge does not appear to be accurate.

NOISE

Five-Mile Woods is large enough to give a visitor a sense of isolation, possibly even a hint of wilderness, yet the area is small enough to be crossed in fifteen minutes of moderate walking. Since the illusion of

space is a desirable characteristic for any urban or suburban natural area, every effort should be made to enhance this illusion. One method used to promote this illusion is to wind the trails through the woods, rather than having straight trails. Another is to avoid trails that are so close together that you can see from one trail to another. However, all the best techniques and tricks can be destroyed by excess noise. What seemed like a wilderness can become a tiny island as more and more noise steals the illusion of space.

Presently, Five-Mile Woods suffers from the constant roar of traffic reverberating off the trees along Big Oak Road and thus effectively reducing the size of the Preserve. Under certain conditions, regular conversation can be difficult 500 feet from the road. The problem appears to be the worst where Big Oak Road is surrounded by trees and is slightly elevated above the forest. This includes the area from the west boundary of the Woods to the Emergency Access Lane. The area from the lane east to the fields is also noisy, but since the road is somewhat lower than the forest, the noise tends to disperse upward. Therefore, I strongly recommend that ⁽²⁾ an earthen berm at least six feet high be constructed along Big Oak Road from the western boundary to the patch of pink ladyslippers when Big Oak Road is straightened.

Another potential noise problem ⁽³⁾ of much greater severity should also be considered in the future. When the new Route 1 is completed, the rear of traffic will cause the "walled in" section of Five-Mile Woods (below the ridge) to sound like the "pits" at the Pocono Raceway. Sound will literally reverberate between the road and the ridge, filling the entire lower section of the woods with a constant drone. The solution for this area is also some type of sound barrier, but unfortunately the problem is amplified by the fact that Rt. 1 is above the surrounding landscape along much of the southern boundary by as much as ten vertical feet.

Thus, any effective sound barrier in this region would need to be fifteen or more feet high. Obviously, this is an engineering problem as well as an ecological problem.

SOIL AND WATER RECOMMENDATIONS

Five-Mile Woods is faced with two closely related and potentially harmful problems associated with the soil and water. The first problem concerns the probable drop in the water table as a result of neighboring development. Presently, surface water needs to sit on the ground for extended periods of time for adequate replenishment of the ground water since permeability is slow (see Table #1). Unfortunately, with increased development comes increased efficiency of drainage, which greatly decreases the absorption of rain into the ground water, thus dropping the water table. Presently rain falling on surrounding lands is being absorbed into the ground and adding ground water to the Preserve, since much of the surrounding land is equal to or higher in elevation than much of Five-Mile Woods. In the future, water absorbed in Five-Mile Woods will be drawn outward from Five-Mile Woods to the depleted water tables under surrounding developments.

The potential drop in the water table will vary according to rainfall conditions and individual soil variations within the Preserve, thus the precise decrease in water table is very difficult to predict. However, the limiting factor for many species does not occur during normal rainfall but rather during periods of drought, and decreasing the water table will increase the length of droughts, which in turn will cause increased survival pressures on wet land species and increased competition from invasive dryer land species. The result will be a reduction in the diversity and populations of wet land species. Unfortunately, many of the prime plants of Five-Mile Woods fall into this category.

(4)

One solution is to require surrounding developments to use retention basins rather than detention basins, thus permitting water to seep into the ground from the retention pond over extended periods to maintain high water tables. However, caution and monitoring must be used or the second major problem, that of (nutrient pollution) of the water table, may occur.

Along with development comes liming and fertilization of lawns and gardens. Since the native soil is very strongly acid and since gardens and lawns need only slightly acid or neutral soil, the amount of lime required will be great. Contrastingly, many of the rare and unusual plants of Five-Mile Woods are unable to compete with commoner species in all but the lowest lime habitats. Thus, even very small amounts of ground water-borne lime may swing the competitive edge away from the rare species and toward the commoner species.

Thus, we are faced with developing an equilibrium between limiting development (which is the ideal environmental solution) and using detention basins (which will help to maintain the water table, but also add to the nutrient levels of the ground water). Ironically, acid rain is a valuable ally for controlling excess lime in Five-Mile Woods.

With this background, the following recommendations are being made for the areas surrounding Five-Mile Woods:

Independence Square: An undisturbed buffer zone should be established starting at the west boundary of the Preserve and extending as far westward as possible. This area can be cut or left to grow into forest, but surface runoff from the development should not be permitted to drain into this area and ditching to encourage rapid drainage should be prohibited. (Presently, the southeast corner of Independence Square property is a natural bowl reservoir that is necessary for the replenishment of the ground water.) If these steps are not taken and the water table drops or nutrients increase,

the result will be the loss of one of the best swampy areas in Five-Mile Woods (habitats C2M2, C2W1, and C2S1).

Oxford Glen and Yardley Oaks: A retention basin should be placed just north of Big Oak Road on Queen Anne Creek where a detention basin is presently planned to assist in ground water replenishment.

Cambridge Estates: The present drainage channel in the southwest corner of Cambridge Estates which drains directly into Five-Mile Woods should be blocked immediately as it does not conform with the accepted plans and the proposed detention basin for that area should be replaced by a retention basin, thus cutting down on the soil and nutrients being dumped in Five-Mile Woods from the development. The basin should be large enough to hold all the runoff from a three-inch rain, thus the only time water would drain directly into the woods would be during times of very heavy rainfall and thus nutrient enrichment would be greatly diluted.

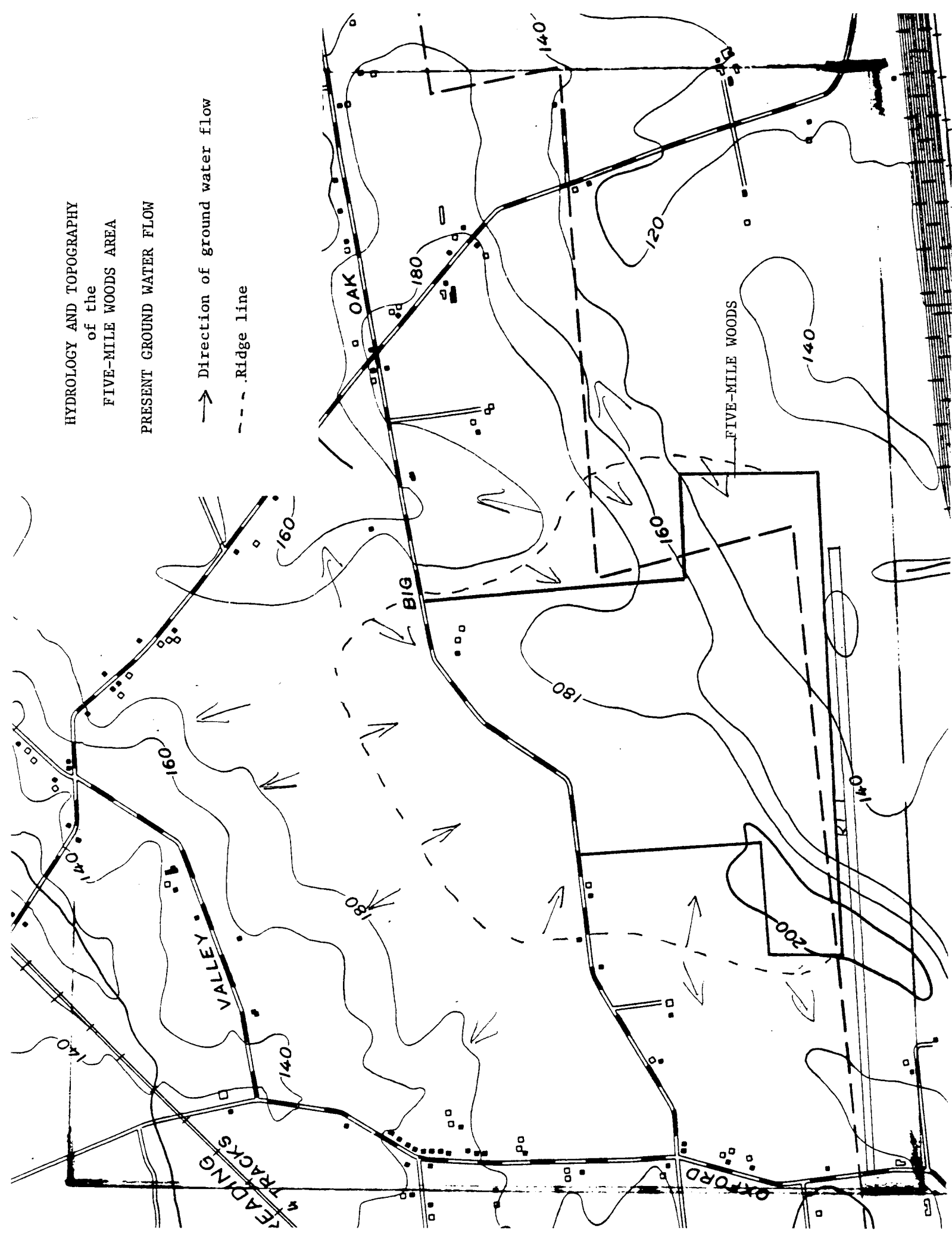
Guzikowski Property: The area between Cambridge Estates and the eastern extension of Five-Mile Woods should be purchased if possible to protect the water table and chemistry in the adjoining areas of the Preserve.

HYDROLOGY AND TOPOGRAPHY
of the
FIVE-MILE WOODS AREA

PRESENT GROUND WATER FLOW

→ Direction of ground water flow

- - - Ridge line

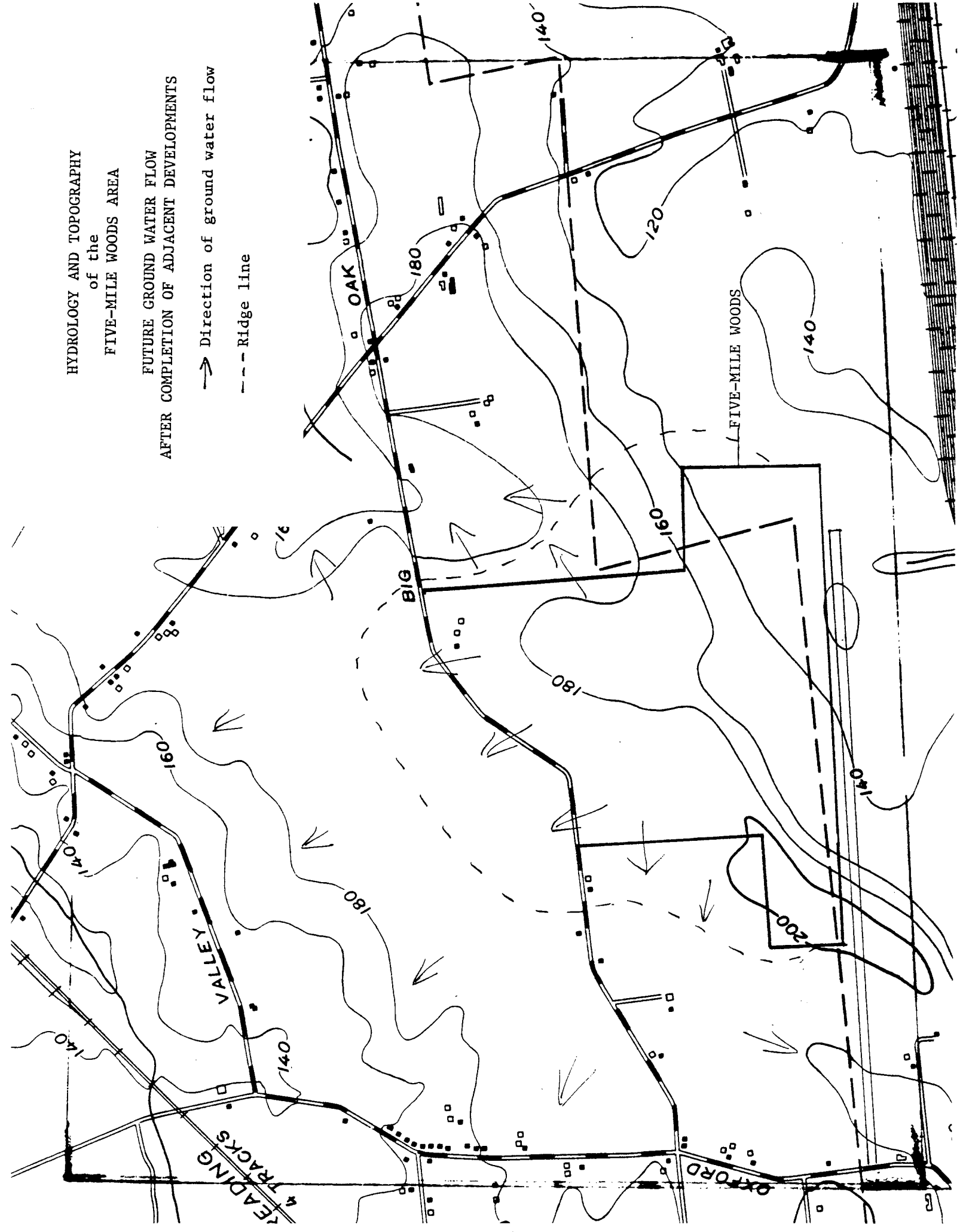


HYDROLOGY AND TOPOGRAPHY
of the
FIVE-MILE WOODS AREA

FUTURE GROUND WATER FLOW
AFTER COMPLETION OF ADJACENT DEVELOPMENTS

→ Direction of ground water flow

--- Ridge line



HABITAT MANAGEMENT

HABITAT MANAGEMENT PLAN

Habitat Management Areas: Successional pressures are very high in Five-Mile Woods. Areas that were open fields 25 years ago are now covered with thirty-foot-high second growth. Therefore, if an active habitat management program is not developed, much of the present diversity will be lost to succession. Since open areas are limited, I recommend that all present open areas be maintained by annual cutting. If cut in the dormant period, the herbaceous material will not be affected, while the tree and shrub seedlings will be controlled.

Further, since only about eight percent of the Preserve is open land and since much of the botanical diversity present on the open land immediately to the west of the Preserve is absent or limited in Five-Mile Woods, I recommend that two areas be cleared of their newly-formed second growth to encourage increased diversity.

The first area is in the northwest portion of the Preserve and would consist of clearing a small area along a seepage stream forming an open woodland glade. The second area includes six acres of second growth in an old field due south of the headquarters. The area is presently in transition from old field to second growth forest and varies markedly according to moisture content. The north end of the area is high and dry and has few young trees. The south end is low and wet and has second growth 15 feet high. This area has a number of species that are not found elsewhere in Five-Mile Woods (e.g., soapwort gentian, bartonia) and will be lost if successional forces are permitted to continue. Therefore, I strongly recommend that the area be selectively cleared of second growth. Further

I recommend that a one-foot-high by three-foot-wide dike stretch across the bottom of the old field to act as a trail and to form a small marshy impoundment of about one acre in size. Since the land slopes gently upward toward the north, the upper part of the field would remain dry and an excellent continuum from dry to wet vegetation would result. Also, this area is relatively unaffected by influences (specifically chemical) outside the Preserve, unlike the bog directly west of the headquarters. And since it more closely resembles the area west of the Preserve, it is the best place to transplant the cranberry bog.

If this area is not cut and an impoundment created, the probability of maintaining cranberry, soapwort gentian, bartonia, meadow beauty and some of the rarer coastal plain grasses, sedges and rushes will be greatly reduced. The only other possible location for many of these species is the bog (F4S1) west of the headquarters. Unfortunately, presently this area is too rich in nutrients for these species and any attempt to encourage acidification would probably result in the loss of the spring peepers and chorus frogs as breeders in Five-Mile Woods.

Specific management plans for each habitat are included on the habitat sheets in the section on habitats under Ecological Components.

ENVIRONMENTAL MONITORING SYSTEM

Develop systems to monitor environmental changes: Periodic monitoring of the water table and chemistry, soil chemistry, and successional changes within Five-Mile Woods will provide an excellent data base on which to make future decisions and can add valuable information to the scientific community.

The following systems should be monitored:

Water table: The water table at specific locations should be monitored

on a monthly basis, recording color, mottling, and available water for each layer. Rainfall should also be recorded to correlate rainfall to groundwater levels.

Water Chemistry: Soluble bases, nitrates, and hardness should be monitored on a monthly basis to set up base information concerning present water chemistry.

Soil Chemistry: Monthly soil samples should be collected and sent to the Merkle Lab at the College of the Agriculture at Pennsylvania State University. Sample soil bags are available from the Extension Service in Doylestown. Depending on the consistency of data, the readings may be reduced to quarterly after about two years.

Plant Succession: Studies should be conducted using annual readings of permanent transects and quadrants at approximately the same date (early to mid-August is preferable for open areas, while early to mid-May is preferable for wooded areas).

DRAINAGE CONTROL

Much of Five-Mile Woods' uniqueness stems from its high water table. In the past, numerous drainage ditches were constructed to increase drainage and thus lower the water table to make the land more suitable for farming. This has added to the severe drying problem that is often inherent in small watersheds (in the light of the 1980 drought, there was no standing water in Five-Mile Woods).

Development of the watershed north of Big Oak Road will probably further aggravate the drying problems in future droughts and may cause a loss of desirable species. Therefore, I recommend that no further draining or clearing of stream debris be undertaken in Five-Mile Woods and that a carefully-monitored, gradual program of eliminating present drainage ditches be undertaken.

PUBLIC USE

EMERGENCY ACCESS SYSTEM

I strongly recommend an emergency access system within the Preserve to adequately handle fire and medical emergencies and to permit proper and efficient maintenance. Although the risk of fire in Five-Mile Woods is usually low due to the high water table, the top of the ridge is often dry and the entire woods can dry out during droughts. Also, fires have occurred in the woods in the past and with increased use, the likelihood of fire also increases. The lanes will have four access points, each with a locked gate (the Fire Department will have a key for emergencies). The lanes should provide access to the entire Preserve without detracting from the overall natural appearance.

Most of the access roads are already cut in the form of old farming and logging roads. However, there would have to be some new construction to tie the whole system to the headquarters and the old roads would have to be improved to permit passage of emergency vehicles. Overall, the impact can be kept to a minimum if construction is strictly supervised, material is restricted to non-alkaline rock, and if the completed lane is covered with woodchips to restore a natural appearance.

Three lengths of new access lanes would be needed. The first would connect the present road at the sound end of habitat F3A1 with the access road that meets Big Oak Road in M2M2. The first 1/4 of the lane from the east end already exists, although some young saplings will have to be removed. The next 1/4 from the eastern end travels through S3M1 and would necessitate the removal of 30 to 50 saplings and second growth trees. Fortunately, botanically this area has nothing of special significance and the drainage should not be adversely affected. The western half of the lane

can be constructed without much harm, since old roads already exist through the southern part of C2A1.

The second new access lane would tie the two main north-south access lanes together in section M2A1. It would be less than 100 yards long and could be placed to avoid excessive environmental damage. This access lane is necessary to limit access on the southern border to one location and to provide internal movement without having to leave the Preserve.

The third new access lane would be a short connector road to tie the western access lane with the dead end street on the ridge in Independence Square. This will provide much-needed access from the western border.

TRAIL SYSTEM

The trail system is designed to present a maximum of diversity and interest with a minimum of environmental damage. The diversity is incorporated by including all the major and minor habitat groups. However, this does not mean that a trail will bisect every special area in the Preserve. Only a sampling of special areas will be visited and then only with great care to preserve the character of each area. Damage will be held to a minimum by the use of boardwalks, erosion bars, and a group limitation policy. Color-coded trail markers will divide the trails into three groups. First, red markers will designate emergency access lanes, while blue markers will signify group use trails. Both trails will be at least six feet wide, thus providing the room necessary for group use. Finally, the green trails will provide the greatest natural appeal and will visit the best areas of all the trails. They will be narrow (1-3 feet wide) and limited to groups of less than eight individuals to lessen the physical impact on the area, while providing a more natural appearance.

All trails will be delineated by small deadfall along the edges. Wood chips and/or gravel will be used to make wet areas passable (If wet areas

are permitted on trails, people will make new trails around the puddles), and erosion bars will be placed on any inclines that show signs of erosion. Boardwalks should be constructed in wet and seasonably wet areas and consist of planks nailed to railroad ties laid perpendicular to the trail.

Trails should be labeled with colored wooden arrows placed on short wooden posts. These provide inexpensive, durable, and easily replaceable signs that are informative yet relatively hard to vandalize.

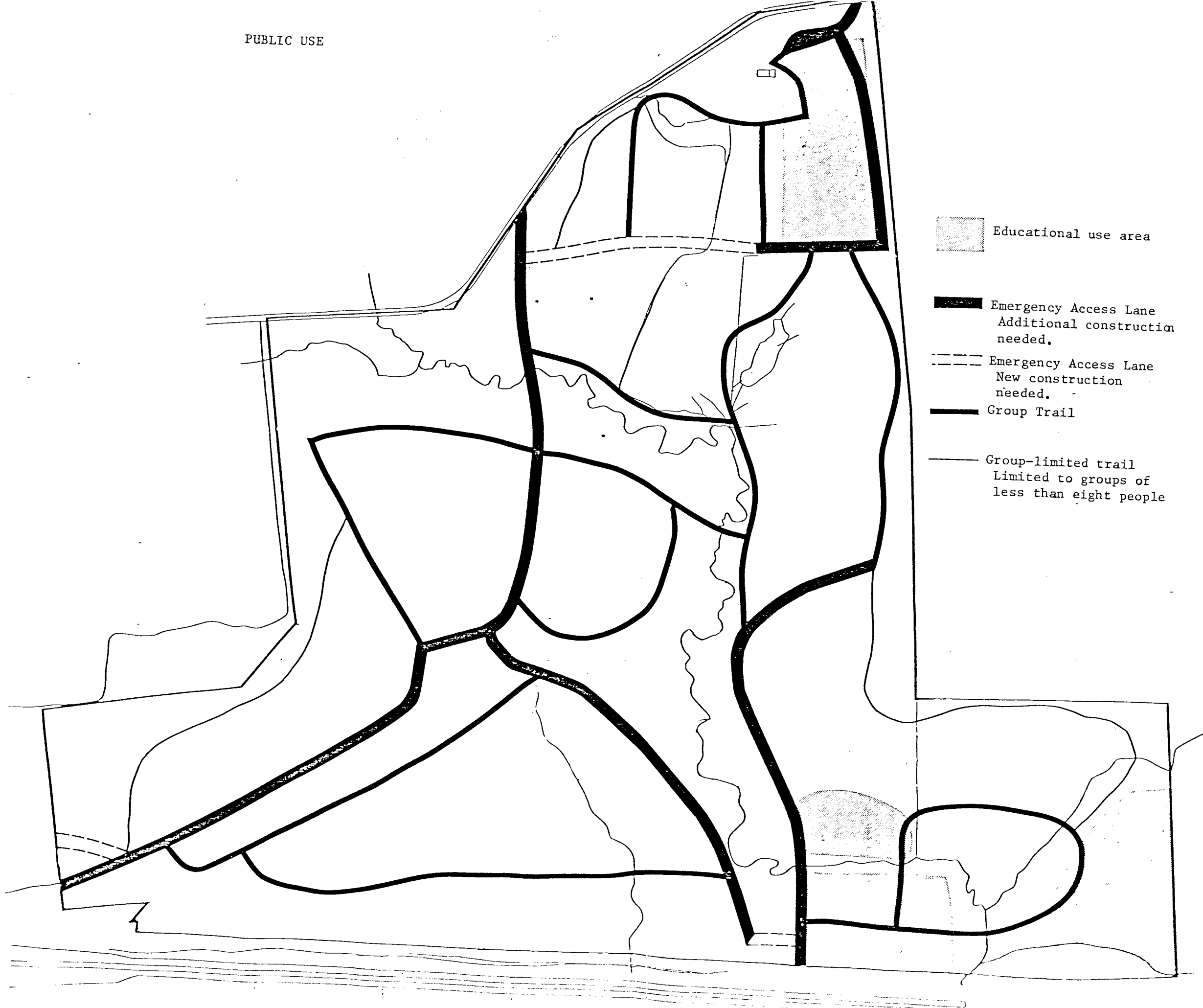
EDUCATIONAL USE PLAN


Developing an educational use plan is an essential part of building community support. The plan includes a delineation of appropriate educational activities, development of educational use areas and development of a good working relationship with the teachers. Educational uses can be divided into on-trail and off-trail uses. On-trail narrative type education should account for better than 90% of all educational activities and should present little negative environmental impact, provided the groups are well-supervised and the students stay on the trails. Group leaders should be held responsible for members of their group. Leaders who repeatedly are unable to control their groups should be denied future permits.


Off-trail use is a much more sensitive problem. Many area biology courses teach the scientific techniques of quadrant and transect studies. These studies involve the off-trail use of various habitats. Since forested and areas with high water tables are highly susceptible to trampling and compaction, this activity should be severely limited in Five-Mile Woods. However, I do NOT recommend the prohibition of all off-trail activities. Rather, I recommend that three forested areas and three field areas be set aside as study areas. Each year, all off-trail work would be limited to one forest area and one field area, allowing the other study areas to recover from previous disturbances. Also, all off-trail users would be required to fill out an application explaining the type of activity planned


and justifying the need to carry out the activity at Five-Mile Woods as opposed to some other location. Finally, close monitoring of the study sites should insure fulfillment of a maximum of educational need, with a minimum of environmental damage. It should also be pointed out that the study areas have been selected for their upland nature (which reduces the problems of trampling and compaction) and for their lack of biologically interesting species.


Cooperation with the local teachers should be the highest priority. Students often pick up nonverbal attitudes from teachers. Therefore, if we want the students to have a positive experience at Five-Mile Woods, it is very important that we cultivate a good working relationship with the teachers.




 Educational use area

 Emergency Access Lane
Additional construction
needed.

 Emergency Access Lane
New construction
needed.

 Group Trail

 Group-limited trail
Limited to groups of
less than eight people