UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

OCTOBER 1992

EPA

HABITAT SURVEYS FOR THE THREATENED SWAMP PINK (HELONIAS BULLATA) AND THE THREATENED KNIESKERN'S BEAKED-RUSH (RHYNCHOSPORA KNIESKERNII) AT VARIOUS NATIONAL PRIORITIES LIST SITES IN NEW JERSEY

HABITAT SURVEYS FOR THE THREATENED SWAMP PINK (*HELONIAS BULLATA*) AND THE THREATENED KNIESKERN'S BEAKED-RUSH (*RHYNCHOSPORA KNIESKERNII*) AT VARIOUS NATIONAL PRIORITIES LIST SITES IN NEW JERSEY

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October 30, 1992

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I. INTRODUCTION

The Comprehensive Environmental Response, Compensation and Liability Act, (CERCLA), commonly referred to as "Superfund", was enacted in December 1980. Under CERCLA, the federal government is authorized to compel responsible parties to conduct cleanup of hazardous waste sites or initiate cleanup actions and then determine who is liable for the cost of clean-up. The Superfund Amendments and Reauthorization Act of 1986 (SARA) provided additional funds for Superfund cleanups but did not significantly change the basic principles of Superfund.

Section 121 of CERCLA establishes general rules for selecting and implementing remedial actions at Superfund sites. This section specifies that remedial actions must comply with all applicable, relevant and appropriate requirements (ARARs). Standards, requirements, criteria or limitations under any federal environmental law are to be met if legally applicable or relevant and appropriate.

Section 7(a) of the Endangered Species Act (1973) requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of federally endangered and/or threatened species, or adversely modify or destroy the critical habitats of such species. In compliance with this Act, the U.S. Environmental Protection Agency (EPA) conducts informal consultations with the U.S. Fish and Wildlife Service (USFWS) to determine whether there are any federally endangered and/or threatened species or critical habitats present on or in the vicinity of CERCLA National Priorities List (NPL) sites.

As a result of several recent informal consultations (Appendix A), the potential for the presence of the threatened plant species, swamp pink (Helonias bullata), has been identified within the vicinity of various NPL sites in New Jersey, including:

1. Wilson Farm, Ocean County
2. Woodland Township/Route 532, Burlington County
3. Woodland Township/Route 72, Burlington County

4. Chemsol Inc., Middlesex County
5. Evor Phillips Leasing, Middlesex County
6. Ewan Property, Burlington County
7. Ciba-Geigy, Ocean County
8. Lang Property, Burlington County

Additionally, the potential for the occurrence of the habitat of another threatened plant, Knieskern's beaked-rush (Rhynchospora knieskernii), has also been identified near several sites, including:

1. Ciba-Geigy, Ocean County
2. Lang Property, Burlington County
3. Woodland Township/Route 532, Burlington County
4. Woodland Township/Route 72, Burlington County

The objective of this special study is to determine through a literature search and possible field survey, whether the federally threatened plant species swamp pink and Knieskern's beaked-rush or their habitats are present on the above-listed NPL sites. Furthermore, because the impact of remedial activities on the above-listed NPL sites may extend beyond the boundaries of the sites, study areas were defined based upon the location of potential habitat for the threatened plant species that may be affected by site remediation.

The Scope of Work for this special study is comprised of task series covering the following items:

1. A review of existing information concerning the habitat requirements of the species;
2. A review of known sightings or locations of suitable species habitat in the vicinity of each of the NPL sites;
3. Development of a habitat survey work plan;
4. Implementation of the habitat survey work plan; and
5. Documentation of the presence or absence of the species in a technical report.

This Habitat Survey presents the findings of the literature review phase and field survey phase of the study. The report begins with a description of the natural history and habitat requirements of swamp pink and Knieskern's beaked-rush. Each of the NPL sites are then described with particular reference to existing on-site habitats. Based upon a comparison of the natural habitats of the species of concern with those habitats mapped on-site and existing sightings for the species, a recommendation is made to conduct or not to conduct a field survey. The methodology employed during the field survey work is described. Finally, the results of the field survey are presented.

II. NATURAL HISTORY

This chapter provides technical background information pertaining to swamp pink and Knieskern's beaked-rush, including detailed descriptions of the plants and their habitat requirements. It represents a review of existing information on these plants. Sources of information included, but were not limited to:

- Technical Manuals such as Gray's Manual of Botany (1950), New Britton & Brown Illustrated Flora (1952), Manual of Vascular Plants (1963) and New Jersey Wild Plants (1983);
- Scientific Journals such as Castanea, Bartonia and Rhodora;
- USFWS Government Publications such as the Swamp Pink and Knieskern's Beaked-rush Recovery Plans, Endangered Species Technical Bulletin and Endangered and Threatened Wildlife and Plants (50 CFR);
- Rutgers University Chrysler Herbarium specimens;
- U.S. Army Corps of Engineers Public Notice on swamp pink;
- Unpublished documents such as the Draft Stewardship Abstract for Swamp Pink (New Jersey Natural Heritage Program) and records from the Plant Species Database (USFWS, National Wetlands Inventory).

The following sections provide background information for each of the species and a description of the species and their preferred habitats.

A. Swamp Pink

1. Background

Swamp pink (Helonias bullata) was first collected in the mid 1700's in New Jersey and subsequently in eight other eastern states, i.e., New York, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina and Georgia. Historically, more than 200 records exist, with 122 extant (presently occurring) populations known from six states (USFWS, 1991). Widespread drainage and development of eastern wetlands has resulted in significant population decline and serious habitat threats to this plant. In response to this threat, the USFWS proposed to list swamp pink as a threatened species on February 25, 1988 (USFWS, 1988b). Formal adoption of the listing as threatened was published in the Federal Register on September 9, 1988 (USFWS, 1988a).

New Jersey supports over half of the total world population of the species. In New Jersey, only 71 extant populations remain of 139 historic records (USFWS, 1991). Because of this, the species has been listed as endangered by the State of New Jersey (NJDEPE, 1990) and as threatened or endangered by the Pinelands Commission (Pinelands Commission, 1987). Figure 1 shows the range of swamp pink in New Jersey relative to the NPL sites. Since 1980, populations have been confirmed in eleven counties: Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Middlesex, Monmouth, Morris, Ocean and Salem (USFWS, 1991). A historical record is known from Mercer County (Rutgers University, Chrysler Herbarium, 1992).

2. Description

Swamp pink is a perennial herb of the lily family (Liliaceae) (USFWS, 1992) with an evergreen basal rosette of six to twelve, flat, parallel-veined, lanceolate to elongate, spatulate leaves, 0.9-2.5 decimeters (dm) long to 2-4 centimeters (cm) wide, narrowed to a broad petiole (Figure 2). Leaves at time of flowering are not more than one fifth the size they afterwards attain (NJNHP, 1990) typically increasing in length to 4 dm or more as the season progresses. During the winter months, the leaves lie flat or slightly raised from the ground, and are often hidden by fallen leaf litter (USFWS, 1992). In the center of the rosette, the flowerhead and leaves of the next season are tightly rolled together appearing like a large button (Brown, 1910). The winter leaves, although evergreen, often turn reddish brown in color (USFWS, 1992) or are edged or tipped with brown (Brown, 1910). Newly emerging spring leaves are bright green in color (Peterson, 1990).

The inflorescence is a terminal raceme consisting of 30-50 (37.5 mean) fragrant flowers each about 1 cm wide produced in early spring atop a hollow scape (Sutter, 1982). The entire infloresence is 3-10 cm long and about 3 cm thick (NJNHP, 1990). Individual flowers have pedicels which are very short at first, elongating to 4-8 millimeters (mm). The perianth is composed of six spatulate-oblong, pink to lavender segments that are 5-9 mm long and 1-2 mm wide. As the inflorescence elongates, the perianth persists and retains a pink color suffused with green (USFWS, 1991). The sparsely bracteate, blue-green scape arises from the basal rosette and may grow from a height of 2-9 dm at the time of flowering to 1.5 meters (m) at the time of

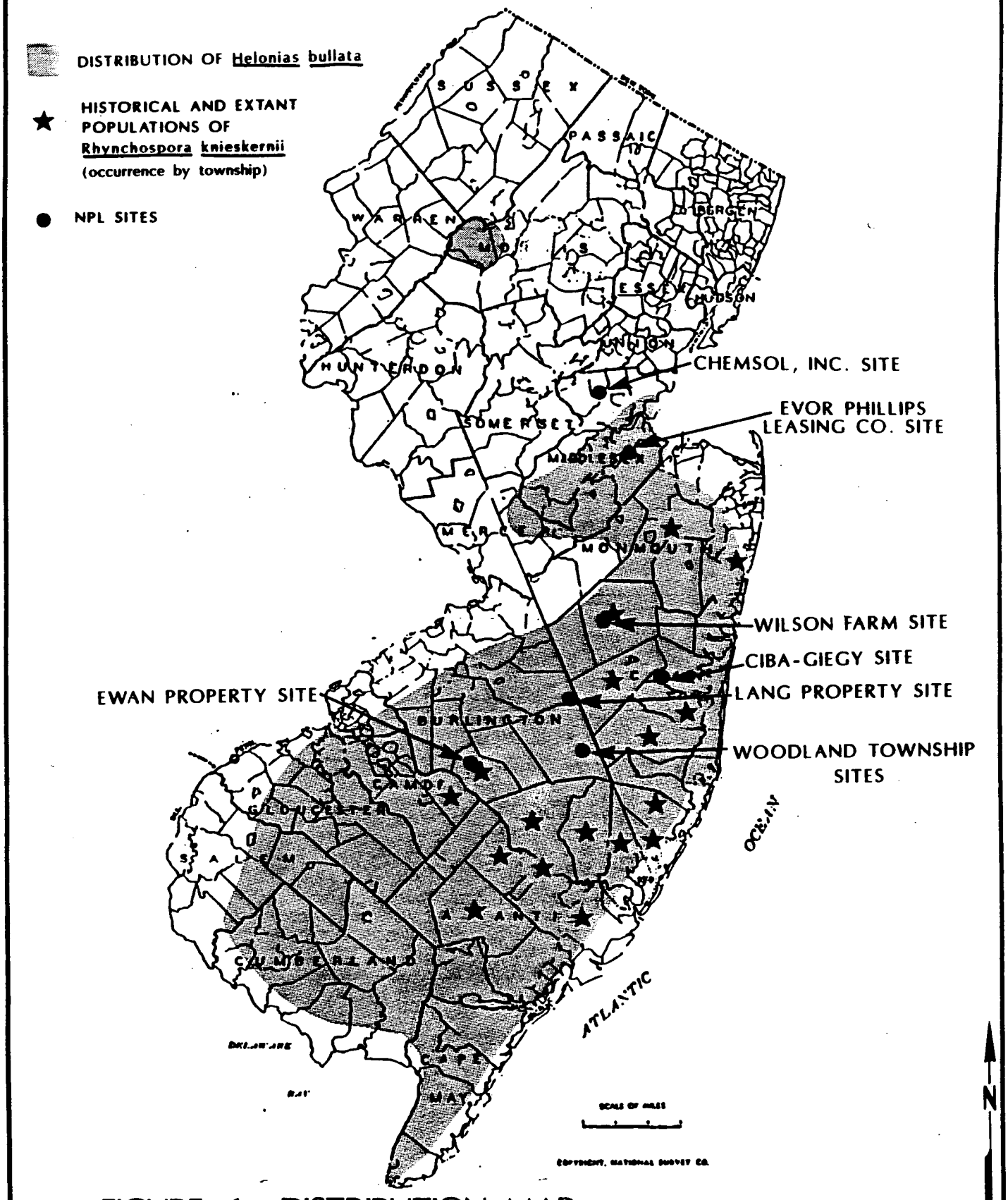

FIGURE 1 : DISTRIBUTION MAP FOR SWAMP PINK AND KNIESKERN'S BEAKED-RUSH IN NEW JERSEY

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seed maturation (USFWS, 1991). Plants bloom as early as March and often the flowers last until May, with seed production occurring in June (USFWS, 1991).

The fruit capsule is 3-lobed, papery, 3-5 mm long and 8-10 mm wide, with an inverted heart shape and consisting of many ovules. The ovule opens into six lobes releasing linear-shaped seeds that are 5 mm long with appendages at both ends (USFWS, 1991). A line drawing of the plant is presented in Figure 2.

3. Habitat Requirements

Swamp pink is an obligate hydrophyte (USFWS, 1992). The technical manuals typically describe swamp pink habitat as swamps and bogs (Stone, 1911; Gray, 1950; Britton & Brown, 1952; Gleason, 1963; Hough, 1983). In Brown's 1910 description of the species, he notes its occurrence in New Jersey as in shady swamps on headwater streams and cold swamps in the pines. According to Brown (1910) "...Helonias thrives best in a shaded swamps, often in a tangle of cat-briar and alder, where its roots may go deep into the soft muck." More specific habitats are recorded in the USFWS, National Wetlands Inventory (NWI) database (1992). In addition to swamps and bogs, the following habitats are noted: low woods; open deciduous swamps; cedar swamps; spruce bogs; acid bogs; acid woods; and sphagnous woodlands. The USFWS Recovery Plan for swamp pink (1992) notes its habitat as: swampy forested wetlands bordering meandering streams; headwaters wetlands; sphagnous, hummocky, dense Atlantic white cedar swamp; Blue Ridge swamps; meadows; bogs; and spring seepage areas.

The habitats listed above have a common hydrology characterized by frequently or permanently saturated soils. In addition, as noted by Brown (1910), associated soils are usually organic mucks. The mucks may overlie a sandy or gravelly subsoil (Sutter, 1982; USFWS, 1992). Such soils are poorly or very poorly drained with a seasonal high water table at the surface for long or very long periods.

Table 1 presents vegetative associates of swamp pink identified in the USFWS Recovery Plan (1992). Based on the Contractor's experience in New Jersey, swamp pink occurs in red maple- or Atlantic white cedar-dominated wooded swamps. Subordinate canopy species include black gum and sweetbay. These swamps are also characterized by a very dense woody understory that

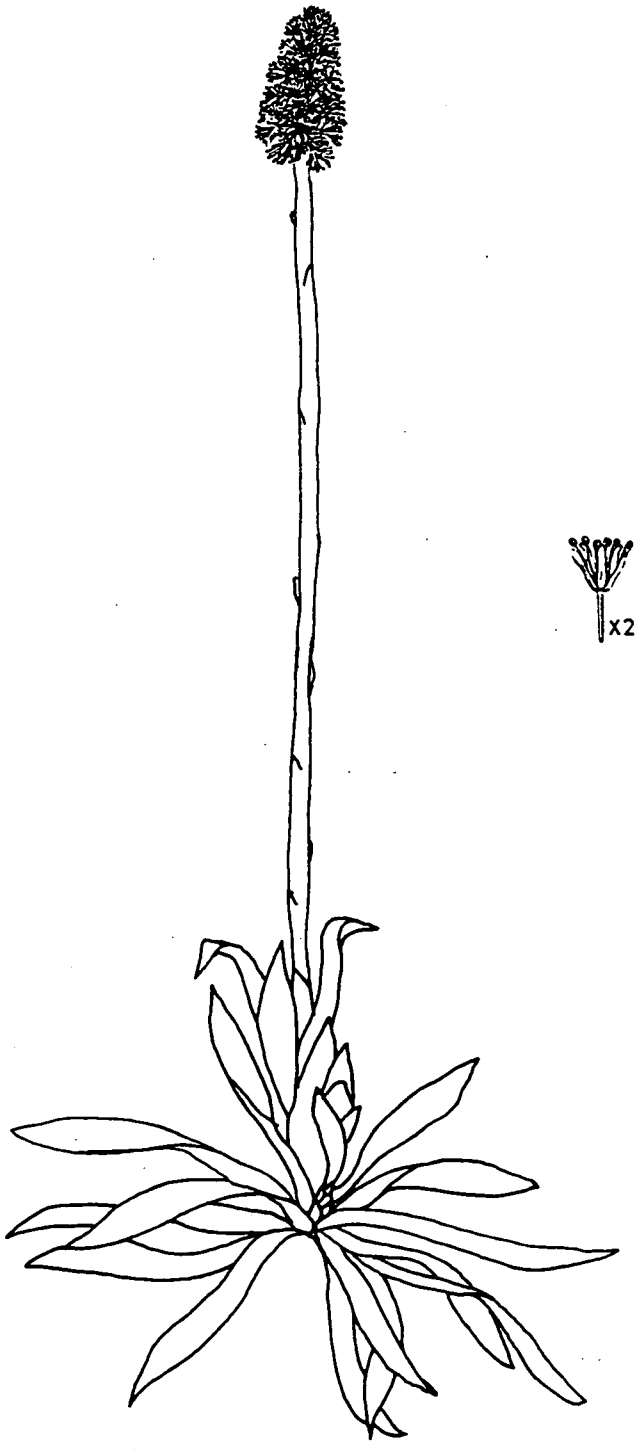

FIGURE 2 : LINE DRAWING OF SWAMP PINK (Helonias bullata)

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TABLE 1

Vegetation Associates of *Helonias bullata* [1]

Trees	
Acer rubrum	Red maple
Chamaecyparis thyoides	Atlantic white cedar
Larix lariciana	Amercian larch
Magnolia virginiana	Sweetbay magnolia
Nyssa sylvatica	Black gum
Picea mariana	Black spruce
Picea rubens	Red spruce
Pinus rigida	Pitch pine
Pinus strobus	Eastern white pine
Tsuga canadensis	Eastern hemlock
Shrubs	
Alnus serrulata	Red alder
Ilex ambigua	Caroline holly
Ilex verticillata	Winterberry
Kalmia latifolia	Mountain laurel
Lindera benzoin	Spicebush
Rhododendron arborescens	Smooth azalea
Rosa palustris	Swamp rose
Sambucus canadensis	Elderberry
Vaccinium constablei	Mountain blueberry
Vaccinium corymbosum	Highbush blueberry
Viburnum cassinoides	Witherod
Herbs	
Aster puniceus	Purple-stemmed aster
Aster radula	Rough-leaved aster
Carex collinsii	Collins' sedge
Carex folliculata	Long sedge
Carex muricata	Lesser prickly sedge
Clintonia borealis	Yellow clintonia
Coptis trifolia	Gold thread

Table 1 (continued)

Herbs(continued)	
Equisetum sylvaticum	Equisetum
Lycopus virginicus	Virginia bugleweed
Orontium aquaticum	Golden club
Osmunda cinnamomea	Cinnamon fern
Sphagnum spp.	Sphagnum moss
Symplocarpus foetidus	Skunk cabbage

[1]Source: USFWS Swamp Pink Recovery Plan (1992)

includes sweet pepperbush, swamp azalea (Rhododendron viscosum), winterberry, highbush blueberry, swamp sweetbells (Leucothoe racemosa), smooth alder, sweetbay, greenbrier and bayberry (Myrica sp.). Hebaceous associates include pitcher plant (Sarracenia purpurea), blue flag iris (Iris versicolor), golden club, cinnamon fern, swamp dewberry (Rubus hispidus), swamp candles (Lysimachia terrestris), Virginia chain fern (Woodwardia virginiana), skunk cabbage and netted chain fern (Woodwardia areolata).

B. Knieskern's Beaked-rush

1. **Background**

Knieskern's beaked-rush (Rhynchospora knieskernii) is an annual plant endemic to the Pine Barrens region of New Jersey. The plant was first discovered by Peter D. Knieskern, M.D. in Ocean County, New Jersey in 1843 (Store, 1973) who originally labelled the specimens as Rhynchospora grayana. The species description was not published until John Carey did so in 1847 (Carey 1847), naming it after Dr. Knieskern. Currently, 27 occurrences exist in four counties of New Jersey: Atlantic, Burlington, Monmouth, and Ocean.

An early-successional, obligate hydrophyte and poor competitor, Knieskern's beaked-rush inhabits sparsely vegetated, muddy substrates of bog-iron, clay, peat, sand, and gravel. Suitable habitat is maintained in early successional stages by natural or human-induced forces. The number of extant occurrences has declined to 27 from the total record of 41 sites. The decline of this species is attributed to the loss of the required specific open habitat due to vegetative succession, development, and commercial and agricultural activities. Knieskern's beaked-rush was listed as a federally threatened species on July 18, 1991 (USFWS, 1991). The species has also been listed as endangered by the State of New Jersey (NJDEPE, 1990) and as threatened or endangered by the Pinelands Commission (Pinelands Commission, 1987). Figure 1 shows the occurrence of Knieskern's beaked-rush by township in relation to the NPL sites.

2. **Description**

Knieskern's beaked-rush is a grass-like annual member of the sedge family (Cyperaceae), although in some relatively stable habitats it may be a short-lived perennial. The plant is in fruit from late July to September. It

grows 1.5 to 60 cm high and has slender, flexuous culms branching from the base. The leaves are filiform-setaceous, involute when dry, to 1.8 mm wide, smooth, becoming serrulate on the margins and keel. The terminal fascicle of 0.4-1 cm wide and there are 2-3 lateral fascicles remote at intervals along the entire length of the culm. Spikelets are ovoid, 2-2.8 mm long, subsessile, 2-3 fruited, terminated by a sterile floret. Scales are caducous, castaneous to dark brown, lower scales apiculate, upper ones slightly so. There are six, stiffly erect, retroverse barbellate bristles, exceeding or slightly less in length than the body of the achene. The achene is obovate, 0.6-0.8 mm wide, 1.1-1.3 mm long, lenticular, biconvex, shining yellow brown in the center, then generally darker toward the margins. The tubercle is deltoid-subulate, compressed, 0.4-0.6 mm high (approximately 1/2 the length of the achene) (Gale, 1944). A line drawing of the plant is presented in Figure 3.

3. **Habitat Requirements**

Knieskern's beaked-rush is an obligate hydrophyte that occurs in groundwater influenced, constantly fluctuating environments. It is an early-successional species that is apparently intolerant of shade and competition, especially from woody species, and is generally found on relatively bare substrates with sparse vegetation and limited duff. Thus the species requires some disturbance for successful colonization, establishment, and maintenance. The vegetative associates of Knieskern's beaked-rush identified in the USFWS Draft Recovery Plan (1992) are presented in Table 2. All the associates listed are herb species except for cranberry.

The oldest records (1800's) for the species are from populations that were found on bog-iron substrates, a naturally-maintained, early-successional habitat found in eroded areas along the slow-moving streams of the New Jersey pine barrens region. Thus, Gray's Manual gives its habitat as on iron-ore in the pine barrens (Fernald, 1970); Stone (1911) as the pine barrens region confined to bog iron deposits; and Hough (1983) as wet soil of pineland bogs over iron deposits. Britton & Brown (1952) and Gleason (1963) give its habitat as simply pine barren bogs. However, locational information from the early 20th century also documents the existence of Knieskern's beaked-rush in human-altered early successional habitats such as rights-of-ways and borrow pits (Hirst, 1958; New Jersey Natural Heritage Program, 1989).

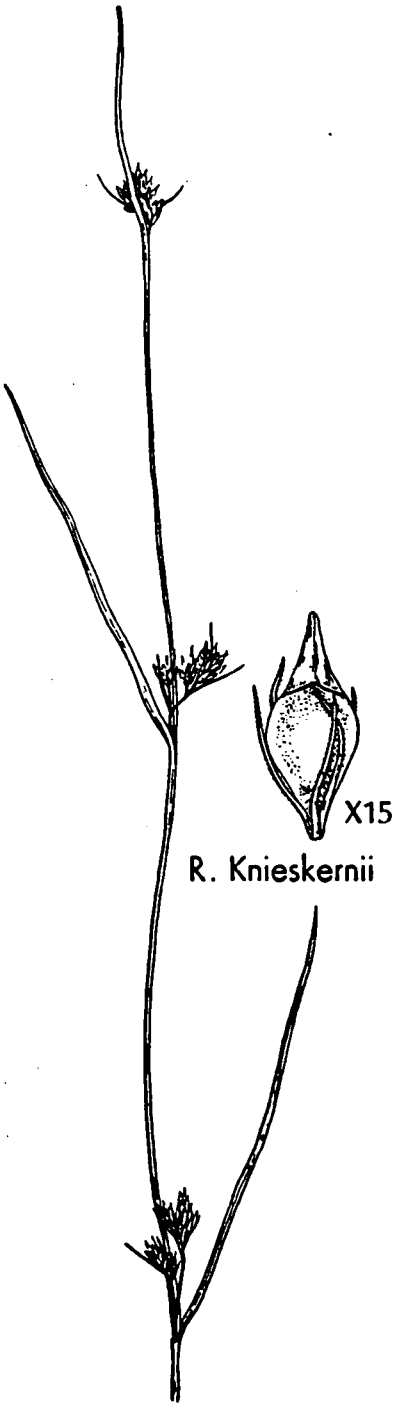

FIGURE 3 :
LINE DRAWING OF KNIESKERN'S
BEAKED-RUSH (Rhynchospora knieskernii)

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TABLE 2

Vegetation Associates of Rhynchospora knieskernii[1]

Asistida longespica	Three-awned grass
Aristida virgata	Wand-like three-awned grass
Calamovilfa brevipilis	Pine barren reedgrass
Cyperus dentatus	Flatsedge
Drosera filiformis	Sundew
Drosera intermedia	Sundew
Gentiana autumnalis	Pine barren gentian
Eupatorium leucolepis	Boneset
Hypericum canadense	St. John's-wort
Juncus caesariensis	New Jersey rush
Lobelia nuttallii	Nuttall's lobelia
Lycopodium carolinianum	Slender clubmoss
Muhlenbergia torreyana	Pine barren smoke grass
Muhlenbergia uniflora	Smoke grass
Narthecium americanum	Bog asphodel
Rhexia virginica	Meadow beauty
Rhynchospora capitellatta	Beaked-rush
Rhynchospora chalarocephala	Beaked-rush
Rhynchospora pallida	Pale beaked-rush
Rhynchospora torreyana	Torrey's beaked-rush
Schizaea pusilla	Curly grass fern
Scleria minor	Slender nut rush
Scleria reticulari var. pubescens	Nut rush
Vaccinium macrocarpon	Cranberry

[1]Source: USFWS Draft Knieskern's Beaked-rush Recovery Plan (1992)

Most of the extant occurrences for this species (22 of 27) are in an early-successional stage due to human distrubance. These sites include abandoned clay pits and borrow pits, ditches, unimproved roads, and rights-of-way. These sites require periodic human-induced disturbance to maintain their early successional character. Recent searches for this species identified Pocomoke soils as being particularly productive in the identification of new populations in Atlantic County (USFWS, 1992). Pocomoke soils are also distributed in adjacent Cape May, Cumberland, Gloucester, Camden and Burlington Counties. Pocomoke soils are very poorly drained, with a seasonal high water table at the surface for long or very long periods. They are classified as hydric soils, by the National Technical Committee for Hydric Soils (1990). Soils with similar properties include the Mullica and Atsion series (Kingsbury, personal communication, 1992).

III. SITE DESCRIPTIONS

This chapter provides descriptions of each of the eight NPL sites identified by the USFWS as of concern for swamp pink and Knieskern's beaked-rush. These sites and their corresponding section are:

A. Wilson Farm, Plumstead Township, Ocean County
B. Woodland Township/Route 532, Burlington County
C. Woodland Township/Route 72, Burlington County
D. Chemsol Inc., Piscataway Township, Middlesex County
E. Evor Phillips Leasing, Old Bridge Township, Middlesex County
F. Ewan Property, Shamong Township, Burlington County
G. Ciba-Geigy, Dover Township, Ocean County
H. Lang Property, Pemberton Township, Burlington County

The site descriptions represent a synthesis of information pertaining to existing conditions on each of the sites. Sources of information include but are not limited to:

- Interviews with the EPA Remedial Project Managers (RPMs) for each of the sites.
- RI/FS Reports and Records of Decision (RODs) for the sites;
- Existing mapping for each of the sites including:
  - United States Geological Survey (USGS) 7.5 minute series topographic quadrangles;
  - USFWS National Wetlands Inventory (NWI) mapping;
  - U.S. Department of Agriculture, Soil Conservation Service (SCS) County Soil Surveys;
  - New Jersey Freshwater Wetlands Mapping, prepared pursuant to the New Jersey Freshwater Wetlands Protection Act, where available;
  - Pine Barrens Vegetation Geography mapping prepared for the New Jersey State Museum (McCormick and Jones, 1973), where appropriate;
- Aerial photographs where available; and
- Miscellaneous site specific reports, where available.

For the purposes of this discussion, the site refers to the area of the dumping, stockpiling of waste, etc. In some cases this area is referred to by municipal block and lot. The study area, on the other hand, refers to the area of contamination, i.e., the area subject to direct impacts due to the proposed remediation plan. Typically, the study area is larger than, and inclusive of, the site.

The following sections describe the sites and study areas in the context of their potential to support populations of swamp pink or Knieskern's beaked-rush. A general site description and brief history is provided, including the current remediation proposals, followed by a description of the existing mapping for the site and a description of any other relevant previous on-site habitat studies.

A. Wilson Farm

1. **Site Description and History**

The Wilson Farm site is a 10-acre area (Acres, 1991) of unauthorized dumping on land known as Block 76, Lot 63 located in Plumsted Township, Ocean County, New Jersey (Figure 4A). The site is located in a rural portion of Ocean County, with the nearest town, New Egypt, located 4 miles west of the site. The site is approximately 1,000 feet west of Hawkin Road (State Rt. 640) and approximately one mile south of the intersection of Hawkin Road and New Egypt-Lakewood Road (State Rt. 528). An unimproved access road leads from Hawkin Road to the entrance of the site. The site includes an unimproved road that follows a buried transcontinental telephone cable right-of-way near the eastern site boundary. A narrow lane curves along the western portion of the site. Bordens Run Creek forms the site's western boundary, and the eastern boundary parallels the cleared right-of-way. The northern site or study area limit is adjacent to a farm field approximately 1,500 feet north of the entrance road. The southern limit is approximately 150 feet south of the entrance road.

The Colliers Mills Wildlife Management Area is located approximately 500 feet southeast of the site. Bordens Run Creek forms the site's western boundary. Bordens Run Creek flows into an unnamed lake within the Colliers Mills Wildlife Management Area approximately 2000 feet southeast (downstream) of the site.

During the 1960s and early 1970s, Wilson Farm was one of seven sites in Plumsted Township reportedly used to dispose of liquid and rummed waste from a Thiokol Chemical (later Morton-Thiokol, Inc.) facility. The period over which dumping occurred is not known with certainty (NJDEPE, October 1986).

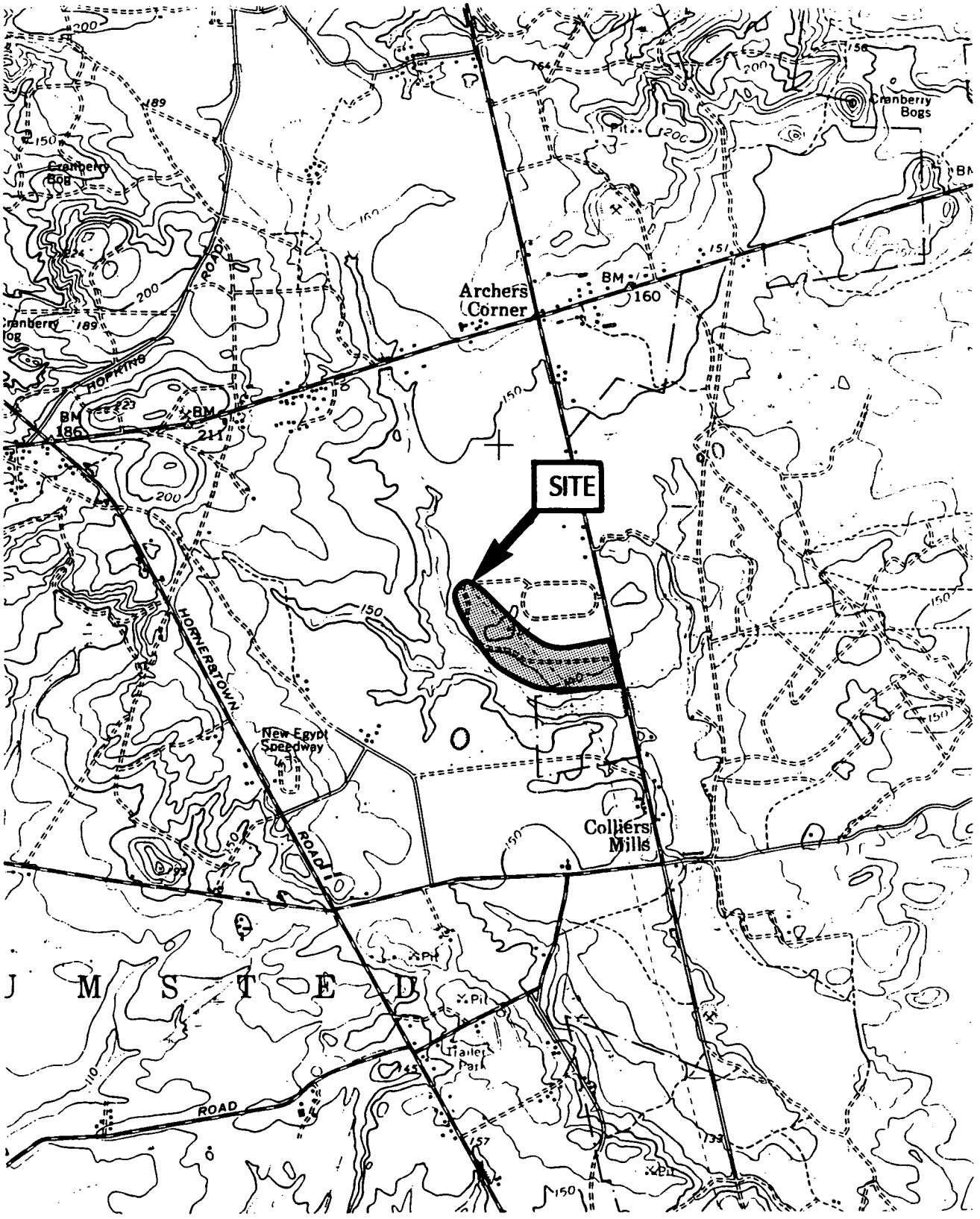

FIGURE 4A: SITE LOCATION

WILSON FARM

BOTH SITE AND STUDY AREA INDICATED BY SHADING

SOURCE: USGS; CASSVILLE, NEW JERSEY QUAD; 1971

SCALE: 1" = 2000'

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In a 1980 removal action, approximately 620 cubic yards of contaminated soil were removed along with an unreported quantity of drums and waste. Wilson Farm was added to the NPL in August, 1990.

The industrial waste is found as thin patches of tar-like, rubbery and spongey material on the ground surface. No buried waste was encountered. In places, the waste was within approximately 80 feet of Bordens Run Creek. The waste could not be classified as hazardous based on TCLP (Toxicity Characteristics Leaching Procedure) standards and other waste classification criteria. Low levels of soil and groundwater contamination were detected, but most contaminants could not be directly linked to the waste. Very low levels of stream water and sediment contamination were reported. These were not determined to be waste-related. Pesticide concentrations on site were typical of agricultural areas (Acres 1991).

2. **Proposed Remedial Action**

The NJDEPE has signed an Administrative Consent Order (ACO) with the Potentially Responsible Party (PRP). Under the terms of the ACO, the contaminated materials on site would be removed by the PRP. This constitutes the remedial action at this site.

As per discussions with Mike Burlingame, the NJDEPE Project Manager, all contaminants have at this time been removed. No further disturbance to the site is proposed other than restoration (see Soil Erosion and Sediment Control Plan prepared by IT Corporation, 1992).

3. **Existing Mapping of Environmental Conditions**

a. <u>USFWS National Wetlands Inventory (NWI) Mapping</u>

The USFWS mapping (Cassville, New Jersey Quadrangle, 1977) identifies palustrine forested wetlands characterized by broad-leaved deciduous species (PFO1) along the western boundary of the site (Figure 4B). These wetlands are mapped in association with Bordens Run Creek, within the Tom's River watershed.

b. <u>SCS Soils Mapping</u>

The Ocean County Soil Survey (1980) mapped two soil series on-site, Berryland sand and Evesboro sand (Figure 4C). The Berryland series is mapped in association with Bordens Run Creek along the site's western boundary, while

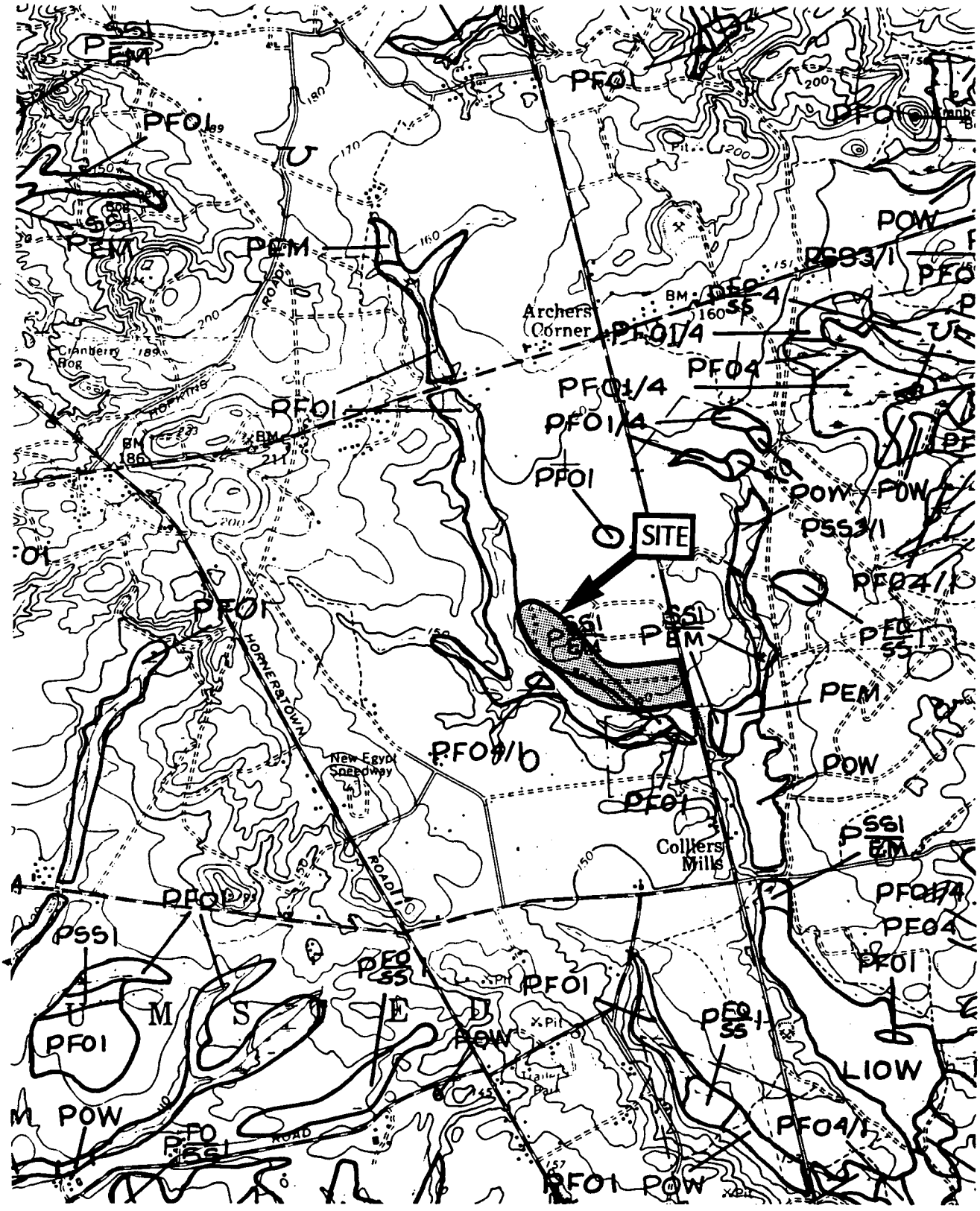

FIGURE 4B: USFWS NWI MAPPING

WILSON FARM SITE

SCALE: 1" = 2000'

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SOURCE: USFWS; CASSVILLE, NEW JERSEY QUAD; 1977

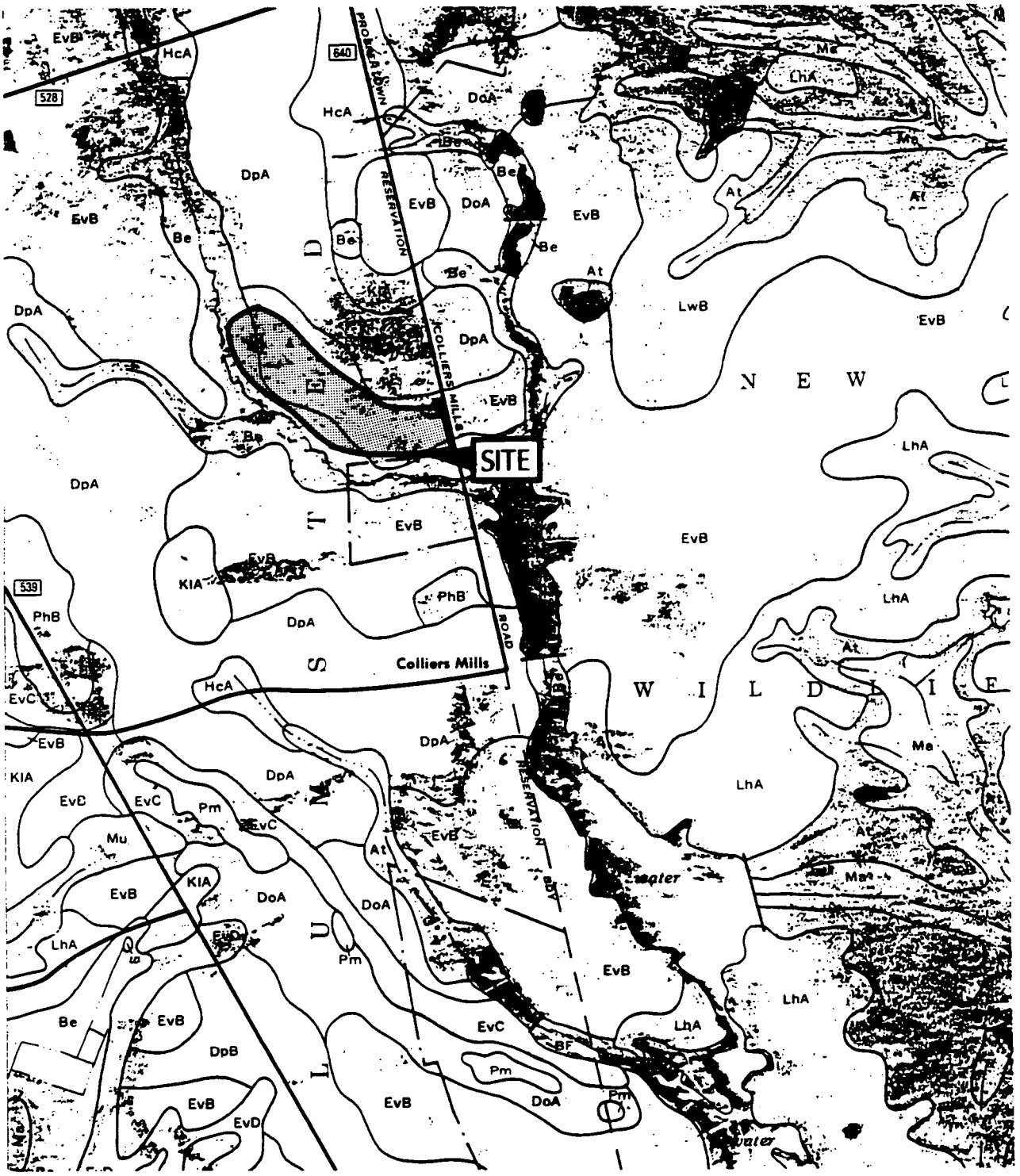

FIGURE 4C: SCS SOILS MAPPING

WILSON FARM SITE

Be: Berryland sand
EvB: Evesboro sand

SOURCE: SCS, OCEAN COUNTY SURVEY, 1980, SHEET 11

SCALE: 1" = 1660'

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the Evesboro series is mapped for the remainder of the site. The Berryland soil is a very poorly drained soil with a seasonal high water table at the surface from October to June. The Berryland soil has been classified as a New Jersey hydric soil by the National Technical Committee for Hydric Soils (1987).

c. Pine Barrens Vegetation Mapping

The vegetation mapping prepared by McCormick and Jones (1973) shows three mapping units within the Wilson Farm site (Figure 4D). The majority of the site is mapped as oak-pine forest (OP), an upland community. Hardwood swamp forest (HDW), a wetland community, is mapped along Bordens Run Creek at the site's western boundary. Agricultural land is mapped northeast of the site.

4. Previous On-site Habitat Studies

A two-day flora and fauna study of the site was conducted in May 1990 (Acres, 1991). The purpose of the study was to compile a site inventory of plants and animals and to identify any rare or endangered species or their habitat. Based on the results of the study, no rare or endangered species were observed nor did the site contain any significant habitat for rare and endangered species.

Common on-site wetland species identified by Acres (1991) included red maple, sour (black) gum, tall (highbush) blueberry, sassafras, chestnut oak, mountain laurel and coast (sweet) pepperbush. Additional species include sweetbay magnolia, cinnamon fern, skunk cabbage and sphagnum moss. Many of these species are associates of swamp pink (see Table 1).

B. Woodland Township/Route 532

1. Site Description and History

The Woodland Township Route 532 site is approximately 20 acres in size and is located on tax block 4210, lot 1 in Woodland Township, Burlington County, New Jersey (Figure 5A). The site is at the end of an unpaved access road approximately 1/8 mile south of Route 532. The unnamed site access road meets Route 532 approximately 1 1/8 miles west of the intersection of Route 532 and Route 72. Goodwater Run, an intermittent stream, and Bayley Road border the site to the east. An unpaved forest fire control road runs along the southern edge of the site. The site is situated within a "special

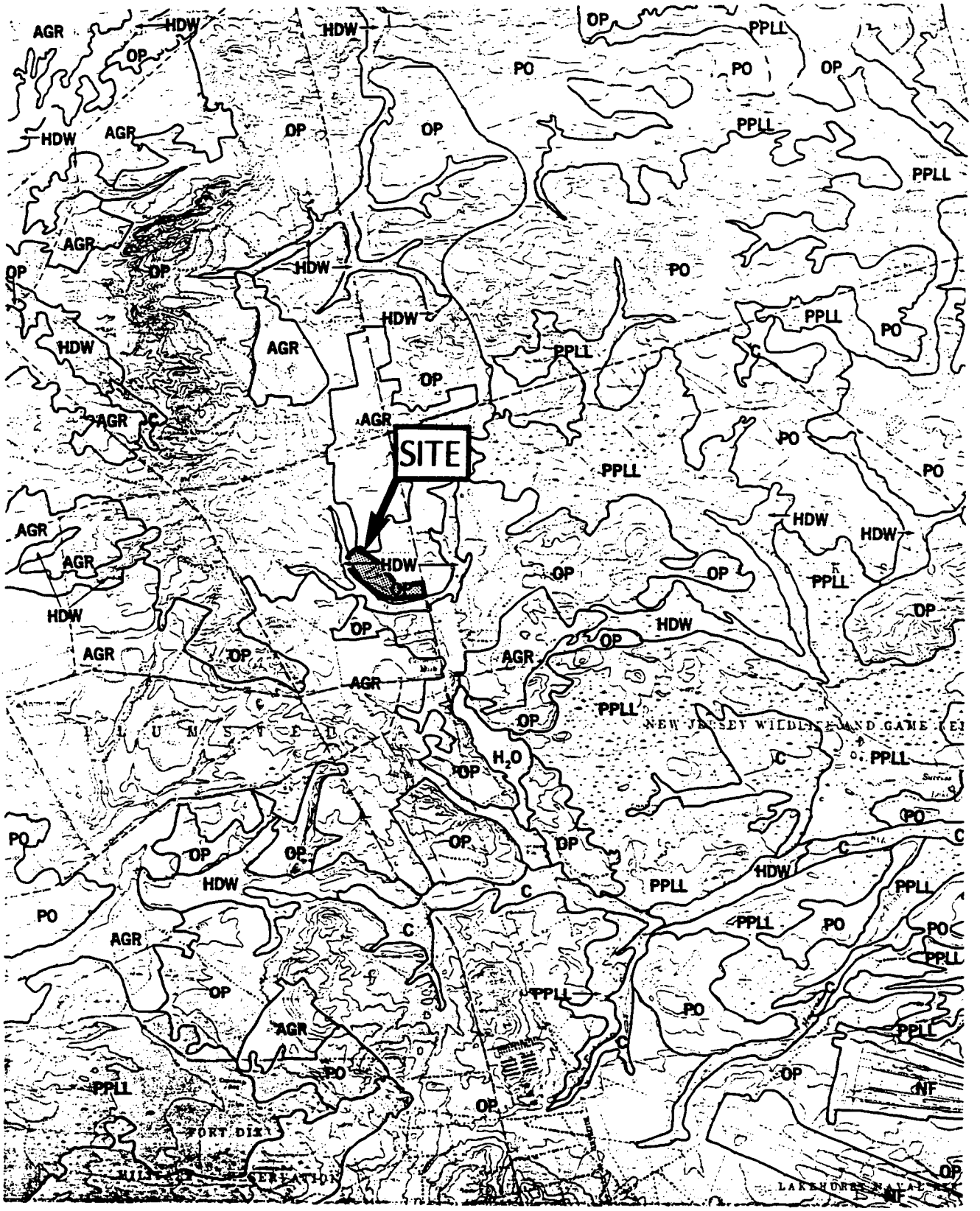

FIGURE 4D: PINE BARRENS MAPPING

WILSON FARM SITE

AGR: Agricultural land
HDW: Hardwood swamp forest
OP: Oak-pine forest

SOURCE: McCORMICK & JONES, 1973, SHEET 12

SCALE: 1" = 4000'

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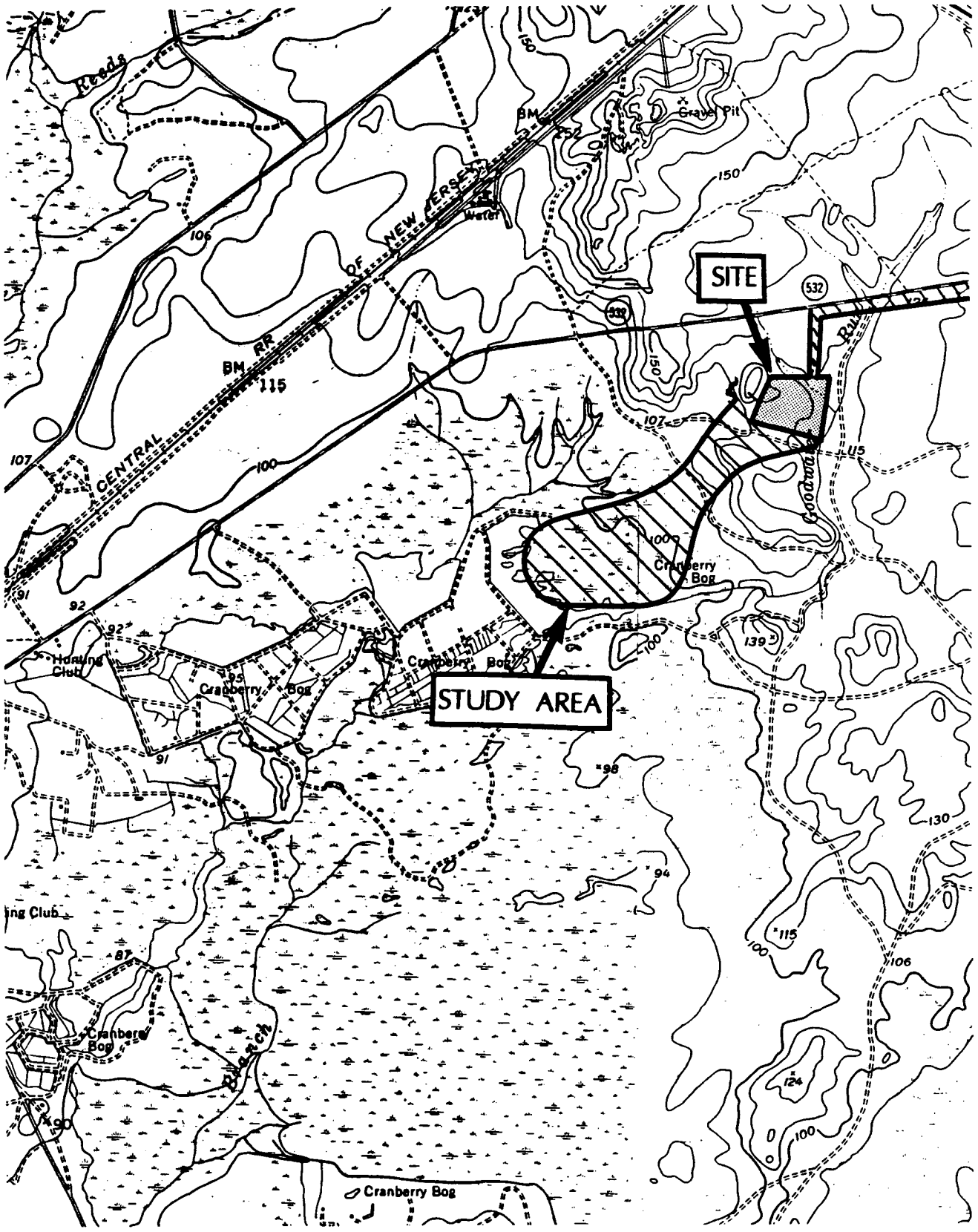

FIGURE 5A: SITE LOCATION
WOODLAND TOWNSHIP - ROUTE 532

SCALE: 1" = 2000'

SOURCE: USGS; CHATSWORTH/WOODMANSIE, NEW JERSEY QUADS; 1957

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agricultural area" of the Preservation Area District of the New Jersey Pinelands. Active commercial cranberry bogs are located approximately 1 mile west-southwest of the site.

An aerial photograph from 1951 shows that a pine forest existed in the study area prior to the beginning of disposal operations. The exact date disposal began is unknown. It is estimated to have begun between 1951 and 1956 and to have continued until 1962. No site controls were in place from 1962 to 1986. In 1986, PRPs constructed a security fence to restrict site access.

The NJDEPE was advised of environmental problems at the site by the Burlington County Health Department in April 1979. The NJDEPE conveyed the information to the EPA. The Woodland Township/Route 532 site was placed on the NPL during September, 1983.

2. **Proposed Remedial Action**

The Remedial Investigation (RI) for the site identified contamination of the surface and subsurface soils as well as groundwater (ROD Summary 1990). The groundwater contaminant plume originating at the Route 532 site is located at a depth between 25 feet and 50 feet and is moving in a southwesterly direction at a rate of 2.1 feet per day. The plume is approximately 4,000 feet in length, 500 to 1500 feet in width, and discharges to a cranberry bog and adjacent bog reservoirs (Woodlands Private Study Group, 1992). Figure 5A illustrates the extent of the Route 532 contaminated groundwater plume. The area of the site and plume constitute the study area for this investigation.

The proposed remedial action for surface materials at the site is the removal of these materials and disposing of them at an acceptable off-site facility. The contaminated subsurface soils will be the subject of a future study and remedial action.

The proposed groundwater remedial action involves the installation of a groundwater recovery and treatment system, consisting of air stripping, metals removal, biological treatment, and advanced oxidation or carbon adsorption. The treated groundwater would be discharged immediately upgradient of the

disposal areas via re-injection wells or infiltration basins. Pumping and treatment of the groundwater would proceed until the remedial goals for the aquifer are met, which is expected to take approximately 30 years. Remediation at this site is closely linked to remediation at the Woodland Township/Route 72 site. One alternative being considered is to construct one treatment facility for both sites. In that case, a pipeline, connecting the sites via Routes 532 and 72, would be constructed.

Discussions with the NJDEPE site managers, Gwen Burranus and Steve McGregor indicate that impacts as a result of the proposed groundwater recovery and treatment system have not yet been fully defined. Additionally, the location and types of support facilities have not been determined.

3. **Existing Mapping of Environmental Conditions**

a. USFWS NWI Mapping

According to the NWI mapping (USFWS, Chatsworth and Woodmansie Quadrangles, 1977), palustrine scrub/shrub wetlands characterized by needle-leaved evergreen and broad-leaved deciduous species (PSS4/1) are mapped along Goodwater Run in the southeast corner of the site (Figure 5B). In addition, the study area has four wetland communities mapped. These wetlands are mapped in distinct zones along an elevational gradient. Beginning at the higher end of the gradient (closest to the site), palustrine forested/ scrub-shrub wetlands characterized by needle-leaved evergreen species (PFO/SS4) are mapped; followed by a zone of palustrine forested wetlands characterized by needle-leaved evergreens (PFO4); followed by palustrine scrub-shrub wetlands characterized by needle-leaved evergreens (PSS4). At the low end of the gradient, lacustrine limnetic open water wetlands are mapped. These correspond to the reservior used in downstream cranberry production.

b. SCS Soils Mapping

The soils mapping prepared by the SCS in the Burlington County Soil Survey (1971) identifies one land type on-site and four soil series and one land type (muck) within the study area (Figure 5C). The mapping unit shown on-site is a land type know as Made land, sanitary fill. This land type consists of areas used for disposal, then covered by soil.

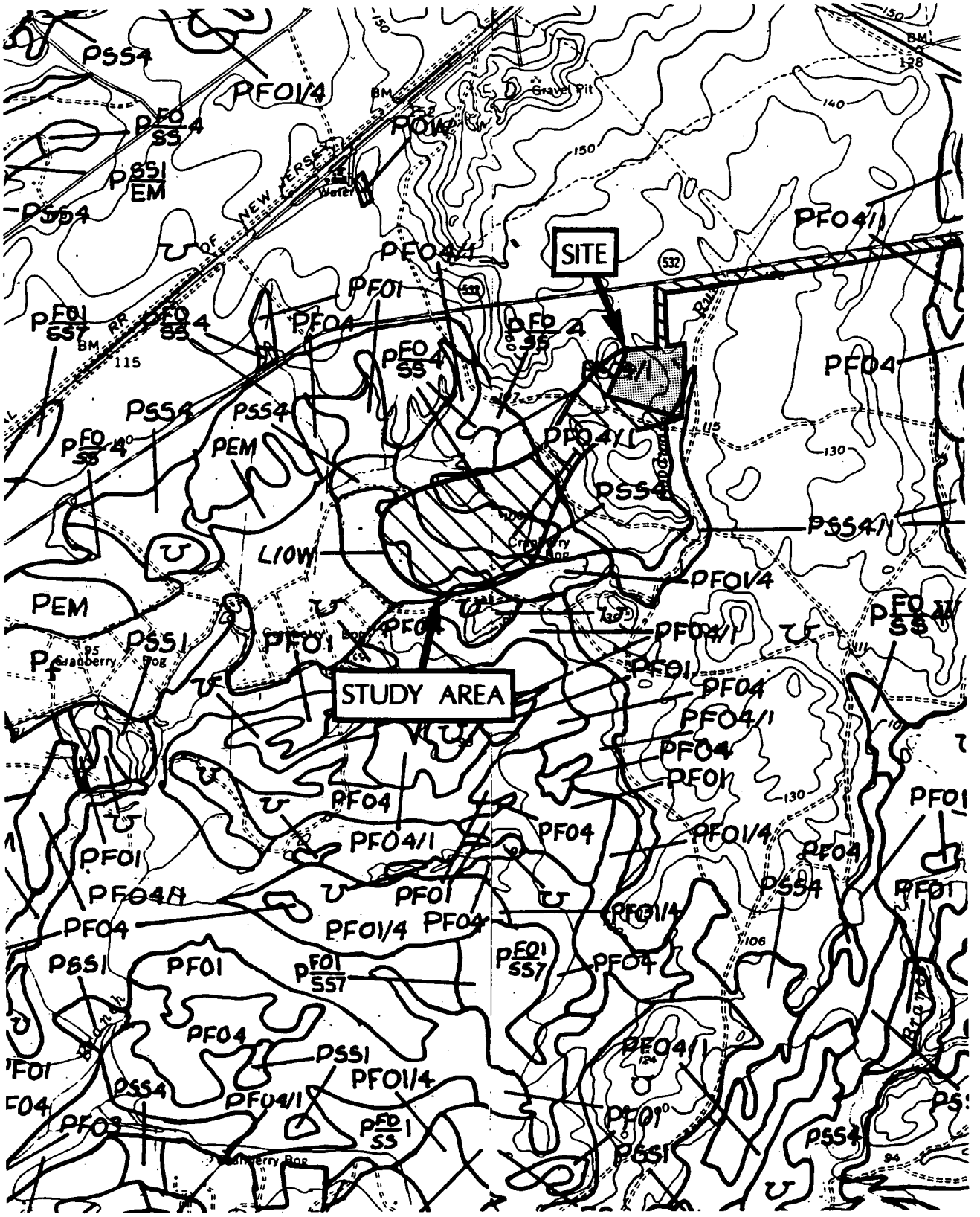

FIGURE 5B: USFWS NWI MAPPING

WOODLAND - ROUTE 532 SITE

SOURCE: USFWS; CHATSWORTH/WOODMANSIE, NEW JERSEY QUADS; 1977

SCALE: 1" = 2000'

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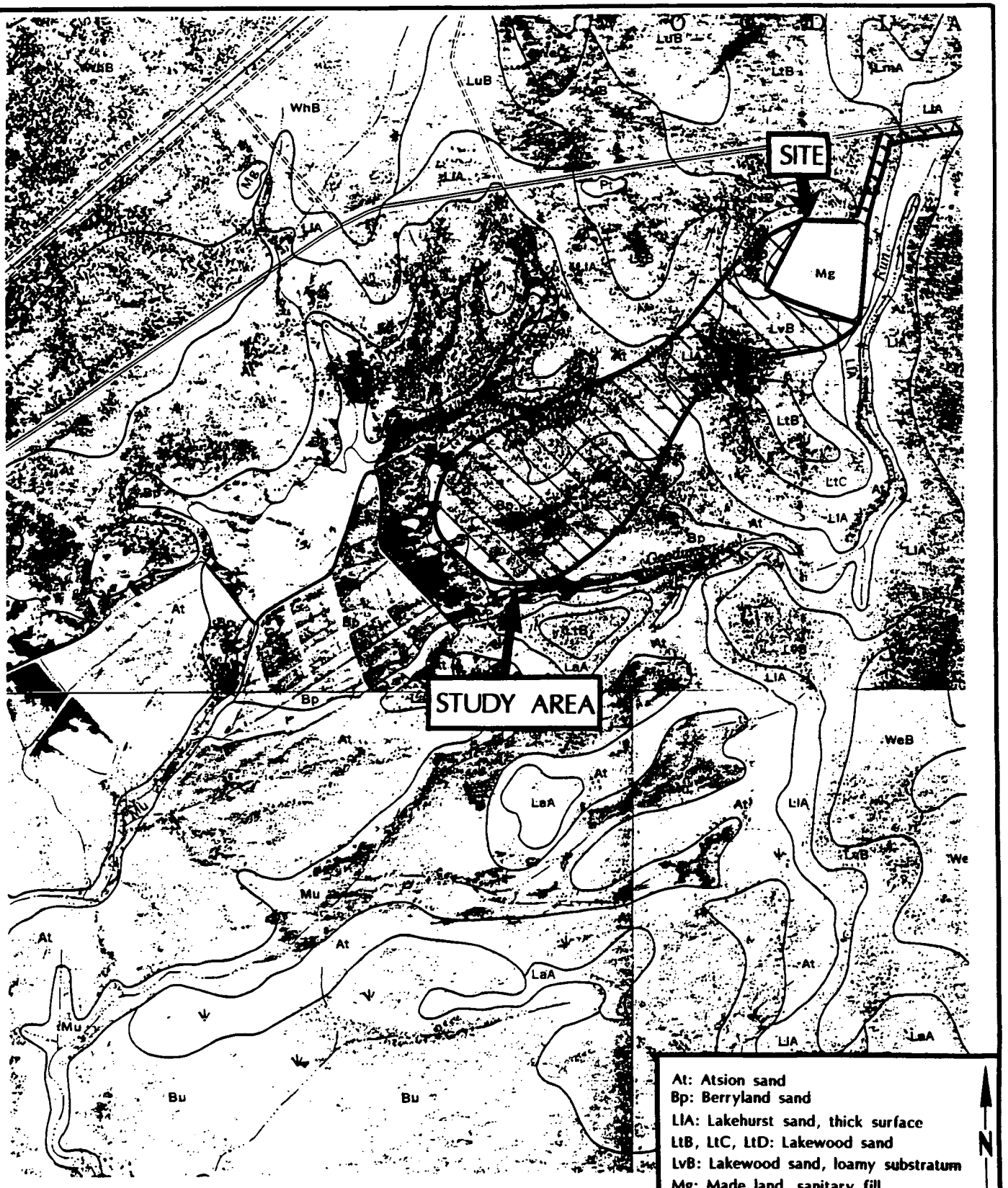

FIGURE 5C: SCS SOILS MAPPING

WOODLAND - ROUTE 532 SITE

SOURCE: SCS, BURLINGTON COUNTY SURVEY, 1971, SHEETS 65 & 72

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Lakewood, Lakehurst, Atsion, Berryland and Muck soils are mapped within the study area. These soils form a natural catena along an elevational gradient from higher (Lakewood) to lower (Muck). Atsion soils are poorly drained with a seasonal high water table at 1 foot. Berryland and Muck soils are very poorly drained with a seasonal high water table at the surface. Atsion, Berryland and Muck soils have been classifed as hydric soils by the National Technical Committee for Hydric Soils (1987).

c. Pine Barrens Vegetation Mapping

The maps of pine barrens vegetation prepared by McCormick and Jones (1973) identify the site and a portion of the study area as being pine-oak forest (PO), an upland community (Figure 5D). The remainder of the study area is mapped as being within pitch-pine lowlands (PPLL), a wetland community. hardwood swamp forest (HDW), another wetland community, is mapped along Goodwater Run.

4. **Previous On-site Habitat Studies**

A prelimary environmental assessment of the impacts of the proposed remediation plan has been conducted (ASGEC, 1992). The limits of the project area investigated were defined by the areas of proposed disturbance, the areas between the proposed roads and pipelines, the proposed treatment plant area(s); plus a 300-foot buffer extending out from potential areas of construction activities. This project area included the site and the groundwater contamination plume. Threatened and endangered plants were sought; however, no methodology is presented. Swamp pink and Knieskern's beaked-rush were not identified.

In 1990, Wander Ecological Consultants conducted an ecological assessment of the area immediately outside of the fenced site perimeter. No federally threatened or endangered species of flora or fauna were observed.

C. Woodland Township/Route 72

1. **Site Description and History**

The Woodland Township/Route 72 site is approximately 12 acres in size and located on tax block 5501, lot 15 and tax block 6301, lot 1 in Woodland Township, Burlington County, New Jersey (Figure 6A). The site is 1/4 mile south of Route 72 along Crawley Road. Crawley Road, an unpaved road, is

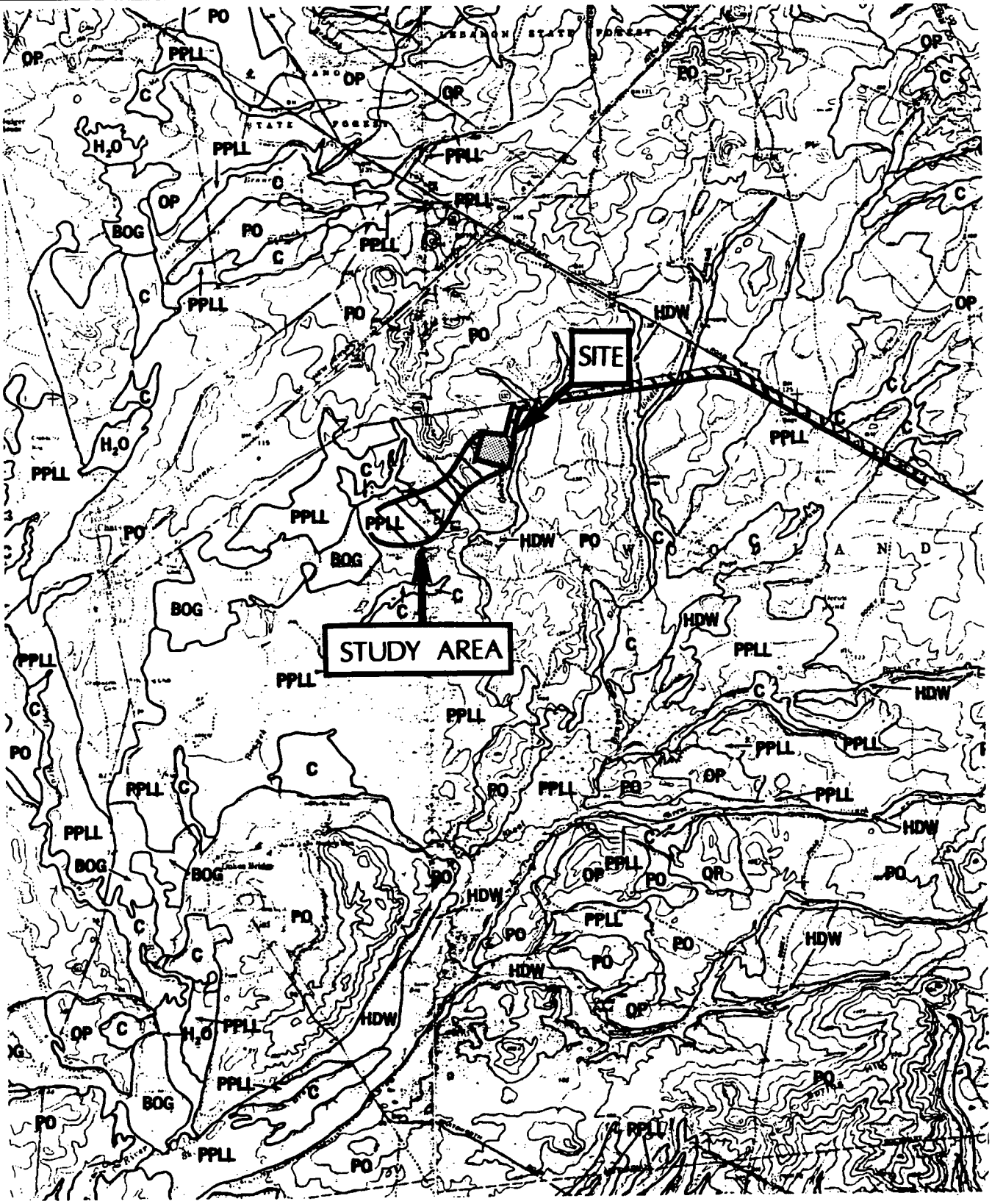

FIGURE 5D: PINE BARRENS MAPPING

WOODLAND - ROUTE 532 SITE

PO: Pine-oak forest
PPLL: Pitch pine lowland forest

SCALE: 1" = 4000'

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SOURCE: McCORMICK & JONES, 1973, SHEETS 27 & 28

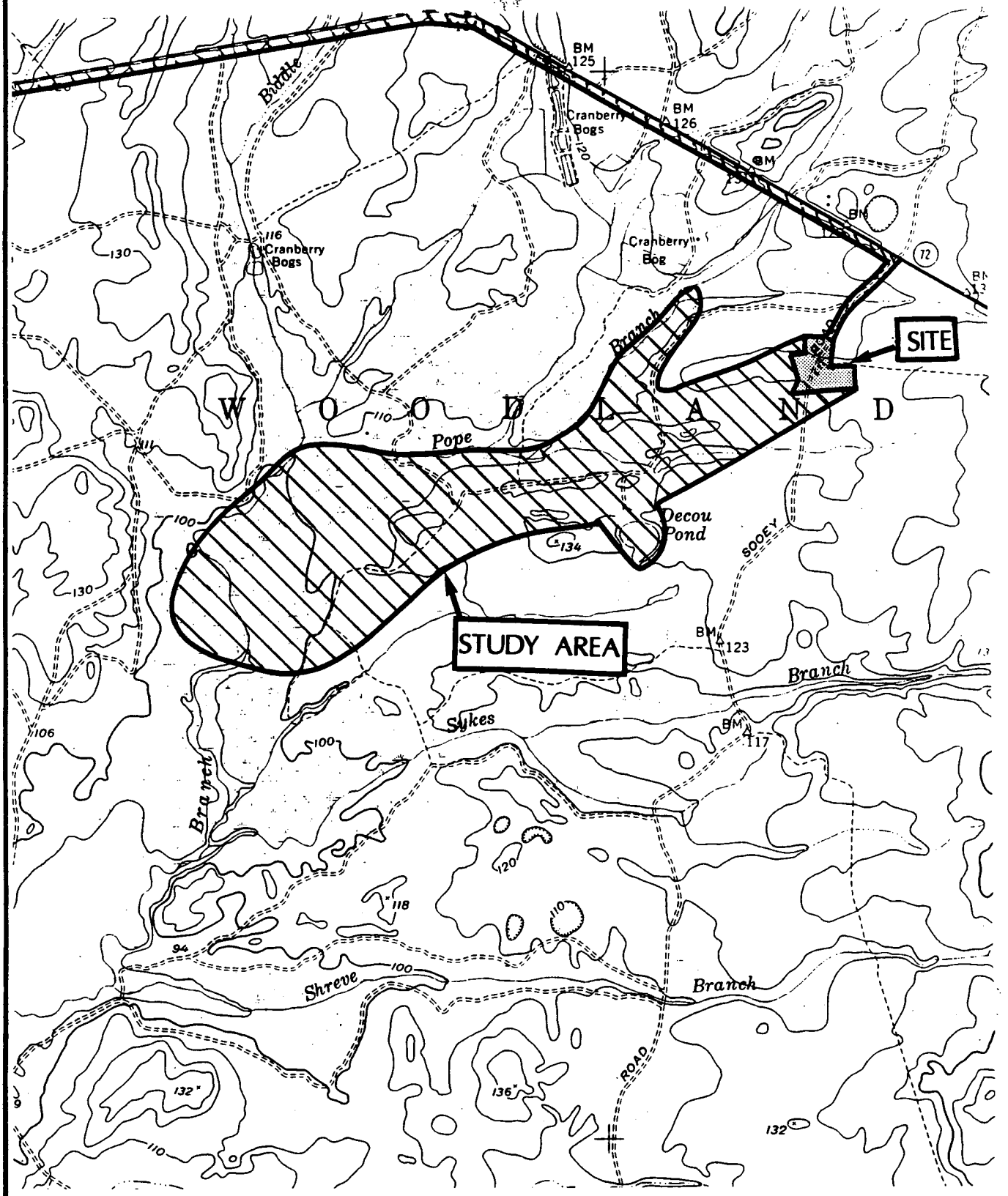

FIGURE 6A: SITE LOCATION

WOODLAND TOWNSHIP - ROUTE 72

SOURCE: USGS; WOODMANSIE, NEW JERSEY QUAD, 1957

SCALE: 1" = 2000'

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labeled as Sooey Road on USGS maps. Crawley Road meets Route 72 approximately 1 1/3 mile southeast of the intersection of Route 532 and Route 72. Previously, Crawley Road bisected the site and denoted the border between tax block 5501, lot 15 and tax block 6301, lot 1. Currently, Crawley Road is diverted around the fenced portion of the site. Pope Branch, an intermittent stream, is located approximately 500 feet to the north and 1,000 feet west of the site. The site is situated in the Pineland Preservation Area District. A "special agricultural area" with active commercial cranberry bogs is located approximately 1/2 mile northwest of the site.

A 1951 aerial photograph of the site illustrates conditions prior to the waste disposal operation. Some development including probable concrete pads, possible basement space, a utility building and sidewalk were observed. Dumping began between 1951 and 1956 and continued until 1962.

The site was uncontrolled between 1962 and 1986. In 1986, PRPs constructed a security fence to restrict site access.

The NJDEPE was advised of environmental problems at the site by the Burlington County Health Department in April 1979. The NJDEPE conveyed the information to the EPA. The Woodland Township/Route 72 site was placed on the NPL during September, 1983.

2. **Proposed Remedial Action**

The RI for the site identified contamination of the surface and subsurface soils as well as groundwater (ROD Summary 1990). The groundwater contaminant plume originating at the Route 72 site is located at a depth between 70 feet and 120 feet and is moving in a southwesterly direction at a rate of 1.2 feet per day. The plume is approximately 9,000 feet in length, 1,000 to 2,000 feet in width (Woodlands Private Study Group, 1992). Figure 6A illustrates the extent of the Route 72 contaminated groundwater plume. The area of the site and plume constitute the study area for this investigation. Additionally, in case the one treatment plant option for this and the previous site is pursued, a proposed connection area along Routes 532 and 72 between the two Woodland sites was included in the study area.

The proposed remedial action for surface materials at the site is the removal of these materials and disposing of them at an acceptable, off-site facility. The contaminated subsurface soils will be the subject of a future study and remedial action.

The proposed groundwater remedial action involves the installation of a groundwater recovery and treatment system consisting of air stripping, metals removal, biological treatment, and advanced oxidation or carbon adsorption.

The treated groundwater would be discharged immediately upgradient of the disposal areas via re-injection wells or infiltration basins. Pumping and treatment of the groundwater would proceed until the remedial goals for the aquifer are met, which is expected to take approximately 30 years.

As per conversations with the NJDEPE site managers, Gwen Burranus and Steve McGregor, impacts of the proposed groundwater recovery and treatment system have not yet been fully analyzed. Additionally, the types and location of proposed support facilities have not been determined.

3. **Existing Mapping of Environmental Conditions**

a. <u>USFWS NWI Mapping</u>

According to the NWI mapping (USFWS, Woodmansie Quadrangle, 1977), no wetlands occur within the site (Figure 6B). The study area is mapped as a mosaic of wetlands and uplands. Palustrine forested wetlands characterized by needle-leaved evergreen species (PFO4) are mapped associated with Shoal Branch and Pope Branch. The remaining wetlands mapped within the study area include: palustrine forested wetlands characterized by broad-leaved deciduous species (PFO1); palustrine forested wetlands characterized by both needle-leaved evergreen and broad-leaved deciduous species (PFO4/1); palustrine scrub-shrub wetlands characterized by both needle-leaved evergreen and broad-leaved deciduous species (PSS4/1, PSS1/4); and palustrine open water wetlands (POW).

b. <u>SCS Soils Mapping</u>

The soils mapping prepared by the SCS in the Burlington County Soil Survey (1971) identifies one land type on-site and four soil series and one

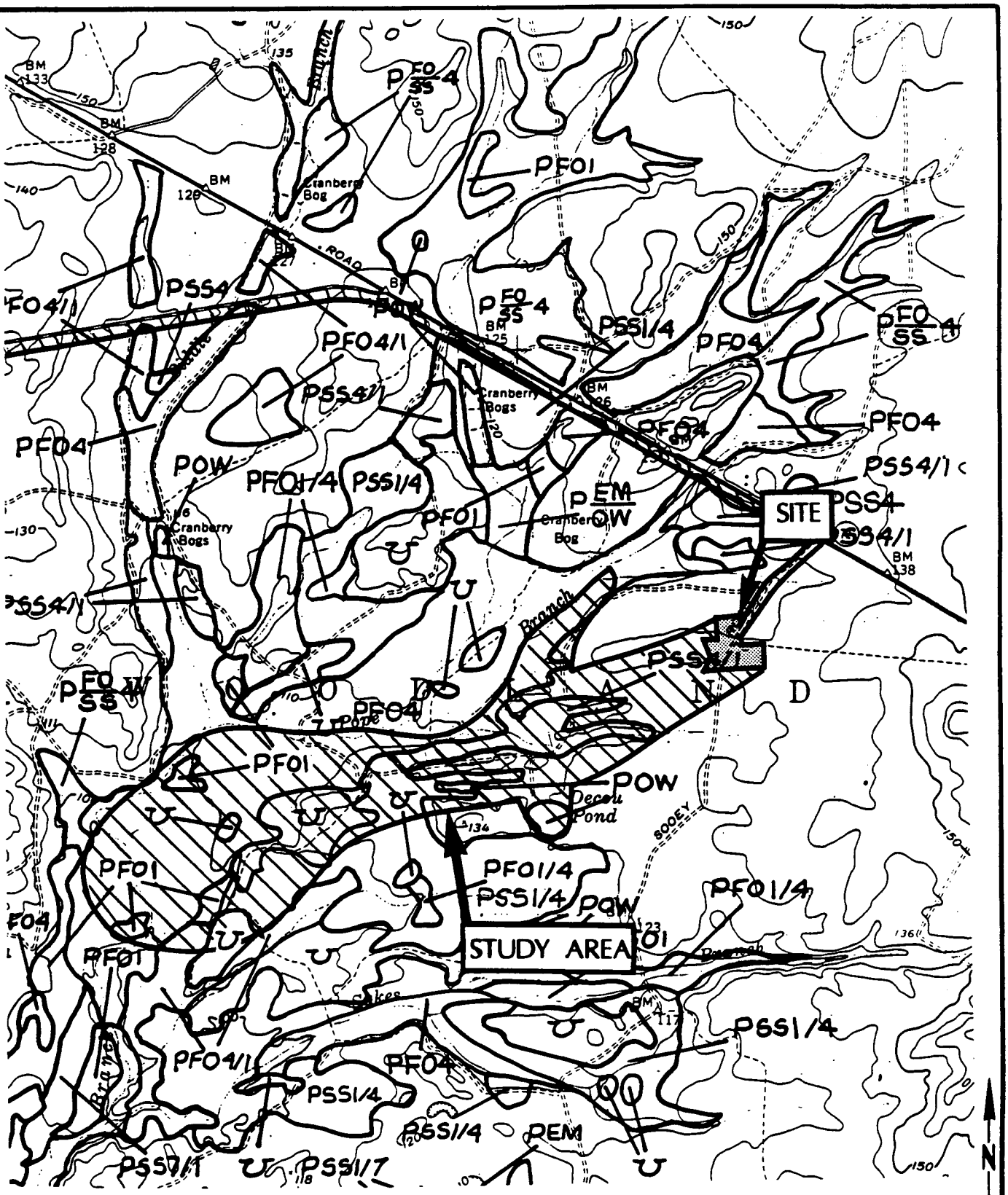

FIGURE 6B: USFWS NWI MAPPING

WOODLAND - ROUTE 72 SITE

SCALE: 1" = 2000'

EcolSciences, Inc.

SOURCE: USFWS; WOODMANSIE, NEW JERSEY QUAD; 1977

land type (Muck) within the study area (Figure 6C). On-site soils are mapped as Made Land, sanitary fill. This land type consists of areas used for disposal and then covered by soil.

The remaining portion of the study area includes the mapped Lakewood, Woodmansie, Lakehurst, Atsion series and the land type, Muck. The Atsion series is poorly drained with a seasonal high water table at one foot and Muck soils are very poorly drained with a seasonal high water table at the surface. The Atsion and Muck soils are classified as hydric soils by the National Technical Committee for Hydric Soils (1987).

c. Pine Barrens Vegetation Mapping

The maps of pine barrens vegetation prepared by McCormick and Jones (1973) identify the site and a portion of the study area as pine-oak forest (PO), an upland community (Figure 6D). The remainder of the study area is mapped as wetland communities including pitch-pine lowland forest (PPLL), hardwood swamp forest (HDW) and cedar swamp forest (C).

4. **Previous On-site Habitat Studies**

A preliminary environmental assessment of the impacts of the proposed remediation plan has been conducted (ASGEC, 1992). The limits of the project area investigated were defined by the areas of proposed disturbance, the areas between the proposed roads and pipelines, the proposed treatment plant area(s); plus a 300-foot buffer extending out from potential areas of construction activities. This project area included the site and the groundwater contamination plume. Threatened and endangered plants were sought; however, no methodology is presented. Swamp pink and Knieskern's beaked-rush were not identified.

In 1990, Wander Ecological consultants conducted an ecological assessment of the area immediatedly outside of the fenced site perimeter. No federally threatened or endangered species of flora or fauna were observed.

D. Chemsol Inc.

1. **Site Description and History**

The Chemsol site is a 40-acre parcel of land known as tax block 229A, lots 1-A and 1-B, located in the Township of Piscataway, Middlesex County, New

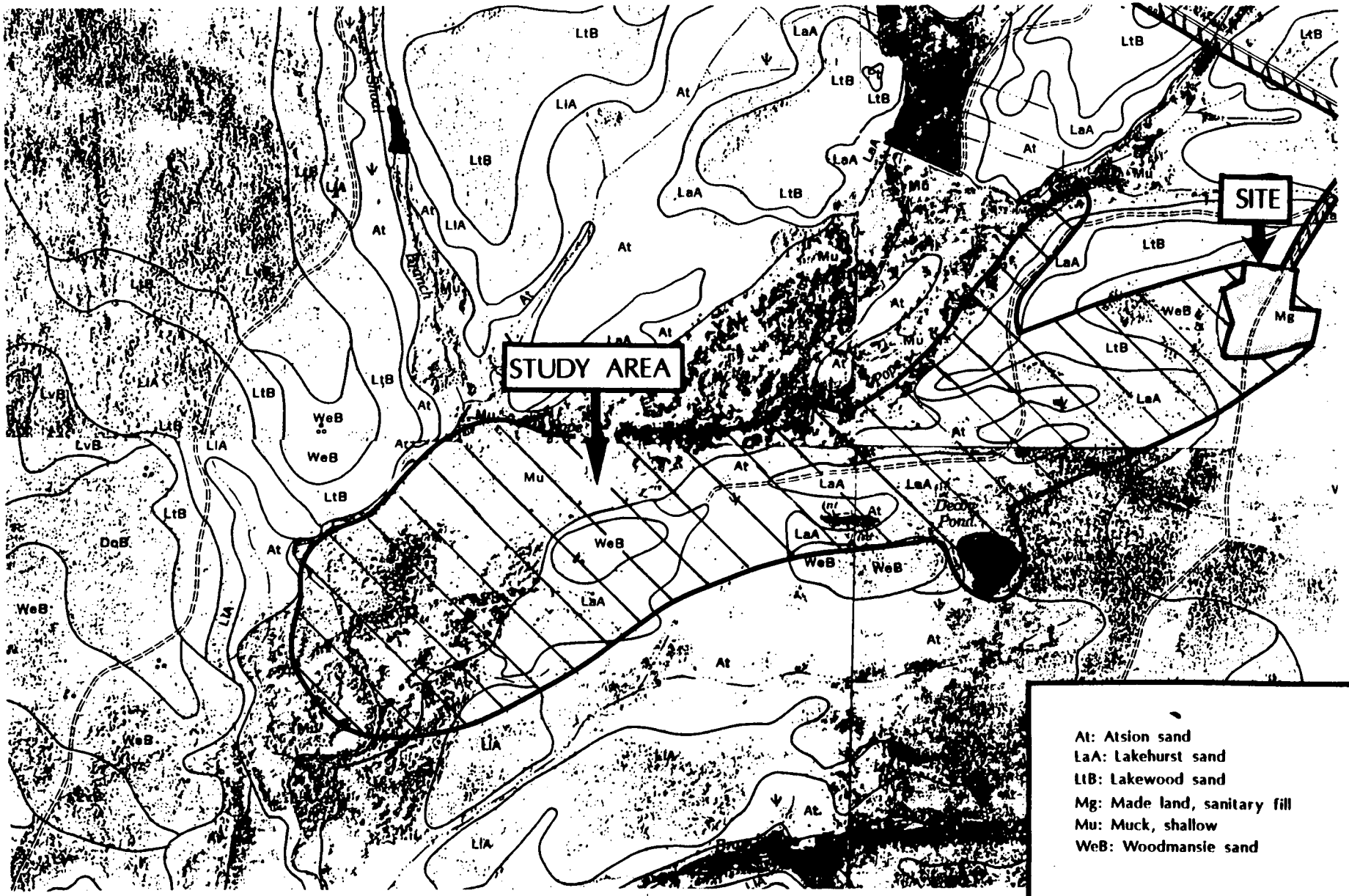

FIGURE 6C: SCS SOILS MAPPING
WOODLAND - ROUTE 72 SITE

SOURCE: SCS, BURLINGTON COUNTY SURVEY, 1971, SHEETS 65, 66, 72, 73.

SCALE: 1" = 1320'

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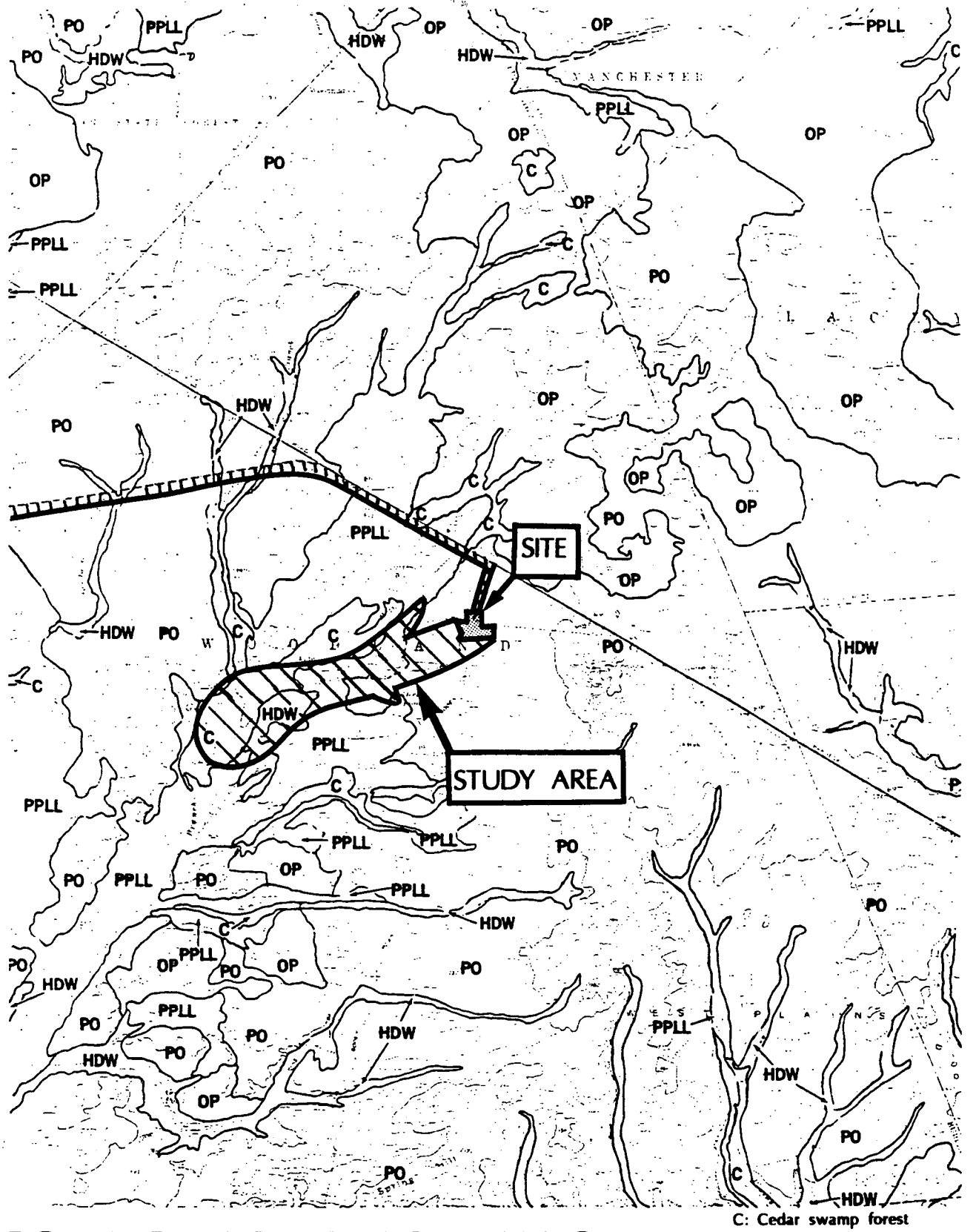

FIGURE 6D: PINE BARRENS MAPPING

WOODLAND - ROUTE 72 SITE

SCALE: 1" = 4000'

SOURCE: McCORMICK & JONES, 1973, SHEET 28

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Jersey (Figure 7A). The site is located within a developed landscape and surrounded by a mix of commercial, industrial and residential areas. A Reading Railroad right-of-way is adjacent to the site's southern boundary. The western half of the site contains three razed concrete foundations representing the remnants of the Chemsol solvent recovery and waste reprocessing facility. The eastern half of the site is undeveloped. According to the FFS (1991), three tributaries to Bound Brook are located within the site.

In the 1950's and 1960's, the Chemsol site was occupied by a chemical reprocessing firm known at various times as Chemsol Corporation and Chemsol, Inc. Operations at the site included solvent recovery and waste reprocessing. The owner was ordered by the Township to cease operations in 1964. The plant was dismantled the following year (1965) and operation ceased. In September 1983, the site was placed on the NPL.

Numerous site investigations have been conducted on behalf of the site owners, under ACOs by the NJDEPE. Organic and inorganic compounds have been detected in the site soil and groundwater. Furthermore, sampling of private (residential) wells, located downgradient of the site indicated the presence of organic contaminants in these wells.

Based on the hydrogeologic tests conducted pursuant to the FFS (1991), two water-bearing zones have been identified: a perched water zone in the overburden and a water table in the bedrock zone. Volatile organic compounds, semivolatile organic compounds, inorganic compounds, and pesticides were detected in both the perched zone and the water table (bedrock) zone.

2. **Proposed Remedial Action**

A remedial plan has been proposed for the purpose of preventing further migration of site-related contaminated groundwater in the perched and shallow bedrock water bearing zones.

The major components of the remedial action include the following:

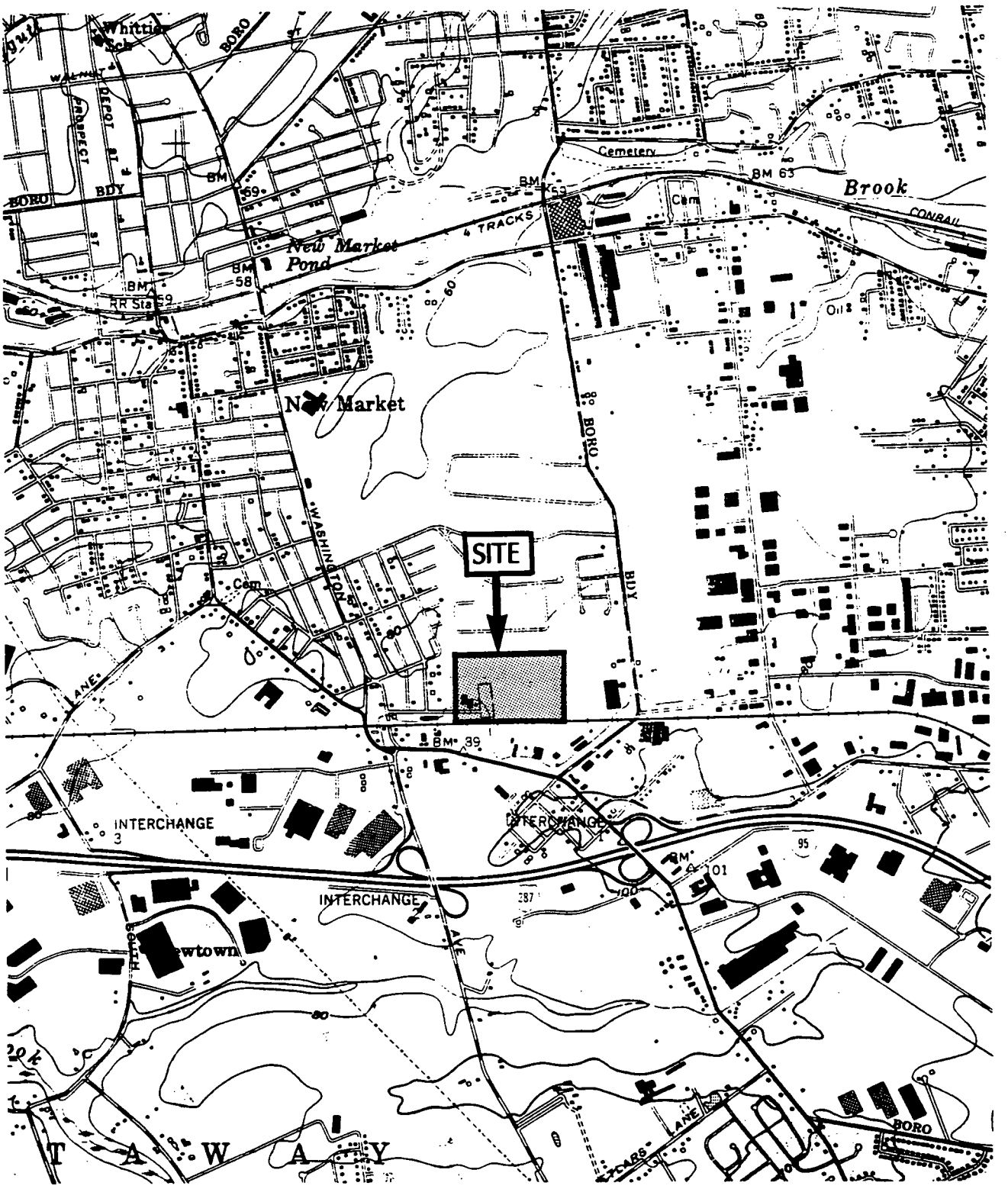

FIGURE 7A: SITE LOCATION

CHEMSOL, INC.

BOTH SITE AND STUDY AREA INDICATED BY SHADING

SOURCE: USGS; PLAINFIELD, NEW JERSEY QUAD; 1981

SCALE: 1" = 2000'

EcolSciences, Inc.

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- o Installation of a groundwater collection and extraction system for removal of contaminated groundwater from the perched zone and upper bedrock aquifer;
- o Installation of an on-site treatment plant to treat the groundwater; and
- o Disposal of the treated groundwater in an on-site surface water body.

3. **Existing Mapping of Environmental Conditions**

a. USFWS NWI Mapping

The USFWS NWI mapping (USFWS, Plainfield Quadrangle, 1976) shows palustrine forested wetlands characterized by broad-leaved deciduous species (PFO1) in the north-central and northeastern parts of the site (Figure 7B).

b. SCS Soils Mapping

According to the Middlesex County Soil Survey (1987) prepared by the SCS, three soil series and two soil complexes are mapped on-site (Figure 7C). The soil series include the Dunellen variant, the Ellington variant and Parsippany soils. The soil complexes are Klinesville-Urban Land and Reaville-Urban Land. The Parsippany series is mapped in association with the drainage features in the undeveloped portions of the site. This series is poorly drained, with a seasonal high water table from 0-1 foot. Outside of the drainages in the southern half of the site, the soil complexes are mapped. These other mapping units are not classified as hydric soils. The Parsippany series is classified as a hydric soil by the National Technical Commmittee for Hydric Soils (1987).

c. NJDEPE Wetlands Mapping

According to the wetlands mapping prepared by the NJDEPE (Map Nos. 0611 and 0613), all of the undeveloped portions of the site consist of wetlands. The forested areas are mapped as palustrine forested wetlands characterized by broad-leaved deciduous species (PFO1C). The "C" is a hydrology modifier and refers to a seasonally wet wetland. The undeveloped portions of the property that are not forested are mapped as palustrine emergent wetlands characterized by persistent species (PEM1B). The "B" refers to a hydrological regime characterized by soil saturation, but surface water is seldom present.

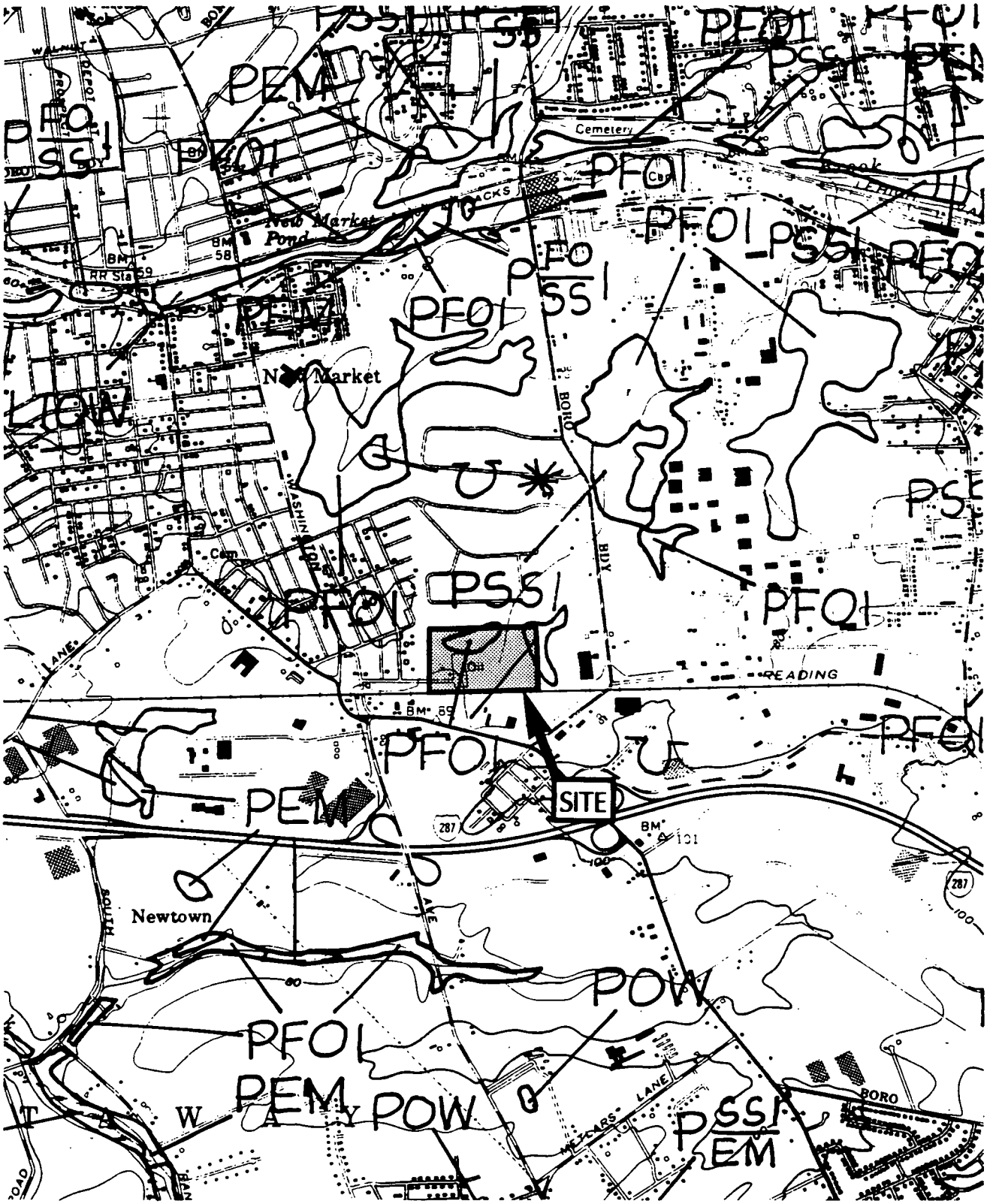

FIGURE 7B: USFWS NWI MAPPING

CHEMSOL, INC. SITE

SCALE: 1" = 2000'

SOURCE: USFWS; PLAINFIELD, NEW JERSEY QUAD; 1976

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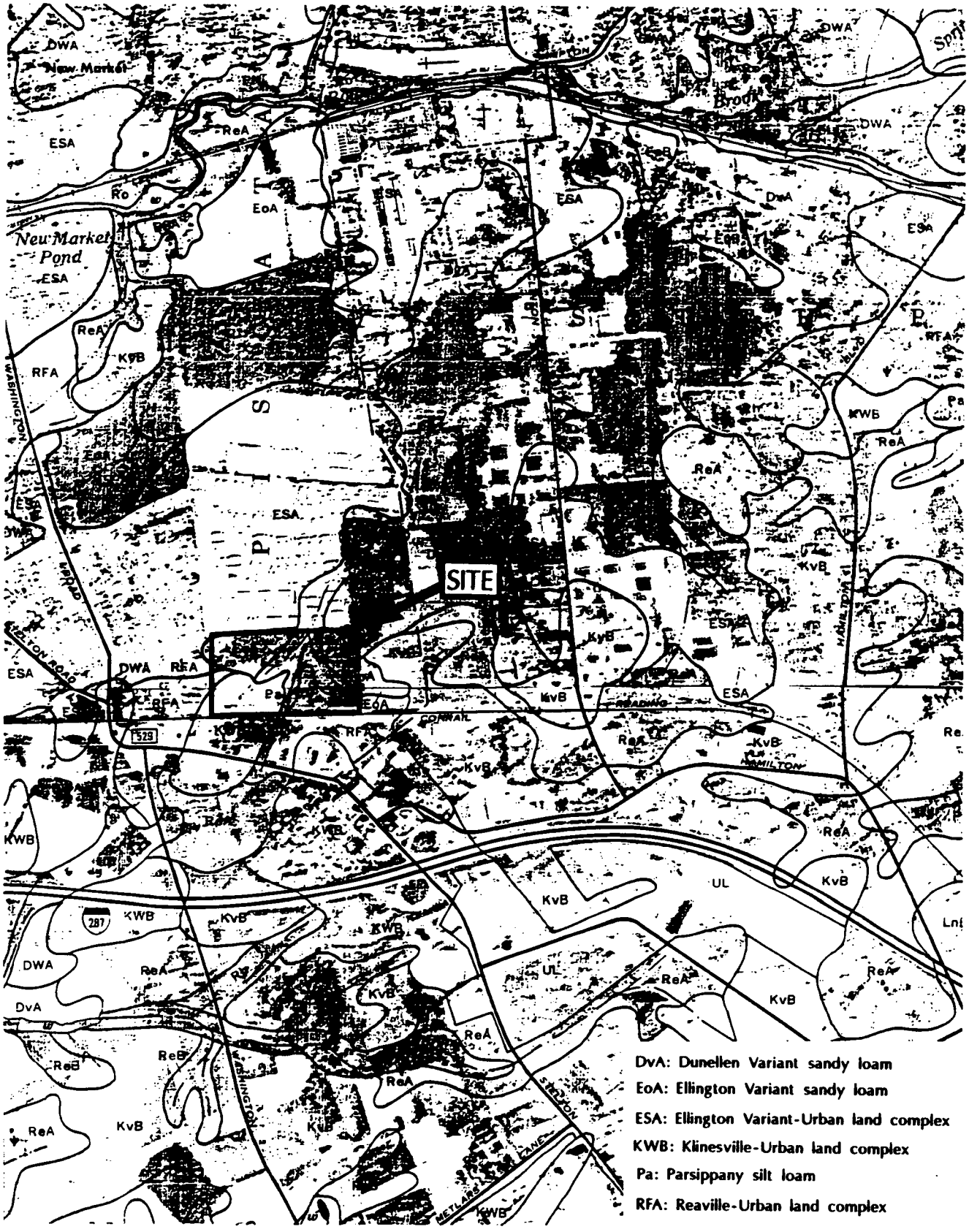

FIGURE 7C: SCS SOILS MAPPING

CHEMSOL, INC. SITE

SOURCE: SCS, MIDDLESEX COUNTY SURVEY, 1987, SHEETS 2 & 6

SCALE: 1" = 1660'

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4. **Previous On-site Habitat Studies**

The ROD (1991) and FFS (1991) prepared by Malcolm Pirnie, Inc., both identify a marshy area on-site that may be classified as wetlands. No other environmental studies appear to have been conducted on this site; therefore, no site-specific vegetation or threatened and endangered species data is available.

E. Evor Phillips Leasing

1. **Site Description and History**

The Evor Phillips Leasing Site consists of a $5.77^{\pm}$ acre triangular shaped parcel located in Old Bridge Township, Middlesex County, New Jersey. The site is largely developed, including buildings and structures previously utilized for industrial waste treatment facilities, oil recovery operations and silver reclamation business. The site is bordered to the north by Bordentown Road, to the northwest and south by active railroad sidings serving adjacent industries, and to the northeast by a service road connecting Bordentown Avenue with Old Water Works Road. The southwestern end of the site narrows in size as a result of the convergence of the railroad tracks northwest and southwest of the site (Figure 8A).

The area surrounding the site is largely industrial. Due to the extent of surrounding development, rail lines and roadways, a surficial hydrologic connection between the site and off-site waters does not exist (Robinson, personal communication, 1992). In the early 1970's, drummed and bulk liquid wastes were allegedly disposed of in a ravine and in pits at the western end of the site. Silver and cyanide contaminated wastewaters were also reportedly discharged directly onto the ground. The primary public health concern related to the site is the potential contamination of area groundwater, which is used for the municipal potable water. Soil contamination, buried drums/waste, underground storage tanks, and the potential for explosive materials on the site are also significant site concerns. The Evor Phillips site was added to the NPL in September 1983.

2. **Proposed Remedial Action**

A ROD for remedial action at the Evor Phillips Leasing Site has not been approved, however, all remedial activities are anticipated to occur within the boundaries of the property (Robinson, personal communication, 1992).

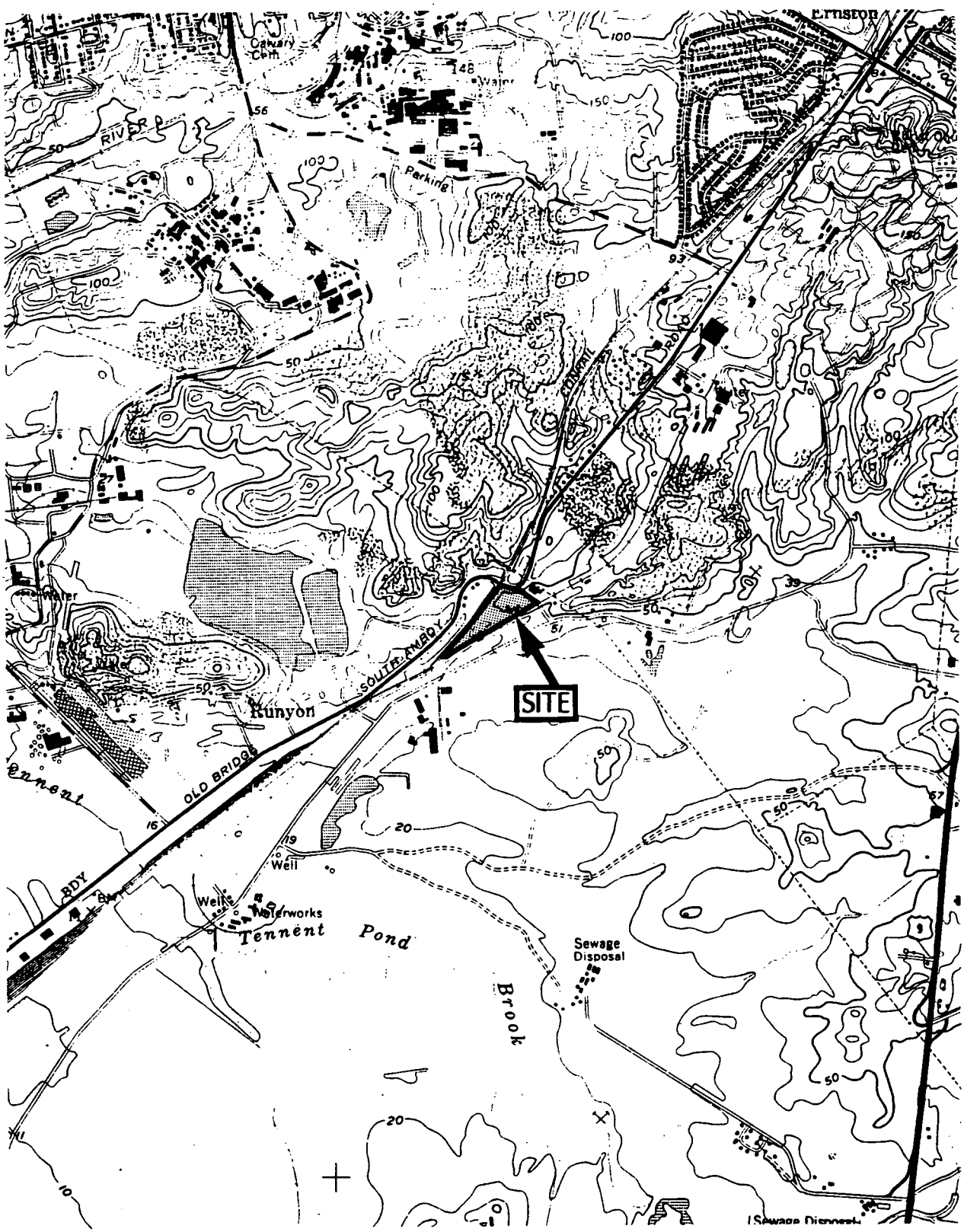

FIGURE 8A: SITE LOCATION

EVOR PHILLIPS LEASING CO.

BOTH SITE AND STUDY AREA INDICATED BY SHADING

SOURCE: USGS; SOUTH AMBOY, NEW JERSEY QUAD; 1981

SCALE: 1" = 2000'

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3. **Existing Mapping of Environmental Conditions**

a. National Wetlands Inventory Mapping

The NWI mapping (USFWS, South Amboy Quadrangle, 1976) does not identify wetlands as occurring within the site (Figure 8B). The nearest mapped wetlands exist south of Old Water Works Road, greater than 250 feet from the site, in association with an unnamed tributary of Tennent Pond Brook. The wetlands mapped in association with the unnamed tributary and their distance from the Evor Phillips Leasing site are: palustrine emergent-open water (PEM/OW) - 250 feet; palustrine forested broad-leaved deciduous wetland (PFO1) - 700 feet; palustrine scrub/shrub wetland (PSS1) - 950 feet; palustrine deciduous forested/scrub-shrub wetland (PFO/SS1) - 1900 feet; and palustrine deciduous and evergreen forested wetlands (PFO1/4) - 2000 feet. The PFO/SS1, PFO1 and PFO1/4 mapping units are largely upstream of the Evor Phillips Leasing site.

b. SCS Soils Mapping

In the Middlesex County Soil Survey (1987), the SCS has mapped two soil series, Atsion (At) and Evesboro (EvB) and one mapping unit, Psamments (PN) on-site (Figure 8C). Only the Atsion soils, mapped in a small area within the central portion of the site, are classified as hydric (NTCHS, 1987). Atsion soils are sandy and poorly drained occurring along drainageways, in basins and in low-lying flats. The seasonal high water table is close to the surface during the winter and spring and is at a depth of 2 to 4 feet during the summer.

c. Pine Barrens Vegetation Mapping

The pine barrens vegetation mapping prepared by McCormick and Jones (1973) does not identify the site as a pine barrens community or wetland (Figure 8D). However, non-pine barrens forest (NPB) and hardwood swamp (HDW) communities have been mapped to the north, west and south of the site. Wetland communities designated as hardwood swamp are mapped to the west and south of the site, across Bordentown Road and Old Water Works Road, respectively.

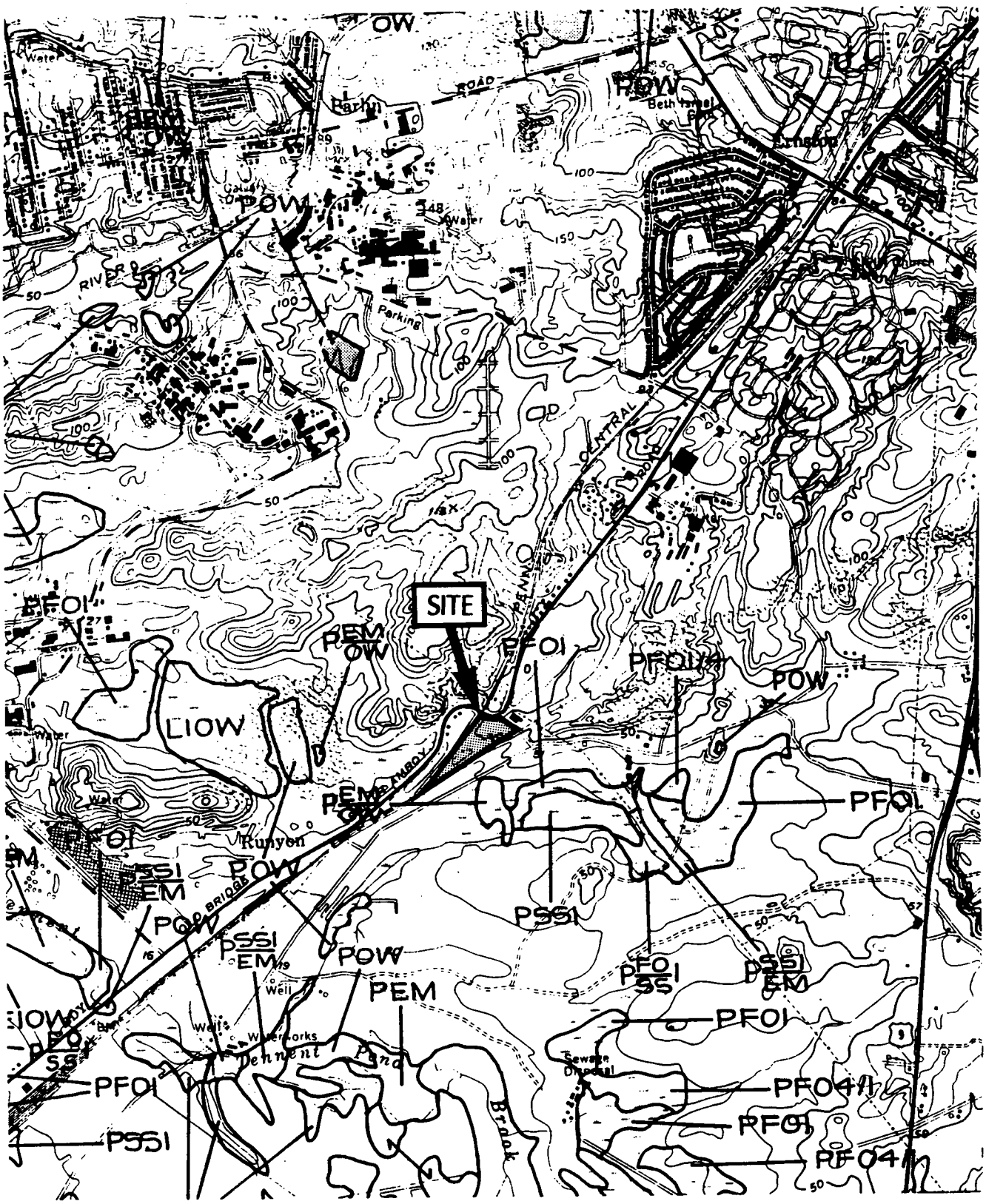

FIGURE 8B: USFWS NWI MAPPING

EVOR PHILLIPS LEASING CO. SITE

SCALE: 1" = 2000'

EcolSciences, Inc.

SOURCE: USFWS; SOUTH AMBOY, NEW JERSEY QUAD; 1976

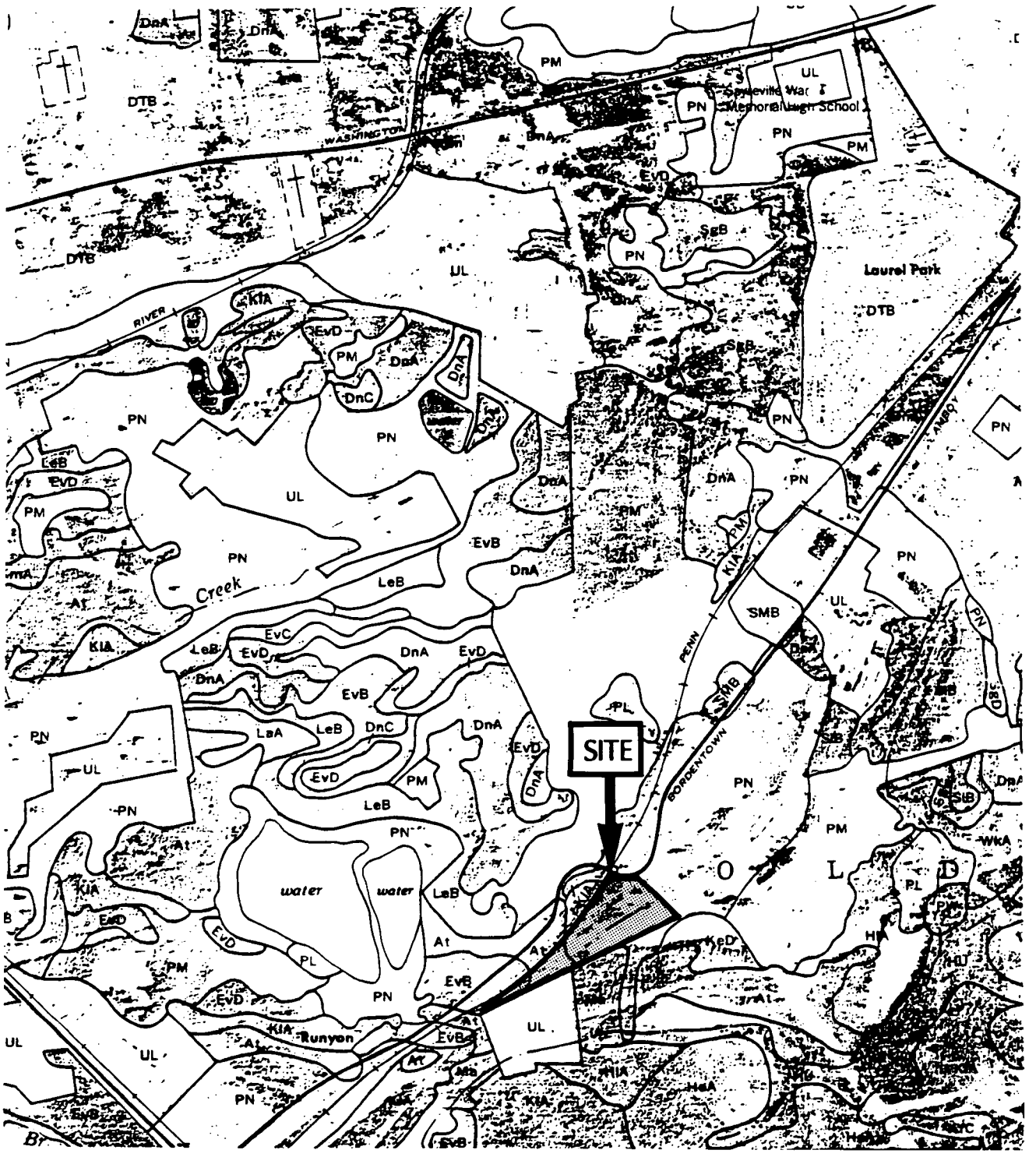

FIGURE 8C: SCS SOILS MAPPING

EVOR PHILLIPS LEASING CO. SITE

At: Atsion sand

EvB: Evesboro sand

PN: Psamments, nearly level

SOURCE: SCS, MIDDLESEX COUNTY SURVEY, 1987, SHEET 15

SCALE: 1" = 1660'

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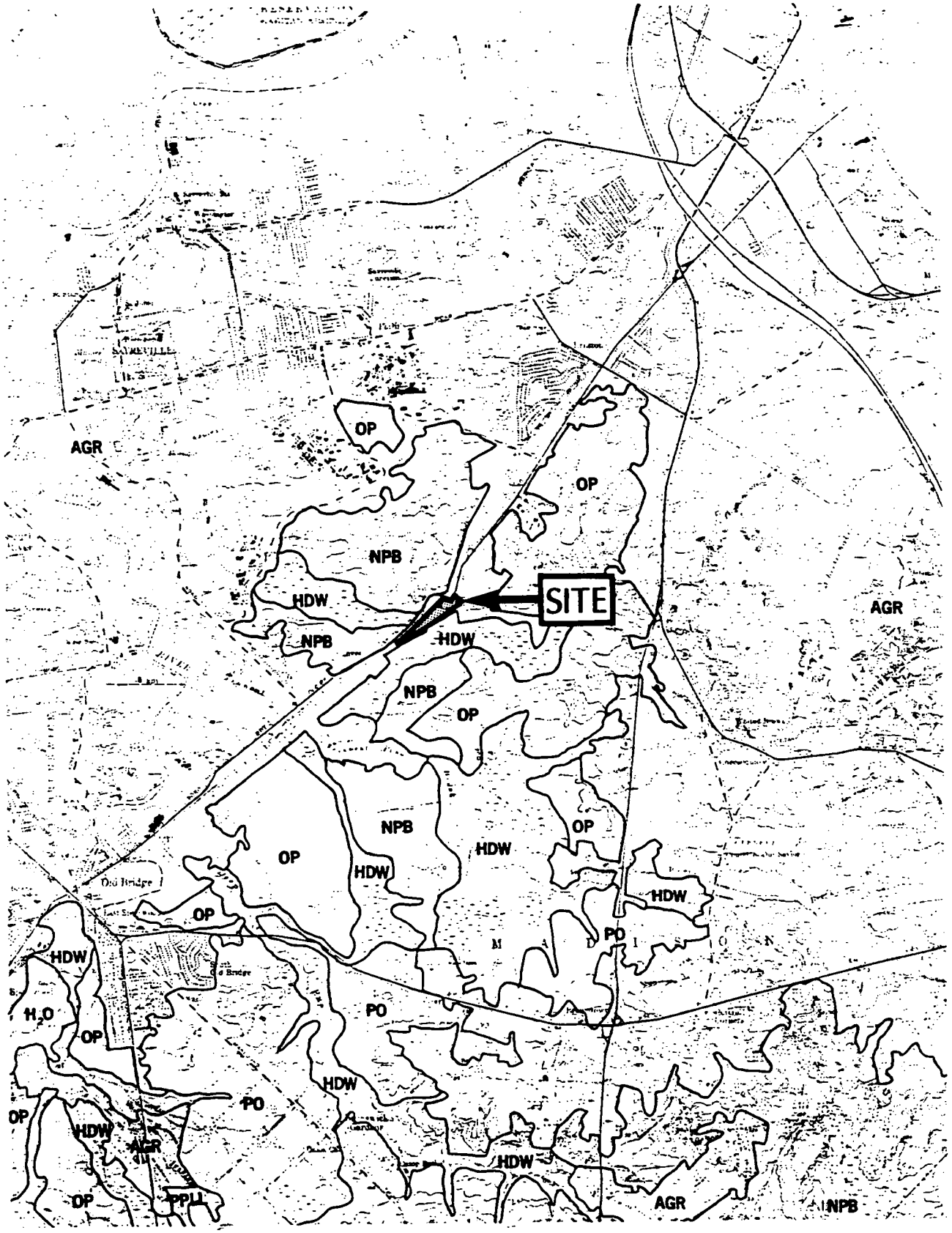

FIGURE 8D: PINE BARRENS MAPPING

EVOR PHILLIPS LEASING CO. SITE

SOURCE: McCORMICK & JONES, 1973, SHEET 2

SCALE: 1" = 4000'

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4. **Previous On-site Habitat Studies**

A feasibility study for the site prepared in January, 1992 by TRC Environmental Consultants, Inc. indicated that no federally threatened or endangered species or wetlands were identified within site, although wetlands were noted south of Old Water Works Road.

F. Ewan Property

1. **Site Description and History**

The Ewan property consists of a 43-acre parcel of land known as tax block 23.01, lots 32.01 and 32.02 located in Shamong Township, Burlington County, New Jersey (Figure 9A). The site is located 4,000 feet south of Tuckerton Road and 1,000 feet east-northeast of Indian Mills Lake. The surrounding area is primarily agricultural and single-family residential. A single-family residential subdivision is currently being developed northeast of the site. The site is located outside of the New Jersey Pinelands Preservation Area. The site is primarily wooded except for the unimproved roadways which enter the site from Tuckerton Road. An unnamed tributary of Springers Brook crosses the property from northeast to southeast. Springers Brook is within the Mullica River watershed.

From 1974 to 1975, a nine-acre area in the southern corner of the site was utilized by the property owner for waste disposal. The waste disposal procedure was to excavate one trench per truckload of drummed waste. Groundwater contaminants identified by the NJDEP in 1983 included volatile organics, solvents and the metals, arsenic, chromium and lead. The site was formally added to the NPL in June, 1986.

2. **Proposed Remedial Action**

The site remediation has been divided into two operable units. Operable unit one was to address the treatment of 4,500 cubic yards of source waste. Operable unit two addresses the remediation of remaining contaminated soils and groundwater. A groundwater plume, approximately 760 feet long, 600 feet wide and 30 feet deep was identified along the site's southeastern boundary (USEPA, 1989).

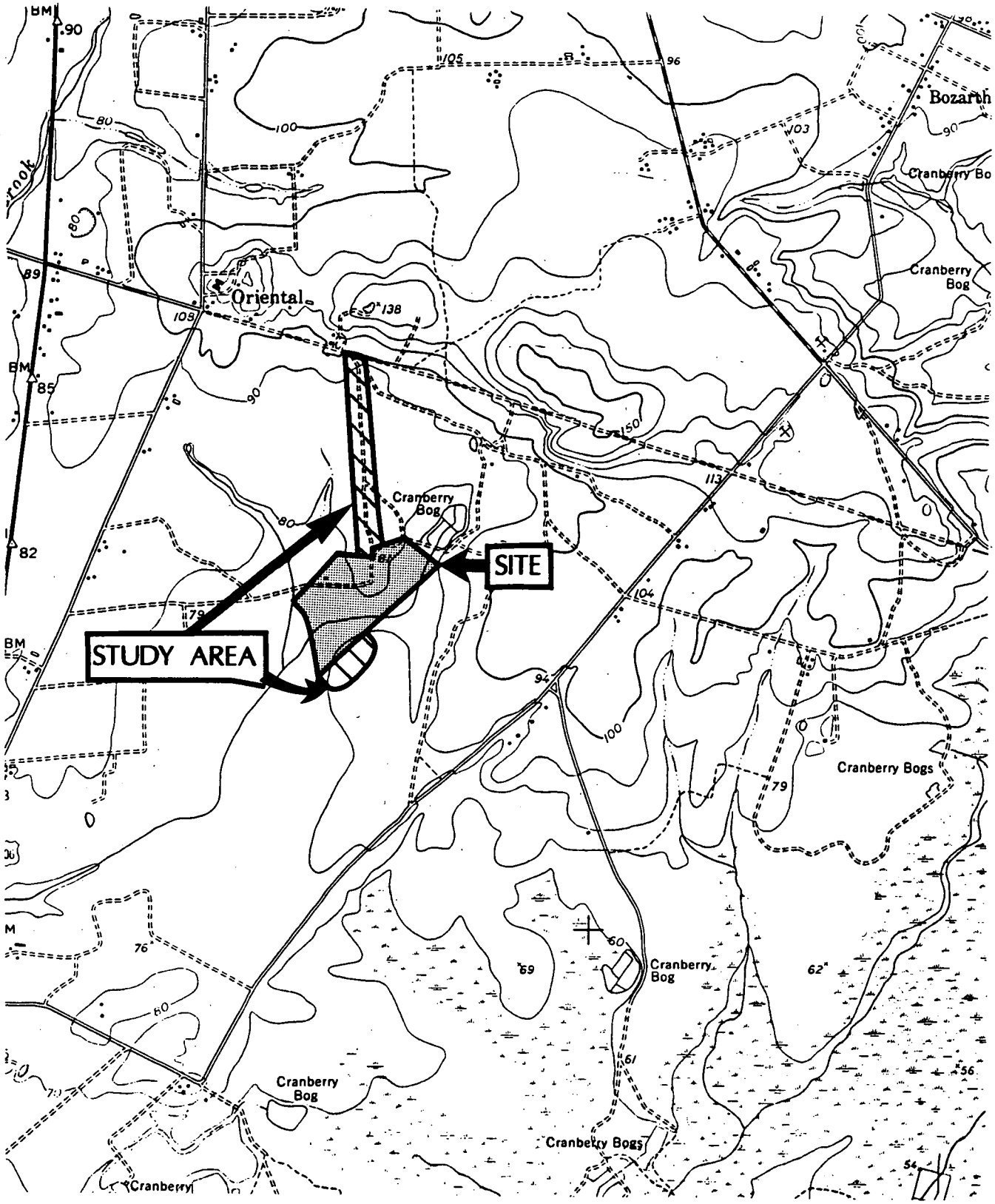


FIGURE 9A: SITE LOCATION

EWAN PROPERTY

SCALE: 1" = 2000'

EcolSciences, Inc.

SOURCE: USGS; INDIAN MILLS, NEW JERSEY QUAD; 1972

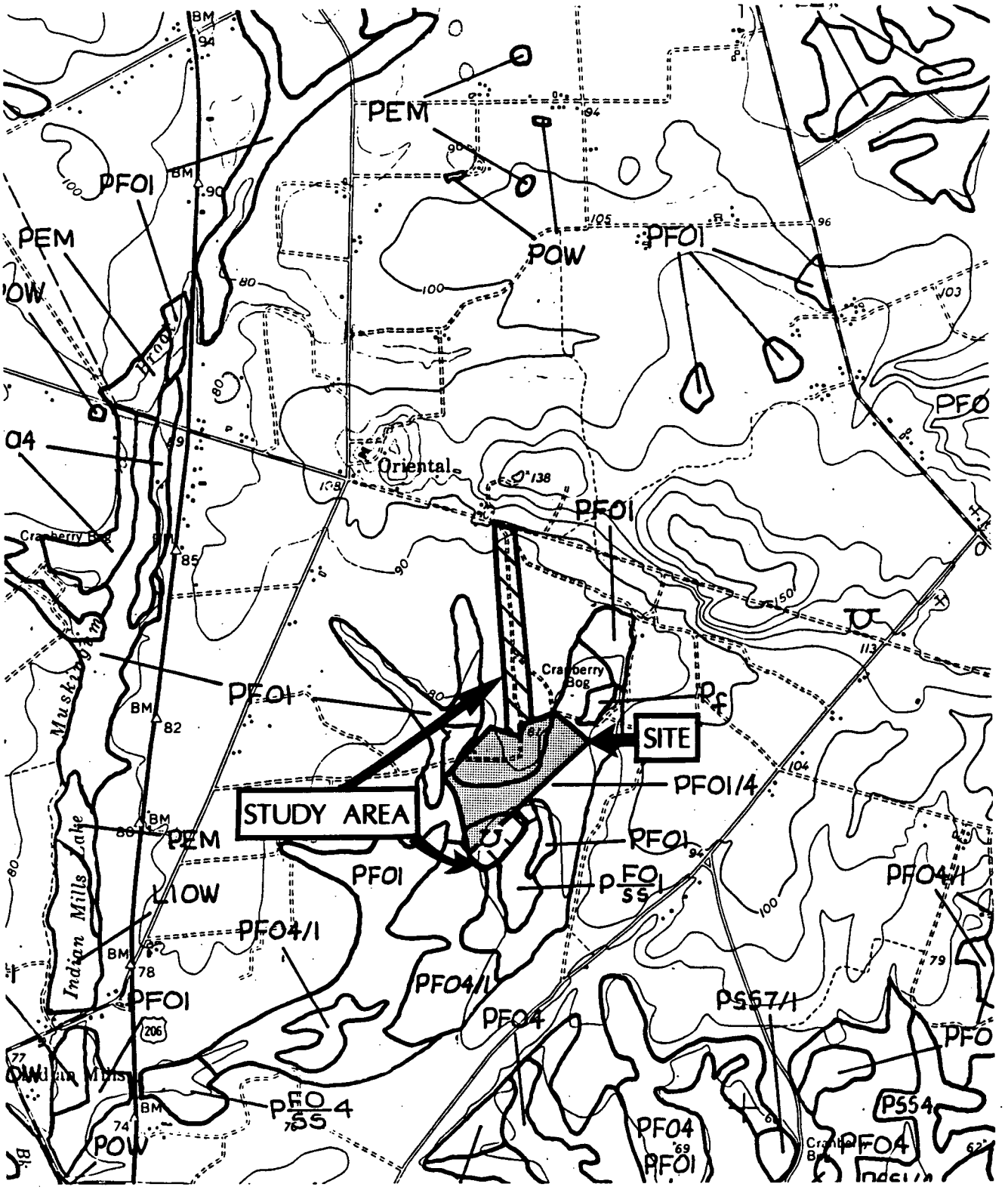


FIGURE 9B: USFWS NWI MAPPING

EWAN PROPERTY SITE

SCALE: 1" = 2000'

EcolSciences, Inc.

SOURCE: USFWS; INDIAN MILLS, NEW JERSEY QUAD; 1975

Due to problems with access into the site, removal of the source waste (operable unit one) and intiation of the remedial activities have not yet been intiated (Rosoff, personal communication, 1992).

The proposed remediation for the site, per operable unit two, includes:

- o Excavation and treatment, via solvent extraction and soil washing, of residually contaminated soils, followed by placement of the treated soils back into the site;
- o Collection and treatment of the contaminated groundwater, and re-injection of the treated groundwater into the underlying aquifer;
- o Recontouring and restoration of the disposal area; and
- o Appropriate environmental monitoring to ensure the effectiveness of the remedy.

3. **Existing Mapping of Environmental Conditions**

a. <u>USFWS NWI Mapping</u>

The NWI wetlands mapping (Indian Mills, New Jersey Quadrangle, 1975) identifies palustrine forested broad-leaved deciduous/needle leaved evergreen (PFO1/4) wetlands occurring in the southern half of the site (Figure 9B). The area where dumping has occurred is indicated as an isolated upland island completely surrounded by palustrine forested (PFO1/4, PFO4/1 and PFO1) and palustrine forested/scrub-shrub (PFO1/SS) wetlands.

b. <u>SCS Soils Mapping</u>

According to the Burlington County Soil Survey (SCS, 1971) three soil types occur within the site and study area; Alluvial land, sandy (Ap), Fallsington fine sandy loam (Fa) and Woodstown fine sandy loam (WmA) (Figure 9C). Alluvial land, due to its variability, has not been classified as a hydric soil by the National Technical Committee for Hydric Soils or as a hydric soil in New Jersey (Tiner, 1985). In Burlington County this land type consists of nearly level soils associated with large meandering perennial streams in the outer coastal plain. Flooding and a seasonal high water table near the surface is common in these soils. Fallsington soils are nearly level, poorly drained soils formed in water-deposited sediments in low positions. These soils have been classified as hydric by the National Technical Committee for Hydric Soils (1987).

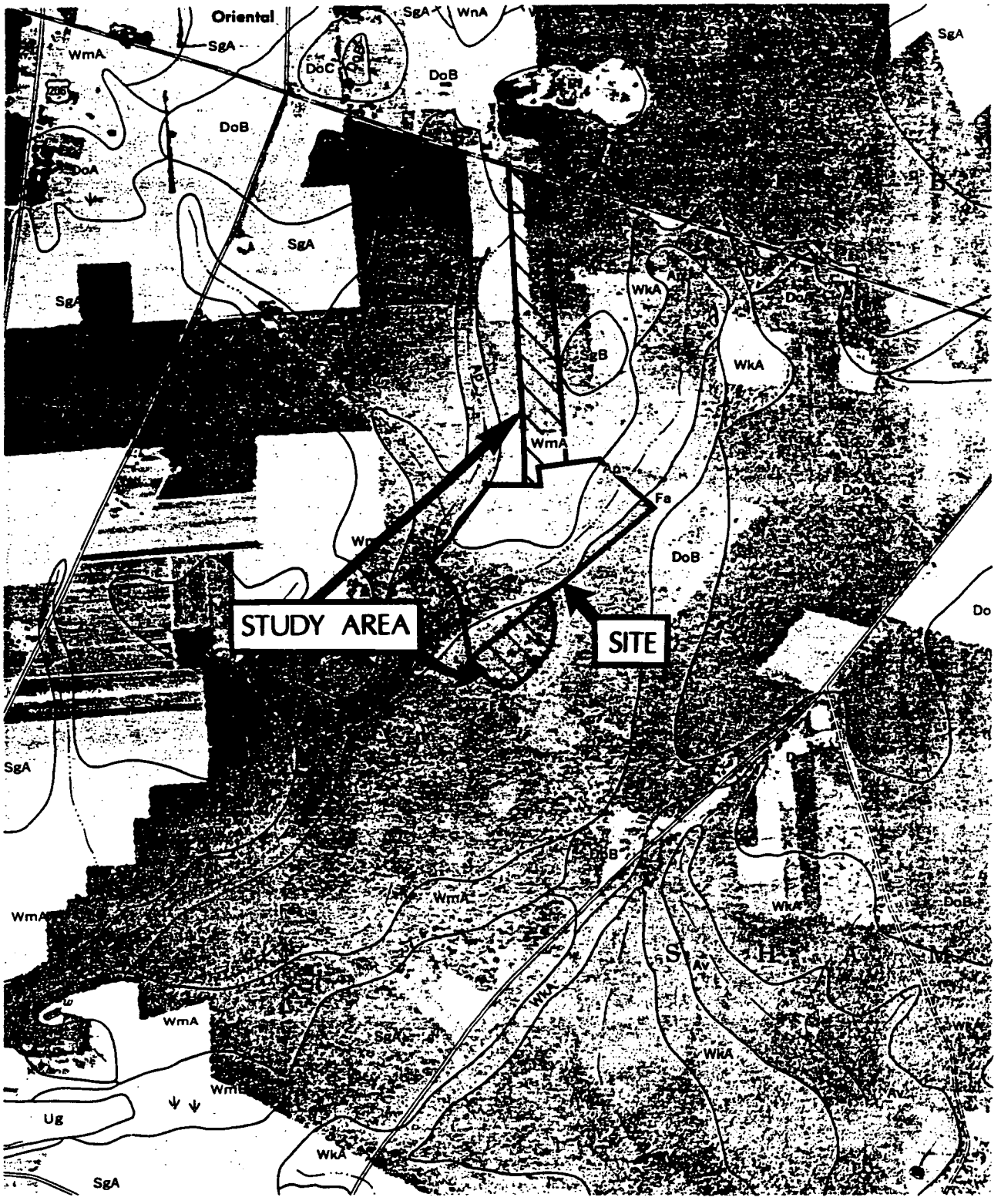


FIGURE 9C: SCS SOILS MAPPING

EWAN PROPERTY SITE

Ap: Alluvial land, sandy
Fa: Fallsington fine sandy loam
WmA: Woodstown fine sandy loam

SOURCE: SCS, BURLINGTON COUNTY SURVEY, 1971, SHEET 69

SCALE: 1" = 1320'

EcolSciences, Inc.

c. Pine Barrens Vegetation Mapping

The pine barrens vegetation and geography maps (McCormick and Jones 1973) identify most of the site and proposed access way as oak-pine (OP) forest type (Figure 9D). The southern quarter of the site along the tributary to Springers Brook is identified as hardwood swamp forest (HDW).

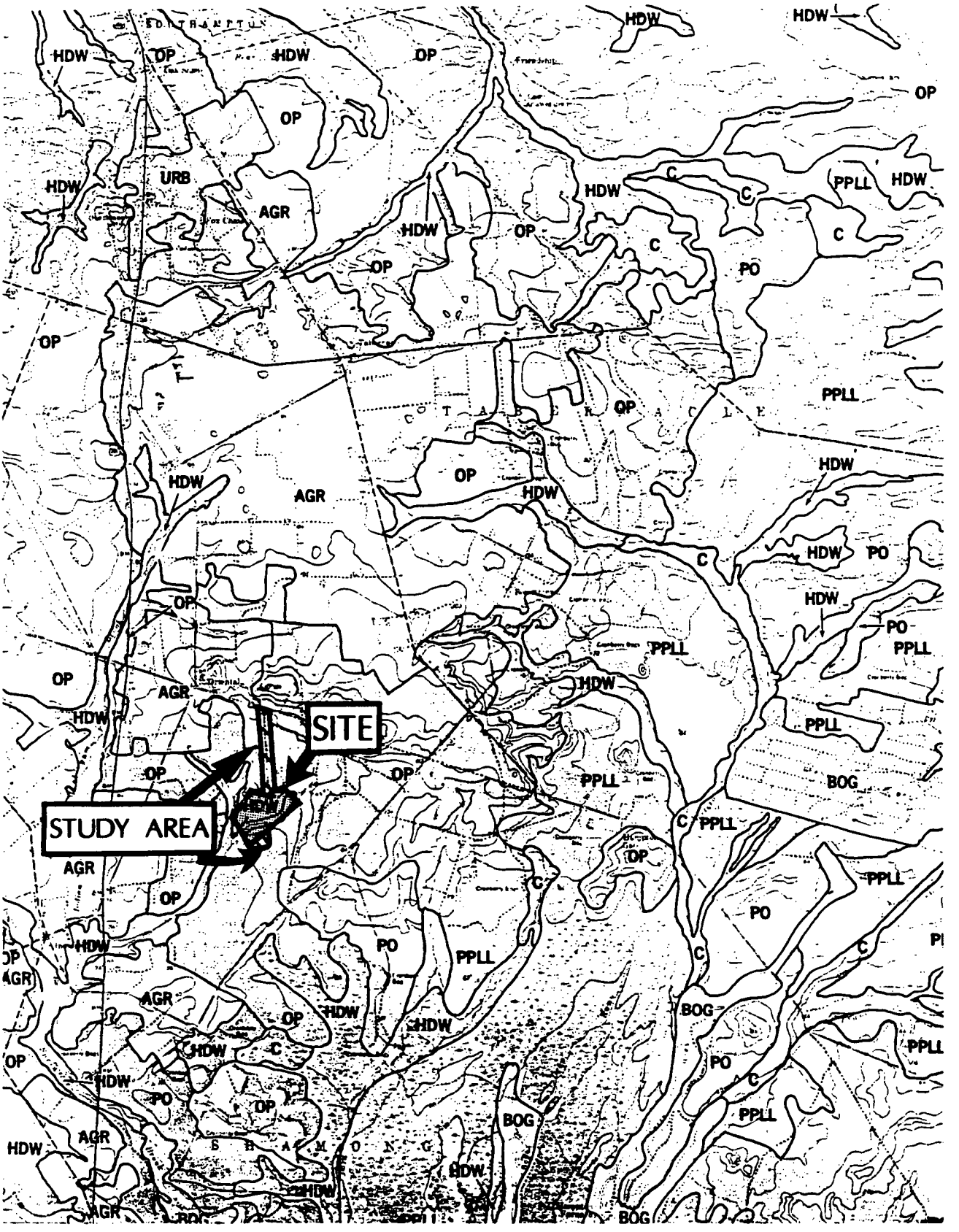
4. **Previous On-site Habitat Studies**

The Engineer's report for the Ewan property (McLaren/Hart Environmental Engineering Corp., September 1990) indicates that a wetland delineation and ecological assessment, including identification of endangered species of flora and fauna, would be included in the technical Scope of Work for the site. The endangered species study has not yet been initiated. Additionally, the ROD for the site recommends a wetland assessment which includes delineating wetlands. A series of maps prepared by McLaren/Hart dated October 15, 1990, that appear to be part of an application to the Pinelands Commission, indicate that wetlands were identified and surveyed within the site. A plan dated May 11, 1992, prepared by James C. Anderson Associates, Inc. and entitled "Plan Showing Location of Access Road", indicates a delineated wetland area adjacent to the proposed access road. Discussions with the RPM for the site indicate that a wetland delineation was conducted for the access road, however, accompanying reports had not yet been completed. In addition to the wetland report, a swamp pink survey was to be conducted along the proposed access roadway (Rosoff, personal communication, 1992).

G. Ciba-Geigy

1. **Site Description and History**

The Ciba-Geigy site is an approximately 1,400± acre site located primarily in Dover Township, Ocean County, New Jersey (Figure 10A). The site is bordered by the Toms River to the east, an industrial park to the west and residential development to the north and south. Three hundred and twenty acres of the site are developed with facilities associated with Ciba-Geigy's production of epoxy resins, dyes, synthetic pigments and other specialty chemicals. Some of the operations and facilities have been recently shut down or demolished. The remainder of the site is predominantly wooded.



HDW: Hardwood swamp forest
OP: Oak-pine forest

FIGURE 9D: PINE BARRENS MAPPING

EWAN PROPERTY SITE

SOURCE: McCORMICK & JONES, 1973, SHEET 26

SCALE: 1" = 4000'

EcolSciences, Inc.

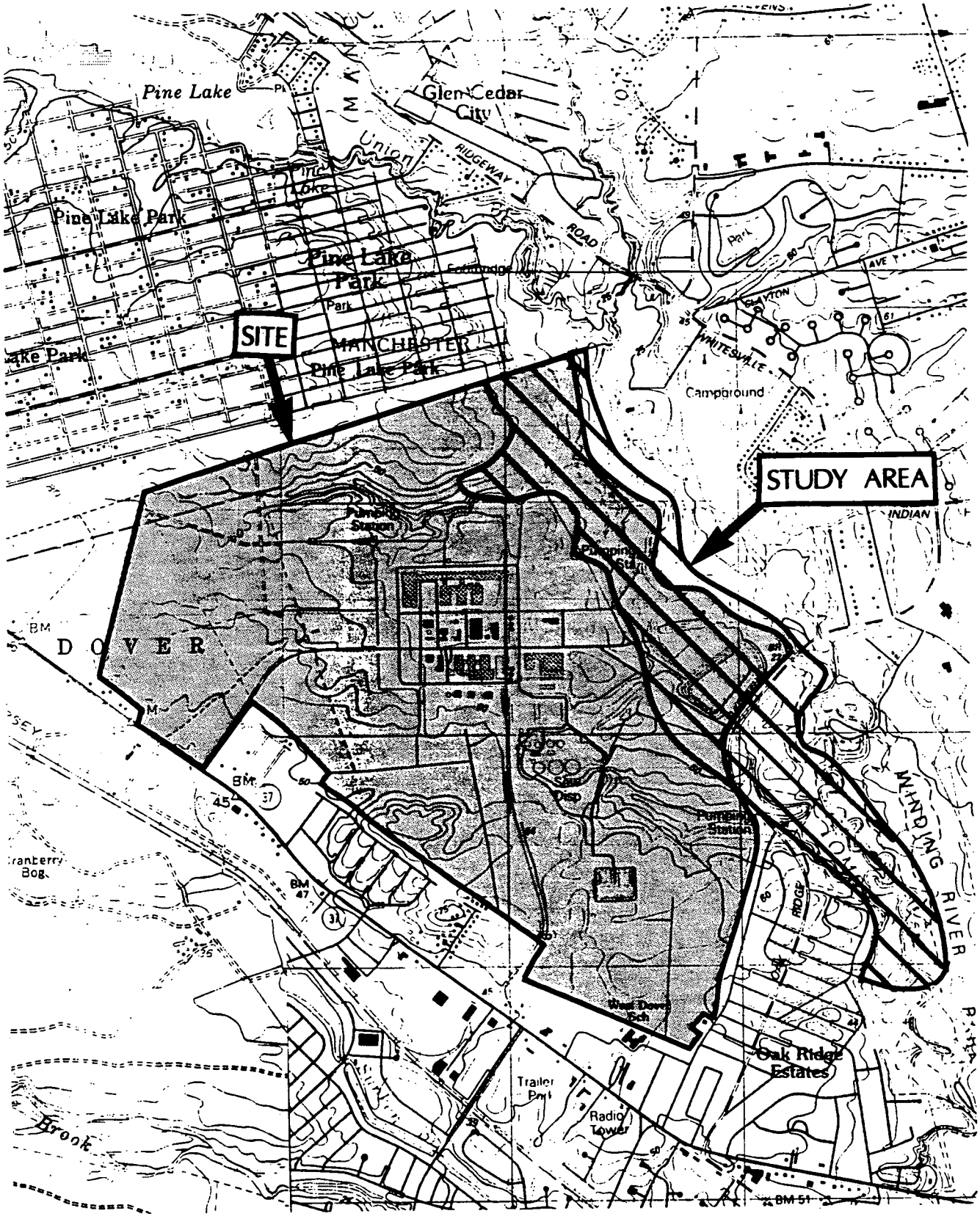


FIGURE 10A: SITE LOCATION

CIBA-GIEGY

SOURCE: USGS; KESWICK GROVE, LAKEHURST/LAKEWOOD, TOMS RIVER QUADS; 1971/1989

SCALE: 1" = 2000'

EcolSciences, Inc.

From the 1950's through the 1970's, Ciba-Geigy disposed of solid and liquid process waste into several known or suspected disposal areas. Additionally, an old wastewater treatment plant discharged directly into the Toms River. The Draft Work Plan Remedial Action/Feasibility Study for the site concluded that contaminants from the site have contaminated the Upper Sands aquifer and that a large plume is migrating off-site towards and into the Toms River (DM Federal Programs Corporation, 1991). The site was proposed for the NPL List in 1982.

The study area for the Ciba-Geigy site was expanded to include the floodplain wetlands of the Toms River south of Oak Ridge Parkway. This included a band of wetlands up to 300 feet east of the eastern bank of the River (Cipoff, 1992). The study area extended southward into Winding River Park to the southern extent of the predicted "Zone of Capture" (Ekenfelder Inc.).

2. **Proposed Remedial Action**

According to the ROD for the site, the first operable unit on the Ciba-Geigy site involves the groundwater contamination. The second unit will address source area remediation, but action is not proposed in the near future.

Under the first operable unit of the remediation plan, the following actions are proposed:

- Sealing of contaminated residential wells in the Cardinal Drive area to prevent human exposure to contaminated groundwater;
- Installation of an extraction well system on-and off-site to stop migration of contaminated groundwater at the property line and capture the contaminated groundwater in the off-site areas;
- After extraction, treatment of the contaminated groundwater separately from the process wastewater in an upgraded existing Ciba-Geigy wastewater treatment plant. The contaminated groundwater will be treated to the discharge levels as specified by the NJDEPE for discharge to the Toms River;
- After treatment, the groundwater will be retained in basins to allow monitoring of residual contaminant levels prior to discharge through a pipeline to the Toms River; and

- o Monitoring of the Toms River to determine current water quality upstream, downstream and adjacent to the site. Monitoring will continue during the implementation of the remedial action to evaluate the effects of the extraction system and river discharge over time.

To date, sealing of residential wells is nearly completed. Currently, Ciba-Geigy is pumping and treating 500,000 gallons of contaminated groundwater per day. Additionally, recharge is no longer proposed directly to the Toms River but will be discharged on-site to underlying groundwater aquifers.

3. Existing Mapping of Environmental Conditions

a. USFWS NWI Mapping

The NWI mapping (Keswick Grove, Lakehurst, Lakewood and Toms River, New Jersey Quadrangles, 1977) for the site and study area primarily identify palustrine forested, broad-leaved deciduous wetlands (PFO1) along the site's eastern boundary in association with the floodplain of the Toms River. Additionally, a number of palustrine open water wetlands (POW) are identified within the developed portion of the site. These areas appear to correspond to the on-site lagoons and disposal areas (Figure 10B).

b. SCS Soil Survey

The Ocean County Soil Survey (1980) identifies eight soil series and two land types within the study area (Figure 10C): Berryland sand (Bf), Downer loamy sand (DoA), Dover sandy loam (DpB), Evesboro sand (EvB, EvC), Lakehurst sand (LhA), Lakewood sand (LwB), Manahawkin muck (Ma), Pits, sand and gravel (Pn) and Urban land (UL). Berryland sand and Manahawkin Muck, identified in limited areas along the Toms River floodplain have been classified as hydric by the National Technical Committee for Hydric Soils (1987).

Berryland soils are deep, very poorly drained soils located on the edge of marshes and large perennial streams subject to frequent flooding. Manahawkin mucks are nearly level, very poorly drained soils located in wide depressional areas and on broad flats. These soils have a seasonal high water table at the surface for most of the year and are subject to frequent flooding.

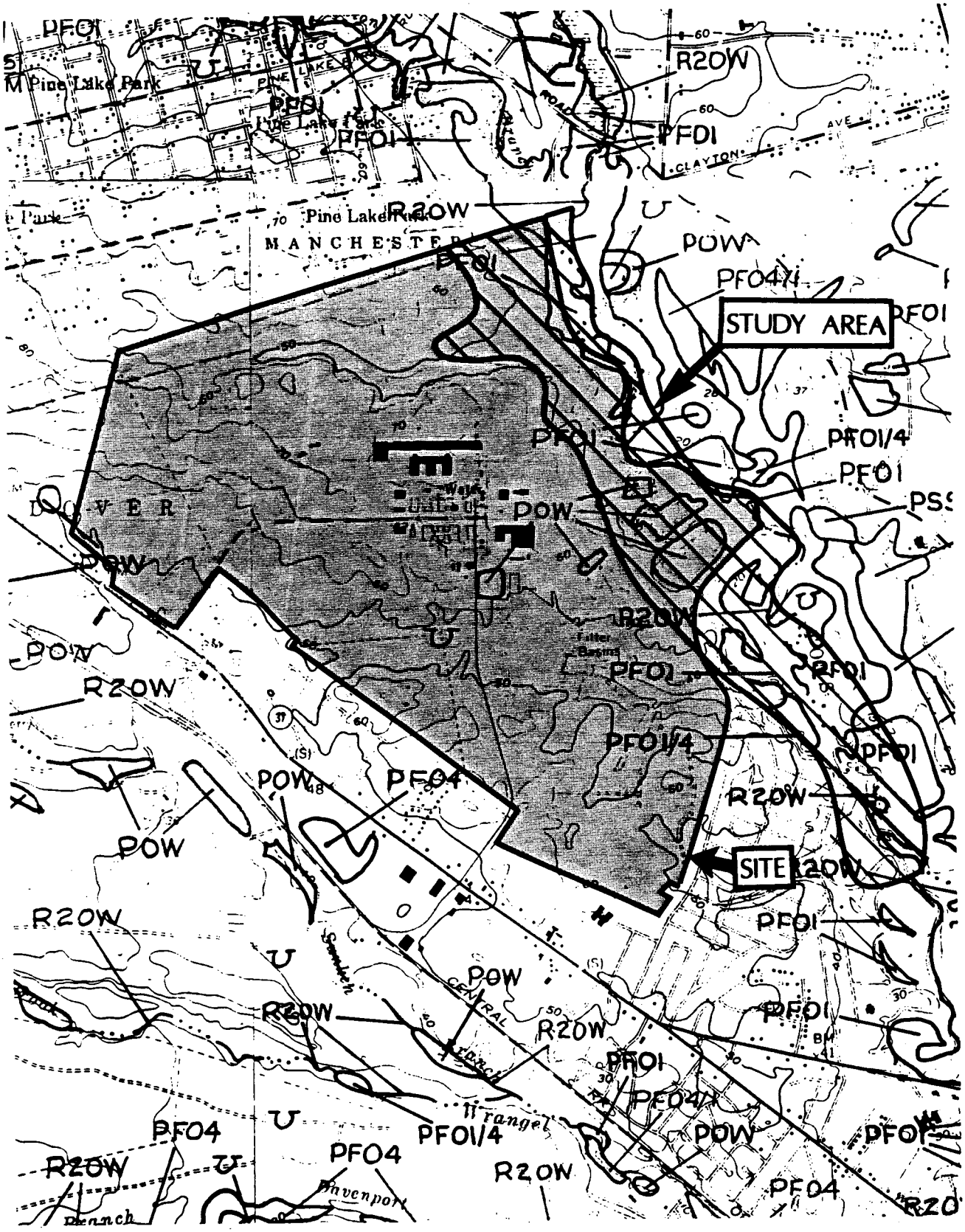


FIGURE 10B: USFWS NWI MAPPING

CIBA-GIEGY SITE

SOURCE: USFWS; KESWICK GROVE, LAKEHURST, LAKEWOOD, TOMS RIVER QUADS; 1977

SCALE: 1" = 2000'

EcolSciences, Inc.

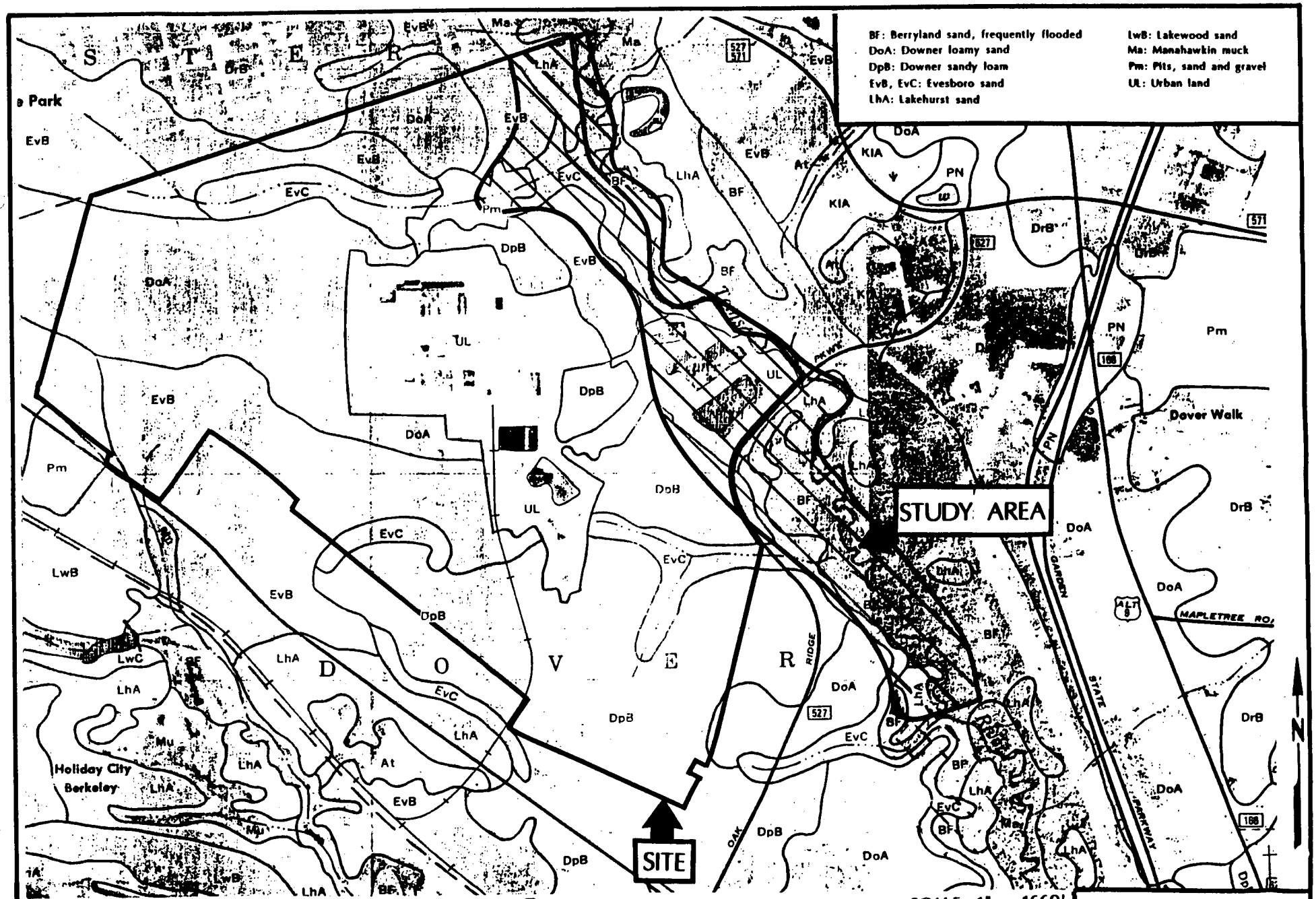


FIGURE 10C: SCS SOILS MAPPING
CIBA-GIEGY SITE

SCALE: 1" = 1660'

SOURCE: SCS, OCEAN COUNTY SURVEY, 1980, SHEET 25

EcolSciences, Inc.

c. Pine Barrens Vegetation Mapping

The pine barrens vegetation and geography maps (McCormick and Jones, 1975) identify most of site as pine-oak upland forest (PO) (Figure 10D). However, the floodplain of the Toms River has been identified as hardwood swamp forest (HDW). This includes most of the study area located south of the site.

d. New Jersey Freshwater Wetlands Mapping

According to the New Jersey Freshwater Wetlands Map for the site (NJDEPE, Toms River, NW, Sheet 110-1), several wetland communities were identified. Along the Toms River floodplain these communities include palustrine scrub/shrub wetlands (PSS1B), palustrine forested broad-leaved deciduous/ needle-leaved evergreen wetlands (PFO1/4C) and palustrine forested needle-leaved evergreen/broad-leaved deciduous wetlands (PFO4/1C). Within the developed portions of the site, a small palustrine scrub/shrub wetland was identified near one of the existing buildings. The "B" and "C" are hydrological modifiers referring to saturation hydrology with infrequent standing water and seasonal wetness respectively. Additionally, the on-site lagoons and seepage fields were identified as palustrine open waters (POWHh). The "H" refers to a permanent water regime and the "h" to a diked/impounded situation.

4. **Previous On-site Habitat Studies**

The Draft Work Plan RI/FS addendum (CDM Federal Programs Corporation, March 1991) for the Ciba-Geigy site does not make reference to the natural environmental conditions of the site. However, in 1990, Normandeau Associates conducted a wetland investigation of the Ciba-Geigy site in preparation for a Letter of Interpretation application to the NJDEPE. Additionally, Normandeau Associates prepared a report (1991, revised 1992) entitled "A Survey of Wetlands Within the Toms River Corridor from the Manchester Township Line to Route 37". This report included the Ciba-Geigy site and study area along the Toms River floodplain. This study mapped wetlands and characterized wetland communities by aerial photography interpretation and limited ground-truthing. The study identified four wetland communities within the Toms River floodplain study area: palustrine scrub/shrub wetlands (PSS1), palustrine forested needle-leaved evergreen wetlands (PFO4), palustrine forested broad-leaved

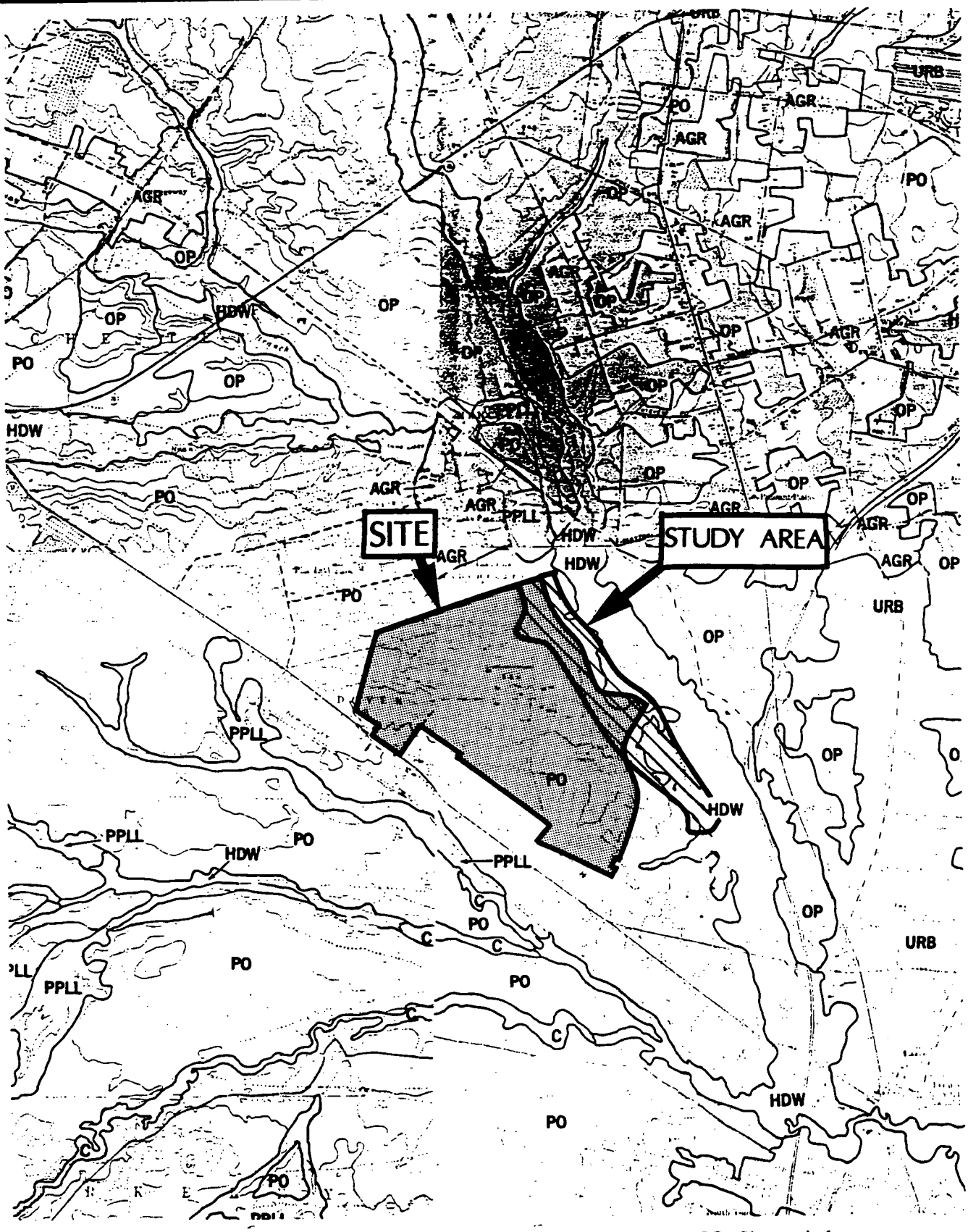


FIGURE 10D: PINE BARRENS MAPPING
CIBA-GIEGY SITE

SOURCE: McCORMICK & JONES, 1973, SHEETS 13, 14, 20, 21

SCALE: 1" = 4000'

EcolSciences, Inc.

deciduous wetlands (PFO1) and palustrine forested broad-leaved deciduous/ needle-leaved evergreen wetlands (PFO1/4).

The dominate wetland community was PFO1. Typical species identified included: red maple, black gum, sweetgum and river birch. Associate species included Atlantic white cedar, sweetbay magnolia, highbush blueberry, inkberry, pitch pine and sweet pepperbush.

The PFO4 communities were limited to small areas on slightly higher elevations within the study area. Pitch pine was the dominant species in association with Atlantic white cedar and red maple. Associated species included highbush blueberry, inkberry, and sweet pepperbush.

These two communities tended to overlap above the annual floodplain (PFO1/4). The dominant species were pitch pine and red maple. The previously listed associate species were also identified with this community.

The palustrine scrub-shrub (PSS1) community was limited to the eastern-most portion of the Normandeau study area (east of the Toms River). This area is outside of the study area for this investigation.

H. Lang Property

1. **Site Description and History**

The Lang Property site consists of a 40-acre site located in Pemberton Township, Burlington County, New Jersey (Figure 11A). The site is located north of the unimproved North Branch Road (City Line Road). Surrounding land is undeveloped, with many areas supporting actively cultivated blueberry and cranberry fields. The site is in close proximity to Lebanon State Forest and is located within the Pinelands National Reserve. Specifically, the site is located within the Pinelands Preservation Area District and the Central Pine Barrens Water Quality Critical Area. The site consists primarily of blueberry fields which are no longer cultivated or maintained. Numerous drainage ditches traverse the site. An unnamed tributary to Baffin Brook is located along the site's north and northeastern boundary. Baffin Brook is within the Rancocas Creek watershed.

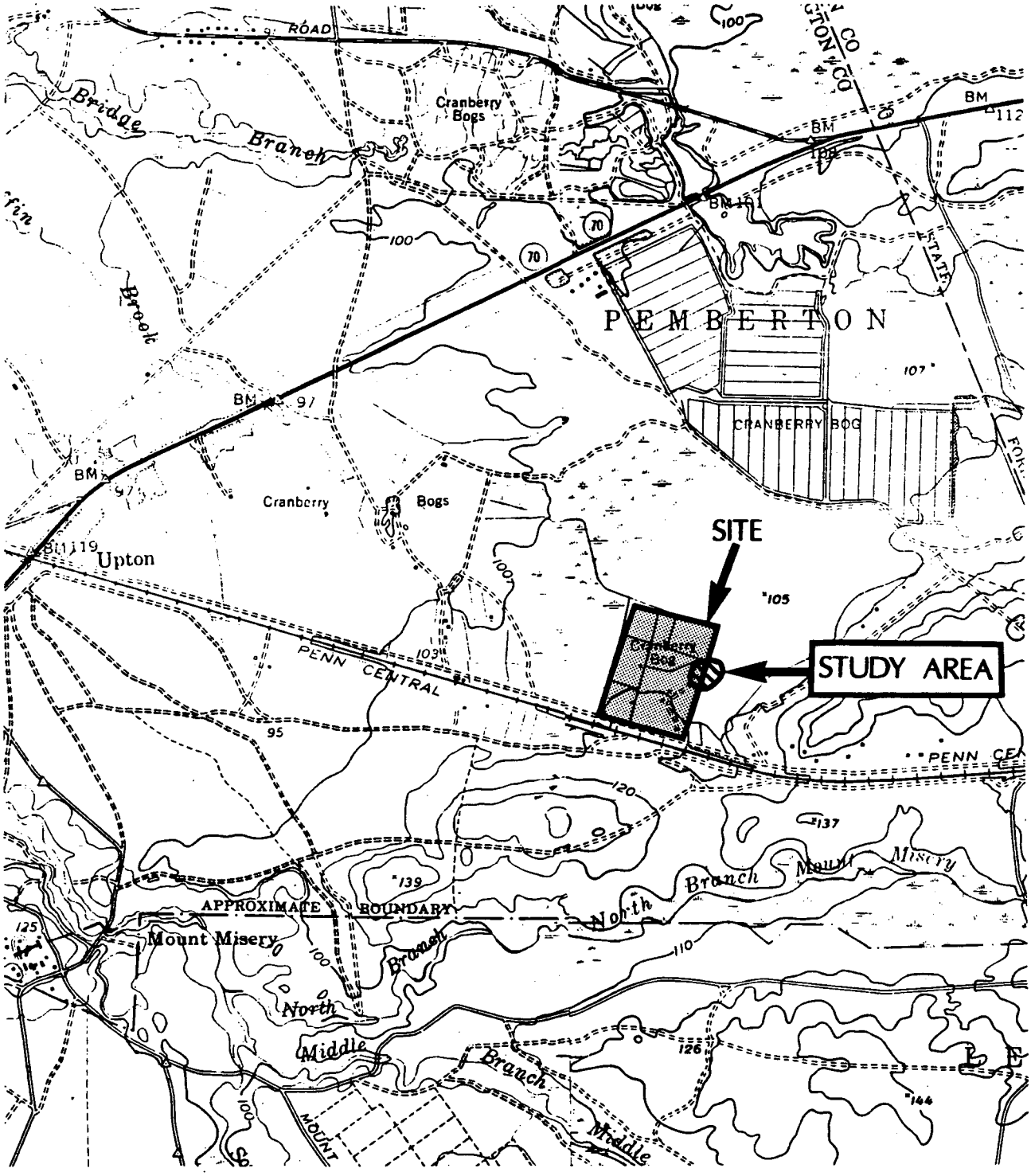


FIGURE 11 A: SITE LOCATION

LANG PROPERTY

SCALE: 1" = 2000'

EcolSciences, Inc.

SOURCE: USGS; BROWNS MILLS/WHITING, NEW JERSEY QUADS, 1971

In 1975, 1200-1500 drums containing chemical wastes were discovered in a two-acre portion of the site, located at the end of an unimproved road which enters the property from the south and ends near the site's eastern boundary. Although the drums were removed, their contents were spilled onto the ground prior to their removal. Contamination of the site appears to be a result of the spilled material. This contamination includes surficial soils (to a depth of twenty feet), surface waters, sediment samples within the disposal area and shallow groundwater (not below 30 feet). Contaminants include volatile organic compounds and metals. Contaminated ground water does not appear to have migrated more than 300 to 500 feet from the disposal area. The Lang site was placed on the NPL in December 1982.

2. **Proposed Remedial Action**

The selected remedial action for the site includes the following (USEPA 1986):

- Excavation of approximately 6500 cubic yards of contaminated soils and waste materials and disposal at an approved off-site landfill facility;
- Extraction and on-site treatment of contaminated groundwater, with reinjection of treated water;
- Restoration of the excavated area by filling and grading, including the removal of surface debris as necessary;
- Installation of a security fence to restrict site access; and
- Appropriate environmental monitoring to ensure the effectiveness of the remedial action.

3. **Existing Mapping of Environmental Conditions**

a. <u>USFWS NWI Mapping</u>

The NWI mapping (Browns Mills and Whiting, New Jersey Quadrangle, 1977), identify the northern half of the parcel as palustrine forested, broad-leaved deciduous/needle-leaved evergreen (PFO1/4) wetlands (Figure 11B). This includes the western boundary of the site in the vicinity of the proposed remedial action.

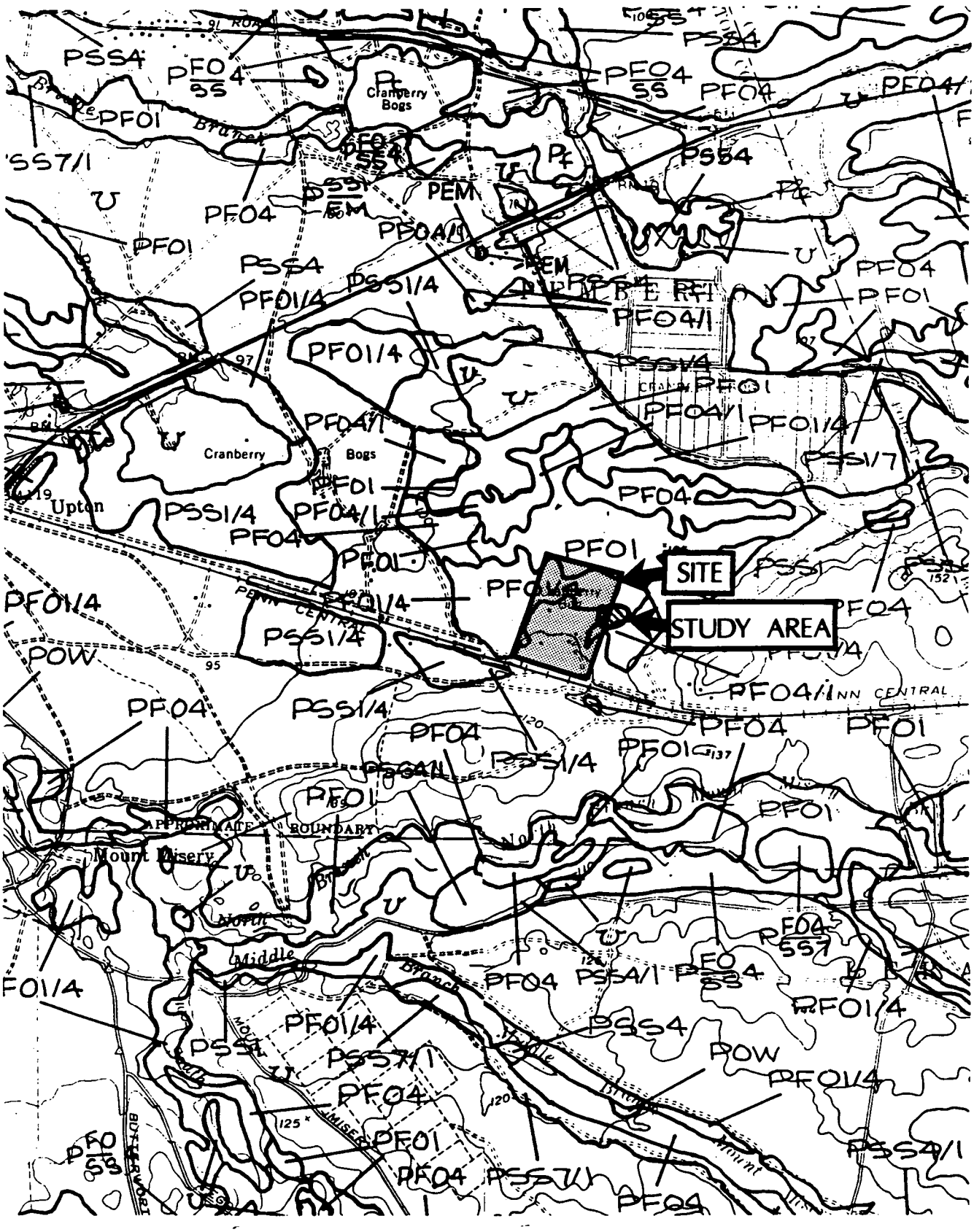


FIGURE 11B: USFWS NWI MAPPING

LANG PROPERTY SITE

SCALE: 1" = 2000'

EcolSciences, Inc.

SOURCE: USFWS; BROWNS MILLS/WHITING, NEW JERSEY QUADS; 1977

b. SCS Soils Mapping

The Soil Survey for Burlington County (SCS, 1971) indicates that Atsion sand (At), Berryland mucky sand (Bu), and Muck (Mu) are the primary soils mapped within the site (Figure 11C). A small area of Lakehurst sand (LlA) is mapped in the site's southeastern corner. The Atsion, Berryland and Muck soils have been classified as hydric by the National Technical Committee for Hydric Soils.

Atsion soils are poorly drained, sandy soils that form on the borders of swamps and bottoms of depressions in the outer coastal plain. Berryland mucky sands are very poorly drained soils occuring along marsh and swamp borders. Typically, a high percentage of organic material is found in the upper 6 to 12 inches of the profile. Muck consists of approximately two feet of finely decomposed, saturated organic material formed along the headwaters of streams or in areas of slow-moving streams.

c. Pine Barrens Vegetation Mapping

The pine barrens vegetation and geography maps (McCormick & Jones, 1973) identify the entire site as wetlands communities (Figure 11D). The northern portion of the site is identified as cedar swamp forest (C) in association with pitch pine lowland forest (PPLL). The southern portion of the site is classified as small ponds or inland marsh (BOG), probably referring to the site's historical use as a blueberry farm.

4. Previous On-site Habitat Studies

Available reports do not reference particular on-site vegetative communities, wetlands, or the potential for threatened and endangered species (ROD 1986, Radian 1991). However, discussions with the RPM for the site (Frigerio, personal communication, 1992) indicate that a small ditch had been filled during the excavations already conducted on the site. Additionally, she noted an additional ditch located north of the remediation area.

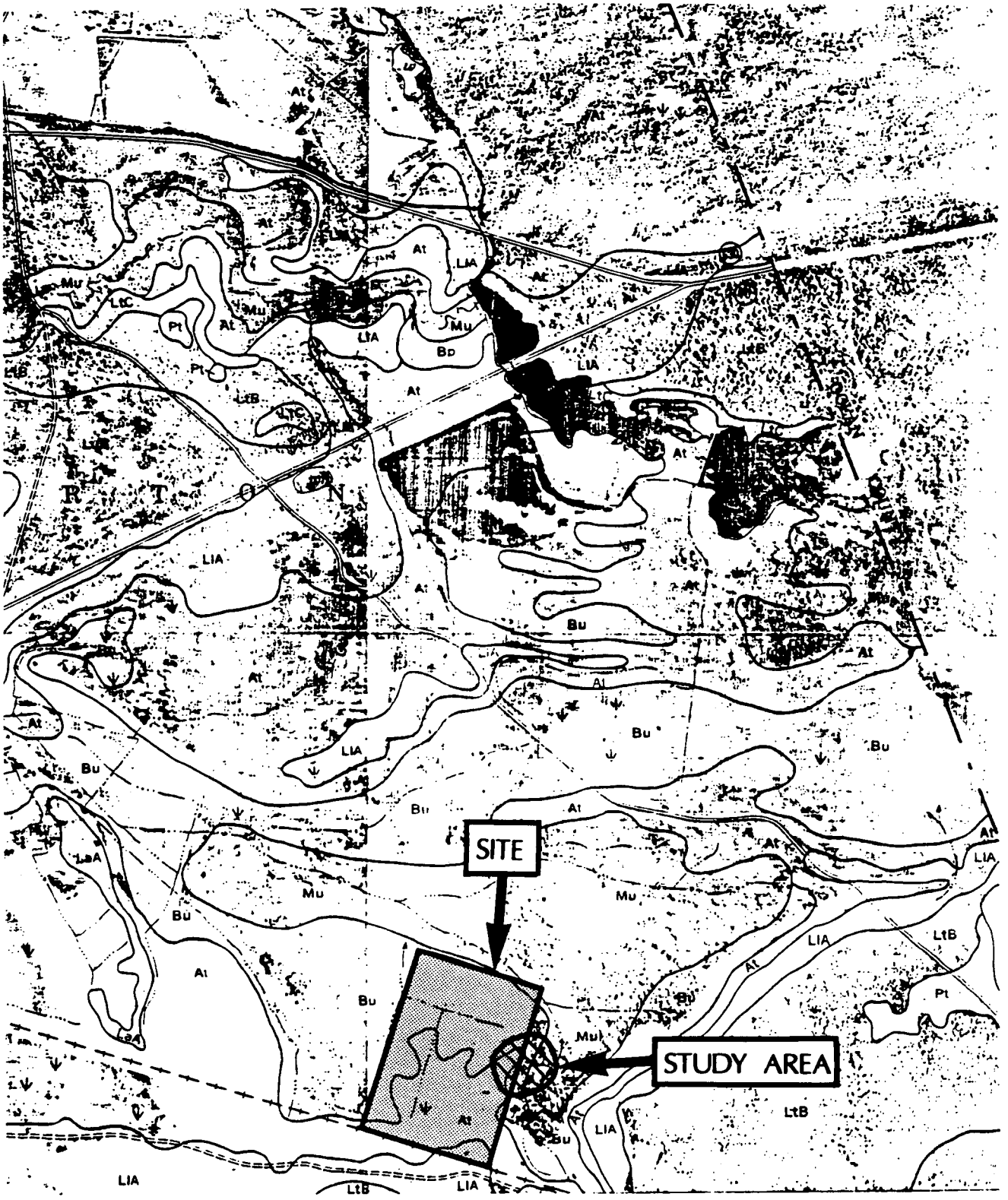


FIGURE 11C: SCS SOILS MAPPING

LANG PROPERTY SITE

At: Atsion sand
Bu : Berryland mucky sand
LIA: Lakehurst sand, thick surface
Mu: Muck, shallow

SOURCE: SCS, BURLINGTON COUNTY SURVEY, 1971, SHEET 42

SCALE: 1" = 1320'

EcolSciences, Inc.

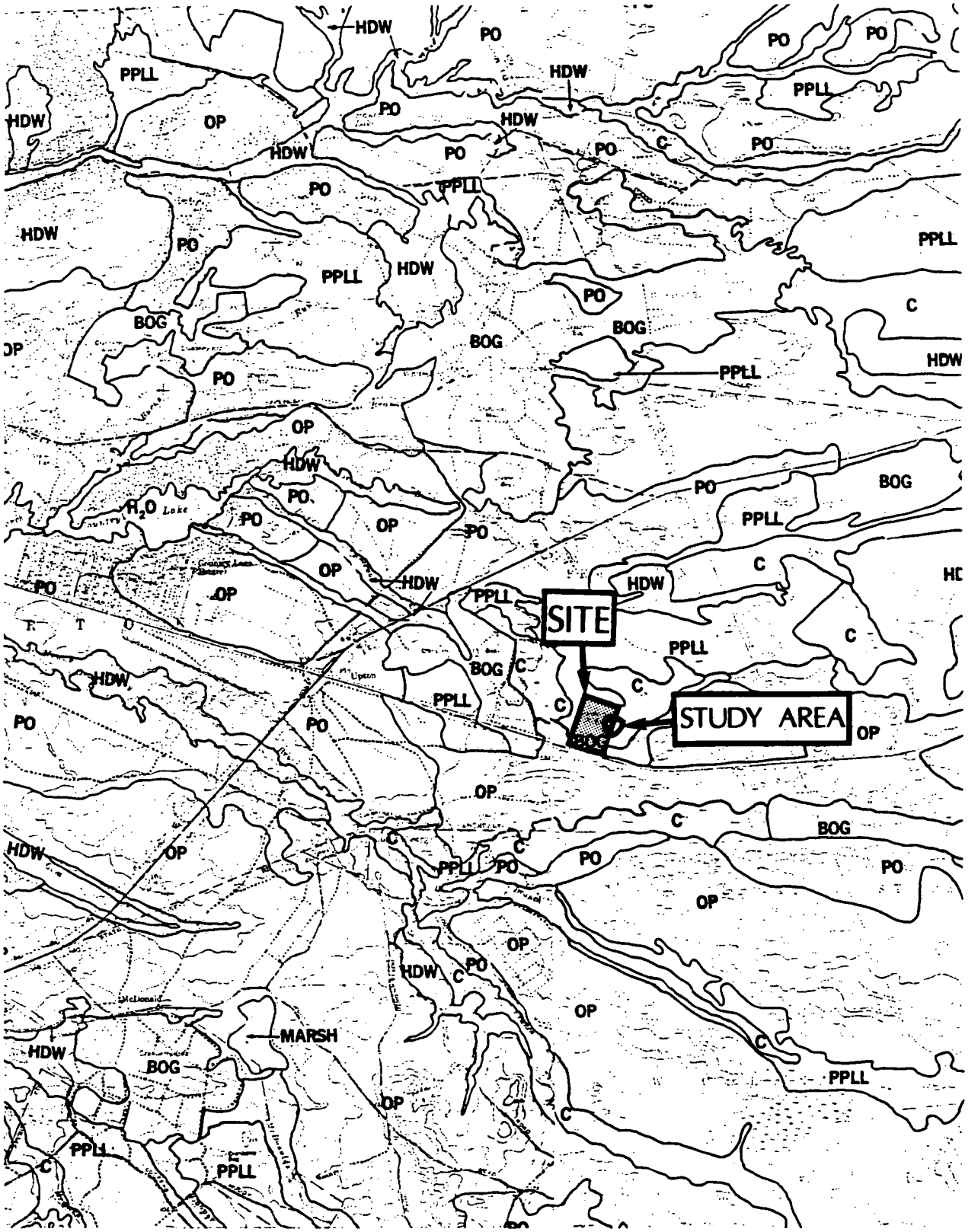


FIGURE 11 D: PINE BARRENS MAPPING

LANG PROPERTY SITE

C: Cedar swamp forest
BOG: Small pond or inland marsh

SCALE: 1" = 4000'

EcolSciences, Inc.

SOURCE: McCORMICK & JONES, 1973, SHEETS 18 & 19

IV. FIELD SURVEY RATIONALE

In this section the information on the habitat requirements for swamp pink and Knieskern's beaked-rush are compared to existing habitats mapped for the NPL sites. Based upon the presence of suitable habitat and documented locations for these species, a recommendation is made concerning the necessity of conducting a field survey of the site. Table 3 summarizes the results of the site review process.

A. Wilson Farm

1. **Swamp Pink**

a. Habitat Comparison

The Wilson Farm site includes forested wetland habitat that is appropriate for swamp pink. Forested wetlands and hydric soils are mapped along the site's western boundary. In addition, vegetative associates of swamp pink were noted in these wetlands in the RI/FS (Acres 1991).

b. Existing Records

In their Section 7 consultation letter, the USFWS noted that swamp pink has been documented within five miles of the Wilson Farm NPL site. They further suggest that, if any site remedial action includes disturbance to wetlands, the presence or absence of swamp pink on the site should be clearly verified and documented. In addition, the NJDEPE Natural Heritage Program database has records for swamp pink identified as being on, or in the immediate vicinity of this site.

c. Recommendation

Based upon the presence of appropriate habitat on-site, the existence of documented records for swamp pink in this area, and the potential that remedial activities may have an impact on the identified wetlands, a field survey of appropriate habitat for swamp pink on this site was recommended.

B. Woodland Township/Route 532

1. **Swamp pink**

a. Habitat Comparison

The forested wetlands that are the preferred habitat for swamp pink have been identified within the study area for this site. They are mapped within

Table 3. Summary of Findings

	USFWS NWI Wetlands	SCS Hydric Soils	Pine Barrens Mapping	New Jersey Wetlands	Potential Habitat		Existing Records				Field Survey	
					Swamp Pink	Knieskern's Beaked-rush	Swamp Pink		Knieskern's Beaked-rush			
							Co	Mun	Co	Mun	Yes	No
Wilson Farm Plumsted Twp. Ocean County Tom's River Watershed	PFO1, PF04/1*	Berryland sand	Hardwood swamp oak-pine forest	-	Yes	NE	Yes	Yes	Yes	Yes	x	
Woodland 532 Woodland Twp. Burlington Cty Wading River Watershed	PSS4/1 PS04/1 PSS4 L10W	Atsion sand, Berryland sand, muck	Pine-oak forest pitch pine lowland forest	-	Yes	?	Yes	No	Yes	No	x	
Woodland 72 Woodland Twp. Burlington Cty Wading River Watershed	PSS4/1 POW PF01 PSS1/4	Atsion sand, muck	Pine-oak forest, Hardwood swamp forest, Cedar swamp forest, pitch pine lowland forest	-	Yes	?	Yes	No	Yes	No	x	
Chemsol Inc. Piscataway Twp. Middlesex Cty Raritan River Watershed	PF01	Parsippany silt loam		PEM1B PF01C	No	NE	Yes	No	No	No		x

Table 3 (continued).

	USFWS NWI Wetlands	SCS Hydric Soils	Pine Barrens Mapping	New Jersey Wetlands	Potential Habitat: Swamp Pink	Potential Habitat: Knieskern's Beaked-rush	Existing Records: Swamp Pink Co	Existing Records: Swamp Pink Mun	Existing Records: Knieskern's Beaked-rush Co	Existing Records: Knieskern's Beaked-rush Mun	Field Survey: Yes	Field Survey: No
Evor Phillips Old Bridge Twp. Middlesex Cty Raritan River Watershed	PFO1* PEM*	Atsion sand	Non pine barren forest Hardwood swamp forest*	-	No	NE	Yes	No	No	No		x
Ewan Shamong Twp. Burlington Cty Mullica River Watershed	PFO1/4	Alluvial land; fallsington fine sand	Oak-pine forest Hardwood swamp	-	Yes	NE	Yes	No	Yes	Yes	x	
Ciba-Geigy Dover Twp. Ocean County Toms River Watershed	PFO1, POW, PFO1/4	Berryland sand Manahawkin muck	Pine oak forest Hardwood swamp forest	PSS1B PFO1/4C PF04/1C POWth	Yes	?	Yes	No	Yes	No	x	
Lang Pemberton Twp. Burlington Cty Rancocas Creek Watershed	PFO1, PF01/4	Atsion sand; Berryland mucky sand muck	Ponds or inland marshes; Cedar swamp forest type; pitch pine lowland forest	-	Yes	?	Yes	Yes	Yes	No	x	

*Adjacent
NE = Not Evaluated
Co = County
Mun = Municipality

the contaminated groundwater plume to be remediated by installation of a groundwater recovery and treatment system. In addition, vegetative associates of swamp pink were identified in these wetlands (ASGEC 1991).

b. Existing Records

The USFWS in their informal consultation letter dated May 8, 1992 (Appendix A) noted that there are documented sightings of swamp pink in the vicinity of this site. They recommended that the area potentially affected by the remediation plan (study area) be searched for swamp pink. The NJDEPE Natural Heritage Program does not have any records for swamp pink within the Goodwater Creek watershed.

c. Recommendation

Given the presence of appropriate habitat for swamp pink, the documented records for it in this area and the potential for remedial actions to have an impact on this species, if present, a field survey of appropriate habitat on this site was recommended.

2. **Knieskern's Beaked-rush**

a. Habitat Comparison

Appropriate habitat for Knieskern's beaked-rush may occur within the study area. This species prefers wet, open, sparsely vegetated areas. Appropriate habitat may exist at the western end of the study area along the edges of the reservoir used to provide water for the adjacent cranberry farms. In addition, vegetative associates of Knieskern's beaked-rush were identified in these wetlands (ASGEC 1991).

b. Existing Records

The USFWS in their informal consultation letter dated May 8, 1992 (Appendix A) noted that there are documented sightings of Knieskern's beaked-rush within 10 miles of the site. They recommended that the area potentially affected by the remediation plan (study area) be searched for this species. The NJDEPE Natural Heritage Program does not have any record for Knieskern's beaked-rush within the Goodwater Creek watershed.

c. Recommendation

Given the potential for appropriate habitat for Knieskern's beaked-rush, the documented records for it in this area and the potential for remedial actions to have an impact on this species, if present, a field survey of appropriate habitat on this site was recommended.

C. Woodland Township/Route 72

1. **Swamp pink**

a. Habitat Comparison

Forested wetlands that are appropriate habitat for swamp pink have been identified within the study area. Specifically, portions of the area of the groundwater plume are mapped as forested wetlands. This area is to be remediated by installation of a groundwater recovery and treatment system.

b. Existing Records

The USFWS in their informal consultation letter dated May 8, 1992 (Appendix A) noted that there are documented sightings of swamp pink in the vicinity of this site. They recommended that the area potentially affected by the remediation plan (study area) be searched for this species. The NJDEPE Natural Heritage Program does not have any records for this species within the Pope Branch watershed.

c. Recommendation

Given the presence of appropriate habitat for swamp pink, the documented records for this species in this area and the potential for remedial actions to have an impact on this species, if present, a field survey of appropriate habitat on this site was recommended.

2. **Knieskern's Beaked-rush**

a. Habitat Comparison

Edge areas around the mapped open water or relatively open areas within the mapped scrub-shrub wetlands may provide the appropriate habitat for Knieskern's beaked-rush.

b. Existing Records

The USFWS in their informal consultation letter dated May 8, 1992 (Appendix A) noted that there are documented sightings of Knieskern's beaked-rush within 10 miles of the site. They recommended that the area potentially affected by the remediation plan (study area) be searched for this species.

c. Recommendation

Given the presence of appropriate habitat for Knieskern's beaked rush, the documented records for this species in this area and the potential for remedial actions to have an impact on this species, if present, a field survey of appropriate habitat on this site was recommended.

D. Evor Phillips Leasing

1. **Swamp pink**

a. Habitat Comparison

Appropriate habitat for swamp pink does not occur on-site. The site is developed and wetlands have not been mapped within the property on the USFWS NWI maps or the Pine Barrens Vegetation Geography maps. Additionally, TRC Environmental Consultants, Inc. during an on-site feasibility study did not identify wetlands within the property.

Downstream wetland communities, although possibly forested, would not be impacted by remedial activities within the site. The site is hydrologically isolated from surface water systems and on-site remediation will be confined to within the site boundaries.

b. Existing Records

The NJDEPE Natural Heritage Program database does not have any records of the species on the site or within the Tennent Pond Brook watershed. The USFWS indicates a swamp pink record within 10 miles of the site; however, the NJDEPE and the Army Corps of Engineers have not identified Old Bridge Township as a municipality with a documented record of swamp pink.

c. Recommendation

Because no wetlands are mapped on-site, remedial actions will not have an impact on wetlands. In addition, swamp pink has not been documented within this municipality. Therefore, a field survey of this property was not recommended.

E. Chemsol, Inc.

1. **Swamp Pink**

a. Habitat Comparison

Forested wetlands have been mapped within this site. These wetlands are most likely not appropriate habitat for swamp pink due to the fact that this community is mapped on a mineral hydric soil, the Parsippany series. Swamp pink prefers highly organic muck soils.

b. Existing Records

The NJDEPE Natural Heritage Program database does not have any records of the species on the site or within the Bound Brook watershed. The USFWS in their consultation letter dated June 21, 1991 (Appendix A) indicates a swamp pink record within 6 miles of the site. However, the Chemsol Inc. site appears to be beyond the established range of swamp pink (Figure 1). The USFWS record must be south of Piscataway within the known range of the species. In addition, the NJDEPE and the Army Corps of Engineers have not identified Piscataway Township as a municipality with a documented record of swamp pink.

c. Recommendation

Forested wetlands are mapped on-site, however, based on characteristics of the mapped hydric soil, this wetland is not typical of swamp pink habitat. In addition, there are no existing records for swamp pink from this municipality. Although swamp pink may occur within six miles of the site, it is not known to occur in Piscataway Township. Based on these considerations, a field survey of the Chemsol Inc. site was not recommended.

F. Ewan Property

1. **Swamp pink**

a. Habitat Comparison

The Ewan property is located within a sparsely populated area within the New Jersey Central Pine Barrens. Based on the USFWS NWI; Pine Barrens vegetation mapping; and SCS soils mapping; the site includes, and is adjacent to, large areas of hardwood swamps. Wetland species associated with these types of forested wetlands are common associates of swamp pink.

b. Existing Records

In Burlington County, historical records exist for Swamp Pink, although within Shamong Township, no records are known. The USFWS in its consultation letter dated March 29, 1991 indicates records for swamp pink within six miles of the site. The NJDEPE Natural Heritage Program database does not have any records for swamp pink within the watershed of Springers Brook.

c. Recommendation

Based upon presence of appropriate swamp pink habitat occurring on-site, the existence of documented records for swamp pink within six miles of the site and the potential for proposed remedial activities to effect wetlands, a field study of the Ewan property was recommended.

G. Ciba-Geigy

1. **Swamp Pink**

a. Habitat Comparison

The representative species identified by Normandeau Associates within the forested wetlands in the Ciba-Geigy study area are common associates of swamp pink. Due to the large area of floodplain forested wetlands represented by the Ciba-Geigy study area, there is a potential for swamp pink to occur. As proposed, remedial activities on this site may effect wetlands within the study area.

b. Existing Records

Within Ocean County, the USFWS maintains records of historical and extant populations of swamp pink. The USFWS and NJDEPE do not have records for swamp

pink in Dover Township, however, the USFWS consultation letter dated August 1, 1991 (Appendix A) does have records for this species within 10 miles of the site. The New Jersey Natural Heritage Program has no records of swamp pink within the Toms River watershed in the vicinity of the Ciba-Geigy site.

c. Recommendation

Based upon the presence of appropriate swamp pink habitat in the study area, the existence of documented records for swamp pink within 10 miles of the site and the potential for proposed remedial activities to effect wetlands, a field study of the Ciba-Geigy study area was recommended.

2. **Knieskern's Beaked-rush**

a. Habitat Comparison

Knieskern's beaked-rush is typically found on unvegetated muddy substrates in early successional wetlands. Available literature concerning the Ciba-Geigy site does not suggest such habitat exists within the site. However, if areas mapped as palustrine open waters are actually abandoned lagoons or drying fields that have over time filled with sediments, these areas may provide potential habitat for Knieskern's beaked-rush. As proposed, remedial activities proposed for this site may effect wetlands within the site and study area.

b. Existing Records

Within Ocean County, the USFWS maintains records of historical and extant populations of Knieskern's beaked-rush. However, no records exist for Knieskern's beaked-rush in Dover Township. Extant populations are known from Berkeley and Manchester Townships. These townships border Dover Township to the south and west. The New Jersey Natural Heritage Program has no records for Knieskern's beaked-rush within the Toms River watershed in the vicinity of the Ciba-Geigy study area.

c. Recommendation

Based upon the results of the literature survey, the potential for Knieskern's beaked-rush habitat on-site, the existence of documented records for Knieskern's beaked-rush within 10 miles of the site and the potential for proposed remedial activities to effect wetlands, a field study of the Ciba-Geigy property was recommended.

H. Lang Property

1. **Swamp Pink**

a. Habitat Comparison

The Lang property is located in a largely undeveloped area within the Pinelands National Reserve. Surrounding the site are large areas of palustrine forested wetlands. Although no site specific information is available characterizing these wetlands, it can be assumed that many of the typical swamp pink associates would be identified in these wetlands.

b. Existing Records

Within Burlington County, the USFWS maintains numerous historic and extant records for populations of swamp pink. This includes records for swamp pink within Pemberton Township. The USFWS consultation letter dated February 6, 1991 (Appendix A), indicates that there are four known populations of swamp pink within 10 miles of the site. However, the New Jersey Natural Heritage Program has no records for swamp pink within the Baffin Brook watershed.

c. Recommendation

The results of the literature survey indicates the presence of appropriate swamp pink habitat occurring within the site and study area. There are documented records for swamp pink within Pemberton Township and within 10 miles of the site. Therefore, a field survey of this site for swamp pink was recommended.

2. **Knieskern's Beaked-rush**

a. Habitat Comparison

Typical Knieskern's beaked-rush habitat, i.e., early successional wetland habitats, bog iron deposits, mud deposits, abandoned sand and clay pits and roadside ditches have not been specifically identified within this site. However, soil and vegetation disturbances relative to in-situ remediation that have already occurred may have created wet, early successional habitats suitable for this species. Such areas, if located on-site, may provide potential habitat for Knieskern's beaked-rush.

b. Existing Records

Within Burlington County, the USFWS maintains numerous historic and

extant records for populations of Knieskern's beaked-rush. The USFWS consultation letter of February 6, 1991 (Appendix A), makes reference to several known populations of this species within 10 miles of the site. However, no extant populations are known from Pemberton Township. The nearest record is from Manchester Township, Ocean County located adjacent to the Pemberton Township's eastern boundary. The New Jersey Natural Heritage Program has no records for Knieskern's beaked-rush in the Baffin Brook watershed.

c. Recommendation

Based upon the results of the literature survey and an account of the activities that have taken place on-site (Frigerio, personal communication, 1992) there is potential for Knieskern's beaked-rush habitat to occur within the distrubed remediation area on-site. In addition, there are documented records for Knieskern's beaked-rush within 10 miles of the site. Based on these considerations, a field study of the Lang property for this species was recommended.

V. HABITAT SURVEY WORK PLAN

A. Introduction

The Habitat Survey Work Plan provides the methodology and rationale for conducting a field survey for the federally threatened plants swamp pink (Helonias bullata) and Knieskern's beaked-rush (Rhyncospora knieskernii) at six National Priorities List (NPL) sites in New Jersey. The six sites were selected from a total of eight sites identified by the USFWS as potentially providing appropriate habitat for one or both of the two plant species. The sites to be surveyed include:

1. Wilson Farm (Swamp pink);
2. Woodland Township/Route 532 site (Swamp pink and Knieskern's beaked-rush);
3. Woodland Township/Route 72 site (Swamp pink and Knieskern's beaked-rush);
4. Ewan property (Swamp pink);
5. Ciba-Geigy (Swamp pink and Knieskern's beaked-rush); and
6. Lang property (Knieskern's beaked-rush).

The two sites determined not to provide appropriate habitat are Evor Phillips Leasing and Chemsol Inc. The review process, which resulted in the selection of the six sites for comprehensive field survey, is detailed in previous chapters of this report. The following sections describe the methodology and rationale of the field survey plan.

B. Study Seasonality

The field survey was conducted during the time periods when swamp pink and Knieskern's beaked-rush are readily identifiable. The season of study is not particularly important for swamp pink because it can be identified at any time of the year due to its evergreen leaves that form a basal rosette. The season of study is critical for Knieskern's beaked-rush because definitive identification requires mature achenes. Knieskern's beaked-rush, is best identified from mid-July to late-September during which time flowering has ended and achene maturation is progressing or completed. As a result, the field survey for both species was conducted during the months of July and August.

C. Plant Identification

Plants encountered during the field survey were identified to the genus level, at a minimum, with the exception of all Rhyncospora species. These were identified to the species level. Similarities between various species of Rhyncospora require study of technical characteristics for accurate species identification. Because Helonias is a monotypic genus and has a unique growth form the same level of effort is not required in order to accurately identify it. Technical manuals which were employed in the identification of species encountered during the field survey include:

- Gleason, H.A., 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada - Volume 1. Macmillan Publishing, New York.
- Fernald, M.L., 1970. Gray's Manual of Botany, Eighth Edition. D. Van Nostrand Company, New York.
- Gleason, H.A. and A. Cronquist, 1963. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. D. Van Nostrand Company, New York.
- Gale, S., 1944. Rhyncospora, Section Eurhyncospora, in Canada, the United States and the West Indies. Rhodora, Vol. 46. No. 544, p. 88-134.

In addition, prior to conducting the field survey, known populations of both plants were inspected to familiarize the plant ecologists with seasonal growth characteristics at the time of the field study. For swamp pink, the control population was in Stafford Township, Ocean County. For Knieskern's beaked-rush, Ms. Dana Peters of the USFWS Pleasantville, New Jersey office escorted the plant ecologists to a known population in Hamilton Township, Atlantic County. Habitat characteristics and preferences of Knieskern's beaked-rush were also discussed with Dr. Ted Gordon, a plant taxonomist/ ecologist, who has been instrumental in discovering new locations of this species in Atlantic County.

D. Field Survey

The field survey involved a three phase approach that first required a field meeting with the RPM; second, appropriate on-site habitats for the two species were identified and mapped; and third, the Timed Meander Search

Procedure as described by Goff et al. (1982) was employed to document the presence or absence of the target species. Each phase is described below.

1. **Phase I - Site Reconnaissance with RPM**

In order to initiate the field survey, a field meeting was held between the field survey team and the RPM. This site reconnaissance allowed the plant ecologists of the field survey team to gain familiarity with on-site habitats, the area of the proposed remedial actions and general layout of the site.

2. **Phase II - Habitat Mapping**

Prior to conducting the field survey for swamp pink and Knieskern's beaked-rush the study areas were evaluated for appropriate on-site habitats. Two experienced plant ecologists conducted a walk-through of the study areas to identify all suitable habitat for the species in question. Base maps used were generally United States Geological Survey 7.5 minute Topographic Quadrangles or Soil Conservation Service County Soil Survey sheets. Site-specific topographic maps were used if available. The stratification of the study areas into appropriate habitats focused the field investigation into those areas with the highest probability of supporting the species.

3. **Phase III - Field Survey Method**

Appropriate habitats for the species of concern at the six sites were investigated by two experienced plant ecologists utilizing the Timed Meander Search Procedure described in Goff et al. (1982). This search method provides a structured, documentable, systematic approach for conducting floristic site examinations in order to determine the presence or absence of threatened or endangered plant species. The procedure has been demonstrated as a means of discovering threatened and endangered species within a site, and documenting a low probability of occurrence of these species when not found.

The procedure involves sampling along a transect that meanders throughout the study area. The transect can meander through the various habitats of the study areas as these habitats are searched for swamp pink and Knieskern's

beaked-rush. The meandering transect may double back over previously covered ground, follow a zig-zag pattern or take any other form so long as there is maximum coverage of vegetative variation within the study area.

Plant species were recorded over time as encountered and the resulting data was plotted to provide a species/effort curve to document the level of effort expended in the search. The plotting also provides an indication of sampling adequacy.

The object of the search was to provide maximum coverage of areas of vegetation variation within the study area. The species effort curve shows a step-like shape as new species were encountered when new areas of vegetation variation were explored. Typically, the search procedure was employed until a definite leveling off of the curve was obtained indicating that no new species were being encountered over time because the vegetation variation within the study area had been sampled. As recommended by Goff et al. (1982) approximately 30 minutes was spent searching without any additional species being encountered before a search was terminated.

VI. RESULTS OF THE HABITAT SURVEY

This chapter provides the results of the field survey for the federally threatened plants swamp pink (Helonias bullata) and Knieskern's beaked-rush (Rhyncospora knieskernii) at six National Priority List (NPL) sites in New Jersey. The six sites were selected from a total of eight sites identified by the USFWS as potentially providing appropriate habitat for one or both of the two plant species. The sites surveyed and their corresponding sections are:

A. Wilson Farm (Swamp pink);

B. Woodland Township/Route 532 site (Swamp pink and Knieskern's beaked-rush);

C. Woodland Township/Route 72 site (Swamp pink and Knieskern's beaked-rush);

D. Ewan property (Swamp pink);

E. Ciba-Geigy (Swamp pink and Knieskern's beaked-rush); and

F. Lang property (Swamp pink and Knieskern's beaked-rush).

The two sites determined not to provide appropriate habitat were Evor Phillips Leasing and Chemsol Inc. The review process that resulted in the selection of the six sites for comprehensive field survey is detailed in Chapters III and IV of this report. Likewise, the method used to sample the sites for these species is described in Chapter V. The following sections describe the results of the field survey for each of the sites selected. Appendix B includes the habitat mapping for each of the sites, Appendix C the results of the timed meander search and Appendix D the plotted results of the timed meander search or species effort curves.

A. Wilson Farm

The Wilson Farm property was searched only for swamp pink based upon a review of existing information about the site. Potential swamp pink habitat was identified in the red maple-dominated hardwood swamp associated with Borden's Run Creek (Appendix B). The results of the timed meander search show that a total of 48 species were identified; however, these did not include swamp pink (Appendix C). The species effort curve shows a definite flattening over time indicating that sampling time was adequate and that all areas of vegetative variation within the study area were encountered (Appendix D).

B. Woodland Township/Route 532

Based upon a review of existing information about the site, the Woodland Township/Route 532 site was searched for both swamp pink and Knieskern's beaked-rush. The habitat mapping of the study area is included in Appendix B. For Woodland Township/Route 532, the swamp pink habitat consisted of the cedar and hardwood swamps associated with unnamed tributaries to the cranberry bog reservoir. Potential Knieskern's beaked-rush habitat was limited to disturbed wetlands where roadway clearings were made to install monitoring wells. Most of the study area consists of pitch pine lowland; a community that is not potential habitat for swamp pink or Knieskern's beaked-rush.

Appendix C includes the results of the timed meander search at this site. A total of 100 species were identified. Neither swamp pink nor Kneiskern's beaked-rush were noted. Even though potential habitat for swamp pink was identified based upon the presence of known associate species and the Contractor's experience, swamp pink was not found. Potential Knieskern's beaked-rush habitat and associates were also identified. Known associates such as brownish beaked-rush (Rhynchospora capitellata), and meadow beauty (Rhexia sp.) were observed in this area; however, Knieskern's beaked-rush was not found.

The species effort curve for the Woodland Township/Route 532 site shows a definite flattening over time, indicating that sampling time was adequate and that all areas of vegetative variation were sampled (Appendix D).

C. Woodland Township/Route 72

Based upon a review of existing information about the site, the Woodland Township/Route 72 site was searched for both swamp pink and Knieskern's beaked-rush. The swamp pink habitat consisted of the cedar swamps associated with the Pope Branch and Biddle Branch (Appendix B). Potential Kneiskern's beaked-rush habitat was limited to edges of the ponds, damp roadway edges and to roadway clearings that crossed wetlands.

A total of 102 species were identified during the timed meander search at this site (Appendix C). Neither swamp pink nor Knieskern's beaked-rush were

noted. Even though potential habitat for swamp pink was identified based upon the presence of known associate species and the Contractor's experience, swamp pink was not found. Potential Knieskern's beaked-rush habitat and associates were also identified. Known associates, such as brownish beaked-rush (R. capitellata), pale beaked-rush (R. pallida) and Canada St. John's wort (Hypericum canadense), were identified in these areas; however, Knieskern's beaked-rush was not found.

The species effort curve for the Woodland Township/Route 72 site also shows a definite flattening over time, indicating that sampling time was adequate and that all areas of vegetative variation were sampled (Appendix D).

D. Ewan Property

As a result of the review of existing information about the site, the Ewan property was searched only for swamp pink. Swamp pink habitat is restricted to a cedar swamp associated with an unnamed tributary of Springer's Brook (Appendix B). Appendix C includes the result of the timed meander search at the site. A total of 65 species were identified. Although potential habitat occurred in the study area, swamp pink was not found.

E. Ciba-Geigy

Based upon a review of existing information about the site, the Ciba-Geigy site was searched for both swamp pink and Knieskern's beaked-rush. The habitat mapping of the study area for this site is included in Appendix B. The swamp pink habitat consists of the hardwood swamps associated with the Toms River floodplain. Potential Kneiskern's beaked-rush habitat was limited to the edges of ponds in the study area and to bog iron deposits along the river.

The results of the timed meander search at this site are located in Appendix C. A total of 112 species were identified. Neither swamp pink nor Knieskern's beaked-rush were noted. Even though potential habitat for swamp pink was identified based upon the presence of known associate species and the Contractor's experience, swamp pink was not found. Potential Knieskern's beaked-rush habitat and associates were also identified. Known associates

such as brownish beaked-rush (R. capitellata) and Canada St. John's wort (Hypericum canadense) were identified in these areas; however, Knieskern's beaked-rush was not found.

Appendix D includes the species effort curve for the Ciba-Geigy site. The plotting shows a definite flattening over time, indicating that sampling time was adequate and that all areas of vegetative variation were sampled.

F. Lang Property

The Lang site was searched for swamp pink and Knieskern's beaked-rush based on a review of existing information about the site. The habitat mapping of the study area at the Lang site is included in Appendix B. The swamp pink habitat consisted of hardward/cedar swamps located outside of the fenced remediation area. Potential Knieskern's beaked-rush habitat included the disturbed wetland areas within the fenced remediation area.

The results of the timed meander search at this site are located in Appendix C. A total of 127 species were identified. Neither swamp pink nor Kneiskern's beaked-rush were noted. Even though potential habitat for swamp pink was identified based upon the presence of known associate species and the Contractor's experience, swamp pink was not found. Potential Knieskern's beaked-rush habitat and known associate species were also identified. Associates such as brownish beaked-rush (R. capitellata), flat sedge (Cyperus sp.) and Canada St. John's wort (Hypericum canadense) were identified in these areas; however, Knieskern's beaked-rush was not found.

Appendix D includes the species effort curve for the Lang site. The plotting shows a steady increase in species over time until near the end of the search indicating a diverse sampling area with new species encountered frequently.

VII. SUMMARY AND CONCLUSIONS

As a result of several recent informal consultations between the EPA and USFWS, potential for the presence of the federally threatened plant species, swamp pink and Knieskern's beaked-rush, has been identified within the vicinity of eight NPL sites in New Jersey. The objective of this study was to determine, through a literature search and field survey, whether swamp pink and Knieskern's beaked-rush or their habitats are present on the NPL sites. Furthermore, because the impact of remedial activities on the NPL sites may extend beyond the boundaries of the sites, study areas were defined based upon the location of potential habitat for the two plant species that may be affected by site remediation.

The review of existing information indicated that the Evor Phillips and Chemsol sites did not contain appropriate habitat for these species and would not require field review. The remaining six sites were investigated in the field for swamp pink only or swamp pink and Knieskern's beaked-rush. The sites and the species for which they were searched are listed below.

A. Wilson Farm (Swamp pink);

B. Woodland Township/Route 532 site (Swamp pink and Knieskern's beaked-rush);

C. Woodland Township/Route 72 site (Swamp pink and Knieskern's beaked-rush);

D. Ewan property (Swamp pink);

E. Ciba-Geigy (Swamp pink and Knieskern's beaked-rush); and

F. Lang property (Swamp pink and Knieskern's beaked-rush).

The six sites investigated in the field were sampled using the Timed Meander Search technique, a method developed to search sites for threatened or endangered plant species. This procedure has been demonstrated as a means of discovering threatened and endangered species and documenting a low probability of occurrence of such species when not found. Although potential habitat for these species was identified, the timed meander search did not identify either swamp pink or Knieskern's beaked-rush in the study areas delineated for the sites. Based on these investigations, there is a very low probability that remediation activities at these sites will have an impact on swamp pink or Knieskern's beaked-rush.

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APPENDIX A

USFWS Consultation Letters

United States Department of the Interior
FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
927 North Main Street (Bldg. D)
Pleasantville, New Jersey 08232
(609) 646-9310

IN REPLY REFER TO:

ES-91/115

August 14, 1991

Mr. Robert W. Hargrove, Chief
Environmental Impacts Branch
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10278

Dear Mr. Hargrove:

This letter responds to your July 30, 1991, request to the U.S. Fish and Wildlife Service (Service) for information on the presence of federally listed and proposed endangered and threatened species within the study area of the Wilson Farm National Priorities List (NPL) Site, located in Plumsted and Jackson Townships, Ocean County, New Jersey.

This response is provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) to ensure the protection of endangered and threatened species and is intended to assist your assessments, investigations and planning being conducted pursuant to Section 104(a) of the Comprehensive Environmental Response, Compensation and Liability Act (P.L. 96-510 94 Stat. 2767) as amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601 et seq.). These comments do not represent any position the U.S. Department of the Interior may adopt concerning possible injury to natural resources under the Department's trusteeship.

Enclosed is a summary of the federally listed and candidate species in New Jersey for your information. A review of our files indicates that there are no known occurrences of these federally listed threatened or endangered species currently documented at the project site. However, the federally listed threatened plant *Helonias bullata* (swamp pink) has been documented from another site within 5 miles of the subject property. As an obligate wetland species, swamp pink typically occurs in palustrine forested wetlands, although occurrence in palustrine scrub/shrub wetlands is not unknown. Vegetative associates of swamp pink include the following species: *Chamaecyparis thyoides* (Atlantic white-cedar), *Acer rubrum* (red maple), *Pinus rigida* (pitch pine), *Clethra alnifolia* (sweet pepperbush), *Sphagnum* spp. (sphagnum mosses), *Osmunda cinnamomea* (cinnamon fern), *Symplocarpus foetidus* (skunk cabbage), *Kalmia* spp. (laurels) and *Smilax* spp. (greenbriars).

In the information you provided to this office, it was stated that a fauna and flora survey of the Wilson Farm site had been conducted. From survey results we infer that forested wetlands exist at the site, and we note that some of the aforementioned swamp pink associate species are present. Based on this,

swamp pink could occur on the project site. However, it is unclear if swamp pink was specifically searched for during the site vegetative survey or if the plant species list you provided represents a comprehensive list.

If any proposed site remedial action includes disturbance to wetlands, we recommend that the presence or absence of swamp pink on the site be clearly verified and documented. Please provide a copy of such documentation to this office, including the name and qualifications of the person(s) conducting the survey.

Information contained in this letter represents the public interest for fish and wildlife resources and should warrant full consideration in the project planning process. The Service requests that no part of this letter be taken out of context and if reproduced, the letter should appear in its entirety. Please contact Dana Peters of my staff if you have any questions or require further assistance regarding threatened or endangered species.

Sincerely,

Craig R. Moore

Craig R. Moore
Acting Supervisor

United States Department of the Interior
FISH AND WILDLIFE SERVICE
P.O. Box 534
705 White Horse Pike
Absecon, New Jersey 08201
(609) 646-9310

September 12, 1989

Mr. Robert W. Hargrove, Chief
Environmental Impacts Branch
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10278

Dear Mr. Hargrove:

This letter is in response to your August 17, 1989 request to the Fish and Wildlife Service (Service) for information on the presence of federally listed and proposed endangered and threatened species within the study area of the Woodland Township Routes 532 and 72 National Priorities List Sites, located in Burlington County, New Jersey.

This response is provided pursuant to the Endangered Species Act (Act) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) to ensure the protection of endangered and threatened species and is intended to assist your assessments, investigations and planning being conducted pursuant to Section 104(a) of the Comprehensive Environmental Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act. These comments do not represent any position the U.S. Department of the Interior may adopt concerning possible injury to natural resources under the Department's trusteeship.

On August 17, 1989, the Service provided comments (copy enclosed) to the Emergency and Remedial Response Division on the Final Draft Remedial Investigation Report for these sites. The Service recommended a survey of the sites and adjacent wetlands to determine the presence or absence of the federally threatened Helonias bullata (swamp pink). Because the biological assessments remain incomplete, the Service is unable to determine the potential for Helonias to occur within the study area. Helonias is documented not far from the Woodland Township sites, thus suitable habitat for the species may exist at these sites as well. Therefore, the Service reiterates its recommendation that a survey be conducted. If it is determined that proposed remedial activities may directly or indirectly affect Helonias, consultation pursuant to section 7 of the Act will be required with the Service.

The Remedial Investigation Report noted the presence of two federal candidate species within the project area: northern pine snake (Pituophis melanoleucas m.) and bog turtle (Clemmys muhlenbergii). As category 2 candidate species, these species are under consideration by the Service for possible inclusion on

the List of Endangered and Threatened Wildlife and Plants. Although these species receive no substantive or procedural protection under the Act, the Service encourages the U.S. Environmental Protection Agency to consider these species in the project planning process. Although there are no current proposals to list these species, it is possible that they will be subject of a listing proposal prior to completion of remedial activities at the Woodland Township sites. The New Jersey Natural Heritage Program provides the most up-to-date data source for candidate species in the State, as well as maintaining information on State listed species, and should be contacted to obtain records of these and other candidate species which may occur on the site. The Natural Heritage Program may be contacted at the following address:

Mr. Thomas Breden
Natural Heritage Program
Division of Parks and Forestry
CN 404
Trenton, New Jersey 08625
(609/984-0097)

Should the Natural Heritage Program data search reveal the presence of any candidate species on the site, the Service should be contacted to ensure that these species are not adversely affected by project activities. Compilations of federally listed, proposed and candidate species are enclosed for your information.

Further information on State listed species may be obtained from the following office:

Ms. JoAnn Frier-Murza
Endangered and Nongame Species Program
Division of Fish, Game and Wildlife
CN 400
Trenton, New Jersey 08625
(609/292-9101)

Information contained in this letter and additional information obtained from the aforementioned State sources represents the public interest for fish and wildlife resources and should warrant full consideration in the project planning process. The Service requests that no part of this letter be taken out of context and if reproduced, the letter should appear in its entirety.

Please contact Lynn Wilson of my staff should you have any questions or require further assistance.

Sincerely,

Clifford G. Day

Clifford G. Day
Supervisor

IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
927 North Main Street (Bldg. D1)
Pleasantville, New Jersey 08232

Tel: 609-646-9310
FAX: 609-646-0352

May 8, 1992

Rick Robinson
U.S. Environmental Protection Agency, Region II
Emergency and Remedial Response Division
New Jersey Superfund Branch 1
Room 710
26 Federal Plaza
New York, New York 10278

Dear Mr. Robinson:

This responds to Thomas Porucznik's April 21, 1992 request that the U. S. Fish and Wildlife Service (Service) review the Draft Final Report entitled, Preliminary Environmental Impacts Evaluation - Proposed Groundwater Recovery And Treatment Project, for the Woodland Route 72 and 532 National Priority List Sites in Burlington County, New Jersey.

The following comments are intended to assist your assessments, investigations, and planning being conducted pursuant to Section 104(a) of the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act. These planning aid comments are being provided on a technical assistance basis only and do not represent any position the U. S. Department of the Interior (DOI) may adopt concerning possible injury to natural resources under the DOI's trusteeship. A November 4, 1991 DOI letter to Vincent Pitruzzello of U.S. Environmental Protection Agency (USEPA) clearly identified the DOI's concerns about the NPL sites, as well as the DOI's position concerning a covenant not to sue as part of a settlement with the responsible parties. Comments herein are also provided pursuant to the Endangered Species Act (Act) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) to ensure the protection of federally listed endangered and threatened species.

The USEPA Region II Biological Technical Assistance Group (BTAG) and the Service have previously identified, via recommendation memoranda and letters, several natural resources issues (e.g., impacts to vegetation and wildlife habitat, fish and wildlife species, endangered species, and wetlands) that require additional study. Since this document mostly reiterates these concerns, the Service concurs with the estimated environmental impacts and recommendation sections in the referenced report. The following specific comments reflect the continuing need to resolve natural resource issues.

The Project Description Section of the report inadequately describes the total area of anticipated impacts from the groundwater treatment alternatives. The report only identifies the physical area of the roadways and pipelines that

would be needed to implement each remedy. Detailed descriptions of all potentially impacted areas (treatment and support plant(s), turning and parking areas, monitoring, recovery, and recharge well access areas) should be provided and evaluated prior to selection of the appropriate remedy.

The report indicates that 9 wetland types are present within the proposed remedial activity area. The Service contends that either selected groundwater treatment remedy will indeed impact a variety of adjacent wetlands both directly via construction, and indirectly via changes in groundwater and surface water hydrology. Therefore, we recommend that a wetland delineation be conducted in areas potentially impacted by the proposed remedial activity.

The report does not address previous BTAG and Service recommendations to further assess the extent of contamination in soils of the Route 532 site, and in the sediments and surface waters in the adjacent wetlands. These wetland areas are of particular concern to the Service as they provide viable habitat for a large variety of organisms, and are directly adjacent and downgradient of the sites. The Service believes this critical information is needed prior to designing the groundwater treatment remedy, as later soil/sediment remediation may be hampered by improper placement of groundwater remedy structures.

The Service recommends that wetland impacts from remedial activities first be avoided, secondly minimized, and then, if no other feasible solution is possible, that unavoidable wetland losses be compensated in accordance with the Service's Mitigation Policy (Federal Register, Vol. 46, No. 15, January 23, 1981). It is recommended that an assessment of adjacent wetland functions be conducted to provide baseline information and a reference for restoration/replacement of any unavoidably lost wetlands. Future documents should contain quantitative information concerning past and proposed impacts from remediation on the adjacent wetlands.

The Service also recommends that future documents pertaining to the remedial action contain quantitative information on upland habitat that has been, and will be impacted during the remediation of these sites. It should be noted that the above comments regarding compensation also apply to impacted uplands.

Swamp pink (Helonias bullata), a federally listed threatened plant, has been documented in the vicinity of the Woodland sites. In September 1989, the Service requested that a survey be conducted to determine its presence on-site and in adjacent wetlands. Additionally, two federal candidate species, northern pine snake (Pituophis m. melanoleucas), and the bog turtle (Clemmys muhlenbergii) were documented on-site in the Remedial Investigation Report. A biological survey conducted by Wander Ecological Consultants in July 1990 did not confirm swamp pink; however, due to health and safety reasons, the area searched was limited to the site perimeter fence, and adjacent to the roads of this area. During field investigations that were needed to generate this current report, representatives of the Amy S. Greene Environmental Consultants, Inc., did not document any federally listed threatened or endangered species. However, the areas of investigation were not clearly defined. The New Jersey Natural Heritage Program (NJNHP) data base printout attached to the Amy Greene report listed one federal candidate invertebrate

species (Buchholz's dart, Agrotis buchholzi) in the immediate vicinity of the sites. Another species listed on the NJNHP printout as a candidate species, Lemmer's pinnion moth (Lithophane lemmeri), is now in Category 3C on the federal candidate list (Federal Register Vol. 56, No. 225 November 21, 1991) and, therefore, no longer under consideration for listing.

Although not documented within the immediate vicinity of the site, and thus not listed on the NJNHP printout, Knieskern's beaked-rush (Rhychospora knieskernii) is known to occur within 10 miles of the project site. This plant was added to the federal list of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 & 17.12) as a threatened species on July 18, 1991, and thus receives protection afforded by the Act. Considered an obligate wetland species, the plant occurs in early successional wetland habitat of the New Jersey pine barrens, and could potentially occur on the Woodland NPL sites and adjacent habitat.

It appears that no federally listed threatened or endangered species are currently documented to occur on the project sites; however, since the areas searched have not been clearly identified, the Service can not rule out the possibility of such occurrence. Furthermore, the selected groundwater treatment remedy has potential to disrupt a large area of viable wetland habitat and it is doubtful that all potentially impacted areas have been adequately searched. The Service recommends that when all wetland delineations and areas of potential impact are clearly defined, a thorough search for the federally listed swamp pink and Knieskern's beaked-rush be conducted. Results of these surveys must be forwarded to this office for review to determine if further consultation pursuant to Section 7(a)(2) of the Act is necessary.

Furthermore, the Service recommends that surveys be conducted on and adjacent to the site for the northern pine snake, bog turtle, and Buchholz's dart, federal candidate species. If any of these species are present, potential project-related impacts should be considered during project planning. Although not currently afforded protection under the Act, it is possible that these species could be proposed for listing and receive protection pursuant to the Act before remediation is completed.

We hope that these comments are given serious consideration by the USEPA. Questions on threatened and endangered species can be directed to Dana Peters, and other questions concerning this correspondence may be directed to Mark Roberts of my staff. Unless the Service receives information to the contrary, we will assume that the USEPA agrees with these comments and will work with the responsible parties to implement all of the recommendations contained herein. Your cooperation in this matter is appreciated.

Sincerely,

Clifford Day
Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
927 North Main Street (Bldg. D1)
Pleasantville, New Jersey 08232

Tel: 609-646-9310
FAX: 609-646-0352

IN REPLY REFER TO:

ES-91/98

June 21, 1991

Mr. Robert W. Hargrove, Chief
Environmental Impacts Branch
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10278

Dear Mr. Hargrove:

This letter responds to your May 30, 1991, request to the Fish and Wildlife Service (Service) for information on the presence of federally listed and proposed endangered and threatened species within the project area of the Chemsol, Inc. National Priorities List Site, located in Piscataway Township, Middlesex County, New Jersey.

This response is provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) to ensure the protection of endangered and threatened species and is intended to assist your assessments, investigations and planning being conducted pursuant to Section 104 (a) of the Comprehensive Environmental Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act. These comments do not represent any position the U.S. Department of the Interior may adopt concerning possible injury to natural resources under the Department's trusteeship.

The federally threatened plant species Helonias bullata (swamp pink) is documented to exist in forested wetlands approximately 6 miles from the project site. A review of the Service's National Wetland Inventory map of the Plainfield, New Jersey Quadrangle indicates palustrine forested wetlands on the project site. Since swamp pink favors forested wetland habitats, it may be present on the project site. If wetlands will be impacted by the proposed project, we recommend that a survey be conducted to determine the absence or presence of swamp pink. The results of the survey should be forwarded to this office for review.

Except for the possible occurrence of swamp pink and an occasional transient Bald Eagle (Haliaeetus leucocephalus) or Peregrine Falcon (Falco peregrinus), no other federally listed or proposed threatened or endangered flora or fauna are known to occur at the project site. Enclosed is a summary of federally listed and candidate species in New Jersey for your information. Candidate species are those species under consideration by the Service for possible inclusion on the List of Endangered and Threatened Wildlife and Plants. Although these species receive no substantive or procedural protection under

the Endangered Species Act, the Service encourages federal agencies and other planners to consider candidate species in the project planning process. The New Jersey Natural Heritage Program provides the most up-to-date data source for candidate species in the State, as well as maintaining information on State listed species, and may be contacted at the following address:

Mr. Thomas Breden
Natural Heritage Program
Division of Parks and Forestry
CN 404
Trenton, New Jersey 08625
(609/984-0097

Should the Natural Heritage Program data search reveal the presence of any candidate species on the site, the Service should be contacted to ensure that these species are not adversely affected by project activities.

Further information on State listed species may be obtained from the following office:

Ms. JoAnn Frier-Murza
Endangered and Nongame Species Program
Division of Fish, Game and Wildlife
CN 400
Trenton, New Jersey 08625
(609/292-9101)

In regard to potential wetland impacts, the specific extent of wetlands on the project site can only be determined by on-site inspection. Wetlands provide habitat for a variety of migratory and resident species of fish and wildlife. Thus, the Service discourages activities in and affecting the Nation's wetlands that would unnecessarily damage, degrade or destroy these habitat values. Without detailed project information, we are unable to provide a more extensive review of the project proposal at this time. Project activities in wetlands may require federal and State permits from the U.S. Army Corps of Engineers pursuant to the Clean Water Act (33 U.S.C. 1344 et seq.) and the New Jersey Department of Environmental Protection pursuant to the Freshwater Wetlands Protection Act (N.J.S.A. 13:9B-1 et seq.). The Department of Environmental Protection, through the Freshwater Wetlands Protection Act, can provide a letter of interpretation stating if wetlands are present on the site and verifying the delineation of any wetland boundary line. Thus, if work is proposed in wetlands, the following offices should be contacted to determine permit compliance:

Regulatory Branch
U.S. Army Corps of Engineers
New York District
26 Federal Plaza
New York, New York 10278-0090
(212/264-90530

Division of Coastal Resources
Department of Environmental Protection
CN 401
Trenton, New Jersey 08625-0401
(609/984-0853)

Information contained in this letter and additional information obtained from the aforementioned sources represents the public interest for fish and wildlife resources and should warrant full consideration in the project planning process. The Service requests that no part of this letter be taken out of context and if reproduced, the letter should appear in its entirety.

Please contact Dana Peters of my staff if you have any questions or require further assistance regarding threatened or endangered species.

Sincerely,

Clifford G. Day
Supervisor

Enclosures

1/9/92 cc -> R.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
927 North Main Street (Bldg. D)
Pleasantville, New Jersey 08232
(609) 646-9310

IN REPLY REFER TO:
ES-91/152

November 8, 1991

Mr. Robert W. Hargrove
Chief, Environmental Impacts Branch
U.S. Environmental Protection Agency
Jacob K. Javits Federal Building
New York, New York 10278

Dear Mr. Hargrove:

This letter responds to your October 22, 1991, request to the U.S. Fish and Wildlife Service (Service) for information on the presence of federally listed and proposed endangered and threatened species on or in the vicinity of the Evor Phillips Leasing Company National Priorities List Site located in Middlesex County, New Jersey.

This response is provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) to ensure the protection of endangered and threatened species and is intended to assist your assessments, investigations, and planning being conducted pursuant to Section 104(a) of the Comprehensive Environmental Response, Compensation and Liability Act (P.L. 96-510 94 Stat. 2767) as amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601 et seq.). These comments do not represent any position the U.S. Department of the Interior may adopt concerning possible injury to natural resources under the Department's trusteeship.

Enclosed are summaries of federally listed and candidate species in New Jersey for your information. The federally listed threatened plant species *Helonias bullata* (swamp pink) is documented to exist in forested wetlands within 10 miles of the Evor Phillips Leasing Company Site. As an obligate wetland species, *Helonias* typically occurs in forested wetlands, although occurrence in scrub/shrub and emergent wetlands is known. Vegetative associates of swamp pink may include the following species: *Chamaecyparis thyoides* (Atlantic white-cedar), *Acer rubrum* (red maple), *Pinus rigida* (pitch pine), *Clethra alnifolia* (sweet pepper bush), *Sphagnum* spp. (sphagnum mosses), *Osmunda cinnamomea* (cinnamon fern), *Symplocarpus foetidus* (skunk cabbage), *Kalmia* spp. (laurels), *Smilax* spp. (greenbriars), etc.

We have reviewed the Service's National Wetland Inventory map (South Amboy quadrangle) for the site and note there are palustrine forested wetlands, and, therefore, possibly swamp pink in several areas adjacent to the main project area. If forested wetlands will be impacted by the proposed project, we recommend that a qualified botanist conduct a vegetative survey of these wetlands to determine the absence or presence of swamp pink. The results of the survey, including the survey method used and the qualifications of the surveyor, should be forwarded to this office for review. Except for an

JB 11/13/92

occasional transient Bald Eagle (*Haliaeetus leucocephalus*) or Peregrine Falcon (*Falco peregrinus*), no other federally listed or proposed threatened or endangered flora or fauna are known to occur at the project site.

Candidate species are species under consideration by the Service for possible inclusion on the List of Endangered and Threatened Wildlife and Plants. Although these species receive no substantive or procedural protection under the Endangered Species Act, the Service encourages federal agencies and other planners to consider candidate species in the project planning process. The New Jersey Natural Heritage Program provides the most up-to-date data source for candidate species in the State, as well as maintaining information on State listed species, and may be contacted at the following address:

Mr. Thomas Breden
Natural Heritage Program
Division of Parks and Forestry
CN 404
Trenton, New Jersey 08625
(609/984-0097)

Should the Natural Heritage Program data search reveal the presence of any candidate species on the site, the Service should be contacted to ensure that these species are not adversely affected by project activities.

Further information on State listed wildlife species may be obtained from the following office:

Ms. JoAnn Frier-Murza
Endangered and Nongame Species Program
Division of Fish, Game and Wildlife
CN 400
Trenton, New Jersey 08625
(609/292-9101)

Information contained in this letter and additional information obtained from the aforementioned sources represents the public interest for fish and wildlife resources and should warrant full consideration in the project planning process. The Service requests that no part of this letter be taken out of context and if reproduced, the letter should appear in its entirety.

Please contact Dana Peters of my staff if you have any questions or require further assistance regarding threatened or endangered species.

Sincerely,

Clifford G. Day
Supervisor

Enclosures

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
927 North Main Street (Bldg. D)
Pleasantville, New Jersey 08232
(609) 646-9310

IN REPLY REFER TO:
ES-91/73

March 29, 1991

Robert W. Hargrove, Chief
Environmental Impacts Branch
U.S. Environmental Protection Agency
Region II
26 Federal Plaza
New York, New York 10278

Dear Mr. Hargrove:

This letter is in response to your March 4, 1991, request to the Fish and Wildlife Service (Service) for information on the presence of federally listed and proposed endangered and threatened species within the study area of the proposed remediation within the Ewan Property National Priorities List Site in Shamong Township, Burlington County, New Jersey.

This response is provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) to ensure the protection of endangered and threatened species and is intended to assist your assessments, investigations and planning being conducted pursuant to Section 104(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (42 U.S.C. 9601 et seq.) (Superfund Amendments and Reauthorization Act). These comments do not represent any position the U.S. Department of the Interior may adopt concerning possible injury to natural resources under the Department's trusteeship.

Except for occasional transient species, no federally listed or proposed threatened or endangered flora or fauna are known to exist within the study area. However, the federally threatened swamp pink (Helonias bullata) has been located in a wetlands area approximately six miles west of the study area. In addition, the candidate species bog asphodel (Narthecium americanum) has been located in a wetlands area approximately four miles southeast of the study area. Review of the Fish and Wildlife Service's National Wetlands Inventory maps for the Indian Mills, New Jersey Quadrangle indicate the presence of forested wetlands on the site. Both of the above listed species favor forested wetland environments and, therefore, they may be present on the project site. We recommend that a detailed survey of the study area be conducted to confirm the presence or absence of federally listed endangered and threatened or candidate species and the results be forwarded to the Service. Enclosed is a summary of federally listed and candidate species in New Jersey (see Enclosure 1).

Candidate species are those species under consideration by the Service for possible inclusion on the List of Endangered and Threatened Wildlife and Plants. Although these species receive no substantive or procedural protection under the Endangered Species Act, the Service encourages federal agencies and other planners to consider candidate species in the project planning process. The New Jersey Natural Heritage Program provides the most up-to-date data source for candidate species in the State, as well as maintaining information on State listed species, and may be contacted at the following address:

Mr. Thomas Breden
Natural Heritage Program
Division of Parks and Forestry
CN 404
Trenton, New Jersey 08625
(609/984-0097)

Should the Natural Heritage Program data search reveal the presence of any candidate species on the site, the Service should be contacted to ensure that these species are not adversely affected by project activities.

Further information on State listed species may be obtained from the following office:

Ms. JoAnn Frier-Murza
Endangered and Nongame Species Program
Division of Fish, Game and Wildlife
CN 400
Trenton, New Jersey 08625
(609/292-9101

As discussed above, our review of the National Wetlands Inventory map for the Indian Mills, New Jersey Quadrangle, shows wetlands within and adjacent to the project site. The specific extent of these wetlands can only be determined by on-site inspection. Wetlands provide habitat for a variety of migratory and resident species of fish and wildlife. Thus, the Service discourages activities in and affecting the Nation's wetlands that would unnecessarily damage, degrade or destroy these habitat values. Without detailed project information, we are unable to provide a more extensive review of the project proposal at this time. Project activities in wetlands may require federal and State permits from the U.S. Army Corps of Engineers pursuant to the Clean Water Act (33 U.S.C. 1344 et seq.) and the New Jersey Department of Environmental Protection pursuant to the Freshwater Wetlands Protection Act (N.J.S.A. 13:9B-1 et seq.). The Department of Environmental Protection, through the Freshwater Wetlands Protection Act, can provide a letter of interpretation, which determines if wetlands are present on the site or verifies the delineation of a wetland boundary line. Thus, if work is

proposed in wetlands, the following offices should be contacted to determine permit compliance:

Regulatory Branch
U.S. Army Corps of Engineers
Philadelphia District
Custom House, 2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106-2991
(215/597-4723)

Division of Coastal Resources
Department of Environmental Protection
CN 401
Trenton, New Jersey 08625-0401
(609/984-0853)

Information contained in this letter and additional information obtained from the aforementioned sources represents the public interest for fish and wildlife resources and should warrant full consideration in the project planning process. The Service requests that no part of this letter be taken out of context and if reproduced, the letter should appear in its entirety.

Please contact Dana Peters of my staff should you have any questions or require further assistance.

Sincerely,

Michael T. Chezik

Michael T. Chezik
Acting Supervisor

Enclosures

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
927 North Main Street (Bldg. D)
Pleasantville, New Jersey 08232
(609) 646-9310

IN REPLY REFER TO:

ES-91/109

August 1, 1991

Mr. Robert W. Hargrove, Chief
Environmental Impacts Branch
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10278

Dear Mr. Hargrove:

This letter responds to your July 2, 1991, request to the Fish and Wildlife Service (Service) for information on the presence of federally listed and proposed endangered and threatened species within the study area of the Ciba-Geigy Landfill National Priorities List Site, located in Tom's River, Ocean County, New Jersey.

This response is provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) to ensure the protection of endangered and threatened species and is intended to assist your assessments, investigations and planning being conducted pursuant to Section 104(a) of the Comprehensive Environmental Response, Compensation and Liability Act (P.L. 96-510 94 Stat. 2767) as amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601 et seq.). These comments do not represent any position the U.S. Department of the Interior may adopt concerning possible injury to natural resources under the Department's trusteeship.

A review of our files indicates that the federally threatened plant species swamp pink (*Helonias bullata*) and Knieskern's beaked-rush (*Rhynchospora knieskernii*), and the federal candidate plant species bog asphodel (*Narthecium americanum*) and pine barrens boneset (*Eupatorium resinosum*) are known to occur within 10 miles of the project site. Swamp pink occurs in forested wetlands, while Knieskern's beaked-rush is typically found on unvegetated muddy substrates in early successional wetlands. Bog asphodel and pine barrens boneset typically occur in emergent floodplain wetlands. A review of the Service's National Wetland Inventory map, Tom's River, New Jersey quadrangle indicates that palustrine forested wetlands are present on the project site. Noting the preference of the above listed plant species for wetlands, it is possible that these species are present on the project site. If wetlands, or upland transition areas within 150 feet of wetlands, will be impacted by the proposed project, we recommend that a qualified botanist conduct a vegetative survey of the project site to determine the absence or presence of swamp pink, Knieskern's beaked-rush, bog asphodel, and pine barrens boneset. The results of the survey, including the survey method used and the qualifications of the surveyor, should be forwarded to this office for review.

Candidate species are species under consideration by the Service for possible inclusion on the List of Endangered and Threatened Wildlife and Plants. Although these species receive no substantive or procedural protection under the Endangered Species Act, the Service encpurages federal agencies and other planners to consider candidate species in the project planning process. The New Jersey Natural Heritage Program provides the most up-to-date data source for candidate species in the State, as well as maintaining information on State listed species, and may be contacted at the following address:

Mr. Thomas Breden
Natural Heritage Program
Division of Parks and Forestry
CN 404
Trenton, New Jersey 08625
(609/984-0097)

Should the Natural Heritage Program data search reveal the presence of any other candidate species on the site, the Service should be contacted to ensure that these species are not adversely affected by project activities.

Further information on State listed species may be obtained from the following office:

Ms. JoAnn Frier-Murza
Endangered and Nongame Species Program
Division of Fish, Game and Wildlife
CN 400
Trenton, New Jersey 08625
(609/292-9101)

Except for the possible occurrence of the above mentioned plant species and occasional use by transient Bald Eagles (*Haliaeetus leucocephalus*) or Peregrine Falcons (*Falco peregrinus*), no other federally listed or proposed threatened or endangered flora or fauna are known to occur at the project site. Enclosed is a summary of federally listed and candidate species in New Jersey for your information.

In regard to potential wetland impacts, the specific extent of wetlands on the project site can only be determined by on-site inspection. Wetlands provide habitat for a variety of migratory and resident species of fish and wildlife. Thus, the Service discourages activities in and affecting the Nation's wetlands that would unnecessarily damage, degrade or destroy these habitat values. Without detailed project information, we are unable to provide a more extensive review of the project proposal at this time. Project activities in wetlands may require federal and State permits from the U.S. Army Corps of Engineers pursuant to the Clean Water Act (33 U.S.C. 1344 et seq.) and the New Jersey Department of Environmental Protection pursuant to the Freshwater Wetlands Protection Act (N.J.S.A. 13:9B-1 et seq.). The Department of Environmental Protection, through the Freshwater Wetlands Protection Act, can

provide a letter of interpretation stating if wetlands are present on the site and verifying the delineation of any wetland boundary line. Thus, if work is proposed in wetlands, the following offices should be contacted to determine permit compliance:

Regulatory Branch
U.S. Army Corps of Engineers
Philadelphia District
Custom House, 2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106-2991
(215/597-4723)

Division of Coastal Resources
Department of Environmental Protection
CN 401
Trenton, New Jersey 08625-0401
(609/984-0853)

Information contained in this letter and additional information obtained from the aforementioned sources represents the public interest for fish and wildlife resources and should warrant full consideration in the project planning process. The Service requests that no part of this letter be taken out of context and if reproduced, the letter should appear in its entirety.

Please contact Dana Peters of my staff if you have any questions or require further assistance regarding threatened or endangered species.

Sincerely,

Clifford G. Day
Supervisor

Enclosures

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
927 North Main Street (Bldg. D)
Pleasantville, New Jersey 08232
(609) 646-9310

IN REPLY REFER TO:

ES-92/187

February 6, 1992

Robert W. Hargrove
Chief, Environmental Impacts Branch
U.S. Environmental Protection Agency
26 Federal Plaza
New York, New York 10278-0090

Dear Mr. Hargrove:

This responds to your January 16, 1992, request to the U.S. Fish and Wildlife Service (Service) for information on the presence of endangered and threatened species within the vicinity of the Lang Property National Priorities List Site in Pemberton Township, Burlington County, New Jersey.

This response is provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) to ensure the protection of endangered and threatened species and is intended to assist your assessments, investigations, and planning being conducted pursuant to Section 104(a) of the Comprehensive Environmental Response, Compensation and Liability Act (P.L. 96-510 94 Stat. 2767) as amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601 et seq.). These comments do not represent any position the U.S. Department of the Interior may adopt concerning possible injury to natural resources under the Department's trusteeship.

Endangered Species

Enclosed are current summaries of federally listed and candidate species in New Jersey for your information. Many natural areas of New Jersey, including the Lang property, have not been thoroughly surveyed for endangered and threatened plant and animal species. Therefore, the lack of a species occurrence in our database for this site cannot be considered a definitive statement on the absence of that species. The possibility of a species occurring on a site will be suspected if suitable habitat for that species is present.

According to our records, *Helonias bullata* (swamp pink), a federally listed threatened plant species, is documented to occur in four locations within 10 miles of the site. Swamp pink typically occurs in forested wetlands, although occurrence in scrub/shrub and emergent wetlands is known. We have reviewed the Service's National Wetlands Inventory map (Whiting, New Jersey quadrangle) for the site and note there are palustrine forested wetlands and, therefore, possibly swamp pink in the project area.

Threats to swamp pink include direct loss of its wetland habitat due to filling or draining, and indirect degradation of its habitat due to sedimentation, erosion, disruption of groundwater hydrology, and adverse impacts to water quality. The proposed remedial action for the Lang property, which involves the pumping of contaminated groundwater to the surface for treatment, may indirectly affect nearby wetlands by reducing groundwater levels. If swamp pink occurs in these wetlands, it could be adversely affected by the remedial action activity.

In addition to swamp pink, several occurrences of *Rhynchospora knieskernii* (Knieskern's beaked-rush), a federally listed threatened plant species, are documented to exist within 10 miles of the site. Knieskern's beaked-rush inhabits early successional wet habitats including bog iron deposits, mud deposits, abandoned sand and clay pits, and roadside ditches. Furthermore, New Jersey's single known occurrence of *Schwalbea americana* (American chaffseed), a federally proposed endangered plant species, is located within 1.5 miles of the site. American chaffseed is generally found in open grass-sedge systems in moist to dry soils. Without a detailed description of the project area, we cannot determine if suitable habitat is present for Knieskern's beaked-rush and American chaffseed.

To determine the absences or presence of these federally listed and proposed species, the Service recommends a qualified botanist conduct a vegetative survey of wetlands and other areas that will be excavated or otherwise adversely affected by remediation. The results of the survey, including the survey method used and the qualifications of the surveyor, must be forwarded to this office for review to determine if formal consultation pursuant to Section 7(b), or a conference pursuant to Section 7(a)(4) of the Endangered Species Act is necessary for the listed or proposed species, respectively.

Except for an occasional transient bald eagle (*Haliaeetus leucocephalus*) or peregrine falcon (*Falco peregrinus*), no other federally listed or proposed threatened or endangered flora or fauna are known to occur within the vicinity of the project area.

Candidate Species

Candidate species are species under consideration by the Service for possible inclusion on the List of Endangered and Threatened Wildlife and Plants. Although candidate species receive no substantive or procedural protection

under the Endangered Species Act, the Service encourages federal agencies and other planners to consider candidate species in the project planning process.

The New Jersey Natural Heritage Program provides the most up-to-date data source for candidate species in the State, as well as maintaining information on State listed species, and may be contacted at the following address:

Mr. Thomas Breden
Natural Heritage Program
Division of Parks and Forestry
CN 404
Trenton, New Jersey 08625
(609/984-0097)

Service records indicate several occurrences of *Eupatorium resinosum* (Pine Barren's boneset) and *Narthecium americanum* (bog asphodel), federal candidate plant species, in wetlands within 10 miles of the project area. Bog asphodel inhabits acidic bogs and Pine Barren's boneset is frequently found in open marshy areas and disturbed wetlands. The wetlands surrounding the project area may provide suitable habitat for these species; therefore, we recommend that the vegetative surveys also include these candidate species. Should the Natural Heritage Program data search or the recommended field surveys reveal the presence of any candidate species on the site, the Service should be contacted to ensure that these species are not adversely affected by project activities.

Further information on State listed wildlife species may be obtained from the following office:

Ms. JoAnn Frier-Murza
Endangered and Nongame Species Program
Division of Fish, Game and Wildlife
CN 400
Trenton, New Jersey 08625
(609/292-9101)

Summary and Conclusions

In summary, the Service recommends a botanist conduct vegetative surveys of the wetlands and other areas that will be affected by remediation to identify the absence or presence of swamp pink, Knieskern's beaked-rush, American chaffseed, Pine Barren's boneset, and bog asphodel.

Information contained in this letter and additional information obtained from the aforementioned sources represents the public interest for fish and wildlife resources and should warrant full consideration in the project planning process. The Service requests that no part of this letter be taken out of context and if reproduced, the letter should appear in its entirety.

Please contact Dana Peters of my staff if you have any questions or require further assistance regarding threatened or endangered species.

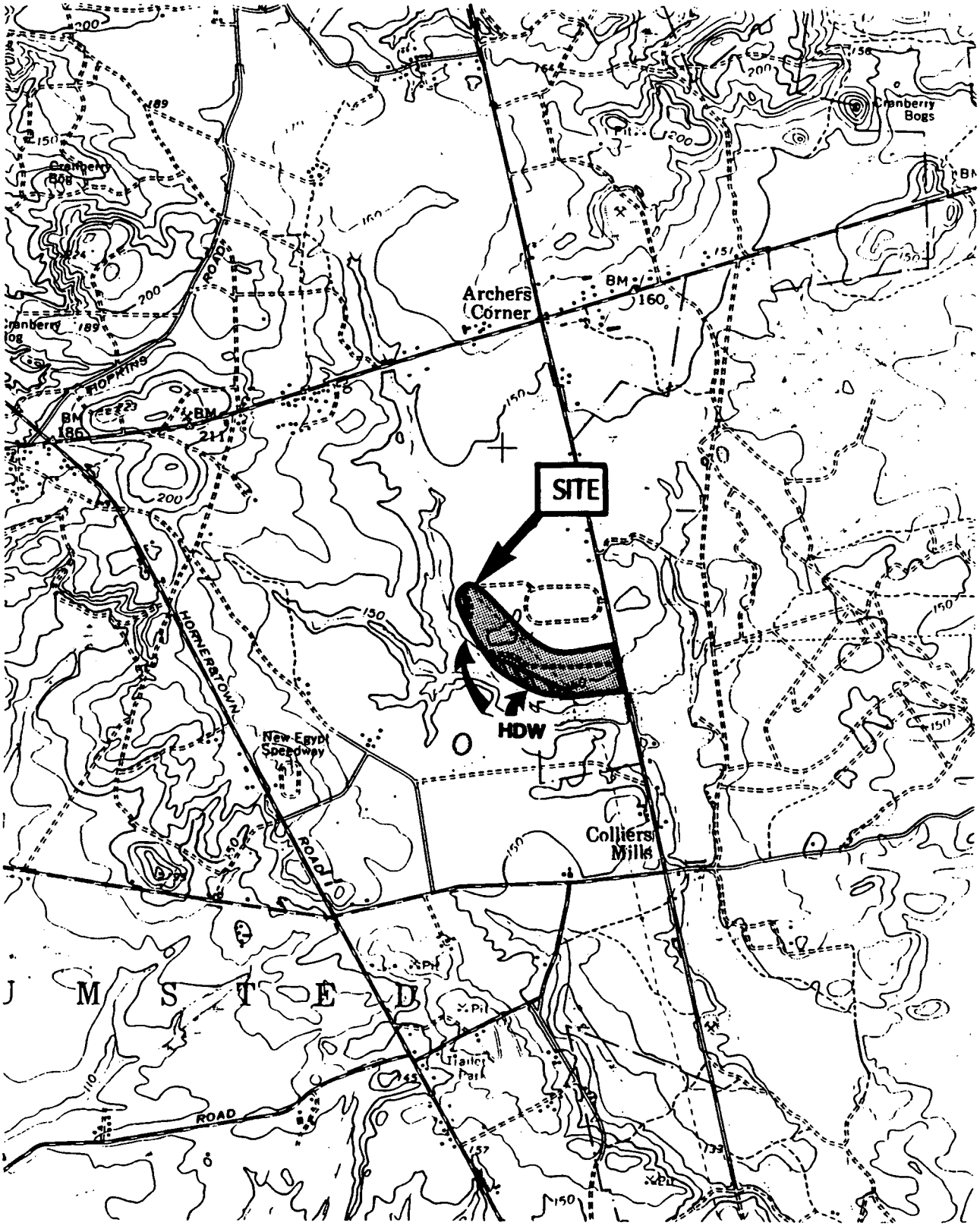
Sincerely,

Clifford G. Day
Supervisor

Enclosures

APPENDIX B

Habitat Mapping



HABITAT MAPPING

WILSON FARM

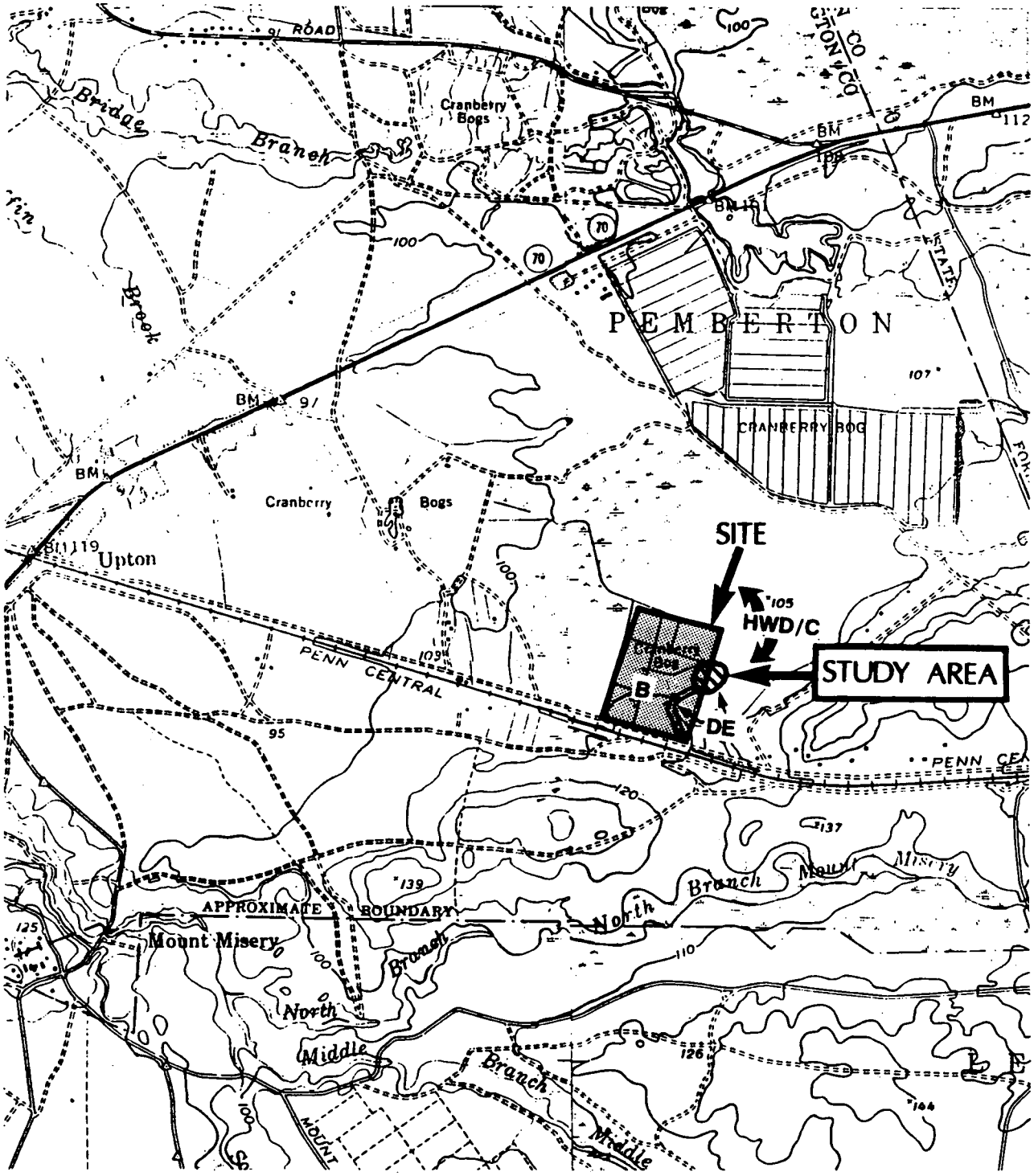
HDW - HARDWOOD SWAMP (PFO1)

BOTH SITE AND STUDY AREA INDICATED BY SHADING

SOURCE: USGS; CASSVILLE, NEW JERSEY QUAD; 1971

SCALE: 1" = 2000'

EcolSciences, Inc.



HABITAT MAPPING

LANG PROPERTY

HDW - HARDWOOD SWAMP (PFO1)
C - ATLANTIC WHITE CEDAR (PFO4)
B - ABANDONED BLUEBERRY FIELDS (PSS1)
DE - DISTURBED EMERGENT WETLAND (PEM)

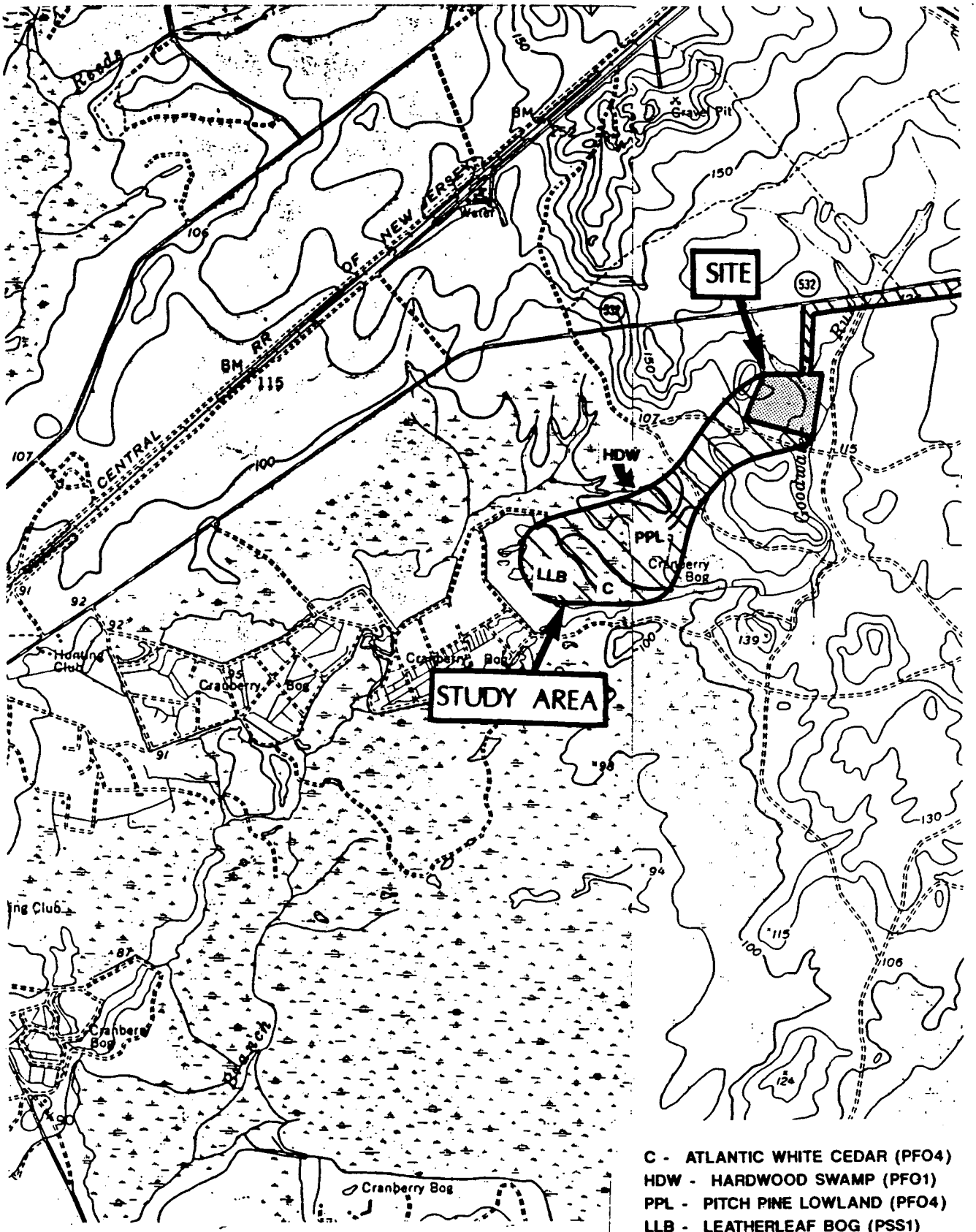
N

SCALE: 1" = 2000'

EcolSciences, Inc.

SOURCE: USGS; BROWNS MILLS/WHITING, NEW JERSEY QUADS, 1971

CBA 008 1217



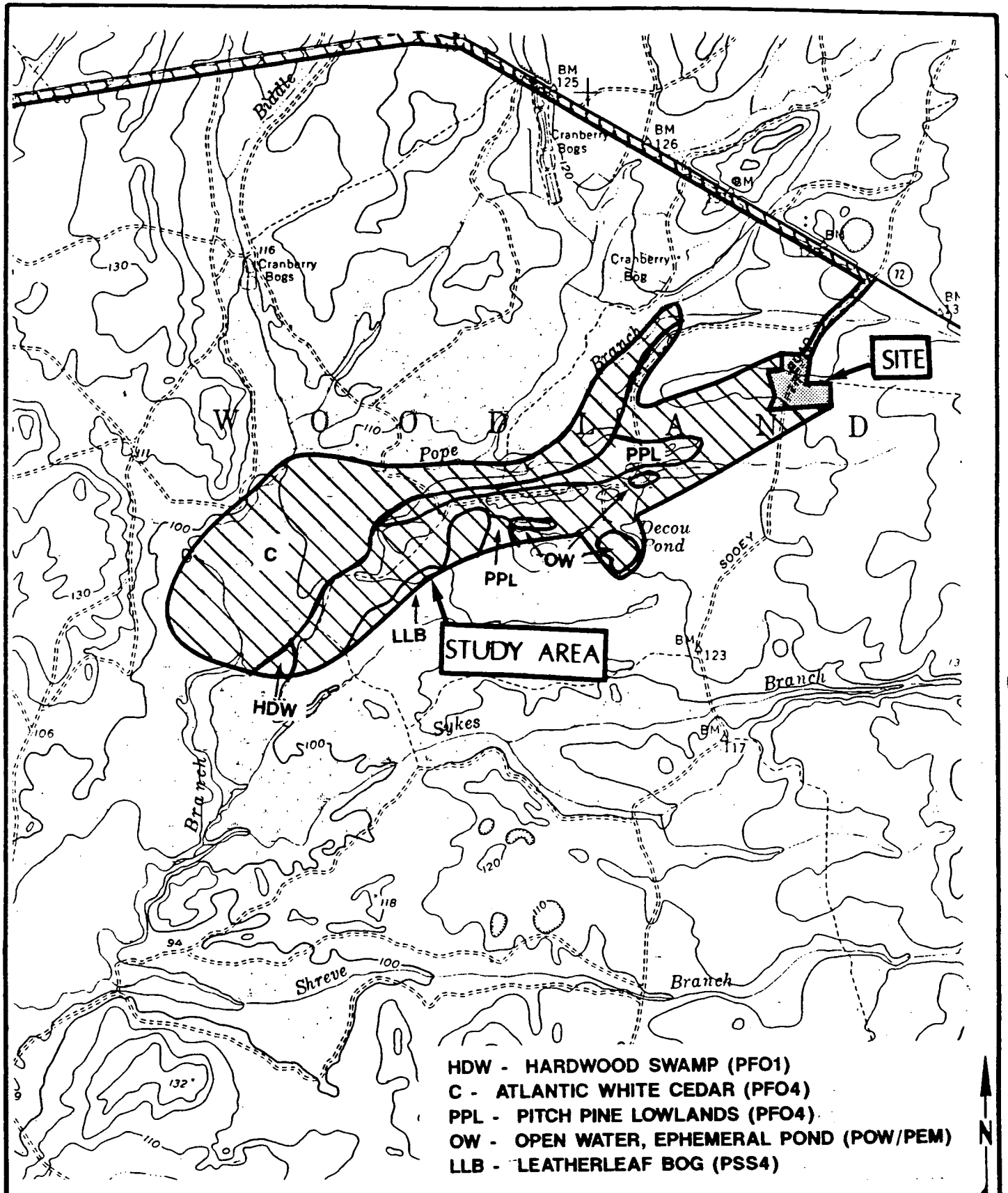
HABITAT MAPPING
WOODLAND TOWNSHIP - ROUTE 532

SOURCE: USGS; CHATSWORTH/WOODMANSIE, NEW JERSEY QUADS; 1957

SCALE: 1" = 2000'

EcolSciences, Inc.

CBA 008 1218



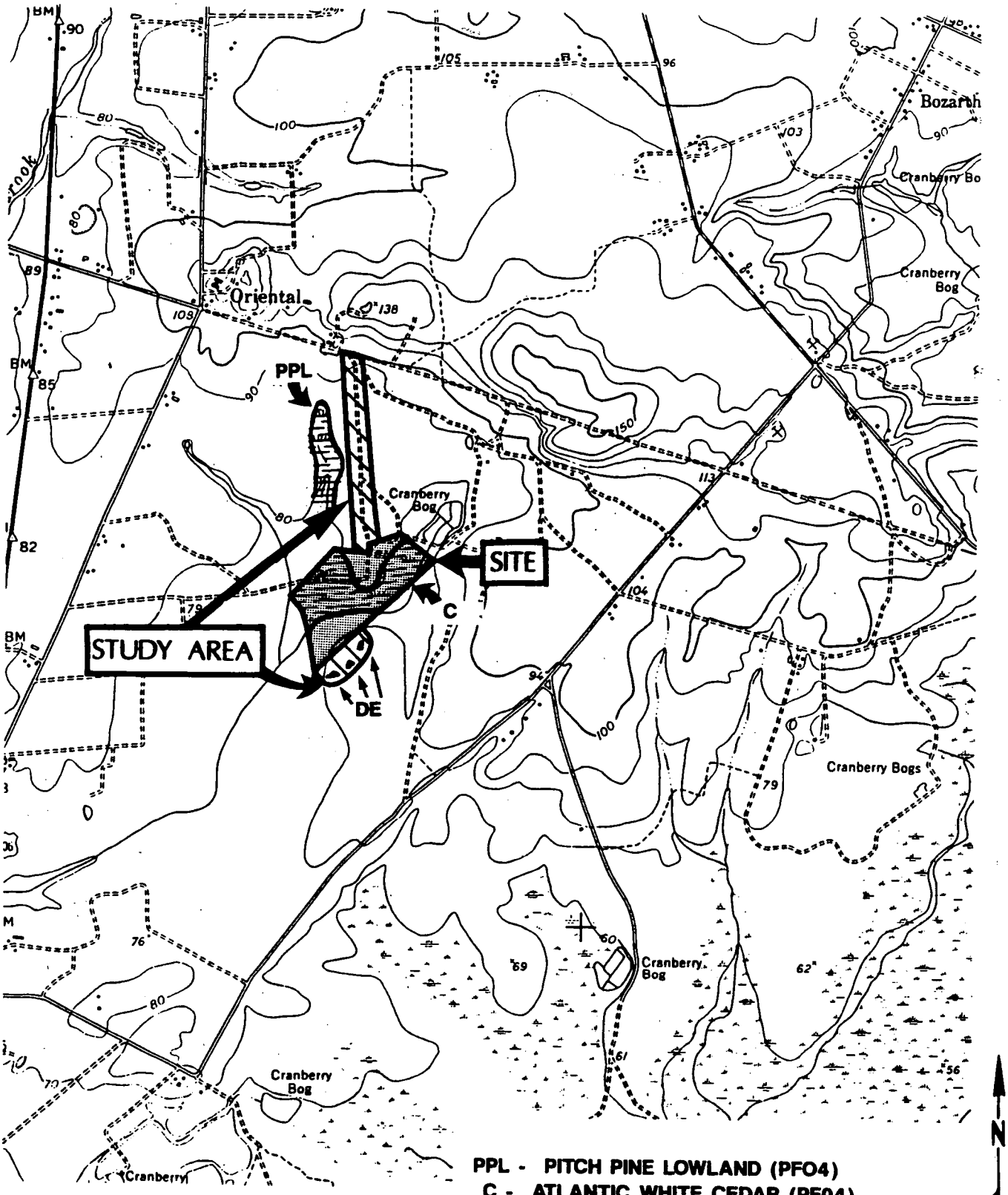
HABITAT MAPPING

WOODLAND TOWNSHIP - ROUTE 72

SOURCE: USGS; WOODMANSIE, NEW JERSEY QUAD, 1957

SCALE: 1" = 2000'

EcolSciences, Inc.



PPL - PITCH PINE LOWLAND (PFO4)
C - ATLANTIC WHITE CEDAR (PF04)
DE - DISTURBED EMERGENT WETLANDS (PEM)

HABITAT MAPPING

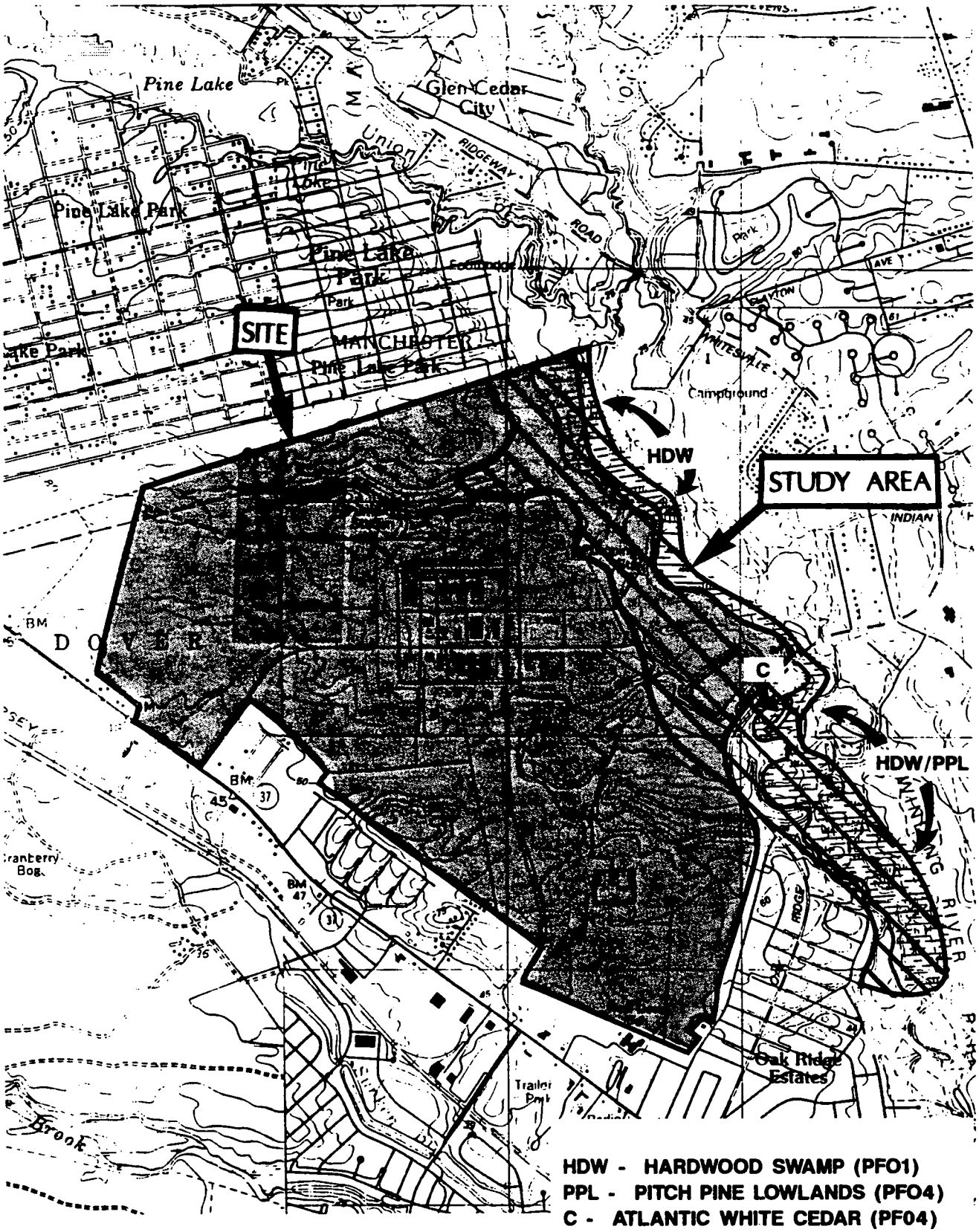
EWAN PROPERTY

SCALE: 1" = 2000'

EcolSciences, Inc.

SOURCE: USGS; INDIAN MILLS, NEW JERSEY QUAD; 1972

CBA 008 1220



HDW - HARDWOOD SWAMP (PFO1)
PPL - PITCH PINE LOWLANDS (PFO4)
C - ATLANTIC WHITE CEDAR (PF04)

HABITAT MAPPING

CIBA-GIEGY

SOURCE: USGS; KESWICK GROVE, LAKEHURST/LAKEWOOD, TOMS RIVER QUADS; 1971/1989

SCALE: 1" = 2000'

EcolSciences, Inc.

APPENDIX C

Results of Timed Meander Search

Wilson Farm Site

Results of Timed Meander Search for Swamp Pink

Time		Species
9:40 AM	Catbrier	*Smilax glauca*
	Sweet pepperbush	*Clethra alnifolia*
	Red maple	*Acer rubrum*
	Mountain laurel	*Kalmia latifolia*
	Black gum	*Nyssa sylvatica*
	Cinnamon fern	*Osmunda cinnamomea*
	Azalea	*Rhododendron sp.*
	Canada mayflower	*Maianthemum canadense*
	Highbush blueberry	*Vaccinium corymbosum*
9:42	Pitch pine	*Pinus rigida*
	Serviceberry	*Amelanchier sp.*
9:45	Sassafras	*Sassafras albidum*
	Netted chainfern	*Woodwardia areolata*
9:50	Three-seeded sedge	*Carex trisperma*
	Burreed	*Sparganium americanum*
	Follicle-bearing sedge	*Carex folliculata*
	Smartweed	*Polygonum sp.*
	Sphagnum moss	*Sphagnum spp.*
	Swamp dewberry	*Rubus hispidus*
	Rice cutgrass	*Leersia oryzoides*
	Bugleweed	*Lycopus sp.*
	Gray birch	*Betula populifolia*
	Partridgeberry	*Mitchella repens*
	Hog peanut	*Amphicarpaea bracteata*
9:54	Unidentified panicum	*Panicum sp.*
	Hayscented fern	*Dennstaedtia punctilobula*
	American holly	*Ilex opaca*
	Halberd-leaved tearthumb	*Polygonum arifolium*
	Marsh St. Johnswort	*Hypericum virginicum*
	Hairy swamp-loosestrife	*Decodon verticillatus*

Time		Species
10:00	Sweetbay	*Magnolia virginiana*
10:01	STOP	
10:05	START	
	Wild yam	*Dioscorea villosa*
	Fetterbush	*Leucothoe racemosa*
	New York fern	*Thelypteris noveboracensis*
10:10	Virginia creeper	*Parthenocissus quinquefolia*
	Skunk cabbage	*Foetidus symplocarpus*
	Unknown wiry sedge	*Carex sp.*
10:14	Bladder sedge	*Carex intumescens*
10:19	Violet	*Viola sp.*
	Elderberry	*Sambucus americana*
10:21	Water purslane	*Ludwigia palustris*
	Dodder	*Cuscuta sp.*
10:29	Common reed	*Phragmites australis*
10:35	Manna grass	*Glyceria sp.*
	Marsh fern	*Thelypteris thelypteroides*
	Poison ivy	*Toxicodendron radicans*
10:43	-	
10:51	Unknown sedge	*Carex sp.*
10:54	Yellow bartonia	*Bartonia virginica*
10:59	-	
11:15	-	
11:21 AM	END SEARCH	

Note: A hyphen for a particular time period indicates that no new species were identified during that time. Goff et al. (1982) recommend that approximately 30 minutes be spent without finding any additional species before a search is terminated.

Woodland Route 532 Site

Results of Timed Meander Search for Swamp Pink
and Knieskerns' Beaked Rush

Time		Species
10:50 AM	Pitch pine	*Pinus rigida*
	Red maple	*Acer rubrum*
	Highbush blueberry	*Vaccinium corymbosum*
	Leatherleaf	*Chameadaphne calyculata*
	Sheep laurel	*Kalmia angustifolia*
	Sweet pepperbush	*Clethra alnifolia*
10:51	Dangleberry	*Gaylussacia frondosa*
	Sassafras	*Sassafras albidum*
	Red cedar	*Juniperus virginiana*
	Swamp azalea	*Rhododendron viscosum*
10:56	Cinnamon fern	*Osmunda cinnamomea*
	American holly	*Ilex opaca*
	Striped wintergreen	*Chimaphila maculata*
11:00	Inkberry	*Ilex glabra*
	Greenbriar	*Smilax rotundifolia*
	Large cranberry	*Vaccinium macrocarpon*
	Marsh fern	*Thelypteris thelypteroides*
11:09	Chokeberry	*Aronia sp.*
11:16	Three-way sedge	*Dulichium arundinacium*
	Bayonet rush	*Juncus militaris*
11:22	Sedge	*Carex sp.*
	Hairy swamp-loosestrife	*Decodon verticillatus*
	Spatterdock	*Nuphar luteum*
11:29	White beaked rush	*Rhynchospora alba*
	Maleberry	*Lyonia ligustrina*
11:46	-	
11:55	-	
12:00 PM	Three-seeded sedge	*Carex trisperma*
	Blackgum	*Nyssa sylvatica*
	Sedge	*Carex sp.*

Time		Species
12:11	Woolgrass	*Scirpus cyperinus*
	Willow herb	*Epilobium sp.*
	Purple loosestrife	*Lythrum salicaria*
	Bushy bluestem	*Andropogon glomeratus*
	Rush	*Juncus sp.*
	Round-leaf sundew	*Drosera rotundifolia*
	Sedge	*Carex sp.*
12:22	Bartonia	*Bartonia virginica*
	Sedge	*Carex sp.*
12:31	Meadow beauty	*Rhexia sp.*
	Collin's sedge	*Carex collinsii*
	Teaberry	*Gaultheria procumbens*
	Turkeybeard	*Xerophyllum asphodeloides*
12:40	STOP	
12:45	START	
	Dewberry	*Rubus sp.*
	Marsh St. Johnswort	*Hypericum virginicum*
	Swamp candles	*Lysimachia terrestris*
	Arrow arum	*Peltandra virginica*
12:48	Rice cutgrass	*Leersia oryzoides*
12:55	Northern pitcher plant	*Sarracenia purpurea*
1:12	Winterberry	*Ilex glabra*
1:18	Cottongrass	*Eriophorum sp.*
	Spikerush	*Eleocharis sp.*
	Arrow-head	*Sagittaria sp.*
	Sweetbay	*Magnolia virginiana*
1:31	Bracken fern	*Pteridium aquilinum*
1:40 PM	STOP	
9:20 AM	START	
9:26	Flatsedge	*Cyperus sp.*
	Bentgrass	*Agrostis sp.*

Time		Species
9:31	Catbriar	*Smilax glauca*
	Willow	*Salix sp.*
	Thoroughwort	*Eupatorium sp.*
	Broomsedge	*Andropogon virginicus*
	Big-tooth aspen	*Populus grandidentata*
	Builder's rye	*Secale sp.*
9:43	Panic grass	*Panicum sp.*
	Barnyard grass	*Echinochloa crusgalli*
	Stinking chamomile	*Matricaria cotula*
	Yarrow	*Achillea millifolium*
	Cress	*Barbarea sp.*
9:52	Quackgrass	*Agropyron repens*
	Timothy	*Phleum pratense*
	Smartweed	*Polygonum sp.*
9:54	Annual ragweed	*Ambrosia artemisiifolia*
	Fireweed	*Erechtites hieracifolia*
	Purslane	*Portulaca oleracea*
10:09	Bearberry	*Arctostaphylos uva-ursi*
	Heather	*Hudsonia ericoides*
10:29	STOP	
10:45	START	
	Twisted yellow-eyed grass	*Xiris torta*
	Grease grass	*Tridens flavus*
	Orange milkwort	*Polygala lutea*
	Short-leaved milkwort	*Polygala brevifolia*
	Dwarf St. Johnswort	*Hypericum mutilum*
	Fox sedge	*Carex vulpinoidia*
	Bugleweed	*Lycopus sp.*
	Canada thistle	*Cirsium arvense*
	Everlasting	*Gnaphalium sp.*
	Horsetail	*Equisetum sp.*
	White fringed orchid	*Platanthera blephariglottis*
	Unknown composite	*Compositae sp.*
	Path rush	*Juncus tenuis*
	Dogbane	*Apocynum cannabinum*
	Daisy fleabane	*Erigeron annuus*
11:13	Swamp sweetbells	*Leucothoe racemosa*

Time		Species
11:35	–	
11:50 AM	–	
12:03 PM	Bayberry	*Myrica pensylvanica*
12:20	–	
12:38	–	
12:46	Dwarf huckleberry	*Gaylussacia dumosa*
1:13	–	
1:45	–	
2:01	Mountain laurel	*Kalmia latifolia*
	Netted chainfern	*Woodwardia areolata*
	Withe-rod	*Viburnum cassinoides*
	Possom-haw viburnum	*Viburnum nudum*
2:14	–	
2:31	–	
2:45	–	
2:55	Thread-leaved sundew	*Drosera filiformis*
	Brownish beaked rush	*Rhynchospora capitellata*
	Canada St. Johnswort	*Hypericum canadense*
	Staggerbush	*Lyonia mariana*
3:00	–	
3:10	–	
3:20	–	
3:30 PM	END SEARCH	

Note: A hyphen for a particular time period indicates that no new species were identified during that time. Goff et al. (1982) recommend that approximately 30 minutes be spent without finding any additional species before a search is terminated.

Woodland Route 72 Site

Results of Timed Meander Search for Swamp Pink
and Knieskerns' Beaked Rush

Time		Species
8:48 AM	Bushy bluestem	*Andropogon glomeratus*
	Atlantic white cedar	*Chamaecyparis thyoides*
	Sheep laurel	*Kalmia angustifolia*
	Teaberry	*Gaultheria procumbens*
	Cross-leaved milkwort	*Polygala cruciata*
	Blackgum	*Nyssa sylvatica*
	Brownish beaked rush	*Rhynchospora capitellata*
	White beaked rush	*Rhynchospora alba*
	Bayberry	*Myrica pensylvanica*
	Red maple	*Acer rubrum*
	Highbush blueberry	*Vaccinium corymbosum*
	Sweet pepperbush	*Clethra alnifolia*
	Pitch pine	*Pinus rigida*
	Large cranberry	*Vaccinium macrocarpon*
	Yellow bartonia	*Bartonia virginica*
	Bayonet rush	*Juncus militaris*
	Swamp dewberry	*Rubus hispidus*
8:55	Sweetbay	*Magnolia virginiana*
	Meadow beauty	*Rhexia virginica*
	Twisted yellow-eyed grass	*Xyris torta*
	Round-leaf sundew	*Drosera rotundifolia*
	Sphagnum moss	*Sphagnum spp.*
	Leatherleaf	*Chamaedaphne calyculata*
	Inkberry	*Ilex glabra*
9:00	Chokeberry	*Aronia sp.*
	Arrow arum	*Peltandra virginica*
	Mountain laurel	*Kalmia latifolia*
	Walter's sedge	*Carex walterana*
	Virginia chainfern	*Woodwardia virginica*
9:04	Northern pitcher plant	*Sarracenia purpurea*
	Collin's sedge	*Carex collinsii*
	Cinnamon fern	*Osmunda cinnamomea*

Time		Species
9:08	Dangleberry	*Gaylussacia frondosa*
	Lance-leaf rose-gentian	*Sabatia difformis*
	Dwarf huckleberry	*Gaylussacia dumosa*
9:15	Three-seed sedge	*Carex trisperma*
	Starflower	*Trientalis borealis*
9:23	Partridgeberry	*Mitchella repens*
	Panic grass	*Panicum sp.*
9:27	Spatulate sundew	*Drosera intermedia*
9:30	Turks cap lily	*Lilium superbum*
	Marsh St. Johnswort	*Triadenum virginicum*
9:36	Seven-angle pipewort	*Eriocaulon septangulare*
	Burreed	*Sparganium americanum*
	Subterminate bulrush	*Scirpus subterminalis*
	Golden club	*Orontium aquaticum*
9:55	Bladderwort	*Utricularia sp.*
	Spikerush	*Eleocharis olivacea*
	Manna grass	*Glyceria obtusa*
	Nutrush	*Scleria sp.*
	Three-way sedge	*Dulichium arundinaceum*
	Round headed plant	*Cyperus sp.*
10:26	Greenbriar	*Smilax rotundifolia*
10:33	Swamp sweetbells	*Leucothoe racemosa*
11:01	Swamp azalea	*Rhododendron viscosum*
11:07 AM	Massachusetts fern	*Thelypteris simulata*
	Royal fern	*Osmunda regalis*
12:14 PM	Red cedar	*Juniperus virginiana*
	Turkeybeard	*Xerophyllum asphodeloides*
	Bracken fern	*Pteridium aquilinum*

Time		Species
12:29	Thread-leaved sundew	*Drosera filiformis*
	Canada St. Johnswort	*Hypericum canadense*
	Round headed flatsedge	*Cyperus ?*
	Path rush	*Juncus tenuis*
	Canada rush	*Juncus canadensis*
	Sweet everlasting	*Gnaphalium obtusifolium*
	Cat's-ear	*Hypochoeris radicata*
12:44	STOP	
1:08	START	
	Unidentified panicum	*Panicum sp.*
1:12	Mermaid weed	*Proserpinaca pectinata*
1:20	STOP	
2:38	START	
	Brown-fruit rush	*Juncus pelocarpus*
	Pale beaked rush	*Rhynchospora pallida*
	STOP	
3:05	START	
	Horned beaked rush	*Rhynchospora inundata*
	White water-lily	*Nymphaea odorata*
	Watershield	*Brasenia schreberi*
	Big aster	*Aster sp.*
3:31	STOP	
3:38	START	
3:44	Robbins' spikerush	*Eleocharis robbinsii*
3:56 PM	STOP	
9:30 AM	START	
	Orange milkwort	*Polygala lutea*
	Horned bladderwort	*Utricularia cornuta*
9:35	Brown beakrush	*Rhynchospora fusca*
9:38	Common bladderwort	*Utricularia macrorhiza*

Time		Species
9:50	Short-leaved milkwort	*Polygala brevifolia*
9:55	Northern bog clubmoss	*Lycopodium inundatum*
10:05	Red root	*Lachnanthes caroliniana*
11:16	Poison ivy Virginia creeper	*Toxicodendron radicans* *Parthenocissus quinquefolia*
11:41	Woolgrass	*Scirpus cyperinus*
11:58 AM	STOP	
12:50 PM	START	
1:14	STOP	
1:20	START	
1:29	Unidentified blueberry	*Vaccinium sp.*
1:33	Maleberry Catbriar	*Lyonia ligustrina* *Smilax glauca*
1:42	STOP	
2:05	START	
2:16	Gray birch Sassafras	*Betula populifolia* *Sassafras albidum*
2:20	Dense-flowered St. Johnswort	*Hypericum densiflorum*
2:29	STOP	
2:36	START	
2:41	Hairy swamp-loosestrife	*Decodon verticillatus*
3:15 PM	STOP	

Time		Species
8:50 AM	START	
9:14	White fringed orchid	*Platanthera blephariglottis*
9:42	Soft rush	*Juncus effusus*
10:12	STOP	
10:20	START	
10:26	Curly grass fern	*Schizaea pusilla*
10:58	Spleenwort	*Asplenium sp.*
11:39	STOP	
11:51	START	
11:59 AM	Orange grass	*Hypericum gentianoides*
12:52 PM	STOP	
1:05	START	
1:22	Possom-haw viburnum	*Viburnum nudum*
1:29	Poison sumac	*Toxicodendron vernix*
	Swamp smartweed	*Polygonum hydropiperoides*
	Netted chainfern	*Woodwardia areolata*
3:19 PM	END SEARCH	

Note: A hyphen for a particular time period indicates that no new species were identified during that time. Goff et al. (1982) recommend that approximately 30 minutes be spent without finding any additional species before a search is terminated.

Ewan Site

Results of Timed Meander Search for Swamp Pink

Time		Species
9:36 AM	Pitch pine	*Pinus rigida*
	American holly	*Ilex opaca*
	Sassafras	*Sassafras albidum*
	Sweet pepperbush	*Clethra alnifolia*
	Highbush blueberry	*Vaccinium corymbosum*
	Dangleberry	*Gaylussacia frondosa*
	Sheep laurel	*Kalmia angustifolia*
	Bracken fern	*Pteridium aquilinum*
9:38	Cinnamon fern	*Osmunda cinnamomea*
	Catbrier	*Smilax glauca*
	Teaberry	*Gaultheria procumbens*
	Red maple	*Acer rubrum*
	Mountain laurel	*Kalmia latifolia*
	Dewberry	*Rubus sp.*
	White oak	*Quercus alba*
9:40	Inkberry	*Ilex glabra*
	Swamp azalea	*Rhododendron viscosum*
9:42	Blackgum	*Nyssa sylvatica*
	Tree clubmoss	*Lycopodium obscurum*
	Variegated unknown	*?*
9:45	-	
9:48	Eastern red cedar	*Juniperus virginiana*
9:50	Big-tooth aspen	*Populus grandidentata*
9:52	STOP	
10:22	START	
	Gray birch	*Betula populifolia*
	Switchgrass	*Panicum virgatum*
	Broomsedge	*Andropogon virginicus*
	Wild strawberry	*Fragaria virginiana*
	Staggerbush	*Lyonia mariana*

Time		Species
10:24	Unknown grass	*Gramineae*
	Hayscented fern	*Dennstaedia punctilobula*
	Black cherry	*Prunus serotina*
10:28	Wool grass	*Scirpus cyperinus*
	Chokeberry	*Aronia sp.*
10:30	Nuttall's lobelia	*Lobelia nuttallii*
	Bear oak	*Quercus ilicifolia*
	Path rush	*Juncus tenuis*
	Canada St. Johnswort	*Hypericum canadense*
	Soft rush	*Juncus effusus*
	Panic grass	*Panicum lanuginosum*
	Bayonet rush	*Juncus militaris*
10:37	White beaked rush	*Rhynchospora alba*
	Unknown rush	*Juncus sp.*
	Huckleberry	*Gaylussacia sp.*
10:42	Fireweed	*Erechtites hieracifolia*
	Dogbane	*Apocynum cannabinum*
10:43	STOP	
10:54	START	
	Blackberry	*Rubus sp.*
	Thoroughwort	*Eupatorium sp.*
	Whorled loosestrife	*Lysimachia quadrifolia*
	Dotted St. Johnswort	*Hypericum punctatum*
10:59	Old-field cinquefoil	*Potentilla simplex*
	Common reed	*Phragmites australis*
	Sensitive fern	*Onoclea sensibilis*
	Indian tobacco	*Lobelia inflata*
	Everlasting	*Gnaphalium sp.*
	Canada thistle	*Cirsium arvense*
11:02	STOP	
11:42	START	
11:44		

Time		Species
11:55 AM	Meadow beauty	*Rhexia sp.*
	Maleberry	*Lyonia ligustrina*
	Turk's cap lily	*Lilium superbum*
12:01 PM	Sweetbay	*Magnolia virginiana*
	Marsh fern	*Thelypteris thelypteroides*
	Swamp candles	*Lysimachia terrestris*
	Button sedge	*Carex bullata*
12:10	Netted chainfern	*Woodwardia areolata*
12:17	Follicle-bearing sedge	*Carex folliculata*
12:25	Swamp sweetbells	*Leucothoe racemosa*
12:30	Panic grass	*Panicum sp.*
12:45	-	
1:10 PM	END SEARCH	

Note: A hyphen for a particular time period indicates that no new species were identified during that time. Goff et al. (1982) recommend that approximately 30 minutes be spent without finding any additional species before a search is terminated.

Ciba-Geigy Site

Results of Timed Meander Search for Swamp Pink
and Knieskerns' Beaked Rush

Time		Species
11:55 AM	Red maple	*Acer rubrum*
	Pitch pine	*Pinus rigida*
	Sweetgum	*Liquidambar styraciflua*
	Black gum	*Nyssa sylvatica*
	Cinnamon fern	*Osmunda cinnamomea*
	Highbush blueberry	*Vaccinium corymbosum*
	Dangleberry	*Gaylussacia frondosa*
	Netted chainfern	*Woodwardia areolata*
	Iris	*Iris versicolor*
	Teaberry	*Gaultheria procumbens*
	Follicle-bearing sedge	*Carex folliculata*
	Swamp dewberry	*Rubus hispidus*
	Swamp azalea	*Rhododendron viscosum*
	Buttonweed	*Diodia teres*
	Catbriar	*Smilax rotundifolia*
	Sweet pepperbush	*Clethra alnifolia*
	Bracken fern	*Pteridium aquilinum*
	Partridgeberry	*Mitchella repens*
12:08 PM	STOP	
12:15	START	
	Gray birch	*Betula populifolia*
	Swamp sweetbells	*Leucothoe racemosa*
	Royal fern	*Osmunda regalis*
	Panicum	*Panicum sp.*
	Marsh St. Johnswort	*Hypericum virginicum*
	Greenbriar	*Smilax glauca*
	American holly	*Ilex opaca*
	Sedge	*Carex sp.*
	Nuttall's lobelia	*Lobelia nuttallii*
	Soft rush	*Juncus effusus*
	Evening primrose	*Oenothera biennis*
	Broomsedge	*Andropogon virginicus*
	Small vine	*?*
12:45	STOP	

Time		Species
1:00	START	
	Tree clubmoss	*Lycopodium obscurum*
	Willow oak	*Quercus phellos*
	Rice cutgrass	*Leersia oryzoides*
	Marshpepper smartweed	*Polygonum hydropiper*
	Bartonia	*Bartonia virginica*
	Tussock sedge	*Carex stricta*
	Button sedge	*Carex bullata*
	Loose uniola	*Uniola laxa*
	Atlantic manna grass	*Glyceria obtusa*
	Fowl manna grass	*Glyceria striata*
	Woolgrass	*Scirpus cyperinus*
	Bladder sedge	*Carex intumescens*
	Meadow beauty	*Rhexia sp.*
	Arrow arum	*Peltandra virginica*
1:50 PM	STOP	
9:05 AM	START	
	Sheep laurel	*Kalmia angustifolia*
	Turkey beard	*Xerophyllum asphodeloides*
9:12	Inkberry	*Ilex glabra*
	Unknown	*?*
	Maleberry	*Lyonia ligustrina*
9:15	Bayberry	*Myrica pensylvanica*
	Scrub oak	*Quercus ilicifolia*
	Eastern red cedar	*Juniperus virginiana*
9:24	Massachusetts fern	*Thelypteris simulata*
	Virginia creeper	*Parthenocissus quinquefolia*
	Bugleweed	*Lycopus sp.*
	Sweetbay	*Magnolia virginiana*
	Sassafras	*Sassafras albidum*
9:40	Hairy swamp-loosestrife	*Decodon verticillatus*
9:47	Collin's sedge	*Carex collinsii*
	Poison ivy	*Toxicodendron radicans*

Time		Species
9:53	Round-leaved sundew	*Drosera rotundifolia*
	White beaked rush	*Rhynchospora alba*
	Northern pitcher plant	*Sarracena purpurea*
	Large cranberry	*Vaccinium macrocarpon*
	Bayonet rush	*Juncus militaris*
10:00	Leatherleaf	*Chamaedaphne calyculata*
10:22	Brown-fruit rush	*Juncus pelocarpus*
10:34 AM	STOP	
8:35 AM	START	
	Dodder	*Cuscuta gronovii*
8:54	River birch	*Betula nigra*
8:57	Lance-leaf violet	*Viola lanceolata*
	Taper-tip rush	*Juncus acuminatus*
9:09	-	
9:16	Indian-pipe	*Monotropa uniflora*
9:25	Three-seeded sedge	*Carex trisperma*
9:35	-	
10:00	-	
10:15	-	
10:26	White oak	*Quercus alba*
	Burreed	*Sparganium sp.*
10:43	Fireweed	*Erechtites hieracifolia*
10:50	Cowbane	*Oxypolis rigidior*
	Common reed	*Phragmites australis*
11:00	STOP	
11:45 AM	START	

Time		Species
12:23 PM	Brownish beaked rush	*Rhynchospora capitellata*
	Switchgrass	*Panicum virgatum*
	Dense-flowered St. Johnswort	*Hypericum densiflorum*
	Willow	*Salix sp.*
12:34	-	
12:51	STOP	
1:04	START	
1:10	Fragrant water lily	*Nymphaea odorata*
1:32	-	
1:37	Path rush	*Juncus tenuis*
	Twisted yellow-eyed grass	*Xyris torta*
1:52	-	
2:06 PM	STOP	
9:10 AM	START	
	Winterberry	*Ilex verticillata*
	Buttonbush	*Cephalanthus occidentalis*
9:15	Bladderwort	*Utricularia sp.*
	Canada St. Johnswort	*Hypericum canadense*
	Water purslane	*Ludwigia palustris*
9:25	-	
9:30	Scarlet oak	*Quercus coccinea*
	Deertongue grass	*Panicum clandestinum*
9:39	-	
9:41	Cardinal flower	*Lobelia cardinalis*
	Sedge	*Carex pensylvanica*
9:54	Skullcap	*Scutellaria sp.*
10:04	Subterminate bulrush	*Scirpus subterminalis*

Time		Species
10:09	Possom-haw viburnum	*Viburnum nudum*
	Arrowwood	*Viburnum dentatum*
10:14	Persimmon	*Diospyros virginiana*
10:18	-	
10:25	Japanese honeysuckle	*Lonicera japonica*
	Serviceberry	*Amelanchier sp.*
10:40	Violet	*Viola sp.*
10:41	Joe-pye-weed	*Eupatorium maculatum*
	Smartweed	*Polygonum sp.*
10:45	Elderberry	*Sambucus canadensis*
	Pickerelweed	*Pontedria cordata*
10:47	Mudwort	*Limosella sp.*
10:48	Walter's sedge	*Carex walterii*
11:00	-	
11:15	-	
11:30	Blueberry	*Vaccinium sp.*
11:50 AM	-	
12:00 PM	Smooth alder	*Alnus serrulata*
12:10	-	
12:20	-	
12:30	-	
12:35	Hoary sedge	*Carex canescens*
12:45	-	
12:55	-	
1:05	END SEARCH	

Note: A hyphen for a particular time period indicates that no new species were identified during that time. Goff et al. (1982) recommend that approximately 30 minutes be spent without finding any additional species before a search is terminated.

Lang Site

Results of Timed Meander Search for Swamp Pink
and Knieskerns' Beaked Rush

Time		Species
9:10 AM	Broomsedge	*Andropogon virginicus*
	Rush	*Juncus dichotomous*
	Goldenrod	*Solidago sp.*
	Highbush blueberry	*Vaccinium corymbosum*
	Pitch pine	*Pinus rugosa*
	Rabbits-foot clover	*Trifolium arvense*
	Bush clover	*Lespedeza sp.*
	Deer tongue	*Panicum clandestinum*
	Plantain	*Plantago aristata*
9:12	Aster	*Aster sp.*
	Common ragweed	*Ambrosia artemisiifolia*
	Everlasting	*Gnaphalium sp.*
	St. Andrew's cross	*Ascyrum hypericoides*
	Sheep sorrel	*Rumex acetosella*
	Fireweed	*Erechtites hieracifolia*
	Flax	*Linum sp.*
	Bracken fern	*Pteridium aquilinum*
	Peppergrass	*Lepidium sp.*
	Panicum	*Panicum sp.*
9:16	Thoroughwort	*Eupatorium sp.*
	Sheep laurel	*Kalmia angustifolia*
	Scrub oak	*Quercus ilicifolia*
	Inkberry	*Ilex glabra*
	Winged sumac	*Rhus copallina*
	Catbriar	*Smilax glauca*
	Chokeberry	*Aronia sp.*
	Heather	*Hudsonia ericoides*
	Bushy bluestem	*Andropogon glomeratus*
9:19	Sassafras	*Sassafras albidum*
	Orange milkwort	*Polygala lutea*
	Sweet pepperbush	*Clethra alnifolia*

Time		Species
9:21	White beaked rush	*Rhynchospora alba*
	Bartonia	*Bartonia virginica*
	Flatsedge	*Cyperus sp.*
	Twisted yellow-eyed grass	*Xyris torta*
	Marsh St. Johnswort	*Hypericum virginicum*
	Carolina redroot	*Lachnanthes caroliniana*
	Meadow beauty	*Rhexia sp.*
	Red maple	*Acer rubrum*
	Thread-leaved sundew	*Drosera filiformis*
9:25	Round-leaved sundew	*Drosera rotundifolia*
	Cottongrass	*Eriophorum sp.*
	Teaberry	*Gaultheria procumbens*
9:31	Maleberry	*Lyonia ligustrina*
9:35	Cinnamon fern	*Osmunda cinnamomea*
	Unknown grass	*Gramineae*
	Blackgum	*Nyssa sylvatica*
9:39	Cross-leaved milkwort	*Polygala cruciata*
	Evening primrose	*Oenothera biennis*
	Partridge-pea	*Cassia fasiculata*
	Grass-leaved goldenrod	*Euthamia graminifolia*
	Soft rush	*Juncus effusus*
	Bramble	*Rubus sp.*
9:45	Willow	*Salix sp.*
	Broad-leaved dock	*Rumex obtusifolis*
	Woolgrass	*Scirpus cyperinus*
	Switch grass	*Panicum virgatum*
	Purple loosestrife	*Lythrum salicaria*
9:50	Gray birch	*Betula populifolia*
9:53	Leatherleaf	*Chamaedaphne calyculata*
9:56	Large cranberry	*Vaccinium macrocarpon*
	Sedge	*Carex sp.*
	Virginia chainfern	*Woodwardia virginica*
10:03	Bayberry	*Myrica pensylvanica*
	Eastern red cedar	*Juniperus virginiana*
	Marsh purslane	*Ludwigia palustris*

Time		Species
10:08	Pale beaked rush	*Rhynchospora pallida*
	Swamp dewberry	*Rubus hispidus*
10:15	Dogbane	*Apocynum cannabinum*
	Daisy fleabane	*Erigeron annuus*
	Swamp azalea	*Rhododendron viscosum*
10:21	Dangleberry	*Gaylussacia frondosa*
10:27	Lady–slipper orchid	*Cypripedium sp.*
	Swamp sweetbells	*Leucothoe racemosa*
10:34	Sweet fern	*Comptonia peregrina*
	Common reed	*Phragmites australis*
	Red top	*Agrostis alba*
	Red clover	*Trifolium pratense*
	Crown vetch	*Coronilla varia*
10:40	Broad–leaved cattail	*Typha latifolia*
	Bayonet rush	*Juncus militaris*
	Sensitive fern	*Onoclea sensibilis*
	Horsetail	*Equisetum sp.*
	Canada thistle	*Cirsium arvense*
10:42	White–fringed orchid	*Platanthera blephariglottis*
	Three–way sedge	*Dulichium arundinaceum*
	Collin's sedge	*Carex collinsii*
	Smartweed	*Polygonum sp.*
	Sedge	*Carex sp.*
	Rice cutgrass	*Leersia oryzoides*
10:56	Nuttall's lobelia	*Lobelia nuttallii*
	Canada rush	*Juncus canadensis*
11:07	Sand myrtle	*Leiophyllum buxifolium*
	STOP	
11:21	START	
	Buttonweed	*Diodia teres*
	Hawkweed	*Hieracium sp.*
	Wooly mullien	*Verbascun thapsus*
	Ox–eye daisy	*Chrysanthemum leucanthemum*
	Cottonwood	*Populus deltoides*

Time		Species
11:25	Beggarticks	*Bidens frondosa*
	Boneset	*Eupatorium perfoliatum*
	Canada St. Johnswort	*Hypericum canadensis*
	Pointed broom sedge	*Carex scoparia*
	Seedbox	*Ludwigia alternifolia*
	Orangegrass	*Hypericum gentianoides*
	Purple gerardia	*Agalinus purpurea*
11:29	Lance-leaved violet	*Viola lanceolata*
11:38	Brownish beaked rush	*Rhynchospora capitellata*
	Beggar-ticks	*Bidens sp.*
11:42	Heal all	*Prunella vulgaris*
	Bugleweed	*Lycopus sp.*
	Winter bentgrass	*Agrostis hyemalis*
	Straw-color flatsedge	*Cyperus strigosus*
	Sundrops	*Oenothera fruticosa*
	Old-field cinquefoil	*Potentilla simplex*
11:47	Indian tobacco	*Lobelia inflata*
	Three-seeded mercury	*Acalypha virginica*
	Purple-leaf willow herb	*Epilobium coloratum*
	Blue vervain	*Verbena hastata*
	Round-headed bush clover	*Lespedeza capitata*
11:53	Deptford pink	*Dianthus armeria*
	Yellow wood sorrel	*Oxalis stricta*
	Black-eyed Susan	*Rudbeckia hirta*
12:03 PM	Spikerush	*Eleocharis sp.*
12:15	Three square	*Scirpus americanus*
	Pinweed	*Lechea sp.*
12:19	Hyssop-leaved thoroughwort	*Eupatorium hyssopifolium*
	Rattlebox	*Crotalaria sagitallis*
12:33	-	
12:39	-	
12:50	END SEARCH	

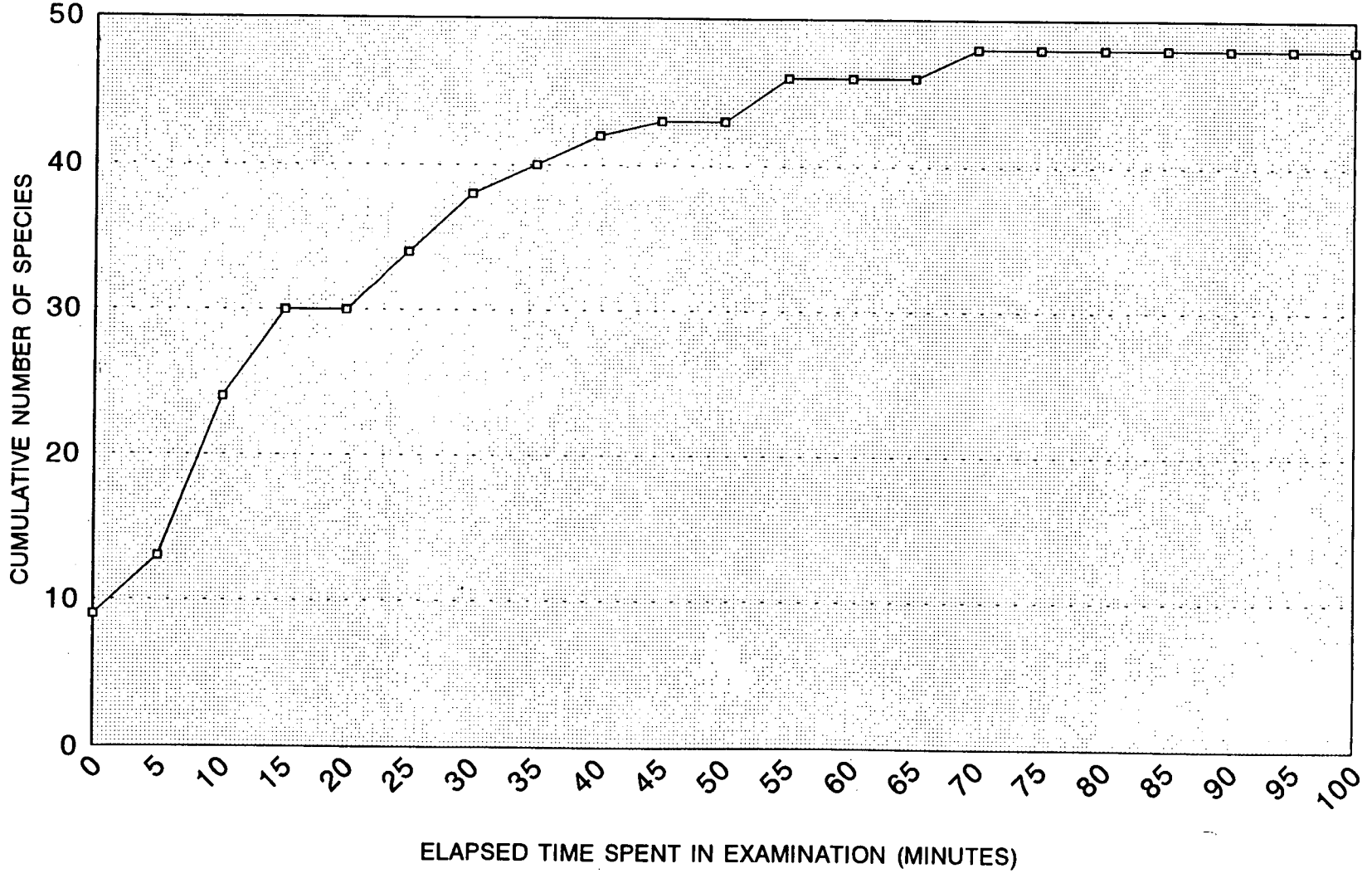
Note: A hyphen for a particular time period indicates that no new species were identified during that time. Goff et al. (1982) recommend that approximately 30 minutes be spent without finding any additional species before a search is terminated.

APPENDIX D

Species Effort Curves

WILSON FARM

SPECIES EFFORT CURVE FOR TIMED MEANDER SEARCH

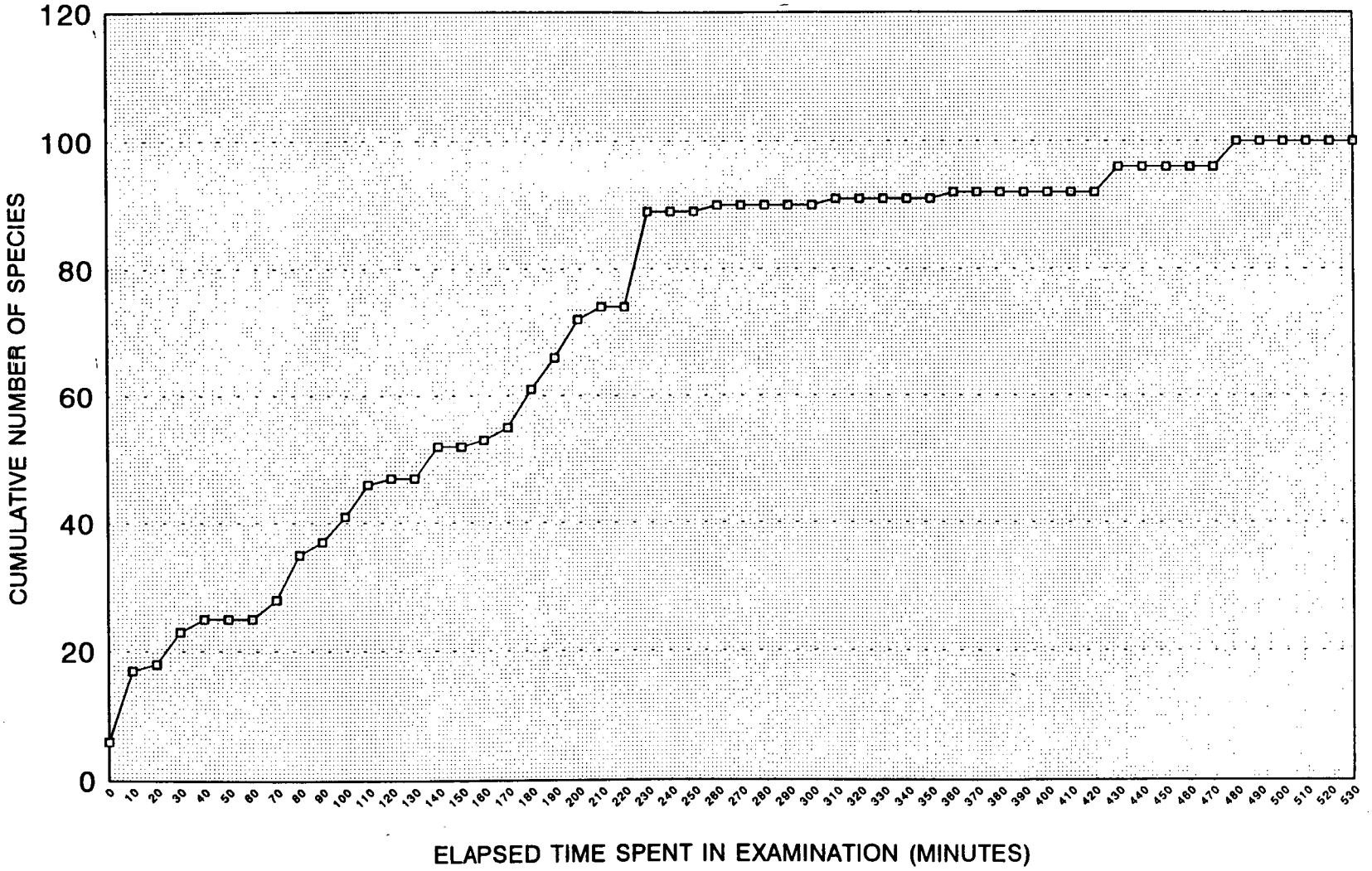


CBA 008 1249

PREPARED BY: ECOLSCIENCES, Inc.

WOODLAND ROUTE 532

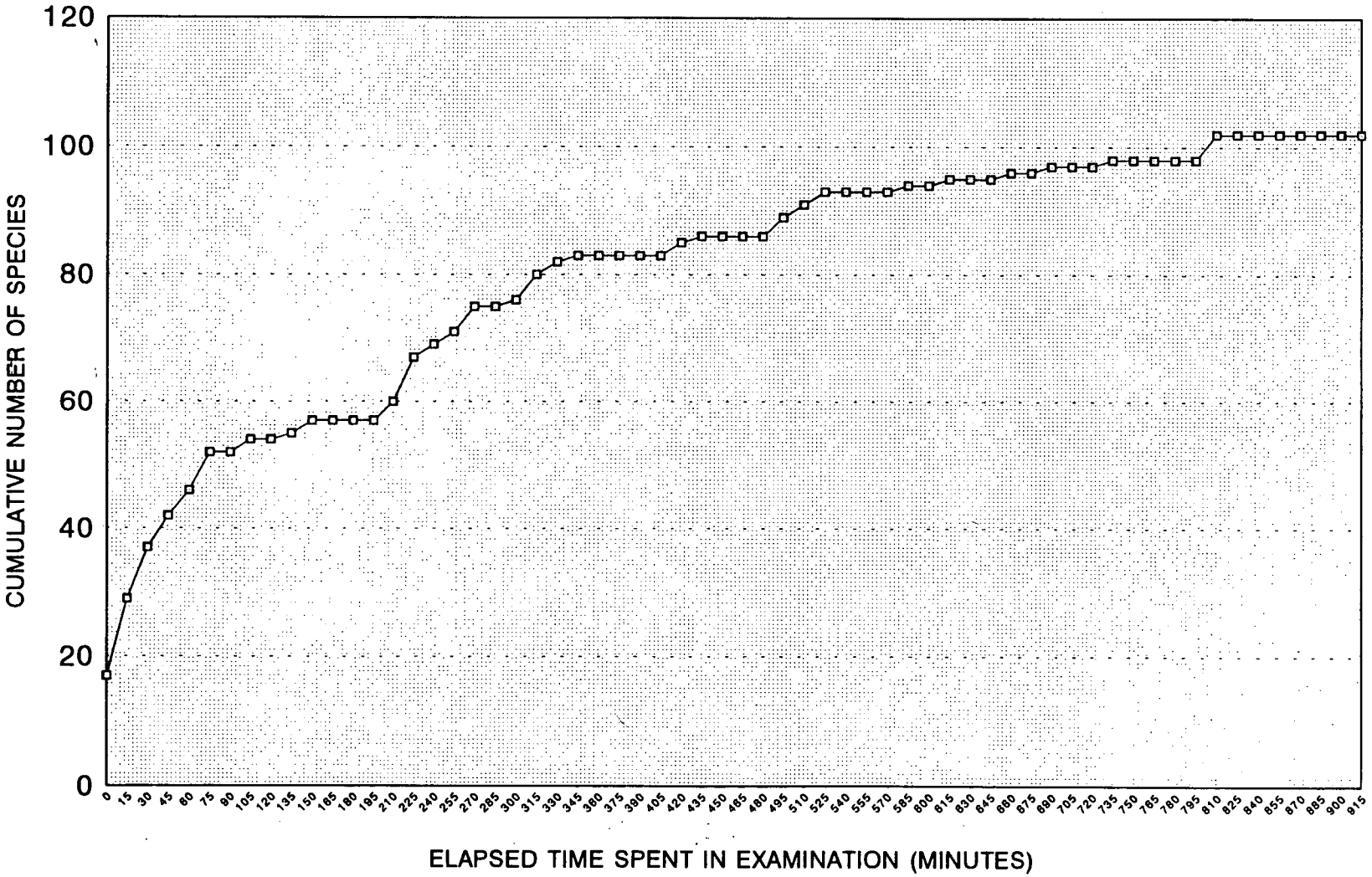
SPECIES EFFORT CURVE FOR TIMED MEANDER SEARCH



PREPARED BY: ECOLSCIENCES, Inc.

WOODLAND ROUTE 72

SPECIES EFFORT CURVE FOR TIMED MEANDER SEARCH

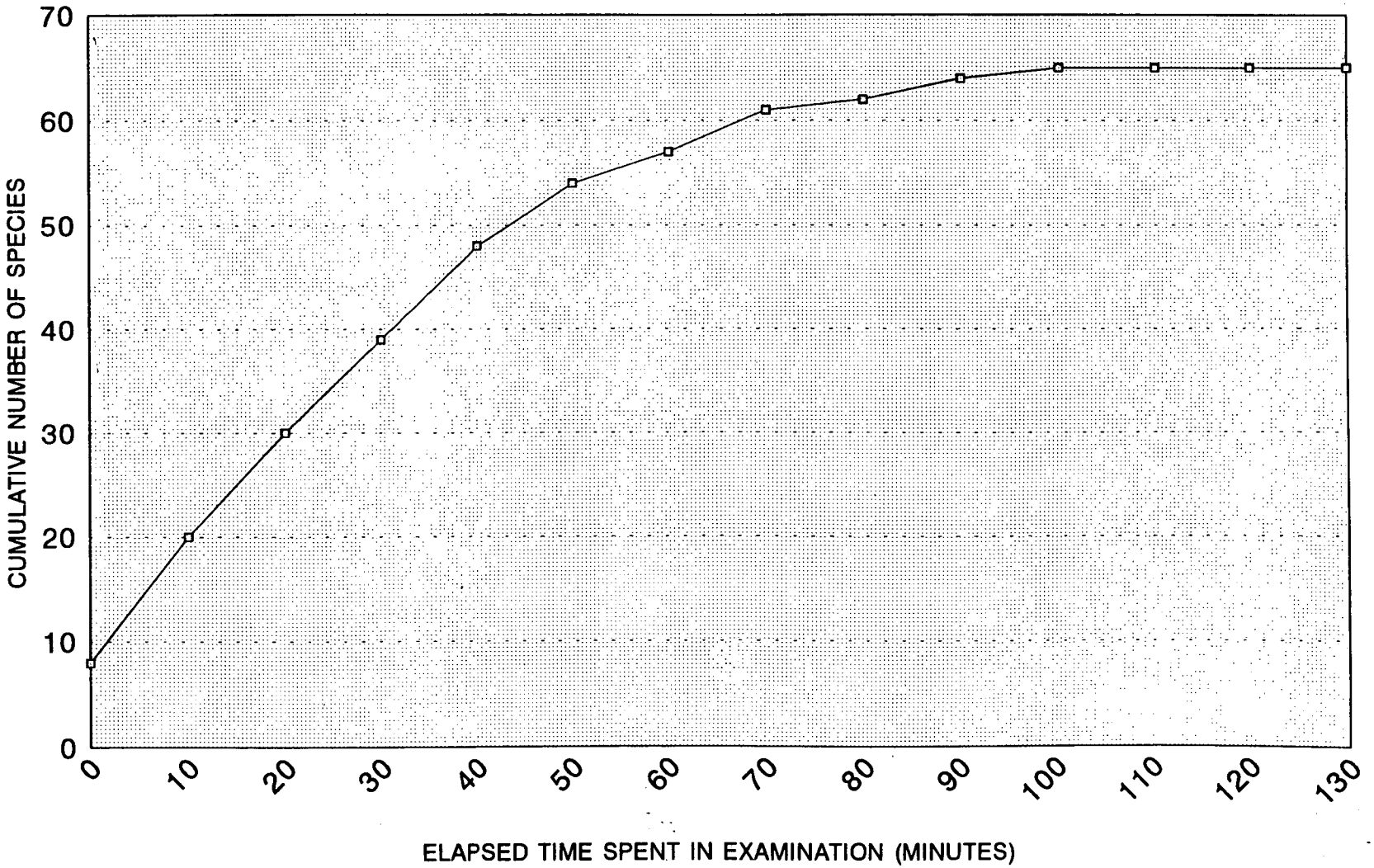


PREPARED BY: ECOLSCIENCES, Inc.

CBA 008 1251

EWAN SITE

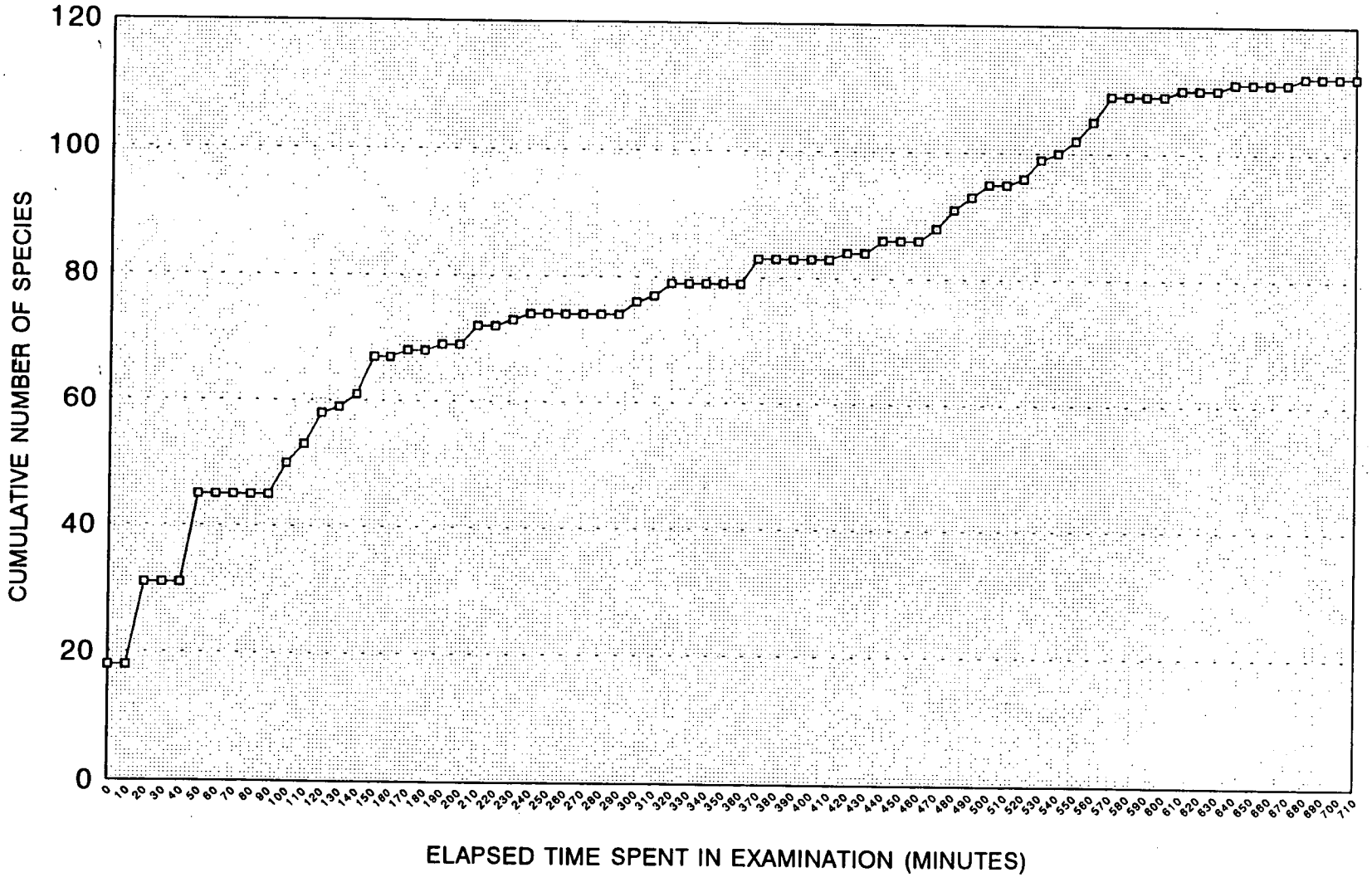
SPECIES EFFORT CURVE FOR TIMED MEANDER SEARCH



PREPARED BY: ECOLSCIENCES, Inc.

CIBA-GEIGY SITE

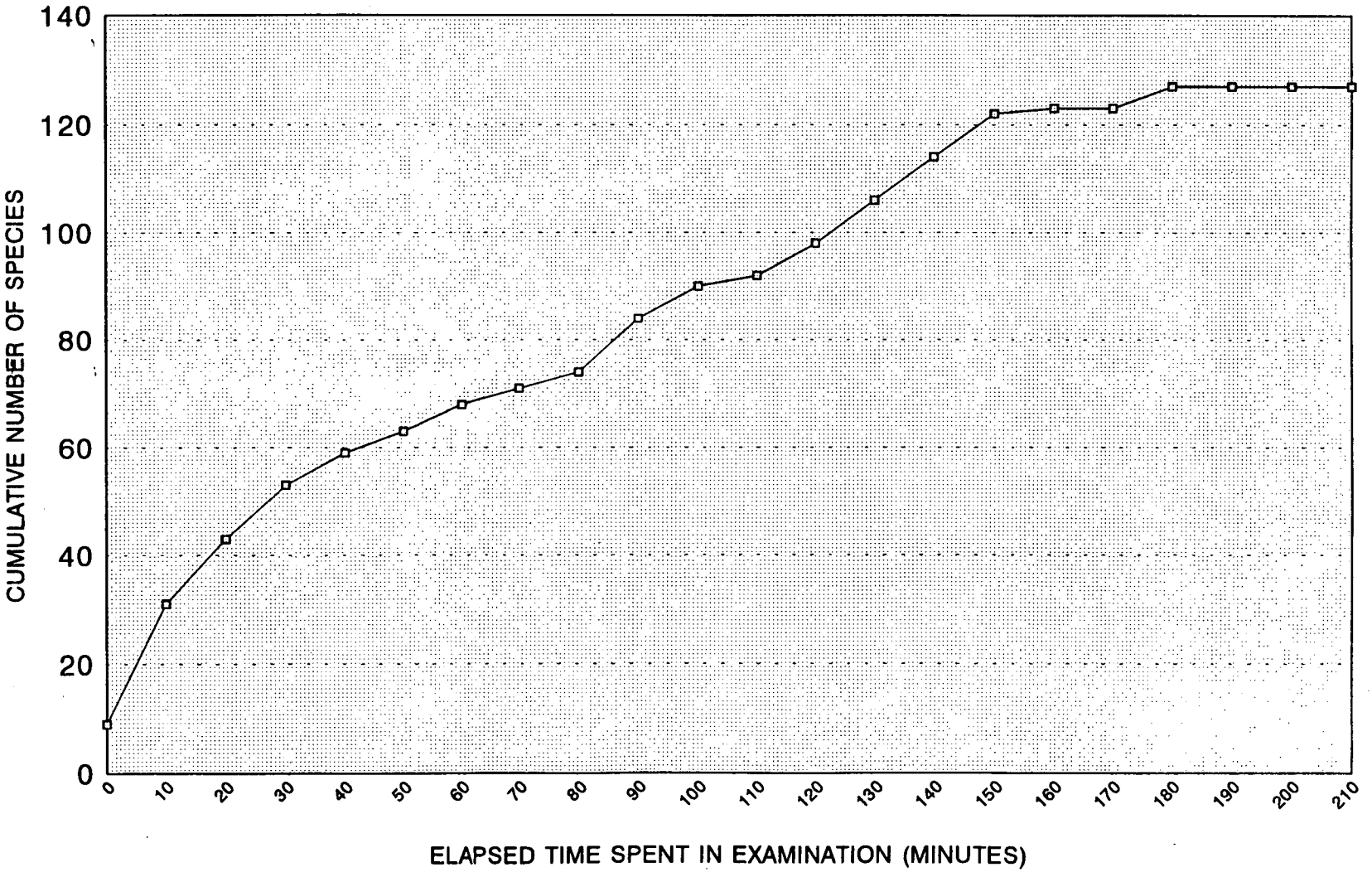
SPECIES EFFORT CURVE FOR TIMED MEANDER SEARCH



PREPARED BY: ECOLSCIENCES, Inc.

LANG SITE

SPECIES EFFORT CURVE FOR TIMED MEANDER SEARCH



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