

BEAR SWAMP EAST NATURAL AREA
MANAGEMENT PLAN

New Jersey Department of Environmental Protection
Division of Parks and Forestry
Office of Natural Lands Management
CN 404
Trenton, New Jersey 08625

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August, 1988

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DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF PARKS AND FORESTRY

MANAGEMENT PLAN FOR BEAR SWAMP EAST NATURAL AREA

TAKE NOTICE that Christopher J. Daggett, pursuant to the Natural Areas System Act, N.J.S.A. 13:1B-15.12a et seq., and N.J.A.C. 7:2-11.8, has adopted the recommendations of the Natural Areas Council regarding the management plan for Bear Swamp East Natural Area.

The Bear Swamp East Natural Area is located in Downe Township, Cumberland County, on land that is owned by the Department of Environmental Protection and administered by the Office of Natural Lands Management. The purpose of the management plan is to identify specific long and short term management techniques which are necessary to achieve the designation objective of the Natural Area. For Bear Swamp East Natural Area, the designation objective is preservation of ecological communities and relationships, management of bald eagle nesting site and other known and potential endangered species habitat.

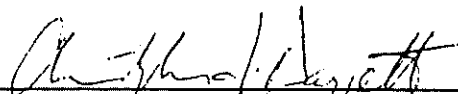
The Natural Areas Council reviewed the staff recommendations and public comments at their meeting on September 24, 1986. By unanimous resolution, the Natural Areas Council adopted recommendations for management and has submitted these recommendations in the form of a management plan to the Commissioner of the Department of Environmental Protection.

Copies of the adopted plan may be obtained from:

Department of Environmental Protection
Division of Parks and Forestry
Office of Natural Lands Management
CN 404
501 E. State Street
Bldg., #5, 2nd Flr.
Trenton, New Jersey 08625

This notice is published as a matter of public information.

Date October 11, 1986


CHRISTOPHER J. DAGGETT, Acting Commissioner
Department of Environmental Protection

BEAR SWAMP EAST NATURAL AREA
MANAGEMENT PLAN

ABSTRACT

The Bear Swamp East Natural Area became incorporated into the Natural Areas System in 1986. The Natural Area is located in Downe Township, Cumberland County, and is within the Outer Coastal Plain physiographic province. Bear Swamp East, which encompasses 1,420 acres, was designated to the System primarily because it supports the nest site for New Jersey's only remaining pair of bald eagles and because this nest is located within one of the state's oldest and most well developed lowland hardwood forests.

This management plan has been developed pursuant to N.J.A.C. 7:2-11.1 et seq. which mandates that such plans be prepared for all areas designated to the Natural Areas System. Management is aimed at prescribed uses and practices that will be allowed and implemented in order to maintain and, if practicable, enhance the natural features which the site contains.

The following is a summary of major management techniques recommended in this plan. Chapter III should be consulted for detailed information on prescribed management techniques.

Classification

Bear Swamp East is primarily classified as an ecological reserve.

Boundaries

Within one year a report shall be prepared outlining viable strategies for preservation of surrounding open space tracts, including Bear Swamp West and the Maurice River estuary area.

Bald Eagle Nest Management

Current methods of direct fostering shall be continued. Use of direct fostering in future years will depend on egg shell thickness or nest failure.

The condition of the nest tree shall be closely monitored and new nesting structures constructed as needed. Platforms may also be constructed in areas distant from the current nest.

Human Use

Lands east of Cedar Creek Trail shall be closed to all recreational uses during the critical eagle nesting period (January 15 to August 1). Exceptions include access along Southern Trail and those obtaining valid permits. Current recreational uses shall continue year-round in areas west of Cedar Creek Trail and from August 2 to January 14 in the restricted use zone. Boundaries of the restricted use zone shall be posted with signs indicating regulations barring use.

All trails leading to the nest tree shall be left to revegetate.

Recreational and research use levels shall be closely monitored and necessary adjustments made to prevent environmental degradation.

Except by authorized D.E.P. personnel, all motorized vehicles, including ATV's, trail bikes and snowmobiles, are prohibited. Locations of gates and proposed berms are indicated.

Access shall be encouraged via a single main entrance along Haleyville Road. A sign identifying the natural area and use restrictions, and an unpaved parking area, shall be placed at this location.

Railroad personnel shall be allowed entry through the gates at both ends of the rail line, but shall be informed of their responsibility for security.

The State Park Service shall bear the primary responsibility for law enforcement patrols. The Division of Fish, Game and Wildlife shall conduct enforcement as it relates only to the eagle nest site and other wildlife-related statutes, and shall assist in enforcement when requested.

Fire

Prescribed burning techniques may be applied to fire-prone areas. The status of fire threat shall be reported to the Administering Agency.

Man-made features

Existing structures shall remain in place. Construction of new permanent structures shall be discouraged.

Habitat Manipulation

The small field at the natural area entrance shall be maintained in its present successional stage.

External Features

Unimin Corporation representatives shall be contacted to seek a solution to the overwash problem which now results in flooding and siltation in the mature swamp forest.

Every effort shall be made to reduce externally generated noise which could negatively impact the eagle pair during the critical period.

NATURAL AREAS COUNCIL

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This document was written and prepared by Robert J. Cartica of the Division of Parks and Forestry, Office of Natural Lands Management, and Larry Niles and Tony Petrongolo of the Division of Fish, Game and Wildlife, Endangered and Nongame Species Program.

Gratitude is due to the following persons for their contributions toward the completion of this plan: The Natural Areas Council (Thomas J. Gilmore, Thomas F. Hampton, Ronald B. Krauth, David F. Moore, Thomas O. Niederer, Kathryn A. Porter), G. Lester Alpaugh, Joseph R. Arsenalt, Thomas Breden, Kathy Clark, Russell A. Cookingham, Sara Davison JoAnn Frier-Murza, Frank Guidotti, Stevens Heckscher, Mark Hedden, Joseph Hughes, Thomas Keck, Stephen L. Kehs, Warren Kell, Hermia Lechner, Larry S. Miller, Carl Nordstrom, Daniel O'Connor, Carl Owen, Charles Riegler, Jane Saks, David B. Snyder, Larry S. Torok, Olin D. White and Robert T. Zappalorti.

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INTRODUCTION

This management plan for the Bear Swamp East Natural Area describes the resource features which this unique site contains and then prescribes uses and practices that will be allowed and implemented to maintain and, if practicable, enhance these features.

Creation of the Natural Areas System was mandated under the Natural Areas System Act of 1976 (N.J.S.A. 13:1B-15.12a et seq.). A "Natural Area" is defined as "an area of land or water, owned in fee simple or held as a conservation easement by the Department, which has retained its natural character, although not necessarily completely undisturbed, or having rare or vanishing species of plant or animal life, or having similar features of interest which are worthy of preservation for present and future residents of the State" (N.J.A.C. 7:2-11.3).

Bear Swamp East Natural Area is located in Cumberland County, Downe Township, within the Outer Coastal Plain physiographic province. Figure 1 shows the general location of the natural area. The current natural area boundaries are indicated in Figure 2.

In 1908 Dallas Lore Sharp, author of Lay of the Land, described Bear Swamp as "... the largest, least-trod area of primeval swamp in southern New Jersey ... a land of tree giants: huge tulip poplar and swamp white oak" (Sutton, 1981). However, although its uniqueness has long been known, public attention only recently became focused upon Bear Swamp East when it was learned that the area was inhabited by the state's only known nesting pair of bald eagles and that this nest site was threatened by a nearby proposed timbering and sand mining operation. Sand mining is an important economic base in Cumberland County, and large ponds within and adjacent to the natural area are a result of this activity. In 1982, DEP submitted Land Acquisition Administrative Authorization NA-78-113 for Bear Swamp East, then known as the Millville Additions, with intent, following acquisition, to designate this site to the Natural Areas System. In 1984 DEP received authorization to acquire 1,566 acres through condemnation proceedings. In October of the same year, recognizing the ecological significance of the entire forested tract of which Bear Swamp East is part, DEP Commissioner Robert E. Hughey signed Administrative Order No. 78 officially listing 3,369 acres of Bear Swamp in Downe and Commercial Townships on the state Register of Natural Areas.

Since 1975, the Endangered and Nongame Species Program within the Division of Fish, Game and Wildlife has made protection and management of the breeding eagle pair a top priority. Recent eagle management activities include the annual removal of the infertile eggs from the nest, replacing them with eaglets from Canadian or captive sources. In 1983, the Division of Fish, Game and Wildlife contracted with Terrestrial Environmental Specialists, Inc. to develop a vegetation and wildlife assessment of Bear Swamp East which proved pivotal in the condemnation proceedings which led to the acquisition and ultimate protection of the area.

In April 1986, 1,420 acres of Bear Swamp East became incorporated within the State Natural Areas System. This acreage figure includes a 20 acre lot not currently under state ownership since its owner is a willing

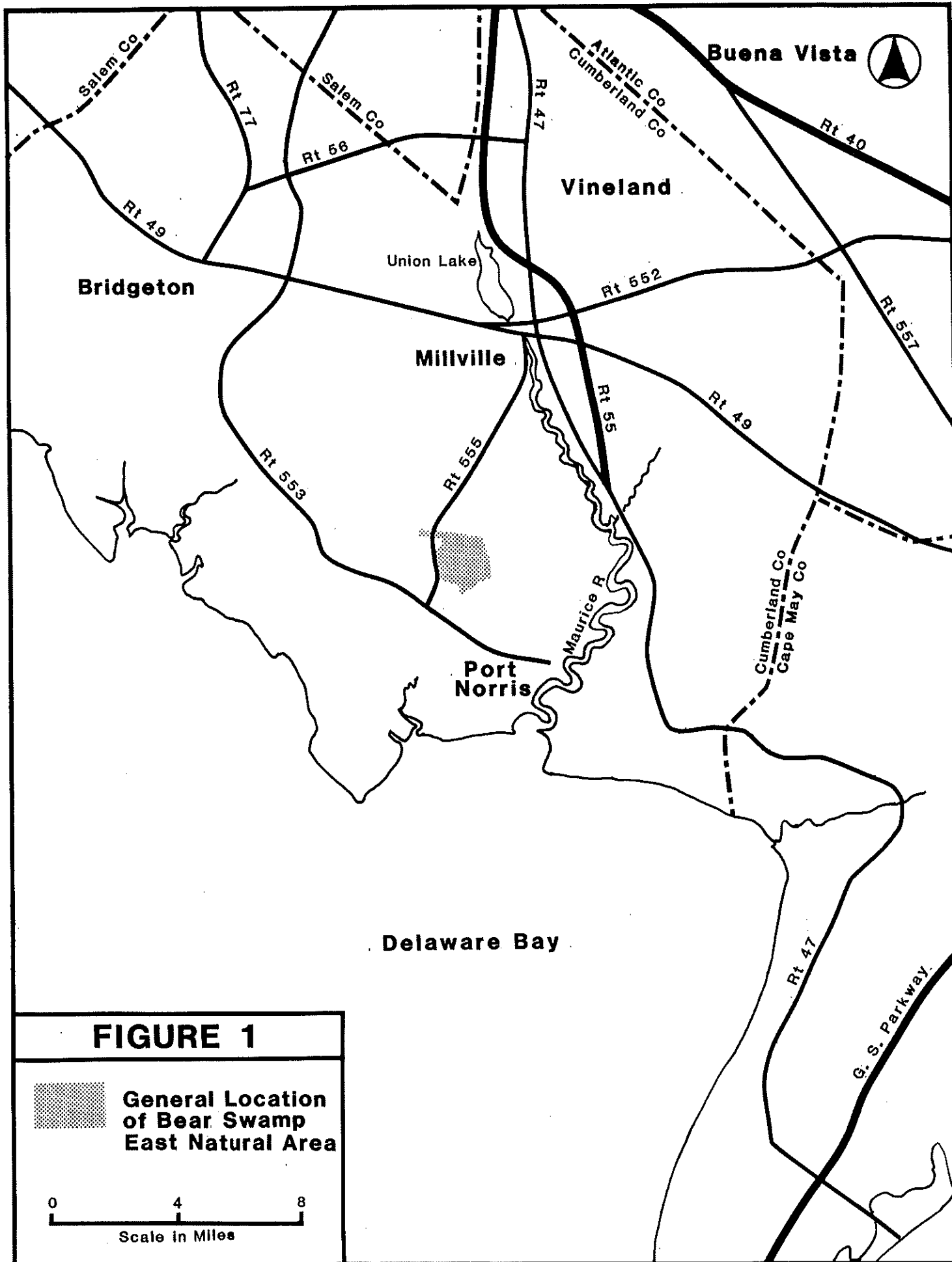
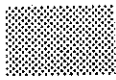
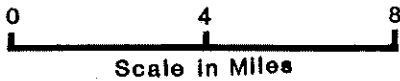


FIGURE 1



**General Location
of Bear Swamp
East Natural Area**



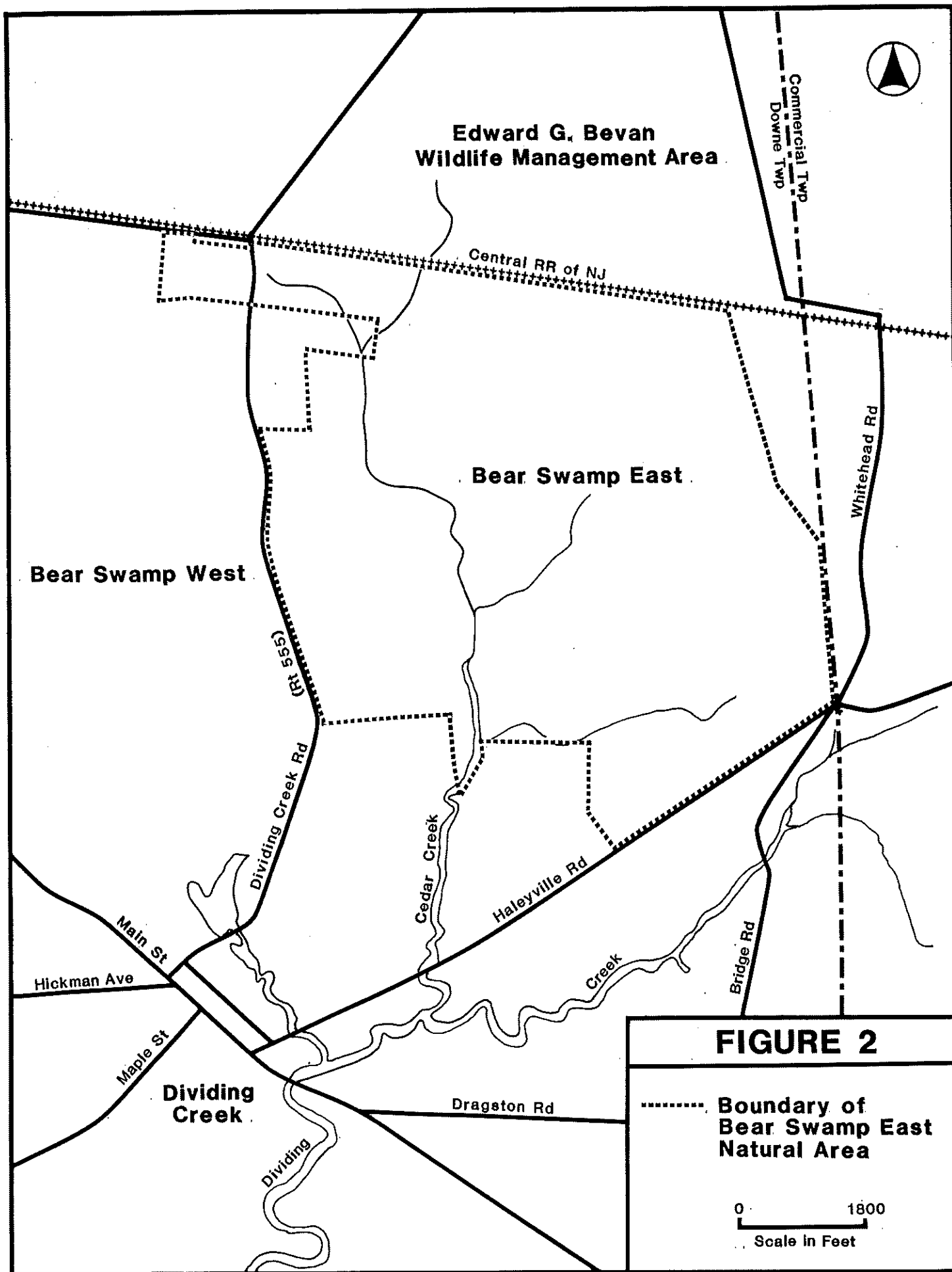


FIGURE 2

..... Boundary of Bear Swamp East Natural Area

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Scale in Feet

seller and, therefore, not subject to condemnation. Because this property will eventually become state owned, it is treated as part of the natural area in this plan. The designation objective for this natural area under the Administrative Code includes "preservation of ecological communities and relationships, management of the bald eagle nesting site and other known and potential endangered species habitat" (N.J.A.C. 7:2-11.12). The Administrative Code also mandates the preparation of this management plan.

The Office of Natural Lands Management shall serve as the Administering Agency, being responsible for establishing policy and, after consultation with other Divisions, organizations and individuals, making land management decisions affecting Bear Swamp East. The Divisions of Fish, Game and Wildlife and Parks and Forestry shall, as indicated, be responsible for effectuating the management techniques outlined in this plan, including those physical actions and enforcement measures required to achieve the designation objective.

SITE DESCRIPTION

Topography and Geology

Bear Swamp lies within the Outer Coastal Plain physiographic province. Topography is flat, the elevation ranging from less than 10 to 50 feet above mean sea level. Highest elevations occur at the northern boundary along the railroad right-of-way. The site consists geologically of quartz sand of the Cohansey formation which occurs near or at the surface, which may be overlain by quaternary sand deposits of the Cape May formation. The Cohansey formation ranges from 100 to 250 feet in thickness and forms the primary aquifer of the New Jersey coastal plain.

Soils

Muck soils uniformly occupy the entire central portion of the natural area and cover approximately 90 percent of the site (U.S. Department of Agriculture, 1978). These variable soils are extremely acid and consist of black, finely decomposed saturated organic material ranging from one to 10 feet in thickness. This muck substrate makes foot travel across much of the site quite arduous. Additional soils which occur in peripheral zones include Fallsington sandy loam (level, poorly drained, moderately permeable sand and gravel soils), Hammonton sandy loam and Hammonton loamy sand (level to gently sloping, well to somewhat poorly drained, moderately rapid permeability), Aura sandy loam (level to gently sloping, well drained, moderately permeable soils supporting hardwood forests), Klej loamy sand (nearly level, moderately well drained, rapid or moderately rapid permeability), and Tidal Marsh soils which border Cedar Creek. Water table is at or near the surface with the exception of the Aura series in which the water table is below five feet.

Surface Hydrology and Water Quality

The natural area drains to the south by Cedar Creek (Dividing Creek watershed, Delaware Bay drainage basin). Numerous small streams converging to Cedar Creek occur throughout the site with water at or closely below the surface throughout the year.

Although stream samples examined in 1982 indicated relatively low water quality, this was attributed to natural factors (stagnation, low flow, salinity, etc.); the surface water is considered to be of natural quality (C.E. Maguire, Inc., 1983). Bear Swamp's situation above the Cohansey aquifer and distance from developed centers provides some indication of high ground and surface water quality.

Vegetation

To date, no thorough description of the vegetation of Bear Swamp is available. In 1981, a brief description of hardwood swamp communities of Bear Swamp East was compiled by Forman et al. (1981). Since 1980, Stevens Heckscher has kept a record of all flora he observed within this area

(Heckscher, 1986). However, although useful in characterizing the flora of this area, Bear Swamp East was least observed of all locations. More recently, the Division of Fish, Game and Wildlife contracted with Terrestrial Environmental Specialists, Inc. (1984) to map community types and provide brief descriptions of each. Aerial photo analysis combined with some ground reconnaissance was utilized to determine characteristic species and community dominants. Stalter and O'Connor (1984) used quadrat analyses to compare community dominants and subdominants for Bear Swamp East and Bear Swamp West.

Figure 3 was derived from the base map provided by Terrestrial Environmental Specialists, Inc. (1984) combined with additional aerial photo analysis. Descriptions of communities were obtained from Terrestrial Environmental Specialists, Inc. (1984), Forman et al. (1981), Stalter and O'Connor (1984) and field examination. Boundaries of the TES base map were not changed nor were new mapping units added without field verification. Figure 3 indicates only general locations and approximate boundaries for the various community types. Since field verification of the entire site was not practicable, this map should be considered diagrammatic.

Mature Swamp Forest

From a vegetative community standpoint, Bear Swamp contains what may be the oldest and most well developed lowland hardwood forests in New Jersey. These wetland forest tracts, present in both eastern and western segments, have been described as primeval in character. Forests in Bear Swamp West have been described as containing up to three strata or vertical layers of trees--a condition very rarely observed in the eastern United States (Heckscher, 1981). Within the natural area, the mature swamp occupies approximately 200 acres in the northeastern sector (Fig. 3). This forest type is the most unique and significant within the natural area.

The north-central portion of the forest is primarily dominated by medium-sized hardwoods including red maple (Acer rubrum), tulip poplar (Liriodendron tulipifera), and sweet gum (Liquidambar styraciflua), and scattered large individuals of pond pine (Pinus serotina). Red maple is the most important tree within the canopy while American holly (Ilex opaca) is the dominant subcanopy tree (Stalter and O'Connor, 1984). Forman et al. (1981) have reported very large trees, perhaps some of the largest in New Jersey, within the central and southern portions of the swamp. O'Connor (1984a) reports state records for pond pine and basket oak (Quercus michauxii), although the basket oak recently died from gypsy moth defoliation. Canopy species reported include red maple, tulip poplar, sweet gum, black gum (Nyssa sylvatica) and basket oak. The understory is composed of a more open canopy of sweet bay magnolia (Magnolia virginiana), American holly and ironwood (Carpinus caroliniana). Common shrub species include sweet pepperbush (Clethra alnifolia), blueberry (Vaccinium corymbosum), and spicebush (Lindera benzoin). The forest floor is characterized by an almost complete cover of ferns including cinnamon fern (Osmunda cinnamomea). Sphagnum moss is common to the extremely moist muck soils of the forest floor. Forman et al. (1981) report that individuals of the canopy species listed above are found in all forest layers, indicating an equilibrium condition with the forest dominants regenerating themselves.

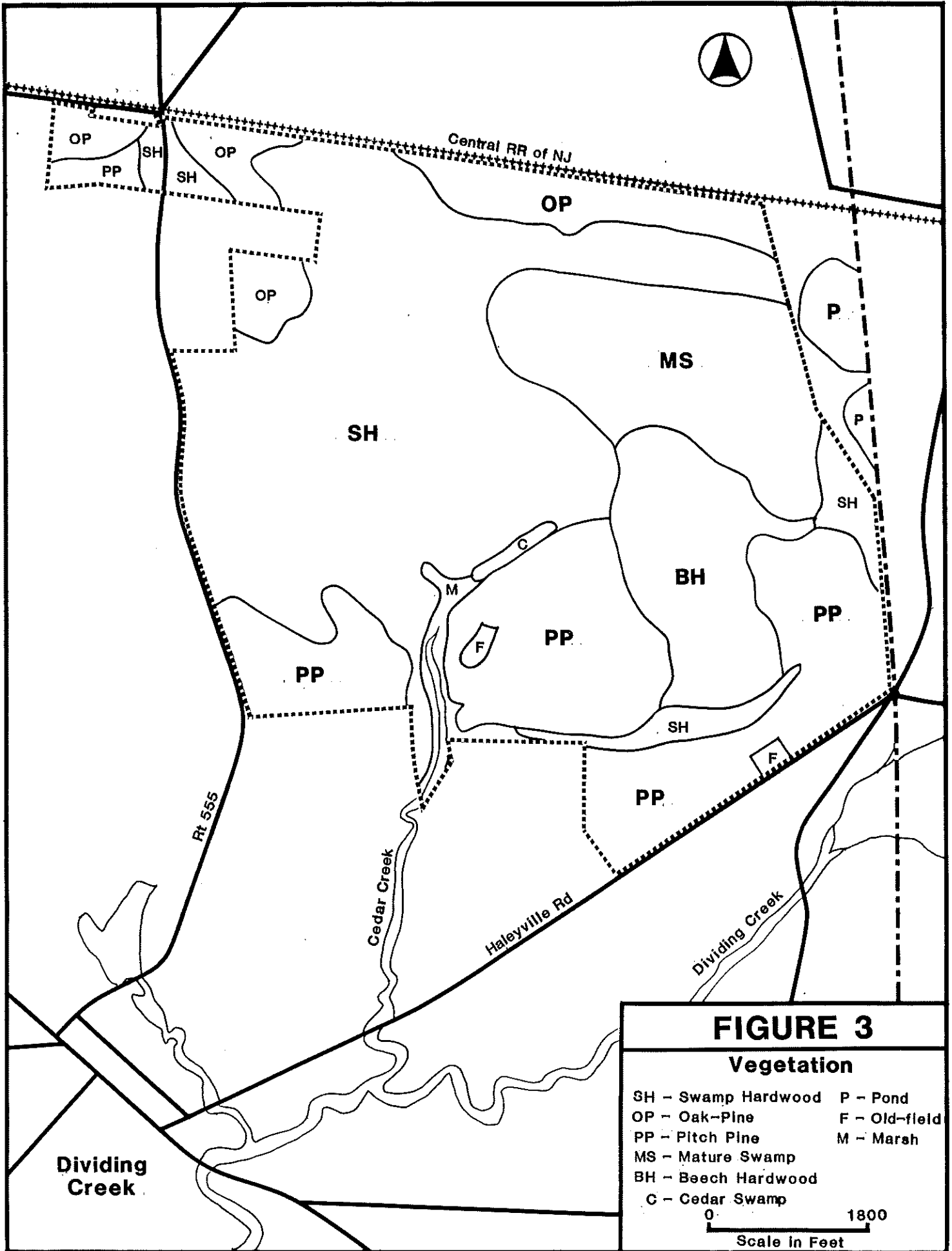


FIGURE 3

Vegetation

- SH - Swamp Hardwood
- OP - Oak-Pine
- PP - Pitch Pine
- MS - Mature Swamp
- BH - Beech Hardwood
- C - Cedar Swamp
- P - Pond
- F - Old-field
- M - Marsh

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 Scale in Feet

Although Forman et. al. (1981) indicates no evidence of cutting, cut stumps, many of which are very decayed, occur in some sections.

Swamp Hardwood Forest

This rather heterogenic community occupies the vast majority of the natural area (629 acres) and supports roughly the same species composition as the mature swamp. Its distinction from the mature swamp includes its younger and more variable age (with reduced vertical stratification), evidence of cutting and, in most of the area, by the presence of pockets of pitch pine (*Pinus rigida*) in slightly elevated zones (Terrestrial Environmental Specialists, Inc., 1984). This community type incorporates the swamp hardwood and swamp hardwood/pitch pine forest zones mapped by Terrestrial Environmental Specialists, Inc. (1984).

According to C.E. Maguire, Inc. (1983) most of this forest zone has been selectively logged in the recent past, including operations conducted in the 1940's, 1950s, 1970s and 1981. The large diameters of cut stumps throughout the area (C.E. Maguire, Inc., 1983) suggests that until recently this extensive forest may have more closely resembled the present mature swamp areas. However, this is refuted by aerial photographs dating to 1940 in which the mature swamp zones show a signature distinct from that of surrounding forests.

Canopy dominants include sweet gum, red maple, willow oak, white oak (*Q. alba*), black gum, beech (*Fagus grandifolia*), and, in scattered patches, pitch pine (Forman et al., 1981; Terrestrial Environmental Specialists, Inc., 1984). Common understory, shrub and herbaceous layer species include sweet bay magnolia, America holly (*Ilex opaca*), sassafras (*Sassafras albidum*), sweet pepperbrush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), greenbriar (*Smilax* spp.), swamp azalea (*Rhododendron viscosum*), cinnamon (*Osmunda cinnamomea*) and various other ferns, Solomon's seal (*Polygonatum biflorum*), and others.

Beech Hardwood Forest

American beech dominates the canopy of approximately 125 acres which also commonly includes white oak, sweet gum and red maple (Terrestrial Environmental Specialists, Inc., 1984) (Fig. 3). Field examination of this forest type was not undertaken and the extent of domination by beech is not known. C.E. Maguire, Inc. (1983) indicates that recent selective cutting also occurred here. Canopy trees are estimated to be 75 to 125 years old (Terrestrial Environmental Specialists, Inc., 1984). Holly dominates the understory and common shrubs include sweet pepperbush and greenbriar.

Pitch Pine Forest

Pitch Pine dominated forest occurs throughout 375 acres in the southeastern portion of the site (Fig. 3). Examination of recent aerial photographs indicate a relatively young, even-aged canopy. This area has been subject to recent selective cutting activity. (C.E. Maguire, Inc., 1983). Pitch pine may occur in pure stands or interspersed with sweet gum and various oak species, and holly is dominant in the shrub layer which also includes greenbriar, highbush blueberry, sweet pepperbush and scrub oak (*Q. ilicifolia*) (Terrestrial Environmental Specialists, Inc., 1984).

Oak-Pine Forest

Northern areas adjacent to the railroad right-of-way and generally lying above the 20 foot elevation contour may contain this forest type (Fig. 3). This is the only portion of the natural area which contains vegetation more characteristic of upland Pine Barrens. Aerial photographic surveys of 1951 indicate what appears to be very recent (within 3 years) clearcutting within this zone, and remnants of logging roads are visible here and in the adjacent swamp hardwood forest in 1940 aerial surveys. The canopy is dominated by pitch pine and various oaks including white, post (Q. stellata) and red oak (Q. rubra) (Terrestrial Environmental Specialists, Inc., 1984). Shrub and herb layers typify the Pine Barrens type.

Cedar Swamp

A fairly extensive white cedar stand exists along a portion of Cedar Creek and a branch which extends northeasterly from it (Fig. 3) (Dan O'Connor, personal communication).

Tidal Marsh

This herbaceous community dominates tidally affected areas adjacent to Cedar Creek and its tributaries. Characteristic species include salt-marsh cordgrass (Spartina alterniflora) in areas bordering the creek beds, salt-meadow grass (Spartina patens), common reed grass (Phragmites australis), marsh mallow (Hybiscus palustris) and an occasional Atlantic white cedar (Chamaecyparis thyoides).

Old Field

Two old fields occur in the southern portion of the natural area. Vegetation is primarily herbaceous and includes various grasses and sedges with invading woody forms.

Wildlife

The unique wildlife communities of Bear Swamp East are a result of the tract's great diversity of habitat types, including one of the state's most extensive remnants of mature swamp forest, its proximity to large contiguous tracts of forest land and productive coastal marshes, and its geographic location in a region where species of both northern and southern affinities may be found. Bear Swamp East represents one of New Jersey's most important wildlife habitats. Of particular significance is the nest site of the state's only breeding pair of bald eagles (Haliaeetus leucocephalus).

Mammals

Most of the characteristic mammals of southern New Jersey would be expected to inhabit the Bear Swamp East tract due to its large size and its diversity of both lowland and upland habitat types. Representative species include the white-tailed deer (Odocoileus virginianus), gray fox (Urocyon cinereoargenteus), river otter (Lutra canadensis), southern flying squirrel

(Glaucomys volans), short-tailed shrew (Blarina brevicauda), pine vole (Pitymys pinetorum), and red bat (Lasiurus borealis). Beaver (Castor canadensis) do not currently inhabit the tract although several colonies exist in the immediate vicinity which could at some point expand into the Cedar Creek drainage.

White-tailed deer densities in the area of the tract are currently 10-20/square mile although more than twice this number could be supported by the existing habitat. Deer densities in this area (Deer Management Zone #44) are being gradually increased by the Division of Fish, Game and Wildlife through the use of harvest regulations.

Reptiles and Amphibians

Bear Swamp East supports a variety of herptile species due to its diversity of habitat types and the extensiveness of its lowland habitats. Most of the characteristic herptile species of southern New Jersey would be expected to occur here.

Several threatened or endangered herptile species inhabit or are likely to inhabit the tract. The presence of the southern gray treefrog (Hyla chrysoscelis), Pine Barren Tree Frog (Hyla andersoni) and northern pine snake (Pituophis m. melanoleucus) have been confirmed. The tiger salamander (Ambystoma t. tigrinum) has not been confirmed but is likely to exist here.

Birds

The bird communities of Bear Swamp East are among the state's most unique and diverse. Bear Swamp East and the large, contiguous forested areas adjoining it are particularly important to the threatened barred owl, red shouldered hawk, and red headed woodpecker, the endangered bald eagle, and to a group of declining neotropical migrants known collectively as "interior forest nesters." These species require large, unbroken tracts of forest to thrive. The interior forest nesters include the Acadian flycatcher (Epidonax virescens), worm-eating warbler (Helmitheros vermivorus), hooded warbler (Wilsonia citrina), Kentucky warbler (Oporornis formosus), parula warbler (Parula americana), yellow throated vireo (Vireo flavifrons), and scarlet tanager (Piranga olivacea). Bear Swamp East and the adjoining 12,056 acre Bevan Wildlife Management Area together afford a measure of protection for these species. Endangered and threatened bird species also utilize Bear Swamp East, and these will be discussed later.

Sutton (1981) found 95 bird species in systematic surveys of the entire 3,500 acre Bear Swamp tract. Eighty-four of these species were found to be breeding there. A more recent census reported 141 species, 104 of which are known breeders (Sutton and Sutton, 1986).

Wild turkeys (Meleagris gallopardo), re-introduced to the adjacent Bevan Wildlife Management Area in 1983, are likely to establish themselves in Bear Swamp East in the very near future as the population in the immediate vicinity continues to expand.

Invertebrates

At present, no survey or list of invertebrates is known.

Threatened Plant Species

Due to the large size of Bear Swamp and the fact that it has been relatively unexplored until recently, extensive field study of rare plant species has not been conducted. However, O'Connor (1984b) and Heckscher (1986) have reported several species within Bear Swamp East classified as rare or imperiled within our state borders by New Jersey Natural Heritage Program (1987). Almost all of these species are also recognized in lists by Fairbrothers and Hough (1973) and Snyder and Vivian (1981). Imperiled species (6-20 population occurrences in state) include American mistletoe (Phoradendron flavescens), pond pine (Pinus serotina) and alga-like pondweed (Potamogeton confervoides). Rare species (21-100 occurrences) include crane-fly orchid (Tipularia discolor), basket oak (Quercus michauxii), purple bladderwort (Utricularia purpurea), fringe tree (Chionanthus virginicus), and little ladies tresses (Spiranthes tuberosa). Future field work may reveal additional rare plant populations.

Endangered and Threatened Wildlife Species

Endangered wildlife species have been the focus of attention at Bear Swamp since the habitat area itself became endangered by sand mining. Eight endangered or threatened species are known to breed on the area and another three species use the area throughout the breeding period (Table 1). New Jersey's only breeding pair of bald eagles nests in Bear Swamp.

Bear Swamp carries an unusual number of endangered and threatened species for several reasons. It includes a great variety of habitats, including the mature hardwood swamp of a size found in only three locations in New Jersey (Sara Davison, personal communication). It lies on the edge of the Pinelands ecosystem and so includes Pinelands species such as the northern pine snake, as well as Pinelands fringe species. Lastly, the swamp is a part of a large unbroken forest system that supports many species characteristic of large forest patches including the bald eagle, barred owl, red shouldered hawk and red headed woodpecker. The area is contiguous with the Bevan Wildlife Management Area to the north and several forest patches to the west and east. Bevan is contiguous with private forest areas to the north and east.

The unbroken forest is the most critical aspect of Bear Swamp to the endangered or threatened species and the many other uncommon species that inhabit the swamp. Many of these species, though not endangered, are declining throughout their range due to the loss of large forest patches (Lynch and Whitcomb, 1978; Whitcomb et al., 1981; Karr, 1982; Blake and Karr, 1984). The importance of an unbroken forest is heightened in New Jersey because of development pressures on private lands outside of Pinelands and CAFRA regulatory areas. Considerable acreages of forest have recently been cleared in the area between Bevan and the City of Millville. Other major forest areas to the southeast and west of Bear Swamp are being cleared for sand mining. The future of the large forest patch of which

Table 1. Confirmed and potential endangered and threatened wildlife species utilizing Bear Swamp East.

	Status	Confirmed extant	Confirmed breeder	Potential ¹
bald eagle	E	*	*	
barred owl	T	*	*	
red-shouldered hawk	T	*	*	
grasshopper sparrow	T	*	*	
red-headed woodpecker	T	*	*	
southern gray tree frog	E	*	*	
Pine Barren tree frog ²	E	*	*	
northern pine snake	T	*	*	
osprey	E	*		
least tern	E	*		
great blue heron	T	*		
tiger salamander	E			*
sedge wren	T			*

¹Species unconfirmed but high probability based on presence of suitable habitat.

²Dan O'Connor (personal communication).

Source: Office of Endangered and Nongame Species, Division of Fish, Game and Wildlife.

Bear Swamp and Bevan are a part is questionable, as may be the populations of some of the existing species which require large forested areas.

Records of eagles using Bear Swamp date back to the 1930's (McLaughlin, 1964). In the late 1950's the Bear Swamp nest was one of 22 nests located in southern New Jersey (Holstrom, 1985). Following the widespread use of pesticides during the fifties and sixties all but the Bear Swamp nest failed to produce young (Niles, Kell and Welton, 1983). The Bear Swamp nest accounted for almost all the state's production from 1960 to 1977, but it failed to produce any young after 1977. The Division of Fish, Game and Wildlife began direct fostering of eagle chicks in 1982. Each year real eggs were replaced with plaster eggs, so the pair would continue incubating, and the real eggs were artificially incubated at the Patuxent Research Laboratory of the U.S. Fish and Wildlife Service. The hatched chicks from Bear Swamp or chicks from other sites were then replaced in the nest. In 1982, the first year of the switch, the single egg was infertile and 25 percent thinner than normal. Since 1982, twelve young have been placed in the nest, of which eleven fledged. Complete nest data is given in Table 2.

In 1987, a second eagle pair was observed in Salem County but did not build a nest. In 1988 the pair built a nest and breeding behavior was observed, but the pair did not lay eggs.

The nest project is part of the Division's effort to restore bald eagles to the Delaware Bay region. This program also involves the release of eagles taken from wild nests in Canada. The method known as hacking, has been used successfully in the restoration of peregrine falcons and is being used on several endangered raptors throughout the world. The hacking site is located just south of Bear Swamp. Thirty-six eagles have been released from the hack site since 1983.

Bear Swamp and adjacent woodlands are important breeding sites for the barred owl and the red-shouldered hawk. A statewide survey of these species will be completed in 1987, but preliminary estimates of the total population indicate less than 100 for the barred owl and less than 50 for the red shouldered hawk. Sutton and Sutton (1986) have documented five barred owl pairs in the area of Bear Swamp and two pairs of red-shouldered hawks.

Man-made Features

The natural area is almost completely devoid of any apparent structures or other features created by man. Two small old fields occur within the southern portion of the area (Fig. 3). The northern boundary is defined by an active railroad, and roads border the western boundary and a portion of the southern boundary. Badly deteriorated foundations of 2-3 buildings also remain on-site (C.E. Maguire Inc., 1983).

Human activity (or lack of) has played an important role in current structure and composition. Although only portions have been documented (C.E. Maguire, Inc., 1983), logging operations, many recent and visible on aerial photographs, have occurred throughout the natural area. Field

Table 2. Bald eagle egg and chick production in New Jersey from 1959 to 1988.

Year	Number of nests	Number of fledged young	Number of eggs	Eggshell thinning (% below pre-DDT levels)	Hatched Yes/no
1959	10	4	-		
1960	8	1	-		
1961	7	1	-		
1962	6	1	-		
1963	8	2	-		
1964	6	0	-		
1965	5	0	-		
1966	6	1	-		
1967	3	0	-		
1968	1	0	-		
1969	1	0	-		
1970	2	0	-		
1974	1	2	-		
1975	1	1	-		
1976	1	1	-		
1977	1	0	-		
1978	1	0	-		
1979	1	0	-		
1980	1	0	-		
1981	1	0	-	17	No
1982	1	1	1	25	No
1983	1	2	2	17	Yes
1984	1	1	1	20	Yes
1985	1	2	2	17-30	Yes
1986	1	2	2	17	Yes
1987	1	1	2	24-27	Yes
1988	2	2	2	12-17	Yes

*Larry Niles, personal communication

Source: Niles, 1987

examination of the mature swamp forest, however, generally indicates a minimum of such activity.

Features of Potential Impact

Most factors which could have an impact on the natural features of Bear Swamp are external in origin, with the exception of fire, insect activity, disease and other such factors. In particular, the loss of surrounding habitat and buffer (e.g., continued sand mining, development) would effectively reduce the usable habitat of those species that require large tracts of forested or other open space for their survival and reproduction.

Sand mining operations began in the vicinity of Bear Swamp in 1924 (C.E. Maguire, Inc., 1983) and have continued up to the present, consuming large areas immediately adjacent to the natural area and Bear Swamp West. Although such operations have resulted in the creation of numerous, sometimes large ponds, loss of terrestrial habitat could have an overall negative impact on some species sensitive to patch size.

Bear Swamp West, adjacent to the Natural Area and occupying a large area of forests and ponds from Dividing Creek Road to Route 553, contains primeval swamp forests equal in quality to that of Bear Swamp East and is extremely important in maintaining genetic and biological diversity of the entire Bear Swamp tract (Stevens Heckscher, personal communication). The proximity and diversity of Bear Swamp West reduces boundary effects and genetic drain on Bear Swamp East. The entire Bear Swamp tract, encompassing both eastern and western segments, became listed on the State Register of Natural Areas in 1984. Bear Swamp West remains in private ownership and, as evidenced by extensive sand mining, is vulnerable to increased habitat alteration.

Activities at the nearby Unimin Corporation plant and along the Winchester and Western Railroad Company tracks, which form the northern boundary of the natural area, sometimes create noise which could disturb the eagle pair. Such noise may be generated from construction activity, track maintenance and derailment repair. In addition, low flying A-10 planes are known to use the nearby sand ponds as turning points and have been observed directly above the nest. Considerable agitation of the eagles has been noted when these planes fly over the nest (JoAnn Frier-Murza, personal communication).

A water filled sand mine lies adjacent to the natural area on the eastern boundary (Fig. 3). Fluctuating water level within this pond, resulting from current sand mining activities and precipitation episodes, has resulted in periodic sand overwash into the eastern portion of the mature swamp forest. This has resulted not only in siltation but also in a substantial raising of the local water table, which could have a negative impact on tree growth and/or survival (Dan O'Connor, personal communication).

There have been no significant fires within the natural area in the past 30 years, although the uplands of the Edward G. Bevan Wildlife Management Area adjacent to the north have experienced much greater fire

incidence (Charles Riegler, Carl Owen, Joseph Hughes; personal communications). Despite the recent absence of fires, the possibility of fire originating from outside the natural area represents a significant threat.

The porous nature of underlying unconsolidated sand predisposes this site to rapid water quality degeneration in the event of contamination from both on-site and relatively distant sources.

Human use of the site appears to have been light, due in part to the presence of extremely wet soils and lack of any roads or distinct trails into interior sections. However, human activity could increase in the future resulting in a negative impact on specific resources. Of primary concern is the integrity of the existing eagle's nest and maintenance of forest structure and composition.

MANAGEMENT ISSUES AND TECHNIQUES

Rules and Regulations

A portion of the Natural Areas System Rules (N.J.A.C. 7:2-11.1 et seq.) appears in Appendix A. An important function of these rules is to provide general interim management guidelines for all natural areas. An "interim management practice" means any use, activity or management conducted within a natural area prior to adoption of a management plan. Upon preparation of a management plan, interim management guidelines may continue or may be superceded by management techniques more appropriate to fulfill the designation objective of the natural area. The following analysis will outline management uses contrary or supplemental to existing rules. Appendix A should be consulted by managers for guidance on issues not covered below.

Designation Objective and Classification

The designation objective for Bear Swamp East Natural Area includes "preservation of ecological communities and relationships, management of bald eagle nesting site and other known and potential endangered species habitat" and, at the time of rule preparation, the area was assigned a primary classification of Ecological Reserve (N.J.A.C. 7:2-11.12). This classification reflects an initial view that, in order to attain the designation objective, the majority of the natural area be managed to allow natural processes to proceed with limited or no habitat manipulation.

Because of its official endangered status in both the state and nation, the bald eagle represents the single most important feature to which management efforts must be directed. The primary objective of bald eagle management is to insure the production of bald eagles from Bear Swamp. Subobjectives include protection of the nest from disturbance during critical periods, maintaining production of eaglets through direct fostering, and maintenance of nesting within the area through construction of new nests in adjacent trees. As the mature swamp forest itself represents a vegetative community type whose rarity may be regional in extent, and because this forest supports the eagle nest tree, its maintenance is paramount in achieving the designation objective. Finally, protection of several other endangered and threatened wildlife and plant species of New Jersey fall within the designation objective. Because, as will be outlined below, little or no habitat manipulation throughout the majority of the natural area will be required to achieve those goals, this area will continue to be classified primarily as an Ecological Reserve.

Following is an analysis of issues, problems and management activities which are directly required to achieve the objectives listed above. These topics are treated separately both for convenience and to accentuate their importance. However these issues should not be considered independent of each other. Techniques are based in part on consultation with appropriate agencies, individuals, and the Natural Areas Council, and are designed to adequately maintain and, if possible, enhance the quality of the natural area.

Throughout this section, the Administering Agency refers to the Office of Natural Lands Management (Division of Parks and Forestry). The Divisions of Fish, Game and Wildlife, State Park Service and State Forestry Services shall, as indicated, be responsible for effectuating the management techniques outlined in this plan, including those physical actions and enforcement measures required to achieve the designation objective.

Boundaries

Issues

1. Although relatively expansive and diverse in content, the natural area itself is not large enough to encompass the critical habitats of all the species it contains. Notable are the following:
 - a. Bald eagle home ranges cover approximately 12 square miles an area much larger than the 2.34 square miles in Bear Swamp East. According to the Division of Fish, Game and Wildlife, areas currently being used by the birds, and which may include potential nesting sites, are Bear Swamp West, Fortescue Glades Wildlife Refuge, Turkey Point and Hansey's Creek Point and the Maurice River estuary which includes the Manumuskin and Menantico Rivers.
 - b. Interior forest nesting passerines, as well as the threatened barred owl and red-shouldered hawk, prefer large areas of old growth forest (Blake and Karr, 1984; Lynch and Whigham, 1984). Although minimum areas for maintaining viable populations of these birds has not been established, protection of large tracts should be a goal of management.

It is reasonable to presume that Bear Swamp East would not accommodate many of the species it currently supports were it not for the large area of surrounding forested habitats and its distance from human activities.

Techniques

1. Every effort should be made to insure that Bear Swamp East remain part of a much larger area of preserved open space. Of particular importance is the fate of Bear Swamp West. This tract, predominantly owned by the Penn Glass Sand Corporation and included within Natural Areas Register boundaries, contains habitats similar in composition and quality to that of the natural area. Within one year of adoption of this plan, the Administering Agency shall prepare a document outlining viable strategies for preservation of needed critical habitat surrounding the natural area including, but not limited to, Bear Swamp West. In devising these strategies, the administering agency shall consult with and incorporate the recommendations of the Philadelphia Conservationists/Natural Lands Trust, The Nature Conservancy, Cumberland Conservation League, the managing

agencies and other professional individuals having knowledge of and an interest in the area.

Bald Eagle Nest Management*

Issues

1. Since 1982, direct fostering techniques have been used by the Division of Fish, Game and Wildlife to improve reproduction in the bald eagle. These techniques, outlined in detail below, are required because of the past history of egg shell thinning and reproductive failure. Since 1982, eggs produced from the Bear Swamp pair have been fertile and in 1986 egg shell thickness had increased to 17 percent thinner than normal--a thickness sufficient to allow chicks to survive incubation (Wiemeyer et al., 1984).
 - a. Using a spotting scope located approximately 800 meters from the nest, behavioral data is recorded twice per week.
 - b. Twenty-one days following egg laying, artificial eggs are placed in the nest and the real eggs are transported to the Patuxent Wildlife Research Center.
 - c. Fifteen days following artificial incubation and hatching, the original chicks are placed back in the nest if they are of normal size and no captive bred chicks are available.
 - d. At approximately 4-5 weeks of age, the chicks are banded and observations are continued until after the eaglets fledge.
2. Maintaining the nest is an essential management objective. In January 1987, a new nest was constructed atop a mast tree nearby to the tree occupied by the eagles. This was done because the occupied tree was determined to be dead and therefore susceptible to felling by winds off the Delaware bayshore. The eagle pair almost immediately moved to the new nest. Although more extensively used in the West, building nests and nesting structures for eagles and other raptors are commonly employed techniques. Use of nesting structures by eagles varies with proximity to existing natural nests. Near 100 percent use occurred when structures were placed adjacent to natural nests (Grubb, 1980).

*Protection of the nest from human disturbance during critical periods is essential to successful bald eagle production. Since this issue is more appropriately covered under Human Use, please refer to this section for a complete discussion of issues and techniques.

Techniques

1. The current methods of direct fostering outlined above shall be continued by the Division of Fish, Game and Wildlife, but will be discontinued if egg shell thicknesses improve in subsequent years. Direct fostering methods shall be resumed in the year following any recurrence of nest failure.
2. The Division of Fish, Game and Wildlife shall monitor the condition of the occupied nest and tree and shall construct additional nesting structures as needed. Newly constructed nests for the existing eagle pair will be placed in a tree adjacent to the currently occupied nest with similar orientation. The structure will follow the design outlined in Grubb (1980). In an attempt to establish a second eagle pair, additional platforms may be constructed on trees of similar height and orientation as the nest tree, but as far from the current nest as possible.

Human Use

Issues

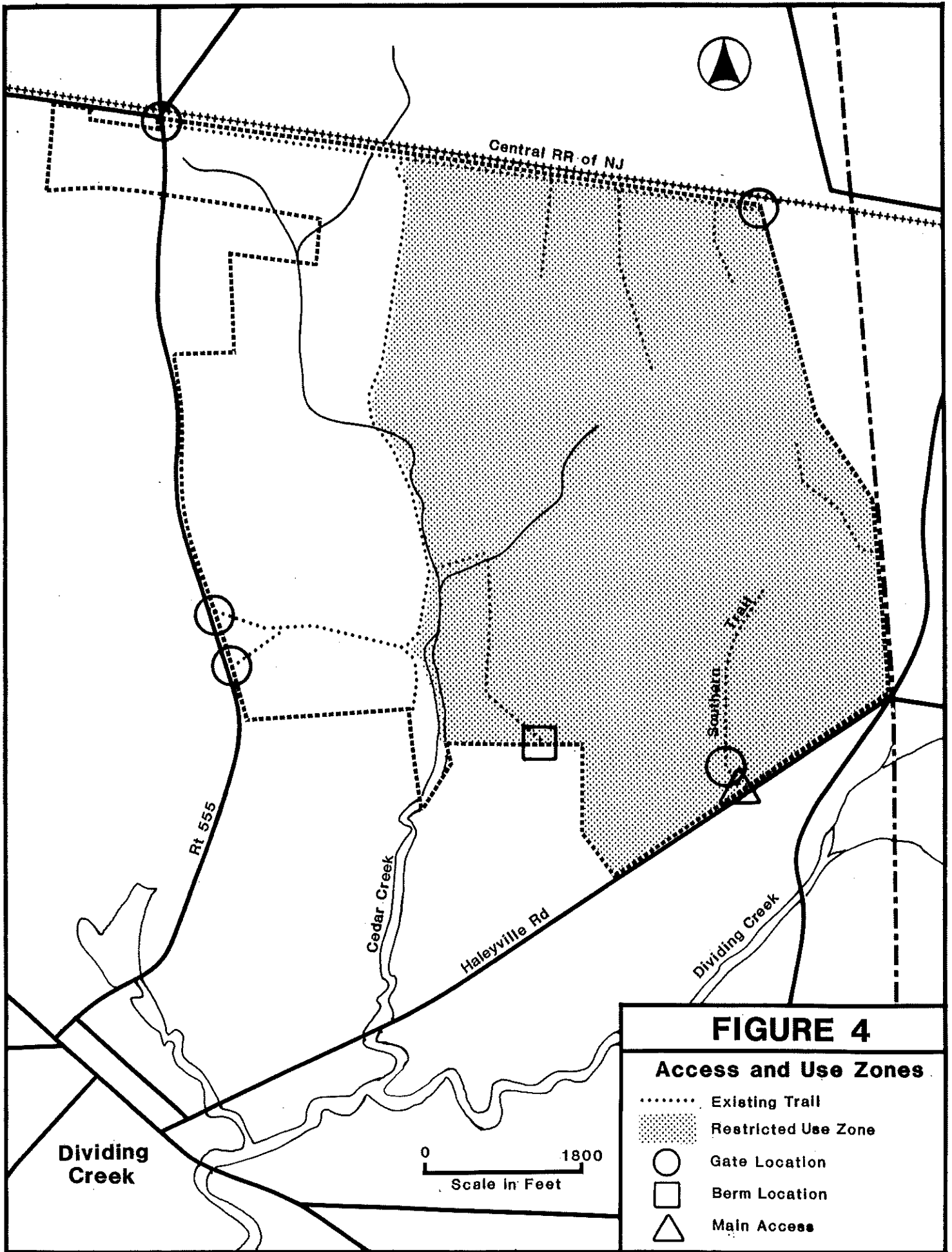
1. Essential to successful Bald Eagle production is protection of the nest from human disturbance during critical periods. The nest is most susceptible during the early nesting period (January to March) when the adult birds establish territory and lay eggs. Disturbance during this period could result in nest abandonment with resultant predation and exposure of the eggs. However, disturbance can have serious negative effects well into the post fledging period, when injuries to eaglets are a major cause of mortality. Therefore no disturbance can be tolerated from January 15 to August 1, hereafter referred to as the "critical period."
2. Boundaries must be set for the protection of the nest against disturbance during the critical period. Recommended boundaries for eagle protection in public lands supporting large numbers of eagles include a minimum of 800 foot radius (Olendorff and Zeedyk, 1978; Cline, 1985). However, since maintenance of eagle nesting is the primary management goal at Bear Swamp East, chosen boundaries should be liberal. In addition, boundaries must be clear and recognizable to users, preferably incorporating physical features such as a road, trail or water corridor.
3. Public recreational uses which currently occur include hiking, birdwatching, hunting, trapping, fishing and occasional entrance of off-road vehicles (ORV's). Recently, ORV tracks were discovered blazing a trail up to the pond pine supporting the eagle nest.
4. The extent and seasonality of human use at Bear Swamp has not been quantified. Since disturbance can profoundly effect eagle

nest success, the extent of human use of the area should be determined and periodically monitored.

5. Provision must be made to allow and encourage researchers to gather needed data on this area and its biota.

Techniques

1. All portions of the natural area east of Cedar Creek Trail (Fig. 4) shall be closed to all recreational use during the critical period with access limited by permission of the Division of Fish, Game and Wildlife. The Cedar Creek Trail provides the only recognizable and enforceable boundary for restricted use which also provides more than ample protection of the eagle nest. (The shortest distance from the nest to the trail is approximately 2,400 feet.) An exception shall include access along Southern Trail (Fig. 4). This trail is well beyond any recommended boundary for eagle protection. However, no physical boundary exists to separate this portion of the natural area from the restricted use zone. Because this is a favored trail for birders, and its continued use year-round will not impact the nesting eagles, Southern Trail shall be excepted from the restricted use zone. Access beyond the path of the trail or its terminus shall not be permitted during the critical period. Boundaries and the Southern Trail shall be posted with signs by the Administering Agency and the Division of Fish, Game and Wildlife, indicating the regulations barring use and the reasons for doing so.
2. All current recreational uses shall continue to be permitted throughout the year in areas west of Cedar Creek Trail and along Southern Trail, and from August 2 to January 14 in the restricted use zone (Fig. 4), with the exception of motorized vehicles (see below). Camping shall be prohibited.
3. Any trails leading to the vicinity of the eagle tree will be left to revegetate. Access to the tree for management reasons will be accomplished through the use of several paths with the intent of leaving no clearly visible trail to the tree.
4. The Division of Fish, Game and Wildlife shall closely monitor recreational and research use levels and activities so as to prevent surpassing those levels that could begin to degrade the natural features of the area. Increasing use of the area during the critical period could signal the need for changes in current regulations to protect the nest site. Concerns on uses and their levels shall be brought to the attention of the Administering Agency and the Natural Areas Council to determine appropriate limits and enforcement.
5. The entire natural area shall be closed to all motorized vehicles, including ATV's, trail bikes and snowmobiles, throughout the year. This can be accomplished in part by closing the railroad right-of-way at both ends, and all roads on the Bevan Wildlife Management Area leading to the right-of-way.



Locations of gates (constructed in 1987 by the Division of Parks and Forestry) and berms (proposed locations) are indicated in Figure 4. Berms shall be maintained by the State Forestry Services. Gates shall be constructed and maintained by the State Park Service. Gates and berms shall be inset from roads and properly signed. Signs shall be supplied and maintained by the State Park Service. Motorized vehicle use shall be restricted to authorized Department of Environmental Protection personnel.

6. Access to the natural area shall be encouraged via a single entrance point. The preferred access point is indicated in Figure 4. Any future improvements to encourage/control use (office, interpretive center) shall occur at or immediately surrounding this location. A small unpaved parking area shall be created as soon as possible by the State Park Service, which shall also oversee its maintenance. A sign identifying the natural area shall be constructed and maintained here by the State Park Service at this entrance point. Information and use restrictions shall be provided at this location. A trash container shall be provided and maintained here by the State Park Service.
7. Railroad officials shall be allowed entry through the gates for track maintenance and derailment repair activities. These officials shall also be informed by the Administering Agency that access carries with it responsibility for security of the area. Field crews shall lock gates after entry into and departure from the natural area, and shall restrict their activities to the service road only. Officials shall also be appraised of the sensitivity of the eagle pair during the critical period and their cooperation sought in preventing disturbance.
8. Law enforcement patrols to ensure compliance with the above management shall be the responsibility of the State Park Service through Belleplain State Forest. The State Park Service shall place signs at the main entrance and at all gates indicating appropriate phone numbers to call for information and emergencies. In addition, because it is the responsibility of the Division of Fish, Game and Wildlife to enforce all state statutes impacting fish and wildlife resources, this division shall be responsible for doing whatever is necessary to protect the eagle nest site from disturbance and to enforce any other wildlife-related statutes on the area (memorandum of Russell A. Cookingham, April 21, 1987). Although the Division of Fish, Game and Wildlife will not routinely conduct patrols or answer complaints regarding non-wildlife-related regulations, they shall enforce regulations that they observe being violated during the course of wildlife investigations or patrols (e.g., illegal woodcutting) and assist other law enforcement officials when requested (memorandum of Russell A. Cookingham, April 21, 1987).
9. Section 7:2-11.10 of the Natural Areas System Rules shall remain effective concerning procedures for conducting research and collecting specimens. Research activities may be conducted throughout the year. However, approval of such projects,

particularly those conducted during the critical period, shall not jeopardize the integrity of the ecosystem or result in disturbance to the eagle pair.

Fire

Issues

1. The threat of fire arising internally or from upland areas to the north, exists throughout the natural area

Techniques

1. Existing rules (Appendix A) shall remain effective regarding fire control and cleanup activities within ecological reserves.
2. Notwithstanding the above provisions, prescribed burning techniques may be applied in those sections of the natural area more prone to fire (pitch pine forests in the southern portion; more upland oak-pine forests along the northern boundary -- Fig. 3) provided that such activities are reviewed by the Natural Areas Council and approved by the Commissioner.
3. The State Forestry Services shall be responsible for determining the status of fire threat arising from within the natural area and shall communicate their concerns and recommendations to the Administering Agency.

Man-made Features

Issues

1. Features include several trails, an unspecified number of building foundations, two small fields and a short segment of Route 555 (Dividing Creek Road) which passes through the northwestern corner of the natural area. In addition, hunting platforms and blinds have been constructed throughout the site. Management must address whether these features conform to the designation objective and therefore should remain or be removed.

Techniques

1. Existing platforms and blinds exert little or no negative impact on vegetation resources and shall remain in place. However, construction of new permanent structures shall be discouraged. Instead, use of portable temporary stands and blinds are recommended.
2. All other features mentioned either cannot be removed or do not negatively impact the natural area.
3. Existing rules (Appendix A) shall remain in effect concerning construction of new structures of a temporary nature.

Habitat ManipulationIssues

1. A small field totalling approximately four acres is located within the southern section of the site (Fig. 3). Maintenance of this area in its present early successional stage may contribute to the suitability of Bear Swamp East as habitat for the threatened grasshopper sparrow and other grassland species.

Techniques

1. The State Park Service and Forestry Services shall be responsible for maintenance of this field in an early successional stage through mowing in late summer (after August 15).

External FeaturesIssues

1. Periodic sand overwash from the pond outside the eastern boundary of the natural area (Fig. 3) has resulted in siltation within the mature swamp forest.
2. Continued sand mining of open space lands adjacent to or in close proximity to the natural area presents several potential threats to the integrity of Bear Swamp East as a viable ecological unit. The following questions need to be addressed:
 - a. Mining results in a loss of forested area. Does this constitute an increasing threat to the suitability of Bear Swamp East as critical habitat for those species that require large contiguous tracts of forested land to fulfill their life requirements?
 - b. Could deep sand mining affect the depth of the water table?
 - c. Could sand mining result in chemical pollution of the ground water?
 - d. Could air pollution resulting from the sand extraction process impact the natural area?
3. Activity at the Unimin facility and along the Winchester and Western Railroad tracks sometimes generates noise which could prove deleterious to the eagle pair during the critical period. Additional noise threats during this period include low flying A-10 planes.

Techniques

1. Unimin representatives shall be contacted by the Administering Agency to seek a remedy to the overwash problem. Possible

solutions include installation of a spillway off-site of the natural area or placement of erosion control structures along the overwash area.

2. With the exception of loss of habitat, it appears unlikely that any of the potential threats of continued sand mining will have any negative impact on the natural area. The most viable strategy to prevent loss of surrounding habitat is to seek preservation of these lands, particularly Bear Swamp West. For recommendations, see section on Boundaries.
3. The Administering Agency shall be responsible for negotiating with adjacent property owners and other parties that create noise or other externally generated impacts which could threaten the eagles during the critical period. This may involve meetings or other communication with Unimin Corporation, Winchester and Western Railroad or other outside groups. Whenever possible, any agreements made to eliminate or reduce such impacts should be put in writing to deter misinterpretation or direct violation. Nearby companies or groups shall be encouraged to contact the Administering Agency should any questions or concerns arise.

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APPENDIX AINTERIM MANAGEMENT PRACTICES FOR NATURAL AREAS

From Natural Areas System Rules
(N.J.A.C. 7:2-11.1 et seq.)

7:2-11.9 INTERIM MANAGEMENT PRACTICES

- (a) Interim management practices shall be implemented by the administering agency, provided that:
 - 1. The practice will have no direct or indirect adverse impact on natural features of concern;
 - 2. The administering agency notifies the secretary of the Council, in writing, no later than 30 days after initiating the practice;
 - 3. Approval of the Commissioner is not required by provision elsewhere in this subchapter; and
 - 4. The practice is consistent with terms of any conservation easement held by the Department.
- (b) Interim management practices which require the approval of the Commissioner shall first be submitted to the Council for its review and recommendation.
- (c) Upon finding that an interim management practice listed below at (e) or (f) would be detrimental to achieving a specific designation objective, the Council shall recommend to the Commissioner the substitution of a more appropriate interim management practice. Should the Commissioner concur with the recommendation of the Council, the Commissioner may approve substitution by a more appropriate interim management practice.
- (d) Where there are conflicts between general practices described below at (e) and practices specific to a natural area classification described below at (f), the latter shall apply.
- (e) The following interim management practices apply generally to all natural areas:
 - 1. Natural area boundaries shall be made clearly evident by posting signs at a maximum density of ten signs per mile; entrance points shall be posted to indicate to users that they are entering a natural area; boundary signs shall be of a standard size and format as approved by the Commissioner and provided by the Division;
 - 2. Boundary fences that are needed to protect the natural area may be installed provided the fence shall not have a

- detrimental effect on movement of wildlife, air circulation, or other natural conditions;
3. Vehicular access lanes may be maintained within a natural area but may not be enlarged in any manner except upon approval of the Commissioner.
 4. Existing firebreaks within a natural area may be maintained for safety purposes; temporary firebreaks made by mowing, raking, plowing or wetting, may be used in conjunction with prescribed burning for habitat management;
 5. Existing structures may be maintained in a natural area but may not be enlarged; new structures, of a temporary nature, may be constructed for research purposes in accordance with N.J.A.C. 7:2-11.10;
 6. No measures, such as cutting of grass, brush, or other vegetation, thinning of trees, opening of scenic vistas, or planting, shall be taken to alter natural processes or features for the purpose of enhancing the beauty or neatness of a natural area;
 7. Except as otherwise provided in this section, there shall be no introduction, removal or consumptive use of any material, product, or object to or from a natural area; prohibited activities include grazing by domestic animals, farming, gathering of plants or parts thereof, mining or quarrying, and dumping, burying, or spreading of garbage, trash, or other materials; structures or materials may be removed as follows:
 - i. Old interior fences may be removed, giving consideration to leaving posts to mark boundaries between former land uses;
 - ii. Rubbish or any other waste material may be removed; and
 - iii. Structures having no historic, scientific or habitat value may be demolished and removed unless such structures are deemed essential for administrative purposes;
 8. Water levels within a natural area shall not be altered except to restore water levels which have been altered due to a sudden natural phenomena or man-induced conditions off-site; routine repairs to existing water control structures may be undertaken but the structures may not be enlarged;
 9. All wildfires shall be brought under control as quickly as possible; after a fire within a natural area, there shall be no cleanup or replanting except as approved by the Commissioner to achieve the designation objective or for reasons of health and safety;

10. Prescribed burning, to eliminate safety hazards and to manage habitat, may be conducted upon review of a proposal for prescribed burning by the Council and approval by the Commissioner; use of vehicles and equipment shall be specified in the proposal for prescribed burning;
11. Erosion control within a natural area shall not be undertaken except to restore existing grades which have been altered due to a sudden natural phenomena or man-induced conditions within or beyond the natural area;
12. Habitat manipulation may be undertaken if preservation of a particular habitat type or species of native flora or fauna is included in the designation objective of the natural area and the prior approval of the Commissioner is obtainable;
13. Gypsy moth control activities may be implemented as an interim management practice after approval by the Commissioner; the Commissioner shall review a control plan only after the State Forester has determined that egg mass counts and prior year defoliation indicates that tree mortality will be severe without intervention; to the extent practicable, biological controls, rather than chemical means, shall be used to control gypsy moths;
14. There shall be no physical manipulation of a natural area or application of chemicals known as adulticides for the purpose of controlling mosquitos; the application of larvacides may be permitted in salt marshes only and only as follows:
 - i. The application of Bacillus thuringensis var. israeliensis (BTI) may be initiated by a mosquito control agency at any time; and
 - ii. The application of other larvacides may be initiated upon approval by the Commissioner of a specific plan submitted by a mosquito control agency; the plan shall identify the specific area where an application will be made, the types and amount of larvacide to be applied, the need for the application, and the reason why BTI cannot be used for this application;
15. Research activities and the collection of specimens may only be conducted in accordance with N.J.A.C. 7:2-11.10 and upon approval of the administering agency; and
16. Public use of natural areas shall be allowed only to the extent and in a manner that it will not impair natural features; the administering agency may restrict access and use as necessary to protect the natural area; the following are permissible public uses:
 - i. Hunting, trapping, and fishing are permitted in accordance with N.J.A.C. 7:25-5 and 7:25-6; except for the stocking of fish and game, habitats may not be

manipulated for the purpose of enhancing hunting, trapping, or fishing;

ii. Occasional camping along trails, boating, and swimming may be permitted in specified locations of natural areas in accordance with N.J.A.C. 7:2-2, 7:2-5, 7:2-7, 7:2-8, and 7:25-2, and are further limited as follows:

- (1) No permanent structures may be erected;
- (2) No motorized methods of boating or camping are permitted;
- (3) Trailside shelters of the type called lean-tos are permitted, but there may not be two such shelters within three miles of each other; and

iii. Existing trails may be maintained, but not enlarged in any manner, by the administering agency to allow public use and prevent erosion, trampling of vegetation beyond the trails, and other deterioration as follows:

- (1) New trails or enlargement of existing trails for interpretive purposes may be initiated subsequent to review of a plan by the Council and approval of that plan by the Commissioner;
- (2) Rare plants may not be removed for the purpose of maintaining existing or constructing new trails; and
- (3) To the extent possible, natural materials shall be used on and along trails; and

iv. All pets shall be kept caged or leashed and under immediate control of the owner except that dogs used while legally hunting shall be exempt from the leashing requirement.

(f) The following interim management practices, unless superseded by an adopted management plan, apply to the appropriate specified natural area classifications:

1. Location markers identifying interpretation points of interest may be installed except within ecological reserves;
2. Trail blazes may be used within any natural area;
3. Existing vehicular access lanes may not be enlarged in any manner within an ecological reserve;
4. New vehicular access lanes may be constructed only within buffer areas and upon approval by the Commissioner;

5. New structures and enlargement of existing structures may be undertaken by the administering agency only within buffer areas, provided the structures directly or indirectly contribute to the designation objective;
6. The alteration of natural processes or features for the purpose of enhancing public use of the natural area may be conducted by the administering agency only within buffer areas; and
7. The following management practices shall not be permitted within ecological reserves:
 - i. New, existing, or temporary firebreaks;
 - ii. Construction of new trails;
 - iii. Alteration or restoration of water levels;
 - iv. Prescribed burning;
 - v. Erosion control measures;
 - vi. Gypsy moth control activities; and
 - vii. Manipulation of vegetation and wildlife habitats.