MANAGEMENT PLAN FOR

DELRAY OAKS

NATURAL AREA

1997

Prepared by:

Palm Beach County
Department of Environmental Resources Management
3323 Belvedere Road, Bldg. 502
West Palm Beach, Florida 33406

and

George Gann & Keith Bradley
The Institute for Regional Conservation
22601 S.W. 152 Avenue
Miami, Florida 33170

B 6/17/97

EXECUTIVE SUMMARY

The Delray Oaks Natural Area site has been acquired as a natural area by Palm Beach County and the City of Delray Beach, Florida. Funds were provided from the Palm Beach County Environmentally Sensitive Lands Bond Issue Referendum of March 12, 1991. Matching funds for the acquisition have been approved by the Florida Communities Trust through its Preservation 2000 Program. The primary purpose of this acquisition is to preserve important remnants of prairie hammock, xeric hammock, and mesic flatwoods vegetation communities. The secondary purposes are to provide for passive recreation, environmental education, and scientific research. The acquisition and associated activities will assist Palm Beach County and the City of Delray Beach to implement several policies within their respective Comprehensive Plans.

The 24.58-acre Delray Oaks Natural Area is located within the City of Delray Beach in southeastern Palm Beach County, Florida. Prairie hammock and xeric hammock are the predominant natural communities present on the site, which also contains mesic flatwoods and strand swamp communities. Xeric hammock is considered to be very rare in the state. The Delray Oaks Natural Area provides habitat for several rare plant and animal species. Thus far, 9 plant and 2 animal species recorded on the site have been listed by at least one government agency or nonprofit environmental organization.

Fire exclusion, pest plant invasions, hydrological alterations, construction of adjacent roads and buildings, illegal dumping, and off-road vehicle traffic have all impacted the site. In addition, managers face special challenges unique to fragmented natural communities located within urban and suburban environments.

In recognition of the significance of the natural vegetation communities on the site, public use must remain limited to passive, non-consumptive recreation, environmental education, and scientific study. Footpaths and an interpretive display will provide a valuable opportunity for the public to observe the distinctive prairie hammock, xeric hammock, mesic flatwoods and strand swamp communities, while also imparting an appreciation of their biological uniqueness. Scientific research will include monitoring of populations of rare species and evaluation of restoration and management activities.

This management plan has been developed to achieve two major goals: 1) to provide specific information required by the Florida Communities Trust's Preservation 2000 Program and 2) to provide additional information and management recommendations so that management activities can begin promptly. A stewardship report will be provided to the Florida Communities Trust each year, and the management plan will be reviewed at least once every 5 years by the Palm Beach County Natural Areas Management Advisory Committee and revised as necessary on the basis of new information, improvements in management techniques, or other relevant factors.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONCLUDED)

LIST OF FIGURES

LIST OF TABLES

APPENDIXES

1. INTRODUCTION

This management plan is intended to provide guidance in the future use and management of the Delray Oaks Natural Area. The Delray Oaks Natural Area was acquired in December 1995 by Palm Beach County (the County) with funds from the Palm Beach County Environmentally Sensitive Lands Bond Issue Referendum of March 12, 1991. Negotiations for the acquisition and other acquisition-related services were provided by the County's contractor, The Nature Conservancy (TNC). The City of Delray Beach (the City) served as the County's partner in an application for State matching funds for the acquisition. The Florida Communities Trust (FCT) has approved matching funds through its Preservation 2000 Program.

This acquisition represents part of a much larger effort to acquire the most important privately held natural areas left in Palm Beach County(Palm Beach County Department of Environmental Resources Management [ERM] and the City 1994). Palm Beach County endorsed the concept of a Wilderness Islands Program, which included an inventory of the remaining high-quality natural areas (Iverson and Austin 1988). Based on the results of that study and the recommendations of citizens' advisory committees, the Delray Oaks Natural Area and 13 other sites were given high priority for acquisition by the County's Environmentally Sensitive Lands Acquisition Advisory Committee in 1990. On March 12, 1991, the voters of Palm Beach County approved a $100 million bond referendum to purchase environmentally sensitive lands.

The Delray Oaks Natural Area is located within the City of Delray Beach on the southern Atlantic coastal strip in Palm Beach County, approximately 0.6 miles south of Linton Boulevard. (Figures 1 and 2). It is bordered on the east by Congress Avenue, and on the south and west by 22nd Avenue. The total area of this site is 24.58 acres.

Common names are used in the text and in Appendix A (Natural Resources Inventory and Assessment) for species recorded on the Delray Oaks Natural Area. Scientific names of plants are listed in Appendix B; those of animals are listed in Appendix C. The scientific name is used when a unique common name does not exist for the taxon or if the species has not been recorded for the project site.

History

The Delray Oaks Natural Area is a portion of a small island of higher ground that was associated with a former sandbar on the northern edge of the historic Yamato Marsh. This marsh was the mouth of a former estuary that flowed into the Atlantic Ocean. When ocean water levels fell and the Pamlico Ridge formed to the east of the site, the ridge blocked the estuary mouth and a freshwater marsh formed. Excess water from the Yamato Marsh system flowed south through north-south wet prairie/marsh swales to the Hillsborough River.

The first major human disturbance in the vicinity of the Delray Oaks Natural Area was the construction of the Seaboard Airline Railroad in the late 1920s approximately 600 feet east of the site. In the 1930s, the E-4 Canal was dug north to south through the Yamato Marsh approximately 1,000 feet west of the site. About the same time, the Model Lands Company dug the drainage canal that evolved into the strand swamp east from the E-4 Canal across the site and the railroad tracks. After crossing the railroad tracks, the canal turned north to drain a large shallow wet prairie system. The E-4 Canal provided a shorter, deeper route for water to reach the Hillsborough River, which had already been channelized and converted to the Hillsborough Canal. Along with its associated lateral canals, the E-4 Canal significantly lowered water levels in the Yamato Marsh.

The lowered water levels made vegetable farming possible. A 1940 aerial photo (USDI 1940) shows farm fields in portions of the marsh sandbars and along the north shore of the marsh. The farms created a need for roads. The first road in this area, Germantown Road, is clearly visible in a 1940 aerial photo, Germantown Road extended westward from U.S. Highway 1 to the farming area 1,500 feet north of the site, in the uplands just north of the marsh.

The 1940 photograph shows the Delray Oaks site as an ovoid island dominated by saw palmettos, fringed by cabbage palms and live oaks and surrounded by wet prairie. The cabbage palms developed into an open scattered forest with a small depression on the eastern edge of the island. A few large oaks mixed with cabbage palms are present on the southern border. Several large slash pines probably existed on the fringe of the saw palmettos; an old "lighter" pine stump observed on the southern border of the site indicates that a large slash pine was removed by logging activities. This vegetation is considered to be the characteristic historic vegetation of the site, because the drainage canals have not been present long enough to have caused significant changes.

In a 1953 aerial photograph (USDI 1953), the effects of drainage are more apparent. Most of the former sandbars and wet prairies in the marsh were being farmed and only the deepest portions of the marsh still had standing water. The Delray Oaks island was completely surrounded by dry land, except for a small pocket of marsh to the southwest of the site. In the late 1950s, the Central and South Florida Flood Control Project widened Lake Worth Drainage District Lateral Canal L-38, which is 1,200 feet south of the site, and dug it east to connect to the Atlantic Intracoastal Waterway. This canal was renamed the C-15 Canal. It provided a direct route to tidewater through the Yamato Marsh. After construction of the C-15 Canal, groundwater levels declined further and the Yamato Marsh ceased to exist.

Aerial photographs show no evidence that the Delray Oaks site was ever farmed or cleared. A 1965 photograph (Palm Beach County Property Appraiser 1965) shows a cattle corral and fencing just west of the

site. It is possible that the site was used as unimproved pasture at this time. Successional change in the vegetation community is apparent in the 1965 photograph and subsequent photographs (Palm Beach County Property Appraiser 1970, 1977, 1984, 1991, 1993). The eastern and southern fringe of oaks and cabbage palms began to thicken and became prairie hammock. North and west of this fringe, young oaks had begun to colonize the saw palmettos and the transition to xeric hammock was underway. The depression in the eastern cabbage palm fringe became smaller and nearly disappeared as cabbage palms, vines, and Brazilian peppers steadily encroached. Brazilian pepper is first visible in the 1977 photograph, and later photographs show that it steadily increased to fill the open spaces between cabbage palms in the eastern fringe area. Many of the Brazilian peppers are associated with illegal dumping piles.

Prior to 1970, very little development occurred in the vicinity of the site. In 1969, Palm Beach County obtained a deed for a 120-foot right-of-way for the extension of Congress Avenue on the east side of the site and a 40-foot easement for a drainage canal across the north border of the site. Congress Avenue was built as a two-lane road in 1970 from Germantown Road to Yamato Road, and the drainage canal was dug at the same time. The old drainage canal that has become the present-day strand swamp had been abandoned by this time and was filled in where Congress Avenue was constructed across it.

Congress Avenue was a little-used road in a lightly-populated area, and it became a catalyst for illegal dumping on the unfenced Delray Oaks site. Dumpers could easily drive unobserved into the open areas between cabbage palms on the eastern side of the side and dump their loads. Vehicle trails and dump piles are clearly visible in the 1977 photograph, and dumping continued into the 1980s. Over 2,000 tires, several whole and partial automobiles, and many piles of auto parts, construction debris, appliances, and household garbage were removed from the site prior to acquisition. Nursery debris, also dumped at this time, was the source of many of the exotic plants present on the site. Individuals also used Congress Avenue to access and remove cabbage palms for landscaping. Many pits where palms were removed have been observed. One palm was discovered that had a trench dug around it for removal, but the palm was left in place.

After the construction of Congress Avenue, Hardrives, Inc. expanded its asphalt plant and offices that it had built in the late 1960s east of Congress Avenue and north of the site. A borrow pit is visible in the 1970 photo just north of the County drainage canal, but the pit was completely filled in by 1977. Another shallow borrow pit is visible in the former deep marsh area southwest of the site; it was dredged and became part of a drainage lake in the early 1980s. The cattle corral had completely disappeared by 1977.

In 1972, the owners of the land containing the project site gave an 80-foot right-of-way to the City of Delray Beach for S.W. 22nd Avenue. This road was constructed from Germantown Road to Congress Avenue by

1977. It was located just south and west of the original Delray Oaks vegetation island. In 1977, the understory vegetation had been cleared to the south and west of S.W. 22nd Avenue and most of the remaining area of dense saw palmetto in the vegetation island had been mowed or roto-chopped, including a portion of the western edge of the natural area. The first phase of the Sabal Pine condominium development had been constructed to the northwest of the site by 1977. Interstate 95 was constructed in the mid-1970s just west of the Seaboard Railroad tracks. Most of the northern leg of the abandoned drainage canal was obliterated during the construction of I-95.

Construction of the Sabal Pines condominium to the west of the Delray Oaks Natural Area and construction of the Delray Oaks condominium to the south and southwest of the site continued in the late 1970s and early 1980s. In the 1984 aerial photo, both developments were nearly completed, with the Sabal Pines East condominium occupying nearly all of the roto-chopped saw palmetto area. The last building was under construction just north of the western leg of the Delray Oaks Natural Area, and the present-day disturbed area in the northern portion of the western leg was cleared and construction vehicles were parked on it. Construction vehicles and trailers were present east of the building under construction in the portion of the Delray Oaks Natural Area that was previously roto-chopped in 1977. Significant amounts of concrete, reinforcing metal bars, and other debris related to the construction of the condominium were dumped in these disturbed areas at this time.

The 1984 photograph also shows Hardrives had constructed an office building west of Congress Avenue to the north of the Delray Oaks Natural Area, and that a large office complex has been built between Hardrives and Germantown Road. East of Congress Avenue, one commercial building has been constructed and another is under construction. In 1985, residential development was completed and the undeveloped natural area site was sold to Park of Commerce Associates for a commercial office park. During the 1980s, a small nursery was established on the south side of the site at the edge of the prairie hammock. The nursery area was enclosed by a wire fence, and had an irrigation system and an electrical hookup. This nursery also was a source of exotic plants, especially asparagus fern. All nursery-related structures were removed prior to acquisition.

In the 1987 aerial photo, Congress Avenue is shown as widened to four lanes and commercial buildings are present on most of the land opposite the Delray Oaks Natural Area on the east side of Congress Avenue. In 1988, a parking lot and sales trailer were constructed at the southeast corner of the site, presumably to help market it as an office park. Although a 3-acre parcel was sold to Florida Power and Light in 1986, the office park concept did not succeed, and the trailer and parking lot were removed in 1992. In December 1995, the County purchased Florida Power and Light parcel for $385,000 and the other 21.5 acres of the site for

$2,800,000 from A & A Associates, the successors to Park of Commerce Associates. In 1996, Office Depot began construction of a new office building on the partially-developed Hardrives tract located immediately north of the Delray Oaks Natural Area.

2. PURPOSE

The primary purpose of the Delray Oaks Natural Area acquisition is to ensure the preservation of high-quality hammock and flatwoods communities, together with their component rare plant and animal species. Nine plant and 2 animal species recorded for the site have been listed by at least one government agency or nonprofit environmental organization (Tables 1 and 2).

The Delray Oaks Natural Area will be developed as a publicly-owned and operated, natural resource-based, passive outdoor recreational site. The site also will be used for environmental education and scientific research. Existing perimeter trails will be maintained for access, and appropriate signs will be placed along the nature trail to be constructed. The signs will identify the site resources and their significance. The preservation of the Delray Oaks Natural Area also will help to protect the quality and quantity of groundwater resources. Both the preservation and recreation components of this project will help Palm Beach County and the City of Delray Beach to comply with portions of their respective Comprehensive Plans. All signs, literature, and advertising will identify the project site as being publicly owned and operated as a natural area and outdoor recreational site. The Delray Oaks Natural Area will be assigned a land use designation as a conservation district, as required by the Open Space and Recreation Element of the City's Comprehensive Plan.

The Delray Oaks Natural Area consists largely of prairie hammock, xeric hammock, and mesic flatwoods natural communities. These communities, which can be considered high-quality within the context of urbanized southeastern Florida, are in a somewhat degraded condition as a result of fire exclusion, pest plant invasions, hydrologic alterations, construction of adjacent roads and buildings, illegal dumping, off-road vehicle traffic, and other human-related disturbances. Maintaining and improving the ecological quality of these communities will be included in the future management of the preserve. These management efforts will include implementing invasive vegetation control programs throughout the entire site and prescribed burning in the mesic flatwoods habitats. The disturbed Brazilian pepper areas will be restored to prairie hammock, xeric hammock and/or mesic flatwoods communities.

Management activities will be coordinated under the direction of ERM, in cooperation with the City. In addition to County and City personnel, volunteers from the community will assist in maintaining trails, removing invasive vegetation, and performing other site management activities that may be needed. The Delray Oaks Natural Area will be managed under the "single-use" concept, which means that it will be managed to preserve

and restore natural resource values. Scientific research, environmental education, and passive resource-based recreation will be encouraged as long as they do not jeopardize the protection of natural resources. In general, passive recreation will include such activities as nature appreciation and study, hiking, and photography.

The acquisition and associated activities will assist the County and the City to implement several policies within their respective Comprehensive Plans. This project will further the following City Comprehensive Plan directives: 1) to conserve and protect natural reservations and sensitive lands which provide habitat and contain native vegetation (Conservation Element Goal Area "B"); 2) to preserve the Delray Oaks area through acquisition (Conservation Element Policy B-1.2); 3) to preserve, conserve, appropriately use and protect fisheries, wildlife, and marine habitats which serve as habitats for endangered and threatened plant and animal species (Conservation Element Policy B-2.6); and 4) to participate with the County in seeking State funding for the acquisition of the Delray Oaks site (Conservation Element Policy B-1.2). The County's Conservation Element directs the County to preserve native upland habitats, with priority given to environmentally sensitive land (Objective 2) and habitat of significant value to existing populations of listed species (Objective 3) and specifically calls for the acquisition and management of parcels identified as environmentally sensitive (Policy 2-e).

The Delray Oaks Natural Area will be managed to protect and maintain native biological diversity and ecosystem functions in perpetuity. The management of this site will be coordinated with the management of other County-managed sites as part of a county-wide system of natural areas. The following objectives will guide the formulation of management policies:

1) Maintenance of ecological integrity by ensuring the long-term viability of native wetland and upland biological communities and the protection of listed plant and animal species on the Delray Oaks Natural Area.

2) Provision of viable habitat for other non-listed wildlife species that use, or could potentially use, the Delray Oaks Natural Area.

3) Restoration of disturbed natural communities, and restoration of highly disturbed areas (including areas dominated by Brazilian pepper) to prairie hammock, xeric hammock and/or mesic flatwoods.

4) Implementation of a prescribed burn regime that maintains fire-dependent vegetative communities, assists in the restoration of disturbed areas, and adequately addresses safety and smoke concerns.

5) Provision of facilities and development of policies for public use that allow for passive, resource-based recreational uses, scientific research, and environmental education activities that do not have a detrimental effect on the Delray Oaks Natural Area.

6) Adoption of appropriate security and access control measures to prevent unauthorized activities, such as use by off-road vehicles, illegal dumping, collection of plants, poaching, and harassment of animals.

7) Reduction of exotic pest plant vegetation cover to no more than 1% of the total vegetation coverage, exclusion and/or removal of exotic non-native animals having a detrimental effect, and reduction of the coverage of invasive native vines.

3. STRUCTURES AND IMPROVEMENTS

3.1 EXISTING AND PROPOSED PHYSICAL IMPROVEMENTS

There are no structures or improvements currently on the Delray Oaks Natural Area. A 125-by-125 foot disturbed area that was created by a former sales trailer and parking area exists in the southeast corner of the site at the intersection of NW 22nd Avenue and Congress Avenue. The 3,600-square-foot parking area was constructed with a shellrock base that probably was covered with wood chips. The area is presently covered by weedy grasses. Many of the proposed improvements, including a kiosk, signs, the trailhead, and a parking area, will be sited within or adjacent to this disturbed area. Although listed species have not been observed within the southeast corner disturbed area, all improvements within this area will be sited to minimize impact to listed species if they are subsequently observed in this area. Listed plants will be relocated on site as necessary.

All major proposed structures and improvements are described in the following sections and shown on the master site plan (Figure 3). Responsibilities for funding and constructing these improvements are identified in an interlocal agreement between the City and the County (Appendix E). Only structures and improvements that will help to achieve the goals of preserving and restoring the natural resources of the Delray Oaks Natural Area and providing for compatible public uses are proposed. No restroom facilities or picnic areas are planned for the site. Proposed public-use facilities (i.e., the handicapped-accessible nature trail and the parking area) will fulfill the Americans with Disabilities Act (ADA) requirements. Written approval from FCT will be requested prior to the construction or installation of any buildings, structures, improvements, or signs or any removal of native vegetation or major land alteration not discussed in this management plan. All improvements and major land alterations will comply with applicable local, state, regional and federal laws and regulations. Evidence will be provided to FCT that all required licenses and permits have been obtained prior to the commencement of any construction or major land alterations.

3.1.1 Fencing and Gates

Due to the prior high incidence of illegal dumping, as well as the potential for poaching of native plants and wildlife, the entire Delray Oaks Natural Area, except for the northern border, has been fenced. The existing canal on the northern border is deep enough to prevent vehicular access and deter unauthorized pedestrian access. This fencing should help control the dumping of debris onto the site.

Two types of fencing were constructed (Figure 3). A six-foot chain-link fence was installed where the site abuts the Sabal Pines East condominium along its western boundary and the northern boundary of the western leg. A split-rail fence was installed along the eastern and southern boundaries adjacent to Congress

Avenue and S.W. 22nd Avenue, and around the perimeter of the parking area. Fencing was constructed within disturbed perimeter areas whenever possible, in order to minimize impacts to intact natural communities.

Four gates are proposed (Figure 3). Two gates were placed at either end of the dirt access road just south of the northern boundary drainage canal to allow for maintenance of the canal. A pair of steel swing gates will be installed in the split-rail fence at the southeast corner of the site and will serve as the parking lot entry and exit gate. Public access to the Delray Oaks Natural Area will be through this gated entrance. A maintenance vehicle access gate was installed where the post-and-rail fence joins the chain-link fence at the westernmost corner of the site, along S.W. 22nd Avenue.

3.1.2 Signs

Six types of signs are proposed for the Delray Oaks Natural Area. All will identify the site as being publicly owned and operated as a natural area and passive outdoor recreation site. Temporary signs identifying the Delray Oaks site as a natural area were installed one month after acquisition. A large dedication sign will be placed at the entrance to the parking area to identify the site as a natural area open to the public, as having been purchased with funds from FCT and the County, and as being managed by the County with assistance from the City. A main gate sign will be installed to specify visiting hours and provide general information about the site. Perimeter signs have been placed along the boundary fence; these signs state that the Delray Oaks Natural Area is a protected natural area and cite appropriate County and City ordinances. Signs will be installed along the nature trail with station numbers corresponding to an interpretive guide. Sign installations will not significantly disturb any natural communities on the site.

3.1.3 Interpretive Facilities

An educational kiosk will be constructed adjacent to the public parking area near the head of the nature trail (Figure 3). This kiosk will provide general information about the Delray Oaks Natural Area, including the geologic origins of the site, its topographic features, aquifer recharge significance, natural communities, listed species, and other natural features of interpretive value. The kiosk will be constructed within the disturbed area, and thus will not impact any intact natural communities.

3.1.4 Boundary and Management Roads and Firebreaks

A boundary/management road and firebreak will be established just inside the chain-link fencing adjacent to the Sabal Pines East condominium (Figure 3). This road will be accessed from gates at either end of the fencing. No significant clearing of native vegetation is needed for this road, because much of the area to be impacted has been mowed by the adjacent condominium. Another management road/firebreak will be

constructed to separate the fire-managed mesic flatwoods community from the fire-intolerant xeric hammock. This firebreak will be placed in the transition zone between these two communities (Figure 3), and will be located in disturbed areas or on existing trails as much as possible. Prior to construction, all boundary/ management/road/firebreak locations will be surveyed for listed species. Based upon a map of gopher tortoise burrow locations prepared by ERM (1992), it seems unlikely that gopher tortoise burrows will be encountered. Any listed species present within the proposed boundary road area will be relocated on the site.

Boundary/management roads/firebreaks will provide numerous benefits, including more rapid access in the event of a wildfire, protection of adjacent areas from wildfire, and facilitation of the monitoring of dumping and other illegal activities along the preserve edge. These roads/firebreaks will be unimproved sand roads and will be no more than 15 feet wide, which is the standard width of boundary firebreaks used by the Florida Department of Environmental Protection on state lands. The firebreak/management roads are to be used primarily for resource management and on-site monitoring. Prior to a prescribed burn, the roads will be widened beyond a minimum 10-foot maintenance width to serve as firebreaks. After the prescribed burn, these firebreaks will be allowed to regenerate and the roads will be maintained at the minimum width. The existing maintenance road lying just south of the northern boundary drainage canal also will be utilized for management access.

3.1.5 Trails

The primary interpretive feature for public access will be a 1,400-foot-long handicapped-accessible nature trail, which will terminate at an observation platform at the southern edge of the strand swamp (Figure 3). A sand footpath, approximately 1,200 feet in length, will loop off the handicapped-accessible nature trail to provide an opportunity for visitors to observe gopher tortoises and other wildlife (Figure 3).

The nature trail and the footpath will be constructed on existing paths, trails, and disturbed areas on the site as much as possible. Public use of existing secondary trails leading off the nature trail, the footpath, and management roads will be discouraged. Prior to construction, all trail locations will be surveyed for listed species. If listed species would be impacted by the construction of the trails, the trails will be rerouted or the listed species relocated on the site.

The nature trail will originate at the parking area and will extend in an northerly direction. This trail will be 4-inch-thick poured and formed concrete with a non-slip finish and a raised lip, and will be approximately 6 feet wide to accommodate wheelchairs. Signs will be installed along the trail indicating station numbers corresponding to a trail guide with interpretive information. Handicapped-access interpretive facilities will be developed to fulfill federal requirements.

The footpath will have a natural soil base and will be maintained at a width of at least 3 feet. This trail will be used for foot traffic only; it is not intended for vehicle access or use as a firebreak. The footpath is available for public use as a wildlife observation trail, but will not be improved or marked for interpretive purposes. All firebreak/management roads also will be available for public use, but will not be improved or marked for interpretive purposes.

3.2 EASEMENTS AND CONCESSIONS

A drainage easement to Palm Beach County runs across the northern 40 feet of the site. A 20-foot-wide drainage canal and a 15-foot-wide access road lying just south of the canal currently are present in the easement. The Palm Beach County Engineering and Public Works Department maintains the easement to provide stormwater drainage from Congress Avenue to the E-4 Canal. Gates have been installed in the perimeter fence at both ends of this easement to provide access. A 6-foot utility easement runs along the northern and eastern borders of the former Florida Power and Light (FPL) tract. A 10-foot utility easement runs adjacent to S.W. 22nd Avenue on the southern and western borders of this tract. No utilities have been placed in these easements. Since these easements were established primarily for the development of the FPL tract, and this tract will not be developed, it is unlikely that these utility easements will ever be used.

No additional easements, concessions, or leases are anticipated. If the Delray Oaks Natural Area is to be subject to any of the following activities or interests, the County will provide FCT with at least 60 days prior written notice and will provide information to FCT on reasonable request in order to evaluate the legal and tax consequences of the activity:

1. any lease or sale of any interest in, or operation of any concession on, the Delray Oaks Natural Area by a non-governmental person or organization;

2. any sales contract or option to buy things attached to the Delray Oaks Natural Area to be severed from the site, with a non-governmental person or organization;

3. any use of the Delray Oaks Natural Area by non-governmental persons other than in such person's capacity as a member of the general public;

4. a management contract for the Delray Oaks Natural Area with a non-governmental person or organization; and

5. such other activity or interest as may be specified from time to time in writing by

FCT.

These activities or interests may not be permitted because they may have negative legal and tax consequences under Florida law and federal income tax law.

3.3 PUBLIC ACCESS

Public access to the Delray Oaks Natural Area will be provided via S.W. 22nd Avenue to an on-site parking lot. Bicycle rack will be provided to encourage the use of alternative transportation to the site. The City or the County will construct a sidewalk along S.W. 22nd Avenue between the entrance and the existing Congress Avenue sidewalk to encourage pedestrian access. The Delray Oaks Natural Area will be open to the public during daylight hours. The hours of operation will be posted at the site. Handicapped-access parking and a handicapped-accessible nature trail will be provided. There are no permanent waterbodies on or adjacent to the site, so no waterbody access is planned.

A 12,500-square-foot parking area will be constructed off S.W. 22nd Avenue. The parking area will be constructed to accommodate 10 vehicles and 2 school buses. The area to be impacted by this parking area has been previously cleared and used as a parking area and currently is covered by weedy grasses. A survey will be conducted within the proposed parking area to verify that its construction would not impact any listed species. If any listed species are present within the proposed parking area, the parking area location will be adjusted to avoid impacts. If impacts are unavoidable, then these species will be relocated on the site.

4. KEY MANAGEMENT ACTIVITIES

4.1 MAINTENANCE

ERM will assume primary responsibility for site management. Responsibilities for management of the Delray Oaks Natural Area are outlined in the interlocal agreement between the City and the County (Appendix E). Maintenance activities include litter cleanup, trail maintenance, facilities maintenance (i.e., fences, gates, kiosk, and parking area). Volunteers from environmental groups, schools, and citizens' organizations will participate in litter cleanup and trail maintenance activities under the direction of ERM's volunteer coordinator. Other volunteer activities will include assistance in native plant restoration, removal of exotic plants, periodic checks of fencing and facilities, patrolling preserves, and monitoring populations of endangered species. All ERM volunteer activities include an educational component to increase the knowledge and effectiveness of the volunteers.

In the unlikely event that any unforseen event, either natural or human-caused, severely alters the natural values of the Delray Oaks Natural Area, ERM staff will assess the nature of the alteration and will take remedial action to secure and/or stabilize the site if necessary. Natural events such as fires, floods and hurricanes may shift the ecology of the site from its present condition and cause damage to human-made structures (i.e., kiosk, signs and fencing), but in no way would severely limit or eliminate the natural values of the site. The first priority following a natural or human-caused event will be to secure the site with fencing to prevent dumping and vandalism. The Delray Oaks Natural Area may be closed for public use until the site is stabilized and repairs are made to the structures. The native communities on the Delray Oaks Natural Area will be managed to naturally regenerate following such an event. The County will inform the City of the altered condition of the site and future management plans and objectives. If the natural values of the site are severely limited or eliminated, the City, County, and State will discuss future plans for the site. All major events affecting the natural communities of the Delray Oaks Natural Area will be discussed in the next annual report to FCT. Management practices will be modified for the new condition of the site, and the management plan will be updated to reflect these changes.

4.1.1 Removal of Debris and Litter

All significant debris located within the Delray Oaks Natural Area was removed by the previous property owners prior to acquisition by the County. Any remaining debris will be removed in a timely manner, unless such removal would cause undesirable damage to natural communities or listed species. A mounted trash can will be installed adjacent to the parking area and will be serviced by the City. The perimeter fence will function to prevent the dumping of trash and hazardous material on the site. Periodic site clean-ups to remove litter will be conducted by City and/or County staff with volunteers.

4.1.2 Trail Maintenance

Periodic trail maintenance will be performed by City and/or County staff and community volunteers. All trails which are not necessary for site management will not be maintained, to discourage access from public-use trails, and allowed to regenerate with native vegetation.

4.1.3 Facilities Maintenance

County staff will be responsible for the maintenance of fences, gates, interpretive facilities, parking area, and signs. City staff will be responsible for maintaining the portion of the Southwest 22nd Avenue right-of-way that borders the Delray Oaks Natural Area

4.2 SECURITY

The City will assume primary responsibility for public safety and law enforcement at the Delray Oaks Natural Area. This includes routine patrols of the boundaries and using the City's best efforts to prevent vandalism, vehicular trespass, dumping, and damage to property and natural resources. No on-site manager or security guard is currently proposed for this site. The City and the County will attempt to recruit a local steward for the site or organize a neighborhood watch group.

The County has adopted a Natural Areas Ordinance (No. 94-13) that regulates public use of the Delray Oaks Natural Area. The ordinance provides for passive recreational activities such as hiking, nature study, and photography; for environmental education; and for scientific research. It prohibits destructive uses such as off-road vehicle use, dumping, and poaching of plants and animals. The ordinance gives law enforcement personnel the authority to arrest persons damaging a natural area. Section 58.02 of the City Code of Ordinances also prohibits dumping on property owned by others. No dogs, cats or other pets will be permitted on the Delray Oaks Natural Area. No vehicles (e.g., ORVs and bicycles) will be permitted beyond the parking area, except during staff maintenance and prescribed burning activities.

The Delray Oaks Natural Area will be open to the public during daylight hours only. Access hours will be posted at the main entrance. Either the City or a local steward or stewardship group will be responsible for opening and closing the main gate. Only the City, the County, or the local stewards will have keys for these gates.

4.3 STAFFING

Because of the relatively small size of the Delray Oaks Natural Area, there will be no on-site staffing. However, ERM will create a roving management team that will assume responsibility for management at this

site and other County-owned natural areas. This management team will be trained to conduct all levels of management activities, including invasive vegetation control, prescribed burning, and monitoring. City staff and volunteers from local citizens' organizations will provide additional support where feasible and necessary. There has been strong interest in the Delray Oaks Natural Area from individuals in the surrounding community, who have indicated that they wish to be involved in management activities. It is anticipated that these individuals will form the basis of a local stewardship group that will assist in the protection and management of the site. Individuals from the community and local environmental organizations will be trained by County staff to lead nature walks on the site.

4.4 NATURAL RESOURCE PROTECTION

The primary goals of site management are to enhance and maintain the prairie hammock, xeric hammock, mesic flatwoods, and strand swamp natural communities, as well as their component species, as described in Appendix A. Particular care will be exercised to prevent the extirpation of listed species from the site. Habitats for listed species will be managed for the needs of individual species when such management would be compatible with the overall management of the ecosystems on the Delray Oaks Natural Area.

Long-term resource management of the site will begin with the baseline inventory and assessment of natural communities and listed species (Appendix A). These and all sightings of listed species not previously recorded for the site will be reported to the Florida Natural Areas Inventory (FNAI). Because the historical hydrology of the site could be restored only by eliminating the regional drainage system, no hydroperiod management is proposed.

4.4.1 Management of Natural Communities

The Delray Oaks Natural Area will be managed under the "single use" concept, which means that it will be managed to perpetuate natural resource values. Five vegetation communities are present on the site (Figure 2): prairie hammock, xeric hammock, mesic flatwoods, strand swamp, and disturbed areas (including areas dominated by Brazilian pepper). Where past human activities have caused the degradation of natural communities, efforts will be made to restore these communities so that they resemble undisturbed natural communities. Prescribed burning and invasive vegetation control will be the primary management techniques used. These management activities are discussed in Section 5.1.2, Resource Enhancement, and Section 5.1.3, Invasive Species Control. The specific types of management and enhancement activities recommended for each vegetation community present at the Delray Oaks Natural Area are described in the following sections.

4.4.1.1 Prairie Hammock

The prairie hammock will be enhanced and maintained through the implementation of an invasive vegetation control program. This invasive vegetation control program will involve hand-pulling, selective pruning, and/or selective herbicide treatments, as described in Section 5.1.3, Invasive Species Control. Of primary concern are non-native invasive trees, shrubs, and vines, which may out-compete native plant species and cause the mortality of those species.

4.4.1.2 Xeric Hammock

The xeric hammock will be enhanced and maintained through the implementation of an invasive vegetation control program. This invasive vegetation control program will involve hand-pulling, selective pruning, and/or selective herbicide treatments, as described in Section 5.1.3, Invasive Species Control. Of primary concern are non-native invasive trees, shrubs, and vines, which may out-compete native plant species and cause the mortality of those species.

4.4.1.3 Mesic Flatwoods

The mesic flatwoods will be enhanced and maintained through the implementation of prescribed burning and invasive vegetation control programs. The specific fire management plan for this area is provided in Appendix H. The mesic flatwoods community will be divided into four sub-blocks. One sub-block will be burned within two years of approval of this plan. The other sub-blocks will be burned at the rate of one every two years. After the initial management burn, each sub-block will be burned in the future at 8-year intervals.

The invasive vegetation control program will involve hand-pulling, selective pruning, and/or selective herbicide treatments, as described in Section 5.1.3, Invasive Species Control. Of primary concern are non-native invasive trees, shrubs, and vines, which may out-compete shade-intolerant native species.

4.4.1.4 Strand Swamp

The strand swamp will be enhanced and maintained through the implementation of an invasive vegetation control program. This invasive vegetation control program will involve hand-pulling, selective pruning, and/or selective herbicide treatments, as described in Section 5.1.3, Invasive Species Control. Of primary concern are non-native invasive trees, shrubs, and vines, which may out-compete native plants species and cause the mortality of those species.

4.4.1.5 Disturbed Areas

The majority of the disturbed areas on the Delray Oaks Natural Area site will be restored to prairie hammock and/or xeric hammock and will be treated as discussed in Sections 4.4.1.1 and 4.4.1.2. However, portions of the disturbed areas connected to the mesic flatwoods community will be restored to mesic flatwoods. This

area will be treated as discussed in Section 4.4.1.3.

4.4.2 Protection and Enhancement of Listed Species - Flora

Nine plant species recorded at the Delray Oaks Natural Area have been listed by at least one of the following governmental agencies or nonprofit environmental organizations: United States Department of the Interior, Fish and Wildlife Service (USFWS); Florida Game and Fresh Water Fish Commission (FGFWFC); Florida Department of Agriculture and Consumer Affairs (FDA); Florida Natural Areas Inventory (FNAI). These species are listed in Table 1 and are ranked and discussed in Appendix A. Definitions of the listing classifications are provided in Appendix D. The following sections contain a summary of the recommended procedures for management of these species.

4.4.2.1 Priority A

Priority A taxa are taxa which are considered by FNAI to be imperiled or critically imperiled in the state. These taxa should receive the highest level of management attention. Under no circumstances should extirpations of these taxa be allowed to occur at the Delray Oaks Natural Area. When needed and appropriate, efforts should be made to augment existing populations. No priority A taxa have been recorded at the Delray Oaks Natural Area.

4.4.2.2 Priority B

Priority B taxa are taxa which are considered by FNAI to be rare in the state. These taxa should receive significant management attention. Under no circumstances should extirpations of these taxa be allowed to occur at the Delray Oaks Natural Area. If needed, population numbers should be increased, so long as this does not adversely impact community-level management.

Banded Wild Pine (*Tillandsia flexuosa*)

This epiphytic bromeliad was recorded at the Delray Oaks Natural Area in the xeric hammock community by ERM (1994), but was not recorded by The Institute for Regional Conservation (IRC) during two site visits in January and February, 1996. It has a very small and localized population that is difficult to detect. This species will be protected by protecting this site from plant collection. It is not fire-tolerant. Its xeric hammock habitat will be protected from prescribed burns and wildfires.

4.4.2.3 Priority C

Priority C taxa are taxa which are listed as Endangered, Threatened or Commercially Exploited by FDA, but which are not listed by FNAI. These taxa should receive moderate management attention. At a minimum, extirpations of these taxa should be prevented at the Delray Oaks Natural Area. If desired, population numbers may be increased, as long as this does not adversely impact natural community level management.

Cinnamon Fern (*Osmunda cinnamomea)*

This terrestrial fern was recorded at the Delray Oaks Natural Area by ERM (1994) and by IRC. It grows along the berm on the edges of the strand swamp. This species will be protected by enhancing and maintaining the strand swamp vegetation community on the site.

Common Wild Pine (*Tillandsia fasciculata*)

This epiphytic bromeliad was recorded at the Delray Oaks Natural Area by ERM (1994) but not by IRC; it is almost certainly still present on the site. It was recorded in the prairie hammock community and will be protected from plant collection. This species is not fire-tolerant. Its prairie hammock habitat will be protected from prescribed burns and wildfires.

Giant Wild Pine (*Tillandsia utriculata*)

This epiphytic bromeliad was recorded at the Delray Oaks Natural Area by ERM (1994) and IRC. It grows nearly throughout the site. This species will be protected by enhancing and maintaining the xeric hammock, prairie hammock, and strand swamp vegetation communities on the site and protecting this site from plant collection.

Reflexed Wild Pine (*Tillandsia balbisiana*)

This epiphytic bromeliad was recorded at the Delray Oaks Natural Area by ERM (1994) and by IRC. It was recorded in the xeric hammock near the western side of the site. This species will be protected by enhancing and maintaining the xeric hammock and prairie hammock vegetation communities on the site.

Royal Fern (*Osmunda regalis*)

This terrestrial fern was recorded at the Delray Oaks Natural Area by ERM (1994) and by IRC. It grows in the strand swamp. This species will be protected by enhancing and maintaining the strand swamp vegetation community on the site.

Strap Fern (*Campyloneurum phyllitidis*)

This mostly-epiphytic fern was recorded at the Delray Oaks Natural Area by ERM (1994) and by IRC. It was observed along the berm on the edge of the strand swamp, growing on trunks and stumps. This species will be protected by enhancing and maintaining the strand swamp vegetation community on the site and protecting the site from plant collectors.

Swamp Plume Polypody Fern (*Pecluma ptilodon*)

This terrestrial or occasionally epiphytic fern was recorded at the Delray Oaks Natural Area by ERM (1994)

and IRC. It was observed in a small area on the berm on the south edge of the strand swamp. This species will be protected by enhancing and maintaining the strand swamp vegetation community on the site and by directing foot traffic away from its location.

Sword Fern (*Nephrolepis biserrata*)
This terrestrial fern was recorded at the Delray Oaks Natural Area by ERM (1994)' but not by IRC during two site visits in January 1996 and February 1996; it may no longer be present on the site. If it is determined to be present, this species will be protected by enhancing and maintaining the strand swamp vegetation community on the site.

4.4.3 Protection and Enhancement of Listed Species - Fauna
Two animal species recorded at the Delray Oaks Natural Area have been listed by at least one of the following governmental agencies or nonprofit environmental organizations: FNAI, FGFWFC, and USFWS (Table 2). These species are ranked and discussed in Appendix A. Recommended procedures for management of these species are described in the following sections.

4.4.3.1 Priority A
Priority A taxa are taxa which are considered by FNAI to be critically imperiled, imperiled, or rare in Florida and are known to occur in viable numbers at the Delray Oaks Natural Area. These taxa should receive the highest level of management attention. Under no circumstances should extirpations of these taxa be allowed to occur at the Delray Oaks Natural Area. When needed and appropriate, efforts should be made to augment existing populations.

No Priority A taxa have been recorded at the Delray Oaks Natural Area.

4.4.3.2 Priority B
Priority B taxa are taxa which are considered by FNAI to be critically imperiled, imperiled, or rare in Florida, but for which a viable population is not known to occur at the Delray Oaks Natural Area, or the taxa are transitory on the site. These taxa, if present, should receive significant management attention. If needed, population numbers of resident taxa should be increased, so long as this does not adversely impact natural community level management. Efforts also should be made to provide suitable habitat for transitory taxa, so long as this does not adversely impact community-level management.

American Redstart (*Setophaga ruticilla*)
This migratory songbird was recorded at the Delray Oaks Natural Area by ERM (1994). Habitat for this

species will be provided through the enhancement and maintenance of the native vegetative communities on the site.

Gopher Tortoise (*Gopherus polyphemus*)

A population of this medium-sized tortoise has been documented within the Delray Oaks Natural Area. Ten active burrows and two inactive burrows were recorded on the site in a September 1992 survey, giving an estimated population of seven tortoises (ERM 1994). The gopher tortoise is considered to be a keystone species in upland natural communities in Florida. Many other species of animals depend upon gopher tortoise burrows for critical habitat.

A new survey for the gopher tortoise will be conducted within 18 months of the approval of this management plan. Gopher tortoise burrows (active, inactive and abandoned) will be counted and mapped, and the population of tortoises will be estimated. Additional gopher tortoise surveys will be conducted periodically to monitor changes in population size and density.

Based upon estimates in Cox et al. (1987), a long-term, viable gopher tortoise population should contain a minimum of 40-50 tortoises and at least 25 acres of appropriate habitat. Appropriate habitat must have well-drained sands, a herbaceous ground cover, and an open canopy and shrub layer. An approximately 3.5-acre area that includes the 1.77-acre mesic flatwoods community and the 1.71-acre western disturbed area fits this description, and will be managed to maintain these conditions. Additional gopher tortoise habitat is available in the 1.22-acre southern disturbed area and the adjacent 40-foot wide mowed right-of-way for S.W. 22nd Avenue.

Although the Delray Oaks Natural Area has sufficient habitat to maintain the existing gopher tortoise population, there is insufficient habitat to expand the population to 40-50 tortoises. Therefore, it may not be possible to maintain a viable population of this species on the site. Cox calculated that a population of ten tortoises could survive for 134 years under favorable conditions. The current gopher tortoise population will be protected through the enhancement and maintenance of the mesic flatwoods vegetation community and the restoration of disturbed areas on the site.

4.4.3.3 Priority C

Priority C taxa are other taxa which are considered by FNAI to be rare in Florida, but whose occurrence at the Delray Oaks Natural Area should be considered accidental. Management for these taxa at the Delray Oaks Natural Area would serve no meaningful purpose. No accidental occurrences of listed species have been recorded at the site.

4.5 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

No archaeological or historic resources are currently known from the Delray Oaks Natural Area (ERM and City 1994). If any archaeological or historic sites are discovered on the site, the County will comply with Chapter 267, Florida Statutes, specifically Sections 267.061(2)(a) and (b). The collection of artifacts or disturbance of any archaeological or historical site on the Delray Oaks Natural Area is prohibited unless prior authorization has been obtained from the Department of State, Division of Historical Resources.

4.6 COORDINATION WITH ADJACENT LAND USERS

The successful ongoing management of the Delray Oaks Natural Area will require the cooperation of the neighborhood residents. Many aspects of maintaining the site (e.g., security and opening and closing the main gate) could be simplified by utilizing a neighborhood watch or volunteer steward. The City and/or ERM will attempt to recruit a local steward or organize a neighborhood watch.

Within 24 months of approval of this plan, ERM will begin a public education campaign to educate the community on the benefits of managed natural areas and the necessity of invasive plant control and prescribed burns in maintaining the native habitat. As part of the outreach program, local schools will be invited to utilize the Delray Oaks Natural Area for nature study, environmental education, and community service projects.

4.7 NATURAL AREAS MANAGEMENT ADVISORY COMMITTEE REVIEW

On August 16, 1994, the Palm Beach County Board of County Commissioners adopted Resolution 94-1051, which established a seven-member Natural Areas Management Advisory Committee (NAMAC) to review and comment on management plans developed by staff for natural areas acquired and/or managed by the County and to hold public hearings on these plans prior to their review and adoption by the Board. The members of NAMAC were appointed on November 1, 1994. The membership categories are: a member with experience in the management of natural areas, a biological scientist, a professional educator with knowledge of South Florida ecosystems, a representative of a local municipal government public recreation program, a member of the Palm Beach County Parks & Recreation Department staff, a citizen having an interest in natural areas, and a member of the County's Environmentally Sensitive Lands Acquisition Selection Committee (ESLASC). Upon sunset of ESLASC, this position will be filled by a citizen with an interest in natural areas.

As part of their responsibilities, the members of NAMAC will hold a public hearing on the proposed management plan for the Delray Oaks Natural Area. The public hearing will be held in the evening in a location close to the site, and will follow an afternoon open house at which the public will be able to review the management plan and a display of the plan for the public use facilities and discuss these with County staff.

Copies of the plan will be available at public facilities such as libraries for several weeks prior to the open house and public hearing. Members of the public who cannot attend the hearing will be allowed to submit written comments to the County during the week following the hearing.

NAMAC members will take those comments into consideration prior to their approval of the plan for forwarding to the Board of County Commissioners. Members of the public also may comment on the plan at the time it is considered by the Board. After adoption of the plan by the Board, the plan will be reviewed at least every 5 years by NAMAC and revised as necessary on the basis of new information, research data, improvements in management techniques, or other relevant factors.

4.8 ENVIRONMENTAL EDUCATION AND SCIENTIFIC RESEARCH

In conjunction with the construction of the nature trail, ERM staff will prepare interpretive signage, a printed nature trail guide, and a recorded nature trail guide on tape for the visually-handicapped. ERM will develop an educational slide show describing the site and its resources and assist the faculty of local schools in developing educational programs for school use of the site. In particular, ERM will cooperate with Atlantic Community High School's Environmental Education Program, which has developed a permanent science curriculum for junior and senior-level students to provide a experiential education. The program, taught by the school's biology teachers, is primarily designed to reach a group of mid-level, non-science-oriented students to inspire their interest in the environment. Delray Oaks Natural Area would serve as a training ground for approximately six monthly class visits from the school. The site visits would be led by the school's biology teachers.

ERM does not anticipate performing any scientific research other than compiling and interpreting the data from monitoring activities, but will allow researchers affiliated with local institutes of higher learning to conduct scientific research on a permit basis. Resource enhancement will be required in all management units at the Delray Oaks Natural Area.

5. RESOURCE ENHANCEMENT

Resource enhancement will be required in all management units at the Delray Oaks Natural Area. The principal enhancement activities will include invasive species eradication and the reintroduction of fire. Active restoration (including direct seeding and out-planting) should not be necessary. If funding from grants or other sources is available for active restoration, replanting of native plants that are indigenous to the Delray Oaks Natural Area will be considered. The goal of these activities is to restore all native vegetation communities to a maintenance condition.

5.1 RESTORATION MEASURES

The goal of fragmented vegetation communities management in southeastern Florida should be to restore and maintain as many of the functions and values of the original natural communities that historically occupied the site as possible. It should be recognized that even the largest and least disturbed sites have experienced significant impact from changes in the regional water table, air pollution, the loss of large predators, and species extinctions. These types of disturbances are mostly irreversible, given the current political and social realities of southeastern Florida. Almost all sites also have been affected by reversible changes such as the exclusion of fire and exotic pest plant invasions.

Certain disturbances that are the products of fragmentation are permanent but can be mitigated by human intervention. The classic example of this in south Florida is natural fire, which cannot be expected to travel between natural area fragments. Prescribed burning is a management tool that can partially substitute for this interrupted natural ecological function, but which must be conducted by natural areas managers in perpetuity.

5.1.1 Management Unit Design

Successful management of small fragmented ecosystems, such as those at the Delray Oaks Natural Area, depends heavily upon management unit design. The Delray Oaks Natural Area is composed of a mosaic of historic natural vegetation communities that have been modified by fire exclusion, pest plant invasions, hydrologic alterations, construction of adjacent roads and buildings, illegal dumping, and off-road vehicle traffic. Each of the represented natural communities historically would have been part of a greater regional mosaic of upland and wetland ecosystems. Today, the Delray Oaks Natural Area is completely isolated from nearby remnants of natural vegetation communities and is continuously affected by human and human-induced disturbances. These disturbances include fire exclusion, the dissemination of invasive species from nearby residential areas, and predation by domestic pets.

The site has been subdivided into two macro-management units, using firebreaks, the footpath, and the nature

trail as boundaries (Figure 4). Each macro-management unit encompasses at least two vegetation communities, together with transition zones between these two communities and adjacent communities (ecotones). Macro-management units have been designed to facilitate different management objectives for adjacent portions of the site. Macro-management units may be further subdivided into micro-management units, which represent distinct natural communities and\or seral stages within the macro-management unit.

5.1.2 Fire Management

Mesic flatwoods are dependent upon fire for long-term restoration and maintenance. Given the extensive alterations that have been made to the local landscape, natural lightning-induced fires cannot be expected to fulfill the fire needs of this community. In addition, given the proximity of the site to adjoining residential properties, major roads, and other forms of urban and suburban development, the risk of damage to these developments from wildfire is high. As such, the use of a combination of controlled, prescribed fire, together with firebreaks and other safety precautions, will be necessary to fully achieve the stated management objectives.

The primary responsibility for prescribed burning will be assumed by ERM. Assistance will be provided by the City, including the provision of fire-fighting staff and equipment to protect surrounding homes from damage. Additional assistance may be provided by the Florida Division of Forestry (DOF), FGFWFC, TNC, and trained volunteers. Fire-related safety training will be required of all County staff and others participating in a prescribed burn. All prescribed burns will comply with the legal mandates stated in the Prescribed Burn Act, Chapter 590.026 of the Florida Administrative Code. The overall goal of the prescribed burn program is to introduce a fire regime (i.e., a repeatable pattern of fire with predictable results) onto the Delray Oaks Natural Area that will sustain mesic flatwoods on the site. General objectives are:

To ensure the long-term existence and viability of mesic flatwoods and the listed plant and animal species that utilize that habitat.

To control the regrowth and regeneration of invasive vegetation following treatment or removal activities, assisting in the restoration of disturbed areas.

To provide viable wildlife habitat for wildlife species that use, or could potentially use, mesic flatwoods on the site.

To reduce the danger of wildfire by reducing the buildup of fuels that has resulted from the limited occurrence of fire in recent years.

A permanent firebreak/management road will be established around the perimeter of the approximately 3.5-acre area to be fire-managed, in order to prevent potentially destructive wildfires and adequately control prescribed fires. Temporary firebreaks will be cut as needed to separate the fire-managed area into four sub-blocks. These firebreaks/management roads will serve as the boundaries of the fire-managed macro-management unit and will provide vehicle access for conducting controlled burns (Figures 3 and 4). Existing trails will be used when possible. New firebreaks/management roads will be constructed where existing trails are not sufficient. Firebreaks will be at least 15 feet wide at the time of a prescribed burn. Vegetation may be cut along the edges of specific firebreaks, if necessary, to widen them further prior to a controlled burn. After the burn, the vegetation will be allowed to regenerate naturally.

Prior to the construction of a firebreak/management road, the area will be surveyed for listed species. If listed species are present, the location of the firebreak will be adjusted where possible to avoid affecting that species, or the listed species present within the proposed firebreak location will be relocated on the site. Some firebreaks or portions of firebreaks may be used for other management activities, such as exotic pest plant control. They also may be contiguous with a portion of a footpath, or as part of the nature trail.

The management units range in size from 3.5 to 21 acres. The fire-managed unit will be burned in separate sub-blocks, resulting in a patchwork of burned areas within the unit. This will produce a mosaic of vegetation at various stages of maturity, thereby maximizing diversity within and among communities. The mosaic will provide habitat for individual species which typically use, or may even be restricted to, communities in a particular state of maturity.

Active fire suppression measures that rely upon the use of heavy machinery and plowlines are extremely destructive to vegetation and other natural features. Active fire suppression measures are to be avoided as much as possible, but will be used to safeguard adjacent residences if necessary. If such measures are undertaken to control a fire, all plowlines will be backfilled after the fire has been extinguished, and other disturbed areas will be rehabilitated to the greatest extent possible.

A flexible fire management program will be initiated within one year following the adoption of this management plan. The four sub-blocks will be burned in rotation, at an average rate of one sub-block every two years. Prior to burning a unit, a survey will be done for fire-intolerant listed plant species. If necessary, individual plants will be relocated outside the burn area. Fire management will begin with the prescribed burn of the first sub-block in 1998, and will follow with burns of the second sub-block in 2000, the third sub-block in 2002, and the fourth sub-block in 2004. The cycle will start again with the first sub-block in 2006.

To the extent possible, the seasonality and frequency of prescribed fires should seek to approximate the

natural incidence of fire in the site's communities. Generally, prescribed fires should be conducted during the early growing season, which extends from March to July. Natural lightning-induced fires normally occur during the growing season, and the natural incidence of winter fires is believed to have been quite low. Prescribed winter fires, therefore, should be similarly rare in occurrence to ensure that fire events correspond with the fire-adapted life histories and reproductive cycles of resident species. However, where fire has been suppressed for a long period of time and fuel loads have become heavy, prescribed winter fires may be used to begin restoration of a natural fire regime. Winter fires are generally cooler fires that can reduce accumulations of excess fuel while limiting the undesirable destruction of vegetation. In areas such as the Delray Oaks Natural Area, where safety is of the utmost concern, winter fuel reduction fires may be more appropriate, at least in the short term.

Prescribed burning in the disturbed areas natural community is complicated by the presence of muscadine grape and Brazilian pepper, which generally do not burn well. The presence of these species is a result of previous human-caused alterations and fire suppression at this site. They are not typical components of the mesic flatwoods natural community that formerly existed in these areas. Disturbed areas may require mechanical cutting and shredding of vegetation or herbicide treatments prior to a prescribed burn. Backing fires and other techniques will be used for prescribed burns in the mesic flatwoods and disturbed areas natural communities to reduce fire intensity and decrease smoke generation. If a wildfire occurs, the appropriate actions will be taken by the authorized fire emergency response agency.

A public education campaign will be developed that will include informing residents of areas surrounding the site of the necessity and benefits of fire, the safety features of prescribed burning versus wildfires, and the strategies that will be developed to minimize the impacts of smoke on nearby communities. The County will coordinate with the City prior to conducting a controlled burn. County staff will meet with local community groups such as homeowners' associations before each burn to coordinate with residents, to provide information on the necessity of conducting prescribed burns, and to describe the safety precautions that will be taken to protect adjacent lands.

ERM has written a fire management plan for the Delray Oaks Natural Area (Appendix H). The development of this plan was coordinated with DOF and FGFWFC. The plan considers the surrounding land uses, safety issues in the event of a wildfire, and the ecological consequences of specific fire management strategies. A prescribed burn program will be implemented within the first three years following acquisition.

A specific burn plan (Appendix H) will be prepared for each sub-block prior to conducting a prescribed burn. Summary of key information on prescribed burning and a pre-burn checklist will be provided in Appendix H.

5.1.3 Invasive Species Control

Like many fragmented natural areas in southeastern Florida, the Delray Oaks Natural Area has been invaded by many invasive pest plant species. Eighty-three species of exotic plants have been recorded within the Delray Oaks Natural Area (Appendix B), with many exhibiting invasive tendencies. Exotic plant species therefore represent approximately 29% of the plant taxa recorded for the site. This number and percentage is typical for a small habitat preserve surrounded by urban and suburban development, and should not be inferred to indicate that the site is of low quality. However, additional species of invasive plants may be found during the early management phases, and new species will continue to colonize the site as long as sexually reproducing exotic plant species are present in the surrounding urban and suburban areas.

Most of the invasive pest plant species at the Delray Oaks Natural Area site can be considered minor or, at worst, moderate problems. Many have originated from vegetation dumping piles within the site or were associated with the former nursery on the site. One invasive species, Brazilian pepper, represents the majority of the problem, although many others, including Senna pendula and climbing fern, have the capability to cause massive problems on the site.

Some exotic species, which do not have the capacity to invade functioning natural communities, are of a low priority. These include species such as Madagascar periwinkle, which prefer open, disturbed sites. They will be controlled through good management practices such as prescribed burning and the elimination of unnecessary disturbances such as off-road vehicle traffic.

For purposes of this management plan, the phrase "invasive species" includes three groups of plants: (1) exotic species; (2) species of uncertain origin; and (3) ruderal species (species which are probably native but are found almost exclusively in disturbed areas).

Rather than discuss invasive plants on a species-by-species basis, it is usually preferable to group them by their habit (life form), preferred habitat, degree of invasiveness, and potential (or real) impacts on natural communities. Although this method is functional for strategic and operational planning purposes, each invasive plant species is unique, and control measures may need to be tailored on a species-by-species basis. Invasive vegetation species have been grouped into the following categories: (1) vines; (2) shade-tolerant trees and shrubs; (3) shade-intolerant trees and shrubs; (4) grasses; (5) perennial forbs; and (6) annual and short-lived forbs. Some invasive species do not fall easily into these categories, and specific priorities may have to be developed for these species.

An invasive species control program will be initiated within six months of approval of this plan. A three-year,

six-phase initial control program is planned. Each of the six phases will be conducted approximately six months apart. If the treatments are thorough, then the treated natural vegetation communities should be in maintenance condition by the end of the three-year period. A management unit will be considered to be in a maintenance condition (in regard to invasive species) when the cover of invasive tree and shrub species does not exceed one percent of the canopy or understory layers within any management year. Once a maintenance condition is reached, follow-up treatments of invasive vegetation will be conducted periodically as needed. Preliminary management priorities and techniques for each of the categories are described in the following sections.

5.1.3.1 Vines

This category includes exotic species as well as aggressive ruderal vines. If possible, exotic vines will be eradicated from the Delray Oaks Natural Area. Aggressive ruderal vines will be treated as invasive species until each management unit reaches a maintenance condition. After this time, aggressive native vines will be allowed to regenerate until they reach historically accurate densities and cover.

Vines pose a significant threat to the natural communities at the Delray Oaks Natural Area because they cover the leaves of shrubs and trees and cause death through reduction of photosynthetic food production. Invasive vines recorded at the Delray Oaks Natural Area include air potato, climbing fern, cutleaf morning-glory, foetid passion-flower, heartleaf, hunter's robe, muscadine grape, nephthytis, night-blooming cereus, rosary pea, self-heading philodendron, white vine, and wild balsam apple.

During invasive vegetation control treatments, most species of vines will be cut at a height of six feet and again near ground level if they are growing into canopy trees. The bases of the vines will be hand-pulled or treated with a systemic herbicide such as Garlon 4 or Rodeo. The vine stems remaining in the canopy may be left to decompose in the trees. Vines growing on shrubs or saplings under six feet in height will be cut near ground level and removed from the supporting plant. The bases of the vines will be hand-pulled or treated with a systemic herbicide. Lateral stems of vines growing along the ground surface will be cut, hand-pulled and/or treated with a systemic herbicide. These methods should be effective in controlling climbing fern, cutleaf morning-glory, foetid passion-flower, muscadine grape, rosary pea, white vine, and wild balsam apple.

Heartleaf, hunter's robe, nephthytis, night-blooming cereus, and self-heading philodendron all sprout easily from cuttings and must be pulled, bagged and removed from the site. Air potato has an underground tuber which must be dug up and aerial tubers which must be collected, bagged, and removed from the site.

5.1.3.2 Shade-tolerant Trees

This category includes woody plants which typically have one main stem that grows over 12 feet in height. In the past, shade-tolerant trees were not a major threat to natural communities in southeastern Florida. However, several species of shade-tolerant trees have become established in natural vegetation communities within the last ten years. These trees, which have the ability to invade undisturbed, intact systems, are especially dangerous to hammocks, drained wetlands, and fire-excluded pyric communities. Shade-tolerant trees recorded at the Delray Oaks Natural Area include areca palm, beautyleaf, bishopwood, carrotwood, Java plum, Indian rubber tree, laurel fig, loquat, mango, queen palm, rose apple, schefflera, solitaire palm, sour orange, strawberry guava, tangerine, and weeping fig.

During invasive vegetation control treatments, seedlings of shade-tolerant trees will be hand-pulled. In general, saplings and mature trees will be left standing and treated with a systemic herbicide such as Garlon 4. This method is effective in controlling most dicotyledons.

Schefflera, however, is known to be highly resistant to basal treatments of Garlon 4. This species has been most successfully controlled by cutting down the tree and applying Garlon 3A or Rodeo to the stump. Relatively mature areca and queen palms are easily killed with bud treatments of Garlon 4.

5.1.3.3 Shade-intolerant Trees

Shade-intolerant trees typically need sunny, often nutrient-poor soils for germination. They generally are located in disturbed areas, and often fix nitrogen. These species are most problematic in disturbed or fire-excluded pyric communities, although they may also invade disturbed hammocks and wetlands. Shade-intolerant trees at the Delray Oaks Natural Area include Australian pine, Brazilian pepper, castor bean, guava, earleaf acacia, mahoe, royal poinciana, and woman's tongue.

Seedlings of shade-intolerant trees will be hand-pulled. Most mature trees can be killed with systemic herbicides such as Garlon while still standing. Because Brazilian pepper is a sprawling, shrub-like tree, special treatments such as cutting and removal may be necessary in especially dense stands.

5.1.3.4 Shade-tolerant Shrubs

Shade-tolerant shrubs are similar to shade-tolerant trees, except that they generally affect a smaller area in the subcanopy and understory. Shade-tolerant shrubs that have been recorded at the Delray Oaks Natural Area are Dracaena sp., flame-of-the-woods, ixora (Ixora sp.), Senna pendula, shoebutton ardisia, soft-tipped yucca, spiral flag, Surinam cherry, ti plant, and Turk's cap.

During invasive vegetation control treatments, seedlings of shade-tolerant shrubs will be hand-pulled. In general, saplings and adults will be cut near ground level and the bases treated with a systemic herbicide such

as Garlon. In low densities, shade-tolerant shrubs may be killed while still standing. Spiral flag, which is a shrub-like herb, has underground stems that must be dug up. The entire plant should be bagged and removed from the site.

5.1.3.5 Shade-intolerant Shrubs

Shade-intolerant shrubs are similar to shade-intolerant trees, except that they generally affect a smaller area in the subcanopy and understory. Shade-intolerant shrubs recorded at the Delray Oaks Natural Area site include Caesar weed, hairy indigo, Indian mallow, and shrub verbena.

Seedlings of shade-intolerant shrubs will be hand-pulled. In general, saplings and mature plants will be left standing and killed with a systemic herbicide such as Garlon. Indian mallow, which is a woody-stemmed perennial, seems to decline and disappear without active disturbance.

5.1.3.6 Grasses and Sedges (Graminoids)

Exotic grasses and sedges can become a significant problem in pyric communities. Exotic graminoids recorded at the Delray Oaks Natural Area include crowfoot grass, goosegrass, Guinea grass, Natal grass, nut-grass, smut grass, and yellow nut-grass. Globe sedge, small-flowered Alexandergrass, sour paspalum, St. Augustine grass, and torpedo grass are invasive graminoids of uncertain origin. Coast sandspur, and gophertail lovegrass are ruderal graminoids.

During invasive vegetation control treatments, most exotic grasses will be hand-pulled. It is possible that gopher tortoises are foraging on these grasses, so the use of herbicides such as Roundup will be discouraged. However, there are a few clumps of Guinea grass on the preserve. This large grass is best controlled by cutting the plant down and treating the resprouts with Roundup or Rodeo. These clumps will be eradicated as soon as possible, so that no further use of herbicides will be necessary. Ruderal graminoids and graminoids of uncertain origin will be treated as necessary. Of most concern in this group are torpedo grass and St. Augustine grass, both of which have shown themselves capable of invading and disturbing natural community fragments. These two species are best controlled through careful applications of Rodeo or Roundup.

5.1.3.7 Perennial Forbs

Invasive perennial forbs can become a problem in all types of natural communities. Exotic perennial forbs recorded at the Delray Oaks Natural Area include African bowstring hemp, aloe, Asian sword fern, coat buttons, creeping indigo, creeping oxeye, devil's backbone, lawn orchid, life plant, green shrimp plant,

common asparagus-fern, inch plant, oyster plant, Sprenger's asparagus-fern, Swedish ivy, tuberous Boston fern, violet wood sorrel, and wandering Jew (*Tradescantia fluminense*, and *Zebrina pendula*). Boston fern and creeping day-flower are perennial forbs of uncertain origin. Carpetweed is a perennial ruderal.

All of these species require special treatment because they sprout easily from cuttings, and many of them have underground stems. All should be bagged and removed from the site. Species with underground rhizomes or tubers include African bowstring hemp, creeping indigo, lawn orchid, common asparagus-fern, violet wood sorrel, Sprenger's asparagus-fern, and tuberous Boston fern. A combination of hand pulling, digging, and the careful application of systemic herbicides should be successful with any of these species. The remainder can all be hand-pulled, but most break easily, and care must be used to remove the entire plant, roots and all.

5.1.3.8 Annual and Short-lived Forbs

In general, annual or short-lived forbs cause temporary problems and are difficult to eradicate. Most respond to disturbance; therefore, their populations will drop in numbers as the restoration process proceeds. Exotic annual and short-lived forbs recorded at the Delray Oaks Natural Area site include Asian ironweed, long-stalked phyllanthus, Madagascar periwinkle, rattlebox, rocketweed, and whitehead broom. Beggar's ticks, Chamaesyce ophthalmica, dry Mary, Eclipta prostrata, Hedyotis corymbosa, lady's sorrel, Mexican tea, milk spurge, pineland heliotrope, puncture vine, purslane, and tassleflowers (*Emilia* spp.) are annual and short-lived forbs of uncertain origin. Ruderals in this category include broom spurge, bushy buttonweed, camphorweed, Chamaesyce blodgettii, common nightshade, common ragweed, dogfennel, dwarf horseweed, eyebane, fiddler's spurge, fireweed, hairy spurge, pencilflower, peppergrass, rustweed, southern sida, Spanish needles, teaweed, and wild poinsettia.

Control measures, when necessary, usually involve hand-pulling of each individual. Invasive forbs may be an important source of food for gopher tortoises at the Delray Oaks Natural Area. Therefore, control measures may be limited until alternative sources of food are available.

5.3.1.9 Exotic animals

Exotic animals also may be a problem within sites like the Delray Oaks Natural Area. Thus far, three exotic animals (one amphibian and two lizards) have been found at the site. Domestic cats and dogs may occasionally utilize the site. Eradication of the exotic amphibians and lizards may not be possible, given their established populations in the surrounding residential areas. These animals are not having a discernable impact on native plants or animals, and control will not be undertaken unless a significant impact is observed in the future. Control of domestic cats and dogs will focus on educating the surrounding community, with selective live-trapping, if necessary.

5.2 COORDINATION WITH ADJACENT LAND USERS

Both direct and indirect impacts from adjacent land uses are to be expected. Direct impacts include the invasion of exotic plant species into the Delray Oaks Natural Area and the possible predation of wildlife by dogs and cats. These types of impacts will be mitigated through interpretive programs, public outreach, an aggressive invasive vegetation control program, and the enforcement of Natural Areas Ordinance provisions concerning the prohibition of pets.

Perhaps the greatest off-site threats to the long-term management of the Delray Oaks Natural Area are public fear of fire and the general dislike of attendant smoke. Smoke management is one of the key issues addressed in the fire management plan (Appendix H). An active public education campaign will be developed that will describe the necessity of fire, the safety features of prescribed burning versus wildfires, and the strategies that will be developed to minimize the impacts of smoke on nearby communities. If public pressures are sufficient to reduce or prohibit the use of prescribed fire at the Delray Oaks Natural Area site, then the indirect impacts of fire exclusion may prevent the attainment of several management goals. Alternatives to prescribed burns will then be considered to best attain the management goals for this Natural Area.

6. COST ESTIMATES AND FUNDING SOURCES

Cost estimates for initial site development and long-term management are provided in Tables 3 and 4, respectively. The primary funding source for site development will be funds from the $100 million Palm Beach County Environmentally Sensitive Lands Bond Referendum passed on March 12, 1991. Responsibility for site development and management is described in the interlocal agreement between the City and the County (Appendix E). Staffing for habitat management and facility maintenance will be accomplished with existing City and County personnel, with assistance from community volunteers.

6.1 DEVELOPMENT COSTS

Initial site development is estimated to cost approximately $171,003 (Table 3). Securing the site with fencing, signs and gates will account for nearly half of this projected cost. Other major expenditures include construction of a parking area, a kiosk, and a handicapped-accessible nature trail. Funding for initial site development will be provided from the Palm Beach County Environmentally Sensitive Lands Bond Referendum, although grant monies may be sought to fund construction of the nature trail and kiosk.

6.2 KEY MANAGEMENT ACTIVITIES AND RESOURCE ENHANCEMENT COSTS

Costs of management will be minimized through the cooperation of local citizens' organizations and by coordinating the management of natural areas on a county-wide basis. The Audubon Society of the Everglades, the Coalition for Wilderness Islands, the Palm Beach County Chapter of the Florida Native Plant Society, the Florida Trail Association, the Royal Palm Audubon Society, and the Sierra Club - Loxahatchee Group have all committed to providing volunteer services for the management of environmentally sensitive lands acquired by the County. However, it is recognized by both the County and the City that the management of the Delray Oaks Natural Area will require more than volunteer assistance. Some activities, such as prescribed burning, herbicide applications, chain saw work, and other hazardous or extremely technical operations are not generally suited to volunteers. The County and City will provide such services internally, or via contract where necessary.

The County has established a Natural Areas Stewardship Endowment Fund. The restricted gift funds received from various sources will be invested and the interest earned used to provide operating funds for management of County-owned and County-leased natural areas. The County also will apply for funds available from the State for management purposes, including the Pollution Recovery Trust Fund administered by DEP. In addition, funds will be available via Section 7.5 (Vegetation Preservation and Protection)of the Palm Beach County Unified Land Development Code. Monies from penalties for violations of the provisions of these Sections will be deposited into a Natural Areas Fund. These monies in the Natural Areas Fund will be available for the management of lands acquired by the County as natural areas. Monies from the sale of development rights on lands purchased by the County as natural areas also could be used for management

purposes.

7. PRIORITY SCHEDULE

Initial site development activities will focus on securing the site against unauthorized use. Fencing, signs and gates were purchased and installed within six months of acquisition. A fire management plan (Appendix H) has been prepared and invasive vegetation removal begun within one year of acquisition. The nature trail and parking area will be constructed, management roads will be cleared, and interpretive facilities and materials such as a kiosk, slide show, and nature trail guide will be developed within the third year following site acquisition. A priority schedule for site development activities is provided in Table 5.

B 6/17/97

8. MONITORING

A monitoring program will be initiated in 1997 to measure whether the management objectives for natural communities and listed species are being achieved. The monitoring program will be designed to evaluate the success of prescribed fires and invasive vegetation control activities within the Delray Oaks Natural Area. Management practices will be adjusted if an analysis of the monitoring data reveals that objectives are not being met.

Permanent photographic stations will be established and photographs taken annually for comparison purposes. Permanent transects will be established to monitor changes in vegetation that would be revealed by data collection surveys made at two-year intervals. Periodic surveys of listed species populations will be undertaken to determine population trends. Assistance will be sought from institutions of higher education and volunteers in carrying out the monitoring program and in analysis and interpretation of the data collected. The monitoring data will be used as the basis for future revisions of the management plan.

8.1 Photomonitoring

Photopoint sites will be selected to provide a visual record of changes in vegetative composition over time, including the effects of planned management activities. The method for photomonitoring is the same as that developed for use by the South Florida Water Management District (Van Horn 1993). A photomonitoring point will be established at one end of each vegetation monitoring transect. Photopoint posts will be 6 feet long and stand 4.5 feet above ground level. A removable platform that fits over the photopoint will be used as a camera mount. An additional permanent stake will be placed in the ground 30 feet from the photopoint as a reference point in each photograph. Three color slides will be taken at each photopoint, and will be combined to produce a 180-degree panorama. A 35mm camera with a 28mm lens and 100 ASA color slide film will be used.

Slides will be taken annually during the wet season (June-October). When a management unit sub-block is burned, changes in vegetation will be measured with photos taken pre-burn, immediate post-burn, three months post-burn, six months post-burn, and one year post-burn. During second and subsequent years, photos will be taken during the wet season only.

At each reference point, quantitative density measurements will be collected using a 30 cm x 2.5 cm density board as described by Nudds (1977). The density board also will allow visual comparisons of vegetation density for each slide at each photopoint from year to year. Additional information that will be collected includes the height and species name of the predominant tree, shrub and/or herbaceous vegetation located between the photo and reference points and the water depth at each reference point. One set of slides will be taken at each reference point in a one-year period. A reference collection of all slides taken will be maintained

by ERM and used when the management plan is periodically reviewed.

8.2 Permanent Transects

Following the method described in Schemnitz (1980), permanent transects will be established in each management unit to monitor changes in vegetation, with data collection surveys made at two-year intervals. The location of each transect will be recorded on a map and numbered, with transect ends permanently marked with metal stakes in the ground. The starting and ending points of each transect, the bearing, and the distance from some easily located point found both on the ground also will be recorded. The starting point and the course of the transect will be marked.

Each transect will be 150 feet long, and will be aligned to pass through at least two different natural communities, or two different subtypes within a single community. At least one of the transects will pass through each of the four natural communities found on the site. Data will be recorded at 3-foot intervals along the transect and will include the predominant plants, presence of any listed species, and any other plants of management interest. If transect data indicate natural community changes, additional transects may be established in the affected management unit to determine if the changes are localized or widespread.

8.3 Wildlife Surveys

Wildlife surveys will be performed annually. Two surveys will be undertaken each year - one when migratory species are present, and the other when only year-round residents are expected. The surveys will consist of random walk-throughs of representative areas and/or transects or quadrants described by Schemnitz (1980). These will be two half-day surveys, one from early- to mid-morning and one from late afternoon to dusk, to observe animals active at different times. Survey information is anticipated to include qualitative and quantitative observations of animals, tracks, burrows/nests, or other signs.

8.4 Listed Animal Species Surveys

Annual population counts will be made for all endangered and threatened animal species, in order to track population trends. Animal species of special concern will have their populations surveyed every two years to determine whether they are suffering any unusual population declines. Locations of nests or burrows may be pinpointed and mapped by use of a global positioning system (GPS) receiver which uses satellite signals to determine the longitude and latitude of a particular spot to an accuracy that can aproach three to six feet. Surveys will be scheduled at the time of year when the target species is most visible and may be conducted in coordination with other activities. Specific surveys will be developed for specific species. Qualitative evaluations of individual species will be made in conjunction with all quantitative surveys.

8.5 Listed Plant Species Surveys

Annual population counts will be made for all endangered plant species in order to track population trends. Locations of individual plants or groups of plants may be pinpointed and mapped by use of a GPS receiver. Annual population counts also will be made of threatened plants with extremely limited populations. GPS receivers and mapping will be used for these species as necessary.

Threatened plants with large populations and commercially-exploited plants will have their populations surveyed every two years to determine whether they are suffering any unusual population declines. Surveys for specific plants will be undertaken at the time of year when those plants are most visible. Qualitative evaluations of individual species will be made in conjunction with all quantitative surveys.

8.6 Annual Report

ERM will prepare an annual stewardship report to FCT. Major structural improvements and management activities conducted during the management year will be discussed, and their degree of success described. The annual report also will include information on any density credits purchased from the Delray Oaks Natural Area as a part of the County's Transfer of Development Rights Program and any changes to the monitoring plan. A general review of management efforts related to natural vegetation communities and the status of listed species also will be completed at the end of each management year.

9. GLOSSARY AND ACRONYMS

ADA - Americans with Disabilities Act

DEP - Florida Department of Environmental Protection

DOF - Florida Department of Agricultural and Consumer Services, Division of Forestry

ERM - Palm Beach County Department of Environmental Resources Management

ESLASC - Palm Beach County Environmentally Sensitive Lands Acquisition Selection Committee

FCT - Florida Communities Trust

FDACS - Florida Department of Agricultural and Consumer Services

FGFWFC - Florida Game and Fresh Water Fish Commission

FIND - Florida Inland Navigation District

NAMAC - Palm Beach County Natural Areas Management Advisory Committee

ORV - Off-road Vehicle

SFWMD - South Florida Water Management District

SOR - Save Our Rivers

USFWS - United States Department of the Interior, Fish and Wildlife Service

Burn unit - an area of predetermined size and shape that remains fixed for monitoring purposes throughout

a course of fire management

Corridor - a route that permits the direct travel or spread of animals or plants from one area or region to another, either by the gradual spread of a population of a species along the route or by actual movement of animals, seeds, pollen, spores, or microbes

Density - the number of individual plants or animals per unit of habitable area

Diversity - the number of species that live together in an ecosystem; a measure of the variety of species in an ecosystem that takes into account the relative abundance of each species

Dominant - the characteristic species in a particular plant community, contributing most to the general appearance and influencing which other plants and animals live there; typically the largest plant species or the one with the greatest areal coverage

Ecosystem - an assemblage of living organisms (plants, animals, microorganisms, etc.) and nonliving components (soil, water, air, etc.) that functions as a dynamic whole through organized energy flows

Ecosystem management - an integrated, flexible approach to management of Florida's biological and physical environments -- conducted through the use of tools such as planning, land acquisition, environmental education, regulation, and pollution prevention -- designed to maintain, protect and improve the state's natural, managed, and human communities

Ecotone - a zone of transition between two ecosystems that has characteristics of both

Endemic - a species or other biological grouping whose distribution is restricted to a particular region o locality

Enhancement - an action taken to introduce, reintroduce or restore vegetation and associated animals b an area where the native ecosystem has been disturbed

Equestrian trail - an unimproved dirt or sand trail that is designated for equestrian travel. Designated management roads and firebreaks also may be used as equestrian trails

Feral - an animal that has reverted to a wild or untamed state from a domesticated state

Firebreak - a strip of land where the vegetation has been cut or removed to stop the spread of a fire; it typically does not exceed 15 feet in width and may be used as a management road and/or a hiking trail Fire regime - a prevailing condition in which ecosystems have evolved under periodic exposure to natural fires such that the vegetative communities have adapted to, are dependent upon, and are reproductively enhanced by this exposure

Footpath - a narrow trail with a natural soil base that is intended for foot traffic only and does not have interpretive signage

Forb - a broad-leaved herbaceous plant that is not a grass

Habitat - the area or type of environment in which a specific kind of organism normally lives

Hiking trail - an unpaved footpath with a natural soil base and directional signage only; may be combined with management roads

Hydroperiod - the average length of time that soils are saturated during a given year

Hydric - an environment that contains an abundance of moisture

Inbreeding depression - A state in which a geographically isolated population becomes vulnerable to extirpation and weakened genetically due to the accumulation of deleterious recessive genes

Kiosk - a small structure used to shelter informational displays

Listed species - a species that is considered to be endangered or threatened with extinction, or a species of special concern, or a species that has been designated in some way by a jurisdictional governmental agency as meriting special protection or consideration

Macro-management unit - a large management unit that contains two or more ecosystems

Management road - an unimproved, single-lane dirt or sand road that is designated for vehicular management activities; it does not exceed 15 feet in width and may be used as a firebreak and/or hiking trail

Mesic - a moist environment that is drier than a hydric environment, and seldom contains standing water

Micro-management unit - a small management unit that contains only one ecosystem

Mitigation - an action taken to lessen the severity or intensity of a human impact on a native ecosystem or offset the impact, either on the site where the impact occurs or at another location

Mosaic - a pattern of vegetation in which two or more different plant communities are interspersed in patches

Natural area - an area containing one or more aquatic, terrestrial, or transitional ecosystems or a combination of ecosystems that has essentially retained its primitive conditions; an area that is a least-disturbed known example of a type of natural ecosystem

Nature trail - a hard-surfaced, handicapped-accessible walking trail with interpretive signage

Off-road vehicle - a vehicle capable of traveling in roadless areas

Outstanding Florida Water - a water body designated by the State of Florida Environmental Regulation Commission as worthy of special protection because of its natural attributes

Passive recreation - any recreational activity which has minimal or no impact on natural resources or ecosystems, such as trail-walking, photography, and plant and wildlife observation

Physiographic region - a region delineated by a specific topography

Pyric community - a community resulting from, induced by, or associated with burning

Relict population - a remnant population of a species that once was widespread

Restoration - the process of repairing damage caused by human activity or a natural disaster to the diversity and dynamics of a native system

Ruderal - a species which generally is considered to be native, but often grows in disturbed areas

Saltwater intrusion - the introduction of saltwater into a previously fresh water aquifer as a consequence of disturbance of the water pressure in the aquifer; saltwater intrusion often is associated with excessive pumping of wells

Saprophyte - a fungus or plant living on dead or decaying organic matter

Seed rain - a sudden dispersal of seeds, which can be triggered by fire or another extreme environmental event

Seral stage - one of the stages in a series of more or less predictable changes in vegetation and animal life as one kind of ecosystem is replaced by another

Soil phase - a subdivision of a soil type that deviates from the typical character of the soil type

Sovereign lands or sovereignty lands - those lands including, but not limited to: tidal lands, islands, sandbars, shallow banks, and lands waterward of the ordinary or mean high water line, to which the State of Florida acquired title on March 3, 1845, by virtue of statehood, and of which it has not since divested its title interest

Subcanopy - the layer of shrubs or trees that is below the canopy, or uppermost layer of vegetation in a forest or woodland

Systemic herbicide - a chemical agent used to destroy or inhibit plant growth that is absorbed into and is effective throughout the entire organism

Taxon (plural - taxa) - a general term for any taxonomic category (for example, a species, genus, family, or order)

Transect - a long, narrow area used for sampling vegetation or counting animals; transects are used for the collection and analysis of data such as frequency of occurrence, size, or number of organisms or kinds of organisms

Transitory taxon (plural - taxa) - a species that is present on a site only for a brief period, often as a response to changing environmental conditions

Vegetative community - the plant component of an ecosystem

Viability - the capability of a seed or organism to grow and develop or the capability of a population of a species or a biological community to reproduce and maintain itself indefinitely

Water table - the level below which soil is saturated with water; the surface of the zone of saturation

Xeric - an environment or habitat that is low or deficient in moisture

10. REFERENCES CITED

Abrahamson, W.G., and D.C. Hartnett. 1990. Pine flatwoods and dry prairies. In Ecosystems of Florida (R.L. Myers and J.J. Ewel, eds.), pp. 103-149. University of Central Florida Press, Orlando, Florida.

Auffenberg, W., and R. Franz. 1982. The status and distribution of the gopher tortoise (Gopherus polyphemus). In North American Tortoises: Conservation and Ecology, pp. 95-126. Wildlife Research Report 12. U.S. Fish and Wildlife Service, Washington, D.C.

Bond, J. 1980. Birds of the West Indies. Houghton Mifflin, Boston, Massachusetts.

Breininger, D.R., P.A. Schmalzer, D.A. Rydene, and C.R. Hinkle. 1988. Burrow and habitat relationships of the gopher tortoise in coastal scrub and slash pine flatwoods on Merritt Island, Florida. Florida Game and Fresh Water Fish Commission Nongame Wildlife Program Final Report.

Brooks, H.K. 1982. Guide to the physiographic divisions of Florida. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida.

Brown, R.B., E.L. Stone, and V.W. Carlisle. 1990. Soils. In Ecosystems of Florida (R.L. Myers and J.J. Ewel, eds.), pp. 35-69. University of Central Florida Press, Orlando, Florida.

Cox, James A., D. Inkley, and R. Kautz. 1987. Ecology and habitat protection needs of gopher tortoise (Gopherus polyphemus) populations found on lands slated for large-scale development in Florida. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program Technical Report 4.

Davis, J.H. 1943. The natural features of southern Florida, especially the vegetation and the Everglades. Florida Geological Survey Bulletin No. 25.

De Schauensee, R.M., and W.H. Phelps, Jr. 1978. Birds of Venezuela. Princeton University Press, Princeton, New Jersey.

Fenneman, N.M. 1938. Physiography of Eastern United States. McGraw-Hill, New York.

Fernald, R.T. 1989. Coastal xeric scrub communities of the Treasure Coast Region, Florida. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program Technical Report No. 6.

Florida Game and Fresh Water Fish Commission. 1994. Official lists of endangered & potentially endangered fauna and flora in Florida: 29 April 1996.

Florida Natural Areas Inventory and Florida Department of Natural Resources. 1990. Guide to the natural communities of Florida.

Gentry, R.C. 1974. Hurricanes in south Florida. In Environments of South Florida: Present and Past (P.J. Gleason, ed.), pp. 73-81. Mem. No. 2; Miami Geological Society, Miami, Florida.

Iverson, G.B., and D.F. Austin. 1988. Inventory of native ecosystems of Palm Beach County, phase III report: location and evaluation of sites for possible preservation as wilderness island park preserves. For Palm Beach County.

Jackson, J.F. 1973b. The phenetics and ecology of a narrow hybrid zone. Evolution 27:58-68.

Kale, H.W., Jr., and D.S. Maehr. 1990. Florida's Birds. Pineapple Press, Sarasota, Florida.

Laessle, A.M. 1942. The plant communities of the Welaka area. Univ. Of Florida Publ. Biol. Sci. Ser. (1). Gainesville, Florida.

Long, R.W., and O. Lakela. 1971. A Flora of Tropical Florida. University of Miami Press, Coral Gables, Florida.

Macdonald, L.A. 1985. The diet of the gopher tortoise, Gopherus polyphemus, in a sandhill habitat in central Florida. In Gopher Tortoise Habitat Management - Strategies and Options (C.K. Dodd, Jr., ed.), pp. 2-14. Proc. 6th Ann. Mtg. Gopher Tortoise Council, Florida Museum of Natural History, Gainesville, Florida.

Myers, Ronald L. 1990. Scrub and high pine. In Ecosystems of South Florida (R. L. Meyers and J.J. Ewel, eds.) Pp. 150-193. University of Central Florida Press, Orlando, Florida.

Nudds, T.D. 1977. Quantifying the vegetative structure of wildlife cover. The Wildlife Society Bulletin, Vol. 5, No. 3.

Palm Beach County Department of Environmental Resources Management, 1996a. Animal list for Delray Oaks Natural Area. Unpublished document. Updated 1/26/96.

Palm Beach County Department of Environmental Resources Management, 1996b. Plant list for Delray Oaks Natural Area. Unpublished document. Updated 1/30/96.

Palm Beach County Department of Environmental Resources Management and the City of Delray Beach. 1994. Delray Oaks Natural Area application to Florida Communities Trust.

Palm Beach County Property Appraiser. 1965, 1970, 1977, 1984, 1991, 1993. Aerial photographs of Section 30, Range 43, Township 46.

Peterson, R.T. 1947. A Field Guide to the Birds. Houghton Mifflin, Boston, Massachusetts.

Schemnitz, S.D. 1980. Wildlife Management Techniques Manual. The Wildlife Society, Washington, D.C.

Snyder, J.R., A. Herndon, and W.B. Robinson. 1990. South Florida rockland. In Ecosystems of Florida (R.L. Myers and J.J. Ewel, eds.), pp. 230-277. University of Central Florida Press, Orlando, Florida

Speake, D.W. 1981. The gopher tortoise burrow community. In The Future of Gopher Tortoise Habitats (R.

Lohoefener, L. Lohmeier, and G. Johnson, eds.) pp. 44-47. Proc. 2nd Annu. Mtg. Gopher Tortoise Council. Florida State Museum, Gainesville, Florida.

Terborgh, J. 1989. Where Have All the Birds Gone? Princeton University Press, Princeton, New Jersey.

United States Department of Agriculture, Soil Conservation Service. 1978. Soil survey of Palm Beach County area, Florida.

United States Department of Agriculture, Soil Conservation Service. 1989. 26 ecological communities of Florida, revised edition. Gainesville, Florida.

United States Department of the Interior, Geological Survey. 1940, 1953. Aerial photographs.

United States Department of the Interior, Geological Survey. 1962, rev. 1983. Topographic map of the Delray Beach, Florida Quadrangle.

B 6/17/97

Van Horn, M. and K. Van Horn. 1993. Save Our Rivers environmental monitoring protocols. Unpublished document. South Florida Water Management District, West Palm Beach, Florida.

Wunderlin, R.P. 1982. Guide to the Vascular Plants of Central Florida. University Presses of Florida, Gainesville, Florida.