Lee County Board Of County Commissioners
Agenda Item Summary

Blue Sheet No. 20050833

1. ACTION REQUESTED/PURPOSE: Approve the Deep Lagoon Preserve (DLP) Land Stewardship Plan.

2. WHAT ACTION ACCOMPLISHES: Approving of the DLP Plan establishes guidelines for restoration and public use facilities at DLP.

3. MANAGEMENT RECOMMENDATION: Approve the plan so Land Stewardship staff can begin implementation.

4. Departmental Category: C/IA		**5. Meeting Date:** 06-28-2005
6. Agenda:	**7. Requirement/Purpose:** *(specify)*	**8. Request Initiated:**
X **Consent**	___ **Statute**	**Commissioner**
___ **Administrative**	___ **Ordinance**	**Department** Parks & Recreation
___ **Appeals**	___ **Admin. Code**	**Division**
___ **Public**	X **Other**	**By:** John Yarbrough, Director
___ **Walk-On**		

9. Background:

A Land Stewardship Plan is necessary for appropriate and planned restoration, management and public use facility development of any Conservation 20/20 Preserve. The CLASAC (Conservation Lands Acquisition and Stewardship Advisory Committee) unanimously passed a motion on May 12, 2005, accepting the Deep Lagoon Preserve Land Stewardship Plan.

The plan was available for public review on the internet, as well as at the Lee County Public Library and the nearby Harlem Heights Recreation Center. A public meeting was held May 24, 2005.

10. Review for Scheduling:

Department Director	Purchasing or Contracts	Human Resources	Other	County Attorney	Budget Services				County Manager/P.W. Director
					Analyst	Risk	Grants	Mgr.	
6/7/05						6/10/05	6/13/05	6/13/05	

11. Commission Action:

_____ **Approved**
_____ **Deferred**
_____ **Denied**
_____ **Other**

RECEIVED BY COUNTY ADMIN: 6/13/05 1:36 pm
COUNTY ADMIN FORWARDED TO: 6-16-05 10 Am

Rec. by County Date: 6-10-05 Time: 4:00
Forwarded To: Co. mgr. 6/10/05 4:45pm

Deep Lagoon Preserve

Land Stewardship Plan

Prepared by the Land Stewardship Section

Lee County Parks and Recreation

Approved by the Lee County Board of County Commissioners: _____

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Vision Statement

It is the vision of the Lee County Department of Parks and Recreation to conserve, protect and restore all of the natural resources at Deep Lagoon Preserve so that they are productive, functional and viable. The Preserve will become a tremendous haven for wildlife as restoration takes place and will serve as a critical component of a wildlife corridor stretching from Estero Bay, in southwest Lee County, north to the Caloosahatchee River. The Preserve will also provide an important scenic opportunity for paddlers and boaters on the Caloosahatchee River.

I. Executive Summary

The parcels comprising the Deep Lagoon Preserve were purchased in multiple stages through various programs. The Cow Slough property was purchased by Lee County in the 1970's for use as a landfill and wastewater treatment. A portion of this property (located south of Summerlin Road) will be donated to the Florida Department of Environmental Protection as an extension of their Estero Bay Preserve State Park. Three parcels were purchased through Lee County's Conservation 20/20 Program. The Conservation 20/20 Program was established in 1996 after Lee County voters approved a referendum that increased property taxes by up to .5 mil ($.50/$1,000 in property value) for the purpose of purchasing and protecting environmentally sensitive lands. Finally, the former Health Park Mitigation Area will be incorporated into the Preserve through a partnership with Lee County's Department of Transportation after it has been restored and existing mitigation requirements, under an active permit, have been met. The purchase and perpetual preservation of this Preserve will provide protection for over 460 acres of tidal swamp, coastal uplands, hammocks and flatwoods that provide habitat and food for both freshwater and saltwater aquatic organisms as well as a wide variety of birds.

The Preserve is oriented in a north/south direction and when combined with the Estero Bay Preserve State Park, the Lucaya subdivision conservation easement, the Heights elementary mangrove area and the mitigation area mentioned above, it creates a green corridor that stretches from the Caloosahatchee River to Estero Bay, which is rapidly being surrounded by development. By conserving and restoring this corridor, there will be significant improvements for wildlife and water quality in the area.

McGregor Boulevard bisects the northern portion of the Preserve. The central portion is bordered by A & W Bulb Road to the east and Gladiolus Drive to the south. Summerlin Road defines the southern boundary of DLP. Western boundaries to the Preserve include Iona Drainage District canals or residential development.

There are two properties within this corridor that would complete the connection but currently are not part of the Preserve boundaries. If acquiring the properties for preservation is not feasible, Land Stewardship staff should pursue a conservation easement, during the development process that connects these properties to the Preserve.

The topography of the Preserve is fairly flat, with a maximum elevation of 6 feet National Geodetic Vertical Datum in the disturbed arm of the Cow Slough property. The majority of the Preserve is at 4 feet with the wetlands closer to 2 feet. The soil composition reflects the plant communities and disturbances of DLP. The entire Preserve is contained within the Deep Lagoon Watershed. Historically, this watershed along with the Cow Slough Watershed located

directly to the south only connected during extreme tidal events. In the 1920's the Deep Lagoon Watershed was channelized to drain the surrounding land for farming and low-density, residential housing. This permanently connected the two systems, bringing saltwater into a historically freshwater system. There is an assortment of wetlands scattered along this corridor, providing critical habitat for wildlife.

Deep Lagoon Preserve provides habitat for several listed animal and plant species. A bald eagle nest is located in the central portion of the Preserve and smalltooth sawfish, a federally endangered species, has been seen swimming off the coast of the Preserve's peninsula. Management practices at the Preserve including exotic plant control, trash removal, hydrologic restoration, brush reduction and enforcement of the no littering, no weapons and no dumping regulations will all help with the protection of listed species. Critical habitats for wildlife include the mangroves, which not only provide habitat, but also produce a tremendous amount of organic material available for the aquatic food web through their continuous shedding of leaves. Additionally, the mixture of temporary and permanent wetlands provide habitat and food sources for wildlife as well as breeding areas for amphibians. The coastal community provides shoreline stabilization in a sensitive, low-lying area.

This Preserve has had a tremendous amount of disturbance during the past 80 years. In addition to the Iona Drainage District canals, a network of mosquito ditches was created. The soil disturbance and drainage to the area created the perfect conditions for invasive exotic plants. There are several scattered monocultures of Brazilian pepper, melaleuca and Australian pines. The current improved pasture was cleared in the 1920's, farmed for almost 60 years until the mid 1980's and is currently a cow pasture.

External influences to Deep Lagoon Preserve relate to the increased development in the area. Both A & W Bulb Road and Gladiolus Drive are scheduled to be widened. Historically the Land Stewardship Staff has had a problem with horticultural dumping on portions of the Preserve. Educating the residents of the future Lucaya development will be important to prevent future problems with dumping, the spread of invasive exotic plants and runoff of chemicals and fertilizers.

This stewardship plan will help guide future development of public use facilities to balance the needs of the public while protecting the natural resources of DLP in perpetuity. Plans include a loop boardwalk on the southern portion of the Preserve and possibly a future boardwalk and trail in the central portion that will be created for the public as well as the students of Heights Elementary School. Several years of restoration will precede development of public use facilities at the Preserve. The peninsula of the Preserve will be featured in Phase III of the Great Calusa Blueway and may have a canoe/kayak landing.

Lee County Bird Patrol is a volunteer group that currently assists with monitoring of wildlife, specifically avian life at the Preserve. This partnership will help to keep track of wildlife utilization at the Preserve and possibly help identify areas needing additional protection. This group is also involved in monitoring eagle activity at the Preserve.

The goal of this land stewardship plan is to identify Preserve resources, develop ways to protect those resources and implement restoration activities to restore DLP to a viable, functioning, natural system while insuring the Preserve will be developed in accordance with Lee County Parks and Recreation's Land Stewardship Operations Manual. A Management Action Plan that divides the Preserve into 15 units has been established. Numerous goals have been adopted that cover exotic plant control, brush removal, hydrologic restoration, removal of debris, termination of cattle and billboard leases, prevention of dumping, restoration of the improved pasture and continuation of wildlife monitoring. A timetable and projected costs table are also included to direct restoration activities.

Restoration of the Preserve will be challenging, especially considering the extensive wetlands. The additional challenge for the central portion of the Preserve will be to conduct all activities outside of bald eagle nesting season, but before the wet season begins. This is a very narrow window of time and may be increased depending on each year's eagle activity. The location of the eagle nest in an Australian pine amongst a monoculture of pines adds to the difficulty in restoring this area. Every effort will be made to minimize disturbance to the nesting area.

II. Introduction

Deep Lagoon Preserve (DLP) was acquired as three separate parcels through the Conservation 20/20 Program (C20/20) at a total cost of over $4 million. Further to the south, Lee County has owned the 170-acre Cow Slough Preserve, since the 1970's. Both conservation areas are located are located in the center of Lee County in the Iona/McGregor area. Due to the close proximity of both areas and the fact that Parks and Recreation manages both, staff decided to add the former Cow Slough to the boundaries of DLP. These parcels together create a 383-acre Preserve in a narrow band running north/south creating a linear corridor from the Caloosahatchee River to Estero Bay Preserve State Park (Figure 1).

DLP contains 8 different native plant communities, the most abundant being tidal or mangrove swamp. Twenty-nine percent of the Preserve is highly disturbed with invasive exotic plants and minimal native plant coverage. An additional 30% of the Preserve consists of exotic plant monocultures, a pasture and ditches.

Land stewardship challenges for this Preserve are varied. Lands included in the Preserve have been disturbed beginning in the 1920's for farming as well as the creation of the Iona Drainage District (IDD) canals. Additional ditches for mosquito control were dug in the 1950's and 60's. Invasive exotic plants are growing, often in thick monocultures, throughout the Preserve. Several listed species utilize the property to varying degrees. This includes an eagle nest that was used as recently as 2004. Utilization by listed and unlisted species may increase dramatically as restoration occurs.

The purpose of this stewardship plan is to define the conservation goals for DLP that will address the above concerns. It is a guide for Lee County's Department of Parks and Recreation to use best management practices with the proper stewardship and protection of the Preserve. It also can be used as a reference guide since a tremendous amount of research was conducted with field work, researching scientific literature, studies and historical records to understand how the Preserve functions in the ecosystem, what wildlife and plants are found within its boundaries as well as historical human influences.

The overall restoration goal for DLP will be to improve wildlife habitat and hydrology. Hydrologic improvements at the Preserve will include removing the invasive exotic plants and where possible, filling the ditches. Invasive exotic plants will be controlled and regular monitoring will ensure exotic plants are kept at a maintenance level. Removal of exotics will be followed with replanting of appropriate native plants where necessary. The improved pasture will be restored to a natural plant community, most likely wet prairie or hydric flatwoods. Staff and volunteers will continue to monitor wildlife utilization of the property.

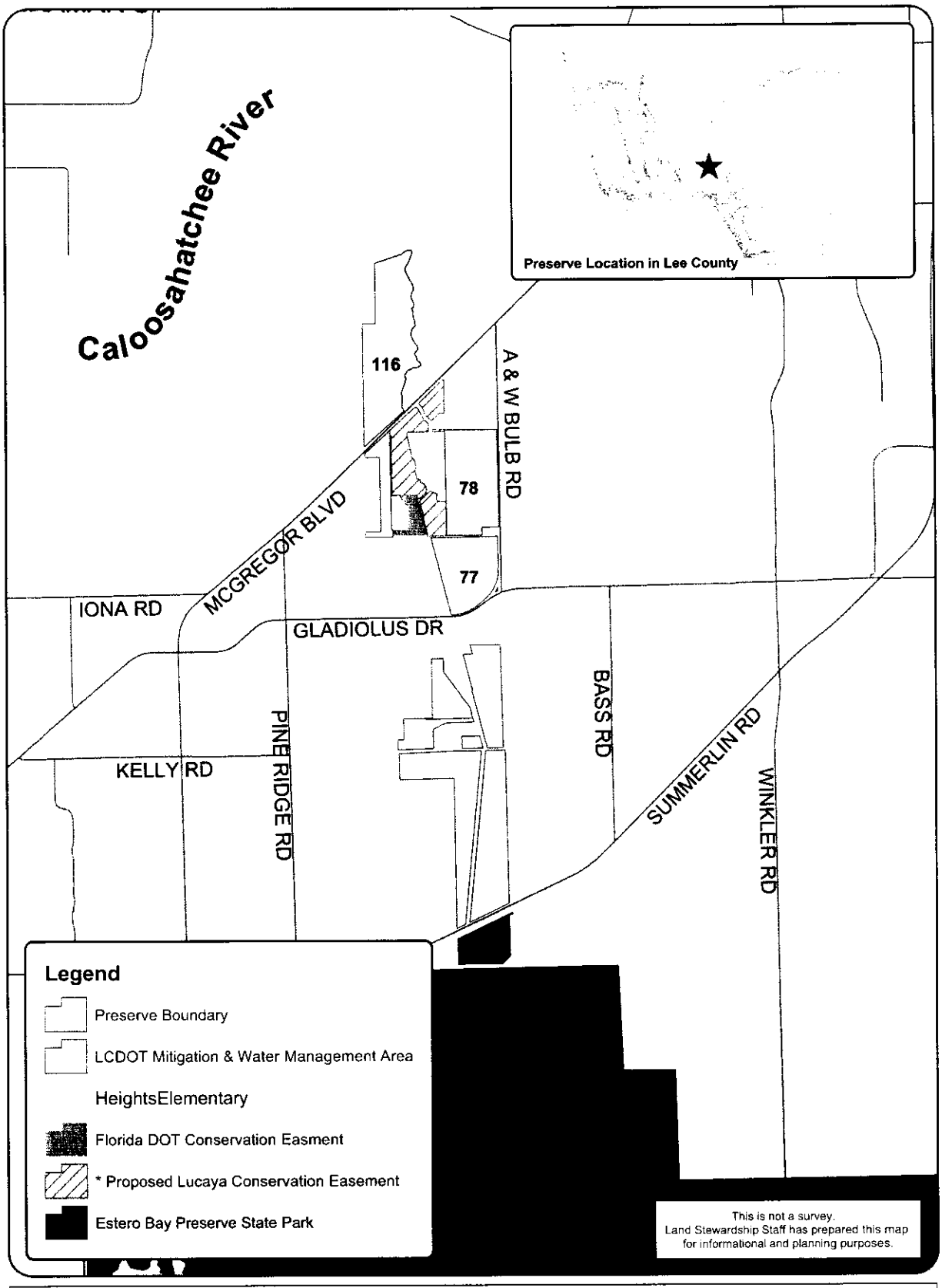
III. Location and Site Description

Deep Lagoon Preserve contains 3 different geographic areas spread along a 3-mile corridor in west-central Lee County (Figures 1 & 2) in Sections 20, 29 and 32, Township 45 South, Range 24 East and Section 5, Township 46 South, Range 24 East. Even though these three areas are not contiguous they are managed as one preserve since they are part of the same historic slough system and help create a green wildlife corridor from the Caloosahatchee River to Estero Bay. McGregor Boulevard bisects the northernmost portion, known as site 116. To the north of McGregor, the Preserve is surrounded by water, consisting of a canal to the west, the Caloosahatchee River to the north and Deep Lagoon to the east. To the south of McGregor, the Preserve has residential housing to the west, a canal on the south border and undeveloped woods to the east, although this property, known as the Lucaya development, is currently in the permitting process for development. The middle geographic area, known as sites 77 and 78, are bordered by A & W Bulb Road and Gladiolus Road to the east and south, respectively. The north boundary of this portion of DLP consists of residential housing and the Temple Judea. The west boundary is the currently undeveloped Lucaya property.

The final portion of DLP, referred to as the Cow Slough section, is approximately .6 miles south of the middle section. Its southern boundary consists of Summerlin Road, Health Park lies to the east, and undeveloped woods currently surround the rest. The IDD Canal C bisects the Preserve from north to south (Figure 2).

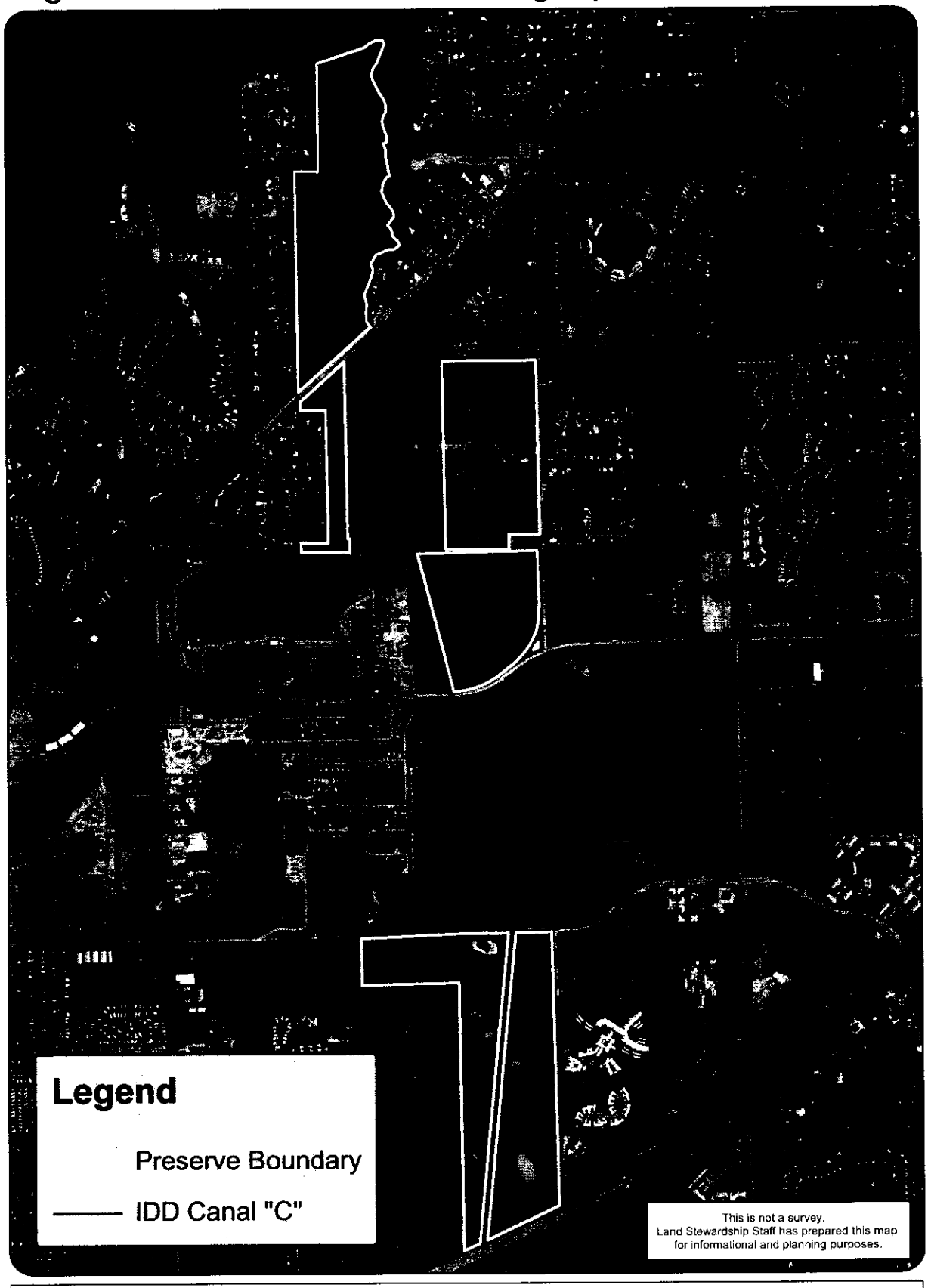
The Preserve has undergone tremendous alterations from human related activities. Approximately 3% of the DLP consists of ditches created for mosquito control and as part of the Iona Drainage District. Nine percent (9%) is currently pasture that previously was used for growing gladiolus flowers. Almost 20% of the Preserve, scattered throughout all three sections, consists of invasive exotic plant monocultures, primarily Australian pines (*Casuarina equisetifolia*), Brazilian pepper (*Schinus terebinthifolius*) and melaleuca (*Melaleuca quinquenervia*). Natural plant communities found at DLP include tidal swamps, tidal marshes, coastal grasslands, wet prairies, prairie hammocks and mesic flatwoods. These community designations are based on Florida Natural Areas Inventory's Guide to the Natural Communities of Florida (1990).

Figure 1: Location Map



*This boundary reflects the planned Lucaya Development's conservation easement as of December, 2004. The actual boundary will be placed in the 5-year revision of this plan

Figure 2: 2002 Aerial Photograph



IV. Natural Resources Description

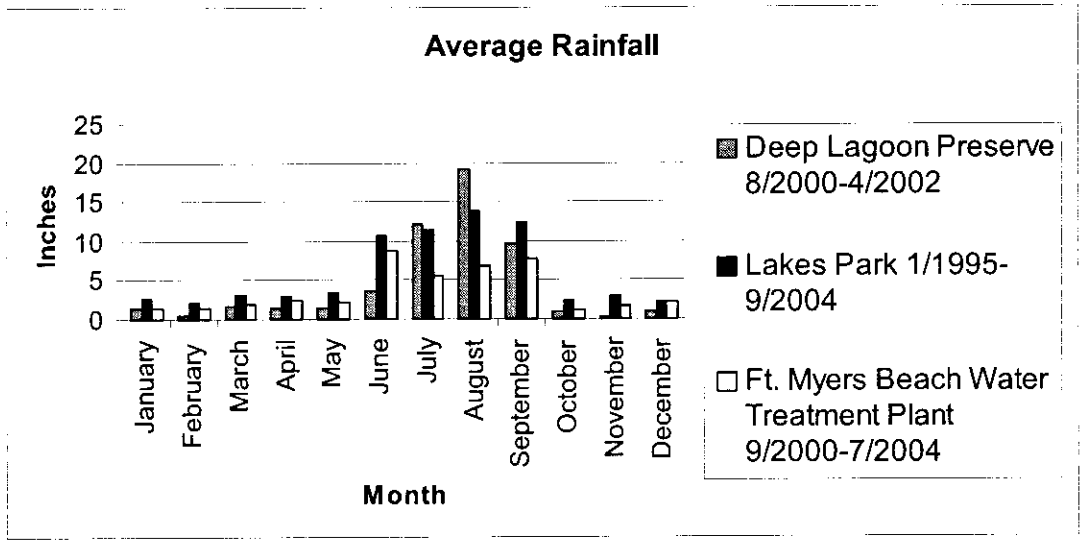
A. Physical Resources

a. Climate

Southwest Florida has a humid, sub-tropical climate due to its maritime influence from the Caribbean Ocean and the Gulf of Mexico. Temperate climate influences are exerted as well, with infrequent but significant freezes occurring. These freezes prevent some of the more tropical plants from becoming established and occasionally damage the subtropical vegetation. Cold fronts regularly push cool, sometimes moist weather from the southeastern U.S. to southwest Florida during the winter.

The graph below depicts the rainfall data recorded at DLP from August 2000 through April 2002 (JEI, 2002) as well as rainfall data collected by Lee County Division of Natural Resources from the Lakes Park rain gauge located on Summerlin Road and the Fort Myers Beach Water Treatment Plant, located at Pine Ridge Road between Summerlin Road and San Carlos Boulevard. The Lakes Park rain gauge is located approximately 3 miles to the east of the central portion of the Preserve, and was selected because of the many years of data collected. The Fort Myers Beach Water Treatment Plant rain gauge is only 1 mile away from the Cow Slough portion of the Preserve. Although the rainfall amounts vary from site to site, the typical pattern of the winter dry season and summer rainy season are apparent with all three sites.

Table 1



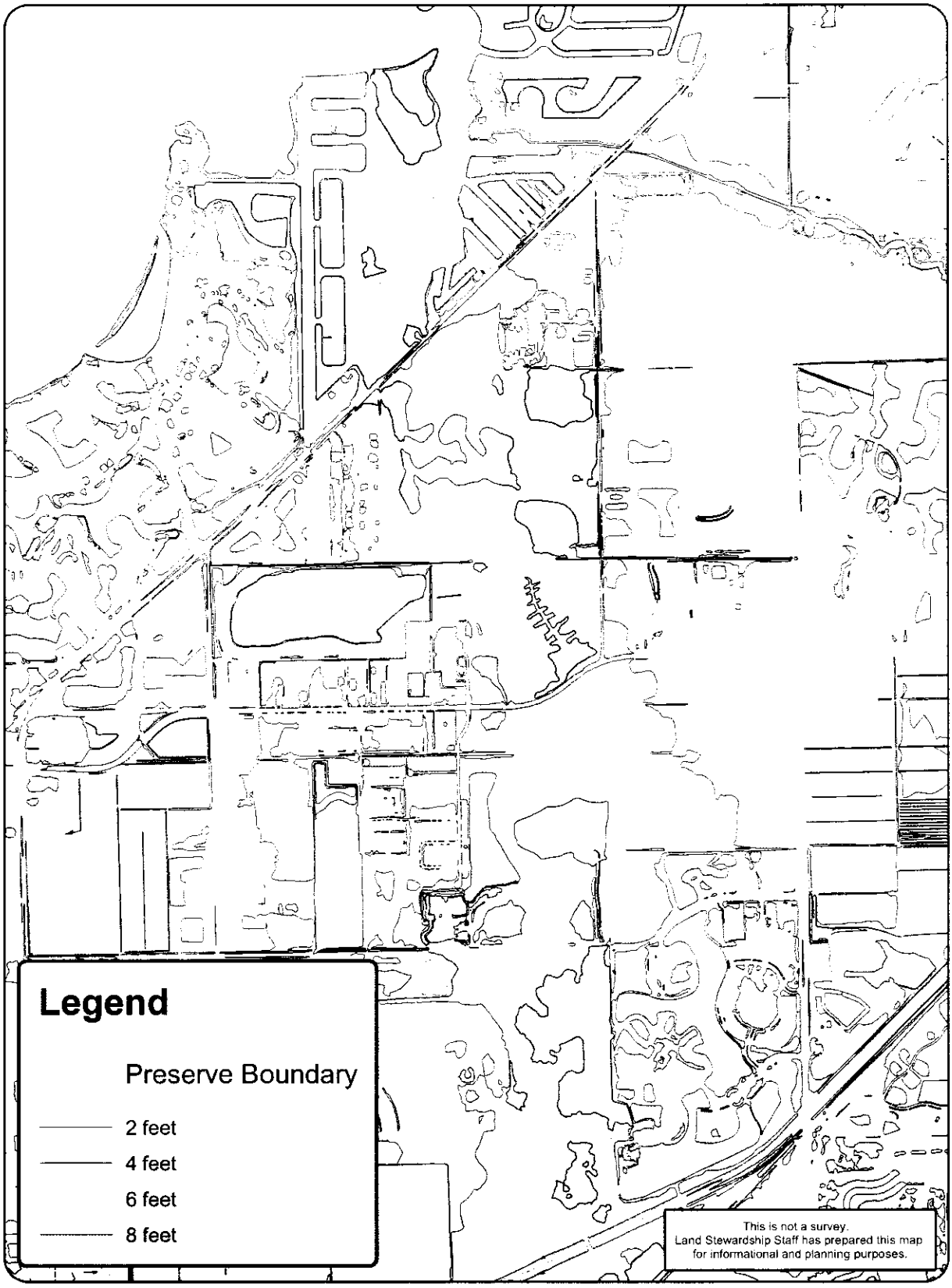
b. Geology

The portion of Florida that Deep Lagoon Preserve is located within was created during the Pleistocene Epoch between 1.8 million to 10,000 years ago. This period is also known as the Ice Age, where huge ice sheets formed across Canada and the northern United States. When these ice sheets were formed, they consumed large quantities of seawater, dropping the current sea level 300 or more feet, which greatly increased the land area of Florida. As the glaciers shrank, sea levels rose, and the Florida peninsula was again flooded. During the peak warm periods, sea level reached 150 feet above the current sea level. The waves and currents during these high sea level periods reworked the sediments and formed a series of formations (Caloosahatchee, Ft. Thompson, Anastasia, Miami Limestone and Key Largo limestone). Each of these geological units is characterized by their unique compositions. However, throughout much of Lee County, including the area where DLP is located, the formations are somewhat indistinct and have been lumped together as undifferentiated Tertiary/Quaternary shell-bearing units. This unit consists of a quartz sand blanket (less than 20 feet thick) covering limestone and clay. Fossils, including mollusks and corals, are very common and usually in excellent condition (FGS, 2001).

c. Topography

The topography of DLP is mainly low and near sea level (Figure 3). The majority of the Preserve is approximately 4 feet above sea level with the wetlands dropping to approximately 2 feet. There is one small portion of the southern Cow Slough arm that rises to 6 feet. The portion of Deep Lagoon Preserve that is north of McGregor Boulevard is at sea level on the southern two thirds with the northern third, which consists of Coastal Strand, ranges from 2-4 feet in elevation. All elevations are based on National Geodetic Vertical Datum (NGVD).

Figure 3: Topography Map



d. Soils

There are eight different soil types at the Deep Lagoon Preserve (Figure 4). The following section is a summary of the soil types as described in the Soil Survey of Lee County, Florida (HENDERSON, 1984). All soils found at DLP are considered nearly level and poorly drained.

Matlacha Gravely Fine Sand is formed by filling and earthmoving operations and found on the arm of the Cow Slough portion of the Preserve. The depth of the water table varies with the amount of fill material, typically a minimum of 24 inches below the surface. Most of the natural vegetation is removed – what remains are typically slash pines (*Pinus elliottii*) and weeds. It is poorly suited to most plants unless topsoil is spread over the surface deep enough to form a suitable root zone. This soil is considered to have severe limitations for sanitary facilities and recreational uses and moderate limitations for most building site development.

Hallandale Fine Sand is found on the upland portions of site 116, the majority of site 78, the outer fringes of site 77 and a very small portion of the Cow Slough parcel. The water table is less than 10 inches below the surface for 1-3 months of the year. It is not the best suited for agricultural uses, which is surprising due to the gladiolus farms which formerly dominated site 78. Native plants expected to be present on this type of soil are saw palmetto (*Serenoa repens*), threeawn (*Aristida ssp.*), bluestem (*Andropogon ssp.*), panicums (*Panicum ssp.*) and slash pine. It is considered to have severe limitations for urban use because of the shallowness to the bedrock as well as for wetness.

Boca Fine Sand is an additional upland soil found on sites 77, 78 and Cow Slough portions of the Preserve. The water table is slightly higher than the Hallandale Fine Sand and has similar native plants, with the addition of wax myrtle (*Myrica cerifera*). This soil is considered to have severe limitations for sanitary facilities, building site development and recreational uses due to the high water table.

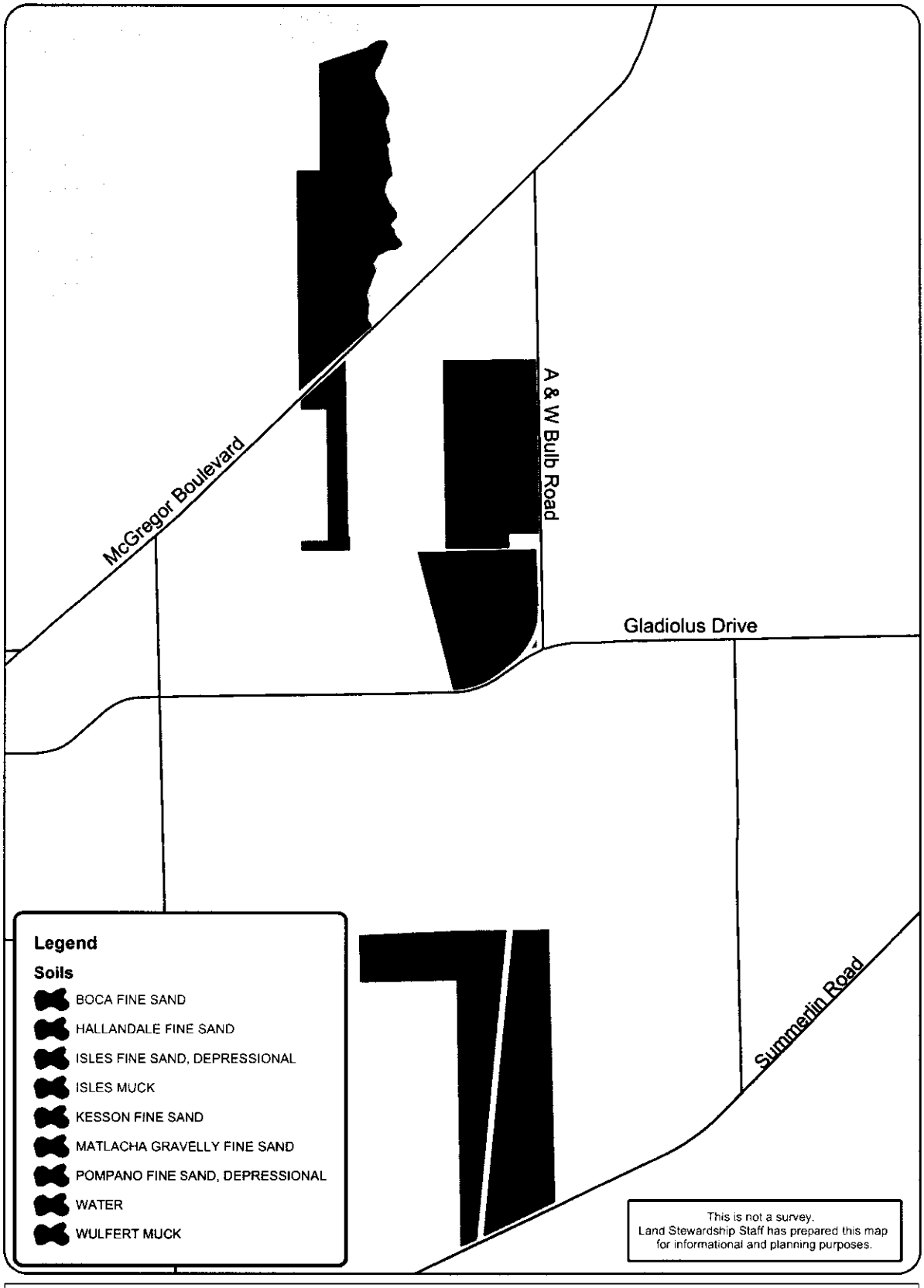
Isles Find Sand – Depressional is restricted to site 77, is nearly level to concave, and is expected to have standing water for 3 to 6 months of the year. Native plants expected to be found in these soils include cabbage palm (*Sabal palmetto*), cypress (*Taxodium distichum*), ferns, and popash (*Fraxinus caroliniana*). This soil is severely limited for urban and recreational uses because of ponding and is excellent habitat for wading birds and other wetland wildlife.

Pompano Fine Sand – Depressional is found on portions of site 116 and Cow Slough in concave areas. The water table is above the surface for 3 months of the year and within the surface for 2-4 months. St. John's wort (*Hypericum* ssp.) and wax myrtles are typical native plants found growing in these soils. This soil has severe limitations for septic tank absorption fields, dwellings without basements, small commercial buildings and local roads and streets.

The final three soils are all associated with tidal swamps. They are all subject to tidal flooding and typically the water levels fluxuate with the tide. Native plants associated with these soils include both black (*Avicennia germinans*) and red (*Rhizophora mangle*) mangroves. They all have severe limitations for urban and recreational development because of flooding and the high salt/sulfur content of the soils. Kesson Fine Sand is located on site 116 of the Preserve. Additional native plants typically found in these areas are oxeye daisy (*Borrichia frutescens*) and batis (*Batis maritima*). Isles Muck, found on the west portion of site 77 and throughout the Cow Slough area of the Preserve often has batis and sea purslane (*Sesuvium portulacastrum*) in addition to mangroves. Finally, Wulfurt Muck, which is found in the northern portion of site 116 is dominated by needlerush (*Juncus roemerianus*).

Hallandale and Pompano fine sands are the only soils found at DLP that do not list specific restrictions for recreational use. For this reason, any trails that are created should be limited as much as possible to these areas.

Figure 4: Soils Map



e. Hydrology and Watershed

DLP lies within the 7 square mile Deep Lagoon Watershed (Figure 5). This watershed was channelized in the 1920's from Deep Lagoon and the Caloosahatchee River to the north and the Florida Power and Light powerline easement south of Summerlin Road. These canals were created as part of the Iona Drainage District (IDD) to drain the surrounding lands for farming and low-density residential housing. The maintenance and operation of the IDD canals are now the responsibility of Lee County Department of Transportation. The main canal, "C", runs south/north and there are 11 side canals "C-1", "C-2", etc. (Figure 6). Several of these canals are either within the Preserve, or form boundaries of the Preserve. Before the digging of these canals, the waters of Deep Lagoon Watershed and Cow Slough Watershed would only connect during extreme tidal events. Canal "C" created a direct link between the watersheds that has led to salt water intrusion into historically freshwater systems. By blocking portions of the canals, upstream (or further south) portions would become fresher and would help with restoration. Health Park's water management system, which filled canals "C-6" and "C-8" to detain water, has improved the water quality of the lakes within their property (JEI, 2002). Typically water flows north from Summerlin Road through the canal system to Deep Lagoon. Water south of Summerlin Road heads south to Estero Bay.

Another impact of the creation of the IDD canals and subsequent drainage is the invasion of exotic plants, especially Australian pines, Brazilian pepper and melaleuca. There are numerous scattered exotic monocultures, often adjacent to the canals. Once again, restoration of some of the IDD canals will help to retain water and possibly kill some of the Brazilian pepper, as well as preventing the establishment of new Brazilian pepper and Australian pine seedlings. Additionally, pushing the spoil piles back into the canals, if followed up with native plantings, will eliminate disturbed areas in which exotic plants tend to thrive.

In addition to the IDD canals, there are several ditch systems located within the northern and central portions of the Preserve. The two ditches located in the abandoned agricultural field were created for additional drainage. Although an exact date for the creation of these ditches was not available, historical aerials indicate that this field was farmed at least since 1944. The southern ditch system and the numerous ditches north of McGregor Boulevard were created for mosquito control. The southern mosquito ditches are heavily impacted with exotics (Figure 7). The southern end of this ditch was historically a small natural wetland and Land Stewardship staff has recorded the presence of numerous waterbirds and fresh water turtles.

In June 2000, Lee County Department of Parks and Recreation and the Division of Natural Resources commissioned JEI to conduct a16 month environmental study on DLP to determine how these wetlands would best be restored. It was felt by both departments that this study was essential to maintain or increase the hydraulic capacity of this system in accordance with the Lee County Surface Water Master Plan. The resulting study, Deep Lagoon Preserve Environmental and Hydrologic Assessment, included an extensive hydrologic analysis. Five monitoring wells were located within the watershed DL 1-3 are located in Canal C, DL-5 is located in adjacent wetland on the central portion of the Preserve and DL-4 was placed at the north end of the Cow Slough watershed (Figure 8). Additionally, a rain gauge was installed near DL-5. The data collected allowed engineers to verify the boundary between the two watersheds as well as confirming the un-natural connection between the two watersheds. The monitoring well located at the north end of the watershed (DL-1) is primarily influenced by tidal fluxations. The other gauges are primarily influenced by rainfall and runoff. However, during the dry season of 2001/2002 DL-2 was also influenced by the tide. This study will act as a guide for hydrological restoration and Deep Lagoon Preserve and therefore information from the report will not be duplicated in this plan.

Figure 5: Watershed Map

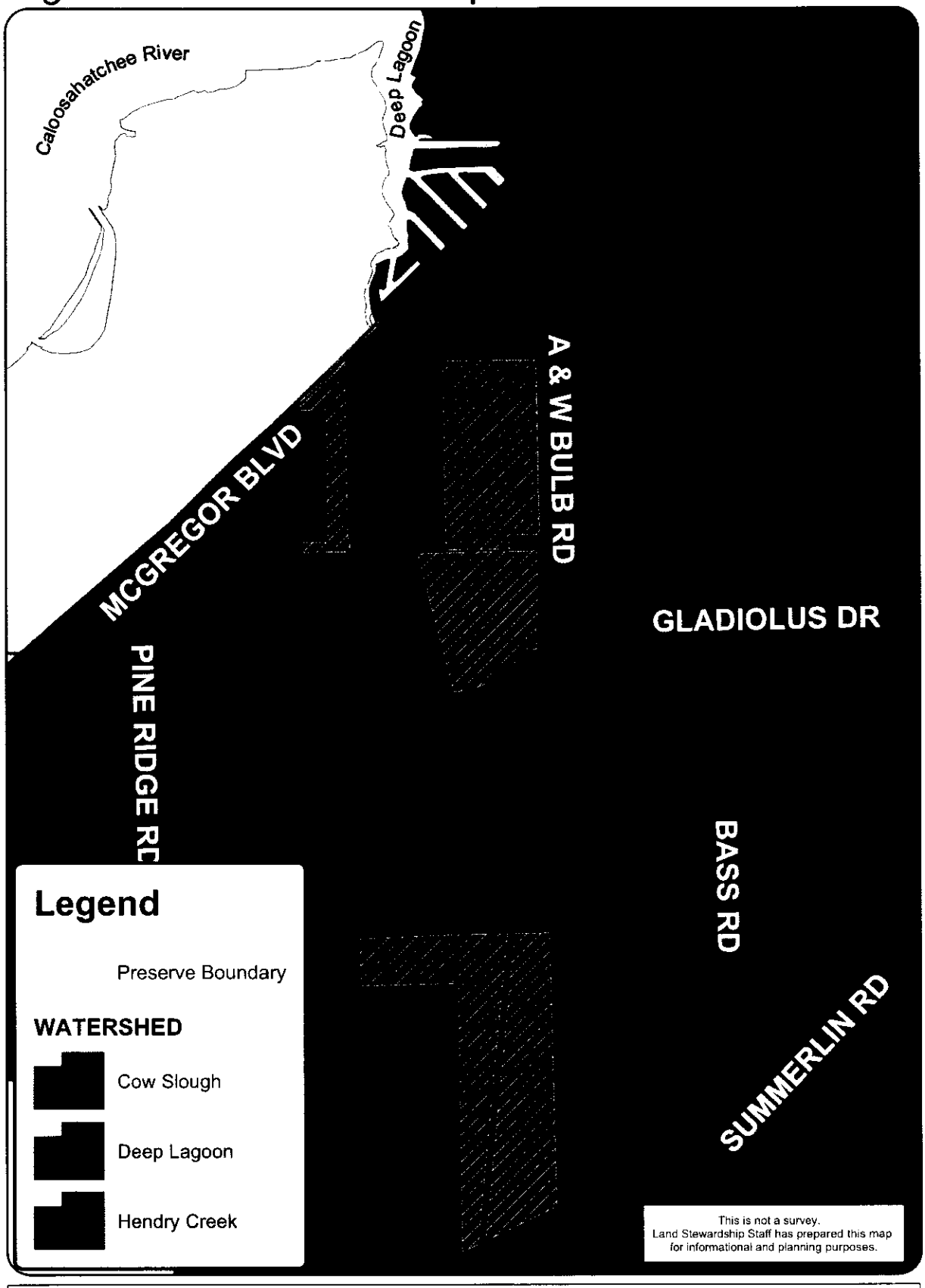


Figure 6: Iona Drainage District Canal Map

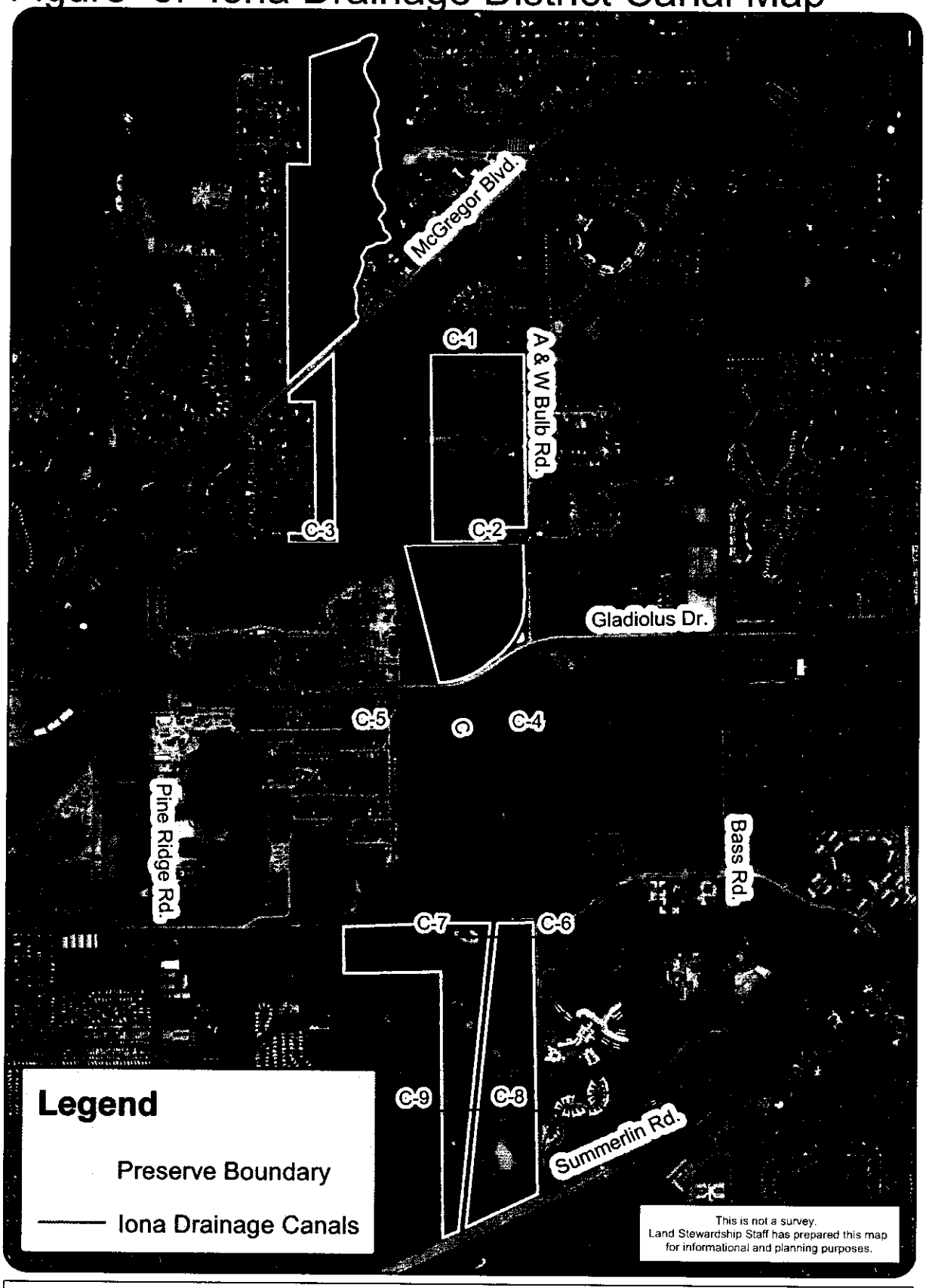


Figure 7: Additional Ditch Location Map

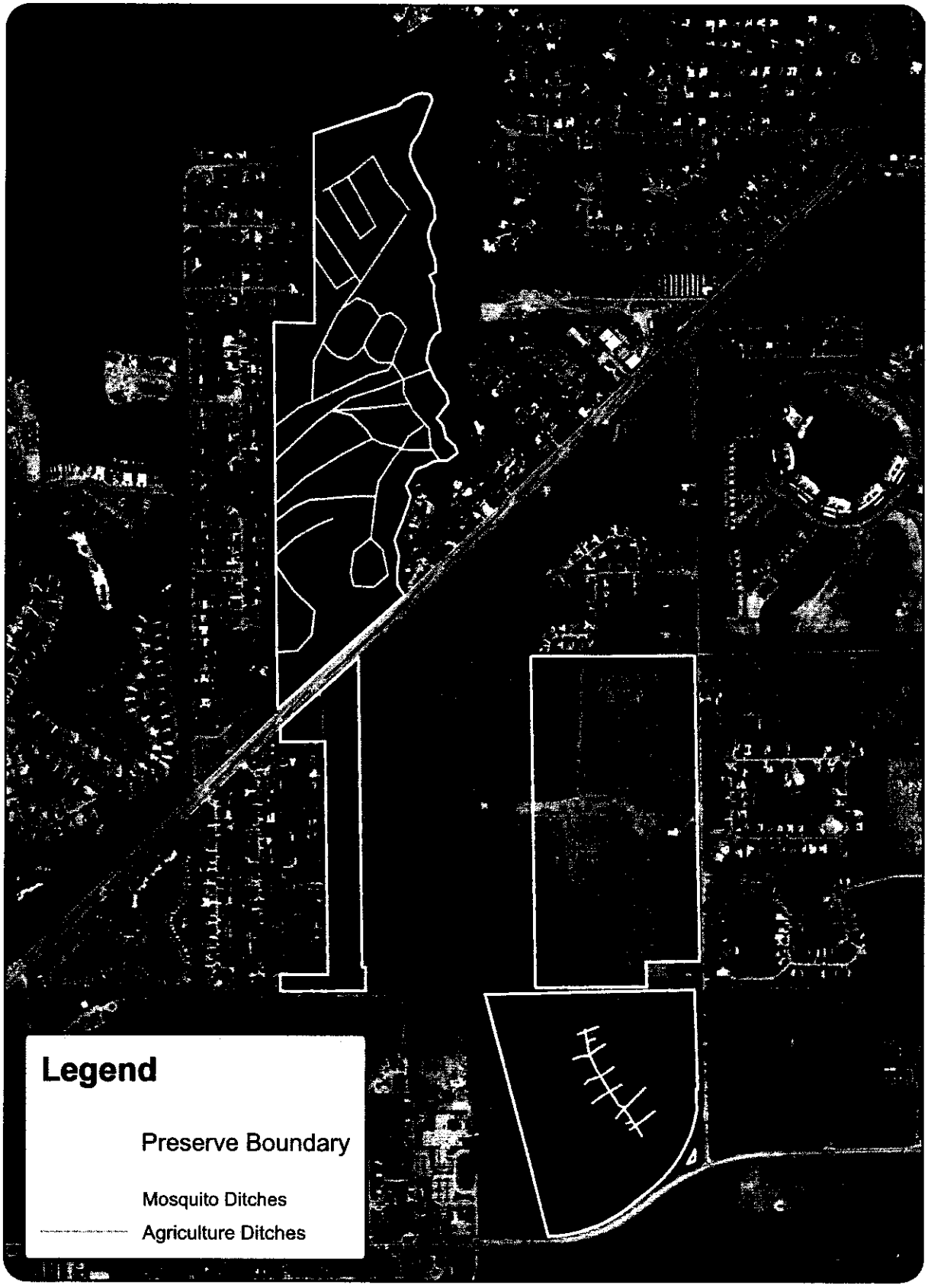
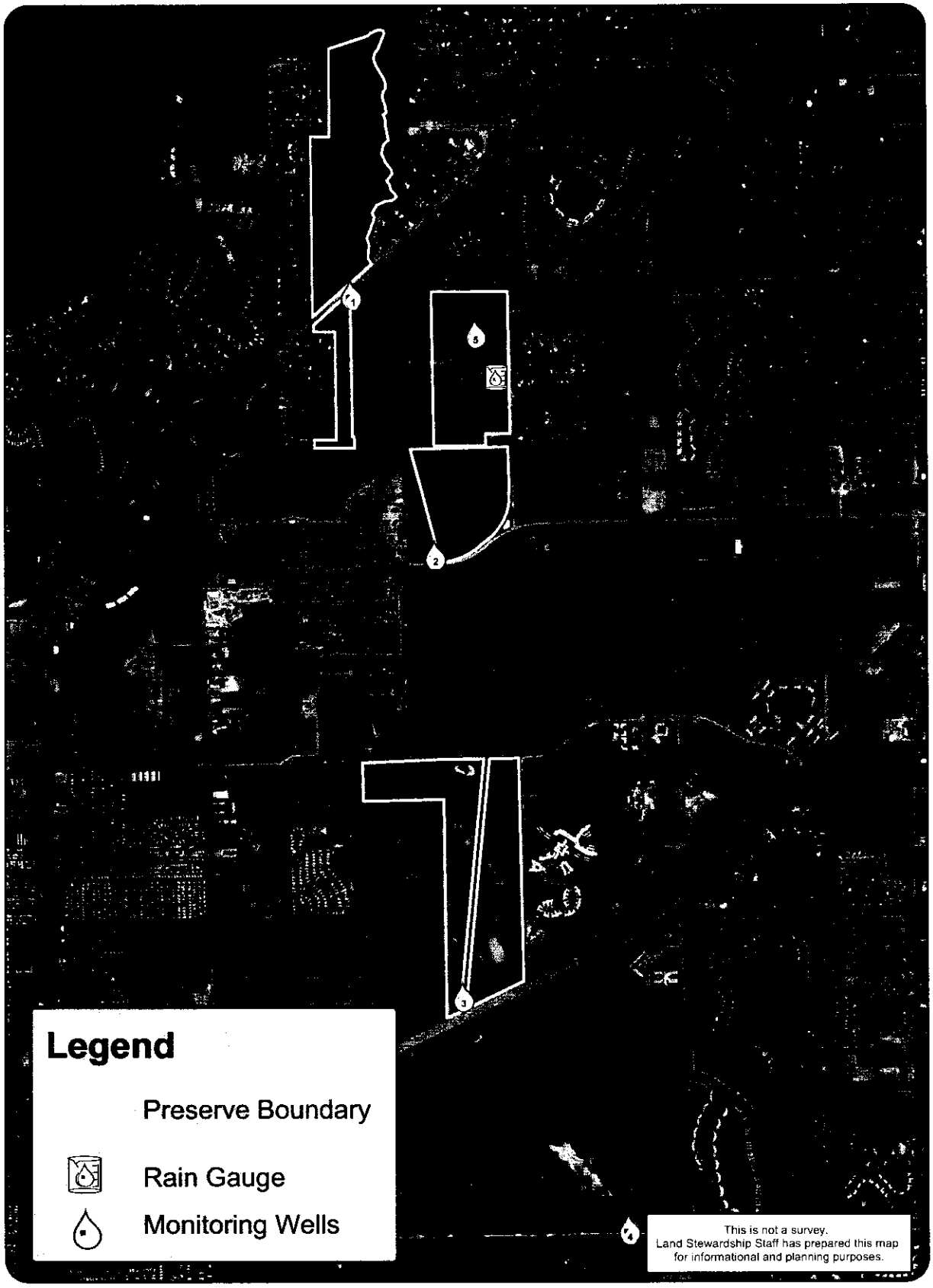


Figure 8: JEI Monitoring Wells and Rain Gauge Location Map



B. Biological Resources

a. Ecosystem Function

A mangrove swamp, such as that found at the north end of DLP, is a significant plant community because it functions as a nursery ground for most of Florida's commercially and recreationally important fish and shellfish. Mangrove swamps also provide breeding grounds for substantial populations of wading birds, shorebirds and other animals (FNAI, 1990). Although nesting has not been confirmed, it is possible that mangrove cuckoos (*Coccyzus minor*), black-whiskered vireos (*Vireo altiloquus*) and gray kingbirds (*Tyrannus dominicensis*) may utilize the mangrove swamps found throughout the Preserve for nesting. These 3 species are dependent on mangroves and their numbers are jeopardized by the fragmentation of mangrove habitat. Although they have not been documented at the Preserve, there are several wildlife species that are found exclusively in mangrove swamps including mangrove salt marsh snakes (*Nerodia clarkii* compressicauda) and at least two butterfly species, the mangrove skipper (*Phocides pigmalion*) and the black mangrove buckeye (*Junonia evarete*), that depend on mangroves as a larval food source (Postmus, per.comm.). Additionally, mangroves can produce up to 80% of the total organic material available in the aquatic food web through the continuous shedding of its leaves and other plant components (FNAI, 1990).

The upland coastal communities, especially the coastal berm and strand, act as shoreline stabilizers that also help to protect inland communities from the most severe damage of storms. This protection is dependent on the heavy vegetation and therefore damage to these areas during restoration must be minimized. Unlike the strand and berm, the coastal grassland community requires periodic overwash during extreme high tides and storms. These flooding events bring in sand which overtime gets covered with pioneer species. On the northern portion of the Preserve, the coastal grassland areas that are dominated by needlerush are particularly important. The high density of plant stems provides abundant cover for wildlife. Additionally, the rate of net primary production in these needlerush marshes is among the highest in any of the world's ecosystems (Myers and Ewel, 1990). There are many terrestrial (insects – spiders - passerine birds) and marine (microalgae and organic detritus – phytoplankton – zooplankton – filter-feeding bivalves – fiddler crabs – snails) food webs occurring within these areas.

The freshwater wetlands of south Florida are important to a variety of wildlife. Birds feed, fish and frogs live and breed, and people rely on these marshes to improve water quality. During the late spring and summer months, the rain begins to fall and the wetlands fill to capacity. Fish populations begin to increase in number and biomass. In the fall when the rains end, the water recedes and the fish are concentrated in the shallow marshes. At the same time,

fall high tides let some fish back into the bays where they contribute to the commercial and recreational fisheries. The wading birds come in to feast and this aids the remaining fish by decreasing the density and increasing the availability of dissolved oxygen. Most wildlife utilizing these communities are adapted to migrate from one wetland to another as the shallow ones dry up. DLP has a mixture of temporary and more permanent wetlands for wildlife to utilize. The deepest areas provide critical habitat for wintering waterfowl such as blue-winged teal (*Anas discors*). Plants in these areas also benefit from the seasonal wet/dry fluxuation. Most aquatic plants cannot germinate under water and require this drying phase. The plants located in the wetlands that do become completely dry die, decay and release nutrients that are bound in their tissues. This makes the soils highly productive for the next wet season. Typically these plants have low nutrient requirements so they stockpile the excess, which is beneficial to herbivores feeding upon them. When the nutrient loads become too high, cattails (*Typha* latifolia) increase (Myers and Ewel, 1990), which is evident in the furthest south portion of the Preserve.

The flatwoods and hammocks that surround these wetlands also serve as very important habitat. Several species of birds find shelter in the palmetto understory, nest in the tall pines and forage in the grasses. Many wading birds feed in the wetlands and roost/nest in the adjacent swamps and forests. Hammocks are also unique in south Florida as they provide the base for the highest number of epiphytic ferns, bromeliads and orchids in the continental United States (Myers and Ewel, 1990). Many bromeliads collect water between their leaves, serving as a habitat for small animals and a water source in drier months.

b. Natural Plant Communities

Deep Lagoon Preserve consists of 9 plant communities described by the Florida Natural Areas Inventory (FNAI) as well as several highly impacted areas that do not fit with FNAI's habitat descriptions. Figures 9 & 10 illustrate the location of each community within the Preserve. The natural communities found at DLP are defined using the Florida Natural Area's Guide to the Natural Communities of Florida (1990). Appendix A contains a complete list of plant species identified on numerous site inspections to DLP, but not necessarily a comprehensive list for the entire Preserve.

Coastal Berm Community – .78 acres, less than 1% coverage of DLP

This plant community is found in a small area on the west boundary of DLP, adjacent to a canal leading to the Caloosahatchee River that was dug between 1966 and 1972. Typically, this plant community originates from storm deposited sand, shells and debris although in this case, some of it may be artificial. This plant community consists of dense thickets of large shrubs and small trees. The three dominant plants in this area are cabbage palm (*Sabal palmetto*), melaleuca

and Australian pine. This community is often associated with and grades into tidal swamp, which occurs at the Preserve.

Coastal Grassland Community – 3.9 acres, 1% coverage of DLP

This community is found in small portions of the north end of the Preserve and just north of Gladiolus Drive in the central portion of DLP. Coastal grasslands are treeless flat lands covered by sand or low groundcover that is adapted to the harsh maritime conditions. This community is dominated by needle rush on the northern portion of the Preserve. The grassland on the central portion has a variety of plant species including sea oxeye daisy (*Borrichia frutescens*), saltwort (*Batis maritima*), saltgrass (*Distichlis spicata*) and glasswort (*Sarcocornia perennis*).

Wildlife expected in this community would include fiddler crab (*Uca sp.*), red-winged blackbird (*Agelaius phoeniceus*) and bobcat (*Lynx rufus*). A large amount of bobcat scat has been documented in the coastal grassland of the central portion of the Preserve.

Coastal Strand Community – 1.73 acres, less than 1% coverage of DLP with an additional 5.87 impacted acres, 2% coverage

This plant community is characterized as stabilized, wind deposited coastal dunes that are vegetated with a dense thicket of salt-tolerant shrubs, especially saw palmetto (*Serenoa repens*). Additional plant species found at the Preserve and considered indicators of this plant community include cabbage palm, sea grape (*Coccoloba uvifera*), lantana (*Lantana camara*), greenbriar (*Smilax sp.*), gray nicker (*Caesalpinia bonduc*), coin vine (*Dalbergia ecastaphyllum*) and Spanish bayonet (*Yucca aloifolia*). This plant community also contains a large amount of the native rouge plant (*Rivina humilis*), as well as invasive exotic Australian pine and Brazilian pepper (*Schinus terebinthifolius*). This plant community is restricted to the northern edge of DLP on the shores of the Caloosahatchee River.

Typical wildlife expected in this plant community includes gopher tortoise (*Gopherus polyphemus*), six-lined racerunner (*Cnemidophorus sexlineatus* sexlineatus) and beach mouse (*Peromyscus polionotus*). Due to its isolation, these species are not likely to reside in this portion of Deep Lagoon Preserve, however numerous birds have been documented including blue-gray gnatcatcher (*Polioptila caerulea*), gray catbird (*Dumetella* carolinensis) and downy woodpecker (*Picoides pubescens*).

Hydric Hammock Community – 42.06 acres, 11% coverage of DLP

Deep Lagoon Preserve has hydric hammock areas on both the central and southern portions. Hydric hammocks are characterized as well developed hardwoods and cabbage palms with an understory of palmetto and ferns. Typical plant species found on DLP include live oak (*Quercus virginiana*), cabbage palm, saw palmetto, myrsine (*Rapanea punctata*), poison ivy (*Toxicodendron radicans*) and swamp fern (*Blechnum serrulatum*). Brazilian pepper has invaded this plant community. Typically the areas dominated by pepper have minimal understory and scattered palms.

Wildlife typically associated with this type of plant community includes green anoles (*Anolis carolinensis*), flycatchers (Family *Tyrannidae*), warblers (Family *Parulidae*) and gray squirrels (*Sciurus carolinensis*).

Mesic Flatwoods Community – 14.08 acres, 4% coverage at DLP

The mesic flatwoods community is found in two small portions of the Preserve. Mesic flatwoods occur on relatively flat, moderately to poorly drained soils. Standing water is common for brief periods during the rainy season. Mesic flatwoods are characterized as having an open canopy with widely spaced pine trees and a dense ground cover of herbs and shrubs. Typical plants growing in these communities at DLP include slash pine, saw palmetto, staggerbush (*Lyonia fruticosa*) and wax myrtle (*Myrica cerifera*). The flatwoods found on the Preserve are highly disturbed with invasive exotic plants including melaleuca and Brazilian pepper.

Wildlife associated with this community that would likely be encountered at the Preserve include black racer (*Coluber constrictor priapus*), pine warbler (*Dendroica pinus*), hispid cotton rat (*Sigmodon hispidus*), raccoon (*Procyon lotor*) and bobcat.

Prairie Hammock Community – 2.48 acres, less than 1% coverage at DLP

A remnant prairie hammock community is located on the central portion of the Preserve, adjacent to the wet prairie. Prairie hammocks typically consist of clumps of tall cabbage palms and live oaks in the midst of prairie or marsh communities with a very open understory. The few understory plants that would be expected are wax myrtle, stoppers (*Eugenia sp.*), marlberry (*Ardisia escallonioides*) and orchids (Family: *Orchidaceae*). At Deep Lagoon, this community contains an overstory of cabbage palm, Australian pine and melaleuca. The understory is an extension of the adjacent wet prairie and improved pasture plants. Restoration at the Preserve will include planting additional hammock species in these areas.

Typical animals found in these prairie hammocks include green anole, common yellowthroat (*Geothlypis trichas*), blue-gray gnatcatcher and cotton mouse (*Peromyscus gossypinus*).

Tidal Swamp Community – 92.49 acres, 24% coverage of DLP
with an additional 103.63 heavily impacted acres, 27% coverage

Tidal swamps are characterized as dense forests located along the shorelines of southern Florida. The dominant plants in this community are black mangrove, red mangrove, white mangrove (*Laguncularia racemosa*) and buttonwood (*Conocarpus erectus*). The dominant species of mangrove found in different areas is dependant on abiotic factors such as tidal flushing and salinity.

At DLP, the peninsular portion is dominated by red mangroves and scattered black mangroves. This area is the most pristine of the tidal swamp communities, although there is scattered Brazilian pepper, melaleuca and Australian pine growing on the spoil piles associated with the mosquito ditches dug in this area. White mangroves are the dominant plant found in the tidal swamps adjacent to McGregor Boulevard. Melaleuca and Australian pines are both present in this portion of the Preserve.

For the central portion of the Preserve, there is a general trend of white mangroves to the north and buttonwood to the south. Australian pines, melaleuca and Brazilian pepper are dominant in these areas. The "tidal swamp, mixed exotics" community, found in the central portion, has very few mangroves or other native species. The western side of this section is characterized by red, black and white mangroves, Brazilian pepper and leather fern.

The southern section of the Preserve has a combination of white, red and black mangroves mixed with Brazilian pepper, cabbage palm and leather fern. By examining historical aerials, most of the area was a marsh community. Channelization may have contributed to the spread of mangrove propagules from the south. Now, the community is dominated primarily by white mangrove hammocks that are several feet above the average water level. The white mangroves in the hammocks have developed extensive adventitious roots that are uncommon.

A variety of animals utilize this community including osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), yellow-crowned night heron (*Nyctanassa violacea*), pileated woodpecker (*Dryocopus pileatus*), prairie warbler (*Dendroica discolor*) and mourning dove (*Zenaida macroura*).

Wet Prairie Community – 14.57 acres, 4% coverage of DLP

The wet prairie community is found in 3 separate areas in the central portion of the Preserve. Wet prairies are described as a treeless plain with a ground cover

of grasses and herbs including maidencane (*Panicum hemitomon*), spikerush, beaksedge (*Rhynchospora sp.*), fringed yellow stargrass (*Hypoxis juncea*), meadowbeauty (*Rhexia sp.*), yellow-eyed grass (*Xyris sp.*) and St. John's wort (*Hypericum sp.*). This community is somewhat disturbed at DLP and additional plants common to this community are climbing hempvine (*Mikania scandens*), capeweed (*Phyla nodiflora*), torpedo grass (*Panicum repens*), danglepod (*Sesbania herbacea*), and Brazilian pepper.

Wildlife that would be expected in wet prairies include Florida cricket frog (*Acris gryllus dorsalis*), yellow rat snake (*Elaphe obsolete quadrivittata*), killdeer (*Charadrius vociferus*) and marsh rabbit (*Sylvilagus palustris*).

Australian Pine – 11.48 acres, 3% coverage at DLP

Monocultures of Australian pine can be found on both the central and southern portions of the Preserve. Because of the dense leaf litter, minimal herbaceous species are present.

Australian Pine/Melaleuca – 5.36 acres, 1% coverage at DLP

This area is located in the arm of the southern portion of DLP. In addition to the mixture of Australian pines and melaleuca, there are scattered cabbage palms and Brazilian pepper. Restoration work conducted on this section of the Preserve in 2004 has removed the invasive exotics, but it will be awhile before any native plant communities become established.

Brazilian Pepper – 2.12 acres, less than 1% coverage at DLP

Also located in the arm of the southern portion of DLP are two upland pockets of Brazilian pepper monoculture.

Brazilian Pepper, Hydric – 3.07 acres, less than 1% coverage at DLP

There are small hydric Brazilian pepper areas on all three sections of the Preserve. The few native plants found in these areas include leather fern, swamp smartweed (*Polygonum hydropiperoides*), bacopa (*Bacopa monnieri*) and cabbage palm.

Brazilian Pepper/Australian Pine – 1.1 acres, less than 1% coverage at DLP

This area of exotics is found on the northeast edge of the central portion of the Preserve bordering A & W Bulb road.

Cattail Marsh – 6.99 acres, 2% coverage of DLP

On the southern portion of the Preserve, the water bodies adjacent to Summerlin Road are dominated by cattail with scattered leather fern, sawgrass and white vine. By looking at the historical aerials (Figures 11-13) these water bodies are remnants of a large tidal basin that's natural hydrology was cut off through various ditches.

Disturbed – 3.5 acres, less than 1% coverage at DLP

The vegetated field surrounding the warehouse, and enclosed by fencing, contains Bahiagrass (*Paspalum notatum*), dog fennel (*Eupatorium capillifolium*), ragweed (*Ambrosia artemisifolia*), star rush (*Rhynchospora colorata*), creeping oxeye (*Sphagneticola trilobata*) and Bermudagrass (*Cynodon dactylon*).

Ditch – 6.96 acres, 2% coverage at DLP

These are mosquito ditches, IDD canals and other areas dug for drainage and discussed in the hydrology section of this stewardship plan.

Herbaceous – Disturbed - .47 acres, less than 1% coverage at DLP

This plant community is located on the northwest corner of the furthest south section of the Preserve. It contains various exotic plants and other weeds, the most common being elephant grass (*Pennisetum purpureum*).

Improved Pasture – 36.57 acres, 10% coverage at DLP

The north - central portion of DLP consists mainly of this plant community. Typical species found in this area include Bahiagrass, Bermudagrass, carpet grass (*Axonopus sp.*), smut grass (*Sporobolus indicus* var. *indicus*), pinebarren goldenrod (*Solidago fistulosa*), danglepod, and swamp sedge (*Cyperus ligularis*).

Melaleuca – 2.21 acres, less than 1% coverage at DLP

Small areas of dense melaleuca monoculture can be found throughout the Preserve. Similar to the Australian pine and Brazilian pepper areas, there is minimal native plant understory located in these areas.

Melaleuca/Brazilian Pepper – 7.35 acres, 2% coverage at DLP

This plant community is found in the northern portion of the DLP, adjacent to Willems Road.

Open, Brackish Water – 14.16 acres, 4% coverage of DLP

There are several, irregularly shaped depressions occurring in the central and southern portion of the Preserve. These areas, like the cattail marshes, are remnants of a former large tidal basin.

Typical plants found growing on the edges of these water bodies are cattail, sawgrass (*Cladium jamaicense*), leatherfern (*Acrostichum danaeifolium*) and mangroves. This habitat is an important breeding area for numerous insects that form the base of many food chains. They are also critical watering holes for many mammals and birds. Typical animal species observed at the Preserve include mosquitofish (*Gambusia affinis*), sailfin molly (*Poecilia latipinna*), common moorhen (*Gallinula chloropus*), blue-winged teal (*Anas discors*) and little blue heron (*Egretta* caerulea).

Figure 9: Natural Plant Communities (North)

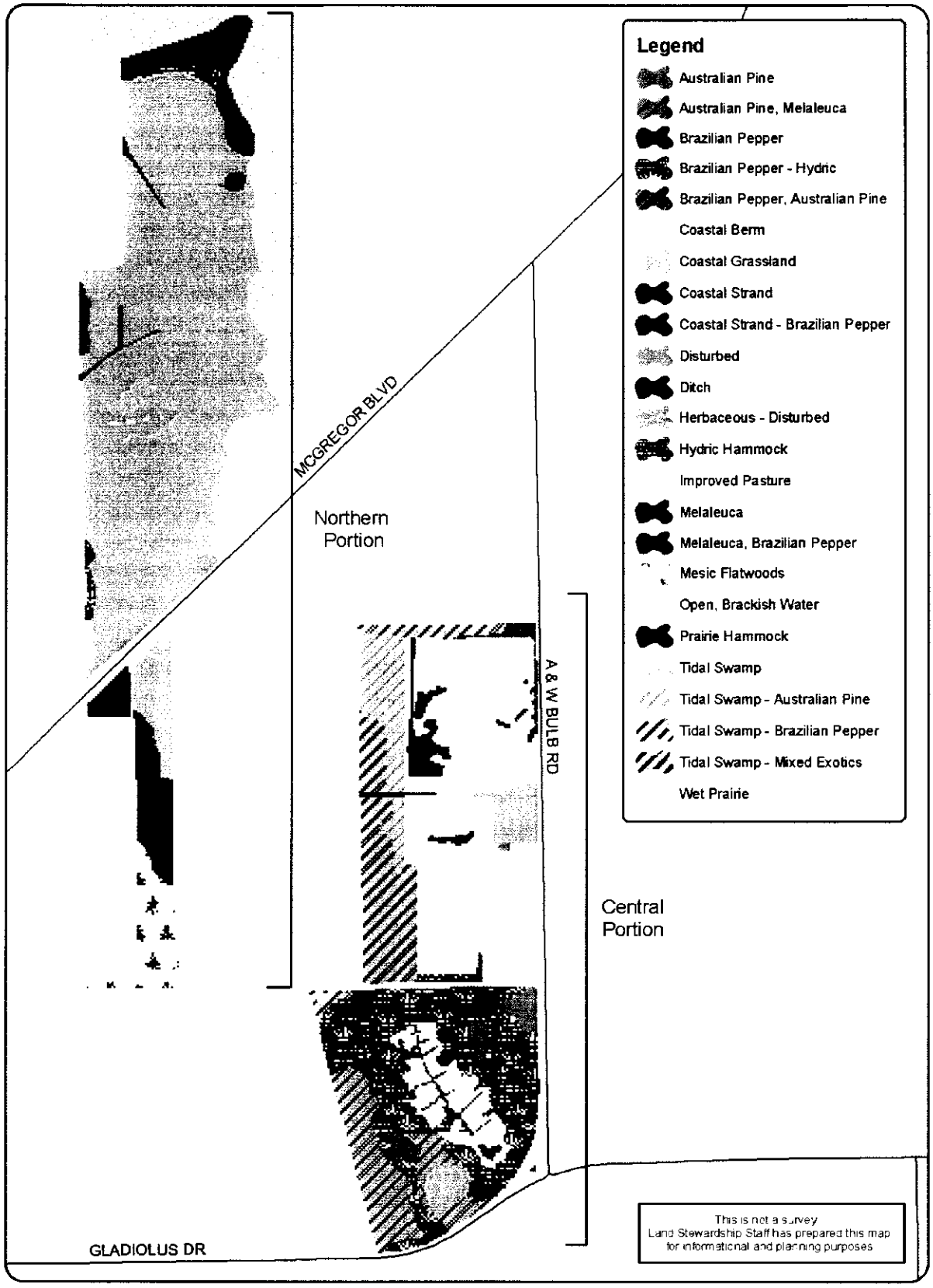
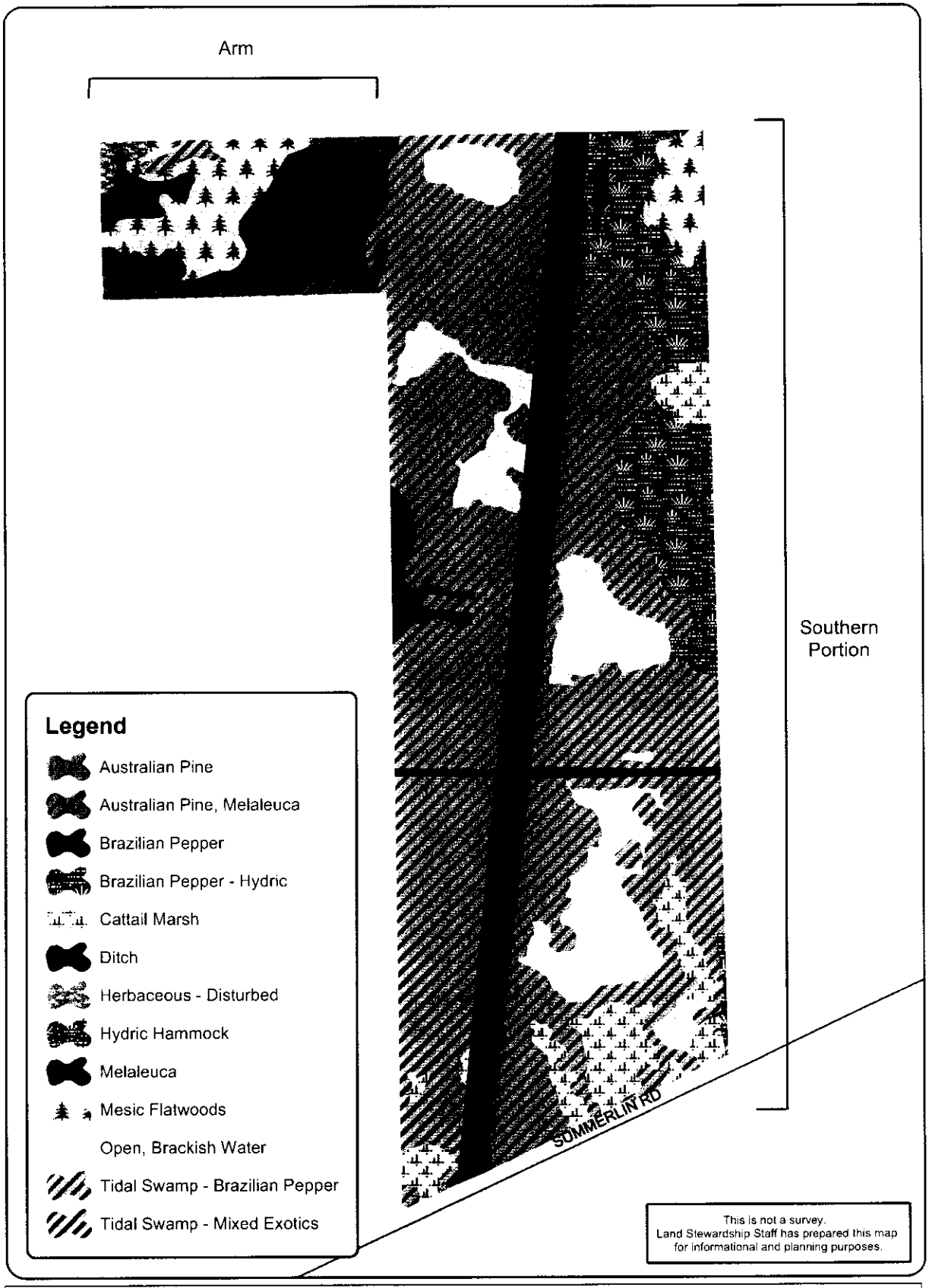


Figure 10: Natural Plant Communities (South)



c. Fauna

Deep Lagoon Preserve provides habitat for a wide variety of wildlife. Species occurring at the Preserve were recorded during quarterly site inspections by staff and by Lee County Bird Patrol volunteers. Future sightings will continue to be recorded. See Appendix B for a complete list of wildlife documented at the Preserve.

The tidal swamp community consists mainly of red, white, and black mangrove, and buttonwood. It is a vital habitat to many animals, such as turtles, frogs, snakes, lizards, raccoons, river otters, many birds, and fish. Many fish take advantage of the protection that the mangroves provide for their nurseries. Wading birds such as wood storks (*Mycteria americana*), white ibis (*Eudocimus albus*), and roseate spoonbills (*Ajaia ajaja*), use large mangroves as nesting and roosting sites. Although these species have not been documented utilizing the Preserve for this purpose, both yellow-crowned night heron and mourning dove nests have been documented.

There are a few small, scattered areas of the coastal grassland community. A few animals have adapted to this unstable area that often fluctuates between dry periods and inundation, but most are just transients that visit the area. Some examples of these animals include ghost crabs (*Ocypode quadrata*), red-winged blackbirds and raccoons.

The tidal marsh community provides abundant food and cover for a variety of wildlife, however the harsh environmental conditions reduce the overall diversity as compared to other habitats. Salt marsh invertebrates such as Atlantic grasshoppers (*Paroxya atlantica*), juice-feeding plant hoppers (*Prokelesia marginata*) and salt marsh periwinkles (*Littorina irrorata*) are permanent residents of this community (Myers, 1990, Capinera, 2001). A number of birds utilize this to forage on these invertebrates.

There are numerous freshwater habitats scattered throughout DLP. Turtles have been documented in these areas, as well as using nearby high spots for nesting. Waterbirds, such as mottled ducks and common moorhens are typically found in the deeper aquatic habitats. Wet prairie communities typically have small, minnow-sized species of fish such as mosquitofish and least killifish (*Heterandria formosa*). Amphibians utilize these habitats for breeding and laying eggs. Some waterbirds, such as green herons (*Butorides striatus*), white ibis, red-winged blackbirds and boat-tailed grackles (*Quiscalus major*) are particularly dependant on freshwater marshes (Myers, 1990).

The upland portions of the Preserve, prairie hammock and mesic flatwoods, are impacted with invasive exotics but still contain a diversity of wildlife. Both green and squirrel treefrogs (*Hyla squirella*) have been documented calling from these

habitats. A variety of smaller birds such as flycatchers, woodpeckers and warblers utilize these plant communities.
There are large areas in Deep Lagoon Preserve that are primarily monocultures of Australian pine, Brazilian pepper and melaleuca. These areas provide diminished habitat value for native wildlife and thus exhibit low biodiversity. There is a bald eagle nest in the central portion of the Preserve that was built in an Australian pine tree and is surrounded by several acres of Australian pines and melaleuca.

d. Designated Species

There are a variety of listed animal and plant species found at Deep Lagoon Preserve (Table 1). Although all native plant and animal species found at the Preserve have some protection due to the preservation of this property, certain species need additional attention. For stewardship purposes, all plants and animals listed by the U.S. Fish and Wildlife Service (USFWS), Florida Fish and Wildlife Conservation Commission (FWC), Florida Department of Agriculture and Consumer Services (FDACS), Florida Natural Areas Inventory (FNAI) and/or the National Marine Fisheries Service (NMFS) will be given special consideration.

Typically, designated species will benefit from proper management of the biological communities in which they occur. However, some species may require additional measures to ensure their protection. Staff is currently evaluating monitoring methods to determine if management techniques on all Conservation 20/20 Preserves are effective. Management practices at the Preserve including exotic plant control, prescribed burning and/or mechanical brush reduction, trash removal, wildlife monitoring, restricting trails in certain areas and enforcement of no littering, no weapons and no motorized vehicles regulations will all help with the protection of listed species. Finally, in areas where extensive exotic plants are removed, the area may be replanted with native plants.

Table 2 documents listed species both known and expected to be found at DLP, followed by a brief summary of each species explaining why they are in decline and the specific management measures at the Preserve that will be taken to protect them. If more listed species are documented on the Preserve they will be added to this list.

Table 2: Designated Species

Scientific Name	Common Name	FDACS	FNAI	FWC	NMFS	USFWS	Occurrence
FISHES							
Pristis pectinata	smalltooth sawfish				E		confirmed
REPTILES							
Alligator mississippiensis	American alligator		G5/S4	SSC		T (S/A)	confirmed
BIRDS							
Coccyzus minor	mangrove cuckoo		G5/S3				expected
Egretta caerulea	little blue heron		G5/S4	SSC			confirmed
Egretta thula	snowy egret		G5/S3	SSC			confirmed
Egretta tricolor	tricolored heron		G5/S4	SSC			confirmed
Eudocimus albus	white ibis		G5/S4	SSC			confirmed
Grus canadensis pratensis	Florida sandhill crane		G5T2T3/ S2S3	T			expected
Haliaeetus leucocephalus	bald eagle		G4/S3	T		T	confirmed
PLANTS							
Acrostichum aureum	golden leather fern	T					confirmed
Encyclia tampensis	Florida butterfly orchid	CE					confirmed
Tillandsia balbisiana	northern needleleaf	T					confirmed
Tillandsia fasciculata	cardinal airplant	E					confirmed
Tillandsia flexuosa	twisted airplant	T					confirmed
Tillandsia utriculata	giant airplant	E					confirmed

Key

FDA = Florida Department of Agriculture and Consumer Services

FNAI = Florida Natural Areas Inventory

FWC = Florida Fish and Wildlife Conservation Commission

NMFS = National Marine Fisheries Service

USFWS = United States Fish & Wildlife Service

E = Endangered
T = Threatened
SSC = Species of Special Concern
CE = Commercially Exploited
G5 = Globally Secure
G4 = Globally Apparently Secure
T3 = Subspecies of Special Population Rare
T2 = Subspecies of Special Population Imperiled

T (S/A) = Threatened due to Similarity of Appearance

S4 = Florida Apparently Secure
S3 = Florida Rare
S2 = Florida Imperiled

The following are brief descriptions of the species listed in Table 1, as well as management recommendations for DLP in regards to the life history needs of each species.

Smalltooth Sawfish

A small group of smalltooth sawfish (*Pristis pectinata*) has been sighted one time off the coast of Deep Lagoon Preserve (Smith, pers. comm.). According to the National Marine Fisheries Service, this species is vulnerable to overexploitation because of their propensity to entangle in fishing nets, their slow rate of growth (taking about 10 years to become sexually mature) and their limited habitat, living in shallow waters very close to shore over muddy and sandy bottoms. The primary conservation concerns for this species are bycatch in various fisheries and habitat degradation.

The state of Florida has prohibited the taking of sawfish. Mote Marine Laboratory in Sarasota, FL has a public sightings database to help researchers better determine the distribution, abundance and habitat use patterns of sawfish. If a smalltooth sawfish is recorded in the waters off of Deep Lagoon Preserve, staff will report it to Mote Marine using the format outlined at: http://www.mote.org/%7Ecolins/ReportASawfish/ReportSawfsih.htm.

American Alligator

American alligators (*Alligator mississippiensis*) have recovered dramatically since the 1960's. There are even some populations large enough to support limited harvests. Pollution and destruction of wetlands are currently the main threat to this species. Protecting wetlands from ditching, filling and pollution are the management recommendations for this species (Hipes et. al. 2000).

The hydrologic restoration activities planned for Deep Lagoon Preserve will benefit this species.

Mangrove Cuckoo

The mangrove cuckoo has not been documented at DLP, but its secretive nature makes it likely to be overlooked. These birds are found in Lee County throughout the year, with their numbers increasing during the summer breeding season. Although little is known about the life history of this species, it is known that unfragmented mangrove forests are essential for their survival (Hipes et. al 2000).

Proper management of DLP will benefit this species.

Little Blue Heron, Snowy Egret, Tricolored Heron, White Ibis

The little blue heron's (*Egretta caerulea*) and the tricolored heron's (*E. tricolor*) and snowy egret's (*E. thula*) decline are due to loss of freshwater wetlands and alteration of their natural hydroperiod. There is also some indication that pesticides and heavy metal contamination may affect little blue herons and human disturbance to rookeries may be an increased factor for the white ibis (Hipes et. al. 2000).

Removing invasive exotic plants, restoring the improved pasture and hydrologic restoration activities will benefit this species.

Florida Sandhill Crane

Florida sandhill cranes (*Grus canadensis pratensis*) and the migratory greater sandhill crane (*Grus canadensis tabida*) are indistinguishable from each other. Although Florida sandhill cranes have not been documented, crane sightings at the Preserve have been during the winter migratory season (October-March), the shallow freshwater wetland habitats found in portions of the Preserve make it possible for the Florida sandhill crane to occur. Threats to Florida sandhill cranes include loss and degradation of wetlands, fire suppression, free ranging dogs and cats and entanglement in fencing (Rodgers et. al., 1996).

Management practices at Deep Lagoon Preserve that will benefit sandhill cranes (both migratory and non-migratory sub-species) include hydrologic restoration, improved pasture restoration and exotic plant removal.

Bald Eagle

Bald eagle numbers have steadily increased in Florida after a low of 120 active nests in 1973 (Hipes et. al. 2000). Still, loss of habitat and human disturbance due to development is a primary concern for this species.

There is a bald eagle nest located in an Australian pine at DLP. Although not used every year, the area will be protected according to Federal and local laws. Any land stewardship activities conducted will minimize disturbance to this nest, as well as any future nesting sites the eagles may utilize. During site inspections Land Stewardship staff will monitor any nesting activities from a distance. Additionally, bird patrol volunteers assigned to the Preserve are always on the look out for nesting activity and report their findings to staff.

Golden Leather Fern

Golden leather fern is found in mangrove swamps, saltwater and brackish marshes and coastal hammocks. Its range is restricted to the southern coastal regions of Florida. It has been documented in several portions of DLP.

There appears to be a healthy population of this fern in the Preserve. During exotic plant removal or other restoration activities, staff will survey the area before work commences to look for and mark, if necessary, areas to avoid.

Florida Butterfly Orchid

Although locally abundant (Brown, 2002), the Florida butterfly orchid (*Encyclia tampensis*) is designated as Commercially Exploited by the FDACS. A plant that is designated as "Commercially Exploited" is considered to be threatened by commercial exploitation. Butterfly orchids are not allowed to be collected, injured or destroyed on public lands and strict limits for collection are permitted on private lands (with permission from the land owner).

Florida butterfly orchids are scattered in a few areas of DLP. When creating any trails, consideration will be made to avoid areas where these plants are growing. If the plants will be damaged during restoration activities, a permit will be obtained from FDA to remove them before work commences. Plants growing on invasive exotic vegetation destined to be destroyed will be relocated on the site if economically feasible.

***Tillandsia* Species**

The northern needleleaf (*Tillandsia balbisiana*), cardinal airplant (*Tillandsia fasciculata var. densispica*), twisted airplant (*Tillandsia flexuosa*) and giant airplant (*Tillandsia utriculata*) are all found in scattered populations throughout the Preserve. Threats to this species include illegal collecting, the exotic Mexican bromeliad weevil (*Metamasius callizana*) and habitat destruction. All four species were considered to be fairly common before the introduction of the weevil (Save, 2004).

During exotic plant removal or construction of any public use areas, staff will survey the area before work commences to look for and mark, if necessary, areas to avoid. Plants growing on invasive exotic vegetation destined to be destroyed will be relocated on the site if economically feasible. Currently, scientists are researching biological control agents for the exotic Mexican bromeliad weevil. Staff will keep current with the research developments and work with scientists in the future if it is determined that these insects are affecting epiphytes and the USDA is in need of release sites.

e. Biological Diversity

Biodiversity at Deep Lagoon Preserve varies depending on the habitat, but should increase significantly as invasive exotic plants are removed. Currently there are >100 plant species (23 exotic) and 70 animal species. Because almost 1/4th of the plants are exotic the number of species may actually decrease after restoration. It will be interesting to compare the numbers for the 5-year revision

of the plan. Freshwater communities including the wet prairies and coastal dune lakes vary from very low diversity in the cattail marshes at the southern section of the Preserve to fairly high in the central portion's wet prairie where there is a greater abundance of plant and animal species. The upland plant communities at the Preserve currently have limited diversity due to the prominence of invasive exotic plants. In general, the coastal upland communities in southwest Florida (coastal strand and coastal berm at DLP) tend to be less diverse than on the east coast (Myers, 1990).

The biological integrity and diversity of the DLP and its associated waters must be protected when and where possible. Management staff will perform the following actions in this regard.

- ✓ Control of invasive exotic vegetation and annual follow-up maintenance will provide more suitable habitat for native aquatic and terrestrial species.

- ✓ Removal of any debris and prevention of future dumping on site will help improve and protect water quality.

- ✓ Removal of hazardous debris such as monofilament line and other potential entrapment debris will also contribute to the quality of surrounding waters and help to protect the species that utilize them.

- ✓ On-going species surveys conducted by volunteers and staff will help catalogue and monitor the diversity that is present.

- ✓ Hydrologic restoration in the form of plugging the numerous ditches to slow water drainage and help resume natural hydroperiods.

- ✓ Implement a mechanical brush reduction program to closely mimic the natural fire regimes for mesic flatwoods to increase plant diversity and insure the canopies remain open.

C. Cultural Resources

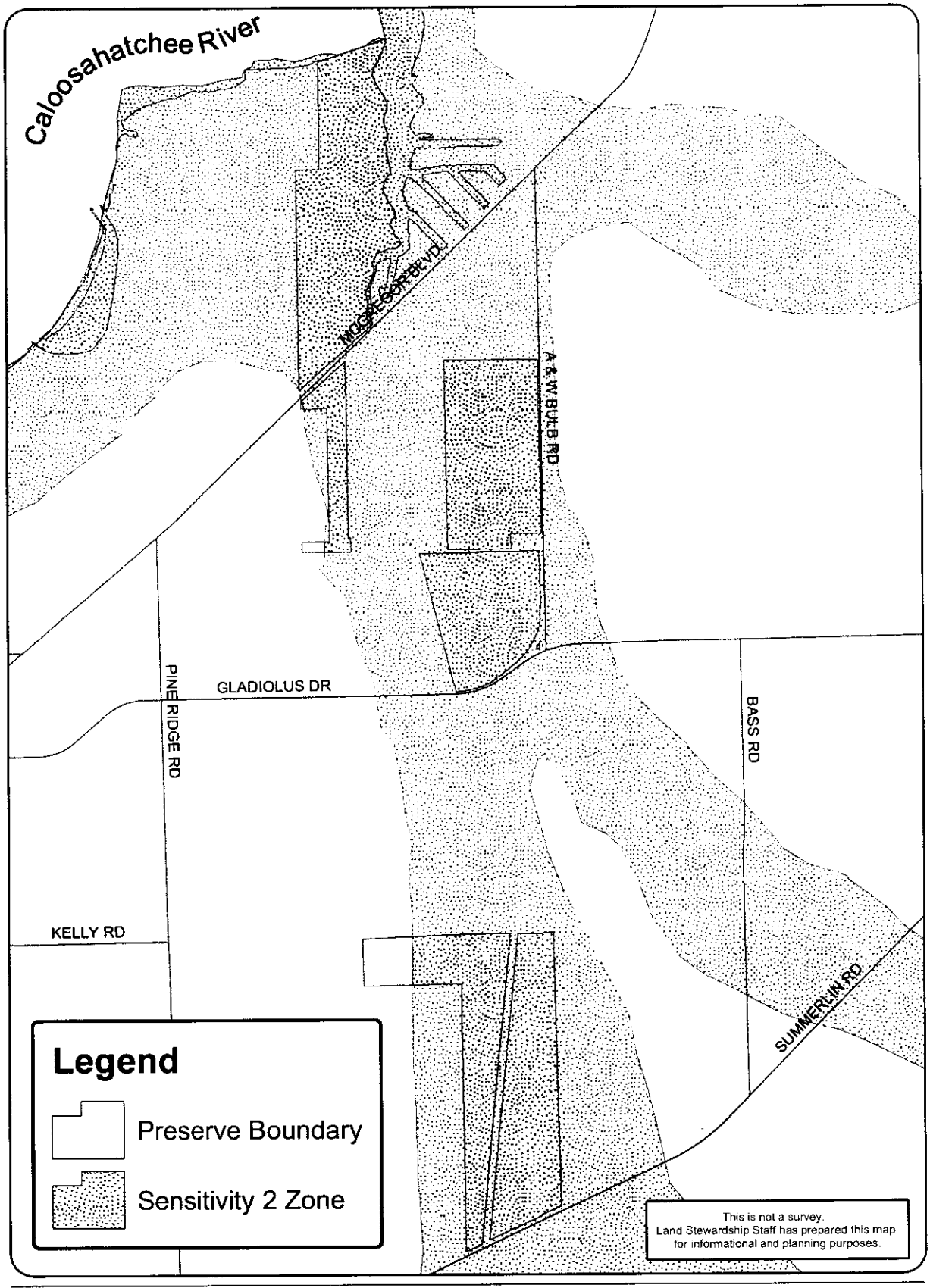
a. Archeological

In 1987, Piper Archaeological Research, Inc. conducted an archaeological site inventory of Lee County. They were able to identify 53 sites increasing the total number of known archaeological sites in Lee County to 204. They also created a site predictive model and archaeological sensitivity map for the county that highlighted potential areas likely to contain additional archaeological sites. The majority of Deep Lagoon Preserve lies within the study's "Sensitivity Level 2" area (Figure 11). The study defines this level as "areas that contain known archaeological sites that have not been assessed for significance and/or conform

to the site predictive model in such a way that there is a high likelihood that unrecorded sites of potential significance are present. If these areas are to be impacted, then they should be subjected to a cultural resource assessment survey by a qualified professional archaeologist in order to 1) determine the presence of any archaeological sites in the impact area and/or 2) assess the significance of these sites." (Austin 1987).

If there will be any major soil disturbance during restoration of the Preserve or during the development of public use facilities, a professional archaeologist will be hired to conduct a survey of the area to be impacted. If evidence of shell middens or other artifacts are found in the area, the Division of Historical Resources will be immediately contacted and protection procedures will comply with the provision of Chapter 267, Florida Statutes, Sections 267.061 2(a) and (b). Collection of artifacts and/or any disturbance to the archaeological site will be prohibited unless prior authorization has been obtained from the Department of State, Division of Historical Resources. Also, the site will be managed in coordination with recommendations from the Division of Historical Resources and, if necessary, the site will be kept confidential with periodic monitoring for impacts. If any significant archaeological resources are found and confidentiality is not found to be necessary, they will be incorporated into the public education program.

Figure 11: Archaeological Sensitivity Map



b. Land Use History

People have impacted Deep Lagoon Preserve since the 1920's when the entire watershed was channelized to drain the land for farming and low-density residential development. Historical aerials, Figures 12 through 14, show some of the changes that happened between 1944 and 1958.

The northern portion of DLP, which today is a peninsula, was part of the mainland until some time between 1966 and 1972 when a canal was dug separating most of that portion of the Preserve from adjacent residential development. Between 1972 and 1977 the canal was extended to the Caloosahatchee River and a deeper channel was dug, creating the peninsula. Other earlier changes that can be observed in Figure 13 are the extensive ditching for mosquito control as well as the clearing of the northeast corner of the Preserve between 1953 and 1958. This area re-vegetated with Australian pines and Brazilian peppers starting sometime between 1958 and 1966. A final development impact on this portion of the Preserve occurred between 1996 and 1999 associated with the widening of McGregor Boulevard. A spoil pile was deposited on the Preserve, adjacent to the road, where it remains today. A natural impact to the peninsula occurred when a Category 4 hurricane (Charley) entered Lee County on August 13, 2004. Numerous Australian pines blew down during the storm, especially in the northeast corner.

Immediately to the south of this section of the Preserve is a narrow strip that previously consisted of tidal swamp and flatwoods that were very open with widely scattered pine trees. Between 1953 and 1958, Willems Road was constructed on the west boundary of the Preserve and between 1966 and 1972 a road and ditch were constructed on a portion of the east boundary, which was not maintained. Between the boundary roads, no development took place, however after 1972 there is an obvious increase in the amount of canopy trees, including both native slash pine and invasive exotics.

The central portion, now consisting of improved pasture, was farmed by A & W Glads, Inc. from the mid 1930's to the mid 1980's. The existing warehouse on this portion of the Preserve was originally built for the sorting and packing of gladiolus flowers. The existing warehouse was one of several buildings on this portion of the property used for gladiolus bulb storage that were demolished between 1984 and 1990. Farm residences were built between 1958 and 1966 on the north end of the fields that were removed during the same time as the bulb storage buildings. Between 1944 and 1953 an airstrip was cleared which was used for insecticide and fungicide application on gladiolus fields in the area. The last chemical mixing and loading on the property would have happened in the late 1980's and there is minimal risk of these chemicals remaining in the environment because of the low half lives of the chemicals used (Water, 1999). In 1990, Southern Yacht Sales owned the property comprising the central portion of the Preserve fronting A&W Bulb Rd. During the 2 years that they owned the

property, a 1,000-gallon gasoline underground storage tank was removed along with 12 tons of contaminated soil. By 1993, the Florida Department of Environmental Protection issued a "No Further Action" letter stating the site had been adequately cleaned up. A final point of interest upon reviewing the historical aerials of this portion of the Preserve is the obvious increase in Brazilian pepper trees, Australian pines and melaleuca from 1966 to the present.

Directly to the south of the area described above is a portion of the property that has had comparatively few impacts. In addition to the ditches on the west and north boundaries that were dug in the 1920's, the only development was an irregularly shaped mosquito ditch dug between 1966 and 1972. The aerials from 1972 to the present show an increase in Brazilian pepper from the ditches outward, as well as an increase in melaleuca and Australian pines.

The Cow Slough property (furthest south) had very few changes after the IDD canals were dug in the 1920's beyond an increase in invasive exotic plants. The arm of this Property was acquired by Lee County and used as a landfill in 1972.

Figure 12: 1944 Aerial Photograph

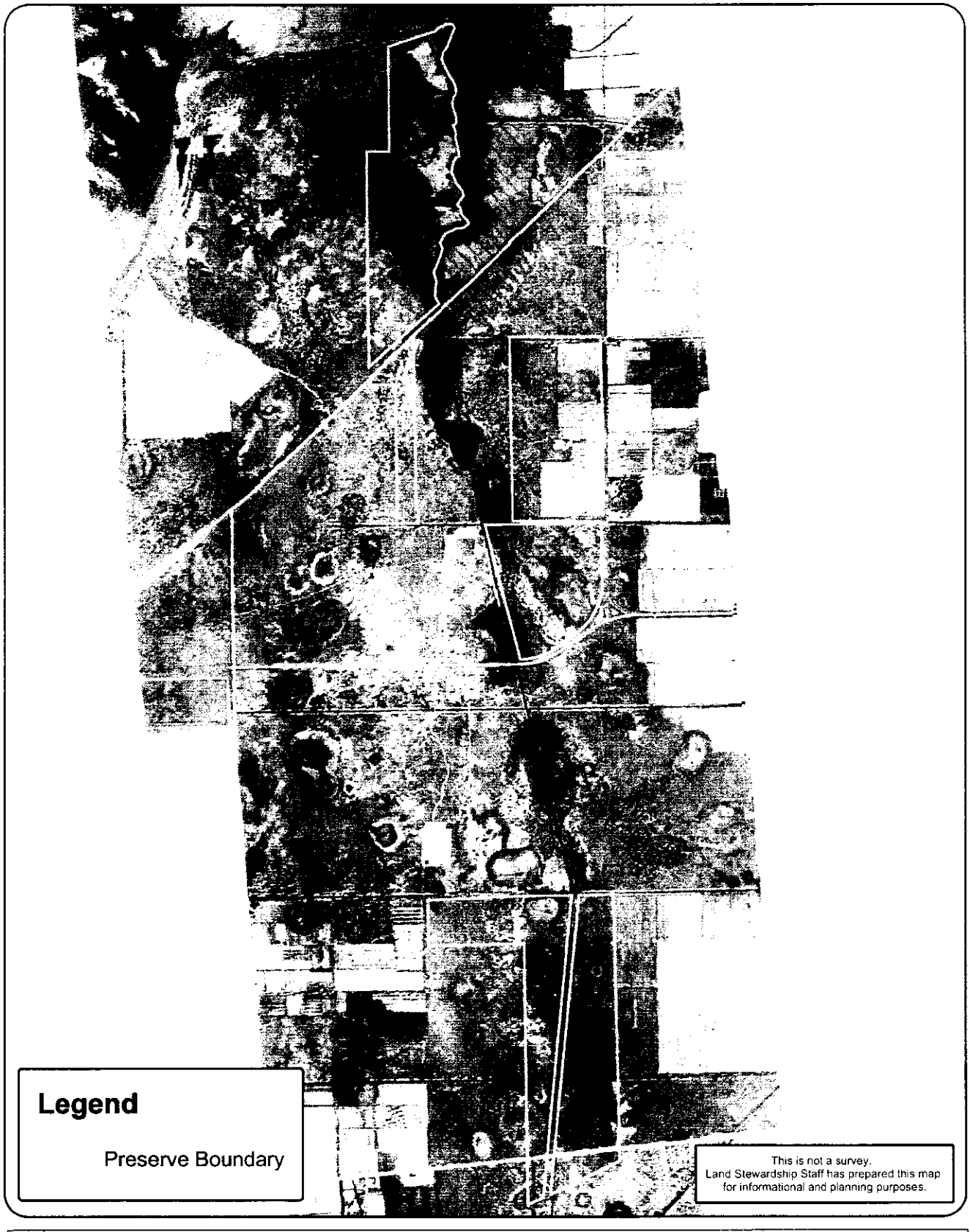


Figure 13: 1953 Aerial Photograph

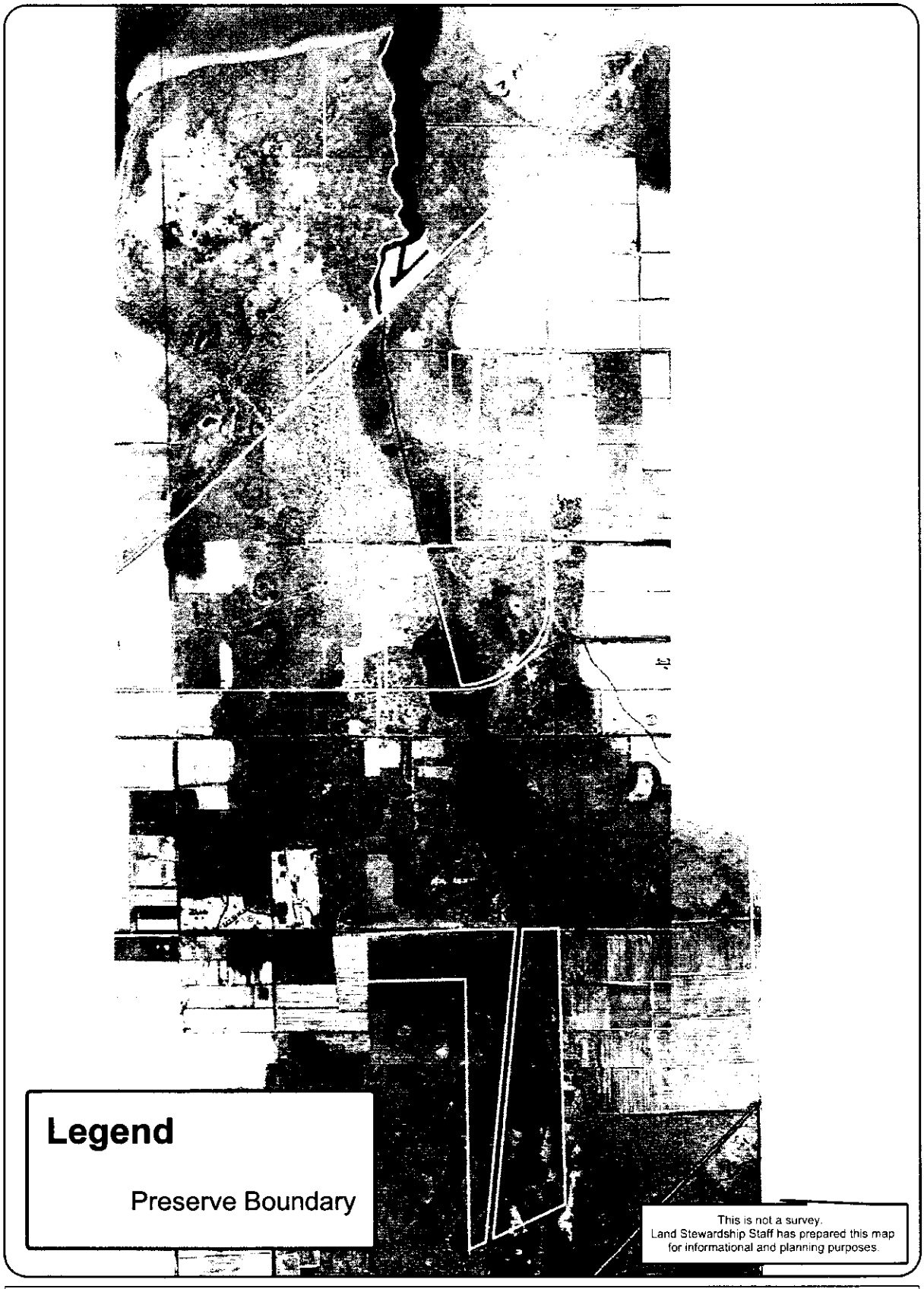
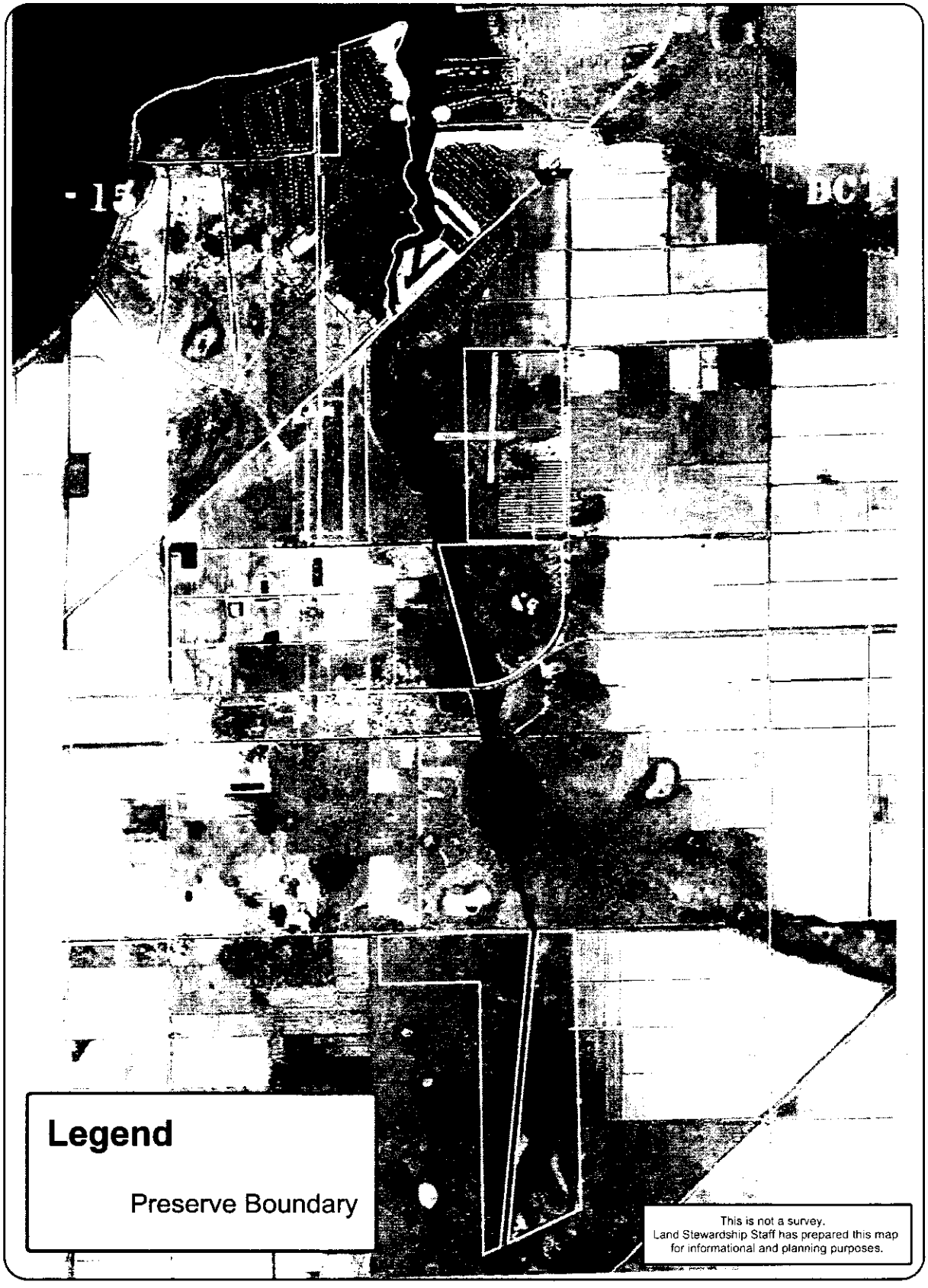


Figure 14: 1958 Aerial Photograph



c. Public Interest

Since acquiring Deep Lagoon Preserve, there has been occasional contact from the public about the Preserve. The two issues that typically arise are about the bald eagle nest, located on the central portion of the Preserve, and concerns with the boundary adjacent to Willems Road. Staff has also received numerous calls from private contractors interested in renting or buying the storage building located in the central portion of the Preserve and fronting on A&W Bulb Rd. These callers are advised that it is being used by this Department and will continue to be used for storage on a long-term basis, and therefore not available for rent or sale.

Lee County Parks and Recreation has a very active group of volunteers called the Bird Patrol that monitor numerous parks and preserves at least once a month and reports their observations to Land Stewardship staff. Currently, there are two Bird Patrol volunteers that monitor DLP and the bald eagle nest. Additionally, there is at least one neighbor that keeps an eye on the nest and has called a couple of times to report his observations.

Neighbors living adjacent to DLP along Willems Road have called on occasion to request trimming of vegetation on the west boundary of the Preserve as well as to report management concerns, especially dumping. In response to neighbors' requests, staff has cleared the invasive exotic plants from the boundary adjacent to Willems Road in September 2003. Additionally, a 2-sided newsletter was mailed to all residents of Willems Road that covered topics including:

- Horticultural and other dumping
- Motor vehicle use
- Melaleuca psyllids – biological control agent

Although problems with dumping continue on occasion, staff will continue to work with residents so that they feel ownership of the Preserve and work with us to help protect it.

County staff maintains a mailing list of private citizens that have requested to be notified of meetings concerning this Preserve and an opportunity to review land stewardship plans.

V. Factors Influencing Management

A. Natural Trends and Disturbances

Natural trends influencing land stewardship at Deep Lagoon Preserve include hurricanes, flooding, the pattern of wet and dry seasons, wildfire, and eagle nesting season. Construction of potential facilities will need to take into

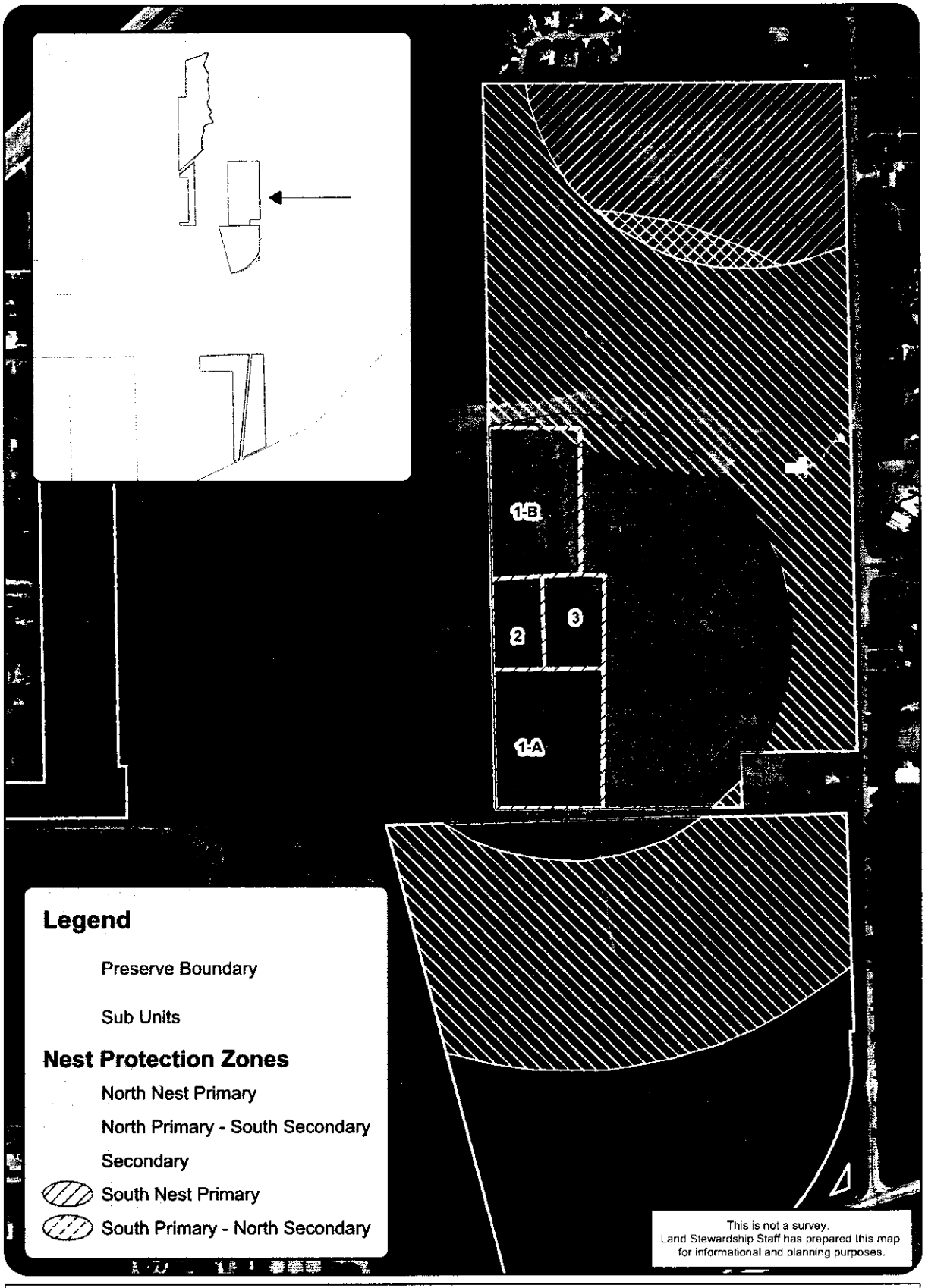
consideration the possibility of tropical storms and flooding. A significant storm could damage the vegetation and it may be necessary to bring in heavy equipment to remove vegetation after a storm. An additional impact from hurricanes is the increased fuel loads from downed trees. The pattern of wet and dry seasons will be most influential on exotic plant removal projects to ensure that herbicide is not washed off during a typical summer thunderstorm. Also, herbicides used will need to take into consideration flooding and submerged vegetation. Heavy equipment will only be able to access most areas of the Preserve during the dry season.

Wildfires caused by lightning are a natural occurrence in Florida. The northern portion of the Preserve creates a challenge due to the dense palmetto growth and proximity of residential communities. This area is not very conducive to using prescribed fires as a management tool, so as an alternative, a mechanical fuel reduction program will be established. The timing of mechanical brush removal will also be influenced by seasonal rain patterns and presence of gopher tortoises. The latter refers to the fact that roller chopping type equipment utilized for fuel reduction must be used during cold weather spells when gopher tortoises are typically deep within their burrows and out or harms way, since roller choppers dig into the ground a few inches.

When any public use facilities are constructed, there will be some disturbance to the habitat. Necessary precautions will be taken to minimize damage to the environment, particularly when using heavy equipment.

There is a bald eagle nest located on the Preserve in an Australian pine/melaleuca monoculture. Restoration in this management unit will need to be phased slowly over a number of years to minimize disturbance to the nest. In 2004, these eagles built a new nest just north of the Preserve. Any stewardship activities within the primary buffer zone of the active eagle's nest will be done under the advisement of Lee County's Eagle Technical Advisory Committee (ETAC) and, if necessary, the United States Fish and Wildlife Service (USFWS). See Figure 15 for approximate locations of eagle nest protection zones. All restoration activities will need to be conducted outside of the nesting season (October 1 – May 15). Future trails established on the Preserve will be located outside of the primary zone and trails located in the secondary zone would be closed during nesting season so that the public does not disturb the nesting area. If necessary, signs will be posted during the nesting season advising visitors of the importance of not disturbing the area.

Figure 15: Eagle Nest Protection Zones and Sub-Unit Map



B. Internal Influences

There are a variety of human influences that impact Deep Lagoon Preserve from within. Ditches have been dug for mosquito control and drainage. Extensive clearing on the extreme northeast corner has grown back with invasive exotic plant species. There is an active cattle lease on a portion of the Preserve and interior fencing exists for this purpose. This same area has been farmed since the 1920's and there is a warehouse on the Preserve located in a disturbed field near A&W Bulb Rd. There is also a billboard lease on the south boundary of the peninsular portion of the Preserve, overlooking McGregor Boulevard. Trash accumulates on the northern peninsula washing in from the Caloosahatchee River. The following section will help to explain these issues further and specify stewardship measures to reduce or eliminate these problems.

As already discussed in the Hydrology and Land Use History sections, numerous ditches have been dug throughout the Preserve. The mosquito ditches in the tidal swamps of the north portion of the Preserve have associated spoil mounds where Brazilian pepper and a few Australian pines grow. Logistically, it would not be realistic to remove the exotic vegetation; therefore it will be treated in place. Brazilian pepper will be mechanically removed from the spoil piles associated with the mosquito ditch on the central portion of DLP. Afterwards, this spoil will be used to fill the ditch using the methodology outlined in JEI's 2002 Environmental and Hydrological Assessment of the Preserve. The ditches created for drainage in the historic pasture area will be restored in the same manner.

Staff will also pursue restoration of portions of the Iona Drainage District ditches C-1 and C-3. The JEI report recommends as part of restoration to this watershed "eliminating (where possible) historic IDD canals and eliminating the spoil associated with patch ditching activities." This complex project will require intensive studies of the potential affects on the resources of adjacent properties, which are low in elevation and vulnerable to flooding. Staff will approach the South Florida Water Management District (SFWMD) about the feasibility of conducting this type of restoration using the methodologies outlined in the Johnson report and if necessary work towards obtaining an Environmental Resource Permit (ERP). Once the hydrologic restoration work begins, the cattle lease will need to be terminated and the interior fencing will be removed from the west side of the pasture.

The improved pasture located between the aforementioned canals has been cleared since the 1920's (see Land Use History section). It also contains a grass airstrip formerly used for treating crops in the area. This area is very wet during the spring and summer and the scattered native plants are more associated with wetland plant communities. However, the soils indicate that the area was once a pine flatwoods community. This could be a result of the tremendous change in

hydrology to the Preserve over the last 80 years. Restoration of this field will require extensive data collection, removal of existing exotic plants and finally planting and/or seeding in native plants. (See Management Action Plan for specific details).

The warehouse and surrounding cleared field will be left alone. The warehouse is used to store equipment used by the Land Stewardship group. There are no similar buildings located at any of the Conservation 20/20 Preserves that could be used, nor space at other facilities to store this equipment. It is possible that the cleared area could eventually be utilized as a parking area for visitors to the Preserve as the area is already highly impacted and fairly dry compared with the rest of the site. Since this area is within the secondary zone of the eagle nest, tall shrubs or trees will be planted to minimize any possible disturbance that this parking area would cause the eagles.

When Lee County purchased the northern portion of Deep Lagoon Preserve, there was a lease with The Lamar Corporation for a billboard adjacent to McGregor Boulevard. This was a five-year lease that expired on January 1, 2000. Following the original term of the lease, the lease was automatically extended for an additional five years, which expired on January 1, 2005. From that date forward, future renewals of the lease will be on a yearly basis. The Lessee or the Lessor may give the other party written notice of nonrenewal at least 60 days prior to the expiration of the then-current term. It is the intention of the Parks and Recreation Department to not renew the lease after 2005. The presence of a commercial billboard on a nature preserve is a distraction from the natural beauty to the area and also might set precedence for future advertisers to want billboards installed on additional preserves.

A final internal influence is trash that has accumulated on the peninsula of DLP, most of which probably washed up during storms and tidal events. Staff will conduct a yearly clean up of this area, hopefully coordinating with the Keep Lee County Beautiful's Annual Coastal Cleanup.

C. External Influences

The biggest external influence to Deep Lagoon Preserve is horticultural and trash dumping from adjacent neighbors. Currently, there have been occasional problems with dumping on the Preserve adjacent to Willems Road. Staff has posted boundary signs and sent all the residents in the area a 2-sided newsletter about the Preserve, mentioning the impact of dumping horticultural debris. A new residential community is being constructed between that portion of the Preserve and the central portion. When construction is complete, staff will send a "Welcome to the Neighborhood" newsletter, introducing the new residents to the Preserve and the C20/20 program. During routine site inspections staff will monitor all areas of the Preserve adjacent to residential areas for possible

dumping or encroachment concerns and a combination of signs and public education will be used if necessary to alleviate any problems.

Lee County Department of Transportation (DOT) has scheduled A & W Bulb Road for widening in October of 2005 or sooner depending on funding. As part of their construction plans, they plan on creating a 15 foot drainage easement north of IDD canal C-2 (see Figure 6 for canal location) and a 30 foot drainage easement to the south of the canal. The proposed drainage easement has not yet been approved by SFWMD, and may change before construction begins.

The final external influence to DLP is the widening of Gladiolus Drive, which will impact approximately 2.3 acres of wetlands on the Preserve. The road will be constructed in the existing Right of Way, however the slopes to accomplish the grade differential between the back of the proposed sidewalk and the existing ground will enter the Preserve. Lee County DOT also needs a 30' drainage easement along the west side of A & W Bulb Road from IDD canal C-2 to Gladiolus Drive. This drainage easement will be a shallow filter marsh that will treat runoff from the road before it is discharged into the canal. The portions of the Preserve that will be affected are currently heavily infested with invasive exotic plants and the work will be beneficial to the Preserve. Most of the mitigation work for wetland impacts from this project will be conducted in another area of the same watershed. However, it is possible that additional mitigation credits will be needed. If so, the work will be conducted on DLP. Currently JEI and Lee County DOT are working on the plans for the entire road-widening project. They hope to have the plans ready to present to the SFWMD and the U.S. Army Corps of Engineers (USCOE) by the beginning of 2005. They anticipate the permitting process to take about 1 year before any work will begin. Any mitigation plans involving the Preserve, in draft or final form, will be included in this plan as an appendix before it is printed and bound.

D. Legal Obligations and Constraints

a. Permitting

Land stewardship activities at Deep Lagoon Preserve may involve obtaining permits from appropriate agencies. Upland portions would require permits from the Florida Division of Forestry to conduct prescribed fires. Exotic plant removal and possible public use amenities in the wetland portions of the Preserve will require permits to be obtained from various agencies, including the Florida Department of Environmental Protection (FDEP) and SFWMD. If necessary, a consultant will be hired to assist with the permitting process, particularly with construction of any facilities, such as a boardwalk. Construction of facilities in either upland or wetland portions of the Preserve will require additional permitting as well as going through the Lee County Development Order process.

The improved pasture community on the central portion of the Preserve consists of a mixture of plants, some of which are typically found in more hydric plant communities. Since the area is highly disturbed it will be important to enlist the assistance of the SFWMD and USACOE to determine the upland/wetland boundaries in this area

The Deep Lagoon Preserve Environmental and Hydrologic Assessment, conducted by JEI, researched what permits might be required for hydrologic restoration activities on the Preserve. A meeting was conducted with representatives from Lee County Parks and Recreation, JEI and SFWMD on March 8th, 2001 (JEI, 2002). Possible restoration activities include filling of some of the IDD canals with the adjacent spoil, as well as the removal of invasive exotic plants. SFWMD staff expressed concern for exacerbating flooding problems that adjacent neighborhoods experience, but also thought that some activities might qualify for a diminimus exemption. It was decided that in order to determine permit requirements, a letter with an explanation and methodology for any restoration work be submitted to the SFWMD. Upon review of the letter, the SFWMD will be better able to determine the types of permits that might be required.

b. Relationship to Other Plans

The Lee Plan, Lee County's comprehensive plan, is designed to depict Lee County, as it will appear in the year 2020. Several themes have been identified as having "great importance as Lee County approaches the planning horizon." (Lee County, 2003).

- The growth patterns of the County will continue to be dictated by the Future Land Use map.
- The continued protection of the County's natural resource base.
- The diversification of the County's traditional economic base.
- The expansion of cultural, educational and recreational opportunities.
- A significant expansion in the County's physical and social infrastructure.

The entire Lee Plan can be found on the Internet at: http://www.lee-county.com/dcd1/Leeplan/Leeplan.pdf. The three chapters that affect the management of DLP are Chapter IV – Community Facilities and Services, Chapter V – Parks, Recreation and Open Space and Chapter VII – Conservation and Coastal Management.

Under **Chapter IV: Community Facilities and Services**, the planned restoration of IDD canals will follow **Policy 40.1.4** "the county will examine steps necessary to restore principal flow-way systems, if feasible, to assure the

continued environmental function, value and use of natural surface water flow-ways and associated wetland systems."

Currently, no public use facilities are planned for Deep Lagoon Preserve. See Public Access and Passive Recreation section for more information. However, if after restoration is completed any trails or other facilities are planned they will follow the guidelines under **Chapter V: Parks, Recreation and Open Space**. Land stewardship staff will ensure that any public use facilities and recreational opportunities will comply with **Goal 60: Park Planning and Design**, which requires that parks are planned, designed and constructed to comply with the best professional standards of design, landscaping, planning and environmental concern. Staff will also work to provide, whenever staffing and funding permit, appropriate environmental programs to the public in order to meet **Goal 61: Environmental and Historic Programs**.

Under **Chapter VII: Conservation and Coastal Management**, and within **Objective 74.1: Environmentally Critical Areas**, Lee County land stewardship staff has the responsibility of managing to conserve and enhance the natural functions of environmentally critical lands such as the wetland habitats and surrounding uplands found at DLP.

Within **Objective 76.1: Coastal High Hazard Area Expenditures**, same Chapter, **Policy 76.1.1** describes the need to seek approval from the County Commission for the use of public funds in a Coastal High Hazard Area, in which the entire Preserve is located, for the development of public use facilities. Currently, no facilities are proposed for this Preserve, but any future design plans will be taken to the county commission for their approval.

Objective 77.1: Resource Management Plan, Policy 77.1.1, Section 4e, same Chapter, states that this Stewardship Plan is written for the long term maintenance and enhancement of the Preserve's health and environmental integrity. Included within this plan are measures to address any necessary people management (e.g., fences and signage to prevent incompatible uses); surface water management and restoration; ecosystems restoration; litter control; fire management; invasive exotic plant and animal control; and, recreational opportunities, as well as a plan for how the maintenance will be funded.

Objective 77.3: Wildlife, same Chapter, land stewardship staff is directed to maintain and enhance the fish and wildlife diversity for the benefit of a balanced ecological system by following **Policy 77.3.1** preserving uplands in and around preserved wetlands to provide habitat diversity, enhance edge effect and promote wildlife conservation. Removing invasive exotic plants and using mechanical methods to imitate natural fire will follow this policy.

Same chapter, **Objective 77.6: Southern Bald Eagles**, land stewardship staff will continue to monitor the eagle nest on the Preserve as well as nesting

activities on adjacent lands. Staff will report all activities to the Eagle Technical Advisory Committee (ETAC). Additionally, staff will coordinate all restoration work near the nest with ETAC.

Same chapter, **Objective 77.10, Policy 77.10.1** and **77.10.2 WOOD STORK**, land stewardship staff will continue to document wood stork utilization of the Preserve and ensure that this stewardship plan follows USFWS's "Habitat Management Guidelines for the Wood Stork in the Southeast Region."

Goal 83: Coastal Planning Areas, same chapter, **Policy 83.1.5**, lists several environmentally sensitive coastal areas to be preserved including, wetlands and mangrove stands like those found at the Preserve. The purchase of this Preserve and eventual restoration will not only preserve these habitats, but greatly improve their function and value as an important natural resource for the citizens of Lee County.

E. Management Constraints

The main management constraints for Deep Lagoon Preserve are encroaching development, limited funding for restoration projects, the brief dry season and the eagle nests.

Any hydrologic restoration of the drainage canals will be limited to areas where the resulting return to natural waterflow will not impact residential communities surrounding the Preserve.

In July 2004 Conservation 20/20 received $10,000 from Taylor Woodrow Homes, LLC as part of an agreement giving them temporary access through the Preserve to conduct exotic plant removal on their adjacent property, which is part of their mitigation for the planned development (located between the north and central portions of the Preserve). The $10,000 has been set-aside for future use on invasive exotic plant work at the Preserve. Efforts to obtain additional funding through grants and other sources will continue.

The Cow Slough portion of the Preserve had initial exotic plant control during 2004. This consisted of methods ranging from hand crews to heavy equipment. The exotic plants were either removed from the site or left standing, depending on which method was more practical. This project was funded by a Coastal Impact Assistance grant from the federal government and offsite mitigation through SFWMD and FDEP.

Deep Lagoon Preserve is very wet most of the year. Most restoration efforts will be limited to the dry months, typically between December and May. If vehicular access is necessary for management when water levels are high, lower-impact vehicles, such as ATVs, will be used.

Restoration activities near the bald eagle nest will be restricted to a very narrow time frame outside of the nesting season officially recognized as October 1-May 15, and during the dry season, which varies from year to year.

Coordination with other agencies and adjacent landowners will be an important part of managing the Preserve. Lee County DOT will be widening Gladiolus Drive, which will impact over 2 acres of disturbed wetlands on the Preserve. Additionally, they will be creating a 30-foot drainage easement on the west side of A & W Bulb Road, just to the north of Gladiolus. To mitigate for these impacts, DOT will be removing invasive exotic plants from a portion of the adjacent Preserve. Land stewardship staff will be actively coordinating with LCDOT on this project, and any future mitigation projects to ensure they adhere to the Management Action Plan of this Land Stewardship Plan. If mitigation will affect the Preserve it will be included in a future revision on this plan.

The School District of Lee County owns 22 acres immediately to the west of the central portion of the Preserve. Heights Elementary School is located on this site, which also includes mangrove wetlands and a boardwalk. There may be opportunities for cooperation between Parks and Recreation and the School District on stewardship activities as well as development of resource-based public recreation opportunities.

F. Public Access and Passive Recreation

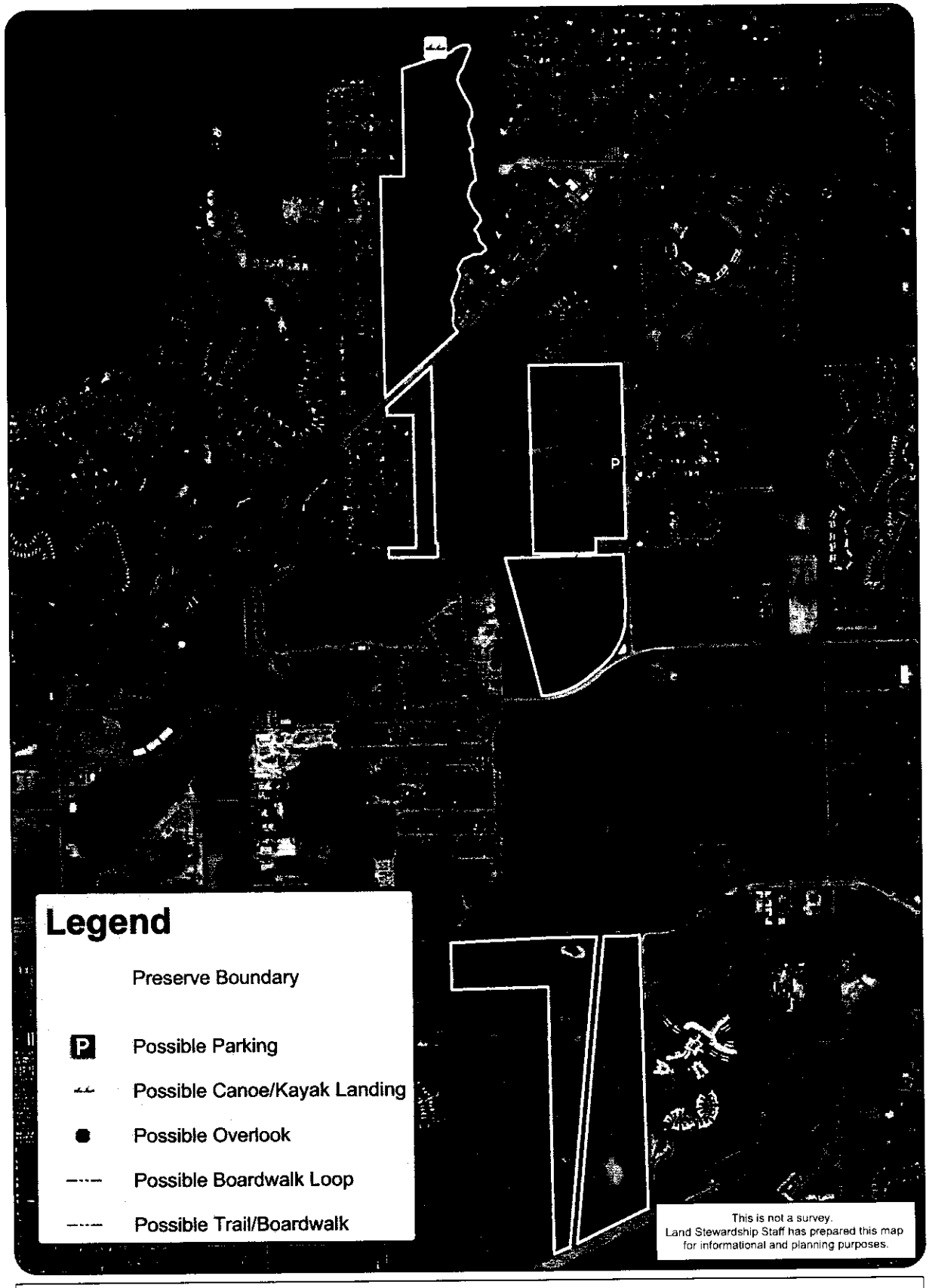
Historically, there has been minimal recreational activity at Deep Lagoon Preserve. Since Lee County has purchased the Preserve, there is evidence of previous fishing, fires and possible hunting and camping on the north end of the Preserve on the peninsula. The Parks and Recreation Ordinance, 02-12 (http://www.lee-county.com/ordinances/PDF/2002/02-12.pdf) prohibits all of these activities, except in designated areas. If future site inspections show continued use, a sign will be posted, alerting visitors to the acquisition of the Preserve and what passive recreation activities are allowed.

At this time, there is no specific planned public recreation amenities proposed for C20/20 portions of Deep Lagoon Preserve. Restoration activities over the next several years will not be conducive to increasing public presence. The majority of the Preserve is currently not very accessible because of the thick invasive exotic plants. Possible future amenities could include a small parking area located in the field off A & W Bulb Road, a boardwalk/trail connecting the parking area to the boardwalk at Heights Elementary School, looping back to the parking lot and a canoe/kayak landing on the peninsula. During the 5-year revision of this plan, the opportunities for trails and any other public use facilities will be reexamined. Figure 16 illustrates approximate locations for these amenities. Actual locations, if these amenities are feasible, will be determined in a future revision of the plan.

For the Cow Slough portion of the Preserve, a .3-mile loop boardwalk from Cypress Cove into the slough has been proposed. A CIP fund will be developed for this project and additional funding through grants and other sources will be researched. Creation of this amenity will be dependant on public support.

Phase III of The Great Calusa Blueway, (Lee County's paddling trail that provides an ecological tour of the bays, rivers, backwaters and shorelines of southwest Florida) will eventually include the peninsula portion of DLP as a point of interest and stop-off point. Information on this canoe trail can be found at www.thegreatcalusablueway.com. Staff will ensure that organizers are aware of Deep Lagoon Preserve so it can be included on the map. Staff will also work to promote the Blueway with signage at the Preserve. Currently, funding is not available for this phase of the development of the Blueway, and no time line has been established.

Figure 16: Conceptual Master Site Plan Map



G. Acquisition

Deep Lagoon Preserve consists of 3 separate nominations purchased through Lee County's Conservation 20/20 Program (C20/20). Sites 77 and 78 were both nominated to C20/20 in April of 1998. The total acreage for the two properties is almost 130 acres and were both purchased in July 1999 for $2,851,875. The third 116.4-acre parcel, site 116, was purchased for $1,198,000 in May 2001 after being nominated to the program 2 years earlier.

The arm of Cow Slough was purchased by Lee County in 1972 for use as a landfill. The remaining portion was donated in 1976 for sewage treatment ponds for the Fort Myers Beach Sewage Treatment Plant on Pine Ridge Road. These ponds were never created because the land was unsuitable as it consisted almost entirely of wetlands. After several years, Lee County Utilities Division gave the property to Lee County Parks and Recreation, creating the Cow Slough Preserve. Lee County is donating the southernmost portion, located south of Summerlin Road, to the Department of Environmental Protection to be incorporated into the Estero Bay Preserve State Park. After the purchase of the C20/20 lands to the north, stewardship staff decided to incorporate Cow Slough into the Deep Lagoon Preserve.

The future land use codes for the majority of the Preserve have been changed to "Conservation Lands." There are two small portions of site 116 that are under the Land Use category "Urban Community." Lee County's Division of Environmental Sciences will be switching these areas to "Conservation Lands" during the next scheduled revision. Future land use codes for the southern, Cow Slough portion are "wetlands", "Urban community" and "public facilities." Currently zoning for Cow Slough, site 77 and site 116, located north of McGregor Boulevard, is agriculture "Ag-2", site 78 is residential planned development or "RPD" and site 116, south of McGregor is residential single family "RS-1." Staff will work with the Division of Planning to change the zoning to "Environmentally Critical" where possible. See Figures 17 & 18 for current land use and zoning of the Preserve, as well as STRAP numbers.

Three other properties have been nominated to the Conservation 20/20 Program that are adjacent to DLP. Two were withdrawn from the Program and the third, nomination #199-2, is currently on hold until Lee County DOT finalizes their road plans for Gladiolus Drive.

Lee County DOT is acquired the former Hidden Lakes development within the Health Park DRI (Figure 19). The existing lake will be used for stormwater management and water quality treatment in conjunction with the widening of Gladiolus Drive. The property was donated with an agreement that DOT will assume the responsibilities for the removal of exotics, maintenance and monitoring of mitigation areas under the USCOE and SFWMD permits.

Eventually, this property will be incorporated into the Deep Lagoon Preserve and will become the responsibility of Parks and Recreation to maintain in perpetuity.

There is a privately owned parcel, consisting primarily of wetlands, sandwiched between the mitigation areas (Figure 19). The Division of County Lands has contacted this landowner and Land Stewardship staff recommends pursuing this property for acquisition.

Figure 17: Future Land Use With Strap Numbers

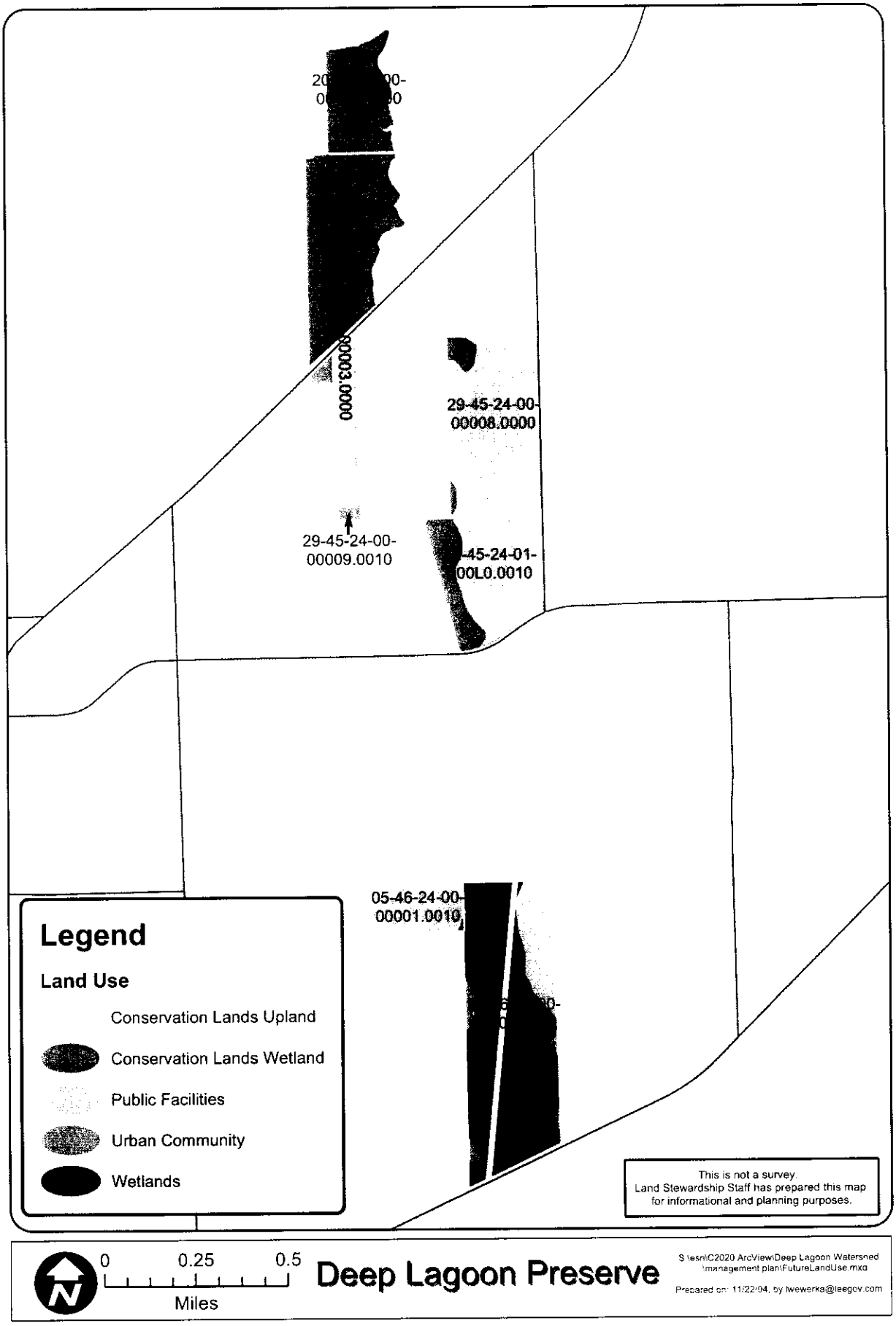


Figure 18: Zoning Map With Strap Numbers

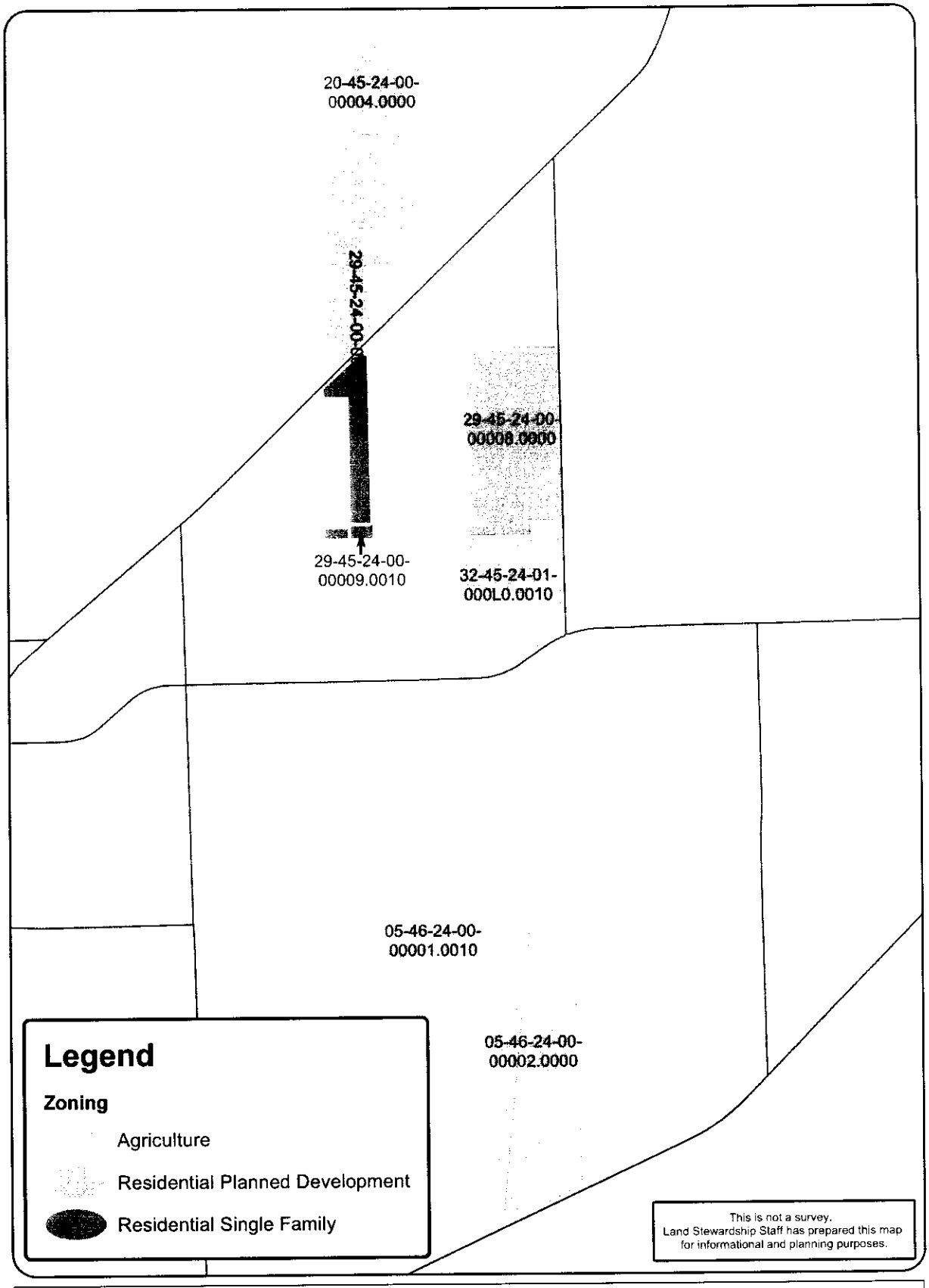
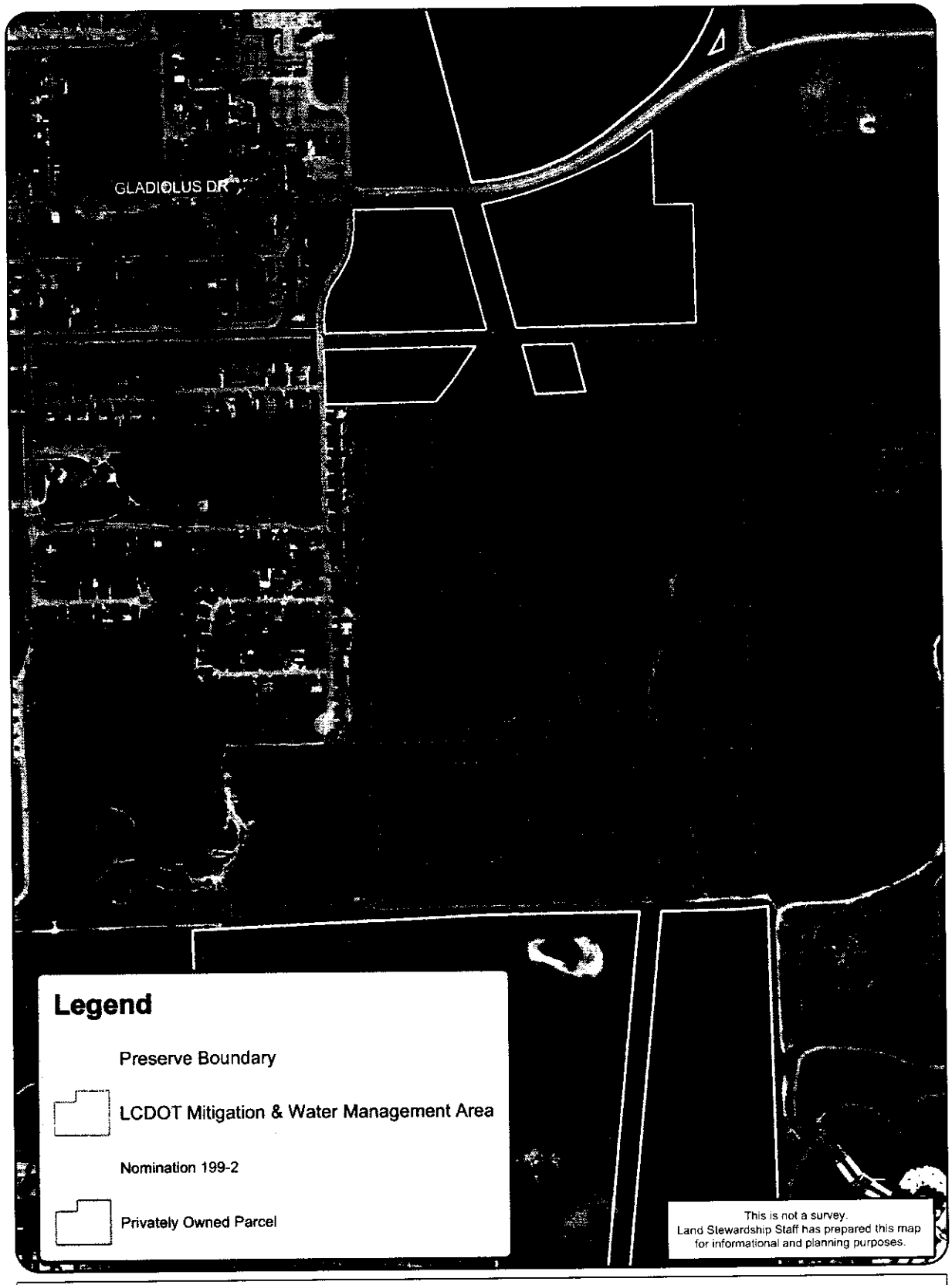


Figure 19: Lee County DOT Conservation Easement Map (for Gladiolus Road Widening Mitigation)



VI. Management Action Plan

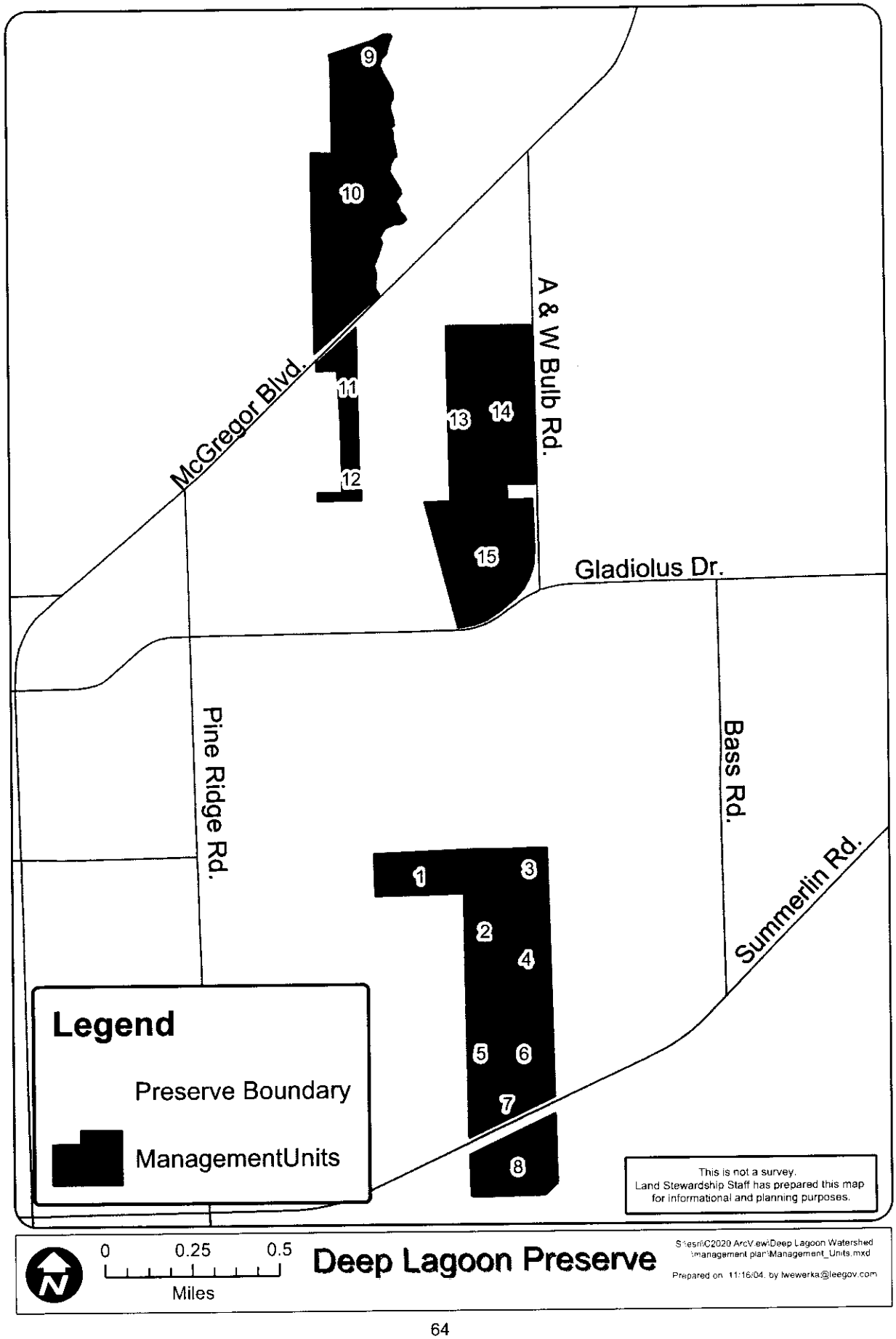
A. Management Unit Description

Deep Lagoon Preserve has been divided into 15 management units to better organize and achieve management goals. Figure 20 delineates the units that were created based on existing roads, canals and habitat types.

- Management Unit 1 (20.5 acres) is the arm of Cow Slough. This Unit was dominated by invasive exotic plants that were removed in 2004. There is a small portion of mesic flatwoods and mangroves in this unit.
- Management Unit 2 (35.72 acres) is bordered on the east by IDD Canal "C" to the north and west by the property boundary and to the south by Unit 5. The majority of this Unit is mangroves and contains two open brackish water bodies.
- Management Unit 3 (7.16 acres) is located in the northeast corner of Cow Slough. Mesic flatwoods and hydric hammock are the two plant communities found in this Unit. This Unit has already had exotic plant removal conducted, as well as supplemental native plantings, as part of off site mitigation for several developments in the area.
- Management Unit 4 (33.95 acres) is located south of Unit 3, east of Unit 2 and north of Unit 6. Its east boundary is the Cypress Cove development. This Unit is a mosaic of mangroves, hammock, cattail marsh and open water. This Unit has already undergone exotic plant removal.
- Management Unit 5 (8.65 acres) is bordered by Units 2, 6, and 7. Mangrove swamp dominates this management Unit.
- Management Unit 6 (18.73 acres) is bordered by IDD canals to the north and west, the Preserve boundary to the east and Unit 7 to the south. A proposal to remove the exotics in this Unit has been presented to the Department of Environmental Protection's (DEP) Regional Offsite Mitigation Area (ROMA) program. Unit 6 is a mixture of mangrove swamp, open water and cattail marsh.
- Management Unit 7 (16.77 acres) is bordered by Summerlin Road to the south and Units 5 & 6 to the north. This Unit has also been used for off-site mitigation and exotic plant removal has already occurred. The plant communities are the same as Unit 6's.
- Management Unit 8 (28.09 acres) is proposed to be donated to DEP since it is located south of a major road, Summerlin Rd. and directly adjacent to the Estero Bay Preserve State Park.

- Management Unit 9 (7.71 acres) is located on the northern peninsula of the Preserve. This Unit consists of coastal upland plant communities. It is bordered by water on three sides and Unit 10 to the south.
- Management Unit 10 (93.61 acres) is south of Unit 9, with the same east and west boundary features. The southern boundary is McGregor Boulevard. The majority of this Unit consists of mangroves.
- Management Unit 11 (12.57 acres) is south of McGregor Boulevard. It consists of coastal habitats, some highly disturbed with invasive exotics. The east and west boundaries are future residential communities and Willems Road and the south boundary is Unit 12.
- Management Unit 12 (6.7 acres) is located south of Unit 11, with residential communities to west and east and an IDD canal to the south. The only plant community in this Unit is mesic flatwoods.
- Management Unit 13 (21.24 acres) is bordered by IDD canals to the north and south, Unit 14 to the east and a residential community under construction to the west. It consists of a variety of mangrove species and is heavily infested with exotic plants. The southern portion of this Unit has been divided into 4 Sub Units to be used for phasing the exotic plant removal surrounding the eagle nest.
- Management Unit 14 (55.07 acres) is adjacent to the east of Unit 13. Its east boundary is A & W Bulb Road. This Unit was the historical gladiolus fields.
- Management Unit 15 (55.31 acres) is bordered by IDD canals to the north and west, A & W Bulb Road to the east and Gladiolus Drive to the south.

Figure 20: Management Unit Map



B. Goals and Strategies

The initial primary management objective for Deep Lagoon Preserve will be to improve restore the pasture on the central portion of the Preserve which will include some of the hydrologic restoration and exotic plant removal that will be conducted on the entire Preserve by May 31st 2009 pending funding.

Additional activities at DLP will focus on the following:

These activities are prioritized according to their importance and ease of accomplishment.

Natural Resource Management

- ✓ Mechanical brush reduction
- ✓ Exotic plant removal and maintenance
- ✓ Hydrologic restoration
- ✓ Monitor and protect listed species

Overall Protection

- ✓ Encourage local public support
- ✓ Debris removal
- ✓ Removal of billboard
- ✓ Sign installation
- ✓ Removal of cattle
- ✓ Fence installation
- ✓ Land Use and Zoning changes
- ✓ Prevent dumping from adjacent developments

The following is a description of how each of these goals will be carried out, the success criteria used to measure accomplishment of each goal and a timetable outlining which units each activity will take place in.

Restoring the improved pasture to a native plant community

To add habitat diversity to the Preserve staff will establish a native plant community replacing Unit 14's improved pasture. Restoration of this field will require several months of data collection to make educated decisions on what plant community would be most successful. Deep soil samples will be taken and analyzed in several portions of the pasture. A rain gauge and additional monitoring wells will be set up in strategic areas to monitor water levels over an entire rainy season and a portion of the dry season. Once that data is analyzed, appropriate plans for native plantings will be developed that could include using seeds and/or plants. At that time a decision will be made on the possibility of re-

grading the airstrip to be level with the rest of the pasture. To prepare the pasture for plantings it will be necessary to eliminate the pasture grasses. This will be accomplished by repeated disking followed by treating the exotic pasture grasses with an appropriate herbicide. Once the exotic plants are under control, the established planting plan will be executed.

To evaluate the success of this restoration project, a photo point will be established before restoration work begins. A pre-restoration photo will be taken, followed by bi-yearly photos during the elimination of pasture grasses and planting phases. Finally, yearly photos will be taken during the growing season for 5 years from completion of the planting project as documentation of progress. A consultant may also be contracted to create two 10 meter transects to record plants both pre/post restoration that will be surveyed once a year for 5 years.

Mechanical brush reduction

The mesic flatwoods (Unit 12) contained on DLP are a community that would historically be maintained by fire to cycle nutrients, increase plant diversity and retain an open canopy. Since the Preserve is in an urban area and the flatwoods community is quite narrow, the primary management tool will be a tractor with rotary mower attachment and/or a roller chopper. This method will be used on a 3-5 year rotation, during the winter when the temperatures are low so there is a reduced chance of injuring a gopher tortoise. Once fuels are mechanically reduced staff will consult with the Florida Division of Forestry (DOF) to determine the feasibility of burning small portions of this area at one time. The benefits of burning go beyond fuels reduction and staff will do what it can to implement this natural management tool.

Exotic plant removal and maintenance

The dominant invasive exotic plants at DLP are melaleuca, Brazilian pepper and Australian pine. The goal will be to remove or treat these plants in place, followed with semi-annual treatment of resprouts and new seedlings. Before any work is conducted an exotic prescription form will be filled out and the contractor will be required to fill our daily report forms, which are both found in the Land Stewardship Operations Manual.

- Light to moderate infestations (except along ditches of northern peninsula of Preserve in Unit 10):

  In areas where invasive exotics are sporadic and below 50% of the vegetation cover, handwork will be utilized for control. Specific methodology will depend on stem size, but generally the stem will be cut near grade and stump sprayed with appropriate herbicide. Hand pulling should be utilized when possible to minimize herbicide use. Stems will be piled as necessary to facilitate future potential burning, chipping or

removal from site. No replanting will be needed in these areas due to significant presence of native vegetation and native seed bank.

- Moderate to heavy infestations (except along ditches of Unit 10 and surrounding the bald eagle nest on Unit 13):

  In areas where the exotics occur as monotypic stands or are higher than 50% of the vegetation cover the use of heavy equipment will be utilized in appropriate habitats and during suitable seasonal conditions. The type of heavy equipment used should minimize soil disturbance or compaction. A barge will be necessary for bringing heavy equipment to Unit 9 as well as the west boundary of Unit 10. In areas along ditches where the hydrology and soils may not be conducive for heavy equipment, hand crews will be used to cut down and mulch, pile and/or burn the plants depending on site conditions. For follow-up treatment of these areas an application of an appropriate herbicide mixture to the foliage of any resprouts or seedlings will be made. Land Stewardship staff will evaluate replanting on a case-by-case basis. Units 1 & 4, that have already undergone exotic plant removal, may be replanted in 2006 after monitoring for native plant recruitment.

- Scattered exotics on berms associated with ditches on northern peninsula (Unit 10):

  The exotic plant typically found on these berms is Brazilian pepper, however an occasional small Australian pine and melaleuca tree have been spotted. These berms are only accessible by canoeing. For that reason, they will be treated in place.

- Exotic monoculture surrounding eagle nest (Unit 13):

  This area will be treated in several phases to minimize disturbance to the nest. The southern portion of Unit 13 has been divided into 4 Sub Units. The first phase will be to use hand crews in all 4 Sub Units to remove all exotic trees that are less than 6 inches in diameter. Phase 2 will utilize heavy equipment to remove the exotic plants from Sub Units 1-A and 1-B. Phase 3 will utilize heavy equipment to remove the exotics from Sub Unit 2. Finally, Sub Unit 2 will have the majority of its exotic plants removed, leaving the Australian pine that the nest is in, as well as other canopy pines within 50 feet of the nesting tree. The remaining pines will be left standing and untreated until there is at least a 5-year time span where this nest is inactive. See Figure 15 for the Primary and Secondary protection zones associated with the nest, as well as the Sub Units.

  Each Sub Unit will be replanted with appropriate native plants so that the area grows up faster and the habitat change is less dramatic for the

eagles. Sub Unit 3 will not be replanted until after the heavy equipment work has been completed in Sub Unit 2 so that operators will not have to work around the new plants.

- All other invasive exotic vegetation

  For other invasive exotic plants occurring at the Preserve, the Land Stewardship Operations Manual and other pertinent references will be consulted for appropriate herbicide mixtures on the control of these invasive exotic plants. A complete list of plants found at this Preserve, including invasive exotics is found in Appendix A.

  After initial treatment, all areas will be treated semi-annually to control resprouts and new seedlings.

Hydrologic restoration

JEI's Deep Lagoon Preserve Environmental and Hydrologic Assessment study concluded that filling canals C-1, C-2, C-3, C-4, C-6, C-8, C-10 and C-11 would significantly enhance the wetland hydroperiods within the watershed. Portions of canals C-1, 2, 6, 7, 8, and 9 (Units 13, 14 and 15) are all contained within the Preserve and should be restored.

It will be critical for staff and an appropriate consultant to work with SFWMD staff to insure this work on the canals will not exacerbate flooding problems to adjacent neighborhoods. A restoration proposal will be presented to SFWMD to determine the feasibility of the project and decide what permits will be required.

In general, to accomplish this work, exotic vegetation would first be removed from the spoil banks. This will be accomplished with a combination of hand crews and mechanical equipment using the appropriate herbicide. This work must be completed when the water table height is low enough to minimize rutting by heavy equipment. Larger stumps should be removed before pushing the spoil banks into the canals. Prior to backfilling, silt fences or floating turbidity curtains will be placed both up and downstream to prevent erosion. Exposed areas will be planted with native herbaceous species and mangroves (JEI, 2002). The plantings will be installed as soon as possible to avoid erosion. Ideally, the planting will occur at the beginning of the rainy season to maximize survival of the plants. If the plants need supplemental watering, an ATV or other piece of equipment with a water tank will be used and temporarily stored in the warehouse to minimize costs and travel time.

The smaller ditches (Units 14 & 15) will be restored using the same methods outlined in the previous paragraph. Since these ditches are considerably smaller, replanting with native species will be evaluated on a case-by-case basis.

For monitoring purposes, photo points will be established at each of the larger ditches. Photos will be taken before, immediately after, six months after, and then once a year during the growing season for 5 years as documentation of progress.

Plantings will be monitored once per month for a six-month period after completion of the planting project, by which time plants should be established. Monitoring will involve visiting all planted areas and noting fatalities, which will need to be replaced.

Monitor and protect listed species

As discussed in the designated species section, there are several listed species that have been documented utilizing the Preserve. For the most part, these species will benefit from restoration activities, such as hydrologic improvements and the removal of invasive exotic plants. During restoration activities, efforts will be made to minimize any negative impact to listed species. Specific examples of this will be to closely work with ETAC during restoration near the bald eagle nest and only working outside of nesting season, as well as either avoiding or relocating listed plant species found on the Preserve. Deep Lagoon Preserve is part of a countywide quarterly site inspection program conducted for all Conservation 20/20 Preserves. A copy of the site inspection form is available in the Land Stewardship Operations Manual. These inspections allow staff to monitor for any impacts and/or changes to each preserve and includes lists of all animal sightings and new plant species that are found. If, during these inspections, staff finds FNAI listed species, they will be reported using the appropriate forms.

Encourage local public support

As management activities take place at DLP, staff will contact adjacent neighbors by a direct mailing or through a contact with a neighborhood association or other group. Additionally, once the adjacent Lucaya development is completed, a "welcome" letter will be sent to the new residents to introduce them to the Preserve as well as the C20/20 program. These contacts will always encourage volunteerism either for keeping an eye on the Preserve or becoming an active Lee County Parks and Recreation volunteer.

Debris removal

Debris removal will be an ongoing project at DLP. During quarterly site inspections, small objects that are encountered will be removed. The peninsula of the Preserve (Units 9 and 10) is particularly susceptible to having debris wash up from the Caloosahatchee River. Each year, staff will coordinate with Keep Lee County Beautiful to participate in the annual Coastal Cleanup. If necessary,

additional debris clean-ups will be organized with the Parks and Recreation Land Stewardship volunteers.

Removal of billboard

The billboard, located on the north side of McGregor Boulevard (Unit 10) will be removed as soon as the lease expires at the end of 2005. To accomplish this goal, a letter of nonrenewal will be sent at the end of October 2005 to the Lamar Corporation. Staff will also require that Lamar pay to remove the sign, as allowed in the lease.

Sign Installation

A sign will be installed off of A & W Bulb Road at the entrance gate where the warehouse is located (Unit 14), on the corner of A & W Bulb Road and Gladiolus Drive and the corner of Willems Drive and McGregor Blvd. It will clearly identify the property as a Conservation 20/20 acquisition and explain that extensive restoration will be taking place on the Preserve over the next several years. A phone number and web address will be provided for additional information.

There will also be signs installed in association with the boardwalk on the Cow Slough portion of the Preserve.

Removal of cattle

The extensive restoration planned to occur on the improved pasture of Deep Lagoon Preserve will require that the cattle be removed (Unit 14). Staff will terminate the lease a minimum of 30 days before restoration work begins. As a courtesy, the cattleman will be given a one-year warning of the upcoming lease termination. Once the cattle are removed, the internal fencing separating Units 13 and 14 will be removed. If the cattle rancher would like to have the internal fence, we will allow him to remove and take it.

Fence installation

Currently, most of the boundaries of the northern and central portions of the Preserve have a thick monoculture of invasive exotic plants that prevents activities such as dumping and use of motorized vehicles on the Preserve. As restoration takes place, it may be necessary to install cattle fencing on portions of the Preserve that are adjacent to A & W Bulb Road, Gladiolus Drive, Willems Road and the Lucaya development.

Land Use and Zoning changes

To better protect all Conservation 20/20 Preserves, Land Stewardship staff has made it a priority to change the Land Use Category to "Conservation Lands"

(Units 1-7, 11 & 12) and the Zoning to "Environmentally Critical" (all Management Units) whenever possible as long as those designations do not interfere with the restoration process. Staff has already contacted the appropriate Divisions (Environmental Sciences and Planning) about changing the designations of DLP and if feasible, will have all changes made by the end of 2006.

Prevent dumping from adjacent developments

Minor amounts of dumping (particularly horticultural waste) have occurred in the past on the portion of the Preserve adjacent to Willems Road (Units 11 and 12). During quarterly site inspections, staff will continue to monitor Preserve boundaries to ensure that this activity does not continue or become a problem in other areas. Once the Lucaya development (to the west of the central section) is complete, staff will post boundary signs and send a "Welcome to the Preserve" newsletter to the new residents. Periodic clean up workdays will be conducted as necessary.

VII. Projected Timetable for Implementation

Projected Timetable for Implementation of Natural Resource Management Activities (September 2005 – September 2009)

Management Activity	9-05	5-06	9-06	4-07	9-07	4-08	5-08	7-08	9-08	1-09	5-09	7-09	9-09	2010 or later[1]
											*Unit 14, Unit 13- Sub Units 1A & 1B			
Follow Up Treatment												Sub Units 1A & 1B		
Hydrologic Restoration of IDD Canals														
Hydrologic Restoration of other Ditches														
Mechanical Brush Reduction				12										
Improved Pasture Restoration – Data Collection														
Improved Pasture Restoration – Exotic Grass Removal														
Improved Pasture Restoration - Plantings														
											Unit 14 Establish transects			
Supplemental Plantings		Units 1 & 4												

**Management activities are currently scheduled OUTSIDE of bald eagle nesting season (May 16 – September 30). This time schedule could be adjusted to earlier in the dry season if the eagles do not show intentions of nesting by January 31st of that particular season.*

[1] *Activities not itemized beyond 2010 since this plan will be revised and updated in five years (2009).*

Projected Timetable for Implementation of Overall Protection Activities (October 2005 – September 2009)

Management Activity	9-05	10-05	1-06	9-06	4-07	9-07	4-08	7-08	9-08	1-09	5-09	7-09	9-09	2010 or later[2]
Debris Removal – Coastal Cleanup Days	Ongoing for all Units Units 9 & 10			Units 9 & 10		Units 9 & 10			Units 9 & 10				Units 9 & 10	
Change Zoning & Land Use Category		Unit – 10 Send letter	Unit 10 – sign removed				Send letter							

[2] *Activities not itemized beyond 2010 since this plan will be revised and updated in five years (2009).*

VIII. Financial Considerations

There is a management fund established in perpetuity for all Conservation 20/20 preserves. Monies from this fund primarily serve to meet the operational needs of the Management section of the C20/20 Program, but a certain amount of this fund will be set aside for planned restoration projects. Activities on the Cow Slough portion of the Preserve will be funded through the Department of Parks and Recreation. Monies will be supplemented through pursuing appropriate grants or other sources of funding, such as, but not limited to; grants from the Florida Department of Environmental Protection Bureau of Invasive Plant Management, Florida Recreational Development Assistance Program, Florida Department of Environmental Protection's Recreational Trails Program, National Fish and Wildlife Foundation, U.S. Fish and Wildlife Service, or Land and Water Conservation Fund. Projected costs and funding sources are listed in Appendix C.

IX. Literature Cited

Brown PM. 2002. Wild Orchids of Florida. Gainesville: University Press of Florida. 409 p.

Capinera JL, Scherer CW, & Squitier JM. 2001. Grasshoppers of Florida. Gainesville: University Press of Florida. 143 p.

(FNAI) Florida Natural Areas Inventory, (FDNR) Florida Department of Natural Resources. 1990. Guide to the Natural Communities of Florida. Tallahassee. 111 p.

Henderson WG (Soil Conservation Service). 1984. Soil Survey of Lee County, Florida. U.S. Department of Agriculture/Soil Conservation Service in cooperation with University of Florida Institute of Food and Agricultural Sciences, Agricultural Experiment Stations and Soil Science Department, and Florida Department of Agriculture and Consumer Services. 185 p.

Hipes D, Jackson DR, NeSmith K, Printiss D, Brandt K. 2001. Field Guide to the Rare Animals of Florida. Tallahassee: Florida Natural Areas Inventory. 122 p.

(JEI) Johnson Engineering, Inc. 2002. Deep Lagoon Preserve Environmental and Hydrologic Assessment. Fort Myers: Johnson Engineering, Inc. 33 p.

Lee County Department of Community Development (LCDCD). The Lee Plan 2003 Codification As Amended through June 2003 [internet]. Ft. Myers: Lee County Department of Community Development; 2003 [cited 2004, Dec 19]. Available from: http://www.lee-county.com/dcd1/Leeplan/Leeplan.pdf.

Missimer TM, Thomas SM, editors. 2001. Geology and hydrology of Lee County, Florida. 9th Annual Southwest Florida Water Resources Conference; 1999 Nov 18 & 19; Ft. Myers (FL). Tallahassee: Florida Geological Survey. 230 p.

Myers RL & Ewel JJ, editors. 1990. Ecosystems of Florida. Orlando: University of Central Florida Press. 765 p.

Postmus B. 2003. Lee County Bird Patrol.

Rodgers JA Jr, Kale HW II, & Smith HT, editors. 1996. Rare and Endangered Biota of Florida. Volume V Birds. Gainesville: University Press of Florida. 688 p.

Save Florida's Native Bromeliads: Conservation of Endangered Airplants

Through Biological Control and Seed Collection [Internet]. Gainesville (FL): University of Florida Institute of Food and Agriculture Sciences. [cited 2004 Nov 8]. Available from: http://savebromeliads.ifas.ufl.edu.

(USFWS) U.S. Fish and Wildlife Service. 1996. Revised recovery plan for the U.S. breeding population of the woods stork. Atlanta (GA): U. S. Fish and Wildlife Service. 41 p.

Water Resource Solutions, Inc [WRSI]. 1999 July. Phase I Environmental Site Assessment Report for the Conservation 2020 Parcel #78, Fort Myers, Florida; Project Number LC-03943.E1. Cape Coral (FL): WRSI. 19 p.

X. Appendices

Appendix A: Plant Sightings at DLP

Scientific names for this list were obtained from Wunderlin & Hansen, 2003.

Scientific Name	Common Name	Native Status
Family: Blechnaceae (midsorus fern)		
Blechnum serrulatum	swamp fern	native
Family: Polypodiaceae (polypody)		
Phlebodium aureum	golden polypody	native
Family: Psilotaceae (whisk-fern)		
Psilotum nudum	whisk-fern	native
Family: Pteridaceae (brake fern)		
Acrostichum aureum	golden leather fern	native
Acrostichum danaeifolium	giant leather fern	native
Family: Thelypteridaceae (marsh fern)		
Thelypteris kunthii	southern shield fern	native
Family: Vittariaceae (shoestring fern)		
Vittaria lineata	shoestring fern	native
Family: Pinaceae (pine)		
Pinus elliottii	slash pine	native
Family: Agavaceae (agave)		
Yucca aloifolia	Spanish bayonet	exotic
Family: Alismataceae (water plantain)		
Sagittaria latifolia	broadleaf arrowhead	native
Family: Amaryllidaceae (amaryllis)		
Crinum americanum	string-lily	native
Family: Arecaceae (palm)		
Sabal palmetto	cabbage palm	native
Serenoa repens	saw palmetto	native
Family: Bromeliaceae (pineapple)		
Tillandsia balbisiana	northern needleleaf	native
Tillandsia fasciculata	cardinal airplant	native
Tillandsia flexuosa	twisted airplant	native
Tillandsia recurvata	ball moss	native
Tillandsia setacea	southern needleleaf	native
Tillandsia usneoides	Spanish moss	native
Tillandsia utriculata	giant airplant	native
Family: Commelinaceae (spiderwort)		
Tradescantia spathacea	oyster-plant	exotic
Family: Cyperaceae (sedge)		
Cladium jamaicense	Jamaica swamp sawgrass	native
Cyperus ligularis	swamp flatsedge	native
Eleocharis ssp.	spikerush	native
Rhynchospora colorata	starrush whitetop	native
Scirpus tabernaemontani	softstem bulrush	native
Family: Iridaceae (iris)		
Sisyrinchium angustifolium	narrowleaf blue-eyed grass	native
Family: Juncaceae (rush)		
Juncus roemerianus	needle rush	native
Family: Musaceae (banana)		
Musa acuminata	dwarf banana	exotic

Appendix A: Plant Sightings at DLP (continued)

Scientific Name	Common Name	Native Status
Family: Orchidaceae (orchid)		
Encyclia tampensis	Florida butterfly orchid	native
Family: Poaceae (grass)		
Cynodon dactylon	bermudagrass	exotic
Distichlis spicata	saltgrass	native
Eustachys petraea	pinewoods fingergrass	native
Panicum hemitomon	maidencane	native
Paspalum notatum	bahiagrass	exotic
Pennisetum purpureum	elephantgrass	exotic
Sorghum bicolor	grain sorghum	exotic
Spartina bakeri	sand cordgrass	native
Sporobolus indicus	smutgrass	exotic
Family: Ruppiaceae (ditchgrass)		
Sansevieria hyacinthoides	bowstring hemp	exotic
Family: Typhaceae (cattail)		
Typha domingensis	southern cattail	native
Family: Acanthaceae (acanthus)		
Ruellia caroliniensis	Carolina wild petunia	native
Thunbergia fragrans	whitelady	exotic
Family: Amaranthaceae (amaranth)		
Sarcocornia perennis	perennial glasswort	native
Family: Anacardiaceae (cashew)		
Schinus terebinthifolius	Brazilian pepper	exotic
Toxicodendron radicans	eastern poison ivy	native
Family: Apiaceae (carrot)		
Lilaeopsis chinensis	eastern grasswort	native
Family: Araliaceae (ginseng)		
Centella asiatica	spadeleaf	native
Family: Asteraceae (aster)		
Ambrosia artemisiifolia	common ragweed	native
Baccharis angustifolia	saltwater falsewillow	native
Borrichia frutescens	bushy seaside oxeye	native
Cirsium nuttallii	Nuttall's thistle	native
Erigeron quercifolius	oakleaf fleabane	native
Eupatorium capillifolium	dogfennel	native
Mikania scandens	climbing hempvine	native
Packera glabella	butterweed	native
Pluchea camphorata	camphorweed	native
Solidago fistulosa	pinebarren goldenrod	native
Solidago sempervirens	seaside goldenrod	native
Sphagneticola trilobata	creeping oxeye	exotic
Family: Avicenniaceae (black mangrove)		
Avicennia germinans	black mangrove	native
Family: Bataceae (saltwort)		
Batis maritima	saltwort	native
Family: Campanulaceae (bellflower)		
Lobelia feayana	bay lobelia	native

Appendix A: Plant Sightings at DLP (continued)

Scientific Name	Common Name	Native Status
Family: Casuarinaceae (sheoak)		
Casuarina equisetifolia	Australian-pine	exotic
Family: Combretaceae (combretum)		
Conocarpus erectus	buttonwood	native
Laguncularia racemosa	white mangrove	native
Family: Fabaceae (pea)		
Abrus precatorius	rosary pea	exotic
Acacia auriculiformis	earleaf acacia	exotic
Caesalpinia bonduc	gray nicker	native
Crotalaria pallida	smooth rattlebox	exotic
Dalbergia ecastaphyllum	coinvine	native
Neptunia pubescens	tropical puff	native
Senna pendula	valamuerto (Christmas cassia)	exotic
Sesbania herbacea	danglepod	native
Family: Fagaceae (beech)		
Quercus virginiana	Virginia live oak	native
Family: Lauraceae (laurel)		
Cinnanonum camphora	camphortree	exotic
Cassytha filiformis	love vine	native
Family: Malvaceae (mallow)		
Kosteletzkya virginica	Virginia saltmarsh mallow	native
Talipariti tiliaceum var. *tiliaceum*	mahoe	exotic
Family: Moraceae (mulberry)		
Ficus aurea	strangler fig	native
Family: Myrsinaceae (myrsine)		
Rapanea punctata	myrsine	native
Family: Myrtaceae (myrtle)		
Melaleuca quinquenervia	punktree	exotic
Psidium cattleianum	strawberry guava	exotic
Syzygium cumini	Java plum	exotic
Family: Passifloraceae (passionflower)		
Passiflora incarnata	purple passionflower	native
Family: Phytolaccaceae (pokeweed)		
Rivina humilis	rougeplant	native
Family: Polygonaceae (buckwheat)		
Coccoloba uvifera	seagrape	native
Polygonum hydropiperoides	swamp smartweed	native
Family: Portulacaceae (purslane)		
Portulaca pilosa	pink purslane	native
Family: Rhizophoraceae (mangrove)		
Rhizophora mangle	red mangrove	native
Family: Rubiaceae (madder)		
Chiococca alba	snowberry	native
Psychotria nervosa	wild coffee	native
Randia aculeata	white indigoberry	native
Family: Salicaceae (willow)		
Salix caroliniana	Carolina willow	native

Appendix A: Plant Sightings at DLP (continued)

Scientific Name	Common Name	Native Status
Family: Sapindaceae (soapberry)		
Cupaniopsis anacardioides	carrotwood	exotic
Family: Sapotaceae (sapodilla)		
Sideroxylon celastrinum	saffron plum	native
Family: Scrophulariaceae (figwort)		
Bacopa monnieri	herb-of-grace	native
Family: Solanaceae (nightshade)		
Lycium carolinianum	Christmasberry	native
Solanum tampicense	aquatic soda apple (wetland nightshade)	exotic
Family: Verbenaceae (vervain)		
Phyla nodiflora	capeweed	native
Family: Vitaceae (grape)		
Parthenocissus quinquefolia	Virginia creeper	native

Appendix B: Wildlife Sightings at DLP

		FWC	FWS	NMFS
		Designated Status		
Crustaceans				
Family: Grapsidae (crab)				
Aratus pisoni	mangrove tree crab			
Butterflies				
Family: Pieridae (whites and sulphurs)				
Ascia monuste	great southern white			
Phoebis philea	orange-barred sulphur			
Family: Nymphalidae (brushfoots)				
Anartia jatrophae	white peacock			
Fish				
Family: Pristidae (sawfishes)				
Pristis pectinata	smalltooth sawfish			E
Amphibians				
Family: Leptodactylidae (tropical frog)				
Eleutherodactylus planirostris	greenhouse frog			
Family: Bufonidae (toads)				
Bufo terrestris	southern toad			
Family: Hylidae (treefrogs)				
Hyla cinerea	green treefrog			
Hyla squirella	squirrel treefrog			
Family: Ranidae (true frogs)				
Rana grylio	pig frog			
Rana utricularia	southern leopard frog			
Family: Microhylidae (narrowmouth toads)				
Gastrophryne carolinensis	eastern narrow-mouth toad			
Reptiles				
Family: Alligatoridae (alligator and caimans)				
Alligator mississippiensis	American alligator	SSC	T S/A	
Family: Emydidae (pond turtles)				
Pseudemys nelsoni	Florida redbelly turtle			
Terrapene carolina bauri	Florida box turtle			
Family: Trionychidae (softshell turtles)				
Apalone ferox	Florida softshell			
Family: Polychridae (anoles)				
Anolis sagrei	brown anole			
Birds				
Family: Podicipedidae (grebes)				
Podilymbus podiceps	pied-billed grebe			
Family: Anhingidae (anhingas)				
Anhinga anhinga	anhinga			
Family: Ardeidae (herons, egrets, bitterns)				
Ardea alba	great egret			
Ardea herodias	great blue heron			
Bubulcus ibis	cattle egret			
Butorides virescens	green heron			
Egretta caerulea	little blue heron	SSC		
Egretta thula	snowy egret	SSC		
Egretta tricolor	tricolored heron	SSC		

Appendix B: Wildlife Sightings at DLP (continued)

		FWC	FWS	NMFS
		Designated Status		
Family: Ardeidae (herons, egrets, bitterns) - continued				
Nycticorax nycticorax	black-crowned night-heron			
Nyctanassa violacea	yellow-crowned night-heron			
Family: Threskiornithidae (ibises and spoonbills)				
Eudocimus albus	white ibis	SSC		
Plegadis falcinellus	glossy ibis			
Family: Gruidae (cranes)				
Grus canadensis	sandhill crane	T		
Family: Anatidae (swans, geese, ducks)				
Subfamily: Anatinae (dabbling ducks)				
Anas discors	blue-winged teal			
Anas fulvigula	mottled duck			
Family: Cathartidae (new world vultures)				
Coragyps atratus	black vulture			
Cathartes aura	turkey vulture			
Family: Accipitridae (hawks, kites, accipiters, harriers and eagles)				
Subfamily: Buteoninae (buteos)				
Buteo lineatus	red-shouldered hawk			
Haliaeetus leucocephalus	bald eagle	T	T	
Family: Pandionidae (ospreys)				
Pandion haliaetus	osprey			
Family: Phasianidae (pheasants, grouse, turkeys and allies)				
Subfamily: Meleagridinae (turkeys)				
Meleagris gallopavo	wild turkey			
Family: Falconidae (falcons)				
Falco sparverius	American kestrel			
Family: Rallidae (coots, gallinules)				
Gallinula chloropus	common moorhen			
Family: Scolopacidae (sandpipers)				
Actitis macularia	spotted sandpiper			
Gallinago gallinago	Wilson's snipe			
Family: Columbidae (pigeons and doves)				
Zenaida macroura	mourning dove			
Family: Cuculidae (cuckoos)				
Crotophaga ani	smooth-billed ani			
Family: Alcedinidae (kingfishers)				
Ceryle alcyon	belted kingfisher			
Family: Picidae (woodpeckers)				
Dryocopus pileatus	pileated woodpecker			
Melanerpes carolinus	red-bellied woodpecker			
Picoides pubescens	downy woodpecker			
Family: Tyrannidae (tyrant flycatchers)				
Myiarchus crinitus	great crested flycatcher			
Sayornis phoebe	eastern phoebe			
Family: Tryglodytidae (wrens)				
Thryothorus ludovicianus	Carolina wren			
Family: Sylviidae				
Subfamily: Polioptilinae (gnatcatchers)				
Polioptila caerulea	blue-gray gnatcatcher			

Appendix B: Wildlife Sightings at DLP (continued)

		FWC	FWS	NMFS
		Designated Status		
Family: Mimidae (mockingbirds and thrashers)				
Dumetella carolinensis	gray catbird			
Mimus polyglottos	northern mockingbird			
Family: Corvidae (crows, jays, etc.)				
Corvus brachyrhynchos	American crow			
Corvus ossifragus	fish crow			
Cyanocitta cristata	blue jay			
Family: Laniidae (shrikes)				
Lanius ludovicianus	loggerhead shrike			
Family: Vireonidae (vireos)				
Vireo griseus	white-eyed vireo			
Family: Parulidae (wood-warblers)				
Dendroica coronata	yellow-rumped warbler			
Dendroica discolor	prairie warbler			
Dendroica palmarum	palm warbler			
Dendroica pinus	pine warbler			
Geothlypis trichas	common yellowthroat			
Vermivora pinus	blue-winged warbler			
Family: Cardinalidae (cardinals)				
Cardinalis cardinalis	northern cardinal			
Family: Icteridae (blackbirds, orioles, etc.)				
Quiscalus quiscula	common grackle			
Mammals				
Family: Dildelphidae (opossums)				
Didelphis virginiana	Virginia opossum			
Family: Procyonidae (raccoons)				
Procyon lotor	raccoon			

Key

FWC: ***Florida Fish & Wildlife Conservation Commission***
FWS: ***U.S. Fish and Wildlife Service***
NMFS: ***National Marine Fisheries Service***

SSC: ***Species of Special Concern***
T: ***Threatened***
E: ***Endangered***

Appendix C - Projected Costs and Funding Sources Table

Structures & Improvements

Item	Possible Funding Sources	Estimated Cost
.3-mile boardwalk at Cow Slough	Lee County Parks & Recreation	$500,000
Overlook at Cow Slough		$25,000
		$525,000

Resource Enhancement & Protection

Item	Possible Funding Sources	Estimated Cost
Initial Invasive Exotic Plant Removal	Conservation 20/20, DEP - Bureau of Invasive Plant Management and/or USFWS Partner's for Wildlife	$980,000
Supplemental plantings around eagle nest	Conservation 20/20 and/or USFWS Partner's for Wildlife	$4,000
Hydrologic monitoring and soil samples for improved pasture		$15,000
Exotic grass removal of improved pasture		$133,410
Native plantings in improved pasture		$21,750
Hiring consultant for hydrologic permitting		$10,000
Backfilling ditches		$20,000
Hiring consultant to monitor pasture restoration & plantings	Conservation 20/20	$15,000
Native plantings - Cow Slough	Lee County Parks and Recreation	$10,000
Mechanical brush reduction	Conservation 20/20	$1,300
Fencing		$65,500
Archaeological Resource Protection		$20,000
		$1,295,960

Signage

Item	Possible Funding Sources	Estimated Cost
Information & Education signs - Cow Slough	Lee County Parks and Recreation	$5,000
Preserve Signs	Conservation 20/20	$2,000
		$7,000

TOTAL COST ESTIMATE **$1,827,960**

Site Management & Maintenance

Item	Possible Funding Sources	Estimated Cost
Exotic Plant Control-Follow Up Maintenance *(this cost will decrease as site reaches maintenance level)*	Conservation 20/20 and/or DEP - Bureau of Invasive Plant Management	$50,000 per year
Brush Maintenance (pine flatwoods)	Conservation 20/20	$500 per year
Cow Slough Trail Maintenance	Lee County Parks & Recreation	$1,000 per year

Yearly Maintenance Estimate **$51,500**

All costs are rough estimates based on information currently available.
Every effort will be made to not exceed this budget by more than 10%.