

Exhibit C

*Florida Scrub-jay Habitat Management Plan for the Lyonia Preserve Phase II and Phase III
Project Site, Volusia County, Florida, revised on March 15, 2004*

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**FLORIDA SCRUB-JAY HABITAT MANAGEMENT PLAN FOR THE
LYONIA PRESERVE PHASE II AND PHASE III PROJECT SITE,
VOLUSIA COUNTY, FLORIDA**

Revised:
March 15, 2004

Prepared for:

Ms. Saralee L. Morrissey, AICP
Director of Site Acquisition
and Intergovernmental Coordination
Volusia County School District
3750 Olson Drive
Daytona Beach, FL 32124

Prepared by:



Robert G. Epperson, Jr., M.S.
President

EXECUTIVE SUMMARY

This habitat management plan is an attachment to a Memorandum of Understanding (MOU) between the County of Volusia, Florida (County), the School Board of Volusia County, Florida (School Board), and the U.S. Fish and Wildlife Service (Service) for the Lyonia Preserve Phase II and Phase III project site. The specific goal of the Lyonia Preserve Phase II and Phase III habitat management plan is to perpetuate optimal habitat for the Florida scrub-jay (*Aphelocoma coerulescens*). Lyonia Preserve will provide a conservation area to offset or compensate for impacts to the scrub-jay from County public works and School Board projects.

The habitat management plan and draft MOU were initially provided to the Service on December 14, 2001 for review and comment, and written comments were issued by the Service on March 11, 2003. The County, School Board and Service met on June 16, 2003 to discuss the written comments, and to resolve outstanding issues concerning the habitat management plan and the MOU. Among the main concerns were issues related to xeric habitat management, cat predation, public access, and potential roadway mortality. Revisions to address these issues were incorporated into the habitat management plan and MOU, and provided to the Service in drafts dated January 16, 2004. Based on February 25, 2004 written comments from the Service, all issues were adequately addressed, and minor revisions were requested for the reporting requirements, which have been incorporated into the final habitat management plan and final MOU, dated March 15, 2004.

The importance of the xeric habitat component has been emphasized in this habitat management plan. The maintenance of suitable vegetative structure has been included along with specific criteria that define optimal habitat conditions. Habitat management and maintenance are now proposed to be performed based on routine assessment of the habitat criteria, and a combination of prescribed fire and/or mechanical restoration and enhancement methods will be implemented based on actual habitat conditions as opposed to the broad window for management and maintenance proposed in the earlier draft of this plan. Management activities and potential future adaptive management strategies have been included to address the issues of cat predation, public access, and potential roadway mortality. During the meeting referenced above, it was agreed that if these issues were addressed to the satisfaction of the Service, mitigation credits would be assigned at 2:1 for occupied habitat and 3:1 for unoccupied habitat. This habitat management plan has been revised accordingly, and fully addresses the issues and concerns of the Service.

The Florida scrub-jay is an endemic species listed as threatened by both the Service and the Florida Fish and Wildlife Conservation Commission (Commission). Florida scrub-jay populations occur in three distinct areas of Volusia County; the southwest, northeast, and southeast. Due to the extent of scrub-jay habitat, the County and the School Board anticipate that County public works and School Board projects currently planned and/or future projects will result in adverse impacts to populations of the Florida scrub-jay.

Section 16, Township 18 South, Range 31 East, is a land tract that was reserved for public education by an Act of Congress in 1845, and was leased for fifty years by the School Board in

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1987. The Section 16 lands currently contain two elementary schools, a middle school, a school bus transportation facility, a public library/environmental learning center, and the Daytona Beach Community College Deltona Campus. The School Board has determined that surplus lands are available in Section 16; therefore, a remainder of land totaling 357.08 acres can be utilized for non-facilities related educational activities. Given the management alternatives available and recognition of the increased need to provide listed species mitigation, the School Board designated those Section 16 lands not slated for development, now known as the "Lyonia Preserve," to serve as a scrub habitat mitigation management area.

In 1993, permits were obtained to establish the northwestern 100.01 acres, Phase I of the Lyonia Preserve, as a Florida scrub-jay mitigation area to offset impacts to four scrub-jay families associated with a County public works project, the West Volusia Beltline. As part of the mitigation, a habitat management plan was developed with the initial management consisting of scrub restoration through removal of the pine tree canopy, and creation of openings within the scrub vegetation. Prior to the 1994 habitat restoration, no scrub-jays had been documented; by the year 2000, the 100.01 acres provided habitat for 11 families of scrub-jays. Due to the success of Phase I, the School Board and the County have developed a MOU with the Service to utilize Phase II and Phase III of the Lyonia Preserve as scrub-jay habitat mitigation. A habitat management plan is required as part of the MOU.

Formal surveys were conducted on the Lyonia Preserve in 2000 to obtain current numbers of scrub-jays and numbers of families, and to define territory limits. This survey represented the first complete survey of all three phases of the project site conducted since 1992, and provided an update of the comprehensive Phase I and II survey last performed in 1996. A total population of 88 Florida scrub-jays was estimated on the Lyonia Preserve based on the results of the 2000 survey. This population estimate represents an increase of 70 birds compared to the 18 scrub-jays found on the project site during the last formal survey that was performed in 1996. In addition, successful breeding and production of young scrub-jays has been documented on the Lyonia Preserve during each of the last eight years, and the present 2003 population is estimated to exceed over 100 scrub-jays. Response by scrub-jays to the habitat management has been significant, particularly given that no scrub-jays occupied Section 16 prior to the Phase I enhancement.

The previous habitat management conducted on the Lyonia Preserve has resulted in a large population of scrub-jays distinguished by a greater average number of birds per family and a higher density of territories per unit area than has been reported for most other scrub-jay populations. Based on these characteristics, an assessment of the habitat encompassed by the 20 scrub-jay territories found on the Lyonia Preserve was performed to provide insight and guidance for future management activities.

Habitat quality and group size are the primary variables affecting territory size, and oak scrub interspersed with numerous sandy openings comprises essential scrub-jay habitat. The Phase I

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area contains 65% managed xeric oak and 31% total open habitat. These data suggest that oak scrub is an essential habitat component, and that higher densities of scrub-jays may occur within smaller areas of xeric oak that are managed to maintain appropriate vegetative structure and composition for both the xeric and open habitat components.

The specific goal of the Lyonia Preserve Phase II and III habitat management plan is to perpetuate optimal habitat for the Florida scrub-jay. The management techniques for these future phases will expand on the methodologies employed under Phase I. Overall management targets for Phases II and III include the provision of 35% total open habitat and 65% managed xeric habitat with less than 1% forested habitat. The initial management activity for both Phase II and Phase III will be a fuel wood harvest of sand pine canopy trees from the overgrown scrub habitats. For Phase II, only a buffer of sand pine remains along the south and west boundaries. The majority of Phase III is vegetated by both sand pine and xeric flatwoods, which will be completely harvested. Prescribed fire and/or mechanical methods will be the selected techniques used to manage the Phase II and III areas, and will be applied on an individual management cell basis. Subsequent maintenance will be performed and specific techniques prescribed based on assessment of actual habitat conditions. Additional openings in the xeric habitat needed by the scrub-jays can be created by a variety of mechanical means, including root raking, which will be the selected technique used to create managed open habitat. Maintenance through periodic mowing of the trails, including fire breaks, will be performed annually, or as needed, to preclude the re-vegetation of these openings by scrub and other woody species.

Establishment of the Lyonia Preserve Florida Scrub-Jay Mitigation Park will provide a conservation area to offset or compensate for impacts to the scrub-jay from County public works and School Board projects. Phase II of the Lyonia Preserve is currently occupied by the Florida scrub-jay and contains 120.69 acres of habitat that is suitable for restoration, management and use as mitigation. Phase III is not currently occupied by scrub-jays, however, it contains 126.50 acres of habitat that is suitable for restoration, management and use as mitigation. Mitigation credits available to the County and School Board will be determined based on scrub-jay occupancy and habitat quality. Scrub-jays already occupy Phase II, and a mitigation ratio of 2:1 will apply to Phase II once optimal habitat conditions have been documented. Mitigation credits for Phase III will occur at a 3:1 mitigation ratio, given that the area is unoccupied habitat. The number of mitigation credits potentially available in Phase II of the Lyonia Preserve is 60.34, which is based on a mitigation ratio of 2:1 for occupied habitat applied to a total available habitat area of 120.69 acres. Phase III of the Lyonia Preserve would have 42.17 mitigation credits available based on a mitigation ratio of 3:1 for unoccupied habitat applied to a total available habitat area of 126.50 acres. The credits available for Phase III will be re-evaluated once the area becomes occupied, and the 2:1 ratio will apply as the phase becomes occupied and optimal habitat conditions are achieved.

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APPENDIX Section 16 School Board Lease

1.0 INTRODUCTION

The County of Volusia, Florida (County) and the School Board of Volusia County, Florida (School Board) anticipate that County public works and School Board projects currently planned and/or future projects will result in adverse impacts to populations of the Florida scrub-jay (*Aphelocoma coerulescens*) in Volusia County. The Florida scrub-jay is listed as a threatened species by both the U.S. Fish and Wildlife Service (Service) and the Florida Fish and Wildlife Conservation Commission (Commission). The School Board has previously established that portion of the Section 16 land known as the “Lyonia Preserve” as a conservation area that allows for natural resource impacts to be mitigated through the management of important wildlife habitats. The County has mitigated previous unavoidable impacts to the scrub-jay within Phase I of the Lyonia Preserve. Based on the availability of the Section 16 to be designated as preservation lands and the success realized in Phase I, the Lyonia Preserve provides a unique opportunity to establish additional Florida scrub-jay habitat mitigation areas in order to mitigate for unavoidable impacts to this listed species resulting from County public works and School Board projects.

The purpose of this habitat management plan is to document the technical foundation for implementing the Lyonia Preserve Phase II and III Florida scrub-jay mitigation areas, and to provide the basis for determining the total number of available mitigation credits. This habitat management plan was prepared as a supporting attachment to the Memorandum of Understanding between the County of Volusia, Florida, School Board of Volusia County, Florida, and U.S. Fish and Wildlife Service for the Lyonia Preserve Phase II and Phase III project site.

1.1 Section 16 Description

The 357.08 acre Lyonia Preserve is located east of Interstate 4 in southwest Volusia County, Florida, along Providence Boulevard between Eustace Avenue and Elkcam Road in Section 16, Township 18 South, Range 31 East (Figure 1). Lyonia Preserve is part of a 640 acre Section 16 tract that was reserved for public education by an Act of Congress when Florida was admitted into the Union in 1845. In addition to the Lyonia Preserve, the balance of Section 16 currently contains two elementary schools, one middle school, a school bus transportation facility, a public library/environmental learning center, and a community college. An electrical power line traverses the section, and borders the northwest corner of Lyonia Preserve. Surrounding land uses adjacent to Section 16 include primarily residential development, along with agricultural and undeveloped woodlands to the east, and a golf course to the west.

1.1.1 School Board Lease Agreement

The School Board utilizes Section 16 for public education purposes through a lease agreement with the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida that

was executed through the Florida Department of Environmental Protection. The lease was executed on June 15, 1987 for a period of 50 years, and the School Board has approximately 34 years remaining on the lease as of the date of this habitat management plan. A copy of this lease (Lease Agreement No. 3403) is provided in the Appendix.

1.1.2 Land Management Plan and Designated Uses

The Section 16 lease held by the School Board required preparation and submittal of a Land Management Plan, which was accomplished on May 22, 1990. The Land Management Plan provides the basic guidance for all management activities on the leased lands. Four management alternatives for Section 16 are available to the School Board: education, preservation, recreation, and development. The Land Management Plan retains education as the primary purpose, however, it recognizes the importance of preservation as a complement to education, and also acknowledges recreation, through nature and hiking trails, as another public purpose for which the tract could be used. The Land Management Plan indicates that current uses include the existing elementary schools, middle school, school bus transportation facility, public library/ environmental learning center, and the future community college. The School Board has determined that surplus lands are available in Section 16; therefore, a remainder of land totaling 357.08 acres can be utilized for non-facilities related educational activities.

Given the management alternatives available and recognition of the increased need to provide listed species mitigation, the School Board designated those Section 16 lands not slated for development to serve as a scrub habitat mitigation management area. The mitigation area was intended to compensate for County public works and School Board project impacts to the scrub-jay that will occur elsewhere in Volusia County. These surplus lands as designated in the Land Management Plan are currently known as the "Lyonia Preserve." This management action was predicated by an extensive history of environmental educational uses of the property, local environmental concerns, and a desire by the School Board to provide environmental education opportunities and proper management of the undeveloped lands. Prior to the School Board lease, the section was previously leased beginning in 1958 by the DeLand Chapter of the Future Farmers of America (FFA). An Educational Agricultural Demonstration Project was initiated by the FFA to manage the tract for its forest resources. In 1982, during development of the first school site, Deltona Lakes Elementary School, located in the southeast corner of the section, a large wet sinkhole was proposed to be filled during construction. Following opposition from community members and school officials, the wet sinkhole was preserved as a natural feature. Subsequently, the wet sinkhole was incorporated into nature trails associated with the Sand Pine Nature Center, which was established on 25 acres of Section 16 located adjacent to the school. The nature center has received numerous state and national awards for its environmental programs.

The School Board recognized that preservation of undeveloped lands on Section 16 would meet the basic purpose of public education by promoting environmental awareness, and combined this use with proposed land management practices that can enhance a threatened ecosystem. The

Land Management Plan specifically proposes restoration of scrub habitats, and indicates that the lands now known as the Lyonia Preserve should be managed as mitigation areas for listed scrub species such as the Florida scrub-jay. As such, this habitat management plan is a supplement to the Land Management Plan.

It is important to recognize that the Lyonia Preserve portion of Section 16 is not a typical public environmental land with underlying assumptions of future management for environmental benefit. As mandated by an Act of Congress, Section 16 is to be used for public education as a first priority. The School Board retains the options of using the land for education, preservation, recreation, and/or development. Prior to designation of the Lyonia Preserve in the approved Land Management Plan as a preservation and scrub habitat mitigation management area, the other options were fully evaluated. As previously described, the School Board did not foresee the need to construct additional schools on the property. The next alternative was to fence the unused portion of the tract and leave it untouched. Simple preservation was not proposed because that option would fail to restore the scrub habitats and forfeit a rare opportunity to provide an environmental learning experience. The remaining option was to relinquish leasehold interest and recommend the uncommitted acreage for surplus. At this point, the property could have been leased by another state agency, and potentially developed for a number of uses, such as a state prison, or even sold for private development. This option would have released the School Board from the obligation of managing a large tract of land. However, it would have also ceded a long held interest by Volusia County in one of the last two remaining section 16's, and would have precluded the opportunity to provide present and future school children with educational benefits intended by the legislative act.

1.2 Previous Florida Scrub-Jay Mitigation

The foresight shown by the School Board in designating a portion of Section 16 for environmental preservation and management provided the opportunity for the initial restoration of scrub habitats on the Lyonia Preserve. In 1994, the northwestern 100.01 acres of the Lyonia Preserve was established as a Florida scrub-jay mitigation area to offset impacts to four scrub-jay families associated with a County public works project, the West Volusia Beltline. This area became Phase I of the scrub-jay mitigation project, and is also known as the North Management Area. The initial habitat management basically consisted of removal of the tree canopy, and creation of openings within the remaining scrub vegetation as discussed in further detail in Section 4.3 of this habitat management plan. Prior to the 1994 habitat restoration, no scrub-jays had been documented in the Phase I area; by the year 2000, Phase I provided habitat for 11 families of scrub-jays as detailed in Section 3.3.3 of this habitat management plan.

1.3 Lyonia Preserve Habitat Management Goals

The specific goal of the Lyonia Preserve habitat management plan is to perpetuate optimal habitat for the Florida scrub-jay. Scrub habitat will be restored and managed to enhance and maintain the

numbers and distribution of scrub-jays within the Lyonia Preserve. Implementation of habitat management activities will establish a conservation area available to offset or compensate for impacts to the scrub-jay from County public works and School Board projects, and to further the conservation of the scrub-jay in Volusia County. The management techniques employed in Phase I provide a basis for restoration of scrub habitats in Phases II and III, and the resulting success in site colonization by scrub-jays in Phase I appears unparalleled. Alternative scrub habitat management practices have been used on many other restoration sites with varying degrees of success, and improved management techniques will undoubtedly be developed in the future. Therefore, the use of adaptive management strategies will be integral to attaining the habitat management goals.

2.0 SITE DESCRIPTION

2.1 Environmental Setting

The 357.08 acre Lyonia Preserve is one of the largest remaining undeveloped tracts of land in the Deltona, Florida area. Providence Boulevard extends north-south through Section 16, and defines the boundaries for the various scrub-jay mitigation area phases. The existing 100.01 acre Phase I area occurs in the northern portion of the lands located west of Providence Boulevard, and Phase II, 127.32 acres, is found immediately south. The Phase III area is 129.75 acres, and occurs east of Providence Boulevard.

Phase I is bounded to the north by the public library/environmental learning center, to the northwest by the electrical power line and a middle school, to the west by residential and golf course development, to the south by Phase II, and to the east by Providence Boulevard. Phase II is bounded to the west by residential and golf course development, to the south by residential development, to the east by Providence Boulevard, and to the north by Phase I. Phase III is bounded to the west by Providence Boulevard, to the south by residential development, to the southeast by the Deltona Lakes Elementary School, to the east by low density housing and undeveloped woodlands, to the north by wetlands, and to the northwest by the future community college site.

Prior to the habitat restoration activities conducted for Phase I, the site was dominated by a closed canopy of mature sand pine (*Pinus clausa*). The Phase III area east of Providence Boulevard still retains its dominance by sand pine, although the northern portion is interspersed with xeric flatwoods, sand pine, freshwater marsh, and deep marsh wetlands. The pines have been removed from the project site west of Providence Boulevard, except for buffer areas along the south and west property boundaries. This western portion of the site is characterized by extensive xeric oak habitat interspersed with natural marshes and associated herbaceous uplands, and within Phase I, numerous man-made clearings created during initial site restoration.

The topographic relief on the Lyonia Preserve varies from undulating sandhills found above the 80 feet NGVD elevation contour to depressional wetlands that lie below the 15 feet NGVD contour.

2.2 Soil Types

There are six soil types found on the project site as mapped in the “Soil Survey of Volusia County, Florida” prepared by the U.S.D.A. Soil Conservation Service (1980), now known as the Natural Resources Conservation Service (NRCS): Daytona sand, 0 to 5 percent slopes (17); Myakka fine sand (32); Myakka fine sand, depressional (33); Orsino fine sand, 0 to 5 percent slopes (37); Paola fine sand, 0 to 8 percent slopes (42); and Paola fine sand, 8 to 17 percent slopes (43) (Figure 2).

As designated by the NRCS, only one hydric, or wetland, soil type, occurs on the project site, Myakka fine sand, depressional (33). This soil type is mapped within the northeast portion of Phase III and generally coincides with freshwater marsh and deep marsh habitats, although its actual occurrence on-site is not as extensive as mapped.

The remaining soil types are considered upland soils by the NRCS. The Myakka fine sand (32) soil type typically occurs in depressions in the flatwoods, and the natural vegetation is upland grasses; this soil type is found on-site in herbaceous uplands surrounding the marshes. The Daytona sand, 0 to 5 percent slopes (17), Orsino fine sand, 0 to 5 percent slopes (37), Paola fine sand, 0 to 8 percent slopes (42), and Paola fine sand, 8 to 17 percent slopes (43) dominate the project site, and are moderately to excessively well drained soils that occur in association with undulating sandhills vegetated by sand pine-scrub oak and/or sand pine vegetation.

2.3 Land Use and Cover Types

Existing land uses and cover types were identified and mapped for the Lyonia Preserve project site based on groundtruthing and photo-interpretation of 1" = 200' true color aerial photography flown in 1998. Boundary surveys were used in production of the base map, which was scaled to overlay on the aerial photograph. A total of 16 different cover types was mapped on the 357.08 acre project site based on the “Florida Land Use, Cover and Forms Classification System” (FLUCFCS) (Florida Department of Transportation 1985). The cover types are depicted on the figure titled “Land Use and Cover Types on the Lyonia Preserve Project Site, Section 16, Volusia County, Florida,” included in the attached map pocket as Figure 3. Acreages were calculated by cover type for each of the three phases, and are summarized in Table 1.

The western portion of the project site, including Phases I and II, is unique due to the previous mitigation performed for the West Volusia Beltline. The initial habitat management for the mitigation project consisted of removal of the tree canopy, and creation of openings, termed “managed open habitat,” within the remaining scrub vegetation as discussed in further detail in Section 4.3 of this habitat management plan. The harvested areas were converted from a sand pine (413) cover type to a xeric oak (421) cover type following pine removal. The xeric oak (421) cover type is dominated by varying densities of four species of oak, including myrtle oak (*Quercus myrtifolia*), sand live oak (*Quercus geminata*), Chapman’s oak (*Quercus chapmanii*),

and turkey oak (*Quercus laevis*). This managed cover type also contains rusty lyonia (*Lyonia ferruginea*) for which the site is named, young sand pine, saw palmetto (*Serenoa repens*), and low densities of various herbaceous species.

Creation of openings in the scrub resulted in a number of managed open habitat cover types for which individual FLUCFS codes were assigned, including the following: managed trail, 50' wide (311); managed clearing (312); managed fire break, 15' wide (313); managed trail, 8' wide (314); other trails, 8' wide/existing, logging, and added trails (315); and managed nature trail, 4' wide (316). The managed openings, with exception of nature trails, were created by root raking to reduce the growth of oaks and to provide sandy open areas. The nature trails were created by hand clearing. Since the initial management by root raking in Phase I, the managed open habitats have re-vegetated with varying densities of young oaks, young sand pine, rusty lyonia, rosemary (*Ceratiola ericoides*), and numerous herbaceous species. Several listed plants have populated the managed openings as discussed in Section 2.4.2 of this habitat management plan.

Natural un-managed cover types found on the project site include herbaceous (310), xeric flatwoods (412), sand pine (413), mixed hardwood-conifer (434), freshwater marsh, seasonally dry (641), and emergent aquatic vegetation (644). The herbaceous (310) cover types are typically associated with the marsh areas, and occur as perimeter uplands dominated by broomsedge (*Andropogon virginicus*) and other upland grasses. Xeric flatwoods (412) are found in the northeast corner of Phase III, and consist of mixed longleaf pine (*Pinus palustris*) and scattered slash pine (*Pinus elliottii*) in the canopy, a subcanopy of xeric oaks (*Quercus* spp.), and saw palmetto in the ground cover. The sand pine (413) cover type contains a moderate to dense canopy of sand pine, an understory of various xeric oaks, and a ground cover dominated by saw palmetto. The mixed hardwood-conifer (434) cover type occurs adjacent to the marshes west of Providence Boulevard. This cover type includes a co-dominance of longleaf pine, slash pine, and sand live oak, along with occasional sweetgum (*Liquidambar styraciflua*).

The freshwater marsh, seasonally dry (641) cover type occurs in the central portion of the project site west of Providence Boulevard, and in the northeast corner of the property. This cover type is dominated by herbaceous wetland species, including maidencane (*Panicum hemitomon*), various sedges (*Cyperus* spp.) and rushes (*Rhynchospora* spp.), yellow-eyed grass (*Xyris* sp.), hat pin (*Eriocaulon compressum*), and bog button (*Lachnocaulon anceps*), along with several species of St. John's wort (*Hypericum* spp.). The marshes are ephemeral, and contain standing water generally only during the summer wet season. The emergent aquatic vegetation (644) cover type occurs in the lower central portions of two of the marshes. Fragrant water lily (*Nymphaea odorata*) is the dominant species, and standing water is present through most of the year in these deep marshes.

Several man-altered cover types, other than managed cover types, are found on the Lyonia Preserve. Mowed landscape/roadway grassland (317) occurs adjacent to Providence Boulevard, and is predominately bahiagrass (*Paspalum notatum*) that is mowed along the roadside. During construction of this roadway, borrow areas (742) were excavated as cut material to meet road

grades. These borrow areas (742) cover types consist of largely bare sand on steep slopes. The marshes found in the northeast corner of Phase III have been subjected to severe disruption by off-road vehicles. The surrounding uplands have been denuded of vegetation, and are classified as a sand, other than beach (720) cover type.

2.3.1 Phase I - North Management Area

Phase I totals 100.01 acres and includes 13 different cover types (Figure 3). Approximately 26% of the North Management Area contains managed open habitat cover types totaling 26.07 acres. The xeric oak (421) cover type totals 65.52 acres, or 66% of Phase I. Remaining cover types include freshwater marsh, seasonally dry (641), herbaceous (310) cover types that border the marsh, and a forested mixed hardwood-conifer (434) stand that was left intact adjacent to the marsh to provide a buffer and increased habitat diversity.

2.3.2 Phase II - South Management Area

Phase II totals 127.32 acres and includes 13 different cover types (Figure 3). The majority, 73%, of the South Management Area is vegetated by managed xeric oak (421) totaling 92.85 acres. Sand pine (413) was left intact along the south and west boundaries of Phase II to provide a buffer from adjacent residential development. Two areas of freshwater marsh, seasonally dry (641) occur within this phase, the largest of which contains an interior emergent aquatic vegetation (644) cover type and an adjacent perimeter herbaceous (310) cover type. Forested mixed hardwood-conifer (434) stands are found adjacent to the marshes.

A portion of Phase II was treated with managed clearings during the Phase I mitigation. This "4.59 Acre Area" occurs between the southern boundary of the east-west managed trail, 50' wide (311) cover type and the Phase I and Phase II boundary. For purposes of management, the 4.59 Acre Area is included in Phase I, however, for purposes of future scrub-jay mitigation credit, the 4.59 Acre Area remains in Phase II.

2.3.3 Phase III - East Management Area

Phase III totals 129.75 acres and includes six different cover types (Figure 3). The majority, 82%, of the East Management Area contains forested cover types, including: xeric flatwoods (412), 11.79 acres; and sand pine (413), 94.50 acres. Several freshwater marsh, seasonally dry (641) cover types occur within this phase, the largest of which contains an interior emergent aquatic vegetation (644) cover type. The sand, other than beach (720) cover type occurs adjacent to these marshes.

2.4 Fish and Wildlife Habitats

As detailed in the previous section of this habitat management plan, the Lyonia Preserve contains a wide range of cover types that span the ecological spectrum from deep marsh to xeric oak habitats. Extensive management of Phase I and partial management of Phase II have increased the diversity of cover types, resulting in an increase in the availability and suitability of habitats for numerous fish and wildlife species, including a variety of listed species.

2.4.1 Fish and Wildlife Occurrence

A total of 91 fish and wildlife species have been observed on the Lyonia Preserve as documented by Volusia County Environmental Management staff (Sleister, pers. comm., 2000). Included are two fish, 10 amphibian, 12 reptile, 60 bird, and seven mammal species. Due to the occurrence of the Florida scrub-jay and the numerous other birds species found on-site, the Lyonia Preserve has been included by the Commission on a list of ecologically significant birding sites known as the Great Florida Birding Trail. Inclusion on the Trail is reflective of the uniqueness of the Lyonia Preserve and the habitat value it provides for birds and other wildlife.

2.4.2 Listed Species Occurrence

In addition to the Florida scrub-jay, the Lyonia Preserve currently provides suitable habitat for another 10 listed wildlife species, including the following species that have been documented to occur on-site: gopher frog (*Rana capito*); indigo snake (*Drymarchon corais couperi*); gopher tortoise (*Gopherus polyphemus*); little blue heron (*Egretta caerulea*); snowy egret (*Egretta thula*); white ibis (*Eudocimus albus*); southeastern American kestrel (*Falco sparverius paulus*); Florida sandhill crane (*Grus canadensis pratensis*); wood stork (*Mycteria americana*); and Florida mouse (*Podomys floridanus*). The County has performed several gopher tortoise relocations onto the Lyonia Preserve, and their burrows are readily evident in the managed open habitats. Prior to management in 1994, few tortoises were observed on-site, likely due to closed canopy conditions and the general absence of herbaceous ground cover, which is used as forage by the tortoise.

Several listed plant species have been documented to occur on the Lyonia Preserve, including jointweed (*Polygonella basiramia*), garberia (*Garberia heterophylla*), and Curtiss' milkweed (*Asclepias curtissii*). The listed species nolina (*Nolina brittoniana*), conradina (*Conradina brevifolia*), and scrub plum (*Prunus geniculata*) were planted on the Lyonia Preserve. Garberia and milkweed have been observed within the managed open habitats, and jointweed has been observed in several localities.

3.0 STATUS OF THE FLORIDA SCRUB-JAY

The Florida scrub-jay is the only avian species endemic to Florida, and is found primarily along well drained ancient interior and coastal dune systems that are vegetated by scrub (Fitzpatrick *et al.* 1991). Scrub, or xeric habitat, is also favored for citrus groves and land development, and consequently, significant decreases in the extent of scrub habitat have occurred in Florida. The remaining scrub exists as fragmented parcels that have decreased in suitability for the scrub-jay due to fire suppression, or lack of other management (Cox 1987). Scrub-jay populations have gradually declined as the scrub disappeared or became unsuitable.

Cox (1987) estimated the total scrub-jay population in 1984 to be 15,600 to 22,800 birds, potentially 50 percent less than levels that existed 100 years ago. Fitzpatrick *et al.* (1991) considered 50 percent to be an underestimate of the statewide decline. As of 1993, the total population was estimated to contain about 4,000 pairs, which suggested a 25 to 50 percent decrease from Cox's (1987) study (Stith *et al.* 1996). Based on an average scrub-jay family group size of 2.8 birds, Toland (1999) translated the 4,000 pair estimate to a total population of $11,000 \pm$ scrub-jays present statewide in 1993. A recent assessment suggests that the current scrub-jay population is less than 10 percent of the historic population (Bowman and Woolfenden 1998).

Concurrent with decreased numbers, the geographical range of the scrub-jay has also declined such that the species is no longer present in 10 of the 39 formerly occupied counties, and five of the 29 remaining counties with scrub-jay populations have only 10 or fewer pairs (Fitzpatrick *et al.* 1994).

For this habitat management plan, a review of documented scrub-jay occurrence in Volusia County was performed, previous studies of the project site and vicinity were evaluated, and specific surveys were conducted on the Lyonia Preserve to obtain a current population estimate.

3.1 Occurrence in Volusia County

Historical and current documentation of Florida scrub-jay occurrence in Volusia County was reported by Cox (1987) based on surveys conducted from 1980 to 1984. A population of 63 scrub-jays was estimated at 17 localities. The scrub-jay observations were clustered in three distinct areas of Volusia County; the southwest, northeast, and southeast. These population clusters are now considered to represent three separate metapopulations, which are defined as demographically independent populations separated by at least 12 km ($7.5 \pm$ miles) (Stith, *et al.* 1996). Four of the localities documented by Cox (1987) occur within a five mile radius of the Lyonia Preserve, including two sites (Deltona No. 5 and Deltona No. 6) harboring 19 scrub-jays, which represented the largest concentration in the southwest metapopulation of Volusia County. Deltona No. 5 is located approximately one mile north of the Lyonia Preserve, and Deltona No. 6 is found about three miles to the south/southeast. Cox (1987) stated that these two sites would probably disappear given continued development in the Deltona area.

Toland (1999) reported that Cox's (1987) study missed a substantial number of smaller scrub-jay subpopulations and isolated family groups throughout Florida; among other localities, this undercount likely occurred for scrub-jays in Volusia County. Data from the most recent statewide scrub-jay surveys conducted in 1992-1993 indicate that 131 scrub-jays in 54 family groups occurred within the southwest metapopulation in Volusia County (Stith 1999). The southwest metapopulation generally extends from DeLand southward to DeBary and Osteen and encompasses the Lyonia Preserve project site.

3.2 Previous Section 16 Florida Scrub-Jay Surveys

The earliest known assessment of the status of scrub-jays on Section 16 was provided by Peacock and Robinson (1989). The authors noted that no scrub-jays had been recorded to date on Section 16. Although specific survey methodologies were not reported, no scrub-jays were documented in their report. Reference was made to the scrub-jay occurrence on Section 9, the adjacent section to the north, as first described by Cox (1987).

Scrub-jay surveys were conducted on Section 16 and adjacent lands during development of the mitigation plan for Phase I (Young and Palmer 1992). The survey methodology employed standard playback of scrub-jay territorial calls. No scrub-jays were found on Section 16, and the researchers surmised that the absence of scrub-jays was due to the lack of suitable habitat. Two scrub-jay families, however, were located on adjacent lands. One family was observed in a partially developed residential area in the southwest quarter of Section 9, which is the adjacent section to the north. This family group contained five individuals, and appears to coincide with the Deltona No. 5 site reported by Cox (1987). The second family group was observed along the electrical power line approximately 1,000 feet west of Section 16. Although reported as a single family, observations of up to five individuals were documented at three separate locations extending over one mile southwest along the power line. This second scrub-jay family group was not previously reported by Cox (1987).

The Lyonia Preserve Phase I mitigation was initiated in February 1994 with timber harvesting that was completed in March 1994. A prescribed fire was conducted on the southeast management cell in April 1994. All initial management activities were completed by August 1994, including creation of the managed open habitats; additional details of the Phase I management techniques are provided in Section 4.3 of this habitat management plan. The first Florida scrub-jay, an individual bird, was documented on the Lyonia Preserve on September 3, 1994 (Sleister, pers. comm. 2000). The bird was seen in the eastern portion of Phase I near Providence Boulevard. The first scrub-jay family was observed on-site in Phase I on March 24, 1995, and three separate scrub-jay families were documented on June 16, 1995. The first scrub-jay observation in the Phase II portion of the Lyonia Preserve occurred on September 27, 1995.

Scrub-jay observations continued through 1995, and the first formal survey subsequent to initiation of the management activities was performed the following spring (Richardson 1996).

The survey was conducted from April 18, 1996 to May 6, 1996 using standard playback of scrub-jay territorial calls broadcast in a grid pattern that fully covered both Phase I and Phase II of the Lyonia Preserve. Based on the survey results, 18 individual scrub-jays representing six family groups were estimated to occur on the Lyonia Preserve. Although territories were not defined during Richardson's (1996) study, four scrub-jay families appeared to occupy the Phase I area, and two families used the Phase II area, which had been harvested but not treated with managed open habitat clearings, prescribed fire, or other enhancements.

3.3 2000 Lyonia Preserve Florida Scrub-Jay Survey

Formal surveys were conducted on the Lyonia Preserve in 2000 to obtain current numbers of scrub-jays and numbers of families, and to define territory limits. This survey represented the first complete survey of all three phases of the project site conducted since 1992, and provided an update of the comprehensive Phase I and II survey last performed in 1996.

The surveys were greatly facilitated by the color-banding of scrub-jays that was initiated in August 1998. Prior to performing the 2000 survey, a total of 47 scrub-jays had been color-banded on the Lyonia Preserve by Volusia County Environmental Management in cooperation with the Florida Park Service (Sleister, pers. comm. 2000). One additional scrub-jay, wearing only a silver metal Service leg band, was known to be present prior to the survey, resulting in a potential occurrence of up to 48 banded individuals on the project site.

Standard surveying techniques based on tape playback of scrub-jay territorial vocalizations (Fitzpatrick *et al.* 1991) were used to locate scrub-jays as described below.

3.3.1 Playback Testing

Prior to conducting the survey, playback of scrub-jay territorial vocalizations obtained from the Archbold Biological Station (Archbold) was evaluated to determine effective distance in various habitat types and terrains representative of the project site. A handheld "boom-box" cassette tape player was used to provide playback at measured intervals along transects located through open habitats, low growth scrub, and densely forested areas. Playback was also tested across topographic gradients in the various habitats, including areas with higher elevations between the observation and playback locations.

The test results indicated that playback was readily detected at distances of up to 500 to 600 feet through open, level terrain. Playback was clearly audible at distances of up 450 feet through low scrub and densely wooded areas and across uneven topography in all habitats.

3.3.2 Survey Methodology

The results of the playback testing and general knowledge of known scrub-jay locations from previous site studies were used to select survey transects and stations. A total of 22 survey transects representing 92 playback stations was established at varying intervals relative to habitat and topographic conditions to obtain effective coverage of all potential scrub-jay habitat on the Lyonia Preserve (Figure 4). Transects and playback stations were placed at more frequent intervals in the Phase I portion of the project site where higher densities of scrub-jays were known to occur. Numerous managed trails and clearings in Phase I and existing trails in Phase II aided in selection of playback locations, and facilitated plotting of stations and scrub-jay observations on aerial photographs.

Playback stations were located throughout the relatively open areas in the northern portion of Phase III. The southern portion of Phase III contains an extensive continuous canopy of dense sand pine, which was assumed to represent unsuitable habitat for the scrub-jay (Fitzpatrick *et al.* 1991). Therefore, playback stations were established around the perimeter of the southern portion of Phase III, and the densely wooded sand pine interior was not surveyed. Playback stations along the west side of Phase III were extended north along Providence Boulevard to determine if the scrub-jays known to be present west of the roadway were also utilizing areas to the east.

Scrub-jay surveys were timed to occur prior to nesting, and were performed between March 10, 2000 and March 28, 2000. Surveys generally began one hour after sunrise and continued until midday. No surveys were conducted during rain or windy conditions. During each playback, the time, temperature, wind speed and direction, barometric pressure, visibility, cloud cover, and precipitation were documented. Playback at each station was broadcast for at least one minute in all four cardinal directions. At the conclusion of the playback, observations continued for several minutes if an immediate response was not obtained, and on several occasions, playback was repeated to confirm the absence of scrub-jays.

The locations, numbers, and color-banding sequences of all observed scrub-jays were recorded. For the majority of the observations, the color-banding sequence, or lack of bands, was confirmed by at least two observers. Initial locations, territorial interactions, other pertinent behaviors, and direction and distance of departure were plotted on an aerial photograph based on compass bearing and distance data obtained for each observation.

The survey was conducted in two phases, with the initial phase targeted to cover all 92 stations and determine the presence or absence of scrub-jays. For those stations where scrub-jays were not observed, playback was repeated on at least one to two subsequent dates. The second phase of the survey involved determination of family groupings and territorial boundaries. Playback was repeated at stations where previous observations indicated the potential for occurrence of two or more separate scrub-jay families. In addition, playback was performed at 50 intermediate stations that were established to refine family numbers, family membership and territorial limits.

In total, 142 transect stations and intermediate stations were surveyed involving 199 playbacks. An intensive and thorough analysis of the survey data was performed to determine total numbers of birds, family affiliations, and territorial boundaries as presented in the following sections of this habitat management plan.

3.3.3 Florida Scrub-Jay Survey Results

A total population of 88 Florida scrub-jays was estimated on the Lyonia Preserve based on the results of the 2000 survey (Table 2). This population estimate represents an increase of 70 birds compared to the 18 scrub-jays found on the project site during the last formal survey that was performed in 1996 (Richardson 1996). In addition, the Lyonia Preserve population as of this report date was estimated to exceed over 100 scrub-jays based on the observed nesting success during the subsequent breeding seasons following the 2000 survey (Sleister, pers. comm. 2003).

Response by scrub-jays to the habitat management has been considerable, particularly given that no scrub-jays occupied Section 16 prior to the Phase I enhancement, and only two groups of scrub-jays were documented in the immediate vicinity (Cox 1987; Young and Palmer 1992). These adjacent groups occur in suburban habitats that have been isolated from large scrub tracts. Breininger (1999) stated that scrub-jays in fragmented habitats can be an important source of individuals to colonize formerly unoccupied habitats that have been restored. Breininger (1999) also noted that dispersal distances were longer for scrub-jays residing in urban habitats than for birds found in natural landscapes where non-breeders typically disperse to adjacent territories. Given these dispersal patterns, in addition to dispersal that has undoubtedly occurred from the two nearby groups, it is likely that scrub-jays from other territories found on fragmented habitats within the southwest metapopulation have dispersed to the Lyonia Preserve.

Scrub-jay dispersal from isolated habitats is one of several mechanisms that can allow colonization of restored habitats. The extensive newly managed habitat on the Lyonia Preserve provided favorable conditions for population increases among the scrub-jays that dispersed to the project site. Available habitat also becomes occupied by territorial expansion and through a process known as territorial budding (Woolfenden and Fitzpatrick 1978). As a scrub-jay pair produces offspring that become helpers, productivity of the pair increases as more helpers are retained, which results in increased territory size. Male helpers frequently become breeders by inheriting a portion of the expanded natal territory and acquiring a mate, thereby, establishing a new territory that may also encompass available adjacent habitat. The population increase on the Lyonia Preserve, from 18 birds in 1996 to 88 birds in 2000, paralleled an increase in the number of family groups as discussed below.

3.3.3.1 Number of Families, Group Size and Family Composition

Based on the results of the 2000 survey, 20 separate family groups of Florida scrub-jays were estimated to occur on the Lyonia Preserve (Table 2). Groups varied in size from two to eight

individuals, and averaged 4.4 members per group. Only one group contained a simple mated pair, 25% of the groups contained three birds, 35% included four members, and 35% had five or more members. The average group size reported by Fitzpatrick *et al.* (1991) was three members, and although large groups are rare, extended-family groups of eight adults and one to four juveniles have been documented. Family No. 5 consisted of eight family members, the highest number among all groups, and may potentially constitute an extended-family group. The current number of family groups represents an increase of 14 families compared to the six families found in 1996 by Richardson (1996).

Color-banded scrub-jays were present in 15 of the 20 family groups (Table 2). The five families with no color-banded individuals occurred on territories found entirely within the Phase II portion of the project site, as discussed in the following section of this habitat management plan. To date, no banding activity has been conducted in the interior of the Phase II area. All groups contained unbanded members, except for Family No. 4 from which two of its members were banded on March 10, 2000 immediately prior to the survey.

A total of 45 color-banded scrub-jays was observed during the survey, which represents 94% of the 48 birds banded on the Lyonia Preserve prior to the survey. No juvenile plumage birds were color-banded due to the seasonal timing of the banding activities, and consequently the ages of individual birds are unknown. However, the survival rate of scrub-jays on the Lyonia Preserve appears to be very high since 50% of the colored-banded birds were banded from one to two years before the survey, and it is likely that a number of these birds were yearlings due to the recent colonization and population expansion on the Lyonia Preserve.

3.3.3.2 Territory Extent

Florida scrub-jay territories as depicted on Figure 5 were primarily estimated based on family group composition and observed locations, and numerous territorial interactions noted during the survey. Several assumptions were also formulated to refine the estimated territory configurations. Members of several of the scrub-jay families found along the northwest side of Phase I were observed off-site within the adjacent power line easement. This easement contains a mosaic of sand roads and trails, and open sandy areas interspersed with xeric oaks that are maintained as low shrubs, which in essence fits the classic description of preferred scrub-jay habitat (Fitzpatrick *et al.* 1991). Territories for Family Nos. 1, 2, 7, and 8 were assumed to extend off-site to fully encompass the adjacent power line easement. The assumed territory limits were terminated at the adjacent school site where fully developed areas and dense sand pine appeared unsuitable for use by scrub-jays.

Scrub-jays in Family Nos. 2 and 3 were observed in the grass areas on the south side of the parking lot of the Deltona Public Library located off-site to the north, and territory limits were extended to include these areas. Scrub-jays from the families adjacent to Providence Boulevard were seen within the grass area on the west side of the right-of-way on several occasions, and

rarely within the grass area on the east side. No observations occurred in the dense sand pine found in Phase III east of the roadway. The territories for Family Nos. 3, 4, 10, 11, and 20 were extended to the east side of the roadway. Few survey observations of scrub-jays occurred along the south and west boundaries, which contain a perimeter fire break bordered by a 100 feet wide zone of sand pine. However, numerous backyard bird feeders occur along the fire break, and the homeowners reported frequent scrub-jay sightings. Territories for Family Nos. 8, 15, 16, 17, 18, 19, and 20 were assumed to extend to the property boundaries.

Territory size was calculated for the 20 scrub-jay families based on the estimated extent, and segregated into the component on-site and off-site acreages (Table 3). Territory size ranged from 6.07 acres to 21.85 acres, and averaged 12.54 acres. All territories combined fully encompassed the 227.33 acres contained within Phases I and II of the Lyonia Preserve, and an additional 23.42 acres was included off-site, primarily within the power line easement and the right-of-way of Providence Boulevard. The smallest territories occurred within the Phase I area, while the largest territories were observed in Phase II (Figure 5).

As cited in Fitzpatrick *et al.* (1991), Woolfenden and Fitzpatrick (1984) reported that overall average territory size in good quality scrub-jay habitat at Archbold is 9.0 hectares (22.23 acres), and stable territories ranged in size from 4 to 18 hectares (10 to 45 acres). Also reported were data for the smallest stable territory sizes that ranged from 2 to 9 hectares (5 to 22 acres) and averaged 5.4 hectares (13.5 acres). Breininger *et al.* (1995) reported an average total territory size of 9.3 hectares (22.97 acres), based on data collected in 1991 at the Kennedy Space Center (KSC) in Brevard County, Florida. The scrub-jay territories consisted of patches of open oak, oak-palmetto, ruderal-maintained, and marsh habitats interspersed with the dominant vegetation, palmetto-lyonia. The average territory contained 6.5 hectares (16.05 acres) of palmetto-lyonia, a mesic association, and only 2.6 hectares (6.42 acres) of open oak and oak-palmetto; the latter associations more closely parallel the xeric oak habitat on the Lyonia Preserve compared to the other habitats at KSC. The smallest territories at KSC were observed where scrub oaks were adjacent to sandy areas among ruderal grass.

The 12.54 acre average territory size observed on the Lyonia Preserve is slightly smaller than the 13.5 acre average territory for small, but stable territories at Archbold. Average territory size on the project site is about half of the 22.97 acre average territory size reported at KSC. Territories at KSC were characterized by scattered patches of scrub in contrast to the extensive contiguous xeric oak found at the Lyonia Preserve.

3.3.3.3 Population Density

Fitzpatrick *et al.* (1991) stated that the most useful measure of scrub-jay density is the number of territories defended within a unit of scrub area, and that mean density in prime habitat at Archbold was about five territories per 40 hectares (100 acres). Natural variation between about two to six territories per 40 hectares was observed. Larger territory sizes and corresponding lower densities

of between 2.5 and 3.5 territories per 40 hectares was noted for poor quality scrub habitats, which consisted of widely scattered oak patches interspersed with extensive areas of low saw palmetto and sparse oaks. In comparison with all previously reported data, Fitzpatrick *et al.* (1991) concluded that 6.5 territories per 40 hectares should be the maximum sustainable density of scrub-jays in optimal habitat. The scrub-jay density at the Lyonia Preserve is 7.9 territories per 40 hectares based on the observed 20 territories and a total combined territory extent of 250.75 acres.

3.3.3.4 Spatial Structure

Based on terminology described by Stith *et al.* (1996), a subpopulation of scrub-jays is spatially separated from other scrub-jays by gaps of 3.5 km (2.2 miles). This distance represents the maximum dispersal distance for 80% of all scrub-jay dispersals at Archbold, on which, along with the KSC, most studies of the Florida scrub-jay have been conducted (Breininger 1999). A metapopulation is separated by 12 km (7.5 miles), representing the maximum dispersal distance for more than 99% of all dispersals at Archbold (Stith *et al.* 1996). The scrub-jays residing on the Lyonia Preserve are members of the southwest metapopulation, one of three metapopulations defined in Volusia County by Stith, *et al.* (1996). The resident scrub-jays represent a significant portion of a subpopulation that appears to be centered on the project site. The scrub-jays found in the section to the north (Cox 1987), and the scrub-jays observed in the adjacent sections to the west and southwest (Young and Palmer 1992) would also be included within this subpopulation.

The Lyonia Preserve, with 20 family groups, forms the nucleus of a subpopulation that is greater in group size than 80% of all known scrub-jay subpopulations evaluated by Stith *et al.* (1996). Woolfenden and Fitzpatrick (1991) estimated that an isolated preserve must be large enough to support 20 to 40 breeding pairs of scrub-jays to allow a 90% chance of persisting for more than 100 years. Since the Lyonia Preserve already contains a scrub-jay population only exceeded by 20% of all known populations, the proposed Phase II and III management will enhance the current significance of the project site as future management is performed and the scrub-jay population increases accordingly.

4.0 FLORIDA SCRUB-JAY HABITAT ASSESSMENT

Oak-dominated scrub, which is classified as the xeric oak (421) cover type, provides the essential habitat component for the scrub-jay. Optimal habitat is described as containing low-growing oaks between one and three meters in height that is interspersed with numerous patches of exposed sand, which can vary down to 10 to 15% open sand (Fitzpatrick *et al.* 1991). The Lyonia Preserve project site contains extensive coverage by the xeric oak (421) cover type, which has been managed in Phases I and II through the removal of the sand pine canopy. To replicate the open sandy component of optimal scrub-jay habitat, managed open habitat was created by clearing a variety of open areas, including wide and narrow trails, pocket clearings, and fire breaks. Scrub-jay territories often contain a variety of other natural herbaceous and forested

cover types that provide habitat. For the Lyonia Preserve, these cover types include herbaceous (310) grasslands, freshwater marsh, seasonally dry (641), and mixed hardwood-conifer (434), which were incorporated into the management area in their natural state.

The previous habitat management conducted on the Lyonia Preserve has resulted in a significant population of scrub-jays distinguished by a greater average number of birds per family and a higher density of territories per unit area than has been reported for most other scrub-jay populations. Based on these characteristics, an assessment of the habitat encompassed by the 20 scrub-jay territories found on the Lyonia Preserve was performed to provide insight and guidance for future management activities.

4.1 Territory Habitat Composition

Individual land use and cover types found within each separate scrub-jay territory were analyzed and grouped into the following primary habitat types: managed open habitat; un-managed open habitat; managed xeric oak habitat; forested habitat; and unsuitable habitat (Table 4). Managed open habitat includes the following cover types: managed trail, 50' wide (311); managed clearing (312); managed fire break, 15' wide (313); managed trail, 8' wide (314); other trails, 8' wide/ existing, logging, and added trails (315); managed nature trail, 4' wide (316); mowed landscape/ roadway grassland (317); and electrical power transmission line (832) the latter of which occur off-site. Un-managed open habitat includes herbaceous (310) grasslands, freshwater marsh, seasonally dry (641), and the bare sand borrow areas (742). Since the managed open habitat and un-managed open habitat provide openings, to varying degrees, that are required by scrub-jays, these habitat categories were combined into total open habitat for purposes of analysis. Forested habitat includes the sand pine (413) and mixed hardwood-conifer (434) cover types, which both contain an understory of scrub oak.

The managed open habitat, un-managed open habitat, and forested habitat constitute the suitable habitat types found on the Lyonia Preserve. On-site unsuitable habitat includes only the deep marsh, emergent aquatic vegetation (644) cover type. The roadway pavement (814) cover type is unsuitable habitat that occurs within several territories, however, this cover type occurs off-site.

4.2 Comparison of Territories in Phase I and Phase II Areas

The Phase I area contains the majority of the managed habitat on the Lyonia Preserve. The pine canopy was harvested from both Phases I and II to create managed xeric habitat, and although Phase II has become populated by scrub-jays, it has not been fully managed to provide the open managed habitat that was created in Phase I. As stated in Section 3.3.3.2 of this habitat management plan, the smallest scrub-jay territories occurred within the Phase I area, while the largest territories were observed in Phase II (Figure 5). It was postulated that this difference may be largely attributed to the lower percentage of total open habitat in Phase II, among other possible factors.

Woolfenden and Fitzpatrick (1978) found that habitat quality and group size are the most important variables affecting territory size. These variables were evaluated for the scrub-jay territories on the Lyonia Preserve with emphasis on the location of individual territories as follows. Three scrub-jay territories (Nos. 5, 6, and 9) occur entirely within the boundaries of the Phase I North Management Area (Figure 5). The limits of eight territories (Nos. 1, 2, 3, 4, 7, 8, 10, and 13) have greater than 50% extent within the Phase I area. Five scrub-jay territories (Nos. 16, 17, 18, 19, and 20) occur entirely within the boundaries of the Phase II South Management Area. The limits of the remaining four territories (Nos. 11, 12, 14, and 15) have greater than 50% extent within the Phase II area.

4.2.1 Group Size

Based on a scatter plot of all scrub-jay territories, the territory size does not appear to be related to group size (Figure 6). However, if the territories found entirely within Phase II are not considered, the remaining territories tend to increase in size as group size increases. Woolfenden and Fitzpatrick (1978) stated that a direct relationship exists between scrub-jay territory size and family group size, and provided supporting data demonstrating that pairs with two or more helpers occupied territories that averaged 50% to 100% larger than those occupied by simple pairs. In addition, territory size within individual families was noted to increase or decrease with comparable changes in family size. The five territories located entirely within Phase II have below average group sizes, yet, above average territory size, which appears to be related to location of these territories within the less intensively managed portion of the Lyonia Preserve.

In contrast, the three territories located entirely within Phase I have above average group size, yet, below average territory size. These smaller territories occur totally within habitats that have been intensively managed. The effect of habitat quality is also apparent at the extremes of group size observed on the Lyonia Preserve. The only territory that contained a single mated pair (No. 16) was located entirely within the Phase II area, whereas, the territory with the highest group size (No. 5) was located entirely within the Phase I area.

4.2.2 Habitat Composition

Based on the analysis presented in the previous section, it appears that smaller territories were occupied by larger groups for those scrub-jay families possessing territories in areas of higher quality habitat. The importance of habitat is also evidenced by the territories located entirely within the intensively managed areas, which had above average group size, yet below average territory size. The relationship between habitat type and territory size on the Lyonia Preserve is discussed in the following sections.

4.2.2.1 Managed Open Habitat

The percent coverage of managed open habitat within scrub-jay territories ranged from as little as 2% to a maximum of 57% (Figure 7). Territory size tended to decrease as the percentage of open managed habitat increased. The majority, 83%, of territories with more than 20% open managed habitat were smaller than the average territory size. All of these territories occurred within the Phase I area with exception of No. 11, which straddled both Phases I and II (Figure 5). The smallest territory (No. 1) had the highest coverage by managed open habitat (57%), and occurred in the Phase I area. The four largest territories (Nos. 16, 17, 18, and 19) all had less than 6% managed open habitat, and occurred entirely within the Phase II area.

4.2.2.2 Un-Managed Open Habitat

Un-managed open habitat constituted from 0% to 7% coverage for the majority of the scrub-jay territories at the Lyonia Preserve (Figure 8). This habitat type did not occur on eight of the 20 territories, and there was no clear relationship between territory size and un-managed open habitat, likely due to the low frequency of occurrence of this habitat type. However, as observed for the managed open habitat, scrub-jay territories with the highest percentage un-managed open habitat were smaller in size than average.

The majority of the un-managed open habitat consisted of herbaceous (310) grasslands and freshwater marsh, seasonally dry (641) cover types. Ruderal-maintained habitats consisting of grasses and bare sand constituted about 3.2% of the territories at KSC (Breininger (1995)). A similar percentage of un-managed herbaceous habitat, totaling 3.3% of the territories, was observed on the Lyonia Preserve.

Woolfenden and Fitzpatrick (1984) excluded marsh in calculation of average territory size, however, marshes comprised 20% of the average territory at KSC (Breininger (1995)). For the Lyonia Preserve, freshwater marsh totaled 24% of Territory No 12, which had the highest coverage by un-managed open habitat, 29%. Although the extent of marsh coverage was the highest in Territory No. 12, the group size was larger than average, and the territory size was smaller than average. During the 2000 survey, scrub-jays were seen foraging in marshes, and defense of territory within marshes was observed. The limits of Territory Nos. 12, 14, 17, and 18 were refined based on territorial interactions wherein each of these four family groups defended a separate portion of a single marsh system (Figure 5). Based on these observations, the seasonally dry marshes found on the Lyonia Preserve provide suitable un-managed open habitat that may constitute up to one-quarter of the territory area.

4.2.2.3 Total Open Habitat

The combined effect of managed and un-managed open habitat was evaluated as natural open areas occur throughout the Lyonia Preserve, and future management will provide both habitat

types, which together will comprise the total open habitat. Territory size decreased as the total open habitat increased on the Lyonia Preserve (Figure 9), and the combined effect of total open habitat appears to be more direct than that of the managed habitat component (Figure 7). The scrub-jay families located primarily in Phase I typically had smaller territory sizes and higher coverage by total open habitat, which ranged between 26% and 57%. Territories in the Phase II area had larger territories with lower total open habitat that ranged from 4% to 38%. The minimum amount of total open habitat for all territories of less than average territory size was 11%, while most exceeded 25%.

Breininger *et al.* (1995) reported that unoccupied habitat at KSC had less than 4% average open space, while occupied habitat averaged 10% open space. Scrub-jay densities at KSC were the highest where open space exceeded 10%. The average coverage of open managed habitat for all territories at the Lyonia Preserve was 29%, over three fold the amount of open space at KSC. The additional open habitat found on the Lyonia Preserve likely contributes to the smaller average territory size of 12.54 acres compared to the 22.97 acre average at KSC. Breininger (1995) found that habitat use increased as open space increased up to 50%, then declined as open space increased beyond 50%, because, although openings are needed, scrub-jays require openings in association with scrub oak.

4.2.2.4 Managed Xeric Habitat

Managed xeric habitat within the scrub-jay territories ranged from a minimum of 39% to a maximum of 84% (Figure 10). Territory size increased as the percentage of managed xeric habitat increased. The smallest territory (No. 1) contained 43% managed xeric habitat, and the largest territory (No. 19) contained the maximum of 84%. The larger territories typically had greater than 60% managed xeric oak and occurred within Phase II, while the smaller territories had between about 40% and 60% managed xeric oak and occurred within Phase I. Breininger (1995) found that unoccupied areas averaged 29% scrub oak and areas occupied by scrub-jays averaged 47% scrub oak.

As previously discussed, habitat quality and group size are the primary variables affecting territory size (Woolfenden and Fitzpatrick 1978), and oak scrub interspersed with numerous sandy openings comprise essential scrub-jay habitat (Fitzpatrick *et al.* 1991). The territories on the Lyonia Preserve with the highest percentage of managed xeric oak also had lower group sizes (Figure 6) and lower percentages of total open habitat (Figure 9). These territories occurred in the Phase II area that is 73% managed xeric habitat, with only 12% total open habitat (Table 1). In contrast, the Phase I area contains 65% managed xeric oak and 31% total open habitat. These data suggest that although oak scrub is an essential habitat component, higher densities of Florida scrub-jays may occur within smaller areas of xeric oak that are managed to provide increased open areas.

While the creation of open habitat appears to reduce the amount of xeric oak habitat required by scrub-jays, the quality of the xeric oak component needs to be sufficient if smaller territory sizes are to be supported. Fitzpatrick *et al.* 1991 characterized the optimal xeric oak component as containing low-growing oaks between one and three meters in height. Long term maintenance of suitable vegetative structure in the xeric oak component is a critical factor in providing quality habitat. Therefore, management of xeric oak habitat on the Lyonia Preserve will focus on the need to provide low-stature oaks and to maintain this vegetative structure.

4.2.2.5 Forested Habitat

Forested areas containing mature, closed canopies, are rare in habitats preferred by scrub-jays (Fitzpatrick *et al.* 1991). Forested habitat, which includes sand pine and mixed hardwood-conifer stands, occurs within 75% of the scrub-jay territories on the Lyonia Preserve (Figure 11). The territories (Nos. 1, 4, 6, 7, and 13) that lack a forested habitat component are all found within the Phase I area, and these territories are also the smallest among all scrub-jay groups. Overall, the territory size tended to increase as the percentage of forested habitat increased. This relationship was more evident for the territories located in the Phase II area.

The two territories (Nos. 10 and 18) with the highest forested habitat coverage, 21%, provide contrast in the effectiveness of site management. Territory No. 10 with 4 group members is located in the Phase I area. The territory contains 51% managed xeric habitat, 26% total open habitat, and is below average in territory size. Territory No. 18 with 3 group members is located in the Phase II area. The territory contains 69% managed xeric habitat, only 10% total open habitat, and is above average in territory size. Although the two scrub-jay territories have equal percentages of forested habitat and similar amounts of managed xeric habitat, territory size was lower and group size was higher for Territory No 10. These differences in group size and territory size may be related to differences in the percentages of open habitat. Higher amounts of total open habitat appear to offset the larger territories associated with increased percentages of forested habitat.

Overall forested habitat use is likely low on the Lyonia Preserve as has been reported elsewhere (Fitzpatrick *et al.* 1991; Breininger 1995). These areas do provide some habitat functions as scrub-jays were observed in the forested habitat on several occasions during the 2000 survey. Most observations were related to perching or sentinel activity that occurred on the habitat edges, often in snags or isolated trees. Territorial interactions were noted where intruders were pursued through forested areas. Scrub-jays also were seen foraging in forested habitat interiors on occasion; these stands contain scrub oaks in the subcanopy. The natural mixed hardwood-conifer (434) stands found on the Lyonia Preserve are proposed to be retained to provide scrub-jay habitat, to serve as wetland buffers, and to increase landscape diversity. Given the provision of sufficient total open habitat in adjacent areas, scrub-jay densities in areas encompassing forested habitat could be increased through intensive management.

4.2.2.6 Unsuitable and Unoccupied Habitat

No unsuitable habitat occurred in 14 of the 20 scrub-jay territories residing on the Lyonia Preserve (Table 4). Territory Nos. 3, 4, 10, 11, and 20 extended off-site to the east side of the Providence Boulevard right-of-way, and therefore, contained an unsuitable roadway pavement (814) cover type that ranged from 2 to 6% of the total territory size. Territory No. 12 included a deep marsh emergent aquatic vegetation (644) cover type that totaled 4% of the total territory size, and was the only unsuitable habitat contained within the Phase I and II areas.

Phase III of the Lyonia Preserve currently represents habitat that is unoccupied by scrub-jays. This phase does not contain any low growth oak scrub, however, extensive areas of sand pine and xeric flatwoods are available for restoration and management, and natural open areas, including marshes and bare sand can provide suitable scrub-jay habitat. The only unsuitable habitat in Phase III includes two deep marsh wetlands totaling 3.25 acres, or 2.5% of the phase.

4.3 Phase I North Management Area Habitat Management

The 100.01 acre Phase I portion of the Lyonia Preserve was established as a scrub-jay mitigation area in 1994 to offset impacts to four scrub-jay families associated with the West Volusia Beltline. This section describes the baseline conditions, initial habitat restoration, and maintenance activities that have been conducted to date, and provides a comparison of the various habitat management techniques implemented in Phase I.

4.3.1 Baseline Conditions and Habitat Restoration

Prior to the 1994 habitat restoration, no scrub-jays had been documented in the Phase I area. The habitats existing at that time were predominantly sand pine and mixed sand pine/xeric oak cover types. Several trails traversed the project site, and the marsh and adjacent herbaceous and mixed hardwood-conifer areas described previously in this habitat management plan were also present.

Phase I was divided into four management cells (Figure 12) that were originally intended to provide habitat for four scrub-jay families (Young and Palmer 1992). Cells were separated by 50' wide clearings to be used as fire breaks, maintenance roads, and pedestrian trails. Perimeter fire breaks were sited along the Phase I boundaries and offset 100' from the east boundary to provide a vegetated buffer between the management area and Providence Boulevard. The fire break was extended into Phase II to the south property boundary. Fire breaks were located along the south and west boundaries that are adjacent to residential areas. Approximately 25% of the mitigation site was proposed for clearings; subsequent vegetation mapping discussed in Section 2.3 of this habitat management plan confirmed that 25.6 acres of open managed habitat are present, including several minor trails that previously existed (Table 1). In addition to the 50' wide clearings and perimeter fire breaks, numerous "pocket" clearings were designed, ranging in size from 0.25 acres

to 1.4 acres. Circular pocket clearings were limited to 1.0 acres. Trails 8' in width were sited between all pocket clearings to provide interconnections.

Management of Phase I was accomplished through a variety of techniques. The initial plan included harvesting of the sand pine canopy in the Phase I area. Prior to logging, the Phase II area was added to the harvest plan to provide a funding source for creation of the managed openings in Phase I and fire breaks around the Phase II perimeter. Harvesting operations began in February 1994 and were completed in March 1994. A 100' wide sand pine area was left unharvested along the south and west property boundaries to provide a buffer. A controlled burn was performed in Cell 4 in April 1994 (Figure 12). Fencing was installed along the Phase I and II boundaries in July 1994.

Pocket clearings, roads, and trails were created in all four cells by root raking. In addition, the herbaceous area surrounding the marsh located in Cell 4 was root raked. The nature trails were created by hand clearing. The xeric habitat in Cell 2 was strip roller chopped in a north-south pattern to create 100' wide strips that were separated by un-chopped strips also 100' wide. Management of Cell 1 and Cell 3 was limited to timber harvest and creation of the clearings. All management activities were completed by August 1994. Final locations and shapes of the open managed areas as delineated on the current land use and cover map (Figure 3) differ slightly from the proposed plan drawing provided by Young and Palmer (1992).

4.3.2 Phase I Habitat Maintenance

The habitat maintenance conducted on Phase I since the initial restoration has included roller chopping of Cell No. 1 in March 2003, along with routine mowing of the main trails. In December 2003, removal of sand pine was initiated in Cell No. 3 using a Franklin Brush Cutter C4950 S2. Early preliminary results from this mechanical treatment are promising, and following further evaluation, the brush cutter will likely be used for sand pine control in the remaining management cells. The 50' wide clearings and several of the minor 8' wide trails that are used for vehicular access have received regular mowing. In addition, encroachment of woody growth from adjacent areas into the trails has been controlled by periodic vegetation trimming. The initial management plan for Phase I specified that maintenance activities would occur as needed without a determinant schedule. The plan also provided latitude for use of various techniques, and indicated that adaptive management strategies would be used if one technique appeared more successful than others, or if new technology became available.

Currently planned maintenance activities include a fuel wood harvest of the sand pine buffers along the west side of Cell No. 1 and Cell No. 3 in Phase I. The logging will occur concurrent with initiation of the Phase II and Phase III restoration harvest in February 2003. These pines occur within 15' of the property boundary, many are aged and leaning, and present a fire and safety hazard to the adjacent residential areas.

4.4 Comparison of Phase I Habitat Management Techniques

The original intent of the Phase I management was to provide sufficient habitat to accommodate four families of scrub-jays (Young and Palmer 1992). As previously discussed, this expectation has been greatly exceeded by the 20 families found on the Lyonia Preserve. The Phase I area presently provides habitat for three scrub-jay families that reside entirely within the Phase I boundaries (Figure 5). In addition, the territories of eight other scrub-jay families occur primarily within Phase I, extending either slightly off-site, or into Phase II to the south. Likewise, the territories of four families that are found primarily within the Phase II area extend partially onto Phase I. The territories of five families occur entirely within Phase II.

Given the extensive overlap of territorial boundaries, scrub-jay densities within individual management cells are not readily determined. Qualitative evaluation revealed that Cell 1, the smallest cell, and Cell 2, which was strip roller chopped, contained portions of the territories of five different families (Figure 5). Cell 3 and Cell 4, which was burned and is also the largest cell, both included portions of six territories. Although no single territory was fully encompassed within the boundaries of any one management cell, Territory No. 10 occurred largely within the burned Cell 4, and Territory No. 13 was found largely within Cell 3, which did not receive any additional management such as strip roller chopping or burning. Group size was identical for these families, and Territory No. 10 was average size while Territory No. 13 was the third smallest. Habitat composition of xeric oak is similar for the two territories, but the open habitat is over 50% larger for Territory No. 13. Additionally, Territory No. 10 contained the highest coverage of forested habitat and Territory No. 13 had no forested habitat. These observations do not directly favor burned versus unburned or chopped versus un-chopped cell management. However, the data seem to confirm that habitat type composition, regardless of the technique from which habitats were derived, is an important variable in determining scrub-jay occupancy and territorial size.

Based on qualitative assessment by Volusia County Environmental Management staff (Sleister, pers. comm. 2000), and observations obtained during this study, the burned area, Cell 4, currently contains more sandy openings within the managed xeric habitat compared to other cells. The open sandy areas can be detected on the aerial photograph provided in Figure 5. The strip roller chopped cell (No. 2) appeared only slightly more effective in creating sandy openings in the managed xeric habitat compared to the two cells (Nos. 1 and 3) where this technique was not employed. Strip roller chopping and burning both allowed regrowth of oaks, while root raking was effective in reducing or eliminating oak occurrence.

4.5 Habitat Management Recommendations

The Lyonia Preserve has been intensively managed to provide scrub-jay habitat as detailed in the previous sections of this habitat management plan. In summary, previous habitat management consisted of removal of the tree canopy to restore the xeric habitat in both Phases I and II, and

more intensive management in Phase I involving creation of openings within the resultant scrub vegetation, prescribed fire, and mechanical management as discussed in detail in Section 4.3 of this habitat management plan. Additional management is proposed for Phase II, and restoration is planned for Phase III. The project site has become occupied by scrub-jays that overall, exhibit group sizes larger than average, and territories that are smaller in size than those reported for most other scrub-jay populations. The scrub-jay territories within the more intensely managed Phase I have yielded larger group sizes and smaller territories in comparison with the families found in the less intensely managed Phase II.

Given these population characteristics, and the results of the habitat assessment previously discussed, the three territories (Nos. 5, 6, and 9) that occur entirely within the managed Phase I boundaries were selected as model territories on which to base future management activities. Habitat type percent occurrences for these territories were summarized and averaged to provide a basis for target goals by managed habitat type (Table 5). Ranges for the target habitat type percentages were based on the variation within the three territories, and supplemented by data from other representative territories occurring within the Phase I area. Overall management targets for Phases II and III include the provision of 35% total open habitat (range 25% to 50%), and 65% managed xeric habitat (range 40% to 75%) with less than 1% forested habitat, as applied in the following section.

5.0 LYONIA PRESERVE PHASES II AND III HABITAT MANAGEMENT PLAN

The specific goal of the Lyonia Preserve Phase II and III habitat management plan is to perpetuate suitable habitat for the Florida scrub-jay. Volusia County has already implemented habitat management within Phase I and portions of Phase II of the project site, and the results have been highly successful. Additional population studies were initiated on the Lyonia Preserve in 2003 by the University of Central Florida, in coordination with the County. These studies will further evaluate scrub-jay demographics, including factors such as productivity and juvenile survival, and may provide data to confirm whether the population represents a biological sink or a biological source. Based on preliminary data, the scrub-jay population on the Lyonia Preserve was estimated to exceed 100 birds in 2003 compared with the 88 birds documented during the 2000 survey.

The proposed habitat management for Phase II and Phase III is intended to continue this success. The management techniques for these future phases will build on the methodologies employed under Phase I, and may be further modified in the future based on analysis of additional population studies currently underway. As discussed in the previous section, management will focus on the provision of an average of 35% total open habitat (range 25% to 50%), and an average of 65% managed xeric habitat (range 40% to 75%). Although the open habitat component has been identified as a factor contributing to larger group size and smaller territory size as exhibited by the scrub-jays found in the intensely managed Phase I, the importance of the managed xeric oak habitat is recognized. Restoration of xeric oak and maintenance of suitable

vegetative structure will be a key to successful management of the xeric oak habitat. The specific management targets for the xeric oak habitat are discussed in Section 5.2.3 of this habitat management plan, and assessment and monitoring of these targets are addressed in Section 7.2.

Habitat management on the Lyonia Preserve will involve initial restoration of overgrown scrub, including pine canopy removal and creation of openings, followed by long term maintenance of the improved habitats. Management and maintenance will be conducted within individual management cells, as described below.

5.1 Management Cells

Similar to Phase I of the Lyonia Preserve, habitat management in Phases II and III will be performed within individual management cells. A total of 14 management cells was identified for Phases II and III based on existing natural and managed features and habitats, and based on various access and maintenance considerations (Figure 13). The existing managed 50' wide trails will be extended from Phase I into Phase II, and expanded into a network that delineates the boundaries between management cells. Pocket clearings were sited along the 50' wide trail network in Phase II to provide open managed habitat within the interior of individual management cells. These locations simplify the logistics of the proposed clearing operations since timber harvesting has already been completed in the majority of Phase II. A single continuous managed 50' wide trail will begin in the northeast corner of Phase III and wind south through the area. The central location of this trail will allow access during the timber harvesting in Phase III. Two enlarged portions of the trail will provide open managed habitat, and also facilitate the logging operations by providing landing and loading areas. A variety of shapes and sizes of managed open habitat was designed for the cells within Phase III.

The patterns of the managed openings in Phase II and Phase III incorporate varying applications of the firebreaks, wide tails, narrow trails, and pocket clearings found to provide suitable scrub-jay habitat in Phase I. The majority of the openings proposed for Phase II and Phase III are more linear compared to the circular openings created in Phase I.

Cell design for Phases II and III was guided by the recommendations for percentages of managed habitat types as presented in Section 4.5 of this habitat management plan (Table 5). The overall goals were to provide 35% total open habitat with individual cells ranging from 25 to 50% total open habitat, and to provide 65% managed xeric habitat ranging from 40 to 75% for individual cells. For both Phases II and III combined, the total open habitat provided is 102.46 acres, or 41%, and the managed xeric habitat is 139.53 acres, or 55% (Figure 13). Forested habitat will total 6.85 acres, or 3%, while unsuitable habitat totals only 3.64 acres, or 1% of the combined Phases II and III.

Individual management cells within Phase II will provide total open habitat ranging between 26.81% and 37.61% (Table 6), which approximates the target 35% and meets the recommended

25% to 50% range for this habitat type (Table 5). Managed xeric habitat proposed in Phase II also meets the recommended ranges, with individual cells varying between 44.09% and 72.75%. The existing forested habitat in Phase II totals 18.24 acres, or 14%, and includes 11.39 acres of sand pine buffer that will be harvested to reduce the overall occurrence of forested habitat to 6.85 acres, or 5% of the Phase II area. Two management cells, Nos. 8 and 9, will have remaining forested habitat consisting of mixed hardwood-conifer stands that will total 17.12% and 10.81% respectively, which is within the recommended range for this habitat type. Unsuitable habitat is minimal in Phase II, and includes only 0.39 acres of deep marsh in Cell No. 8, or 1.18% of the management cell.

Individual management cells within Phase III, with exception of Cell No. 18, will meet the targeted habitat percentages with total open habitat ranging between 34.04% and 50.91% and managed xeric habitat ranging between 49.09% and 65.96% (Table 7). The existing un-managed open habitat in Cell No. 18 totals 41.40%, and includes 26.37% seasonally dry marsh and 15.03% bare sand. The total open habitat was necessarily increased to provide fire breaks and managed 50' wide access trails, yet Cell No. 18 will still provide 36.29% managed xeric habitat, which is only slightly below the targeted 40 to 75% range. Forested habitat will not occur in the managed Phase III area, while unsuitable habitat will total only 3.25 acres, or 2.5% of the entire area.

5.2 Habitat Management and Maintenance Techniques

Management and maintenance of habitats will be performed through a combination of prescribed fire and/or mechanical techniques. Timber harvest, roller chopping, strip chopping, root raking, and mowing are included among the proposed mechanical techniques. The initial management activity will involve a timber harvest conducted to restore the overgrown scrub habitats and root raking to create the open habitats. Subsequent maintenance will be performed by either fire and/or mechanical methods, and the timing and specific maintenance activity will be determined by actual habitat conditions as monitored within individual management cells.

5.2.1 Initial Restoration of Xeric Oak - Fuel Wood Harvest

Sand pine regeneration has been identified as a potential constraint to successful long term habitat management and maintenance on the Lyonia Preserve. Areas of regeneration have been observed along some of the trails, in many of the openings, and in several xeric stands in Phases I and II that were initially restored in 1994. Based on these findings, a fuel wood harvest is proposed for the initial restoration of Phase III, which is vegetated primarily by sand pine with limited xeric flatwoods. Concurrently, the fuel wood harvest will be extended to the sand pine buffer areas that remain in Phases I and II. During the fuel wood harvest, the trees along with most of the stems, branches, needles, and cones will be removed. The fuel wood harvest is anticipated to be more effective in control of sand pine regeneration compared to tradition logging methods, and should minimize sand pine regeneration in the treated areas.

Although it is unlikely that the sand pine will be completely eliminated from Phases I and II, maintenance activities as discussed later in Section 5.2.3 will be implemented to specifically control sand pine at desirable levels, and to generally maintain optimal habitat conditions.

5.2.2 Initial Enhancement of Created Open Habitat - Root Raking

Timber harvest alone can provide habitat suitable for occupancy by scrub-jays, as demonstrated in the Phase II area. Scrub-jay habitat in the Ocala National Forest, which has the highest known scrub-jay population, has been maintained by mechanical harvesting of sand pine largely without the use of fire or other management practices (MacAllister and Harper 1998). Differences in scrub-jay response to varying management practices in the four original management cells on the Lyonia Preserve are not readily apparent at this time, however, higher densities and larger group sizes were observed in Phase I where a variety of management practices was implemented in addition to timber harvest. These additional management practices included a prescribed fire in Cell No. 4 following the timber harvest, and the mechanical creation of pocket clearings and trails that comprise the managed open habitat found throughout Phase I.

The additional openings in the xeric habitat needed by scrub-jays can be created by mechanical means, including chopping and root raking, or through use of herbicides. Breininger and Schmalzer (1990) studied the long-term effects of mechanical disturbance in an oak scrub site that was cleared 20 years earlier. Compared to an adjacent undisturbed scrub site, the managed site had lower occurrences of saw palmetto in the ground cover and more bare ground was present. The root raking performed in Phase I was successful in providing openings and precluding oak regrowth (Sleister, pers. comm. 2003), and this technique will be repeated to create the managed open habitats in Phases II and III (Figure 13). The majority of the created openings in Phases II and III will be more linear compared to the circular openings created in Phase I. This design will provide a greater edge effect, and increase the habitat value of the openings.

The effectiveness of root raking in creating openings is due to the total removal of plant biomass, including below ground roots. Root raking creates soil disturbance, which as a negative aspect, may temporarily effect soil arthropods and provide conditions suitable for exotic plant invasion. Typical scrub habitat contains several thousand species of arthropods per acre, however, only a few of these insect species are actually restricted to scrub (Myers 1990). An extensive area of undisturbed xeric soils will remain following initial management in Phases II and III; 139.53 acres of managed xeric oak habitats will provide conditions suitable for scrub arthropods (Table 6 and Table 7). The potential for invasion by exotic plant species is likely only a minor issue for the Lyonia Preserve; occurrence to date has been limited to scattered sprouts of Chinese tallow (*Sapium sebiferum*) that have been successfully controlled by hand removal. Conversely, many listed scrub plant species, including the garberia (*Garberia heterophylla*) and scrub beargrass (*Nolina brittoniana*) that currently occur on-site, respond favorably to bare soils conditions that result from disturbances such as root raking (Myers 1990).

Management techniques other than root raking are often less efficient in creating bare soil conditions. Mowing will not remove the plant biomass, and will only encourage herbaceous growth. Burning of slash piles is dependent on attaining an intense burn, and fire may need to be repeated several times to achieve the bare soil conditions created by root raking. For these reasons, and based on the success of Phase I, root raking will be performed to create the trails, fire breaks, and pocket clearings in Phases II and III. The root raking will be conducted subsequent to the fuel wood harvest. Creation of the managed open habitat using this two step approach is anticipated to reduce the potential for sand pine regeneration in the clearings due to removal of biomass within the clearings and due to elimination of the sand pine seed sources from the adjacent xeric habitats.

5.2.3 Habitat Maintenance - Prescribed Fire and Mechanical Methods

Use of prescribed fire, widely regarded as the preferred management technique for scrub-jay habitat, has the highest potential to provide the most long-term benefit (Fitzpatrick *et al.* 1991). Prescribed fire is proposed as the preferred management tool for the Lyonia Preserve. However, given the inherent restrictions and logistical complications associated with the use of prescribed fire, mechanical habitat maintenance may be performed as an alternative or supplement to burning. A prescribed fire had been planned for several years for Cell No. 1 in Phase I, but, was repeatedly postponed due to constraints related to weather conditions. It was recognized that maintenance was needed, and since a controlled burn could not be implemented, Cell No. 1 was roller chopped in March 2003. Although prescribed fire is preferred, habitat maintenance will be performed using a combination of prescribed fire and/or mechanical methods, such as chopping and mowing.

Fitzpatrick *et al.* 1991 stated that the optimal frequency for prescribed fire within scrub habitat occurs within a 10 to 20 year interval. The time interval between prescribed burns, or other habitat maintenance activities, depends on a number of factors, including soils, nutrients, water table, climate, previous stand composition, level of regeneration, and previous fire history. Based on recent discussions with Service staff, a more frequent maintenance cycle may be needed for the Lyonia Preserve given the habitat conditions observed within the previously managed areas. Sand pine regenerated along some of the trails, in many of the openings, and in several xeric stands in Phases I and II following initial restoration in 1994. A future maintenance frequency of less than 10 years may be performed as was conducted in Cell No. 1, and the need for maintenance will be based on actual habitat conditions rather than a specified time period.

The need for habitat maintenance will be determined through qualitative site assessment applied on an individual management cell basis. Management and maintenance activities on the Lyonia Preserve will be implemented as needed to achieve optimal habitat conditions, which are defined by the following criteria:

- a.) the average canopy coverage of sand pine shall not exceed 10% aerial cover of a management cell; and

- b.) the canopy, including sand pine and xeric oak, shall not exceed an average of 10 feet in height within a management cell.

These criteria will be applied on an individual management cell basis, and separately for the following habitat components of an individual cell: the managed xeric habitat; the un-managed open habitat, which is primarily freshwater marshes; and the pocket clearings. Maintenance of the trails and firebreaks will be conducted through periodic mowing to preclude re-vegetation of these openings by scrub, or other woody plant species including sand pine. Mowing will be performed annually, or as needed. Habitat maintenance will, therefore, be scheduled pursuant to actual habitat conditions rather than determined by a specific time table.

Management prescriptions will be flexible for the various techniques, whether prescribed fire and/or mechanical methods, and will be based on an evaluation of vegetative structure, including canopy height, degree of pine invasion, extent of openings, and other structural conditions. Selection of a particular management technique will be based on the most cost-effective means to obtain the desired vegetative structure. Assessment of weather conditions, smoke management issues, and the availability of burning permits will be important considerations for the timing and execution of prescribed fires.

Latitude will be provided to implement maintenance for individual cells, or cell portions, based on actual habitat conditions. The management cells have been designed with numerous trails and other clearings, which can serve to define mechanical maintenance areas, or provides fire breaks if a partial burn of an individual cell is specified. Maintenance activities will be scheduled to occur outside of the scrub-jay nesting season, and fire prescriptions will be designed to avoid burns that encompass the entire territory of a scrub-jay family as recommended by Toland (1999).

5.2.4 Nuisance and Exotic Plant Control

Nuisance and exotic plant species occurrence has been minor to date, and limited solely to scattered Chinese tallow sprouts. After the initial restoration of Phase I, scattered tallow seedlings were observed in several areas. Higher concentrations of tallow seedlings occurred along the managed openings, including cell boundaries and fire breaks, although some seedlings were found in the managed xeric areas where the sand pine had been harvested. Off-site residential areas were the most likely seed source. Tallow seedling were controlled by hand removal, and completely eliminated within two years of the initial restoration. Subsequent monitoring indicated no further sprouting by tallow until after Cell No. 1 was roller chopped in March 2003. Less than 10 Chinese tallow sprouts were observed at that time, and the plants were controlled by hand removal, which will continue as needed. The newly restored areas within Phase II and Phase III will be monitored for the presence of tallow and other nuisance and exotic plant species, and appropriate treatment will be applied as needed.

5.3 Habitat Management and Maintenance Schedule

The initial habitat management of Phase I was completed in 1994, and on-going maintenance activities continue to date (Table 8). The Phase I initial site restoration included removal of the sand pine canopy and the creation of managed open areas through clearing of ground cover by root raking. In addition, Cell No. 2 was strip roller chopped, and Cell No. 4 received a prescribed burn during initial restoration. Maintenance of Phase I since the initial restoration has included roller chopping of Cell No. 1 in March 2003, removal of sand pine in Cell No. 3 in December 2003 using a Franklin Brush Cutter, and routine mowing of the main trails.

Future maintenance planned in Phase I includes the following activities as identified in Table 8. Removal of the sand pine buffer areas that extend along the perimeters of Cell Nos. 1 and 3 will be performed during a fuel wood harvest conducted in February to March 2004. Maintenance of the remaining three cells (Nos. 1, 2, and 3) in Phase I is anticipated during the next few years based on a combination of prescribed fire and/or mechanical means. Timing of maintenance will be determined based on assessment of habitat conditions with emphasis on evaluation of vegetative structure as discussed in the previous section.

The proposed management activities in Phase II will be initiated in February 2004 beginning with the fuel wood harvest of the timber in the sand pine buffer areas (Table 8). Subsequently, the managed openings in Phase II will be created by root raking of these areas as identified on Figure 13. As an additional management enhancement, prescribed fire is planned for both Cell No. 7 and Cell No. 9 in March to April 2004. Future maintenance will be determined based on assessment of habitat conditions with emphasis on evaluation of vegetative structure. Routine maintenance of the trails in Phase II will be performed annually beginning in 2005.

The initial restoration and management of Phase III of the Lyonia Preserve will begin in February 2004 (Table 8), although it is not anticipated that mitigation credits will be needed for several years. The initial restoration will involve a fuel wood harvest of the sand pine areas and xeric flatwoods, and the creation of managed open habitat (Figure 13). In addition, prescribed fires will be conducted in Cell Nos. 15 and 17 in March to April 2004. Future maintenance will be determined based on assessment of habitat conditions with emphasis on evaluation of vegetative structure. Annual maintenance of the trails, including fire breaks, will be initiated in Phase III in 2005.

5.4 Adaptive Management

The County and School Board will manage the Lyonia Preserve, using the previously described techniques, to perpetuate the Florida scrub-jay, and adaptive management strategies other than those specified in this habitat management plan may be used in consultation with the Service. The results of the qualitative habitat assessment based on the optimal habitat criteria presented in Section 5.2.3 will be used to evaluate on-going management techniques, and to determine the

need for adaptive management. Adaptive management strategies will be used if one technique appears more successful than others, or if new technology becomes available.

Adaptive management may also be needed for related issues other than habitat management. Potential impacts associated with public and educational uses, feral and domestic cat predation, and roadway mortality, are addressed below.

5.4.1 Management of Public and Educational Uses

The educational value of the Lyonia Preserve, as realized through public access, provides significant benefits to scrub-jay conservation. Few other areas exist in Volusia County where the public can so readily view scrub-jays. Public access is promoted at the Lyonia Preserve, particularly for school groups given that the site is controlled by the School Board and three adjacent public schools border the property. Public access to date has consisted mainly of small groups or school classes, totaling up to \pm 20 to 30 individuals, that are escorted through the property via foot traffic using the existing trail system in Phase I.

The County and the School Board recognize the concerns that the Service has expressed over the potential for impacts to scrub-jays related to unrestricted public access. To address this issue, future public access to Phase II and Phase III of the Lyonia Preserve will have the following restrictions: a) access will be limited to foot traffic; b) access will be limited to the trails; and c) access will be limited to a single entry location west of Providence Boulevard and a single entry location east of Providence Boulevard. These actions should minimize the potential for impacts to the resident scrub-jays. Additional strategies may be implemented in the future, and public access issues will be monitored by County land management staff.

5.4.2 Management of Feral and Domestic Cats

Contrary to previous understanding by the Service, feral and domestic cats are not frequently observed within the Lyonia Preserve, and cat predation is not a problem on the property. Observations of feral or domestic cats have been extremely rare, and have been limited to only two individual sightings during the past nine years that the Lyonia Preserve has been managed for scrub-jays. Furthermore, no incidences of cat predation on scrub-jays have been identified. The County and the School Board concur that feral and domestic cats could possibly become an issue in the future, and agree to address this issue now by promoting awareness among management staff and by providing visitor education regarding problems associated with feral and free-ranging domestic cats. In addition, should feral and domestic cats become a concern, control actions will be implemented as an adaptive management strategy.

5.4.3 Management of Potential Roadway Mortality

Road mortality has been documented as a potential threat to scrub-jay populations elsewhere (Dreschel *et al.* 1990). Based on banding data and observations from the 2000 scrub-jay survey, road mortality does not appear to be an issue for the Lyonia Preserve. A total of 45 color-banded scrub-jays was observed during the survey, which represented 94% of the 48 birds banded on the Lyonia Preserve between 1998 and 2000. No juvenile plumage birds were color-banded due to the seasonal timing of the banding activities, and consequently the ages of individual birds were unknown. However, the survival rate of scrub-jays on the Lyonia Preserve appears to be very high since 50% of the colored-banded birds were banded from one to two years before the survey, and it is likely that a number of these birds were yearlings due to the recent colonization and population expansion on the Lyonia Preserve.

During the 2000 survey, scrub-jays were occasionally observed along the west side of Providence Boulevard, and only rarely crossed the roadway. It is likely that the few documented crossings were in direct response to the played tape vocalizations as opposed to normal foraging behavior. Currently no suitable habitat exists east of Providence Boulevard, except for a narrow band of mowed grass found in the right-of-way.

These habitat conditions will change once future management is initiated in Phase III, and future road improvements are constructed. Following the restoration management proposed east of the roadway, Providence Boulevard will bisect the Lyonia Preserve. In addition, the roadway will eventually be widened to four lanes in the future. As a positive aspect of the road improvement, most of the right-of way that is currently mowed grassland will be paved, and the right-of-way will become less attractive as potential scrub-jay foraging habitat. Although no incidences of scrub-jay road mortality have been documented for the project site, measures will be implemented to lessen the potential for future occurrence. Based on discussions with the Service, it was agreed that a narrow buffer of mature trees would be maintained along the road side to minimize the potential impacts of Providence Boulevard. The potential for road mortality will be monitored, and adaptive management actions such as educational signage, and/or potential lowering of the current 45 mph speed limit will be evaluated and implemented as practicable.

5.5 Other Future Land Uses

The County and School Board, at their discretion and with the concurrence of the Service, may elect to use areas within the Lyonia Preserve for wetlands mitigation or other listed species mitigation, as long as use of the area in question does not detract from its management as mitigation for the scrub-jay. In addition, an extensive network of nature trails has been established in Phases I and II. These trails may be expanded in Phases I and II, and undoubtedly replicated in the future Phase III as this portion of the site comes under active management.

Public access will continue to be promoted, and the access restrictions are compatible with the educational uses. Numerous pamphlets and other literature regarding the Lyonia Preserve are available in the adjacent Sand Pine Nature Center and Deltona Library/Environmental Learning Center. The educational benefits of these interpretative uses are consistent with the land management goals of the School Board, and the managed Lyonia Preserve provides a unique opportunity to promote environmental education and awareness of the threatened scrub-jay and its associated habitat. As stated in Section 5.4.1, to minimize the potential for impacts associated with educational use and public access, restrictions of public access will be implemented, and public access issues will be monitored by County land management staff.

5.6 Management and Maintenance Funding

The County and the School Board will provide the funding necessary to conduct the management and maintenance activities for the Lyonia Preserve. In 2000, a Volusia County voter referendum was approved that will provide at least \$100 million in funding over a 20 year period with the monies targeted for acquisition and management of environmentally sensitive lands. The \$100 million is a conservative estimate that will most likely be exceeded based on the first three years of funding. Following the voter referendum, the County demonstrated its commitment to land management through a reorganization in 2001 that resulted in the creation of a Land Acquisition and Management Division. The Division will receive 10% annually from this ad valorem tax funding source for use in management and maintenance, with the remainder allocated to acquisition. Budgets for management and maintenance of individual parcels are not available, however, the County is committed to providing funding for the Lyonia Preserve and other environmentally sensitive lands in need of management and maintenance.

Additional funding will be available from the sale of timber to be harvested from the extensive pine stands in Phase III and from the forested buffer areas in Phase I and Phase II. Exact dollar amounts will depend on market conditions at time of harvest, and it is anticipated that the timber value will off-set a large portion of the initial management costs for Phase II and Phase III. All of the initial restoration and management in Phase I was accomplished through the proceeds from the timber harvest in 1994.

Alternative funding will be available on an individual project basis for those County and School Board projects that impact scrub-jay habitat and utilize the Lyonia Preserve for mitigation. It is anticipated that this funding mechanism will be implemented as a permit condition, similar to the requirements of the Incidental Take Permit (No. TE05160-0), which was issued by the Service on April 14, 2003 for impacts to 3.21 acres of scrub-jay habitat on Howland Boulevard public road improvement project. The County was required to provide funding for the initial enhancement and restoration of 6.24 acres within the Lyonia Preserve. Additional funds were placed in escrow for five years to provide for land management. The \$38,180.00 total funding requirement was allocated from the general roadway budget, and was based on estimated costs of \$4,000.00 per acre for restoration and \$2,500 per acre for management. Assurances of future funding

allocations will be provided by the County and School Board prior to the release of mitigation credits for those individual County and School Board projects that utilize the Lyonia Preserve for scrub-jay mitigation.

Annual funding allocations and expenditures associated with all management and maintenance activities will be provided in the annual reports as discussed in Section 7.4.

6.0 MITIGATION CREDIT ESTABLISHMENT AND ALLOCATION

6.1 Available Mitigation Credits

Based on recent negotiations with the Service, it was agreed that mitigation credits will be assigned at 2:1 for occupied habitat and 3:1 for unoccupied habitat if the importance of xeric habitat management and optimal habitat conditions, and the issues of feral cat, public access, and road mortality were incorporated to the satisfaction of the Service in this habitat management plan. The importance of xeric habitat management has been addressed throughout this revised document, and optimal habitat conditions have been defined and included as the criteria for management and maintenance under Section 5.2.3. Management activities related to the issues of feral cat, public access, and road mortality have been addressed under Section 5.4. The discussion below details the available mitigation credits using these mitigation ratios of 2:1 for occupied habitat and 3:1 for unoccupied habitat.

Phase II of the Lyonia Preserve is currently occupied by the Florida scrub-jay and contains 126.93 acres of habitat suitable for restoration, management and use as mitigation for impacts to scrub-jay habitat. A total of 6.24 acres was recently reserved in Phase II as mitigation for scrub-jay habitat impacts associated with the Howland Boulevard road improvement project, pursuant to Permit No. TE054160-0 issued by the Service on February 21, 2003. Thus, Phase II presently has 120.69 acres that are suitable for restoration, management and use as mitigation for impacts to scrub-jay habitat. Phase III is not currently occupied by scrub-jays, however, it contains 126.50 acres of habitat that is suitable for restoration, management and use as mitigation. Mitigation credits available to the County and School Board will be determined based on scrub-jay occupancy and habitat quality. Allowable mitigation credits will be calculated at a 2:1 ratio when Florida scrub-jays occupy mitigation lands and optimal habitat conditions have been achieved, as defined in Section 5.2.3. Mitigation credits will be calculated at a 3:1 ratio when Florida scrub-jays do not occupy mitigation lands, regardless of the habitat conditions. The number of mitigation credits available to the County and School Board in Phase II of the Lyonia Preserve is 60.34, which is based on a mitigation ratio of 2:1 for occupied habitat applied to a total available habitat area of 120.69 acres. Phase III of the Lyonia Preserve has 42.17 mitigation credits available to the County and School Board based on a mitigation ratio of 3:1 for unoccupied habitat applied to a total available habitat area of 126.50 acres.

6.2 Mitigation Service Area, Credit Users, and Withdrawal of Credits

Use of the Lyonia Preserve to mitigate impacts to the scrub-jay will apply to those Volusia County public works and School Board projects that occur within the service area that encompasses the West Volusia Scrub-jay Metapopulation (Figure 14). Use of the Lyonia Preserve will be contingent upon maintenance of the Deltona Section 16 lands lease, management of Phase II and Phase III pursuant to Section 5.0 of this habitat management plan, and concurrence by the Service, on an individual project basis, that directing all or part of required mitigation to Phase II and/or Phase III of the Lyonia Preserve is an acceptable and effective biological solution for resolving impacts to the Florida scrub-jay that result from County public works and School Board projects.

The number of mitigation credits the County or School Board must withdraw to mitigate for Florida scrub-jay impacts will be based on the amount of occupied habitat impacted for each individual project determined at the conclusion of any consultation under Section 7 of the Act or permitting under Section 10 of the Act associated with individual County public works projects or School Board projects. Efforts to avoid or minimize impacts to the scrub-jay at the construction site must be explored by the County and/or School Board prior to use of the Lyonia Preserve for mitigation.

The County and School Board may begin to withdraw mitigation credits from Phase II of the Lyonia Preserve upon demonstration that optimal habitat conditions have been achieved. Optimal habitat conditions include the following criteria: a) the average canopy coverage of sand pine shall not exceed 10% aerial cover of a management cell; and b) the canopy, including sand pine and xeric oak, shall not exceed 10 feet in height within a management cell.

The withdrawal of scrub-jay mitigation credits from Lyonia Preserve must be satisfied prior to the commencement of clearing or construction activities at the County public works or School Board project site identified in a Notice of Withdrawal, unless otherwise agreed to by all signatories to the Memorandum of Understanding, to which this habitat management plan is an attachment.

The Service will maintain records regarding the status of the mitigation credits within the Lyonia Preserve. A simple mitigation credit ledger will be maintained, by Phase, listing the total number of credits available, the number of credits withdrawn to date, and the number of remaining available credits.

The County or School Board shall provide the Service with a written Notification of Withdrawal requesting a withdrawal of mitigation credits from the Lyonia Preserve. The notice shall specify the County public works or School Board project and its impacts, the Phase from which the credits will be withdrawn, and provide a proposed Balance Statement reflecting the requested withdrawal. Within 30 days of each withdrawal, the Service shall provide a Balance Statement to the County and the School Board showing the total number of credits available, and the balance of mitigation credits.

6.3 Future Credit Determination for Phase III - East Management Area

It is anticipated that following timber harvest and other initial management activities, Phase III will become occupied by Florida scrub-jays based on the success realized in Phase I of the Lyonia Preserve. Accordingly, the 42.17 mitigation credits available initially in Phase III, based on a 3:1 mitigation ratio for unoccupied habitat, will eventually increase once the phase becomes occupied by scrub-jays and optimal habitat conditions are demonstrated. The maximum availability for Phase III is 63.25 mitigation credits, based on a mitigation ratio of 2:1 for occupied habitat.

If Phase III is entirely occupied, the 2:1 mitigation ratios will apply to the total acreage of suitable habitat. Partially occupied areas of Phase III must be defined by acreage to allow determination of the number of credits using a 2:1 mitigation acreage applied to the occupied acreage, and a 3:1 mitigation ratio applied to the unoccupied acreage.

7.0 FLORIDA SCRUB-JAY OCCURRENCE AND HABITAT MONITORING

Monitoring of the Phase II and III management areas is proposed to evaluate the occurrence of the Florida scrub-jay on the Lyonia Preserve, to assess vegetative composition and structure as a basis for future maintenance prescriptions, and to evaluate other potential impacts.

7.1 Florida Scrub-Jay Occurrence Monitoring

For the purposes of maintaining the availability of mitigation credits in Phases II and III, scrub-jays will be monitored through annual survey intended to document occurrence. The survey will not entail a complete census since the mitigation credits are based on occupied versus unoccupied habitat, rather than on scrub-jay density, productivity, or other demographics. The survey will be designed by the County and School Board to document that family groups continue to occupy the area, and transects and stations will be located to fully assess the Phase II area, and the Phase III area once it becomes occupied. Surveys will be performed annually in late-summer for a period of five years, then repeated at five year intervals, or until the mitigation credits are completely withdrawn. Additional insight on habitat suitability can be gained by conducting the survey during the late-summer period when the yearling scrub-jays are still in juvenile plumage.

7.2 Habitat Monitoring

Monitoring of the habitat conditions on the Lyonia Preserve project site will be performed periodically by a qualified biologist, and will consist of a qualitative assessment of the vegetative composition and structure of the managed habitats. Given the importance of maintaining optimal habitat through appropriate vegetative composition and structure in both the xeric and open

habitats, the conditions defining optimal habitat that will guide the qualitative assessment are again reiterated as follows:

- a.) the average canopy coverage of sand pine shall not exceed 10% aerial cover of a management cell; and
- b.) the canopy, including sand pine and xeric oak, shall not exceed an average of 10 feet in height within a management cell.

The need for habitat maintenance will be determined based on the results of the qualitative site assessment as monitored on an individual management cell basis. The results of the habitat monitoring will be translated to specific maintenance prescriptions as discussed in Section 5.2.3 of this habitat management plan. Maintenance activities will be performed as needed based on actual habitat conditions rather than a specified time table. In addition, the results of the qualitative habitat assessment will be used to evaluate on-going management techniques, and to determine the need for adaptive management.

7.3 Monitoring of Other Potential Impacts

Strategies have been developed to address potential impacts associated with public and educational uses, feral and domestic cat predation, and roadway mortality as detailed in Section 5.4. Future management may require adaptation as circumstances dictate, and could potentially include actions such as additional restrictions on public access, removal of feral cats, and/or education of the public regarding other potential impacts. The County and School Board will monitor these issues, and implement future management actions as needed.

7.4 Reporting

The County and School Board will prepare and submit a monitoring and compliance report to the Service after completion of the restoration of Phases II and III, and subsequent reports will be submitted every five years until all mitigation credits are withdrawn. The reports will detail all management and maintenance activities involving the Lyonia Preserve within the previous reporting period, and projected future land management actions required in the coming reporting period, including associated funding allocations and expenditures for the reporting period. The reports will include the results of the scrub-jay occurrence monitoring, habitat assessment monitoring, and monitoring of other potential impacts performed since the previous reporting period. The reports will also contain a current Balance Statement enumerating the total number of credits available, the number of credits withdrawn to date, and the number of remaining available credits.

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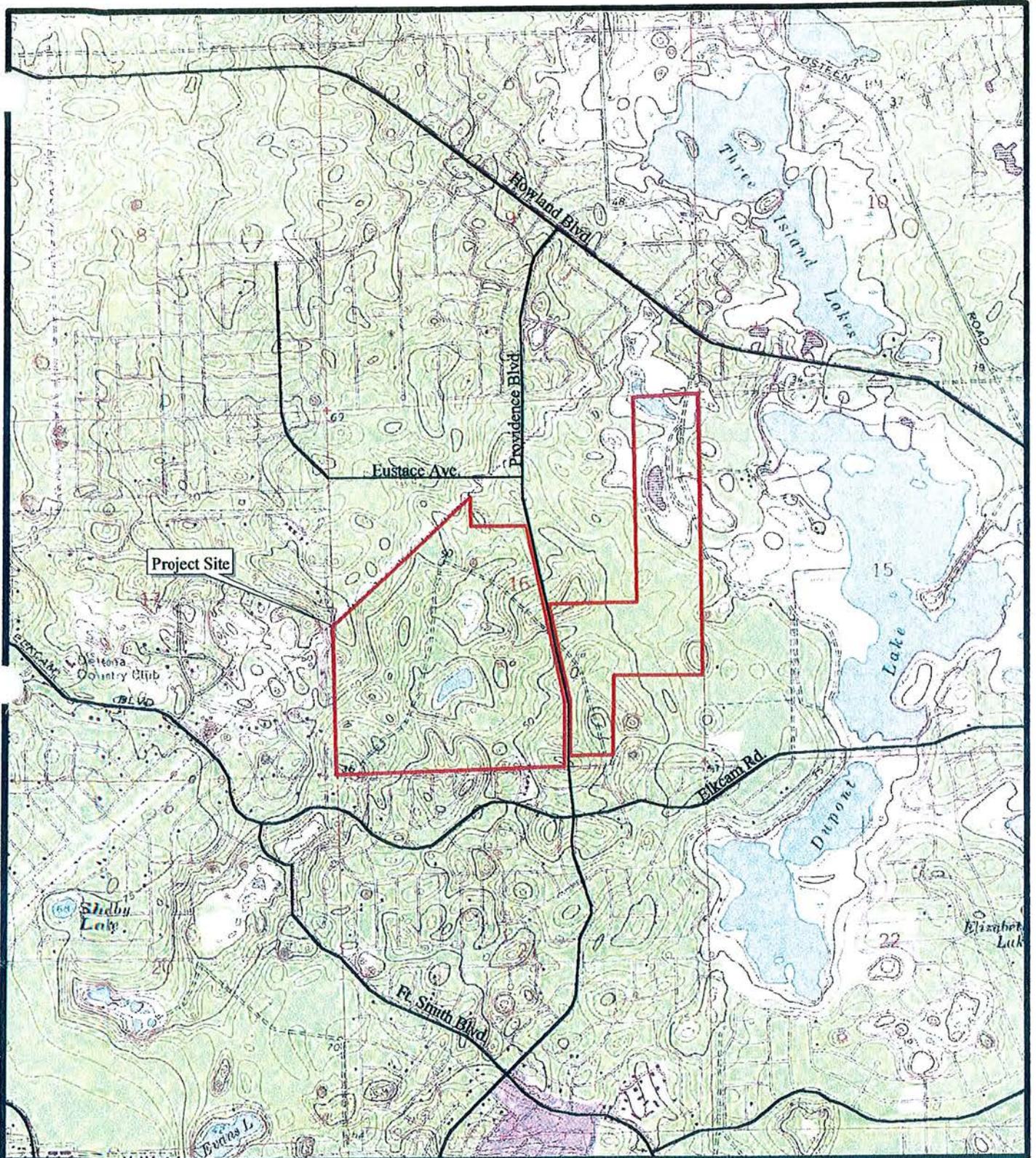
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Table 1. Land Use and Cover Types on the Lyonia Preserve Project Site, Section 16, Volusia County, Florida

Cover Type	Cover Type Description	Cover Type Acreage			
		Phase I North Management Area	Phase II South Management Area	Phase III East Management Area	Lyonia Preserve Totals
310	Herbaceous	2.76	4.69		7.45
311	Managed Trail 50' Wide	6.31	0.48		6.79
312	Managed Clearing	12.43	0.23		12.66
313	Managed Fire Break 15' Wide	2.24	2.70		4.94
314	Managed Trail 8' Wide	2.46	0.05		2.51
315	Other Trails 8' Wide/ Existing, Logging, and Added Trails	1.47	1.81		3.28
316	Managed Nature Trail 4' Wide	0.69	0.78		1.47
317	Mowed Landscape/ Roadway Grassland	0.47	0.57		1.04
412	Xeric Flatwoods			11.79	11.79
413	Sand Pine	0.92	11.39	94.50	106.81
421	Xeric Oak	65.52	92.85		158.37
434	Mixed Hardwood- Conifer	2.79	6.85		9.64
641	Freshwater Marsh, Seasonally Dry	1.21	4.53	11.83	17.57
644	Emergent Aquatic Vegetation		0.39	3.25	3.64
720	Sand, Other than Beach			8.02	8.02
742	Borrow Areas	0.74		0.36	1.10
TOTALS		100.01	127.32	129.75	357.08



U.S.G.S. Topographic Quadrangle, LAKE HELEN, FLA., Photorevised 1980.

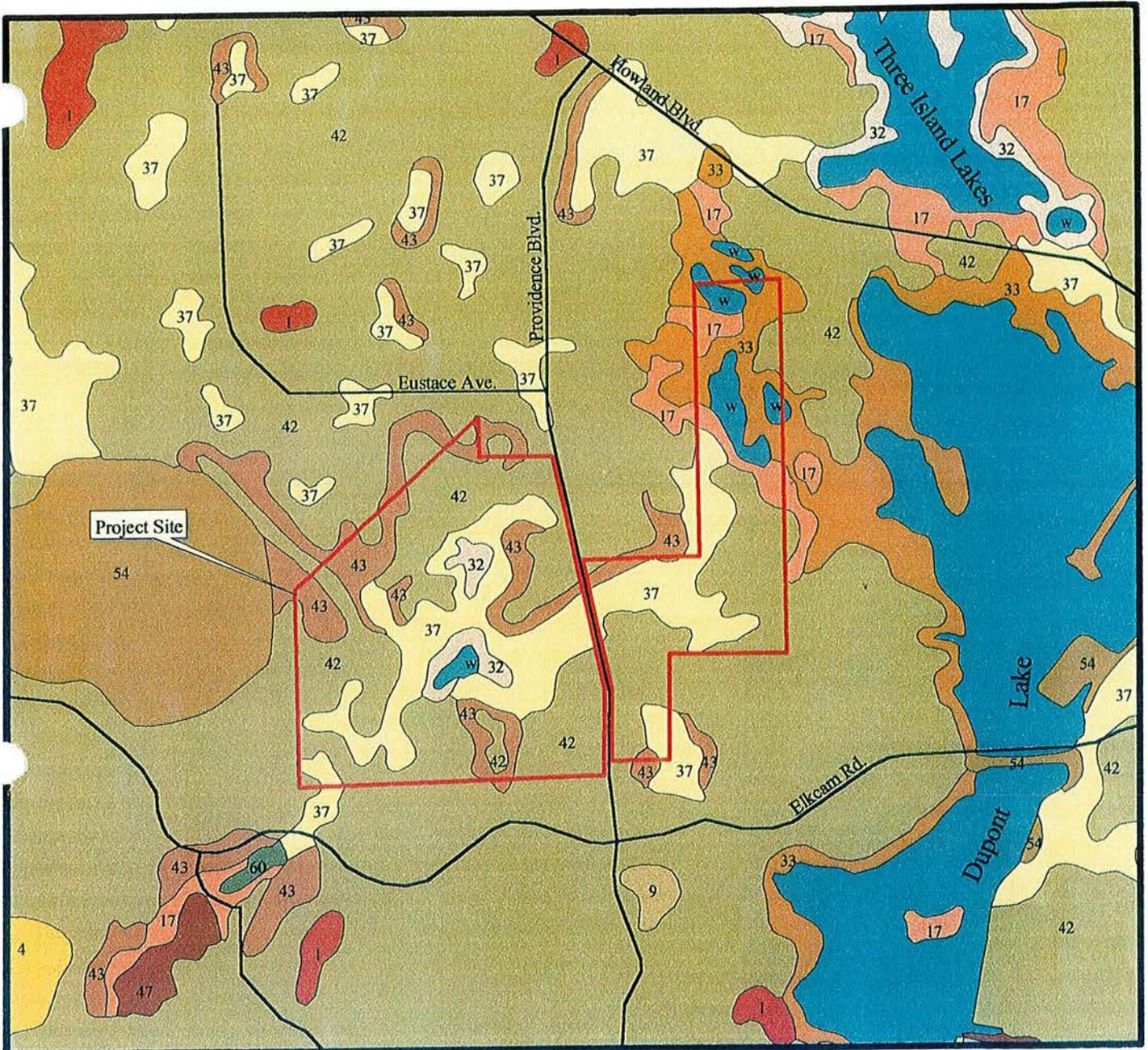
Figure 1. Location of the Lyonia Preserve Project Site, Section 16, Township 18 South, Range 31 East, Volusia County, Florida

**Tierra
Verde
Consulting, Inc.**
1035 South Semoran Boulevard, Suite 1013
Winter Park, FL 32792 (407) 678-1881

LOCATION MAP
LYONIA PRESERVE



Project: 98094
Prepared by: MR
Date: 08/16/01
Scale: 1: 24 000



Based on digital georeferenced spatial data of the U.S.D.A. Soil Survey Geographic (SSURGO) data base

Specific Soils - SSURGO - VOLUSIA	
	1 - Apopka fine sand, 0 to 5% slopes
	4 - Astatula fine sand, 0 to 8% slopes
	9 - Beaches
	17 - Daytona sand, 0 to 5% slopes
	32 - Myakka fine sand (15% hydric)
	33 - Myakka fine sand, depressional (95% hydric)
	37 - Orsino fine sand, 0 to 5% slopes
	42 - Paola fine sand, 0 to 8% slopes
	43 - Paola fine sand, 8 to 17% slopes
	47 - Pits
	54 - Quartzipsamments, gently sloping
	60 - Smyrna fine sand (15% hydric)

Figure 2. Soils of the Lyonia Preserve Project Site, Volusia County, Florida

<p>Tierra Verde Consulting, Inc.  1035 South Semoran Boulevard, Suite 1013 Winter Park, FL 32792 (407) 678-1881</p>	<p>SOILS MAP</p> <p>LYONIA PRESERVE</p>	<p>Project: 98094 Prepared by: MR Date: 08/16/01 Scale: 1:20 000</p> 
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FIGURE 5. ESTIMATED FLORIDA SCRUB-JAY TERRITORIES ON THE LYONIA PRESERVE PROJECT SITE, VOLUSIA COUNTY, FLORIDA, MARCH 2000



LEGEND

- 3 FAMILY NUMBER
- TERRITORY BOUNDARY
- OFF-SITE TERRITORY BOUNDARY

SUMMARY OF FLORIDA SCRUB JAY FAMILY COMPOSITION AND ESTIMATED TERRITORY SIZE

Territory No.	Banded Scrub Jay Identification No. Based on Color Code	No. Unbanded Scrub Jays	Total No. Family Members	Estimated Territory Size (acres)
1	25	2	3	6.07
2	17	3	4	12.77
3	1, 7	1	3	12.69
4	14, 42, 43	0	3	6.63
5	6, 8, 12, 18, 32, 41, 46	1	8	12.23
6	20, 26, 27, 40	1	5	8.33
7	28, 29	2	4	7.80
8	16, 22, 30	3	6	16.25
9	10, 11, 21, 44, 45	2	7	11.02
10	4, 15, 47	1	4	11.94
11	33, 34	3	5	16.19
12	5, 13, Silver	2	5	11.38
13	2, 3	2	4	7.45
14	23, 24, 37, 38, 39	2	7	8.72
15	35, 36	2	4	10.38
16	none	2	2	17.36
17	none	4	4	21.85
18	none	3	3	18.87
19	none	4	4	17.89
20	none	3	3	14.93
Totals	45	43	88.0	250.75
Ave. No. of Scrub Jays and Territory Size Per Family				4.4 12.54

File No: 98094
 Prepared by: CS
 Date: 06/05/00
 Scale: 1" = 400'



Tierra Verde Consulting, Inc.
 APPLIED ECOLOGICAL CONSULTANTS
 1035 S. Semoran Blvd., Suite 1013
 Winter Park, FL 32792 Tel: 407.678.1881

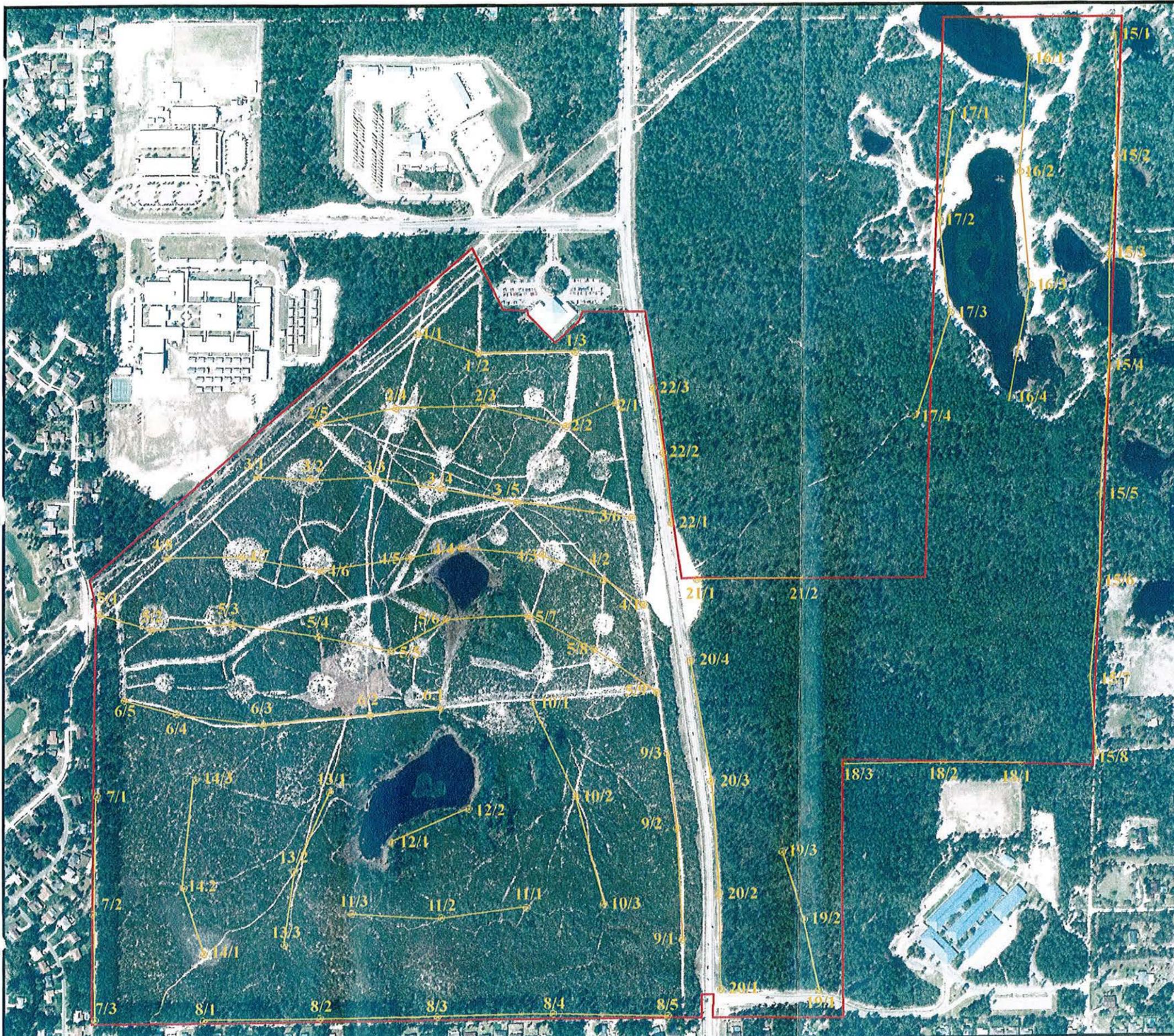


FIGURE 4. LOCATION OF FLORIDA SCRUB-JAY SURVEY TRANSECTS AND PLAYBACK STATIONS ON THE LYONIA PRESERVE PROJECT SITE, VOLUSIA COUNTY, FLORIDA, MARCH 2000

LEGEND

-  TRANSECT
-  PLAYBACK STATION
- 15/2** TRANSECT NO./STATION NO.



File: 98094
 Prepared by: CS
 Date: 08/24/01
 Scale: 1" = 600'



Tierra Verde Consulting, inc.
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 1035 S. Semoran Blvd., Suite 1013
 Winter Park, FL 32792 Tel: 407.678.1881

LEGEND

- 8 Territories at Least 50% within Phase I North Management Area
- 5 Territories Entirely in Phase I North Management Area
- 11 Territories at Least 50% within Phase II South Management Area
- 19 Territories Entirely in Phase II South Management Area

Family No.	Territory Size	No. of Birds
1	6.07	3
4	6.63	3
13	7.45	4
7	7.80	4
6	8.33	5
14	8.72	7
15	10.38	4
9	11.02	7
12	11.38	5
10	11.94	4
5	12.23	8
3	12.69	3
2	12.77	4
20	14.93	3
11	16.19	5
8	16.25	6
16	17.36	2
19	17.89	4
18	18.87	3
17	21.85	4

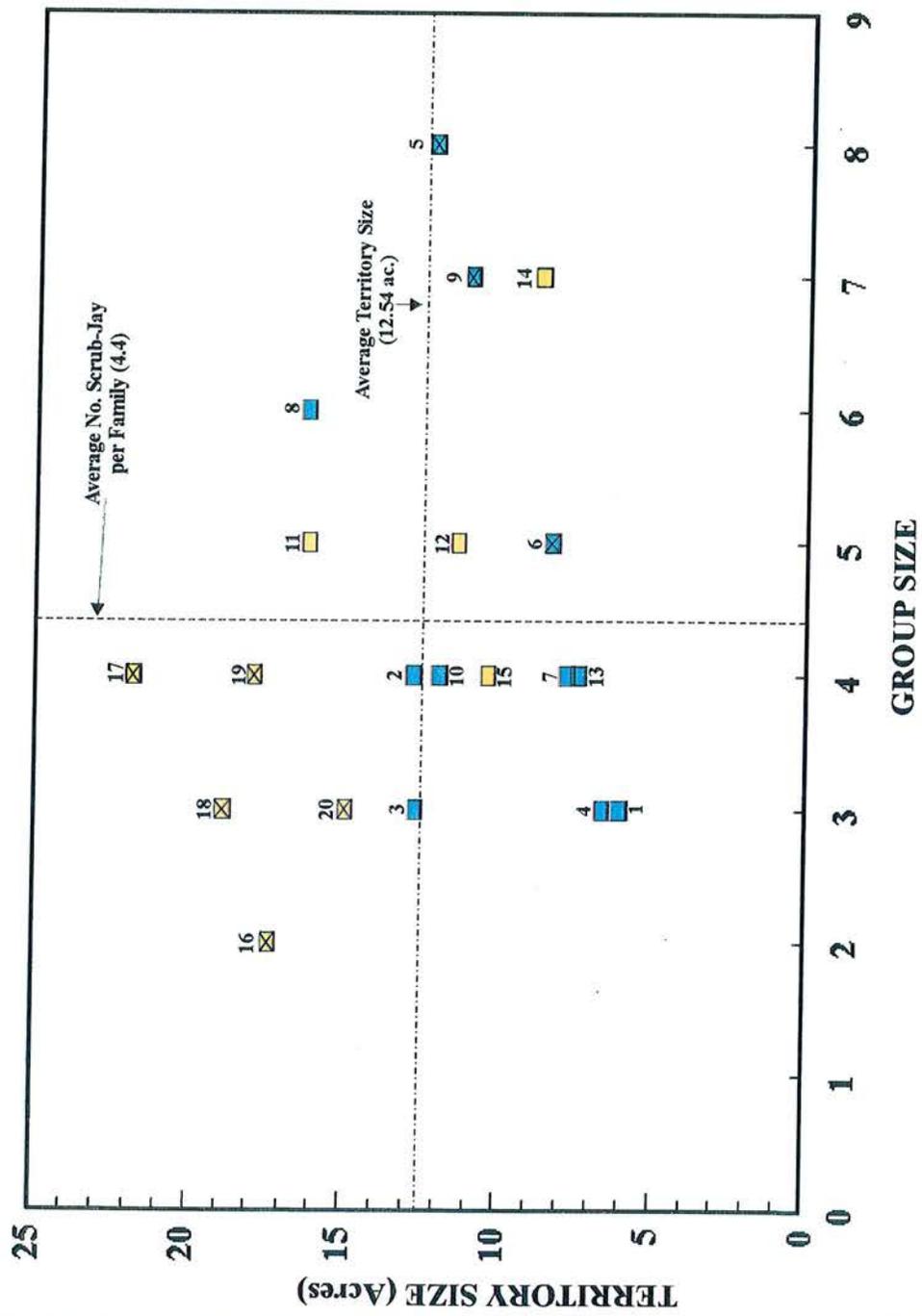


Figure 6. Florida Scrub-Jay Territory Size Relative to Group Size on the Lyonia Preserve Project Site, Volusia County, FL, March 2000

Terra Verde Consulting, Inc.
 1035 South Semoran Boulevard, Suite 1013
 Winter Park, FL 32792
 (407) 678-1881

**TERRITORY SIZE RELATIVE TO GROUP SIZE
 LYONIA PRESERVE**

N Project: 98094
 Prepared by: CS
 Date: 08/17/01
 Scale: N/A

LEGEND

- 8 Territories at Least 50% within Phase I North Management Area
- 5 Territories Entirely in Phase I North Management Area
- 11 Territories at Least 50% within Phase II South Management Area
- 19 Territories Entirely in Phase II South Management Area

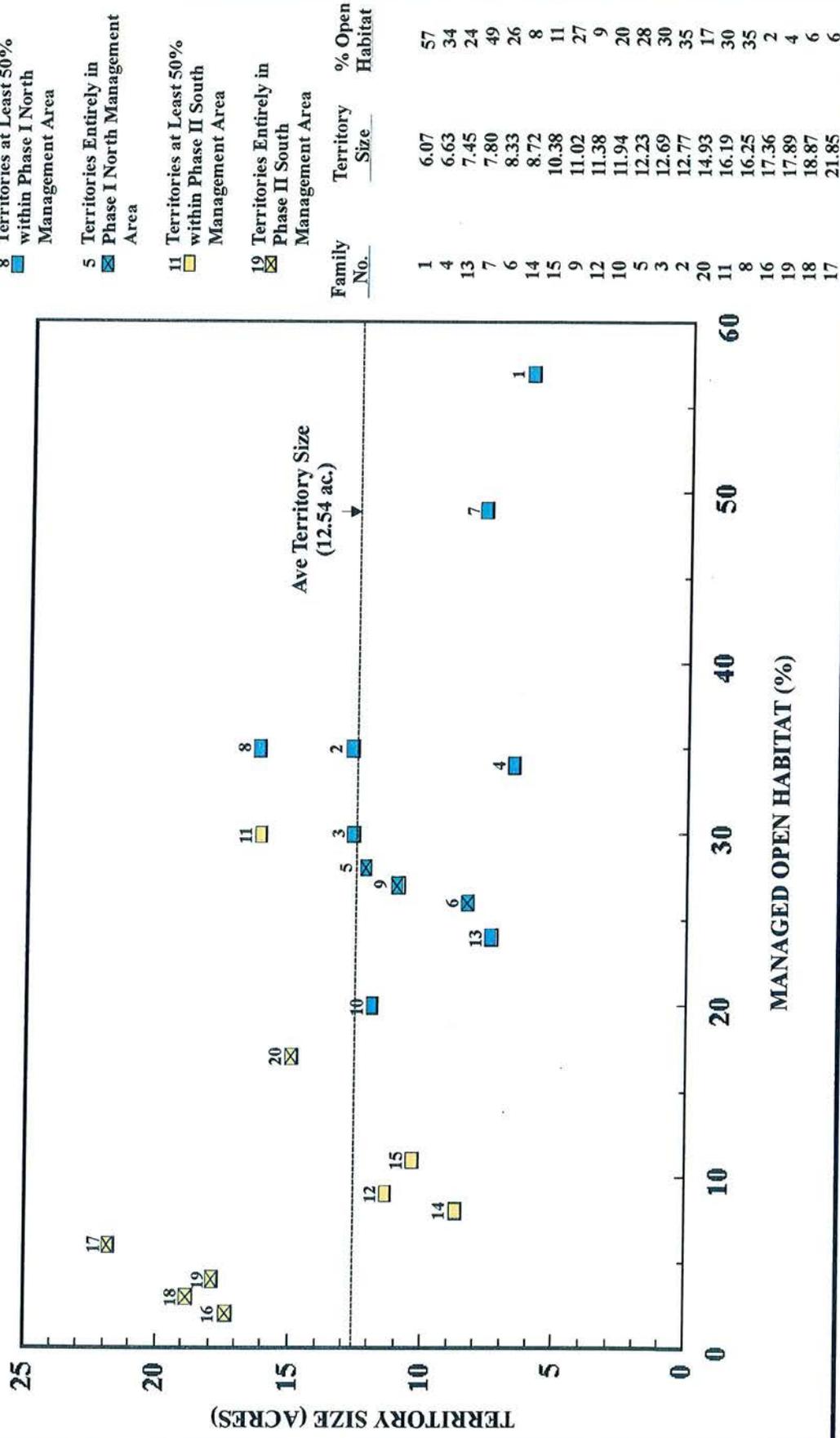


Figure 7. Florida Scrub-Jay Territory Size Relative to Percentage of Managed Open Habitat on the Lyonia Preserve Project, Volusia County, FL, March 2000

Merle Vetric Consulting, Inc.
 1035 South Semoran Boulevard, Suite 1013
 Winter Park, FL 32792 (407) 678-1881

**TERRITORY SIZE RELATIVE TO
 MANAGED OPEN HABITAT
 LYONIA PRESERVE**

N Project: 98094
 Prepared by: CS
 Date: 08/17/01
 Scale: N/A

LEGEND

- 8 Territories at Least 50% within Phase I North Management Area
- 5 Territories Entirely in Phase I North Management Area
- 11 Territories at Least 50% within Phase II South Management Area
- 19 Territories Entirely in Phase II South Management Area

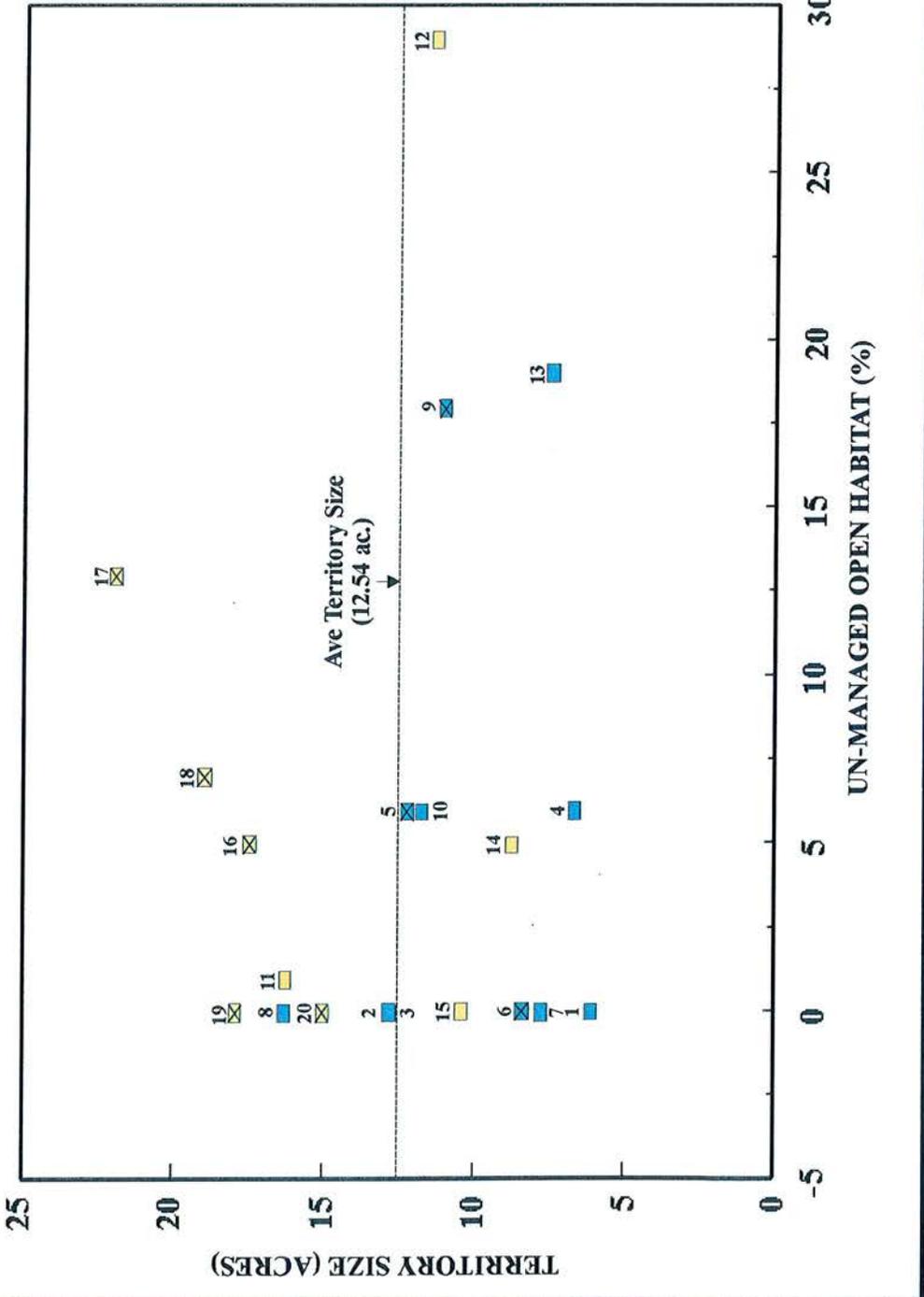


Figure 8. Florida Scrub-Jay Territory Size Relative to Percentage of Un-Managed Open Habitat on the Lyonia Preserve Project Site, Volusia County, FL, March 2000

Micro Verdec Consulting, Inc.
 1035 South Semoran Boulevard, Suite 1013
 Winter Park, FL 32792 (407) 678-1881

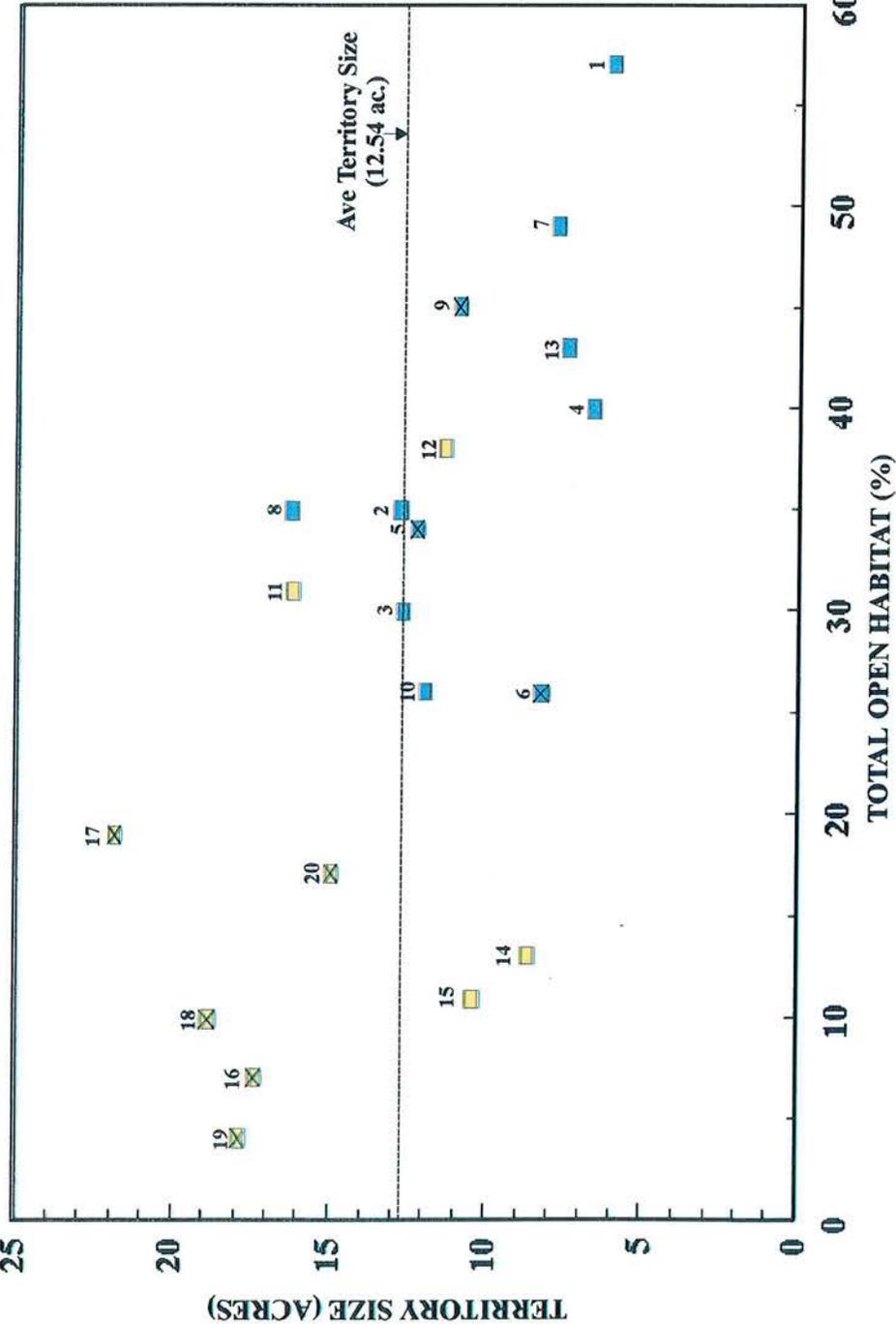
TERRITORY SIZE RELATIVE TO UN-MANAGED OPEN HABITAT LYONIA PRESERVE



Project: 98094
 Prepared by: CS
 Date: 08/20/01
 Scale: N/A

LEGEND

- 8 Territories at Least 50% within Phase I North Management Area
- 5 Territories Entirely in Phase I North Management Area
- 11 Territories at Least 50% within Phase II South Management Area
- 19 Territories Entirely in Phase II South Management Area



Family No.	Territory Size	% Open Habitat
1	6.07	57
4	6.63	40
13	7.45	43
7	7.80	49
6	8.33	26
14	8.72	13
15	10.38	11
9	11.02	45
12	11.38	38
10	11.94	26
5	12.23	34
3	12.69	30
2	12.77	35
20	14.93	17
11	16.19	31
8	16.25	35
16	17.36	7
19	17.89	4
18	18.87	10
17	21.85	19

Figure 9. Florida Scrub-Jay Territory Size Relative to Percentage of Total Open Habitat on the Lyonia Preserve Project Site, Volusia County, FL, March 2000

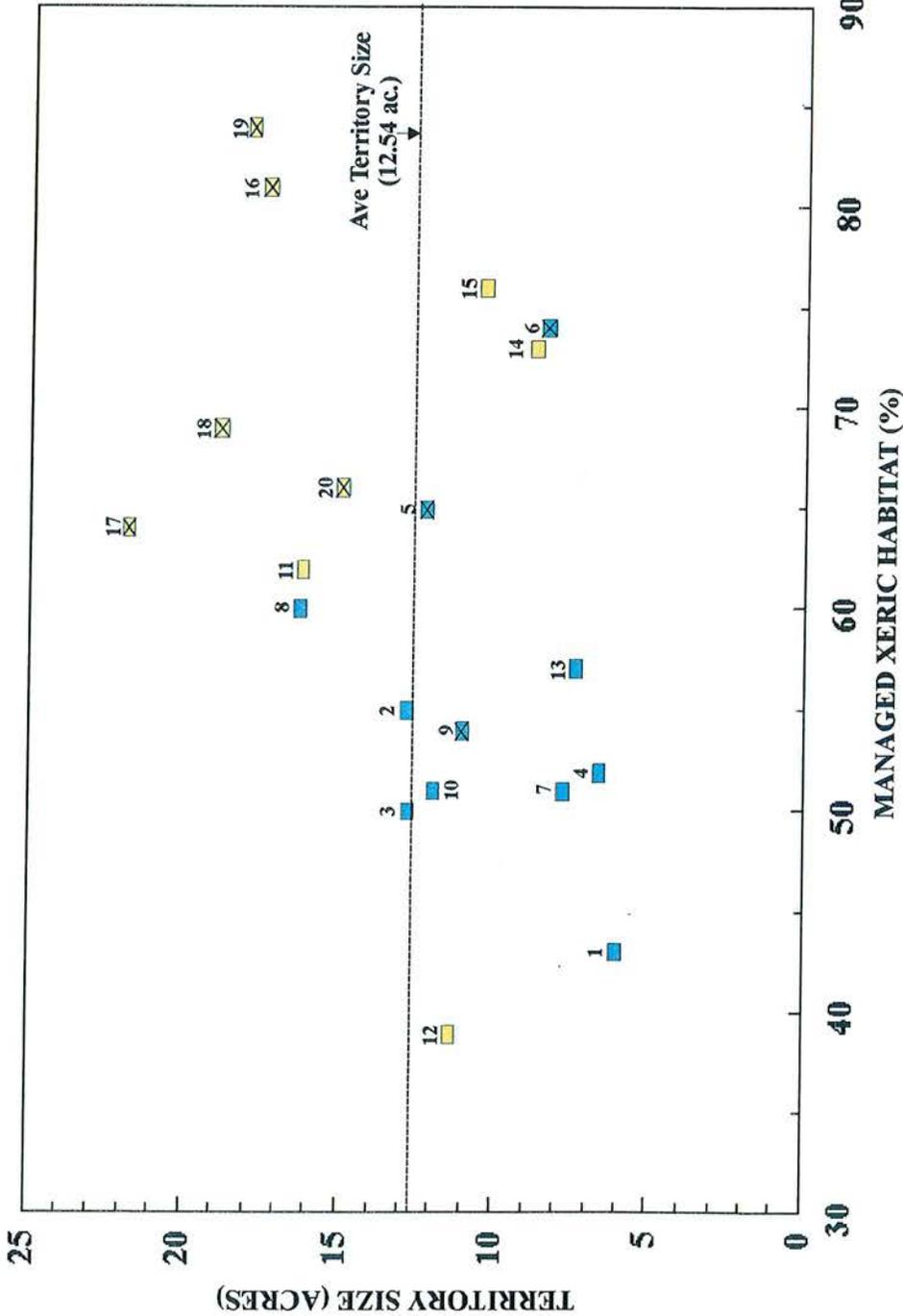
Tierra Verde Consulting, Inc.
 1035 South Semoran Boulevard, Suite 1013
 Winter Park, FL 32792
 (407) 678-1881

TERRITORY SIZE RELATIVE TO TOTAL OPEN HABITAT LYONIA PRESERVE

N Project: 98094
A Prepared by: CS
 Date: 08/20/01
 Scale: N/A

LEGEND

- 8 Territories at Least 50% within Phase I North Management Area
- 5 Territories Entirely in Phase I North Management Area
- 11 Territories at Least 50% within Phase II South Management Area
- 19 Territories Entirely in Phase II South Management Area



Family No.	Territory Size	% Xeric Habitat
1	6.07	43
4	6.63	52
13	7.45	57
7	7.80	51
6	8.33	74
14	8.72	73
15	10.38	76
9	11.02	54
12	11.38	39
10	11.94	51
5	12.23	65
3	12.69	50
2	12.77	55
20	14.93	66
11	16.19	62
8	16.25	60
16	17.36	81
19	17.89	84
18	18.87	69
17	21.85	64

Figure 10. Florida Scrub-Jay Territory Size Relative to Percentage of Managed Xeric Habitat on the Lyonia Preserve Project Site, Volusia County, FL, March 2000

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**TERRITORY SIZE RELATIVE TO
 MANAGED XERIC HABITAT
 LYONIA PRESERVE**

N Project: 98094
 Prepared by: CS
 Date: 08/20/01
 Scale: N/A

LEGEND

8 Territories at Least 50% within Phase I North Management Area

5 Territories Entirely in Phase I North Management Area

11 Territories at Least 50% within Phase II South Management Area

19 Territories Entirely in Phase II South Management Area

Family No.	Territory Size	% Forested Habitat
1	6.07	0
4	6.63	0
13	7.45	0
7	7.80	0
6	8.33	0
14	8.72	14
15	10.38	13
9	11.02	1
12	11.38	19
10	11.94	21
5	12.23	1
3	12.69	15
2	12.77	10
20	14.93	11
11	16.19	1
8	16.25	5
16	17.36	12
19	17.89	12
18	18.87	21
17	21.85	17

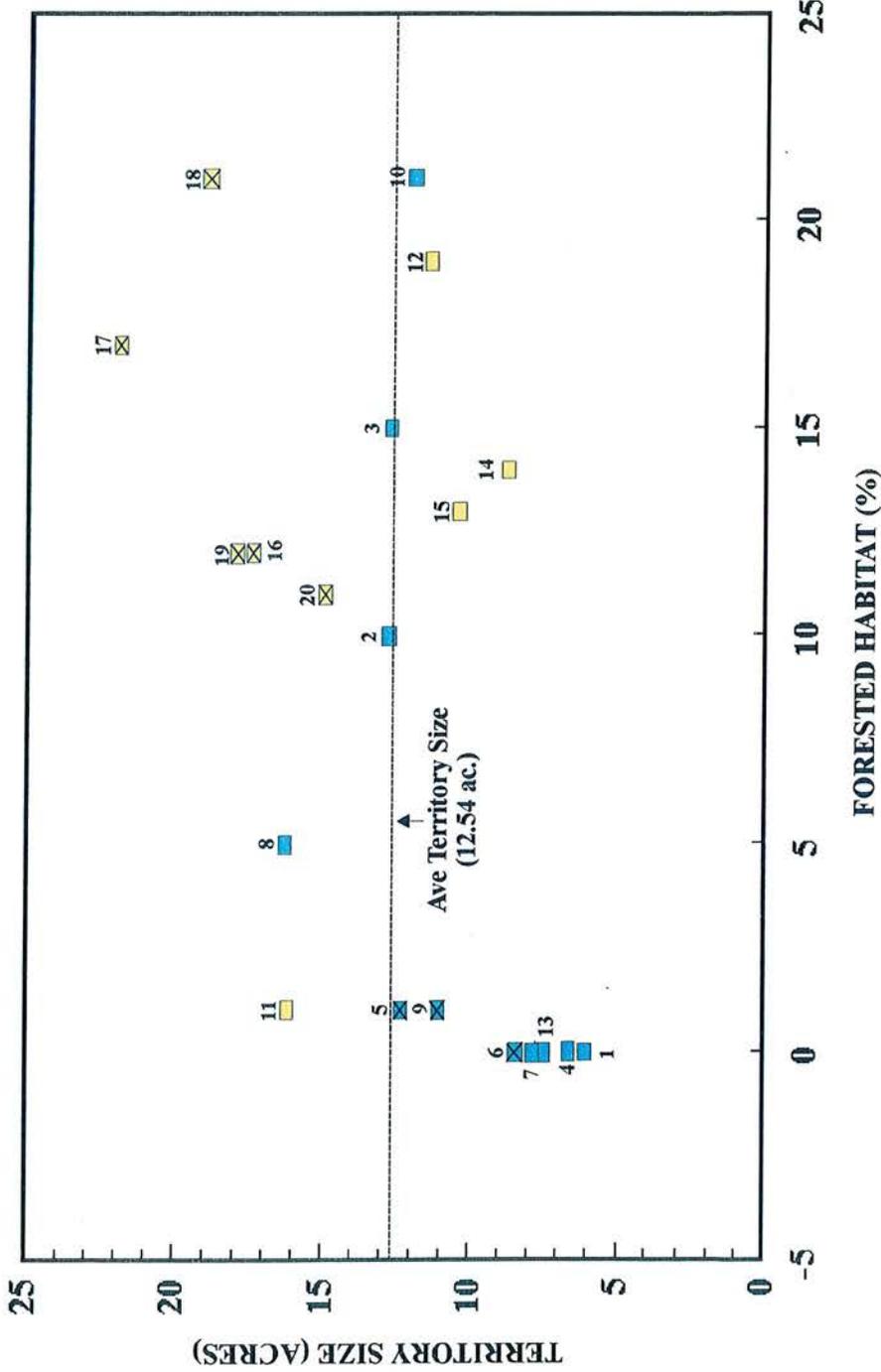


Figure 11. Florida Scrub-Jay Territory Size Relative to Percentage of Forested Habitat on the Lyonia Preserve Project Site, Volusia County, FL, March 2000

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 1035 South Semoran Boulevard, Suite 1013
 Winter Park, FL 32792 (407) 678-1881

TERRITORY SIZE RELATIVE TO FORESTED HABITAT LYONIA PRESERVE



Project: 98094
 Prepared by: CS
 Date: 08/20/01
 Scale: N/A

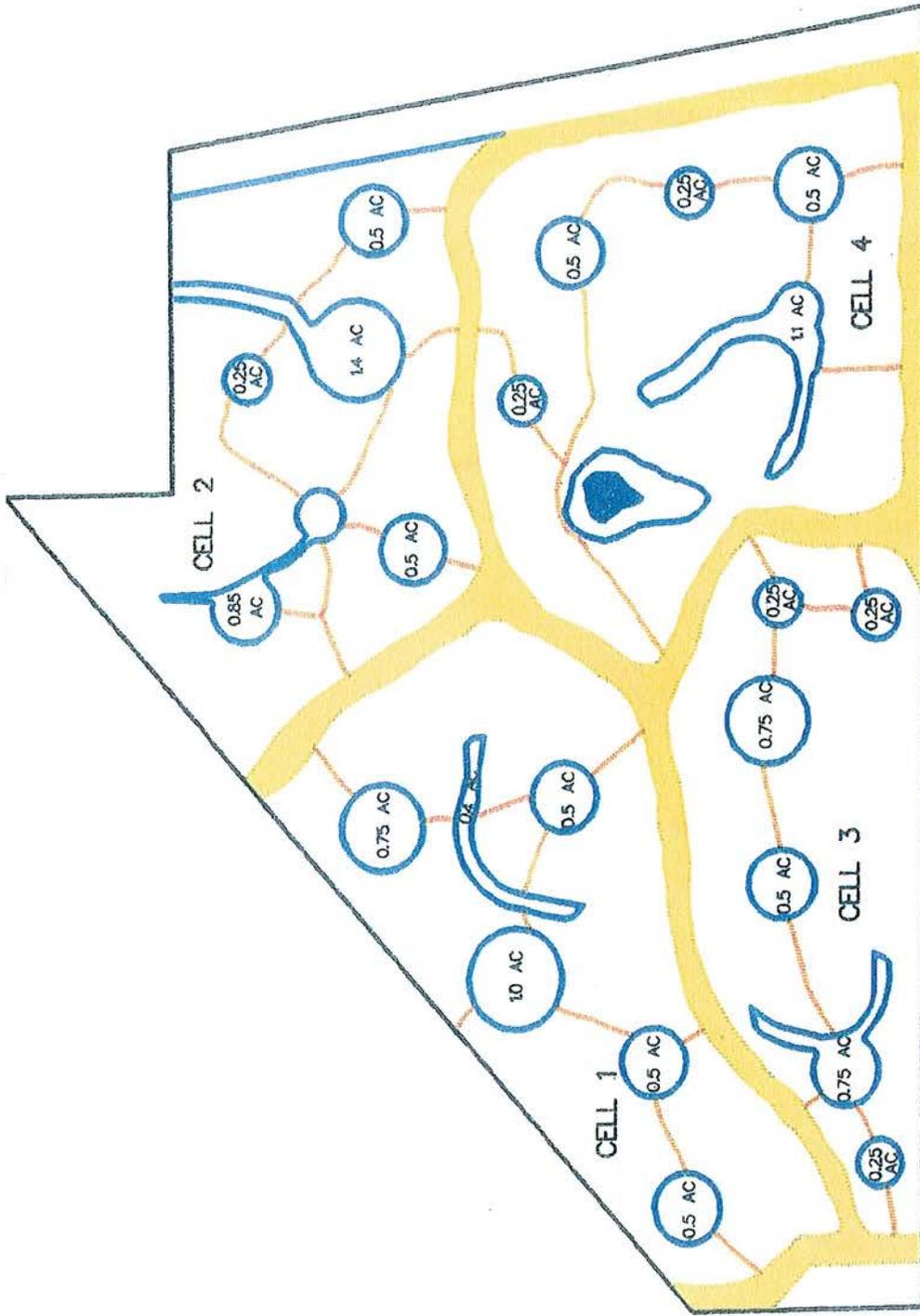


Figure 12. Typical Tract and Cell Structure of Section 16, Deltona, FL. (Taken from Young and Palmer 1992)

**Terra
Verde
Consulting, Inc.**
1035 South Semoran Boulevard, Suite 1013
Winter Park, FL 32792
(407) 678-1881

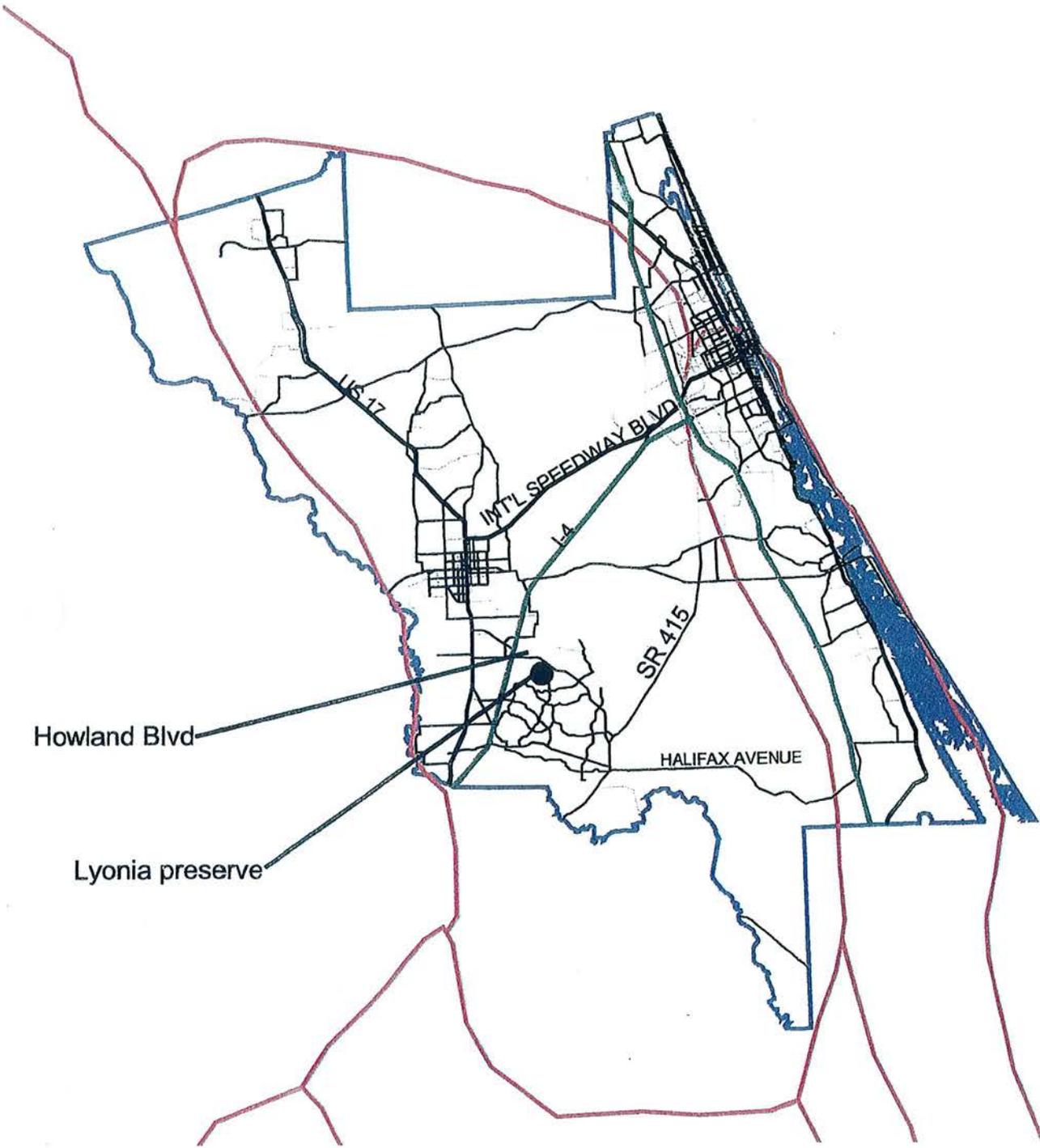
**TYPICAL TRACT & CELL STRUCTURE
LYONIA PRESERVE**



Project: 98094
Prepared by: CS
Date: 08/24/01
Scale: NTS

Florida Scrub-Jay Mitigation Service Area For The Lyonia Preserve

Figure 14



Howland Blvd

Lyonia preserve

4 0 4 8 Miles

FDOT Major Roads - 1998 - VOLUSIA

- Interstate
- U.S. Road
- State Road
- County Road
- Local Road
- Roadway Feature
- FSJ Mitigation Service Area Polygon



Table 2. Florida Scrub-Jay Numbers and Family Composition for the Lyonia Preserve Project Site, Section 16, Volusia County, Florida, March 2000

Territory No.	Banded Scrub Jay Identification No. Based on Color Code	No. Banded Scrub Jays	No. Unbanded Scrub Jays	Total No. Family Members
1	25	1	2	3
2	17	1	3	4
3	1, 7	2	1	3
4	14, 42, 43	3	0	3
5	6, 8, 12, 18, 32, 41, 46	7 ¹	1	8
6	20, 26, 27, 40	4	1	5
7	28, 29	2	2	4
8	16, 22, 30	3	3	6
9	10, 11, 21 ² , 44, 45	5	2	7
10	4, 15, 47	3	1	4
11	33, 34	2	3	5
12	5, 13, Silver ³	3	2	5
13	2, 3	2	2	4
14	23, 24, 37, 38, 39	5	2	7
15	35, 36	2	2	4
16	none	0	2	2
17	none	0	4	4
18	none	0	3	3
19	none	0	4	4
20	none	0	3	3
Totals		45	43	88
Average Number of Scrub Jays Per Family				4.4

¹ Territory may be shared by dual family group with Nos. 6, 12, and 32 as one sub-group and Nos. 8, 18, and 41 as another sub-group, with No. 46 associating with both sub-groups.

² No. 21 is missing white band from left leg.

³ "Silver" has U.S. Fish and Wildlife Service band, only; no color coded bands.

Table 3. Estimated Florida Scrub-Jay Territory Size and Number of Family Members for the Lyonia Preserve Project Site, Volusia County, Florida, March 2000

Territory No.	Estimated Territory Size for Management Area (acres)	Estimated Off-site Territory Size (acres)¹	Total Estimated Territory Size (acres)	No. Family Members
1	3.86	2.21	6.07	3
2	8.14	4.63	12.77	4
3	8.52	4.17	12.69	3
4	4.81	1.82	6.63	3
5	12.23	n/a	12.23	8
6	8.33	n/a	8.33	5
7	5.41	2.39	7.80	4
8	14.24	2.01	16.25	6
9	11.02	n/a	11.02	7
10	11.25	0.69	11.94	4
11	13.14	3.05	16.19	5
12	11.38	n/a	11.38	5
13	7.45	n/a	7.45	4
14	8.72	n/a	8.72	7
15	10.38	n/a	10.38	4
16	17.36	n/a	17.36	2
17	21.85	n/a	21.85	4
18	18.87	n/a	18.87	3
19	17.89	n/a	17.89	4
20	12.48	2.45	14.93	3
Totals	227.33	23.42	250.75	88
Averages	11.37	1.17	12.54	4.4

¹ Territory Nos. 1, 2, 3, 4, 7, 8, 10, 11, and 20 extend off-site of the Lyonia Preserve.

Table 4. Summary of Habitat Types for the Florida Scrub-Jay Territories on the Lyonia Preserve Project Site, Volusia County, Florida, March 2000

Habitat Type (Cover Types Included in Habitat Type ¹)	Florida Scrub-Jay Territory Acreage by Habitat Type and Percentage of Total Territory Acreage									
	1	2	3	4	5	6	7	8	9	10
Managed Open Habitat (311, 312, 313, 314, 315, 316, 317, and 832)	3.49 57%	4.48 35%	3.76 30%	2.25 34%	3.38 28%	2.16 26%	3.84 49%	5.74 35%	2.95 27%	2.38 20%
Un-managed Open Habitat (310, 641, and 742)				0.40 6%	0.84 6%				2.02 18%	0.76 6%
Managed Xeric Oak Habitat (421)	2.58 43%	6.99 55%	6.41 50%	3.42 52%	7.91 65%	6.17 74%	3.96 51%	9.65 60%	5.97 54%	6.08 51%
Forested Habitat (413 and 434)		1.30 10%	1.88 15%		0.10 1%			0.86 5%	0.08 1%	2.53 21%
Sub-total Suitable Habitat	6.07 100%	12.77 100%	12.05 95%	6.07 92%	12.23 100%	8.33 100%	7.80 100%	16.25 100%	11.02 100%	11.75 98%
Unsuitable Habitat (644 and 814)			0.64 5%	0.56 8%						0.19 2%
Total Territory Acreage	6.07	12.77	12.69	6.63	12.23	8.33	7.80	16.25	11.02	11.94

Table 4. Summary of Habitat Types for the Florida Scrub-Jay Territories on the Lyonia Preserve Project Site, Volusia County, Florida, March 2000 (Continued)

Habitat Type (Cover Types Included in Habitat Type ¹)	Florida Scrub-Jay Territory Acreage by Habitat Type and Percentage of Total Territory Acreage									
	11	12	13	14	15	16	17	18	19	20
Managed Open Habitat (311, 312, 313, 314, 315, 316, 317, and 832)	4.91 30%	1.07 9%	1.81 24%	0.68 8%	1.11 11%	0.33 2%	1.22 6%	0.57 3%	0.63 4%	2.65 17%
Un-managed Open Habitat (310, 641, and 742)	0.05 1%	3.34 29%	1.40 19%	0.46 5%		0.83 5%	2.84 13%	1.31 7%		
Managed Xeric Oak Habitat (421)	10.10 62%	4.45 39%	4.24 57%	6.38 73%	7.92 76%	14.16 81%	14.02 64%	13.08 69%	15.12 84%	9.83 66%
Forested Habitat (413 and 434)	0.22 1%	2.13 19%		1.20 14%	1.35 13%	2.04 12%	3.77 17%	3.91 21%	2.14 12%	1.62 11%
Sub-total Suitable Habitat	15.28 94%	10.99 96%	7.45 100%	8.72 100%	10.38 100%	17.36 100%	21.85 100%	18.87 100%	17.89 100%	14.10 94%
Sub-total Unsuitable Habitat (644 and 814)	0.91 6%	0.39 4%								0.83 6%
Total Territory Acreage	16.19	11.38	7.45	8.72	10.38	17.36	21.85	18.87	17.89	14.93

Table 4. Summary of Habitat Types for the Florida Scrub-jay Territories on the Lyonia Preserve Project Site, Volusia County, Florida, March 2000 (Continued)

¹ Cover Types are as follows:

310	Herbaceous
311	Managed Trail 50' Wide
312	Managed Clearing
313	Managed Fire Break 15' Wide
314	Managed Trail 8' Wide
315	Other Trails 8' Wide/Existing, Logging, and Added Trails
316	Managed Nature Trail 4' Wide
317	Mowed Landscape/Roadway Grassland
413	Sand Pine
421	Xeric Oak
434	Mixed Hardwood-Conifer
641	Freshwater Marsh, Seasonally Dry
644	Emergent Aquatic Vegetation
742	Borrow Areas
814	Roadway Pavement
832	Electrical Power Transmission Line

Table 6. Summary of Habitat Types by Management Cell for the Phase II South Management Area on the Lyonia Preserve Project Site, Volusia County, Florida

Habitat Type (Cover Types Included in Habitat Type ¹)		Management Cell Acreage by Habitat Type and Percentage of Total Territory Acreage						
		5	6	7	8	9	10	11
Managed Open Habitat	311	1.55	1.26	2.51	2.86	1.35	2.41	2.01
	312	1.90	1.41	0.88	3.05	1.30	2.27	3.25
	313	0.30		0.92	0.21		0.34	0.93
	315			0.27	0.04			
	316		0.06		0.16	0.14	0.10	0.10
	317							0.57
	Total Acreage	3.75	2.73	4.58	6.32	2.79	5.12	6.86
	% of Total Cell Acreage	32.64	27.25	20.94	19.05	25.79	35.63	32.70
Un-managed Open Habitat	310			2.95	1.74			
	641				4.42	0.11		
	Total Acreage			2.95	6.16	0.11		
	% of Total Cell Acreage			13.49	18.56	1.02		
Total Open Habitat	Total Acreage	3.75	2.73	7.53	12.48	2.90	5.12	6.86
	% of Total Cell Acreage	32.64	27.25	34.43	37.61	26.81	35.63	32.70
Managed Xeric Habitat	413	2.11		3.32	0.33		0.65	0.82
	421	5.63	7.29	11.02	14.30	6.75	8.60	13.30
	Total Acreage	7.74	7.29	14.34	14.63	6.75	9.25	14.12
	% of Total Cell Acreage	67.36	72.75	65.57	44.09	62.38	64.37	67.30
Forested Habitat (434)	Total Acreage				5.68	1.17		
	% of Total Cell Acreage				17.12	10.81		

Table 6. Summary of Habitat Types by Management Cell for the Phase II South Management Area on the Lyonia Preserve Project Site, Volusia County, Florida (Continued)

Habitat Type (Cover Types Included in Habitat Type ¹)		Management Cell Acreage by Habitat Type and Percentage of Total Territory Acreage						
		5	6	7	8	9	10	11
Sub-total Suitable Habitat	Total Acreage	11.49	10.02	21.87	32.79	10.82	14.37	20.98
	% of Total Cell Acreage	100.00	100.00	100.00	98.82	100.00	100.00	100.00
Unsuitable Habitat (644)	Total Acreage				0.39			
	% of Total Cell Acreage				1.18			
Total Management Cell Acreage		11.49	10.02	21.87	33.18	10.82	14.37	20.98

¹ Cover types are as follows:

- 310 Herbaceous
- 311 Managed Trail 50' Wide
- 312 Managed Clearing
- 313 Managed Fire Break 15' Wide
- 315 Other Trails 8' Wide/Existing, Logging, and Added Trails
- 316 Managed Nature Trail 4' Wide
- 317 Mowed Landscape/Roadway Grassland

- 413 Sand Pine
- 421 Xeric Oak
- 434 Mixed Hardwood-Conifer

- 641 Freshwater Marsh, Seasonally Dry
- 644 Emergent Aquatic Vegetation

Table 7. Summary of Habitat Types by Management Cell for the Phase III East Management Area on the Lyonia Preserve Project Site, Volusia County, Florida (Continued)

Habitat Type (Cover Types Included in Habitat Type ¹)		Management Cell Acreage by Habitat Type and Percentage of Total Territory Acreage						
		12	13	14	15	16	17	18
Unsuitable Habitat (644)	Total Acreage							3.25
	% of Total Cell Acreage							7.24
Total Management Cell Acreage		18.33	15.21	8.65	11.72	15.89	15.09	44.86

¹ Cover types are as follows:

- 311 Managed Trail 50' Wide
- 312 Managed Clearing
- 313 Managed Fire Break 15' Wide
- 314 Managed Trail 8' Wide

- 412 Xeric Flatwoods
- 413 Sand Pine

- 641 Freshwater Marsh, Seasonally Dry
- 644 Emergent Aquatic Vegetation

- 720 Sand, other than Beach
- 742 Borrow Areas

Table 8. Schedule of Management and Maintenance Activities for the Lyonia Preserve Project Site, Volusia County, Florida

Management Area		Management Activity Initial Management/Date Conducted and Future Restoration/Date Scheduled	Maintenance Activity by Cover Type Date Completed/Date Scheduled	
Management Phase	Cell No.		Trails	Xeric Oak/ Open Habitat ¹
Phase I North Management Area	1	Initial harvest occurred February to March 1994. Managed Open Area Clearings occurred March to August 1994. <i>Buffer fuel wood harvest February to March 2004.</i>	Annual mowing as needed; began 1995.	Cell roller chopped in March 2003. <i>Future, per habitat assessment, as needed.</i>
	2	Initial harvest occurred February to March 1994. Managed Open Area Clearings, and Strip Roller Chop occurred March to August 1994.	Annual mowing as needed; began 1995.	<i>Future, per habitat assessment, as needed.</i>
	3	Initial harvest occurred February to March 1994. Managed Open Area Clearings occurred March to August 1994. <i>Buffer fuel wood harvest February to March 2004.</i>	Annual mowing as needed; began 1995.	Brush cutter removal of sand pine, Dec. 2003. <i>Future, per habitat assessment, as needed.</i>
	4	Initial harvest occurred February to March 1994. Prescribed Fire occurred March 1994. Managed Open Area Clearings occurred March to August 1994.	Annual mowing as needed; began 1995.	<i>Future, per habitat assessment, as needed.</i>
Phase II South Management Area	5	Initial harvest occurred February to March 1994. <i>Buffer fuel wood harvest and Managed Open Area Clearings February to March 2004.</i>	<i>Annual mowing as needed; begin 2005.</i>	<i>Future, per habitat assessment, as needed.</i>
	6	Initial harvest occurred February to March 1994. <i>Managed Open Area Clearings, February to March 2004.</i>	<i>Annual mowing as needed; begin 2005.</i>	<i>Future, per habitat assessment, as needed.</i>
	7	Initial harvest occurred February to March 1994. <i>Buffer fuel wood harvest and Managed Open Area Clearings February to March 2004. Prescribed Fire March to April 2004.</i>	<i>Annual mowing as needed; begin 2005.</i>	<i>Future, per habitat assessment, as needed.</i>
	8	Initial harvest occurred February to March 1994. <i>Buffer fuel wood harvest and Managed Open Area Clearings February to March 2004.</i>	<i>Annual mowing as needed; begin 2005.</i>	<i>Future, per habitat assessment, as needed.</i>

¹ The schedule for mechanical maintenance and/or prescribed fire will be based on habitat assessment, and performed if average canopy coverage of sand pine exceeds 10%, and/or the average canopy height exceeds 10 feet.

Table 8. Schedule of Management and Maintenance Activities for the Lyonia Preserve Project Site, Volusia County, Florida (Continued)

Management Area		Management Activity Initial Management/Date Conducted and Future Restoration/Date Scheduled	Maintenance Activity by Cover Type Date Completed/Date Scheduled	
Management Phase	Cell No.		Trails	Xeric Oak/ Open Habitat ¹
Phase II South Management Area (Continued)	9	Initial harvest occurred February to March 1994. Managed Open Area Clearings, February to March 2004. Prescribed fire March to April 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
	10	Initial harvest occurred February to March 1994. Buffer fuel wood harvest Feb.-Mar. 2004. Managed Open Area Clearings, February to March 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
	11	Initial harvest occurred February to March 1994. Buffer fuel wood harvest Feb.-Mar. 2004. Managed Open Area Clearings, February to March 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
Phase III East Management Area	12	Fuel wood harvest February to March 2004. Managed Open Area Clearings, February to March 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
	13	Fuel wood harvest February to March 2004. Managed Open Area Clearings, February to March 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
	14	Fuel wood harvest February to March 2004. Managed Open Area Clearings, February to March 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
	15	Fuel wood harvest February to March 2004. Managed Open Area Clearings, February to March 2004. Prescribed fire March to April 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
	16	Fuel wood harvest February to March 2004. Managed Open Area Clearings, February to March 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
	17	Fuel wood harvest February to March 2004. Managed Open Area Clearings, February to March 2004. Prescribed fire March to April 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.
	18	Fuel wood harvest February to March 2004. Managed Open Area Clearings, February to March 2004.	Annual mowing as needed; begin 2005.	Future, per habitat assessment, as needed.

¹ The schedule for mechanical maintenance and/or prescribed fire will be based on habitat assessment, and performed if average canopy coverage of sand pine exceeds 10%, and/or the average canopy height exceeds 10 feet.

APPENDIX

Section 16 School Board Lease

BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

LEASE AGREEMENT

No. 3403

WHEREAS, the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida holds title to certain lands and property being utilized by the State of Florida for public purposes, and

WHEREAS, the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida is authorized in Section 253.03, Florida Statutes, to enter into leases for the use, benefit and possession of public lands by State agencies which may properly use and possess them for the benefit of the State;

NOW, THEREFORE, this agreement made between the BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND of the State of Florida, as Lessor, and the School Board of Volusia County as lessee and

WITNESSETH:

The parties, for and in consideration of mutual covenants and agreements hereinafter contained, hereby covenant and agree as follows:

1. The lessor does hereby lease to the lessee the following described premises in the County of Volusia, State of Florida, together with the improvements thereon (if applicable), viz:

(Exhibit A - attached)

TO HAVE AND TO HOLD the above described land for a period of 50 years for public school purposes.

2. The lessee shall have the right to enter upon said land for all purposes necessary to the full enjoyment by said lessee of the rights herein conveyed to it.

3. The lessee shall through its agents and employees prevent the unauthorized use of said land or any use thereof not in conformity with this lease.

EXHIBIT "C"

4. This lease shall terminate at the sole option of the lessor, and the lessee shall surrender up the premises to the lessor, when and if said premises, including lands and improvements, shall cease to be used for school purposes. Any costs arising out of the enforcement of the terms of this lease agreement shall be the exclusive obligation of the lessee, payable upon demand of the lessor.

5. The lessee hereby covenants and agrees to investigate all claims of every nature at its own expense and to indemnify, protect, defend, hold and save harmless the lessor from any and all claims, actions, lawsuits and demands of any kind or nature arising out of this agreement to the extent allowable by law.

6. The lessor does not warrant or guarantee title, right or interest in the hereinabove described property.

7. The lessor or its duly authorized agents shall have the right at any time to inspect the said land and the works and operations thereon of the lessee in any matter pertaining to this agreement.

8. The lessee agrees to assume all responsibility for liabilities that accrue to the subject property or to the improvements thereon, including any and all drainage or special assessments or taxes of every kind and description which are now or may be hereafter lawfully assessed and levied against the subject property during the effective period of this lease.

9. The lessee is hereby authorized to grant utility and road easements which will be necessary to service authorized facilities located within the leased premises. Copies of any such easements granted shall be filed timely with the lessor.

10. This agreement is for the purposes specified herein, and subleases of any nature, excepting utility and road easements incident to authorized facilities, (Provision 9), are prohibited, unless previously authorized by the lessor.

11. A Management Plan for this tract shall be prepared by the lessee, in accordance with Section 253.034, Florida Statutes, within 12 months of the execution date of this Lease and shall be submitted to the Board for approval through State Lands, acting as agent for the Board. The approved Management Plan shall provide the basic guidance for all management activities and shall be reviewed jointly by the lessee and the Board at least every five (5) years. The lessee shall not use or alter the property except as provided for in the approved Management Plan without the advance written approval of State Lands, as agent for the Board. The land management plan prepared under this lease shall identify management strategies for exotic species, if present. The introduction of exotic species is prohibited, except when specifically authorized by the approved land management plan.

12. Upon cessation of occupation of said property, the lessee agrees to leave all fixed improvements for the use of the lessor and to put no claim upon said fixed improvements; or, at the option of the lessor, the lessee agrees to remove any or all improvements on the property at the lessee's expense.

13. Execution of this agreement in no way affects the lessee's obligations pursuant to Chapter 267, Florida Statutes.

14. The lessee hereby agrees that annual evidence of insurance will be submitted to the following: Bureau of State Lands Management, 3900 Commonwealth Boulevard, Tallahassee, Florida 32303.

15. The lessee hereby agrees that in the event no further use of this parcel or any part thereof is needed, notification will be given to the Bureau of State Lands Management, 3900 Commonwealth Boulevard, Tallahassee, Florida 32303, at least six months prior to the release of any or all of the premises. Notification will include a legal description, the

lease number, and an explanation of the release. The release will only be valid if approved by the Board of Trustees.

16. The lessee further agrees that any buildings on the premises will meet the following conditions upon release:

(a) The premises shall meet the building and safety codes in the location situated.

(b) The lessee shall properly dispose of utility fees, including having utilities turned off.

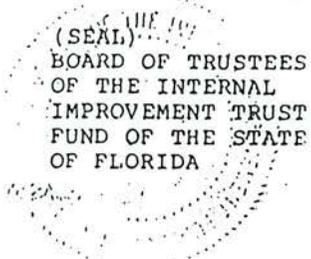
(c) The lessee shall not commit waste; fair wear and tear is acceptable.

(d) Prior to formal release a representative of the Bureau of State Lands Management shall perform an on-site inspection and the keys to any buildings on the premises shall be turned over to that Bureau.

(e) If the premises does not meet all conditions agreed upon, the lessee shall reimburse the Board for any expenses incurred in meeting the prescribed conditions.

(f) Any structures erected shall inure to the benefit of the State of Florida.

IN TESTIMONY WHEREOF, the lawfully designated agent of the Board of Trustees of the Internal Improvement Trust Fund has hereunto subscribed his name and has caused the official seal of said Board to be hereunto affixed, in the City of Tallahassee, Florida, on the 12 day of June, A.D. 1982.



(SEAL)
BOARD OF TRUSTEES
OF THE INTERNAL
IMPROVEMENT TRUST
FUND OF THE STATE
OF FLORIDA

BOARD OF TRUSTEES OF THE
INTERNAL IMPROVEMENT TRUST
FUND OF THE STATE OF FLORIDA
By: [Signature]
EXECUTIVE DIRECTOR, AGENT FOR
THE BOARD OF TRUSTEES OF THE
INTERNAL IMPROVEMENT TRUST
FUND OF THE STATE OF FLORIDA

APPROVED AS TO FORM AND
LEGALITY
By: Dary L. Heen

THIS INSTRUMENT PREPARED
AND REVIEWED
By: Catherine Daniels

SCHOOL BOARD OF VOLUSTA COUNTY
By: Beebe J. White

DATE November 18, 1986

VOLUSIA COUNTY SCHOOL BOARD
PROPERTY IN SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST

DESCRIPTION OF THE VOCATIONAL, AGRICULTURE AND FOREST LAB LANDS

BEGINNING AT THE SOUTH 1/4 CORNER OF SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA, AS SHOWN ON THE PLAT OF DELTONA LAKES, UNIT FIFTEEN, AS RECORDED IN MAP BOOK 25, PAGES 230 THROUGH 233, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; THENCE RUN N 89° 04' 39" E ALONG THE SOUTH LINE OF THE SE 1/4 OF SAID SECTION 16 A DISTANCE OF 597.05 FT.; THENCE N 00° 54' 02" W A DISTANCE OF 639.628 FT. TO THE POINT OF CURVATURE (P.C.) OF A CURVE CONCAVE TO THE WEST HAVING A CENTRAL ANGLE OF 08° 24' 02", A RADIUS OF 2,814.79 FT. AND A CHORD BEARING OF N 05° 06' 03" W; THENCE NORTHERLY ALONG THE ARC OF SAID CURVE 412.70 FT. TO THE POINT OF TANGENCY (P.T.); THENCE N 09° 16' 04" W A DISTANCE OF 2,823.97 FT. TO THE P.C. OF A CURVE CONCAVE TO THE EAST HAVING A CENTRAL ANGLE OF 08° 21' 55", A RADIUS OF 2,914.79 FT. AND A CHORD BEARING OF N 05° 07' 06" W; THENCE NORTHERLY ALONG THE ARC OF SAID CURVE 425.57 FT. TO THE P.T.; THENCE N 00° 56' 08" W A DISTANCE OF 991.65 FT. TO THE NORTH LINE OF THE NE 1/4 OF SAID SECTION 16 AT A POINT 50.00 FT. WESTERLY OF THE CENTERLINE OF IDLEWEISE DR. AS SHOWN ON THE PLAT OF DELTONA LAKES, UNIT FIFTY-THREE, AS RECORDED IN MAP BOOK 28, PAGES 32 THROUGH 42, AFORESAID PUBLIC RECORDS; THENCE S 88° 58' 33" W ALONG SAID NORTH LINE 11.89 FT. TO THE NORTH 1/4 CORNER OF SAID SECTION 16; THENCE S 88° 58' 07" W ALONG THE NORTH LINE OF THE NW 1/4 OF SAID SECTION 16 A DISTANCE OF 1,876.76 FT. TO THE WEST LINE OF THE EAST 530 FT. OF THE WEST 1/2 OF THE SAID NW 1/4; THENCE S 00° 10' 47" W ALONG THE SAID WEST LINE 1,072.34 FT.; THENCE N 88° 58' 07" E PARALLEL WITH THE NORTH LINE OF THE SAID NW 1/4 A DISTANCE OF 165 FT. TO THE WEST LINE OF THE EAST 365 FT. OF THE WEST 1/2 OF THE SAID NW 1/4; THENCE S 00° 10' 47" W ALONG THE SAID WEST LINE 943.11 FT. TO THE NORTHERLY LINE OF FLORIDA POWER & LIGHT COMPANY'S EASEMENT AS RECORDED IN OFFICIAL RECORDS BOOK 211, PAGE 143, AND OFFICIAL RECORDS BOOK 1294, PAGE 494, AFORESAID PUBLIC RECORDS; THENCE S 47° 52' 07" W A DISTANCE OF 927.04 FT. TO THE SOUTH LINE OF THE NW 1/4 OF SAID SECTION 16; THENCE S 89° 04' 33" W ALONG SAID SOUTH LINE 290.27 FT. TO THE WEST 1/4 CORNER OF SAID SECTION 16; THENCE S 00° 01' 03" W ALONG THE WEST LINE OF THE SW 1/4 OF SAID SECTION 16 A DISTANCE OF 2,631.05 FT. TO THE SW CORNER OF SAID SECTION 16; THENCE N 89° 05' 21" E ALONG THE SOUTH LINE OF SAID SECTION 16 A DISTANCE 2,668.96 FT. TO THE POINT OF BEGINNING; EXCEPT THE FOLLOWING DESCRIBED PARCEL:

COMMENCING AT THE INTERSECTION OF THE CENTERLINE OF IDLEWEISE DRIVE AND THE NORTH LINE OF THE NE 1/4 OF SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA, AS SHOWN ON THE PLAT OF DELTONA LAKES, UNIT FIFTY-THREE, RECORDED IN MAP BOOK 28, PAGES 32 THROUGH 42, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; THENCE S 88° 58' 33" W ALONG THE SAID NORTH LINE 50.00 FT.; THENCE S 00° 56' 08" E A DISTANCE OF 991.55 FT. TO THE POINT OF CURVATURE (P.C.) OF A CURVE CONCAVE TO THE WEST HAVING A CENTRAL ANGLE OF 00° 06' 29", A RADIUS OF 2,914.79 FT. AND A CHORD BEARING OF S 00° 59' 23" E; THENCE SOUTHERLY ALONG THE ARC OF SAID CURVE 5.50 FT. TO THE POINT OF BEGINNING;

THENCE CONTINUE ALONG THE ARC OF SAID CURVE 148.79 FT. THROUGH A CENTRAL ANGLE OF 02° 55' 29" AND A CHORD BEARING OF S 02° 30' 21" E TO THE POINT OF REVERSE CURVE (P.R.C.) OF A CURVE CONCAVE TO THE SOUTHWEST HAVING A CENTRAL ANGLE OF 87° 03' 46", A RADIUS OF 25.00 FT. AND A CHORD BEARING OF N 47° 30' 00" W; THENCE NORTHWESTERLY ALONG THE ARC OF SAID CURVE 37.99 FT. TO THE POINT OF TANGENCY (P.T.); THENCE S 88° 58' 07" W, PARALLEL WITH THE NORTH LINE OF THE NW 1/4 OF SAID SECTION 16 A DISTANCE OF 1,724.63 FT. TO THE WEST LINE OF THE EAST 365 FT. OF THE WEST 1/2 OF THE NW 1/4 OF SAID SECTION 16; THENCE N 00° 10' 47" E ALONG SAID WEST LINE 50.01 FT. TO THE SOUTH LINE OF THE NORTH 1072.34 FT. OF THE SAID NW 1/4; THENCE S 88° 58' 07" W ALONG SAID SOUTH LINE 165.00 FT. TO THE WEST LINE OF THE EAST 530 FT. OF THE SAID WEST 1/2 OF THE NW 1/4; THENCE N 00° 10' 47" E ALONG SAID WEST LINE 50.01 FT.; THENCE N 88° 58' 07" E PARALLEL WITH THE NORTH LINE OF THE SAID NW 1/4 A DISTANCE OF 1,883.65 FT. TO THE P.C. OF A CURVE CONCAVE TO THE NORTHWEST HAVING A CENTRAL ANGLE OF 90° 00' 44", A RADIUS OF 25.00 FT. AND A CHORD BEARING OF N 43° 57' 45" E; THENCE NORTHEASTERLY ALONG THE ARC OF SAID CURVE 39.27 FT. TO THE P.T. AND THE POINT OF BEGINNING OF THE HEREIN DESCRIBED EXCEPTION; CONTAINING 290.49 ACRES, MORE OR LESS; SUBJECT TO A FLORIDA POWER AND LIGHT COMPANY EASEMENT AS RECORDED IN O.R. BK. 211, PG. 143, AND O.R. BK. 1294, PG. 494, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; AND BEING SUBJECT TO A UTILITY EASEMENT OVER THE WEST 20 FT. THEREOF AND THE SOUTH 20 FT. THEREOF.

Prepared By: ARTHUR W. STEINMAN & ASSOCIATES, INC., DeLand, Florida
EXHIBIT "C"

NO. 3403
EXHIBIT A
PAGE 1 OF 6

VOLUSIA COUNTY SCHOOL BOARD

PROPERTY IN SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST

DESCRIPTION OF ENVIRONMENTAL STUDY AREA:

COMMENCING AT THE SOUTH 1/4 CORNER OF SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA AS SHOWN ON THE PLAT OF DELTONA LAKES UNIT FIFTEEN, AS RECORDED IN MAP BOOK 25, PAGES 230 THROUGH 233, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; THENCE N 09° 04' 39" E ALONG THE SOUTH LINE OF THE SE 1/4 OF SAID SECTION 16 A DISTANCE OF 697.052 FT. TO THE POINT OF BEGINNING; THENCE N 00° 54' 02" W A DISTANCE OF 639.59 FT. TO THE POINT OF CURVATURE (P.C.) OF A CURVE CONCAVE TO THE WEST HAVING A CENTRAL ANGLE OF 08° 24' 02", A RADIUS OF 2,914.79 FT. AND A CHORD BEARING OF N 05° 06' 03" W; THENCE NORTHERLY ALONG THE ARC OF SAID CURVE 427.36 FT. TO THE POINT OF TANGENCY (P.T.); THENCE N 09° 18' 04" W A DISTANCE OF 2,823.97 FT. TO THE P.C. OF A CURVE CONCAVE TO THE EAST HAVING A CENTRAL ANGLE OF 08° 21' 55", A RADIUS OF 2,814.79 FT. AND A CHORD BEARING OF N 05° 07' 06" W; THENCE NORTHERLY ALONG THE ARC OF SAID CURVE 410.97 FT. TO THE P.T.; THENCE N 00° 56' 09" W A DISTANCE OF 991.801 FT. TO THE NORTH LINE OF THE NE 1/4 OF SAID SECTION 16 AT A POINT 50.00 FT. EASTERLY OF THE CENTERLINE OF IDLEWISE DRIVE AS SHOWN ON THE PLAT OF DELTONA LAKES, UNIT FIFTY-THREE AS RECORDED IN MAP BOOK 28, PAGES 32 THROUGH 42, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; THENCE N 88° 58' 33" E ALONG SAID NORTH LINE 2,556.79 FT. TO THE NE CORNER OF SAID NE 1/4; THENCE S 00° 19' 53" W ALONG THE EAST LINE OF THE SAID NE 1/4 A DISTANCE OF 2,634.33 FT. TO THE EAST 1/4 CORNER OF SAID SECTION 16; THENCE S 00° 42' 14" W ALONG THE EAST LINE OF THE SE 1/4 OF SAID SECTION 16 A DISTANCE OF 1312.45 FT. TO THE NORTH LINE OF THE SOUTH 1320 FT. OF THE SAID SE 1/4; THENCE S 89° 04' 39" W ALONG SAID NORTH LINE 1320 FT. TO THE WEST LINE OF THE EAST 1320 FT. OF THE SAID SE 1/4; THENCE S 00° 42' 14" W ALONG SAID WEST LINE 1320 FT. TO THE SOUTH LINE OF SAID SE 1/4; THENCE S 89° 04' 36" W ALONG THE SAID SOUTH LINE 631.81 FT. TO THE POINT OF BEGINNING; EXCEPT THE FOLLOWING DESCRIBED PARCEL:

COMMENCING AT THE SOUTH 1/4 CORNER OF SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA AS SHOWN ON THE PLAT OF DELTONA LAKES UNIT FIFTEEN, AS RECORDED IN MAP BOOK 25, PAGES 230 THROUGH 233, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; RUN THENCE N 89° 04' 39" E ALONG THE SOUTH LINE OF THE SE 1/4 OF SAID SECTION 16 A DISTANCE OF 697.05 FT.; THENCE N 00° 54' 02" W A DISTANCE OF 25.00 FT. TO THE POINT OF BEGINNING OF THE HEREIN DESCRIBED EXCEPTION; THENCE CONTINUE N 00° 54' 02" W A DISTANCE OF 150.00 FT. TO THE POINT OF CURVATURE (P.C.) OF A CURVE CONCAVE TO THE NORTHEAST HAVING A CENTRAL ANGLE OF 90° 01' 19", A RADIUS OF 25.00 FT. AND A CHORD BEARING OF S 45° 54' 41" E; THENCE SOUTHEASTERLY ALONG THE ARC OF SAID CURVE 39.28 FT. TO THE POINT OF TANGENCY (P.T.); THENCE N 89° 04' 39" E PARALLEL WITH THE SOUTH LINE OF THE SE 1/4 OF SAID SECTION 16 A DISTANCE OF 611.00 FT. TO THE WEST LINE OF THE EAST 1320.00 FT. OF THE SAID SE 1/4; THENCE S 00° 42' 14" W ALONG SAID WEST LINE 100.04 FT.; THENCE S 89° 04' 39" W PARALLEL WITH THE SOUTH LINE OF THE SAID SE 1/4 A DISTANCE OF 608.222 FT. TO THE P.C. OF A CURVE CONCAVE TO THE SOUTHEAST HAVING A CENTRAL ANGLE OF 89° 58' 41", A RADIUS OF 25.00 FT. AND A CHORD BEARING OF S 44° 05' 18" W; THENCE SOUTHWESTERLY ALONG THE ARC OF SAID CURVE 39.26 FT. TO THE P.T. AND THE POINT OF BEGINNING OF THE HEREIN DESCRIBED EXCEPTION; SAID ENVIRONMENTAL AND STUDY AREA CONTAINING 230.31 ACRES, MORE OR LESS.

SUBJECT TO A FLORIDA POWER AND LIGHT COMPANY EASEMENT AS RECORDED IN OFFICIAL RECORDS BOOK 211, PAGE 143, AND OFFICIAL RECORDS BOOK 1294, PAGE 494, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; AND SUBJECT TO A UTILITY EASEMENT OVER THE SOUTH 20 FT. THEREOF.

Prepared By: ARTHUR W. STEINMAN & ASSOCIATES, INC., DeLand, Florida

EXHIBIT "C"

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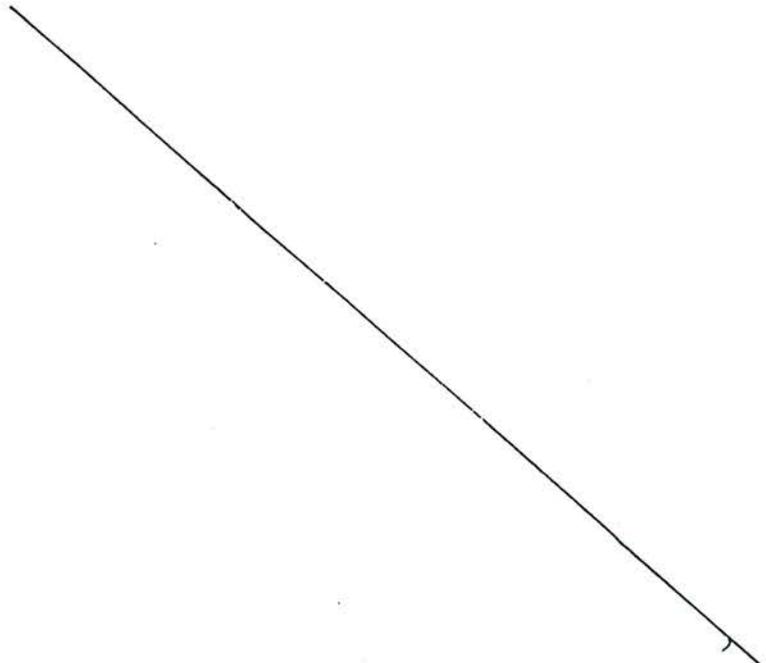
VOLUSIA COUNTY SCHOOL BOARD

PROPERTY IN SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST

DESCRIPTION OF ROAD "A":

COMMENCING AT THE SOUTH 1/4 CORNER OF SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA, AS SHOWN ON THE PLAT OF DELTONA LAKES, UNIT FIFTEEN, AS RECORDED IN MAP BOOK 25, PAGES 230 THROUGH 233, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; THENCE RUN N 89° 04' 39" E ALONG THE SOUTH LINE OF THE SE 1/4 OF SAID SECTION 16 A DISTANCE OF 597.05 FT. TO THE POINT OF BEGINNING; THENCE N 00° 54' 02" W A DISTANCE OF 639.63 FT. TO THE POINT OF CURVATURE (P.C.) OF A CURVE CONCAVE TO THE WEST HAVING A CENTRAL ANGLE OF 08° 24' 02" AND A RADIUS OF 2,814.79 FT. AND A CHORD BEARING OF N 05° 06' 03" W; THENCE NORTHERLY ALONG THE ARC OF SAID CURVE 412.70 FT. TO THE POINT OF TANGENCY (P.T.); THENCE N 09° 18' 04" W A DISTANCE OF 2,823.97 FT. TO THE P.C. OF A CURVE CONCAVE TO THE EAST HAVING A CENTRAL ANGLE OF 08° 21' 55", A RADIUS OF 2,914.79 FT. AND A CHORD BEARING OF N 05° 07' 06" W; THENCE NORTHERLY ALONG THE ARC OF SAID CURVE 425.57 FT. TO THE P.T.; THENCE N 00° 56' 08" W A DISTANCE OF 991.65 FT. TO THE NORTH LINE OF THE NE 1/4 OF SAID SECTION 16 AT A POINT 50.00 FT. WESTERLY OF THE CENTERLINE OF IDLEWEISE DR. AS SHOWN ON THE PLAT OF DELTONA LAKES, UNIT FIFTY-THREE, AS RECORDED IN MAP BOOK 28, PAGES 32 THROUGH 42, AFORESAID PUBLIC RECORDS; THENCE N 88° 58' 33" E ALONG SAID NORTH LINE 100.00 FT.; THENCE S 00° 56' 08" E A DISTANCE OF 991.80 FT. TO THE P.C. OF A CURVE CONCAVE TO THE EAST, HAVING A CENTRAL ANGLE OF 08° 21' 55", A RADIUS OF 2,814.79 FT. AND A CHORD BEARING OF S 05° 07' 06" E; THENCE SOUTHERLY ALONG THE ARC OF SAID CURVE 410.97 FT. TO THE P.T.; THENCE S 09° 18' 04" E A DISTANCE OF 2,823.97 FT. TO THE P.C. OF A CURVE CONCAVE TO THE WEST, HAVING A CENTRAL ANGLE OF 08° 24' 02", A RADIUS OF 2,914.79 FT. AND A CHORD BEARING OF S 05° 06' 03" E; THENCE SOUTHERLY ALONG THE ARC OF SAID CURVE 427.36 FT. TO THE P.T.; THENCE S 00° 54' 02" E A DISTANCE OF 639.59 FT. TO THE SOUTH LINE OF THE SE 1/4 OF SAID SECTION 16; THENCE S 89° 04' 39" W ALONG THE SAID SOUTH LINE 100.00 FT. TO THE POINT OF BEGINNING; CONTAINING 12.152 ACRES, MORE OR LESS.

SUBJECT TO A FLORIDA POWER AND LIGHT COMPANY EASEMENT AS RECORDED IN OFFICIAL RECORDS BOOK 211, PAGE 143, AND OFFICIAL RECORDS BOOK 1294, PAGE 494, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA.



Prepared By: ARTHUR W. STEINMAN & ASSOCIATES, INC., DeLand, Florida

EXHIBIT "C"

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EXHIBIT "A"
PAGE 3 OF 6

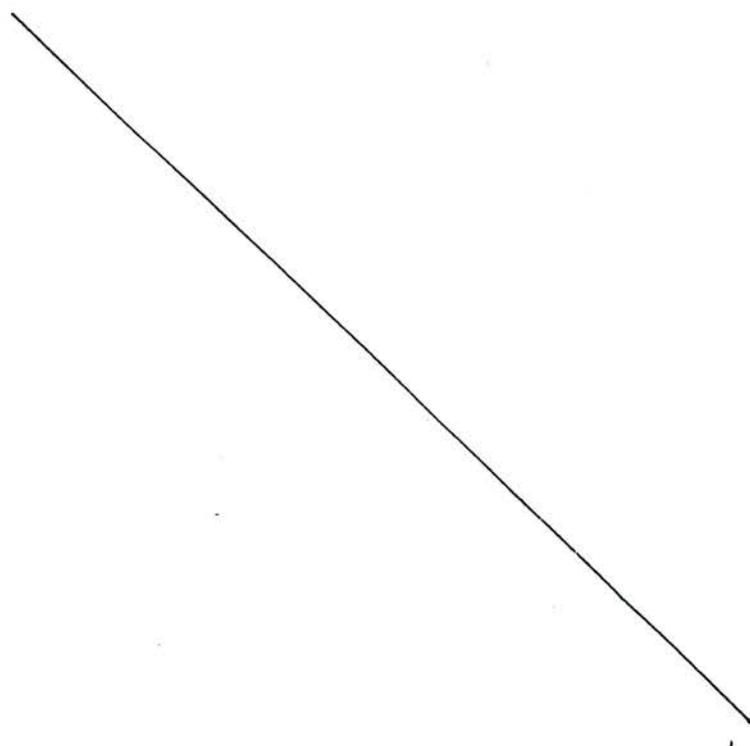
VOLUSIA COUNTY SCHOOL BOARD

PROPERTY IN SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST

DESCRIPTION OF ROAD "B":

COMMENCING AT THE INTERSECTION OF THE CENTERLINE OF IOLEWEISE DRIVE AND THE NORTH LINE OF THE NE 1/4 OF SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA, AS SHOWN ON THE PLAT OF DELTONA LAKES, UNIT FIFTY-THREE, RECORDED IN MAP BOOK 28, PAGES 32 THROUGH 42, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; THENCE S 88° 58' 33" W ALONG THE SAID NORTH LINE 50.00 FT.; THENCE S 00° 56' 08" E A DISTANCE OF 991.65 FT. TO THE POINT OF CURVATURE (P.C.) OF A CURVE CONCAVE TO THE WEST HAVING A CENTRAL ANGLE OF 00° 06' 29", A RADIUS OF 2,914.79 FT. AND A CHORD BEARING OF S 00° 59' 23" E; THENCE SOUTHERLY ALONG THE ARC OF SAID CURVE 5.50 FT. TO THE POINT OF BEGINNING;

THENCE CONTINUE ALONG THE ARC OF SAID CURVE 140.79 FT. THROUGH A CENTRAL ANGLE OF 02° 55' 29" AND A CHORD BEARING OF S 02° 30' 21" E TO THE POINT OF REVERSE CURVE (P.R.C.) OF A CURVE CONCAVE TO THE SOUTHWEST HAVING A CENTRAL ANGLE OF 87° 03' 46", A RADIUS OF 25.00 FT. AND A CHORD BEARING OF N 47° 30' 00" W; THENCE NORTHWESTERLY ALONG THE ARC OF SAID CURVE 37.99 FT. TO THE POINT OF TANGENCY (P.T.); THENCE S 80° 58' 07" W, PARALLEL WITH THE NORTH LINE OF THE NW 1/4 OF SAID SECTION 16 A DISTANCE OF 1,724.63 FT. TO THE WEST LINE OF THE EAST 365 FT. OF THE WEST 1/2 OF THE NW 1/4 OF SAID SECTION 16; THENCE N 00° 10' 47" E ALONG SAID WEST LINE 50.01 FT. TO THE SOUTH LINE OF THE NORTH 1072.34 FT. OF THE SAID NW 1/4; THENCE S 88° 58' 07" W ALONG SAID SOUTH LINE 165.00 FT. TO THE WEST LINE OF THE EAST 530 FT. OF THE SAID WEST 1/2 OF THE NW 1/4; THENCE N 00° 10' 47" E ALONG SAID WEST LINE 50.01 FT.; THENCE N 88° 58' 07" E PARALLEL WITH THE NORTH LINE OF THE SAID NW 1/4 A DISTANCE OF 1,883.65 FT. TO THE P.C. OF A CURVE CONCAVE TO THE NORTHWEST HAVING A CENTRAL ANGLE OF 90° 00' 44", A RADIUS OF 25.00 FT. AND A CHORD BEARING OF N 43° 57' 45" E; THENCE NORTHEASTERLY ALONG THE ARC OF SAID CURVE 39.27 FT. TO THE P.T. AND THE POINT OF BEGINNING; CONTAINING 4.20 ACRES, MORE OR LESS; SUBJECT TO A FLORIDA POWER AND LIGHT COMPANY EASEMENT AS RECORDED IN O.R. BK. 211, PG. 143, AND O.R. BK. 1294, PG. 494, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA;



Prepared By: ARTHUR W. STEINMAN & ASSOCIATES, INC., DeLand, Florida

EXHIBIT "C"

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NO. 3403

EXHIBIT "A"

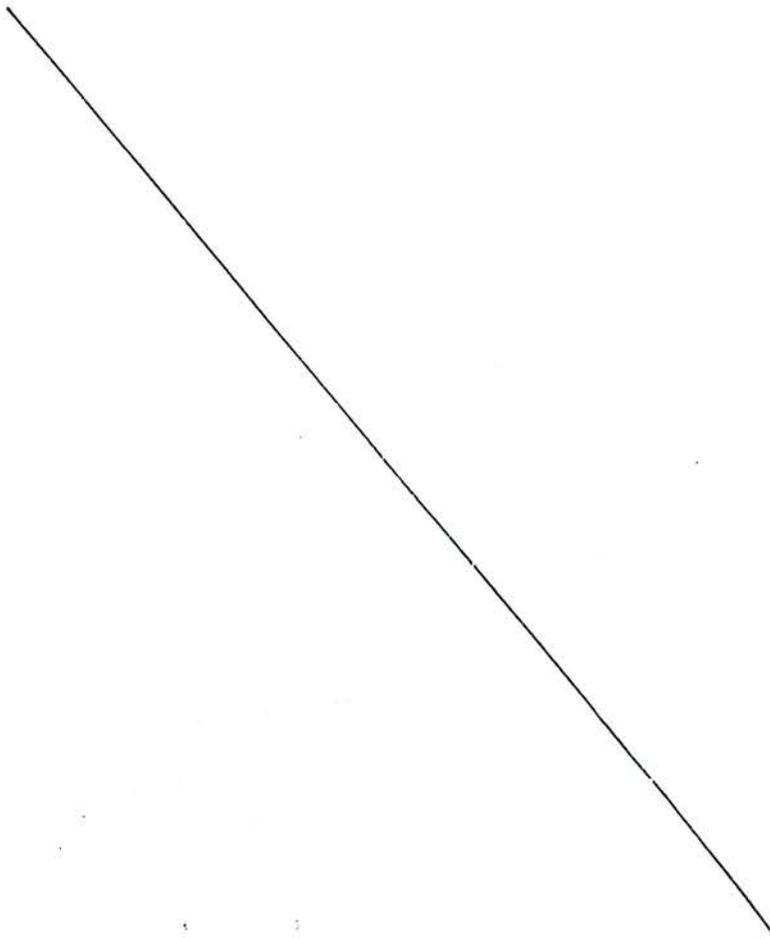
PAGE 4 OF 6

VOLUSIA COUNTY SCHOOL BOARD

PROPERTY IN SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST

DESCRIPTION OF ROAD "C":

COMMENCING AT THE SOUTH 1/4 CORNER OF SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA AS SHOWN ON THE PLAT OF DELTONA LAKES UNIT FIFTEEN, AS RECORDED IN MAP BOOK 25, PAGES 230 THROUGH 233, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; RUN THENCE N 89° 04' 39" E ALONG THE SOUTH LINE OF THE SE 1/4 OF SAID SECTION 16 A DISTANCE OF 697.05 FT.; THENCE N 00° 54' 02" W A DISTANCE OF 25.00 FT. TO THE POINT OF BEGINNING; THENCE CONTINUE N 00° 54' 02" W A DISTANCE OF 150.00 FT. TO THE POINT OF CURVATURE (P.C.) OF A CURVE CONCAVE TO THE NORTHEAST HAVING A CENTRAL ANGLE OF 90° 01' 19", A RADIUS OF 25.00 FT. AND A CHORD BEARING OF S 45° 54' 41" E; THENCE SOUTHEASTERLY ALONG THE ARC OF SAID CURVE 39.28 FT. TO THE POINT OF TANGENCY (P.T.); THENCE N 89° 04' 39" E PARALLEL WITH THE SOUTH LINE OF THE SE 1/4 OF SAID SECTION 16 A DISTANCE OF 611.00 FT. TO THE WEST LINE OF THE EAST 1320.00 FT. OF THE SAID SE 1/4; THENCE S 00° 42' 14" W ALONG SAID WEST LINE 100.04 FT.; THENCE S 89° 04' 39" W PARALLEL WITH THE SOUTH LINE OF THE SAID SE 1/4 A DISTANCE OF 608.222 FT. TO THE P.C. OF A CURVE CONCAVE TO THE SOUTHEAST HAVING A CENTRAL ANGLE OF 89° 58' 41", A RADIUS OF 25.00 FT. AND A CHORD BEARING OF S 44° 05' 18" W; THENCE SOUTHWESTERLY ALONG THE ARC OF SAID CURVE 39.26 FT. TO THE P.T. AND THE POINT OF BEGINNING; CONTAINING 1.463 ACRES, MORE OR LESS.



Prepared By: ARTHUR W. STEINMAN & ASSOCIATES, INC., DeLand, Florida

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VOLUSIA COUNTY SCHOOL BOARD

PROPERTY IN SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST

DESCRIPTION OF 20 FT. UTILITY EASEMENT

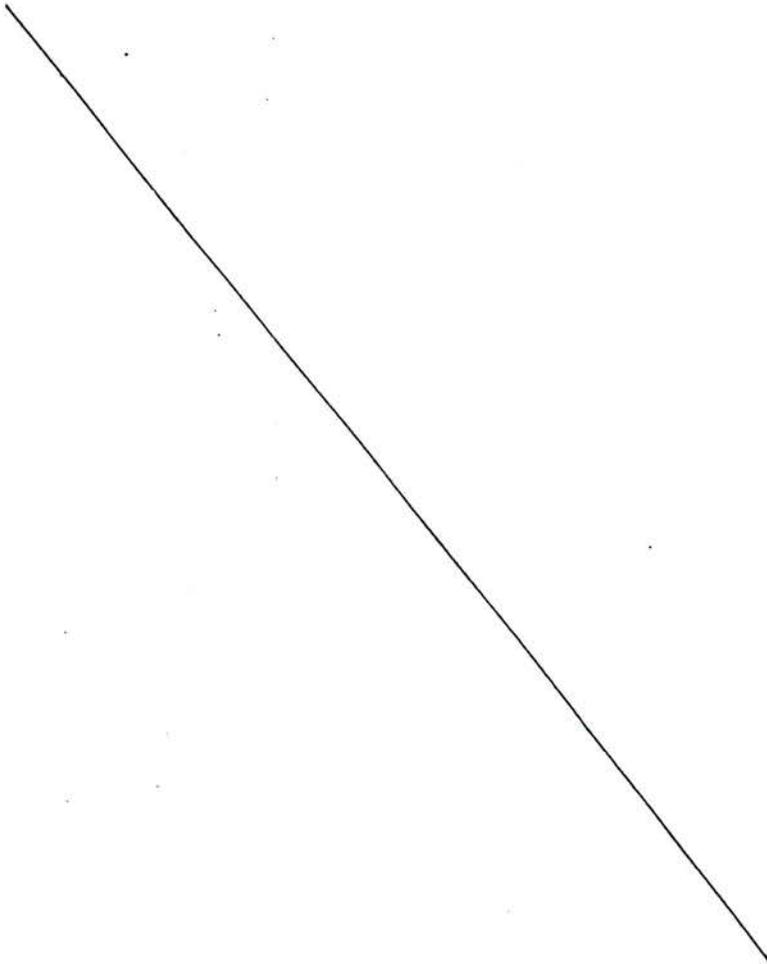
THE WEST 20 FT. AND THE SOUTH 20 FT. OF SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA, EXCEPT THE EAST 1320 FT. THEREOF; CONTAINING 4.239 ACRES, MORE OR LESS.

DESCRIPTION OF FUTURE ELEMENTARY SCHOOL:

THE NORTH 1072.34 FT. OF THE WEST 1/2 OF THE NW 1/4; EXCEPT THE EAST 530 FT. THEREOF, SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA, CONTAINING 20.07 ACRES, MORE OR LESS, AND BEING SUBJECT TO A UTILITY EASEMENT OVER THE WEST 20 FT. THEREOF.

DESCRIPTION OF FUTURE MIDDLE SCHOOL

THE WEST 1/2 OF THE NW 1/4 LYING NORTH OF FLORIDA POWER & LIGHT COMPANY'S RIGHT-OF-WAY EASEMENT PER O.R. BK. 211, PAGE 143 AND O.R. BK. 1294, PAGE 494, PUBLIC RECORDS OF VOLUSIA COUNTY, FLORIDA; EXCEPT THE NORTH 1072.34 FT. THEREOF AND EXCEPT THE EAST 365 FT. THEREOF; ALL IN SECTION 16, TOWNSHIP 18 SOUTH, RANGE 31 EAST, VOLUSIA COUNTY, FLORIDA, CONTAINING 30.04 ACRES, MORE OR LESS, AND BEING SUBJECT TO A UTILITY EASEMENT OVER THE WEST 20 FT. THEREOF.



Prepared By: ARTHUR W. STEINMAN & ASSOCIATES, INC., Deland, Florida

EXHIBIT "C"

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NO. 3403

EXHIBIT "A"

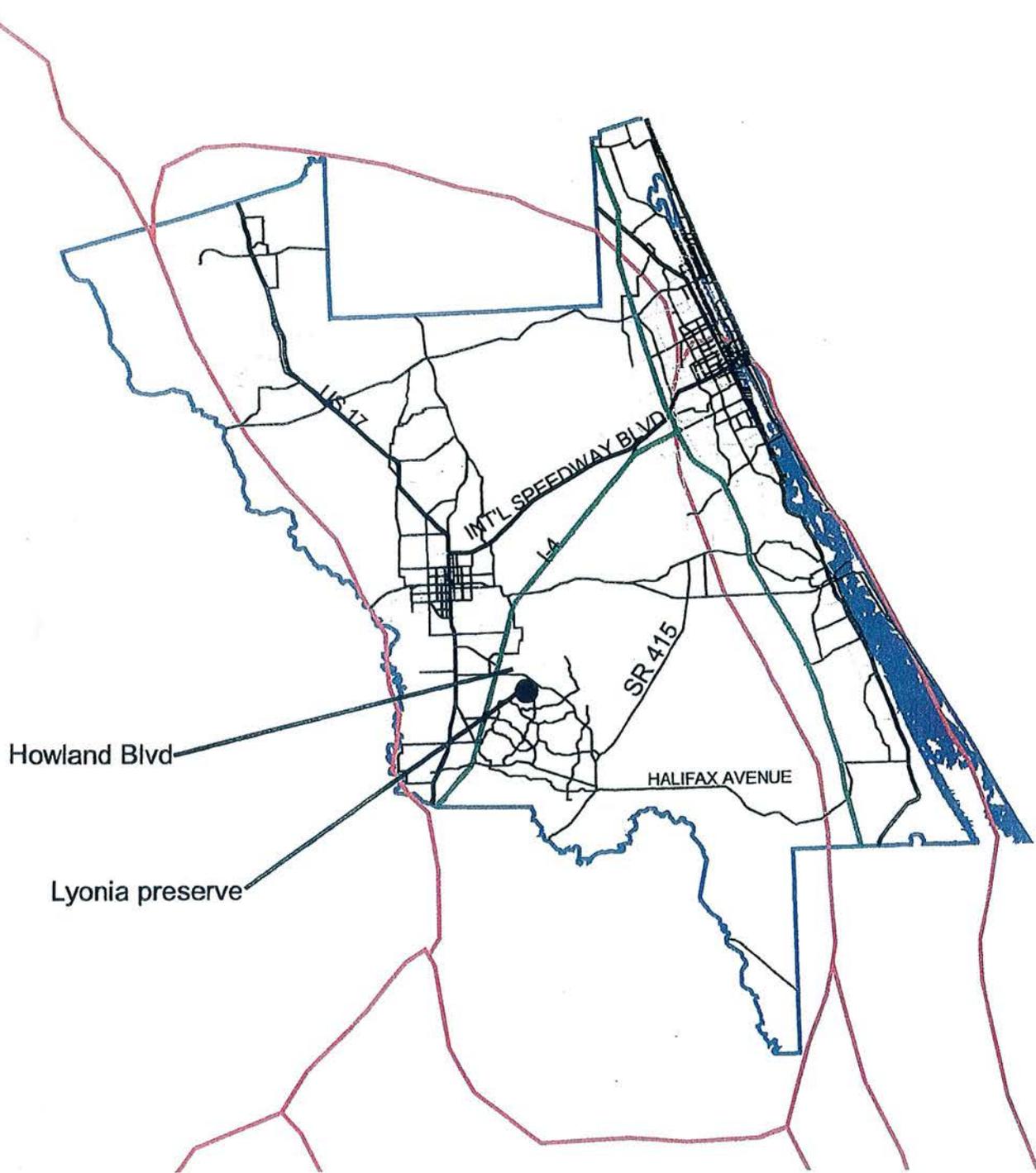
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Exhibit D

Florida Scrub-Jay Mitigation Service Area for the Lyonia Preserve (figure)

Florida Scrub-Jay Mitigation Service Area For The Lyonia Preserve

Figure 14



4 0 4 8 Miles

FDOT Major Roads - 1998 - VOLUSIA

- Interstate
- U.S. Road
- State Road
- County Road
- Local Road

Roadway Feature

FSJ Mitigation Service Area Polygon

