EASTERN COLLIER MULTIPLE SPECIES HCP

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EXECUTIVE SUMMARY

The Eastern Collier Multiple Species Habitat Conservation Plan (HCP) will permanently preserve approximately 107,000 acres of privately held land, that could otherwise be developed, to provide valuable habitat for the Florida panther and fifteen other protected species in Southwest Florida. The Plan will also cluster and direct 45,000 acres of development toward areas of less valuable habitat.

The HCP is being prepared in connection with an application by landowners in eastern Collier County, Florida, for an Incidental Take Permit (ITP) under section 10 of the Endangered Species Act. 16 U.S.C. § 1539. Section 10 of the Act authorizes the U.S. Fish & Wildlife Service (USFWS) to issue permits for take of Federally-listed species that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." 16 U.S.C. §1539(a)(1)(B). An applicant for an incidental take permit must submit an HCP that describes likely impacts, steps to minimize and mitigate those impacts, funding to implement those steps, and alternatives considered by the applicant. 16 U.S.C. §1539(a)(2)(A). This HCP is designed to offset any incidental take that results from covered activities within the 45,000 acres of land identified for development (land that has lower habitat value for listed species) through permanent preservation and enhancement of approximately 107,000 acres of land that is substantially more valuable to listed species, and through additional minimization and mitigation measures.

Landscape Level Initiative By Landowners in Collaboration With Key Conservation Organizations

This Plan is the result of a collaborative effort by the landowner applicants and four leading conservation organizations including Defenders of Wildlife, Florida Wildlife Federation, Audubon of Florida and Collier County Audubon Society. To plan for future development while protecting the endangered Florida panther in Southwest Florida, this group formed the Florida Panther Protection Program (FPPP). The FPPP builds on Collier County's successful Rural Land Stewardship Program by establishing a funding mechanism based on use of panther habitat unit (PHU) mitigation credits. Funds generated through the use of PHUs will be deposited into the Paul J. Marinelli Fund, created by the FPPP to fund panther conservation activities. The Marinelli Fund will be administered by a board of directors comprised of representatives of each of the conservation organizations that are members of the FPPP, a representative of the landowner members of the FPPP, and representatives of the Florida Fish and Wildlife Conservation Commission (FWC) and USFWS.

The FPPP will be implemented through the HCP. The landowner members of the FPPP worked with their conservation organization partners, as well as FWC and USFWS, to develop this Plan for the benefit of the Florida panther, seven other federally-listed species, six species listed as threatened by the State of Florida, one species that is under review for federal listing, and one candidate species for federal listing.

Permanent Protection of the 107,000 Acres of Private Land Identified for Preservation Will Provide Valuable Habitat and Serve as A Critical Linkage For Species Movements Between Public Lands

The Plan will provide for preservation of approximately 107,000 acres of otherwise developable, privately owned lands within the 152,124-acre area covered by the Plan (the HCP Area). These preserved lands will serve as habitat for the sixteen species covered by the Plan, while allowing economically productive land uses in smaller, clustered parts of the HCP Area. Under the Plan, the approximately 107,000 acres of preserved land will be placed under permanent protection for use by those species, and restricted to the types of rural and agricultural uses that have occurred historically throughout the HCP Area. The 107,000 acre area of preservation lands include areas that function as regional wildlife corridors, allowing wildlife movement between publicly owned conservation lands in

Southwest Florida, such as the Florida Panther National Wildlife Refuge, Big Cypress National Preserve, Corkscrew Regional Ecosystem Watershed, and the Okaloacoochee Slough State Forest, among others.

The 45,000 Acres of Clustered Development on Lands that Comprise Less Valuable Habitat Will Generate Funding for Additional Panther Conservation Activities

Approximately 45,000 acres of land within the HCP Area are identified in the Plan for residential and commercial development and earth mining. These 45,000 acres will be clustered, and located in areas that are less valuable to the covered species than the preservation lands. These lands have less native habitat, and much of the land is already disturbed. Development within these 45,000 acres will be offset by mitigation that includes the 107,000 acres of preservation, and the use of PHUs, resulting in substantial funding to be used for additional panther conservation activities.

The Plan will employ a credit-based system under which PHUs are created through preservation of lands with high natural resource values to offset impacts of development. Preserved lands will be placed under permanent conservation easements as development occurs, and landowners will make contributions to the Marinelli Fund in accordance with an established formula for each PHU used for development, transferred, or sold. In addition, the Plan provides for 25% additional mitigation beyond that required by current USFWS methodology for impacts to lands in the panther primary zone. The conservation activities paid for by the Marinelli Fund are expected to include enhancement and management of the wildlife corridors within the preservation area, location and construction of panther and other wildlife crossings along roadways, and funding for land acquisition, enhancement, and management, to provide additional species habitat. A separate funding mechanism, based on per-unit fees tied to the sale of residential housing within the HCP Area, will be used to pay for the costs of implementing the Plan, including maintenance and monitoring.

The Plan Will Be Further Refined Through Public Involvement and Agency Review

USFWS, in cooperation with the U.S. Army Corps of Engineers, will prepare an environmental impact statement (EIS) under the National Environmental Policy Act (NEPA) to evaluate the ITP application and associated HCP. USFWS will publish a public notice in the Federal Register describing the Plan and ITP application, and announcing the start of a public scoping period, during which the public can provide comments regarding the scope of issues and alternatives to be included in the EIS. The public will also be involved through review of and an opportunity to comment on a draft EIS and the HCP. Comments received from a variety of stakeholders, including Federal and State agencies, Tribes, businesses, environmental organizations, and interested members of the public, will be important to development of the final HCP.

Success Will Be Ensured by an Enforceable Implementing Agreement and 50-Year Permit

This draft HCP establishes an overall framework for the permanent protection of approximately 107,000 acres of land to benefit covered species. The Implementing Agreement and requested 50-Year ITP will be developed by USFWS to describe the specific mechanisms that will implement the framework described in the HCP. The HCP, which is the product of collaboration among landowners, conservation organizations, and State and Federal agencies, will provide a robust program for the protection of the Florida panther and the other fifteen species covered by the Plan, and serve as a model for future HCPs.

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ACRONYMS AND ABBREVIATIONS

ACSC	Area of Critical State Concern
AFR	Air Force Range (Avon Park AFR)
BCFS	Big Cypress fox squirrel
BCNP	Big Cypress National Preserve
BSR	Biological Status Review (FWC)
CCWMP	Collier County Watershed Management Plan
CFA	Core foraging area (wood stork)
CFR	Code of Federal Regulations
CREW	Corkscrew Regional Ecosystem Watershed
DO	Dissolved oxygen
DPS	Distinct Population Segment
EAA	Everglades Agricultural Area
ECMSHCP	Eastern Collier Multiple Species Habitat Conservation Plan
ECPO	Eastern Collier Property Owners
ENP	Everglades National Park
ESA	Endangered Species Act
ET	Evapotranspiration
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FLUCCS	Florida Land Use, Cover and Forms Classification System
FNAI	Florida Natural Areas Inventory
FPNWR	Florida Panther National Wildlife Refuge
FPPP	Florida Panther Protection Program
Fed. Reg.	Federal Register
FSSP	Fakahatchee Strand State Preserve
FWC	Florida Fish and Wildlife Conservation Commission
GIS	Geographic Information System
GPS	Global Positioning System
HCP	Habitat Conservation Plan
IA	Implementing Agreement
ITP	Incidental Take Permit
KCOL	Kissimmee Chain of Lakes
LIDAR	Light Detection And Ranging
LRTP	Long-Range Transportation Plan
LULC	Land use/land cover

MERIT	Multi-species/Ecosystem Recovery Implementation Team
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MSHCP	Multiple Species Habitat Conservation Plan
MSRP	Multi-Species Recovery Plan
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSLP	Natural Soils Landscape Position
OSSF	Okaloacoochee Slough State Forest
PHU	Panther habitat unit
PRT	Panther Review Team (FPPP)
PSSF	Picayune Strand State Forest
PVA	Population viability analysis
RCW	Red-cockaded woodpecker
RLSA	Rural Land Stewardship Area
RLSP	Rural Land Stewardship Program
SFWMD	South Florida Water Management District
SHPO	State Historic Preservation Office
SR-29	State Route 29
SR-82	State Route 82
SSA	Stewardship Sending Area
TBD	To Be Determined
TMDL	Total Maximum Daily Load
TTINWR	Ten Thousand Islands National Wildlife Refuge
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VHF	Very high frequency (radio telemetry)
WBID	Water body identification (FDEP basin code)
WCA	Water Conservation Area
WMA	Wildlife Management Area

1. INTRODUCTION AND BACKGROUND

1.1 OVERVIEW/BACKGROUND

Southwest Florida encompasses a variety of urban, agricultural, and natural landscapes that support, among other things, residential, commercial, and public activities, food production, recreation, natural ecosystem functions, and wildlife. Collier County, located west of the Everglades and south of the Caloosahatchee River (Figure 1-1), has experienced rapid human population growth over the past several decades, while simultaneously witnessing the dedication of vast expanses of natural areas to conservation as State and Federal lands. Over two-thirds of Collier County's land area is currently in conservation status, with over 877,000 of the county's 1,300,000 acres protected (FNAI 2014a).

The Federal preserves within Collier County include the Big Cypress National Preserve (BCNP), the Florida Panther National Wildlife Refuge (FPNWR), the Ten Thousand Islands National Wildlife Refuge (TTINWR), and the western coastal portions of Everglades National Park (ENP). State conservation lands within the County include the Fakahatchee Strand State Preserve (FSSP), the Picayune Strand State Forest (PSSF), the Okaloacoochee Slough State Forest (OSSF), and extensive portions of the Corkscrew Regional Ecosystem Watershed (CREW). In addition, the National Audubon Society maintains approximately 13,000 acres of conservation lands in Collier County, comprised of the Corkscrew Swamp Sanctuary and nearby lands.

These Federal and State preserves were generally established in an effort to protect vast tracts of Southwest Florida's diverse natural ecosystems, which harbor a wide variety of plants and wildlife, including many species listed as endangered or threatened under the Endangered Species Act, 16 U.S.C. §§ 1531 *et seq*. (ESA or Act), protected by the State of Florida, or both. Among these listed species, the Florida panther (*Puma concolor coryi*) represents a major "focal species," meaning that conservation activities directed toward conserving the panther also promote multiple aspects of regional biodiversity conservation (Lambeck 1997; Noss 2007). The public conservation lands within Collier County protect many species that have limited localized distributions, home ranges, and/or dispersal distances (e.g., red-cockaded woodpeckers; rare orchids; Big Cypress fox squirrels), but the Florida panther utilizes habitats and establishes home ranges on a landscape scale that extends well beyond the boundaries of the existing public conservation lands.

The role of private lands for sustaining the Florida panther has been addressed repeatedly in the scientific literature for over 25 years (e.g., Belden et al. 1988; Maehr 1990; Logan et al. 1993; Main et al. 1999; Beier 2009). Beier et al. (2003; 142) stated "it is certainly true that private lands are essential to security of this population, and that conserving these lands *will require active support* from water management districts, Seminoles, and private landowners." [italics added] Scientific literature on the panther contains numerous discussions related to the development and implementation of private landowner incentives for preserving and maintaining panther habitat as an alternative to prohibitively expensive public land acquisition and management (Logan et al. 1993; Evans 1994; Maehr 1997).

MANATEE
HARDEE
OKEECHOBEE
HIGHLANDS
DESOTO
SARASOTA
17
CHARLOTTE
GLADES
Lake Okeechobee
29
27
LA BELLE
Caloosahatchee River
FORT MYERS
LEE
82
OKALOACOOCHEE SLOUGH STATE FOREST
HENDRY
PALMBEACH
Immokalee
29
75
FLORIDA PANTHER NATIONAL WILDLIFE REFUGE
BROWARD
NAPLES
PICAYUNE STRAND STATE FOREST
COLLIER
41
FAKAHATCHEE STRAND PRESERVE STATE PARK
BIG CYPRESS NATIONAL PRESERVE
MIAMI-DADE
EVERGLADES NATIONAL PARK
MONROE
Gulf of Mexico

LEGEND

- HCP Area
- Rural Land Stewardship Area Boundary
- Existing Conservation Land
- Water
- County Boundary

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FIGURE 1-1
Eastern Collier MSHCP Location Map
December 2014

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N

0 5 10 Miles

However, to date, the types of incentives offered to private landowners, and the conservation funding available to State and Federal agencies to consistently engage private landowners, have been limited and largely ineffective.

Since 1981, State and Federal wildlife biologists have captured over 224 Florida panthers in Southwest Florida, and fitted them with radiotelemetry collars and, more recently, geographic positioning system (GPS) collars (FWC 2014). The location data provided by these collared panthers have helped to define the "core population area" for the species (USFWS 2002a, Figure 37) and general patterns of habitat utilization throughout the panther's range (see Section 4, Florida Panther). While the majority of the core population area lands are currently protected within public conservation lands, including the BCNP, FPNWR, and FSSP, sizable portions of the core population area extend onto private lands in eastern Collier County and southern Hendry County that adjoin these public lands. The panther radiotelemetry and GPS data also reveal regular utilization of native habitats within two regional flowway systems in eastern Collier County (Okaloacoochee Slough and Camp Keais Strand), and sporadic utilization of extensive nearby agricultural areas.

Scientific literature on the Florida panther indicates that existing public conservation lands alone are insufficient for viable long-term conservation of the Florida panther's core population (USFWS 2002a; Kautz et al. 2006). There is broad-based agreement among Federal and State wildlife biologists, academic conservation researchers, a variety of non-governmental organizations (NGOs), and a group of rural property owners, that the engagement and active support of private landowners is essential to landscape-scale conservation efforts designed to address the panther's ecological needs.

Given the potential for privately-held native habitats within eastern Collier County to benefit the conservation of the Florida panther, a Habitat Conservation Plan (HCP) can provide a valuable mechanism for achieving permanent protection of the landscape-scale features that support panther ecology. The proposed HCP would also provide conservation benefits for other species that occur within the lands proposed to be covered by the HCP.

The following description of ESA section 10, which appears in the U.S. Fish & Wildlife Service (USFWS) "Habitat Conservation Planning and Incidental Take Permit Processing Handbook" (USFWS and NMFS 1996, hereinafter "HCP Handbook," at 1-2) speaks to the type of situation that exists in eastern Collier County, and advocates striking a balance between agriculture, economic development, and species conservation:

> [S]ection 10, as revised, provides a clear regulatory mechanism to permit the incidental take of federally listed fish and wildlife species by private interests and non-Federal government agencies during lawful land, water, and ocean use activities. However, Congress also intended this process to reduce conflicts between listed species and economic development activities, and to provide a framework that would encourage "creative partnerships" between the public and private sectors and state, municipal, and Federal agencies in the interests of endangered and threatened species and habitat conservation (H.R. Rep. No. 97-835, 97th Congress, Second Session).

> This is critically important, for Congress was not instituting merely a permit procedure but a process that, at its best, would integrate non-Federal development and land use activities with conservation goals, resolve conflicts between endangered species protection and economic activities on non-Federal lands, and create a climate of partnership and cooperation.

Indeed, the benefits of protecting private lands in eastern Collier County for the Florida panther are well documented (see Beier et al. 2003 for a literature review), and this HCP represents a viable means for achieving the permanent protection of native panther habitats. Thus, the purpose of this HCP is to create a long-term balance among the complementary goals of environmental preservation, species protection, sustainable agriculture, and economic development. The Plan will achieve these goals through a combination of economic incentives and regulatory mechanisms, and will provide a balanced, sustainable future for the region. Because multiple species in eastern Collier County will be covered by this HCP, the plan is named the Eastern Collier Multiple Species Habitat Conservation Plan (the Plan).

1.2 THE EASTERN COLLIER MULTIPLE SPECIES HABITAT CONSERVATION PLAN

The Plan provides a detailed, long-term, science-based methodology for the permanent protection of habitats for the endangered Florida panther and other species within the lands proposed to be covered by the HCP (referred to herein as the HCP Area, depicted in Figure 2-1, *infra*). The Plan is required to support the application for an Incidental Take Permit (ITP) under Section 10(a)(1)(B) of the ESA. 16 U.S.C. § 1539(a)(1)(B).[1] The Plan provides a long-term (50-year) conservation and land-use planning framework for 152,124±[2] acres in Southwest Florida (Figure 1-1).

The eastern portions of Collier County comprise a variety of land uses, including, among other things, crop production, ranching, native vegetation communities, urban areas, and public lands (see Section 3, Environmental Setting). The ultimate planning goal for this region is to ensure a long-term compatible balance of conservation, sustainable agriculture, and economic development that contributes to the protection, survival, and recovery of the species covered by the Plan.

The Plan arose from a collaborative effort among property owners in eastern Collier County, NGOs, and Federal and State wildlife agencies, to address long-term planning issues related to the conservation of the Florida panther. As explained above, the landscape-scale mosaic of habitats that support the Florida panther also support several other species, allowing for a multi-species approach for the Plan and ITP. The Plan emphasizes the preservation of large expanses of native panther habitats, in a way that maintains landscape-scale habitat connectivity and facilitates panther utilization and movement.

The Plan covers eight federally-listed species: five avian species, one reptile species, and two mammal species. The Plan also covers two species – the gopher tortoise and the eastern diamondback rattlesnake – that are being considered for listing but are not currently federally-listed. The gopher tortoise is currently designated as candidate species for federal listing within its Florida range and the

[1] Citations hereinafter are only to the Act.

[2] For the purpose of this Plan document, geographic information system (GIS) acreages are the best currently available estimates. Precise acreages will be determined during the ITP process.

eastern diamondback rattlesnake is currently proposed for federal listing. The Plan also covers six other non-federally-listed species that are currently listed by the State of Florida. All species to be covered by the Plan are included, along with their listing status, in Tables 1-1, 1-2, and 1-3, below (the Covered Species).

Table 1-1. Covered Species for the Eastern Collier Multiple Species Habitat Conservation Plan: federally-listed species.

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS[1]
BIRDS		
Florida scrub jay	*Aphelocoma coerulescens*	T
Northern crested caracara	*Caracara cheriway*	T
Wood stork	*Mycteria americana*	T
Red-cockaded woodpecker	*Picoides borealis*	E
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E
REPTILES		
Eastern indigo snake	*Drymarchon corais couperi*	T
MAMMALS		
Florida bonneted bat	*Eumops floridanus*	E
Florida panther	*Puma concolor coryi*	E

[1] Federal status abbreviations (as of December 2014): T -Threatened; E – Endangered

Table 1-2. Covered Species for the Eastern Collier Multiple Species Habitat Conservation Plan: candidate species and species under review for Federal listing.

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS[1]
REPTILES		
Gopher tortoise	*Gopherus polyphemus*	C
Eastern diamondback rattlesnake	*Crotalus adamanteus*	Under Review

[1] Federal status abbreviations (as of December 2014): C- Candidate species for federal listing

Table 1-3. Covered Species for the Eastern Collier Multiple Species Habitat Conservation Plan: species listed by the State of Florida.

COMMON NAME	SCIENTIFIC NAME	STATE STATUS[1]
BIRDS		
Burrowing owl	*Athene cunicularia*	T
Florida sandhill crane	*Grus canadensis pratensis*	T
Little blue heron	*Egretta caerulea*	T
Southeastern American kestrel	*Falco sparverius paulus*	T
Tricolored heron	*Egretta tricolor*	T
MAMMALS		
Big Cypress fox squirrel	*Sciurus niger avicennia*	T

[1] State status abbreviations (as of January 2013): T –Threatened

The USFWS (2002) characterized the long-acknowledged role of private lands for Florida panther conservation as follows:

> Regional conservation planning also recognizes the importance of the ecological interactions among native ecosystems, agricultural areas, and developed lands and attempts to design conservation areas and strategies that maximize compatibility and effectively conserve natural resources including biodiversity and important ecosystem processes.
>
> A regional landscape strategy for the Florida panther in south Florida is dependent on two complementary aspects: science-based management of existing and potential future public lands consistent with panther conservation, and cooperation with private landowners that currently manage thousands of acres of panther habitat (Maehr 1990).

Ultimately, the Plan and ITP allow participating property owners to plan and coordinate future permitted activities within defined areas in the HCP Area (the areas designated for Covered Activities, depicted on Figure 2-1, *infra*), enabling integrated and more effective conservation planning, avoiding piecemeal development scenarios, supporting effective long-term cumulative impact analyses, and simplifying future individual consultations between the USFWS and other Federal agencies. These goals are consistent with the longstanding consensus that private lands constitute a key component for successful Florida panther conservation, and that the active cooperation of private property owners is an essential component.

1.3 PERMIT APPLICANTS AND PERMIT DURATION

The applicants for the ITP are a group of landowners known as the Eastern Collier Property Owners (ECPO). Collectively, ECPO members own approximately 90 percent of the private land within eastern Collier County (see Section 1.7 and Figure 2-1), as well as other lands in South and Central Florida outside the eastern Collier County area. The ECPO applicants and eventual permit holders would be (in alphabetical order): Alico, Inc.; Barron Collier Investment, Ltd.; Collier Enterprises Management, Inc.; Consolidated Citrus Limited Partnership; English Brothers Partnership; Half Circle L Ranch, LLP; Heller Bros. Packing Corp., John E. Price, Jr. Trust; Pacific Land, Ltd.; and Sunniland Family Limited Partnership.

The duration of the ITP will be 50 years. This is the time period necessary to complete planned and/or foreseeable permitted activities within the portion of the HCP Area designated for Covered Activities, and to fully enact conservation provisions associated with the Implementing Agreement (IA) to the Plan.

1.4 PERMIT BOUNDARY/HCP AREA

The HCP Area is located in the northeastern corner of Collier County, and surrounds the Town of Immokalee (Figure 1-1). The ITP permit boundary that encompasses the HCP Area comprises approximately 152,124 acres, which do not include existing or future County and State roads within eastern Collier County. The HCP Area does not currently include approximately 17,800 acres of non-ECPO private property, although non-ECPO property may later be voluntarily incorporated into the Plan through Certificates of Inclusion (see Section 2.4).

As shown on Figure 1-1, the HCP Area borders the FPNWR and BCNP to the south, public conservation lands that support the core population area for the Florida panther. The HCP Area also borders the OSSF to the north and east, which is heavily utilized by panthers and serves as a landscape linkage in a panther dispersal corridor to Central Florida. To the west are the privately owned 13,000-acre Audubon Corkscrew Swamp Sanctuary, which harbors the largest breeding colony of endangered wood storks in South Florida, and the publicly owned CREW conservation lands. The HCP Area therefore occupies a strategic area that, if properly planned and managed, can function as an area of increased value to the Florida panther, featuring important and landscape-scale habitat linkages (“critical linkages”) in perpetuity (Oetting et al. 2014). The avoidance, minimization, mitigation, and management actions proposed in the Plan and IA would promote and maintain these linkages.

1.5 SPECIES TO BE COVERED BY PERMIT

The federally-listed species to be covered under the ITP are listed in Table 1-1. These species are included in the official USFWS database of federally-listed and candidate species for Collier County (http://ecos.fws.gov/ipac/wizard/chooseLocation!prepare.action). A candidate species for federal listing in Florida, the gopher tortoise (*Gopherus polyphemus*), is also included in the Plan, along with a species that is proposed for federal listing, the eastern diamondback rattlesnake (*Crotalus adamanteus*) (Table 1-2). Section 8.1.4 details the measures to be taken if, subsequent to issuance of the ITP, additional species become federally-listed within the HCP Area. Table 1-1 excludes those federally-listed species that occur exclusively in marine environments, coastal ecosystems (beaches, mangroves, nearshore

environments), and other environments not present within the HCP Area. Only one plant species is currently designated for Collier County as a candidate species for listing (Florida prairie clover, *Dalea carthagenesis floridana*), but the marl prairies that the plant inhabits are not found within the HCP Area. Therefore, no plant species are included in the Covered Species.

In addition to the federally-listed Covered Species, the Plan will cover six species currently listed by the State of Florida as "Threatened" (Table 1-3), based on recent Biological Status Reviews performed by the Florida Fish and Wildlife Conservation Commission (FWC). All of the State-listed species in Table 1-3 will benefit directly from the Plan, because each of these species utilizes the same or similar habitat(s) as the federally-listed Covered Species. Given the expanse of the areas designated under the Plan for Preservation/Plan-Wide Activities and Very Low Density Use (see Section 2, Plan Description), other game and non-game species that are not currently listed or recommended for listing by State or Federal agencies and that are not covered by the Plan, such as the Florida black bear, will also benefit from these conservation actions.

For the status, distribution, habitat utilization, and occurrence of each Covered Species within the HCP Area, please refer to Section 4 (Florida Panther) and Section 5 (Other Covered Species) of this document.

1.6 REGULATORY FRAMEWORK

1.6.1 Federal Endangered Species Act

Section 9 of the Act and Federal Regulations enacted pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct." ESA § 3(19). Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species "by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species by annoying them "to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." Incidental take is defined as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." 50 CFR § 17.3.

Pursuant to section 11(a) and (b) of the Act, any person who knowingly violates section 9 of the Act or any permit, certificate, or regulation issued pursuant to section 9, may be subject to civil penalties of up to $25,000 for each violation or criminal penalties up to $50,000 and/or imprisonment of up to one year.

Individuals and State and local agencies proposing action that is expected to result in the take of federally-listed species may apply for an ITP under section 10(a)(1)(B) of the Act to be in compliance with the law. Such permits are issued by the USFWS when take is not intentional, and is incidental to otherwise legal activities. An application for an ITP must be accompanied by an HCP. The regulatory standard under section 10(a)(1)(B) of the Act is that the effects of authorized incidental takes must be minimized and mitigated to the maximum extent practicable. Under section 10(a)(1)(B) of the Act, a

proposed project also must not appreciably reduce the likelihood of the survival and recovery of the species in the wild, and adequate funding for a plan to minimize and mitigate impacts must be ensured.

Section 7 of the Act requires Federal agencies to ensure that their actions, including issuing permits, are not likely to jeopardize the continued existence of listed species or destroy or adversely modify listed species' critical habitat. "Jeopardize the continued existence of" pursuant to 50 CFR § 402.02, means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." Issuance of an incidental take permit under section 10(a)(1)(B) of the Act by the USFWS is a Federal action subject to section 7 of the Act. Under section 7, the USFWS is required to consult with itself (i.e., conduct an internal consultation), as well as other Federal agencies.

Cumulative effects are effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area, pursuant to section 7(a)(2) of the Act. The action area is defined by the influence of direct and indirect impacts of certain activities. The action area may or may not be contained completely within the HCP boundary. These additional analyses are included in the Plan to meet the requirements of section 7 and to assist the USFWS with its internal consultation.

1.6.2 The Section 10(a)(1)(B) Process - HCP Requirements and Guidelines

The Section 10(a)(1)(B) process for obtaining an ITP includes three primary phases: (i) the HCP development phase; (ii) the formal permit processing phase; and (iii) the post-issuance phase.

During the HCP development phase, the project applicant prepares a plan that integrates the proposed project or activity with the protection of listed species. An HCP submitted in support of an ITP application must include the following information:

- impacts likely to result from the proposed taking of the species for which permit coverage is requested;
- measures that will be implemented to monitor, minimize, and mitigate impacts; the funding that will be made available to undertake such measures; and the procedures to deal with unforeseen circumstances;
- alternative actions considered that would not result in take, and an explanation of why those alternatives were not selected; and
- additional measures USFWS may require as necessary or appropriate for purposes of the plan.

The HCP development phase concludes and the permit processing phase begins when a complete application package is submitted to the appropriate permit-issuing office. A complete application package consists of (i) an HCP, (ii) an IA, if applicable, (iii) a permit application, and (iv) payment of a $100 fee by the applicant(s). USFWS must publish a Notice of Availability of the HCP package in the Federal Register and allow for public comment. The USFWS also prepares an Intra-Service Section 7 Biological Opinion and a Set of Findings, which evaluates the Section 10(a)(1)(B) permit application in

the context of permit issuance criteria (see below). An Environmental Action Statement, Environmental Assessment, or Environmental Impact Statement serves as the USFWS's record of compliance with the National Environmental Policy Act (NEPA), and is subject to a 30-day, 60-day, or 90-day public comment period. An IA is required for HCPs unless the HCP qualifies as a low-effect HCP. A Section 10(a)(1)(B) ITP will be granted upon a determination by the USFWS that all requirements for permit issuance have been met. Statutory criteria for issuance of the permit require that:

- the taking will be incidental;
- the impacts of incidental take will be minimized and mitigated to the maximum extent practicable;
- adequate funding for the HCP and procedures to handle unforeseen circumstances will be provided;
- the taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild;
- the applicant will provide additional measures that the Service requires as being necessary or appropriate; and
- USFWS has received assurances, as may be required, that the HCP will be implemented.

During the post-issuance phase, the permittee and other responsible entities implement the HCP, and the USFWS monitors the permittee's compliance with the HCP as well as the long-term progress and success of the HCP. The public is notified of permit issuance by publication in the Federal Register.

1.6.3 National Environmental Policy Act

The purpose of NEPA is two-fold: to ensure that Federal agencies examine environmental impacts of their actions (in this case, deciding whether to issue an ITP) and to allow for public participation. NEPA serves as an analytical tool on direct, indirect, and cumulative impacts of the proposed project alternatives to help the USFWS decide whether to issue an ITP. The USFWS will complete a NEPA analysis for each HCP as part of the ITP application process.

1.6.4 National Historic Preservation Act

All Federal agencies are required to examine the cultural impacts of their actions (e.g. issuance of a permit). This may require consultation with the State Historic Preservation Office and appropriate American Indian tribes. All ITP applicants are requested to submit a Request for Cultural Resources Compliance form to the USFWS. To complete compliance, the applicants may be required to contract for cultural resource surveys and possibly mitigation.

1.7 COUNTY-LEVEL PLANNING AND ZONING

The existing Collier County zoning within the HCP Area allows for one dwelling unit per five-acre area, and thus defines one baseline alternative to the Plan (see Chapter 10, Alternatives). This zoning plan can result in low-density growth patterns that fragment habitat, create inefficiencies in infrastructure and services, and generally complicate effective conservation actions. These low-density patterns are found immediately west of the HCP Area in the area known as "Golden Gate Estates." In 1999, ECPO members worked with local conservation organizations, Collier County, and State agencies to create the Collier County Rural Land Stewardship Program (RLSP). The RLSP, approved by Collier County and the State of Florida in 2002, offers an alternative to existing zoning, at the option of the property owner, which provides for a more strategic and environmentally sensitive balance between conservation and development.

The RLSP creates incentives for property owners to protect environmentally sensitive lands permanently, in exchange for "stewardship credits" that allow for compact forms of development at higher densities than baseline zoning. According to the terms of the RLSP, compact development at higher densities can only occur within areas that have been mapped as having limited natural resource values, and only through use of stewardship credits. Entry into the program is voluntary, to avoid "down-zoning" conflicts and other property rights issues, but the incentives were carefully designed to encourage property owner participation. The stewardship credit system was calibrated in a manner that required several acres of native habitat to be preserved in exchange for one acre of higher-density development (the exact ratio depends upon habitat quality and other environmental factors).

By design, implementation of the RLSP preserves the large regional wetland flowway systems and large blocks of interconnected upland and wetland native habitats that occur within the program area. Skeptics of the RLSP initially questioned whether the program would protect environmentally sensitive lands as planned. To date, however, over 50,000 acres have been designated for protection under the RLSP, including the vast majority of one regional flowway, and 20,000 acres of high-value panther habitats directly adjacent to the FPNWR and BCNP. A five-year review of the RLSP completed in 2009 concluded that the program was meeting the policy objectives it sought to achieve (Collier County 2009).

One major review recommendation was that agricultural preservation should also be eligible to generate stewardship credits in order to preserve open space, sustainable agriculture, and the rural economy. The original RLSP concept, augmented by incentives for preserving agricultural lands, forms the basis for a long-term balance of land uses that underpin the Florida Panther Protection Program (FPPP), a program that was negotiated and put into place years ago by ECPO and several NGOs, as well as the Plan.

The HCP Area owned by ECPO members occupies approximately 90 percent of the private lands within the RLSP area, including two parcels – the Hogan Island Quarry and the Immokalee Sand Mine – that are not included in the HCP because the Federal permit process and Section 7 consultations have already been initiated with respect to them (Figure 1-1; also see Figure 2-1). Approximately 17,800 acres of

private lands not owned by ECPO also occur within the RLSP area, but are not included within the HCP Area (Figure 2-1). As described in section 2.4, these lands could become part of the Plan through Certificates of Inclusion.

The major existing and traditional land uses and land cover within the HCP Area include agriculture, ranching, native vegetation communities, residential and commercial development, and earth mining. The goal of the RLSP and the Plan is to create a long-term balance between environmental preservation, species protection, sustainable agriculture, and economic development. The RLSP and the Plan work in concert through a combination of economic incentives and regulatory mechanisms to achieve a balanced, sustainable future for the region.

The five-year review and modification of the RLSP resulted in a recommendation that residential and commercial development be capped at 45,000 acres within the RLSP area. In order to reach that development cap, the balance of the HCP Area (approximately 107,000 acres, or 70 percent) would be protected permanently, in return for sufficient stewardship credits to entitle the development. Protected lands would include the regional wetland flowway systems, large interconnected blocks of native habitat that support the Florida panther and other Covered Species, agricultural fields, and cattle ranches. This landscape-scale mosaic of native habitats and agricultural uses currently supports the Covered Species, as well as game and other non-game species.

The requested term of the ITP– 50 years – will allow for planning, permitting and completion of contemplated or foreseeable development within the portion of the HCP Area designated for Covered Activities, and for implementation of conservation actions that benefit Covered Species in the portions of the HCP Area designated for Preservation/Plan-Wide Activities and Very Low Density Use. The permit holders would be the ECPO members listed in Section 1.3. Property bordering the HCP Area owned by other entities could become part of the Plan through a Certificate of Inclusion, if acceptable to USFWS (see Section 2.4).

1.8 CONSERVATION PARTNERSHIPS

The RLSP created strong incentives for the permanent protection of environmentally sensitive lands, including prime panther habitats, in exchange for compact forms of residential and commercial development on lands with relatively low natural resource values. The collaborative creation of the RLSP, while far from easy, also fostered enhanced cooperation between private property owners, local conservation organizations, and eventually statewide conservation NGOs.

Building on this successful collaboration, ECPO and leading conservation organizations collaborated to launch the FPPP,[3] which integrates a variety of programs, studies, and strategies to enhance and fund a

[3] "The purpose of the Florida Panther Protection Program …is to facilitate the management and protection of panthers within the Enhanced Protection Area [i.e., RLSP/Plan area] by providing a contiguous range of preserved panther habitat in the Enhanced Protection Area to assist recovery through the use of buffering against panther-human interaction, locating and construction of panther crossings, and the protection, enhancement, restoration, including corridor enhancement or restoration, or acquisition of panther habitat demonstrated to be important to panther protection and management within the Enhanced Protection Area based upon a technical review and

science-based program “to better protect and manage the Florida panther in southwest Florida.” (FPPP 2010). The program incorporates RLSP provisions related to panther habitat restoration and enhancement of panther movement corridors, suggests adjustments to panther-related aspects of the RLSP, and creates funding mechanisms that are tied to generation and utilization of panther habitat unit (PHU) mitigation credits. As described in Chapter 2, the Plan will contribute substantial funding to support FPPP conservation activities to support the panther (see Sections 2.1 and 2.7).

1.9 CONCLUSION

The Plan furthers the goal of panther conservation, and conserves other federally-listed species, by working with USFWS to incorporate RLSP and FPPP program elements in a formal plan under Section 10 of the ESA. At the conclusion of the ITP process and its associated NEPA process, an IA will be signed that specifies the rights and responsibilities of all parties to the Plan, and legally binds the parties to its provisions. After several decades of panther research, meetings, agency outreach, and discussions, this Plan finally provides a viable science-based, legally binding mechanism for the realization of Florida panther habitat preservation on private lands, along with preservation of other Covered Species habitat, and a long-range vision for sustainable regional planning in eastern Collier County.

analysis of available data...” (excerpt from FPPP MOU between Rural Landowners and Conservation Organizations, June 2008).

2. PLAN DESCRIPTION AND ACTIVITIES COVERED BY PERMIT

2.1 PLAN DESCRIPTION

The Plan provides a long-term (50-year) framework for the preservation and management of approximately 107,000 acres of privately owned land, located within the 152,124± acres of privately owned lands in eastern Collier County. The approximately 107,000 acres protected through the Plan – the lands that will ultimately be dedicated for Preservation/Plan-Wide Activities and Very Low Density Use at Plan completion (described in section 2.2 below and depicted in Figure 2-1) – comprise an ecologically important landscape-scale mosaic of habitats and land uses that support the Florida panther and seven other federally-listed species. These lands also support one candidate species for federal listing, one species that has been proposed for federal listing, and six non-federally-listed species that are listed threatened by the State of Florida.[4]

The Plan conserves major regional wildlife habitat linkages, preserving habitat connectivity between the existing public conservation lands to the south of the HCP Area that are part of the panther's core population area, and the public conservation lands and dispersal corridors to the north and east of the HCP Area. Specifically, these regional linkages connect the Big Cypress National Preserve (BCNP), Florida Panther National Wildlife Refuge (FPNWR), Fakahatchee Strand State Preserve (FSSP) and Picayune Strand State Forest to the Corkscrew Regional Ecosystem Watershed (CREW), Okaloacoochee Slough State Forest (OSSF), Dinner Island Ranch Wildlife Management Area, Spirit of the Wild Wildlife Management Area, and the panther "Dispersal Zone" (USFWS 2002a; Kautz et al. 2006). The conservation and management of these lands will also provide important ecological benefits for Covered Species other than the panther.

Under the Plan, the historic, ongoing, and future land uses within the approximately 107,000 acres of protected lands — primarily agriculture and ranching — will continue and will provide the basis for long-term sustainable activities compatible with conserving the Covered Species. Outside of the protected areas, Covered Activities will include up to 45,000 acres (combined total) of residential/commercial development and earth mining within predefined portions of the 152,124±-acre HCP Area, consistent with the Collier County RLSP. These 45,000 acres include the 5,027-acre Town of Ave Maria, for which Federal permitting and Section 7 consultations have been completed. The acreage of Covered Activities attributable to the ITP, therefore, is actually less than 40,000 acres (45,000 – 5,027 = 39,973). The Covered Activities will occur primarily within previously-cleared agricultural areas that currently possess low proportions of native habitats, and exhibit little native habitat connectivity. These previously-cleared or otherwise disturbed areas generally consist of active agricultural fields, fallow fields, pastures, and other areas managed for agricultural production, which may include minor remnants of native vegetation (e.g., small cypress domes; small depressional wetlands). The Plan will thereby provide prospective, landscape-level management of future development on privately owned lands, by consolidating and directing development away from more ecologically valuable areas of interconnected native habitats and toward pre-existing cleared areas with lower habitat support functions. This

[4] The species covered by the Plan are listed in Tables 1-1, 1-2, and 1-3 (see Chapter 1, Background).

integrated landscape approach provides significant ecological benefits over a project-by-project piecemeal approach.

The Plan builds upon the ecological benefits arising from the RLSP (see Chapter 1), augmenting the RLSP by providing greater certainty for long-term planning of economic activities, as well as habitat preservation for the Florida panther and other Covered Species, through extensive preservation of habitats and regional wildlife corridors. The Plan institutes a 50-year integrated framework, and will reduce planning risks and regulatory uncertainties for property owners, regulatory agencies, environmental advocates, and the general public. Expanding upon the potential benefits of the RLSP, the Plan will provide the following benefits that will further long-term protection goals for the Florida panther and other Covered Species:

- Preservation, through conservation easements or equivalent mechanisms, of approximately 107,000 acres of land, which include existing regional wildlife corridors ("critical linkages") that provide landscape-scale "ecological greenways" among existing public conservation lands;
- Maintenance of lands designated as Preservation/Plan-Wide Activities and Very Low Density Use, to preserve the ecological value of those lands for Covered Species, through land management practices such as control of invasive plant species;
- Minimization of adverse impacts to Covered Species (e.g., concentrating and directing development to the more heavily developed western portions of the RLSP, directing lights and noise away from habitat);
- Monitoring potential impacts of the Covered Activities to listed species and their habitat to ensure that impacts are accounted for and minimized;
- Enhanced panther habitat mitigation (25% additional mitigation beyond that currently required by USFWS panther habitat functional analyses for activities subject to Federal approval within the panther primary zone); and
- Incorporation and implementation of the Florida Panther Protection Program (FPPP).

The Plan will also provide funding for activities undertaken through the Paul J. Marinelli Florida Panther Protection Fund (the Marinelli Fund, described in section 2.7 below). The Marinelli Fund was established through the FPPP to fund panther conservation activities. The Plan will support the Marinelli Fund through contribution of the proceeds of the use and sale of PHUs. The enhanced mitigation required through the Plan will result in increased financial contribution to the Marinelli Fund for activities subject to Federal approval within the panther primary zone. Future initiatives will continue to be undertaken at the discretion of the fund's Board of Directors, and are expected to include the following:

- Enhancement and management of wildlife corridors (the "North" and "South" corridors, described in Section 2.2 *infra*, with areas to be enhanced depicted as arrows on Figure 4-9) that facilitate landscape-scale panther movement;

- Funding for the construction of panther and other wildlife crossings on roadways within the HCP Area; and
- Funding for land acquisition, enhancement, and management, providing additional panther habitat.

Figure 2-1 depicts the extent of the HCP Area, the areas designated for Covered Activities (residential/commercial development and earth mining), Preservation/Plan-Wide Activities, Very Low Density Use, and Base Zoning (each described below). The Plan sets forth the acreage and general location for each of the designated uses. See Fig 2-1. Precise locations will be determined in the future.

The Plan designates 97,885 acres as "Preservation/Plan-Wide Activities." The Plan also designates a 49,848-acre area where Covered Activities may occur, but caps the total for Covered Activities at 45,000 acres. Thus, 45,000 acres of Covered Activities may occur anywhere within this 49,848-acre area. The unused balance (4,848 acres) will be placed in the "Preservation/Plan-Wide Activities" designation, bringing the total of that designation to 102,733 acres. The Plan designates 1,961 acres "Very Low Density Use," indicating an area that may be used for such purposes as isolated residences, lodges, and hunting/fishing camps. In the event this property is used for such purposes, any construction would be limited to less than one structure or dwelling unit per 50 acres. Finally, the 2,431-acre area within the HCP Area that makes up the Half Circle L Ranch is currently identified as "Base Zoning." These lands are located in an RLSP "Open" overlay area, where either development or preservation can occur under RLSP regulations, and where base zoning (1 dwelling unit per 5 acres) under the Collier County Land Development Code applies. The Half Circle L Ranch is for sale on the open market, and the current property owner is an applicant for the ITP. The status of this property will be resolved during the timeframe for USFWS review of the HCP document, drafting of the IA, and processing of the ITP. Currently, this Base Zoning area is simply identified. If the current or future owner chooses not to develop the area, it will be included in the Plan as land designated for Preservation/Plan-Wide Activities. If the current or future owner develops the area at base zoning or higher densities, the development footprint will be included under the 45,000-acre cap for Covered Activities and 2,431 acres that would have otherwise been designated for Covered Activities will be included in the area designated for Preservation/Plan-Wide Activities. Thus, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use will ultimately total approximately 107,000 acres, and the land designated for Covered Activities will be capped at 45,000 acres.

Figure 2-2 provides a regional view that illustrates how areas within the HCP Area designated for Preservation/Plan-Wide Activities serve to link existing public conservation lands. Table 2-1 summarizes the current land use and land cover within the HCP Area, by land designation category.

Okaloacoochee Slough State Forest

Corkscrew Regional Ecosystem Watershed

Lake Trafford

Faith Landing

Arrowhead

Immokalee

Everglades Blvd N

Oil Well Rd

Everglades Blvd N

Big Bear Plaza

Everglades Blvd S

Desoto Blvd S

Big Cypress National Preserve

Florida Panther National Wildlife Refuge

Fakahatchee Strand State Preserve

LEGEND

- HCP Area
- Preservation/ Plan-Wide Activities
- Covered Activities
- Very Low Density Use (≤ 1DU : 50 Acres)
- Base Zoning (1DU : 5 Acres)
- Prior Federal Permitting Initiated
- Eligible for HCP Inclusion
- Rural Land Stewardship Area Boundary
- Existing Conservation Land
- County and State Roads (not covered in ECMSHCP)

Note: The location of covered activities was delineated in a Geographic Information System (GIS) to define the location, extent, and general configuration of where these Covered Activities may occur over a 50-year timeframe. The acres depicted in Covered Activities total approximately 49,848 acres. The actual total acreage of covered activities is constrained by the Plan to 45,000 acres within the HCP Area. The exact configuration of covered activities will be refined during the design and permitting processes for each project.

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Stantec

FIGURE 2-1
HCP Land Designations
December 2014

Stantec Consulting Services Inc.
3200 Bailey Ln. Ste. 200
Naples, FL 34105
tel 239.649.4040
fax 239.649.5716

N

0 1 2 Miles

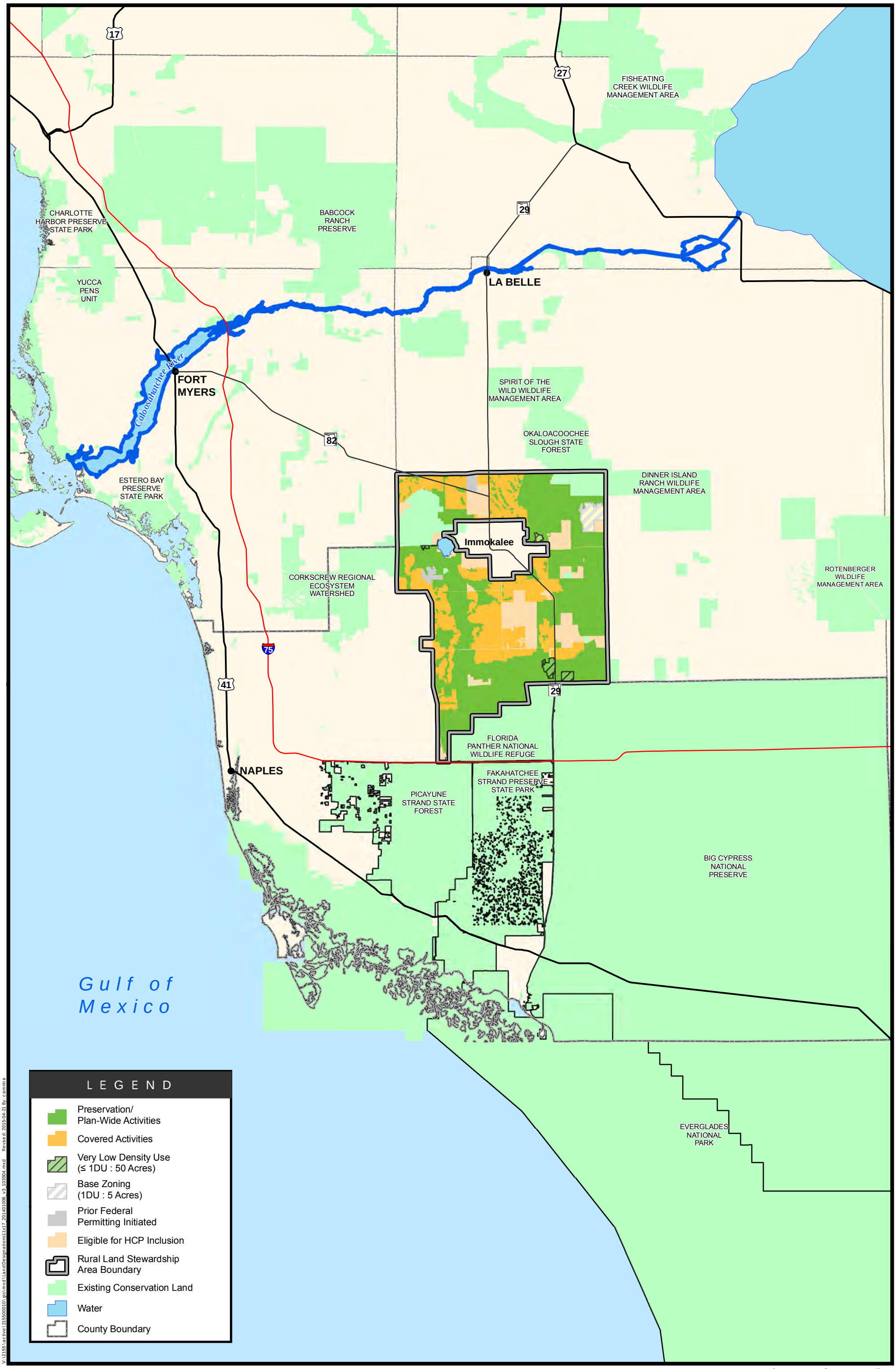
17
27
29
82
75
41
CHARLOTTE HARBOR PRESERVE STATE PARK
BABCOCK RANCH PRESERVE
FISHEATING CREEK WILDLIFE MANAGEMENT AREA
YUCCA PENS UNIT
LA BELLE
Caloosahatchee River
FORT MYERS
SPIRIT OF THE WILD WILDLIFE MANAGEMENT AREA
OKALOACOOCHEE SLOUGH STATE FOREST
ESTERO BAY PRESERVE STATE PARK
DINNER ISLAND RANCH WILDLIFE MANAGEMENT AREA
Immokalee
CORKSCREW REGIONAL ECOSYSTEM WATERSHED
ROTENBERGER WILDLIFE MANAGEMENT AREA
FLORIDA PANTHER NATIONAL WILDLIFE REFUGE
NAPLES
FAKAHATCHEE STRAND PRESERVE STATE PARK
PICAYUNE STRAND STATE FOREST
BIG CYPRESS NATIONAL PRESERVE
Gulf of Mexico
EVERGLADES NATIONAL PARK
LEGEND
Preservation/ Plan-Wide Activities
Covered Activities
Very Low Density Use (≤ 1DU : 50 Acres)
Base Zoning (1DU : 5 Acres)
Prior Federal Permitting Initiated
Eligible for HCP Inclusion
Rural Land Stewardship Area Boundary
Existing Conservation Land
Water
County Boundary
V:\2155\active\215500010\gis\mxd\LandDesignations11x17_20140106_v3_103504.mxd Revised: 2015-04-21 By: camine
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FIGURE 2-2
HCP Land Designations - Regional View
December 2014
Stantec Consulting Services Inc.
3200 Bailey Ln. Ste. 200
Naples, FL 34105
tel 239.649.4040
fax 239.649.5716
N
0
5
10
Miles

Table 2-1. Existing land use/land cover within the HCP Area, by land designation category.

LAND USE / LAND COVER CATEGORY	COVERED ACTIVITIES (ACRES)[1]	PRESERVATION/ PLAN-WIDE ACTIVITIES (ACRES)	VERY LOW DENSITY USE (ACRES)	BASE ZONING (ACRES)[2]	TOTAL ACRES
Urban/Infrastructure	539	462	21	18	**1,039**
Mining/Oil and Gas	11	386	702	0	**1,099**
Pastures (Improved/Unimproved)	3,146	8,269	327	827	**12,569**
Row crops	16,294	8,530	0	619	**25,443**
Citrus groves/other groves	20,799	8,903	0	1	**29,703**
Other agriculture	584	21	0	0	**605**
Fallow crop land	2,692	3,763	0	308	**6,763**
Brazilian pepper	434	215	0	0	**648**
Native upland non-forested	577	2,150	39	0	**2,766**
Native upland forested	1,892	11,339	381	67	**13,679**
Native wetland non-forested	1,837	24,880	196	558	**27,470**
Native wetland forested	861	28,758	290	33	**29,941**
Water	183	209	6	0	**398**
TOTALS PER FIGURE 2-1	**49,848**	**97,885**	**1,961**	**2,431**	**152,124**
TOTALS AT PLAN COMPLETION[3]	**45,000**	**105,164**	**1,961**	**0**	**152,124**

[1] "Covered Activities" may occur anywhere within the 49,848-acre area shown on Figure 2-1, but will be capped at 45,000 acres total. The balance of acreage between Figure 2-1 and the 45,000-acre cap (4,848 acres) will be placed into "Preservation/Plan-Wide Activities."

[2] "Base Zoning" was retained on the Half Circle L Ranch, and refers to a maximum of 1 dwelling unit per 5 acres. See section 2.5 of text.

[3] "Totals at Plan Completion" reflect (i) the 45,000-acre cap for "Covered Activities," with the balance of acreage between Figure 2-1 and the 45,000-acre cap (4,848 acres), and (ii) the 2,431 "Base Zoning" acres (or equivalent) being placed into "Preservation/Plan-Wide Activities."

The primary elements of the Plan are outlined in sections 2.2 and 2.3 below. The first two elements, Preservation/Plan-Wide Activities and Very Low Density Use currently occur and/or will occur within the approximately 107,000 acres slated for permanent protection. The Covered Activities (residential/commercial development and earth mining activities), will occur within the 45,000 acres identified for Covered Activities described in section 2.3 ("Activities Covered By Incidental Take Permit").

2.2 PRESERVATION/PLAN-WIDE ACTIVITIES AND VERY LOW DENSITY USE

Activities that may occur in the lands designated for Preservation/Plan-Wide Activities include the types of agricultural, ranching, and other rural activities that have occurred throughout the HCP Area historically, and are expected to continue into the future. These predominantly agricultural activities preserve the current extent and function of the landscape-scale mosaic of habitats and land uses in this area that support the Covered Species, and are consistent with the protection of lands under the Plan.

These include activities such as the following:

- Crop Cultivation;
- Ranching/Livestock Operations;
- Forestry and Silviculture;
- Recreation;
- Exotic and Nuisance Species Control; and
- Oil and Gas Exploration and Production.

Many of these activities have generally occurred for a century or more in eastern Collier County, and in their present form are compatible with use of the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use by the Covered Species. Some historic land use practices, such as the establishment and maintenance of pastures, directly benefit one or more Covered Species (e.g., northern caracara). In addition, existing land management practices may benefit the Covered Species. For example, prescribed burning benefits the Florida panther, gopher tortoise, and Eastern indigo snake; water retention area management may benefit wood stork and snail kite; and exotic species control benefits the Florida panther and many of the other Covered Species). Allowing these activities to continue also provides the opportunity for sustainable agriculture, environmentally beneficial land management, and species conservation within a contiguous regional landscape.

Active oil and gas production has occurred within the HCP Area since the 1940s, and remains ongoing. Long-term radiotelemetry data demonstrate that oil and gas production is compatible with utilization of the surrounding habitat by the Florida panther. No adverse effects of oil and/or gas exploration or production have been documented for the Covered Species within the HCP Area, and no incidental take of Covered Species is expected. The oil and gas activities conducted in the HCP Area are subject to regulation and permitting by the State of Florida (FDEP) and Federal agencies. Under the Plan, oil and

gas exploration and production are activities that may occur anywhere within the HCP Area, as there are inherent uncertainties related to locating productive oil and gas reserves.

The permittees will also have the option of using the 1,961-area designated for Very Low Density Use for such purposes as isolated residences, lodges, and hunting/fishing camps (see Figure 2-1, Very Low Density Use). Any construction in this area would be limited to less than one structure or dwelling unit per 50 acres. The low density of any development on these lands would be compatible with the panther's continued use of these lands.

The Plan will designate the vast majority (approximately 107,000 acres, or 70%) of the HCP Area as Preservation/Plan-Wide Activities and Very Low Density Use, which represent over 91 percent of the native habitats found within the HCP Area. This will ensure that the approximately 107,000 acres of contiguous areas can continue to support the needs of the Florida panther and other Covered Species through preservation, management, and ecological restoration (to be initiated through the Marinelli Fund where feasible). These areas include large blocks of native habitat where panthers have been extensively documented (Maehr 1990; USFWS 2002a; FPPP Technical Review Team [FPPPTRT] 2009).

The Plan includes the following activities that are collectively designed to meet biological goals and objectives for the Covered Species within the HCP Area:

- **Extensive, Contiguous Land Preservation.** The primary ecological benefit of the Plan is the designation of approximately 107,000 acres of contiguous lands for Preservation/Plan-Wide Activities and Very Low Density Use by Plan completion. These vast interconnected lands support the Florida panther as the Plan's major focal species (Beier 2010), as well as the other Covered Species. The approximately 107,000 acres of contiguous lands contain an ecologically valuable landscape-scale mosaic of native habitats and agricultural land uses that are utilized by the Florida panther and the other Covered Species. The preservation of these lands, which include two existing regional wildlife corridors – the Camp Keais Strand and Okaloacoochee Slough flowways – has been a goal of conservationists dating back several decades, and a goal identified specifically with respect to the panther since the 1980s (Belden et al. 1988; Maehr 1990; Logan et al. 1993). The Plan will prevent impacts that would have resulted from more intensive uses or development of the land designated for Preservation/Plan-Wide Activities and Very Low Density Use; preserve large, interconnected blocks of panther habitat; and minimize potential impacts of future development by concentrating and directing that development toward existing development in the western portions of the HCP Area, in the area designated for Covered Activities.

  As residential/commercial and earth-mining activities are approved and implemented in the area designated for Covered Activities, commensurate acreages within the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use will be placed under conservation easements to compensate for permitted impacts. A summary of the current acreage of various types of land cover and land use within the approximately 107,000-acre area that will be designated for Preservation/Plan-Wide Activities and Very Low Density Use is provided in Table

2-1, and depicted in Figure 3-4 (see Chapter 3, Environmental Setting). These phased land preservation activities will be augmented by the land management, mitigation, and monitoring activities described below, which will preserve and enhance the ecological function of these lands.

- **Management of Preserved Lands.** The lands designated for Preservation/Plan-Wide Activities and Very Low Density Use will be managed to preserve their existing ecological functions. Many of the activities that already occur within the lands designated for Preservation/Plan-Wide Activities, such as exotic and nuisance species control and pasture management, will benefit some or all of the Covered Species.

  The management activities that may occur within areas designated for Preservation/Plan-Wide Activities and Very Low Density Use in native habitat areas include, but are not limited to: exotic and nuisance species control; prescribed burning; mechanical control of excessive forest understory/fuel loads; tree thinning to improve native forest productivity; mechanical, hydrologic, and/or chemical control of vegetation to improve community structure and/or plant species diversity; construction and maintenance of surface water management structures for preservation or enhancement of existing/natural hydrologic function; scouting and monitoring of lands on foot, horseback, or by vehicle.

  The management activities that may occur within areas designated for Preservation/Plan-Wide Activities and Very Low Density Use in areas with non-native land cover types (predominantly agricultural fields and pastures) include a subset of the activities as listed above: crop cultivation; ranching/livestock operations; forestry and silvicultural operations; and exotic and nuisance species control. Collectively, these predominantly agricultural management activities will preserve the ecological functions of the area by maintaining healthy agro-ecosystems, controlling invasive species, and providing varying degrees of direct habitat support to some or all of the Covered Species.

- **Mitigation and Monitoring.** The designation of these lands for Preservation/Plan-Wide Activities and Very Low Density Use provides an effective framework for the implementation of systematic (rather than *ad-hoc*) mitigation and monitoring activities within the HCP Area. The Plan will restrict residential/commercial development activities and earth mining (Section 2.3) to areas designated for Covered Activities, which are largely previously cleared or otherwise disturbed areas with little native panther habitat and little habitat connectivity. Potential impacts to the Florida panther and the other Covered Species will be covered under an ITP, which will provide for appropriate levels of mitigation and subsequent monitoring, as determined by USFWS with respect to each portion of the lands designated for Preservation/Plan-Wide Activities as development in the area designated for Covered Activities occurs, and conservation easements attach. The general activities included under the category of mitigation and monitoring are expected to include: wildlife mitigation activities designed to benefit one or more of the Covered Species, in coordination with USFWS and/or FWC; wetland mitigation activities required by Federal and/or State resource agencies (USACE, EPA, SFWMD,

FDEP); monitoring activities to verify mitigation compliance; and any other activities that provide a quantifiable benefit to environmental resources in and around the HCP Area.

Wildlife mitigation activities may include habitat enhancement (invasive species control, prescribed burning, supplemental planting, etc.); hydrologic enhancement (increasing/decreasing seasonal high water to influence community composition); surface water management for species-specific requirements (e.g., northern caracara, wood stork, Everglade snail kite); and wetland creation, restoration, and/or enhancement.

- **Preservation of Existing Panther Movement Corridors.** Several planning and conservation efforts have identified the potential benefit of creating and/or enhancing wildlife movement corridors within Southwest Florida and eastern Collier County (Collier County 2009; FPPPTRT 2009; Small et al. 2012). As part of a comprehensive mitigation program, the Plan sets aside lands designated for Preservation/Plan-Wide Activities and Very Low Density Use that will allow for preservation and enhancement of these panther movement corridors, which link large blocks of preserved habitat within and beyond the HCP Area. As depicted schematically in Small et al. (2012), setting aside these lands will allow for the enhancement of two corridors within the HCP Area: one corridor linking the Corkscrew Marsh system with the Okaloacoochee Slough system ("North" corridor); and another corridor linking habitats just east of SR 29 to the middle portions of the Okaloacoochee Slough ("South" corridor) (See Chapter 4, Florida Panther, and Figure 4-9). The Marinelli Fund is expected to enhance the utility of these corridors through the planting of native vegetation used as cover by the panther and other Covered Species. Additionally, where these panther movement corridors intersect roadways, the Marinelli Fund is expected to arrange for construction of fenced wildlife crossings to ensure safe passage of panthers and other wildlife through the landscape.

2.3 ACTIVITIES COVERED BY INCIDENTAL TAKE PERMIT

The Plan proposes two general categories of Covered Activities that will be conducted by or under the direction or control of the applicants: (i) residential/commercial development and (ii) earth mining. Upon full implementation of the Plan, including full build-out of the 45,000 acres of land designated for Covered Activities, the areas that will be designated for Preservation/Plan-Wide Activities and Very Low Density Use will encompass approximately 107,000 acres of the HCP Area, with the land permanently protected under conservation easements or equivalent mechanisms. The land utilized for Covered Activities will be capped at a maximum combined total of 45,000 acres, but as indicated above, the maximum combined total attributable to the ITP is less than 40,000 acres due to the inclusion of the Town of Ave Maria.

The applicants are seeking authorization for incidental take of the Covered Species resulting from Covered Activities conducted by or on behalf of the applicants, their lessees, their contractors, and/or holders of Certificates of Inclusion,[5] that may occur within the pre-defined "Covered Activities" land

[5] The ITP will provide mechanisms for other property owners within the HCP Area to obtain a Certificate of Inclusion. See section 2.4, below.

designation areas within the HCP Area (Figure 2-1). The applicants request that an ITP be issued to the Plan applicants at the conclusion of Plan development. Any other activities that may potentially affect federally-listed species are not covered by the Plan.[6]

As shown in Figures 2-1 and 2-2, and summarized in Table 2-1, the Plan will accommodate up to a maximum of 45,000 acres of residential/commercial development and earth mining, in areas largely already cleared for agriculture that have low qualities of native habitat and little or no native habitat connectivity. The Town of Ave Maria (5,027 acres) will be included in this 45,000 acres cap. The Covered Activities will be phased over the 50-year duration of the ITP. Prior to the conversion of a given tract within the "Covered Activities" areas designated for development and/or earth mining activities (Figure 2-1), pre-existing activities (Section 2.2) can continue to occur. At any given time during the 50-year ITP duration, the total area designated for development will be a mix of agricultural lands, earth mining, and residential/commercial development, but at no time will the combined acreage of residential/commercial development and earth mining within the area designated for Covered Activities exceed 45,000 acres. The residential/commercial development and earth mining activities included in the Plan, for which incidental take authorization is requested, are described in the following bulleted paragraphs.

- **Residential/Commercial Development.** These activities include the planning, design, permitting, construction, and maintenance of mixed-use residential communities and associated commercial facilities, along with infrastructure internal to the development footprint necessary to support these activities. Land uses within these developments may include, but are not limited to: single-family housing; multi-unit housing; public and private institutional facilities; commercial space; office space; retail establishments; surface water management; internal roadways; utilities; open space (e.g., parks, landscaping buffers, lakes); and other elements typical of mixed-use developments. Wherever feasible, developments will employ environmentally friendly planning and designs, such as clustering, low-impact development, water reuse techniques, greenspace buffers, etc. These activities are subject to local, State, and Federal regulatory programs related to the establishment and operation of residential/commercial developments.

- **Earth Mining.** These activities include the planning, design, permitting, construction, operation, and decommissioning of surface earth mines. Within the area designated for Covered Activities, the earth materials extracted will be soil, sand, limestone, and similar earth materials used for

[6] The ITP will not cover incidental take resulting from panther-vehicle collisions, except to the extent such vehicle strikes occur in the course of a Covered Activity that is conducted in accordance with the terms and conditions of the ITP. Panther-vehicle collisions that occur during construction and maintenance of roads internal to development areas permitted under the ITP, while unlikely and not expected, would therefore be covered by the Plan, but the Plan will not cover general use of the roads and therefore other panther strikes on these internal roads will not be covered. In addition, the ITP will not cover panther strikes on any other roadways within the HCP Area (whether public or private. For example, roadway improvements conducted as part of county and/or State programs are not covered by the Plan, including any current or future Long-Range Transportation Plans (LRTPs) developed by the Collier County Metropolitan Planning Organization (MPO).

construction fill, roadway fill, landscaping, and similar uses. Earth mines may occur as a prelude to future land uses, such as development, or may occur as an end-use. Permitting and regulation of earth mining activities is administered by USACE, FDEP, and Collier County.

2.4 CERTIFICATES OF INCLUSION HOLDERS AND LESSEES

The permit applicants seek incidental take authorization for the Covered Activities, up to a maximum footprint of 45,000 acres, which will occur within the 49,848-acre area designated for Covered Activities on Figure 2-1. This incidental take authorization will extend to the applicants' subsidiaries, employees, lessees, and contractors, and other parties carrying out otherwise lawful activities conducted under the direction of the applicants and in compliance with the terms of the ITP.

Although the applicants (ECPO members) own the entirety of the 152,124± acres within the HCP Area, non-ECPO private property owners hold approximately 17,800 acres of land (as calculated from the Collier County Property Appraiser database) within the RLSP area where the Plan is set. Figure 2-1 depicts these non-ECPO private property holdings as "Eligible for HCP Inclusion" within RLSP boundary. Some of these non-ECPO lands possess conservation value that could augment the conservation benefits provided by the Plan, should the current or future non-ECPO property owners choose to add some or all of their land to the Plan.

Given the 50-year duration of the ITP, the intent of this Plan element is to provide additional flexibility in implementing the Plan, while adhering to the 45,000-acre limit for Covered Activities and without changing the areas within which the Covered Activities may occur. The goal is to recognize the possibility that future land transfers, purchases of new conservation lands, conservation incentives, or other mechanisms may provide new opportunities for enhancing the Plan, especially for the Florida panther.

Programmatic HCPs, such as those implemented by counties or states, often include a mechanism for non-participating property owners to participate in an HCP after issuance of the ITP. The reason for doing this is to facilitate the assembly of a wider and/or more complete conservation area and comprehensively address activities within the area to the extent practicable. In such cases, a "Certificate of Inclusion" may be issued, which conveys the incidental take authorization to the new participant, while maintaining the take limitations and conservation requirements of the ITP.

At least one private-sector HCP has utilized this mechanism. The permit applicants recognize the potential benefits of such an approach for augmenting the Plan, and also for providing flexibility in responding to changed or unforeseen circumstances. The use of "Certificates of Inclusion" would not result in any increased take or reduce the conservation benefits specified in the ITP, or result in changes to the extent or location of Covered Activities, but would provide a means for flexibly enhancing the Plan.

2.5 BASE ZONING AREA

Figure 2-1 depicts a "Base Zoning" area on 2,431 acres of the Half Circle L Ranch, east of Immokalee. The 2,431 acres represents an RLSP "Open" overlay area, where either development or preservation could

occur under RLSP regulations, and where base zoning (1 dwelling unit per 5 acres) under the Collier County Land Development Code applies. As of this writing, the Half Circle L Ranch is for sale on the open market. Although the current property owner is an applicant for the ITP, it is not known whether the property will be sold before the HCP/ITP process is concluded, or what land designation would be applied to the 2,431 acres in the event of a sale.

The status of this property will be resolved during the timeframe for USFWS review of the HCP document, drafting of the IA, and processing of the ITP. For the purposes of this initial draft of the HCP document, the Base Zoning area is simply identified, and counts neither as land designated for Covered Activities, or for Preservation/Plan-Wide Activities or Very Low Density Use. Should the current or future owner choose not to develop the area, it will be included in the Plan as land designated for Preservation/Plan-Wide Activities. Should the current or future owner develop the area at base zoning or higher densities, the development footprint will be included under the 45,000-acre cap for Covered Activities, and 2,431 acres that would have otherwise been designated for Covered Activities will be included in the area designated for Preservation/Plan-Wide Activities.

2.6 OTHER TAKE AVOIDANCE AND MINIMIZATION MEASURES

The primary avoidance and minimization measure for potential impacts to the Florida panther and other Covered Species is the designation of approximately 107,000 acres of contiguous lands for Preservation/Plan-Wide Activities and Very Low Density Use. Within the 45,000 acres proposed for Covered Activities, multiple avoidance and minimization measures will be implemented at project-level scales as part of project planning, design, permitting, and construction. The Plan's direction of development toward less valuable, previously cleared areas, and preservation of more ecologically valuable contiguous areas of land, serves as a significant avoidance and minimization strategy. Other project-level avoidance and minimization measures for the Covered Species are described in Chapter 4 (Florida Panther) and Chapter 7 (Conservation Plan for Other Covered Species).

2.7 OTHER PLAN ELEMENTS

A major benefit of the Plan is the opportunity for coordination with the FPPP (see Chapters 1 and 9). The FPPP is a collaborative effort among the applicants and several major environmental groups to assist in the conservation and recovery of the Florida panther. A central component of the FPPP is the establishment of the Marinelli Fund. The Marinelli Fund is governed by its own board of directors, and will be funded by the Plan.

The Fund will be underwritten by contributions from the generation and utilization of "panther habitat units," according to a pre-agreed formula, for Covered Activities. The enhanced mitigation required through the Plan – 25% additional mitigation beyond that currently required by USFWS panther habitat functional analyses for activities subject to Federal approval within the panther primary zone – will result in increased financial contribution to the Marinelli Fund for activities subject to Federal approval within the panther primary zone. In addition to enhancement of the North and South Corridors described above, the Marinelli Fund is expected to be used for a variety of conservation activities that assist with panther recovery, such as design and construction of wildlife underpasses and fencing along

roadways to prevent vehicle wildlife collisions; panther habitat acquisition, management, restoration and/or enhancement; and other activities that are consistent with the FPPP goals (Chapter 9).

The Plan also identifies potential changes in circumstances, under the USFWS “No Surprises” rule, that may require additional measures to respond effectively to those changes (see Chapter 8). Examples of reasonably foreseeable changed circumstances include the potential impacts of hurricanes; wildfires; pests and diseases afflicting Covered Species and/or their habitats; effects of climate change; and new listings of species not covered by the Plan. The Plan also incorporates general measures for responding to unforeseen circumstances that may impact one or more plan elements.

The Plan identifies alternatives to the incidental take as proposed under the Plan, and explains why the other alternatives were not selected (see Chapter 10, Alternatives).

The detailed provisions for implementing this Plan will be incorporated into the IA. The IA will specify the mutual obligations of the applicants and USFWS for executing the Plan elements, and for carrying out the Plan in accordance with the terms of the ITP and Federal regulations.

3. ENVIRONMENTAL SETTING

This chapter describes the environmental setting for the Plan, including the regional ecosystem relationships; climate; topography; geology; soils; land cover/land use; hydrology; and hydrogeology. Detailed accounts of the ecology of the Covered Species are provided in Chapter 4 (Florida Panther), and Chapter 5 (Other Covered Species). These chapters include information related to habitat requirements and utilization, ecological relationships among/between listed and non-listed wildlife species, and species occurrence within the HCP Area. Together, the environmental setting and species accounts provide the baseline conditions for the design and implementation of the Plan.

All figures included in this chapter depict the Collier County RLSA boundary, within which the Plan occurs (Figure 2-1), to cartographically simplify the figures so area-wide patterns in environmental variations can be visualized easily without interference from depictions of internal Plan boundaries.

3.1 GENERAL ENVIRONMENTAL SETTING

The general environmental setting for the Plan can best be described in terms of "ecoregions." Ecoregions are broadly defined as geographic areas possessing similar ecosystems, classified either by single factors (e.g., vegetation) or multiple factors (e.g., climate, vegetation, geology, topography, hydrology, and soils). The purpose of ecoregion classification and mapping is to provide a resource-based framework for environmental assessment, research, monitoring, and management of ecosystems and their associated components. As such, ecoregion classification assists with environmental characterization and is useful for regional conservation planning.

Federal agencies have utilized a variety of schemes to classify and map environmental attributes at various scales, according to agency needs. USFWS has divided peninsular Florida into two major ecosystem units, North Florida and South Florida, based primarily on regional watersheds and county boundaries (USFWS 2000). The U.S. Environmental Protection Agency (USEPA) has delineated finer-scale ecoregions in Florida, determined by the interactions of multiple environmental factors, including climate, vegetation, geology, topography, hydrology, soils, human land use, and other abiotic and biotic factors (Omernik 1987; Griffith et al. 1994). EPA "Level IV" ecoregions correspond most closely to the interrelated ecological characteristics and gradients within and around the HCP Area. See *http://www.epa.gov/wed/pages/ecoregions/fl_eco.htm*.

Figure 3-1 shows the location of the HCP Area relative to the "Level III and IV Ecoregions of Florida" map (USEPA 2012). The majority of the HCP Area is located within the "Southwestern Florida Flatwoods" Level IV ecoregion, specifically within a physiographic division known as the Immokalee Rise (Brooks 1981a; Griffith 1997). The Immokalee Rise comprises a local topographic high between the Caloosahatchee River valley and Big Cypress, with extensive uplands, large slough (flowway) wetland systems, and depressional wetlands (see Section 3.3). Within this major portion of the HCP Area, the total acreage of non-hydric soils, native upland communities, and agricultural land uses exceeds the total acreage of hydric soils and wetlands (WilsonMiller Inc. 2000; SFWMD 2011).

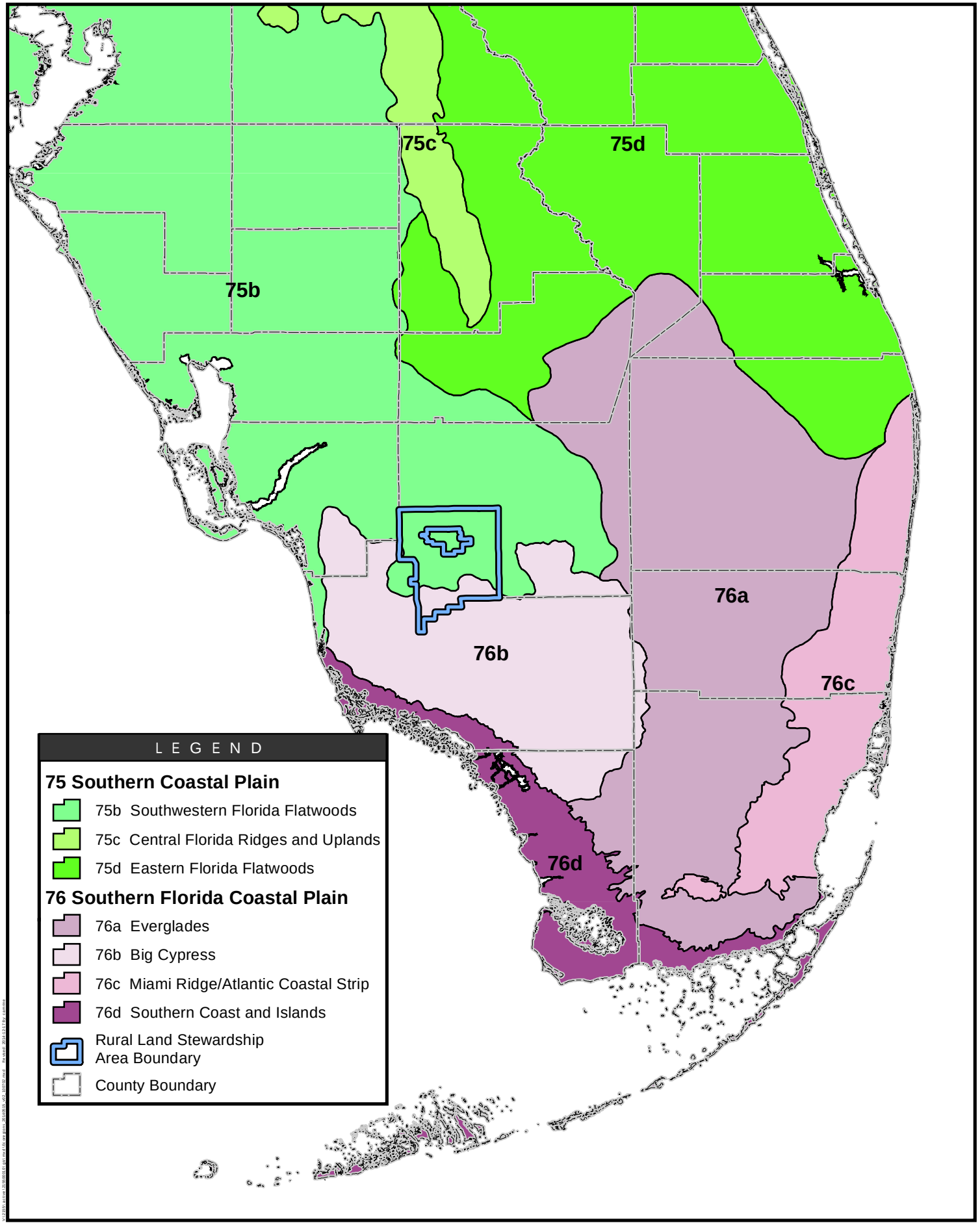

FIGURE 3-1 Florida Ecoregions

Level III and IV Ecoregions

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Stantec Consulting Services Inc.
3200 Bailey Ln. Ste. 200
Naples, FL 34105
tel 239.649.4040
fax 239.649.5716

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The southern portion of the HCP Area, roughly located south of Oil Well Road and adjacent to the FPNWR, comprises a lower elevation landscape with a higher proportion of hydric soils and native wetland communities (wetland forests, wet prairies, and freshwater marshes). Local topographic highs within this landscape support upland forests and some areas have been historically utilized for agriculture. This southern area falls within the "Big Cypress" Level IV ecoregion, part of the greater "Southern Florida Coastal Plain" ecoregion (Figure 3-1, Ecoregion 76b). Topography, soils, vegetation communities, and drainage networks within the Big Cypress Level IV ecoregion are generally similar in nature to those found elsewhere within the HCP Area, but differ in primarily in extent and proportion from those found on the Immokalee Rise ecoregion. For example, forested wetlands occur throughout the HCP Area, but comprise a much greater proportion of the land area south of Oil Well Road as compared to areas north of the road (see Figure 3-4).

The HCP Area is topographically and hydrologically separated from the Everglades ecoregion to the east by the Immokalee Rise in southern Hendry County, and the Big Cypress Spur topographic feature along the Collier, Broward, and Miami-Dade county boundaries (USEPA 2012; Brooks 1981; White 1970).

The following sections briefly summarize the major environmental attributes found within the HCP Area, which interact on a landscape-level scale to influence the ecosystem patterns that are reflected in the ecoregion mapping (Figure 3-1).

3.2 CLIMATE

The climate of southwestern Florida and the HCP Area can generally be described as humid sub-tropical, with a hot and humid wet season and a cool dry season (Peel et al. 2007). The wet season months extend from June through October, with October representing the wet-to-dry season transition. The dry season extends from November through May, with May representing the dry-to-wet season transition (Ali and Abtew 1999).

Long-term averages for total annual precipitation within the HCP Area cluster around 50 inches per year (MacVicar 1981; NOAA 2007; NOAA 2010). The most recent long-term precipitation data for the period 1981-2010 reflect a mean annual precipitation total of 50.7 inches at the Corkscrew Swamp Sanctuary headquarters, and 49.8 inches at the Immokalee station (University of Florida experiment station) just north of Immokalee (NOAA 2010). In general, more than half of the total annual precipitation occurs during just four months (June-September), and more than 70 percent of the total annual precipitation occurs during the five wet season months (Ali and Abtew 1999; NOAA 2010).The precipitation data for basin-wide analyses presented by Ali and Abtew (1999) indicate that the Southwest Florida region experiences the greatest seasonal contrast in average rainfall in southern Florida, with the lowest average dry-season precipitation and the highest average wet-season precipitation.

In addition to precipitation, unbiased estimates of daily, monthly, and annual evapotranspiration (ET) are important for characterizing the hydrologic cycle and water budget within a region. ET was quantified and published for the period 2007-2010 within the BCNP, across sites representing five different native land cover types (Shoemaker et al. 2011), with one of the measurement sites (Marsh) located approximately three miles south of the HCP Area. Monthly and annual ET values were

comparable at all five sites in year three of the three-year study period (2009-2010), when the effects of recent fires and drought conditions reduced spatial variations between sites. Year three of the study therefore represented more typical conditions for accurately assessing ET in native vegetation communities. The total annual ET values for year three ranged from 1270 to 1372 millimeters (50 to 54 inches) across the five sites. For the study period, the authors stated, "Available water is computed as the difference between rainfall and ET on an annual and monthly basis. Available water was always positive on an annual basis, indicating surplus rainfall was always available for aquifer recharge and runoff toward the coast." (Shoemaker et al. 2011, 34). In terms of seasonal variability, the wet season months generally exhibited positive available water (evapotranspiration < rainfall), while the dry season months exhibited negative available water (evapotranspiration > rainfall).

The long-term average (1981-2000) for annual mean temperature equaled 73.7 °F at the Immokalee station (NOAA 2010). For the same period of record (1981-2010), the long-term average of mean summer temperature equaled 81.9 °F, while the average of mean winter temperature equaled 64.4 °F. In terms of seasonal temperature patterns, the average summer maximum temperatures equaled 92.3 °F, while winter temperature minima averaged 51.3 °F. Over the 1981-2010 recording period, the lowest temperature observed at the Immokalee station was 20 °F (January 12, 1982), while the highest temperature recorded was 102 °F (June 18, 1998).

From 1981-2010, there were an average of 3.1 days per winter when the temperature dropped below 32 °F, which can damage native vegetation as well as agricultural crops (NOAA 2010). For the same period, there were 14.5 days on average when the temperature fell below 40 °F. The nearly annual recurrence of sub-freezing daily minimum winter temperatures explains why the distribution of frost-intolerant tropical vegetation is generally limited to lands south of the HCP Area, and found especially within the large wetland systems that are well-buffered from low temperatures by surrounding vegetation and/or surface water.

3.3 TOPOGRAPHY

Most of the HCP Area is located on a regional topographic high known as the Immokalee Rise, which corresponds to the southern limit of Southwestern Florida Flatwoods ecoregion (Figure 3-1, Ecoregion 75b). The Immokalee Rise was described and delineated as a geomorphic unit by White (1970), and was included in the Physiographic Divisions of Florida map (Brooks 1981a) and accompanying geomorphic unit summaries (Brooks 1981b). The Immokalee Rise is bounded on the southeast (outside the HCP Area) by a geomorphic feature White (1970) mapped as the Big Cypress Spur, an area with elevations lower than the Immokalee Rise but slightly higher than the Everglades ecoregion to the east (Campbell 1988). The southern and southwestern portions of the HCP Area grade into an area termed the Southwestern Slope, which dips generally to the southwest at a very low gradient. The boundary between the Immokalee Rise and Southwestern Slope geomorphic units of White (1970) corresponds closely to the Level IV ecoregions boundary between the Southwestern Florida Flatwoods and Big Cypress ecoregions (Figure 3-1).

Figure 3-2 depicts the surface elevations within the HCP Area, derived from Light Detection and Ranging (LIDAR) data (FDEM 2009). The highest topographic areas within the HCP Area are found on the Immokalee Rise north and northeast of Lake Trafford near the Collier County-Hendry County line, with maximum elevations of 41 feet North American Vertical Datum of 1988 (NAVD 88) (USGS 1987; FDEM 2009). From the Immokalee Rise area, elevation generally decreases toward the south and southwest, with slough systems and localized depressions occurring throughout the landscape. The lowest elevations within the HCP Area are found within its southwestern portions, where 12-foot spot measurements comprise the minimum recorded land elevation (USGS 1990; FDEM 2009).

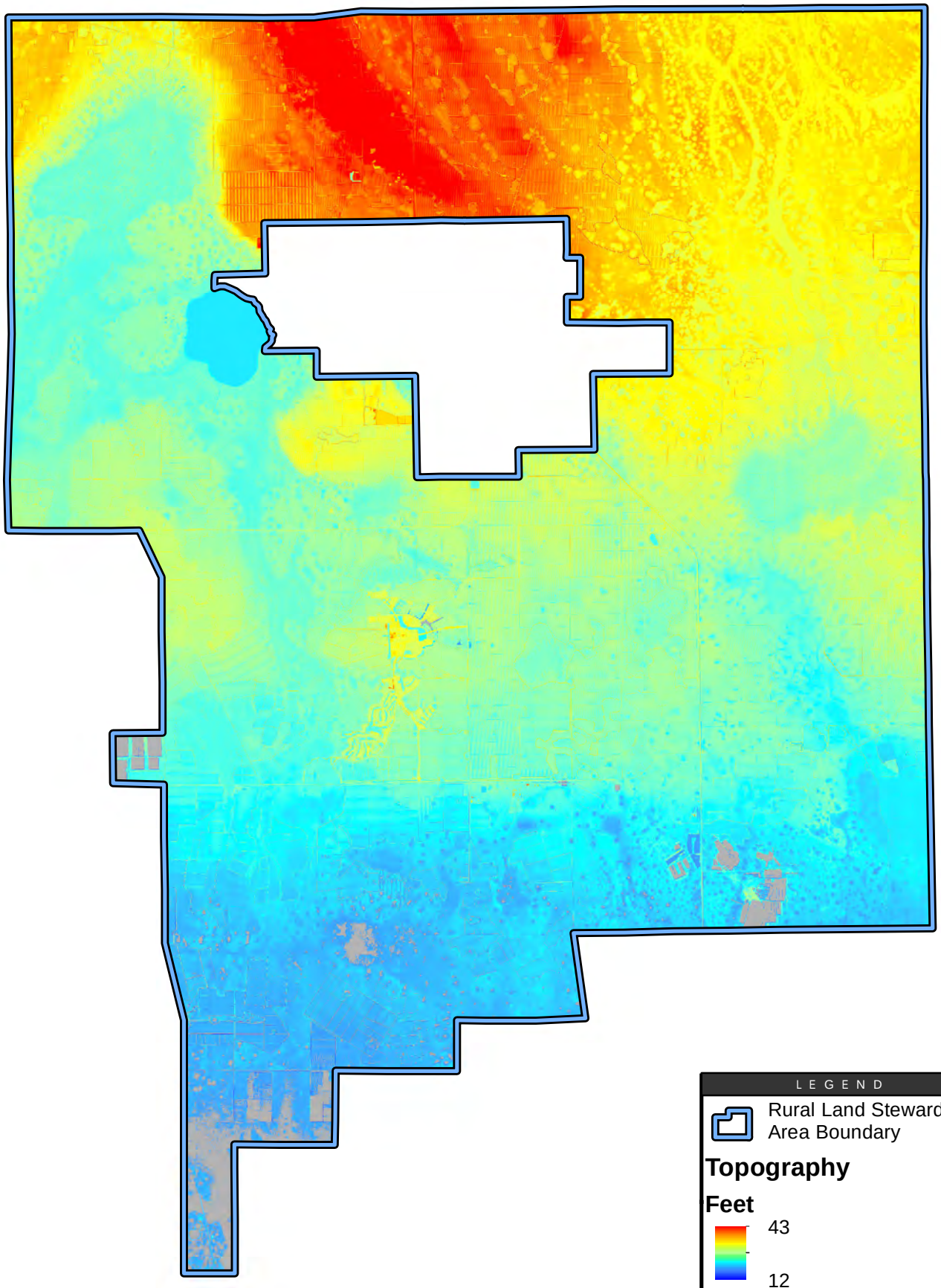
3.4 GEOLOGY

Peninsular Florida is comprised of a thick sedimentary sequence of predominantly carbonate rocks, which rests on an igneous-metamorphic basement complex known as the Florida Platform (Scott 1992). In Collier County, the sedimentary sequence is approximately 17,000 feet (5.2 miles) thick and the deepest/oldest sedimentary rocks date to the Jurassic Period (Applegate and Lloyd 1985; Campbell 1988). These basal clastic sedimentary rocks, known as the Wood River Formation, are overlain by more than ten thousand feet of Cretaceous limestone, dolomite, and evaporite deposits (Scott 1992; Pollastro et al. 2000).

At 11,000-12,000 feet below mean sea level, a lower Cretaceous geologic (stratigraphic) unit known as the Sunniland Formation contains scattered fields of petroleum deposits (the Sunniland Trend). The petroleum was first discovered in the early 1940s near Sunniland, in the southeast portion of the HCP Area. Since the discovery of petroleum in the area, a total of eleven oil and gas fields have been identified and placed into production in Collier County. Most of those oil and gas fields are still in production (Applegate and Lloyd 1985). Oil and gas exploration and production activities continue within the Sunniland Trend, extending across the HCP Area, BCNP, Hendry County, and Lee County.

The Cretaceous rocks in eastern Collier County are overlain by more than 5,000 feet of Cenozoic strata, predominantly carbonate rocks. Siliciclastic materials (transported sediments like quartz sand, silt, and/or clay) appear more frequently in strata of the Miocene epoch and younger (23 million years ago and younger) than in older Cenozoic strata. Detailed stratigraphic descriptions for various units and geologic interpretations are well documented in several publications (Knapp et al. 1986; Campbell 1988; CDM 2002). Aside from oil and gas deposits at depth, the significance of Collier County's geologic framework for the Plan is limited to the upper portions of the geologic column. These near-surface strata and deposits are significant because they determine the characteristics of the regional aquifer systems and water supply, serve as substrate (parent materials) for soil formation, and provide construction materials, such as limestone and sand, for human activities.

The mined mineral resources in eastern Collier County currently consist of crushed limestone and fill sand, excavated by open pit methods from near-surface deposits (Campbell 1988). One active mine (Sunniland Mine) exists in the southeast portion of the HCP Area. The Hogan Island Quarry was excluded



Stantec

FIGURE 3-2 Topography

Rural Land Stewardship Area – Collier County, FL

December 2014

Stantec Consulting Services Inc.
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tel 239.649.4040
fax 239.649.5716

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from the HCP Area because it has completed federal permitting, including ESA section 7 consultation. The Immokalee Sand Mine had already initiated federal permitting, and was therefore also excluded from the HCP Area.

3.5 SOILS

Collier County and the HCP Area have been mapped and characterized by two U.S. Department of Agriculture soil surveys within the past 70 years. The first published soil survey (Leighty et al. 1954) was based on field work performed in the early-1940s. Although that soil survey has limited utility for present-day applications, it provides an excellent technical basis (along with 1940-1950 aerial photography) for evaluating pre-settlement land cover and hydrology patterns within the county (see, for example, Zahina et al. 2007). The 1954 soil survey provided detailed soil map-unit descriptions that inventoried dominant vegetation, and also provided tabular correlation of vegetation and soil types.

Field work for the modern soil survey of the Collier County area (excluding BCNP and ENP) was completed in 1988, using 1984-1986 aerial photography as the mapping base (Liudahl et al. 1990). The small-scale (1:380,160) general soil map developed in connection with the 1990 survey reflects a similar landscape-scale pattern to the USEPA ecoregion map (Figure 3-1), where the Immokalee Rise area contains a higher proportion of upland soils and areas south of the rise exhibit a higher proportion of wetland soils. In general, eastern Collier County consists mainly of poorly to very poorly drained soils, where small changes in ground elevation can influence the range of water table depths and consequently the native vegetation patterns. As noted in Section 3.7 below (Hydrology), extensive ditching and canal excavations for agriculture, highways, urban stormwater drainage, etc. have historically altered the drainage class of many soils.

These soils generally formed in the sandy unconsolidated deposits associated with Pleistocene sea-level fluctuations, nearshore depositional environments, and marine terrace sequences (Liudahl et al. 1990; Scott 1992). Sandy deposits tend to be thicker (20-40 feet) in the northern part of the county (near Immokalee) and become thin or absent in the southern portions of the HCP Area, often exposing the underlying limestone or “caprock” (Campbell 1988).

In terms of soil classification, the eastern Collier County soils classify into the Alfisol, Spodosol, Entisol, Mollisol, and Histosol soil orders. With few exceptions, the soils classify into the “aquic” suborders, reflecting their generally poor natural drainage and seasonally high water tables. Alfisols contain a clay-enriched subsurface horizon, while Spodosols are generally associated with flatwood and dry prairie landscapes, and possess an organic-enriched subsurface horizon that contains higher amounts of aluminum and/or iron. The Entisols are soils with minimal horizon development that formed in sandy parent materials. Mollisols are mineral soils with a thick dark surface and high base saturation (high percentage of available Ca, Mg, and K), occurring in lower, consistently moist or wet landscapes. Histosols are organic soils, which signify the year-round presence of water at or above the soil surface in normal rainfall years; they are typically found in the deepest marshes and/or adjacent to open water.

Visualizing and interpreting the landscape-scale pattern of soil map-units, soil properties, and their ecological significance over a large area can be challenging. For this reason, Zahina et al. (2001)

developed a soil classification database that sorted and grouped soil survey map units by similar landform, hydrological, morphological (e.g., soil texture, color, horizonization), and natural vegetation characteristics. The classification scheme derived from this database is known as the Natural Soils Landscape Position (NSLP) classification. The purpose of the database was "to provide a clearer understanding of the relationships that exist between soil, hydrology, and the vegetation community." (Zahina et al. 2001, p.1).

Figure 3-3 depicts the NSLP classification for the HCP Area. One major advantage of the NSLP is that the natural patterns of topography, soils, and hydrology are readily evident at smaller (county-wide) mapping scales. The most extensive NSLP units within the HCP Area are the "Flatwood Soils," which Zahina et al. (2001, 20) characterized as "poorly drained, nonhydric, upland soils with sandy marine sediments throughout the profile…Most of the soils in this category are Spodosols." In the HCP Area, the next most extensive NSLP units are "Sand Depression" soils, which are hydric soils and very poorly drained. The Sand Depression soils depicted in Figure 3-3 generally coincide with the locations of the major flowways, cypress strands, and the depressional wetlands that are scattered across the landscape.

The NSLP "Flats Soils" occupy a landscape position between Flatwood and Sand Depression soils, and are considered transitional between upland and wetland characteristics, tending toward wetland natural communities. Although categorized as hydric soils within the NSLP classification, they include some upland areas because the depth and/or duration of the seasonal high water table may not be sufficient to meet hydric soil and/or wetland hydrology criteria in slightly higher landscape positions.

Three NSLP classifications occupy relatively limited areas within the HCP Area (Figure 3-3). "Knolls" are found on small ridges or knolls that rise a few feet higher than the surrounding uplands, but possess deeper water tables and support more xeric (drier) vegetation communities, such as upland hammocks, scrubby flatwoods, or scrub vegetation. At the opposite end of the soil hydrology continuum, "Muck Depressions" are found only where year-round soil saturation allows the development and persistence of thick layers of decomposed organic materials (muck). Finally, "Urban or Made" NSLP units correspond to areas where the soils have been altered extensively by human activities, generally for urban development purposes, and such areas no longer function as they did in the natural landscape.

3.6 LAND USE AND LAND COVER

A variety of agencies and researchers have performed land cover and land use/land cover (LULC) mapping in southern Florida over the last several decades, at multiple scales and employing various methodologies. The South Florida Water Management District (SFWMD) has performed vector-based LULC mapping on aerial photography base maps since the 1970s. Geographic Information System (GIS) databases of this LULC mapping have been available beginning with the 1988 and now include the 1995, 1999, 2004, 2008 databases (SFWMD 2011). The classification scheme used for the SFWMD LULC mapping was the Florida Land Use, Cover and Forms Classification System (FLUCCS) (FDOT 1999). Early mapping did not include accuracy analyses for classification errors, but post-1995 mapping requires an overall accuracy of greater than 75 percent for FLUCCS Level III and IV mapping, at an overall classification accuracy of 90% (SFWMD 2011; see metadata).

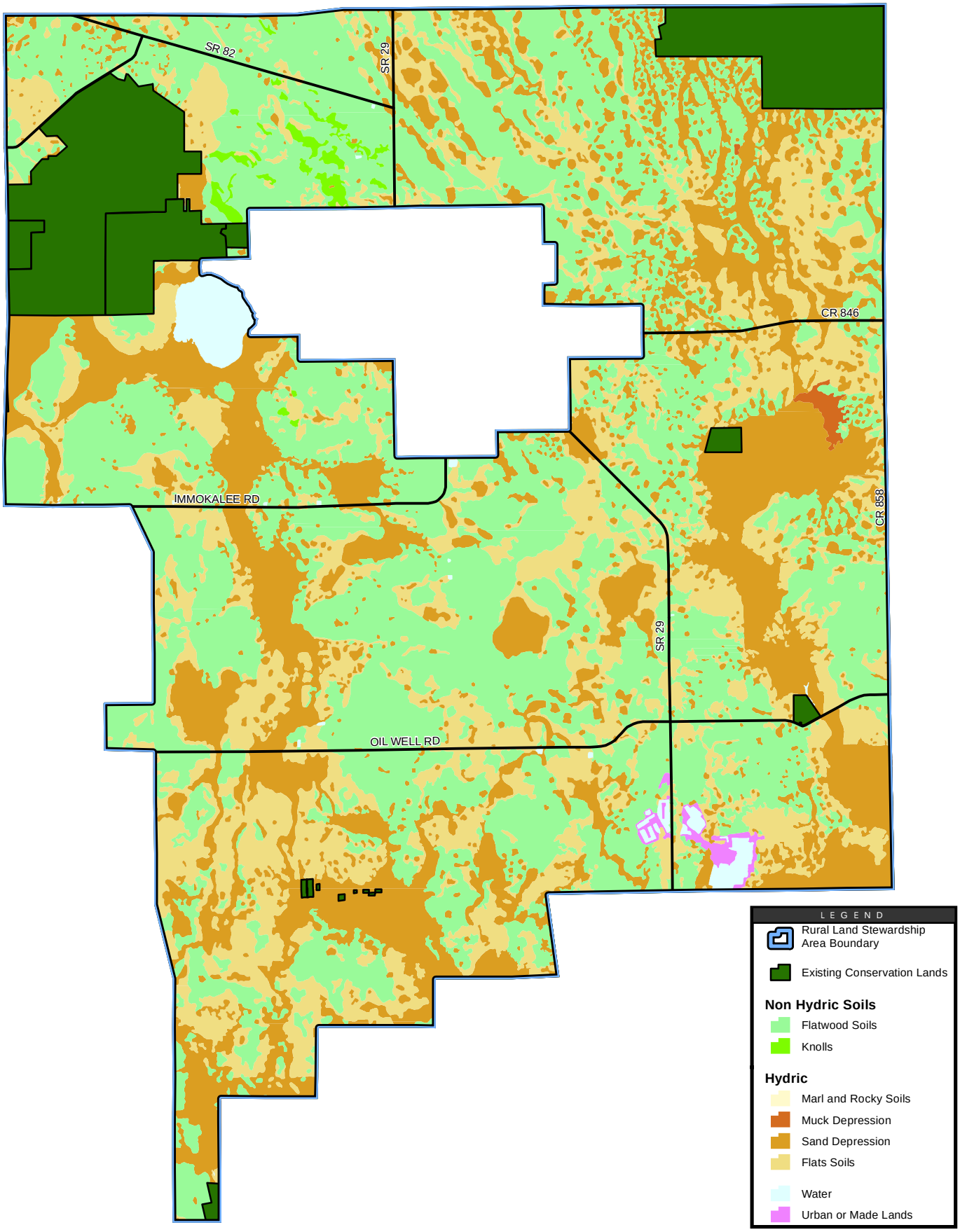

FIGURE 3-3 Natural Soil Landscape Position

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FWC initially performed statewide land cover mapping for preliminary identification of conservation "gaps" using 1985-1989 Landsat Thematic Mapper imagery and unsupervised image classification (Kautz et al. 1993; Cox et al. 1994). Subsequent satellite-based land cover mapping has been performed by FWC, the University of Florida, and the Florida Natural Areas Inventory (FNAI). These land cover maps provide regional to statewide classification of land cover, which is most useful for mapping landscape-scale conservation linkages on a statewide scale. Some of the more recent satellite-based mapping has undergone limited ground-truthing by ecologists and stakeholders, but none have been subjected to formal accuracy assessment procedures for classification accuracy.

The HCP Area was mapped in detail in 1999-2000, as part of the design process for the RLSP (WilsonMiller 2000). The land cover mapping utilized true color and color infrared aerial photography as mapping bases, at a field mapping scale of 1:12,000 (1" = 1000'). Land cover map units were delineated by aerial photo interpretation, and classified according the FLUCCS Level III categories (FDOT 1999). A formal accuracy assessment of the mapping was performed using National Biological Service standard methods (Stadelmann et al. 1994), with polygons in each land cover class selected randomly by a GIS. The statistics for the stratified random sampling of 135 polygons indicated an overall map accuracy of 91 percent, with a 90 percent probability that the true map accuracy was within ±5 percent of this estimate.

Figure 3-4 shows a thematic grouping of the original mapping, updated in 2008 as part of a mandated five-year review of the Collier County RLSA Program (see Collier County 2009). Table 3-1 provides a breakdown of LULC categories by FLUCCS code and land designation. In terms of LULC, active agriculture (including cultivated crops, citrus, sod, pastures, and specialty crops) comprises approximately 49 percent of the HCP Area. Native wetlands account for approximately 38 percent of the total HCP Area, and are split roughly evenly between forested and non-forested (mainly herbaceous) wetland systems. Native uplands comprise 11 percent of the HCP Area, with forested uplands comprising over 83 percent of native uplands. Open water, consisting of major canals, and small lakes/ponds total 398 acres, or 0.2 percent of the HCP Area (Lake Trafford is not included within the HCP Area). Approximately 1 percent of the HCP Area consists of existing development, primarily the Town of Ave Maria, although these data will require an updated acreage estimate for changes since 2009. The remaining land uses, including earth mining, roads, power transmission lines, and oil and gas facilities, comprise approximately 1 percent of the total HCP Area.

The amount of land actually used for agriculture within the HCP Area is much greater than the simple acreage quantified by agricultural land cover types. For example, grazing leases exist throughout the HCP Area, across virtually all vegetated cover types. Cattle graze in improved and unimproved pastures, rangeland in varying stages of succession, native uplands and native wetland communities. Cattle-grazing is an important land management tool for land owners, especially for the control of exotics, such as Brazilian pepper (*Schinus terebinthifolia*).

Overall, the distribution of land cover types within the HCP Area creates a landscape-scale matrix of habitats that allows for support of the Covered Species. Large blocks of interconnected native habitats

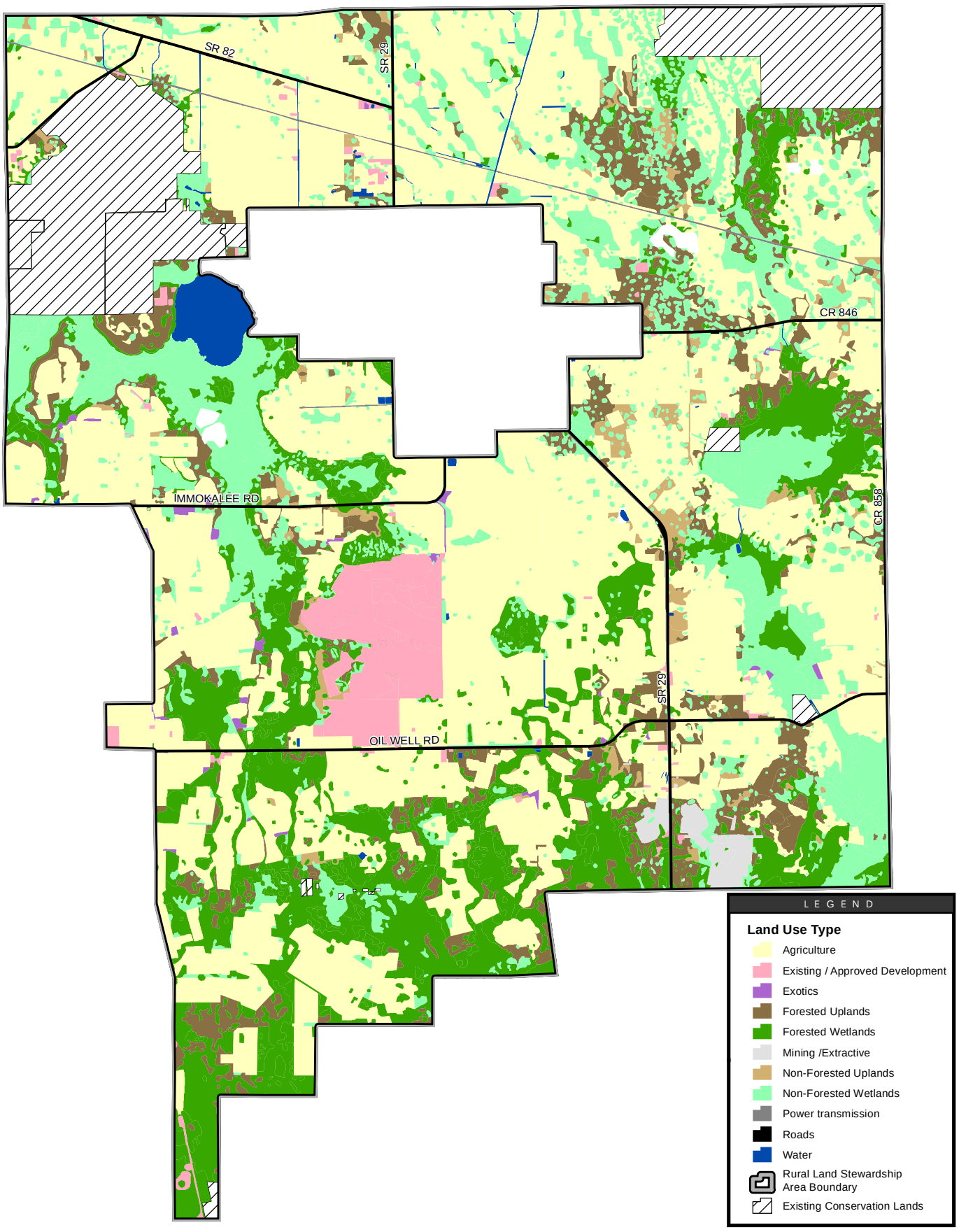

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FIGURE 3-5 Land Cover/Land Use

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Table 3-1. Land use/land cover within the HCP Area, by FLUCCS category (Collier County, 2009).

FLUCCS (LEVEL 3)	FLUCCS DESCRIPTION	COVERED ACTIVITIES (ACRES)[1]	PRESERVATION (ACRES)	V. LOW DENSITY (ACRES)	BASE ZONING (ACRES)	TOTAL ACRES
111	Single Family (low density)	66	50	19	0	**135**
112	Mobile Home Units	11	12	0	0	**23**
121	Single family (med density)	19	8	0	0	**26**
151	Food Processing	57	1	0	0	**58**
155	Other light industrial	51	37	0	0	**89**
160	Extractive	0	41	134	0	**175**
163	Rock quarries	0	321	568	0	**888**
164	Oil and gas fields	11	25	0	0	**36**
211	Improved pastures	2,495	6,071	325	37	**8,928**
212	Unimproved pastures	650	2,095	2	767	**3,514**
213	Woodland pastures	0	103	0	23	**126**
214	Row crops	16,294	8,530	0	619	**25,443**
221	Citrus groves	20,784	8,775	0	1	**29,559**
223	Other groves	15	129	0	0	**143**
242	Sod farms	555	0	0	0	**555**
243	Ornamentals	16	5	0	0	**22**
250	Specialty farms	0	0	0	0	**0**
260	Other open lands (rural)	12	15	0	0	**28**
261	Fallow crop land	2,692	3,763	0	308	**6,763**
310	Herbaceous (dry prairie)	40	216	29	0	**285**
321	Palmetto prairies	315	1,058	0	0	**1,373**
329	Other shrubs and brush	147	416	11	0	**574**
330	Mixed rangeland	74	461	0	0	**535**
411	Pine flatwoods	1,706	6,665	242	43	**8,656**
422	Brazilian pepper	434	215	0	0	**648**
425	Temperate hardwood	9	1,557	16	17	**1,599**
428	Cabbage palm	15	57	0	0	**72**
434	Hardwood-conifer mixed	156	3,059	123	7	**3,345**
439	Other hardwoods	7	0	0	0	**7**
510	Streams and waterways	148	143	0	0	**291**
521	Lakes larger than 500 acres	0	0	6	0	**6**
523	Lakes (10-100 acres)	0	10	0	0	**10**
524	Lakes less than 10 acres	0	10	0	0	**10**
533	Reservoirs (10-100 acres)	8	28	0	0	**37**
534	Reservoirs <10 acres	27	19	0	0	**46**
617	Mixed wetland hardwoods	18	383	58	2	**460**
621	Cypress	358	18,007	72	31	**18,469**
624	Cypress-pine-cabbage palm	384	3,697	34	0	**4,115**
630	Wetland forested mixed	101	6,671	127	0	**6,898**
631	Wetland scrub	665	7,749	66	0	**8,480**
641	Freshwater marshes	608	12,793	34	304	**13,740**
643	Wet prairies	563	4,338	96	254	**5,251**
743	Spoil areas	2	0	0	0	**2**
814	Roads and highways	162	154	0	0	**316**
832	Power transmission lines	172	200	2	18	**391**
TOTALS		**49,848**	**97,885**	**1,961**	**2,431**	**152,124**

[1] The actual acreage of Covered Activities at Plan completion will be 45,000 acres. The balance (4,848 acres) will be placed in Preservation/Plan-Wide Activities.

[2] The Base Zoning acres will be placed in Preservation/Plan-Wide Activities or Covered Activities by Plan completion. If these acres are placed in Covered Activities, an equivalent number of acres that otherwise would have been included in Covered Activities will be placed into Preservation/Plan-Wide Activities to maintain the 45,000-acre cap on Covered Activities.

exist, providing an opportunity for the preservation and potential enhancement of regional wildlife corridors. The Camp Keais Strand and Okaloacoochee Slough flowways form the core of the two major wildlife corridors that extend through the HCP Area (Oetting et al. 2014), and are of particular benefit to wide-ranging species, such as the Florida panther.

3.7 HYDROLOGY

The surface hydrology of eastern Collier County lacks continuous natural stream or river channel networks, and instead reflects a "disjointed drainage" system that occurs extensively south of the Caloosahatchee River (Mossa 1998). In low-relief landscapes with disjointed drainage patterns, surface water flows across the landscape in shallow depressional flowways (sloughs), marshes, and swamps, or moves as a broad shallow sheet (sheetflow) across relatively flat terrain. Sheetflow can cover extensive portions of the landscape during periods of extreme rainfall, even briefly inundating areas that are dominated by native upland vegetation.

Another characteristic of low-relief disjointed drainage systems is that watershed boundaries can be ill-defined, such that a flood stage at a given elevation can flow in one direction, while the same general area may drain to one or more different outfalls at higher flood stages. This phenomenon has been documented within the HCP Area during the Imperial River flooding events in October 1995, which were subsequently addressed by SFWMD in its integrated hydrologic-hydraulic computer models.

Surface water in eastern Collier County interacts directly with the Water Table aquifer, which along with the Lower Tamiami Aquifer comprises the regional Surficial Aquifer System (CDM 2002; Atkins 2011). The proportion of surface water runoff versus aquifer recharge over time is determined by dynamic conditions related to local water table depths, surface water stages, precipitation events and rates, and ET. In general, the entire HCP Area, including the large regional flowways, serves as a groundwater recharge area for the Water Table Aquifer. The Lower Tamiami aquifer is also recharged through most of the HCP Area, but the Okaloacoochee Slough is a discharge area for the Lower Tamiami (Fairbank and Hohner 1995; Atkins 2011).

The major natural surface-water features of the HCP Area are Lake Trafford, Corkscrew Marsh, the Camp Keais Strand flowway system, and the Okaloacoochee Slough flowway system. Lake Trafford, which is not included in the HCP Area, is a 1,500-acre karstic lake formed via limestone dissolution and/or sinkhole processes (Petuch and Roberts 2007). At higher stages, it drains via surface flow to the south into the Camp Keais Strand and southwest into the Corkscrew Marsh system. Lake Trafford recently benefitted from a major restoration effort that removed several feet of muck from the central lake bottom, removed 1-2 feet of muck from the littoral zone, and initiated restoration of native submerged aquatic vegetation in the littoral zone (SFWMD 2012). Although ECPO property ownership includes portions of the Lake Trafford shoreline, the lake itself was not included within the HCP Area because no activities are proposed in the lake, nor are any incidental takings anticipated.

The head of the Corkscrew Marsh system is located in the northwest portion of the HCP Area, and is already under a combination of public and private conservation ownership. Surface water

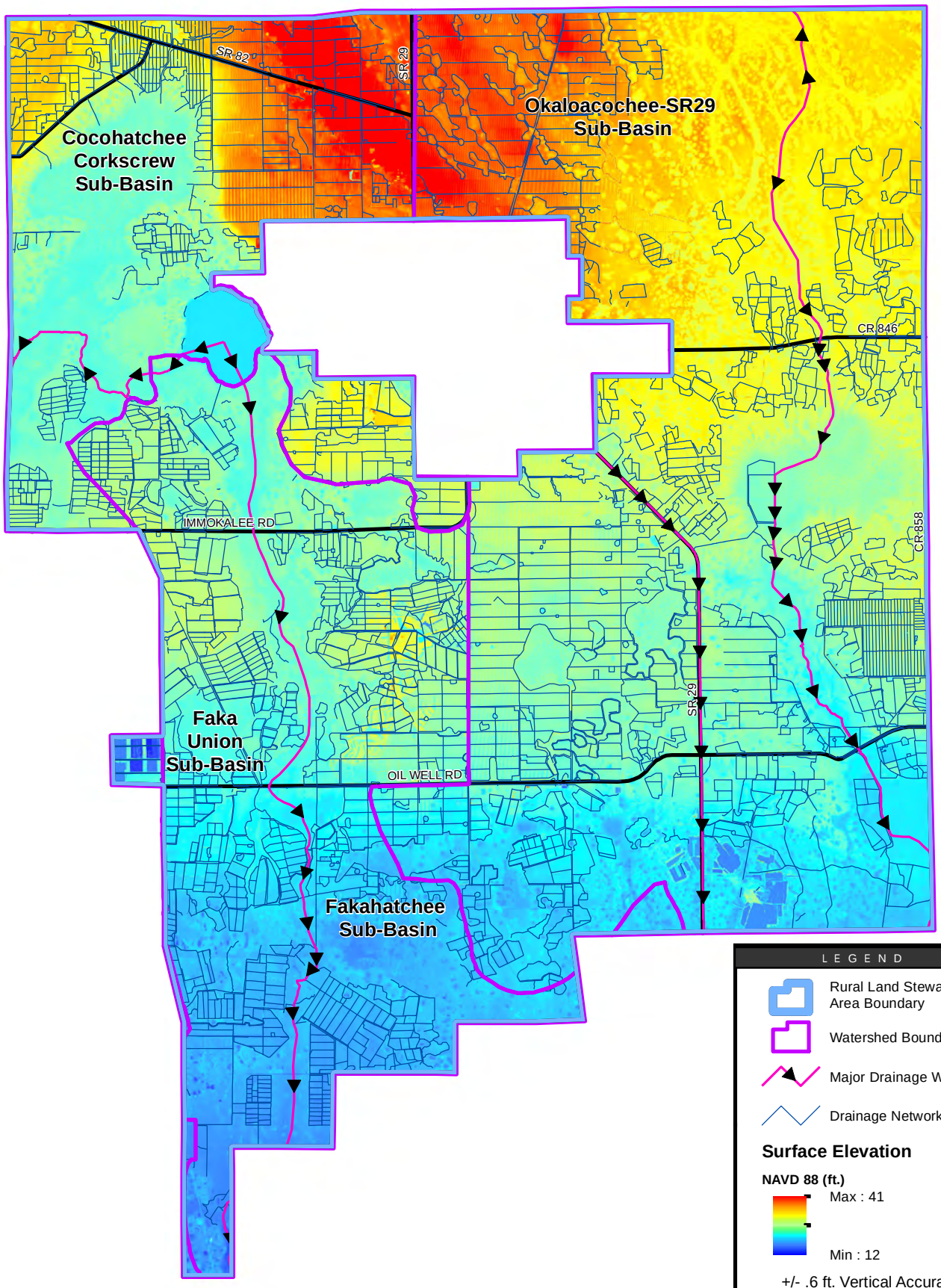

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FIGURE 3-5 Hydrology

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from Corkscrew Marsh flows primarily toward the southwest though the Cocohatchee Basin drainage network (Atkins 2011). The Camp Keais Strand flowway extends southward from Lake Trafford toward the FPNWR, connecting with other large wetland systems (Stumpy Strand, Fakahatchee Strand) at the southern end of the HCP Area, and discharges to the south via the Merrit Canal (HydroGeoLogic et al. 2006). Along the course of the flowway, historic alterations from abandoned road and railroad grades, existing highway crossings, former agricultural fields, and agricultural drainage infrastructure have constricted flow at various points within the flowway during peak events, which have been assessed by SFWMD as part of a Camp Keais Strand restoration initiative (HydroGeoLogic et al. 2006; Atkins 2011). The Collier County Watershed Management Plan (Atkins 2011) describes several opportunities for structural improvements within and around Camp Keais Strand that could restore flowway functions, especially during peak flow events.

The Okaloacoochee Slough flowway extends southward from the Okaloacoochee Slough State Forest in the northeastern corner of the HCP Area, eventually draining into BCNP and FPNWR. A small portion of the HCP Area adjacent to the boundaries of the Okaloacoochee Slough State Forest drains northward into a different drainage basin. The majority of surface water flowing within the slough flows southward beyond the southern boundary of the HCP Area, where it deflects to the southwest. In pre-development conditions, the water flow continued through what is now the FPNWR, eventually flowing down the Fakahatchee Strand. The construction of the Barron River Canal and a railroad grade in the 1920s diverted some of this flow down the canal and altered the natural hydrology of the FPNWR (Reese 2010). Three bridges along SR29 allow some water to flow into the FPNWR area, but berms along the canal only permit these flows under high-water conditions. Much of the Okaloacoochee Slough system within the HCP Area remains relatively undisturbed in terms of hydrologic alterations, but some areas of historic ditching, berm construction, and vegetation changes could be restored to optimize the natural flowway functions (Atkins 2011).

Upland areas within the HCP Area exhibit extensive ditching to provide drainage for agricultural operations. Agricultural stormwater is collected via ditch networks that are managed by field-level water control structures, which discharge into water retention areas. The water retention areas attenuate the stormwater flow and increase the residence time for nutrient uptake within the retention areas, prior to discharge into the flowways. Agricultural stormwater is extensively regulated and managed by the SFWMD through permits and best management practices.

3.8 HYDROGEOLOGY

The subsurface hydrogeology of the HCP Area has typically been described in terms of three major aquifer systems: the Surficial Aquifer System, the Intermediate Aquifer System, and the Floridan Aquifer System (Campbell 1988; Brown et al. 1996; CDM 2002). Although the aquifers are generally separated by relatively low-permeability confining beds, some leakage typically occurs between aquifers, and in some locations the confining beds may be thin or absent. The degree of groundwater transmission between aquifers depends primarily upon the hydraulic head between the aquifers, and the thickness and permeability of the confining strata (Knapp et al. 1986; CDM 2002).

Within eastern Collier County, the Surficial Aquifer System is comprised of the Water Table Aquifer and the Lower Tamiami Aquifer (CDM 2002; Atkins 2011). The Water Table Aquifer occurs within the unconsolidated Pamlico Sand surface deposits, the Fort Thompson Formation (limestone), and the upper portions of the Tamiami Formation (limestone). The surface elevation dynamics of the Water Table Aquifer affect the distribution and character of native vegetation communities, particularly wetlands. The aquifer is estimated to be 30-90 feet thick and possesses generally good water quality in terms of salinity. However, relatively high concentrations of iron and organic acids often produce discolored water, and may produce trihalomethane (TMH) and other disinfection by-products at water treatment plants (CDM 2002).

A low permeability semi-confining bed, where present, separates the Water Table Aquifer from the Lower Tamiami aquifer. The Water Table Aquifer occurs within the Ochopee Member of the Tamiami Formation, which ranges from 40-150 feet thick within the HCP Area (CDM 2002). Water quality is generally good, with chloride concentrations less than 200 milligrams per liter (mg/l). Dissolved iron and organic acid concentrations can be higher where the confining bed is thin or absent, and the Lower Tamiami aquifer mixes with the Water Table Aquifer.

The Intermediate Aquifer System is comprised of two aquifers: the Sandstone Aquifer and the mid-Hawthorn or Hawthorn Zone 1 Aquifer (Knapp et al., 1986; CDM 2002). Knapp et al. (1986) mapped the top surface of the Sandstone Aquifer at elevations between -100 to -300 feet NGVD, and mapped the thickness of the Sandstone Aquifer at more than 50 feet thick near Corkscrew Marsh, diminishing to less than 25 feet near the Sunniland Mine. CDM (2002) stated that the Sandstone Aquifer is hydraulically connected to the Lower Tamiami Aquifer in eastern portions of the HCP Area. Water quality within the Sandstone Aquifer is generally good, with chloride concentrations less than 250 mg/l, although salinity increases with depth. This aquifer provides water for agricultural uses in eastern Collier County (CDM 2002).

The mid-Hawthorn or Hawthorn Zone I Aquifer occurs at depths of approximately -290 to -420 feet NGVD within the HCP Area, with a thickness of approximately 100-135 feet (CDM, 2002). Water quality is generally good in the northeastern portion of Collier County, but dissolved chloride concentrations increase by an order of magnitude from 200 mg/l to 2000-3000 mg/l to the south and west (CDM 2002).

The Surficial and Intermediate Aquifer Systems are the primary sources for potable drinking water and agricultural irrigation water in Southwest Florida. The Floridan Aquifer System, described below, contains brackish water that cannot be used for these purposes without pre-treatment. Several utilities within Southwest Florida do utilize water from the upper Floridan Aquifer System as a source for potable water, after desalination via reverse osmosis (RO) or other technologies (SFWMD 2012).

Below the mid-Hawthorn Aquifer, a confining zone averaging 150 feet thick separates the Intermediate Aquifer System from the Floridan Aquifer System. The Floridan system underlies the entire State of Florida and much of the southeastern U.S. Although the aquifer provides usable water up-gradient in central and northern Florida, the high dissolved chloride concentrations limit its use in southern Florida. The Floridan aquifer water quality is generally so poor in Collier County that some authors explicitly omit

discussion of the aquifer as a potential water source (Knapp et al. 1986; Campbell 1988). However, while CDM (2002) noted that desalination would be necessary before the undiluted Lower Hawthorn (upper Floridan) water could be used for potable, agricultural, or industrial uses, they noted that it may be possible to blend the upper Floridan water with low-salinity sources for non-potable uses, such as landscaping irrigation applications. Blending, RO, and other strategies for conditioning marginal groundwater sources could potentially be used to augment the regional water supply.

3.9 SURFACE WATER QUALITY

The Collier County Watershed Management Plan (CCWMP) provides the most recent and comprehensive evaluation of surface water quality conditions in and around the HCP Area (Atkins 2011). The study area included six watersheds west of BCNP, with portions of four watersheds occurring within the HCP Area (Cocohatchee-Corkscrew; Faka Union; Fakahatchee; and Okaloacoochee/SR29 watersheds). The FDEP further subdivides the six watersheds into more localized water body identification (WBID) basins for the purpose of evaluating water quality. The HCP Area contains portions of nine WBID basins.

In-stream water quality conditions were evaluated in the context of FDEP Total Maximum Daily Load (TMDL) impairment criteria, and were based upon FDEP data and previous published reports (Atkins 2011). Overall, the data analyses indicated that in-stream surface water quality was within FDEP limits for total nitrogen, total phosphorus, chlorophyll-*a*, and total suspended solids concentrations across the HCP Area.

A total of 14 water quality impairments were designated by FDEP within Collier County, where water quality parameters exceeded limits set by the State. Of these 14 identified impairments, six occurred within WBIDs that are located at least partially within the HCP Area. Water quality impairments within Lake Trafford, which adjoins portions of the HCP Area but is not included in the Plan, included nutrients, un-ionized ammonia, and low dissolved oxygen (DO). The recently completed Lake Trafford restoration/sediment removal project was directed at improving water quality issues, and will be assessed by FDEP during its next evaluation cycle. The other impairments identified by FDEP within the HCP Area are briefly detailed below, by watershed. Figure 3-5 depicts the extent of each watershed within eastern Collier County.

The Okaloacoochee-SR29 watershed comprises the largest watershed area within the HCP Area, accounting for over half of the total acreage. FDEP determined that two WBIDs within this watershed were impaired for dissolved oxygen, with values consistently below the 5.0 mg/l threshold. Using regression analyses, Atkins (2011) determined that color (largely derived from tannins in natural wetland systems) was the primary causative factor for low DO. Other natural and anthropogenic factors likely included a combination of low DO from groundwater baseflow, and periodic increases in total nitrogen inputs from the upper portion of the watershed.

Downstream within the Okaloacoochee watershed, but south of the HCP Area, FDEP also identified the Barron River/SR29 canal as impaired for iron. Atkins (2011) identified iron as a “potential concern” for

the entire watershed. The primary causative factor for elevated iron concentrations in the canal appears to be the high iron concentrations in groundwater discharges that occur upstream from the canal.

Three WBIDs within the Cocohatchee-Corkscrew watershed were verified as impaired for DO by FDEP (Atkins 2011). The three WBIDs were the Immokalee Basin (i.e., Immokalee urban area), Lake Trafford, and Corkscrew Marsh. The low DO levels within these basins were attributed to color (largely derived from tannins in natural wetland systems), nutrient loadings from urban and agricultural stormwater runoff, and low DO levels associated with groundwater baseflow (Atkins 2011).

The Fakahatchee watershed was verified by FDEP as impaired for DO and fecal coliform bacteria, but only in the WBID located south of Oil Well Road and west of the Barron River/SR29 canal. The vast majority of that WBID exists under natural land cover with an absence of large anthropogenic nutrient inputs and few hydrologic impacts, leading FDEP to designate it as a water quality reference area (Atkins 2011). The low DO values were attributed primarily to color (tannins) from wetland systems. Although this WBID was identified as impaired for fecal coliform bacteria, these indicator organisms are non-specific for identifying human activities as a source of contamination (Atkins 2011). As there a few residences within the WBID or upstream from it, further source identification is warranted, and could indicate natural sources as the causative factor.

The Faka Union watershed occupies an estimated 345 acres along the western margins of the HCP Area. FDEP did not designate any water quality impairments within this watershed. Atkins (2011) identified DO and color as water quality “parameters of concern” (see below).

Overall, the Atkins (2011) watershed study found no disagreements between the FDEP and the Atkins WBID water quality impairment analyses. Atkins (2011) did identify additional water quality “parameters of concern” across all six watersheds, where the existing data did not support an “impaired” determination by FDEP, but did warrant further monitoring and research for trends. The parameters of concern that were identified in the four watersheds found within the HCP Area include: DO (four watersheds); color (four watersheds); fecal coliform bacteria (two watersheds); and total nitrogen (one watershed). In summary, the data provided by the CCWMP (Atkins 2011) provide a robust water quality environmental baseline for the Plan.

4. FLORIDA PANTHER

4.1 NATURAL HISTORY AND OCCURRENCE

4.1.1 Natural History

The Florida panther (*Puma concolor coryi*) occurs throughout wide expanses of South Florida, including the HCP Area, and functions as an apex predator within the regional ecosystem. This large felid, first described over 100 years ago (Cory 1896), has been the subject of intensive research and management efforts since the 1970s (Nowak and McBride 1973; USFWS 1981; Logan et al. 1993; Beier et al. 2003; USFWS 2008a).

Multiple natural history accounts of the Florida panther exist in the scientific literature and agency documents from the past several decades, and much of the basic information in these accounts remains applicable for a general understanding of the species. Due to the evolving science regarding the Florida panther over the past decade, however, the more recent summaries (e.g., USFWS 2008a; USFWS 2009a) and selected peer-reviewed articles are acknowledged by USFWS and the scientific community as providing a more accurate foundation than earlier documents for characterizing Florida panther ecology, especially with regard to habitat selection, movements, fecundity, and population trends.

Species Description

The following description of the Florida panther comes from the Florida Panther Recovery Plan, Third Revision (USFWS 2008) and is the standard description used in recent panther USFWS Biological Opinions:

> An adult Florida panther is unspotted and typically rusty reddish-brown on the back, tawny on the sides, and pale gray underneath. There has never been a melanistic (black) puma documented in North America (Tinsley 1970, 1987). Adult males can reach a length of seven feet (ft) (2.1 meters [m]) from their nose to the tip of their tail and may exceed 161 pounds (lbs) (73 kilograms [kg]) in weight; but, typically adult males average around 116 lbs (52.6 kg) and stand approximately 24-28 inches (in) (60-70 centimeters [cm]) at the shoulder (Roelke 1990). Female panthers are smaller with an average weight of 75 lbs (34 kg) and length of 6 ft (1.8 m) (Roelke 1990). The skull of the Florida panther is unique in that it has a broad, flat, frontal region, and broad, high-arched or upward-expanded nasal bones (Young and Goldman 1946).
>
> Florida panther kittens are gray with dark brown or blackish spots and five bands around the tail. The spots gradually fade as the kittens grow older and are almost unnoticeable by the time they are 6 months old. At this age, their bright blue eyes slowly turn to the light-brown straw color of the adult (Belden 1988). Three external characteristics: a right angle crook at the terminal end of the tail, a whorl of hair or cowlick in the middle of the back, and irregular, white flecking on the head, nape, and shoulders—not found in combination in other subspecies of Puma (Belden 1986), were commonly observed in Florida panthers through the mid-1990s. The kinked tail and cowlicks were considered manifestations of inbreeding (Seal 1994); whereas the white flecking was thought to be a result of scarring from tick bites (Maehr 1992; Wilkins et al. 1997). Four other

abnormalities prevalent in the panther population prior to the mid-1990s were cryptorchidism (one or two undescended testicles), low sperm quality, atrial septal defects (the opening between two atria in the heart fails to close normally during fetal development), and immune deficiencies; and these were suspected to be the result of low genetic variability (Roelke et al. 1993).

A plan for genetic restoration and management of the Florida panther was developed in September 1994 (Seal 1994) and eight non-pregnant adult female Texas panthers (*Puma concolor stanleyana*) were released in five areas of south Florida from March to July 1995. Since this introgression, rates of genetic defects, including crooked tails and cowlicks, have dramatically decreased (Land et al. 2004). In addition, to date, neither atrial septal defects nor cryptorchidism have been found in introgressed panthers (M. Cunningham, personal communication, 2005 as cited in USFWS 2008a, p. 6). As of January 27, 2003, none of the eight female Texas panthers introduced in 1995 remained in the wild.

Distribution

The Florida panther previously ranged throughout the southeastern United States, from Arkansas, Louisiana and southern Tennessee to western South Carolina and the southern tip of Florida (Young and Goldman 1946; USFWS 2008, Figure 1). Currently, the known breeding range of the Florida panther occurs within an estimated 9,189 km^2 (2.27 million acres) in southern Florida, south of the Caloosahatchee River (Kautz et al. 2006; USFWS 2008; USFWS 2009). No Florida panther kittens or breeding have been documented north of the Caloosahatchee River in over 30 years of surveys (USFWS 2008).

The current distribution of the Florida panther in Southwest and South-central Florida is well-documented through the accumulation of over 30 years of very high frequency (VHF) radiotelemetry studies that have provided data on at least 232 individual panthers (FWC 2014). The VHF telemetry dataset (1981-present) was collected from fixed-wing aircraft several days per week, almost exclusively between 0700-1100 hours (See Land et al. 2008; FWC 2014). The radiotelemetry datasets have been augmented with global positioning system (GPS) telemetry data; tracking locations of panther mortalities (collared and uncollared panthers); the deployment of automated trail cameras; and verified field observations. While male panthers have been documented in counties north of the Caloosahatchee River, much of the current known panther distribution occurs in Collier, Hendry, and Lee Counties in Southwest Florida; and Broward, Miami-Dade and Monroe Counties in South-central Florida.

Taxonomy

The most recent 5-year review for the Florida panther (USFWS 2009) provides an extended discussion of Florida panther taxonomy, from the first description of the panther (Cory 1896) through recent molecular genetic studies (Culver et al. 2000; Pimm et al. 2006). The Florida panther was federally-listed as an endangered species (*Felis concolor coryi*) in 1967 under the Endangered Species Preservation Act of 1966 (32 Fed. Reg. 4001 (Mar. 11, 1967)), the predecessor to the Endangered Species Act of 1973 (ESA), and remains listed as endangered under the ESA. 50 CFR §§ 17.11(a), (b), (h). Critical habitat has not been designated for the Florida panther.

A subsequent re-classification of cougars (Wozencraft 1993) moved cougars, including the Florida panther (as well as the Texas cougar), into the single genus *Puma* (species *Puma concolor*) from the genus *Felis.* The currently accepted species name for the panther is therefore *Puma concolor coryi*. Culver et al. (2000) proposed a single subspecies for North American cougars, based on molecular genetic evidence from puma subspecies throughout North, Central, and South America. However, USFWS's 2009 5-year review noted that, "The degree to which the scientific community has accepted the use of genetics in puma taxonomy is not resolved at this time" (USFWS 2009). The Florida panther, therefore, currently remains listed as a separate subspecies of cougar.

Habitat Characteristics and Use

Multiple studies since the 1980s have attempted to characterize and/or quantify the habitats utilized by the Florida panther within its breeding range and peripheral areas (Belden et al. 1988; Maehr and Cox 1995; Comiskey et al. 2002; Cox et al. 2006; Kautz et al. 2006; Land et al. 2008; Onorato et al. 2011). Much of the original habitat-related research – for example, the "vital importance" of upland and wetland forested land cover classes to the Florida panther (Onorato et al. 2011, citing the studies listed above), and the preferential selection of dense saw palmetto thickets for natal denning (Benson et al. 2008) – has been further validated by subsequent studies.

Recent scientific and technical developments have also refined the current understanding of panther-habitat relationships. Beier et al. (2006) published an independent review of the scientific literature related to the Florida panther, which determined that the following four panther-habitat inferences from pre-2002 scientific publications were unreliable: (i) panthers are forest obligates; (ii) panthers need forest patches greater than 500 hectares (ha) in size; (iii) panthers are reluctant to cross non-forested gaps greater than 90 meters wide; and (iv) panther habitat value decreases linearly as a function of distance from the core population area. Each of these erroneous inferences resulted from scientific methodological deficiencies, and these four panther-habitat inferences are therefore no longer considered valid.

The deployment of GPS collars on panthers, beginning in 2002, allowed researchers to document diurnal (daytime) and nocturnal panther locations with greater positional accuracy than VHF telemetry. Beier et al. (2003) summarized what many panther researchers acknowledged as an inherent limitation of this diurnal panther VHF telemetry: that it definitively documented only daytime home range characteristics, and indicated only that forested cover comprises an important daytime panther habitat. Beier et al. (2003) also noted that the diurnal dataset was effective for characterizing general panther occurrence on the landscape, for describing juvenile dispersal events, and for documenting the use of highway underpasses. They recommended that data on nocturnal panther locations be obtained and analyzed to provide a 24-hour characterization of panther habitat utilization.

Land et al. (2008) deployed GPS collars on 12 panthers from 2002-2006. Most of the GPS data acquisitions were scheduled during crepuscular (twilight) and nocturnal hours (1900-0700) when panthers are most active (Land et al. 2008; Onorato et al. 2011). The results of the GPS study confirmed previous habitat selection analyses that indicated upland and wetland forests were preferentially

selected by panthers, relative to the availability of forested habitats within each panther's home range. The results of the GPS study further indicated that all other habitat types were neither selected nor avoided by panthers. However, the authors noted that prairie-grassland habitats did approach statistical significance for selection. The authors concluded that, within the limitations of their study, VHF radiotelemetry and GPS telemetry produced consistent results for characterizing panther habitat selection, generally validating previous studies.

Onorato et al. (2011) deployed GPS collars on 20 panthers between 2005 and 2009, on an equal number of male and female panthers ranging in age from 1.5 to 13.3 years. The study results were consistent with the selection and ranking of native habitats utilized by panthers in Land et al. (2008), but the results also indicated that prairie grassland and marsh-shrub-swamp were selected habitats that met statistical tests for significance, a novel finding. The study authors noted that the landscape context of forest edges and open areas was an important factor, stating, "Our findings thus emphasize not only the importance of forest to panther conservation but also the benefits of heterogeneous habitat matrices and their high proportion of edge." (Onorato et al. 2011, 201)

To summarize the literature on panther habitat selection, VHF and GPS telemetry data demonstrate that panthers select forested habitats throughout the 24-hour period (Kautz et al. 2006; Land et al. 2008; Onorato et al. 2011). Both of the GPS studies reported that agricultural lands were neither selected nor avoided during the day or night. Onorato et al. (2011) found that panthers select marsh-shrub-swamps and prairie grasslands, and also noted in an extended discussion that landscape and edge context along forest patches may determine the relative value of these types of habitats to panthers.

As of June 30, 2014, the VHF telemetry database contained nearly 104,000 records from 232 Florida panthers (FWC 2014). The GPS databases from 2002-2009 contain over 50,000 records (the past five years of GPS panther data collected after 2009 are not yet publicly available). Although certain nuances of panther habitat utilization may require further study, and the five most recent years of GPS data is not yet available to the public, the vast datasets and scientific literature currently provide a robust body of knowledge for panther-habitat relationships.

Predator-Prey Relationships

Beier et al. (2003), in their review of scientific literature, identified two publications that described in detail the foods consumed by the Florida panther, and concluded that both studies were based on solid data. Maehr et al. (1990) described the food habits of panthers in Southwest Florida, based on 38 kill sites and 270 scat samples, and determined that wild hogs (*Sus scrofa*) dominated the panther's diet in terms of frequency and biomass in the northern part of the study area (north of latitude 26°11'N, or the northern boundary of Fakahatchee Strand State Preserve). They found that white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), and nine-banded armadillo (*Dasypus novemcinctus*) were also consumed by panther. In the northern portion of the study area, where the HCP Area is located, Maehr et al. (1990) estimated that deer and hogs accounted for more than 85% of the biomass consumed by panthers. South of that latitude within the study area, deer accounted for the most biomass in the panther diet, with raccoon estimated to be the most frequently consumed prey.

Panther depredation of livestock was not generally reported prior to 2004, and recent increases in the frequency of livestock depredations are generally attributed to an expanding panther population. The latest Florida panther annual report (FWC 2014) reported 37 panther depredation events, with 36 goats, seven calves, four sheep, and other assorted animals killed. Multiple panther depredations of calves have been documented on ranches within the HCP Area. A two-year study (2011-2013) by the University of Florida (funded by USFWS) estimated average calf losses due to panther kills at approximately 3 percent, with results varying between ranches and years.

4.1.2 Status and Regulatory History

In 1967, USFWS listed the Florida panther as an endangered species under the Endangered Species Preservation Act of October 15, 1966. 32 Fed. Reg. 4001 (Mar. 11, 1967). The panther remained on the list of endangered species upon enactment of the ESA and subsequent amendments. *See* 50 CFR §§ 17.1(b); 17.11(h). USFWS published the first recovery plan for the panther in 1981, and revised the plan in 1987. In 2001, USFWS initiated a major revision to the panther recovery plan, which was published in 2008 and remains the current version (USFWS 2008). The plan provides goals and strategies for panther recovery in accordance with 16 U.S.C. § 1533(f).

The 2008 plan revision incorporated much of the Florida panther information and studies available at that time, including a landscape conservation strategy developed by the Multi-species/Ecosystem Recovery Implementation Team (MERIT), portions of which were published in Kautz et al. (2006). The plan defined the “panther zones” (primary, secondary, and dispersal zones) that guide current conservation strategies and regulatory guidance for panther recovery efforts. The primary, secondary, and dispersal zones are depicted on Figure 4-1, and a more localized depiction of the panther zones relative to the HCP Area is provided by Figure 4-2.

The MERIT findings and Kautz et al. (2006) serve as the basis for the USFWS panther habitat assessment methodology used in recent ESA section 7 and section 10 consultations, providing landscape-level assessments and evaluations of panther habitat functional values where Federal actions are proposed. The assessment methodology was developed in 2006, and updated in 2009 with information from Land et al. (2008) (USFWS 2012a). An update to the methodology is currently under development.

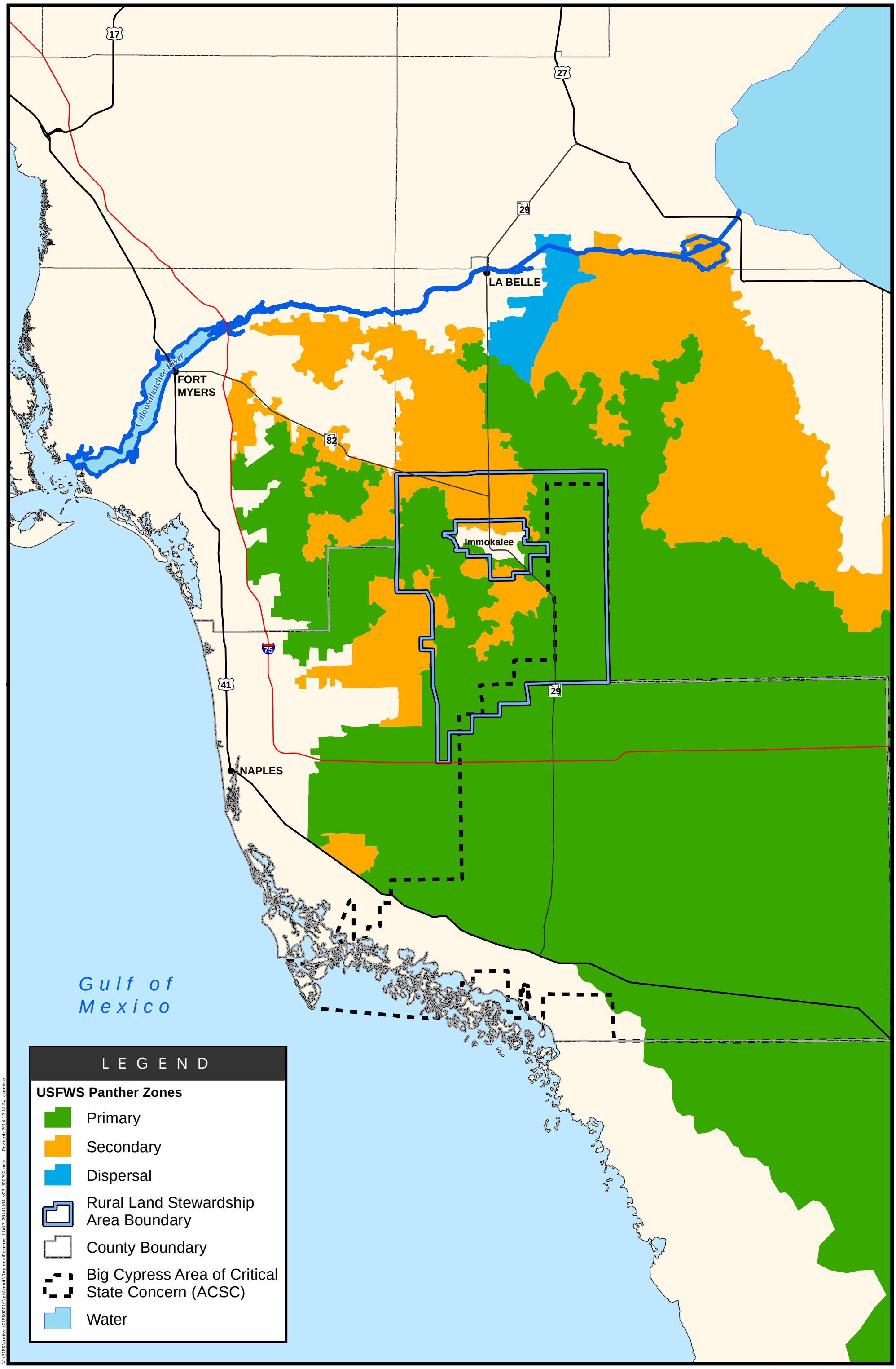

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FIGURE 4-1
Panther Zones - Regional View
December 2014

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N

0 5 10 Miles

Immokalee

29
82
850
846
858
75

LEGEND

Rural Land Stewardship Area Boundary

Big Cypress Area of Critical State Concern (ACSC)

County Boundary

USFWS Panther Zones

Primary

Secondary

0 1 2 Miles

N

V:\12155\active\215500010\gis\mxd\LocalPanther_11x17_20141104_v02_100702.mxd Revised: 2014-12-18 By: cammine

FIGURE 4-2
Panther Zones - HCP Area
December 2014

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4.1.3 Panther Population Trends and Densities

As discussed in section 4.1.4, from the early 1980s through the mid-1990s, the panther population declined to an estimated 20-25 adult cats (McBride et al. 2008), and genetic evidence and physical abnormalities indicated significant problems with inbreeding depression. The recommendation to restore genetic diversity through introgression with eight Texas cougars was highly controversial, but was approved as a revision to the 1987 recovery plan, and eight female cougars were released into the panther breeding range (USFWS 2008; Hostetler et al. 2013).

Hostetler et al. (2013) estimated that, without the genetic restoration (interbreeding Texas cougars with Florida panthers), the panther population was expected to decline at an approximate rate of 5% per year after 1995. By contrast, with the release of female Texas cougars into the Florida panther population, the authors reported that a population viability analysis (PVA) suggested a panther population increase of 3-4% per year in the post-1995 period, which is consistent with minimum count data for panthers across that timeframe (McBride and Sensor 2013).

The most recent 5-year review conducted in 2009 (USFWS 2009) reported annual minimum panther counts (adults and sub-adults, no kittens) of 62, 78, 80, and 87 from 2000-2003. Over the time period 2004-2008, minimum panther counts were 78, 82, 97, 117, and 104. The most recent available minimum panther count report (McBride and Sensor 2013) reported 104 adult and sub-adult panthers for the period January 1, 2012 through December 31, 2012. These increases in the minimum population numbers were accompanied by increases in panther-vehicle mortalities (see section 4.1.4 and Figure 4-4).

In 2010, FWC extrapolated minimum count data to estimate a panther population range of 100-160 adults and sub-adults. This estimation does not include adult panthers north of the Caloosahatchee River, or kittens. Based upon the 2012 minimum count data, this estimated population range was revised upward to 100-180 panthers in 2014 (FWC June 18, 2014). FWC is currently performing research to develop statistically sound estimates of the panther population size using mark/recapture modeling, camera surveys, and roadkill data.

Density estimates for the Florida panther population traditionally ranged from one panther per 27,181 acres to one panther per 31,923 acres. A more recent study from the Picayune Strand State Preserve provided panther density estimates of 1.5 individuals per 100 km^2 (Sollmann et al. 2013), which equates to one panther per 16,474 acres. This recent study was notable because the density was estimated with a high degree of statistical precision, whereas previous studies lacked confidence intervals. The study also validated the combined use of telemetry and camera trapping to model density estimates. Nonetheless, the panther habitat assessment methodology (USFWS 2012) is currently based on a conservative density estimate of one panther per 31,923 acres (Kautz et al. 2006).

4.1.4 Reasons for Decline and Ongoing Threats

The South Florida Multi-Species Recovery Plan (USFWS 1999) extensively documents the reasons attributed to the decline of the Florida panther, from its original estimated range to its numbers and

distribution in the late-1990s. The range-wide decline of the panther was caused by a combination of activities that occurred beginning in the 1800s through the mid-1900s, including widespread active persecution (hunting) of panthers; land clearing for agriculture; extensive lumbering operations; and a major reduction in the white-tailed deer population (Maehr 1997; USFWS 1999). As noted previously, by the 1980s, only an estimated 20-25 adult panthers remained in South Florida (McBride et al. 2008).

Pursuant to ESA section 4(c)(1), the Service undertook a 5-year review for the panther to determine whether the panther should be removed from the endangered list or be changed in status from endangered to threatened. During its review, the Service considered threats to the species, conservation measures, and regulatory mechanisms. The review concluded in 2009 that "Habitat loss, fragmentation, and degradation and associated human disturbance are the greatest threats to panther survival and recovery," (USFWS 2009, 12). FWS cited multiple estimates of the scale and rate of land use conversions in South Florida (Cox et al. 1994; Kautz et al. 2006). It also found that a lack of land use planning (not simply land use conversions) was a contributing factor.

The 5-year review described the role of highways in the loss and fragmentation of habitat, as barriers to movement and as a significant source of panther mortalities. The review also stated that, "The addition of wildlife crossings and fencing has ameliorated this threat in the immediate vicinity of these structures. The addition of more wildlife crossings, especially in areas with a history of collisions and where traffic is projected to increase, can help address this significant threat." (USFWS 2009, 14-15).

Figure 4-3 depicts the locations of panther-vehicle collisions from 1972 through October 2014 (FWC 2014), along with the locations of wildlife crossings. Since the publication of the Smith et al. (2006) wildlife movement study for eastern Collier County, four wildlife crossings have been constructed within the HCP Area, two of which were located where panther mortalities had previously occurred (CR-846 east of Immokalee, and CR-846 at Camp Keais Strand, south of Lake Trafford).

Panther mortalities resulting from panther-vehicle collisions have increased as a function of panther population increases, as well as increased vehicular traffic within the panther's range (Smith et al. 2006; USFWS 2008; McBride and Sensor 2013). Figure 4-4 (from McBride and Sensor 2013) depicts data trends for annual panther counts and highway mortalities from 1981 through 2013. Prior to the 1995 genetic restoration program, trends were flat for the annual panther count and highway mortalities. Since that time, annual panther counts and highway mortalities have been strongly correlated (McBride and Sensor 2013). As described in section 4.3.1.1, although the Plan does not cover existing roadways or roadways that may be built in the future that are not internal to the Covered Activities, the Plan will provide a source of funding and land preservation for the construction of additional wildlife crossings and fencing.

Regarding the potential overutilization of the Florida panther for commercial, recreational, scientific, or educational purposes, the 5-year review found no threat to panthers. Diseases and parasites have been

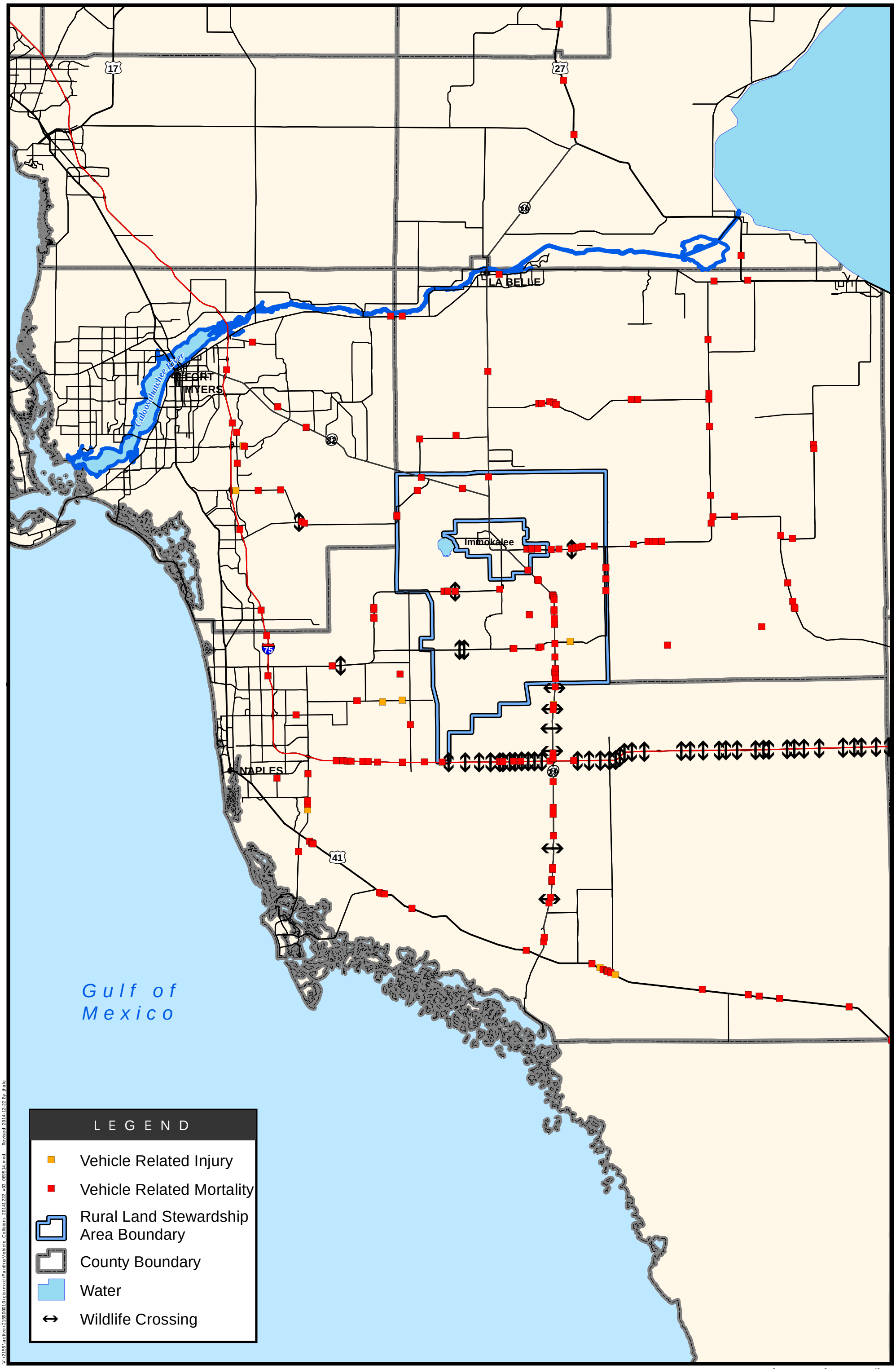

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FIGURE 4-3
Panther-Vehicle Collisions, 1972-2014
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N

0 5 10 Miles

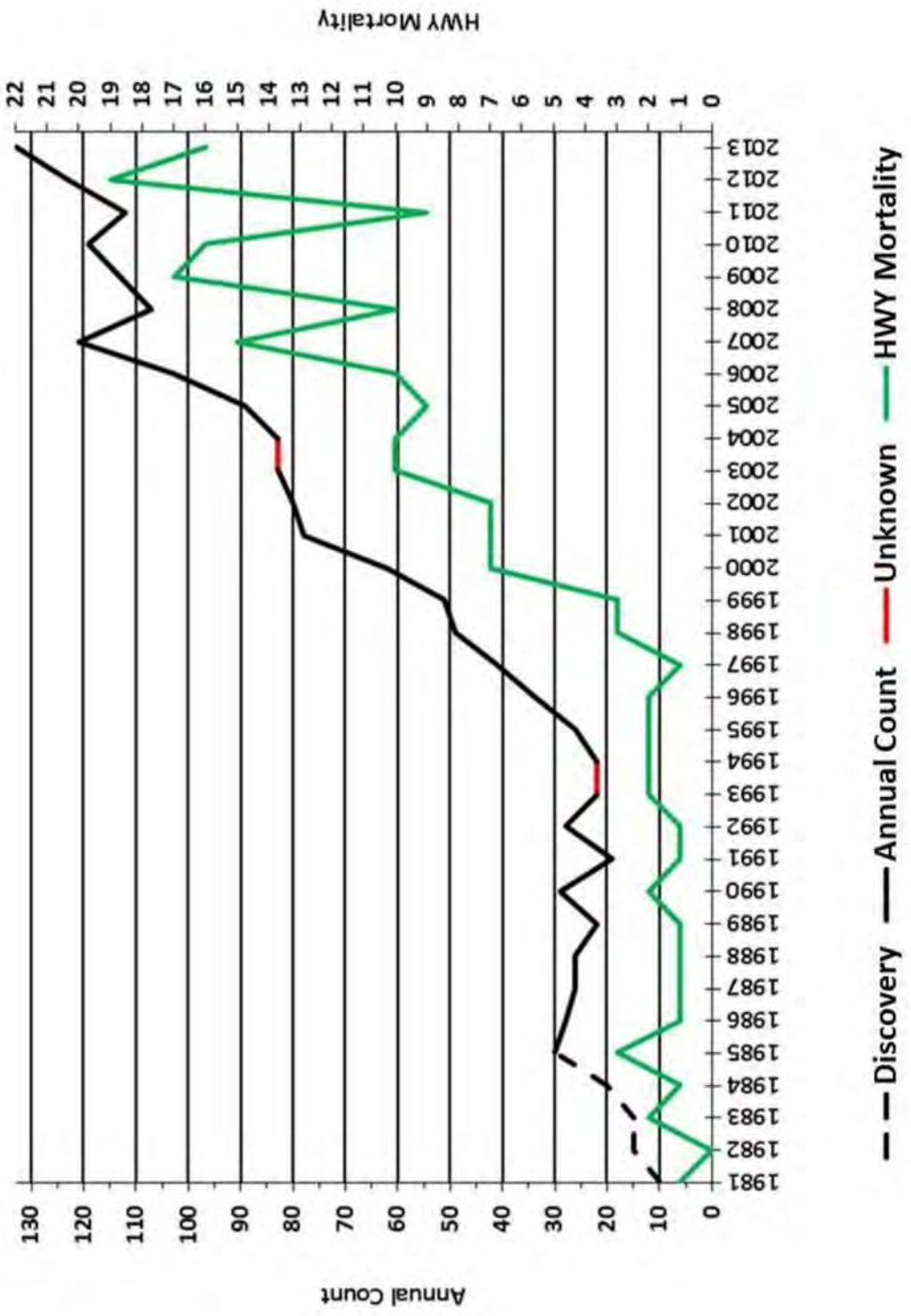

Figure 4-4: Annual Panther Count, 1985-2013, and Highway Mortalities (figure from McBride and Sensor 2013).

documented in the panther population, but have not been documented as a major mortality factor. As an isolated breeding population, pathogens such as Feline Leukemia Virus remain a threat, particularly until another breeding population is established elsewhere within the historic panther's range (USFWS 2009).

The 5-year review does not definitively state whether existing regulatory mechanisms are adequate for panther conservation. The review noted that while habitat losses and conversions have occurred due to permitted activities, approximately 40,000 acres (161 km^2) of conservation lands within the primary, secondary, and dispersal zones had been dedicated as conservation lands for panther. The current panther habitat assessment methodology (USFWS 2012) notes that the premise for using a base compensation ratio of 2.5 acres of conservation habitat for every 1 acre of habitat impacts (see section 4.2.3) is very conservative, relative to a calculated panther population density within the panther zones south of the Caloosahatchee River (Kautz et al. 2006). New panther population estimates (FWC June 18, 2014) and statistically rigorous density estimates (Sollmann et al. 2013) underscore the conservative nature of the methodology assumptions.

Panther-vehicle collisions and intraspecific aggression are the leading causes of panther mortalities (USFWS 2009; FWC 2014, Appendix IV). Loss of genetic diversity was also cited as a threat to the panther population, but the 1995 genetic restoration program substantially contributed to the genetic health and observed increases in the Florida panther population (Pimm et al. 2006; Hostetler et al. 2013).

4.1.5 Occurrence in the HCP Area

Figures 4-5 and 4-6 depict VHF radiotelemetry data for 231 panthers from 1981-2014, defining a pattern of panther occurrence within and around the HCP Area. These figures depict the RLSA boundary instead of the more detailed HCP Area boundaries, to allow easier visualization of the data points in relation to the aerial imagery. Each dot on the figures represents a single panther location acquired from VHF telemetry on a specific date, and the figures do not include telemetry recorded in ENP or other areas east or north of the figure view extent. Figure 4-5 depicts a regional view of the data, and a more localized depiction of the data relative to the HCP Area is provided by Figure 4-6. As noted in Beier et al. (2003), the VHF radiotelemetry defines the locations of panthers between 0700-1100 hours, as observed from a fixed-wing aircraft generally sampling 2-3 times per week. The panther data presented in these figures include only collared panthers, which represent only a portion of the population (41 panthers were collared as of June 30, 2014; FWC 2014).

Figures 4-7 and 4-8 depict the locations of panthers fitted with GPS collars, which are able to acquire (fix) panther locations throughout a 24-hour period as determined by a customized programming schedule (Land et al. 2008; Onorato et al. 2011). The GPS data were collected from 20 panthers collared between 2005 and 2009, primarily within Collier and Hendry Counties, so the GPS data do not represent as extensive a data set as the VHF radiotelemetry data depicted in Figure 4-5 (most apparent in BCNP and FSSP). Each dot on the figures represents a single panther location acquired from GPS telemetry on

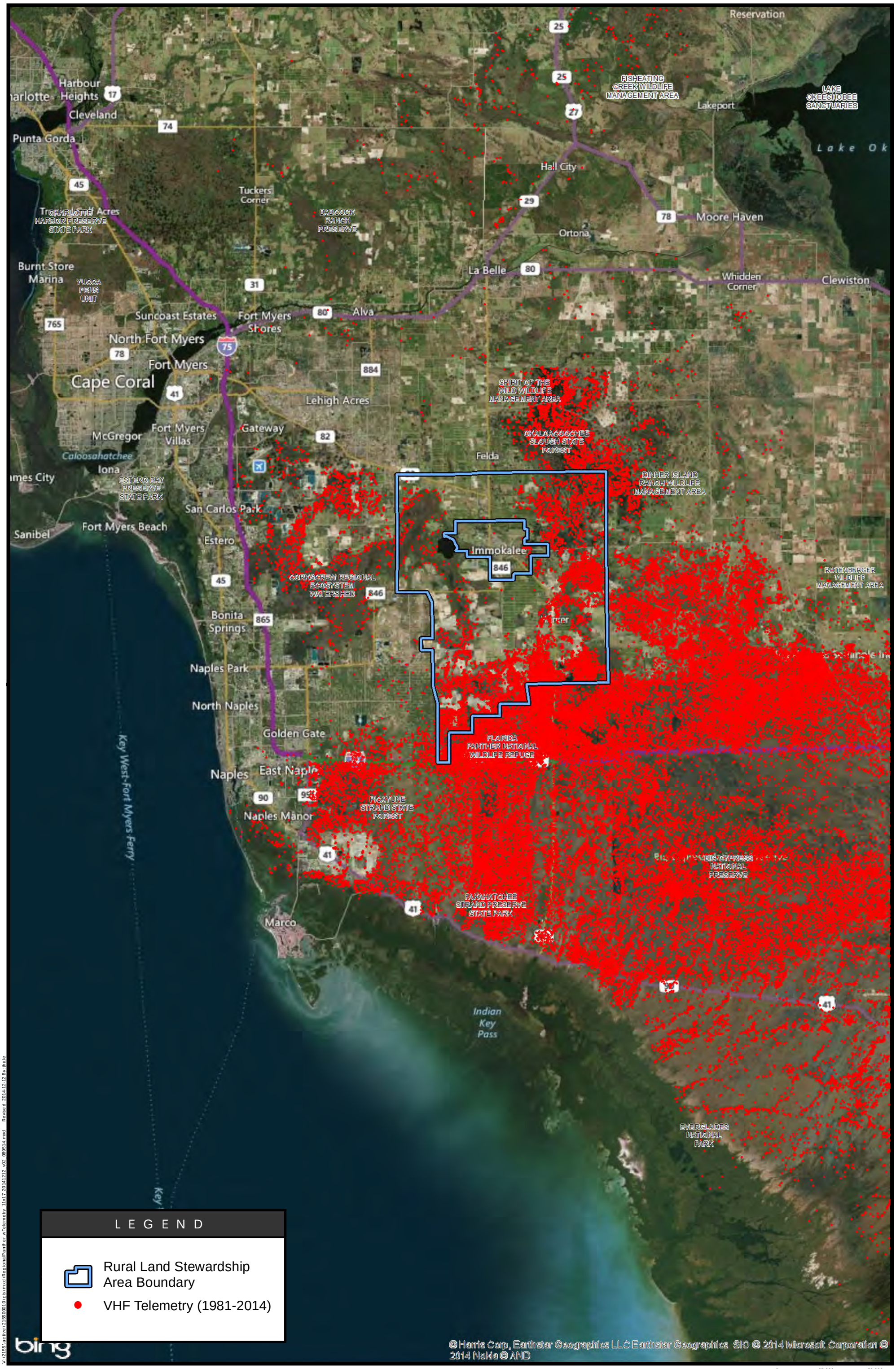

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FIGURE 4-5

Panther Radio Telemetry Data - Regional View

November 2014

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fax 239.649.5716

N

0 25,000 50,000 Feet

Church Rd
Felda
S SR-29
82
830
850
Faith Landing
Arrowhead
Lake Trafford
Immokalee
S 1st St
Collier Village
846
29
Immokalee Rd
Everglades Blvd N
Oil Well Grade Rd
Camp Keais Rd
Harker
Oil Well Rd
858
Everglades Blvd S
Desoto Blvd S
Big Bear Plaza
50th Ave SE
Miller Blvd
64th Ave SE
Basil Rd
Rock Island

LEGEND

Rural Land Stewardship Area Boundary

VHF Telemetry (1981-2014)

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FIGURE 4-6

Panther Radio Telemetry Data - HCP Area

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N

0 1 2 Miles

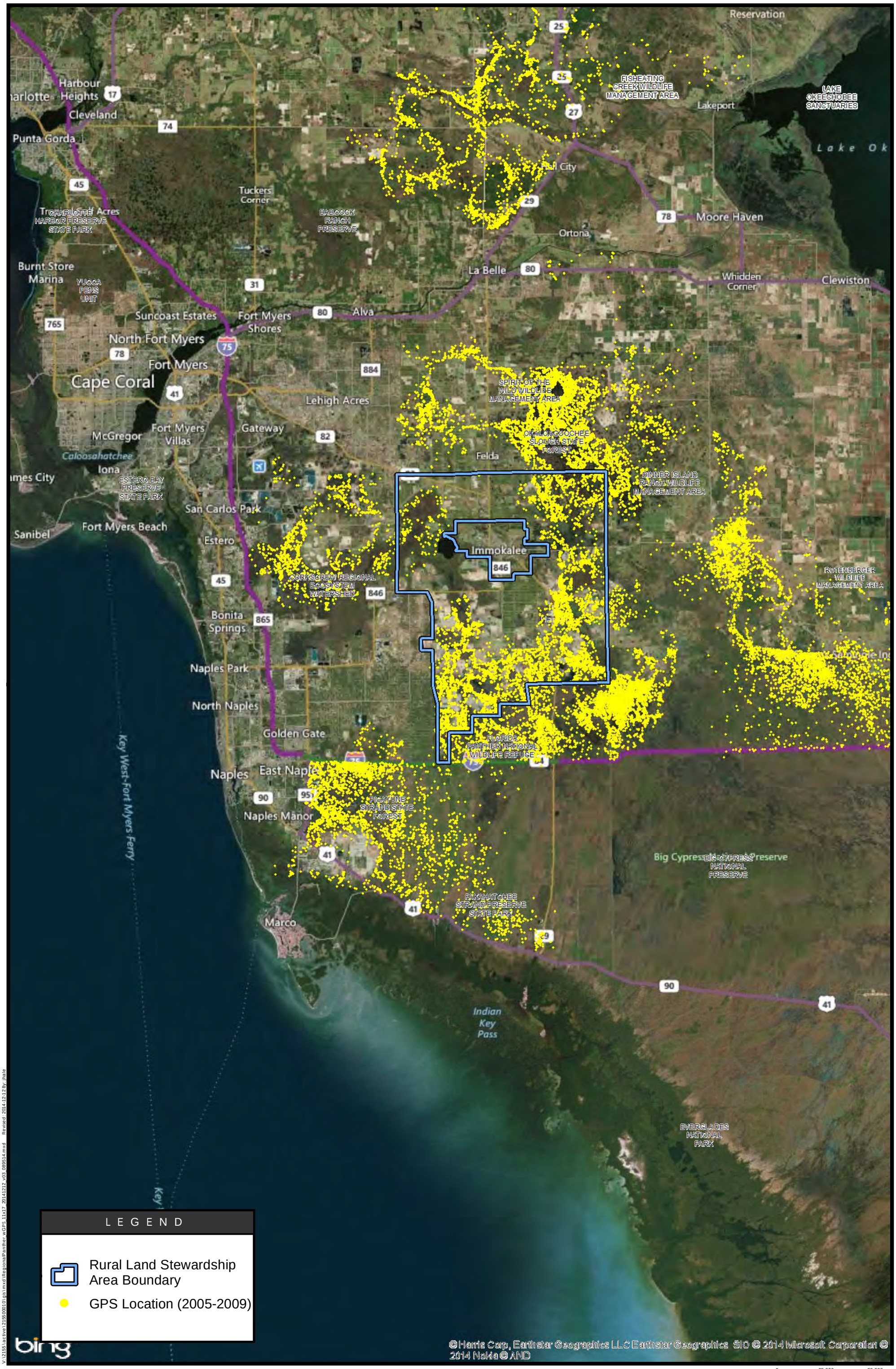

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FIGURE 4-7

Panther GPS Data - Regional View

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N

0 25,000 50,000 Feet

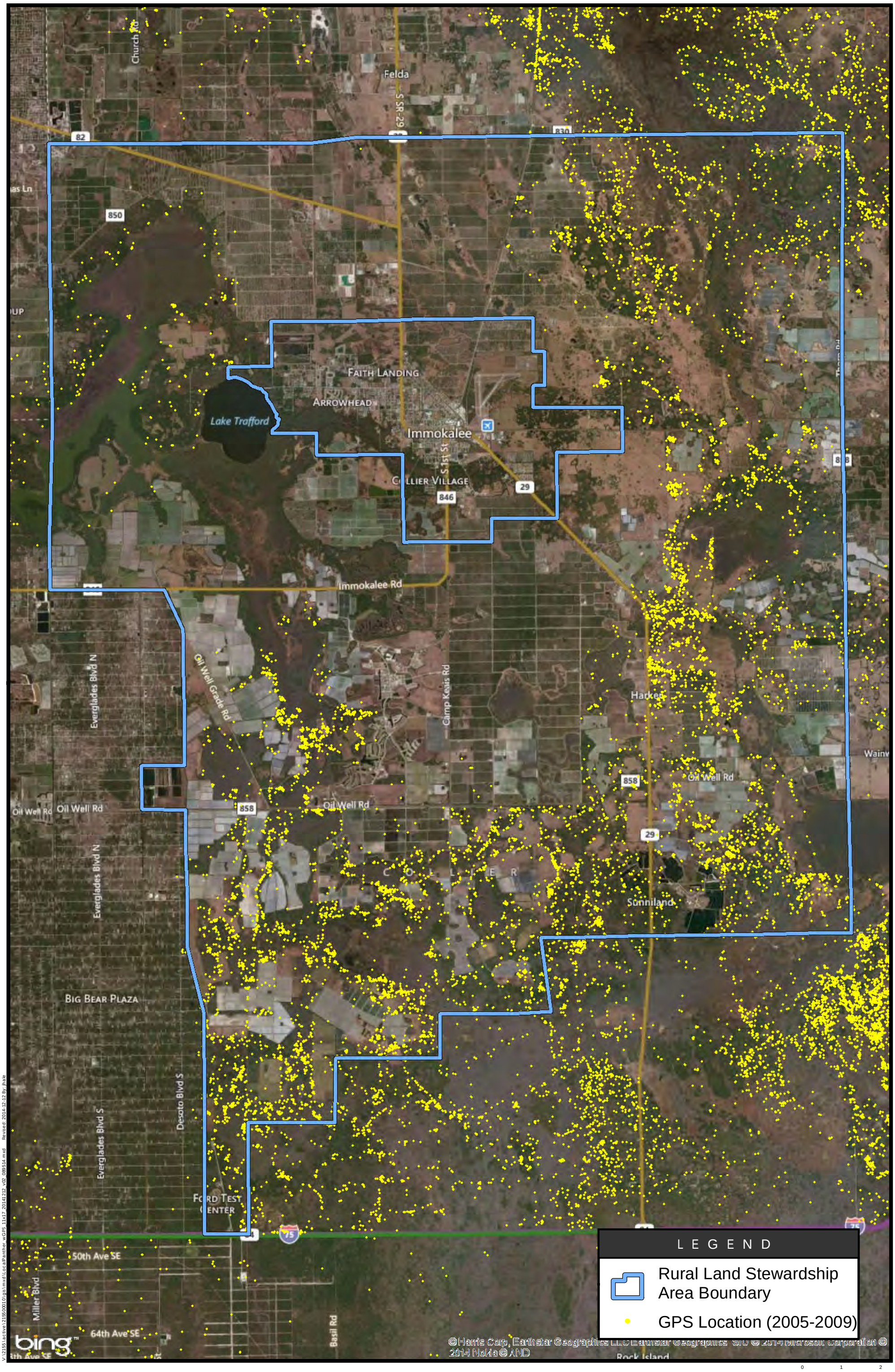

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FIGURE 4-8

Panther GPS Data - HCP Area

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a specific date, and the figures do not include telemetry recorded 65 miles southeast of the RLSA in ENP or other areas east or north of the figure view extent. Once again, Figure 4-7 depicts a regional view of the data, and a more localized depiction of the data relative to the HCP Area is provided by Figure 4-8. A visual comparison of Figure 4-6 and Figure 4-8 reveal a similar general pattern of panther occurrence and habitat utilization throughout eastern Collier County, despite the fact that the data were collected across different years and at different times of day. The sheer amount of available occurrence data provides a sound basis in support of the various Plan elements, including the location for preservation of extensive habitat areas and landscape linkages, determining the general locations for restoring panther corridors, and determining locations for wildlife crossings.

4.2 POTENTIAL BIOLOGICAL IMPACTS/TAKE ASSESSMENT

4.2.1 Impacts on the Florida Panther

4.2.1.1 Covered Activities

As described in Chapter 2 (Plan Description and Activities Covered by Permit), the Covered Activities include residential/commercial development and earth mining activities that may occur within the 49,848-acre area depicted on Figure 2-1 as "Covered Activities." The Plan limits the total area of Covered Activities at Plan completion to 45,000 acres

The sections below address potential impacts to the Florida panther that may occur while carrying out otherwise lawful activities (the Covered Activities) within the HCP Area. The descriptions of potential impacts below are supplemented by a detailed panther habitat assessment (PHU analysis) as presented in section 4.2.2.

4.2.1.1.1 Residential/Commercial Development

Potential Direct Impacts to Panther

Figure 2-1 depicts the 49,848-acre area where Covered Activities, including residential/commercial development activities, may occur, subject to the overall 45,000-acre cap. The Plan places more restrictions on development in the HCP Area than exist under the Collier County RLSP. The RLSP defined approximately 70,892 acres primarily consisting of previously-converted agricultural areas within the HCP Area as "Open" land use overlays, which are generally open to future development. Approximately 13,495 acres of these "Open" lands under the RLSP exist within the Big Cypress Area of Critical State Concern (ACSC), which is located generally east of State Route 29 (SR-29) and north of the FPNWR within the HCP Area (Figure 4-2). The remaining 57,398 "Open" acres occur within the HCP Area west and north of the ACSC. When the applicants initiated the planning process for this HCP, they could have proposed residential/commercial development activities on previously converted lands throughout these 70,892 acres of "Open" areas. Accordingly, the Plan reflects a significant reduction in areas open to further development, and comprehensive landscape-level planning designed to benefit the panther and other species and resources.

Figure 4-5 depicts the distribution of VHF telemetry for Florida panther locations within Southwest Florida, and Figure 4-6 depicts the same VHF data for the HCP Area. Likewise, GPS telemetry data points indicating Florida panther locations within Southwest Florida are depicted on Figure 4-7, and Figure 4-8 depicts the same GPS data for the HCP Area. The areas most consistently utilized by panthers within the HCP Area largely correspond to lands within the ACSC, primarily along the Okaloacoochee Slough and within the southern portion adjacent to the FPNWR. Out of the 70,892 acres of "Open" lands potentially available for development, the Plan (Figure 2-1) generally directs the Covered Activities away from these areas. The vast majority of areas consistently used by panthers are included within the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use (Chapter 2; Figure 2-1).

Other areas of consistent panther utilization within the HCP Area include portions of Camp Keais Strand, peripheral areas around Corkscrew Marsh, and some of the larger agricultural stormwater retention areas. Many of these areas are also included within the approximately 107,000 acres designated for Preservation/Plan-Wide Activities and Very Low Density Use, and project-level planning can avoid, minimize, and mitigate impacts to panther habitat along the borders between the Covered Activities land designation areas and areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

The 49,848-acre envelope of land designated for up to 45,000 acres of potential Covered Activities (including residential/commercial development) contains an estimated 40,369 acres (Table 3-1) that are currently in active use for intensive agricultural production (row crops, citrus groves, sod farms, excluding pastures). Another 995 acres within this envelope of land designated for Covered Activities (Table 3-1) classify into the "Other" land cover class used by Onorato et al. (2011). Land et al. (2008) and Onorato et al. (2011) statistically characterized these agricultural and "Other" land cover classes as neither selected nor avoided by panthers throughout the diel (24-hour) period, based upon telemetry data and habitat availability within each panther's home range, consistent with the telemetry patterns depicted in Figures 4-6 and 4-8. Agricultural lands (excluding pastures) and "Other" land cover classes therefore comprise an estimated 41,364 acres out of the 49,848-acre envelope designated for Covered Activities (83 percent). This is potentially up to 92 percent of the 45,000-acre limit for Covered Activities at Plan completion.

The potential direct impacts to land cover classes typically selected by the panther (permanent habitat loss) within the area designated for Covered Activities can be bracketed by adding the acreages of various land cover classes as shown in Table 3-1 under the "Covered Activities" column. As a first approximation, assuming that a minimum area of native habitats within these extensive agricultural areas were directly impacted, only 481 acres of native habitats would be impacted, comprising 1% of the 45,000-acre area at Plan completion. By contrast, if all native habitats within the area designated for Covered Activities were directly impacted, 5,166 acres of native habitats would be directly impacted. Indeed, only 10% of the area designated for Covered Activities consists of native habitats (5,166 acres/49,848 acres). Based on the interest of the applicants in avoiding native habitat and thereby limiting the allocation of mitigation credits required under the Plan for any particular activity, as well as other planning considerations and an overall interest in conserving and protecting resources, impacts to native habitat are likely to be much closer to the low end of this range.

An estimated 3,195 acres of pasture occur within the Covered Activities land designation (Table 3-1). Onorato et al. (2011) concluded that pastures (included in the prairie-grassland land cover class) were selected by panthers, along with native land cover classes. Therefore, even in the highly unlikely event that all native habitats and pasture areas combined within the 49,848-acre Covered Activities land designation were directly impacted, the impacts would account for only 19% of the 45,000-acre area at Plan completion. Moreover, the native habitat acreage total includes an estimated 2,697 acres of native wetlands, for which Federal and State permitting agencies would require avoidance, minimization, and mitigation. Similarly, a significant proportion of pasture areas in the HCP Area are likely to be jurisdictional wetlands, subject to the same avoidance and minimization. Proposed impacts to native habitat generally require more mitigation than impacts to other land types, meaning surrender of more panther habitat units ("PHUs") (see section 4.2.2). Therefore, regulatory constraints and economic incentives will tend to discourage impacts to native habitat and encourage directing impacts toward areas already cleared or otherwise impacted by agriculture or other activities.

The USFWS panther habitat assessment methodology (USFWS 2012) considers not only direct impacts within the project footprint, but also areas of native habitats that become effectively inaccessible to panthers and their prey base in the post-development state (see section 4.2.2). The land cover type and extent of these types of impacts will depend on the final location of the 45,000 acres of Covered Activities within the 49,848-acre land designation (Figure 2-1), as well as project-level master planning and impact minimization strategies. As outlined in section 4.2.2, the effect of these "other" assumed impacts (permanent habitat losses) are effectively compensated for by the fact that the surplus 4,848 acres of Covered Activities lands that are not impacted at Plan completion (49,848 – 45,000 = 4,848) will be re-designated as Preservation/Plan-Wide Activities that will provide panther habitat in perpetuity.

Potential direct impacts to panthers and their prey base due to habitat fragmentation are largely avoided by the spatial configuration of the Covered Activities land designation. Depending upon the final configuration of the 45,000 acres at Plan completion, which will be the subject of project-level master planning, most panther habitat fragmentation can be avoided and/or minimized. In fact, a key feature and benefit of the Plan is the preservation of extensive interconnected panther habitats, which is the result of the cooperative efforts of 10 private property owners (permittees) under the Plan. The ability to preserve extensive interconnected areas of panther habitat is not normally achievable with standard development project planning. The preservation of these private lands has been a long-sought goal for panther conservation (Belden et al. 1988; Maehr 1990; Logan et al. 1993; Main et al. 1999; USFWS 2008; Beier 2010). Preserving interconnected private lands that comprise most of the Okaloacoochee Slough is a particularly important panther conservation achievement, because this landscape linkage connects the panther core population area south and east of the HCP Area (Maehr 1997; USFWS 2002a) to the panther dispersal zone (Kautz et al. 2006; USFWS 2008). The Plan also reserves areas for the restoration of local panther corridors to aid in the safe passage of panthers across the landscape as shown conceptually in Figure 4-9.

Potential Indirect Impacts to Panther

Indirect impacts to panthers from residential/commercial development activities include, for example, reduction in the utilization of habitats adjacent to those development areas by panthers and/or panther prey base.

By largely directing development away from the Okaloacoochee Slough and areas adjacent to the FPNWR, and by preserving extensive areas of interconnected panther habitats (Figure 2-1), the Plan reduces the likelihood of these sorts of indirect impacts. Moreover, developments will be planned in a manner that will minimize light and noise from human activities and direct them away from preserve areas, especially at night when panthers are most active (see section 4.4.1.2).

4.2.1.1.2 Earth Mining

Earth mining operations are Covered Activities under the Plan, and they therefore count toward the 45,000-acre limit. The nature and economics of earth mining are such that earth mining can be a precursor to residential/commercial development, and mining operations are sometimes planned with that end use in mind.

The direct impacts from earth mining activities (habitat losses and/or fragmentation) are the same as those addressed as direct habitat impacts in section 4.2.1.1.1 above. The total direct impacts from the Covered Activities are limited to 45,000 acres, regardless of the final proportion of earth mining to overall Covered Activities at Plan completion.

The indirect impacts to panthers from earth mining activities include the reduction in the utilization of habitats adjacent to development areas by panthers and/or panther prey base in response to noise, light and other disturbances potentially felt outside the mine area.

These potential indirect impacts will be minimized by generally limiting mine activities to daylight hours. Moreover, once an earth mine is reclaimed and decommissioned, any potential indirect impacts due to noise and human activity would cease, unless the mine is later transitioned into residential/commercial development.

Spirit of the Wild Wildlife Management Area

Okaloacoochee Slough State Forest

Corkscrew Regional Ecosystem Watershed

Florida Panther National Wildlife Refuge

Big Cypress National Preserve

Fakahatchee Strand State Preserve

LEGEND

- Southwest Hendry County Sector Plan Natural Resources District
- Rodina Long-Term Agriculture and Natural Resource Areas
- Twelvemile Slough
- HCP Area
- Preservation/ Plan-Wide Activities
- Covered Activities
- Very Low Density Use (≤ 1DU : 50 Acres)
- Base Zoning (1DU : 5 Acres)
- Rural Land Stewardship Area Boundary
- Proposed Panther Corridor
- Existing Conservation Land
- County and State Roads (not covered in Plan)

V:\2155\active\215500010\gis\mxd\HCP_PantherCorridors_11x17_20141104_v01_088514.mxd Revised: 2015-04-21 By: camrine

FIGURE 4-9
HCP Panther Corridor Locations
December 2014

Stantec Consulting Services Inc.
3200 Bailey Ln. Ste. 200
Naples, FL 34105
tel 239.649.4040
fax 239.649.5716

N

0 1 2 Miles

4.2.2 Panther Habitat Assessment

The Plan proposes to designate approximately 107,000 acres for Preservation/Plan-Wide Activities and Very Low Density Use, most of which will consist of large interconnected areas of native habitats and agricultural lands that serve as habitat for the Florida panther and the panther's prey base. These areas will not only provide habitat support for panthers, but will also preserve two existing regional wildlife corridors that allow for regional panther movements and dispersal: the Okaloacoochee Slough and Camp Keais Strand.

The Plan also provides for up to 45,000 acres of Covered Activities. Implementation of Covered Activities will require mitigation to account for potential impacts to panther habitat through the use of PHUs, discussed below. This section details the results of analyses conducted using the USFWS Panther Habitat Assessment Methodology (USFWS 2012) to evaluate the overall effects of the Plan in terms of mitigation and potential panther habitat impacts, on the basis of land cover acreage and panther habitat functional value.

The purpose of these analyses was to determine whether, as configured (Figure 2-1), the Plan provides sufficient habitat conservation (mitigation) to offset the potential for panther habitat impacts for up to 45,000 acres of Covered Activities. Typically, the Panther Habitat Assessment Methodology is applied at the project-level scale after a master site plan has been designed, when project boundaries have already been set, and land cover and exotic vegetation are mapped at project-level scales. Applying the analyses to the Plan requires accounting for the fact that the Plan allows for up to 45,000 acres of Covered Activities to occur within a pre-defined 49,848-acre area (see Chapter 2 and Figure 2-1). Therefore the exact locations of the 45,000 or fewer acres where Covered Activities will occur are constrained by the fact that the 49,848-acre envelope for Covered Activities is only 10% larger than the total area of Covered Activities that may occur under the Plan. Likewise, locations of the 4,848 acres of land within that same 49,848-acre envelope that will be preserved (49,848 - 45,000 = 4,848 acres), representing approximately 3% of the total HCP Area, are not determined at this time. Those 4,848 acres will become part of the lands designated for Preservation/Plan-Wide Activities. To conservatively account for this flexibility in the final precise location of Covered Activities, two scenarios representing conservative analytical approaches were incorporated, each of which assumed the maximum potential impact to panther habitat in terms of (i) USFWS panther habitat suitability values; and (ii) primary zone impacts versus secondary zone impacts. The use of these conservative approaches in the analyses was intended to ensure that sufficient habitat conservation will be provided for the Florida panther under the Plan, even under highly unlikely scenarios based on maximum potential habitat impacts. The methodology for each approach, and the results of the analyses, are presented in the following sections.

4.2.2.1 Analyses Used To Estimate Impacts

4.2.2.1.1 Scenario Assuming Highest Habitat Values Impacted

The USFWS methodology assigns a habitat suitability value, or functional value, for various land cover types that occur within the Florida panther's range (USFWS 2012, Table PM2). These habitat suitability values were derived from three peer-reviewed studies that examined panther-habitat relationships

using a total of six statistical rankings (Cox et al. 2006; Kautz 2006; Land et al. 2008; USFWS 2012, 4). USFWS averaged the rankings of the habitat suitability values from the six statistical rankings, and the results ranged from a value of 9.5 (most selected by panthers) to 0 (least selected) on a 0-10 scale.

For the analyses presented in this section, each land cover type within the HCP Area was assigned a habitat suitability value in a Geographic Information System (GIS), according to the USFWS methodology. These values were used to calculate PHUs. To determine the number of PHUs in the area where Covered Activities will occur, the habitat suitability value of each land cover type was multiplied by the number of acres of impacts to that land cover type. For this analysis, the land cover data within the Covered Activities land designation (Figure 2-1) was sorted in the database from highest habitat suitability value (9.5, pine forest) to lowest (0, water or urban). The land cover types were then assumed to be impacted sequentially from highest habitat suitability value to lowest, until the acreage limit for Covered Activities was reached.

The town of Ave Maria (5,027 acres) was previously assessed in terms of potential impacts and mitigation during Federal permitting (USFWS 2005) and was therefore removed from the PHU calculations. Ave Maria's 5,027 acres still contribute to the 45,000-acre cap for Covered Activities under the Plan, however. Removing Ave Maria from the analysis resulted in a total acreage of 39,973 acres for this PHU analysis (45,000 – 5,027 = 39,973 acres). Therefore, the 39,973 acres of highest habitat value acreage was used as the basis for PHU calculations.

The results of the PHU calculations for this scenario are presented in Table 4-1, broken down by primary versus secondary panther zone. (The concept of acres of land in the primary zone being impacted first is addressed in the next section and is not considered in this section.) This scenario resulted in 22,045.7 acres of primary zone impacts (which, when multiplied by the habitat values assigned to each land cover type within those lands per Table 4-1, equals 126,615.9 PHUs), and 17,927.3 acres of secondary zone impacts (which, when multiplied by the habitat values assigned to each land cover type within those lands per Table 4-1, equals 89,896.9 PHUs), for a total of 39,973 acres and 216,512.8 PHUs. These calculations are reflected in Tables 4-1 and 4-2, which depict the total mitigation in terms of PHUs required to offset potential impacts to panther habitat for Covered Activities under the Plan.

Table 4-1. Florida Panther Habitat Matrix for Covered Activities, Assuming Highest Habitat Suitability Values Impacted First

		Primary Zone Covered Activities 22,045.7 acres[1]				Secondary Zone Covered Activities 17,927.3 acres[1]			
		Current		w/ Covered Activities		Current		w/ Covered Activities	
Land Cover Type	**Score**	**Acres**	**PHUs**	**Acres**	**PHUs**	**Acres**	**PHUs**	**Acres**	**PHUs**
Pine Forest	9.5	1571.0	14924.2	0.0	0.0	441.2	4190.9	0.0	0.0
Hardwood-Pine	9.3	712.0	6621.6	0.0	0.0	116.3	1081.2	0.0	0.0
Cypress Swamp	9.2	1989.0	18299.2	0.0	0.0	90.4	831.3	0.0	0.0
Hardwood Swamp	9.2	7.6	69.7	0.0	0.0	52.2	480.5	0.0	0.0
Upland Hardwood Forest	9.0	30.0	270.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Prairie	6.3	40.2	253.4	0.0	0.0	7.0	43.8	0.0	0.0
Unimproved Pasture	5.7	445.4	2539.0	0.0	0.0	277.6	1582.5	0.0	0.0
Shrub Swamp/Brush	5.5	825.7	4541.6	0.0	0.0	960.6	5283.5	0.0	0.0
Improved Pasture	5.2	1584.3	8238.4	0.0	0.0	680.6	3539.2	0.0	0.0
Cropland	4.8	11089.5	53229.6	0.0	0.0	5594.7	26854.7	0.0	0.0
Marsh/Wet Prairie	4.7	904.7	4252.0	0.0	0.0	1451.6	6822.5	0.0	0.0
Orchards/Groves	4.7	2846.2	13377.1	0.0	0.0	8255.2	39186.7	0.0	0.0
Exotic /Nuisance Plants	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barren/Disturbed Lands	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Urban	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	**22,045.7**	**126,615.9**	**0.0**	**0.0**	**17,927.3**	**89,896.9**	**0.0**	**0.0**

[1] The acreage subtotals above for Covered Activities within the Primary and Secodary Zones produce a combined acreage total of 39,973.0 acres. When combined with the existing acreage at Ave Maria (5,027 acres), the total acreage of the Covered Activities will equal 45,000 acres.

Table 4-2. Panther Habitat Unit (PHU) Calculations for Covered Activities, by Highest Habitat Values

Zone	Acres[1]	PHUs[2]	Base Ratio	Landscape Multiplier	USFWS (2012) Mitigation Required	FPPP Primary Zone Factor[3]	FPPP Mitigation Required
Primary	22,045.7	126,615.9	2.5	1	316,539.8	1.25	395,674.7
Secondary	4,031.5	20,216.1	2.5	1	50,540.3	N/A	50,540.3
	13,895.8	69,680.8	2.5	0.69	120,199.4	N/A	120,199.4
TOTALS	**39,973.0**				**487,279.4**	**-**	**566,414.3**

[1] Secondary Zone impacts were sub-divided to balance the 4,031.5 acres (20,216.1 PHUs) from Covered Activities impacts with the 4,031.5 acres of Secondary Zone compensation within the Preservation/Plan-Wide Activities areas. The total acreage (39,973 acres) plus Ave Maria (5,027 acres) equals 45,000 acres. Ave Maria has already compensated for PHU impacts.

[2] As the precise location of the 45,000 acres of Covered Activities within the 49,848 acre envelope will be determined later, the estimated PHUs for the 4,031.5 acres were taken as a proportion of the Secondary Zone impact acreage.

[3] The FPPP adds a 25% factor to PHUs generated from Primary Zone impacts.

The USFWS methodology employs a "Base Ratio" factor "that will provide for the protection of sufficient acreage of primary zone equivalent lands for a population of 90 panthers" (USFWS 2012). In the methodology, the base ratio itself assumes a very conservative panther density of 31,923 acres per panther, along with estimated annual habitat losses, and indirect effects. Per the USFWS methodology, and as shown in Table 4-2, the PHU totals from Table 4-1 are multiplied by the base conservation to impact ratio of 2.5:1, and then by a "Landscape Multiplier," to estimate the total mitigation required.

The "Landscape Multiplier" is a factor utilized to translate impacts from a given panther zone into "primary zone equivalent" compensation. Where habitat impacts and compensation both occur within the same panther zone, a landscape multiplier of "1" is used. Where impacts to secondary zone habitats are compensated with preservation of more valuable primary zone habitats, the landscape multiplier is 0.69 (USFWS, 2012; Table PM5).

In this scenario, where the highest habitat suitability value areas were presumed to be impacted by the Covered Activities, the remaining Preservation/Plan-Wide Activities areas contained 4,031.5 acres of secondary zone lands. Therefore, Table 4-2 subdivides the secondary zone acreage and PHU totals (columns 2 and 3) to illustrate that 4,031.5 acres (20,216.1 PHUs) of secondary zone impacts would be mitigated by preservation of an equivalent 4,031.5 acres of secondary zone lands in this scenario, using "1" as the landscape multiplier. The remaining 13,895.8 acres of secondary zone impacts in this scenario would be mitigated by the preservation of panther habitat in the primary zone, using 0.69 as the landscape multiplier.

Table 4-2 provides two different totals for the compensation required under this scenario. The "USFWS (2012) Mitigation Required" column totals 487,279.4 PHUs, and represents the estimated total mitigation required for the Covered Activities under the USFWS (2012) methodology. This methodology is similar to the methodology employed in current FWS Biological Opinions. The second total, "FPPP Mitigation Required," reflects a provision in the FPPP that panther habitat impacts within the primary zone will be compensated with 25% more PHUs than the standard calculation, thereby providing additional conservation value. Accordingly, this column reflects the increase in compensation provided under the FPPP framework to 566,414.3 PHUs.

4.2.2.1.2 Scenario Assuming Primary Zone Impacted First

The second scenario, also designed to conservatively estimate the total mitigation required under the Plan, assumed that impacts to panther habitat would consume all primary zone habitat within the Covered Activities land designation first (Figure 2-1; Figure 4-2). Furthermore, it was assumed that once all of the primary zone lands within the Covered Activities were impacted, the balance of secondary zone acreage to be impacted (up to a total of 39,973 acres) would include the highest habitat suitability values within that zone.

Under the assumption that primary zone is impacted first, Table 4-3 shows that the total impact acreage is the same (39,973 acres), and that the total estimated PHUs (222,741.1) are only slightly higher than the 216,512.8 PHUs estimated under the first scenario (highest habitat values impacted first). However,

Table 4-3. Florida Panther Habitat Matrix for Covered Activities, Assuming Primary Zone Impacted First

		Primary Zone Covered Activities 24,587.7 acres[1]				Secondary Zone Covered Activities 15,385.3 acres[1]			
		Current		w/ Covered Activities		Current		w/ Covered Activities	
Land Cover Type	**Score**	**Acres**	**PHUs**	**Acres**	**PHUs**	**Acres**	**PHUs**	**Acres**	**PHUs**
Pine Forest	9.5	1626.1	15447.5	0.0	0.0	441.2	4190.9	0.0	0.0
Hardwood-Pine	9.3	727.2	6763.3	0.0	0.0	116.3	1081.2	0.0	0.0
Cypress Swamp	9.2	2005.4	18449.7	0.0	0.0	99.6	916.1	0.0	0.0
Hardwood Swamp	9.2	7.6	69.7	0.0	0.0	52.2	480.5	0.0	0.0
Upland Hardwood Forest	9.0	30.0	270.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Prairie	6.3	40.2	253.4	0.0	0.0	7.0	43.8	0.0	0.0
Unimproved Pasture	5.7	445.4	2539.0	0.0	0.0	277.6	1582.5	0.0	0.0
Shrub Swamp/Brush	5.5	905.0	4977.8	0.0	0.0	966.6	5316.3	0.0	0.0
Improved Pasture	5.2	1584.3	8238.4	0.0	0.0	1086.8	5651.6	0.0	0.0
Cropland	4.8	12685.2	60888.7	0.0	0.0	7183.7	34481.6	0.0	0.0
Marsh/Wet Prairie	4.7	939.6	4416.1	0.0	0.0	208.3	978.9	0.0	0.0
Orchards/Groves	4.7	2990.7	14056.1	0.0	0.0	4946.1	30670.5	0.0	0.0
Exotic /Nuisance Plants	3	315.2	945.5	0.0	0.0	0.0	0.0	0.0	0.0
Barren/Disturbed Lands	3	10.6	31.9	0.0	0.0	0.0	0.0	0.0	0.0
Water	0	51.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Urban	0	223.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	**24,587.7**	**137,347.2**	**0.0**	**0.0**	**15,385.3**	**85,393.9**	**0.00**	**0.00**

[1] The acreage subtotals above for Covered Activities within the Primary and Secodary Zones produce a combined acreage total of 39,973.0 acres. When combined with the existing acreage at Ave Maria (5,027 acres), the total acreage of the Covered Activities will equal 45,000 acres.

this second scenario results in 2,542 additional acres of primary zone impacts as compared to the first scenario, which are subject to a higher landscape multiplier than secondary zone impacts. As shown in Table 4-4, the estimated PHUs required under the USFWS methodology for the second scenario therefore total 508,014.1, as compared to 487,279.4 for the first scenario (an increase of 20,761.1 PHUs).

Unsurprisingly, the estimated FPPP mitigation required under this "primary zone" scenario increased even more substantially, because the FPPP assesses an additional 25% compensation for PHU impacts occurring within the primary zone. Whereas the PHUs required as compensation under the FPPP totaled 566,414.3 PHUs under the first scenario (Table 4-2), impacting primary zone areas first within the Covered Activities land designation would result in an estimated 593,856.1 PHUs (Table 4-4), an increase of 27,441.8 PHUs for the same total acreage of impacts (39,973).

Notably, in both scenarios, 72-75% of the potential impacts within the Covered Activities areas occurred within agricultural or other non-native land cover types. By contrast, the corresponding areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under each scenario contained approximately 70% native habitats.

4.2.2.2 Analyses of PHUs Generated Through Preservation, by Land Designation

4.2.2.2.1 PHUs Generated Through Preservation of Areas Designated for Preservation/Plan-Wide Activities

The panther habitat assessment methodology (USFWS 2012) was used to estimate the PHUs generated through the protection of the Preservation/Plan-Wide Areas under the Plan. Just as the town of Ave Maria was excluded from the analyses for potential PHU impacts due to its prior assessment during Federal permitting (Section 4.2.2.1), the PHUs already generated by Stewardship Sending Areas (SSAs) 1, 2, 3, 4, and portions of SSA 6 for Ave Maria were removed from this analysis.

Table 4-5 provides a summary of the PHUs generated through the preservation of lands within the Preservation/Plan-Wide Activities land designation (Figure 2-1). Overall, the panther habitat assessment methodology estimated that a total of 576,903.2 PHUs could be generated from the preservation of 87,499 acres of interconnected panther habitats within the Preservation/Plan-Wide Activities land designation. Primary zone lands accounted for over 95 percent of the preservation acreage, and accounted for over 96 percent of the PHUs generated by preserving these areas.

The preservation acreage used to calculate PHU generation (87,499) is substantially less than the overall Preservation/Plan-Wide Activities acreage that will be provided under the HCP, and is based only on the extensive interconnected habitat areas. The purpose of using this subset of the total preservation area is to provide a conservative estimate of the amount and value of PHUs that will be generated. For example, some preservation areas that have conservation value for other Covered Species, such as water retention areas within the Covered Activities areas, may be effectively unavailable for panther utilization due to habitat extent and/or connectivity; therefore they were not included in the

Table 4-4. Panther Habitat Unit (PHU) Calculations for Covered Activities, by Primary Zone Precedence

Zone	Acres[1]	PHUs[2]	Base Ratio	Landscape Multiplier	USFWS (2012) Mitigation Required	FPPP Primary Zone Factor[3]	FPPP Mitigation Required
Primary	24,587.7	137,347.2	2.5	1	343,368.0	1.25	429,210.0
Secondary	4,031.5	22,376.3	2.5	1	55,940.8	N/A	55,940.8
	11,353.8	63,017.6	2.5	0.69	108,705.4	N/A	108,705.4
TOTALS	**39,973.0**				**508,014.1**	**-**	**593,856.1**

[1] Secondary Zone impacts were sub-divided to balance the 4,031.5 acres (22,376.3 PHUs) from Covered Activities impacts with the 4,031.5 acres of Secondary Zone compensation within the Preservation/Plan-Wide Activities areas. The total acreage (39,973 acres) plus Ave Maria (5,027 acres) equals 45,000 acres. Ave Maria has already compensated for PHU impacts.

[2] As the precise location of the 45,000 acres of Covered Activities within the 49,848 acre envelope will be determined later, the estimated PHUs for the 4,031.5 acres were taken as a proportion of the Secondary Zone impacts.

[3] The FPPP adds a 25% factor to PHUs generated from Primary Zone impacts.

Table 4-5. Florida Panther Habitat Matrix for Preservation/Plan-Wide Activities

		Primary Zone Preservation/ Plan-Wide Activities 83,467.7 acres[1]				Secondary Zone Preservation/ Plan-Wide Activities 4,031.5 acres[1]			
		Current		w/ Preservation		Current		w/ Preservation	
Land Cover Type	**Score**	**Acres**	**PHUs**	**Acres**	**PHUs**	**Acres**	**PHUs**	**Acres**	**PHUs**
Pine Forest	9.5	6212.4	59017.4	6212.4	59017.4	12.9	122.1	12.9	122.1
Hardwood-Pine	9.3	12985.4	120764.2	12985.4	120764.2	22.7	211.0	22.7	211.0
Cypress Swamp	9.2	15862.7	145936.8	15862.7	145936.8	0.0	0.0	0.0	0.0
Hardwood Swamp	9.2	326.8	3006.9	326.8	3006.9	0.0	0.0	0.0	0.0
Upland Hardwood Forest	9.0	1488.6	13397.3	1488.6	13397.3	0.0	0.0	0.0	0.0
Dry Prairie	6.3	206.3	1299.8	206.3	1299.8	1.1	6.9	1.1	6.9
Unimproved Pasture	5.7	1563.5	8912.1	1563.5	8912.1	146.3	833.7	146.3	833.7
Shrub Swamp/Brush	5.5	8430.7	46368.8	8430.7	46368.8	100.6	553.3	100.6	553.3
Improved Pasture	5.2	5614.3	29194.1	5614.3	29194.1	260.6	1355.2	260.6	1355.2
Cropland	4.8	10449.4	50156.9	10449.4	50156.9	41.7	200.1	41.7	200.1
Marsh/Wet Prairie	4.7	13607.9	63957.3	13607.9	63957.3	316.3	1486.6	316.3	1486.6
Orchards/Groves	4.7	5731.6	26938.4	5731.6	26938.4	3071.7	14436.8	3071.7	14436.8
Exotic /Nuisance Plants	3	148.7	446.2	148.7	446.2	0.0	0.0	0.0	0.0
Barren/Disturbed Lands	3	65.7	197.2	65.7	197.2	0.0	0.0	0.0	0.0
Water	0	408.5	0.0	408.5	0.0	33.1	0.0	33.1	0.0
Urban	0	365.2	0.0	365.2	0.0	24.6	0.0	24.6	0.0
Less Committed SSA 6 PHUs[2]		-	**-11,896.0**	**-**	**-11,896.0**	-	-	-	-
TOTAL		**83,467.7**	**557,697.5**	**83,467.7**	**557,697.5**	**4,031.5**	**19,205.7**	**4,031.5**	**19,205.7**

[1] The acreage subtotals above for Preservation/Plan-Wide Activities within the Primary and Secondary Zones produce a combined acreage total of 87,499.2 acres. For PHU purposes, this total acreage is less than the overall acreage for Presevation/Plan-Wide Activities under the Plan, because the acreages for SSAs 1-4 (4,628 acres) are not included (see text). Also, some Preservation areas designated for Preservation/Plan-Wide Activities may designated for Covered Activities, and are therefore considered as impacted (unusable) for panther. Finally,the 4,848-acre difference between the Covered Activities envelope and the 45,000-acre cap will ultimately be placed into Preservation status. [2] SSA 6 was included in this PHU analysis because portions of that SSA can generate PHUs. The 11,896 PHUs subtracted from the total above represent the PHUs from SSA 6 that were previously used to compensate for PHU impacts at Ave Maria.

calculations. The removal of previously assessed SSAs also reduced the total acreage contributing to the PHU generation analysis, as did spatial flexibility as to the ultimate configuration of preservation areas (see Section 4.2.2.4).

4.2.2.2.2 PHUs Generated Through Preservation of Areas Designated for Very Low Density Use

As depicted in Figure 2-1 and noted in Section 2.2, the permittees identified 1,961 acres of land where future low-impact development compatible with panther utilization could occur. In these "Very Low Density Use" areas, permittees retain the right to use the land for such purposes as establishing hunting lodges, fishing camps, other dwellings and support structures at a maximum density of one dwelling unit per 50 acres, with minimal disturbance to the surrounding land cover.

These areas, by virtue of their land cover types, isolation, support of panther prey base, and very low density of dwelling structures represent areas that contribute to panther conservation and therefore generate PHUs, primarily because they maintain permeability of lands to the panther and support the panther's prey base. Table 4-6 provides the acreage and PHU totals for these areas. A total of 1,961 acres generates an estimated 9,582.4 PHUs.

4.2.2.2.3 PHUs Estimated for Base Zoning Area

Figure 2-1 depicts a "Base Zoning" area, comprised of 2,431 acres of the Half Circle L Ranch, east of Immokalee. These 2,431 acres represent an RLSA "Open" overlay area where development could potentially occur, and which maintains its Base Zoning (1 dwelling unit per 5 acres) under the Collier County Land Development Code. As of this writing, the Half Circle L Ranch is for sale on the open market. Although the current property owner is an applicant for the ITP, it is not known if the property will be sold before the HCP/ITP process is concluded.

For these reasons, the PHUs were estimated for the 2,431 acres, but were not assigned as either PHU impacts or credits (Table 4-7). The ultimate disposition of the estimated 12,705 PHUs for this property will depend upon whether the land is developed, and if so, whether cluster development would be employed to minimize impacts. Any development, if pursued, would contribute toward the 45,000-acre cap for Covered Activities. Land dedicated to panther conservation in this area could be used to generate PHUs.

4.2.2.3 Estimated PHU Balance for the Plan

The results of the analyses described in this section demonstrate that, as configured (Figure 2-1), the Plan provides more than sufficient mitigation to offset potential panther habitat impacts. Based upon the dual-scenario estimates of potential impacts (Tables 4-2 and 4-4), and the estimates of PHUs generated as mitigation (Tables 4-5 and 4-6), the Plan will generate enough PHUs to fully offset potential impacts to panther habitat.

Table 4-6. Florida Panther Habitat Matrix for Very Low Density Use

		Very Low Density Use Primary Zone 1,796.7 acres[1]				Very Low Density Use Secondary Zone 164.4 acres[1]			
		Current		w/ Preservation		Current		w/ Preservation	
Land Cover Type	**Score**	**Acres**	**PHUs**	**Acres**	**PHUs**	**Acres**	**PHUs**	**Acres**	**PHUs**
Pine Forest	9.5	241.6	2295.1	241.6	2295.1	0.0	0.0	0.0	0.0
Hardwood-Pine	9.3	283.4	2635.8	283.4	2635.8	0.0	0.0	0.0	0.0
Cypress Swamp	9.2	71.9	661.1	71.9	661.1	0.0	0.0	0.0	0.0
Hardwood Swamp	9.2	57.5	528.9	57.5	528.9	0.0	0.0	0.0	0.0
Upland Hardwood Forest	9.0	16.4	147.3	16.4	147.3	0.0	0.0	0.0	0.0
Dry Prairie	6.3	9.8	61.5	9.8	61.5	18.7	117.8	18.7	117.8
Unimproved Pasture	5.7	2.4	13.6	2.4	13.6	0.0	0.0	0.0	0.0
Shrub Swamp/Brush	5.5	76.0	418.2	76.0	418.2	0.0	0.0	0.0	0.0
Improved Pasture	5.2	204.3	1062.6	204.3	1062.6	120.5	626.5	120.5	626.5
Cropland	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Marsh/Wet Prairie	4.7	104.8	492.4	104.8	492.4	25.2	118.4	25.2	118.4
Orchards/Groves	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Exotic /Nuisance Plants	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barren/Disturbed Lands	3	134.4	403.1	134.4	403.1	0.0	0.0	0.0	0.0
Water	0	573.6	0.0	573.6	0.0	0.0	0.0	0.0	0.0
Urban	0	20.7	0.0	20.7	0.0	0.0	0.0	0.0	0.0
	TOTAL	**1,796.7**	**8,719.6**	**1,796.7**	**8,719.6**	**164.4**	**862.8**	**164.4**	**862.8**

[1] The acreage subtotals above for Very Low Density Use within the Primary and Secodary Zones produce a combined acreage total of 1,961.1 acres. Very Low Density Use comprises less than or equal to one dwelling unit per 50 acres (≤ 1DU/50 acres), with minimal change to land cover surrounding isolated structures (hunting lodges, fishing camps, etc.) For the purposes of estimating PHUs for the Plan, these areas are considered available and permeable to panthers and their prey base, and contribute to panther habitat preservation.

Table 4-7. Panther Habitat Unit (PHU) Estimates for Base Zoning[1]

		Base Zoning (all in Primary Zone) 2430.76 acres			
		Current		w/ Covered Activities	
Land Cover Type	**Score**	**Acres**	**PHUs**	**Acres**	**PHUs**
Pine Forest	9.5	43.3	411.5	0.0	0.0
Hardwood-Pine	9.3	7.0	65.3	0.0	0.0
Cypress Swamp	9.2	31.6	291.0	0.0	0.0
Hardwood Swamp	9.2	1.6	15.1	0.0	0.0
Upland Hardwood Forest	9.0	16.7	150.3	0.0	0.0
Dry Prairie	6.3	0.0	0.0	0.0	0.0
Unimproved Pasture	5.7	790.0	4502.8	0.0	0.0
Shrub Swamp/Brush	5.5	0.2	0.9	0.0	0.0
Improved Pasture	5.2	37.0	192.2	0.0	0.0
Cropland	4.8	927.2	4450.5	0.0	0.0
Marsh/Wet Prairie	4.7	558.0	2622.7	0.0	0.0
Orchards/Groves	4.7	0.6	2.8	0.0	0.0
Exotic /Nuisance Plants	3	0.0	0.0	0.0	0.0
Barren/Disturbed Lands	3	0.0	0.0	0.0	0.0
Water	0	0.0	0.0	0.0	0.0
Urban	0	17.5	0.0	0.0	0.0
	TOTAL	**2,430.8**	**12,705.2**	**0.0**	**0.0**

[1] At the time of this writing, the ranch with retained Base Zoning rights is on the open market for sale. If the current or future owner elects to place the land in Preservation/ Plan-Wide Activities, the PHUs will count as compensation. If the land is developed under Base Zoning rights, PHUs for the impact footprint acreage will count as impacts.

Under each of the impact scenarios, the total number of PHUs generated through preservation of panther conservation lands would exceed PHU compensation levels required for potential impacts as calculated by the standard panther habitat assessment methodology (USFWS, 2012; Tables 4-2, 4-4, and 4-5). Using the methodology employed in current USFWS Biological opinions, under scenario 1 (highest habitat suitability impacted), an estimated 487,279.4 PHUs would be required as mitigation (Table 4-2). Using the same methodology, under scenario 2 (primary zone impacted first), an estimated 508,014.1 PHUs would be required as mitigation (Table 4-4). The PHUs generated from lands conserved under the Preservation/Plan-Wide Activities were estimated at 576,903.2 PHUs (Table 4-5), exceeding the mitigation required under either impact scenario. This balance does not include the additional 9,582 PHUs generated from the Very Low Density Use areas. Therefore, under the standard methodology used in current FWS Biological Opinions for the Florida panther, the Plan will generate PHUs in excess of the mitigation required for potential impacts to panther habitat.

PHUs required for impacts estimated under the first scenario (highest habitat values impacted first) were less than the estimated PHUs generated via preservation, even for the FPPP conditions (25% additional PHUs for primary zone impacts; Table 4-2), which would result in a surplus of PHU credits. For the second scenario (primary zone impacted first), the conservatively under-estimated PHUs generated through preservation are sufficient to offset impacts under the standard USFWS methodology, but would be approximately 17,000 PHUs below the level established for the FPPP (due to the higher acreage of primary zone impacted under that scenario). The PHU credits generated from the Very Low Density Use areas would reduce this theoretical FPPP deficit to approximately 7,400 PHUs.

As a practical matter, the PHU value of the specific lands that are actually impacted is likely to be much lower than conservatively estimated because actual impacts are not likely to occur only on the highest value lands within the 49,848-acre envelope. To the contrary, the applicants will have an incentive to preserve their PHU credit balance through site-specific planning, avoidance of higher value lands, and minimization. Furthermore, the applicants would generate additional PHU credits, if necessary, though additional habitat restoration (such as converting additional farmland into pine forest habitat) or other adaptive measures (such as adjusting the configuration of the conservation areas). Accordingly, based on the conservative approach employed in estimating PHU generation and the ability to generate additional PHUs as necessary, actual PHU generation will be more than sufficient to offset potential panther habitat impacts from the full 45,000 acres of development. Finally, this HCP is structured to ensure that the level of PHUs required under the FPPP will be generated for all Covered Activities and, if necessary, the 45,000 acre cap would be lowered to ensure the FPPP requirement is met.

Given the conservative assumptions regarding maximum PHU impact scenarios, and a probable underestimation of the PHUs that could be generated through panther habitat preservation alone, the Plan provides reasonable assurances that sufficient PHUs can and will be generated to offset potential impacts to panther habitat by the Covered Activities. Multiple options for generating PHUs via panther habitat restoration provide an additional level of assurance that full compensation will be achieved for potential impacts (see section 4.2.2.5).

4.2.2.4 Additional Notes Regarding PHU Analyses for the HCP Area

The two scenarios that were employed to estimate the impacts under the Plan, and the corresponding analyses for estimating PHU generation provided by the Plan as mitigation, were limited by the conservative assumptions behind each of the scenarios. While the calculation of potential impacts occurred entirely within the Covered Activities land designation (Figure 2-1), the impacts were not calculated in a spatially explicit model for either scenario. In other words, because the GIS selected all or some land cover polygons preferentially based upon habitat suitability scoring, the selected polygons did not necessarily conform with spatial patterns that would occur under actual project-level development patterns (i.e., the selected polygons may or may not occur together spatially). The uncertainties regarding the spatial pattern of potential impacts within the Covered Activities areas do not allow a precise projection of the potential panther habitat impacts to future "onsite" preserve areas within the Covered Activities land designation (Figure 2-1).

These spatial variables result in a currently undetermined acreage of habitats that may not be directly impacted (converted) by future Covered Activities, but which nonetheless may be effectively unavailable for panther utilization in a post-development condition. An estimated 5,721 acres of preservation areas (primarily wetland areas) are dispersed throughout the Covered Activities areas, but many of these areas could still remain functional for panther and prey base utilization in a post-development condition, depending upon the ultimate development patterns within the Covered Activities land designation, and site planning considerations (minimization of impacts). Therefore, these additional potential impacts could not be accurately quantified, and were not included in the impact totals.

Correspondingly, as each of the two potential impact scenarios considered a total cap of 45,000 acres of potential impacts within the 49,848-acre Covered Activities land designation, both scenarios will ultimately result in the re-allocation of 4,898 acres from the Covered Activities land designation to the Preservation/Plan-Wide Activities land designation for future preservation (and PHU generation) at Plan completion. As with the additional impacts described above, spatial variables regarding which specific land cover types would be preserved, and their configuration on the landscape, made the corresponding PHU generation not susceptible to a precise estimate. Thus, these expected and corresponding PHU credits were also not included in the preservation PHU totals.

4.2.2.5 Summary: Panther Habitat Assessment

As noted, even under the conservative assumptions of the first impact scenario (highest habitat values impacted first), the PHU calculations estimate that the Plan can generate an excess of 10,000 PHUs even under the FPPP conditions (25% additional PHUs for impacts within the primary zone). The second scenario (primary zone impacted first) estimated that a deficit of nearly 17,000 PHUs would result under FPPP conditions if all primary zone lands within the Covered Activities designation were impacted first. However, the scenarios for potential impacts and preservation are not only unlikely and highly conservative, but did not include the PHUs to be generated by the restoration of lands for the north and south panther corridors (Figure 4-9), and these restoration activities will generate thousands of PHUs.

The PHU estimates for these corridor areas cannot be precisely calculated until the extent and land cover types within the restored corridors are determined, in coordination with USFWS.

Under the most conservative assumptions for panther habitat assessment calculations under the Plan (i.e., maximum impacts), the permittees would still retain a number of options for either reducing impacts, or generating additional PHU credits to ensure all impacts are fully offset in accordance with the FPPP. In terms of reducing potential impacts, property owners could: minimize potential impacts on their holdings within the primary zone; forego development of some portion(s) of their property(-ies); and/or reconfigure site plans to avoid impacting areas with high potential impacts. Additionally, multiple options are available to the permittees if a project-specific or overall deficit of PHUs would require the generation of additional PHUs: habitat restoration in the vicinity of existing and future wildlife crossings; additional habitat restoration for the north and south panther corridors (Figure 4-9); habitat restoration to fill open-space gaps or to widen existing corridors; and/or restoration of active agricultural fields to high-value panther habitat (e.g., pine forest). The Plan is structured to ensure that the PHUs required under the FPPP will be generated for all Covered Activities.

In summary, the panther habitat assessment methodology demonstrates that, under even the most conservative assumptions, the Plan will generate sufficient PHUs as mitigation to offset potential impacts to panther habitat using the standard USFWS methodology (USFWS, 2012). Under the additional PHU requirements prescribed by the FPPP (25% additional PHUs for impacts within the primary zone), the calculations demonstrate that the Plan will generate sufficient PHUs. Minor adjustments to the overall PHU balance or the acreage cap for Covered Activities could be achieved, if necessary, during the Plan review process and/or implementation via a reduction of project-level impacts, an increase in PHU generation from restoration activities, or both.

4.2.3 Anticipated Take of Florida Panther

4.2.3.1 Forms of Take

The purpose of the Plan is two-fold: (i) to develop an integrated plan for development that will be compatible with conservation of the Florida panther and other Covered Species and fund the implementation of long-term conservation measures for the Florida panther and other Covered Species; and (ii) meet the requirements for issuance of an ITP for Covered Species that may be impacted while carrying out otherwise lawful activities (the Covered Activities). The ESA defines “take” as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct” (50 CFR § 17.3). Most of the activities included in the definition of “take” categorically do not apply to the Plan. No intentional take of the Florida panther is proposed or anticipated. The two forms of “take” that could potentially result from the Covered Activities are “harm” and “harass.”

“Harm” is defined (50 CFR § 17.3) as an act “which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.”

"Harass" is defined (50 CFR § 17.3) as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering."

The goal of the Plan is to avoid take resulting from Covered Activities occurring within the HCP Area to the extent practicable, and for any take that occurs, minimize, rectify, reduce, and compensate for the impact of that take.

4.2.3.2 Take Assessment

The direct and indirect impacts to panther discussed previously (section 4.2.1.1) could potentially result in take of the Florida panther in the form of harm and/or harassment. The take assessment for each of these potential impacts is summarized below.

The Covered Activities will result in up to 45,000 acres of permanent habitat loss that could potentially result in take of the Florida panther. This take could occur in the form of harm if significant habitat modification actually killed or injured a panther. Based on the characteristics of panther ecology and information on documented causes of panther injury and mortality, incidental take of the panther in the form of harm is possible but unlikely. Take in the form of harassment has the potential to occur if a Covered Activity annoys a panther to such an extent that the panther's normal behavioral patterns are significantly disrupted. This could occur as a result of the increased potential for panther-human interactions, and reduction in the utilization of habitats adjacent to development areas by panthers and/or panther prey base that disrupt behavior patterns (feeding, sheltering, breeding). Potential impacts include light and noise associated with construction activities, earth mining, and other activities while the Plan is being implemented. Light, noise, and human activities have the potential to affect panther and panther prey base habitat utilization. These impacts were accounted for in the panther habitat assessment and calculation of the habitat compensation required under the Plan. Additionally, the Plan's general avoidance of the Okaloacoochee Slough, FPNWR area, and other areas of intensive panther utilization limit the scale of panther-human interactions, while site planning techniques can be employed at the project-level scale to minimize interactions.

Based on the nature of anticipated take and the difficulties inherent in monitoring for or otherwise quantifying instances of harassment, take for purposes of this Plan is quantified in terms of acres of Covered Activities (45,000). Of the approximately 107,000 acres designated for Preservation/Plan-Wide Activities and Very Low Density Use by Plan completion, approximately 87,500 acres comprise interconnected, high-value panther habitat today. The remainder of these lands provide lower value to the panther (e.g., water retention areas), but many would still provide at least some habitat value or otherwise benefit the panther (e.g., by supporting panther prey species) and also provide valuable habitat for other Covered Species. The actual acreage of high-value panther habitat that will be eventually preserved at Plan completion will likely approach 95,000 acres in total (the exact total will depend on the final configuration of Covered Activities, and includes lands designated for Very Low Density Use). Approximately 95 percent of this high-value panther habitat will be located within the primary zone. Application of the panther habitat assessment methodology (section 4.2.2) calculates that

panther habitat losses will be fully mitigated by the preservation of these approximately 87,500 to 95,000 acres, even using conservative assumptions. Habitat losses will also be mitigated by the restoration of panther habitat through the Marinelli Fund, including in areas within local panther corridors (the "North and "South" corridors within the HCP Area); areas leading to and from wildlife crossings; and areas where large gaps between forested habitats may inhibit panther movements. Habitat management activities (prescribed burning; mechanical control of understory vegetation) can improve the productivity of preserved habitats for panther prey base. On balance, habitat loss is not expected to result in direct take of the Florida panther in the form of harm (mortality or injury).

Habitat fragmentation is avoided and minimized under the Plan, while the preservation of extensive interconnected panther habitat will provide panther habitat connectivity in perpetuity. The preservation of these landscape-scale linkages has been a major panther conservation goal for decades, and will be achieved under the Plan through the cooperation of 10 private property owners. In addition to this land preservation, the Plan will provide funding for the Marinelli Fund, which is expected to provide habitat restoration activities, and to construct wildlife crossings that will maintain this functional connectivity.

4.3 BIOLOGICAL GOALS AND OBJECTIVES

Section 10(a)(2)(A) of the Act requires, inter alia, that an HCP specify the measures that the permittee will take to minimize and mitigate, to the maximum extent practicable, the impacts of the taking of any federally-listed animal species as a result of activities addressed by the plan.

As part of the HCP Handbook Addendum, or "Five Point" Policy, adopted by the Services in 2000, HCPs establish biological goals and objectives (65 Fed. Reg. 35242 (June 1, 2000)). The purpose of these biological goals is to ensure that the operating conservation program in the HCP is consistent with the conservation and recovery goals established for the species. The goals are also intended to provide an understanding of why specific conservation measures are necessary. These goals are developed based on the species' biology, threats to the species, the potential effects of the Covered Activities, and the scope of the Plan. Under the Plan, the biological goals for the Florida panther are:

- Preservation, through conservation easements or equivalent mechanisms, of large, interconnected blocks of panther habitat (approximately 95,000 acres) within the HCP Area, including existing regional wildlife corridors that provide landscape-scale linkages among existing public conservation lands;

- Avoidance and minimization of impacts to panther habitat by directing Covered Activities to previously cleared lands, where the predominant land use is intensive agriculture, and away from large, interconnected blocks of panther habitat; and

- Enhancement of panther habitat through funding for the Marinelli Fund, anticipated to be used for such actions as: (i) enhancement of regional wildlife corridors through planting of native vegetation; (ii) location and construction of new fenced wildlife crossings on roadways within the HCP Area; (iii) habitat restoration and management activities within the HCP Area, including in areas around existing and future wildlife crossings and where higher quality habitat would

enhance panther utilization or movement, and management of lands to maintain panther prey base; and (iv) possible land acquisition, enhancement, and management outside the HCP Area , to assist the recovery of the Florida panther throughout its range.

4.3.1 Biological Goals Implemented Outside of the HCP Area

4.3.1.1 Wildlife Crossings

The HCP Area does not include the existing state and county roadway network, and avoidance and minimization of environmental impacts resulting from improvements to the transportation network are the responsibility of Florida Department of Transportation (FDOT) and the Collier County Metropolitan Planning Organization (MPO), together with State and Federal environmental regulatory agencies. Land preservation through the Plan, however, will help to avoid and minimize transportation-related impacts to panthers.

The preservation of interconnected panther habitats on both sides of a wildlife crossing is considered an essential prerequisite for the locating and construction of new wildlife crossings (FWC 2006; Smith et al. 2006; USFWS 2008; Downs et al. 2014). The Plan will provide land preservation that will make the construction of more fenced wildlife crossings possible through the Marinelli Fund.

The paragraphs below briefly describe the currently known planned improvements that are scheduled or contemplated for eastern Collier County, independently of the Plan, which will influence the eventual location, design and construction of future wildlife crossings (see also Figure 4-3). The location and construction of future wildlife crossings will be determined by the Marinelli Fund's board of directors, in cooperation with FWC, USFWS, and FDOT.

Future transportation improvements in Collier County are generally planned and programmed by the MPO with input from the member agencies/jurisdictions (FDOT, Collier County, City of Naples, City of Marco Island, City of Everglades), and from interested stakeholders, including the public. Long-range planning is based upon the Federal requirement of a minimum of 20 years. The MPO's adopted 2035 Long Range Transportation Plan (LRTP) (http://www.colliermpo.com/index.aspx?page=185) is currently being updated (to 2040), a process that is scheduled to be completed by December 2015. MPO Plans are updated, at a minimum, every five years by extending the planning horizon to maintain a minimum 20-year planning timeframe.

In addition to the 20+ year planning horizon of the MPO's LRTP, other "programming" documents are prepared annually that cover a shorter (usually 5-year) window of systems improvements. The FDOT District 1 Five-Year Work Program is released in its "draft tentative" form in early December of each year, ultimately becoming final (adopted)on the following July 1st.

The current FDOT Work Program covering the five year period from 2014/15 – 2018/19 includes a number of improvement phases for transportation projects within eastern Collier County, independent of the Plan. For example, FDOT is currently conducting a Project Development and Environment (PD&E) study for improvements to SR-29 between Oil Well Road and SR-82 (see Figure 2-1), evaluating the

widening two-lane sections to four lanes, and studying alternative corridors to bypass downtown Immokalee. The current FDOT Work Program for the HCP Area is provided below:

- SR-29 from Oil Well Road to SR-82 – PD&E phase (2014/15, in process); scheduled for completion in 2016 (see also at http://sr29collier.com/);
- SR-29 from Oil Well Road to I-75 – PD&E phase (2015/16), Design phase (2018/19);
- SR-29 from SR-82 to Hendry County Line – Design phase (2014/15) Environmental Services/Permits/Mitigation (2017/18);
- SR-82 from Hendry County Line to SR-29 – Design phase (2015/16) and Right-of-way Acquisition (2016/17 & 2018/19) (see also: http://sr82design.com/); and
- SR-82 at Corkscrew Road – Add Turn Lanes Design (2015/16) and Construction (2016/17).

It should also be noted that because the MPO's planning horizon is 20 years, the transportation "Needs Assessment" is based upon the land uses expected to be "on the ground" in 20 years. However, the MPO and FDOT often maintain and/or acquire rights-of-way that are intended to accommodate potential future traffic needs beyond a 20-year timeframe. For example, the proposed improvements to widen SR-82 from two lanes to four lanes currently include the right-of-way to accommodate six lanes, if needed for future expansion.

4.3.1.2 Habitat Acquisition, Restoration, and Management

The Plan anticipates that panther conservation priorities may change at various times over the 50-year duration of the ITP, and that conservation opportunities may arise where actions taken outside of the HCP Area may provide the most effective means for promoting panther recovery. The Marinelli Fund may be available to enable a fee-simple acquisition of panther habitat that would provide critical linkages outside of the HCP Area, or to restore habitat outside of the HCP Area where existing data suggest a major benefit to the overall panther population. Similarly, the Marinelli Fund may undertake habitat management activities on existing conservation lands outside of the HCP Area.

4.4 AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

This section describes the measures that the Plan will implement to avoid, minimize, and mitigate impacts to the Florida panther and its habitat. The Plan considers spatial scales ranging from regional landscape-level conservation planning to site-specific project design principles for incorporating avoidance, minimization, and mitigation strategies into an overall conservation plan.

4.4.1 Measures to Avoid and Minimize Impacts

4.4.1.1 Regional Planning

The Plan's overall design evolved based on a primary conservation goal of avoiding and permanently protecting extensive areas of interconnected panther habitats that occur within the Okaloacoochee

Slough and the areas bordering the FPNWR. The Okaloacoochee Slough provides a critical linkage for panthers dispersing from the core population area (southern Hendry County, BCNP, FPNWR, FSSP) northward to the dispersal zone, and potentially to lands north of the Caloosahatchee River. The areas directly adjacent to the FPNWR also provide extensive interconnected areas of high-value panther habitats that have been consistently utilized by panthers (Figures 4-6 and 4-8). Therefore, the avoidance of these areas was central to the Plan design.

A review of Figure 2-1 shows these extensive preservation areas, north of the FPNWR and along the eastern one-third of the HCP Area. Two of the co-permittees own properties within the HCP Area that are wholly within the ACSC. Each of these property owners has avoided potential impacts to panther by directing Covered Activities to previously cleared agricultural areas, and dedicating the majority of their property acreage to preservation.

Figures 2-2 and 4-5 illustrate the importance of these avoidance strategies for maintaining regional habitat linkages for the Florida panther. Figure 2-2 demonstrates how the permanent preservation of lands within and around the Okaloacoochee Slough serve to connect existing public lands on a regional scale, securing most of the wildlife corridor necessary for panthers to disperse from the BCNP, the FPNWR, and southern Hendry County to the dispersal zone. Figure 4-5 highlights the importance of these same critical linkages with over 30 years of panther VHF telemetry data.

The Plan avoided impacts to these extensive panther habitat areas in the eastern and southern portions of the HCP Area, primarily by directing Covered Activities to the central, western, and northern portions of the HCP Area where intensive agricultural land uses predominate. Even while doing so, the Plan was designed to avoid impacts to the Camp Keais Strand wildlife corridor. The permanent protection of these lands serves to maintain the landscape-scale linkages between the FPNWR, Camp Keais Strand, and the CREW lands (Figures 2-1, 2-2, 4-5, and 4-7).

4.4.1.2 Project-Level (Site-Specific) Planning

Avoidance measures were incorporated into the design of the HCP Area, and the relationship of the areas designated for Covered Activities to the Preservation/Plan-Wide Activities areas (Figure 2-1). Project-level avoidance measures will also be employed. These measures primarily involve the configuration of master plans to avoid direct impacts to potential panther habitat, and to direct the more intensive land uses away from panther habitat preservation areas.

At project-level scales where avoidance measures have already been employed to the extent practicable, the goal is to minimize the direct and indirect impacts to panthers, panther prey base, and their habitats. Within the lands designated for Covered Activities, the techniques to be employed for minimizing unavoidable impacts at project-level scales generally include:

- Designing master plans that (i) concentrate more intensive land uses within the center of mixed-use residential/commercial developments (town centers), located at a distance from panther habitat preservation areas, and (ii) diminish land use intensities adjacent to panther habitat

preservation areas (e.g., providing transitions from mixed-use town centers, to residential neighborhoods, to community open space areas, to project boundaries);

- Minimizing impacts to native habitats within project boundaries that occur along the interface with panther habitat preservation areas;
- Utilizing a combination of design elements, including surface water management lakes, berms, structural buffers, fencing, and directional and/or low-level lighting along the periphery of Covered Activities to minimize the effects of light, noise, and human activity on preservation areas outside the project boundaries, and to minimize human-panther interactions;
- Designing internal road networks and roadway design elements to minimize the potential for panther-vehicle collisions within the lands designated for Covered Activities;
- Providing a sustainable mix of residential, commercial, retail, office, civic, and recreational land uses where non-residential components minimize the need for residents to leave the development for basic needs (maintaining a high internal capture rate), thereby minimizing travel on the regional transportation network; and
- In the case of earth mining, establishing perimeter berms to separate the mine areas from adjacent preservation areas (if present adjacent to the mine), and limiting mining operations to daylight hours.

While the Plan (Figure 2-1) achieves avoidance through the designation of large interconnected panther habitat preservation areas, and the direction of Covered Activities toward the more intensively farmed portions of the HCP Area, the strategies listed above serve to refine avoidance and minimization of impacts at project-level scales. The combined application of these strategies serves to avoid and minimize direct and indirect impacts to panthers, and to separate Covered Activities from the Preservation/Plan-Wide Activities areas.

4.4.1.3 Transportation Network and Wildlife Crossings

The HCP Area does not include the existing roadway network, and avoidance and minimization of environmental impacts resulting from improvements to the transportation network are the responsibility of FDOT and the MPO, together with State and Federal environmental regulatory agencies. The Plan, however, can still provide a source of funding and the necessary land preservation to help avoid and minimize transportation-related impacts to panthers.

The Marinelli Fund is expected to continue assisting in Florida panther recovery efforts through a variety of conservation actions, which include the location and construction of wildlife crossings and associated fencing for panthers (FPPP 2008). The Plan provides the necessary land preservation (perpetual conservation easements) where the wildlife crossings may be located. Therefore, the Plan facilitates avoidance and minimization of traffic impacts to panthers, even though the existing transportation network is not included as part of the Covered Activities.

4.4.2 Measures to Mitigate Unavoidable Impacts

After demonstrating avoidance of impacts throughout the HCP Area, and minimization of impacts at project-level scales, mitigation is required to fully offset unavoidable direct and indirect impacts to the Florida panther that may result from the Plan's implementation. The major mitigation element is the permanent preservation of approximately 95,000 acres of extensive interconnected panther habitat within the area designated for Preservation/Plan-Wide Activities and Very Low Density Use (Figures 2-1 and 2-2).

Section 4.2.2 (Panther Habitat Assessment) demonstrated that even using very conservative assumptions, the Plan will generate sufficient PHUs as mitigation to offset potential impacts to panther habitat using the standard USFWS methodology (USFWS 2012). As noted, even under the additional PHU requirements prescribed by the FPPP (25% additional PHUs for impacts within the primary zone), the calculations demonstrate that the Plan is capable of generating sufficient PHUs. Minor adjustments to the overall PHU balance or the acreage cap for Covered Activities could be made, if necessary, during the Plan review process and/or implementation.

4.5 MONITORING AND REPORTING

Federal regulations require that HCPs include monitoring programs to: (i) evaluate compliance with the terms and conditions of the HCP, IA, and ITP; (ii) determine whether biological goals and objectives are being met; and (iii) provide data and information for an adaptive management strategy, if one is used (50 CFR §§17.22, 17.32, and 222.307; 65 Fed. Reg. at 35253). The first type of monitoring (item (i) above) is considered "compliance monitoring," while the latter two items fall under the heading of "effects and effectiveness monitoring."

Moreover, the HCP Handbook (USFWS and NMFS 1996, 3-26) states, "For regional and other large-scale HCPs, monitoring programs should include periodic accountings of take, surveys to determine species status in project areas or mitigation habitats, and progress reports on fulfillment of mitigation requirements (e.g., habitat acres acquired)." The sections below describe the general methods and objectives of the monitoring program with regard to the Florida panther.

4.5.1 Compliance Monitoring

Compliance monitoring ties directly to the measures the applicants described for avoidance, minimization, and mitigation of direct and indirect impacts to the Florida panther and its habitat, along with any additional terms and conditions issued with the ITP. The sections below describe briefly the type, extent, frequency, and timing of monitoring events necessary to determine compliance with these measures.

Covered Activities

The monitoring program will verify that the location and extent of Covered Activities conforms to the areas depicted in Figure 2-1, and that the types of activities within these areas are consistent with the activities described in Chapter 2 (Plan Description and Activities Covered by Incidental Take Permit).

Monitoring for the compliance of individual projects can occur on a project-by-project basis as each project engages in the Federal permitting process (typically Clean Water Act section 404 permitting) and subsequent interagency coordination with USFWS.

For the HCP Area as a whole, Covered Activities may be monitored for compliance on an annual basis through the use of aerial imagery, analysis of State and Federal permits, local development orders, legal sketch and description surveys, and onsite inspections. Each project will undergo Federal permitting review, and interagency review with USFWS, which will provide a pre-construction opportunity to ensure that project plans are in compliance with the Covered Activities under the ITP. Projects that have commenced construction during the monitoring year will be added to a GIS database to verify compliance with the limits of the Covered Activities land designation. Because the boundaries for Covered Activities were digitized in a GIS originally, some scrivener's errors may be revealed during the project's permitting and land survey activities where small deviations exist between GIS boundaries and project boundaries as actually surveyed. Projects will be in compliance with the Plan if they conform generally to the Covered Activities boundary, have received State and Federal permits, and accurately quantify impacts to all land cover classes present within the project boundary.

In accounting for take, the annual monitoring will summarize the panther habitat impacts that occurred during the monitoring year, in terms of functional units (PHUs), and the mitigation placed under permanent conservation easement(s) to offset the impacts and avoid a taking. The boundaries of any permanent conservation easements will be added to the GIS database. The annual monitoring will also include an estimate of the total acreage constructed each year that counts toward the 45,000-acre cap on Covered Activities, and a summary of the total acreage of Covered Activities implemented through that monitoring year.

Preservation/Plan-Wide Activities

The monitoring program will verify that the location and extent of Preservation/Plan-Wide Activities conforms to the areas depicted in Figure 2-1, and that the types of activities within these areas are consistent with the activities described in Chapter 2 (Plan Description and Preservation/Plan-Wide Activities and Very Low Density Use).

In general, the areas designated for Preservation/Plan-Wide Activities will be monitored on an annual basis, to ensure that the activities and land uses occurring there are consistent with the traditional land activities that have occurred in these areas historically, and to ensure the general extent of native vegetation communities is maintained over the 50-year duration of the ITP. For the HCP Area as a whole, Preservation/Plan-Wide Activities may be monitored for compliance on an annual basis through the use of aerial imagery and GIS land cover data. As noted, permanent conservation easements recorded during the monitoring year within the Preservation/Plan-Wide Activities areas will be added to the GIS database.

Very Low Density Use

The areas depicted on Figure 2-1 as Very Low Density Use are intended to support hunting lodges, fishing camps, other dwellings, support structures, and other very low density rural uses at a maximum density of 1 dwelling unit per 50 acres. No more than 10 percent of the existing native vegetation may be cleared from Very Low Density Use areas. These areas may be monitored on an annual basis in a manner similar to the Preservation/Plan-Wide Activities areas, through the use of aerial imagery, GIS land cover data and, if necessary, onsite inspections.

Base Zoning Area

As noted in Chapter 2 (Plan Description and Base Zoning Area), the Base Zoning area is for sale on the open market at the time of this writing. The monitoring program for this area will be described when the end-use is determined under the Plan. If the area is eventually designated for Preservation/Plan-Wide Activities, the monitoring plan will mirror that for the Preservation/Plan-Wide Activities areas. If the area is developed at densities equal to Base Zoning or greater densities, the monitoring plan will mirror that of the Covered Activities, and the development will count toward the 45,000-acre Covered Activities cap.

Habitat Restoration

Panther habitat restoration may or may not be required to achieve an overall PHU balance by Plan completion, but it is a potential feature of the Plan. If panther habitat is required, for example to generate additional PHUs required to satisfy mitigation requirements, those habitat restoration areas will be subject to compliance monitoring.

The type of each habitat restoration area will depend on the objectives of the restoration, such as providing cover on approach to wildlife crossings; increasing denning habitat; narrowing gaps between forested patches; and other purposes as determined by USFWS and the applicants. For compliance purposes, habitat restoration must conform to the terms of the IA and ITP. The type and extent of the habitat restoration must be clearly stated, along with the success criteria (vegetation cover/densities, vegetation diversity, exotic vegetation levels, etc.) for PHU credit release. The annual monitoring will summarize habitat restoration activities over the past monitoring year, and will include qualitative and quantitative data regarding the type(s), acreage, and status of each restoration area within the HCP Area.

4.5.2 Effectiveness Monitoring

Surveys to Determine Florida Panther Status

FWC maintains a longstanding panther research and management program that monitors multiple aspects of panther ecology, including occurrence data (through panther capture, deployment of VHF and/or GPS collars, and VHF/GPS data acquisition); habitat selection; movement data; home-range estimation; demographics (including population estimates and densities); mortality data and cause; and

disease status. FWC has also deployed trail cameras for a number of studies and monitoring efforts, which are helpful in monitoring panthers in the HCP Area.

Based on FWC's experience and existing infrastructure, the applicants propose that FWC be responsible for monitoring panthers within the HCP Area. As stated in the HCP Handbook (1996, 3-27), "Monitoring programs can be carried out by a mutually-identified party other than the permittee, so long as this is specified in the HCP, funding is provided, and the party is qualified." FWC provides the necessary expertise and resources to effectively monitor the status of the Panther within the HCP Area. The applicants will provide the wildlife agencies (FWC and/or USFWS) reasonable access to their properties within the HCP Area for inspection and monitoring purposes as detailed in the Implementing Agreement.

If the panther monitoring performed by FWC within the HCP Area requires additional monetary support, per-unit fees tied to the sale of residential housing within the HCP Area (described in chapter 9 below) will be used as a source of that support. The applicants will work with FWC and USFWS to determine whether additional monitoring protocols and/or studies may be required to effectively monitor the Florida panther within the HCP Area.

No take of the Florida panther is anticipated under the Plan, except for the potential for harassment as identified above. The direct impacts potentially associated with the Plan are habitat-based. The mitigation program addresses direct and indirect impacts to panther. Compliance monitoring to quantify direct impacts to panther habitat, and the recording of perpetual conservation easements to mitigate for those impacts, will serve as the primary measure for the amount and extent of take and mitigation.

Habitat Restoration

Panther habitat restoration may or may not be required to achieve an overall PHU balance by Plan completion. Monitoring techniques to assess the effectiveness of a specific restoration area will be dependent upon the objective of the habitat restoration. If the purpose of the habitat restoration is to facilitate panther utilization of a specific wildlife crossing, for example, data can be collected pre-restoration and post-restoration (e.g., through use of telemetry data and/or trail cameras) to gauge the effectiveness of restoration. The same is true of other habitat restoration that meets a specific restoration objective, such as the creation of panther denning habitat.

Habitat restoration efforts may be dictated by unforeseen events (e.g., wildfires) or other situations requiring adaptive management. Therefore, the IA provides some flexibility as to the location, type, and purpose of panther habitat restoration activities. These efforts will be coordinated by the applicants, USFWS, FWC, and the FPPP.

4.5.3 Reporting Requirements

The applicants will provide an annual monitoring report, to be submitted to USFWS each year, by the anniversary of the ITP issuance (or as determined by USFWS and FWC, timed to coincide with the issuance of the FWC Annual Report on the Research and Management of Florida Panthers). The annual

report will contain the information listed in the addendum to the HCP Handbook (65 Fed. Reg. at 35255):

1. Biological goals and objectives of the Plan (which may need to be reported only once);
2. Objectives for the monitoring program (which may need to be reported only once);
3. Effects on the Florida panther or its habitat within the HCP Area;
4. Location of sampling sites within the HCP Area;
5. Methods for data collection and variables measured;
6. Frequency, timing, and duration of sampling for the variables;
7. Description of the data analysis and who conducted the analyses; and
8. Evaluation of progress toward achieving measurable biological goals and objectives of the Plan, and other terms and conditions as required by the ITP or IA.

In addition to the annual monitoring report, the GIS databases created or updated for monitoring purposes, and any other electronic data related to the monitoring program, will be transmitted to USFWS in electronic format according to technical specifications as described in the IA.

4.6 ADAPTIVE MANAGEMENT

For the purposes of the HCP program, USFWS defines the term “adaptive management” as “a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned.” 65 Fed. Reg. at 35245. The HCP Handbook (USFWS and NMFS 1996, 3-24) states that adaptive management concepts are used in HCPs “to minimize the uncertainty associated with listed or unlisted species where there are gaps in the scientific information or their biological requirements.”

The Florida panther has been the subject of extensive monitoring and research efforts over the past several decades. Beier et al. (2006) noted that, “Approximately 4,000 pages of scientific literature have been published on the panther since 1975, including about 700 pages in peer-reviewed journal articles, 2050 pages in agency reports and policy documents, 850 pages in transactions or proceedings, and 350 pages in books and book chapters.” Since 2006, major wildlife agency publications include the third revision of the Florida Panther Recovery Plan (USFWS 2008), an updated 5-year review (USFWS 2009), and seven FWC annual reports (2007-2013). Additionally, peer-reviewed publications and ongoing FWC research efforts regarding the Florida panther have added to that extensive foundation of scientific knowledge.

The biological goals and objectives of the Plan (described at section 4.3), which are important to panther recovery, are relatively straightforward. In addition to the extensive land preservation accomplished

through the Plan, funding provided by the Plan will support conservation activities and panther recover efforts within and possibly beyond the HCP Area through the Marinelli Fund.

Given the vast amount of scientific information regarding panther ecology, and the straightforward and objectively verifiable nature of the biological goals and objectives, the applicants do not propose specific adaptive management measures under the Plan. The applicants have planned for changed and unforeseen circumstances (Chapter 8, Changed Circumstances and Plan Implementation), and have developed responses to such contingencies to the extent possible, which will be incorporated into the IA. The applicants will also coordinate with USFWS, FWC, and the Board of Directors of the Marinelli Fund throughout the duration of the ITP, to effectively respond to any opportunities for enhancing panther recovery efforts.

5. OTHER COVERED SPECIES

5.1 METHODS AND INFORMATION SOURCES

The Plan covers the Florida panther, seven other federally-listed species, one candidate species, and one species proposed for federal listing (see Chapter 1, Tables 1-1 and 1-2). It also covers six species that are listed as threatened by the State of Florida but are not federally-listed (see Chapter 1, Table 1-3). This chapter provides a natural history account for each of the "Other Covered Species" (aside from the Florida panther, which is addressed in Chapter 4), and serves as the basis for analyses of the effects of the proposed activities described in Chapter 6 (Potential Biological Impacts and Take Assessment) and Chapter 7 (Conservation Plan for Other Covered Species).

The discussion below reflects recent, applicable USFWS Biological Opinions that address the Covered Species. In order to maintain the integrity of the work that FWS has previously issued, the species accounts were excerpted largely verbatim and with minimal editing. The species accounts were augmented with information from USFWS 5-Year reviews, Habitat Management Guidelines, *Federal Register* notices, peer-review publications, and other cited sources as needed for completeness. The purpose is to provide accurate and complete baseline data for each of the Covered Species for evaluation of potential biological impacts and take (see Chapter 6, Potential Biological Impacts and Take Assessment), and appropriate conservation actions (See Chapter 7, Conservation Plan for Other Covered Species).

This chapter addresses three principal aspects of the species' ecology: (i) Status and Distribution; (ii) Habitat Characteristics and Use; and (iii) Occurrence in HCP Area. The Status and Distribution section for each species includes regulatory history, life history, distribution and population trends, and reasons for decline. The Habitat Characteristics and Use section describes the range of habitat characteristics and ecological interactions necessary for supporting each species throughout its life cycle. The Occurrence in HCP Area section documents available verified occurrence data for each species. Sources for the occurrence data included information from Federal and State wildlife agencies (USFWS and FWC); research databases (e.g., wood stork); and peer-reviewed publications as cited.

The species accounts below provide information to assess and implement the Plan in terms of Biological Goals and Objectives, and reflect a synthesis of information from Biological Opinions and other sources, excerpted and edited as relevant to the Plan.

A thorough scientific literature search was performed for each species beyond literature cited in Biological Opinions and similar sources, especially when occurrence data were lacking within the HCP Area or the habitats utilized by the Covered Species in Collier County differed significantly from typical habitats utilized by a species in other portions of its range (e.g., Florida scrub-jay; gopher tortoise). Occurrence data were included in this chapter if the data were obtained from wildlife agencies, peer-reviewed publications, and/or the data were subject to a vouchering process. The citations provided in the *Literature Cited* section (Chapter 11) include those sources that are cited within the text of this document, which represent a portion of the literature reviewed for developing and evaluating the Plan.

5.2 FEDERALLY-LISTED AND CANDIDATE WILDLIFE SPECIES

5.2.1 Birds

5.2.1.1 Northern Crested Caracara (Audubon's Crested Caracara)[7]

The following species account is compiled from recent USFWS Biological Opinions (USFWS 2005; USFWS 2012b), supplemented with highly cited caracara literature (e.g., Morrison and Humphrey 2001), and recent peer-reviewed publications (e.g., Dwyer et al. 2013).

The northern crested caracara (*Caracara cheriway*; herein caracara) is a medium-sized raptor with a crest, naked face, heavy bill, elongated neck, and unusually long legs. It is ranges from 50 to 64 cm long and has a maximum wingspan of 120 cm. The adult is dark brownish black on the crown, wings, back, and lower abdomen. The lower part of the head, throat, upper abdomen, and under tail coverts are white, the breast and upper back are whitish, heavily barred with black. The tail is white with narrow, dark crossbars and a broad, dark terminal band. Prominent white patches are visible near the tips of the wings in flight. The large, white patches in the primaries and the white tail, broadly tipped with black, are both very conspicuous in flight and can be recognized at a long distance (Bent 1961).

Juveniles have a similar color pattern but are brownish and buffy with the breast and upper back streaked instead of barred. Sub-adults resemble adults but are more brownish in color. Adults have yellow-orange facial skin and yellow legs. Facial skin of juveniles is pinkish in color, and the legs are gray (Layne 1978). Full adult plumage is obtained sometime after 2 years of age (J. Morrison, University of Florida, personal communication, 1997), with age of first breeding estimated at three years of age (USFWS 2009b). There is no evidence of sexual dimorphism, the sexes being similar in color and size; however, gender can be determined surgically or through blood analysis (Morrison and Maltbie 1999).

The caracara is a member of the Class Aves, Order Falconiformes, and Family Falconidae.
It was originally described by John James Audubon (1834), who discovered the caracara near St. Augustine, Florida and published an account under the name *Polyborus vulgaris*. John Cassin renamed it in 1865 to *Polyborus plancus audubonii*, the scientific name still used at the time of federal listing in 1987. In 1999, Dove and Banks definitively renamed the North American caracara as *Caracara cheriway* and eliminated all subspecies classifications (Dove and Banks 1999). The Federal list of threatened and endangered animals (50 CFR § 17.11) continues to reference the outdated *Polyborus* nomenclature, but this HCP document employs *Caracara cheriway* as the taxonomic identification, and northern crested caracara as the common name (USFWS 2009).

[7] This species is officially listed under the ESA with the common name Audubon's crested caracara, scientific name *Polyborus plancus audubonii*. A taxonomic reclassification (Dove and Banks 1999) renamed the species as the northern crested caracara (*Caracara cheriway*), which is used in the current scientific literature and this account.

5.2.1.1.1 Status and Distribution

Regulatory History

Although the species occurs extensively in Texas, Louisiana, and Arizona, and is scattered in neighboring states, when the caracara was listed as "Threatened" under the ESA in 1987 the listing was limited to the Florida population. Recovery plans for the caracara were issued in 1989 (USFWS 1989), and as part of the South Florida Multi-species Recovery Plan (USFWS 1999). The most recent five-year review (USFWS 2009) noted that the Florida caracara population is listed as a Distinct Population Segment (DPS), even though its listing predated the 1996 DPS policy, because the original Federal listing was geographically limited to Florida. No critical habitat has been designated for the northern crested caracara Florida population.

Life History

Caracaras are resident, diurnal, and non-migratory. Adult caracaras may be found in their home range year-round. Home ranges average approximately 1,200 hectares (ha), or approximately 3,000 acres (ac), corresponding to a radius of 2 to 3 kilometers (km) or 1.2 to 1.9 miles (mi) surrounding the nest site (Morrison and Humphrey 2001). Foraging typically occurs throughout the home range during nesting and non-nesting seasons.

Morrison (1999) reported that breeding pairs of caracaras are apparently monogamous, highly territorial, and exhibit fidelity to both their mate and the site. The age at first breeding has been documented as 3 years of age (Nemeth and Morrison 2002). Details of breeding behavior in the crested caracara have been documented by Morrison (1998, 1999). Caracaras are one of the first of Florida's raptors to begin nesting. Although breeding activity can occur from September through April, the primary breeding season is considered to be October through March, with 61% of nesting initiation occurring in December and January (Morrison 1999; Dwyer 2010).

Caracaras construct new nests each nesting season, often in the same tree as the previous year. Both males and females participate in nest building. Nests are well concealed and most often found in the tops of cabbage palms (*Sabal palmetto*) (Morrison and Humphrey 2001), although nests have been found in live oaks (*Quercus virginiana*), bald cypress (*Taxodium distichum*), Australian pine (*Casuarina* spp.), saw palmetto (*Serenoa repens*), and black gum (*Nyssa sylvatica*). Caracaras usually construct their nests, which primarily consist of long pieces of woven vines, stalks, and twigs trampled to form a depression, 4 to 18 m above the ground (Bent 1938; Sprunt 1954; Humphrey and Morrison 1996). Caracaras vigorously defend their nesting territory during the breeding season (Morrison 2001).

Dwyer et al (2013) reported that home ranges for individual non-breeding caracaras were several times larger during the breeding season than the non-breeding season, and were more than 250 times larger than ranges reported for breeding caracaras. The authors hypothesized that the search for prospective mates and territories during the breeding season accounts for the greatly expanded home ranges of non-breeding caracara.

Caracaras are highly opportunistic in their feeding habits, eating carrion and capturing live prey. Their diets include insects and other invertebrates, fish, snakes, turtles, birds, and mammals (Layne 1978). Live prey also include rabbits, young opossums (*Didelphis marsupialis*), rats (*Rattus* spp.), mice, squirrels, frogs, lizards, young alligators, crabs, crayfish, fish, young birds, cattle egrets (*Bubulcus ibis*), beetles, grasshoppers, maggots, and worms (Bent 1961; Layne et al. 1977; Morrison 2001). Scavenging at urban dumps has also been observed (Morrison 2001).

Caracaras also closely follow mowers in pastures, tractors plowing fields, etc., in order to capitalize on prey that may be exposed. Caracaras frequently make use of agricultural drainage ditches, cattle ponds, roadside ditches, and other shallow water features for feeding (Morrison 2001).

There appears to be no migration or genetic exchange between the Florida population and other populations of the northern caracara (Dwyer 2010). Detailed studies on natural predators are lacking; however, crows (*Corvus* spp.) and raccoons have been documented as nest predators (J. Layne, Archbold Biological Station, personal communication 1996; J. Morrison, University of Florida, personal communication 1996).

Distribution and Population Trends

Caracaras are known to occur throughout the southern half of the Florida peninsula, from Brevard County in the north to Collier County in the south (USFWS 2012b). Eastern Collier County represents the southwestern limit of the caracara's known breeding range in Florida (USFWS, 2005).

Morrison and Humphrey (2001) stated no data are available on historic abundance, habitat use, or nest distribution of caracara in Florida. The size of Florida's caracara population remains in question. Accurate counts become difficult because of limited access to areas of suitable habitat and because of the bird's behavior and detectability (Humphrey and Morrison 1997). In 1970, Heinzman (1967-1970) published the results of a 4-year road survey, which indicated fewer than 100 individual caracaras at 58 localities remained in Florida. Stevenson (1976) concurred with this estimate in 1974. Layne (1995) monitored caracara distribution and population status in Florida from 1972 to 1989. Based on roadside surveys, he estimated the population was stable with a minimum adult population of about 300 in 150 territories. Layne (1995) estimated the immature population to be between 100 and 200 individuals, bringing the total statewide population to between 400 and 500 birds.

Morrison (1999), using marked birds and more thorough surveys of the caracara's range, estimated a minimum of 200 territories, with an average of 1.4 ±0.1 independent young produced annually. Counts of non-breeding caracaras at communal roosts (gathering areas) have routinely exceeded 100 individual birds, with occasional observations of more than 200 individuals (Dwyer 2010). Available evidence and research suggests a reasonable population estimate of 1000 individuals in Florida (Barnes, 2007).

A recent population viability analysis for caracara indicated that "Florida's caracara population is stable with a zero probability of extinction (100% decline) over the next hundred years under current conditions, meaning no reduction or changes in habitat and no catastrophes," with adult survival having the greatest effect on population persistence (Morrison et al. 2007). The authors concluded that

caracara in Florida are not likely limited by demography, but by factors such as availability of suitable habitat. However, given continued landscape change in areas where caracaras have been known to occur, and the fact that not all the probable breeding range has been adequately surveyed for breeding pairs (most territories occur on private land), accurately estimating and modeling the Florida caracara population size remains challenging and uncertain (USFWS 2009).

Reasons for Decline

The caracara's perceived decline, as described in historic literature, is attributed primarily to habitat loss (Layne 1996). Large areas of native prairie and pasture lands in South-central Florida were converted to citrus operations, tree farms, other forms of agriculture, and real estate development, and this loss of habitat accelerated in the latter part of the Twentieth Century (Morrison and Humphrey 2001). A perceived population decline, coupled with the geographic isolation of the Florida population, eventually resulted in the listing of the caracara as threatened in 1987 (52 Fed. Reg. 25229 (Jul. 6, 1987)). However, historical conversion of forested habitats to pasture has not been adequately documented as partially offsetting losses of caracara habitat (i.e., forest conversions may have added to caracara habitat), so a full accounting of historic habitat changes is lacking.

As discussed in section 5.2.1.1.2 below, the caracara prefers open habitats with low-stature vegetation for foraging and nesting (Morrison and Humphrey 2001; Morrison et al. 2007). Cattle ranching and extensive pastures appear to be compatible with, and may promote, caracara survival. The number of territories occurring in improved or unimproved pasture can be expected to increase if sufficiently large overgrown pastures are reclaimed and/or new pastures are created from other agricultural land uses. The conversion of pasture to citrus (Cox et al. 1994), sugarcane, and residential development is cause for concern. Morrison and Humphrey (2001) found that improved pasture constitutes the highest percentage of habitat cover type found within the home ranges of breeding caracaras. Recognizing the conservation value of cattle ranches and enlisting landowner cooperation in the preservation and management of these lands are critical elements in the recovery of Florida's caracara population.

Lack of habitat management is also a potential threat to caracaras in some areas, and can result in habitat degradation to the point where it is no longer suitable for occupancy. In particular, encroachment of woody shrubs and trees into open dry prairies, pastures, and similar habitats will result in some reduction in habitat suitability. Complete clearing of large areas that includes removal of cabbage palms and other trees may also reduce the suitability of habitat, but generally only when very large areas are completely cleared.

Road mortalities may also be a significant cause of caracara decline. Florida's burgeoning human population increased the number of motor vehicles and roads. The increase in traffic, as well as the caracara's predisposition for feeding on road-killed animals, has probably increased the number of caracaras killed or injured as a result of vehicle strikes. Morrison (2003) identifies highway mortalities as a major cause of juvenile mortalities, with young birds especially vulnerable within the first six months after fledging.

5.2.1.1.2 Habitat Characteristics and Use

The caracara in Florida historically inhabited native dry or wet prairie areas containing scattered cabbage palms their preferred nesting tree. Scattered saw palmetto, scrub oaks (*Quercus geminata, Q. minima, Q. pumila*), and cypress also occur within these native communities. Morrison and Humphrey (2001) hypothesize the vegetation structure of open grasslands (short-stature vegetation, scattered shrub cover, and nest trees) may be preferred by caracara, due to its tendency to walk on the ground during foraging activities. The short vegetation structure may directly facilitate foraging by caracara and provide less cover for predators.

Consequently, caracaras appear to benefit from management actions, such as prescribed burning, that maintain habitat in a low stature and structurally simple condition. Within agricultural lands, regular mowing, burning, and high-density grazing may maintain this low vegetative structure, an important habitat characteristic of the caracara's nest stand area (Morrison and Humphrey 2001). Regular prescribed burning maintains habitat in a favorable condition in native dry prairies. These field observations are consistent with the territory compositional analyses that indicate non-random selection of improved and semi-improved pasture land use.

Morrison and Humphrey (2001) characterized caracara distribution, reproductive activity, and land use patterns within a 5,180,000-acre (21,000-km^2) area in south-central Florida. Comparisons of caracara territories to randomly selected areas and available habitat within the study area revealed caracara home ranges contained higher proportions of improved pasture and lower proportions of forest, woodland, oak scrub, and marsh. Territory size was inversely related to the proportion of improved pasture within the territory. In addition, breeding-area occupancy rate, breeding rates, and nesting success were consistently higher on private ranch lands during the study. Although it is unclear exactly which management activities best promote habitat utilization by caracaras, the mowing, burning, and grazing activities associated with improved pastures serve to maintain the short vegetation structure they seem to favor. The scattered cabbage palms that are often present within improved pastures to serve as shade for cattle provide nesting substrate for caracaras.

Additional investigations into habitat suitability for caracara (Morrison et al. 2007) indicate that maintaining habitat heterogeneity, which includes specific land cover types as well as small (less than 2.47 ac) freshwater wetlands, is important in maintaining suitable habitat for the caracara in Florida. The proportion of six vegetation and land cover types (i.e., cabbage palm-live oak hammock, grassland, improved pasture, unimproved pasture, hardwood hammocks and forest, and cypress/pine/cabbage palm) and two types of aquatic habitats (i.e., lentic/non-flowing and lotic/flowing) were determined to be the most important characteristics for predicting habitat suitability for caracara. Most known nest locations (72.9 percent) in the study were present on improved pasture, although that habitat type only comprised 12.5 percent of the entire study area. Caracara appear to be exploiting pastures, ditches, and impounded wetlands that have replaced the historic land cover, as shown by the high occurrence of improved and unimproved pastures and lotic (flowing) waters in caracara home ranges (Morrison et al. 2007).

Routine observation and radio-telemetry monitoring suggest there are several “gathering areas” in South-central Florida that may be important to caracaras during the first three years after leaving their natal territory, before first breeding (Morrison 2001). These gathering areas are regularly but not continually used by sub-adult and non-breeding caracaras and consist of large expanses of improved pasture. Dwyer et al. (2013) found that non-breeding caracaras utilized citrus groves more than expected by citrus grove availability within the landscape, and hypothesized that groves could serve as refuges from territorial breeding caracaras. The authors suggested that management plans for areas occupied by caracara should “encourage a habitat matrix of pasture for all life stages, citrus groves for non-breeders, and palm hammocks for breeders,” in order to balance conservation of breeding and non-breeding caracara populations.

5.2.1.1.3 Occurrence in the HCP Area

Figure 5-1 depicts available GIS data provided by USFWS for caracara nest locations, and the southern portion of the USFWS caracara consultation area that intersects the HCP Area. The nest locations and associated breeding territories shown on Figure 5-1 occur within and around extensive areas of pastures, open grasslands, cabbage palm-oak hammocks and water features that are the land cover types preferred by caracara (Morrison et al. 2007).

In addition to the caracara nest locations depicted on Figure 5-1, another confirmed breeding pair and two juveniles were identified in 2006 on the Pepper Ranch Preserve conservation lands just northwest of Lake Trafford, which is outside the HCP Area. Caracara adults and juveniles have also been documented on the Caracara Prairie Preserve conservation lands west of Corkscrew Marsh, which is also outside the HCP Area. One or more adult caracaras have been observed near SR 29 just north of BCNP, and adult caracaras have been observed west of the FPNWR (J. Morrison, Trinity College, personal communication 2007). The latter two locations are consistent with the caracara habitat suitability model of Morrison et al. (2007). A caracara communal roost or “gathering area” has also been documented within the HCP Area north of Immokalee and east of SR 29 (Dwyer 2010).

Prior to the documentation of breeding caracaras at Ave Maria (USFWS 2005), the known breeding range of caracaras extended just to the northern boundary of Collier County (Morrison, 2001). Overall, the confirmed breeding observations in eastern Collier County during the last 10-15 years have extended the known caracara breeding range over 10 miles to the south, extending through the majority of the HCP Area.

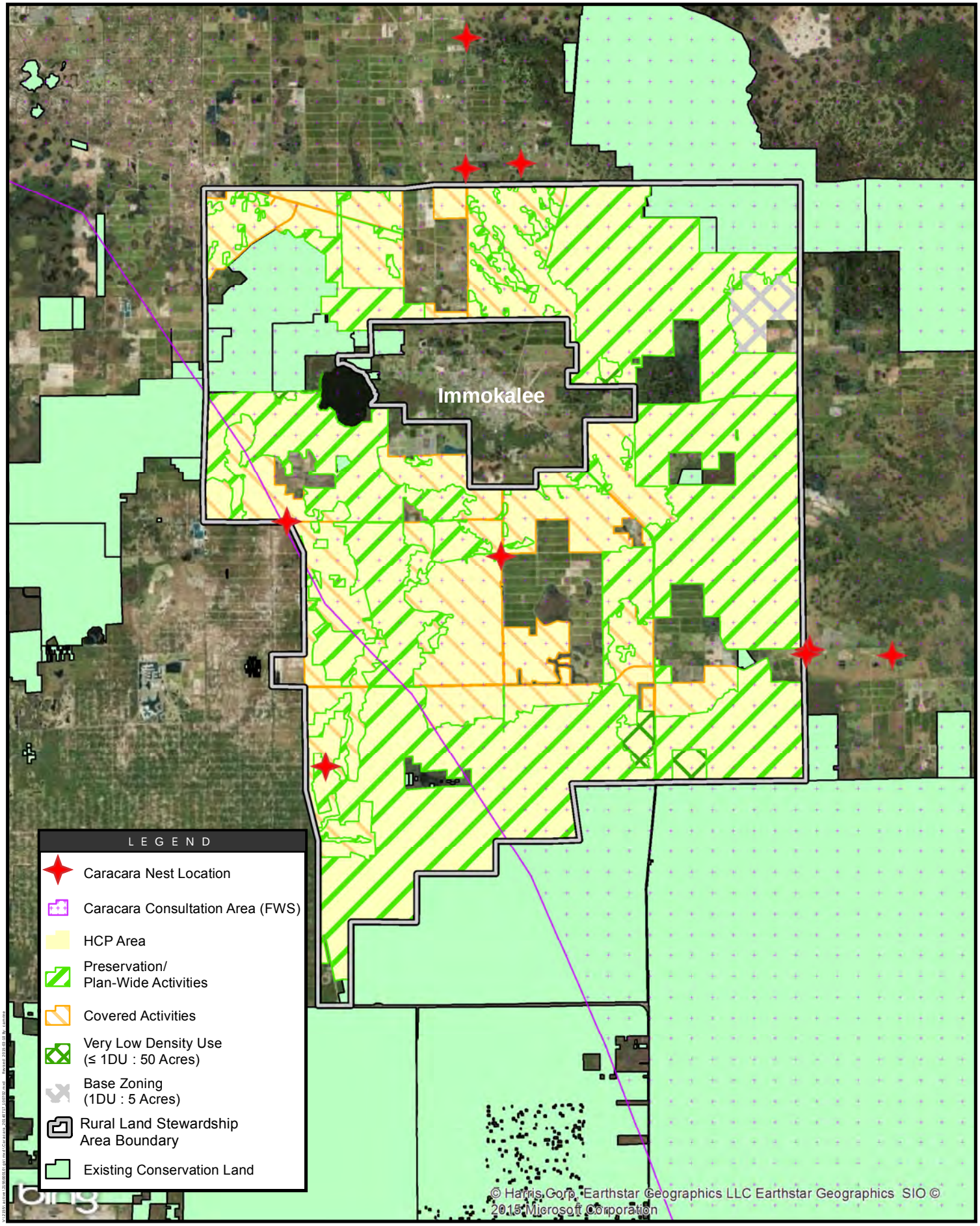

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FIGURE 5-1
Caracara Consultation Area and Nest Locations

December 2014

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0 2 4 Miles

N

5.2.1.2 Wood Stork

This species account for the wood stork (*Mycteria americana*) is compiled from recent USFWS Biological Opinions relevant to the Plan (USFWS 2011a; USFWS 2013a), and updated with additional information from the recent final rule reclassifying the U.S. breeding population of the wood stork from endangered to threatened (79 Fed. Reg. 37078).

The wood stork is a large, long-legged wading bird, with a head to tail length of 85 to 115 cm (33 to 45 in) and a wingspan of 150 to 165 cm (59 to 65 in) (Coulter et al. 1999). The plumage is white, except for iridescent black primary and secondary wing feathers and a short black tail. Wood storks fly with their neck and legs extended. On adults, the rough scaly skin of the head and neck is unfeathered and blackish in color, the legs are dark, and the feet are dull pink. The bill color is also blackish. During courtship and the early nesting season, adults have pale salmon coloring under the wings, fluffy undertail coverts that are longer than the tail, and their toes are bright pink. Immature wood storks, up to the age of about 3 years, have yellowish or straw-colored bills and varying amounts of dusky feathering on the head and neck (Coulter et al. 1999).

The wood stork is a member of the Class Aves, Order Ciconiiformes (which includes herons, egrets, ibises, storks, etc.) and Family Ciconiidae (storks). The only family currently retained in the order is Ciconiidae.

5.2.1.2.1 Status and Distribution

Regulatory History

The wood stork was listed as endangered under the ESA on February 28, 1984 (49 Fed. Reg. 7332). Recovery plans for wood stork were issued in 1986 and 1997 (USFWS 1986; USFWS 1997). The most recent five-year review (USFWS 2007a) recommended preparation of a proposed rule to reclassify the species from endangered to threatened status, and recommended evaluation of wood storks under the 1996 Distinct Population Segment (DPS) policy. As USFWS noted in its final rule to reclassify the wood stork (79 Fed. Reg. 37078 (June 30, 2014)), “The best available scientific and commercial data indicate that, since the U.S. breeding population of wood stork was listed as endangered in 1984, the breeding population has been increasing and its breeding range has expanded significantly.” In terms of recovery goals, USFWS stated that “The 3-year average for nesting pairs has exceeded the reclassification criterion of 6,000 every year since 2003” 79 Fed. Reg. at 37090.

Life History

Wood stork nesting habitat consists of mangroves as low as 3 feet, cypress as tall as 100 feet, and various other live or dead shrubs or trees located in standing water (swamps) or on islands surrounded by relatively broad expanses of open water (Palmer 1962, Rodgers et al. 1987, Ogden 1991, Coulter et al. 1999). Wood storks nest colonially, often in conjunction with other wading bird species, and generally occupy the larger-diameter trees at a colony site (Rodgers et al. 1996). The same colony site will be used for many years as long as the colony is undisturbed and sufficient feeding habitat remains in

surrounding wetlands. However, not all storks nesting in a colony will return to the same site in subsequent years (Kushlan and Frohring 1986).

Wood storks are seasonally monogamous, probably forming a new pair bond every season. First breeding has been documented at 3 and 4 years old. Nest initiation varies geographically. Wood storks can lay eggs as early as October and as late as June in Florida (Rodgers 1990, 48– 51). Wood storks in northern Florida, Georgia, and South Carolina initiate nesting on a seasonal basis regardless of environmental conditions (USFWS 1997, 6). They lay eggs from March to late May, with fledging occurring in July and August. Historically, nest initiation in South Florida was in November to January; however, in response to the altered habitat conditions (wetland drainage, hydroperiod alteration) in South Florida, wood storks nesting in Everglades National Park and in the Big Cypress region of Florida have delayed initiation of nesting to February or March in most years since the 1970s.

Colonies that start nesting after January in South Florida risk having young still in the nests when May-June rains flood marshes and disperse fish, which can cause nest abandonment. Frederick (2012, 44) states that later nesting increases the risk of mortality of nestlings that have not fledged prior to the onset of the wet season, which is likely the difference between the South Florida segment of the population being a source or a sink to the wood stork population. Based upon their analysis of fledgling survival, Borkhataria et al. 2012 (p. 525) also note the possibility that South Florida is acting as a population sink.

Females generally lay a single clutch of two to five eggs per breeding season, but the average is three eggs. Females sometimes lay a second clutch if nest failure occurs early in the season (Coulter et al. 1999, 11). Average clutch size may increase during years of favorable water levels and food resources. Incubation requires about 30 days and begins after the female lays the first one or two eggs. Nestlings require about 9 weeks for fledging, but the young return to the nest for an additional 3 to 4 weeks to be fed. Actual colony production measurements are difficult to determine because of the prolonged fledging period, during which time the young return daily to the colony to be fed.

During the period when a nesting colony is active, storks are dependent on consistent foraging opportunities in wetlands within about 12.4 to 18.6 mi of the nest site (Kahl 1964; Coulter and Bryan 1993) with the greatest energy demands occurring during the middle of the nestling period, when nestlings are 23 to 45 days old (Kahl 1964). The average wood stork family requires 443 pounds of fish during the breeding season, with 50 percent of the nestling stork's food requirement occurring during the middle third of the nestling period (Kahl 1964). Receding water levels are necessary in South Florida to concentrate suitable densities of forage fish (Kahl 1964, Kushlan et al. 1975).

In southern Florida, both adult and juvenile storks consistently disperse northward following fledging in what has been described as a mass exodus (Kahl 1964). Storks in central Florida also appear to move northward following the completion of breeding, but generally do not move as far (Coulter et al. 1999). Many of the juvenile storks from southern Florida move far beyond Florida into Georgia, Alabama, Mississippi, and South Carolina (Coulter et al. 1999; Borkhataria et al. 2004; Borkhataria et al. 2006b). Some flocks of juvenile storks have also been reported to move well beyond the breeding range of

storks in the months following fledging (Kahl 1964). This post-breeding northward movement appears consistent across years.

Adult and juvenile storks return southward in the late fall and early winter months. In a study employing satellite telemetry, Borkhataria et al. (2006b) reported that nearly all storks that had been tagged in the southeastern U.S. moved into Florida near the beginning of the dry season, including all sub-adult storks that fledged from Florida and Georgia colonies. Adult storks that breed in Georgia remained in Florida until March, and then moved back to northern breeding colonies (Borkhataria et al. 2006a). Overall, about 75 percent of all locations of radio-tagged wood storks occurred within Florida (Borkhataria et al. 2006a). Range-wide occurrence of wood storks in December, recorded during the 1995 to 2008 Audubon Society Christmas Bird Counts for the Southeast U.S. (Audubon Society 2009) suggests that the majority of the southeastern United States wood stork population occurs in central and southern Florida during this period of the year. Relative abundance of storks in this region during the fall and winter months was 10 to 100 times higher than in northern Florida and Georgia during the same period (USFWS 2007a). As a result of these general population-level movement patterns during the earlier period of the stork breeding season in southern Florida, the wetlands upon which the Florida population of nesting storks depend are also being heavily used by a significant portion of the southeastern United States wood stork population, including storks that breed in Georgia and the Carolinas, and sub-adult storks from throughout the stork's range. In addition, these same wetlands support a wide variety of other wading bird species (Gawlik 2002).

Distribution and Population Trends

The wood stork occurs in South America from northern Argentina, eastern Peru, and western Ecuador, north into Central America, Mexico, Cuba, Hispaniola, and the southern United States. The breeding range includes the southeastern United States in North America, Cuba and Hispaniola in the Caribbean, and southern Mexico through Central America.

At the time of listing in 1984, the range of the U.S. population of wood storks was Florida, Georgia, South Carolina, and Alabama. At that time, breeding was restricted primarily to 22 nesting colonies in peninsular Florida and four colonies in Georgia and South Carolina. The current breeding range and number of breeding colonies have expanded, and include peninsular Florida (39–57 colonies), the coastal plain and large river systems of Georgia (17–28 colonies) and South Carolina (14–23 colonies), and southeastern North Carolina (1–3 colonies). The breeding season range has expanded west to South-central Georgia and to the panhandle of Florida, including the Apalachicola River system. The nesting colony database for the U.S. breeding population of the wood stork can be found at http://www.wec.ufl.edu/faculty/frederickp/woodstork/. The nonbreeding season range includes all of Florida, the coastal plains and large river systems of Alabama, Georgia, South Carolina, southern North Carolina, and eastern Mississippi.

The U.S. wood stork population declined from 1930 to 1978. This decline was attributed to reduction in the food base necessary to support breeding colonies, thought to have been related to loss of wetland habitats and changes in hydroperiods (Ogden and Nesbitt 1979, 521; Ogden and Patty 1981, 97; USFWS

1997, 10; Coulter et al. 1999, 18). Ogden (1978, 143) concluded the U.S. wood stork breeding population in the 1930s was probably between 15,000 and 20,000 pairs (or 30,000 to 40,000 individuals). The estimated U.S. population of breeding wood storks throughout the southeastern United States declined to about 10,000 pairs in 1960, and further declined to a low of 2,700–5,700 pairs between 1977 and 1980 (Ogden et al. 1987, 752). The low of 2,700 estimated nesting pairs was documented in 1978, during a severe drought when many wood storks likely did not breed.

The U.S. breeding population of the wood stork has more than doubled since 1978 (Brooks and Dean 2008, 58; Borkhataria 2009, 34). The use of regional synoptic nesting surveys to census wood stork colonies has been continuous in South Florida and Georgia since 1976, and in South Carolina since 1981. Nest censuses of the entire breeding range were conducted in 1975–1986, 1991, 1993–1995, 1997, 1999, and 2001–2013 with a census of almost every active colony. The 3-year average for nesting pairs has exceeded the reclassification criterion of 6,000 every year since 2003. The nesting pair average is still below the 5-year average of 10,000 nesting pair benchmark for delisting, and the 5-year averages for nesting in the Everglades and Big Cypress Systems is below the 2,500 nesting pair benchmark for delisting. While the nesting population has increased throughout most of the wood stork's range, nesting in South Florida remains variable.

Three counts of more than 10,000 pairs have occurred during the past 8 years, and the count of 12,720 pairs in 2009 is the highest on record since the early 1960s. This population estimate, along with a conservative estimate of 4,000 pre-breeding age birds, suggests 30,000 storks were inhabiting the United States in 2009 (Bryan and Borkhataria 2010, 2). Nest counts were 8,149 in 2010, 9,579 in 2011, 8,452 in 2012, and 11,046 in 2013.

Wood stork colonies experience considerable variation in production among colonies and years in response to local habitat conditions and food availability (Holt 1929, Kahl 1964, Ogden et al. 1978, Clark 1978, Hopkins and Humphries 1983, Rodgers and Schwikert 1997). Recent studies (Rodgers et al. 2008, Bryan and Robinett 2008, Winn et al. 2008, Murphy and Coker 2008) documented production rates to be similar to rates published between the 1970s and 1990s.

Nest initiation date, colony size, nest abandonment, and fledging success of a wood stork colony varies from year-to-year based on availability of suitable wetland foraging areas and conditions, which can be affected by local rainfall patterns, regional weather patterns, and anthropogenic hydrologic management (USFWS 1997). A colony site may be vacant in years of drought or unfavorable conditions due to inadequate foraging conditions in the surrounding area (Kahl 1964). Traditional colony nesting sites may be abandoned completely by storks when hydrological changes occur, such as removal of surface water from beneath the colony trees (USFWS 1997, Coulter et al. 1999). Nesting failures and colony abandonment may also occur if unseasonable rainfall causes water levels to rise when they are normally receding, thus dispersing rather than concentrating forage fish (Kahl 1964, USFWS 1997, Coulter et al. 1999).

The annual climatological pattern that appeared to stimulate the heaviest nesting efforts by storks was a combination of the average or above-average rainfall during the summer rainy season prior to colony

formation and an absence of unusually rainy or cold weather during the following winter-spring nesting season. This pattern produced widespread and prolonged flooding of summer marshes that maximized production of freshwater fishes, followed by steady drying that concentrated fish during the dry season when storks nest (Kahl 1964).

Reasons for Decline

The primary causes of the wood stork population decline in the United States are loss of wetland habitats and loss of wetland function, resulting in reduced prey availability. Almost any shallow wetland depression where fish become concentrated, through either local reproduction or receding water levels, may be used as feeding habitat by the wood stork during some portion of the year, but only a small portion of the available wetlands support the foraging conditions (high prey density and favorable vegetation structure) that storks need to maintain growing nestlings. Browder et al. (1976) and Browder (1978) documented the distribution and the total acreage of wetland types occurring south of Lake Okeechobee, Florida, for the period from 1900 through 1973. USFWS (2013) combined their data for habitat types known to be important foraging habitat for wood storks (cypress domes and strands, wet prairies, scrub cypress, freshwater marshes and sloughs, and sawgrass marshes) and found these South Florida wetland habitat types have been reduced by about 35 percent since 1900.

Ceilley and Bartone (2000, 70) suggest that short hydroperiod wetlands provide a more important pre-nesting food source and provide for a greater early nestling survivorship for wood storks than previously known. Wetlands that wood storks use for foraging are being lost through permitted activities where mitigation is provided. However, it is not known if wood stork foraging wetlands are being replaced with like-quality foraging wetlands within the core foraging area of an impacted colony. Lauritsen (2010, 4–5) suggests that today's mitigation practices lead to a disproportionate loss of short hydroperiod wetlands. The impacts of the loss of short hydroperiod (isolated) wetlands, which supply most of the food energy for initiating reproduction (Fleming et al. 1994, 754), may result in no nesting or abandonment of nesting attempts by wood storks at colonies like Corkscrew Swamp Sanctuary. Lauritsen (2010, 2) indicates the historic extent of wet prairies within the core foraging area of the Corkscrew Swamp colony has decreased by 70 percent, while deep marsh habitat has increased when compared to pre-development conditions. Frederick and Meyer (2008, 15) suggest that the decline in colony size in Florida reflects the increasingly fragmented nature of Florida's wetlands resulting from development.

Wood storks use manmade wetlands for foraging and breeding purposes. Human-made wetlands include, but are not limited to, storm water treatment areas and ponds, golf course ponds, borrow pits, reservoirs, roadside ditches, agricultural ditches, drainages, flow-ways, mining and mine reclamation areas, and dredge material sites. The impacts can be positive in certain scenarios as these wetlands can provide protected foraging and nesting habitat, and may offset some losses of natural wetlands caused by development. A significant number of wood stork colonies are located where water management practices can impact the nesting habitat negatively. Colonies that are perpetually flooded will have no tree regeneration. Draining surface waters of a colony's wetland or pond will prevent wood storks from nesting, and lowered water levels after nest initiation facilitate raccoon predation. Lowering surface water or water table may occur through water control structures, manipulating adjacent wetlands, or

water withdrawals from the local aquifer, and can prevent wood storks from nesting or cause colony failure.

Other natural or manmade factors affecting the wood stork's continued existence, such as contaminants, harmful algal blooms, electrocution, road kill, invasion of exotic plants and animals, human disturbance, and stochastic events, are all documented to affect wood storks at minimal levels (USFWS 2014).

5.2.1.2.2 Habitat Characteristics and Use

Wood storks forage in a wide variety of wetland types, where prey are available and the water is shallow and open enough to hunt successfully (Ogden et al. 1978, Browder 1984, Coulter 1987). Calm water, about 2 to 16 inches in depth and free of dense aquatic vegetation, is ideal (Coulter and Bryan 1993). Typical foraging sites include freshwater marshes, ponds, cypress domes and strands, hardwood swamps, wet prairies, narrow tidal creeks or shallow tidal pools, and artificial wetlands such as stock ponds, shallow, seasonally flooded roadside or agricultural ditches, and managed impoundments (Coulter and Bryan 1993, Coulter et al. 1999).

Wood storks generally use a specialized feeding behavior called tactilocation, or grope feeding, but also forage visually under some conditions (Kushlan 1979). Storks typically wade through the water with the beak immersed and open about 2.5 to 3.5 inches. When the wood stork senses prey within its bill, the mandibles snap shut, the head is raised, and the food is swallowed (Kahl 1964). Occasionally, wood storks stir the water with their feet in an attempt to startle hiding prey (Rand 1956, Kahl 1964, Kushlan 1979). This foraging method allows them to forage effectively in turbid waters, at night, and under conditions when other wading birds that employ visual foraging may not be able to forage successfully.

Several factors affect the suitability of potential foraging habitat for wood storks. Suitable foraging habitats must provide both a sufficient density and biomass of forage fish and other prey, and have vegetation characteristics that allow storks to locate and capture prey. During nesting, these areas must also be sufficiently close to the colony to allow storks to deliver prey to nestlings efficiently. Hydrologic and environmental characteristics have strong effects on fish density, and these factors may be some of the most significant in determining foraging habitat suitability, particularly in southern Florida. Important to wood stork productivity is the timing of two different factors of wetland hydrology: uninterrupted hydroperiods of certain durations prior to the nesting season that lead to production of prey, and short-term drawdown of water levels that make the prey available and that cue and support wood stork nesting (79 Fed. Reg. 37078).

Carlson and Duever (1979) noted in their study that long distance movement of fish into deeper habitats is not a regular occurrence in the Big Cypress watershed communities. They also noted that the preponderance of obstacles and plant debris all contribute to hindering mobility and limiting movement across the site. In addition, Chapman and Warburton's (2006) studies on *Gambusia* noted that movement between drying pools was limited. Carlson and Duever (1979) concluded that "density and biomass of both wet and dry season fish populations are dependent primarily on the production of the particular site and not of adjacent habitats from which fish may have migrated."

Wood storks feed almost entirely on fish between 1 to 10 inches in length (Kahl 1964, Ogden et al. 1976, Coulter 1987), but may consume crustaceans, amphibians, reptiles, mammals, birds, and arthropods. Lauritsen (2007; 2009) observed wood stork foraging on crayfish. In the foraging studies conducted by Ogden et al. (1976), Coulter et al. (1999), Carlson and Duever (1979), Turner et al. (1999) and Trexler et al. (2002), little information is provided on consumption of invertebrates. Ogden et al. (1976) summarized information from Kahl's publications (1962, 1964) on stomach contents of wood storks sampled in South Florida and Southwest Florida and noted that all individuals examined contained only fish. Ogden et al.'s (1976) study also noted that the prey consumed were fish, although the average density of prawns was 2.5 times the density of the most abundant fish.

5.2.1.2.3 Occurrence in the HCP Area

USFWS recently issued a map of "Wood Stork Nesting Colonies and Core Foraging Areas Active Within 2004-2013 in Florida" (USFWS 2014a), showing six wood stork nesting colonies within and adjacent to the HCP Area (Figure 5-2). Although the USFWS map depicts six active colonies in the HCP Area and adjacent areas within the past decade, a cross-check of the previously mentioned wood stork nesting database indicates that there is a redundant entry for the Corkscrew colony; there is only a single nesting colony at that location (J. Lauritsen, 2014, personal communication). The USFWS displays 23 other wood stork colonies in Monroe, Miami-Dade, and Broward counties active within the 2004-2013 period.

The colony at the National Audubon Society's Corkscrew Swamp Sanctuary (Corkscrew) has been monitored annually since 1958, and "has recorded more successful fledglings than any other single colony in the United States." (Lauritsen 2010, 1). The other nesting colonies within the HCP Area are located within and adjacent to the Okaloacoochee Slough regional flowway (Figure 5-2). The USFWS recognizes an 18.6-mile radius around each nesting colony in South Florida as the "core foraging area" (CFA) for regulatory purposes (USFWS 2010). The CFAs for the nesting colonies depicted on Figure 5-2 overlap to a high degree, and all of the HCP Area are therefore within at least one wood stork core foraging area.

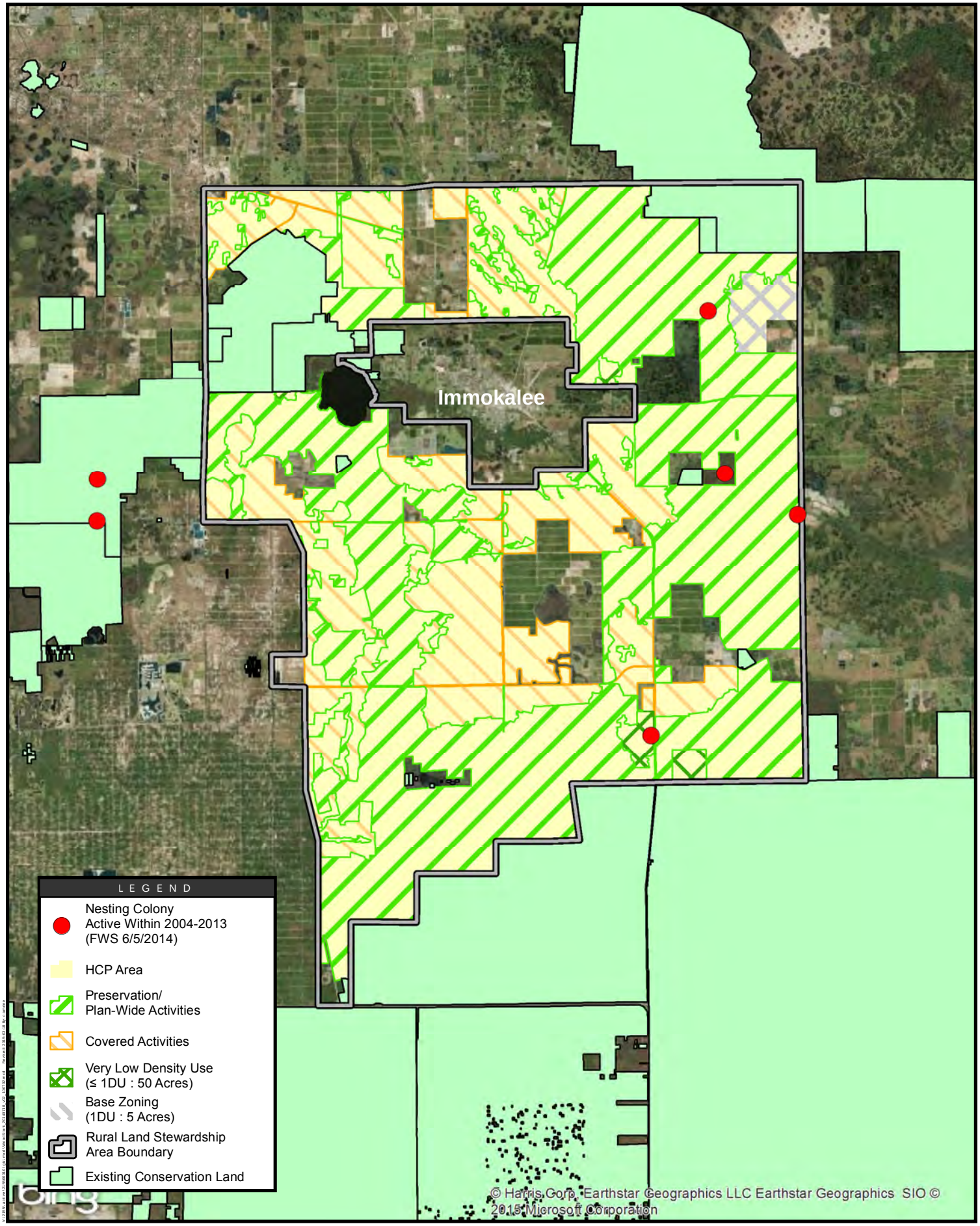

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FIGURE 5-2
Wood Stork Nesting Colonies

December 2014

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0 2 4 Miles

N

5.2.1.3 Red-Cockaded Woodpecker

The following species account for the red-cockaded woodpecker (*Picoides borealis*, herein RCW) is compiled from recent USFWS Biological Opinions (USFWS 2009c; USFWS 2014b), supplemented with information from the South Florida Multi-Species Recovery Plan (USFWS 1999), the RCW Revised Recovery Plan (USFWS 2003) and the most recent five-year review (USFWS 2006). As the language in recent Biological Opinions has been previously reviewed and approved by USFWS, most of the language below is taken directly from the cited Biological Opinions, with only minor modifications.

The RCW, which is a member of the Order Piciformes and Family Picidae, is relatively small. Adults measure 20 to 23 cm (8 to 9 in) and weigh roughly 40 to 55 g (1.5 to 1.75 oz.) (Jackson 1994; Conner et al. 2001). They are larger than downy woodpeckers (*Picoides pubescens*), similar in size to yellowbellied sapsuckers (*Sphyrapicus varius*), and smaller than other southeastern woodpeckers. The size of RCWs varies geographically, with larger birds to the north (Mengel and Jackson 1977). Because of this, Wetmore (1941) considered the birds of peninsular Florida to be a subspecies (*P. b. hylonomus*) which was later recognized by the American Ornithologists' Union (1957). Mengel and Jackson (1977), however, examined a larger series of specimens and considered the variation in the species to be smoothly clinal with no justification for distinguishing the birds in south Florida from those elsewhere.

Red-cockaded woodpeckers are black and white with a ladder back and large white cheek patches. These cheek patches distinguish red-cockaded woodpeckers from all others in their range. Red-cockaded woodpeckers have a black cap and nape that encircle their white cheek patches, with black and white barring on their backs and wings. Their breasts and bellies are white to grayish white with distinctive black spots along the sides of breast changing to bars on the flanks. Central tail feathers are black and outer tail feathers are white with black barring. Adults have black crowns, a narrow white line above the black eye, a heavy black stripe separating the white cheek from a white throat, and white to grayish or buffy nasal tufts. Bills are black, and legs are gray to black.

5.2.1.3.1 Status and Distribution

Regulatory History

The Service identified the RCW as a rare and endangered species in 1968 and officially listed it as endangered in 1970 (35 Fed. Reg. 16047 (Oct. 13, 1970)). With passage of the Act in 1973, the RCW received the protection afforded listed species under the Act. No critical habitat has been designated for the RCW. A complete discussion of the status of the species in South Florida and throughout its range can be found in the Service's South Florida Multi-species Recovery Plan (USFWS 1999) and Revised Recovery Plan (USFWS 2003a), respectively. In addition, a 5-year review was completed in 2006 resulting in no change to the status of the species (USFWS 2006).

Life History

The RCW is a territorial, non-migratory, cooperative breeding species (Lennartz et al. 1987). It is unique in that it is the only North American woodpecker that exclusively excavates its roost and nest cavities in

living pines. Each group member has its own cavity, although there may be multiple cavities in a cavity tree. The aggregate of cavity trees, surrounded by a 200-ft (61-m) forested buffer, is called a cluster (Walters 1990). Cavities within a cluster may be complete or under construction and may be active, inactive, or abandoned.

RCWs live in social units called groups. Groups usually consist of a breeding pair, the current year's offspring and zero to four helpers; helpers are typically adults, normally male offspring of the breeding pair from previous years (Walters 1990). Helpers assist in defending territories (territorial disputes between neighboring groups are common) and in feeding and otherwise caring for the young. Mated pairs usually remain together until one dies, but some inter-group movement of breeding adults occurs (Walters et al. 1988). Breeding groups average 2 to 4 birds prior to breeding and 4 to 6 afterward, but groups numbering up to 8 to 10 birds have been observed.

Red-cockaded woodpeckers can excavate cavities within a few months, but more typically take 1 to 3 years. It is also possible for a start hole to be created that remains unattended for several months or even years before excavation is resumed; the heartwood may be initially too hard for successful cavity completion, but will soften over time. Once a cavity is completed, small, conical "resin wells" are excavated above, alongside, and below the cavity, as well as on the opposite side of the tree (Jackson and Thompson 1971). Resin wells are continuously maintained to sustain exudation of sap for the life of the tree. The resulting resin flow gives the tree a glazed, "candle-like" appearance, which makes it unmistakable as a red-cockaded woodpecker cavity. The resin flow is an effective deterrent to rat snakes (*Elaphe guttata*) and perhaps other predators of cavity-nesting birds (Jackson 1974, Rudolph et al. 1990).

RCWs forage almost exclusively on live pine trees, although they will forage on recently killed pines (Franzreb 2004). Their prey consists of wood cockroaches, caterpillars, spiders, woodborer larvae, centipedes, and ants (Hanula and Horn 2004). Although they will use smaller pine trees as foraging substrate, RCWs prefer pines greater than 10 in in diameter at breast height (Hooper and Harlow 1986; Engstrom and Sanders 1997).

Red-cockaded woodpeckers attain breeding age at 1 year; however, reproductive success improves with increased age (Walters 1990). The nesting season in Florida is late April through early June. The nest cavity is usually the roost cavity of the breeding male (Ligon 1970; Lennartz et al. 1987). The red-cockaded woodpecker is monogamous, and essentially single-brooded, although rare instances of double-brooding in a given year have been documented (Jackson 1994; Schillaci and Smith 1994). Clutch size is normally two to four eggs (Ligon 1970), and incubation is 10 to 11 days; this is one of the shortest incubation periods among birds (Ligon 1970; Crosby 1971). Both parents and helpers incubate the eggs (Jackson 1994). Usually one to three young fledge at 26 to 29 days of age (Ligon 1970), but they are dependent to some degree upon their parents and any helpers for 2 to 5 months thereafter (Jackson 1994). Although not all groups produce young, in South Florida, 81 percent of groups were found to be successful.

The red-cockaded woodpecker is long-lived for a bird its size; banded birds in the wild have reached 15 years of age, and a captive-reared bird was documented at 13 years (Jackson 1994).

Most female red-cockaded woodpeckers disperse within 1 year after fledging. They may attain breeding status in another territory or become floaters that are not definitively associated with a particular group of birds or cluster of cavity trees (Hovis and Labisky 1996). Some fledgling males also disperse to become breeders or floaters, or to establish and defend a territory, while others remain on their natal territory as helpers until a breeding opportunity arises (Walters et al. 1988). There is little information on dispersal distances for RCWs in South Florida; however, a dispersal distance of 17 km (10.5 mi) was reported from Avon Park Air Force Range (AFR) (P. Ebersbach, Avon Park AFR, personal communication 1996).

Distribution and Population Trends

The current distribution of this non-migratory, territorial species (endemic to open, mature and old growth pine ecosystems) is restricted to the remaining fragmented parcels of suitable pine forest in 11 southeastern States; it has been extirpated in New Jersey, Maryland, Missouri, Tennessee, and Kentucky (Costa 2004). As of April 2003, approximately 14,500 RCWs were living in 5,800 known active clusters across 11 states (USFWS 2003a). This is less than 3 percent of the estimated abundance at the time of European settlement.

South Florida contains support populations necessary for the Federal recovery of red-cockaded woodpeckers. Pine stands, or pine-dominated pine/hardwood stands, with a low or sparse understory and ample old-growth pines, constitute primary RCW nesting and roosting habitat. In Southwest Florida (Charlotte, Collier, and Lee Counties), hydric slash pine (*P. elliotii* var. *densa*) flatwoods provide the preferred nesting and foraging habitat for the RCW (Beever and Dryden 1992).

In Southwest Florida, there are an estimated 85 active RCW clusters; 51 percent are on Federal lands, 35 percent are on State lands, and 14 percent are on private lands. The known RCW populations on public lands are periodically monitored and the status of birds on these lands is variable. Effective land management actions are currently ongoing in the Cecil M. Webb Wildlife Management Area (WMA), where 27 known active RCW clusters occur. Big Cypress National Preserve contains 43 clusters that are actively managed and this population is increasing. Picayune Strand State Forest (PSSF) has three active clusters and is receiving land management actions to stabilize the population and increase the number of active clusters. However, this population is small and may be vulnerable to stochastic events that could lead to extirpation despite current efforts by the State to manage RCW habitat.

Reproductive rates, population density, and re-colonization rates may influence RCW population variability more than mortality rates, sex ratios, and genetic variability. RCWs exhibit relatively low adult mortality rates; annual survivorship of breeding adults is high, ranging from 72 to 84 percent for males and 51 to 81 percent for females (Lennartz and Heckel 1987; Walters et al. 1988; Delotelle and Epting 1992). The average number of fledglings produced per breeding group in central Florida is 1.0, which is lower than that of other populations in the Southeast (DeLotelle and Epting 1992).

The availability of suitable cavity trees is a limiting factor for RCW populations. Use of artificial cavities can dramatically increase RCW populations because of the birds' ability to re colonize unoccupied habitat made suitable by this management action (Copeyon 1990; Allen 1991). Significant population expansions have been documented where artificial cavity provisioning has been employed (Gaines et al. 1995; Franzreb 1999; Carlile et al. 2004; Doresky et al. 2004; Hagan et al. 2004; Hedman et al. 2004; Marston and Morrow 2004; Stober and Jack 2004).

Reasons for Decline

Red-cockaded woodpeckers are vulnerable to habitat loss and habitat degradation, which are the two primary factors in the species' original decline. These factors result from direct conversion of habitat to other land uses, fire suppression, and loss of mature pines within pine woodlands. Direct conversion of habitat no longer occurs on public lands, which form the basis of recovery for red-cockaded woodpeckers. However, currently, lack of frequent fire and mature pines continue to threaten the species on public and private lands. Red-cockaded woodpeckers are most vulnerable to loss and degradation of nesting habitat, but are also vulnerable to loss and degradation of foraging habitat. Addressing these threats is a primary objective of the recovery plan (USFWS 2006).

Primary threats to species viability for red-cockaded woodpeckers all have the same basic cause: lack of suitable habitat. Red-cockaded woodpeckers require open mature pine woodlands and savannahs maintained by frequent fire, and there is very little of this habitat remaining (Lennartz et al. 1983; Frost 1993; Simberloff 1993; Ware et al. 1993). On public and private lands, both the quantity and quality of red-cockaded woodpecker habitat are impacted by past and current fire suppression and detrimental silvicultural practices (Ligon et al. 1986, 1991; Baker 1995; Cely and Ferral 1995; Masters et al. 1995; Conner et al. 2001). Serious threats stemming from this lack of suitable habitat include (i) insufficient numbers of cavities and continuing net loss of cavity trees (Costa and Escano 1989; James 1995; Hardesty et al. 1995); (ii) habitat fragmentation and its effects on genetic variation, dispersal, and demography (Conner and Rudolph 1991); (iii) lack of foraging habitat of adequate quality (Walters et al. 2000, 2002; James et al. 2001); and (iv) fundamental risks of extinction inherent to critically small populations from random demographic, environmental, genetic, and catastrophic events (Shaffer 1981, 1987).

5.2.1.3.2 Habitat Characteristics and Use

Red-cockaded woodpeckers require open pine woodlands and savannahs with large old pines for nesting and roosting habitat (clusters). Large old pines are required as cavity trees because the cavities are excavated completely within inactive heartwood, so that the cavity interior remains free from resin that can entrap the birds. Also, old pines are preferred as cavity trees, because of the higher incidence of the heartwood decay that greatly facilitates cavity excavation. Cavity trees must be in open stands with little or no hardwood midstory and few or no overstory hardwoods. Hardwood encroachment resulting from fire suppression is a well-known cause of cluster abandonment. Red-cockaded woodpeckers also require abundant foraging habitat. Suitable foraging habitat consists of mature pines

with an open canopy, low densities of small pines, little or no hardwood or pine midstory, few or no overstory hardwoods, and abundant native bunchgrass and forb groundcovers.

The spatial extent needed to sustain red-cockaded woodpeckers depends primarily on habitat quality. Home ranges in optimal habitat in the Carolinas average 70 to 90 ha. In most of Florida, however, habitat quality is considerably lower than the optimal conditions in the Carolinas, as well as other areas within the species' range. Home ranges for red-cockaded woodpeckers in northern Florida average 120 to 140 ha (Porter and Labisky 1986). Habitat quality in southern and central Florida is particularly marginal in that respect; home ranges average 140 to 160 ha, but can exceed 200 ha (Patterson and Robertson 1981, Nesbitt et al. 1983, DeLotelle et al. 1987; Wood 1996).

Red-cockaded woodpeckers forage primarily on arthropods, taken by chipping away the outer layer of tree bark and gleaning what they find underneath. They will occasionally feed on vegetative matter such as pine mast and fruits (Jackson 1994). They have also been observed taking flying insects on the wing. Red-cockaded woodpeckers typically forage in larger pines in pine-dominated habitat (90 percent), rather than in hardwoods (Ramey 1980; Bradshaw 1990). Male red-cockaded woodpeckers tend to forage primarily on the branches and upper trunk of pines, whereas females forage primarily on the trunk below the lowest branches (Ligon 1968; Ramey 1980; Jackson and Parris 1995). As stated previously, because of the poor habitat quality in South Florida, more habitat is needed for foraging than in areas farther north (Beever and Dryden 1992).

Population-limiting factors are those that directly affect the number of potential breeding groups, because this is the primary determinant of population size and trend. Several factors currently impact the persistence of breeding groups. Foremost among these are the factors that limit suitable nesting habitat, namely fire suppression and lack of cavity trees. Fire suppression has resulted in loss of potential breeding groups throughout the range of red-cockaded woodpeckers, because the birds cannot tolerate the hardwood encroachment that results from lack of fire. This limitation is addressed through the use of prescribed burning. Lack of cavity trees, and potential cavity trees, limits the number of breeding groups in most populations. This limitation is addressed in the short-term through cavity management tools such as artificial cavities and restrictor plates, and over the long-term by growing large old trees in abundance.

Another factor directly limiting the number of potential breeding groups is habitat fragmentation and consequent isolation of groups, which results in disrupted dispersal of helpers and failure to replace breeders. This limitation is best addressed through the appropriate placement of clusters of artificial cavities, and implementation of silvicultural practices that minimize fragmentation.

Native slash pine communities support red-cockaded woodpeckers in South Florida (Beever and Dryden 1992). This subspecies of slash pine (*Pinus elliottii* var. *densa*) is the only native pine in this region and is similar to longleaf in both appearance and fire resistance. Native slash pine has a grass stage and large taproot, as does longleaf pine (Landers 1991). Much of the native slash used by red-cockaded woodpeckers is in hydric communities (Beever and Dryden 1992). It may be that slash pine replaces longleaf pine in this region because it can better tolerate very wet conditions.

For red-cockaded woodpeckers, native slash pine habitats differ from those farther north in that the pines are generally smaller and may be more sparsely distributed (Patterson and Robertson 1981; Beever and Dryden 1992; Landers and Boyer 1999). The largest size that South Florida slash pines achieve, even in old growth woodlands, is typically 20 to 30 cm (8 to 12 in) in diameter. Cavity trees in this habitat type are much smaller than normally found in other habitats (Beever and Dryden 1992; Bowman and Huh 1995). However, the presence of fire and old trees in both nesting and foraging areas are critically important here as elsewhere.

Woodpeckers in native slash pine have not been well studied. Preliminary research has indicated that home ranges of birds in native slash pine are larger than those in other habitats (Patterson and Robertson 1981; Beever and Dryden 1992), but the relationship between habitat requirements and habitat quality has not been investigated in this forest type. Thus, it is not known whether larger home ranges in South Florida result from degraded habitat, natural differences in habitat quality, population density, or even lack of cavity trees. Although further research is necessary to determine the cause of large home ranges in South Florida, results from studies elsewhere suggest that as habitat quality increases, the size of these home ranges will decrease. It is likely that, as pine density, age, and herbaceous groundcovers of South Florida slash pine woodlands increase, resident woodpeckers will still require more foraging habitat than woodpeckers in most other regions but less than they appear to be using at the present time.

5.2.1.3.3 Occurrence in the HCP Area

Collier County represents the southwestern limit of the RCW's current range in Florida. No known RCW clusters currently exist within the HCP Area (Figure 5-3). Multiple RCW clusters occur within BCNP and the Belle Meade area of Golden Gate estates (shown on Figure 5-3), with additional RCW occurrence data recorded within BCNP, PSSF, and private lands in the vicinity of Naples. The minimum distance from a known RCW cluster to the HCP Area is approximately seven (7) miles, which does not preclude the dispersal of RCWs into the HCP Area. Therefore, although no RCW occurrences are currently documented within the HCP Area, the Plan includes the RCW as one of the Covered Species to account for any future stochastic dispersal events.

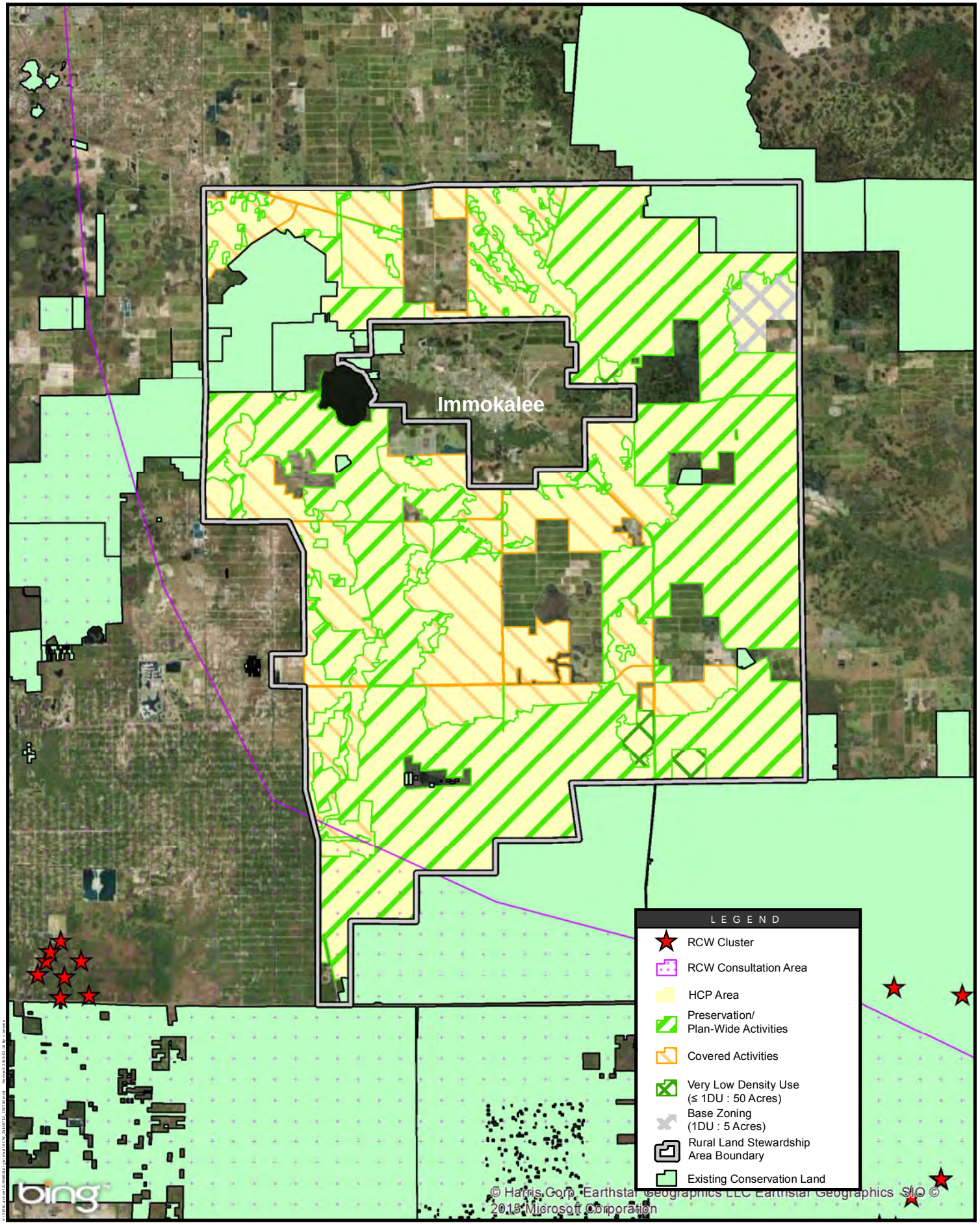

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FIGURE 5-3
Red-Cockaded Woodpecker Consultation Area and Clusters

December 2014

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5.2.1.4 Florida Scrub Jay

The following account for the Florida scrub-jay (*Aphelocoma coerulescen*s) is compiled primarily from the 2014 USFWS Biological Opinion for the Kissimmee Prairie Preserve State Park (USFWS 2014c), which incorporates by reference information from the South Florida Multi-Species recovery Plan (USFWS 1999), and the most recent five-year review (USFWS 2007b).

Florida scrub-jays are about 25 to 30 cm (10 to 12 in) long and weigh about 85 grams (3 ounces). They are similar in size and shape to blue jays (*Cyanocitta cristata*), but differ significantly in coloration (Woolfenden and Fitzpatrick 1996a). Unlike the blue jay, the scrub-jay lacks a crest. It also lacks the conspicuous white-tipped wing and tail feathers, black barring, and bridle of the blue jay. The scrub-jay's head, nape, wings, and tail are pale blue, and its body is pale gray on its back and belly. Its throat and upper breast are lightly striped and bordered by a pale blue gray "bib" (Woolfenden and Fitzpatrick 1996a). Scrub-jay sexes are not distinguishable by plumage (Woolfenden and Fitzpatrick 1984), and males, on the average, are only slightly larger than females (Woolfenden 1978). The sexes may be identified by a distinct "hiccup" call made only by females (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1986). Scrub-jays that are less than about 5 months of age are easily distinguishable from adults; their plumage is smoky gray on the head and back, and they lack the blue crown and nape of adults. Molting occurs between early June and late November and peaks between mid-July and late September (Bancroft and Woolfenden 1982). During late summer and early fall, when the first basic molt is nearly done, fledgling scrub-jays may be indistinguishable from adults in the wild (Woolfenden and Fitzpatrick 1984). The wide variety of vocalizations of scrub-jays is described in Woolfenden and Fitzpatrick (1996b).

Scrub-jays are in the order Passeriformes and the family Corvidae. The Florida scrub-jay, which was originally named *Corvus coerulescens* by Bosc in 1795, was transferred to the genus *Aphelocoma* in 1851 by Cabanis. In 1858, Baird made *coerulescens* the type species for the genus, and it has been considered a subspecies (*A. c. coerulescens*) for the past several decades (AOU 1957). It recently regained recognition as a full species (Florida scrub-jay, *Aphelocoma coerulescens*) from the American Ornithologists' Union (AOU 1995) because of genetic, morphological, and behavioral differences from other members of this group: the western scrub-jay (*A. californica*) and the island scrub-jay (*A. insularis)*. This species account references the full species name, *A. coerulescens*, as listed in the Federal Register (USFWS 1987a). The group name is retained for species in this complex; however, it is now hyphenated to "scrub-jay" (AOU 1995). Critical habitat has not been designated for the Florida scrub-jay.

5.2.1.4.1 Status and Distribution

Regulatory History

The Florida scrub-jay (herein "scrub-jay") was federally-listed as threatened in 1987 primarily because of habitat fragmentation, degradation, and loss (52 FR 20715). A recovery plan was issued in 1990 (USFWS 1990). A complete discussion of the status of the species in south Florida and throughout its range can be found in the South Florida Multi-species Recovery Plan (USFWS 1999). The most recent 5-year review

was completed in 2007, which resulted in no change to the status of the species, but the review found that an updated recovery plan was needed (USFWS 2007b).

Life History

Scrub-jays have a social structure that involves cooperative breeding, a trait the other North American species of scrub-jays do not show (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1990). Scrub-jays live in families ranging from two birds (a single mated pair) to extended families of eight adults (Woolfenden and Fitzpatrick 1984) and one to four juveniles. Fledgling scrub-jays stay with the breeding pair in their natal territory as "helpers," forming a closely-knit, cooperative family group. Pre-breeding numbers are generally reduced to either a pair with no helpers or families of three or four individuals (a pair plus one or two helpers) (Woolfenden and Fitzpatrick 1996a).

Scrub-jay pairs occupy year-round, multipurpose territories (Woolfenden and Fitzpatrick 1978; Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). Territory size averages 22 to 25 acres (Woolfenden and Fitzpatrick 1990; Fitzpatrick et al. 1991), with a minimum size of about 12 acres (Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). The availability of territories is a limiting factor for scrub-jay populations (Woolfenden and Fitzpatrick 1984). Because of this limitation, nonbreeding adult males may stay at the natal territory as helpers for up to 6 years, waiting for either a mate or territory to become available (Woolfenden and Fitzpatrick 1984).

To become a breeder, a scrub-jay must find a territory and a mate. Evidence presented by Woolfenden and Fitzpatrick (1984) suggests that scrub jays are monogamous. The pair retains ownership and sole breeding privileges in its particular territory year after year. Age at first breeding in the scrub-jay varies from 1 to 7 years, although most individuals become breeders between 2 and 4 years of age (Fitzpatrick and Woolfenden 1988). Persistent breeding populations of scrub-jays exist only where there are scrub oaks in sufficient quantity and form to provide an ample winter acorn supply, cover from predators, and nest sites during the spring (Woolfenden and Fitzpatrick 1996b).

Scrub-jay nests are typically constructed in shrubby oaks, at a height of 1.6 to 8.2 feet (Woolfenden 1974). Sand live oak and scrub oak are the preferred shrubs on the Lake Wales Ridge (Woolfenden and Fitzpatrick 1996b), and myrtle oak is favored on the Atlantic Coastal Ridge (Toland 1991) and southern Gulf Coast (Thaxton 1998). In suburban areas, scrub jays nest in the same evergreen oak species, as well as in introduced or exotic trees; however, they build their nests in a significantly higher position in these oaks than when in natural scrub habitat (Bowman et al. 1996). Scrub-jay nests are an open cup, about 7 to 8 inches outside diameter and 3 to 4 inches inside diameter. The outer basket is bulky and built of course twigs from oaks and other vegetation, and the inside is lined with tightly wound palmetto or cabbage palm fibers. There is no foreign material as may be present in a blue jay nest (Woolfenden and Fitzpatrick 1996b)

Nesting is synchronous, normally occurring from March 1 through June 30 (Woolfenden and Fitzpatrick 1984). On the Atlantic Coastal Ridge and southern Gulf Coast, nesting may be protracted through the end of July. In suburban habitats, nesting is consistently started earlier (March) than in natural scrub habitat (Fleischer 1996), although the reason for this is unknown.

Clutch size ranges from one to five eggs, but is typically three or four eggs (Woolfenden and Fitzpatrick 1990). Clutch size is generally larger in suburban habitats, and the birds try to rear more broods per year (Fleischer 1996). Double brooding by as much as 20 percent has been documented on the Atlantic Coastal Ridge and in suburban habitat within the southern Gulf Coast, compared to about 2 percent on the Lake Wales Ridge (Thaxton 1998). Eggs are incubated for 17 to 19 days (Woolfenden 1974), and fledging occurs 15 to 21 days after hatching (Woolfenden 1978). Only the breeding female incubates and broods eggs and nestlings (Woolfenden and Fitzpatrick 1984). Average production of young is two fledglings per pair, per year (Woolfenden and Fitzpatrick 1990; Fitzpatrick et al. 1991), and the presence of helpers improves fledging success (Woolfenden and Fitzpatrick 1990; Mumme 1992). Annual productivity must average at least two young fledged per pair for a population of scrub-jays to support long-term stability (Fitzpatrick et al. 1991).

Fledglings depend upon adults for food for about ten weeks, during which time they are fed by both breeders and helpers (Woolfenden 1975; McGowan and Woolfenden 1990). Survival of scrub jay fledglings to yearling age class averages about 35 percent in optimal scrub; while annual survival of both adult males and females averages around 80 percent (Woolfenden and Fitzpatrick 1996b). Data from Archbold Biological Station, however, suggest that survival and reproductive success of scrub-jays in suboptimal habitat is lower (Woolfenden and Fitzpatrick 1991). These data help explain why local populations inhabiting unburned, late successional habitats become extirpated. Similarly, data from Indian River County show that mean annual productivity declines significantly in suburban areas where Toland (1991) reported that productivity averaged 2.2 young fledged per pair in contiguous optimal scrub, 1.8 young fledged per pair in fragmented moderately-developed scrub, and 1.2 young per pair fledged in very fragmented suboptimal scrub. The longest observed lifespan of a scrub jay is 15.5 years at Archbold Biological Station in Highlands County (Woolfenden and Fitzpatrick 1996b).

Scrub-jays are nonmigratory and permanently territorial. Juveniles stay in their natal territory for up to 6 years before dispersing to become breeders (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1986). Once scrub-jays pair and become breeders, generally within two territories of their natal area, they stay on their breeding territory until death. In suitable habitat, fewer than 5 percent of scrub-jays disperse more than 5 miles (Fitzpatrick et al. unpublished data). All documented long-distance dispersals have been in unsuitable habitat such as woodland, pasture, or suburban plantations. Scrub-jay dispersal behavior is affected by the intervening land uses. Protected scrub habitats will most effectively sustain scrub-jay populations if they are located within surrounding habitat types that can be used and traversed by scrub-jays. Brushy pastures, scrubby corridors along railway and road rights-of-way, and open burned flatwoods offer links for colonization among scrub-jay populations. Stith et al. (1996) believe that a dispersal distance of 5 miles is close to the biological maximum for scrub-jays.

Scrub-jays forage mostly on or near the ground, often along the edges of natural or man-made openings. They visually search for food by hopping or running along the ground beneath the scrub or by jumping from shrub to shrub. Insects, particularly orthopterans (e.g., locusts, crickets, grasshoppers, beetles) and lepidopteran (e.g., butterfly and moth) larvae form most of the animal diet throughout most of the year (Woolfenden and Fitzpatrick 1984). Small vertebrates are eaten when encountered, including frogs and toads (*Hyla femoralis*, *H. squirella*, rarely *Bufo quercicus*, and unidentified tadpoles),

lizards (*Anolis carolinensis*, *Cnemidophorus sexlineatus*, *Sceloporus woodi*, *Eumeces inexpectatus*, *Neoseps reynoldsi*, *Ophisaurus compressus, 0.ventralis*), small snakes (*Thamnophis sauritus*, *Opheodrys aestivus*, *Diadophis punctatus*), small rodents (cotton rat [*Sigmodon hispidus*], *Peromyscus polionotus*, and black rat [*Rattus rattus*] young), downy chicks of the bobwhite (*Colinus virginianus*), and fledgling common yellowthroat (*Geothlypis trichas*). In suburban areas, scrub-jays will accept supplemental foods once the scrub-jays have learned about them (Woolfenden and Fitzpatrick 1984).

Acorns are the principal plant food (Woolfenden and Fitzpatrick 1984; Fitzpatrick et at. 1991). From August to November each year, scrub-jays may harvest and cache 6,500 to 8,000 oak (*Quercus* spp.) acorns throughout their territory. Acorns are typically buried beneath the surface of bare sand patches in the scrub during fall, and retrieved and consumed year round, though most are consumed in fall and winter (DeGange et al. 1989). On the Atlantic Coastal Ridge, acorns are often cached in pine trees, either in forks of branches, in distal pine boughs, under bark, or on epiphytic plants, between 1 to 30 feet in height. Other small nuts, fruits, and seeds also are eaten (Woolfenden and Fitzpatrick 1984).

Distribution and Population Trends

Historically, oak scrub occurred as numerous isolated patches in peninsular Florida. These patches were concentrated along both the Atlantic and Gulf Coasts and on the central ridges of the peninsula (Davis 1967). Probably until as recently as the 1950s, scrub-jay populations occurred in the scrub habitats of 39 of the 40 counties south of, and including Levy, Gilchrist, Alachua, Clay, and Duval Counties. Historically, most of these counties would have contained hundreds or even thousands of breeding pairs (Fitzpatrick et al. 1994). Only the southernmost county, Monroe, lacked scrub-jays (Woolfenden and Fitzpatrick 1996a).

A statewide scrub-jay census was last conducted in 1992 and 1993, at which time there were an estimated 4,000 pairs of scrub-jays left in Florida (Fitzpatrick et al. 1994). At that time, the scrub-jay was considered extirpated in ten counties (Alachua, Broward, Clay, Dade, Duval, Gilchrist, Hernando, Hendry, Pinellas, and St. Johns), and were considered functionally extinct in an additional five counties (Flagler, Hardee, Levy, Orange, and Putnam), where 10 or fewer pairs remained. Recent information indicates that there are at least 12 to 14 breeding pairs of scrub-jays located within Levy County, higher than previously thought (Miller 2004), and there is at least one breeding pair of scrub-jays remaining in Clay County (Miller 2004). A scrub-jay has been documented in St. Johns County as recently as 2003 (Miller 2003). Populations are close to becoming extirpated in Gulf Coast counties (from Levy south to Collier) (Woolfenden and Fitzpatrick 1996a). In 1992 and 1993, population numbers in 21 of the counties were below 30 breeding pairs (Fitzpatrick et al. 1994). Based on the amount of destroyed scrub habitat, scrub-jay population loss along the Lake Wales Ridge is 80 percent or more since pre-European settlement (Fitzpatrick et al. 1991). Since the early 1980s, Fitzpatrick et al. (1994) estimated that, in the northern third of the species' range, the scrub-jay has declined somewhere between 25 and 50 percent. The species may have declined by as much as 25 to 50 percent in the last decade alone (Stith et al. 1996).

Stith (1999) used a spatially explicit individual-based population model developed specifically for the scrub-jay to complete a metapopulation viability analysis of the species. The species' metapopulations

are defined as collections of relatively discrete demographic populations distributed over the landscape; these populations are connected within the metapopulations through dispersal or migration (Hanski and Gilpin 1991). A series of simulations were run for each of the 21 metapopulations based on different scenarios of reserve design ranging from the minimal configuration consisting of only currently protected patches of scrub (no acquisition option) to the maximum configuration, where all remaining significant scrub patches were acquired for protection (complete acquisition option) (Stith 1999). The assumption was made that all areas that were protected were also restored and properly managed.

Results from Stith's (1999) simulation model included estimates of extinction, quasi-extinction (the probability of a scrub-jay metapopulation falling below 10 pairs), and percent population decline. These were then used to rank the different statewide metapopulations by vulnerability. The model predicted that five metapopulations (Northeast Lake, Martin, Merritt Island, Ocala National Forest, and Lake Wales Ridge) have low risk of quasi-extinction. Two of the five (Martin and Northeast Lake), however, experienced significant population declines under the "no acquisition" option; the probability for survival of both of these metapopulations could be improved with more acquisitions.

Eleven of the remaining 21 metapopulations were shown to be highly vulnerable to quasi-extinction if no more habitat was acquired (Central Brevard, North Brevard, Central Charlotte, Northwest Charlotte, Citrus, Lee, Levy, Manatee, Pasco, Saint Lucie, and West Volusia). The model predicted that the risk of quasi-extinction would be greatly reduced for 7 of the 11 metapopulations (Central Brevard, North Brevard, Central Charlotte, Northwest Charlotte, Levy, Saint Lucie, and West Volusia) by acquiring all or most of the remaining scrub habitat. The model predicted that the remaining four metapopulations (Citrus, Lee, Manatee, and Pasco) would moderately benefit if more acquisitions were made.

Scrub-jay observations recorded during the 1992-1993 statewide survey in the Immokalee area (Fitzpatrick et al. 1994) were included with the Lee metapopulation for the population model (Stith 1999).

Reasons for Decline

Scrub habitats have continued to decline throughout peninsular Florida since listing occurred, and habitat destruction continues to be one of the main threats to the scrub-jay. Cox (1987) noted local extirpations and major decreases in numbers of scrub-jays and attributed them to the clearing of scrub for housing and citrus groves. Eighty percent or more of the scrub habitats have been destroyed along the Lake Wales Ridge since pre-European settlement (Fitzpatrick et al. 1991; Turner et al. 2006). Fernald (1989), Fitzpatrick et al. (1991), and Woolfenden and Fitzpatrick (1996a) noted habitat losses due to agriculture, silviculture, and commercial and residential development have continued to play a role in the decline in numbers of scrub-jays throughout the state. Statewide, estimates of scrub habitat loss range from 70 to 90 percent (Woolfenden and Fitzpatrick 1996a). Various populations of scrub-jays within the species' range have been monitored closely, and more precise estimates of habitat loss in these locations are available (Snodgrass et al. 1993; Thaxton and Hingtgen 1996).

Habitat destruction not only reduces the amount of area scrub-jays can occupy, but may also increase fragmentation of habitat. As more scrub habitat is altered, the habitat is cut into smaller and smaller

pieces, and separated from other patches by larger distances; such fragmentation increases the probability of inbreeding and genetic isolation, which is likely to increase extinction probability (Fitzpatrick et al. 1991; Woolfenden and Fitzpatrick 1991; Stith et al. 1996; Thaxton and Hingtgen 1996). Dispersal distances of scrub-jays in fragmented habitat are further than in optimal unfragmented habitats, and demographic success is poor (Thaxton and Hingtgen 1996; Breininger 1999).

On protected lands, scrub-jays have continued to decline due to inadequate habitat management (Stith 1999; Boughton and Bowman 2011). However, over the last several years, steps to reverse this decline have occurred, and management of scrub habitat is continuing in many areas of Florida (Hastie and EckI 1999; Stith 1999; The Nature Conservancy 2001; Turner et al. 2006). If the decline can be reversed, managed lands have the potential to support about twice the number of scrub-jay groups as in 2009-2010 (Boughton and Bowman 2011).

Most scrub-jay morality probably results from predation (Woolfenden and Fitzpatrick 1996b). The second most frequent cause may be disease, or predation on disease weakened scrub-jays (Woolfenden and Fitzpatrick 1996b). Known predators of scrub-jays are listed by Woolfenden and Fitzpatrick (1990), Fitzpatrick et al. (1991), Schaub et al. (1992), Woolfenden and Fitzpatrick (1996a, 1996b), Breininger (1999), and Miller (2004). The list of predators includes a wide variety of snakes, mammals, and birds.

Bowman and Averill (1993) noted scrub-jays occupying fragments of scrub found in or near housing developments were more prone to predation by free-roaming cats and competition from blue jays and mockingbirds. Woolfenden and Fitzpatrick (1996a, 1996b) stated proximity to housing developments (and increased exposure to free-roaming cats) needs to be taken into consideration when designing scrub preserves. Young scrub-jays are especially vulnerable to ground predators (e.g., snakes and mammals) before they are fully capable of sustained flight.

Housing and commercial developments within scrub habitats are accompanied by the development of roads. Since scrub-jays often forage along roadsides and other openings in the scrub, they are often killed by passing cars. Research by Mumme et al. (2000) along a two-lane paved road indicated that clusters of scrub-jay territories found next to the roadside represented population sinks (breeder mortality exceeds production of breeding-age recruits), which could be supported only by immigration. Since this species may be attracted to roadsides because of their open habitat characteristics, vehicular mortality presents a significant and growing management problem throughout the remaining range of the scrub-jay (Dreschel et al. 1990; Mumme et al. 2000), and proximity to high-speed, paved roads needs to be considered when designing scrub preserves (Woolfenden and Fitzpatrick 1996a).

Disease and parasitism may also contribute to scrub-jay decline. The scrub-jay hosts two protozoan blood parasites (*Plasmodium cathemerium* and *Haemoproleus danilewskyi*), but incidence is low (Woolfenden and Fitzpatrick 1996b). The scrub-jay carries at least three types of mosquito-borne encephalitis (Saint Louis, eastern equine, and “Highlands jay”) (Woolfenden and Fitzpatrick 1996b). Of particular concern is the arrival of West Nile virus (the agent of another type of encephalitis) in Florida during 2001 (Stark and Kazanis 2001); since corvids have been particularly susceptible to the disease in states north of Florida, it is expected scrub-jays will be affected (Breininger et al. 2003).

5.2.1.4.2 Habitat Characteristics and Use

The scrub-jay has specific habitat needs. It is endemic to peninsular Florida's ancient dune ecosystems or scrubs, which occur on well-drained to excessively well-drained sandy soils (Laessle 1958; Laessle 1968; Myers 1990). This relict oak-dominated scrub, or xeric (dry) oak scrub, is essential habitat to the scrub-jay. This community type is adapted to nutrient poor soils, periodic drought, and frequent fires (Abrahamson 1984). Xeric oak scrub on the Lake Wales Ridge is predominantly made up of four species of stunted, low-growing oaks: sand live oak (*Quercus geminata*), Chapman oak (*Quercus chapmanii)*, myrtle oak (*Quercus myrtifolia*), and scrub oak (*Quercus inopina*) (Myers 1990). In optimal habitat for scrub-jays on the Lake Wales Ridge, these oaks are 1 to 3 m (3 to 10 ft) high, interspersed with 10 to 50 percent unvegetated, sandy openings, and a sand pine (*Pinus clausa*) canopy of less than 20 percent (Woolfenden and Fitzpatrick 1991). Other trees and dense herbaceous vegetation are rare. Vegetation noted along with the oaks includes saw palmetto and scrub palmetto (*Sabal etonia*) as well as woody shrubs such as Florida rosemary (*Ceratiola ericoides*) and rusty lyonia (*Lyonia ferruginea*).

Scrub-jays occupy areas with less scrub oak cover and fewer openings on the Merritt Island-Cape Canaveral Complex and in Southwest Florida than is typical of xeric oak scrub habitat on the Lake Wales Ridge (Schmalzer and Hinkle 1992; Breininger et al. 1995; Thaxton and Hingtgen 1996). The predominant communities there are oak scrub and scrubby flatwoods. Scrubby flatwoods differ from scrub by having a sparse canopy of slash pine (*Pinus elliottii*); sand pines are rare. Shrub species mentioned above are common, except for scrub oak and scrub palmetto, which are restricted to the Lake Wales Ridge. Runner oak (*Q. minima*), turkey oak (*Q. laevis*), bluejack oak (*Q. incana*), and longleaf pine (*Pinus palustris*) also have been reported.

Optimal scrub-jay habitat occurs as patches with the following attributes: (i) 10 to 50 percent of the oak scrub made up of bare sand or sparse herbaceous vegetation; (ii) greater than 50 percent of the shrub layer made up of scrub oaks; (iii) a mosaic of oak scrubs that occur in optimal height (1 to 3 m) and shorter; (iv) less than 15 percent canopy cover; and (v) greater than 300 m (984 ft) from a forest (Breininger et al. 1998). Much potential scrub-jay habitat occurs as patches of oak scrub within a matrix of little-used habitat of saw palmetto and herbaceous swale marshes (Breininger et al. 1991, Breininger et al. 1995). These native matrix habitats supply prey for scrub jays and habitat for other species of conservation concern. The flammability of native matrix habitats is important for spreading fires into oak scrub (Breininger et al. 1995; Breininger et al. 2002). Degradation or replacement of native matrix habitats with habitat fragments and industrial areas attract predators of scrub-jays, such as fish crows (*Corvus ossifragus*), that are rare in most regularly burned native matrix habitats (Breininger and Schmalzer 1990; Woolfenden and Fitzpatrick 1991). Matrix habitats often develop into woodlands and forests when there is a disruption of fire regimes. These woodlands and forests are not suitable for scrub-jays, decrease the habitat suitability of nearby scrub, attract predators, and further disrupt fire patterns.

Human interference with natural fire regimes has continued to play a major part in the decline of the scrub-jay and today may exceed habitat loss as the single most important limiting factor (Woolfenden and Fitzpatrick 1991; Woolfenden and Fitzpatrick 1996a; Fitzpatrick et al. 1994). Lightning strikes cause

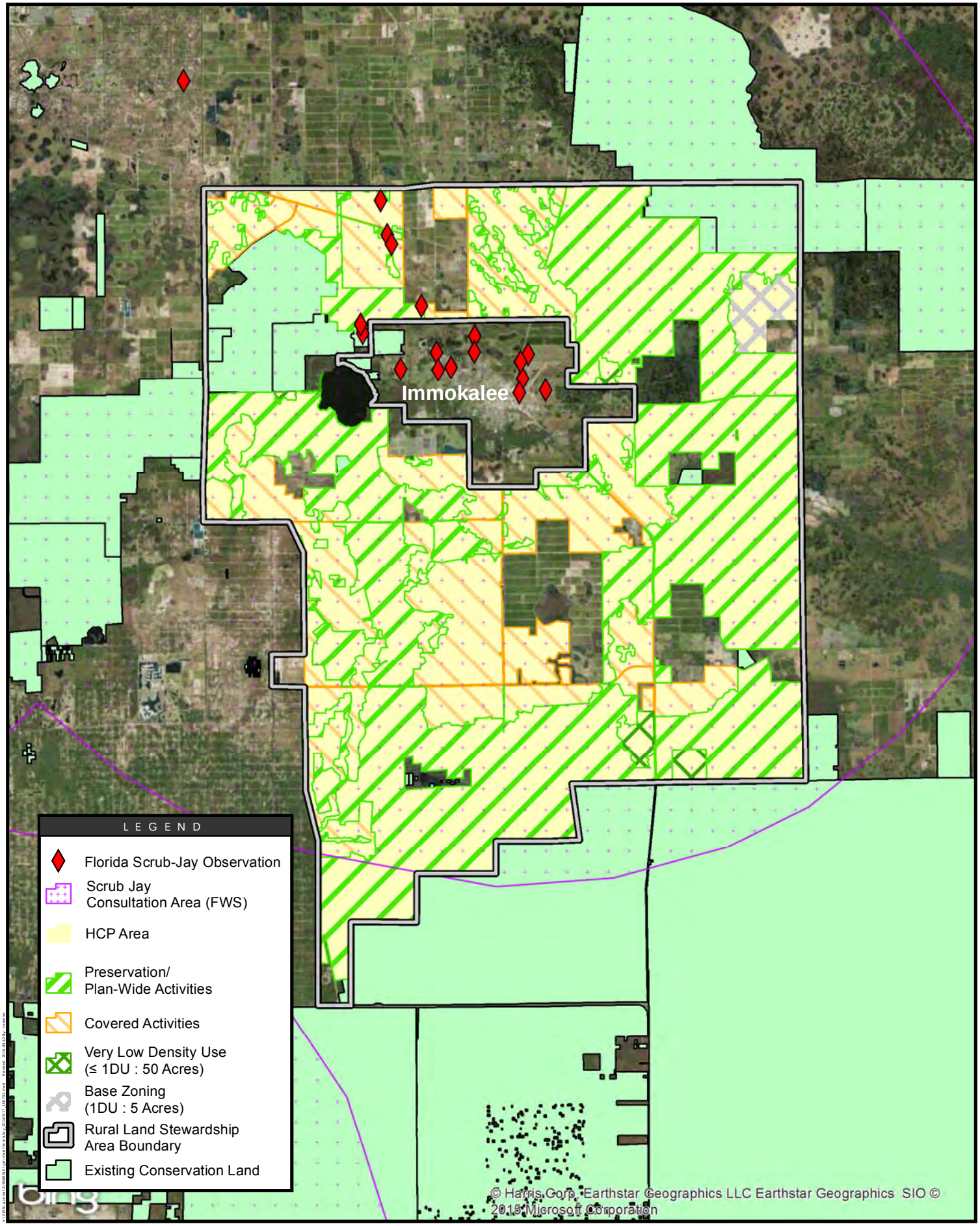
all naturally-occurring fires in South Florida scrub habitat (Abrahamson 1984; Hofstetter 1984; Woolfenden and Fitzpatrick 1990). Fire has been noted to be important in maintenance of scrub habitat for decades (Nash 1895; Harper 1927; Webber 1935; Davis 1943; Laessle 1968; Abrahamson et al. 1984). Human efforts to prevent and control natural fires have allowed the scrub to become too dense and tall to support populations of scrub-jays, resulting in the decline of local populations of scrub-jays throughout the State (Fernald 1989; Fitzpatrick et al. 1994, Percival et al. 1995; Stith et al. 1996; Thaxton and Hingtgen 1996; Woolfenden and Fitzpatrick 1990; Woolfenden and Fitzpatrick 1996a; Toland 1999).

Stith et al. (1996) estimated at least 2,100 breeding pairs of scrub-jays were living in overgrown habitat. Toland (1999) reported most of Brevard County's remaining scrub (estimated to be 15 percent of the original acreage) is overgrown due to fire suppression. He further suggests the overgrowth of scrub habitats reduces the number and size of sand openings which are crucial not only to scrub-jays, but also many other scrub plants and animals. Reduction in the number of potential scrub-jay nesting sites, acorn cache sites, and foraging sites presents a problem for scrub-jays. Fernald (1989) reported overgrowth of scrub results not only in the decline of species diversity and abundance but also a reduction in the percentage of open sandy patches (Fernald 1989; Woolfenden and Fitzpatrick 1996b). Fitzpatrick et al. (1994) believed fire suppression was just as responsible as habitat loss in the decline of the scrub-jay, especially in the northern third of its range. Likewise, the continued population decline of scrub-jays within Brevard County between 1991 and 1999 has been attributed mainly to the overgrowth of remaining habitat patches (Breininger et al. 2001). Breininger et al. (1999) concluded optimal habitat management is essential in fragmented ecosystems maintained by periodic fire, especially to lessen risks of decline and extinction resulting from epidemics and hurricanes.

5.2.1.4.3 Occurrence in the HCP Area

The only verified occurrence data for scrub-jays within the HCP Area and adjacent areas derive from the statewide scrub-jay census that was conducted in 1992 and 1993 (Fitzpatrick et al. 1994). No independent verifications of local scrub-jay status exist or have been made available since that survey was completed, and it is not known if scrub-jays are currently active in these locations (R. Bowman, personal communication, 2014).

Figure 5-4 depicts the locations of scrub-jays observed during the 1992-1993 survey (Fitzpatrick et al. 1994). Eleven scrub-jay observations were located within the City of Immokalee, which is not within the HCP Area. The five observations located within the HCP Area in the 1992-1993 survey generally occurred on small remnant patches of scrubby habitat within and adjacent to citrus groves; the current ecological condition of these habitat patches is unknown. Except for a few scrub-jays at the coast near Estero Bay, the 1992-1993 survey observations represented the southernmost extent of scrub-jays in Florida, poorly connected to other scrub-jay sub-populations (Stith, 1999).



Stantec

FIGURE 5-4
Florida Scrub-Jay Consultation Area and Occurrences

December 2014

Stantec Consulting Services Inc.
3200 Bailey Ln. Ste. 200
Naples, FL 34105
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5.2.1.5 Everglade Snail Kite

The following species account for the Everglade snail kite (*Rostrhamus sociabilis plumbeus*; or snail kite) is compiled primarily from the 2013 USFWS Biological Opinion for the Central Everglades Planning Project (USFWS 2013a), supplemented with information from the South Florida Multi-Species Recovery Plan (USFWS 1999) and the 2007 five-year review (USFWS 2007c).

The snail kite is a medium-sized raptor, with a total body length for adult birds of 36 to 39.5 cm and a wingspan of 109 to 116 cm (Sykes et al. 1995). In both sexes, the tail is square-tipped with a distinctive white base, and the wings are broad, and paddle-shaped. Adults of both sexes have red eyes, while juveniles have brown eyes (Brown and Amadon 1979; Clark and Wheeler 1987). The slender, decurved bill is an adaptation for extracting the kite's primary prey, the apple snail; the bill is a distinguishing characteristic for field identification in both adults and juveniles.

Sexual dimorphism is exhibited in this species, with adult males uniformly slate gray and adult females brown with cream streaking in the face, throat, and breast. Most adult females have a cream superciliary line and cream chin and throat (Sykes et al. 1995). Females are slightly larger than males. Immature snail kites are similar to adult females but are more cinnamon-colored with tawny or buff-colored streaking rather than cream streaking. The legs and cere of females and juveniles are yellow to orange; those of adult males are orange, turning more reddish during breeding (Sykes et al. 1995).

5.2.1.5.1 Status and Distribution

Regulatory History

The Florida population was first listed under the Endangered Species Preservation Act in 1967 (32 Fed. Reg. 4001 (Mar. 11, 1967)), and protection was continued under the Endangered Species Conservation Act of 1969. The Everglade snail kite, and all the other species listed under the Endangered Species Conservation Act of 1969 were the first species protected under the Act of 1973, as amended, and all of these species were given the "endangered" status.

In total, about 841,635 acres of critical habitat for the Everglade snail kite were designated in 1977 (42 Fed. Reg. 40685 (Aug. 11, 1977)). Because this designation was one of the earliest under the Act, primary constituent elements were not defined. The designation identified nine critical habitat units that included two small reservoirs, the littoral zone of Lake Okeechobee, and areas of the Everglades marshes within the Water Conservation Areas (WCAs) and ENP. Since this designation, the utilization of these critical habitat units by snail kites as productive nesting areas has varied significantly and has also

included areas that were not designated as critical habitat. Most recently, the Kissimmee Chain of Lakes (KCOL), Lake Tohopekaliga in particular, now supports the greatest number of snail kites in Florida. This shift in productive nesting areas has been in response to regional droughts as well as habitat degradation in historic breeding locations. While the KCOL is now considered an important habitat for the snail kite, this was not the case when critical habitat was designated in 1977, and the KCOL was not

included in the original designation. No critical habitat for the Everglade snail kite has been designated in Collier County.

Life History

The Everglade snail kite breeding season in Florida varies from year-to-year and is probably affected by rainfall and water levels (Sykes et al. 1995). Ninety-eight percent of the nesting attempts are initiated from December through July, while 89 percent are initiated from January through June (Sykes 1987a; Beissinger 1988; Snyder et al. 1989), with the peak in nest initiation occurring from February to April (Sykes 1987a). Snail kites often re-nest following failed attempts early in the season as well as after successful attempts (Beissinger 1986; Snyder et al. 1989), but the actual number of clutches per breeding season is not well documented (Sykes et al. 1995).

Pair bonds are established prior to egg-laying and are relatively short, typically lasting from nest initiation through most of the nestling stage (Beissinger 1986; Sykes et al. 1995). Male kites select nest sites and conduct most nest-building, which is probably part of courtship (Sykes 1987a; Sykes et al. 1995). Egg-laying begins soon after completion of the nest, but may be delayed a week or more (Sykes 1987a). An average 2-day interval between laying each egg results in the laying of a 3-egg clutch in about 6 days (Sykes et al. 1995). The clutch size ranges from one to five eggs, with a mode of three (Sykes 1987a; Beissinger 1988; Snyder et al. 1989). Incubation may begin after the first egg is laid, but generally after the second egg (Sykes 1987a). In Florida, the incubation period lasts 24 to 30 days (Sykes 1987a). Incubation is shared by both sexes, but the contribution of incubation time between the male and female is variable (Beissinger 1987).

Hatching success is variable from year-to-year and between areas. In nests where at least one egg hatched, hatching success averaged 2.3 chicks per nest (Sykes 1987a). After hatching, both parents initially participate in feeding young, but there is variability in the contribution of each member of the pair (Beissinger 1987). The nestling period lasts about 23 to 34 days and fledging dates may vary by 5 days among chicks (Sykes et al. 1995). Following fledging, young are fed by one or both adults until they are 9 to 11 weeks old (Beissinger 1987). In total, snail kites have a nesting cycle that lasts about 4 months from initiation of nest-building through independence of young (Beissinger 1986; Sykes et al. 1995).

Snail kites also have a relatively unique mating system in Florida that is described as ambisexual mate desertion, in which either the male or female may abandon nests part way through the nestling stage (Beissinger 1986, 1987). This behavior appears to occur primarily under conditions when prey is abundant, and it may be an adaptation to maximize productivity during favorable conditions. Following abandonment, the remaining parent continues to feed and attend chicks through independence (Beissinger 1986). Abandoning parents presumably form new pair bonds and initiate a new nesting attempt. Snail kites mature early compared with many other raptors and can breed successfully the first spring after they hatch, when they are about 8 to 10 months old. However, not all kites breed at this age. Adult kites generally attempt to breed every year with the exception of drought years, when some kites may not attempt to nest (Sykes et al. 1995).

Nesting almost always occurs over water, which deters predation (Sykes 1987b). An important feature for snail kite nesting habitat is the proximity of suitable nesting sites to favorable foraging areas. Thus, extensive stands of contiguous woody vegetation are generally unsuitable for nesting, whereas suitable nest sites consist of single trees or shrubs or small clumps of trees and shrubs within or adjacent to an extensive area of suitable foraging habitat. Trees usually less than 32 feet tall are used for nesting include willow (*Salix* spp.), bald cypress, pond cypress (*Taxodium ascendens*), melaleuca (*Melaleuca quinquenervia*), sweetbay (*Magnolia virginiana*), swamp bay (*Persea borbonia*), pond apple (*Annona glabra*), and dahoon holly (*Ilex cassine*). Shrubs used for nesting include wax myrtle (*Myrica cerifera*), cocoplum (*Chrysobalanus icaco*), buttonbush (*Cephalanthus occidentalis*), danglepod (*Sesbania* spp.), elderberry (*Sambucus simpsonii*), and Brazilian pepper (*Schinus terebinthifolius*). Nesting also can occur in herbaceous vegetation, such as sawgrass (*Cladium jamaicense*), cattail (*Typhus* spp.), bulrush (*Scirpus* spp.), and reed (*Phragmites australis*) (Sykes et al. 1995).

On average, adult snail kites have relatively high annual survival rates with estimated average rates ranging from 85 to 98 percent (Nichols et al. 1980; Bennetts et al. 1999; Martin et al. 2006). Adult survival is probably reduced in drought years (Takekawa and Beissinger 1989; Martin et al. 2006). However, adult survival appears to be relatively constant over time at a relatively high level (>80 percent) (Bennetts et al. 1999; Martin et al. 2006; Cattau et al. 2009). Adult longevity records indicate that kites may frequently live longer than 13 years in the wild (Sykes et al. 1995).

Everglade snail kites may roost communally outside of breeding season and, occasionally, roost in groups of up to 400 or more individuals (Bennetts et al. 1994). Roosting sites are also usually located over water. On average, in Florida, 91.6 percent are located in willows, 5.6 percent in *Melaleuca*, and 2.8 percent in pond cypress. Roost sites are in taller vegetation among low profile marshes. Snail kites tend to roost around small openings in willow stands at a height of 5.9 to 20.0 feet in stand sizes of 0.05 to 12.35 acres. Roosting also has been observed in *Melaleuca* or pond cypress stands with tree heights of 13 to 40 feet (Sykes 1985).

Snail kites are considered nomadic, and this behavior pattern is probably a response to changing hydrologic conditions (Sykes 1979). During breeding season, kites remain close to their nest sites until they fledge young or fail. Following fledging, adults may remain around the nest for several weeks, but once young are fully independent adults may depart the area. Outside of breeding season, snail kites regularly travel long distances within and among wetland systems in southern Florida (Bennetts and Kitchens 1997). Snail kites are gregarious. In addition to nesting in loose colonies and roosting communally in large numbers, kites may also forage in common areas in proximity to other foraging kites.

Distribution and Population Trends

The Everglade snail kite is one of three subspecies of snail kite, a wide-ranging New World raptor found primarily in lowland freshwater marshes in tropical and subtropical America from Florida, Cuba, and Mexico south to Argentina and Peru. The Everglade subspecies occurs in Florida and Cuba, though only the Florida population is listed. Snail kites in Florida are not migratory (USFWS 1999).

In Florida, the historic range of the snail kite was larger than at present. The current distribution of the snail kite in Florida is limited to central and southern portions of the State. Six large freshwater systems are located within the current range of the snail kite: Upper St. Johns marshes, KCOL, Lake Okeechobee, Loxahatchee Slough, the Everglades, and the Big Cypress basin (Beissinger and Takekawa 1983; Sykes 1984; Rodgers et al. 1988; Bennetts and Kitchens 1992; Rumbold and Mihalik 1994; Sykes et al. 1995; Martin et al. 2005). Within the Big Cypress basin, snail kites may occur within most of the non-forested and sparsely forested wetlands. Nesting has not been regularly documented in this area in recent years, though some nesting likely occurs.

In addition to the primary wetlands discussed above, there are numerous records of kite occurrence and nesting within isolated wetlands throughout the region. In the 1990s, Sykes et al. (1995) observed snail kites using smaller, more isolated wetlands including the Savannas State Preserve in St. Lucie County, Hancock Impoundment in Hendry County, and Lehigh Acres in Lee County. Takekawa and Beissinger (1989) identified numerous wetlands that they considered drought refugia, which may provide kite foraging habitat when conditions in the larger more traditionally occupied wetlands are unsuitable. Radio tracking of snail kites has also revealed that the network of habitats used by the species includes many smaller, widely dispersed wetlands within this overall range (Bennetts and Kitchens 1997). Snail kites may use nearly any wetland within southern Florida under some conditions and during some portions of their life history. For example, 2010 snail kite nesting surveys documented nesting in surprisingly high numbers in peripheral areas such as Harns Marsh, in Lehigh Acres, and stormwater treatment area (STA) 5 (a constructed wetland related to the Everglades restoration). However, the majority of nesting continues to be concentrated within the large marsh and lake systems of the Greater Everglades, the Kissimmee basin, and the Upper St. John's marshes.

From a demographic perspective, Everglade snail kites appear to exhibit high levels of variability in some demographic parameters, while others remain relatively constant. For example, distribution of nesting appears to fluctuate dramatically based on annual variability of specific environmental factors, most notably apple snail density and availability (which in turn are affected by current and previous year water levels). Similarly, productivity appears to be highly variable and heavily influenced by environmental conditions (Sykes 1979; Beissinger 1989, 1995; Sykes et al. 1995). Duration of breeding season and amount of double or triple-brooding are also variable (Beissinger 1986). Juvenile survival also appears to be highly variable among years, reaching a record low in 2000 (Beissinger 1995; Bennetts and Kitchens 1999; Martin and Kitchens 2003; Martin et al. 2006; Cattau et al. 2009). The observed variability in juvenile survival is related to variation in environmental conditions, including those hydrologic conditions that directly affect the survival and productivity of the apple snail. Because the apple snail is the primary source of food for the snail kite, hydrologic conditions that affect the survival and productivity of the apple snail have significant effects on snail kite nest success and the survival of juvenile snail kites.

In contrast, adult survival appears to be relatively constant over time at a relatively high level (>80 percent) (Bennetts et al. 1999; Martin et al. 2006; Cattau et al. 2009), with the exception of appreciable drops from 2000 through 2002, and again from 2006 through 2008. During these years, adult survival decreased by 16 percent from 2000 to 2002 (Martin et al. 2006), and by approximately 35 percent from

2006 to 2008 (Cattau et al. 2009). These temporary low adult survival rates coincided with significant declines in the overall population associated with region-wide droughts during 2001 and 2007. During more localized droughts, their nomadic behavior allows kites to survive and even reproduce (at lower levels) in areas less affected by the unfavorable conditions. Under favorable environmental conditions, kites have the ability to achieve high reproductive rates (Beissinger 1986), and similarly, juvenile survival rates appear to be higher under more favorable conditions.

Since 1997, population estimates and estimates of demographic parameters have been generated exclusively employing mark-recapture methods that incorporate detection probabilities. From 1997 through 1999, the snail kite population was estimated to be approximately 3,000 birds (Dreitz et al. 2002). From 1999 through 2002, the population estimates declined each year until they reached a low level of approximately 1,400 birds in 2002 and 2003, then increased slightly to about 1,700 birds in 2004 and 2005 (Martin et al. 2006). The snail kite population exhibited steep declines in both 2007 and 2008, with estimates of 1,204 birds and 685 birds, respectively, but rebounded slightly starting in 2010. The 2012 population estimate was 1,218 birds (Cattau et al. 2012). At this time, there is no published estimate for 2013; however, preliminary indications are that it is similar or slightly lower than for 2012.

Based on demographic parameters generated using mark-recapture methodology, a population viability analysis (PVA) for the Everglade snail kites was conducted in 2006. This PVA indicated that there is a high probability of quasi-extinction (identified as $\leq$ 50 female snail kites) within the next 50 years if current reproduction, survival, and drought frequency rates remain the same as those observed from 1996 to 2006 (Martin et al. 2007; Cattau et al. 2008, 2009). Quasi-extinction risk is the probability of a population falling below a critical density – an extremely undesirable population level that may be unlikely to be recoverable even with drastic management steps, such as captive breeding. Snail kite researchers conducted a new PVA which updated the demographic parameters and incorporated effects of variable environmental (hydrologic) states. According to Cattau et al. (2012), the results from the PVA conducted in 2010 "predict a 95 percent probability of population extinction within 40 years." They further state, "These results are especially concerning, as they indicate an increased risk of extinction when compared to results from a previous PVA conducted in 2006. Recent analyses also provide indications of an aging population with problems inherent to older individuals, including increased adult mortality rates and decreased probabilities of attempting to breed, both of which have been shown to be exacerbated during times of harsh environmental conditions" (Cattau et al. 2012).

Reasons for Decline

There are a variety of threats that have been identified which affect kite nesting, kite foraging, and survival. These threats include loss of wetland habitats, degradation of wetland habitat, changes in hydrologic conditions, and impacts to prey base.

The principal threat to the snail kite is the loss, fragmentation, and degradation of wetlands in central and southern Florida resulting from urbanized and agricultural development and alterations to wetland hydrology through ditching, impoundment, and water level management. Nearly half of the Everglades have been drained for agriculture and urban development (Davis and Ogden 1994; USACE 1999). The

Everglades Agricultural Area (EAA) alone eliminated 3,100 square-miles of the original Everglades and the urban areas in Miami-Dade, Broward, and Palm Beach Counties have contributed to the reduction of habitat. North of ENP, which has preserved only about one-fifth of the original extent of the Everglades, the remaining marsh has been fragmented into impoundments (*i.e.*, WCAs). Drainage of Florida's interior wetlands has reduced the extent and quality of habitat for both the apple snail and the snail kite (Sykes 1983). Widespread drainage has permanently lowered the water table in some areas. This drainage permitted development in areas that were once kite habitat.

Habitat loss and fragmentation are also factors influencing survival during droughts, despite the species' dispersal ability (Martin et al. 2006). In dry years, snail kites depend on water bodies that normally are suboptimal for feeding, such as canals, impoundments, or small marsh areas, remote from regularly used sites (Beissinger and Takekawa 1983; Bennetts et al. 1988; Takekawa and Beissinger 1989). The fragmentation or loss of wetland habitat significantly limits the snail kites' ability to be resilient to disturbance events such as various climatic events. As wetland habitats become more fragmented, the dispersal distances become greater putting increased stress on dispersing kites that may not be able to replenish energy supplies.

Degradation of wetland habitat, particularly due to degradation in water quality primarily through runoff of phosphorus from agricultural and urban sources, is another concern for the snail kite. Although there are no direct scientific investigations that we are aware of that directly relate effects of differing nutrient concentrations to success of snail kites, snail kite habitat, apple snails, or apple snail habitat, there is a weight of evidence that indicates that most of these lakes, and large areas of Everglades wetlands within the snail kites range have received nutrient inputs higher than normal and at levels which requires various governmental agencies to perform habitat management.

The abundance of the snail kites' primary prey, apple snails, has been definitively linked to water regimes (Kushlan 1975; Sykes 1979, 1983a; Darby et al. 2005). Extremely low water levels and rapid recession rates can limit foraging opportunities for juvenile snail kites and nesting adults, both of which require a sufficient forage base in the vicinity of the nest (Mooij et al. 2002). Water levels which are too high or too low during the snail breeding season can delay, curtail, or entirely preclude egg cluster production in a given year, thereby resulting in decreased snail abundance and density in the following year(s). Within a given year and at a given location, the availability of apple snails is also dependent on hydrologic conditions (Darby et al., 2006), including water levels and recession rates, and thus water management actions.

Additional potential threats to snail kites include exposure to bioaccumulated contaminants in their prey, the proliferation of exotic snails, and naturally occurring but extreme weather conditions. Copper, used in fungicide applications and commonly found in disturbed areas of Everglades wetlands, has been shown to bioaccumulate in apple snails and may lead to birth defects in snail kite nestlings (Frakes et al. 2008). Uptake of copper through sediments and diet has been demonstrated, with uptake from the latter, as being the primary exposure route for the Florida apple snail (Frakes et al. 2008; Hoang et al. 2008).

5.2.1.5.2 Habitat Characteristics and Use

Everglade snail kites are dietary specialists, a relatively rare foraging strategy among raptors. The Florida apple snail (*Pomacea paludosa*) is the kite's principal prey in Florida and makes up the great majority of the kites' diet (Sykes 1987c; Kitchens et al. 2002). Throughout the range of all subspecies of snail kites, *Pomacea* snails consistently compose the primary prey of snail kites (Sykes 1987c; Beissinger 1990). Several species of non-native apple snails have become established recently within the kite's range in Florida and have been used to varying degrees by snail kites. Whether exotic apple snails are a threat to snail kites is not yet known (SEI 2007a,b). The close tie between the Everglade snail kite and the Florida apple snail require consideration of both species when developing management strategies and addressing potential impacts.

Everglade snail kites and their primary prey are both wetland-dependent species and rely on wetland habitats for all aspects of their life history. The primary wetland habitat types upon which kites rely consist of freshwater marshes and the shallow-vegetated littoral zones along the edges of lakes (natural and man-made) where apple snails occur in relatively high abundance and can be found and captured by kites.

While kites are capable of foraging successfully under a variety of habitat conditions, the preferred foraging habitat is typically a combination of relatively short-stature, sparse graminoid marsh vegetation less than 6.5 feet in height. The apple snail requires emergent aquatic plants to provide substrate that allows them to reach the water surface to breathe. However, for kites to feed, the emergent vegetation must be sparse enough that they are capable of locating and capturing snails (Kitchens et al. 2002). Marshes and lake littoral zones composed of interconnected areas of open water 0.6 to 4.3 feet deep which are relatively clear and calm and patches of herbaceous emergent wetland plants or sparse continuous growth of herbaceous wetland plants generally provide the appropriate balance of emergent vegetation and open water (Sykes et al. 1995; Kitchens et al. 2002). Marsh species that commonly occur within favorable kite foraging habitat include spike rush (*Eleocharis cellulosa*), maidencane (*Panicum hemitomon*), sawgrass, bulrush, and/or cattails. Shallow open-water areas may also contain sparse cover of species such as white water lily (*Nymphaea odorata*), arrowhead (*Sagittaria lancifolia*), pickerel weed (*Pontederia lanceolata*), and floating heart (*Nymphoides aquatica*). Periphyton growth on the submerged substrate provides food source for apple snails, and submergent aquatic plants, such as bladderworts (*Utricularia* spp.) and eelgrass (*Vallisneria* spp), may contribute to favorable conditions for apple snails while not preventing kites from detecting snails (Sykes et al. 1995).

Using field data from 1995 to 2004, Darby et al. (2006) estimated that snail densities less than 0.14 individuals per square-meter are unable to support kite foraging. Darby et al. (2008) also reported that adult snails can survive dry downs lasting up to 12 weeks, although smaller snails survive at lower rates (<50 percent alive after 8 dry weeks). Snail recruitment may be truncated if dry downs occur during the peak breeding season when young snails can become stranded (Darby et al. 2008). Darby et al. (2009) recommended a range of water depths between 4 and 20 inches during the peak apple snail breeding period between April and June.

Foraging habitat conditions that differ substantially from those described above will result in either reduced apple snail density or reduced ability of snail kites to locate and capture snails. Vegetation cover that is either too dense or too sparse can result in reduction in the quality of the area as foraging habitat.

5.2.1.5.3 Occurrence in the HCP Area

The snail kite consultation area map (USFWS 2003b) covers most of Collier County, including all of the HCP Area. The South Florida Multi-Species Recovery Plan (USFWS 1999) identified Okaloacoochee Slough as one area utilized by snail kite within the HCP Area, along with Hinson Marsh in the northwestern portion of BCNP. As noted previously, snail kites may occur within most of the non-forested and sparsely forested wetlands within the Big Cypress basin (USFWS 2013a). Snail kite occurrences have also been recorded in Hancock Impoundment in Hendry County, and nesting in Harns Marsh in Lee County.

GPS telemetry data collected by the Avian Research and Conservation Institute in 2012-2013 recorded the presence of three adult snail kites within the HCP Area (Romañach and Gray 2014). Telemetry points were recorded in Corkscrew Marsh, in the Okaloacoochee Slough, and north of Immokalee within the HCP Area. The overall telemetry dataset through 2014 revealed that adult snail kites utilize “peripheral wetlands” (e.g., canals, ponds, stormwater treatment areas) throughout south Florida, in addition to natural wetland systems (Meyer et al. 2014).

5.2.2 Reptiles

5.2.2.1 Eastern Indigo Snake

The following species account for the eastern indigo snake (*Drymarchon corais couperi*) is compiled primarily from the 2014 USFWS Biological Opinion for the Kissimmee Prairie Preserve State Park (USFWS 2014), supplemented with information from the South Florida Multi-Species Recovery Plan (MSRP; USFWS 1999) and the 2008 five-year review (USFWS 2008b). The eastern indigo snake is the largest non-venomous snake in North America, obtaining lengths of up to 8.5 ft (2.6 m) (Moler 1992). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. Its scales are large and smooth (the central 3 to 5 scale rows are lightly keeled in adult males) in 17 scale rows at mid-body. Its anal plate is undivided. In the Florida Keys, adult indigo snakes seem to have less red on their faces or throats compared to most mainland specimens (Lazell 1989). Several researchers have informally suggested that Lower Keys indigo snakes may differ from mainland snakes in ways other than color.

At the time of listing, the eastern indigo snake was considered a subspecies, *Drymarchon corais couperi.* Currently, the eastern indigo snake is accepted by the scientific community as a separate species, *Drymarchon couperi* (Crother 2000). In 1991, Collins elevated this lineage to specific status based on allopatry and diagnosibility. Subsequent work has supported this designation (Wuster et al. 2001).

5.2.2.1.1 Status and Distribution

Regulatory History

The eastern indigo snake was listed as threatened on January 31, 1978, (43 Fed. Reg. 4028), due to population declines caused by habitat loss, over-collecting for the domestic and international pet trade, and mortality caused by rattlesnake collectors who gas gopher tortoise burrows to collect snakes. A 5-year review was completed in 2008 resulting in no change to the species designation (USFWS 2008). The 5-year review builds upon the detailed information in the MSRP for this species and is located at http://www.fws.gov/southeast/5yearReviews/5yearreviews/easternindigofinal.pdf . No critical habitat has been designated for the eastern indigo snake.

Life History

In South-central Florida, limited information on the reproductive cycle suggests that eastern indigo snake breeding extends from June to January, egg laying occurs from April to July, and hatching occurs from mid-summer to early fall (Layne and Steiner 1996). Young hatch approximately 3 months after egg-laying and there is no evidence of parental care. Eastern indigo snakes in captivity take 3 to 4 years to reach sexual maturity (Speake et al. 1987). Female eastern indigo snakes can store sperm and delay fertilization of eggs. There is a single record of a captive eastern indigo snake laying five eggs (at least one of which was fertile) after being isolated for more than 4 years (Carson 1945). However, there have been several recent reports of parthogenetic reproduction by virginal snakes. Hence, sperm storage may not have been involved in Carson's (1945) example (Moler 1998). There is no information on the eastern indigo snake lifespan in the wild, although one captive individual lived 25 years, 11 months (Snider and Bowler 1992).

Eastern indigo snakes are active and spend a great deal of time foraging and searching for mates. They are one of the few snake species that are active during the day and rest at night. The eastern indigo snake is a generalized predator and will eat any vertebrate small enough to be overpowered. They swallow their prey alive. Food items include fish, frogs, toads, snakes (venomous, as well as non-venomous), lizards, turtles, turtle eggs, small alligators, birds, and small mammals (Keegan 1944; Babis 1949; Kochman 1978; Steiner et al. 1983).

Distribution and Population Trends

The indigo snake (*Drymarchon corais*) ranges from the southeastern United States to northern Argentina (Conant and Collins 1998). This species has eight recognized subspecies, two of which occur in the United States: the eastern indigo and the Texas indigo (*D. c. erebennus*). In the United States, the eastern indigo snake historically occurred throughout Florida and in the coastal plain of Georgia and has been recorded in Alabama and Mississippi (Diemer and Speake 1983; Moler 1985). It may have occurred in southern South Carolina, but its occurrence there cannot be confirmed. Georgia and Florida currently support the remaining endemic populations of the eastern indigo snake (Lawler 1977). The eastern indigo snake occurs throughout most of Florida and is absent only from the Dry Tortugas and Marquesas

Keys, and regions of north Florida where cold temperatures and deeper clay soils exist (Cox and Kautz 2000).

The broad distribution and large territory size of the eastern indigo snake complicate evaluation of its population status and trends. Thus, population trend data for the eastern indigo snake are virtually absent. This species is very difficult to locate in the wild, even in areas where it is known to occur. It is not amenable to standard population survey and mark/recapture studies. Therefore, population attributes such as sex ratio, age structure, reproductive variables, and mortality in the wild are generally unknown. Several estimates of sex ratios and size at maturity are available from wild populations. Two studies of hatchlings/juveniles (Moulis 1976, Steiner et al. 1983) reported sex ratios not differing from 1 male: 1 female. However, sex ratios become more male biased in adult snakes. Layne and Steiner (1996) reported an adult sex ratio of 1.54 males: 1 female for eastern indigo snakes in South Florida. Maturity in wild snakes has been estimated to be attained at 60 inches (1500 millimeters) total length (Speake et al. 1987, Layne and Steiner 1996).

Some data can be gleaned from work with captive populations, especially information on breeding. Speake et al. (1987) reported that two females, captive since birth, bred at 40 and 41 months of age. The average clutch size of 20 females, removed from the wild and laying eggs in the spring following their capture, was 9.4. Moulis (1976) reported a range of 4 to 12 eggs for captive females and estimated their sexual maturity to be reached at 3 to 4 years of age based on their rate of growth. Captive female indigo snakes typically lay eggs every year. In a two-year study of a wild population, three of five females studied were gravid in both years (Bolt 2006).

Inferences about abundance and population trends of the eastern indigo snake have been made using data on movements and estimates of home range size (100% minimum convex polygons) developed from studies using radio telemetry. In peninsular Florida, data on home ranges for females vary from 4.75 ac (1.9 ha) to 375 ac (150 ha); male home ranges vary from 4 ac (1.6 ha) to 818 ac (327 ha) (Moler 1985b, Layne and Steiner 1996, Bolt 2006, Dodd and Barichivich 2007). Summer home ranges tend to be much larger than winter home ranges.

Collecting more explicit eastern indigo snake population trend data is impossible without the ability to successfully survey for the species. At the Eastern Indigo Snake Conservation Summit held in 2001, a group of herpetologists familiar with the species selected “developing reliable survey methods” as the most pressing research and monitoring need for the snake (USFWS 2001). Research has been ongoing since that meeting to address this need.

In 2002 and 2003, for example, a study to test the efficiency and applicability of three commonly-used herpetological survey techniques for detecting eastern indigo snakes was conducted in Brevard County, Florida (Smith and Dyer 2003). The three techniques tested were drift fence arrays with box and funnel traps, road cruising, and gopher tortoise burrow camera surveys. All techniques were used in areas known to be inhabited by eastern indigo snakes (snakes were monitored using radio telemetry). The results of the study indicated that none of the tested techniques could be relied on to easily or efficiently detect the species.

Reasons for Decline

Effective law enforcement has reduced pressure on the species from the pet trade. However, because of its relatively large home range, the eastern indigo snake is vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977; Moler 1985a). The primary threat to the eastern indigo snake is habitat loss due to development and fragmentation. In the interface areas between urban and native habitats, residential housing is also a threat because it increases the likelihood of snakes being killed by property owners and domestic pets. Extensive tracts of undeveloped land are important for maintaining eastern indigo snakes. In citrus groves, eastern indigo snake mortality occurs from vehicular traffic and management techniques such as pesticide usage, lawn mowers, and heavy equipment usage (Zeigler 2006). Within the 2000 to 2005 timeframe, since the spread of citrus canker, Zeigler (2006) reported seeing at least 12 dead eastern indigo snakes that were killed by heavy equipment operators in the act of clearing infected trees.

5.2.2.1.2 Habitat Characteristics and Use

Eastern indigo snakes need a mosaic of habitats to complete their annual life cycle. Over most of its range, the eastern indigo snake frequents several habitat types, including pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. Eastern indigo snakes also use some agricultural lands (such as citrus) and various types of wetlands (USFWS 1999). A study in southern Georgia found that interspersion of tortoise-inhabited sandhills and wetlands improve habitat quality for the eastern indigo snake (Landers and Speake 1980).

Eastern indigo snakes shelter in gopher tortoise burrows, hollowed root channels, hollow logs, or the burrows of rodents, armadillos, or land crabs (Lawler 1977; Moler 1985a; Layne and Steiner 1996). Throughout peninsular Florida, this species may be found in all terrestrial habitats which have not experienced high density urban development. They are especially common in the hydric hammocks throughout this region (USFWS 1999a). In central and coastal Florida, eastern indigo snakes are mainly found within many of the State's high, sandy ridges. In extreme South Florida (i.e., the Everglades and Florida Keys), eastern indigo snakes are found in tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats (Steiner et al. 1983; USFWS 1999).

Underground refugia used by this species include natural ground holes; hollows at the base of trees or shrubs; ground litter; trash piles; and in the crevices of rock-lined ditch walls (Layne and Steiner 1996). It is thought they prefer hammocks and pine forests since most observations occur there and use of these areas is disproportionate compared to the relatively small total area of these habitats (Steiner et al. 1983). Observations over the last 50 years made by maintenance workers in citrus groves in east-central Florida indicate eastern indigo snakes are occasionally observed on the ground in the tree rows and more frequently near the canals, roads, and wet ditches (Zeigler 2006). In the sugar cane fields at the A-1 Reservoir Project site in the Everglades Agriculture Area, eastern indigo snakes have been observed (including one mortality) during earthmoving and other construction-related activities.

5.2.2.1.3 Occurrence in the HCP Area

No GIS occurrence data were available for Collier County or the HCP Area, and a consultation area has not been defined for this species. However, the eastern indigo snake is known to occur throughout peninsular Florida (USFWS, 2008; Krysko et al. 2011) and a Programmatic Effect Determination Key developed by USACE and approved by USFWS applies to all counties within Southwest Florida, based on historic and current distribution data (USFWS 2013b).

Published data sources for eastern indigo snake occurrence within and adjacent to the HCP Area included the *Atlas of Amphibians and Reptiles in Florida* (Krysko et al. 2011) and a recent peer-reviewed journal article (Enge et al. 2013). Verified observations were recorded in the very northwest portion of the HCP Area, and near the eastern boundary of the Okaloacoochee Slough State Forest in Hendry County.

5.2.3 Mammals

5.2.3.1 Florida Bonneted Bat

The following species account for the Florida bonneted bat (*Eumops floridanus*) is compiled primarily from the 2013 USFWS Federal Register notice that listed the species as endangered under the ESA (78 Fed. Reg. 61004 (Oct. 2, 2013)), supplemented with recent occurrence data (USFWS 2014d). The Florida bonneted bat is a member of the Molossidae (free-tailed bats) family within the order Chiroptera. The species is the largest bat in Florida (Owre 1978a, 43; Belwood 1992, 216; Florida Bat Conservancy [FBC] 2005, 1). Males and females are not significantly different in size, and there is no pattern of size-related geographic variation in this species (Timm and Genoways 2004, 857).

Members of the genus *Eumops* have large, rounded pinnae (ears), arising from a single point or joined medially on the forehead (Best et al. 1997, 1). The common name of ‘‘bonneted bat’’ originates from characteristic large broad ears, which project forward over the eyes (FBC 2005, 1). Ears are joined at the midline of the head. This feature, along with its large size, distinguishes the Florida bonneted bat from the smaller Brazilian (or Mexican) free-tailed bat (*Tadarida brasiliensis*).

Wings of the members of the genus *Eumops* are among the narrowest of all molossids (Freeman 1981, as cited in Best et al. 1997, 3) and are well adapted for rapid, prolonged flight (Vaughan 1959 as cited in Best et al. 1997, 3). This wing structure is conducive to high-speed flight in open areas (Findley et al. 1972 as cited in Best et al. 1997, 3).

The Florida bonneted bat’s fur is short and glossy, with hairs sharply bicolored with a white base (Belwood 1992, 216; Timm and Genoways 2004, 857). Like other molossids, color is highly variable, varying from black to brown to brownish-gray or cinnamon brown with ventral pelage (fur) paler than dorsal (Owre 1978a, 43; Belwood 1992, 216; Timm and Genoways 2004, 857).

The Florida bonneted bat was previously known as Florida mastiff bat, Wagner’s mastiff bat, and mastiff bat (*E. glaucinus floridanus*) (Owre 1978a, 43; Belwood 1992, 216; Best et al. 1997, 1). While earlier literature found the Florida bonneted bat distinct at the subspecies level, the most current scientific

information confirms that *E. floridanus* is a full species, and this taxonomic change has been accepted by the scientific community (Timm and Genoways 2004, 852, 856, 861; McDonough et al. 2008, 1306–1315; Baker et al. 2009, 9–10).

5.2.3.1.1 Status and Distribution

Regulatory History

Federal actions for the Florida bonneted bat prior to October 4, 2012, are outlined in the USFWS proposed rule (77 Fed. Reg. 60750 (Oct. 4, 2012)), which was published on that date. Publication of the proposed rule opened a 60-day comment period, which closed on December 3, 2012.

The proposed rule also included a finding that designation of critical habitat was prudent, but that critical habitat was not determinable. Under the Act, the Service has two years from the date of the proposed listing to designate critical habitat. Accordingly, USFWS intends to publish a separate rule proposing designation of critical habitat for the Florida bonneted bat in the near future.

USFWS listed the Florida bonneted bat as an endangered species on October 2, 2013 (78 Fed. Reg. 61004).

Life History

Relatively little is known about the Florida bonneted bat's life history. Lifespan is not known. Based upon the work of Wilkinson and South (2002, 124–131), Gore et al. (2010, 1) inferred a lifespan of 10 to 20 years for the Florida bonneted bat, with an average generation time of 5 to 10 years.

The Florida bonneted bat has a fairly extensive breeding season during summer months (Timm and Genoways 2004, 859). The maternity season for most bat species in Florida occurs from mid-April through mid-August (Marks and Marks 2008a, 8). During the early portion of this period, females give birth and leave young in the roost while they make multiple foraging excursions to support lactation (Marks and Marks 2008a, 8–9). During the latter portion of the season, young and females forage together until the young become sufficiently skilled to forage and survive on their own (Marks and Marks 2008a, p. 9). The Florida bonneted bat is a subtropical species, and pregnant females have been found in June through September (FBC 2005, 1; Marks and Marks 2008a, 9). Examination of limited data suggests that this species may be polyestrous (having more than one period of estrous in a year), with a second birthing season possibly in January and February (Timm and Genoways 2004, 859; FBC 2005, 1).

Information on reproduction and demography is sparse. The Florida bonneted bat has low fecundity; litter size is one (FBC 2005, 1; Timm and Arroyo-Cabrales 2008, 1). The colony studied by Belwood (1981, 412) consisted of eight adults and included five post-lactating females, one pregnant female with a single fetus, and one male with enlarged testicles; the other female escaped before examination. The pregnant female captured was the first record of a gestating Florida bonneted bat in September (Belwood 1981, 412). However, Belwood (1981, 412) noted that this finding is consistent with the reproductive chronology of bonneted bats in Cuba, which are polyestrous.

The capture of a juvenile male in a mist net at Picayune Strand State Forest (PSSF) on December 17, 2009, suggested that there was breeding in the area (Smith 2010, 1–2).

Based upon limited information, the species roosts singly or in colonies consisting of a male and several females (Belwood 1992, 221). G.T. Hubbell believed that individuals in Miami roosted singly (Belwood 1992, 221). However, Belwood (1981, 412) suggested that a colony, consisting of seven females and one male using a longleaf pine cavity as a roost site in Punta Gorda, was a harem group, based on its sex ratio. Belwood (1981, 412; 1992, 221) suggested that this behavior has been recorded in a few bat species and such social groupings may be facilitated by roosting in tree cavities, which can be defended from other males (Morrison 1979, 11–15).

Information on roosting habits from artificial structures is also limited. A Florida bonneted bat colony using bat houses on private property in Lee County consisted of 8 to 25 individuals, including one albino (S. Trokey, pers. comm. 2006a, 2006b, 2008a, 2008b, 2012, 2013). After prolonged cold temperatures killed and displaced several bats in early 2010, a total of 10 individuals remained by April 2010, with seven occupying one house and three occupying another (S. Trokey, pers. comm. 2010a, 2010b, 2010c). As of March 2013, there are 20 bats using two houses at this location (S. Trokey, pers. comm. 2013). Sex ratio is not known. Some movement between the houses has been observed; the albino individual has been observed to be in one house one day and the other house the next (S. Trokey, pers. comm. 2006a).

At the Fred C. Babcock/Cecil M. Webb Wildlife Management Area (Babcock- Webb WMA), 39 to 43 individuals have been found to use 3 to 5 separate roosts (all bat houses) during periodic simultaneous counts conducted on 4 occasions over the past year (FWC, *in litt.* 2012; Marks and Marks 2012, 8, 12, A61; J. Myers, pers. comm. 2012a, 2012b, 2013). Simultaneous counts taken at emergence on April 2, 2013, at 4 roosts sites, documented 39 individuals with the number at each roost as follows: 37, 1, 1, and 0 (J. Myers, pers. comm. 2013). Periodic simultaneous counts taken at roosts over the course of a year suggest that use fluctuates among five roost sites (FWC, *in litt.* 2012; J. Myers, pers. comm. 2013). Apparent 'non-use' of a previous roost during monitoring may not be indicative of permanent abandonment (J. Myers, pers. comm. 2013). It is not known if there is movement between houses or among roost locations or between artificial and unknown natural roosts within Babcock-Webb WMA.

Understanding of roosting behavior and site selection is limited. However, there is a high probability that individuals tend towards high roost site fidelity (H. Ober, *in litt.* 2012). Lewis (1995, 481–496) found that bats that roost in buildings tend to be more site-faithful than those that roost in trees. Among bats that roost in trees, those that use cavities in large trees tend to be more site-faithful than those that use smaller trees (Brigham 1991; Fenton and Rautenbach 1986; Fenton et al. 1993 as cited in Lewis 1995, 487; H. Ober, *in litt.* 2012). Given its size, the Florida bonneted bat is likely to select large trees (H. Ober, *in litt.* 2012). The large accumulation of guano (excrement) 1 meter (m) (3.3 feet (ft)) deep in one known natural roost felled in 1979 (see Belwood 1981, p. 412) suggests high roost fidelity, especially considering the small number of individuals per colony (H. Ober, *in litt.* 2012).

The Florida bonneted bat is active year-round and does not have periods of hibernation or torpor. The species is not migratory, but there might be seasonal shifts in roosting sites (Timm and Genoways 2004, p. 860).

Precise foraging and roosting habits and long-term requirements are unknown (Belwood 1992, 219). Active year-round, the species is likely dependent upon a constant and sufficient food supply, consisting of insects, to maintain its generally high metabolism. The available information indicates Florida bonneted bats feed on flying insects of the following orders: Coleoptera (beetles), Diptera (flies), Hemiptera (true bugs), and Lepidoptera (moths) (Belwood 1981, 412; Belwood 1992, 220; FBC 2005, 1; Marks 2013, 1–2).

Foraging and dispersal distances and home range sizes for the Florida bonneted bat are not known and have not been studied in detail (K. Gillies, *in litt.* 2012; G. Marks, pers. comm. 2012; H. Ober, *in litt.* 2012). Like other molossids, the species' morphological characteristics make it capable of dispersing large distances and generally adapted for low cost, swift, long distance travel from roost site to foraging areas (Norberg and Rayner 1987, 399–400; K. Gillies, *in litt.* 2012; H. Ober, *in litt.* 2012). Given this, it seems likely that foraging areas may be located fairly long distances from roost sites (H. Ober, *in litt.* 2012). However, despite its capabilities, the species likely does not travel farther than necessary to acquire food needed for survival (G. Marks, pers. comm. 2012).

Bonneted bats are ''fast hawking'' bats that rely on speed and agility to catch target insects in the absence of background clutter, such as dense vegetation (Simmons et al. 1979, 16–21; Belwood 1992, 221; Best et al. 1997, 5). Foraging in open spaces, these bats use echolocation to detect prey at relatively long range, roughly 3 to 5 m (10 to 16 ft) (Belwood 1992, 221). Based upon information from G.T. Hubbell, Belwood (1992, 221) indicated that individuals leave roosts to forage after dark, seldom occur below 10 m (33 ft) in the air, and produce loud, audible calls when flying; calls are easily recognized by some humans (Belwood 1992, 221; Best et al. 1997, 5; Marks and Marks 2008a, 5). For example, on the evening of April 19, 2012, Florida bonneted bats using bat houses at Babcock-Webb WMA emerged to forage at dusk; emergence began roughly 26 minutes after sunset and continued for approximately 20 minutes (P. Halupa, pers. obs. 2012; J. Myers, pers. comm. 2012).

Distribution and Population Trends

Endemic to Florida, the Florida bonneted bat has one of the most restricted distributions of any species of bat in the New World (Belwood 1992, 218–219; Timm and Genoways 2004, 852, 856–858, 861–862). Although numerous acoustical surveys for the Florida bonneted bat have been conducted in the past decade by various parties, the best scientific information indicates that the species exists only within a very restricted range, largely confined to south and southwest Florida (Timm and Genoways 2004, 852, 856–858, 861–862; Marks and Marks 2008a, 15; 2012, 10–11).

Little information exists on historical population levels. Details are provided in the proposed listing rule (77 Fed. Reg. 60750). Based upon available data and information, the Florida bonneted bat currently occurs within a restricted range and in apparent low abundance (Marks and Marks 2008a, 15; 2012, 9-15; Timm and Arroyo-Cabrales 2008, 1; FWC 2011b, 3–4; FWC 2011c, 3, 6; R. Timm, pers. comm. 2012,

in litt. 2012). Actual population size is not known, and no population viability analyses are available (FWC 2011b, 4; 2013, 16; K. Bohn, *in litt.* 2012). However, population size is thought to be less than that needed for optimum viability (Timm and Arroyo-Cabrales 2008, 1; K. Bohn, *in litt.* 2012). As part of their evaluation of listing criteria for the species, Gore et al. (2010, 2) found that the extent of occurrence appears to have decreased on the east coast of Florida, but trends on the west coast could not be inferred due to limited information.

Estimates of population size are crude, relative, and largely based on expert opinions and inferences from available data. Due to the numerous challenges associated with censusing bats (Kunz 2003, 9–17), it will likely be difficult to accurately estimate the size of the Florida bonneted bat population (FWC 2013a, 13). Alternative approaches, such as occupancy modeling and analysis of genetic diversity, may provide better estimates and more useful information about population size in the future (K. Gillies, *in litt.* 2012; FWC 2013, 16).

Reasons for Decline

In its listing decision, USFWS carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Florida bonneted bat (USFWS 2013c). The species occurs in limited numbers in a restricted range in south Florida. Habitat loss, degradation, and modification from human population growth and associated development and agriculture have impacted the Florida bonneted bat and are expected to further curtail its limited range. Environmental effects from climate change, including sea level rise and coastal squeeze, are predicted to become severe in the future, resulting in additional habitat losses that are expected to place the species at greater risk.

The Florida bonneted bat also faces threats from a wide array of natural and manmade factors. Effects of small population size, restricted range, few colonies, slow reproduction, low fecundity, and relative isolation contribute to the species' vulnerability. Other aspects of the species' natural history (e.g., aerial-hawking foraging, tree-roosting habits) and environmental stochasticity may also contribute to its imperilment. Multiple anthropogenic factors are also threats (e.g., impacts or intolerance by humans) or potential threats (e.g., wind energy projects, ecological light pollution) of varying severity. As an insectivore, the species is also likely exposed to a variety of pesticides and contaminants through multiple routes of exposure; pesticides may also affect its prey base. Given its vulnerability, disease and predation have the potential to impact the species. Finally, existing regulatory mechanisms, due to a variety of constraints, do not provide adequate protection for the species. Overall, impacts from increasing threats, operating singly or in combination, place the species at risk of extinction.

5.2.3.1.2 Habitat Characteristics and Use

Relatively little is known of the ecology of the Florida bonneted bat, and long-term habitat requirements are poorly understood (Robson 1989, 2; Robson et al. 1989, 81; Belwood 1992, 219; Timm and Genoways 2004, 859). Habitat for the Florida bonneted bat mainly consists of foraging areas and roosting sites, including artificial structures. At present, no active, natural roost sites are known, and only limited information on historical sites is available.

Recent information on habitat has been obtained largely through acoustical surveys, designed to detect and record bat echolocation calls (Marks and Marks 2008a, 5). Acoustical methods have generally been selected over mist netting as the primary survey methodology because this species flies and primarily forages at heights of 9 m (30 ft) or more (Marks and Marks 2008a, 3).

In general, open, fresh water and wetlands provide prime foraging areas for bats (Marks and Marks 2008c, 4). Bats will forage over ponds, streams, and wetlands and will drink when flying over open water (Marks and Marks 2008c, 4). During dry seasons, bats become more dependent on remaining ponds, streams, and wetland areas for foraging purposes (Marks and Marks 2008c, 4). The presence of roosting habitat is critical for day roosts, protection from predators, and the rearing of young (Marks and Marks 2008c, 4). For most bats, the availability of suitable roosts is an important, limiting factor (Humphrey 1975, 341–343). Bats in South Florida roost primarily in trees and manmade structures (Marks and Marks 2008a, 8). Protective tree cover around bat roosts may be important for predator avoidance and allowing earlier emergence from the roost, thereby allowing bats to take advantage of the peak in insect activity at dusk and extend foraging time (Duverge et al. 2000, 39).

Available information on roosting sites for the Florida bonneted bat is extremely limited. Roosting and foraging areas appear varied, with the species occurring in forested, suburban, and urban areas (Timm and Arroyo- Cabrales 2008, 1). Data from acoustical surveys and other methods suggest that the species uses a wide variety of habitats (R. Arwood, Inside- Out Photography, Inc., pers. comm. 2008a, 2008b, 2012, 2013a,b; Marks and Marks 2008a, 13–14; 2008b, 2–5; 2008c, 1–28; 2012, 1–22; Smith 2010, 1–4; S. Snow, pers. comm. 2011a, 2011b, 2012b–h; *in litt.*2012; M. Owen, pers. comm. 2012a, 2012b; R. Rau, pers. comm. 2012; Maehr 2013, pp. 1–13; S. Maehr, pers. comm. 2013a, 2013b; K. Relish, pers. comm. 2013; F. Ridgley, pers. comm. 2013a–c; B. Scofield, pers. comm. 2013a–f; K. Smith, pers. comm. 2013).

Attempts to locate natural roost sites (e.g., large cavity trees) in February 2013 using scent-detection dogs were inconclusive. No active natural roosts for Florida bonneted bats have been identified or confirmed to date. At this time, all known active roost sites are artificial structures (i.e., bat houses)

Bonneted bats are closely associated with forested areas because of their tree roosting habits (Robson 1989, 2; Belwood 1992, 220; Eger 1999, 132), but specific information is limited. Eger (1999, 132) noted that in forested areas, old, mature trees are essential roosting sites for this species. Acoustical data and other information indicate that the Florida bonneted bat uses forests and a variety of other natural areas. Echolocation calls have been recorded in a wide array of habitat types: pine flatwoods, pine rocklands, cypress, hardwood hammocks, mangroves, wetlands, rivers, lakes, ponds, canals, and so forth. Recent results from a study at Florida Panther NWR conducted in 2013 also show the species' use of forested areas, open water, and wetlands (Maehr 2013, 1–13). Of the 13 locations examined, the highest detection of Florida bonneted bat calls occurred in areas with the largest amount of open water (Maehr 2013, 8). The area with the highest detection was an open water pond, surrounded primarily by pine flatwoods and oak hammock (S. Maehr, pers. comm. 2013a–c). That area has been regularly burned and contains a large amount of old snags that have been hollowed by woodpeckers (C. Maehr, pers. comm. 2013c).

The Florida bonneted bat uses human-built structures and other non-natural environments. Recordings taken continuously from a balcony from a fifth floor condominium detected presence in Naples (R. Arwood, pers. comm. 2008a). Recordings taken from a house and at a boat dock along the Barron River in Everglades City also detected presence in this area (R. Arwood, pers. comm. 2008a).

5.2.3.1.3 Occurrence in the HCP Area

The Florida bonneted bat has been recorded or observed at multiple sites within Collier County, including the FPNWR, BCNP, FSSP, and PSSF protected areas, and within urban/residential areas in Naples and Everglades City (USFWS 2013c, Table 1). The occurrence data in Collier County are consistent with rangewide surveys suggesting that Florida bonneted bats utilize a wide variety of habitats.

Figure 5-5 depicts the Florida bonneted bat consultation area and focal area within the HCP Area. Although GIS occurrence data were not available at the time of this writing, a recent map depicted the previously mentioned survey results from FPNWR, PSSF, and BCNP, which border the HCP Area (USFWS, 2014d). Surveys did not detect Florida bonneted bats near the Corkscrew Swamp Sanctuary or the Okaloacoochee Slough State Forest.

5.3 FEDERALLY-LISTED PLANT SPECIES

The best available scientific information indicates that no federally-listed plant species or candidate plant species occur within the HCP Area.

The USFWS Information, Planning, and Conservation (IPaC) decision support system was queried multiple times during the development of the Plan document, to verify that no new species within eastern Collier County had been added to Federal list of endangered and threatened wildlife and plants. The IPaC system identified one listed plant species that could potentially occur in Collier County, Garber's spurge (*Chamaesyce garberi*). Upon further review, there are only 15 known occurrences of this plant species within the ENP and the Florida Keys, and it has been extirpated through most of its former range (NatureServe 2014). The only documented occurrence of Garber's spurge in Collier County was on coastal Cape Romano, and that occurrence was extirpated (Green et al. 2008).

The IPaC system identified another plant species, Florida prairie-clover (*Dalea carthagenensis floridana*), which is currently a candidate species for listing. The most recent Federal register entry for this species stated, "*Dalea carthagenensis* var. *floridana* is found in pine rocklands, edges of rockland hammocks, coastal uplands, and marl prairie. *Dalea carthagenensis* var. *floridana* occurs in the BCNP in Monroe and Collier Counties and at six locations within Miami-Dade County, Florida, albeit mostly in limited numbers" (78 Fed. Reg. 70144 (Nov. 22, 2013)). The habitat types associated with Florida prairie-clover do not occur within the HCP Area.

5.4 SPECIES UNDER REVIEW FOR FEDERAL LISTING

5.4.1 Eastern Diamondback Rattlesnake

The following species account is compiled primarily from a 2012 USFWS 90-Day Finding (77 Fed. Reg. 27403 (May 10, 2012)), which indicated that the listing of the eastern diamondback rattlesnake as Threatened may be warranted.

The eastern diamondback rattlesnake (*Crotalus adamanteus*) is recognized by its large size, diamond patterned dorsal (upper) side, yellowish unpatterned underbelly, dark tail with rattle, and infrared sensitive pit between the eye and nostril. The eastern diamondback is the largest rattlesnake in the world (Timmerman and Martin 2003). Adult snakes average 4 to 5 ft (1.2 to 1.5 m) in length and average 4 to 5 lbs (1.8 to 2.3 kg) in weight. Eastern diamondbacks in the 6-ft (1.8-m) range are considered quite large and can reach 12 lbs (5.4 kg) or more (Timmerman and Martin 2003).

No taxonomic history other than *C. adamanteus* was found during the course of the 90-day finding. The eastern diamondback is recognized as a valid species in the Checklist of Vertebrates of the United States, the U.S. Territories, and Canada, according to the Integrated Taxonomic Information System on-line database (ITIS). Therefore, USFWS accepts the taxonomic description of the eastern diamondback as *Crotalus adamanteus.*

5.4.1.1 Status and Distribution

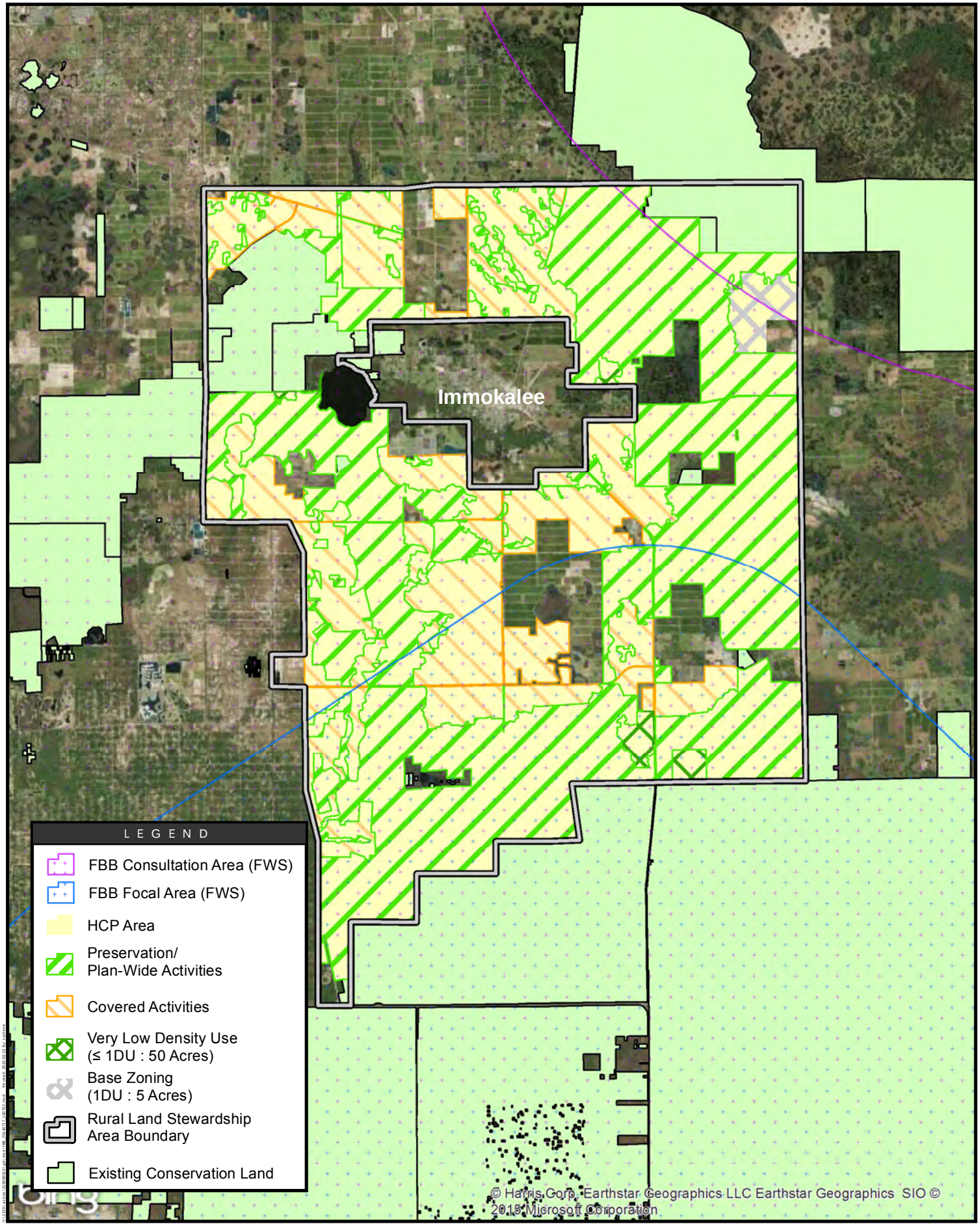
Regulatory History

Prior to the 90-day finding, there were no Federal actions concerning the eastern diamondback rattlesnake under the ESA. The species is currently under review by USFWS for possible Federal listing.

Life History

The natural lifespan of an eastern diamondback rattlesnake is probably 15 to 20 years, but field evidence indicates that few individuals today live beyond 10 years, likely due to anthropogenic threats. Mating occurs in the late summer and early fall (Timmerman and Martin 2003). Ovulation apparently occurs in the late spring of the following year with births centered in late August and ranging from late July to early October. Female eastern diamondbacks reach sexual maturity between 2 and 6 years of age (Timmerman and Martin 2003).

The eastern diamondback rattlesnake is an ambush predator that feeds on a wide variety of small mammals and some birds. The bulk of its prey consists of rabbits (*Sylvilagus sp.*), cotton rats, and gray squirrels (*Sciurus carolinensis*) (Timmerman and Martin 2003). The open-canopy habitats of the eastern diamondback favor the development of an herbaceous groundcover on which its primary prey depend. The eastern diamondback is terrestrial, hunting almost exclusively on the ground. As a member of the pit viper family, it is able to hunt in total darkness and identify warm-blooded prey via infrared detection



Stantec

FIGURE 5-5
Florida Bonneted Bat Consultation Area and Focal Area

December 2014

Stantec Consulting Services Inc.
3200 Bailey Ln. Ste. 200
Naples, FL 34105
tel 239.649.4040
fax 239.649.5716

0 2 4 Miles

N

(Timmerman and Martin 2003). Timmerman (1995) found that home ranges for females averaged 114.9 ac (46.5 ha), home ranges for males averaged 208.3 ac (84.3 ha), and that the species does not defend a territory. Eastern diamondbacks do not den communally (Means 2009, 138).

Distribution and Population Trends

The historical (pre-European settlement or pre-settlement) range of the eastern diamondback rattlesnake encompasses the Coastal Plain of the southeastern United States from North Carolina to South Florida, and west to Mississippi and Louisiana. At the broadest spatial scale, the historical range of the eastern diamondback is largely congruent with the historical distribution of the longleaf pine savanna ecosystem (Martin and Means 2000).

In Florida, the eastern diamondback has become rare and has disappeared completely from many sites within its historical range that was essentially statewide, including barrier islands and keys. Much of the species' habitat in the Florida peninsula has been lost to urbanization and conversion to citrus groves and improved pasture during the last half of the twentieth century (Martin and Means 2000). Florida encompasses half of the species' current range (Timmerman and Martin 2003).

Reasons for Decline

The species has likely been declining since the 1930s. The greatest population decline has occurred since the 1970s, as the human population grew in the southeastern United States (Timmerman and Martin 2003). The area of occupancy, number of subpopulations, and population size of the eastern diamondback is declining throughout the species' range. Its range has contracted because of habitat loss from agriculture, silviculture, urbanization, and plant succession resulting from fire suppression (Timmerman and Martin 2003). Remaining intact range supporting large populations of the eastern diamondback is now located only in northern Florida and southern Georgia (Martin and Means 2000).

Since the 1930s there has been a variety of markets for the eastern diamondback. The snake's meat has been used as a food delicacy, its skins for clothing, its parts for the curio trade, its venom for human safety, and eastern diamondback rattlesnakes and their parts have been sold at festivals or events for recreation and tourism (Timmerman and Martin 2003). Although there has been a decline in the capture rate of snakes for harvest and research (due to fewer snakes, market changes, and regulation), overall, eastern diamondback populations have experienced the disappearance of larger eastern diamondbacks and increased capture of smaller diamondbacks (Timmerman and Martin 2003).

5.4.1.2 Habitat Characteristics and Use

The principal native habitat of the eastern diamondback rattlesnake in pre-settlement times was longleaf pine savannas (Martin and Means 2000). Today, nearly all of the old growth longleaf pine savannas are gone, and the eastern diamondback survives wherever the pine savannas still exist and or where open-canopy, ruderal forests, and grasslands that mimic that native habitat have developed. Martin and Means (2000, Appendix 1) list flatwoods, dry prairie, xeric and mesic hardwood hammocks, and xeric oak scrub among the habitats utilized by the species, and note that the rattlesnake "is able to

exist in silvicultural and agricultural areas provided there are either patches of relatively natural habitat or successional habitats nearby. Old field successional situations or abandoned citrus groves can have high populations."

Shelters from fire and cold are important microhabitats for the eastern diamondback rattlesnake (Martin and Means 2000). Eastern diamondbacks seek subterranean overwintering shelters throughout their range with the exception of extreme southern Florida and the Florida Keys (Timmerman and Martin 2003). They also use gopher tortoise and armadillo burrows, as well as fire-burned pine stump holes and cavities at the bases of hardwood trees, as shelters (Timmerman and Martin 2003).

Eastern diamondback rattlesnakes overlap suitable habitats with other federally-protected species and derive conservation benefits through their protection. Eastern diamondbacks share suitable habitat with the eastern indigo snake and the gopher tortoise (77 Fed. Reg. at 27409).

5.4.1.3 Occurrence in the HCP Area

Published data sources for eastern diamondback rattlesnake occurrence were limited to two publications. The Atlas of Amphibians and Reptiles in Florida (Krysko et al. 2011) identified three vouchered records within the HCP Area, two of them catalogued since 1980. Martin and Means (2000) included a map with several additional occurrence records within the HCP Area that were based on museum samples, some of which were distinct from the locations shown in Krysko et al. (2011).

5.4.2 Gopher Tortoise

The following species account for the gopher tortoise (*Gopherus polyphemus*) is compiled primarily from the 2014 USFWS Biological Opinion for the Kissimmee Prairie Preserve State Park (USFWS 2014), supplemented with information from the gopher tortoise 12-month finding (USFWS 2011b). The gopher tortoise is larger than any of the other terrestrial turtles in this region, with a domed, dark-brown to grayish black shell (carapace) up to 14.6 in long, and weighing up to 13 pounds (6 kilograms [kg]). The lower shell (plastron) is yellowish and hingeless. Tortoises cannot completely withdraw their limbs, which remain visible when folded and retracted. The hind feet are elephantine or stumpy, and the forelimbs are shovel-like, with claws used for digging. In comparison to females, males are smaller; usually have a larger gland under the chin, a longer gular projection, and more concave plastron. Hatchlings are up to 2 in in length, with a somewhat soft, yellow-orange shell. As with other chelonians, gopher tortoises possess a keratinized beak, and lack teeth.

Gopher Tortoises are members of the Class Reptilia, Order Testudines, and Family Testudinidae. Of four North American tortoise species (genus *Gopherus*), the Gopher Tortoise is the only one that occurs east of the Mississippi River (FWC 2012).

5.4.2.1 Status and Distribution

Regulatory History

On July 7, 1987, USFWS listed the population of the gopher tortoise as a threatened species in the western portion of its range (west of the Mobile and Tombigbee Rivers in Alabama, Louisiana, and Mississippi) (52 Fed. Reg. 25376). On January 18, 2006, USFWS received a petition dated January 13, 2006, from Save Our Big Scrub, Inc. and Wild South requesting that the population of the gopher tortoise in the eastern portion of its range (east of the Mobile and Tombigbee Rivers in Alabama, Florida, Georgia, and South Carolina) be listed as a threatened species under the Act and that critical habitat be designated. The gopher tortoise in the eastern portion of its range was be added to the list of candidate species upon publication of the 12-month finding on July 27, 2011 (76 Fed. Reg. 45130).

As a candidate species for listing, no critical habitat has been designated for the gopher tortoise.

Life History

The gopher tortoise is a long-lived, native burrowing species of the open, fire-maintained longleaf pine ecosystem. Historically, typical gopher tortoise habitat consisted of open, frequently burned longleaf pine or longleaf pine/scrub oak uplands and flatwoods on moderately well drained to xeric soils. Such habitat provided adequate sunlight reaching the forest floor to stimulate the growth and development of the herbaceous plant stratum for forage, with sufficient warmth for basking and the incubation of eggs. The burrows of the gopher tortoise are at the center of normal feeding, breeding, and sheltering activity. Gopher tortoises excavate burrows for shelter beneath the ground surface. Burrows, which may extend for more than 30 feet, provide shelter from canid predators, fire, winter cold, and summer heat. Dogs and large canids are the most common predator of adult tortoises (Causey and Cude 1978).

In stable populations with fire-maintained, open longleaf pine habitat, females may use an average of five burrows each while males occupy an average of 10 burrows (Eubanks et al. 2003). In poor habitat due to encroaching, fire intolerant shrubs and hardwoods, gopher tortoises tend to excavate and use fewer burrows, probably because of limited sites that are sufficiently open. Males tend to use more burrows and move more frequently among their different burrows than females as they seek breeding opportunities with females (McRae et al. 1981; Diemer 1992a, 1992b; Smith 1995; Tuma 1996; Boglioli et al. 2000; Eubanks et al. 2003).

Gopher tortoises spend most of their time within burrows and emerge during the day to bask in sunlight, to feed, and reproduce. They are active above ground during the growing season when daytime temperatures range from 75 to 87 °F (McRae et al. 1981; Butler et al. 1995). Daily active periods usually are unimodal in spring, followed by bimodal periods (early to mid-morning, middle to late afternoon) during the hotter temperatures of summer (McRae et al. 1981). Daily activity above ground becomes significantly reduced by the end of the growing season during October with cooler temperatures. Tortoises take shelter within their burrows during the dormant season, become torpid, do not eat, and rarely emerge except during periods of warm days to bask in sunlight at the burrow

entrance. Except for those tortoises in southern peninsular Florida that do not have an overwintering period, most tortoises become active again during early spring.

Tortoises mostly forage on foliage, seeds, and fruits of grasses and forbs, generally in an area of about 150 feet surrounding each burrow (McRae et al. 1981; Diemer 1992b). The diet of adults resembles that of a generalist herbivore, with at least some preference for some plants over others, and may also include insects and carrion (MacDonald and Mushinsky 1988; Birkhead 2001). Juvenile tortoises tend to forage on fewer plant species, eat fewer grasses, and select more forbs, including legumes, than adults (Mushinsky et al. 2003).

Burrows are not randomly located in the environment. Tortoises select and prefer burrow sites in open sunny areas (Boglioli et al. 2000; Rostal and Jones 2002). Such sites reflect areas where herbaceous plants for food are more abundant on the forest floor and, for females, sunlight and soil temperatures for egg incubation are more suitable. Also, males select sites and burrows that increase their proximity to females and breeding opportunities (Boglioli et al. 2000; Eubanks et al. 2003). The repeated use and travel to the same burrows by individual tortoises in stable habitat reveal that tortoises know the geography of their home range, burrows, and the location of neighboring tortoises (Eubanks et al. 2003).

Tortoises breed from May through October (e.g., Landers et al. 1980; McRae et al. 1981; Taylor 1982; Wright 1982; USFWS 1987b; Diemer 1992a; Eubanks et al. 2003). Douglass (1986) described gopher tortoise as having “colonial” tendencies with aggregations of burrows in which dominant males competitively and behaviorally exclude other males at female burrows to maintain a loose female harem as a mating system. More recent studies do not indicate the clear existence of an exclusive dominance hierarchy. Also, aggregations of burrows in some habitat and study sites probably are an artifact of fragmentation and the concentration of burrows in the available remaining suitable habitat (Mushinsky and McCoy 1994; Boglioli et al. 2003).

Females do not reproduce every year. Females excavate a shallow nest to lay and bury eggs, usually in the apron of soil at the mouth of the burrow, but they may lay elsewhere if the apron is excessively shaded (Landers and Buckner 1981). Range-wide, average clutch size varies from about 4 to 12 eggs/clutch. Average clutch size in the listed range (west of the Mobile and Tombigbee Rivers in Alabama, Mississippi, and Louisiana), from 4.8 to 5.6 eggs/clutch, is comparably low (Seigel and Hurley 1993; Seigel and Smith 1995; Tuma 1996; Epperson 2003). Clutch size generally is positively correlated with adult female size (Diemer and Moore 1994; Smith 1995; Rostal and Jones 2002).

Females usually lay about five to seven eggs from mid-May through mid-July (Butler and Hull 1996; Smith et al. 1997) and egg incubation lasts 80 - 110 days (Diemer 1986; Smith et al. 1997). Incubation at temperatures from 81°F to 90°F is required for successful development and hatching (e.g., Spotila et al. 1994; Burke et al. 1996; DeMuth 2001; Rostal and Jones 2002; Noel and Qualls 2004). As in other species, sex determination is temperature dependent (Burke et al. 1996; DeMuth 2001). Nest depredation by vertebrates typically has been considered substantial, although little quantitative data is available. From studies in southern Georgia, Landers et al. (1980) estimated about 90 percent of nests

were destroyed by predators. In a much smaller study from southern Alabama, about 46 percent of nests (n = 11) were destroyed by raccoons, opossums, and armadillos (Marshall 1986).

Hatchlings excavate themselves from the nest and emerge from the middle of August through October (Ashton and Ashton 2008). Hatchlings and yearlings (0 to 1 year old) may temporarily use the adult burrow, bury under sand or leaf litter, or excavate a small burrow nearby (Douglass 1978; Wilson et al. 1994; Butler et al. 1995; Pike 2006). Growth is most rapid during the juvenile stage, becoming slower at the onset of adulthood and reproductive maturity, followed by little or no adult growth (Mushinsky et al. 1994; Aresco and Guyer 1998, 1999). Generally, tortoises become adults at about 20 years of age, although the minimal stage to reach reproductive maturity is determined by size rather than age. Growth rates and sizes at sexual maturity can vary among populations and habitat types (Landers et al. 1982; Mushinsky et al. 1994; Aresco and Guyer 1998, 1999).

Home range size and movements increase with age and body size. The burrows of a gopher tortoise represent the general boundaries of a home range, which is the area used for feeding, breeding, and sheltering. Home range area tends to vary with habitat quality, becoming larger in areas of poor habitat (Auffenberg and Iverson 1979). Males typically have larger home ranges than females. Mean home ranges of individual tortoises in Alabama, Florida, and Georgia outside the federally-listed area have varied from 1.3 to 5.2 acres (3.2 to 2.2 ha) for males and 0.2 to 2.5 acres (0.09 to 1.0 ha) for females (McRae et al. 1981; Auffenberg and Franz 1982; Diemer 1992b; Tuma 1996; Ott 1999; Eubanks et al. 2003; Guyer 2003). In comparison to females, male tortoises use more burrows, and during breeding season, move among burrows more frequently over longer distances (McRae et al. 1981; Auffenberg and Franz 1982; Diemer 1992b; Smith 1995; Tuma 1996; Ott 1999; Eubanks et al. 2003; Guyer 2003).

A burrow may or may not be exclusively used by just one gopher tortoise. Two or more tortoises may share the same burrow, although the burrow is used at different times of the year by different individuals. Home ranges overlap when a burrow is used by more than one tortoise. Eubanks et al. (2002) found that about 50 percent of the area occupied by 123 tortoises was shared by 2 or more tortoises in relatively pristine, stable habitat in southwestern Georgia.

As distances increase between gopher tortoise burrows, isolation among tortoises also increases due to the decreasing rate of visitation and breeding (Boglioli et al. 2003; Guyer 2003). Using extensive data from individual tortoise inter-burrow movements and home range size, Eubanks et al. (2003) found that most colonies or breeding population segments would consist of burrows no greater than about 558 feet (170 m) apart. Guyer (2003) found that males only rarely will move from their burrows up to 1,640 feet (500 m) to a female burrow for mating opportunities, and females typically experience a visitation rate of near zero when their burrows are 460 to 623 feet (140 to 190 m) from nearest neighbors. Demographically, tortoises located at distances of about 600 feet (200 m) from other tortoises are functionally isolated and subdivided as separate breeding populations. Thus, breeding populations or colonies likely consist of tortoises and burrows in suitable, unfragmented habitat within 600 feet or less from each other.

Distribution and Population Trends

In the western portion of their range, gopher tortoise populations are small and occur in fragmented habitat. The largest and most substantial gopher tortoise populations in the western portion of its range occur on the De Soto National Forest in southern Mississippi. Long-term monitoring here indicates a decline in population sizes, a tendency towards adult-dominated populations, and a lack of, or very low, recruitment. Results of smaller-scale surveys of forest lands in Mississippi and public and private lands in Louisiana are largely consistent with findings on the De Soto National Forest. There are no known populations large enough (e.g., > 250 individuals) to persist long-term based on projections resulting from recent modeling efforts.

The gopher tortoise is more widespread and abundant in parts of the eastern portion of its range, particularly southern Georgia and central and northern Florida. Long-term monitoring data indicate that many populations have declined and most are relatively small and fragmented. Smaller-scale, short-term or one-time surveys throughout the unlisted portion of the range indicate that tortoise populations typically occur in fragmented and degraded habitat, are small, and densities of individuals are low within populations. Unlike the western portion of the range, there are several known populations of tortoises in the eastern portion of the range that appear to be sufficiently large to persist long-term (e.g., Camp Blanding Joint Training Center, Florida; Chassahowitzka WMA, Florida; Fort White Wildlife and Environmental Area, Florida; Jennings Forest WMA, Florida; TLWMA, Florida; Fort Benning, Georgia; Fort Stewart, Georgia; River Creek WMA, Georgia; Townsend WMA, Georgia). There are about 80 other public parcels in Florida that contain a substantial amount of potential gopher tortoise habitat but surveys or censuses of these areas have not been conducted to estimate the number of tortoises present (FWC 2011a).

A wide variety of information is available on the number and density of gopher tortoises and their burrows from many areas throughout their range. These data resulted from numerous surveys/censuses using a variety of methodologies ranging from one-time censuses to repeated surveys over several decades. The diversity of data poses a challenge when trying to evaluate the status of a species from a landscape perspective. For example, in some areas more data exist (e.g., Florida and in portions of the listed range), justifying higher confidence in drawing conclusions about status of tortoises in these areas. In other areas, where there is little or no data, confidence in assessing the status of tortoises is lower. Because of disparities in the type of data collected, methodologies in collecting data, and differences in the scope of studies, it is not possible to simply combine datasets to evaluate the status of the gopher tortoise throughout its range. Instead, USFWS has considered each individual dataset in the context of all other best available science to form general conclusions about the status of the gopher tortoise (USFWS 2014c).

Reasons for Decline

Gopher tortoise habitat in both the eastern and western portions of its range has been destroyed or modified in the past due to: (i) Conversion of natural pine forests to intensely managed planted pine plantations or naturally regenerated stands (Hermann et al. 2002, 296; Siry 2002, 335; Conner and

Hartsell 2002, 373–376); (ii) loss of natural pine forests resulting from urban development, conversion of xeric vegetative communities to citrus, and phosphate mining (Kautz 1998, 184; FWC 2006, 4 and 8); and (iii) degradation of natural pine forest due to lack, or insufficient use, of prescribed fire (FWC 2006, 10; Bailey and Smith 2007, 8; Yager et al. 2007, 1).

In addition to habitat loss, gopher tortoise habitat will continue to be degraded due to fragmentation, conversion to intensively managed pine forests, and lack, or ineffective use of prescribed fire. The spatial and temporal scale of fragmentation from silvicultural activities will vary depending on location, size, and timing of these activities, but frequent alterations of intensely managed pine forests are unlikely to support stable tortoise populations (Diemer 1992a, 288).

Overall, the USFWS assessment is that gopher tortoise habitat is diminishing and that populations are declining. Disease and human-related impacts are documented threats to the species and sea level rise will likely also eliminate some coastal habitats. There are likely some viable gopher tortoise populations on both public and private lands in the eastern portion of the species' range. However, the extent to which these populations are sufficient in both number and security to ensure the long-term persistence of gopher tortoises throughout their range is unknown. The positive effects of recent commitments by landowners through the Candidate Conservation Agreement (a formalized voluntary conservation agreement between USFWS and public and private parties) and more protective state regulations in Florida are just beginning to be realized. Regardless, there are no programs in place that would ensure the maintenance of contiguous, suitable, occupied habitats to secure the species against stochastic events and to provide for sufficient genetic diversity.

5.4.2.2 Habitat Characteristics and Use

Gopher tortoises require well-drained, sandy soils for burrowing and nest construction, an abundance of herbaceous ground cover for food, and a generally open canopy that allows sunlight to reach the forest floor (Landers 1980; Auffenberg and Franz 1982). Longleaf pine and oak uplands, xeric hammock, sand pine and oak ridges (beach scrub), and ruderal (disturbed) habitat most often provide the conditions necessary to support gopher tortoises (Auffenberg and Franz 1982). Ruderal (i.e., disturbed or atypical) habitats include roadsides and utility rights-of-way, grove/forest edges, fencerows, and clearing edges. In the western range, soils contain more silt, and xeric conditions are less common west of the Florida panhandle (Craul et al. 2005). Ground cover in this Coastal Plains area can be separated into two general regions with the division in the central part of southern Alabama and northwest Florida. To the west, bluestem (*Andropogon* spp.) and panicum (*Panicum* spp.) grasses predominate; to the east, wiregrass (*Aristida stricta*) is most common (Boyer 1990). However, gopher tortoises do not necessarily respond to specific plants, but rather the physical characteristics of habitat (Diemer 1986). Historic gopher tortoise habitats were open pine forests, savannahs, and xeric grasslands that covered the coastal plain from Mexico and Texas to Florida. Historic habitats might have had wetter soils at times and been somewhat cooler but were generally xeric, open, and diverse (Ashton and Ashton 2008).

Gopher tortoises have a well-defined activity range where all feeding and reproduction take place and that is limited by the amount of herbaceous ground cover (Auffenberg and Iverson 1979). Tortoises are

obligate herbivores eating mainly grasses, plants, fallen flowers, fruits, and leaves. Gopher tortoises prefer grassy, open-canopy microhabitats (Boglioli et al. 2000), and their population density directly relates to the density of herbaceous biomass (Auffenberg and Iverson 1979; Landers and Speake 1980; Wright 1982; Stewart et al. 1993) and a lack of canopy (Breininger et al. 1994; Boglioli et al. 2000). Grasses and grass-like plants are important in gopher tortoise diets (Auffenberg and Iverson 1979; Landers 1980; Wright 1982; Macdonald and Mushinsky 1988; Mushinsky et al. 2003). A lack of vegetative diversity may negatively impact the long-term sustainability of gopher tortoise populations (Ashton and Ashton 2008).

Gopher tortoises require a sparse canopy and litter-free ground not only for feeding, but also for nesting (Landers and Speake 1980). In Florida, McCoy and Mushinsky (1995) found the number of active burrows per tortoise was lower where canopy cover was high. Females require almost full sunlight for nesting (Landers and Buckner 1981) because eggs are often laid in the burrow apron or other sunny spot and require the warmth of the sun for appropriate incubation (Landers and Speake 1980). At one site in Southwest Georgia, Boglioli et al. (2000) found most tortoises in areas with 30 percent or less canopy cover. Diemer (1992a) found ecotones created by clearing were also favored by tortoises in North Florida. When canopies become too dense, usually due to fire suppression, tortoises tend to move into ruderal habitats such as roadsides with more herbaceous ground cover, lower tree cover, and significant sun exposure (Garner and Landers 1981; McCoy et al. 1993; Baskaran et al. 2006). In Georgia, Hermann et al. (2002) found that open pine areas (e.g., pine forests with canopies that allow light to penetrate to the forest floor) were more likely to have burrows, support higher burrow densities, and have more burrows used by large, adult tortoises than closed-canopy forests. Historically, open-canopied pine forests were maintained by frequent, lightning-generated fires.

Regarding South Florida, the FWC Gopher Tortoise Management Plan (FWC 2012) noted that, “Throughout much of their geographical range, gopher tortoises are found primarily in habitats with moderately well-drained to excessively drained soils. In Florida, and especially in southern portions of the peninsula, tortoises use areas that are classified as somewhat poorly to poorly-drained. There may be small ’islands’ of better-drained soils scattered in these vast flatwoods and dry prairies, but how tortoises use the poorly-drained areas, particularly during wetter years, is inadequately understood. Tortoises have been observed foraging in margins of wetlands and will use berms to gain higher ground for burrowing. Additional research is needed to refine our understanding of tortoise habitat use and movements in south Florida flatwoods.”

5.4.2.3 Occurrence in the HCP Area

Gopher tortoise GIS occurrence data from FWC are depicted on Figure 5-6. A consultation area has not been defined due to the species’ Federal candidate status. The gopher tortoise is known to occur throughout peninsular Florida (FWC 2006; Krysko et al. 2011), based upon historic and current distribution data.

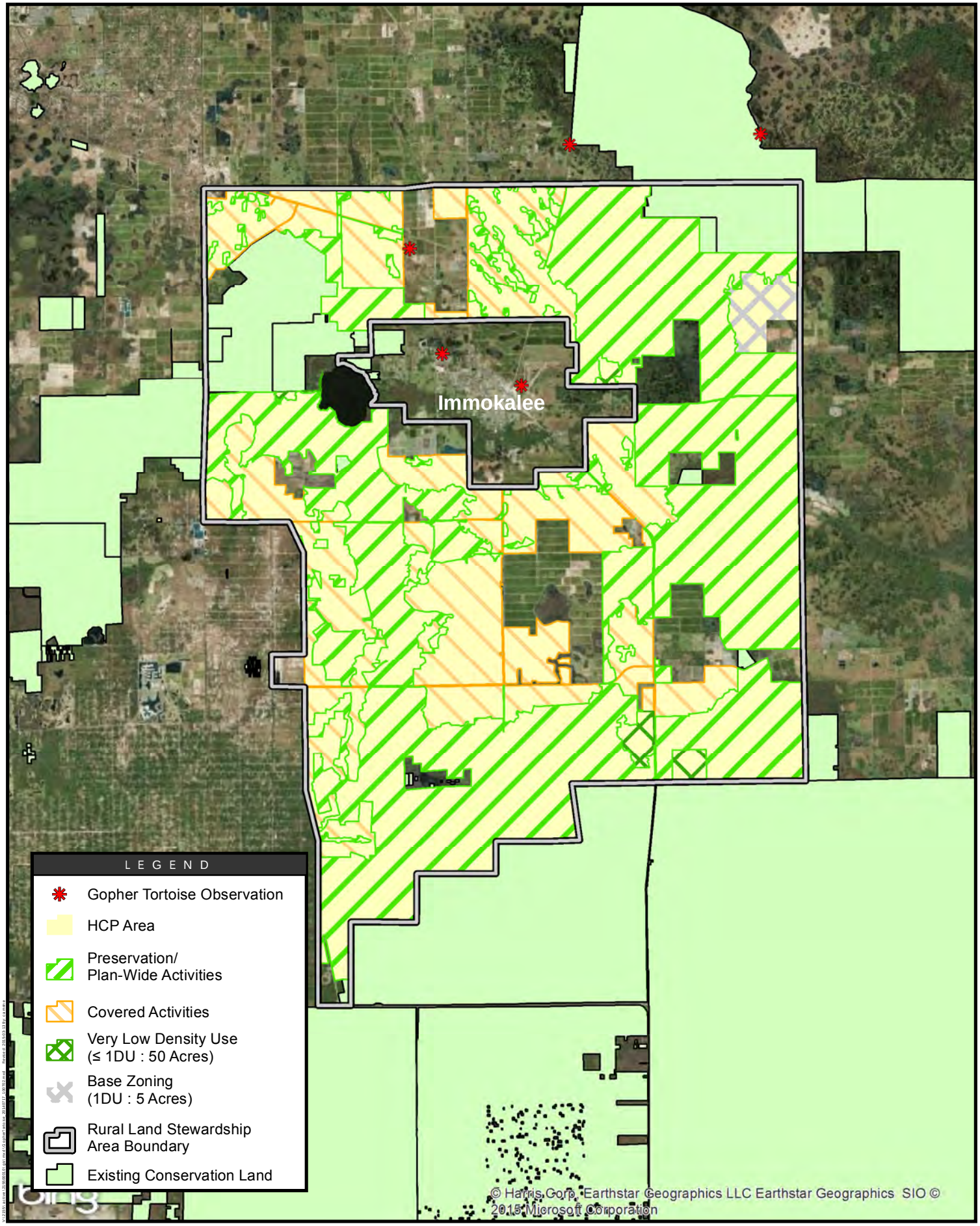


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FIGURE 5-6
Gopher Tortoise Occurrence Data

December 2014

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Published data sources for gopher tortoise occurrence were limited to the *Atlas of Amphibians and Reptiles in Florida* (Krysko et al. 2011), which identified no vouchered records within or adjacent to the HCP Area.

5.5 STATE-LISTED SPECIES

The extensive preservation provided by the Plan provides an outstanding opportunity to conserve habitats on a landscape scale and therefore protect multiple species that may be listed or unlisted.

FWC recently completed a multi-year, science-based program of Biological Status Reviews (BSRs) to determine the appropriate state-level listing status for 60 imperiled species found within the State of Florida. FWC staff ultimately recommended that 40 species be included on the State's Threatened list. Of these 40 species, six species (five birds and one mammal) are known or suspected to occur within the HCP Area. These six species are therefore included as Covered Species under the Plan (see Table 1-3). FWC is currently developing a comprehensive imperiled species management plan for listed species, which will complement and augment Federal MSHCP efforts at the state level.

FWC recently completed final draft Species Action Plans for each state-listed species, which describe the biology, threats, and conservation needs for the individual species. As with the Federal Covered Species, the accounts below were excerpted directly from the FWC Species Action Plans, largely verbatim and with minimal editing. The purpose of these accounts is to provide accurate, unbiased and up-to-date baseline data for each of the state-listed Covered Species, as a basis for the evaluation of potential biological impacts and take (see Chapter 6, *Potential Biological Impacts and Take Assessment*), and for the design and implementation of appropriate conservation actions (See Chapter 7, *Conservation Plan for Other Covered Species*).

5.5.1 Birds

5.5.1.1 Florida Sandhill Crane

The following account is comprised of excerpts from: A Species Action Plan for the Florida Sandhill Crane *Grus canadensis pratensis* (FWC 2013b).

Description and Taxonomy

Sandhill cranes are omnivorous, heavy-bodied gray birds with long necks and legs. They inhabit open grasslands and marshes (Tacha et al. 1992). Their distinctive, rattling calls can be heard from far away. The sexes appear identical except the male is slightly larger. The Florida sandhill crane (*Grus canadensis pratensis*) is non-migratory and one of two subspecies of sandhill crane occurring in Florida. The migratory greater sandhill crane (*G. c. tabida*) winters in Florida, arriving in October and November and leaving for breeding grounds in the northern U.S. and Canada in late February and early March. Although the two sandhill crane subspecies occurring in Florida cannot be distinguished, those observed in the peninsula from April to September can be assumed to be the resident Florida subspecies. The two subspecies are not known to interbreed.

Range and Habitat

Florida sandhill cranes occur from southern Georgia, primarily in the Okefenokee Swamp, to the Everglades (Stys 1997). However, most of the population is in peninsular Florida, from Alachua County in the north to the northern edge of the Everglades in the south.

Sandhill cranes rely on shallow marshes for roosting and nesting and open upland and wetland habitats for foraging (Wood and Nesbitt 2001). Preferred crane habitat occurs where most vegetation is less than 50 cm (20 in) high (Stys 1997). Cranes in North Florida spend 86% of their time in 4 habitat types: pasture, freshwater marsh, pasture– marsh transition, and pasture–forest transition (Nesbitt and Williams 1990). As explained below, sandhill cranes are monogamous and live in pairs. A pair's average home range is about 450 ha (1,100 ac). Home ranges overlap but core nesting areas are defended from other cranes and vary from 120 to 250 ha (300 to 635 ac).

Life History

Florida sandhill cranes are perennially monogamous and long-lived, with a low annual reproductive potential (Wood and Nesbitt 2001). They begin breeding at 3 years of age but are rarely successful until age 5 (Nesbitt 1992). Although Florida sandhill cranes can begin breeding as early as December and extend nesting through August, they nest primarily from February through April. Nests are built of plant stems in shallow marshes. Water depth at nests averages 13 to 33 cm (5 to 13 in). Although each pair's eggs are laid in only one nest, accessory nests or platforms are also built. Nesting success is dependent on relatively predictable water levels and absence of predators. Pairs can re-nest after a nest failure.

A clutch consists of 1 to 3 eggs, but is usually 2 (mean 1.72) (Nesbitt 1988). Both members of the pair share in incubating the eggs and raising the young; the average incubation period is 30 days. Brood size averages 1.32. The downy young are cinnamon brown and achieve flight at 65 to 70 days of age. Young sandhill cranes stay with their parents about 10 months before becoming independent and gaining their featherless red crowns.

Observed dispersal distances for this species average 11.58 km (7.2 mi), with a maximum observed of 48 km (29.8 mi). Females disperse farther (mean = 11.6 km) than males (mean = 3.9 km) from their natal territory (Nesbitt et al. 2002).

Population Status

The Florida sandhill crane population was estimated to be 4,000 to 6,000 individuals in 1992 (Tacha et al. 1992), with about 25% being non-breeding sub-adults. In 2008, their population was estimated using habitat data at just under 4,600 individuals (Nesbitt and Hatchitt 2008).

Threats

The primary threats to Florida sandhill cranes are habitat loss and degradation. These threats result from development and lack of appropriate land management, and are increasingly likely to be exacerbated by climate change, which is expected to affect habitat through altered hydroperiods and

changing fire regimes. Florida sandhill cranes depend on open habitats such as prairies, improved pastures, and freshwater marshes. Much of their habitat is found on privately owned land. Cranes avoid overgrown habitats and dense forest canopies that result from ecological succession unchecked by disturbances, such as fire. Loss of natural fire regimes in both upland and wetland plant communities across the Florida landscape hamper crane success. As habitat conditions degrade, cranes will leave their home range and travel up to 15 km (9.3 mi) to find resources, making them more vulnerable to mortality from predators and collisions with vehicles, utility lines, and fences. Thus, proximity of wetlands for roosting and nesting to upland foraging areas is important.

Dense vegetation contributes to increased crane mortality through predation. As crane habitat has become less abundant, cranes have become more common in overgrown areas where predators like bobcats (*Lynx rufus*) are more successful at killing cranes. Crane predation is also exacerbated by an abundance of native predators, like raccoons, that thrive near humans. Non-native predators such as coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), domestic dogs (*Canis lupus familiaris*), feral hogs, and fire ants (*Solenopsis invicta*) are also a threat.

Due to their reliance on wetlands for roosting and nesting, cranes are particularly vulnerable to factors affecting water levels, including flooding, drought, storms, and ground water withdrawal by humans. Droughts threaten crane nesting success and extended droughts can lead to low annual reproduction. Cranes usually forgo nesting when wetlands are dry. Low water levels leave nests and young vulnerable to predation. Increased duration and intensity of drought due to climate change threaten historic hydrological levels, leading to loss of nesting habitat. Longer dry periods can also cause changes in fire regime that would affect vegetation structure of upland crane habitat. Other human impacts, such as ditching and diverting water to drain wetlands, are far-reaching and detrimental.

Conversely, rapid rises in water levels can also cause crane nests to fail. Wetlands near impermeable surfaces such as roads and parking lots are subject to more rapid flooding. Climate change predictions for Florida also include increased heavy rainfall events, which will likely lead to localized flooding, another source of nest failure. Additionally, the timing of precipitation events may shift, contracting the breeding season and resulting in lower nesting success.

Crane mortality in Florida is often human-related (Folk et al. 2001). Cranes are frequently killed by vehicle collisions, especially with their increasing reliance on road right-of-ways for foraging. Collisions with utility lines and fences also occur. Entanglement in foreign objects such as monofilament line and other plastic debris is another source of mortality. Less visible, and more difficult to assess, is the effect of exposure to pesticides and other toxins in human-altered landscapes.

Occurrence in the HCP Area

No GIS occurrence data within eastern Collier County are publicly available for the Florida sandhill crane. The FWC Species Action Plan (FWC 2013b, Figure 2) identifies extensive areas of potential suitable habitat for Florida sandhill cranes within the HCP Area.

5.5.1.2 Florida Burrowing Owl

The following account is comprised of excerpts from: A Species Action Plan for the Florida Burrowing Owl *Athene cunicularia floridana* (FWC 2013c).

Description and Taxonomy

The Florida burrowing owl (*Athene cunicularia floridana*) is geographically distinct from burrowing owls (*A. c. hypugaea*) occurring in the western United States, and is unique among North American burrowing owls in that it is the only burrowing owl to exist east of the Mississippi River (Haug et al. 1993).

The burrowing owl is a small bird averaging 23 cm (9 in) in height with a mean wingspan of 53 cm (21 in). The burrowing owl spends most of its time on the ground, where its sandy brown plumage provides camouflage from potential predators. The burrowing owl lacks the ear tufts of more familiar woodland owls. Bright yellow eyes accent the face, sometimes with black mottling, and a white chin. Unusually long legs provide additional height for a better view from a typical ground-level perch.

Range and Habitat

The Florida subspecies occurs primarily in peninsular Florida although isolated pairs and small colonies have been found as far west as Eglin Air Force Base on the Florida panhandle and as far south as the Dry Tortugas. Its distribution is localized and patchy, especially in the northern part of its range.

Burrowing owls inhabit open-type habitats that offer short groundcover. Historically, these habitat requirements were met by native dry prairies that covered much of central Florida; however, due to human development in natural areas, there has been a range expansion into North and South Florida. More recently, burrowing owls have turned to pastures, agricultural fields, golf courses, airports, schools, and vacant lots in residential areas as most native open habitats have been converted by humans to these new uses.

Life History

Burrowing owls live as single breeding pairs or in loose colonies consisting of 2 or more families. Unlike most owls, burrowing owls are active during both day and night. During the day, they are usually seen standing erect at the mouth of their burrow or on a nearby post. When disturbed, the owl bobs in agitation and utters a chattering or clucking call. In flight, burrowing owls typically undulate as if they are flying an invisible obstacle course. They also can hover in midair, a technique effective for capturing food.

Burrowing owls mainly eat insects, especially grasshoppers and beetles. They can be of special benefit in urban settings because they also consume roaches and crickets. Small lizards, frogs, snakes, birds, and rodents are also important prey.

Florida burrowing owls typically dig their own burrows but will use gopher tortoise or armadillo burrows and other structures such as manholes, sewer drains, and concrete pipes. Owl family units will often use

a breeding burrow and one or more satellite burrows. Juvenile owls rely on both primary and satellite burrows 30 to 60 days after they are flight capable (Mealy 1997). Burrows are typically 2 to 3 m (6 to 9 ft) in length, up to 1 m (3 ft) deep, and are lined with materials such as grass clippings, feathers, paper, and manure. Use of burrows may vary between owls that reside in urban areas and those that reside in rural environments (e.g., pastures). Burrowing owls in urban areas are known to use burrows year-round, for roosting during the winter and for raising young during the breeding season (Millsap 1996). However, year-round use of burrows by owls in rural environments has not been as well documented. In fact, some research suggests that burrowing owls may have limited use of burrows outside of the breeding season. Mrykalo (2007) reported decreased burrow use in pastures that are frequently flooded during the summer rainy season. Whether or not these owls use alternate burrows during this time is unknown. Burrowing owls may also roost in structures (Zambrano 1998) or trees.

The typical nesting season is from February (courtship begins) to July (brood-rearing), with eggs primarily laid in March, but nesting can also occur from October through May. The female lays 6 to 8 eggs over a 1-week period. She will incubate the eggs for 21 to 28 days. At hatching, white, downy feathers cover the young owls and their eyes are closed. They emerge from the burrow when they are 2 weeks old. At 4 weeks, they are learning to fly but cannot fly well until they are 6 weeks old. They remain with their parents until they are 12 weeks old.

Population Status

The current population status of the Florida burrowing owl is unknown. There are a number of indications of fluctuation and possible decline, including local establishment and subsequent extirpation of small colonies of burrowing owls. Since the 1800s, the number of burrowing owls using native habitats appears to have decreased in response to loss of this habitat (Courser 1979). In contrast, numbers of burrowing owls in South Florida coastal habitats have apparently increased, due mainly to habitat modification during the development of coastal urban centers such as Cape Coral and Marco Island (dredge and fill projects). Other development activities that have attracted burrowing owls to inhabit urban areas include clearing of forests and draining of wetlands. This has facilitated the recruitment of owls from interior portions of Florida's peninsula. These urban birds have adapted to human activity and now occupy these areas, sometimes in high densities. These easily accessible areas have facilitated research efforts resulting in the subsequent development of nest-protection guidelines for urban areas. While this information has been extremely important for owl conservation in urban environments, the long-term viability of these populations is uncertain because of the persistent threats (e.g., automobile collisions) of living in close proximity to people. Conversely, obtaining population information on burrowing owls in rural areas remains a challenge because owl populations are dispersed over vast, undeveloped areas and there is very limited access to private lands.

Threats

The major threats to the Florida burrowing owl are reliance on human-altered habitats and loss of native habitat (Owre 1978b, Millsap 1996). Habitat is created by clearing of vegetation and draining of wetlands in preparation for development, but this habitat is temporary as it is lost when construction

begins. In urban and suburban areas, preferred nesting habitat and burrows are destroyed by construction activities, domestic animals (e.g., dogs), and humans. Collisions with automobiles also are a frequent cause of owl mortality in these areas (Millsap and Bear 2000), while burrow abandonment can be caused by harassment by people. It also is likely that domestic (e.g. cats, dogs) and exotic wildlife (tegus [*Tupinambis merianae*]), monitor lizards [*Varanus niloticus*], etc.) contribute to owl mortality but the full impact on owl populations needs further investigation. No known data exist on the effects of contaminants (e.g., pesticides and herbicides) on survival and reproduction of owls using urban or rural habitats, but given the propensity for the use of such chemicals in both the urban and rural landscape, research assessing this potential threat is warranted.

For burrowing owls in rural areas, lack of protected habitat is a concern. Most human-altered habitats, including those in rural areas (e.g., improved pasture), have not previously been made a priority for conservation (Mueller et al. 2007), but often are preferred by burrowing owls. Mrykalo et al. (2007) noted the lack of management strategies for burrowing owls in rural areas. Additional monitoring of burrowing owls in rural settings is necessary to determine how important these areas are to the conservation of the species. Also, it is unknown how many burrowing owls are being impacted by land-use changes in rural areas. Management strategies are needed to address conservation needs of both urban and rural burrowing owls.

Occurrence in the HCP Area

The FWC Species Action Plan (FWC 2013c, Figure 1) identified two burrowing owl locations within the HCP Area. Three other burrowing owl locations were identified within five miles outside of the boundary of the HCP Area. Eleven burrowing owls were also identified within the Town of Ave Maria during State and Federal permitting in 2004-2005.

5.5.1.3 Southeastern American Kestrel

The following account is comprised of excerpts from: A Species Action Plan for the Southeastern American Kestrel *Falco sparverius paulus* (FWC 2013d).

Description and Taxonomy

The smallest falcon in North America, American kestrels are distinguished in flight by long, pointed wings and deep, sometimes fluttering, wing-beats. Adult kestrels are sexually dimorphic; males have buffy underparts with variable spotting, blue-gray wings, a streaked rufous back, and a mostly solid rufous tail, whereas females have buffy underparts with heavy streaking and barred rufous wings, back, and tail. Both sexes have two vertical black stripes on each side of their head, one across the base of the beak (malar region), and one across the back of the head (auricular region). Female American kestrels are larger than male kestrels. Body mass in Florida, in summer, averages 100 g (3.5 oz) for males and 120 g (4.2 oz) for females.

The southeastern American kestrel is 1 of 17 described subspecies of American kestrel in the western hemisphere (Smallwood and Bird 2002). The southeastern American kestrel is the only subspecies that is

a non-migratory, permanent resident in Florida; however, the northern subspecies of American kestrel (*F. s. sparverius*) occurs in Florida as a migrant and winter visitor. Male southeastern American kestrels tend to have paler under parts with fewer markings than the *F. s. sparverius* subspecies (Collopy 1996, Smallwood and Bird 2002), but considerable plumage variation exists. Therefore, confident identification of southeastern American kestrels can only be made during the portion of the breeding season when migrants are not present (May through June).

Range and Habitat

The southeastern American kestrel was once widely distributed throughout seven southeastern states (Arkansas, Louisiana, Mississippi, Alabama, Georgia, South Carolina, and Florida). Today, the subspecies occurs primarily in Florida and is patchily distributed elsewhere in the coastal plain of South Carolina and Georgia. Within Florida, the southeastern American kestrel was once distributed as far south as the rockland pine forests of Dade County (Holt and Sutton 1926), but now breeds no farther south than Highlands and Lee counties (Robertson and Woolfenden 1992; FWC 2003). The FWC's BSR of the southeastern American kestrel identified four large clusters of kestrel occurrence or "subpopulations" based on recent distribution data (FWC 2003). These regional subpopulations of southeastern American kestrels include: (i) Western Panhandle, (ii) Brooksville Ridge and vicinity, (iii) Trail Ridge and vicinity, and (iv) Lake Wales Ridge and vicinity. The degree of isolation among these subpopulations is unknown, but given the subspecies' non-migratory status and its relatively short dispersal distances (Miller and Smallwood 1997), connectivity may be limited. Kestrels nest elsewhere in Florida, but their status and extent are poorly known.

The southeastern American kestrel is closely associated with the southeastern sandhill ecosystem. The typical sandhill landscape consists of a widely spaced canopy of longleaf pine (*Pinus palustris*) or slash pine (*P. elliottii* var *densa*) with wiregrass (*Aristida stricta*) and forb dominated groundcover. This ecosystem provides both prey (e.g., insects) and nesting sites (e.g., tree cavities) for kestrels (Bohall-Wood and Collopy 1986; Hoffman and Collopy 1987; Collopy 1996). Southeastern American kestrels also use a variety of other natural communities in Florida including scrub, scrubby flatwoods, and dry prairie. Pastures, parks, golf courses, and orange groves are also used (Stys 1993), but no information is available about kestrel survivorship and reproductive success in these human-modified habitats.

Life History

Southeastern American kestrels are secondary cavity nesters, meaning they depend on tree cavities excavated by woodpeckers or other natural tree cavities for nesting sites. Most natural nest cavities are in dead longleaf pine, sand pine (*P. clausa*), or various oak (*Quercus* spp.) trees. Nesting also can occur in live pines in cavities originally excavated by red-cockaded woodpeckers (*Picoides borealis*) and subsequently enlarged by other woodpeckers (Gault et al. 2004). Kestrels have been recorded nesting in abandoned or occupied buildings, in manmade nest boxes (e.g., Smallwood and Collopy 2009), and in utility transmission towers (Beasley and Parrish 2009). Southeastern American kestrels have high territory fidelity (Bohall-Wood and Collopy 1986) and presumably maintain their territories throughout most of the year. Southeastern American kestrel territory size has not been measured, but it likely varies

based on habitat quality, prey availability, and the presence of nesting cavities and perches. Studies of kestrels in suitable habitat elsewhere in North America suggest that kestrel densities can range from about 0.4 to 1.8 pairs per km^2 (Smallwood and Bird 2002), which is equivalent to territory sizes as large as 2.5 km^2 (0.9 mi^2) or as small as 0.6 km^2 (0.2 mi^2). Stys (1993) suggested 0.5 km^2 (0.19 mi^2) as an approximation for territory size for mitigation and conservation planning purposes. Territories that include areas of unsuitable plant communities (e.g., dense pinelands or other closed canopy forest) are probably much larger.

American kestrels hunt for food by searching the ground from elevated perches and hovering or soaring over open areas. Major prey items of the southeastern American kestrel are insects, lizards, and less frequently small rodents or birds (Bohall-Wood and Collopy 1986).

Courtship and pair bonding begins in early January (Bohall-Wood and Collopy 1986). From mid-March through May, 3 to 5 eggs per clutch are laid. Egg color varies from white to a yellowish or light reddish-brown, and is typically blotched or mottled with gray or brown (Smallwood and Bird 2002). Incubation lasts 29 to 31 days and young fledge in 28 to 30 days. Sexual maturity is reached when kestrels are 1 year old and life expectancy is estimated at 2 years and 9 months for kestrels that survive their first winter (Smallwood and Bird 2002).

Population Status

Southeastern American kestrels in Florida appear to exist in four to eight regional subpopulations. There is a small population size of 2,700 to 3,000 mature individuals statewide with no subpopulation having greater than 1,000 mature individuals. Additionally, continuing declines in area of occupancy, habitat, and population size have been observed. Most habitat patches are likely too small to support viable populations and are isolated from other habitat patches. The subspecies is non-migratory and demonstrates limited dispersal ability (Miller and Smallwood 1997).

Threats

Population declines of southeastern American kestrels in Florida have been largely attributed to clearing of older pine forests, conversion of sandhill and other upland habitats for agriculture and urban development and the habitat changes that occur with fire suppression. These habitat changes lead to a lack of suitable nest sites (i.e., tree cavities) and a loss of suitable foraging habitat (i.e., open ground cover) for kestrels (Hoffman and Collopy 1988; Smallwood and Collopy 2009). In addition, habitat fragmentation may potentially have a negative effect on kestrels given that juvenile southeastern American kestrels have a median dispersal distance less than 5 km (3 mi) (Miller and Smallwood 1997). However, southeastern American kestrel habitat relationships are poorly understood at both the plant community level and the landscape level; therefore, reasons for kestrel population decline are still unclear. It is likely that the effects of habitat loss, habitat fragmentation, and habitat degradation magnify each other.

Occurrence in the HCP Area

The Florida Natural Areas Inventory (FNAI) depicts Lee and Hendry Counties as part of southeastern American kestrel's range in Florida, but not Collier County (FNAI 2014b). No occurrence data were available for this species. The FWC Species Action Plan (FWC 2013d, Figure 3) identified no southeastern American kestrel breeding records within the HCP Area. A confirmed breeding site was recorded in the Lehigh Acres area, and an unconfirmed breeding site was depicted within BCNP.

5.5.1.4 Little Blue Heron and Tricolored Heron

The following account is comprised of excerpts from: A Species Action Plan for Six Imperiled Wading Birds: Little Blue Heron (*Egretta caerulea*); Reddish Egret (*Egretta rufescens*); Roseate Spoonbill (*Platalea ajaja)*; Snowy Egret (*Egretta thula)*; Tricolored Heron (*Egretta tricolor*); White Ibis (*Eudocimus albus*) (FWC 2013e). Of these six species, only two species, the little blue heron and tricolored heron, are Covered Species under the Plan because they are listed as Threatened by the State of Florida and have been documented to occur within the HCP Area. In light of the significant overlap in habitat, distribution and geographic range, as well as shared threats faced by these two species, the combined management needs for both species are addressed in this section.

Description and Taxonomy

The little blue heron is a small wading bird species that can reach a length of up to 29 inches (74 centimeters), with a wingspan of 41 inches (104 centimeters) and a weight of 14 ounces (397 grams). Little blue herons have a grayish-blue body and a dark red head during breeding, and a purplish head and neck during non-breeding periods. Little blue herons are members of the Family Ardeidae, along with egrets, bitterns and other herons (Frederick 1997). Despite the species' large range, no subspecies are formally recognized. Previously the species was placed in the monotypic genus *Florida*.

Previously referred to as the Louisiana heron, tricolored herons are also members of the Family Ardeidae. Three subspecies are generally recognized: *E. t. tricolor* (South America, Trinidad and Tobago), *E. t. occidentalis* (southwest USA and northwest Mexico), and *E. t. ruficollis* (eastern USA, Mexico, Central America). Previously, the species was placed in the monotypic genus *Hydranassa*.

Range and Habitat

Little blue herons breed from Maine and California south to northern South America. The species is widely distributed throughout Florida.

The breeding range for the tricolored heron in the U.S. extends along the Atlantic and Gulf of Mexico coasts, into the southeastern coastal plain and throughout the Caribbean (Frederick 1997). Breeding also occurs along both coasts of Mexico and the coastal areas of South America. The species occurs throughout most of Florida in both freshwater and estuarine habitats (Runde et al. 1991; Kale et al. 1992; Rodgers 1996; Mikuska et al. 1998; Rodgers et al. 1999; FWC 2003).

Wading birds, including the little blue heron and the tricolored heron, depend on healthy wetlands, mangrove and other islands, and vegetated areas suitable for resting and breeding that are near foraging habitat. The little blue heron and tricolored heron forage in shallow marine, brackish, or freshwater sites, including tidal ponds and sloughs, mudflats, mangrove-dominated pools, freshwater sloughs and marshes, and human-created impoundments. The little blue heron relies on freshwater forage sites to raise young until they become more salt tolerant (Frederick 1996; Rodgers 1996).

Tricolored herons are active foragers, stalking wetland fish and vertebrate and invertebrate prey. Little blue herons are more stealthy hunters and feed on a variety of fish, aquatic crustaceans, insects, small amphibians, worms, and snakes (Ogden 1996; Rodgers 1996).

Life History

The little blue heron and tricolored heron typically nest in multi-species colonies of various sizes. They nest in a variety of woody vegetation including cypress (*Taxodium distichum*), willow (*Salix* spp.), red maple (*Acer rubrum*), buttonwood (*Conocarpus erectus*), mangroves (most commonly *Rhizophora mangle*), and Brazilian pepper (*Schinus terebinthifolius*) (Ogden 1996; Rodgers 1996). Tricolored herons nest in similar conditions, though they are primarily found nesting in coastal habitat (Ogden 1996).

Population Status

Runde et al. (1991) documented a possible decline in the Florida population from greater than 20,000 individuals in the late 1970s to less than 17,000 birds in the late 1980s, while Rodgers et al. (1999) found a decrease in number of breeding colonies and smaller colonies in 1999. Although there has not been a statewide survey for this species since 1999, wading birds are monitored and surveyed regularly through aerial surveys in South Florida and the Everglades region by the South Florida Water Management District (Cook and Kobza 2009; Lantz et al. 2010), subject to the limitations of aerial surveys (see below). There are indications that the species has exhibited a slow but steady decline since the latter 1990s, especially in South Florida (FWC 2003).

Once considered one of the most common herons in the state, Runde et al. (1991) determined that the tricolored heron population experienced a decrease from 35,000 individuals in the late 1970s to 16,000 birds in the late 1980s. However, aerial surveys of wading bird populations have been shown to include error rates that raise questions about their validity and usefulness in determining trends, particularly for small, dark-plumaged species that nest beneath the nesting canopy as do little blue herons and tricolored herons (Rodgers et al. 2005; Frederick et al. 2006; Conroy et al. 2008; Green et al. 2008).

Annual surveys of colonial waterbirds in the Everglades region and elsewhere in Florida, and the range of the species, indicate that nesting numbers for wading birds can be highly variable from season to season (Ogden 1994; Gawlik 1999; Frederick and Ogden 2001; Cook and Kobza 2009). About 1,144 pairs of tricolored herons nested in the three Water Conservation Areas and mainland Everglades National Park in 2009 (Cook and Kobza 2009). This compares to 1,723 nesting pairs in the area during the 1999 nesting season and an estimated 10,000-15,000 pairs in the 1930s (Ogden 1994; Gawlik 1999).

Threats

Although significant historic threats such as plume hunting and loss of eggs and young to the effects of DDT have been minimized, wading birds are still vulnerable. Key threats to Florida's imperiled wading birds are: (i) loss of suitable foraging and breeding areas due to human disturbance of nesting colonies; (ii) elevated populations of native and exotic predators that cause nest failure; and (iii) habitat degradation, including altered hydrological regimes, lower water tables, and nutrient enrichment of waters.

Wading birds generally require a variety of wetland sites to accommodate the annual variation in rainfall, and flexibility to such conditions has been documented by use of alternative nesting and foraging sites during particularly wet or dry years (Ogden 1996). However, dredge and fill activities have largely eliminated this natural variability in wetlands.

Nesting sites for wading birds must have suitable foraging habitat nearby. Foraging habitat is largely affected by water quality, as pollutants and turbidity may reduce the composition or quality of prey and altered drainage may also impact prey availability (Ogden 1996). Reproductive success is strongly linked to foraging success (Frederick and Spalding 1994; Frederick 2002), which is tied to water depth, prey density (Gawlik 2002), and vegetation type and density (Lantz et al. 2010). Effects of food supply and food availability are so strong that they can be seen as the most important natural limitations to reproduction and perhaps life history in these birds.

Wading birds are also vulnerable to pesticides, heavy metals, and other environmental contaminants. As top predators in an aquatic food web, these species have high exposure to biomagnified chemicals. The effects of most substances at low, chronic levels or as cocktails of multiple chemicals are largely unknown but may be significant.

In addition to limited availability of suitable habitat, wading bird populations are threatened by disturbance during key stages in their life cycle. In response to disturbance, nesting birds may leave eggs and young unattended, thereby increasing the risk of loss to waiting predators (Rodgers 1996) and exposing eggs or young to the sun or cold.

Occurrence in the HCP Area

The FWC Species Action Plan (FWC 2013e, Figure 1) identified extensive areas of potential suitable habitat for imperiled wading birds within the HCP Area, but did not depict any occurrence data. The areas of potential suitable habitat included the major regional flowway systems (Corkscrew Marsh, Camp Keais Strand, and Okaloacoochee Slough) and major wetland areas bordering the FPNWR.

5.5.2 Mammals

5.5.2.1 Big Cypress Fox Squirrel

The following account is comprised of excerpts from: A Species Action Plan for the Big Cypress fox squirrel *Sciurus niger avicennia* (FWC 2013g).

Description and Taxonomy

The Big Cypress fox squirrel (*Sciurus niger avicennia*) (BCFS) is a subspecies of the eastern fox squirrel (*Sciurus niger*). The BCFS was originally described by Howell (1919) on the basis of its coloration and small size. Moore (1956) confirmed the subspecies status of BCFS and expanded its range (extent of occurrence [EOO]) in Southwest Florida approximately to the limits that are generally accepted today, including the standard northern limit at the Caloosahatchee River. The BCFS is one of four eastern fox squirrel subspecies that occur in Florida, but it is generally recognized as being smaller in size than Sherman's fox squirrel (*S. n. shermani*), whose range is close, if not adjacent, to that of BCFS in Florida (Howell 1919; Moore 1956; Humphrey and Jodice 1992; Turner and Laerm 1993).

The BCFS is a large tree squirrel, highly variable in color and patterning. The most common pattern includes a black head and dorsal fur, buff sides and belly, buff and black tail, and white nose and ears (Moore 1956, Florida Natural Areas Inventory [FNAI] 2001).

In a study conducted on the BCNP, Kellam et al (2013) identified three study-specific color phases in captured BCFS. They described the squirrels as being: (i) buff (*n* = 16), where buff with black agouti was the dominant dorsal fur color and the head was black with white fur on the nose, lips, and ear tips; the belly was usually either white or buff colored; tail fur was typically buff and black agouti; (ii) black (*n* = 6), where black was the dominant dorsal fur color and the head was black with white fur on the nose, lips, and ear tips; the belly varied, being either black, white, or buff colored; tail fur was typically black, but often with white or buff and agouti fur present; or (iii) tan (*n* = 2), where the dorsal fur was typically tan and black agouti, and the head was black with white fur on the nose, lips, and ear tips; the belly was typically white or tan; tail fur was usually tan and black agouti.

Range and Habitat

The BCFS is the only subspecies of fox squirrel endemic to Florida (Turner and Laerm 1993 as cited in Wooding 1997, Hafner et al. 1998, FNAI 2001). The extent of occurrence is recognized as being limited to southwestern peninsular Florida, south of the Caloosahatchee River, in Hendry, Lee, and Collier Counties, the northern part of mainland Monroe County, and extreme western Miami-Dade County (a strip of land that occurs largely within BCNP) (Moore 1956; Williams and Humphrey 1979; USFWS 2002b). Moore (1956) described the range of *Sciurus n. avicennia* as occupying "the mangrove, the pinelands, and the Big Cypress west of the Everglades and south of the Caloosahatchee River."

Natural habitats for BCFS include south Florida slash pine (*Pinus elliottii* var. *densa*) forests, cypress swamp forests, live oak (*Quercus virginiana*) hammocks, tropical hardwood forests, coastal broadleaf evergreen hammocks, and mangrove swamps (FWC 2013g). Optimal habitat conditions for BCFS are dependent upon the availability of appropriate trees for nest sites, abundant year-round food resources, and an open understory with little or no bushes or shrub layer present (Jodice and Humphrey 1992; Eisenberg et al. 2011).

The diet of BCFS includes items found in both natural and developed habitats: java plums (*Syzygium cumini*), figs (*Ficus* spp.), bischofia (*Bischofia javanica*) berries, acorns (*Quercus* spp.), red maple (*Acer*

rubrum) seeds, bottlebrush (*Callistemon citrinus*) and silk oak (*Grevillea robusta*) flowers, insects, fungi, bromeliad (Bromeliaceae) buds, thistle (*Cirsium spp.*) seeds, pond apple (*Annona glabra*) fruit, cabbage palm (*Sabal palmetto*) fruit, holly (*Ilex spp.*) fruit, queen palm (*Syagrus romanzoffiana*) fruit, saw palmetto (*Serenoa repens*) fruit, hog plum (*Ximenia americana*) fruit, wax myrtle (*Morella cerifera*) berries, cocoplum (*Chrysobalanus icaco*) berries, pine (*Pinus* spp.) seeds, and cypress (*Taxodium* spp.) seeds (Jodice and Humphrey 1992; Ditgen et al. 2007; Jansen 2008; Kellam et al. 2013). Scatter hoarding of some foods such as pine cones, cypress cones, and queen palm fruits has been reported (Jodice and Humphrey 1992; Ditgen et al. 2007).

The USFWS reviewed the status of the BCFS and concluded that this subspecies did not qualify for Federal listing as Endangered or Threatened, in large part due to a lack of data on BCFS ecology and the large number of acres of potential BCFS habitat found on State and Federal conservation lands (USFWS 2002b). S*ciurus niger avicennia* is currently listed as being at lower risk, but conservation-dependent, by the International Union for Conservation of Nature (IUCN) Rodent Specialist Group, "based on the historical loss of habitat and restricted number and distribution of populations of *S. n. avicennia*, probably including [BCNP]" (Hafner et al. 1998).

Life History

Reproductive behavior is summarized as follows, based in part on information for *Sciurus niger* overall (see Koprowski 1994 for additional references). Fox squirrels can mate at any time of the year, but most breeding occurs between November and February, with a peak in December, and between April and July, with a peak in June. On a golf course in western Collier County, observed productivity was higher in summer than in winter. This was attributed to the availability of foods from non-native plants in summer, which supplemented a limited diet of native plants (Ditgen et al. 2007). *Sciurus niger* females go into estrus for only one day during a breeding season, and it is typical for several males to aggregate on a female's home range during that time. Females generally mate with more than one male. Average litter size is typically two or three offspring. Females can become sexually mature at 8 months of age, but more commonly delay reproduction until they are over a year old. Females are able to breed for more than 12 years.

Territoriality has not been observed in *Sciurus niger* (see Koprowski 1994 and additional references cited there). While adults, especially females, often defend exclusive core areas, home ranges of individuals typically overlap. All juveniles eventually disperse from their mother's home range, but some may remain with their mother during their first winter. BCFSs translocated from Naples, Florida to BCNP exhibited inconsistent site fidelity and movements of up to 32 km (20 mi), which could be attributed to homing, post-release investigative behavior, or long-distance foraging (Jodice 1993).

Kellam et al (2013) reported mean home range sizes of 75.6 ha (187 ac) for male and 10.4 ha (26 ac) for female BCFS in natural habitats in BCNP. Thus, the male home range size is more than seven times greater than the female home range size and more than 70% greater than that of male Sherman's fox squirrel (SFS) (42.8 ha [106 ac]) (Kantola and Humphrey 1990). The male-to-female ratio of home range size reported by Kellam et al. (2013) is much greater than the ratio reported for SFS by Kantola and

Humphrey (1990), in which the male's home range was only 2 to 3 times larger than the female's home range. Although the reported female BCFS home range size is smaller than the mean reported for female SFS (16.7 ha [41.2 ac]) (Kantola and Humphrey 1990), it is within the span of reported female fox squirrel home ranges (0.85 to 17.2 ha [2.1 to 42.5 ac]) (Geeslin 1970; Adams 1976; Hilliard 1979; Benson 1980; Weigl et al. 1989; Koprowski 1994).

Crude estimates of BCFS local population densities have been calculated at 0.0009 squirrels/ha (0.00036 squirrels/ac) in typical cypress swamp habitat in Corkscrew Swamp Sanctuary and 0.0192 squirrels/ha (0.0078 squirrels/ac) in ranchland woodlots (Jodice and Humphrey 1993). However, Humphrey and Jodice (1992) stated that these estimates are probably much too low, because they included some unoccupied habitat. Density estimates for other fox squirrels in the southeastern United States average 0.05 squirrels/ha (0.02 squirrels/ac) for *S. n. niger* (as summarized in Koprowski 1994) and from 0.04 to 0.38 squirrels/ha (0.016 to 0.153 squirrels/ac) for SFS (Moore 1957; Humphrey et al. 1985; Kantola 1986; Kantola and Humphrey 1990; Wooding 1997).

Kellam et al. (2013) reported that 98% of 403 observed BCFS nests in BCNP were built in bald cypress (*Taxodium distichum*) trees. Cabbage palm and slash pine (*Pinus elliottii*) trees were only occasionally used (1% and 0.2%, respectively) as nest sites. Kellam et al. (2013) identified 6 types of nest that are built by BCFS: (i) stick platform with stripped cypress bark, (ii) bromeliad (*Tillandsia fasciculata*) with stripped cypress bark, (iii) cabbage palm with stripped cypress bark and palm frond fibers, (iv) cypress tree defect (splintered trunk) with stripped cypress bark, (v) bromeliad with Spanish moss (*Tillandsia usneoides*), and (vi) stick platform with Spanish moss. The two most common nest types were stick nests with stripped cypress bark and bromeliad nests with stripped cypress bark (Kellam et al. 2013). Jodice (1993) reported that nests made by BCFS translocated into BCNP were either stick structures or were nestled among the leaves of bromeliads in cypress trees, which is consistent with nest structures observed by Kellam et al. (2013).

Population Status

This section on population status was excerpted from the Biological Status Review for the Big Cypress fox squirrel (FWC 2011d).

The status of Big Cypress fox squirrels in the core of their range in BCNP and the Everglades is largely unknown because of the difficulty of studying and observing squirrels in such habitat (Jansen 2008; Jodice and Humphrey 1992; Jodice and Humphrey 1993; Maehr 1993). According to Humphrey and Jodice (1992), "since the Big Cypress National Preserve was established in 1974, preserve staff have recorded progressively fewer fox squirrels, concluding that the population is not prospering there." Furthermore, according to the IUCN Rodent Specialist Group, *S. n. avicennia* has not been seen recently in the Everglades and is currently restricted in distribution to Big Cypress Swamp and its adjacent pinelands (Brown 1978). In particular, the Big Cypress fox squirrel is no longer present at the Cape Sable coast of Everglades National Park in the vicinity of Flamingo, Monroe County (USFWS 2002b). Big Cypress fox squirrels have also been completely extirpated from Corkscrew Swamp Sanctuary and Everglades City (Jodice and Humphrey 1992). Isolation of Big Cypress fox squirrel populations has

occurred in western Lee and Collier counties due to rapid urbanization (Ditgen et al. 2007; Endries et al. 2009; Kellam and Jansen 2010).

In the future, the Big Cypress fox squirrel is likely to lose some habitat to urbanization, agriculture, and mining. Although at least fifty-five percent of potential Big Cypress fox squirrel habitat exists in conservation lands and is therefore protected from development (USFWS 2002b; Endries *et al*. 2009), analyses by Florida's Wildlife Legacy Initiative indicate that the majority of *S. n. avicennia*'s habitat (natural pineland and pine rockland) is both poor in quality and declining (FWC 2005). Big Cypress fox squirrels are, however, fairly adaptable; they can be found in disturbed/transitional habitat such as on private ranches and in urban areas like golf courses (Ditgen and Shepherd 2007; FWC 2005; USFWS 2002b; Jodice and Humphrey 1992), although status on private ranches is difficult to verify (Munim et al. 2007).

Threats

The main threats to the BCFS are the loss, degradation, and fragmentation of suitable habitat that have resulted mostly from development and conversion to other uses, especially on the western periphery of the species' range (Jodice and Humphrey 1992; Koprowski 1994; FWC 2005; Zwick and Carr 2006; FWC 2008; Jansen 2008; Munim 2008). Rapid urbanization has isolated BCFS local populations within fragmented habitat patches in western Lee and Collier counties (Ditgen et al. 2007). Similarly, grazed slash pine rangeland that has been converted to citrus groves has caused habitat loss in Hendry County (Ditgen et al. 2007).

Problems resulting from loss of habitat are exacerbated by degradation of conservation lands. Insufficient management may be causing declines in habitat quality for BCFS across large segments of the remaining natural pineland or slash pine forest communities within its range or extent of occurrence (FWC 2005). Fire exclusion or insufficient prescribed fire (in which fire return intervals are longer than appropriate to optimize habitat quality) is believed to have caused declines in BCFS numbers in some habitats (Ditgen et al. 2007). However, most available information on the relationship between fire frequency and habitat quality comes from studies of the BCFS local population at a single site in the BCNP (Jansen 2008; Kellam and Jansen 2010; Kellam et al. 2013). Thus, the threat of insufficient fire to the viability of BCFS local populations across habitats is not fully understood. Kellam et al. (2013) have shown clearly that fire can be important for maintaining or increasing the quality of natural habitats for BCFS, but their analyses have not been replicated at multiple sites and they only studied one habitat type. These constraints make it difficult to draw broad conclusions regarding fire and habitat use by BCFS.

The loss of large trees for nest sites and cover in urban and rural developed lands could be a significant threat to maintaining the quality of those areas for BCFS (Eisenberg et al. 2011). Developed lands typically have a reduced understory and may provide suitable habitat for BCFS so long as large trees remain available in those areas to provide food and nest sites. However, it appears that large trees that could otherwise provide suitable habitat in many urbanized and agricultural areas are often not replaced when they die.

Another threat to habitat quality for BCFS is potentially large reductions of native bromeliads (e.g., *Tillandsia fasciculata*). The Mexican bromeliad weevil (*Metamasius callizona*) (MBW), an invasive non-native species, was first reported in Florida in 1989 (O'Brien et al. 1990), and has spread to the urban and natural areas of Collier, Lee, and Hendry Counties (Frank 1999). MBW larvae eat into bromeliads, killing them. Where it occurs in Florida, the MBW has had a devastating effect on Florida's native bromeliad populations (Frank and Thomas 1994). BCFS utilize *T. fasciculata* for nest substrate, a non-nesting refuge, and as an important seasonal food item in urban green spaces (Ditgen et al. 2007) and natural habitats (Kellam et al. 2013). The recent study of BCFS at BCNP (Kellam et al. 2013) revealed that *T. fasciculata* was the primary substrate component in 44.9% of all observed BCFS nests (*n* = 403) and the principal documented food item from March to May.

Diseases may also pose significant threats to the stability and viability of BCFS local populations. A skin fungus is known to cause mortality of BCFS in urban areas, although researchers have not indicated the fungus is a major threat to the viability of local populations (USFWS 2002b). Mange also is known to cause mortality in BCFS, but rates of mortality and potential impacts on local populations are not well understood. Squirrel poxvirus is an infectious disease (Robinson and Kerr 2001) that can cause high rates of mortality in infected squirrels (Terrell et al. 2002). In 2010, squirrel poxvirus was reported at BCNP in a single BCFS (Kellam 2010).

Historically, the BCFS was a game species (Williams and Humphrey 1979). As a result of the general decline in the BCFS population, legal hunting ended in 1972 (Duever et al. 1986; Wooding 1997). However, many authors believed that illegal killing (poaching) of BCFS continued after the closure and that the rate of mortality due to poaching was significant (Williams and Humphrey 1979; Duever et al. 1986; Humphrey and Jodice 1992). However, USFWS stated that it did not have evidence to support the claim of significant illegal hunting mortality (USFWS 2002b). The current rates of mortality to BCFS from poaching are unknown.

While BCFS local populations do occur in urbanized habitats on sites such as golf courses (Jodice and Humphrey 1992; USFWS 2002b; FWC 2005; Ditgen et al. 2007), these sites are able to support fox squirrels only when the habitat provides sufficient food, other needed resources (e.g., nest sites) are available, and predation or other causes of mortality are sufficiently low. However, Meehan and Jodice (2010) found that the ability of individual fox squirrels to move among patches of suitable habitat in urbanized areas may have been important in determining whether local populations remained present on selected sites. Vehicle-caused mortality can be especially high in urbanized areas. Where mortality rates are unsustainably high, urbanized habitats can be population sinks for BCFS (Ditgen et al. 2007; Munim 2008; Eisenberg et al. 2011).

Impacts from climate change may produce further challenges for conservation of the BCFS. Adaptation of conservation efforts to those changes will require an understanding of projected impacts to the habitats and ecological systems on which the BCFS is dependent. However, potential impacts from climate change are not well understood; therefore, identification of appropriate management strategies is not possible (Dubois et al. 2011). The vulnerability of BCFS local populations to climate change will depend on many factors, including the degree to which the BCFS is likely to experience harm from

stressors produced by changes in large-scale climatic drivers (IPCC 2007; Dubois et al. 2011). BCFS vulnerability may be a result of multiple variables, including the intensity and duration of climate changes, innate sensitivities of the BCFS to those changes, and, ultimately, the capacity of the BCFS to adapt to changes that occur (IPCC 2007; Dubois et al. 2011).

Occurrence in the HCP Area

No GIS occurrence data within eastern Collier County are publicly available for the BCFS. The FWC Species Action Plan (FWC 2013g, Appendix 3, Figure A) depicted three BCFS occurrence records within the HCP Area, which were obtained from a University of Florida-FWC survey of fox squirrel sightings that ran from August 2011 to April 2012.

6. POTENTIAL BIOLOGICAL IMPACTS/TAKE ASSESSMENT FOR OTHER COVERED SPECIES

6.1 EFFECTS OF COVERED ACTIVITIES ANALYSIS: METHODS AND ASSUMPTIONS

Chapter 4 (Florida Panther) described the natural history and current status of the panther, the potential impacts to the panther associated with the Covered Activities, and the actions to be implemented for panther conservation. Chapter 5 (Other Covered Species) described the natural history and current status of seven other federally-listed species, one candidate species for federal listing (gopher tortoise), one species under review for federal listing (eastern diamondback rattlesnake), and six species listed as Threatened by the State of Florida. This chapter assesses the potential biological impacts and take assessment for each of these other Covered Species within the HCP Area (see Tables 1-1, 1-2, and 1-3; Figure 2-1). Conservation measures for each of the other Covered Species are described in Chapter 7 (Conservation Plan for Other Covered Species).

The Florida panther (Chapter 4) has been studied extensively for several decades, and its occurrence within the HCP Area has been documented with a large dataset of VHF and GPS telemetry data. These studies and datasets provide a solid foundation for assessing panther habitat utilization, potential impacts, and conservation actions. However, occurrence data for the other Covered Species are generally sparse to absent within the HCP Area (see Chapter 5). This lack of occurrence data is not specific to the HCP Area; a similar lack of occurrence data for several of these other Covered Species exists across large portions of their ranges.

The HCP Handbook (USFWS and NMFS 1996, 3-14) states that the determination of potential impacts and take assessments for Covered Species can be expressed in one of two ways: (i) the number of animals subject to incidental take, “if those numbers are known or can be determined”; or (ii) “in terms of habitat acres or other appropriate habitat units.” Based on the lack of occurrence data for the other Covered Species in the HCP Area, this chapter assesses impacts using the latter method.

The Plan area comprises a landscape-scale mosaic of agricultural areas and native habitats totaling approximately 152,124 acres. The approximately 107,000 acres of lands that will ultimately be included in areas designated for Preservation/Plan-Wide Activities and Very Low Density Use[8] were delineated for

[8] As explained in Chapter 2, the Plan initially designates 97,885 acres “Preservation/Plan-Wide Activities.” Activities that may occur in this area will be restricted to the same agricultural, ranching, and other rural activities that have historically occurred throughout the HCP Area. These predominantly agricultural activities are compatible with use of the same lands by the Covered Species, and will maintain the existence of open corridors that will allow the Covered Species to move through these lands. The Plan initially sets aside 49,848-acre area where Covered Activities may occur. Although the Covered Activities may occur anywhere within this 49,848-acre area, the Covered Activities will be capped at 45,000 acres, and the balance (4,848 acres) will be placed into the “Preservation/Plan-Wide Activities” designation, bringing the total of that designation to 102,733 acres. The Plan designates 1,961 acres “Very Low Density Use,” indicating an area that may be used for such purposes as isolated residences, lodges, and hunting/fishing camps. In the event the ECPO Property Owners exercise this option, any construction would be limited to less than one structure or dwelling unit per 50 acres. Finally, the 2,431-acre area within the HCP Area that makes up the Half Circle L Ranch is currently identified as “Base Zoning.” These lands are located in an RLSP “Open” overlay area, where either development or preservation can occur under RLSP regulations, and where base zoning (1 dwelling unit per 5 acres) under the Collier County Land Development Code

the conservation of the Plan's primary focal species, the Florida panther. Because the panther is a focal species in the area of Southwest Florida where the HCP Area is located, however, the designation of lands for Preservation/Plan-Wide Activities and Very Low Density Use will also protect extensive habitat areas and landscape context that provide major conservation benefits to the other Covered Species.

The habitat requirements of the other Covered Species are sufficiently well established that habitat characteristics and acreage can adequately serve as a sound basis for determining potential impacts and take assessments under the Plan. This is especially true with respect to the other Covered Species, because the availability of suitable habitat was cited both as the primary threat to recovery and as the primary conservation priority for each of the species. The acreage of suitable habitat types for the Covered Species can be quantified in terms of potential impacts and lands designated for Preservation/Plan-Wide Activities and Very Low Density Use, and can be monitored in terms of habitat quality and management over the duration of the Plan.

Therefore, the potential biological impacts and take assessment for the other Covered Species were determined through analyzing the acreage of potential habitat impacts associated with the Covered Activities, and the acreage of corresponding habitats in lands designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan. The complete assessment for the other Covered Species also includes the implementation of avoidance and minimization measures, and the actions implemented under the Plan, which are described in Chapter 7 (Conservation Plan for Other Covered Species). As described in that chapter, biological surveys for the Covered Species will be performed at project-level scales during the planning and environmental permitting phases of each project, and mitigation for unavoidable impacts to Covered Species and their habitats will be implemented under the terms of the IA.

The following principles, based on the species accounts (Chapter 5), the Plan description (Chapter 2; Figure 2-1), and the conservation plan for other Covered Species (Chapter 7), form the framework for the assessment of potential biological impacts and incidental take for other Covered Species:

- The occurrence and numbers of each "other Covered Species" within the HCP Area is primarily determined by the extent and condition of suitable habitat(s);
- The Covered Activities may result in some level of unavoidable impacts to other Covered Species habitat(s), which can be accurately quantified on an acreage basis;

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applies. The Half Circle L Ranch is currently for sale on the open market, and the current property owner is an applicant for the ITP. The status of this property will be resolved during the timeframe for USFWS review of the HCP document, drafting of the IA, and processing of the ITP. Currently, this Base Zoning area is simply identified. If the current or future owner chooses not to develop the area, it will be included in the Plan as land designated for Preservation/Plan-Wide Activities. If the current or future owner develops the area at base zoning or higher densities, the development footprint will be included under the 45,000-acre cap for Covered Activities and 2,431 acres that would have otherwise been designated for Covered Activities will be included in the area designated for Preservation/Plan-Wide Activities. Thus, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use will ultimately total approximately 107,000 acres. See Chapter 2, including Figure 2-1 and Table 2-1.

- The Plan will designate an extensive area (approximately 107,000 acres) as Preservation/Plan-Wide Activities and Very Low Density Use, where activities will be restricted to historical uses and low density uses that will be compatible with use of these areas by the Covered Species;
- Project-level implementation of Covered Activities will map the existing land cover (habitats) in detail within the project boundary, and will implement biological surveys at the project level according to USFWS, FWC, and generally accepted survey protocols; and
- Avoidance, minimization, and mitigation for unavoidable impacts to other Covered Species habitats, along with the permanent preservation and monitoring of the species' habitats, will provide extensive conservation benefits.

Potential impacts to other Covered Species habitats are based on the acreages provided in Chapter 3 (Table 3-1), which is reproduced in this chapter as Table 6-1. Estimates for potential impacts are based on the entire 49,848 acres delineated as Covered Activities (Figure 2-1), which over-estimates total impacts and represents a theoretical maximum for each habitat type, since a maximum of 45,000 acres of Covered Activities can be implemented under the Plan. The acreage of specific habitat types to be preserved under the Plan includes habitats found within the Preservation/Plan-Wide Activities and the Very Low Density Use areas delineated on Figure 2-1. The surplus 4,848 acres of Covered Activities lands that are not impacted at Plan completion (49,848 – 45,000 = 4,848) will be re-designated as Preservation/Plan-Wide Activities. As noted in Chapter 2 (section 2.5), the area designated as "Base Zoning" (Half Circle L Ranch) is currently for sale, and habitats within that parcel are not considered as impacted or preserved under these analyses.

6.2 POTENTIAL TAKE AND IMPACTS TO OTHER COVERED SPECIES (FEDERALLY-LISTED SPECIES)

The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct" (16 U.S.C. § 1532(19)). Most of the activities included in the definition of "take" categorically do not apply to the Plan. No intentional take of any other Covered Species is proposed or anticipated. The two forms of "take" that could potentially result from the Covered Activities are "harm" and "harass."

"Harm" is defined (50 CFR § 17.3) as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering."

"Harass" is defined (50 CFR § 17.3) as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering."

The goal of the Plan is to avoid take resulting from Covered Activities occurring within the HCP Area to the extent practicable, and for any take that occurs, to minimize, rectify, reduce, and compensate for the impact of that take.

As discussed in section 6.1 above, and as detailed for each species below, the primary effect on other Covered Species of implementing the Covered Activities consists of direct impacts to their habitat(s). Table 6.1 shows that over 40,000 acres of the land cover within the Covered Activities land designation are comprised of intensive row crop agriculture, citrus groves, and other land uses (excluding pastures) that are not primary habitats for the other Covered Species (FLUCCS codes 213, 214, 221, 223, 242, 243, 250, 260, and 261). For some species (e.g., Florida scrub-jay, red-cockaded woodpecker), these major agricultural land cover types do not serve as habitat. Therefore, while some direct impacts to other Covered Species habitats may occur, even the potential habitat impacts are limited in extent through the avoidance measures that governed the Plan's design.

No critical habitat has been designated within the HCP Area for any of the Covered Species, and therefore no critical habitat is affected by the implementation of the Plan.

6.2.1 Birds

6.2.1.1 Northern Crested Caracara

Potential Impacts to Caracara Habitat

Improved and semi-improved pastures with scattered cabbage palms constitute the core habitat areas for caracara, along with native herbaceous dry prairie and wet prairie (Morrison and Humphrey 2001; Morrison et al. 2007). Morrison et al. (2007) also found that habitat heterogeneity (interspersed pastures, small wetland areas, water features, forest patches, presence of cabbage palms) is important for maintaining caracara habitat suitability. Caracaras prefer open habitats with low-stature vegetation, and a lack of habitat management can result in changes in vegetation composition and structure that degrade caracara habitat. Management activities associated with cattle ranching (grazing, mowing, prescribed burning) and the use of cabbage palms for cattle shading promote caracara habitat utilization.

An estimated 2,495 acres of improved pasture, 650 acres of unimproved pasture, 563 acres of wet prairie, and 40 acres of herbaceous dry prairie (3,748 acres total) occur within the Covered Activities land designation. Five caracara nest locations occur within or on the periphery of the Covered Activities areas (Figure 5-1). The areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 6,396 acres of improved pasture, 2,097 acres of unimproved pasture, 4,434 acres of wet prairie, and 245 acres of herbaceous dry prairie (13,172 acres total).

Therefore, even if all potential core habitat areas for caracara (3,748 acres) were impacted within the Covered Activities areas, more than three times that area (13,172 acres) of potentially suitable caracara habitat will be included in the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use and available for mitigation activities under the Plan. The actual acreage of caracara habitat to be perpetually preserved will be dictated by mitigation needs determined during project-level assessment and permitting, under the terms of the IA.

Table 6-1. Land use/land cover within the HCP Area, by FLUCCS category (Collier County, 2009).

FLUCCS (LEVEL 3)	FLUCCS DESCRIPTION	COVERED ACTIVITIES (ACRES)[1]	PRESERVATION (ACRES)	V. LOW DENSITY (ACRES)	BASE ZONING (ACRES)	TOTAL ACRES
111	Single Family (low density)	66	50	19	0	**135**
112	Mobile Home Units	11	12	0	0	**23**
121	Single family (med density)	19	8	0	0	**26**
151	Food Processing	57	1	0	0	**58**
155	Other light industrial	51	37	0	0	**89**
160	Extractive	0	41	134	0	**175**
163	Rock quarries	0	321	568	0	**888**
164	Oil and gas fields	11	25	0	0	**36**
211	Improved pastures	2,495	6,071	325	37	**8,928**
212	Unimproved pastures	650	2,095	2	767	**3,514**
213	Woodland pastures	0	103	0	23	**126**
214	Row crops	16,294	8,530	0	619	**25,443**
221	Citrus groves	20,784	8,775	0	1	**29,559**
223	Other groves	15	129	0	0	**143**
242	Sod farms	555	0	0	0	**555**
243	Ornamentals	16	5	0	0	**22**
250	Specialty farms	0	0	0	0	**0**
260	Other open lands (rural)	12	15	0	0	**28**
261	Fallow crop land	2,692	3,763	0	308	**6,763**
310	Herbaceous (dry prairie)	40	216	29	0	**285**
321	Palmetto prairies	315	1,058	0	0	**1,373**
329	Other shrubs and brush	147	416	11	0	**574**
330	Mixed rangeland	74	461	0	0	**535**
411	Pine flatwoods	1,706	6,665	242	43	**8,656**
422	Brazilian pepper	434	215	0	0	**648**
425	Temperate hardwood	9	1,557	16	17	**1,599**
428	Cabbage palm	15	57	0	0	**72**
434	Hardwood-confier mixed	156	3,059	123	7	**3,345**
439	Other hardwoods	7	0	0	0	**7**
510	Streams and waterways	148	143	0	0	**291**
521	Lakes larger than 500 acres	0	0	6	0	**6**
523	Lakes (10-100 acres)	0	10	0	0	**10**
524	Lakes less than 10 acres	0	10	0	0	**10**
533	Reservoirs (10-100 acres)	8	28	0	0	**37**
534	Reservoirs <10 acres	27	19	0	0	**46**
617	Mixed wetland hardwoods	18	383	58	2	**460**
621	Cypress	358	18,007	72	31	**18,469**
624	Cypress-pine-cabbage palm	384	3,697	34	0	**4,115**
630	Wetland forested mixed	101	6,671	127	0	**6,898**
631	Wetland scrub	665	7,749	66	0	**8,480**
641	Freshwater marshes	608	12,793	34	304	**13,740**
643	Wet prairies	563	4,338	96	254	**5,251**
743	Spoil areas	2	0	0	0	**2**
814	Roads and highways	162	154	0	0	**316**
832	Power transmission lines	172	200	2	18	**391**
TOTALS		**49,848**	**97,885**	**1,961**	**2,431**	**152,124**

[1] The actual acreage of Covered Activities at Plan completion will be 45,000 acres. The balance (4,848 acres) will be placed in Preservation/Plan-Wide Activities.

[2] The Base Zoning acres will be placed in Preservation/Plan-Wide Activities or Covered Activities by Plan completion. If these acres are placed in Covered Activities, an equivalent number of acres that otherwise would have been included in Covered Activities will be placed into Preservation/Plan-Wide Activities to maintain the 45,000-acre cap on Covered Activities.

The pasture areas found within the Covered Activities land designation are generally small, fragmented, and occur near existing roadways (a potential source of caracara mortalities). Furthermore, the existing conditions within the HCP Area do not require property owners to manage lands for caracara, except as the result of prior permitting commitments, and habitat management is a major factor for caracara occurrence. The areas of caracara habitat in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, most importantly areas within the Area of Critical State Concern (ACSC), contain large pasture areas set within a mix of native and agricultural habitats, and a large proportion of pastures are located away from roadways. Under the Plan, potentially thousands of acres of caracara habitat would be preserved in perpetuity within the southern limit of its Florida range.

Potential Take of Northern Crested Caracara

The Covered Activities could result in permanent core habitat losses (improved pastures, unimproved pastures, wet prairie and dry prairie) totaling an estimated 3,748 acres, which could potentially result in take of the northern crested caracara in the form of harm and/or harassment. Take could occur in the form of harm if the habitat modification actually killed or injured a caracara. Based on the characteristics of caracara ecology and information on documented causes of caracara injury and mortality, incidental take of the caracara in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a caracara to such an extent that the caracara's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Caracara individuals vary in their tolerance of human activity (Morrison 2007). A breeding pair of caracaras at Ave Maria was habituated to farm worker and vehicle activity prior to being displaced by permitted development activities during the non-breeding season (USFWS 2005). After they moved, the pair was monitored annually and successfully produced offspring through multiple years of monitoring, initially shifting their territory approximately 1.2 miles away from the development.

Five caracara nest trees occur within or directly adjacent to the Covered Activities areas (Figure 5-1), including the nest site north of Ave Maria. If the Covered Activities impact areas where nest trees are documented at the time of project implementation, the permittees will provide appropriate mitigation as determined during project-level assessment and permitting, under the terms of the IA, similar to the successful mitigation implemented for the Ave Maria caracaras.

A caracara communal roost or "gathering area" was reported within the HCP Area, north of Immokalee and east of SR 29 (Dwyer, 2010). The communal roost was documented in a citrus grove, which could potentially be impacted by Covered Activities. However, large areas of citrus groves exist directly east and south of this area that would provide identical communal roosting habitat and that are within the lands to be protected as Preservation/Plan-Wide Activities areas under the Plan.

Incidental take in the form of harm and/or harassment is not anticipated for the northern crested caracara. The Plan's general avoidance of impacts to lands within the ACSC, where the vast majority of suitable caracara habitats occur, maintains extensive areas for the perpetual preservation of caracara

habitat. Caracara surveys will be performed according to USFWS protocols during the planning and environmental permitting phases of each project within the HCP Area. Mitigation for unavoidable impacts to caracara habitat and/or removal of nest trees will occur within the Plan-Wide Activities and Very Low Density Use areas, where a heterogeneous mosaic of pastures, native habitats, water features and a general lack of roads provide valuable conservation areas for caracaras.

6.2.1.2 Wood Stork

Potential Impacts to Wood Stork Habitat

The habitats where wood storks forage and roost include a wide variety of wetland types, where prey are available and the water is shallow and open enough to hunt successfully (Ogden et al. 1978, Browder 1984, Coulter 1987). Habitats serving as foraging sites within the HCP Area include freshwater marshes, ponds, cypress domes and strands, hardwood swamps, wet prairies, and artificial wetlands such as stock ponds, shallow roadside or agricultural ditches, and managed impoundments (Coulter and Bryan 1993, Coulter et al. 1999). Foraging habitat suitability is associated with high prey density and an open wetland vegetation structure. Shallow and/or short-hydroperiod wetlands (e.g., shallow marshes, wet prairies) are important for pre-nesting foraging and nestling survivorship (Ceilly and Bartone 2000).

The land designated for Covered Activities is located within the 18.6-mile radius core foraging area (CFA) surrounding each wood stork colony. Most importantly, all of the wood stork colonies found within the HCP Area occur within lands designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan. The vast majority of potentially suitable wood stork habitats also occur within these areas, providing extensive opportunities for the implementation of wood stork conservation measures. Two other colonies, Corkscrew Marsh and Sadie Cypress are not located within the HCP Area, but are surrounded by existing conservation lands (Corkscrew) or by proposed preservation areas under the Plan (Sadie Cypress, found within non-ECPO land in the central portion of Okaloacoochee Slough).

The acreages of various wetland types within the HCP Area provide gross estimates of potential impacts to wood stork habitat, and similar estimates of the potential for habitat conservation measures (Table 6-1). Within the areas designated for Covered Activities, the total acreage of native wetlands (Table 6-1, FLUCCS codes 617, 621, 624, 630, 631, 643, and 641) is estimated to be 2,697 acres. By contrast, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 54,123 acres of native wetlands. These acreage estimates do not provide information regarding habitat suitability, but do indicate that the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain approximately 20 times the area of potential wood stork habitat as compared to the Covered Activities areas.

As noted in Chapter 4 (Florida Panther), of the estimated 2,697 acres of native wetlands within lands designated for the Covered Activities, Federal and State permitting agencies will require avoidance, minimization, and mitigation of proposed wetland impacts. Thus, although theoretically subject to development, as a practical matter, much of native wetland acreage subject to Covered Activities would be maintained in a post-development condition, and these wetlands can continue to provide habitat support functions for wood storks (USFWS 2012c).

Potential Take of Wood Stork

The Covered Activities could result in permanent foraging and/or roosting habitat losses totaling up to an estimated 2,697 acres, which could potentially result in take of the wood stork in the form of harm and/or harassment. Take could occur in the form of harm if the habitat modification actually killed or injured a wood stork. Based on the characteristics of wood stork ecology and information on documented causes of wood stork injury and mortality, incidental take of the wood stork in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a wood stork to such an extent that the wood stork's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Wood storks utilize manmade habitats (e.g., stormwater treatment areas, ponds, ditches) for foraging where humans are present (USFWS 2012c), and recommended buffer distances for foraging wood storks are less than 80 meters (Rodgers and Smith 1997). Given that the Covered Activities areas contain a low proportion of potential foraging habitats, and that the nesting colonies are located in areas designated for Preservation/Plan-Wide Activities and Very Low Density Use with extensive availability of native wetland habitats, human disturbance of wood storks is unlikely to cause harassment.

Incidental take in the form of harm and/or harassment is therefore not anticipated for the wood stork. The Plan's general avoidance of impacts to lands within the ACSC, where multiple wood stork nesting colonies have been documented, provides extensive areas for the perpetual preservation of wood stork roosting and foraging habitat. In addition, the extent of potential wood stork habitat within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use (54,123 acres) also provides the potential for hydrologic enhancements that can provide more reliable foraging conditions over a range of seasonal conditions. Because the areas designated in the Plan for Preservation/Plan-Wide Activities and Very Low Density Use include areas containing wood stork colonies, and/or areas directly adjacent to known colonies, opportunities exist to enhance foraging areas closest to the colonies that are most important to wood stork pre-nesting foraging and fledgling survival (Ceilly and Bartone 2000; Borkhataria et al. 2012; Borkhataria et al. 2013).

6.2.1.3 Red-Cockaded Woodpecker

Potential Impacts to Red-cockaded Woodpecker Habitat

No occurrences of the red-cockaded woodpecker (RCW) are documented within the HCP Area (Chapter 5, section 5.2.1.3.3; Figure 5-3). The closest documented occurrences of RCW are approximately 7-10 miles away from the boundary of the land designated for Covered Activities, with RCW clusters located in Golden Gate Estates and BCNP. The RCW was included as a Covered Species primarily because small areas of potential RCW habitat exist within the HCP Area, and chance RCW dispersal events could occur into these areas. Since RCWs are a cooperative breeding species, the probability of random dispersal events leading to colony establishment appears to be very low.

Although RCWs are not currently known to occur within the HCP Area, areas of pine forest and pine savanna habitats within the Plan-Wide Activities and Very Low Density Use areas will be managed in the future to benefit the Florida panther and other Covered Species, which could create and/or restore suitable habitat for RCW.

RCWs require open pine woodlands and pine savannahs with large old pines for nesting and roosting habitat (See Chapter 5, section 5.2.1.3.2). The areas designated for Covered Activities contain an estimated 1,706 acres of pine flatwoods habitat. Approximately 6,907 acres of pine flatwoods are estimated to occur within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, over four times the acreage present in the Covered Activities areas. Assuming that the Covered Activities resulted in the permanent loss of all 1,706 acres of pine flatwoods habitat, there is ample capacity within the Plan-Wide Activities and Very Low Density Use areas for mitigation in the form of preservation, restoration, and management of pine flatwoods habitat in perpetuity.

Potential Take of RCW

As no RCW clusters are known to occur within at least seven miles of the Covered Activities areas, and because the existing areas of pine flatwoods are limited in extent and fragmented, no incidental take in the form of harm and/or harassment is anticipated for the RCW within the HCP Area.

6.2.1.4 Florida Scrub Jay

Potential Impacts to Florida Scrub Jay Habitat

Figure 5-4 depicts five confirmed observations of Florida scrub jays ("scrub jays") within the HCP Area, two of which occurred in Preservation/Plan-Wide Activities areas, and three that occurred with areas designated for Covered Activities. The observations were recorded over twenty years ago during the statewide scrub jay survey in 1992-1993 (Fitzpatrick et al. 1994). The observations recorded within the Immokalee Urban Area occurred within open oak-dominated communities, while the occurrences within the HCP Area occurred on small remnant scrub patches. These observations defined the southernmost extent of scrub jays in the interior portions of the Florida peninsula.

Scrub jay habitats include xeric oak scrub and scrubby flatwoods, with open patches maintained by frequent fires. Land cover mapping at planning scales does not reveal any map units of xeric oak communities or scrubby flatwoods within the HCP Area (Table 6-1). The scrub jay was included as a Covered Species primarily because Florida scrub jays persist within the Immokalee Urban Area, and could hypothetically utilize marginal habitats (field edges with scrub oaks; isolated remnant scrub patches) within areas designated for Covered Activities. Scrub jays are a cooperative breeding species, requiring a mean territory area of 25 acres per breeding group. Scrub jays can disperse up to an estimated five miles, so individuals could hypothetically occur within the HCP Area, but the occurrence of a breeding group appears highly unlikely due to lack of suitable habitat.

Because of the apparent lack of scrub jay habitat within the HCP Area, no impacts to scrub jay habitat are anticipated, and no scrub jay habitats are expected to be restored and/or preserved within the Plan-Wide Activities and Very Low Density Use areas.

Potential Take of Florida Scrub Jay

As detailed in Chapter 7 (Conservation Plan for Other Covered Species), biological surveys will be performed for Covered Species, including scrub jays, during the planning and environmental permitting phases for each project within the Covered Activities areas. Scrub jay surveys will be performed wherever suitable habitats (including marginal habitats) are identified, according to USFWS survey protocols.

Based on current land cover mapping, no scrub jay habitat areas are known to exist within the HCP Area. The 1992-1993 survey data recorded three of the five scrub jay occurrences on scrub remnants north of Immokalee, but the current conditions within these small areas are unknown. If scrub remnants still exist and are occupied by scrub jays, the Covered Activities could result in a minimal acreage of permanent habitat loss that could potentially result in take of the Florida scrub jay in the form of harm and/or harassment. Based on the characteristics of Florida scrub jay ecology, the possibility that no scrub jay habitat exists within the HCP Area, and information on documented causes of scrub jay injury and mortality, incidental take of the Florida scrub jay in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a scrub jay to such an extent that the scrub jay's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. The Covered Activities will not occur within the Immokalee Urban Boundary where scrub jays are still known to occur, and no scrub jays are currently known to occur within the HCP Area. Therefore, no incidental take in the form of harassment is anticipated for the Florida scrub jay within the HCP Area.

6.2.1.5 Everglade Snail Kite

Potential Impacts to Everglade Snail Kite Habitat

The Everglade snail kite is a wetland-dependent species and a dietary specialist, feeding primarily on the Florida apple snail (*Pomacea paludosa*) (Sykes 1987a; Kitchens et al. 2002). The preferred foraging habitats for the snail kite are freshwater marshes and shallow littoral zones of lakes and impoundments that possess a balance of sparse herbaceous vegetation cover, open water areas 0.6-4.3 feet deep, and patches of emergent aquatic plants. These features simultaneously promote apple snail occurrence, and the ability for the snail kite to detect and capture the snails (Kitchens et al. 2002).

Because the snail kite forages only within a subset of freshwater marsh habitat conditions, the total acreage of freshwater marsh within the Covered Activities areas provides only a gross estimate of potential impacts to snail kite habitat, and similar estimates of the potential for snail kite habitat are included in the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use (Table

6-1). Within the areas designated for Covered Activities, the total acreage of freshwater marsh is estimated to be 608 acres. By contrast, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 12,827 acres of freshwater marsh. These acreage estimates do not provide information regarding habitat suitability, but do indicate that the Plan-Wide Activities and Very Low Density Use areas under the Plan contain over 20 times the area of potential snail kite habitat as compared to the Covered Activities areas.

Of the estimated 608 acres of freshwater marshes within lands designated for the Covered Activities, Federal and State permitting agencies will require avoidance, minimization, and mitigation of proposed wetland impacts. Thus, although theoretically subject to development, as a practical matter, much of freshwater marsh acreage potentially subject to Covered Activities impacts would be maintained in a post-development condition, and these wetlands could potentially provide habitat support functions for snail kites.

Potential Take of Everglade Snail Kite

The Covered Activities could result in permanent foraging habitat losses totaling up to an estimated 608 acres, which could potentially result in take of the snail kite in the form of harm and/or harassment. Take could occur in the form of harm if the habitat modification actually killed or injured a snail kite. Based on the characteristics of snail kite ecology and information on documented causes of snail kite injury and mortality, incidental take of the snail kite in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a snail kite to such an extent that the snail kite's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Given that the Covered Activities areas contain a low proportion of potential freshwater marsh foraging habitats, and that extensive freshwater marsh habitat exist near the Covered Activities, human disturbance of snail kites appears unlikely to cause harassment. Snail kite surveys will be performed according to USFWS protocols (USFWS 2004a) during the planning and environmental permitting phases of each project within the HCP Area to minimize potential disturbances. Mitigation for unavoidable impacts to snail kite habitat will occur within the Plan-Wide Activities and Very Low Density Use areas, where over 12,000 acres of freshwater marsh, miles of Lake Trafford littoral zone, other water features and a general low intensity of human activity provide valuable conservation areas for snail kites.

Incidental take in the form of harm and/or harassment is therefore not anticipated for the snail kite. The Plan's general avoidance of impacts to over 12,000 acres of freshwater marsh and other native wetland habitats provides extensive areas for the perpetual preservation and management of snail kite foraging and nesting habitat. In addition to habitat preservation and management, the extensive snail kite habitat within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use also provides the potential for hydrologic enhancements that can provide more reliable snail kite foraging conditions over a range of seasonal conditions.

6.2.2 Reptiles

6.2.2.1 Eastern Indigo Snake

Potential Impacts to Eastern Indigo Snake Habitat

In natural landscapes, eastern indigo snakes prefer upland habitat types (USFWS 2008b), and are commonly associated with gopher tortoises where tortoises occur. Native upland habitats utilized by the species within the HCP Area include pine flatwoods, dry prairie, hardwood hammocks, and xeric habitats. The eastern indigo snake is considered a terrestrial habitat generalist in the southern portions of its range, also utilizing agricultural areas, citrus groves, and other human-altered habitats. The species seeks underground refugia in gopher tortoise burrows, hollowed root channels, hollow logs, or the burrows of other animals. For the purposes of assessing potential impacts, this analysis considers the acreage of native upland habitats potentially impacted by the Covered Activities.

Native upland habitats (FLUCCS codes 310, 321, 411, 425, 428, 434, 439) within the areas designated for Covered Activities comprise an estimated 2,247 acres, and occur within a predominantly agricultural landscape fragmented by existing roads. By contrast, an estimated 13,022 acres of native upland habitats will be preserved within the approximately 107,000 acres of Plan-Wide Activities and Very Low Density Use areas under the Plan, including extensive interconnected habitat mosaics that are an important element for eastern indigo snake conservation. The preserved native upland habitat acreage is more than five times the native upland acreage potentially impacted by the Covered Activities, and few existing roads pass through the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

USFWS Biological Opinions for the eastern indigo snake in Florida emphasize that preserving extensive areas of largely undeveloped land (USFWS 2014b), such as the Plan-Wide Activities and Very Low Density Use areas, is important for conserving this species. The most recent 5-year review (USFWS 2008) stated, “The eastern indigo snake will likely persist in localities where large, unfragmented pieces of natural habitat remain. It has been suggested that eastern indigo snake populations that occur on Federal, state, or other privately managed preservation lands of at least 2,500 ac (1,000 ha), with few roads or human-altered habitats which increase habitat fragmentation and mortality, may have the best chance of long-term viability (Moler 1992, Breininger et al. 2004).”

Potential Take of Eastern Indigo Snake

The Covered Activities will result in the permanent conversion of primarily agricultural lands, and lower proportions of native land cover types, up to a maximum of 45,000 acres. These land cover conversions could potentially result in take of the eastern indigo snake in the form of harm and/or harassment. Take could occur in the form of harm if the habitat conversion actually killed or injured an eastern indigo snake. Based on the characteristics of eastern indigo snake ecology and information on documented causes of eastern indigo snake injury and mortality, incidental take of the eastern indigo snake in the form of harm is possible, but the number of individual snakes potentially harmed is indeterminable.

Take in the form of harassment has the potential to occur if a Covered Activity annoys an eastern indigo snake to such an extent that the snake's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity, vibration and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. As noted, the *Standard Protection Measures for the Eastern Indigo Snake* (USFWS 2013b) will be used during project site preparation and project construction to minimize potential harm and/or harassment to the eastern indigo snake.

Incidental take in the form of harm and/or harassment for the eastern indigo snake will be minimized through implementation of the *Standard Protection Measures for the Eastern Indigo Snake* (USFWS 2013b). The Plan's designation of approximately 107,000 acres for Preservation/Plan-Wide Activities and Very Low Density Use, which includes an estimated 13,022 acres of native upland habitats (FLUCCS codes 310, 321, 411, 425, 428, 434, 439), provides the type of large-scale eastern indigo snake conservation recommended by Breininger et al. (2004).

6.2.3 Mammals

6.2.3.1 Florida Bonneted Bat

Potential Impacts to Florida Bonneted Bat Habitat

As noted in Chapter 5 (section 5.2.3.1.2), the long-term habitat requirements for the Florida bonneted bat are poorly understood. Bonneted bats are closely associated with forested areas because of their tree roosting habits (Robson 1989, 2; Belwood 1992, 220; Eger 1999, 132), but specific information is limited. Recent results from a study at Florida Panther NWR conducted in 2013 also show the species' use of forested areas, open water, and wetlands (Maehr 2013, 1–13). Of the 13 locations examined, the highest detection of Florida bonneted bat calls occurred in areas with the largest amount of open water (Maehr 2013, 8). The area with the highest detection was an open water pond, surrounded primarily by pine flatwoods and oak hammock (S. Maehr, pers. comm. 2013a–c).

The potential impacts to Florida bonneted bat habitats were estimated on the basis of the extent of forests and wetlands within the HCP Area. Open water features (ponds, reservoirs) were not included because these features were either lumped with other land cover types (e.g., Sunniland mine) in the existing land cover mapping, and/or because they are generally finer-scale features that were not mapped at a planning scale. The combined acreage of upland forest, wetland forest, and herbaceous wetland habitats (FLUCCS codes 411, 425, 428, 434, 439; 617, 621, 624, 630; and 641, 643) within the Covered Activities areas comprise an estimated 4,589 acres. The same habitat types within the Plan-Wide Activities and Very Low Density Use areas total 65,843 acres. Notably, more than 20,000 acres of these preservation areas are contiguous with the FPNWR where Maehr (2013) detected Florida bonneted bat calls.

Potential Take of Florida Bonneted Bat

The Covered Activities will result in the permanent conversion of primarily agricultural lands, and lower proportions of native land cover types, up to a maximum of 45,000 acres. These land cover conversions could potentially result in take of the Florida bonneted bat in the form of harm and/or harassment. Take could occur in the form of harm if the habitat conversion actually killed or injured a Florida bonneted bat. Based on what is known about general bat ecology and Florida bonneted bat ecology, incidental take of the Florida bonneted bat in the form of harm is possible, but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys Florida bonneted bat to such an extent that the bat's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity, light and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Given that the Covered Activities areas contain a low proportion of upland forest, wetland forest, and herbaceous wetland habitats, and that extensive areas of these habitat types exist near areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, human disturbance of Florida bonneted bats appears unlikely to cause harassment.

6.3 POTENTIAL TAKE AND IMPACTS TO FEDERALLY-LISTED PLANT SPECIES

The HCP Handbook states, "although incidental take of plants may not be prohibited by section 9, the section 7(a)(2) prohibition against jeopardy does apply to plants" (USFWS and NMFS 1996, 3-8). USFWS accordingly encourages applicants to consider including federally-listed plants in their HCP planning.

However, the best available scientific information indicates that no federally-listed plant species or candidate plant species occur within the HCP Area. No potential impacts or incidental take of plant species are therefore anticipated.

6.4 CANDIDATE SPECIES AND SPECIES UNDER REVIEW FOR FEDERAL LISTING

6.4.1 Eastern Diamondback Rattlesnake

Potential Impacts to Eastern Diamondback Rattlesnake Habitat

Martin and Means (2000, Appendix 1) list flatwoods, dry prairie, xeric and mesic hardwood hammocks, and xeric oak scrub among the habitats utilized by the eastern diamondback rattlesnake, and note that the rattlesnake "is able to exist in silvicultural and agricultural areas provided there are either patches of relatively natural habitat or successional habitats nearby. Old field successional situations or abandoned citrus groves can have high populations."

Within the land designated for Covered Activities under the Plan, fallow agricultural fields frequently cycle back into production, and there are no areas of abandoned citrus groves. Therefore, native upland habitats form the basis for estimating potential habitat impacts to the rattlesnake. Native upland habitats (FLUCCS codes 310, 321, 411, 425, 428, 434, 439) within the areas designated for Covered Activities comprise an estimated 2,247 acres. By contrast, an estimated 13,022 acres of native upland

habitats will be included in the approximately 107,000 acres of Plan-Wide Activities and Very Low Density Use areas under the plan, including extensive interconnected habitat mosaics. The preserved native upland habitat acreage is more than five times the native upland acreage potentially impacted by the Covered Activities, and few existing roads pass through the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Potential Take of Eastern Diamondback Rattlesnake

The Covered Activities will result in the permanent conversion of primarily agricultural lands, and lower proportions of native land cover types, up to a maximum of 45,000 acres. These land cover conversions could potentially result in take of the eastern diamondback rattlesnake in the form of harm and/or harassment. Take could occur in the form of harm if the habitat conversion actually killed or injured an eastern diamondback rattlesnake. Based on the characteristics of eastern diamondback rattlesnake ecology, incidental take of the eastern diamondback rattlesnake in the form of harm is possible, but the number of individual snakes potentially harmed is indeterminable.

Take in the form of harassment has the potential to occur if a Covered Activity annoys an eastern diamondback rattlesnake to such an extent that the snake's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity, vibration and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. As noted, the *Standard Protection Measures for the Eastern Indigo Snake* (USFWS 2013b) will be used during project site preparation and project construction to minimize potential harm and/or harassment to the eastern indigo snake, and the same standard protection measures can be employed for the eastern diamondback rattlesnake. Incidental take in the form of harassment is not anticipated for the eastern diamondback rattlesnake.

6.4.2 Gopher Tortoise

Potential Impacts to Gopher Tortoise Habitat

Gopher tortoises require well-drained, sandy soils for burrowing and nest construction, an abundance of herbaceous ground cover for food, and a generally open canopy that allows sunlight to reach the forest floor (Landers 1980; Auffenberg and Franz 1982). Gopher tortoises require a sparse canopy and litter-free ground not only for feeding, but also for nesting (Landers and Speake 1980). Typical gopher tortoise habitats include longleaf pine and oak uplands, xeric hammock, sand pine and oak ridges (beach scrub), and ruderal (disturbed) habitats that provide the conditions necessary to support gopher tortoises (Auffenberg and Franz 1982). Ruderal (i.e., disturbed or atypical) habitats include roadsides and utility rights-of-way, grove/forest edges, fencerows, and clearing edges.

Few of the typical native habitats that gopher tortoises utilize in North Florida and Central Florida occur within the HCP Area, with the exception of pine and oak uplands (FLUCCS codes 411, 425, and 434). Regarding South Florida, the FWC Gopher Tortoise Management Plan (FWC 2012) noted that, "Throughout much of their geographical range, gopher tortoises are found primarily in habitats with moderately well-drained to excessively drained soils. In Florida, and especially in southern portions of

the peninsula, tortoises use areas that are classified as somewhat poorly to poorly-drained. There may be small "islands" of better-drained soils scattered in these vast flatwoods and dry prairies, but how tortoises use the poorly-drained areas, particularly during wetter years, is inadequately understood. Tortoises have been observed foraging in margins of wetlands and will use berms to gain higher ground for burrowing. Additional research is needed to refine our understanding of tortoise habitat use and movements in south Florida flatwoods."

The potential impacts to gopher tortoise habitats were estimated on the basis of the extent of native uplands within the HCP Area. Native upland habitats (FLUCCS codes 310, 321, 411, 425, 428, 434, 439) within the areas designated for Covered Activities comprise an estimated 2,247 acres, and occur within a predominantly agricultural landscape fragmented by existing roads. By contrast, an estimated 13,022 acres of native upland habitats occur within the extensive interconnected Plan-Wide Activities and Very Low Density Use areas, where there are few existing roads.

Potential Take of Gopher Tortoise

The Covered Activities will result in the permanent conversion of primarily agricultural lands, and lower proportions of native land cover types, up to a maximum of 45,000 acres. These land cover conversions could potentially result in take of the gopher tortoise in the form of harm and/or harassment. Take could occur in the form of harm if the habitat conversion actually killed or injured a gopher tortoise. Based upon the characteristics of gopher tortoise ecology, FWC gopher tortoise permitting requirements, and information on documented causes of gopher tortoise injury and mortality, incidental take of the gopher tortoise in the form of harm is possible, but unlikely.

FWC maintains a robust gopher tortoise permitting system, with well-established permitting guidelines (FWC 2013f). The guidelines require thorough surveys for gopher tortoise burrows, subject to verification by FWC, where permitted activities would require the relocation of gopher tortoises. These standard practices ensure that any potential harm to gopher tortoises is minimized.

Take in the form of harassment has the potential to occur if a Covered Activity annoys gopher tortoise to such an extent that the tortoise's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity, vibration and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. However, FWC permitting guidelines require that gopher tortoises be relocated to suitable onsite areas (if available) or offsite recipient sites prior to commencement of permitted activities. Therefore, incidental take of gopher tortoises in the form of harm and/or harassment is unlikely.

6.5 STATE-LISTED SPECIES

The state-listed species that are included as Covered Species under the Plan are not currently listed under the Federal Endangered Species Act. The HCP Handbook (USFWS and NMFS 1996, 4-4) states the following with regard to the treatment of unlisted species within a HCP: "an unlisted species is said to be 'adequately covered' by an HCP and subject to the assurances of 'No Surprises' when the species is addressed in the HCP 'as if it was listed pursuant to section 4 of the ESA, and in which HCP measures for

that species would satisfy permit issuance criteria under section 10(a)(1)(B) of the ESA if the species was listed.'"

The Plan-Wide Activities and Very Low Density Use areas under the Plan (approximately 107,000 acres at Plan completion) protect the extensive habitat areas and landscape context that provide major conservation benefits the Florida panther and the other federally-listed Covered Species. All of the six State-listed Covered Species (Chapter 5, section 5.5; Table 1-3) possess habitat requirements that overlap to a high degree with the habitat requirements for one or more of the federally-listed Covered Species. This is true even where species habitat requirements are highly specific and/or dependent upon habitat management.

For example, providing suitable habitat for caracara (low-stature vegetation within improved pastures, herbaceous dry prairie, wet prairie, and water features) provides many of the habitat requirements for Florida sandhill cranes and burrowing owls. Managing shallow freshwater marshes for wood stork foraging can also provide foraging habitat for snail kite, and nesting areas for Florida sandhill cranes. Performing prescribed burns in pine flatwoods can benefit panther, panther prey base, Big Cypress fox squirrel (BCFS), and eastern indigo snake. The preservation of various habitat types to benefit multiple listed species is consistent with the USFWS approach to multiple species HCPs, and the ongoing FWC program to create a comprehensive imperiled species management plan.

The assumptions and methods for assessing potential biological impacts and incidental take for the State-listed Covered Species are identical to those described previously (in section 6.1).

6.5.1 Birds

6.5.1.1 Florida Sandhill Crane

Potential Impacts to Florida Sandhill Crane Habitat

Sandhill cranes rely on shallow marshes for roosting and nesting and open upland and wetland habitats for foraging (Wood and Nesbitt 2001). Preferred crane habitat occurs where most vegetation is less than 50 cm (20 in) high (Stys 1997). Florida sandhill cranes depend on open habitats such as prairies, improved pastures, and freshwater marshes.

An estimated 2,495 acres of improved pasture, 650 acres of unimproved pasture, 563 acres of wet prairie, and 40 acres of herbaceous dry prairie (3,748 acres total) occur within the Covered Activities land designation. The areas included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 6,396 acres of improved pasture, 2,097 acres of unimproved pasture, 4,434 acres of wet prairie, and 245 acres of herbaceous dry prairie (13,172 acres total).

Therefore, if all potential habitat areas for the Florida sandhill crane (3,749 acres) were impacted within the Covered Activities areas, more than three times that area (13,172 acres) of potentially suitable Florida sandhill crane habitat will be preserved and available for mitigation activities under the Plan. The

actual acreage of Florida sandhill crane habitat to be perpetually preserved will be dictated by mitigation needs determined during project-level assessment and permitting, under the terms of the IA.

The pasture areas found within the Covered Activities land designation are generally small, fragmented, and occur near existing roadways (a potential source of Florida sandhill crane mortalities). The areas designated for Preservation/Plan-Wide Activities and Very Low Density Use including Florida sandhill crane habitat, most importantly areas within the ACSC, contain large pasture areas set within a mix of native and agricultural habitats, and a large proportion of pastures are located away from roadways. Furthermore, the existing conditions within the Plan area do not require property owners to manage lands for Florida sandhill crane, except as the result of prior permitting commitments, and habitat management is a major factor for Florida sandhill crane occurrence. Under the Plan, potentially thousands of acres of Florida sandhill crane habitat would be preserved in perpetuity.

Potential Take of Florida Sandhill Crane

The Covered Activities could result in permanent habitat losses (improved pastures, unimproved pastures, wet prairie and dry prairie) totaling an estimated 3,748 acres, which could potentially result in take of the Florida sandhill crane in the form of harm and/or harassment. Take could occur in the form of harm if the habitat modification actually killed or injured a Florida sandhill crane. Based on the characteristics of Florida sandhill crane ecology and information on documented causes of Florida sandhill crane injury and mortality, incidental take of the Florida sandhill crane in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a Florida sandhill crane to such an extent that the crane's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Florida sandhill cranes are tolerant of many human activities, and are present within areas such as suburban yards and golf courses (FWC 2013b). Therefore, incidental take of the Florida sandhill crane in the form of harassment is possible but unlikely.

6.5.1.2 Florida Burrowing Owl

Potential Impacts to Florida Burrowing Owl Habitat

Florida burrowing owls inhabit open-type habitats that offer short groundcover. Historically, these habitat requirements were met by native dry prairies that covered much of central Florida; however, due to human development in natural areas, there has been a range expansion into North and South Florida. More recently, burrowing owls have turned to pastures, agricultural fields, golf courses, airports, schools, and vacant lots in residential areas as most native open habitats have been converted by humans to these new uses.

The rural habitats utilized by the Florida burrowing owl have a high degree of overlap with caracara habitats, as both species prefer open areas with short-stature vegetation. Accordingly, the habitat

impact assessment included improved pasture, unimproved pasture, herbaceous dry prairie, and wet prairie. An estimated 2,495 acres of improved pasture, 650 acres of unimproved pasture, 563 acres of wet prairie, and 40 acres of herbaceous dry prairie (3,748 acres total) occur within the Covered Activities land designation. The areas designated under the Plan for Preservation/Plan-Wide Activities and Very Low Density Use contain an estimated 6,396 acres of improved pasture, 2,097 acres of unimproved pasture, 4,434 acres of wet prairie, and 245 acres of herbaceous dry prairie (13,172 acres total).

Therefore, if all potential habitat areas for the Florida burrowing owl (3,748 acres) were impacted within the Covered Activities areas, more than three times that area (13,172 acres) of potentially suitable Florida burrowing owl habitat will be preserved and available for mitigation activities under the Plan. The actual acreage of Florida burrowing owl habitat to be perpetually preserved and managed will be dictated by mitigation needs determined during project-level assessment and permitting, under the terms of the IA.

As noted for the caracara and the Florida sandhill crane, the existing conditions within the HCP Area do not require property owners to manage lands for Florida burrowing owl, except as the result of prior permitting commitments, and habitat management is a major factor for Florida burrowing owl occurrence. Under the Plan, potentially thousands of acres of suitable habitats would be preserved in perpetuity for the mutual benefit of caracara, Florida sandhill crane, and Florida burrowing owl.

Potential Take of Florida Burrowing Owl

The Covered Activities could result in permanent habitat losses (improved pastures, unimproved pastures, wet prairie and dry prairie) totaling an estimated 3,748 acres, which could potentially result in take of the Florida burrowing owl in the form of harm and/or harassment. Take could occur in the form of harm if the habitat modification actually killed or injured a Florida burrowing owl. Based on the characteristics of Florida burrowing owl ecology and information on documented causes of Florida burrowing owl injury and mortality, incidental take of the Florida burrowing owl in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a Florida burrowing owl to such an extent that the owl's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Florida burrowing owls are tolerant of many human activities, and utilize vacant lots within urban areas, and may use these areas year-round (FWC 2013). Incidental take of the Florida burrowing owl in the form of harassment is therefore considered possible, but unlikely, given the availability of an estimated 13,172 acres of potential habitat in the Plan-Wide Activities and Very Low Density Use areas.

6.5.1.3 Southeastern American Kestrel

Potential Impacts to Southeastern American Kestrel Habitat

The southeastern American kestrel is closely associated with the southeastern sandhill ecosystem. The typical sandhill landscape consists of a widely spaced canopy of longleaf pine (*Pinus palustris*) or slash pine (*P. elliottii* var *densa*) with wiregrass (*Aristida stricta*) and forb dominated groundcover. This ecosystem does not occur within the HCP Area, but open-canopy pine flatwoods are a habitat analogue. Southeastern American kestrels also use a variety of other natural communities in Florida including scrub, scrubby flatwoods, and dry prairie. Pasture areas can also serve as habitat, including breeding habitat, as long as nesting substrates such as nest boxes are provided.

The habitat impact assessment for the southeastern American kestrel within the Plan area included improved pasture, pine flatwoods, unimproved pasture, herbaceous dry prairie, and wet prairie. An estimated 2,495 acres of improved pasture, 1,706 acres of pine flatwoods, 650 acres of unimproved pasture, 563 acres of wet prairie, and 40 acres of herbaceous dry prairie (5,454 acres total) occur within the Covered Activities land designation. The areas designated under the Plan for Preservation/Plan-Wide Activities and Very Low Density Use contain an estimated 6,396 acres of improved pasture, 6,907 acres of pine flatwoods 2,097 acres of unimproved pasture, 4,434 acres of wet prairie, and 245 acres of herbaceous dry prairie (20,079 acres total).

Therefore, if all potential habitat areas for the southeastern American kestrel (5,454 acres) were impacted within the Covered Activities areas, more than three times that area (20,079 acres) of potentially suitable southeastern American kestrel habitat will be preserved and available for mitigation activities under the Plan. The actual acreage of southeastern American kestrel habitat to be perpetually preserved and managed will be dictated by mitigation needs determined during project-level assessment and permitting, under the terms of the IA.

Potential Take of Southeastern American Kestrel

The Covered Activities could result in permanent habitat losses (improved pastures, unimproved pastures, wet prairie and dry prairie) totaling an estimated 5,454 acres, which could potentially result in take of the southeastern American kestrel in the form of harm and/or harassment. Take could occur in the form of harm if the habitat modification actually killed or injured a southeastern American kestrel. Based on the characteristics of southeastern American kestrel ecology and information on documented causes of southeastern American kestrel injury and mortality, incidental take of the southeastern American kestrel in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a southeastern American kestrel to such an extent that the kestrel's normal behavioral patterns are significantly disrupted. Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. FWC (2013d) noted that "Research is needed on the acceptable thresholds of noise and disturbance tolerable by southeastern American kestrels in agricultural-dominated landscapes in Florida, where many nest boxes

are located." Incidental take of the southeastern American kestrel in the form of harassment is therefore considered possible, but unlikely, given the availability of an estimated 20,079 acres of potential habitat in the Plan-Wide Activities and Very Low Density Use areas. Additionally, areas designated for Preservation/Plan-Wide Activities and Very Low Density Use that provide suitable habitat for caracara, Florida sandhill cranes, and Florida burrowing owls will also provide suitable habitat for southeastern American kestrels.

6.5.1.4 Little Blue Heron and Tricolored Heron

Potential Impacts to Little Blue Heron and Tricolored Heron Habitat

In light of the significant overlap in habitat, distribution and geographic range, as well as shared threats faced by the little blue heron and the tricolored heron, the combined potential habitat impacts and take assessments for both species are addressed in this section.

Wading birds, including the little blue heron and the tricolored heron, depend on healthy wetlands, mangrove and other islands, and vegetated areas suitable for resting and breeding that are near foraging habitat. The little blue heron and tricolored heron forage in shallow marine, brackish, or freshwater sites, including tidal ponds and sloughs, mudflats, mangrove-dominated pools, freshwater sloughs and marshes, and human-created impoundments. The little blue heron relies on freshwater forage sites to raise young until they become more salt tolerant (Frederick 1996, Rodgers 1996).

The acreages of various freshwater wetland types within the Plan area provide gross estimates of potential impacts to wading bird habitat, and similar estimates of the potential for habitat conservation measures (Table 6-1). Within the areas designated for Covered Activities, the total acreage of native wetlands (FLUCCS codes 617, 621, 624, 630, 631, 641, and 643) is estimated to be 2,697 acres. By contrast, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 54,123 acres of native wetlands. These acreage estimates do not provide information regarding habitat suitability, but do indicate that the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain approximately 20 times the area of potential wading bird habitat as compared to the Covered Activities areas.

Potential Take of Little Blue Heron and Tricolored Heron

The Covered Activities could result in permanent foraging and/or roosting habitat losses totaling up to an estimated 2,697 acres, which could potentially result in take of the little blue heron and tricolored heron in the form of harm and/or harassment. Take could occur in the form of harm if the habitat modification actually killed or injured a little blue heron or tricolored heron. Based on the characteristics of little blue heron and tricolored heron ecology and information on documented causes of wading bird injury and mortality, incidental take of the little blue heron and tricolored heron in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a little blue heron or tricolored heron to such an extent that the wood stork's normal behavioral patterns are significantly

disrupted. Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Little blue herons and tricolored herons utilize manmade habitats (e.g., stormwater treatment areas, ponds, ditches) for foraging where humans are present (FWC 2013e), and recommended buffer distances for little blue herons and tricolored herons are approximately 100 meters (Rodgers and Smith 1997). Given that the Covered Activities areas contain a low proportion of potential foraging habitats, and that the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use possess extensive availability of native wetland habitats, human disturbance of little blue herons and tricolored herons would appear unlikely to cause harassment.

6.5.2 Mammals

6.5.2.1 Big Cypress Fox Squirrel

Potential Impacts to Big Cypress Fox Squirrel Habitat

Natural habitats for BCFS include south Florida slash pine (*Pinus elliottii* var. *densa*) forests, cypress swamp forests, live oak (*Quercus virginiana*) hammocks, tropical hardwood forests, coastal broadleaf evergreen hammocks, and mangrove swamps (FWC 2013g). Optimal habitat conditions for BCFS are dependent upon the availability of appropriate trees for nest sites, abundant year-round food resources, and an open understory with little or no bushes or shrub layer present (Jodice and Humphrey 1992, Eisenberg et al. 2011).

The habitat impact assessment for the BCFS within the HCP Area included all forest types, which included pine flatwoods, hardwood-conifer mixed, temperate hardwood (oak hammock), cabbage palm, cypress, cypress-pine-cabbage palm, and wetland forested mixed (Table 6-1). An estimated 2,729 acres of forested habitats occur within the Covered Activities land designation, occurring primarily as fragmented forest patches. The areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 40,768 acres of forested habitats, much of which is not fragmented by roads or agricultural land uses. These acreage estimates do not provide information regarding habitat suitability, but do indicate that the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain almost 15 times the area of potential BCFS native habitat as compared to the Covered Activities areas.

Potential Take of Big Cypress Fox Squirrel

The Covered Activities could result in permanent habitat losses (native forested land cover) totaling an estimated 2,729 acres, which could potentially result in take of the BCFS in the form of harm and/or harassment. Take could occur in the form of harm if the habitat modification actually killed or injured a BCFS. Based on the characteristics of BCFS ecology and information on documented causes of BCFS injury and mortality, incidental take of the BCFS in the form of harm is possible but unlikely.

Take in the form of harassment has the potential to occur if a Covered Activity annoys a BCFS to such an extent that the squirrel's normal behavioral patterns are significantly disrupted. Potential impacts may

include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Big Cypress fox squirrels are tolerant of many human activities, inhabiting urbanized areas with sufficient food sources and nest sites, such as golf courses and parks (FWC 2013). Given that the Covered Activities areas contain a low proportion of forested habitats, which exist in fragmented patches, and that the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use possess extensive interconnected areas of native forested cover, human disturbance of BCFS would appear unlikely to cause harassment.

7. CONSERVATION PLAN FOR OTHER COVERED SPECIES

The HCP Area comprises 152,124 acres, of which approximately 107,000 acres will ultimately be included in areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan. (See Chapter 2, including Figure 2-1 and Table 2-1, and note 9 above for an explanation of the area designations under the Plan.) Chapter 4 (Florida Panther) described the natural history and current status of the panther, the potential impacts to the panther associated with the Covered Activities, and the actions to be implemented for panther conservation. Chapter 5 (Other Covered Species) described the natural history and current status of the 15 other Covered Species, and Chapter 6 provided potential habitat impact estimates and incidental take assessments for each of the 15 species.

This chapter describes the conservation plan for the 15 Covered Species other than the Florida panther, including biological goals and objectives. These other Covered Species, along with the Florida panther, benefit primarily from the permanent preservation of large, interconnected, and ecologically important blocks of habitat mosaics within the HCP Area. Through the permanent preservation of these extensive unfragmented South Florida landscapes, the Plan creates exceptional opportunities for habitat-specific and species-specific conservation actions that can serve as multi-species mitigation for unavoidable impacts associated with the Covered Activities.

7.1 OVERALL CONSERVATION GOALS

Section 10(a)(2)(A) of the Act requires that an HCP specify the measures that the permittee will take to minimize and mitigate, to the maximum extent practicable, the impacts of the taking of any federally-listed species as a result of activities addressed by the plan.

As part of the HCP Handbook Addendum, or “Five Point Policy,” adopted by the Services in 2000, HCPs establish biological goals and objectives (65 Fed. Reg. 35242 (June 1, 2000)). The purpose of the biological goals is to ensure that the conservation program in the HCP is consistent with the conservation and recovery goals established for the species. The goals are also intended to provide an understanding of why these actions are necessary. These goals are developed based on the species’ biology, threats to the species, the potential effects of the Covered Activities, and the scope of the HCP.

The general conservation goals for the other Covered Species under the Plan include the following:

- Maintaining a landscape mosaic of native habitats, pastures, and rural open space within the approximately 107,000 acres designated under the Plan for Preservation/Plan-Wide Activities and Low Density Use that provides major conservation benefits to the Covered Species (Figure 2-1);

- In-kind mitigation for permanent losses of other Covered Species habitat associated with implementation of the Covered Activities, including habitat preservation, and potentially habitat restoration, enhancement, and/or creation; and

- Preservation of habitat for the panther that will also benefit the other Covered Species.

Biological surveys for all of the Covered Species will be performed at project-level scales during the planning and environmental permitting phases of each individual project, and during pre-construction activities if required. Detailed land cover mapping will also be performed at the project-level scale to serve as a basis for quantifying project habitat impacts and preservation. Depending on the land cover types (potential habitats) present on the project site, species-specific surveys may be performed to document occurrences of Covered Species onsite. If no potential habitat for a Covered Species exists onsite or adjacent to the project, a species-specific survey for that species will not be performed. For example, if no pine flatwoods exist on or near a project site, no surveys for RCW will be performed.

The "Five Point Policy" (65 Fed. Reg. at 35251) states that "Multiple species HCPs may categorize goals by species or by habitat, depending on the structure of the operating conservation program….Habitat-based goals are expressed in terms of amount and/or quality of habitat. Species-based goals are expressed in terms specific to individuals or populations of that species. Complex multispecies or regional HCPs may use a combination of habitat- and species-specific goals and objectives."

For the purpose of establishing biological goals and objectives that address habitat conservation for each of the other Covered Species, the sections below follow an outline and numbering system similar to those used in the species accounts provided in Chapter 5, and the potential impacts and incidental take assessments described in Chapter 6. For example, the northern crested caracara species account and impact assessment were provided in sections 5.2.1.1 and 6.2.1.1, respectively, while the caracara biological goals and objectives can be found below in section 7.2.1.1. This organizational format facilitates the cross-referencing of the other Covered Species' ecological requirements, the potential impacts from the Covered Activities, and the conservation measures to be implemented for each species in terms of biological goals and objectives.

7.2 BIOLOGICAL GOALS AND OBJECTIVES FOR OTHER COVERED SPECIES (FEDERALLY-LISTED SPECIES)

7.2.1 Birds

7.2.1.1 Northern Crested Caracara

Goal 1: Preservation of caracara habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

> Objective 1.1: An estimated 13,172 acres of core habitat areas for caracara are included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, consisting of a combination of improved pasture, unimproved pasture, herbaceous dry prairie, and wet prairie habitats. These habitats also provide multiple species benefits for Florida sandhill crane, Florida burrowing owl, and southeastern American kestrel.

Goal 2: Restoration, as needed, of suitable caracara habitat to mitigate for permanent caracara habitat losses associated with the Covered Activities

Objective 2.1: Permanent losses of caracara habitat associated with the Covered Activities will be mitigated through restoration of an equal acreage of in-kind caracara habitat restoration.

Goal 3: Timing of Covered Activities to avoid and minimize impacts to caracara nesting where breeding caracara pairs are present

Objective 3.1: Caracara nest surveys will be conducted during project permitting and prior to commencement of construction activities, according to USFWS survey protocols.

Objective 3.2: Construction activities will not occur within a caracara nest tree primary zone (300 meters/984 feet radius) during the nesting season (November through April).

7.2.1.2 Wood Stork

Goal 1: Preservation of wood stork foraging and roosting habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 54,123 acres of native wetland habitats (Table 6-1, FLUCCS codes 617, 621, 624, 630, 631, 643, and 641) for wood stork are included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, consisting of a combination of native wetland forested communities and native wetland herbaceous communities.

Goal 2: Preservation, restoration, enhancement, and/or creation of suitable wood stork habitat to mitigate for permanent wood stork habitat losses associated with the Covered Activities

Objective 2.1: Permanent habitat losses to native wood stork habitat associated with the area designated for Covered Activities will be mitigated for through preservation, restoration, enhancement, and/or creation of an equal acreage of in-kind wood stork habitat.

Objective 2.2: Where possible, in-kind wetland mitigation will enhance and/or restore suitable short-hydroperiod foraging habitats (shallow open marshes, wet prairies) for wood storks, that function across a range of hydrologic conditions during pre-nesting and fledging periods. These specific habitat conditions also provide nesting habitat for the Florida sandhill crane.

Objective 2.3: Where possible, foraging habitat restoration/enhancement will be directed to areas designated for Preservation/Plan-Wide Activities and Very Low Density Use as close to nesting colony locations as practicable. The conservation objective is to increase the probability of successful foraging by pre-nesting adults and fledgling wood storks (Tsai et al. 2011; Borkhataria et al. 2013).

7.2.1.3 Red-Cockaded Woodpecker

Goal 1: Determine presence/absence of RCW within lands designated for Covered Activities on a project-by-project basis

Objective 1.1: As RCW occurrence has not been documented within the HCP Area, RCW surveys will be performed within RCW potential habitat according to USFWS protocols during project permitting to determine presence/absence of RCW within a project area

Goal 2: Preservation of potential RCW habitat within areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 2.1: An estimated 6,907 acres of potential RCW habitat will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, consisting of pine flatwoods.

Goal 3: Inclusion of pine flatwoods within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use to benefit multiple Covered Species, including RCW (if colonized)

Objective 3.1: Inclusion of pine flatwoods preservation as suitable RCW habitat (e.g., open understory, graminoid groundcover) also maintains suitable habitat for Florida panther, panther prey base, eastern indigo snake, gopher tortoise, and BCFS.

7.2.1.4 Florida Scrub Jay

Goal 1: Determine presence/absence of Florida scrub jay within the area designated for Covered Activities on a project-by-project basis

Objective 1.1: Florida scrub jay occurrence was last documented within the HCP Area over 20 years ago, and no suitable scrub jay habitats are known to exist within the HCP Area. Florida scrub jay surveys will be performed to determine presence/absence during project permitting, in locations where prior occurrence data and/or the presence of potential habitats (scrub oaks, scrubby flatwoods, etc.) are observed. Scrub jay surveys will follow USFWS survey protocols to determine presence/absence of scrub jays within a project area.

Goal 2: Translocate any isolated individual Florida scrub jays or family groups located within the Covered Activities areas to viable populations to the extent possible

Objective 2.1: Coordinate with USFWS to translocate any "individual birds and/or family groups on private lands that are covered by Federal incidental take permits/authorizations where any legally required minimization and/or mitigation obligations have been fully met" (USFWS 2011c).

Goal 3: Provide mitigation for unavoidable impacts to potential scrub jay habitat areas if Florida scrub jays are documented within a project area

Objective 3.1: Permanent losses of occupied Florida scrub jay habitat associated with the Covered Activities will be mitigated through enhancement and/or restoration of an equal acreage of in-kind Florida scrub jay habitat within the Immokalee Urban Area; OR

Objective 3.2: Deposit funding into the Florida Scrub-jay Conservation Fund (USFWS 2009), according to a formula to be determined by USFWS and the applicants.

7.2.1.5 Everglade Snail Kite

Goal 1: Inclusion of extensive and varied wetland systems in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use that serve as snail kite foraging and roosting habitats within those areas

Objective 1.1: An estimated 12,827 acres of freshwater marsh habitats for snail kite will be included in the areas designated for Preservation/Plan-Wide Activities and Very-Low Density Use. An additional 4,434 acres of wet prairie habitats will also be preserved.

Goal 2: Preservation, and possible restoration, enhancement, and/or creation of suitable snail kite habitat to mitigate for permanent snail kite habitat losses associated with the Covered Activities

Objective 2.1: Permanent habitat losses to native snail kite habitat associated with the Covered Activities will be mitigated through preservation, and possibly restoration, enhancement and/or creation of an equal acreage of in-kind snail kite habitat.

7.2.2 Reptiles

7.2.2.1 Eastern Indigo Snake

Goal 1: Preservation of native eastern indigo snake habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 13,022 acres of native upland habitats (FLUCCS codes 310, 321, 411, 425, 428, 434, 439) for the eastern indigo snake will be included within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use. This preservation is consistent with the recovery action plan (USFWS 2009e): “Extensive tracts of wild land (not fragmented by roads) are the most important refuge for eastern indigo snake populations.”

7.2.3 Mammals

7.2.3.1 Florida Bonneted Bat

Goal 1: Preservation of Florida bonneted bat potential habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 65,843 acres of upland forest, wetland forest, and herbaceous wetlands (FLUCCS codes 411, 425, 428, 434, 439; 617, 621, 624, 630; and 641, 643) for the Florida bonneted bat will be included within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Goal 2: Documentation of Florida bonneted bat occurrence throughout the HCP Area

Objective 2.1: Document the occurrence of Florida bonneted bats throughout the HCP Area through the use of acoustical surveys, in cooperation with USFWS. The objective is to gain sufficient occurrence data for the applicants to avoid and minimize potential impacts to the Florida bonneted bat, and to identify the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use where Florida bonneted bats occur.

Goal 3: Retention and possibly establishment of roosting sites for Florida bonneted bats at suitable locations within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan, away from human habitation and near productive foraging habitat

Objective 3.1: Retain large cavity trees and snags as potential Florida bonneted bat roosting sites within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 3.2: Establish bat houses in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use where acoustical surveys indicate the presence of Florida bonneted bats, and where suitable foraging habitats are located nearby

7.3 BIOLOGICAL GOALS AND OBJECTIVES FOR FEDERALLY-LISTED PLANT SPECIES

The best available scientific information indicates that no federally listed plant species or candidate plant species occur within the HCP Area. Therefore, no biological goals or objectives are proposed for federally listed plant species.

7.4 BIOLOGICAL GOALS AND OBJECTIVES FOR CANDIDATE SPECIES AND SPECIES UNDER REVIEW FOR FEDERAL LISTING

7.4.1 Eastern Diamondback Rattlesnake

Goal 1: Preservation of native eastern diamondback rattlesnake habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 13,022 acres of native upland habitats (FLUCCS codes 310, 321, 411, 425, 428, 434, 439) for the eastern diamondback rattlesnake will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

7.4.2 Gopher Tortoise

Goal 1: Determine presence/absence of gopher tortoise within Covered Activities on a project-by-project basis

Objective 1.1: Where potential gopher tortoise habitats exist on a project site, gopher tortoise burrow surveys will be conducted according to the FWC Gopher Tortoise Permitting Guidelines (FWC 2013). Berms, spoil areas, and other non-native habitats that may be occupied by gopher tortoises will be included in the surveys.

Goal 2: Preservation of native gopher tortoise habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 13,022 acres of native upland habitats (FLUCCS codes 310, 321, 411, 425, 428, 434, 439) for the gopher tortoise will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Goal 2: Potential relocation of gopher tortoises to suitable recipient sites within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan

Objective 2.1: To the extent practicable, relocation of gopher tortoises from Covered Activities areas to long-term protected recipient sites within the areas will occur according to the FWC Gopher Tortoise Permitting Guidelines (FWC 2013f).

7.5 BIOLOGICAL GOALS AND OBJECTIVES FOR STATE-LISTED SPECIES

7.5.1 Birds

7.5.1.1 Florida Sandhill Crane

Goal 1: Preservation of Florida sandhill crane habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 13,172 acres of habitat areas for the Florida sandhill crane will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, consisting of a combination of improved pasture, unimproved pasture, herbaceous dry prairie, and wet prairie habitats. These habitats also provide multiple species benefits for caracara, Florida burrowing owl, and southeastern American kestrel.

Goal 2: Preservation, and possible restoration, enhancement, and/or creation of suitable Florida sandhill crane habitat to mitigate for permanent Florida sandhill crane habitat losses associated with the Covered Activities

Objective 2.1: Permanent losses of Florida sandhill crane habitat associated with the Covered Activities will be mitigated through preservation, and possibly restoration, enhancement and/or creation of an equal acreage of in-kind Florida sandhill crane habitat.

Goal 3: Possible enhancement and/or restoration of short-hydroperiod wetlands for Florida sandhill crane nesting habitat

Objective 3.1: Where practicable, in-kind wetland mitigation will enhance and/or restore suitable short-hydroperiod nesting habitats (shallow open marshes, wet prairies) for the Florida sandhill crane that function across a range of hydrologic conditions. These specific habitat conditions also provide foraging habitat for wood stork.

7.5.1.2 Florida Burrowing Owl

Goal 1: Preservation of Florida burrowing owl habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 13,172 acres of habitat areas for Florida burrowing owl will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, consisting of a combination of improved pasture, unimproved pasture, herbaceous dry prairie, and wet prairie habitats. These habitats also provide multiple species benefits for caracara, Florida sandhill crane, and southeastern American kestrel.

Goal 2: Possible preservation, restoration, enhancement, and/or creation of suitable Florida burrowing owl habitat to mitigate for permanent Florida burrowing owl habitat losses associated with the Covered Activities

Objective 2.1: Permanent losses of Florida burrowing owl habitat associated with the Covered Activities will be mitigated through preservation, and possibly restoration, enhancement and/or creation of an equal acreage of in-kind Florida burrowing owl habitat.

Goal 3: Timing of Covered Activities will be planned to avoid and minimize impacts to Florida burrowing owl nesting

Objective 3.1: Florida burrowing owl nest surveys will be conducted during project permitting and prior to commencement of construction activities, according to FWC survey protocols.

Objective 3.2: Construction activities will occur within areas containing inactive burrows only during the non-nesting season (10 July through 15 February), and will require a burrowing owl nest removal permit from FWC.

7.5.1.3 Southeastern American Kestrel

Goal 1: Preservation of southeastern American kestrel habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 20,079 acres of habitat areas for southeastern American kestrel will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, consisting of a combination of improved pasture, pine flatwoods, unimproved pasture, herbaceous dry prairie, and wet prairie habitats. The herbaceous habitats also provide multiple species benefits for caracara, Florida sandhill crane, and Florida burrowing owl.

Goal 2: Preservation, and possible restoration, enhancement, and/or creation of suitable southeastern American kestrel habitat to mitigate for permanent Florida burrowing owl habitat losses associated with the Covered Activities

Objective 2.1: Permanent losses of southeastern American kestrel habitat associated with the Covered Activities may be mitigated through preservation, restoration, enhancement and/or creation of an equal acreage of in-kind southeastern American kestrel habitat.

7.5.1.4 Little Blue Heron and Tricolored Heron

Goal 1: Preservation of little blue heron and tricolored heron foraging and roosting habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 54,123 acres of native wetland habitats for little blue heron, tricolored heron, and other wading birds will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, consisting of a combination of native wetland forested communities and native wetland herbaceous communities (FLUCCS codes 617, 621, 624, 630, 631, 643, and 641).

Goal 2: Preservation, and potential restoration, enhancement, and/or creation of suitable little blue heron and tricolored heron habitat to mitigate for permanent little blue heron and tricolored heron habitat losses associated with the Covered Activities

Objective 2.1: Permanent habitat losses to native little blue heron and tricolored heron habitat associated with the Covered Activities will be mitigated for through preservation, and possible restoration, enhancement and/or creation of an equal acreage of in-kind little blue heron and tricolored heron habitat.

7.5.2 Mammals

7.5.2.1 Big Cypress Fox Squirrel

Goal 1: Preservation of native BCFS habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Objective 1.1: An estimated 40,768 acres of forested habitats (FLUCCS codes 411, 425, 428, 434, 617, 621, 624, 630) for the BCFS will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

7.6 AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

This section describes the measures that the Plan will implement to avoid, minimize, and mitigate impacts to the other Covered Species and their associated habitats. The Plan considers spatial scales ranging from regional landscape-level conservation planning to site-specific project design principles for incorporating avoidance, minimization, and mitigation strategies into an overall multiple species conservation plan.

The HCP Handbook (USFWS and NMFS 1996, 3-19) states, “Mitigation actions under HCPs usually take one of the following forms: (1) avoiding the impact (to the extent practicable); (2) minimizing the impact; (3) rectifying the impact; (4) reducing or eliminating the impact over time; or (5) compensating

for the impact." Avoidance and minimization (items 1 and 2 listed above) are the primary actions taken by the applicants to further the goals of the Plan.

The avoidance and minimization strategies described below generally overlap with those presented in Chapter 4 (Florida Panther, section 4.4.1), because the conservation strategies that benefit the panther also benefit the other Covered Species greatly. While the panther may be considered a focal species for the Plan in terms of major design elements, there are some unique conservation actions and benefits associated with specific avoidance, minimization, and mitigation strategies for the other Covered Species that are not directly dependent upon panther conservation.

7.6.1 Measures To Avoid And Minimize Impacts

7.6.1.1 Regional Planning

The Plan's overall design evolved from the primary conservation goal of avoiding and permanently protecting the extensive areas of interconnected habitats that occur within the Okaloacoochee Slough and the areas directly north of the FPNWR. These areas are characterized by vast open spaces (approximately 107,000 acres), large habitat blocks, a variety of habitat types, a general lack of roadways, and minimal human activity levels (generally associated with agriculture, ranching, forestry, and other rural land uses). Therefore, the avoidance of these areas was central to the Plan design for the conservation of the Florida panther and the other Covered Species.

The Plan avoided impacts to these extensive habitat areas in the eastern and southern portions of the HCP Area, primarily by directing Covered Activities to the central, western, and northern portions of the HCP Area where intensive agricultural land uses predominate and native habitats are more highly fragmented and limited in extent. Even while directing the Covered Activities to these agricultural lands, the Plan was designed to avoid impacts to the Camp Keais Strand wildlife corridor that provides habitat support to many of the other Covered Species. The permanent protection of these preservation lands serves to maintain the landscape-scale linkages between the FPNWR, Camp Keais Strand, and the Corkscrew Regional Ecosystem Watershed (CREW) lands (Figures 2-1 and 2-2).

7.6.1.2 Project-Level (Site-Specific) Planning

Avoidance measures were incorporated into the design of the overall Plan area, and the relationship of the areas designated for Covered Activities to the Preservation/Plan-Wide Activities areas (Figure 2-1). Project-level avoidance measures will also be employed. These measures primarily involve the configuration of master plans to avoid direct impacts to other Covered Species habitat, and to direct the more intensive land uses away from habitat preservation areas.

At project-level scales where avoidance measures have already been employed to the extent practicable, the goal is to minimize the direct and indirect impacts to other Covered Species and their habitats. Within the lands designated for Covered Activities, the techniques to be employed for minimizing unavoidable impacts at project-level scales generally include:

- Designing master plans that (i) concentrate more intensive land uses within the center of mixed-use residential/commercial developments (town centers), located at a distance from habitat preservation areas outside the development area, and (ii) diminish land use intensities adjacent to habitat preservation areas (e.g., providing transitions from mixed-use town centers, to residential neighborhoods, to community open space areas, to project boundaries);

- Minimizing impacts to native habitats within project boundaries that occur along the interface with habitat preservation areas external to the project;

- Utilizing a combination of design elements, including surface water management lakes, berms, structural buffers, fencing, and directional and/or low-level lighting along the periphery of Covered Activities to minimize the effects of light, noise, and human activity on areas outside the project boundaries, and to minimize human interactions with other Covered Species;

- Designing internal road networks and roadway elements to minimize the potential for wildlife-vehicle collisions within the lands designated for Covered Activities; and

- In the case of earth mining, establishing perimeter berms to separate the mine areas from adjacent preservation areas (if present adjacent to the mine), and limiting mining operations to daylight hours.

While the overall Plan achieves avoidance through the designation of large interconnected habitat areas for Preservation/Plan-Wide Activities and Very Low Density Use, and the direction of Covered Activities toward the more intensively farmed portions of the HCP Area, the strategies listed above serve to refine avoidance and minimization of impacts at project-level scales. (See Figure 2-1.) The combined application of these strategies serves to avoid and minimize impacts to panthers and the Other Covered Species, and to separate Covered Activities from the Preservation/Plan-Wide Activities and Very Low Density Use areas.

7.7 OTHER COVERED SPECIES MONITORING AND REPORTING

Federal regulations require that HCPs include monitoring programs to: (i) evaluate compliance with the terms and conditions of the HCP, IA, and ITP; (ii) determine whether biological goals and objectives are being met; and (iii) provide data and information for an adaptive management strategy, if one is used (50 CFR §§ 17.22, 17.32, and 222.307; 65 Fed. Reg. at 35253). The first type of monitoring (item (i) above) is considered “compliance monitoring,” while the latter two items fall under the heading of “effects and effectiveness monitoring.”

Moreover, the HCP Handbook (USFWS and NMFS 1996, 3-26) states, “For regional and other large-scale HCPs, monitoring programs should include periodic accountings of take, surveys to determine species status in project areas or mitigation habitats, and progress reports on fulfillment of mitigation requirements (e.g., habitat acres acquired).” The sections below describe the general methods and objectives of the monitoring program with regard to the other Covered Species, which share many elements with the monitoring program for the Florida panther (Chapter 4, section 4.5).

7.7.1 Compliance Monitoring

Compliance monitoring ties directly to the measures the applicants described for avoidance, minimization, and mitigation of direct and indirect impacts to the other Covered Species and their habitats, along with any additional terms and conditions issued with the ITP. The sections below describe briefly the type, extent, frequency, and timing of monitoring events necessary to determine compliance with these measures.

Covered Activities

The monitoring program will verify that the location and extent of Covered Activities conforms to the areas depicted in Figure 2-1, and that the types of activities within these areas are consistent with the activities described in Chapter 2 (Plan Description and Activities Covered by Incidental Take Permit). Monitoring for the compliance of individual projects can occur on a project-by-project basis as each project engages in the Federal permitting process (typically Clean Water Act section 404 permitting) and subsequent interagency coordination with USFWS.

For the HCP Area as a whole, Covered Activities will be monitored for compliance on an annual basis through the use of aerial imagery, analysis of State and Federal permits, local development orders, legal sketch and description surveys, and onsite inspections. Each project will undergo Federal permitting review, and interagency review with USFWS, which will provide a pre-construction opportunity to ensure that project plans are in compliance with the Covered Activities under the ITP. Any Federal permit conditions or FWC permits that require avoidance of areas during avian nesting seasons (e.g., caracara nest tree primary zone; active burrowing owl nest burrows) will be documented through pre-construction species surveys and monitoring reports (section 7.7.3, below).

Projects that have commenced construction during the monitoring year will be added to a GIS database to verify compliance with the limits of the Covered Activities land designation. Because the boundaries for Covered Activities were digitized in a GIS originally, some scrivener's errors may be revealed during the project's permitting and land survey activities where small deviations exist between GIS boundaries and project boundaries as actually surveyed. Projects will be in compliance with the Plan if they conform generally to the Covered Activities boundary, have received State and Federal permits, and accurately quantify impacts to all land cover classes present within the project boundary.

In accounting for take, the annual monitoring will summarize the acreage of other Covered Species habitat impacts that occurred during the monitoring year, by Level 3 FLUCCS codes and/or land cover type groupings. The annual monitoring will likewise report the acreage and land cover type(s) of mitigation placed under permanent conservation easement(s) to offset the impacts and avoid a taking. The boundaries of any permanent conservation easements will be added to the GIS database. The annual monitoring will also include an estimate of the total acreage constructed each year that counts toward the 45,000-acre cap on Covered Activities, and a summary of the total acreage of Covered Activities implemented through that monitoring year.

Preservation/Plan-Wide Activities

The monitoring program will verify that the location and extent of Preservation/Plan-Wide Activities conforms to the areas depicted in Figure 2-1, and that the types of activities within these areas are consistent with the activities described in Chapter 2 (Plan Description and Preservation/Plan-Wide Activities and Very Low Density Use).

In general, the areas designated for Preservation/Plan-Wide Activities will be monitored on an annual basis, to ensure that the activities and land uses occurring there are consistent with the traditional land activities that have occurred in these areas historically, and to ensure the general extent of native vegetation communities is maintained over the 50-year duration of the ITP. For the HCP Area as a whole, Preservation/Plan-Wide Activities may be monitored for compliance on an annual basis through the use of aerial imagery and GIS land cover data. As noted, permanent conservation easements recorded during the monitoring year within the Preservation/Plan-Wide Activities areas will be added to the GIS database.

Very Low Density Use

The areas depicted on Figure 2-1 as Very Low Density Use are intended to support hunting lodges, fishing camps, other dwellings, support structures, and other very low density rural uses at a maximum density of 1 dwelling unit per 50 acres. No more than 10 percent of the existing native vegetation may be cleared from Very Low Density Use areas. These areas may be monitored on an annual basis in a manner similar to the Preservation/Plan-Wide Activities areas, through the use of aerial imagery, GIS land cover data and, if necessary, onsite inspections.

Base Zoning Area

As noted in Chapter 2 (Plan Description and Base Zoning Area), the Base Zoning area is for sale on the open market at the time of this writing. The monitoring program for this area will be described when the end-use is determined under the Plan. If the area is eventually designated for Preservation/Plan-Wide Activities, it will be included in the monitoring plan for the Preservation/Plan-Wide Activities areas. If the area is developed at densities equal to base zoning or greater densities, the monitoring plan will be included in the monitoring plan for the Covered Activities, and the development will count toward the 45,000-acre Covered Activities cap.

Habitat Restoration

The type and extent of any habitat restoration that may be necessary will depend on the nature and extent of direct impacts to existing habitat, the objectives of the restoration, and whether the restoration is designed to support one Covered Species or multiple Covered Species. The Addendum to the HCP Handbook (65 Fed. Reg. at 35246) noted, “Although the specific methods used to gather necessary data may differ depending on the species and habitat types, monitoring programs should use a multispecies approach when appropriate.’’ Using a multispecies approach can benefit the applicants

by providing mitigation for more than one species within a single restoration area, while simultaneously increasing the capacity for total conservation benefits under the Plan.

For compliance purposes, any habitat restoration completed under the Plan must conform to the specific terms of the IA and ITP. The objective(s), type(s) and extent of any habitat restoration must be clearly stated, along with the success criteria (vegetation cover/densities, vegetation diversity, exotic vegetation levels, etc.) that are required as a basis for evaluation. The annual monitoring will summarize habitat restoration activities over the past monitoring year, and will include qualitative and quantitative data regarding the type(s), acreage, and status of each restoration area within the HCP Area.

7.7.2 Effects and Effectiveness Monitoring

The Addendum to the HCP Handbook (65 Fed. Reg. at 35254) provides the following guidance for effects and effectiveness monitoring:

> Effects and effectiveness monitoring includes, but is not limited to, the following:
>
> 1. Periodic accounting of incidental take that occurred in conjunction with the permitted activity;
>
> 2. Surveys to determine species status, appropriately measured for the particular operating conservation program (*e.g.,* presence, density, or reproductive rates);
>
> 3. Assessments of habitat condition;
>
> 4. Progress reports on fulfillment of the operating conservation program (e.g., habitat acres acquired and/or restored); and
>
> 5. Evaluations of the operating conservation program and its progress toward its intended biological goals.

As outlined in Chapter 6 (Potential Biological Impacts/Take Assessment for Other Covered Species), the periodic accounting of incidental take for other Covered Species will be based upon the acreage of other Covered Species habitat(s) impacted by the Covered Activities, as well as the acreage of the in-kind habitat(s) preserved, restored, enhanced, and/or created within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan.

Biological surveys to determine species status will be performed for the other Covered Species within the Covered Activities areas, during the environmental permitting phase of each project. Those surveys will document the status of each species on the project site, and the extent of land cover (habitat) types prior to implementation of Covered Activities. Biological surveys will also be performed post-activity to document the status of each species on the project site, and the extent of land cover (habitat) types.

Performance of comprehensive biological surveys throughout the entirety of the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use is not practicable for determining the overall status of the other Covered Species within the HCP Area (Chapter 6, section 6.1). The habitat requirements of the other Covered Species are sufficiently well established that habitat characteristics

and acreage within these areas can adequately serve as a sound basis for effectiveness monitoring under the Plan, as perpetual conservation easements are recorded. This habitat-based monitoring is especially applicable for the other Covered Species, where the availability of suitable habitat was cited as the primary threat to recovery, and also as the primary conservation priority for each of the species. The acreage of suitable habitat types for the Covered Species generally can be quantified in terms of potential impacts and preservation, and monitored in terms of habitat quality over the duration of the Plan.

Assessments of habitat conditions will document pre-activity and post-activity habitat conditions on a project-by-project basis. Within the Covered Activities areas, pre-activity habitat assessments will document conditions within those onsite areas to be set aside as preservation areas within the project boundaries, and will subsequently document the post-activity conditions of those same areas. Within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan, habitat assessments will be performed for areas to be placed under perpetual conservation easements, to document baseline conditions at the time of easement recording. Habitat assessments will be performed on an annual basis to document the relative habitat quality of the preserved areas relative to baseline conditions.

Effectiveness monitoring for habitat restoration areas will generally consist of biological surveys for other Covered Species prior to habitat restoration (baseline); at “time-zero” for restoration (completion of initial restoration activities); and when the areas have met restoration success criteria. Habitat restoration area conditions will be assessed annually and included in the annual monitoring report.

Progress reports for effectiveness monitoring will be included within the annual monitoring report for the Plan (see section 7.7.3 below). In cases where the applicants and USFWS jointly determine that certain other Covered Species and/or habitat areas require more frequent monitoring, interim progress reports can be submitted to USFWS and then be incorporated into the annual monitoring report.

Evaluations of the operating conservation program and its progress toward its intended biological goals will be jointly conducted by USFWS and the applicants on a semi-annual basis, and will be included in the annual monitoring report.

7.7.3 Reporting Requirements

The applicants will provide an annual monitoring report, to be submitted to USFWS each year, by the anniversary date of the ITP issuance (or as determined by USFWS and FWC, timed to coincide with the issuance of the FWC Annual Report on the Research and Management of Florida Panthers). The annual report will contain the information listed in the addendum to the HCP Handbook (65 Fed. Reg. at 35255):

1. Biological goals and objectives of the HCP (which may need to be reported only once);
2. Objectives for the monitoring program (which may need to be reported only once);
3. Effects on the Florida panther, other Covered Species, and habitats within the HCP Area;

4. Location of sampling sites within the HCP Area;
5. Methods for data collection and variables measured;
6. Frequency, timing, and duration of sampling for the variables;
7. Description of the data analysis and who conducted the analyses; and
8. Evaluation of progress toward achieving measurable biological goals and objectives of the Plan, and other terms and conditions as required by the ITP or IA.

In addition to the annual monitoring report, the GIS databases created or updated for monitoring purposes, and any other electronic data related to the monitoring program, will be transmitted to USFWS in electronic format according to technical specifications as described in the IA.

7.8 ADAPTIVE MANAGEMENT

For the purposes of the HCP program, USFWS defines the term "adaptive management" as "a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned" (65 Fed. Reg. at 35245). The HCP Handbook (USFWS and NMFS 1996, 3-24) states that adaptive management concepts are used in HCPs "to minimize the uncertainty associated with listed or unlisted species where there are gaps in the scientific information or their biological requirements."

The primary biological objective of the Plan is to preserve in perpetuity the extensive interconnected habitat mosaics within the HCP Area, which provide habitats and wildlife corridors for the Florida panther and the other Covered Species. The vast extent of lands designated within the HCP Area as Preservation/Plan-Wide Activities and Very Low Density Use under the Plan, and the varied habitat types present in those areas, underscore that the nature of the preservation itself provides an inherent "adaptive management" for most of the Covered Species. Conservation biology emphasizes that large, interconnected habitat mosaics provide resiliency for imperiled species by allowing for essential behavioral patterns to continue under changing environmental conditions (e.g., variations in inter-annual or seasonal rainfall and surface water levels).

The biological requirements for most of the other Covered Species are well known, and the preservation of habitats for these species do not involve much uncertainty, even where some gaps in the scientific information exist. For example, preserving and restoring improved pastures as core habitat for caracara does not involve much uncertainty, especially when the pastures occur within a native habitat mosaic (Morrison et al. 2007). The conservation benefits to caracara within the HCP Area are simply a matter of successful implementation and monitoring.

The Five Point Policy notes that "Not all HCPs or all species covered in an incidental take permit need an adaptive management strategy. However, an adaptive management strategy is essential for HCPs that would otherwise pose a significant risk to the species at the time the permit is issued due to significant data or information gaps. Possible significant data gaps that may require an adaptive management

strategy include, but are not limited to, a significant lack of specific information about the ecology of the species or its habitat (*e.g.*, food preferences, relative importance of predators, territory size), uncertainty in the effectiveness of habitat or species management techniques, or lack of knowledge on the degree of potential effects of the activity on the species covered in the incidental take permit." 65 Fed. Reg. at 35252.

The Florida bonneted bat is the only Covered Species for which significant data or information gaps exist regarding its basic ecology. However, the best available scientific data indicate that the primary native habitats for the Florida bonneted bat include forests, wetlands, and other natural habitats (USFWS 2014d). These native habitats are limited in extent and fragmented within the areas designated for the Covered Activities, and few potential impacts for this species are anticipated. By contrast, the data suggest that preserving the large blocks of forested habitat, freshwater marshes, and water features within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan provide the roosting and foraging habitats and lack of human activity necessary for Florida bonneted bat conservation, without prescribing adaptive management beyond the biological goals and objectives listed in section 7.2.3.1.

In keeping with the purpose and intent of a multiple species HCP, the applicants will work with USFWS throughout the development of the Plan, the IA, and issuance of the ITP to determine if adaptive management is appropriate for the Florida bonneted bat and/or any of the other Covered Species within the HCP Area.

8. CHANGED AND UNFORESEEN CIRCUMSTANCES AND PLAN IMPLEMENTATION

8.1 CHANGED CIRCUMSTANCES

Section 10 regulations 50 CFR §§ 17.22(b)(2) and 17.32(b)(2) require that an HCP specify the procedures to be used for addressing changed and unforeseen circumstances that may arise during the implementation of the HCP.

Changed circumstances are defined in 50 CFR § 17.3 as changes in circumstances affecting a species or geographic area covered by an HCP that can reasonably be anticipated by plan developers and USFWS and for which contingency plans can be prepared (e.g., the new listing of species, a fire, or other natural catastrophic event in areas prone to such event). Permittees will implement the measures specified in the Plan to respond to changed circumstances.

Changed circumstances addressed by the Plan include changes resulting from the following scenarios:

- Hurricanes;
- Fires;
- Invasive Species, Pests, and Diseases;
- New Listings for Species Not Covered by the Plan; and
- Climate Change.

8.1.1 Hurricanes

For the purposes of defining changed circumstances, a hurricane is defined as a cyclonic storm with minimum sustained winds of 74 miles per hour and includes the storm categories of both “hurricane” and “major hurricane” as defined by the National Hurricane Center.

Risk Assessment

Hurricanes are cyclical phenomena that are beyond human control. The National Hurricane Center models (NOAA 2014) for Southwest Florida project typical return periods of 8-11 years for standard hurricanes (maximum sustained winds of 74 mph and higher) and 14-22 years for major hurricanes (maximum sustained winds of 111mph and higher). The duration of immediate impacts from hurricanes can range from a few hours to a week or more. Immediate impacts to habitats and wildlife are a result of the high winds, flying debris, and potential flooding. Direct impacts to the Covered Species may include species injury and/or mortality, prey base mortality, regional flooding, alteration of habitat characteristics, loss of foraging areas, and loss of dens, nests, or nest cavity features. The HCP Area is approximately 15 miles inland, at a minimum elevation of 12 feet above mean sea level, and storm surge from hurricanes is therefore not anticipated to impact the HCP Area directly.

Natural communities in Southwest Florida, including those in the HCP Area, have adapted to periodic hurricane occurrences and typically recover from the immediate impacts from hurricanes within days to several weeks following events. Loss of canopy trees due to hurricane-related winds has occurred historically in South Florida, and may occur again in the future. Secondary impacts to canopy vegetation may include the loss of trees over time due to subsequent disease or pest infestation of stressed trees. Full habitat recovery in areas with significant canopy tree loss may require years to decades.

Preventative Measures

No measures are available to prevent hurricanes or prevent hurricane movement through the HCP Area.

The South Florida Water Management District ("SFWMD") operates the regional flood control system (major canals and control structures), and prior to hurricane events, the SFWMD will draw down surface water levels as ambient conditions allow. These flood control measures may lessen the impact of flooding during and immediately following hurricane events.

Planned Response to Hurricanes

Following a hurricane that significantly impacts the biological resources of the HCP Area, the USFWS and permittees will coordinate action on the following activities:

- Determine whether the degree and/or extent of the hurricane impacts rise to the level of a "changed circumstance."
- If considered a changed circumstance, prepare a damage estimate report with a focus on lost canopy vegetation and lost denning, nesting, or cavity nesting sites. The report should include estimates of flooding damage and potential long-term effects on habitats (if any).
- Recommended actions, as necessary, to ameliorate the effects of the hurricane damage. Such actions may include timber management efforts to eliminate stressed trees with potential to harbor invasive pests or disease, and coordination with state and local water management agencies to assure proper functioning of local and regional water drainage features and structures.
- Work with SFWMD to determine whether any flood-related damage can be prevented or attenuated in the future through drainage improvements.

8.1.2 Fires

Natural fires have occurred historically, and will continue to occur, within the HCP Area. Prescribed and controlled burns that are implemented correctly under an approved land management plan will not be considered changed circumstances. Fires, including prescribed fires that become uncontrolled or lightning-induced fires, that burn greater than 200 acres will be reported to USFWS by the permittees to determine an appropriate course of action.

Risk Assessment

Fire is a natural occurrence within and around the HCP Area, and many native vegetation communities are adapted to fire. Natural fire frequency in unaltered upland landscapes have return intervals ranging from 2 to 10 years. Shallow wetland systems experience natural fires less frequently than native uplands, while deep swamps are estimated to have fire return intervals of 100 years or more (Watts 2012).

Preventative Measures

The permittees have successfully implemented land management practices throughout the HCP Area for many decades, reducing forest fuel loads where needed through prescribed burning and mechanical vegetation control. Implementation of best management practices for forested areas is the most effective method to reduce the potential for adverse impacts from unplanned burning. Lightning-induced fires are a natural occurrence and no methods are reasonably available to prevent such fires.

Planned Response to Fires

For fire events that are not the result of properly implemented prescribed burns, and which result in more than 200 acres of fire damage to biological resources, the permittees will coordinate with USFWS to undertake the following actions:

- Assess burned areas to evaluate need for timber salvage/removal;
- Monitor the area for the rate of natural recruitment of tree canopy species; and
- Determine whether supplemental plantings of tree canopy species and other forest management is needed for successful forest regeneration.

8.1.3 Invasive Species, Pests, and Diseases

Southwest Florida, including the HCP Area, has long been subject to the effects of invasive species, pests and disease. The permittees as land managers, farmers, cattlemen, and citrus growers routinely manage these challenges within agricultural and natural areas.

Risk Assessment

Invasive species can disrupt native habitats, and the resultant changes in ecological characteristics can decrease the habitat functionality. Brazilian pepper, melaleuca, and Old World climbing fern (*Lygodium microphyllum*) are three major exotic invasive plant species that occur within the HCP Area and require active control to prevent adverse ecological changes. In South Florida, more recent challenges include invasive vertebrate species such as the Burmese python (*Python molurus*) which has been documented in Collier County. The Burmese python is reproducing rapidly and disrupting the ecological food web in the Everglades system.

Preventative Measures

To reduce the probability of new invasive species becoming established within the HCP Area, the permittees and their contractors will continue to be vigilant in recognizing and addressing any sightings and/or documented occurrences of new invasive species in the HCP Area, and/or sudden increases in the numbers or coverage of invasive species. Rapid responses to initial reports of new invasive species are the most effective means for preventing disruptive invasive species occurrences.

Planned Response to Invasive Species, Pests, and Disease

The permittees will coordinate with USFWS, FWC, the Florida Forest Service, the Florida Department of Agriculture, and other agencies and experts as needed to rapidly and effectively respond to new occurrences of or significant increases in invasive species within the HCP Area. The goal is to suppress new invasive species occurrences promptly and rapidly. Specific actions taken will depend on the type of invasive species, where it is located, and recommendations from various agencies and experts. New occurrences of or significant increases in invasive species within the HCP Area will be documented in the annual monitoring report for tracking purposes.

8.1.4 New Listings of Species Not Covered by the Plan

If a new species that is not covered by the Plan but that may be affected by activities covered by the Plan is listed endangered or threatened under the Act during the term of the ITP, the Section 10 permit will be reevaluated by USFWS and the Covered Activities may be modified, as necessary, to insure that the Covered Activities are not likely to jeopardize or result in the take of the newly-listed species or adversely modify any newly-designated critical habitat. The permittees shall implement the modifications to the Covered Activities identified by USFWS as necessary to avoid the likelihood of jeopardy to or take of the newly-listed species or adverse modification of newly-designated critical habitat. The permittees shall continue to implement such modifications until such time as the permittees have applied for and USFWS has approved an amendment to the ITP, in accordance with applicable statutory and regulatory requirements, to cover the newly-listed species or until USFWS notifies the permittees in writing that the modifications to the Covered Activities are no longer required.

8.1.5 Climate Change

Climate change is considered a potential “Changed Circumstance” under the Plan. Current climate change models do not predict changes in climate or sea level rise over the next 50 years that, if experienced at the local level, would require the permittees to implement new measures. Computer models for sea-level rise predict an increase of 1.2 meters or less by the year 2100, even under maximum assumed global warming increases (Horton et al. 2014). These changes would not require a response by the permittees. The likely effects of climate change on a local or regional scale cannot be accurately projected by current climate change models. Overall, climate change is expected to lead to such events as sea-level rise, increased fire activity, and volatile weather patterns. The permittees will respond to any hurricane or fire as described in sections 8.1.1 and 8.1.2 above.

8.2 UNFORESEEN CIRCUMSTANCES

Unforeseen circumstances are defined in 50 CFR § 17.3 as changes in circumstances that affect a species or geographic area covered by the HCP that could not reasonably be anticipated by plan developers and USFWS at the time of the HCP's negotiation and development and that result in a substantial and adverse change in status of the Covered Species. The purpose of the No Surprises Rule is to provide assurances to non-Federal landowners participating in habitat conservation planning under the Act that no additional land restrictions or financial compensation will be required for species adequately covered by a properly implemented HCP, in light of unforeseen circumstances, without the consent of the permittee.

In case of an unforeseen event, the permittees shall notify USFWS staff who have functioned as the principal contacts for the proposed action immediately. The Service bears the burden of demonstrating that unforeseen circumstances exist using the best available scientific and commercial data available while considering certain factors. (50 CFR §§ 17.22(b)(5)(iii)(C) and 17.32(b)(5)(iii)(C)). In determining whether such an event constitutes an unforeseen circumstance, USFWS shall consider, but not be limited to, the following factors: (i) size of the current range of the affected species; (ii) percentage of range adversely affected by the Plan; (iii) percentage of range conserved by the Plan; (iv) ecological significance of that portion of the range affected by the Plan; (v) level of knowledge about the affected species and the degree of specificity of the species' conservation program under the Plan; (vi) whether the HCP was originally designed to provide an overall net benefit to the affected species and contained measurable criteria for assessing the biological success of the Plan; and (vii) whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild. See HCP Handbook at 3-31.

In negotiating unforeseen circumstances, USFWS will not require the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water or other natural resources beyond the level otherwise agreed upon for the species covered by the Plan without the consent of the permittee. (50 CFR §§ 17.22(b)(5)(iii)(A)). If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, USFWS may require additional measures of the permittee where the Plan is being properly implemented only if such measures are limited to modifications within conserved habitat areas, if any, or to the Plan's operating conservation program for the affected species, and maintain the original terms of the plan to the maximum extent possible. (50 CFR §§ 17.22(b)(5)(iii)(B) and 17.32(b)(5)(iii)(B)). Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee.

8.3 AMENDMENTS

8.3.1 Minor Amendments

Minor amendments to the HCP and ITP are changes that do not (i) affect the scope of the Plan's impact and conservation strategy, (ii) change the amount of take authorized, (iii) add new species, or (iv) change significantly the boundaries of the HCP. Examples of minor amendments include correction of spelling errors or minor corrections in boundary descriptions. The minor amendment process is accomplished through an exchange of letters between the permit holder and the USFWS Field Office.

8.3.2 Major Amendments

Major amendments to the HCP and ITP are changes that *do* (i) affect the scope of the Plan and conservation strategy, (ii) increase the amount of take authorized, (iii) add new species, or (iv) change significantly the boundaries of the HCP. Major amendments often require amendments to the USFWS decision documents, including the NEPA document, the biological opinion, and findings and recommendations document. Major amendments will often require additional public review and comment.

8.4 SUSPENSION/REVOCATION

USFWS may suspend or revoke an ITP if the permittees fail to implement the HCP in accordance with its terms and conditions or if suspension or revocation is otherwise required by law. Suspension or revocation of the ITP, in whole or in part, must be in accordance with 50 CFR §§13.27-29, 17.32(b)(8).

8.5 RENEWAL OF THE SECTION 10(A)(1)(B) PERMIT

Upon expiration, the ITP may be renewed without the issuance of a new permit, provided that the permit is renewable, and that biological circumstances and other pertinent factors affecting covered species are not significantly different than those described in the original HCP. To renew the permit, permittees shall submit to USFWS, in writing:

- a request to renew the permit, referencing the original permit number;
- certification that all statements and information provided in the original HCP and permit application, together with any approved HCP amendments, are still true and correct, and inclusion of a list of changes;
- a description of any take that has occurred under the existing permit; and
- a description of any portions of the project still to be completed, if applicable, or what activities under the original permit the renewal is intended to cover.

If USFWS concurs with the information provided in the request, it shall renew the permit consistent with permit renewal procedures required by Federal regulation (50 CFR § 13.22). If permittees file a renewal request and the request is on file with USFWS office at least 30 days prior to the permits expiration, the

permit shall remain valid while the renewal is being processed, provided the existing permit is renewable. However, permittees may not take listed species beyond the quantity authorized by the original permit or change the scope of the HCP. If permittees fail to file a renewal request within 30 days prior to permit expiration, the permit shall become invalid upon expiration. Permittees must have complied with all annual reporting requirements to qualify for a permit renewal.

8.6 PERMIT TRANSFER

In the event of a sale or transfer of ownership of the property during the life of the permit, the following will be submitted to USFWS by the new owner(s): a new permit application, permit fee, and written documentation providing assurances pursuant to 50 CFR § 13.25 (b)(2) that the new owner will provide sufficient funding for the HCP and will implement the relevant terms and conditions of the permit, including any outstanding minimization and mitigation. The new owner(s) will commit to all requirements regarding the take authorization and mitigation obligations of this Plan unless otherwise specified in writing and agreed to in advance by USFWS.

8.7 OTHER MEASURES REQUIRED BY DIRECTOR

The IA, which contractually specifies the roles, responsibilities, obligations, and procedures under the Plan, will be developed cooperatively between the 10 co-permittees and USFWS as this draft HCP is reviewed and finalized. The IA will be included as an appendix to the final Plan.

9. FUNDING

The ESA and the implementing regulations (50 CFR §§ 17 and 222) require HCPs to specify the measures the permittees will adopt to ensure adequate funding for the HCP. The HCP reflects a commitment by the ECPO landowners to restrict the future use and economic value of their private lands identified for preservation. Approximately 107,000 acres of land owned by the permittees will be designated under the Plan for Preservation/Plan-Wide Activities and Very Low Density Use. The current value of those lands is conservatively estimated to total over $550,000,000, based on current approximate land values of $10,000 per acre for cropland and citrus land, and $5,000 per acre for pasture land, range land, and native lands.

Accordingly, a significant cost of the Plan involves the landowners' foregone opportunity to develop these lands for residential, commercial, or other purposes that could generate additional revenue and increase the economic value of the land. The ability of the landowners to pay these "costs" of the HCP – the preservation of their lands – is assured by their ownership of those lands. In addition, as described below, per-unit fees tied to the sale of residential housing within the HCP Area will be used as necessary to pay for maintenance of the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use, such as removal of exotic vegetation. The per-unit fees are expected to be approximately equivalent to $200 multiplied by the number of times a unit is expected to be transferred over a 50-year term. The precise dollar value of these "costs" is difficult to estimate prior to knowing the actual nature, type, and extent of development, but tying these fees to the sale of housing and making their payment enforceable conditions of the ITP ensures these costs will be paid. Finally, the Marinelli Fund created under the Florida Panther Protection Plan (FPPP) is expected to be used for panther conservation initiatives that go beyond the Plan, undertaking such activities as habitat restoration, corridor enhancement, construction of panther crossings, and other conservation activities. As further described below, for each PHU generated from a Stewardship Sending Area (SSA) within the HCP Area, monies will be contributed to the Marinelli Fund by the landowners in accordance with an established formula.

A Memorandum of Understanding (MOU) between the permittees (referred to as the "Rural Landowners" in the MOU) and Audubon of Florida, Collier County Audubon Society, Inc., Defenders of Wildlife, and the Florida Wildlife Federation, Inc. (referred to collectively as the "Conservation Organizations" in the MOU) was signed on June 2, 2008 to establish the framework of the FPPP. A copy of the MOU is available at http://www.floridapantherprotection.com/. The MOU explained that framework as follows:

> The purpose of the Florida Panther Protection Program … is to facilitate the management and protection of panthers within the Enhanced Protection Area [i.e., the RLSP/HCP Area] by providing a contiguous range of preserved panther habitat in the Enhanced Protection Area to assist recovery through the use of buffering against panther-human interaction, locating and construction of panther crossings, and the protection, enhancement, restoration, including corridor enhancement or restoration, or acquisition of panther habitat demonstrated to be important to panther protection and management within the Enhanced Protection Area based upon a technical review and analysis of available data.... (MOU at 7.)

The MOU acknowledged that in addition to the collaborative efforts of the parties, Conservation Organizations, USFWS and FWC, a dedicated funding source would be required to achieve the FPPP objectives. The Fund is tied directly to the generation of panther habitat units (PHUs; see Chapter 4, section 4.2.2):

> For each PHU generated from [a Stewardship Sending Area (SSA)] established within the Collier RLSA, the Rural Landowners agree to make a contribution to the Florida Panther Protection Fund of (i) an amount equal to 10% of the sales price of the PHU for each PHU transferred or sold to third persons for such purposes hereafter provided, or (ii) the lesser of $75 or 10% of fair market value for each PHU used internally or as part of a joint venture by a Rural Landowner [as such $75 sum is adjusted periodically to account for adjustments in the Consumer Price Index] …, whether such SSAs were designated prior to the Effective Date of this MOU, or the effective date of the FWS Agreement. (MOU at 9.)

"Stewardship Sending Areas," are conservation areas set aside under the RLSP to entitle development activities at the local level. The RLSP operates at the county level for local planning and entitlements, while the Plan complements these local planning efforts with listed species protection at the federal level.

The MOU further provides that, to augment the contributions tied to PHU generation, a fee-based mechanism tied to implementation of the Covered Activities will be implemented. The use and details of the fee-based mechanism will be developed and refined in coordination with USFWS, but it was originally contemplated that $200 would be collected for "each sale of residential housing (both initial sale and resale) located within the Collier County RLSA." (MOU at 10.)

The administration of the Fund is described as follows in the MOU:

> The Florida Panther Protection Fund shall be administered by an independent nonprofit tax exempt entity governed by a Board of Directors comprised of representatives of Audubon of Florida, Collier County Audubon Society, Inc., Defenders of Wildlife, Florida Wildlife Federation, Fish and Wildlife Service, Florida Fish and Wildlife Conservation Commission, and a representative of the Rural Landowners (collectively, the "Florida Panther Protection Fund Board of Directors"). The Florida Panther Protection Fund Board of Directors shall prioritize the utilization of and authorize the expenditure of the Florida Panther Protection Fund to achieve the purposes described herein and, in doing so, give appropriate consideration to the area from which the funds were generated. The Florida Panther Protection Fund shall be held by the Wildlife Foundation of Florida, Inc. and used as approved by the Florida Panther Protection Fund Board of Directors. The Florida Panther Protection Fund Board of Directors will receive copies of federal easements to protect the Florida Panther and easements created in SSAs under the Collier RLSA and the Rural Landowners will facilitate delivery of same. The Florida Fish and Wildlife Conservation Commission shall be named as a co-grantee in easements created in SSAs under the RLSA Program. At the suggestion of the Conservation Organizations, the Florida Panther Protection Fund will be named the "Paul J. Marinelli Florida Panther Protection Fund" in honor of Paul Marinelli for his vision in bringing the Parties together. (MOU at 10.)

The Fund will fulfill the purpose of the FPPP, “to facilitate the management and protection of panthers within the Enhanced Protection Area [i.e., the RLSP/HCP Area] by providing a contiguous range of preserved panther habitat,” MOU at 7, which aligns with the overall goals and conservation activities of the Plan. Refinements to the Fund mechanisms, uses, administration, and assurances will be developed in concert with the final HCP document, IA, and ITP.

10. ALTERNATIVES

ESA section 10(a)(2)(A)(iii) and 50 CFR §§ 17.22(b)(1)(iii) and 17.32(b)(1)(iii) require that an HCP describe the alternatives considered by the applicant and the reasons why those alternatives are not proposed by the applicant. This section describes four alternatives: a No Action Alternative; the Proposed HCP; a Panther Only HCP Alternative; and a Panther Review Team (PRT) Configuration Alternative.

All of the alternatives would occur within the same overall 152,124-acre HCP Area described herein, which reflects the applicants' land ownership, as depicted in Figure 2-1. In all four alternatives, current agricultural and rural land uses would be expected to continue indefinitely over some of the area, and other portions of the area would be undergo new land uses in accordance with current zoning such as residential or commercial development, earth mining, and similar activities.

All of the alternatives occur within the Collier County Rural Land Stewardship Program (RLSP) area. As noted in Chapter 4, the RLSP defined approximately 70,892 acres primarily consisting of previously-converted agricultural areas as generally "Open" to future development. The permittees could have proposed residential or commercial development activities on previously converted agricultural lands throughout these 70,892 acres of "Open" areas. In addition, within the RLSP area, property owners can exercise development rights at a density of one dwelling unit per five gross acres under existing baseline standards. The RLSP creates incentives, however, for property owners to protect environmentally sensitive lands in the RLSP area permanently in exchange for "stewardship credits" that allow development in other parts of the RLSP area at higher densities than baseline zoning would otherwise allow. Compact development at higher densities can occur within areas that have been mapped as having lower natural resource values through the use of the credits. Entry into the RLSP is an option for property owners under all four alternatives.

The No Action Alternative is different from the other three alternatives, in that it does not include an integrated plan beyond the application of local land use regulations. As such, a wide variety of future land uses and configurations are possible under the No Action Alternative. The other three alternatives would provide greater certainty as to the locations of future development and other permitted activities, and would allow for landscape level planning of preservation and conservation activities. Those three alternatives differ primarily in the number of species covered and the configuration of lands designated for Covered Activities. The following sections provide a brief description and analysis of each of the four alternatives.

10.1 NO ACTION ALTERNATIVE

The No Action Alternative does not include the issuance of an ITP or the implementation of a HCP program. Under the No Action Alternative, the agricultural, ranching and other rural activities that have historically occurred throughout the HCP Area would be expected to continue indefinitely throughout the entire HCP Area. These activities include, but are not limited to, the following:

- Crop Cultivation;

- Ranching/Livestock Operations;
- Forestry and Silviculture;
- Recreation;
- Exotic and Nuisance Species Control;
- Lodges, Hunting/Fishing Camps; and
- Oil and Gas Exploration and Production.

In addition to these traditional rural land uses, the landowners would be free to pursue residential or commercial development activities on previously converted agricultural lands throughout the "Open" areas in the RLSP area. Accordingly, residential development could occur under baseline conditions of one dwelling unit per five gross acres, similar to the Golden Gate Estates development, located just west of the area. Property owners could also enter the RLSP to engage in residential and commercial development at higher densities, in exchange for setting aside environmentally sensitive lands as "Stewardship Sending Areas" ("SSAs"), or by purchasing stewardship credits from a property owner who had designated his land as an SSA.

Under the current RLSP, the maximum development footprint could potentially reach 87,000 acres, with 43,300 acres of higher-density Stewardship Receiving Areas ("SRAs") and 43,700 acres of remaining developable land that could be developed at the baseline conditions (1 dwelling unit per 5 acres). Proposed amendments to the Collier County comprehensive plan would structure the RLSP to accommodate up to a maximum of 45,000 acres of SRA development, by allowing agricultural lands to generate stewardship credits, and leaving no substantial acreage for baseline development (at 1 dwelling unit per 5 acres). The proposed amendments would also allow for the voluntary restoration of panther corridors as a means to generate stewardship credits. These proposed amendments were not adopted during the last comprehensive planning cycle, however, but could be adopted at a future time.

The No Action Alternative therefore could result in up to 87,000 acres of residential/commercial development under the current RLSP, and up to 45,000 acres if the proposed amendments were adopted. If these maximum scenarios actually occurred, full implementation of the RLSP would result in the protection of 92,000 acres of environmentally sensitive lands in both cases. The 92,000 acres would be protected through the use of stewardship easements that run with the land, but which also allow certain activities normally precluded by traditional conservation easements (e.g., row crop agriculture, citrus groves).

The difference between the current RLSP and the proposed RLSP amendments is that the current RLSP could result in the conversion of an additional 43,700 acres of agricultural lands, reducing the extent of agricultural habitats that could potentially benefit listed species. As compared to HCP alternatives, the RLSP does not require ecological monitoring (except for restoration activities), provisions for changed or unforeseen circumstances, or other elements required for HCPs, and does not provide the same

landscape-level planning and conservation as an HCP (which directs overall development to certain areas while identifying large, contiguous tracts for preservation).

Accordingly, the No Action Alternative would allow development on a project-by-project basis with no predefined development pattern (regardless of whether the proposed RLSP amendments are eventually adopted). Some projects would require federal permits, such as Clean Water Act section 404 permits if discharges of dredged or fill material to waters of the U.S. would be required, and ESA section 7 consultations between USACE and USFWS would be undertaken for those permits as required. For projects triggering formal ESA section 7 consultation, USFWS would issue biological opinions with Incidental Take Statement(s) authorizing incidental take, as appropriate, for the affected federally listed species.

10.2 PROPOSED HCP

The Proposed HCP (as described in Chapters 1-9) involves an HCP and ITP with a 50-year duration for all the Covered Species and Covered Activities within the HCP Area, implemented as described and depicted in this document (see Chapter 2; Figure 2-1).

Ten property owners (the applicants) reached agreement among themselves to design an HCP program that was economically and logistically feasible and that would benefit the Florida panther and other Covered Species.

The permittees designated 49,848 acres of land for Covered Activities, within which up to 45,000 acres of residential/commercial development and/or earth mining could occur. Each property owner designated a portion of their land for Covered Activities. The Plan was designed to work in concert with the RLSP.

Approximately 107,000 acres would be preserved under the Plan, to be placed under preservation in phased conservation easements as the Covered Activities are implemented. The Plan would cover the Florida panther, seven other federally listed species, one candidate species for federal listing, one species under review for federal listing, and six state-listed species. The primary biological goal of the Plan is to preserve in perpetuity the extensive interconnected habitat mosaics within the HCP Area, which provide habitats and movement corridors for the Florida panther and the 15 other Covered Species. The preservation of these vast areas and habitats benefits multiple species and creates opportunities for additional future conservation activities.

The Proposed HCP would achieve a panther conservation goal that has been sought for decades: a cooperative effort among private property owners within eastern Collier County to preserve the landscape-scale mosaic of habitats connecting the Florida Panther National Wildlife Refuge and Big Cypress National Preserve to the Okaloacoochee Slough State Forest and the Corkscrew Regional Ecosystem Watershed.

The HCP reflects and furthers the goals of the Florida Panther Protection Plan (“FPPP”). The FPPP is a collaborative effort between leading conservation organizations (Audubon of Florida, Collier County

Audubon Society, Defenders of Wildlife, and Florida Wildlife Federation) and the landowner applicants. The purpose of the FPPP is to undertake an environmentally and economically balanced program to better protect and manage the Florida Panther in Southwest Florida and assist in its recovery, including by securing a contiguous range of panther habitat connecting the Florida Panther National Wildlife Refuge and Big Cypress National Preserve through Camp Keais Strand and the Okaloacoochee Slough with Corkscrew Marsh and adjacent lands in the region. In addition to the activities undertaken through the Plan, the Marinelli Fund, which was founded by the FPPP and will be funded with monies arising from PHU generation associated with habitat preservation activities under the Plan, is expected to supplement the Plan through additional panther conservation activities around and within the HCP Area. The Marinelli Fund would be used "for panther habitat restoration, including restoration of the functional corridors, buffering against panther-human interaction, locating and construction of panther crossings, and acquisition of habitat demonstrated to be important to panther management within the [RLSP area]" (FPPP 2008).

10.3 PANTHER-ONLY HCP ALTERNATIVE

The Panther-Only HCP Alternative is similar to the proposed HCP, but addresses only the Florida panther and the Florida panther would be the only species covered under the ITP. Although an integrated long-term plan would be provided for Florida panther conservation, any conservation measures to benefit the other Covered Species would be determined on a project-by-project basis by the landowners and the relevant permitting authorities for those projects.

The Panther-Only HCP Alternative is similar in most respects to the Proposed Alternative, in terms of the total acreage of Covered Activities (45,000 acres), the configuration of lands designated for Covered Activities, and the lands designated for Preservation/Plan-Wide Activities, Very Low Density Use, and Base Zoning (see Chapter 2; Figure 2-1). The FPPP would provide the funding and direct the various panther conservation activities as described in the previous section.

The Panther-Only HCP Alternative would be effective for meeting the primary conservation goal of protecting extensive land areas for the Florida panther through an overall integrated plan, and would allow HCP efforts to focus on the panther. Because this alternative would not include the 15 other Covered Species, however, biological goals and objectives would not be established for those species and an integrated approach to their conservation within the HCP Area would not be included. Monitoring for these other species would not be required, missing a valuable opportunity to collect important data on their status, habitat utilization, and responses to variable environmental conditions on private lands, and similar conservation information.

10.4 PRT CONFIGURATION ALTERNATIVE

Under the PRT Configuration Alternative, the PRT map (discussed below) would be the basis for configuring the extent of Covered Activities within the HCP Area. Aside from differences in the specific location of Covered Activities, this alternative is very similar to the Proposed HCP.

In 2008, the FPPP parties assembled a team of panther biologists and landscape ecologists as a Florida Panther Protection Program Review Team (PRT), to determine whether the FPPP provided conservation benefits greater than or in addition to the current RLSP (the RLSP is effectively the No Action Alternative). The PRT performed a detailed technical review of the RLSP in terms of panther ecology and conservation, analyzed panther mitigation scenarios on the basis of PHUs and impacts to the panther primary zone, evaluated proposed RLSP amendments for preserving agricultural lands, examined the transportation network, and evaluated proposed panther corridors within the HCP Area.

The PRT recommended revisions to the RLSP overlay map, and mapped specific areas for consideration as additional preservation areas under the RLSP and an HCP or similar conservation agreement. The PRT reported that, "Such additional protection in specific areas will serve to guide planned development into areas of less value to Florida panthers, preserve additional acreages of most important habitats, provide buffers to habitats occupied by Florida panthers, maintain the integrity of the natural habitats of Okaloacoochee Slough and CKS [Camp Keais Strand], improve proposed movement corridors connecting larger patches of occupied habitat, and further minimize habitat fragmentation" (FPPPTRT 2009, 8).

The main difference between the PRT Configuration Alternative and the Proposed Alternative is the location and direction of areas designated for Covered Activities within the HCP Area. Figure 10-1, which was taken from the PRT report (FPPPTRT 2009, Figure 13) depicts the PRT recommendations in relation to the RLSP. Figure 10-2 depicts the lands designated under the HCP for Covered Activities, Plan-Wide Activities, and Very Low Density Use (from Chapter 2, Figure 2-1). The maps display a high degree of overlap in terms of the locations proposed for the Covered Activities. The primary difference between the maps is that Figure 10-1 includes additional preservation areas south of CR 858 and southeast of the Immokalee Urban Area; buffers added along the Camp Keais Strand and Corkscrew system; and different configurations and widths for panther corridors.

Overall, the Proposed HCP and the PRT Configuration Alternative are similar, with some differences in land designations. For example, the Proposed HCP configures the north corridor (Chapter 4, Figure 4-9) based on landscape linkages north of the HCP Area. Although both the PRT Configuration Alternative and the Proposed HCP would provide substantial benefits to the Florida panther and the other Covered Species, the permittees selected the Proposed HCP over the PRT for several reasons. First, some of the PRT's recommendations are not economically feasible, or are not logistically feasible based on land ownership configurations. Second, the PRT recommendations are outdated in a number of respects, in that some of the recommendations are no longer available based on activities that have proceeded in the five years since the PRT recommendation was made. Finally, the PRT Configuration Alternative would eliminate the landowner interests of some of the permittees, and is therefore not practicable or viable. On balance, the proposed HCP provides similar benefits to those proposed by the PRT in 2009 but, unlike the PRT Configuration, the proposed HCP reflects negotiation between the ten landowner applicants and is practicable and economically and logistically viable for the applicants.

10.5 ALTERNATIVE SELECTED

The permittees selected the Proposed HCP, which represents the culmination of many years of work by the permittees, wildlife agencies, conservation organizations, Collier County, and citizens to strike a careful balance between wildlife conservation, economic development, and the individual private land ownership rights and interests of the permittees.

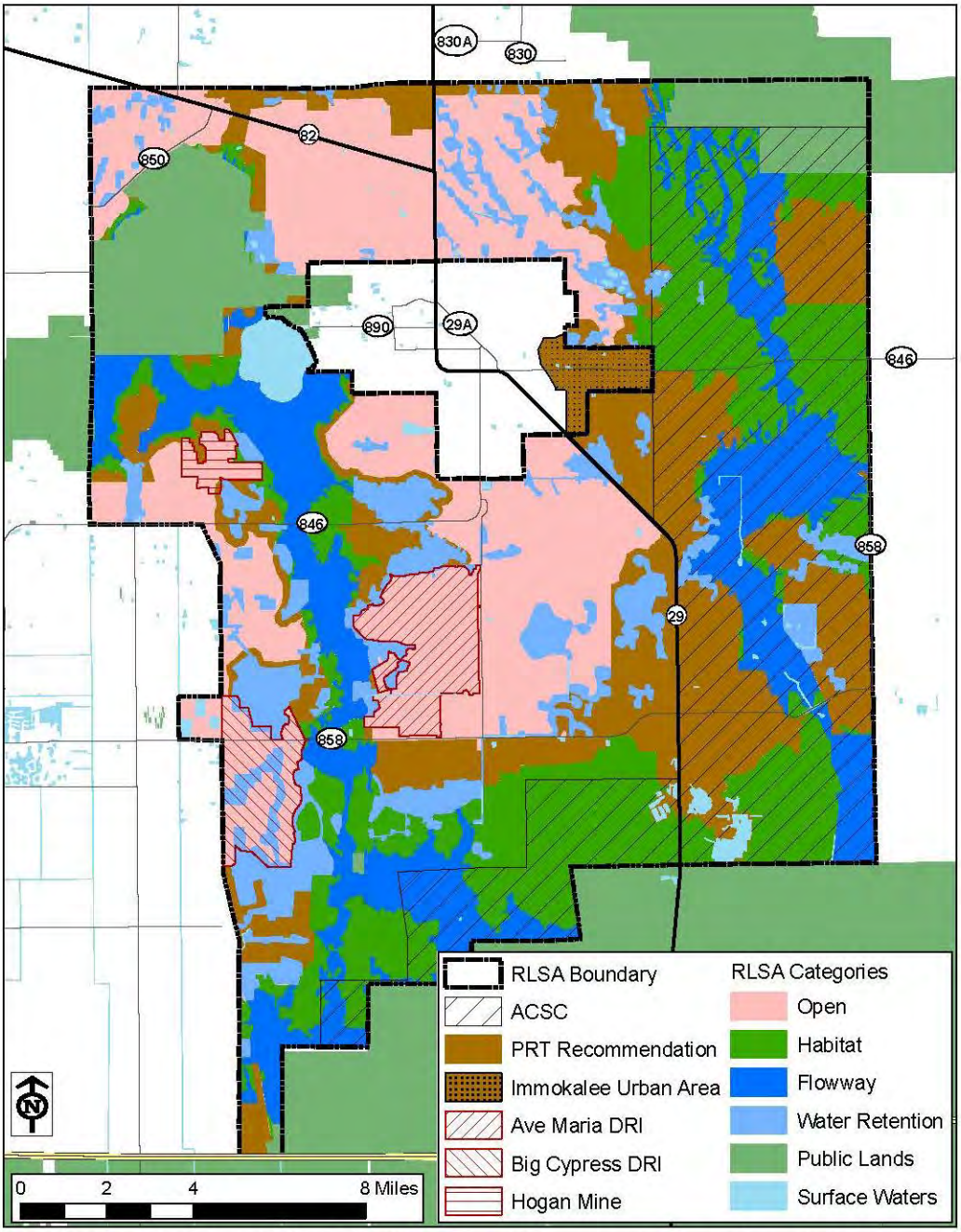

Figure 13. RLSA lands for which the Panther Review Team (PRT) recommends that land uses should be maintained at no greater than existing uses. Natural area restoration may be appropriate for some areas to enhance them as functional habitats for Florida panthers. It is the PRT's understanding that the Parties are recommending that RLSA Open Lands within the ACSC should be dedicated to Agricultural Preservation.

Figure 10-1: PRT Recommendations for the RLSP Area (from FPPPTRT 2009, Figure 13)

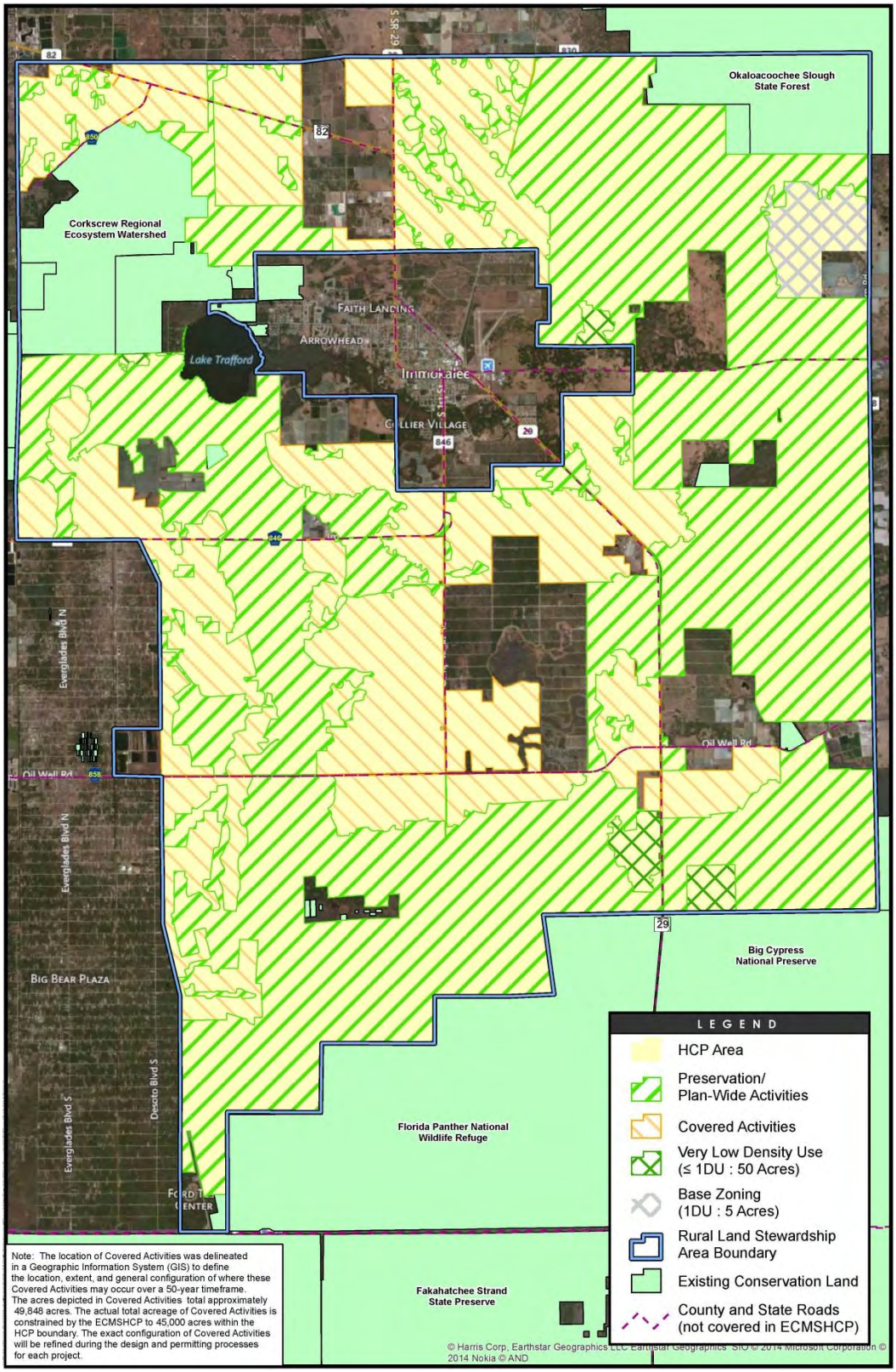

Figure 10-2: Land Designations under the Plan (from Chapter 2, Figure 2-1)

The PRT Configuration Alternative, though similar to the Proposed HCP, does not provide the balance of interests among the 10 permittees that is essential for plan viability. The property owners navigated several years of collaborative discussions, differences of opinion, balancing of individual interests, and final compromises that resulted in the Proposed HCP. Each permittee requires that the chosen plan be economically and logistically feasible for their particular property attributes and objectives over a 50-year permit duration, while accounting for uncertainties in future market conditions for agriculture, residential/commercial development, and other potential land uses. Those uncertainties, and the inherent difficulties in finding long-term compromise among 10 separate entities, are reasons that developing a viable HCP covering such a large area of diverse private property ownership takes years to complete.

The permittees have already invested considerable time, energy, financing, and patience in crafting a practicable plan as reflected in this document. The Proposed HCP represents the most viable opportunity for long-term, comprehensive conservation planning for the Florida panther and the 15 other Covered Species.

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