

EASTERN COLLIER MULTIPLE SPECIES HABITAT CONSERVATION PLAN

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Prepared for:

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For submittal to:

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EXECUTIVE SUMMARY

The Eastern Collier Multiple Species Habitat Conservation Plan (ECMSHCP or Plan) will permanently preserve 106,442 acres of privately held land worth an estimated \$1.4 billion that could otherwise be developed, to provide valuable habitat for the Florida panther and eighteen other protected species in Southwest Florida. The Plan will also cluster and direct up to 45,000 acres of development toward areas of less valuable habitat (primarily intensive row crop fields and citrus groves), permanently preserving wildlife dispersal corridors that provide crucial linkages between existing public conservation lands. Because the Plan is the result of a novel partnership between eleven private landowners and four leading conservation organizations, the substantial conservation benefit that the Plan will create will come at no direct cost to taxpayers.

The ECMSHCP is being prepared in connection with applications by several landowners in eastern Collier County, Florida, for Incidental Take Permits (ITPs) 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 ITP 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). The form of take anticipated to occur is, for most species, limited to unintentional “harassment” – e.g., a development activity that unintentionally annoys a species to the extent that normal behavioral patterns are disrupted. No intentional take (such as hunting, capturing or killing) will occur, and no such take authorization is requested.

The Plan is designed to more than fully offset any incidental take (e.g., unintentional harassment) that results from covered activities within the 45,000 acres of land identified as available for development (land that has lower habitat value for listed species). Specifically, the plan will provide permanent preservation and maintenance of 106,442 acres of land that is substantially more valuable to listed species and other wildlife than the 45,000 acres that will be available for development and will provide substantial 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 Florida and Audubon of the Western Everglades. 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 (RLSP)¹ by ensuring

¹ The RLSP is effective within the Rural Land Stewardship Area (RLSA), the boundaries of which are depicted in Figure 2-1. As explained in Chapter 1, the area covered by the Plan (HCP Area) is contained within the boundaries of the RLSA.

coordinated landscape-scale planning for future development, avoiding piecemeal development under the RLSP that could fragment valuable habitat, and providing revenue that will create a multi-million-dollar fund for species conservation activities.

Under the Plan, the primary mitigation for the covered activities includes the phased perpetual preservation of 106,442 acres of diverse habitats (Table 3-1), and the maintenance of these preservation lands in perpetuity. In addition to this primary mitigation, the implementation of the HCP will produce the multi-million-dollar fund revenues through dual funding mechanisms based on (i) contributions to be made on a per-acre basis as lands within the HCP Area are developed and (ii) transfer fees to be paid on a per-unit basis as homes within the HCP Area are sold and re-sold. These contributions will be deposited into the Paul J. Marinelli Fund, originally conceptualized 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 four conservation organizations that are members of the FPPP, two representatives of the landowner members of the FPPP, and one at-large member who will serve at the invitation of the other six members of the Board.

In 2016, the FPPP expanded the potential scope of the Fund's uses to include funding conservation activities to benefit other species covered by the ECMSHCP, in addition to panther.² The Marinelli Fund is expected to grow to approximately \$150 million during the 50-year term of the ITPs, and to be used for conservation activities that go beyond the Plan, including such initiatives as enhancement and management of the wildlife corridors within the preservation area; location and construction of panther and other wildlife fencing along and crossings under roadways; funding for land acquisition, enhancement, and/or management, to provide additional species habitat; and scientific research relevant to conservation of the species addressed by the HCP.

The FPPP will be implemented through the Plan. 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, eight species listed as threatened by the State of Florida, two species that are under review for federal listing, and one candidate species for federal listing.

Permanent Protection of 106,442 Acres of Private Lands Will Provide Valuable Habitat and Serve as A Critical Linkage For Species Movements Between Public Lands

The Plan will provide for preservation through permanent conservation easements of 106,442 acres of otherwise developable, privately owned lands within the approximately 151,442-acre HCP Area. These preserved lands will serve as habitat for the nineteen species covered by the Plan, as well as other wildlife, while allowing for economically productive land uses in smaller, clustered parts of the HCP Area. Under the Plan, the 106,442 acres of preserved lands will be placed under permanent protection through conservation easements for use by those species,³ and restricted to the types of rural and

² The Marinelli Fund and funding to support the ECMSHCP are described in greater detail in Chapter 9.

³ The conservation easements will be held by a State agency, such as the Florida Fish and Wildlife Conservation Commission (FWC), the Florida Department of Agriculture and Consumer Services (FDACS), the Florida Department

agricultural uses that have occurred historically throughout the HCP Area. The 106,442-acre area of preservation lands include areas that function as regional wildlife corridors, allowing for 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 a low proportion of native habitats, and most of the land is already disturbed. Based upon existing developments at Ave Maria and the design of planned developments at Rural Lands West (aka Collier Ranch), the 50-year buildout on 45,000 acres will comprise an estimated 91,480 dwelling units that will accommodate 174,000 residents. Development within these 45,000 acres will be offset by mitigation that includes the 106,442 acres of preservation. This will allow future population growth in Southwest Florida to be accommodated within a detailed regional plan that protects existing and future habitat and habitat linkages.

The Plan will offset the potential impacts of development through extensive preservation and perpetual maintenance of lands with high natural resource values, securing a vast area of interconnected habitats for the Florida panther and eighteen other covered species. Preserved lands will be placed under permanent conservation easements as development occurs. In addition, contributions to the Marinelli Fund will be made as lands within the HCP Area are developed, and as homes are sold.

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

USFWS, in cooperation with the U.S. Army Corps of Engineers, is in the process of preparing a final environmental impact statement (EIS) under the National Environmental Policy Act (NEPA) to evaluate the ITP applications and associated ECMSHCP. In March of 2016, USFWS published a public notice in the Federal Register describing the Plan and ITP applications, and announcing the start of a public scoping period, during which the public had the opportunity to provide comments regarding the scope of issues and alternatives to be included in the EIS. 81 Fed. Reg. 16,200 (March 25, 2016). A public scoping meeting was held in Naples, Florida on April 12, 2016, and USFWS received over 2,400 comments from Federal and State agencies, local government, non-governmental organizations, and private citizens, including businesses. In October 2018, USFWS published a notice in the Federal Register announcing the availability of the ECMSHCP and associated draft EIS for public review, and initiating a 45-day public comment period. 83 Fed. Reg. 53,078 (Oct. 19, 2018). Over 1,800 comments were submitted during the public comment period. The applicants reviewed and considered all public comments submitted,

of Environmental Protection (FDEP), or the South Florida Water Management District (SFWMD), and will identify the Service as a third-party beneficiary with enforcement rights.

provided USFWS with the applicants' responses to comments, and made revisions to the ECMSHCP to account for public comments as appropriate.

Success Will Be Ensured by Enforceable 50-Year Permits

This draft Plan establishes an overall framework for the permanent protection of 106,442 acres of land to benefit covered species. The requested 50-Year ITPs will be developed by USFWS to describe the specific mechanisms that will implement the framework described in the Plan. The Plan, which is the product of collaboration among landowners and conservation organizations, in coordination with State and Federal agencies, will provide a robust program for the protection of the Florida panther and the other eighteen species covered by the Plan, and will 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
CLC	Cooperative Land Cover
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
FDACS	Florida Department of Agriculture and Consumer Services
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
FPRIIT	Florida Panther Recovery Implementation Team
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
L RTP	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
NGVD	National Geodetic 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
RO	Reverse Osmosis
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
TDR	Transfer of Development Rights
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

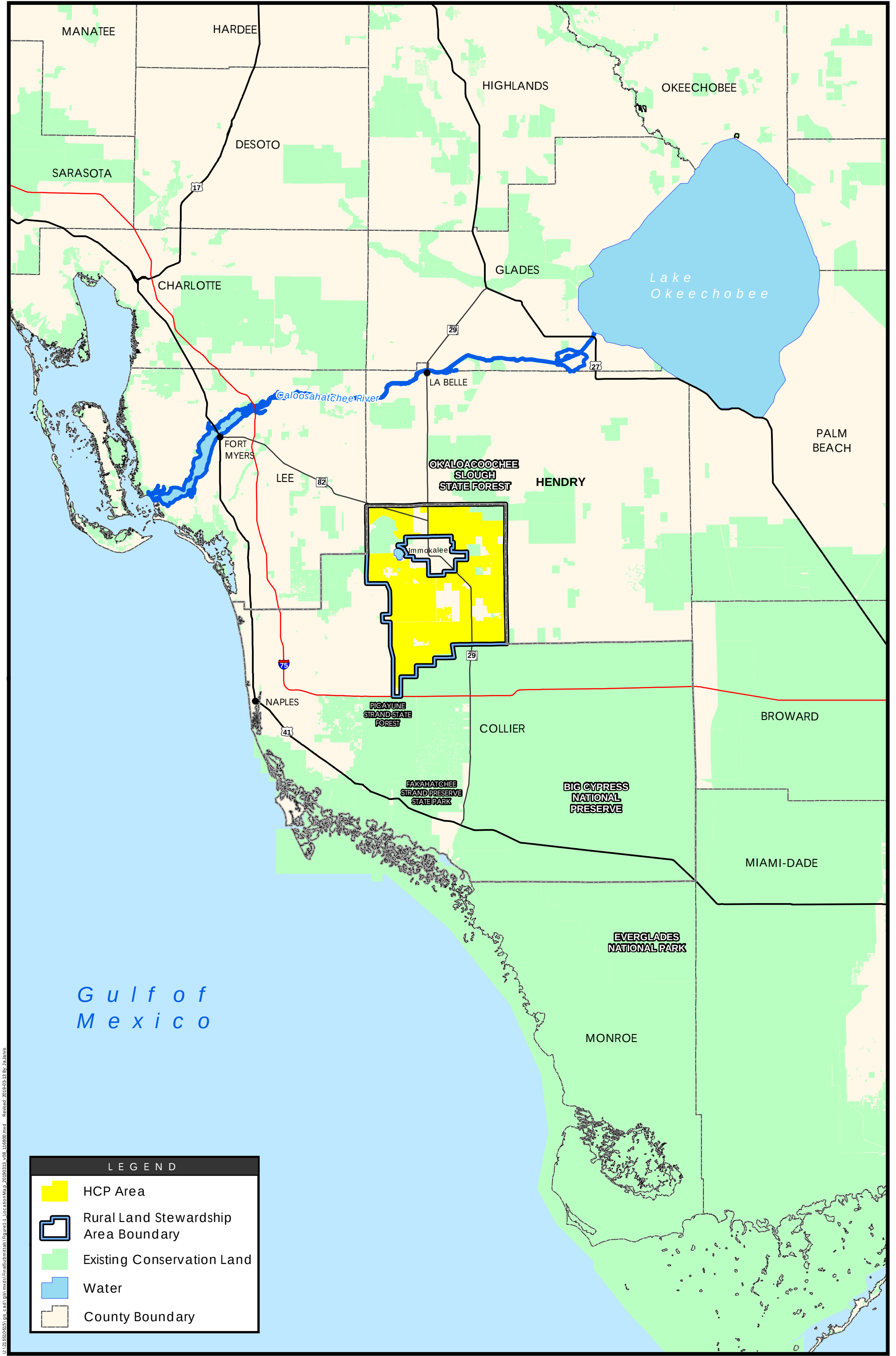
1.1 OVERVIEW/BACKGROUND

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 880,000 of the county's 1,300,000 acres protected (FNAI 2017).

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 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 30 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.) A recent panther annual monitoring report (FWC 2016b, 15) stated that "[c]onserving panther habitat on private lands is essential for advancing panther recovery throughout its range." 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 valuable tools that are needed to complement public land acquisition and management (Logan et al. 1993; Evans 1994; Maehr 1997;

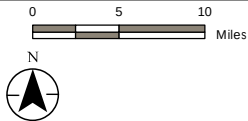


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FIGURE 1-1
Eastern Collier MSHCP Location Map
March 2019

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Kreye and Pienaar 2015). However, to date, the types of incentives offered to private landowners, and the conservation funding available to State and Federal agencies to engage private landowners, have been limited and largely ineffective.

Since 1981, State and Federal wildlife biologists have captured over 249 Florida panthers in Southwest Florida, and fitted them with radiotelemetry collars and, more recently, global positioning system (GPS) collars (FWC 2017a). 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, and many environmental non-governmental organizations (NGOs) 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 U.S. Fish & Wildlife Service’s (USFWS) “Habitat Conservation Planning and Incidental Take Permit Processing Handbook” (USFWS and NMFS 2016, hereinafter “HCP Handbook”) speaks to the type of situation that exists in eastern Collier County, and advocates striking a balance between agriculture, economic development, and species conservation:

Congress intended the HCP program to address listed and at-risk species in an ecosystem context, generate long-term commitments to conserve such species, and deliver regulatory assurances to project proponents. Congress also envisioned the HCP program as an opportunity to establish “creative partnerships” between the public and private sectors and State, municipal, and Federal agencies to conserve endangered and threatened species and their habitats (H.R. Rep. No. 97-835 (1982)). . . . Congress intended the HCP program to function not only to authorize incidental take, but also as a process to integrate non-Federal development and land-use activities with conservation goals, resolve conflicts between protection of listed species and economic activities on non-Federal lands, and create a climate of partnership and cooperation.

In that spirit, the Services should encourage permit applicants and partners to use Congress' intent as the foundation for working together to develop an HCP. Collaboration, flexibility, ingenuity, innovation, and thoughtful planning are key to developing effective HCPs and resolving complex and controversial issues that may arise.

(HCP Handbook at 1-2.) Indeed, the HCP Handbook notes that “[a]lthough some listed species are located on wildlife refuges, national parks, military bases, and other Federal lands, the majority of them are on non-federal lands [, and for that reason,] [t]he Services and other Federal agencies cannot recover those listed species alone.” (HCP Handbook at 2-5.) 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 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, continued agricultural use of lands, and economic development. This HCP 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 (ECMSHCP, or the Plan).

1.2 THE EASTERN COLLIER MULTIPLE SPECIES HABITAT CONSERVATION PLAN

The ECMSHCP 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 Plan, referred to herein as the HCP Area (depicted in Figure 2-1, *infra*). The Plan is required to support the applications submitted by several Collier County landowners for Incidental Take Permits (ITPs) under Section 10(a)(1)(B) of the ESA. 16 U.S.C. § 1539(a)(1)(B).⁴ The Plan provides a long-term (50-year) conservation and land-use planning framework for 151,442± acres⁵ 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 Chapter 3, Environmental Setting). The ultimate planning goal for this region is to ensure a long-term compatible balance of conservation, continued agricultural land use, and economic development that contributes to the protection, survival, and recovery of the species covered by the Plan.

This Plan arose from a collaborative effort among a group of landowners in eastern Collier County, Florida (the Eastern Collier Property Owners, or “ECPO,” described in section 1.3), and four leading conservation organizations, including Defenders of Wildlife, Florida Wildlife Federation, Audubon Florida and Audubon of the Western Everglades (hereinafter, ECPO’s “conservation partners”), along with 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

⁴ Citations hereinafter are only to the Act.

⁵ For the purpose of this Plan document, geographic information system (GIS) acreages are the best currently available estimates. Precise acreages will be determined during ITP processing.

panther also support many other federal and state-listed species, allowing for a multi-species approach for the Plan and ITPs. 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 three species – the gopher tortoise, eastern diamondback rattlesnake, and gopher frog – that are being considered for listing but are not currently federally-listed. The gopher tortoise is currently designated as a candidate species for federal listing within its Florida range, and also is listed as threatened by the State of Florida; the eastern diamondback rattlesnake and gopher frog are currently proposed for federal listing. The Plan also covers eight other non-federally-listed species that are currently listed as threatened 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). The landowners have submitted applications for ITPs that would provide take coverage for each of these species under section 10 of the ESA.

The USFWS (2002a, 73) 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 ITPs 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.

**Table 1-1. Covered Species for the Eastern Collier Multiple Species Habitat Conservation Plan:
federally-listed species.⁶**

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

¹ Federal status abbreviations (as of March 2019): 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	<i>Gopherus polyphemus</i>	C
Eastern diamondback rattlesnake	<i>Crotalus adamanteus</i>	Under Review
Gopher frog	<i>Lithobates capito</i>	Under review

¹ Federal status abbreviations (as of March 2019): C- Candidate species for federal listing; the gopher tortoise is also listed as Threatened by the State of Florida.

⁶ All federally-listed species are also protected by the State of Florida.

Table 1-3. Covered Species for the Eastern Collier Multiple Species Habitat Conservation Plan: species listed by the State of Florida (not federally listed).

COMMON NAME	SCIENTIFIC NAME	STATE STATUS ¹
BIRDS		
Burrowing owl	<i>Athene cunicularia</i>	T
Florida sandhill crane	<i>Antigone canadensis pratensis</i>	T
Little blue heron	<i>Egretta caerulea</i>	T
Roseate spoonbill	<i>Platalea ajaja</i>	T
Southeastern American kestrel	<i>Falco sparverius paulus</i>	T
Tricolored heron	<i>Egretta tricolor</i>	T
MAMMALS		
Big Cypress fox squirrel	<i>Sciurus niger avicennia</i>	T
Everglades mink	<i>Neovison vison evergladensis</i>	T

¹ State status abbreviations (as of March 2019): T –Threatened

1.3 PERMIT APPLICANTS AND PERMIT DURATION

As noted above, the ITP applicants are a group of landowners known as the Eastern Collier Property Owners, or ECPO. Collectively, ECPO members own approximately 85 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.; JB Ranch; Owl Hammock Immokalee, LLC; Pacific Land, Ltd.; and Sunniland Family Limited Partnership.

The duration of the ITPs 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 Plan elements and ITP conditions.

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 HCP Area is located within the boundaries of Collier County's Rural Land

Stewardship Area (RLSA) – the geographical area within which Collier County’s Rural Land Stewardship Program (RLSP) applies⁷ (see Figure 2-1) – and comprises approximately 151,442 acres of lands owned by the applicants, which do not include existing or future County and State roads within eastern Collier County. Over 20,000 acres of non-ECPO private property are located within the RLSA. Because the applicants do not own these lands, they are outside the HCP Area. These non-ECPO lands may later be voluntarily incorporated into the Plan through Certificates of Inclusion, and are therefore depicted in Figure 2-1 as lands “Eligible for HCP Inclusion (Non-ECPO Lands)” (see section 2.4). 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.

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 leading to the Caloosahatchee River and then northward into Central Florida. To the west are the privately owned 13,000-acre Audubon Corkscrew Swamp Sanctuary, which harbors the largest breeding colony of threatened 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 and other species, featuring important, landscape-scale habitat linkages (“critical linkages”) in perpetuity (Oetting et al. 2014). The avoidance, minimization, mitigation, and management actions proposed in the Plan and specified in the ITPs would promote and maintain these linkages.

The approximately 151,442-acre HCP Area – all of which is owned by ECPO members – occupies approximately 85 percent of the private lands within the RLSA in eastern Collier County. As described in greater detail in Chapter 2, the Plan designates 49,276 acres of lands, primarily within previously-cleared agricultural areas, where up to 45,000 acres of Covered Activities may occur. The remaining 106,442 acres, which include existing regional wildlife corridors that allow for wildlife movement among existing public conservation lands, will be permanently preserved under the Plan. Further enhancing the ratio of preserved areas to development, the 5,027-acre Town of Ave Maria will be included in the 45,000 acres where Covered Activities may occur, even though Federal permitting and section 7 consultation has been completed for the Town of Ave Maria, and the applicants do not seek take coverage for any species within this 5,027-acre area, reducing the maximum acreage of Covered Activities attributable to the ITPs to 39,973 acres. There are two parcels of land located within the RLSA (and the outer boundaries of the HCP Area) – the Hogan Island Quarry and the Immokalee Sand Mine – that are owned by ECPO members but are not included in the HCP Area or as Covered Activities because the Federal permitting process for each, including section 7 consultations, is either already complete or is expected to be complete by the time the ITPs are issued (depicted in Figure 2-1 as “Prior Federal Permitting Initiated”). Nonetheless, these two parcels are accounted for in the overall configuration and planning for wildlife corridors and other ecologically beneficial features of the Plan.

⁷ Please see section 1.7 for a description of the RLSP.

1.5 SPECIES TO BE COVERED BY PERMIT

The federally-listed species to be covered under the ITPs are listed in Table 1-1. These species are included in the online USFWS database of federally-listed and candidate species for Collier County (Information for Planning and Consultation database at: <https://ecos.fws.gov/ipac/location/index>). A candidate species for federal listing in Florida, the gopher tortoise (*Gopherus polyphemus*), is also included in the Plan, along with two species that are proposed for federal listing, the eastern diamondback rattlesnake (*Crotalus adamanteus*) and the gopher frog (*Lithobates capito*) (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. Federally-listed species that occur exclusively in marine environments, coastal ecosystems (beaches, mangroves, nearshore environments), and other environments are not present within the HCP Area and therefore are not included as Covered Species under the Plan. Only one plant species that occurs within Collier County – Florida prairie clover (*Dalea carthagenesis floridana*) – is federally listed. This species was listed as endangered on October 2017. 82 Fed. Reg. 46,691 (Oct. 6, 2017). However, the rocklands, costal uplands, and marl prairies that the plant inhabits are not found within the HCP Area. For this reason, no plant species are included in the Covered Species.

In addition to the federally-listed Covered Species, the Plan will cover eight 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 large 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 may result in the take of federally-listed species may apply for an ITP under section 10(a)(1)(B) of the Act to maintain 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. Under section 10(a)(1)(B) of the Act, the anticipated take to be authorized must be incidental, the applicant must “minimize and mitigate the impacts of” take “to the maximum extent practicable,” the authorized take must not “appreciably reduce the likelihood of the survival and recovery of the species in the wild,” and adequate funding for the plan 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 [federally-listed] species or result in the destruction or adverse modification of habitat of such species. ESA § 7(a)(2). “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.

Under ESA section 7, cumulative effects are effects of future State or private actions that are reasonably certain to occur in the action area, which is defined by the influence of direct and indirect impacts of the Federal action.

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

Although the Section 10(a)(1)(B) process is iterative and often non-linear, the process includes four primary phases: (1) pre-application; (2) development of the HCP and environmental compliance documents; (3) application processing, permit decision-making, and issuance of the ITP; and (4) the post-issuance phase, including implementation of the HCP and compliance monitoring.

During the first phase, USFWS provides guidance to prospective applicants, and determines the level of analysis required under the National Environmental Policy Act (NEPA) based on the nature and scale of the HCP.

During the second phase, the 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 per the HCP Handbook (USFWS and NMFS 2016, C-1):

- 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;
- a description of alternative actions that the applicant considered, 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) a draft HCP, (ii) an Implementing Agreement, if applicable, (iii) a permit application, and (iv) payment of a \$100 fee by the applicant(s). [HCP Handbook at 2-13.] USFWS is required to 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 under NEPA and is subject to public comment. As noted in the Executive Summary, USFWS published a notice of intent to prepare an EIS in the Federal Register in March 2016 (81 Fed. Reg. 16,200 (March 25, 2016)), held a public scoping meeting on April 12, 2016, and has begun drafting an EIS analyzing the proposed ITPs.

During the third phase, USFWS oversees the public review process and undertakes decision-making. This phase includes development by USFWS of a document that describes USFWS's findings and provides a basis for USFWS's permitting decision. The third phase ends with USFWS's permit issuance decision. Pursuant to ESA § 10(a)(1)(B), USFWS will issue an ITP if the following statutory criteria for issuance of the permit are met:

- 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 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 any additional measures that the Secretary of the Interior requires as being necessary or appropriate; and

- the Secretary of the Interior has received any other assurances, as may be required, that the HCP will be implemented.

The public is notified of permit issuance by publication in the Federal Register.

During the fourth phase, the permittee and other responsible entities implement the Plan, and the USFWS monitors the permittee's compliance with the Plan as well as the long-term progress and success of the Plan.

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 inform and involve the public. NEPA serves as an analytical tool to consider direct, indirect, and cumulative impacts of the proposed action and alternatives to help the USFWS decide whether to issue an ITP. The USFWS will complete a NEPA analysis 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 provide mitigation to address the impacts on cultural resources, if any, of authorizing incidental take of listed species.

1.7 COUNTY-LEVEL PLANNING AND ZONING

The Plan builds upon, and closely integrates with, Collier County's planning and zoning framework for lands within eastern Collier County. This section briefly summarizes the recent history of planning and zoning in eastern Collier County, the evolution of the County's innovative program to protect natural resources and agriculture while allowing for economic development, how that program underpins several key elements of the Plan, and how the Plan builds on the RLSP to provide significant conservation value beyond what is possible under the RLSP alone.

1.7.1 Background

In the late 1990s, the State of Florida challenged Collier County's comprehensive plan, contending that the required conservation elements would not sufficiently protect natural resources (including listed species and their habitats). Two environmental NGOs – which are now two of ECPO's conservation partners – intervened in support of the State. The challenge was upheld by a Florida administrative law judge in a March 1999 ruling. In June 1999, Governor Jeb Bush issued Final Order AC-99-02, which directed Collier County to perform an assessment of 195,000 acres in eastern Collier County (known as the "Immokalee Area Study"). Specifically, the order required that the assessment address long-term

planning issues in order to balance natural resource protection, agriculture, and economic development within the 195,000-acre area.

Between 1999 and 2002, the applicants collaborated with Collier County, conservation groups, consultants, local citizens, and State agencies to complete the assessment, and to develop new comprehensive planning strategies and policies that would satisfy the requirements of the State's Final Order. The initial efforts involved a thorough compilation, mapping, and synthesis of natural resource and land use data for the 195,000-acre area, to serve as an objective and verifiable basis for planning and natural resource protection. The datasets collected through this process were entered into a geographic information system (GIS) to allow for spatial analyses, data visualizations, data updating, and reporting. A report synthesizing this information was submitted to Collier County in December 2000.

Between 2000 and 2002, stakeholders utilized the GIS data to develop and test various scenarios for meeting the requirements of the Final Order. The stakeholders realized that any attempt to simply impose restrictive new zoning regulations would seriously compromise any chance of creating a broadly supported and viable long-term plan for the area. Collaborative stakeholder engagement likely would have ceased as a result of new zoning restrictions that would have effectively imposed the most restrictive burdens on those property owners who possessed the highest value natural resources, preventing those property owners from realizing the economic value of their land, including the benefits of future development and continued agricultural land use. Moreover, State of Florida statutes require that any such change that compromises private property vested rights (e.g., "downzoning" property) be considered a taking that must be compensated economically by the government entity imposing the change (Chapter 70, Florida Statutes). In short, simply imposing new zoning and/or land use regulations in eastern Collier County would likely have been counterproductive, logistically difficult, subject to protracted legal challenges, and ultimately unworkable.

As various scenarios were considered (with a 2002 Final Order deadline looming), the stakeholders understood that any effort to successfully achieve a long-term balance between agriculture, natural resource conservation, and economic development must recognize the potential economic value of *each* of these activities, and be available to all property owners within the 195,000-acre area. A breakthrough occurred when the parties concluded that economic development, primarily master-planned residential and commercial development, must be directly and quantifiably tied to permanent conservation benefits that could achieve the desired balance for future land uses. Ultimately, this collaborative process resulted in a system for calculating "credits" generated by protecting environmentally sensitive lands, and established procedures for calculating how many credits would be required to entitle a proposed development. Although the system possessed some similarities to Transfer of Development Rights programs, this system provided more economic and regulatory incentives to protect the highest-quality natural environments and allowed more flexibility to property owners for relinquishing various land-use rights. The resulting system was carefully calibrated, using GIS, to generate a total number of credits that could entitle a maximum development footprint within the 195,000-acre area. The plan was designed as a "closed system," so a maximum development footprint would leave the balance of the area as agricultural lands and native habitats.

This credit system became the basis for new planning policies and amendments, and was codified as the Collier County Rural Land Stewardship Program (RLSP).⁸ The RLSP, approved by Collier County and the State of Florida in 2002, offers landowners a voluntary alternative to existing zoning, at the option of the property owner, and provides for a more strategic and environmentally sensitive balance between conservation and development. Because entry into the program is purely voluntary for each property owner, no downzoning or property rights issues are triggered. As of this writing, the RLSP has operated continuously for nearly 17 years and has proven successful in meeting the policy goals for balanced economic development, agricultural land use, and permanent protection of environmentally sensitive lands.

1.7.2 Rural Land Stewardship Program (RLSP) Basics

Prior to the 2002 adoption of the RLSP, the zoning in eastern Collier County was (and to this day remains) one dwelling unit per five-acre area. 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” (see Figure 2-1, aerial imagery on left side of figure).

The RLSP did not change the underlying zoning of eastern Collier County, for the reasons outlined in the previous section. Rather, the RLSP operates as a zoning overlay, where the standards and criteria defined for the RLSP are applicable only if a property owner within the RLSA voluntarily elects to enter the program. The RLSP created a purely voluntary framework under which property owners may elect to participate when they wish to develop their property at densities greater than one dwelling unit per five acres, when they wish to set aside environmentally sensitive lands for protection, when they wish to receive credit for permanently limiting land uses to agriculture, and/or when they want to undertake other allowable activities incentivized by the program.

The RLSP creates incentives for property owners to protect environmentally sensitive lands (sending areas) permanently, in exchange for “stewardship credits” that can be used, traded, or sold to entitle compact forms of development (receiving areas) at higher densities than baseline zoning. RLSP policies mandate that compact development at higher densities can only occur within those areas that have been mapped as having limited natural resource values (i.e., previously cleared areas), and then only through the use of stewardship credits. The RLSP does not, however, require or provide an incentive for coordination among separate landowner participants. Stewardship credits are only recognized after a perpetual “Stewardship Easement” is recorded for the land parcel being protected. The easement runs with the land in favor of Collier County and a State agency such as the Florida Department of Agriculture and Consumer Services (FDACS), the Florida Department of Environmental Protection (FDEP), or the South Florida Water Management District (SFWMD).

⁸ The acronym “RLSP” is used throughout this document to refer to the Rural Land Stewardship Program and its associated elements. The Collier County Land Development Code (LDC), which implements the RLSP, utilizes the acronym “RLSA” to refer to the Rural Land Stewardship Area, the geographic area within which the County’s RLSP policies and codes apply.

Under the RLSP, the local approval process for sending areas and receiving areas involves applicant submittal of a technical report that characterizes the sending area's natural resources and credits generated, a rigorous application review by county planning and environmental staff, issuance of a staff report to the Collier County Board of County Commissioners, a public hearing before the commissioners (with a minimum 15 days' notice in local newspapers), and majority approval of a resolution by the Board. Easements are recorded in the official County records after Board approval.

For property owners who enter the RLSP and seek to develop land at densities greater than existing zoning, Collier County will not issue any development approvals until the owner obtains (generates or purchases) the quantity of stewardship credits necessary to entitle the development. In essence, this mechanism ensures that the construction of higher-density development (receiving areas) cannot commence until after the associated sending areas are under permanent protection with recorded easements.

The stewardship credit system was calibrated in a manner that protects several acres of native habitat and/or open space in exchange for one acre of higher-density development (the exact ratio depends upon habitat quality and other environmental factors). Implementation of the RLSP is intended to preserve 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 questioned whether the program would protect environmentally sensitive lands as planned. To date, however, over 50,000 acres have been designated for future 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.⁹ 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 2009a).

The five-year review resulted in a recommendation that residential and commercial development be capped at 45,000 acres within the RLSA. In order to reach that development cap, the balance of the HCP Area (106,442 acres, or 70 percent) would be protected permanently, in return for sufficient stewardship credits to entitle the development. Another recommendation was to increase the incentives for agricultural preservation, in order to preserve open space, agriculture, and the rural

⁹ Of these 50,000 acres of stewardship sending areas (SSAs), 17,000 acres have been permanently preserved through transfer of stewardship credits to a stewardship receiving area (SRA). The 17,000 acres was preserved under the RLSP to allow the development of the 5,027-acre town of Ave Maria, which is located within the HCP Area. Approximately 16,000 of the preserved acres are within the HCP Area. As explained in Chapter 4, although the town of Ave Maria and its associated preservation were considered in the landscape-level planning of the HCP Area and the 5,027-acre town of Ave Maria counts toward the 45,000-acre cap on Covered Activities under the Plan, the applicants do not seek take coverage for the 5,027-acre portion of the Covered Activities area that consists of the town of Ave Maria. In addition, because the town of Ave Maria was previously assessed in terms of potential impacts and mitigation during Federal permitting (USFWS 2005; USFWS 2018c), the acreages of both the town and the panther mitigation previously assessed for Ave Maria (approximately 6,293 acres within the HCP Area) were removed from the panther habitat unit (PHU) calculations for the Plan. See discussion at Chapter 4. The remainder of the preserved acreage within the HCP Area (approximately 10,000 acres) was included in the PHU calculations for the Plan because preservation under the RLSP does not provide the same level of habitat protection and benefits as incorporation in a larger landscape scale HCP and separate preservation under the HCP conservation easements that afford additional habitat protections and federal enforcement provisions.

economy. This landscape-scale mosaic of native habitats and agricultural uses currently supports the Covered Species, as well as other species.

Since 2002, the RLSP policies have been implemented through the Collier County Land Development Code, which provides the detailed standards, procedures, protection mechanisms, site design criteria, and related program elements. The documentation may be accessed online at: https://library.municode.com/fl/collier_county/codes/land_development_code; see Section 4.08).

Several aspects of the RLSP provide assurance that the protection of environmentally sensitive lands (sending areas) will precede any local approvals to begin development activities within designated receiving areas:

- Lands within the RLSA cannot be developed at densities greater than existing zoning (1 dwelling unit per 5 acres) unless a property owner voluntarily enters the program;
- Stewardship credits can only be generated (and officially recorded in the County ledger) through the designation of environmentally sensitive lands as sending areas, which requires the recording of perpetual easements over those lands;
- A receiving area (and its associated development plans) cannot be approved by Collier County unless/until the applicant can demonstrate that it possesses a sufficient number of stewardship credits;
- Therefore, no construction activities within receiving areas may commence until the Collier County staff and the Board of County Commissioners have verified that the required stewardship easements over the associated sending areas have been recorded; that the applicant possesses a sufficient number of credits to entitle the development; and the receiving area development plans are in compliance with the Collier County Land Development Code, Section 4.08.
- Stewardship credits can only be generated and utilized within the RLSA. The system was initially calibrated to limit the extent of potential future development. Current proposed RLSP amendments would enforce a strict cap for receiving areas of 45,000 acres total, and the system would be recalibrated to achieve that policy goal.

Many factors provide assurance that the RLSP will remain in place through the 50-year term of the ITP:

- The RLSP has been in place for nearly 17 years, and the program is working as designed;
- The RLSP is considered a great planning success by Collier County commissioners, staff, and RLSP stakeholders;
- The first development under the RLSP – the Town of Ave Maria – brought mixed-use economic development to the area and preserved over three acres of environmentally valuable lands for every acre of development;

- The tax base for Collier County is increased by the new developments, and the sending areas (placed under perpetual easements) remain on the County tax rolls;
- All of the requirements of the 1999 Final Order are satisfied through the adoption and implementation of the RLSP.

The RLSP is unlikely to be changed substantially or replaced. If the RLSP were discontinued, all of the benefits listed above would cease. The county's comprehensive plan would no longer be in compliance with State regulations, and new natural resource protection measures would need to be developed for eastern Collier County (a process that spanned three years until the RLSP was created). There would be a high likelihood of litigation resulting from any new comprehensive plan element for the area, brought by property owners and/or third-party challenges. In short, the RLSP is working so well, and the downsides of changing it substantially are so great, that the probability of such change is exceptionally low.

1.7.3 Added Benefits of the Plan

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 Plan builds upon the goals of the RLSP and increases substantially the conservation benefits that are possible under the RLSP to create a long-term balance between environmental preservation, listed species protection, agriculture, and economic development.

The Plan will integrate with and reinforce the RLSP elements addressed in the section above. 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 Certificates of Inclusion, if acceptable to USFWS (see section 2.4). The Plan itself limits future development to those lands depicted on Figure 2-1 as "Covered Activities," and caps that development at 45,000 acres. Additionally, under the terms of the ITPs, any development within the HCP Area must provide compensation for panther habitat loss in the form of panther habitat units (PHUs; see Chapter 4). The Plan verifies that sufficient PHUs can be generated by the 106,442 acres set aside for protection in perpetuity.

In addition, the Plan will use the framework provided by the RLSP to provide benefits that extend well beyond those that would be possible through the purely voluntary RLSP alone. These benefits include the following:

- Creation of a binding mechanism that will permanently preserve and maintain 106,442 acres of privately-held land which could otherwise be developed;
- Landscape-level planning that will result in greater conservation benefits than would exist under uncoordinated participation in the RLSP, including systematic preservation of regional wildlife habitat corridors that allow for movement of wildlife among existing public conservation lands in Southwest Florida;

- Incorporation and implementation of the Florida Panther Protection Program (FPPP)¹⁰, a collaboration between ECPO and several leading conservation organizations that integrates a variety of programs, studies, and strategies to enhance and fund a science-based program “to better protect and manage the Florida panther in southwest Florida.” (FPPP 2008).
- Creation and funding of the Marinelli Fund, which will be used for conservation activities that will benefit the Florida panther, as well as other wildlife;
- Coordination with the Service and FWC and continuing oversight by the Service; and
- Additional monitoring required under the ITPs that is not required under the RLSP.

The requested term of the ITPs – 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.

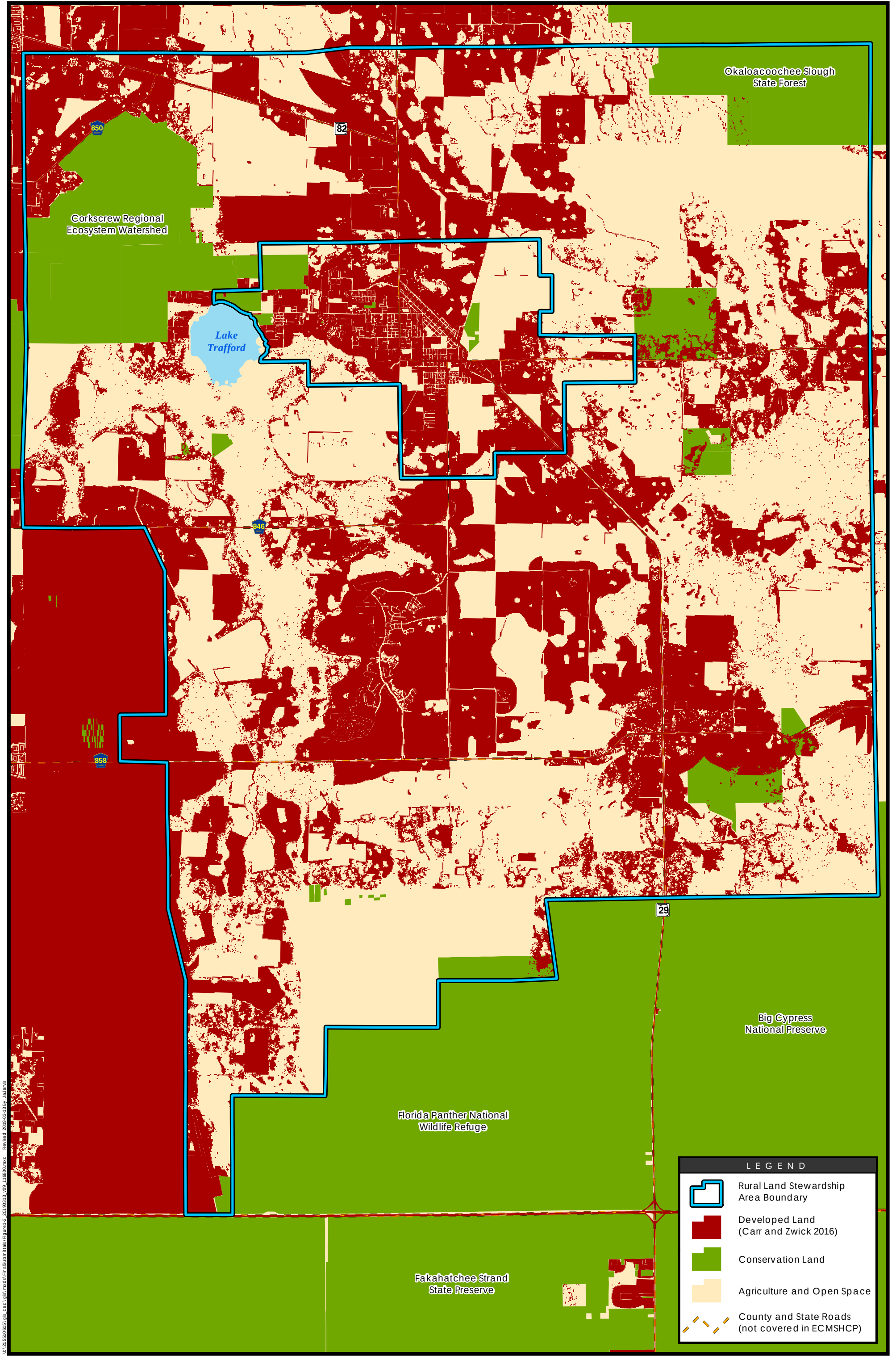
1.8 SUMMARY OF ALTERNATIVES TO THE ECMSHCP

Chapter 10 of this document describes four basic alternatives considered by the applicants (ECPO), and the reasons why the Plan emerged as the most practicable viable alternative. The four alternatives included: Existing Zoning (no HCP); the Proposed HCP (Plan); a Panther-Only HCP; and a Panther Review Team (PRT) HCP Configuration.

When assessing these four alternatives, it is useful to consider a 2016 academic study of statewide population growth and projected land use, and specifically the projected land use patterns for eastern Collier County. The widely cited “Florida 2070” report (Carr and Zwick 2016) utilized population projections from 2010-2070, the existing gross urban densities (as of 2010), and estimates of developable land (considering proximity of urban centers; absence of wetlands; soil ratings; road densities; and other factors) to model population distributions on 1-acre grid cells in GIS.

Figure 1-2 depicts the Florida 2070 data within the RLSP. In this modeled scenario, approximately 135,000 acres of land would be developed and populated. This 2070 scenario would impact much of the native habitat acreage in eastern Collier County and would disconnect and fragment regional flowways and wildlife corridors. In short, Figure 1-2 depicts one scenario of how unplanned development patterns contrast with the preservation of unfragmented habitats and habitat linkages under the proposed HCP (Figure 2-1).

¹⁰ “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 analysis of available data...” (excerpt from FPPP MOU between Rural Landowners and Conservation Organizations, June 2008).



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FIGURE 1-2
Florida 2070 Projected Development
March 2019

Stantec Consulting Services Inc.
5801 Pelican Bay Blvd, Suite 300
Naples, FL 34108
tel 239.649.4040
fax 239.263.6449

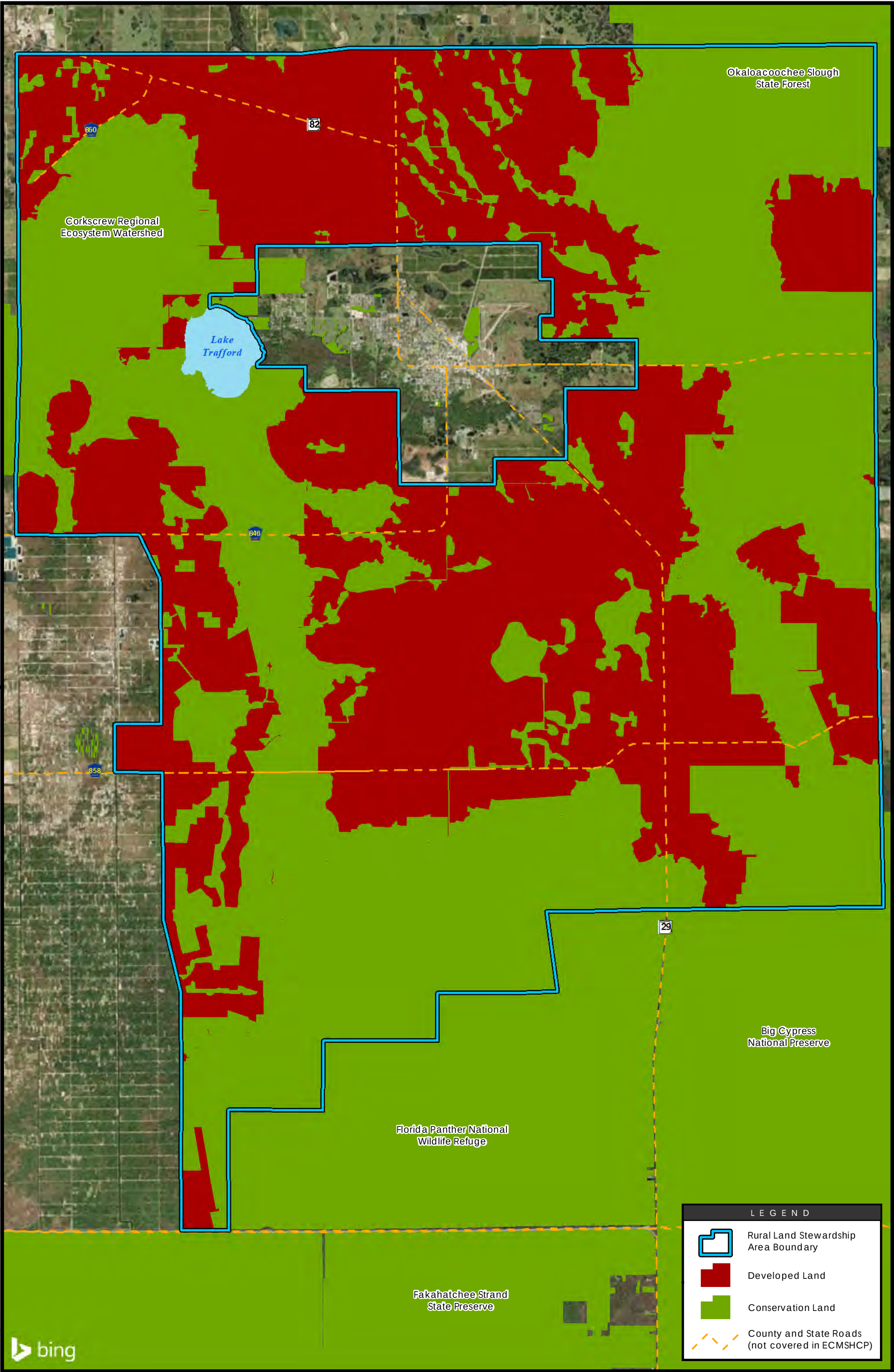


The existing Collier County zoning within the HCP Area allows for one dwelling unit per five-acre area, and thus defines one baseline alternative to the Plan. Figure 1-3 illustrates the extent of potential development for the “Existing Zoning” alternative, using the same color scheme as Figure 1-2 to allow for visual comparisons. Under the existing program, over 90,000 acres of land within the RLSP area are designated as “Open” to allow potential development. Approximately half of this acreage could be developed if property owners voluntarily entered the RLSP and developed within receiving areas. Those owners who voluntarily chose not to enter the program and elected to develop at the existing 1:5 zoning could develop the other half of the “Open” lands, bringing the total development footprint (RLSP and existing zoning) to over 90,000 acres. This scenario would preserve the core of the regional flowways, large blocks of habitat, and wildlife corridors, but would preserve far less land and native habitats than the proposed HCP.

The proposed ECMSHCP (Plan), schematically depicted in Figure 2-1, occupies 151,442 acres within the RLSP, and proposes up to 45,000 acres of development (see Chapter 2). The balance of the HCP Area, 106,442 acres, would be placed under perpetual easements that run with the land (see section 2.2). The proposed Plan limits potential development, preserves the greatest land acreage, preserves the greatest extent of native habitats, and protects the existing flowways and wildlife corridors within the RLSP. The proposed Plan provides an integrated conservation plan for the Florida panther and eighteen other species on a landscape scale, while the other alternatives lack a long-term plan and would result in ad-hoc development patterns and mitigation.

The third alternative, a “Panther-Only HCP,” would cover the same land area as the proposed Plan (Figure 2-1), but would only cover the Florida panther under the terms of the ITPs. The eighteen other Covered Species would be evaluated by the relevant permitting authorities on a project-by-project basis, and conservation actions for those species would be determined for each project. While the panther would benefit from an integrated conservation plan under the ITPs, the other species would not be “Covered Species.”

The “Panther Review Team (PRT) Configuration” alternative accommodated up to 45,000 acres of development, as does the proposed HCP (see section 10.4). Although much of the potentially developable land area in this alternative overlaps with the proposed Plan, the PRT configuration proposed some additional area for preservation, additional buffers along the Camp Keais and Corkscrew systems, and different configurations for two panther corridors. However, the PRT alternative included approximately 13,000 acres of non-ECPO lands outside the HCP Area in its analyses (see Figure 2-1 and section 2.4). While those lands could eventually be included in the Covered Lands, they are not currently in the Plan. Additionally, the configuration of ECPO land ownership and landowner interests do not align with the PRT configuration, rendering the alternative impracticable.



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In summary, the proposed Plan represents the alternative that provides the best opportunity for perpetual preservation of habitats for the Florida panther and the eighteen other Covered Species. The applicants control over 71,000 of the 90,000 acres of the lands designated as “Open” to potential development under the RLSP. Under the HCP, the applicants will limit their development within the RLSA to a maximum of 45,000 acres. In comparing the proposed HCP to a “Panther-Only HCP,” there are clear conservation and regulatory benefits to including the eighteen other Covered Species. Finally, although the PRT alternative proposed a similar development footprint as the proposed HCP, the PRT configuration includes non-ECPO lands outside of the HCP area, and does not align with ECPO land ownership patterns and landowner interests. The proposed HCP therefore represents the most practicable alternative.

1.9 CONCLUSION

The Plan furthers the goal of panther conservation, and conserves many other federally-listed and state-listed species, by working with USFWS to incorporate RLSP and FPPP program elements in a formal plan under Section 10 of the ESA. The RLSP and the Plan synergistically provide assurances at the local and federal levels that conservation measures will be implemented, and that a long-term balance of land uses will be achieved. Using the framework established by the RLSP, the Plan provides landscape-level planning and other benefits that extend well beyond what the RLSP could accomplish alone.

Once issued, the ITPs will specify the rights and responsibilities of all parties to the Plan, and legally bind 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 federal 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.

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 106,442 acres of privately-owned land, located within the 151,442± acres of privately-owned lands in eastern Collier County. The 106,442 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, two species that are under review for federal listing, and eight non-federally-listed species that are listed as threatened by the State of Florida.¹¹

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 between the public conservation lands and dispersal corridors to the north and east of the HCP Area. Specifically, these regional linkages – which are depicted in Figure 2-2 – 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 provide important ecological benefits for the Florida panther, the other Covered Species, and other wildlife, including black bear.

Under the Plan, the traditional, historic, and ongoing rural land uses within the 106,442 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 151,442±-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 ITPs, 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

¹¹ The species covered by the Plan are listed in Tables 1-1, 1-2, and 1-3 (see Chapter 1, Background).

lands, by consolidating and directing development away from more ecologically valuable areas of interconnected native habitats and toward previously cleared areas with lower habitat support functions. This integrated landscape approach provides substantial ecological benefits over the piecemeal, project-by-project approach that typically occurs without landscape-level coordination and planning of conservation actions among separate, private landowners.

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, of 106,442 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; 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 Chapter 9). The Marinelli Fund was established through the FPPP to fund panther conservation activities. In 2016, the FPPP expanded the potential scope of the Fund’s uses to include funding conservation activities to benefit other Covered Species, in addition to the panther. The Plan will support the Marinelli Fund through (i) contributions to be made on a per-acre basis as Covered Activities are initiated and (ii) transfer fees to be paid on a per-unit basis as homes within the HCP Area are sold and re-sold. Initiatives to benefit the Florida panther and other Covered Species will be undertaken at the discretion of the Fund’s Board of Directors, and are expected to include funding for activities such as the following:

- Restoration, enhancement, and management of habitat within the HCP Area, including enhancement 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 movement of panther and black bear, in addition to other wildlife;

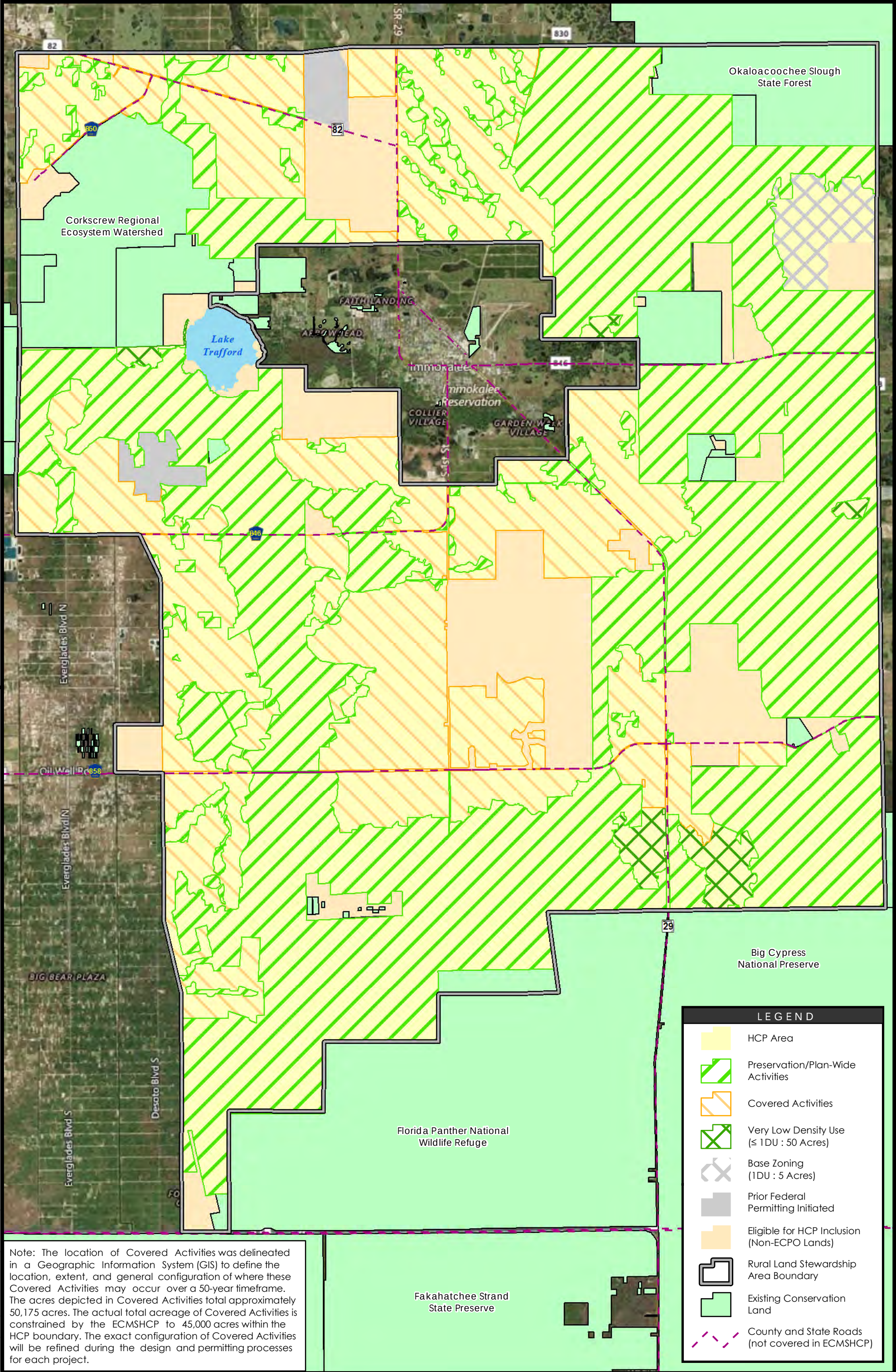
- Construction of panther and other wildlife crossings on roadways within the HCP Area;
- Land acquisition, enhancement, and/or management, providing additional habitat for panther and other Covered Species; and
- Scientific research relevant to conservation of the species addressed by the HCP.

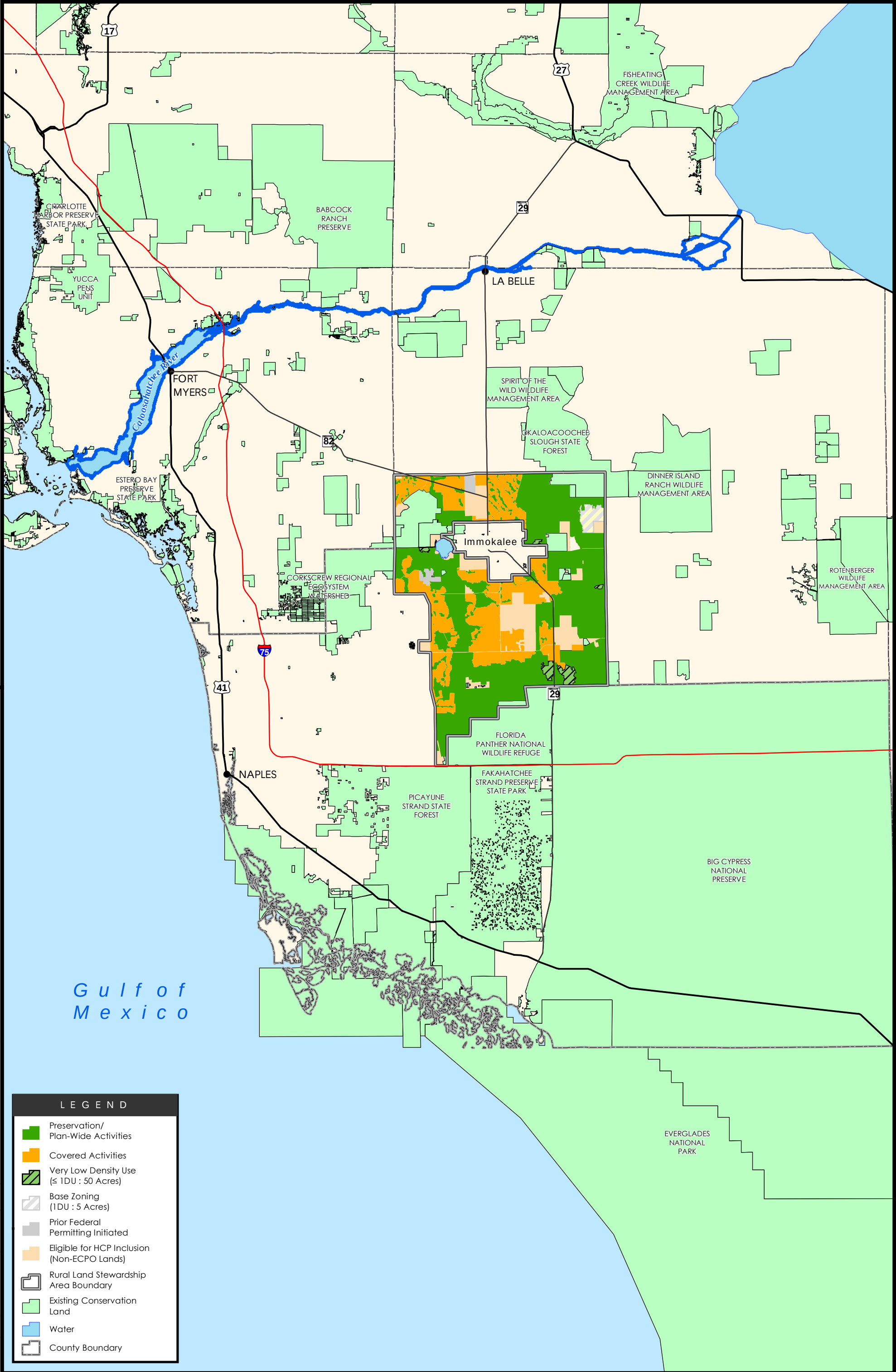
Figure 2-1 depicts the extent of the HCP Area within the RLSA, the areas designated for Covered Activities (residential/commercial development and earth mining), Preservation/Plan-Wide Activities, Very Low Density Use, and Base Zoning (each described below). The Plan sets forth the acreage and general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

The Plan designates 97,069 acres as “Preservation/Plan-Wide Activities.” The Plan also designates a 49,276-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 49,276-acre area. The unused balance (4,276 acres) will be placed in the “Preservation/Plan-Wide Activities” designation, bringing the total of that designation to 102,261 acres. The Plan designates 2,667 acres “Very Low Density Use,” indicating areas 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 no more than one dwelling unit per 50 acres, and no more than 10 percent of the existing native vegetation may be cleared from Very Low Density Use areas. In addition, in order to preserve the ability of Florida panther and other Covered Species to move freely through the lands designated for Very Low Density Use, no large-animal exclusionary fencing will be used within these lands. 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 a member of the FPPP and an applicant for an ITP (see section 2.5).

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.

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 106,442 acres slated for permanent protection. The Covered Activities (residential/commercial development and earth mining activities), will occur on up to 45,000 acres





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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
(Non-ECPO Lands)

Rural Land Stewardship
Area Boundary

Existing Conservation
Land

Water

County Boundary

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

FIGURE 2-2
HCP Land Designations - Regional View
March 2019

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

LAND USE / LAND COVER CATEGORY	COVERED ACTIVITIES (ACRES) ¹	PRESERVATION/ PLAN-WIDE ACTIVITIES (ACRES) ²	VERY LOW DENSITY USE (ACRES) ³	BASE ZONING (ACRES) ⁴	TOTAL ACRES
Urban / Infrastructure	1,848.1	162.3	14.2	3.9	2,028.5
Mining / Oil and Gas	0.0	161.8	708.3	0.0	870.1
Pastures (Improved)	5,074.6	9,297.6	501.8	1,211.2	16,085.2
Cropland / Pasture	16,309.7	12,868.3	5.2	568.2	29,751.4
Citrus groves / other groves	19,695.2	8,434.1	0.0	1.2	28,130.5
Other Agriculture/Rural Open Lands	686.4	1,475.1	235.7	0.3	2,397.5
Exotic Plants	370.5	547.2	1.9	0.0	919.6
Native upland non-forested	395.9	1,043.2	138.0	0.0	1,577.1
Native upland forested	1,674.9	9,815.0	308.6	16.3	11,814.8
Native wetland non-forested	2,084.2	25,520.5	233.1	536.4	28,374.2
Native wetland forested	771.4	27,674.4	509.9	93.3	29,049.0
Water	364.6	69.3	10.5	0.0	444.4
TOTALS PER FIGURE 2-1⁵	49,275.6	97,068.6	2,667.2	2,430.9	151,442.3
TOTALS AT PLAN COMPLETION⁶	45,000.0	101,344.2	2,667.2	TBD	151,442.3

¹ "Covered Activities" may occur anywhere within the 50,175-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 (4,275.6 acres) eventually will be placed into "Preservation/Plan-Wide Activities."

² "Preservation/Plan-Wide Activities" (101,344.2 acres) refers to land areas preserved at Plan completion.

³ "Very Low Density Use" refers to isolated rural structures (lodges, camps), and the acreage contributes to habitat support for Covered Species.

⁴ "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.

⁵ The "Totals Per Figure 2-1" are reported from GIS calculations. The sum for each land designation category may differ by up to 0.1% due to rounding.

⁶ "Totals at Plan Completion" reflect the 45,000-acre cap for "Covered Activities," with the balance of land dedicated to the other land designations. The "TBD" (To Be Determined) notation reflects the fact that the Half Circle L Ranch is currently for sale, and its current zoning is retained until the current or new property owner places the land into a specific designation under the ECMSHCP.

within the 49,276 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 will be limited to 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 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. The annual report submitted to USFWS on behalf of the permittees will document the proportion of landcover within the lands designated for preservation that consists of native habitats and the proportion of landcover within the lands designated for preservation that consists of lands used for agricultural purposes, and will demonstrate that these proportions remain within 95 percent of the proportions that existed at the time the ITPs were issued throughout the life of the ITPs.¹² Maintaining overall native land cover will be accomplished on an individual permittee basis by requiring each permittee to maintain the proportion of native land cover on that exists on their own lands at the time the ITPs are issued, although the landowners will be authorized to work together at the plan-wide level to ensure a sufficient amount of overall native habitat, as necessary. Some historic land use practices, such as the establishment and maintenance of pastures, directly benefit one or more Covered Species (e.g., northern crested caracara; Florida burrowing owl; Florida sandhill crane). 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 control of

¹² While the permittees’ goal will be to maintain 100 percent of native land cover, a 95 percent standard is employed to allow a degree of flexibility in accomplishing restoration of land cover as needed.

exotic species benefits the Florida panther and many of the other Covered Species). Allowing these activities to continue also provides the opportunity for long-term agricultural use of lands, 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. Figure 3-3 (see Chapter 3, Environmental Setting). Long-term radiotelemetry data and GPS 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 based on these activities. 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 2,667-acre 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 no more than one dwelling unit per 50 acres, with no more than 10 percent of the total existing native vegetation subject to clearing. In addition, in order to preserve the ability of Florida panther and other Covered Species to move freely through the lands designated for Very Low Density Use, no large-animal exclusionary fencing will be used within these lands. The low density of any development on these lands, and restrictions on clearing, would be compatible with the panther's continued use of these lands.

The Plan will designate the vast majority (106,442 acres, or 70%) of the HCP Area as Preservation/Plan-Wide Activities and Very Low Density Use, which represent over 92 percent of the native habitats found within the HCP Area. This will ensure that the 106,442 acres of contiguous lands will 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 lands include large blocks of native habitat where panthers have been documented extensively (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 106,442 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 106,442 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 and previously cleared areas 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 perpetual conservation easements to compensate for permitted impacts. The conservation easements will run with the land and will be held by a State of Florida agency (FWC, FDACS, FDEP, or SFWMD), with USFWS retaining full third-party enforcement rights. A summary of the current acreage of various types of land cover and land use within the 106,442-acre area that will be designated for Preservation/Plan-Wide Activities and Very Low Density Use is provided in Table 3-1, and depicted in Figure 3-5 (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 land management activities will be performed by the permittees and/or their agents, as has been done for the past several decades.

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 ITPs issued to the applicants, which will provide for appropriate levels of mitigation and subsequent monitoring. Consistent with the RLSP, and as specified by USFWS under the ITPs, mitigation will be provided by placing conservation easements on lands designated for Preservation/Plan-Wide Activities as development in the area designated for Covered Activities occurs. Monitoring will be conducted by the permittees and/or their agents to verify mitigation compliance, with USFWS having access to the preservation areas, monitoring data, and aerial imagery to independently monitor site conditions.

Additional mitigation activities may include: wildlife mitigation activities designed to benefit one or more of the Covered Species, in coordination with USFWS and/or FWC; and wetland mitigation activities required by Federal and/or State resource agencies, including the U.S. Army Corps of Engineers (USACE), U.S. Environmental Protection Agency (USEPA), South Florida Water Management District (SFWMD), and Florida Department of Environmental Protection (FDEP).

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 2009b; FPPTRT 2009; Love 2013). 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 of these corridors, which link large blocks of preserved habitat within and beyond the HCP Area. As depicted schematically in Love (2013), setting aside these lands will allow for the enhancement of two local “passage” 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 could be used to fund activities 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 could be used to fund activities to arrange for construction of fenced wildlife crossings to ensure safe passage of panthers and other wildlife through the landscape. As described in Chapter 9, at least fifty percent of the first \$25 million deposited into the Fund by permittees through the \$350-per-acre fee and through transfer fees for

homes sold within the HCP Area will be set aside for use in funding construction of large mammal wildlife crossings and associated fencing.

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 up to 45,000 acres of land within the 49,276 acres designated for Covered Activities, the areas that will be designated for Preservation/Plan-Wide Activities and Very Low Density Use will encompass 106,442 acres within the HCP Area, with the land permanently protected under conservation easements. 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 ITPs will be 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,¹³ that may occur within the pre-defined “Covered Activities” land designation areas within the HCP Area (Figure 2-1). The applicants request that ITPs 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.¹⁴

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-acre cap.¹⁵ The

¹³ See section 2.4, below.

¹⁴ For example, the ITPs will not authorize or control incidental take (or any other form of take) resulting from activities of third parties (*e.g.*, actions that are not conducted by or on behalf of the applicants), such as collisions between vehicles and panthers or other Covered Species on roadways external to development projects. Collisions between vehicles and panthers or other Covered Species, are not expected during construction and maintenance of roads internal to development areas permitted under the ITPs, based on factors such as the low speed of travel of construction and maintenance vehicles on these roads and relatively lower likelihood of Covered Species crossing roads, and therefore take coverage for such collisions on these internal roads is not requested. In addition, the ITPs will not cover potential vehicle collisions with panthers or other Covered Species by third parties on roadways internal to development areas or 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 improvements made pursuant to any current or future Long-Range Transportation Plans (LRTPs) developed by the Collier County Metropolitan Planning Organization (MPO).

¹⁵ As described in Chapter 1, there are two parcels of land located within the RLSA (and the outer boundaries of the HCP Area) – the Hogan Island Quarry and the Immokalee Sand Mine – that are owned by ECPO members but are not included in the HCP Area or as Covered Activities because the Federal permitting process for each, including section 7 consultations, is either already complete or is expected to be complete by the time the ITPs are issued. These two parcels are accounted for in the overall configuration and planning for wildlife corridors and other ecologically beneficial features of the Plan.

Covered Activities will be phased over the 50-year duration of the ITPs. The number of residences that could be present at full buildout (within a maximum of 45,000 acres), based on data from the Ave Maria and the proposed Rural Lands West (aka Collier Ranch) projects, is estimated to be 91,480 units, corresponding to a projected population of 174,000 residents. This analysis is based upon the approved land uses, densities and intensities for the existing Ave Maria development, and comparable planning data for Rural Lands West, which represent the best available data for making forward-looking projections within the HCP Area. Ave Maria and Rural Lands West reflect an overall density of 2.5 dwelling units per gross acre, consistent with past and current market demands in Southwest Florida and consistent with data used in Carr and Zwick (2016, Appendix 2).

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, and construction 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, and greenspace buffers. 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 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.

Land Management. In addition to the Covered Activities, the applicants also seek take coverage for land management and maintenance activities to be conducted within the lands designated as Plan-Wide/Preservation and Very Low Density Use will require periodic land management in perpetuity to maintain or improve habitat functions; maintain agriculture operations; maintain drainage infrastructure; control exotic vegetation; and control pests and diseases. Under the Plan, these activities

will be performed by the applicants or their agents, as the applicants have successfully done for many decades. The activities include land management techniques such as prescribed burning; mechanical control of groundcover (e.g., roller chopping, brush-hogging, mowing); ditch and canal maintenance; mechanical and/or chemical control of exotic vegetation; soil tillage; and similar activities that maintain or improve land quality. The applicants also seek take coverage for these activities.

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 49,276-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 ITPs.

Although the applicants (ECPO members) own the entirety of the 151,442± acres within the HCP Area, non-ECPO private property owners hold over 20,000 acres of land (as calculated from the Collier County Property Appraiser database) within the RLSP where the Plan is set. Figure 2-1 depicts these non-ECPO private property holdings as "Eligible for HCP Inclusion" within the 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 ITPs, 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. 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 – the Tehachapi Uplands Multiple Species Habitat Conservation Plan – 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, reduce the conservation benefits specified in the ITP, or result in changes to the extent 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 comprising the Half Circle L Ranch, east of Immokalee. These 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 a member of the FPPP and an applicant for an ITP, it is not currently known what land designation may ultimately be applied to these 2,431 acres in the event of a sale. State and county conservation acquisition programs (Florida Forever and Conservation Collier) have targeted the property for potential acquisition.

The status of this property is expected to be resolved during the timeframe for USFWS review of the HCP document, completion of the NEPA process, and processing of the ITP applications. For the purposes of this 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. If the current owner or a future owner that elects to participate in the Plan chooses not to develop the area, it will be included in the Plan as land designated for Preservation/Plan-Wide Activities. If the current owner or a future owner that elects to participate in the Plan chooses to 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. If the area is purchased by a person or entity that chooses not to participate in the Plan, the property will be removed from the HCP Area, and take coverage will not be provided for that area. Exclusion of Half Circle Ranch from the HCP Area would have the effect of reducing the total area designated for Preservation/Plan-Wide Activities and Very Low Density Use to approximately 104,011 acres.

Regardless of the eventual status of the Half Circle L Ranch property under the HCP, or whether the property remains within the HCP, the Plan as described will still be robust and viable in terms of its overall design, conservation value, and regulatory compliance. In particular, the Half Circle L Ranch comprises a relatively small portion (only 1.6 percent) of the HCP Area. The Plan-Wide/Preservation and Very Low Density Use habitat acreage preservation areas and/or specific habitat restorations (e.g., caracara habitat) will more than fully offset anticipated take and will exceed the mitigation required for the Florida panther and the other Covered Species habitat impacts occurring within the Covered Activities areas, even if Half Circle L Ranch (the Base Zoning Area) or another 2,431-acre area is not added to the lands designated for Preservation/Plan-Wide Activities.

The ECPO members do not anticipate other applicants will decide to withdraw their ITP application. In the event that an ECPO member withdraws its ITP application and as a result the amount of Plan-Wide/Preservation and Very Low Density Use habitat acreage is not sufficient to fully offset take or exceed the mitigation required for the Florida panther and the other Covered Species, which is not expected, the ECPO members will work with the Service to proportionally reduce the amount of acreage available for covered activities under this Plan.

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 strategic designation of 106,442 acres of contiguous lands for Preservation/Plan-Wide Activities and Very Low Density Use (Figure 2-1). 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 ecologically 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, which will be governed by its own board of directors and will be funded by the Plan.

The Fund will be underwritten by (i) contributions to be made on a per-acre basis as Covered Activities are initiated and (ii) transfer fees to be paid on a per-unit basis as homes within the HCP Area are sold and re-sold (see Chapter 9 for more detail). In addition to possible creation and/or enhancement of the North and South Corridors (described above), the Marinelli Fund may 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 wildlife vehicle collisions; panther habitat acquisition, management, restoration and/or enhancement; and other activities that are consistent with the FPPP goals; the Fund may also be used to benefit the other Covered Species (Chapter 9).

The Plan also identifies the potential for changed and unforeseen circumstances (see Chapter 8). Examples of reasonably foreseeable changed circumstances include the potential impacts of hurricanes; wildfires; pests, and diseases affecting Covered Species and/or their habitats; effects of climate change; and new listings of species not covered by the Plan. The Plan also incorporates measures for responding to changed circumstances that may impact one or more Plan elements. Under USFWS's "No Surprises" rule, permittees are not required to provide additional resources or funds to address unforeseen circumstances.

The Plan identifies alternatives to the issuance of the ITPs 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 terms and conditions of the ITPs, which will specify the mutual obligations of the applicants and USFWS for executing the Plan elements, and for carrying out the Plan in accordance with 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.

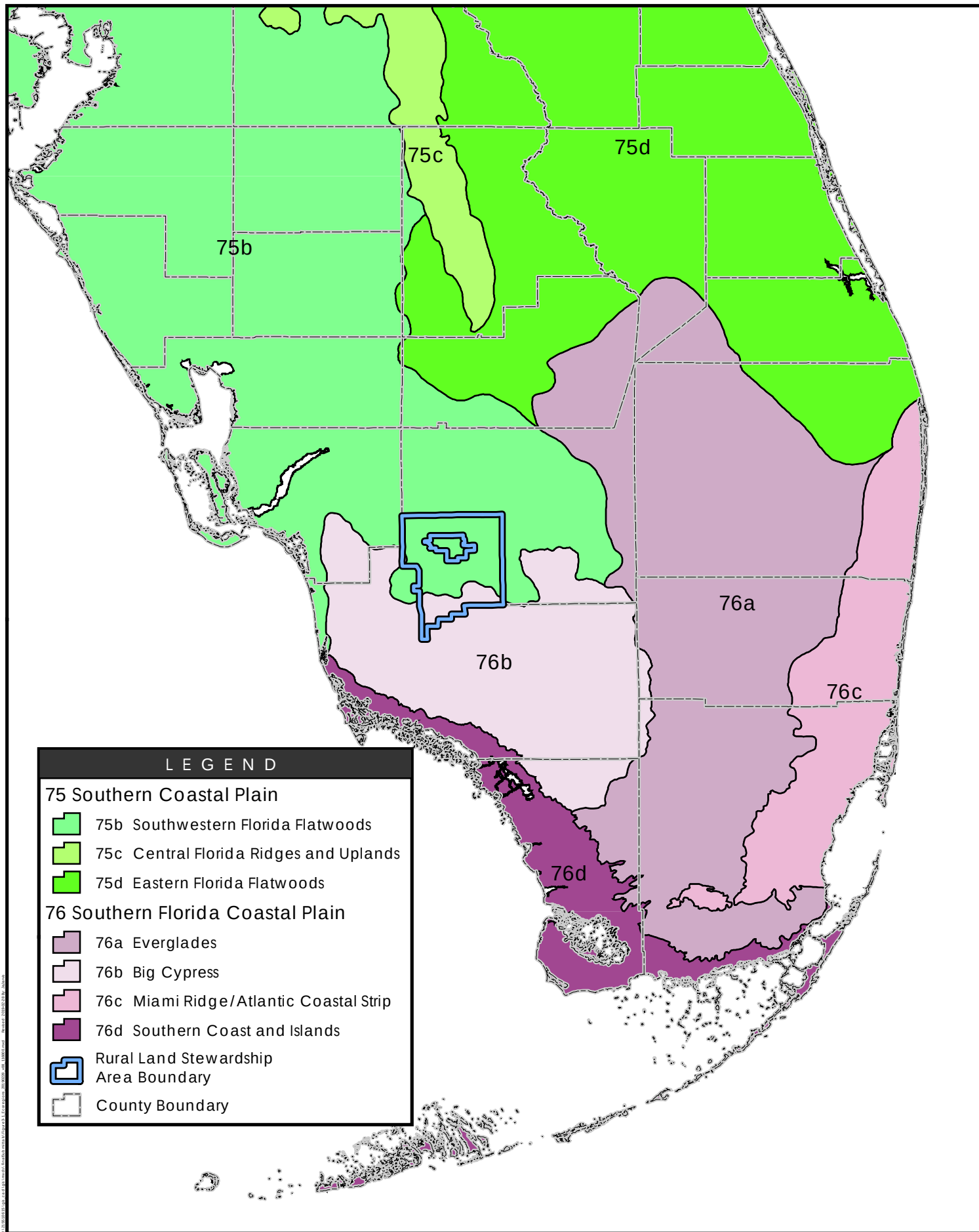
All figures included in this chapter depict the Collier County RLSA boundary, within which the Plan occurs (Figure 2-1), to cartographically simplify the figures so area-wide patterns in environmental variations can be visualized easily without interference from depictions of internal Plan boundaries.

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 within 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). USEPA “Level IV” ecoregions correspond most closely to the interrelated ecological characteristics and gradients within and around the HCP Area. See <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-4#pane-08>.

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 (Figure 3-1, Ecoregion 75b), 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 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 (FWC and FNAI 2016).



LEGEND

75 Southern Coastal Plain

75b Southwestern Florida Flatwoods

75c Central Florida Ridges and Uplands

75d Eastern Florida Flatwoods

76 Southern Florida Coastal Plain

76a Everglades

76b Big Cypress

76c Miami Ridge/Atlantic Coastal Strip

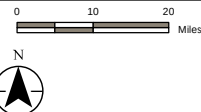
76d Southern Coast and Islands

Rural Land Stewardship Area Boundary

County Boundary

FIGURE 3-1
 Florida Ecoregions
 Level III & IV Ecoregions
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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 to those found elsewhere within the HCP Area, but differ 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 to the north (see Figure 3-5).

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 of the wet season (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 five 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 that 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 above sea level (North American Vertical Datum of 1988; 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 in the southwestern portion of the area, where spot measurements of 12 feet above sea level comprise the minimum recorded land elevation (USGS 1990; FDEM 2009).

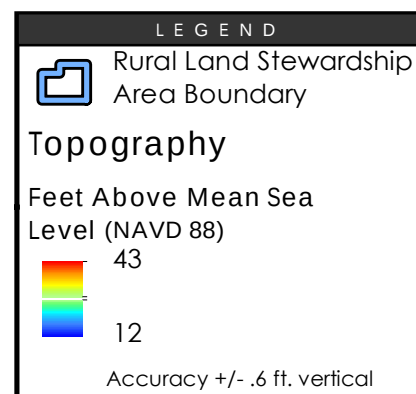
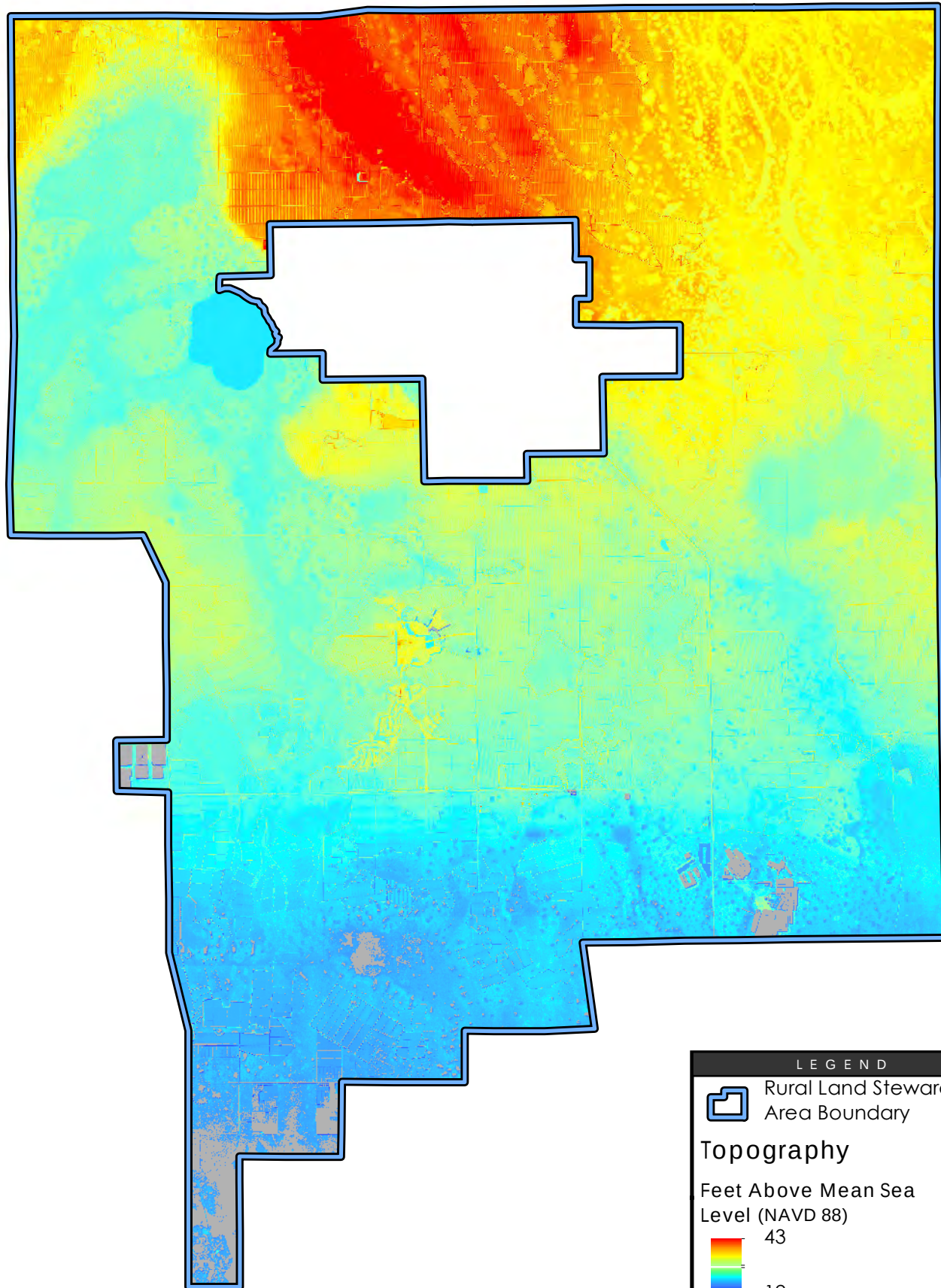
3.4 GEOLOGY

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 and 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 in the Sunniland Trend was first discovered in the early 1940s near Sunniland, in the southeastern 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 these 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 (Figure 3-3).

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, which are excavated by open pit methods from near-surface deposits (Campbell 1988). One active mine (Sunniland Mine) exists in the southeastern portion of the HCP Area.



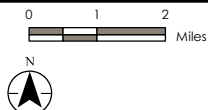
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FIGURE 3-2
Topography
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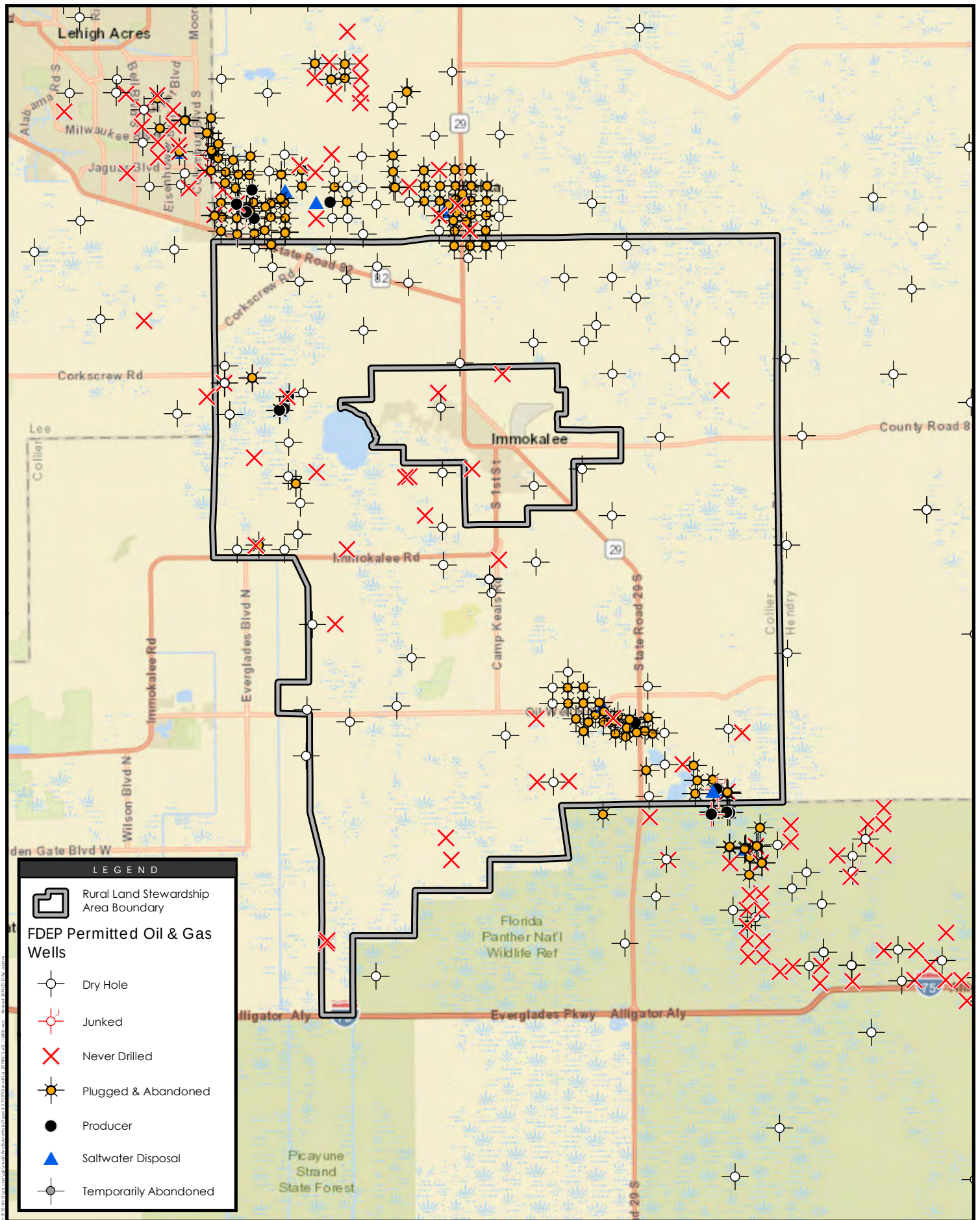
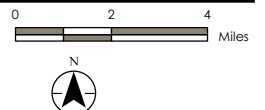


FIGURE 3-3
FDEP Permitted Oil & Gas Wells
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3.5 SOILS

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 second, more 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, and other land uses 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, these 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 calcium, magnesium, and potassium), 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, 1).

Figure 3-4 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 3-4 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 3-4). “Knolls” soils 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 Lands” 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 database, 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).

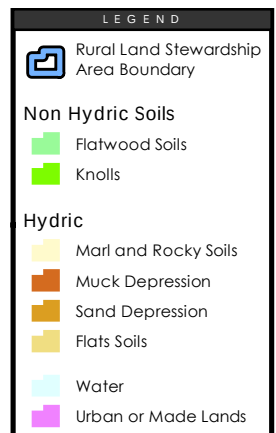
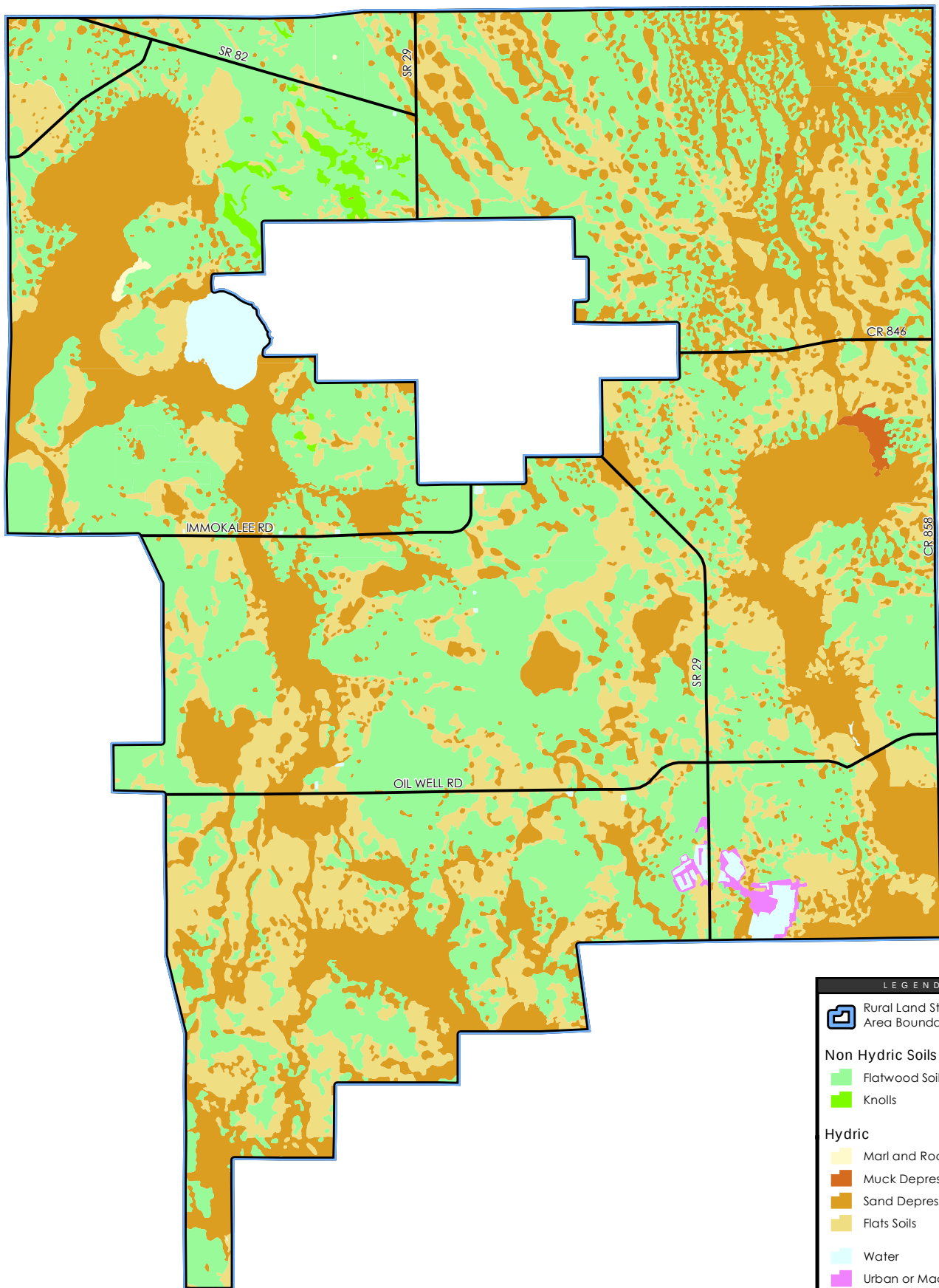
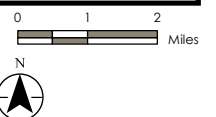


FIGURE 3-4
Natural Soil Landscape Position
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FWC initially performed statewide land cover mapping for preliminary identification of conservation “gaps” using 1985-1989 Landsat Thematic Mapper imagery and unsupervised image classification (Kautz et al. 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 efforts have 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 1995 USGS 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.

FWC subsequently developed and implemented a State Wildlife Action Plan that highlighted the need for habitat-based land cover mapping and an associated land cover classification system (FWC 2014). FWC partnered with FNAI to develop the land cover mapping from existing data sources and expert reviews of aerial photography, resulting in a statewide Cooperative Land Cover (CLC) Map. The CLC classification schema incorporated classifications from the FWC, FNAI, and FDOT classification systems, and was reviewed and revised by experts knowledgeable of Florida’s natural communities and image processing (FWC 2014). For conservation planning purposes, the CLC mapping represents the best available data set for characterizing land cover within the HCP Area and was therefore used for GIS analyses in this HCP.

Figure 3-5 shows a thematic grouping of the current iteration (version 3.2, vector) of the CLC mapping (FWC and FNAI 2016). Table 3-1 provides a breakdown of LULC categories grouped by broad CLC classes and HCP land designations. In terms of LULC, active agriculture (including cultivated crops, citrus, sod, pastures, and specialty crops) comprises approximately 50 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 9 percent of the HCP Area, with forested uplands comprising over 88 percent of native uplands. Over 92 percent of the total native vegetation acreage within the HCP Area occurs within land designations slated for protection. Open water, consisting of major canals, and small lakes/ponds total 1,245 acres, or 1 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 (depicted on Figure 3-5), based on the latest CLC revision (the CLC is now continuously revised, with version updates every 6-12 months). The remaining land uses, including exotic vegetation removal, earth mining, roadways, power transmission lines, and oil/gas facilities, comprise approximately 1 percent of the total HCP Area.

Table 3-1. Land use / land cover within the HCP Area, by CLC classes (FWC and FNAI 2016)

CLC CODE	COOPERATIVE LAND COVER (CLC) CLASS	COVERED ACTIVITIES (ACRES)*	PLAN-WIDE/ PRESERVATION (ACRES)	VERY LOW DENSITY USE (ACRES)	BASE ZONING (ACRES)**	TOTAL ACRES
1120	Mesic Hammock	417.6	1,185.1	61.3	16.3	1,680.3
1210	Scrub	0.0	9.3	0.0	0.0	9.3
1311	Mesic Flatwoods	1,007.5	6,299.2	112.2	0.0	7,418.9
1312	Scrubby Flatwoods	0.0	29.4	0.0	0.0	29.4
1340	Palmetto Prairie	1.5	127.0	0.0	0.0	128.4
1400	Mixed Hardwood-Coniferous	249.9	2,292.1	135.0	0.0	2,676.9
1500	Shrub and Brushland	394.4	916.3	138.0	0.0	1,448.7
1800	Cultural - Terrestrial	0.0	7.4	0.0	0.0	7.4
1821	Low Intensity Urban	1,183.7	52.7	0.4	0.0	1,236.8
1822	High Intensity Urban	335.7	10.4	0.0	0.0	346.1
1830	Rural (Rural Open Lands)	685.5	1,427.8	235.7	0.3	2,349.3
183311	Row Crops	14,195.1	9,391.3	0.0	568.2	24,154.6
183312	Field Crops	47.1	258.5	0.0	0.0	305.6
183313	Improved Pasture	5,074.6	9,297.6	501.8	1,211.2	16,085.1
183314	Unimproved/Woodland Pasture	1,056.5	2,845.6	5.2	0.0	3,907.2
183315	Fallow Cropland	1,011.0	373.0	0.0	0.0	1,384.0
18332	Orchards/Groves	19,695.2	8,434.1	0.0	1.2	28,130.5
18334	Nurseries	0.9	39.1	0.0	0.0	40.0
18335	Other Agriculture	0.0	1.1	0.0	0.0	1.1
1840	Transportation	303.4	89.9	13.8	3.9	411.0
1850	Communication	3.0	0.0	0.0	0.0	3.1
1860	Utilities	22.4	1.7	0.0	0.0	24.1
1870	Extractive	0.0	8.1	61.2	0.0	69.3
1880	Bare Soil/Clear Cut	0.0	7.1	0.0	0.0	7.1
2112	Mixed Scrub-Shrub Wetland	869.6	8,431.2	97.6	0.0	9,398.3
2120	Marshes	1,195.0	15,577.6	133.9	0.0	16,906.5
2121	Isolated Freshwater Marsh	9.4	1,408.3	1.7	536.4	1,955.8
2140	Floating/Emergent Aquatic Vegetation	10.2	0.4	0.0	0.0	10.6
2141	Slough (Non-Forested)	0.0	102.9	0.0	0.0	102.9
2210	Cypress/Tupelo	142.5	1,799.1	69.7	0.0	2,011.3
2211	Cypress	141.2	12,454.0	17.4	0.0	12,612.6
2213	Isolated Freshwater Swamp	190.1	3,982.9	40.4	0.0	4,213.5
22131	Dome Swamp	0.0	279.6	0.0	37.2	316.8
2214	Strand Swamp	0.0	1,754.1	0.0	1.1	1,755.2
2220	Other Coniferous Wetlands	11.0	12.7	0.0	0.0	23.7
2221	Wet Flatwoods	168.8	2,411.3	3.2	53.2	2,636.5
2230	Other Hardwood Wetlands	4.3	436.9	22.1	0.0	463.3
2232	Hydric Hammock	0.0	117.8	0.0	1.8	119.6
2233	Mixed Wetland Hardwoods	51.8	2,429.8	83.0	0.0	2,564.6
2240	Other Wetland Forested Mixed	40.4	1,588.2	274.1	0.0	1,902.7
2242	Cypress/Pine/Cabbage Palm	21.3	408.0	0.0	0.0	429.3
3000	Lacustrine	0.0	48.4	9.3	0.0	57.7
3100	Natural Lakes and Ponds	0.0	20.8	1.2	0.0	22.1
3200	Cultural - Lacustrine	332.0	61.2	647.1	0.0	1,040.3
4200	Cultural - Riverine (Canals/Ditches)	32.6	92.5	0.0	0.0	125.1
7000	Exotic Plants	370.5	547.2	1.9	0.0	919.6
TOTALS		49,275.6	97,068.6	2,667.2	2,430.9	151,442.3

* The actual acreage of Covered Activities at Plan completion will be 45,000 acres. The balance (4,275.6 acres) will be placed in Preservation/Plan-Wide Activities.

** 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.

*** Acreage data entries in this table were rounded to the nearest 0.1 acre. The sub-totals reflect the total acreage of each Plan land designation as calculated by GIS.

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 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 rising to 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 was 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, and no incidental take is anticipated within the lake.

The head of the Corkscrew Marsh system is located in the northwestern portion of the HCP Area and is already under a combination of public and private conservation ownership. Surface water from Corkscrew Marsh flows primarily toward the southwest through 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 Merritt 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. Under 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. A significant additional wildlife benefit of the HCP's proposed agricultural preservation is wading bird foraging habitat value found in wet season and

early dry season flooded farm fields. These wet fields mimic the functions of vital and scarce short-hydroperiod wetlands.

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 to possess 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 (National Geodetic Vertical Datum) 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 1 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 use water from the upper Floridan Aquifer System as a source of 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 concentrations of dissolved chloride present in the aquifer limit its use in southern Florida. Water quality in the Floridan aquifer 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 3-6 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, 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 are 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; FWC 2016).

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 relevant to 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 (e.g., Onorato et al. 2011; Hostetler et al. 2013) 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.

As of this writing, USFWS has initiated a 5-year status review for 23 southeastern species under the ESA, including the Florida panther (82 Fed. Reg. 29916 (June 30, 2017)).

Species Description

The following description of the Florida panther comes from the Florida Panther Recovery Plan, Third Revision (USFWS 2008a) and has been the standard description used for multiple 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, FWC, pers. comm. 2005; USFWS 2008a, 6).

As of January 27, 2003, none of the eight female Texas panthers introduced in 1995 remained in the wild.

Distribution

The Florida panther's historic range covered much of the southeastern United States, including all but the western edge of Arkansas; the entire states of Louisiana, Mississippi, Alabama, and Georgia; the entire peninsula of Florida; as well as southern Tennessee and western South Carolina (Young and Goldman 1946; USFWS 2008a, Figure 1). The panther is currently known to occur only in Florida, and until recently, no female panthers or panther kittens had been documented north of the Caloosahatchee River since 1973, although male panthers continued to be documented there (USFWS 2008a). For this reason, since 1973, the known breeding range of the Florida panther was constrained to lands south of the Caloosahatchee River, and it was later more precisely defined as including an estimated 9,189 km² (2.27 million acres) in southern Florida (Kautz et al. 2006; USFWS 2008a; USFWS 2009a).

In late 2016, FWC documented the presence of a female panther north of the Caloosahatchee River, within the Babcock Ranch Preserve Wildlife Management Area (FWC 2016a). Then, in January 2017, trail cameras captured images of a female panther that appeared to be nursing, and in March 2017, a trail camera captured images of two panther kittens. This discovery represents the first known occurrence of natural breeding by the Florida panther north of the Caloosahatchee River in over 40 years of surveys (FWC 2017b).

In March 2017, a trail camera at the Platt Branch Wildlife and Environmental Area also documented a suspected pairing of a male and female panther. The two panthers were captured together in two separate photographs. One of the panthers in the photographs was clearly a large male; the other was

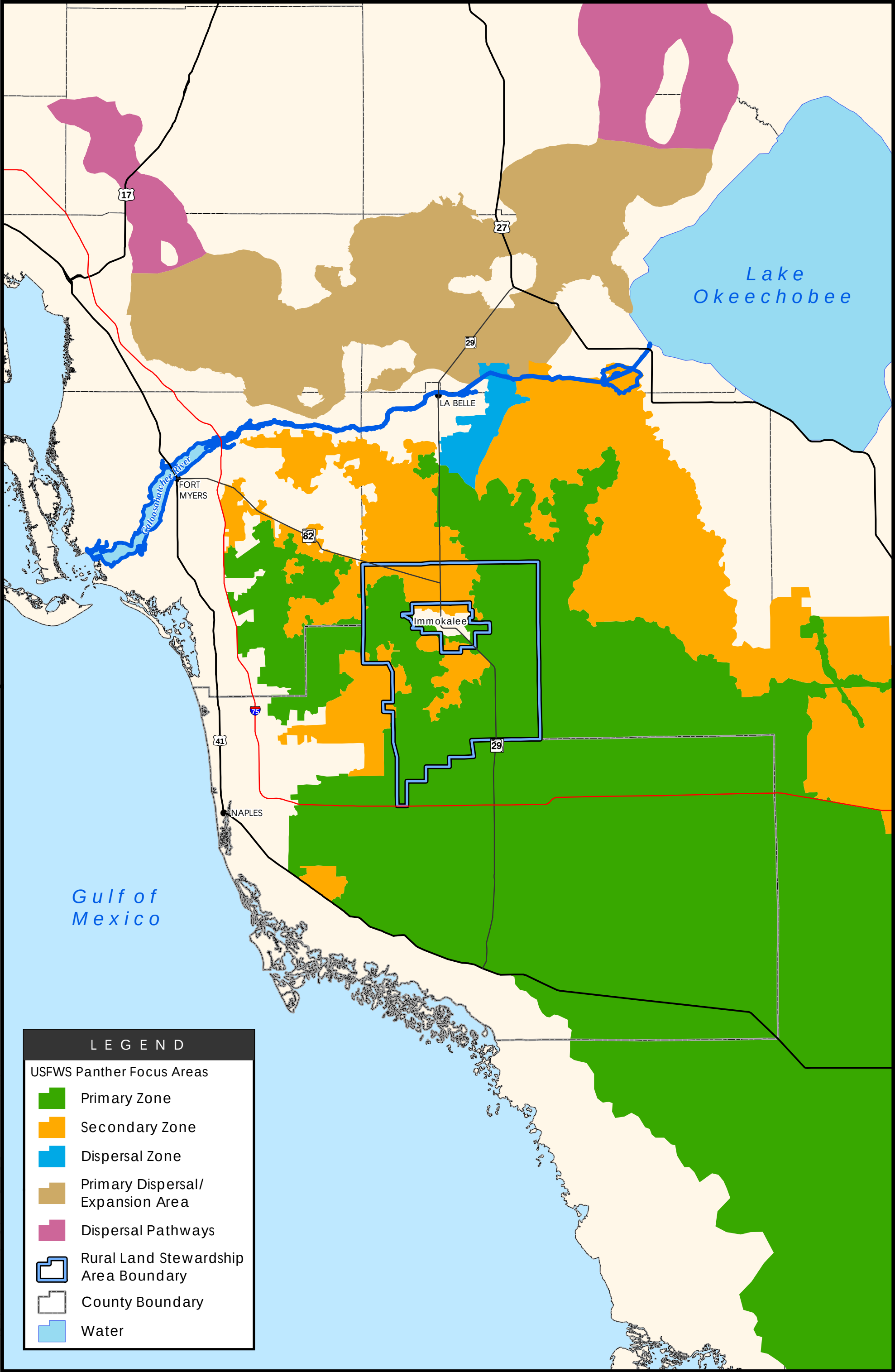
thought to be female based on the pair's behaviors, but its sex could not be confirmed definitively from the photos.

The presence of one breeding female panther north of the Caloosahatchee River, and possibly a second breeding female, creates the potential for a substantial expansion of the panther's distribution and breeding range throughout central Florida. Most of the inland areas between the Caloosahatchee River and the Interstate 4 (I-4) corridor, located approximately 100 miles to the north, are rural and comprised of ranches, citrus groves, and riparian forest areas, interspersed with small towns and rural residences. Thatcher et al. (2009) modeled Florida panther habitat patches north of the Caloosahatchee River and estimated that the larger habitat patches (>100,00 acres each) could each support approximately 36 panthers. Figure 4-1 depicts two of these habitat patches (Babcock-Webb and Fisheating Creek) together as a "Primary Dispersal/Expansion Area" that links with the panther "Dispersal Zone" south of the Caloosahatchee River. Multiple male panthers have dispersed from Southwest Florida across the river into Central Florida and points northward, with documented emigration to points as far north as the Daytona Beach area, the Tallahassee area, and Troup County, Georgia (60 miles southwest of Atlanta) (FWC 2017a). The ECMSHCP will play a central role in preserving the major landscape linkages in Southwest Florida that connect the core panther population to the Dispersal Zone, facilitating dispersal into the panther expansion areas north of the river (Thatcher et al. 2009, Figure 4) and ultimately into the southeastern U.S.

A recent paper by Frakes et al. (2015), which describes modeling that was used to produce a predictive distribution map for breeding panthers south of the Caloosahatchee River, estimated that 5,579 km² (1.38 million acres) of suitable panther breeding habitat remained. This projection contrasted with Kautz et al. (2006), who estimated 9,189 km² (2.27 million acres) of panther habitat remained south of the river. This large discrepancy (3,610 km², or 892,000 acres) is explained in part by the fact that much of the panther habitat that Kautz et al. (2006) modeled consisted of small forest patches that can support sub-adult panthers that have not yet established breeding territories, while Frakes et al. (2015) focused on breeding habitat.

Empirical data from annual panther counts (McBride and McBride 2015), statistically rigorous panther density estimates (Sollmann et al. 2013), and current panther population estimates (FWC 2017b) indicate that the Kautz et al. (2006) habitat estimates are more consistent with current panther demographics than are the Frakes et al. (2015) estimates. Using the Sollmann et al. (2013) density estimate of one panther per 16,474 acres (discussed in section 4.1.2 below), the Kautz panther habitat estimate of 2.27 million acres could support 138 panthers, which falls within the current population estimate of 120-230 panthers (FWC 2017b) and falls slightly below the most recent annual panther count of 149 panthers (McBride and McBride 2015). The Frakes et al. (2015) model estimate of 1.38 million acres could only support 84 panthers, which is well below the 2015 annual panther count and current population estimate (FWC 2017b).

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



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FIGURE 4-1
USFWS Panther Zones - Regional View
March 2019

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0 5 10
Miles

studies that have provided data on at least 249 individual panthers (FWC 2017a). 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 2017a). The radiotelemetry dataset has been augmented with global positioning system (GPS) telemetry data, which has been collected since 2002; research tracking locations of panther mortalities (collared and uncollared panthers); the deployment of automated trail cameras; and verified field observations. While 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 Florida.

Taxonomy

The most recent 5-year review for the Florida panther (USFWS 2009a) 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), from the genus *Felis* into the single genus *Puma* (species *Puma concolor*). 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 2009a). The Florida panther, therefore, currently remains listed as a separate subspecies of cougar.

The current 5-year status review of the Florida panther will include a review of panther genetics, panther taxonomy, and listing status under the ESA.

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). Conclusions drawn from much of the original habitat-related research – for example, the "vital importance" of upland and wetland forested land cover to the Florida panther (Onorato et al. 2011, citing the studies listed above), and the preferential selection by Florida panther of dense saw palmetto thickets for natal denning (Benson et al. 2008) – have 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 is 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 and sampling frequency than VHF telemetry. Beier et al. (2003) identified what many panther researchers acknowledged as an inherent limitation of diurnal panther VHF telemetry: it documented only daytime home range characteristics, and therefore indicated only that forested cover comprises an important daytime panther habitat. Beier et al. (2003) noted, however, 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, using 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 together demonstrate that panthers select forested habitats throughout the 24-hour period (Kautz et al. 2006; Land et al. 2008; Onorato et al. 2011). Both 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 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, 2017, the VHF telemetry database contained more than 109,000 records from 249 Florida panthers (FWC 2017a). The GPS databases from 2005-2014 contain over 78,000 records from 28 panthers. Although certain nuances of panther habitat utilization may require further study, the datasets and scientific literature currently available provide a robust body of knowledge related to 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. One of these publications – Maehr et al. (1990) – focused on Southwest Florida; the other focused on Everglades National Park. Maehr et al. (1990) described the eating habits of panthers in Southwest Florida, based on 38 kill sites and 270 scat samples. Results showed that, in the northern part of the study area (north of latitude 26°11'N, or the northern boundary of Fakahatchee Strand State Preserve), where the HCP Area is located, wild hogs (*Sus scrofa*) dominated the panther's diet in terms of frequency and biomass, and that white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), and nine-banded armadillo (*Dasypus novemcinctus*) were also consumed by panther. Maehr et al. (1990) estimated that deer and hogs accounted for more than 85% of the biomass consumed by panthers. In the southern part of 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 routinely 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 2017a) reported 47 panther depredation events, including 65 goats, 37 sheep, 22 calves, 4 pigs, 2 turkeys, 2 ducks, 2 geese, a dog, a cat, a miniature horse, and an alpaca (1 each). 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%, with results varying between ranches and years (Jacobs and Main 2015).

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 (USFWS 1981) and revised the plan in 1987 (USFWS 1987a). In 2001, USFWS initiated a major revision to the panther recovery plan, which was published in 2008 and remains the current version (USFWS 2008a). 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 three “panther zones” (primary, secondary, and dispersal) 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. Figure 4-1 also depicts the Primary Dispersal/Expansion Area and Dispersal Pathways based on Thatcher et al. (2009).

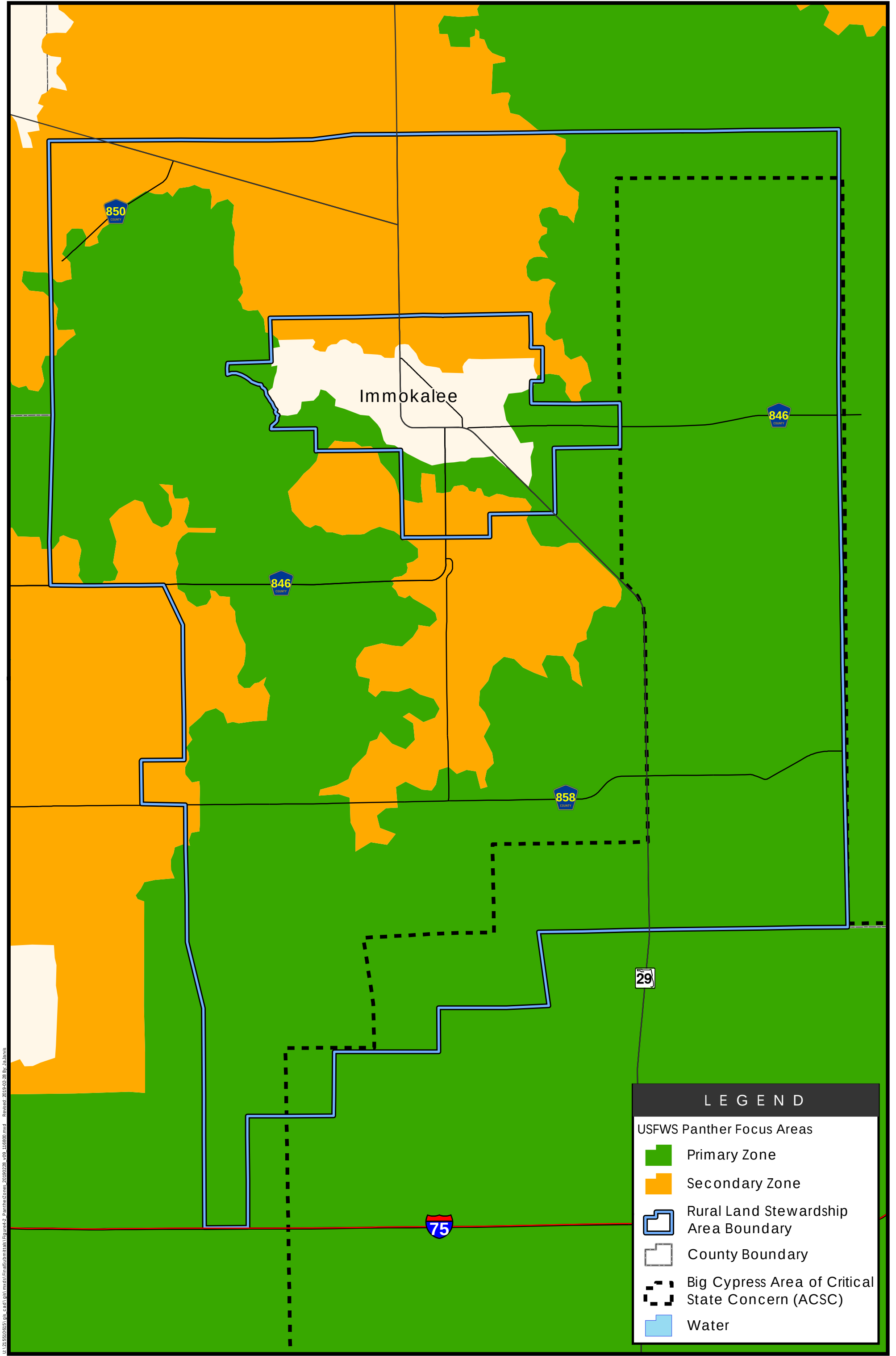
The MERIT findings and Kautz et al. (2006) serve as the basis for the USFWS panther habitat assessment methodology used in recent ESA section 7 and section 10 consultations, providing landscape-level assessments and evaluations of panther habitat functional values where Federal actions are proposed. 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.

4.1.3 Panther Population Trends and Densities

As discussed in section 4.1.4, by the early 1980s and continuing through the mid-1990s, the panther population had declined to an estimated 20-25 adult cats (McBride et al. 2008), and genetic evidence and physical abnormalities (e.g., kinked tails, cowlicks, cryptorchidism, atrial septal defects) indicated significant problems with inbreeding depression. The recommendation to restore genetic diversity through introgression was highly controversial, but was approved as a revision to the 1987 recovery plan, and eight female Texas cougars were released into the panther breeding range in 1995 (USFWS 2008a; Hostetler et al. 2013).

Hostetler et al. (2013) estimated that without the genetic restoration (interbreeding Texas cougars with Florida panthers), the panther population would have declined 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 has underestimated the Florida panther annual count data across that timeframe (McBride and McBride 2015). Johnson et al. (2010) documented a significant reduction in the incidence of physical abnormalities in the 14 years after the 1995 genetic restoration was implemented.

Data from annual Florida panther counts – which include numbers of adult, sub-adult, and juvenile panthers detected during field studies, but do not include kittens – indicate an upward trend since 2000. The most recent 5-year review conducted in 2009 reported Florida panther annual counts of 62, 78, 80, and 87 from 2000-2003, and 78, 82, 97, 117, and 104 from 2004-2008 (USFWS 2009a). Results of Florida panther counts conducted from 2009-2014 were as follows: 113, 115, 111, 123, 133, and 140 (McBride and McBride 2015). The most recent available annual panther count report (McBride and McBride 2015) reported that 149 adult, sub-adult, and juvenile panthers were detected for the period January 1, 2015 through December 31, 2015. These increases in the annual counts were accompanied by increases in panther-vehicle mortalities (see section 4.1.4 and Figure 4-4).



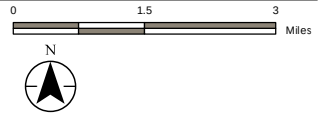
U:\2155106151\gs_cad\gsi\mxd\FinalSubmittals\Figure4-2 PantherZones 20180228_V09_116800.mxd Revised: 2019-02-28 By: J.J. Davis



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FIGURE 4-2
USFWS Panther Zones - HCP Area
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The Florida panther annual counts provide an indicator of the minimum panther population within a given time interval, but they do not represent a scientific population estimate. In 2010, FWC extrapolated annual 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). The most recent annual count data and panther density calculations provide a population estimate of 120-230 panthers (FWC 2017c). FWC is currently conducting research to develop statistically sound estimates of the panther population size using mark/recapture modeling, camera surveys, and roadkill data, but sample sizes and statistical margins of error are not yet sufficient to produce more precise estimates (McLintock et al. 2015; FWC 2017c).

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 km² (Sollmann et al. 2013), which equates to one panther per 16,474 acres. This recent study was notable because panther 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 current panther habitat assessment methodology (USFWS 2012) is 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 mid-1990s. The range-wide decline of the panther was caused by a combination of factors and activities that occurred beginning in the 1800s and continued 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), in 2005, the Service undertook a 5-year review for the panther to determine whether the panther should be removed from the endangered species 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 2009a, 12). USFWS cited multiple estimates of the scale and rate of land-use conversions in South Florida (Cox et al. 1994; Kautz et al. 2006), and 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 2009a, 14-15).

Figure 4-3 depicts the locations of panther-vehicle collisions from 1972 through mid-June 2017 (FWC 2017d), along with the locations of wildlife crossings.

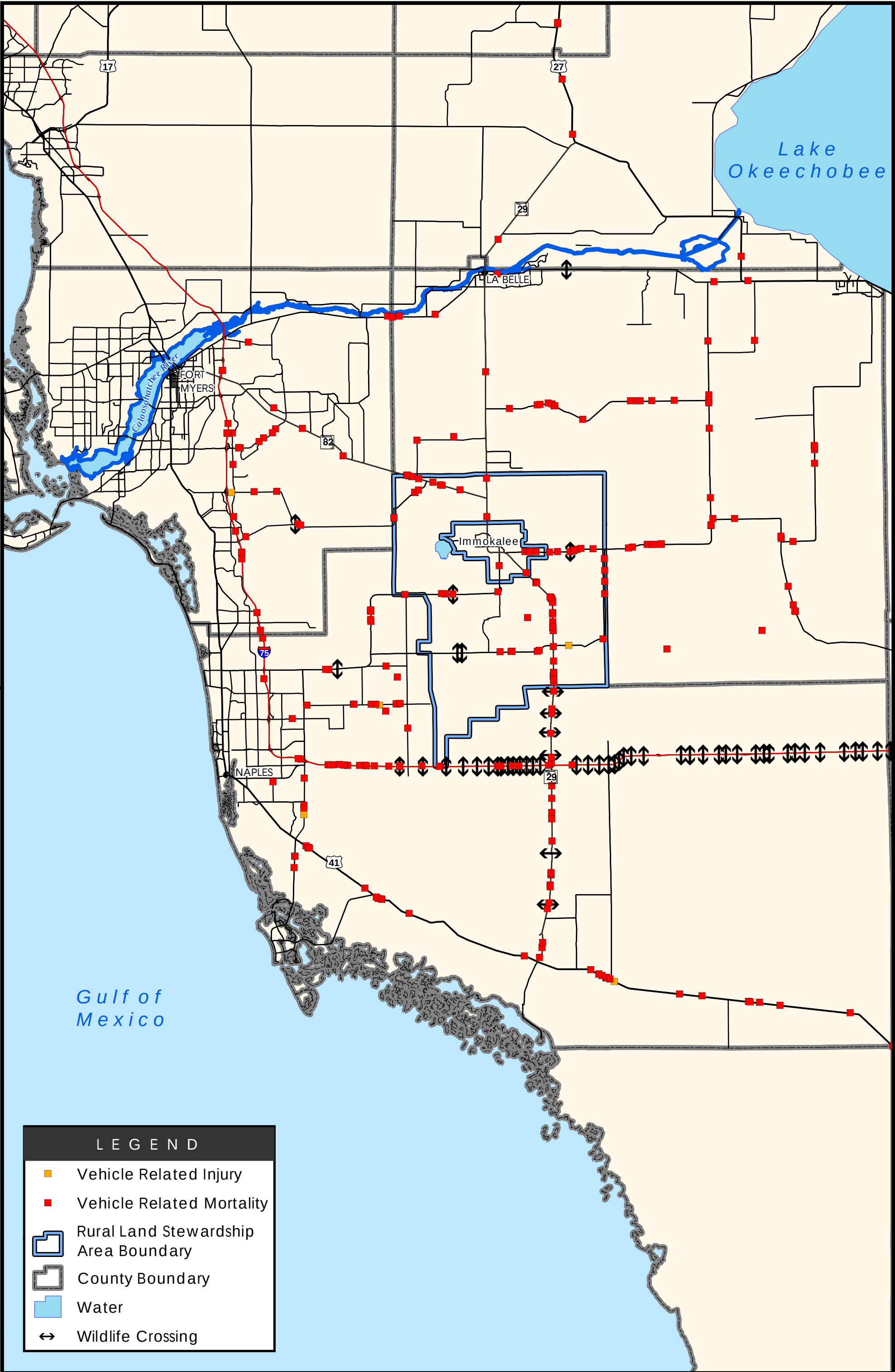
Over time, panther mortalities resulting from panther-vehicle collisions have increased as a function of panther population increases, as well as increased vehicular traffic within the panther’s range (Smith et al. 2006; USFWS 2008a; McBride and McBride 2015). Figure 4-4 (from McBride and McBride 2015) depicts data trends for annual panther counts and highway mortalities from 1981 through 2015. 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.

In August 2017, the Transportation Sub-Team of the Florida Panther Recovery Implementation Team (FPRIT) issued a report on “Southwest Florida Road Hot Spots” (FPRIT 2017). The report identified road segments where numerous panther-vehicle collisions have occurred, based on documented Florida panther vehicle mortalities and injuries as of December 31, 2016. The report does not include as “hot spots” road segments where, although panther-vehicle collisions were documented historically as a result of panther access to the roadways, wildlife crossings and fencing have been constructed and thereafter panther-vehicle collisions were practically eliminated. In particular, as the report notes, there were a large number of panther-vehicle collisions along that portion of I-75 known as “Alligator Alley” prior to installation of wildlife crossings and fencing along the roadway (see Figure 4-3), but the report does not identify most portions of Alligator Alley as hot spots because today panther-vehicle collisions have been virtually eliminated by the installation of crossings and fencing that keep panthers from accessing the roadway. This demonstrates that, along road segments that are subject to high vehicle speeds and increasing traffic volume, installation of wildlife crossings and appropriate fencing can greatly reduce if not eliminate panther-vehicle collisions.

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).

As described in section 4.3.2, although the permits and Plan do not anticipate that the Covered Activities will cause, and therefore do not cover, panther-vehicle collisions, the Plan will provide a source of funding for land preservation and activities that will help address the risk of such collisions, such as construction of additional wildlife crossings under and fencing along roadways.

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 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



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LEGEND

Vehicle Related Injury

Vehicle Related Mortality

Rural Land Stewardship Area Boundary

County Boundary

Water

Wildlife Crossing

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Figure 4-3
Panther-Vehicle Collisions, 1972-2017
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Miles

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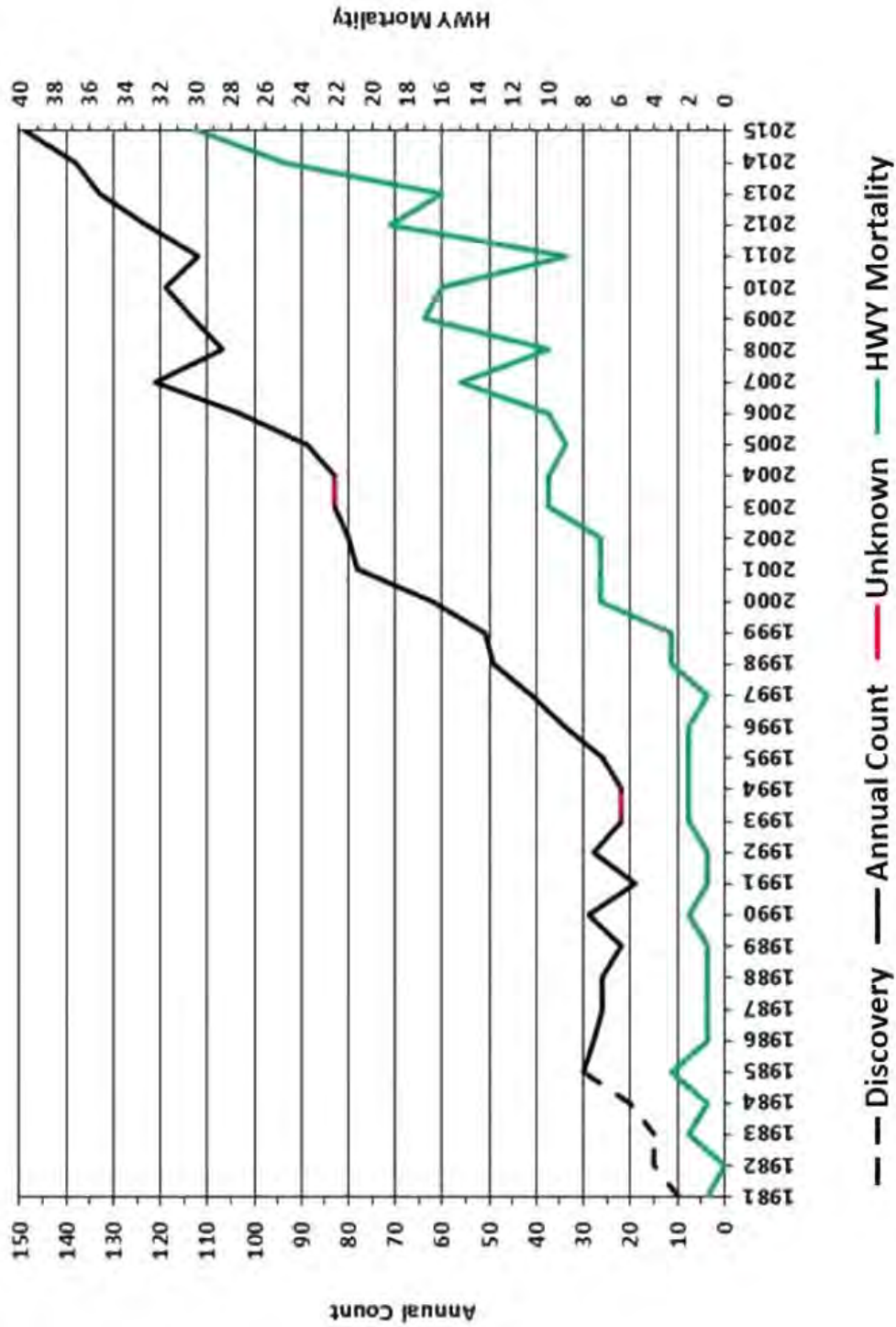


Figure 4-4: Annual Panther Count, 1985-2015, and Highway Mortalities (figure from McBride and McBride 2015).

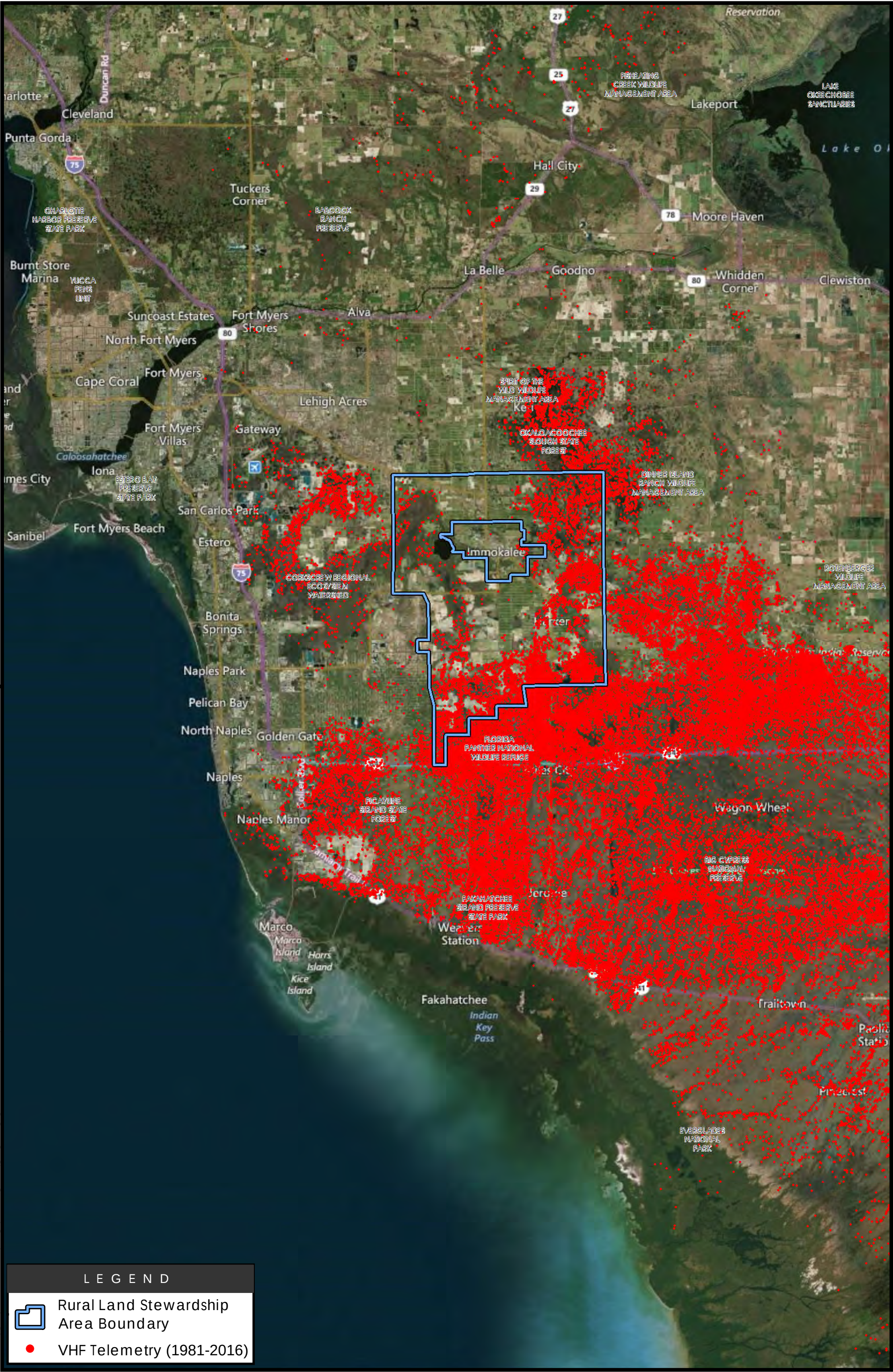
until another breeding population is established elsewhere within the panther's historic range (USFWS 2009a). Panther-vehicle collisions and intraspecific aggression are the leading causes of panther mortalities (USFWS 2009a; FWC 2017a, Appendix IV). Loss of genetic diversity was also cited as a threat 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).

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 km²) of conservation lands within the primary, secondary, and dispersal zones were dedicated as conservation lands for panther between 2003 and 2008 (USFWS 2008a). The current panther habitat assessment methodology (USFWS 2012a) 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 4.2.2.1) 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 2017c) and statistically rigorous density estimates (Sollmann et al. 2013) underscore the conservative nature of this methodology.

4.1.5 Occurrence in the HCP Area

Figures 4-5 and 4-6 depict VHF radiotelemetry data for 243 panthers from 1981 through June 2016, 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 Everglades National Park (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 in 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. In addition, the panther data presented in these figures include only collared panthers, which represent only a portion of the population (telemetry data were recorded from 19 panthers during the 2016-2017 reporting period; FWC 2017a). Until recently, panthers were not routinely collared on private lands in Southwest Florida; therefore, the telemetry dataset is biased toward areas within and adjacent to public lands.

Figures 4-7 and 4-8 depict the locations of panthers fitted with GPS collars, which can 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 24 panthers collared between 2009 and 2017, primarily within Collier and Hendry Counties, so the GPS data do not represent as geographically extensive a data set as the VHF radiotelemetry data depicted in Figures 4-5 and 4-6 (most apparent in BCNP and FSSP). Each dot on Figures 4-7 and 4-8 represents a single panther location acquired from GPS telemetry on a specific date and time (many collars were programmed to sample multiple times per 24-hour period), and the figures do not include telemetry recorded 65 miles



LEGEND

Rural Land Stewardship Area Boundary

VHF Telemetry (1981-2016)

FIGURE 4-5
Panther Radio Telemetry Data - Regional View
March 2019

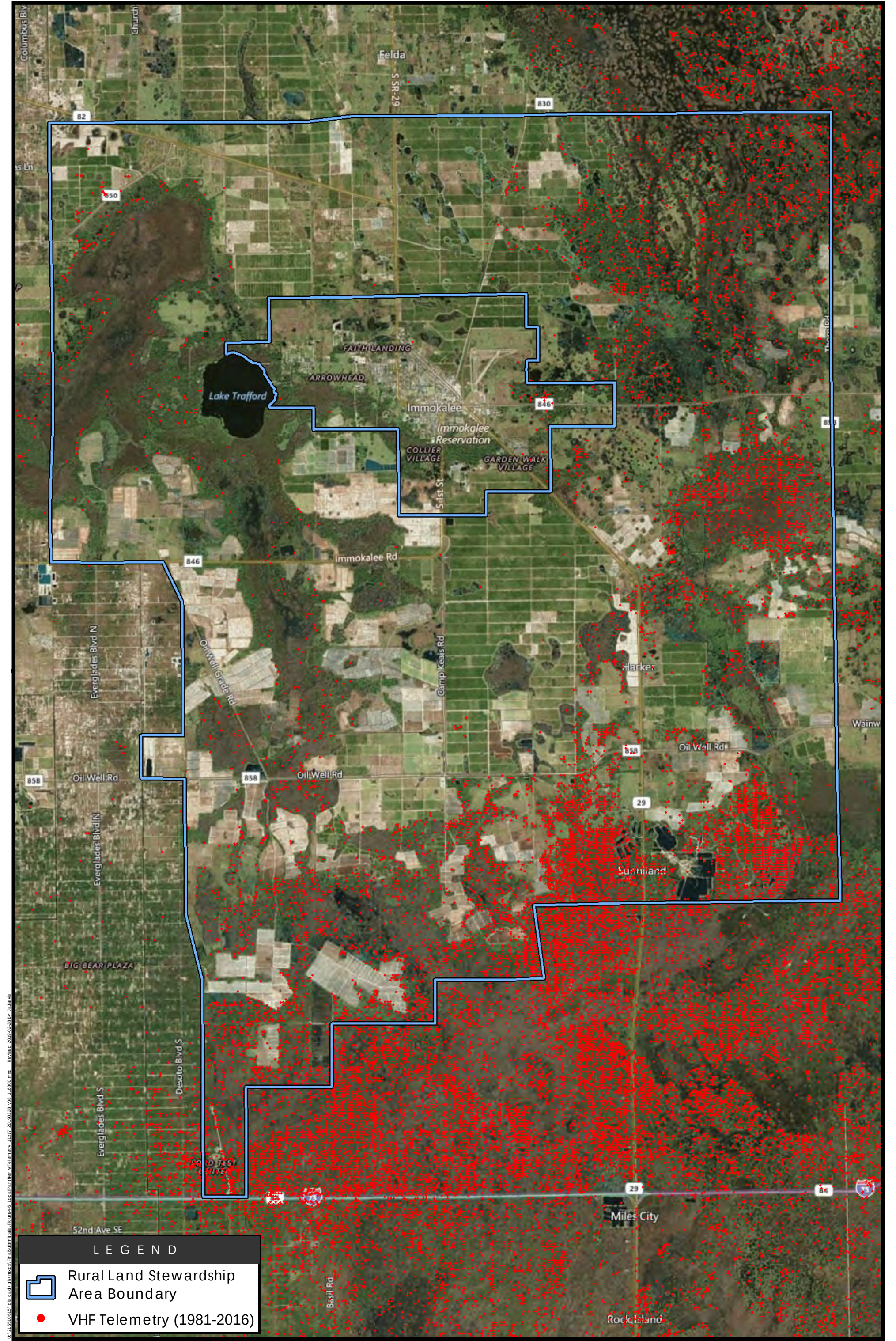


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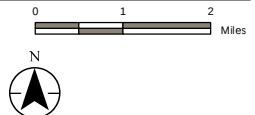
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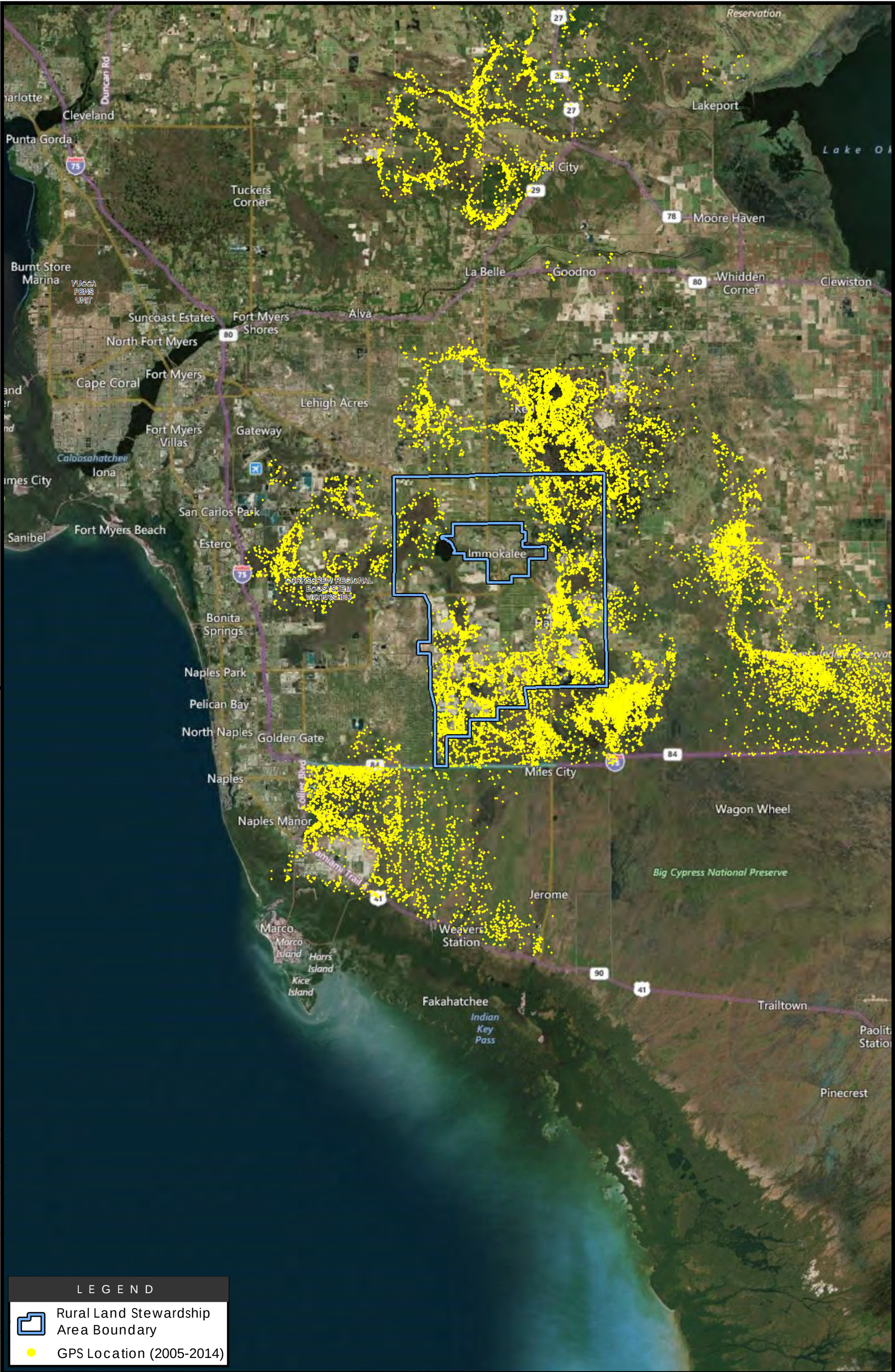


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FIGURE 4-6
Panther Radio Telemetry Data - Rural Land Stewardship Area
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LEGEND

 Rural Land Stewardship Area Boundary

 GPS Location (2005-2014)

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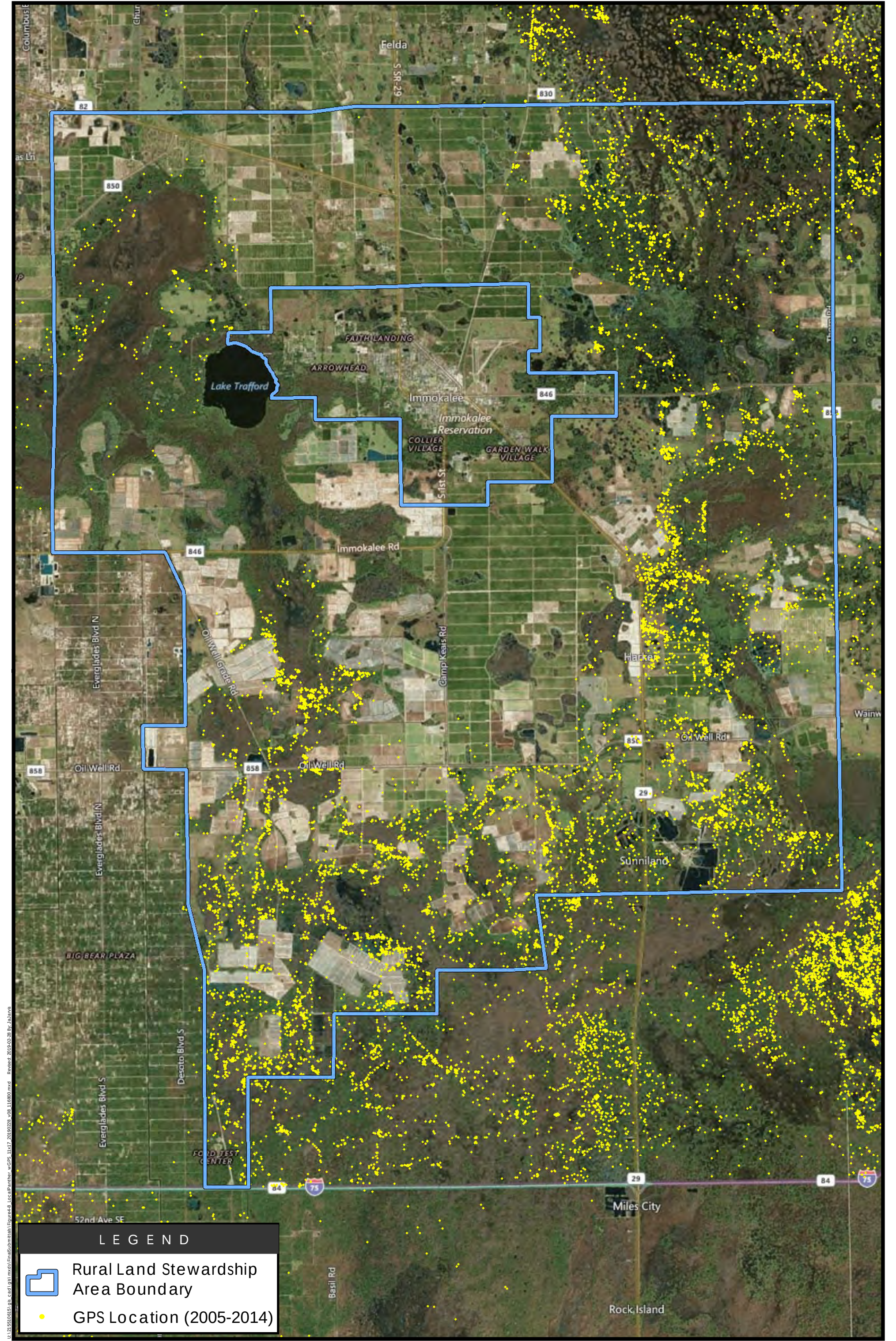
FIGURE 4-7
Panther GPS Data - Regional View
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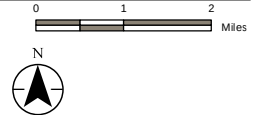
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FIGURE 4-8
Panther GPS Data - Rural Land Stewardship Area
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southeast of the RLSA in ENP or other areas east or north of the figure view extent. Figure 4-7 depicts a regional view of the GPS data, and a more localized depiction of the data relative to the HCP Area is provided by Figure 4-8. A visual comparison of Figures 4-6 and 4-8 reveals a similar 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, including panther-vehicle collision data, provides a sound basis in support of various Plan elements, including the location for preservation of extensive habitat areas and landscape linkages.

4.2 POTENTIAL BIOLOGICAL IMPACTS/TAKE ASSESSMENT

4.2.1 Potential Impacts to 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 49,276-acre area depicted on Figure 2-1 as “Covered Activities.” The Plan limits the total area of Covered Activities at Plan completion to a maximum of 45,000 acres. The applicants also seek take coverage for land maintenance activities to be conducted within the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use.

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

USFWS utilizes an “assessment framework” that follows a series of logical steps to analyze the effects of the action. In this case, the action is the Service’s issuance of the ITPs. Under the framework, this action is “deconstructed” into its constituent elements, to a level of detail sufficient to characterize the specific biological, physical, and/or chemical stressors to which species may be exposed. This characterization includes the intensity, spatial distribution, and temporal distribution (frequency/duration) of each stressor.

Spreadsheets assessing the deconstructed actions associated with the Covered Activities (Residential/Commercial Development and Earth Mining) are provided in Appendix A for the Florida panther and each of the 18 other Covered Species. These deconstructed activities provide a basis for assessing (i) the species’ exposure to stressors, (ii) the species’ response, and (iii) potential risk to individuals. During the Service’s section 7 consultation for ITP issuance, the Service will utilize this information to complete the assessment framework in full.

4.2.1.1.1 Residential/Commercial Development

Potential Direct Impacts to Panther: Habitat Loss

Some habitat loss will occur in connection with the Covered Activities, but under the Plan, habitat loss will be minimized, clustered, and directed away from higher value habitat and toward areas of less valuable habitat. For these reasons, the total habitat loss within the HCP Area will be much lower than it likely would be under the RLSP without the Plan. Figure 2-1 depicts the 49,276-acre area where Covered 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 current zoning laws. Under current zoning, 71,275 acres of the HCP Area are open to development at a one-residence-per-five-acre ratio. The Plan also places more restrictions on development in the HCP Area than would exist if the voluntary Collier County RLSP were mandatory (which it is not). The RLSP originally defined approximately 93,100 acres primarily consisting of previously-converted agricultural areas within the HCP Area as “Open” land use overlays, which means those areas are generally open and available for future development. Approximately 17,916 acres of these “Open” lands under the RLSP exist within the Big Cypress Area of Critical State Concern (ACSC), which is located primarily east of State Route 29 (SR-29) and north of the FPNWR within the HCP Area (Figure 4-2). Restrictions on site development within the ACSC effectively preclude higher-density residential developments, but development may still occur under base zoning regulations (1 dwelling unit per five-acre area).

Of the 93,100 acres of RLSP “Open” lands, the HCP Area contains 71,275 acres where development could occur consistent with the RLSP. This acreage includes 13,935 acres of “Open” land within the ACSC, where large blocks of interconnected panther habitat exist. The remaining 57,340 “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 71,275 acres of “Open” areas, but instead chose to identify a much smaller area available for Covered Activities, and thereby not only conserve additional land but also direct development activities away from high-value habitat and toward already-disturbed lands and other areas of less valuable habitat. 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 depict 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 private lands adjacent to the FPNWR. The Plan generally directs the Covered Activities away from the 13,935 acres of “Open” lands within the ACSC (Figure 2-1). Under the Plan, the vast majority of lands 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 lands designated by the Plan for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan. Project-level planning can further avoid, minimize, and mitigate impacts to panther habitat along the borders between the areas designated for Covered Activities and the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

The 49,276-acre envelope of land designated for up to 45,000 acres of potential Covered Activities (including residential/commercial development) contains an estimated 35,638 acres (Table 3-1) that are currently in active use for intensive agricultural production (row crops, citrus groves, and sod farms, excluding improved pastures). Another 4,407 acres within this envelope of land are classified as 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 on 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 40,045 acres out of the 49,276-acre envelope designated for Covered Activities (approximately 78%). This represents potentially up to 85% 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. In the deconstructed activities (Appendix A), these habitat losses would be associated with land clearing activities prior to construction. As a first approximation, assuming that a minimum area of native habitats within these extensive agricultural areas were directly impacted, only 651 acres of native habitats would be impacted, comprising 1.5% of the 45,000-acre area at Plan completion. Indeed, only 10% of the area designated for Covered Activities consists of native habitats (4,926 acres/49,276 acres), resulting in a maximum total of 4,926 acres of impacts to native habitats. Most of these potentially impacted native habitats occur as small, isolated patches within large agricultural areas, and are less utilized by panthers than extensive interconnected native habitats (see Figures 4-6 and 4-8). Based on the interest of the applicants in avoiding native habitat impacts, thereby limiting the allocation of mitigation credits required under the Plan for any particular activity, and satisfying other planning considerations, including an overall interest in conserving and protecting resources, impacts to native habitat are likely to be closer to the low end of this range.

An estimated 5,075 acres of improved pasture occur within the Covered Activities land designation (Table 3-1). The Cooperative Land Cover data lumps unimproved pastures in with woodland pasture, which does not allow for a separate tabulation of unimproved pastures. 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. Because improved pastures are a specific habitat preference for the northern caracara, the Plan requires an acre-for-acre in-kind replacement of impacts to improved pastures.

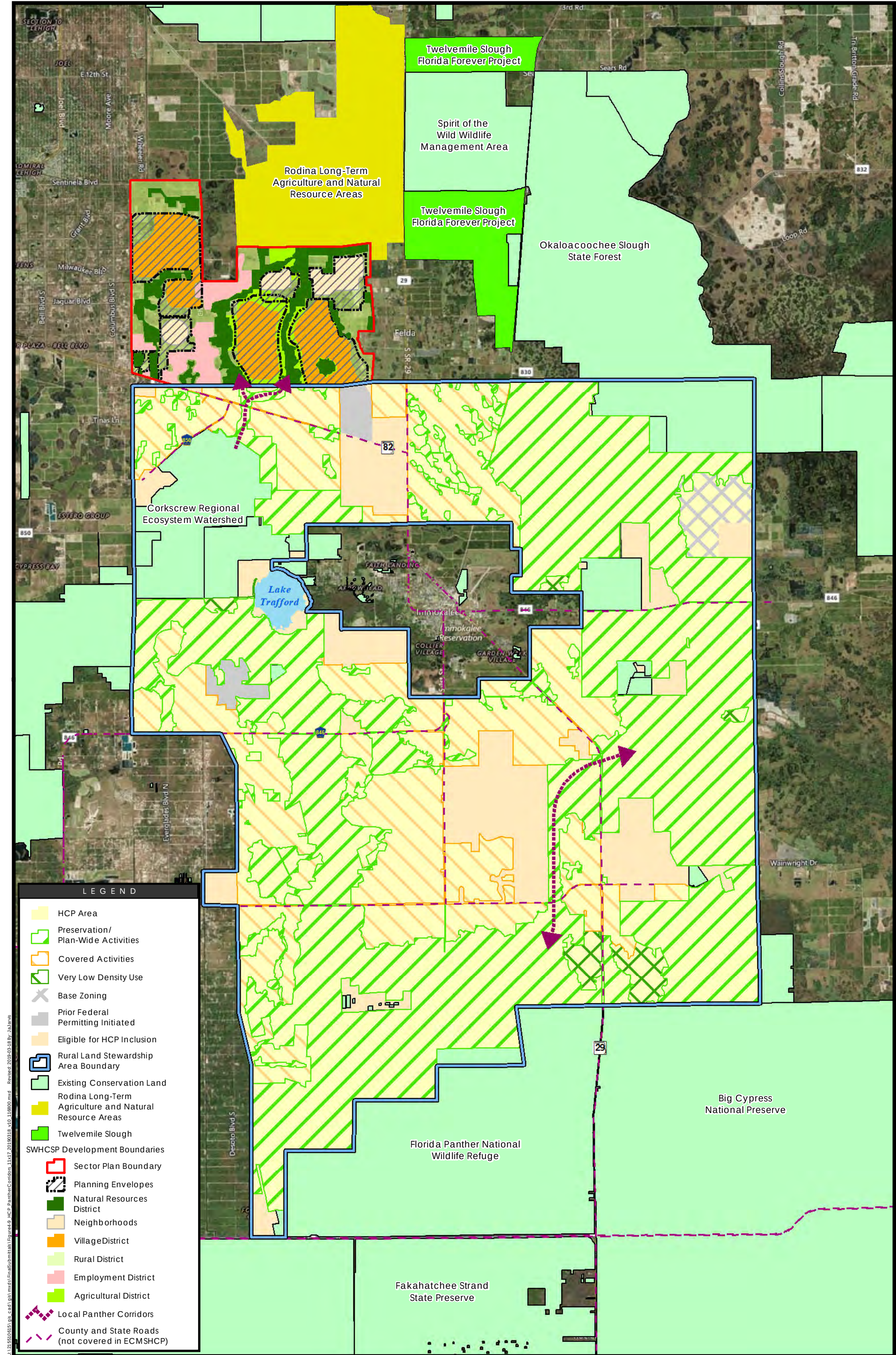
Therefore, there will be no net loss of improved pasture habitat for panthers, and the compensation for improved pasture impacts will tend to be directed to those interconnected Plan-Wide/Preservation lands that are more highly utilized by panthers.

The native habitat acreage total includes an estimated 2,856 acres of native wetlands, for which Federal and State permitting agencies would require avoidance, minimization, and mitigation. Similarly, a substantial 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 panther 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 the applicants to direct impacts toward areas already cleared or otherwise impacted by agriculture or other activities.

The USFWS panther habitat assessment methodology (USFWS 2012a) 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 impacts will depend on the final location of the 45,000 acres of Covered Activities within the 49,276-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 4,276 acres of Covered Activities lands that are not impacted at Plan completion ($49,276 - 45,000 = 4,276$) 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 up to 45,000 acres of Covered Activities at Plan completion, which will be the subject of project-level master planning, most panther habitat fragmentation will 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 11 private property owners (applicants) under the Plan.

The ability to preserve extensive interconnected areas of panther habitat is not normally achievable with standard development (project-by-project) planning. The preservation of these private lands has been a long-sought goal for panther conservation (Belden et al. 1988; Maeher 1990; Logan et al. 1993; Main et al. 1999; USFWS 2008a; Beier 2010). Preserving interconnected private lands that comprise most of the Okaloacoochee Slough is a particularly important panther conservation achievement, because this regional landscape linkage connects the panther core population area south and east of the HCP Area (Maeher 1997; USFWS 2002a) to the panther dispersal zone (Kautz et al. 2006; USFWS 2008a). The Plan also reserves areas for the restoration of local panther corridors to aid in the safe passage of panthers across the local landscape, as shown conceptually in Figure 4-9.



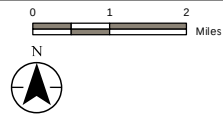
U:\215510615\gs_cad\gs\mxd\Final\submit\fig4-9_HCP_PantherCorridor\11x17-20190318_v10_118800.mxd Revised: 2019-03-18 By: Jalaris



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FIGURE 4-9
HCP Panther Corridor Locations
March 2019

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Potential Direct Impacts to Panther: Construction Disturbance and Related Stressors

The spreadsheet on deconstructed activities relating to Residential/Commercial Development provided in Appendix A defines three general phases related to construction activities (Pre-Construction, Horizontal Construction, and Vertical Construction), and identifies activities within these phases that may result in physical, chemical, and/or biological stressors that elicit responses from panthers. Potential stressors associated with habitat losses are covered in the previous section; this section addresses the direct impacts from temporary stressors that can occur during active construction of residential/commercial developments.

It is essential to consider issues of scale, the timing of direct impacts, and the duration of direct impacts when evaluating the potential effects of each activity/sub-activity on panthers. For example, many of the large agricultural fields that may be converted to development are over one mile wide, so construction activities in the middle of a large field may have no discernable effects on panthers. As construction activities approach field edges adjacent to suitable panther habitat, the probability that a stressor (noise, human activity) will elicit a response from a panther increases. Given the scale of proposed development areas, the duration of impacts (disturbance) will be limited to only a small proportion of the field edges at any given time.

The Plan also requires that nearly all residential/commercial construction activities occur between sunrise and sunset, avoiding the crepuscular (dawn/dusk) and nocturnal periods when panthers are most active. The only exceptions for construction activities occurring during darkness will be for the clearing of limited areas of trees (generally isolated habitat patches with agricultural fields) that could potentially contain Florida bonneted bat roosts. This measure may be required to avoid and minimize potential harm to bonneted bats and will be coordinated with USFWS. The probability of a panther being directly affected by construction activities is therefore very low, especially because panthers avoid large, open agricultural areas that are devoid of cover during daylight hours.

The deconstructed activities spreadsheet for Florida panther (Appendix A) provides a “spatial distribution” or radius distance over which a given stressor may be expected to elicit a response from panthers. The distances listed in the spreadsheet are based on published data where available, and inferences from published literature where no data are available. The “temporal distribution” metric estimates the duration and frequency of a given stressor for each sub-activity. The duration is sometimes expressed as “X days per zone,” which acknowledges that construction activities and associated potential stressors will affect a given land area only when the activity occurs within a given radius from panther habitat, after which the construction activities will move to a new area.

The Pre-Construction activities consist of relatively low-impact activities such as listed species surveys, land surveying, and geotechnical investigations that involve small truck-mounted drilling rigs. These activities are similar in nature to ongoing agricultural and land management activities that continually occur within the HCP Area. Janis and Clark (2002) and McCarthy and Fletcher (2015) analyzed the effects of similar (off-road vehicle or ORV) effects on panther and panther prey base behavior and

concluded that the effects extended to a distance of 180 meters. Therefore, 180 meters was used as the “spatial distribution” (radius distance) for these stressors in the spreadsheet.

The Horizontal Construction activities involve land clearing, earth moving/grading, dewatering activities, and general infrastructure construction. The use of large machinery (bulldozers, excavators, dump trucks) produce a relatively high intensity of noise and disturbance. No published data exist regarding the distance at which panthers would no longer react to those stressors, and a distance of 300 meters (1,000 feet) was used to evaluate potential effects. As noted, when construction activities occur more than 300 meters from a field edge adjacent to panther habitat, the stressors would not be expected to produce discernable effects.

Additionally, it is reasonable to anticipate that panthers may be at least partially habituated to loud machinery and human disturbance within the extensive agricultural areas where the majority of residential/commercial development construction will occur. Past and ongoing agricultural operations involve large tractors, bulldozers (for field leveling), excavators (for canal and berm maintenance), large trucks (for planting and harvesting), buses (for farmworker transport), and work crews. These activities should be considered a baseline for comparison with the proposed construction activities.

The third general phase of residential/commercial construction involves vertical construction, primarily of residential and commercial buildings. These construction activities will generally create fewer stressors that affect panthers, because building construction in large master-planned communities is generally concentrated toward the center of the developments, with more passive (open space) uses such as recreational areas and stormwater management lakes occurring along the interface with natural areas. The intensity of disturbances (e.g., noise) is generally lower than disturbances associated with horizontal construction.

To summarize, the direct impacts from residential/commercial development construction on the Florida panther will be temporary, similar in certain locations and respects to ongoing activities on those same lands, and at any given time will be limited to those areas where construction is actively ongoing within a few hundred meters of panther habitat. The Biological Opinion for the Picayune Strand Restoration Project noted, “Panthers and their prey may temporarily avoid locations of construction disturbance but are not expected to leave the area entirely and will be expected to resume normal behaviors after the disturbance ceases.” (USFWS 2009b, 98)

Potential Indirect Impacts to Panther: Construction Activities and Related Stressors

Potential 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 effects 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

Potential Direct Impacts to Panther

Earth mining operations are Covered Activities under the Plan, and they therefore count toward the 45,000-acre cap. 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 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 direct impacts from earth mining activities (habitat loss, noise, human disturbance) are similar to those addressed as direct habitat impacts of residential/commercial development described in section 4.2.1.1.1 above. The duration of direct impacts will generally be longer for mining activities at any given location, since extraction of sand and/or rock takes longer than development-related earth moving. However, as with construction, the effects will be temporary and limited only to a few hundred meters from the operating machinery. Onsite mining operations may operate day and/or night, but the Plan requires that offsite transport of mining products can only occur between sunrise and sunset.

Potential Indirect Impacts to Panther

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

Once an earth mine is reclaimed and decommissioned, any potential indirect impacts due to noise and human activity will cease, unless the mine is later transitioned into residential/commercial development.

4.2.1.1.3 Land Management

Potential Direct Impacts to Panther

The lands designated as Plan-Wide/Preservation and Very Low Density Use will require periodic land management in perpetuity to maintain and/or improve habitat functions; maintain agricultural operations and drainage infrastructure; control exotic vegetation; and control pests and diseases. Past, present, and future land management activities conducted by the applicants represent valuable contributions to agricultural and ecological sustainability.

Under the Plan, these activities include land management techniques such as prescribed burning; mechanical control of groundcover (e.g., roller chopping, brush-hogging, mowing); ditch and canal maintenance; mechanical and/or chemical control of exotic vegetation; soil tillage; and similar activities that maintain or improve land quality.

These ongoing land management practices could impact adult and sub-adult panthers in a manner similar to residential/commercial construction activities, depending on the activity and the intensity of machinery noise. Unlike the construction activities, however, land management activities maintain or improve habitat extent and/or functions. Panthers and their prey base may temporarily avoid the immediate area where land management activities occur and return to use the area when those activities cease. In cases where prescribed burning, roller chopping, and exotic vegetation control improve prey base foraging, there likely will be a net positive impact from the activities.

The permittees will coordinate with FWC and USFWS panther biologists within 30 days prior to the initiation of land management activities that may impact panthers (e.g., prescribed burning; roller chopping in dense palmetto or other woody vegetation). This coordination will allow panther biologists to alert the permittee(s) to recent panther activity in the immediate vicinity of the project boundary, especially any evidence of denning activity. Potential take of panthers from land management activities is addressed in sections 4.2.3 and 4.4.1.

Potential Indirect Impacts to Panther

Potential indirect impacts to panthers from land management activities are expected to be beneficial or neutral. The beneficial effects result primarily from maintaining or improving foraging opportunities for the panther prey base (primarily deer and hogs) through prescribed burning, roller chopping, mowing, and exotic vegetation control. Some land management activities (e.g., maintaining drainage infrastructure) may have no discernable direct or indirect effect on panthers.

4.2.2 Panther Habitat Assessment

Most of the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan 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; they 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 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 Panther Habitat Units (PHUs), discussed below. This section details the results of analyses conducted using the USFWS Panther Habitat Assessment Methodology (USFWS 2012a) to evaluate the overall effects of the Plan in terms of mitigation and potential panther habitat impacts, based on land cover acreage and functional value of land cover types as panther habitat.

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 resulting from 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 methodology 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 49,276-acre area (see Chapter 2 and Figure 2-1). Although the exact locations of the 45,000 or fewer acres where Covered Activities will occur are unknown, potential locations are constrained by the fact that they can only occur within the 49,276-acre envelope provided in the Plan for Covered Activities, which is only 10% larger than the total area provided for Covered Activities under the Plan. Likewise, exact locations of the 4,276 acres of land that will be preserved within that same 49,276-acre envelope ($49,276 - 45,000 = 4,276$ acres) — representing approximately 3% of the total HCP Area — are currently unknown. Those 4,276 acres will become part of the lands designated for Preservation/Plan-Wide Activities.

To account for this flexibility in the final precise location of Covered Activities, two conservative scenarios were analyzed, 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 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 First

The USFWS Panther Habitat Assessment Methodology assigns a habitat suitability value, or functional value, for various land cover types that occur within the Florida panther's range (USFWS 2012a, Table PM2). These habitat suitability values were derived from three peer-reviewed studies that examined panther-habitat relationships using a total of six statistical habitat rankings (Cox et al. 2006; Kautz 2006; and Land et al. 2008) (USFWS 2012a, 4). USFWS averaged the rankings of the habitat suitability values for each land cover type, and the results ranged from a value of 9.5 (most selected by panthers) to 0 (least selected by panthers) 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 (USFWS 2012a, Table PM2). 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; USFWS 2018c) and was therefore removed from the PHU calculations. Similarly, the 6,293 acres of panther mitigation previously assessed for Ave Maria were removed from the analysis (Ave Maria's 5,027 acres still contribute to the overall 45,000-acre cap for Covered Activities under the Plan, however). We note that, under the HCP, the conservation value of

these lands will be enhanced by the permanent preservation and management of lands adjoining these parcels. Although the town of Ave Maria was considered in the landscape-level planning of the HCP Area and counts toward the 45,000-acre cap on Covered Activities under the Plan, the applicants do not seek take coverage for any species within the 5,027-acre portion of the Covered Activities area that consists of the town of Ave Maria. 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 within the Covered Activities was used as the basis for PHU calculations. In addition to the 39,973 acres of lands designated for Covered Activities, the PHU analysis includes 4,262.4 acres designated for Preservation/Plan-Wide Activities that are within the lands designated for Covered Activities (i.e., the Covered Activities “footprint”), and that may become isolated after implementation of the Covered Activities. Although these lands will provide valuable habitat for many of the other Covered Species, they may be inaccessible to panther.

The results of the PHU calculations for this scenario (highest habitat values impacted first) are presented in Table 4-1, broken down by primary versus secondary panther zone habitat. (The concept of acres of land in the Primary Zone being impacted first is addressed in section 4.2.2.1.2.) This scenario resulted in 17,214.9 acres of primary zone habitat impacts (which, when multiplied by the habitat values assigned to each land cover type within those lands per Table 4-1, equals 87,088.1 PHUs), and 22,758.1 acres of secondary zone habitat impacts (which, when multiplied by the habitat values assigned to each land cover type within those lands per Table 4-1, equals 108,742.1 PHUs), for a total of 39,973 acres and 195,830.2 PHUs. In the USFWS methodology, the raw PHU calculations reflected in Table 4-1 must be adjusted to account for whether the impacts occur within the Primary Zone or Secondary Zone, and similarly whether the mitigation occurs in the Primary or Secondary Zone.

The USFWS Panther Habitat Assessment 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 2012a). As discussed above, the methodology assumes a very conservative panther density of 31,923 acres per panther, and also accounts for estimated annual habitat losses and indirect effects. As shown in Tables 4-2a-c¹⁶, 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, 2012a; Table PM5).

In this scenario, where the highest habitat suitability value areas were presumed to be impacted by the Covered Activities first, the Preservation/Plan-Wide Activities areas contained 4,266.8 acres of

¹⁶ Table 4-2a provides PHU calculations for the 39,973 acres of lands designated for Covered Activities; Table 4-2b provides PHU calculations for the 4,262.4 acres of potentially isolated lands designated for Preservation/Plan-Wide Activities; Table 4-2c provides the sum of the calculations in Tables 4-2a and 4-2b.

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

		Primary Zone Covered Activities 17,214.9 acres*				Secondary Zone Covered Activities 22,758.1 acres*			
		Current		w/ Covered Activities		Current		w/ Covered Activities	
Cooperative Land Cover (CLC) Class	Score	Acres	PHUs	Acres**	PHUs	Acres	PHUs	Acres**	PHUs
Mesic Flatwoods	9.5	841.3	7992.1	-	0.0	136.3	1294.7	-	0.0
Hydric Pine Flatwoods	9.5	123.8	1176.1	-	0.0	19.7	187.2	-	0.0
Mixed Hardwood-Coniferous	9.3	241.7	2247.4	-	0.0	8.1	75.6	-	0.0
Cypress/Pine/Cabbage Palm	9.3	17.9	166.3	-	0.0	0.0	0.0	-	0.0
Cypress/Tupelo (incl Cy/Tu mixed)	9.2	129.1	1187.5	-	0.0	13.2	121.2	-	0.0
Other Wetland Forested Mixed	9.2	39.1	359.9	-	0.0	1.1	9.7	-	0.0
Other Coniferous Wetlands	9.2	11.0	100.9	-	0.0	0.0	0.0	-	0.0
Other Hardwood Wetlands	9.2	0.0	0.0	-	0.0	4.3	39.2	-	0.0
Mixed Wetland Hardwoods	9.2	37.2	342.6	-	0.0	11.4	105.2	-	0.0
Cypress	9.2	124.2	1142.4	-	0.0	15.3	140.5	-	0.0
Cabbage Palm	9.0	10.6	95.2	-	0.0	12.0	108.3	-	0.0
Mesic Hammock	9.0	306.1	2754.8	-	0.0	88.8	799.5	-	0.0
Palmetto Prairie	6.3	0.3	1.6	-	0.0	1.1	7.1	-	0.0
Unimproved/Woodland Pasture	5.7	548.5	3126.4	-	0.0	501.0	2855.8	-	0.0
Rural Open Forested	5.7	49.0	279.6	-	0.0	10.8	61.8	-	0.0
Rural Open	5.7	191.0	1088.7	-	0.0	162.7	927.3	-	0.0
Mixed Scrub-Shrub Wetland	5.7	429.1	2360.0	-	0.0	306.1	1683.6	-	0.0
Shrub and Brushland	5.5	201.4	1107.8	-	0.0	48.6	267.1	-	0.0
Improved Pasture	5.2	3410.0	17732.2	-	0.0	1340.8	6972.2	-	0.0
Citrus	5.5	2833.6	13318.1	-	0.0	16486.2	77485.1	-	0.0
Pecan	5.2	61.2	287.7	-	0.0	68.6	322.2	-	0.0
Fallow Orchards	4.7	21.5	101.0	-	0.0	69.9	328.3	-	0.0
Isolated Freshwater Marsh	4.7	8.5	40.1	-	0.0	0.9	4.1	-	0.0
Ornamentals	4.7	0.6	2.7	-	0.0	0.3	1.6	-	0.0
Isolated Freshwater Swamp	4.7	141.8	666.4	-	0.0	26.0	122.0	-	0.0
Marshes	4.7	510.5	2399.3	-	0.0	516.4	2427.0	-	0.0
Row Crops	4.7	6926.0	27011.6	-	0.0	2908.6	12395.9	-	0.0
TOTALS***		17,214.9	87,088.1	-	0.0	22,758.1	108,742.1	-	0.0

* The acreage subtotals above for Covered Activities within the Primary and Secondary 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.

** The acreages of post-development land cover types within Covered Activities cannot be precisely quantified because of location and site design factors, but post-activity PHU values were all set to zero to reflect impacts.

*** The acreages and PHU totals shown are rounded to 0.1 unit.

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

Zone	Acres ¹	PHUs ²	Base Ratio	Landscape Multiplier	USFWS (2012) Mitigation Required
Primary	17,214.9	87,088.1	2.5	1	217,720.3
Secondary	4,266.8	20,387.5	2.5	1	50,968.8
	18,491.3	88,354.6	2.5	0.69	152,411.7
TOTALS	39,973.0				421,100.8

**Table 4-2b. Panther Habitat Unit (PHU) Calculations for Isolated Preserve Areas within
Covered Activities Areas**

Zone	Acres ¹	PHUs ²	Base Ratio	Landscape Multiplier	USFWS (2012) Mitigation Required
Primary	1,545.9	9,904.3	2.5	1	24,760.8
Secondary	2,716.5	13,566.7	2.5	0.69	23,402.6
TOTALS	4,262.4				48,163.3

**Table 4-2c. PHU Calculations for Covered Activities and Isolated Preserve Areas within
Covered Activities Areas (By Highest Habitat Suitability Values)**

Zone	Acres ¹	PHUs ²	Base Ratio	Landscape Multiplier	USFWS (2012) Mitigation Required
Primary	18,760.8	96,992.4	2.5	1	242,481.0
Secondary	4,266.8	20,387.5	2.5	1	50,968.8
	21,207.8	101,921.3	2.5	0.69	175,814.2
TOTALS ³	44,235.4				469,264.0

¹ Secondary Zone impacts were sub-divided to balance the 4,266.8 acres (20,387.5 PHUs) from Covered Activities impacts with the 4,266.8 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 49,275-acre envelope will be determined later, the estimated PHUs for the 4,266.8 acres were calculated as a proportion of the Secondary Zone impact acreage.

³ The total of 44,235.4 acres results from the 39,973 acres of Covered Activities, plus the 4,262.4 acres of isolated preserve areas within the Covered Activities areas that would be unavailable for panther utilization post-development.

secondary zone lands. Therefore, Tables 4-2a and 4-2c subdivide the secondary zone acreage and PHU totals to illustrate that 4,266.8 acres (20,387.5 PHUs) of secondary zone impacts would be mitigated by preservation of an equivalent 4,266.8 acres of secondary zone lands in this scenario, using “1” as the landscape multiplier. The remaining 18,491.3 acres (88,354.6 PHUs) 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.

As noted above, the Covered Activities area contains small habitat patches that are designated as preservation areas, but that may be inaccessible to panthers in the post-development state. To account for the fact that these 4,262.4 acres of inaccessible preservation areas may not be used by panther (although they will be used by other Covered Species), the analysis included an additional 4,262.4 acres of habitat impacts above and beyond the 39,973 acres of Covered Activities. Table 4-2b presents the results from that analysis.

The “USFWS (2012) Mitigation Required” column in Table 4-2c totals 469,264.0 PHUs, and represents the estimated total mitigation required for the Covered Activities under the USFWS methodology. This methodology is similar to the methodology employed in current USFWS Biological Opinions. Table 4-2c represents the sum of the PHU totals from Table 4-2a (impacts from Covered Activities), and Table 4-2b (impacts from preserve areas within the Covered Activities areas that may be inaccessible to panther in post-development).

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, under this scenario, 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 in comparison to Table 4-1, the total impact acreage is the same (39,973 acres), and that the total estimated raw PHUs (193,475.2) is slightly lower than the 195,830.2 PHUs estimated under the first scenario (highest habitat values impacted first).

Although this second scenario results in 1,694.3 additional acres of primary zone impacts as compared to the first scenario, which are subject to a higher landscape multiplier than secondary zone impacts, the lower raw PHU total largely negates that effect. Tables 4-4a-c provide summaries of the PHU calculations for the second scenario. As shown in Table 4-4c, the estimated PHUs required under the USFWS methodology for the second scenario total 473,508.3, as compared to 469,264.0 for the first scenario (an increase of 4,244.3 PHUs).

Notably, under both scenarios, 78-80% of the potential impacts within the Covered Activities areas occurred within agricultural or other non-native land cover types. Potential impacts to native habitat

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

		Primary Zone Covered Activities 18,909.2 acres*				Secondary Zone Covered Activities 21,063.8 acres*			
		Current		w/ Covered Activities		Current		w/ Covered Activities	
Cooperative Land Cover (CLC) Class	Score	Acres	PHUs	Acres**	PHUs	Acres	PHUs	Acres**	PHUs
Mesic Flatwoods	9.5	841.3	7992.1	-	0.0	136.3	1294.7	-	0.0
Hydric Pine Flatwoods	9.5	123.8	1176.1	-	0.0	19.7	187.2	-	0.0
Mixed Hardwood-Coniferous	9.3	241.7	2247.4	-	0.0	8.1	75.6	-	0.0
Cypress/Pine/Cabbage Palm	9.3	17.9	166.3	-	0.0	0.0	0.0	-	0.0
Cypress/Tupelo(incl Cy/Tu mixed)	9.2	129.1	1187.5	-	0.0	13.2	121.2	-	0.0
Other Wetland Forested Mixed	9.2	39.1	359.9	-	0.0	1.1	9.7	-	0.0
Other Coniferous Wetlands	9.2	11.0	100.9	-	0.0	0.0	0.0	-	0.0
Other Hardwood Wetlands	9.2	0.0	0.0	-	0.0	4.3	39.2	-	0.0
Mixed Wetland Hardwoods	9.2	37.2	342.6	-	0.0	11.4	105.2	-	0.0
Cypress	9.2	124.2	1142.4	-	0.0	15.3	140.5	-	0.0
Cabbage Palm	9.0	10.6	95.2	-	0.0	12.0	108.3	-	0.0
Mesic Hammock	9.0	306.1	2754.8	-	0.0	88.8	799.5	-	0.0
Palmetto Prairie	6.3	0.3	1.6	-	0.0	1.1	7.1	-	0.0
Unimproved/Woodland Pasture	5.7	548.5	3126.4	-	0.0	501.0	2855.8	-	0.0
Rural Open Forested	5.7	49.0	279.6	-	0.0	10.8	61.8	-	0.0
Rural Open	5.7	191.0	1088.7	-	0.0	162.7	927.3	-	0.0
Mixed Scrub-Shrub Wetland	5.5	429.1	2360.0	-	0.0	306.1	1683.6	-	0.0
Shrub and Brushland	5.5	201.4	1107.8	-	0.0	48.6	267.1	-	0.0
Improved Pasture	5.2	3410.0	17732.2	-	0.0	1340.8	6972.2	-	0.0
Citrus	4.7	2833.6	13318.1	-	0.0	16486.2	77485.1	-	0.0
Fallow Orchards	4.7	21.5	101.0	-	0.0	69.9	328.3	-	0.0
Isolated Freshwater Marsh	4.7	8.5	40.1	-	0.0	0.9	4.1	-	0.0
Pecan	4.7	61.2	287.7	-	0.0	68.6	322.2	-	0.0
Ornamentals	4.7	0.6	2.7	-	0.0	0.3	1.6	-	0.0
Isolated Freshwater Swamp	4.7	141.8	666.4	-	0.0	26.0	122.0	-	0.0
Marshes	4.7	510.5	2399.3	-	0.0	516.4	2427.0	-	0.0
Row Crops	3.9	7860.0	30653.9	-	0.0	1214.3	4735.7	-	0.0
Rural Structures	3.0	16.9	50.8	-	0.0	0.0	0.0	-	0.0
Exotic Wetland Hardwoods	3.0	3.7	11.2	-	0.0	0.0	0.0	-	0.0
Brazilian Pepper	3.0	217.7	653.2	-	0.0	0.0	0.0	-	0.0
Fallow Cropland	3.0	315.8	947.5	-	0.0	0.0	0.0	-	0.0
Ditch/Artificial Intermittent Stream	0.0	0.0	0.0	-	0.0	0.0	0.0	-	0.0
Commercial and Services	0.0	19.4	0.0	-	0.0	0.0	0.0	-	0.0
Communication	0.0	3.0	0.0	-	0.0	0.0	0.0	-	0.0
Cultural - Lacustrine	0.0	35.4	0.0	-	0.0	0.0	0.0	-	0.0
Industrial	0.0	3.3	0.0	-	0.0	0.0	0.0	-	0.0
Residential, Low Density	0.0	36.5	0.0	-	0.0	0.0	0.0	-	0.0
Transportation	0.0	40.8	0.0	-	0.0	0.0	0.0	-	0.0
Floating/Emergent Aquatic Vegetation	0.0	4.1	0.0	-	0.0	0.0	0.0	-	0.0
Canal	0.0	14.7	0.0	-	0.0	0.0	0.0	-	0.0
Utilities	0.0	0.5	0.0	-	0.0	0.0	0.0	-	0.0
Low Intensity Urban	0.0	48.5	0.0	-	0.0	0.0	0.0	-	0.0
TOTALS***		18909.2	92393.3	-	0.0	21063.8	101081.9	-	0.0

* The acreage subtotals above for Covered Activities within the Primary and Secondary 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.

** The acreages of post-development land cover types within Covered Activities cannot be precisely quantified because of location and site design factors, but post-activity PHU values were all set to zero to reflect impacts.

*** The acreages and PHU totals shown are rounded to 0.1 unit.

**Table 4-4a. 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
Primary	18,909.2	92,393.3	2.5	1	230,983.2
Secondary	4,266.8	20,475.7	2.5	1	51,189.3
	16,797.0	80,606.2	2.5	0.69	139,045.7
TOTALS	39,973.0				421,218.1

**Table 4-4b. Panther Habitat Unit (PHU) Calculations for Isolated Preserve Areas
within Covered Activities Areas**

Zone	Acres	PHUs	Base Ratio	Landscape Multiplier	USFWS (2012) Mitigation Required
Primary	1,545.9	9,904.3	2.5	1	24,760.8
Secondary	2,716.5	13,566.7	2.5	0.69	23,402.6
TOTALS	4,262.4				48,163.3

**Table 4-4c. PHU Calculations for Covered Activities and Isolated Preserve Areas
within Covered Activities Areas (By Primary Zone Precedence)**

Zone	Acres ¹	PHUs ²	Base Ratio	Landscape Multiplier	USFWS (2012) Mitigation Required
Primary	20,455.1	105,463.3	2.5	1	263,658.3
Secondary	4,266.8	19,749.3	2.5	1	49,373.3
	19,513.5	93,030.0	2.5	0.69	160,476.8
TOTALS ³	44,235.4				473,508.3

¹ Secondary Zone impacts were sub-divided to balance the 4,266.8 acres (20,475.7 PHUs) from Covered Activities impacts with the 4,266.8 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 50,175-acre envelope will be determined later, the estimated PHUs for the 4,266.8 acres were calculated as a proportion of the Secondary Zone impacts.

³ The total of 44,235.4 acres results from the 39,973 acres of Covered Activities, plus the 4,262.4 acres of isolated preserve areas within the Covered Activities areas that would be unavailable for panther utilization post-development.

result largely from impacts to small native habitat remnants within extensive agricultural fields, which have relatively low functional value for panthers. By contrast, the corresponding areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under each scenario contained approximately 65% native habitats, which occur in a contiguous landscape-scale matrix favorable for panther utilization.

4.2.2.2 Analyses of PHUs Provided Through Preservation, by Land Designation

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

The Panther Habitat Assessment Methodology (USFWS 2012a) was also used to estimate the PHUs provided 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 provided by Stewardship Sending Areas (SSAs) 1, 2, 3, 4, and portions of SSA 6 for Ave Maria were removed from this analysis.¹⁷ All SSA lands that have not been assessed for PHUs by USFWS as part of a federal permitting action, and are not currently encumbered by a conservation easement in favor of a federal agency to memorialize PHUs, may provide PHUs under the Plan.

Table 4-5 provides a summary of the PHUs provided through the preservation of lands within the Preservation/Plan-Wide Activities land designation (Figure 2-1). Overall, the USFWS methodology estimated that a total of 558,077.7 PHUs could be provided from the preservation of 86,936.0 acres of interconnected panther habitats within the Preservation/Plan-Wide Activities land designation.¹⁸ Primary zone lands accounted for over 95% of the preservation acreage and accounted for over 96% of the PHUs provided by preserving these areas.

The preservation acreage used for the PHU analysis (86,936.0) is substantially lower than the overall Preservation/Plan-Wide Activities acreage that will be provided under the Plan and is based only on 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 provided. 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 calculations. The removal of previously assessed SSAs (for Ave Maria) also reduced the total acreage contributing to the

¹⁷ As noted in section 4.2.2.1.1 above, under the HCP, the conservation value of these SSA lands will be enhanced by the permanent preservation and management of lands adjoining these parcels. Moreover, although the town of Ave Maria was considered in the landscape-level planning of the HCP Area and counts toward the 45,000-acre cap on Covered Activities under the Plan, the applicants do not seek take coverage for the 5,027-acre portion of the Covered Activities area that consists of the town of Ave Maria.

¹⁸ The numbers in this sentence and those that follow consist of the total PHUs provided through primary zone and secondary zone preservation.

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

Cooperative Land Cover (CLC) Class	Score	Primary Zone, Preservation/Plan-Wide Activities 82,735.5 acres*				Secondary Zone, Preservation/Plan-Wide Activities 4,200.5 acres*			
		Current		w/ Preservation		Current		w/ Preservation	
		Acres	PHUs	Acres	PHUs	Acres	PHUs	Acres	PHUs
Wet Flatwoods	9.5	751.0	7134.1	751.0	7134.1	0.0	0.0	0.0	0.0
Scrubby Flatwoods	9.5	29.4	279.0	29.4	279.0	0.0	0.0	0.0	0.0
Hydric Pine Flatwoods	9.5	1514.8	14390.9	1514.8	14390.9	2.5	24.1	2.5	24.1
Mesic Flatwoods	9.5	5868.6	55751.4	5868.6	55751.4	47.0	446.1	47.0	446.1
Mixed Hardwood-Coniferous	9.3	2207.0	20525.5	2207.0	20525.5	1.9	17.3	1.9	17.3
Cypress/Pine/Cabbage Palm	9.3	402.2	3740.2	402.2	3740.2	0.0	0.0	0.0	0.0
Cypress	9.2	11416.5	105032.2	11416.5	105032.2	0.4	3.4	0.4	3.4
Mixed Wetland Hardwoods	9.2	2286.3	21033.7	2286.3	21033.7	0.0	0.0	0.0	0.0
Cypress/Tupelo(incl Cy/Tu mixed)	9.2	1776.4	16342.8	1776.4	16342.8	0.0	0.0	0.0	0.0
Other Wetland Forested Mixed	9.2	1327.4	12211.8	1327.4	12211.8	0.0	0.0	0.0	0.0
Other Hardwood Wetlands	9.2	426.6	3924.6	426.6	3924.6	0.0	0.0	0.0	0.0
Other Coniferous Wetlands	9.2	12.7	116.9	12.7	116.9	0.0	0.0	0.0	0.0
Strand Swamp	9.2	1754.1	16137.4	1754.1	16137.4	0.0	0.0	0.0	0.0
Hydric Hammock	9.2	116.8	1074.5	116.8	1074.5	0.0	0.0	0.0	0.0
Dome Swamp	9.2	279.3	2569.8	279.3	2569.8	0.0	0.0	0.0	0.0
Cabbage Palm	9.0	245.4	2208.3	245.4	2208.3	27.5	247.9	27.5	247.9
Mesic Hammock	9.0	806.3	7256.8	806.3	7256.8	0.0	0.0	0.0	0.0
Oak - Cabbage Palm Forests	9.0	280.4	2524.0	280.4	2524.0	0.0	0.0	0.0	0.0
Palmetto Prairie	6.3	113.3	714.0	113.3	714.0	13.6	85.8	13.6	85.8
Rural Open Forested	5.7	31.8	181.3	31.8	181.3	0.0	0.0	0.0	0.0
Rural Open	5.7	676.9	3858.4	676.9	3858.4	38.2	218.0	38.2	218.0
Unimproved/Woodland Pasture	5.7	2628.3	14981.2	2628.3	14981.2	4.8	27.6	4.8	27.6
Shrub and Brushland	5.5	602.3	3312.9	602.3	3312.9	61.4	337.6	61.4	337.6
Mixed Scrub-Shrub Wetland	5.5	7550.9	41530.0	7550.9	41530.0	243.8	1341.0	243.8	1341.0
Sod Farms	5.2	38.3	199.4	38.3	199.4	0.0	0.0	0.0	0.0
Feeding Operations	5.2	1.1	5.8	1.1	5.8	0.0	0.0	0.0	0.0
Improved Pasture	5.2	7746.3	40280.8	7746.3	40280.8	439.8	2286.8	439.8	2286.8
Isolated Freshwater Swamp	4.7	3618.9	17009.0	3618.9	17009.0	0.0	0.0	0.0	0.0
Citrus	4.7	5340.6	25100.8	5340.6	25100.8	2985.3	14030.9	2985.3	14030.9
Depression Marsh	4.7	0.2	1.1	0.2	1.1	0.0	0.0	0.0	0.0
Slough	4.7	99.0	465.4	99.0	465.4	0.0	0.0	0.0	0.0
Glades Marsh	4.7	60.8	285.9	60.8	285.9	0.0	0.0	0.0	0.0
Isolated Freshwater Marsh	4.7	1152.9	5418.6	1152.9	5418.6	2.9	13.5	2.9	13.5
Marshes	4.7	12091.9	56831.8	12091.9	56831.8	278.7	1310.1	278.7	1310.1
Row Crops	3.9	8357.6	32594.7	8357.6	32594.7	23.2	90.5	23.2	90.5
Field Crops	3.9	89.6	349.5	89.6	349.5	0.0	0.0	0.0	0.0
TABLE CONTINUED ON FOLLOWING PAGE									

* The acreage subtotals above for Preservation/Plan-Wide Activities within the Primary and Secondary Zones produce a combined acreage total of 86,936.0 acres. For PHU purposes, this total acreage is less than the overall Preservation/Plan-Wide acreage under the Plan, because some isolated Preservation areas occur within lands designated for Covered Activities, and are therefore considered as impacted (unusable) for panther. Additionally, 4,275.6 acres of the Covered Activities land designation will revert to Preservation when the 45,000-acre cap is reached. The Preservation/Plan-Wide acreage and PHU totals do not include 6.3 acres (51.5 PHUs) of "Other Zone" (outside of the Primary and Secondary Zones) near the Immokalee Urban Boundary.

** The acreage and PHU totals shown are calculated to 0.1 unit.

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

		Primary Zone, Preservation/Plan-WideActivities 82,735.5 acres*				Secondary Zone, Preservation/Plan-Wide Activities 4,200.5 acres*			
		Current		w/ Preservation		Current		w/ Preservation	
Cooperative Land Cover (CLC) Class	Score	Acres	PHUs	Acres	PHUs	Acres	PHUs	Acres	PHUs
Exotic Wetland Hardwoods	3.0	3.7	11.1	3.7	11.1	0.0	0.0	0.0	0.0
Melaleuca	3.0	3.5	10.4	3.5	10.4	0.0	0.0	0.0	0.0
Oil & Gas Fields	3.0	8.1	24.4	8.1	24.4	0.0	0.0	0.0	0.0
Extractive	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brazilian Pepper	3.0	346.3	1039.0	346.3	1039.0	24.7	74.0	24.7	74.0
Vegetative Berm	3.0	7.4	22.3	7.4	22.3	0.0	0.0	0.0	0.0
Fallow Cropland	3.0	340.1	1020.3	340.1	1020.3	0.0	0.0	0.0	0.0
Rural Structures	3.0	7.1	21.4	7.1	21.4	0.0	0.0	0.0	0.0
Cultural - Lacustrine	0.0	37.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0
Urban Open Land	0.0	6.2	0.0	6.2	0.0	0.0	0.0	0.0	0.0
Transportation	0.0	80.4	0.0	80.4	0.0	1.2	0.0	1.2	0.0
Commercial and Services	0.0	9.7	0.0	9.7	0.0	0.0	0.0	0.0	0.0
Artificial Impoundment/Reservoir	0.0	5.9	0.0	5.9	0.0	0.0	0.0	0.0	0.0
Ditch/Artificial Intermittent Stream	0.0	14.9	0.0	14.9	0.0	0.0	0.0	0.0	0.0
Natural Lakes and Ponds	0.0	20.8	0.0	20.8	0.0	0.0	0.0	0.0	0.0
Floating/Emergent Aquatic Vegetation	0.0	0.4	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Residential, Low Density	0.0	24.8	0.0	24.8	0.0	2.8	0.0	2.8	0.0
Sewage Treatment Pond	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Utilities	0.0	1.7	0.0	1.7	0.0	0.0	0.0	0.0	0.0
Lacustrine	0.0	48.4	0.0	48.4	0.0	0.0	0.0	0.0	0.0
Canal	0.0	59.7	0.0	59.7	0.0	0.8	0.0	0.8	0.0
Parks and Zoos	0.0	3.3	0.0	3.3	0.0	0.0	0.0	0.0	0.0
Low Intensity Urban	0.0	3.8	0.0	3.8	0.0	0.0	0.0	0.0	0.0
TOTALS**		82,735.5	537,523.1	82,735.5	537,523.1	4,200.5	20,554.6	4,200.5	20,554.6

* The acreage subtotals above for Preservation/Plan-Wide Activities within the Primary and Secodary Zones produce a combined acreage total of 86,936.0 acres. For PHU purposes, this total acreage is less than the overall Presevation/Plan-Wide acreage under the Plan, because some isolated Preservation areas occur within lands designated for Covered Activities, and are therefore considered as impacted (unusable) for panther. Additionally, 4,275.6 acres of the Covered Activities land designation will revert to Preservation when the 45,000-acre cap is reached. The Preservation/Plan-Wide acreage and PHU totals do not include 6.3 acres (51.5 PHUs) of "Other Zone" (outside of the Primary and Secondary Zones) near the Immokalee Urban Boundary.

** The acreage and PHU totals shown are correct to 0.1 unit.

PHU analysis, as did spatial (planning) flexibility as to the ultimate configuration of preservation areas (see section 4.2.2.4).

4.2.2.2.2 PHUs Provided 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 approximately 2,666 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 provide 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 2,666.3 acres provides an estimated 13,483.9 PHUs.

4.2.2.2.3 PHUs Estimated for Base Zoning Area

Figure 2-1 depicts a “Base Zoning” area, comprised of the 2,430.7-acre Half Circle L Ranch, east of Immokalee. These 2,430.7 acres represent an RLSA “Open” overlay area where development could potentially occur, and which maintain 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 a member of the FPPP and an applicant for an 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 these 2,430.7 acres, but were not assigned as either PHU impacts or credits (Table 4-7). The ultimate disposition of the estimated 12,062.4 PHUs for this property will depend upon whether the land is developed, and if so, whether cluster development is employed to minimize impacts. Any development, of these 2,430.7 acres, would contribute toward the 45,000-acre cap for Covered Activities. Land dedicated to panther conservation in this area could be used to provide 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 on the dual-scenario estimates of potential impacts (Tables 4-2a-c and 4-4a-c), and the estimates of PHUs provided as mitigation (Tables 4-5 and 4-6), the Plan will provide more than enough PHUs to fully offset potential impacts to panther habitat.

Under each of the impact scenarios, the total number of PHUs provided through preservation of panther conservation lands would exceed PHU compensation levels required for potential impacts as calculated

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

		Primary Zone, Very Low Density Use 2600.0 acres*				Secondary Zone, Very Low Density Use 66.3 acres*			
		Current		w/ Preservation		Current		w/ Preservation	
Cooperative Land Cover (CLC) Class	Score	Acres	PHUs	Acres	PHUs	Acres	PHUs	Acres	PHUs
Wet Flatwoods	9.5	3.2	30.3	3.2	30.3	0.0	0.0	0.0	0.0
Mesic Flatwoods	9.5	112.1	1065.4	112.1	1065.4	0.0	0.0	0.0	0.0
Mixed Hardwood-Coniferous	9.3	123.4	1147.4	123.4	1147.4	11.6	108.3	11.6	108.3
Other Wetland Forested Mixed	9.2	274.1	2522.1	274.1	2522.1	0.0	0.0	0.0	0.0
Mixed Wetland Hardwoods	9.2	83.0	763.8	83.0	763.8	0.0	0.0	0.0	0.0
Cypress	9.2	17.3	159.0	17.3	159.0	0.0	0.0	0.0	0.0
Cypress/Tupelo(incl Cy/Tu mixed)	9.2	69.7	641.1	69.7	641.1	0.0	0.0	0.0	0.0
Other Hardwood Wetlands	9.2	22.1	202.9	22.1	202.9	0.0	0.0	0.0	0.0
Cabbage Palm	9.0	15.0	134.8	15.0	134.8	0.0	0.0	0.0	0.0
Mesic Hammock	9.0	46.4	417.3	46.4	417.3	0.0	0.0	0.0	0.0
Rural Open	5.7	235.5	1342.3	235.5	1342.3	0.0	0.0	0.0	0.0
Unimproved/Woodland Pasture	5.7	5.2	29.6	5.2	29.6	0.0	0.0	0.0	0.0
Shrub and Brushland	5.5	137.9	758.5	137.9	758.5	0.0	0.0	0.0	0.0
Mixed Scrub-Shrub Wetland	5.5	97.5	536.5	97.5	536.5	0.0	0.0	0.0	0.0
Improved Pasture	5.2	458.1	2382.0	458.1	2382.0	43.6	226.8	43.6	226.8
Marshes	4.7	122.7	576.8	122.7	576.8	11.1	51.9	11.1	51.9
Isolated Freshwater Marsh	4.7	1.7	8.0	1.7	8.0	0.0	0.0	0.0	0.0
Isolated Freshwater Swamp	4.7	40.4	190.0	40.4	190.0	0.0	0.0	0.0	0.0
Brazilian Pepper	3.0	1.9	5.7	1.9	5.7	0.0	0.0	0.0	0.0
Extractive	3.0	61.1	183.4	61.1	183.4	0.0	0.0	0.0	0.0
Residential, Low Density	0.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Artificial Impoundment/Reservoir	0.0	409.6	0.0	409.6	0.0	0.0	0.0	0.0	0.0
Transportation	0.0	13.8	0.0	13.8	0.0	0.0	0.0	0.0	0.0
Cultural - Lacustrine	0.0	237.5	0.0	237.5	0.0	0.0	0.0	0.0	0.0
Lacustrine	0.0	9.3	0.0	9.3	0.0	0.0	0.0	0.0	0.0
Natural Lakes and Ponds	0.0	1.2	0.0	1.2	0.0	0.0	0.0	0.0	0.0
TOTALS**		2,600.0	13,096.8	2,600.0	13,096.8	66.3	387.1	66.3	387.1

* The acreage subtotals above for Very Low Density Use within the Primary and Secodary Zones produce a combined acreage total of 2666.3 acres. Very Low Density Use comprises less than 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.

** The acreage and PHU totals shown are calculated to 0.1 unit.

Table 4-7. Florida Panther Habitat Matrix for Base Zoning*

		Base Zoning (all in Primary Zone) 2,430.7 acres			
		Current		w/ Preservation	
Cooperative Land Cover (CLC) Class	Score	Acres	PHUs	Acres	PHUs
Wet Flatwoods	9.5	53.2	505.8	0.9	8.5
Dome Swamp	9.2	37.0	340.7	125.3	1190.2
Strand Swamp	9.2	1.1	10.3	98.9	920.2
Hydric Hammock	9.2	1.8	16.2	240.8	2215.7
Mesic Hammock	9.0	16.3	147.0	49.5	455.3
Rural Open	5.7	0.3	1.7	71.8	660.9
Improved Pasture	5.2	1211.2	6298.1	67.5	620.7
Citrus	4.7	1.2	5.8	8.6	78.7
Isolated Freshwater Marsh	4.7	536.3	2520.6	25.1	226.0
Row Crops	3.9	568.2	2216.2	46.4	417.3
Transportation	0.0	3.9	0.0	1.2	0.0
TOTALS**		2,430.7	12,062.4	2,430.7	12,062.4

* 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. The final status of the Base Zoning area under the HCP will be determined during the processing of the Incidental Take Permit (ITP).

** The acreage and PHU totals shown are rounded to 0.1 unit.

by the USFWS Panther Habitat Assessment Methodology (USFWS, 2012a; Tables 4-2a-c, 4-4a-c, 4-5a-c, and 4-6a-c). Using the methodology employed in current USFWS Biological Opinions, under scenario 1 (highest habitat suitability impacted), an estimated 469,264.0 PHUs would be required as mitigation (Table 4-2c). Using the same methodology, under scenario 2 (Primary Zone impacted first), an estimated 473,508.3 PHUs would be required as mitigation (Table 4-4c). The PHUs provided from lands conserved under the Preservation/Plan-Wide Activities were estimated at 558,077.7 PHUs (Table 4-5), exceeding the mitigation required under either impact scenario. This balance does not include the additional 13,483.9 PHUs provided from the Very Low Density Use areas. Together, the combined total PHUs for the Preservation/Plan-Wide and Very Low Density Use Areas equaled 571,561.6 PHUs. Therefore, under the standard methodology used in current USFWS Biological Opinions for the Florida panther, the Plan will provide PHUs well in excess of the mitigation required for potential impacts to panther habitat. Indeed, under either of the conservative scenarios assessed, the Plan would provide approximately 100,000 PHUs in excess of that required to cover panther habitat impacts under the USFWS methodology.

Importantly, as a practical matter, the total PHU value of the lands that are actually impacted under the Plan is likely to be lower than conservatively estimated in these analyses because actual impacts are not likely to occur only on the highest value lands within the 49,276-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 could provide additional PHU credits, if necessary, through additional habitat restoration (such as converting additional farmland into pine forest habitat along the north and south corridors) or other adaptive measures (such as adjusting the configuration of the conservation areas). For example, the proposed configuration of the north and south corridors (section 4.3.1) would involve the creation of approximately 400 acres of mesic pine flatwoods to close gaps in forested cover within the corridors. This would result in approximately 3,800 PHUs under the current methodology. Accordingly, based on the conservative approach employed in the PHU analysis and the ability to provide additional PHUs as necessary, the actual PHU compensation will be more than sufficient to offset potential panther habitat impacts from the full 45,000 acres of development.

Given the conservative assumptions regarding maximum PHU impact scenarios, and a probable underestimation of the PHUs that could be provided through panther habitat preservation alone, the Plan provides reasonable assurances that sufficient PHUs can and will be provided to offset potential impacts to panther habitat by the Covered Activities. Multiple options for providing 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 analyzed to estimate impacts under the Plan, and the corresponding analyses for estimating PHUs provided by the Plan as mitigation, were limited by the conservative assumptions underlying each of the scenarios. While the calculation of potential impacts occurred within the Covered Activities land designation under both scenarios (Figure 2-1), the impacts were not

calculated in a spatially explicit model for either scenario. In other words, because the GIS selected the land cover polygons preferentially based upon habitat suitability scoring or Primary Zone status, the selected polygons did not necessarily conform with spatial patterns that would (or could) occur under 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).

Additionally, at least a portion of the estimated 4,262.4 acres of potentially isolated preservation areas (primarily wetland areas) that are dispersed throughout the Covered Activities areas, may 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, to be conservative in the PHU impact analysis, these additional potential impacts were assumed to occur (Table 4-2b; Table 4-4b), when they may not actually occur in the final configuration.

Correspondingly, as each of the two potential impact scenarios considered a total cap of 45,000 acres of potential impacts within the 49,276-acre Covered Activities land designation, both scenarios will ultimately result in the re-allocation of 4,276 acres from the Covered Activities land designation to the Preservation/Plan-Wide Activities land designation for future preservation (and additional PHUs) at Plan completion. As with the additional impacts described above, spatial variables regarding which specific land cover types would be preserved, and the configuration of preserved lands within the landscape, made the corresponding PHU analysis imprecise. 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 both impact scenarios (highest habitat values impacted first; Primary Zone lands impacted first), the PHU calculations estimate that the Plan can provide an excess of approximately 100,000 PHUs. These estimates did not include the PHUs to be provided by the restoration of lands for the north and south panther corridors (Figure 4-9), which could provide thousands of additional 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 as part of the ITP conditions.

In summary, the panther habitat assessment methodology demonstrates that, under even the most conservative assumptions, the Plan will provide more than sufficient PHUs to offset potential impacts to panther habitat using the standard USFWS methodology (USFWS 2012a). While the Plan qualitatively demonstrates that the landscape-scale perpetual preservation of contiguous habitat benefits the panther at a regional level (see Figures 2-1 and 2-2), the PHU calculations demonstrate quantitatively that the Plan will more than fully offset impacts to panther habitat resulting from the Covered Activities.

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, while funding the implementation of long-term conservation measures for those species; and (ii) to meet the requirements for issuance of an ITP for species (the 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).

“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 only form of potential take anticipated for Florida panther and most other Covered Species within the 45,000 acres of Covered Activities – and the only form of take for which applicants seek take coverage for those species within that area – is harassment.¹⁹ With respect to the panther, harm is not expected for the reasons described in section 4.2.1 above. Specifically, no panthers are expected to be killed or injured by the Covered Activities. Furthermore, habitat loss will be minimized by clustering the Covered Activities and directing them away from higher value habitat and toward areas of less valuable habitat; and any disturbance caused by construction activities or earth mining will be temporary within a given area and will be similar in many respects to activities that have been ongoing in the HCP Area for many years. The goal of the Plan is to avoid take resulting from Covered Activities 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.

Although ecologically beneficial overall, certain land management activities may create some theoretical potential, albeit very low, for take of panthers in the form of harm when conducted within panther habitat areas. Prescribed burns can create intense fires within dense saw palmetto thickets, which are favored as panther den sites, and some mechanical vegetation control (e.g., roller chopping) is used to reduce palmetto overgrowth and fuel loads. However, these types of activities are frequently conducted throughout the region, with no documented occurrence of take of panthers resulting from these

¹⁹ While unlikely, the applicants believe it is possible that certain ground-burrowing species – including gopher tortoise, gopher frog, eastern indigo snake, and eastern diamondback rattlesnake – as well as the Florida bonneted bat – may be harmed by the Covered Activities. The potential for harm to these species is discussed in the sections of chapter 6 that address these species.

activities.²⁰ Accordingly, take of panthers in the form of harm is not expected as a result of the Covered Activities, and therefore such take authorization is not requested.

4.2.3.2 Take Assessment

The direct and indirect impacts to panther discussed previously (section 4.2.1) could potentially result in take of the Florida panther only in the form of harassment.

Harassment of Florida panther 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, for example, as a result of the increased potential for panther-human interactions, or 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 sources of impacts include light, noise, and human activity associated with construction activities, earth mining, and other activities that occur while the Plan is being implemented. These potential impacts were accounted for in the panther habitat assessment and calculation of the habitat compensation required under the Plan. Critically, the Plan's general avoidance of the Okaloacoochee Slough, FPNWR area, and other areas of intensive panther utilization limit substantially the potential for take of Florida panther. Additionally, site planning techniques will be employed at the project-level scale to further minimize the potential for take.

Based on the nature of anticipated take, the scale of the HCP Area, 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 (up to 45,000). USFWS noted in a recent Biological Opinion that, "The Service anticipates incidental take of the panther will be difficult to detect and quantify because it is difficult to document the adverse effects of habitat loss and disturbance from the Project on survival and reproduction of panthers. Therefore, the Service will use [acres] of panther habitat as a surrogate for the number of individuals taken." (USFWS 2017a).

Within the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use, approximately 89,600 acres comprise interconnected, high-value panther habitat. Although some of the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use provide lower value habitat to the panther (e.g., water retention areas), many of these preservation lands will still provide at least some habitat value or otherwise benefit the panther (e.g., by supporting panther prey species) and will 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 exceed 96,000 acres in total (the exact total will depend on the final configuration of Covered Activities, and includes lands designated for Very Low Density Use).

²⁰ The Biological Opinion for the BCNP and FPNWR Fire Management Plans (USFWS 2018a) did note the mortality of four panther kittens due to a large wildfire in BCNP. Prescribed burns performed by the permittees will be restricted to relatively small acreages, and the permittees or their agents will coordinate with FWC and FWS panther biologists prior to any burning of dense palmetto or other dense vegetation where panther dens may exist.

Approximately 95% of this high-value panther habitat will be located within the panther Primary Zone. Application of the USFWS Panther Habitat Assessment Methodology (section 4.2.2) indicates that panther habitat losses will be fully mitigated by the preservation of these approximately 89,600 to 96,000+ acres, even using conservative assumptions. Habitat losses will also be offset beyond standard panther mitigation requirements 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.

Most importantly, the Plan will avoid and minimize habitat fragmentation within the panther’s primary breeding range and preserve extensive interconnected panther habitat that will provide panther habitat connectivity in perpetuity and allow for continued dispersal. 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 11 private property owners and close coordination with NGO conservation partners. In addition to this land preservation, implementation of 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 while reducing panther mortalities.

4.3 BIOLOGICAL GOALS AND OBJECTIVES

The HCP Handbook Addendum, or “Five Point” Policy, adopted by the Services in 2000, addressed how biological goals and objectives are to be established in HCPs (65 Fed. Reg. 35242 (June 1, 2000)). The biological goals and objectives established in an HCP must be consistent with the conservation and recovery goals established by USFWS for the species. The goals are 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 conservation scope of the Plan. The revised HCP Handbook (USFWS and NMFS 2016) provides more detailed guidance related to the “Five Point” Policy and the development of biological goals and objectives for HCPs.

In accordance with the revised HCP Handbook, the following sections provide clear statements of biological goals for the Florida panther under the Plan. Specific objectives are stated for each goal, along with the measures that will be taken to meet the biological goals and objectives. The objectives form the basis for tracking progress under the HCP monitoring program, and for employing adaptive management strategies as needed.

Under the Plan, conservation will occur through two mechanisms. First, pursuant to the Plan, the ITPs will require preservation of the vast, interconnected lands designated for Preservation/Plan-Wide Activities and Very Low Density Use through conservation easements, and maintenance of these lands in their current state. The conservation easements will be held by a State of Florida agency (FWC, FDACS, FDEP, or SFWMD), with USFWS retaining full third-party enforcement rights (see section 2.2). Second, implementation of the Plan will generate funds that will be deposited to the Marinelli Fund and used to pay all costs of implementing the Plan. The Marinelli Fund is estimated to receive approximately \$150

million during the 50-year term of the ITPs, far in excess of what will be required to implement the Plan. These additional funds will be used for additional conservation initiatives, which will be undertaken at the discretion of the Fund's Board of Directors – comprised of representatives of each of the four conservation organizations that are members of the FPPP (Audubon Florida, Audubon of the Western Everglades, Defenders of Wildlife, and Florida Wildlife Federation), two representatives of the landowner members of the FPPP, and one at-large member who will serve at the invitation of the other six members of the Board – in coordination with the Service and FWC, where appropriate. The Marinelli Fund is described in more detail in Chapter 9.

Therefore, the biological goals for the Florida panther are as follows:

- Preserve and maintain large, interconnected blocks of panther habitat (over 100,000 acres²¹) within the HCP Area, including existing regional wildlife corridors that provide landscape-scale linkages among existing public conservation lands;
- Ensure that the most valuable panther habitat in the HCP Area is preserved by clustering Covered Activities and directing them away from higher-value habitat and toward areas of less valuable habitat;
- Enhance panther habitat and facilitate panther movement across the landscape by providing funding for the Marinelli Fund, which is 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 crossing 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; (iv) scientific research focusing on panther biology and behavior; (v) public education; and (vi) possible land acquisition, enhancement, and management outside the HCP Area, to assist the recovery of the Florida panther throughout its range.

The conservation measures associated with avoidance and minimization, in support of the Plan's goals and objectives, are detailed in section 4.4.

4.3.1 Biological Goals and Objectives Implemented Within the HCP Area

Objective 1: Preserve and maintain large, interconnected blocks of panther habitat (approximately 100,000 acres as calculated by GIS) by directing Covered Activities away from higher-value habitat and toward areas of less valuable habitat.

Measure 1: Each permittee will record one or more perpetual conservation easement(s) prior to the initiation of a Covered Activity (Residential/Commercial Development and/or Earth Mining)

²¹ As described above, 4,262.4 acres of small, isolated preserved areas within the preservation area may be inaccessible to panthers in a post-development state (see section 4.2.2.1.1). Nonetheless, the acreage preserved and maintained specifically to benefit the Florida panther under the Plan will be approximately 100,000 acres.

that impacts panther habitat. The lands placed under conservation easement(s), prior to initiation of impacts to panther habitat, will provide sufficient PHUs to fully offset panther habitat impacts.

Measure 2: Permittees will maintain the lands to be preserved within existing land cover types, preserving the overall ecological functions that exist at the time of ITP issuance (see section 2.2, Management of Preserved Lands, for a description of typical land management activities).

Measure 3: The baseline conditions of the HCP Area will be documented through the use of publicly available and/or commercial orthorectified aerial imagery, acquired during the first dry season after ITP permit issuance. The baseline conditions documented in the imagery will provide the primary dataset for compliance monitoring of land cover types and conditions throughout the 50-year term of the ITPs.

Objective 2: Provide funding to the Marinelli Fund that can be used to enhance, restore, and/or establish panther habitat to facilitate panther movements across the landscape within the HCP Area. While impacts to panther habitat (predominantly previously-cleared areas) are fully offset through the preservation and maintenance of approximately 100,000 acres of land by the permittees (per section 4.2.2), this funding is expected to provide additional conservation benefits through the enhancement of an existing corridor that has been historically traversed by panthers crossing SR-29, and the establishment of a corridor to facilitate dispersal of panthers northward from the Corkscrew Marsh area. Although the Marinelli Fund Board will be an independent body with discretion over expenditures from the Fund, the applicants and their conservation partners (who will comprise the majority of the Board) have identified these as among their priorities for use of the Fund.

Measure 1: Enhance the documented panther corridor that occurs just west of SR-29 and north of CR-858 (see Figure 4-9, southern corridor) through a combination of site design and buffers from Covered Activities; establishment of high-value habitat conducive to panther movement and utilization (e.g., mesic pine flatwoods) where gaps in native cover occur; establishment of high-value habitat cover adjacent to future wildlife crossing locations along SR-29 and CR-858; and control of exotic vegetation within the corridor. The proposed southern corridor configuration will maintain a minimum core width of 500 meters (1,640 feet or 0.3 mile) over the 3.2km distance between a vast habitat area south of Oil Well Road and a 1,900-acre habitat block (stopover habitat) that includes Summerland Swamp and surrounding citrus groves (see Figures 2-1 and 4-9). The portion of the corridor north of Oil Well Road and south of Summerland Swamp will be buffered from development to the east through a combination of berms, surface water management lakes, low-intensity land uses, and lighting. The panther is both the focal species for this corridor and is considered a “passage species” that can traverse the local corridor within hours or days (Beier et al. 2007; Beier 2009).

Measure 2: Establish a panther corridor that crosses SR-82 approximately 0.4 mile east of CR-850 (see Figure 4-9, northern corridor). The applicants adjusted the location of this corridor to intentionally intersect a future FDOT wildlife crossing for SR-82 that is currently in the design

and permitting phase. A functional corridor will be established with high-value habitat conducive to panther movement and utilization (e.g., mesic pine flatwoods); adjacent Covered Activities will utilize site design techniques and buffers to isolate and protect the corridor; establishment of high-value habitat cover adjacent to the future wildlife crossing location on SR-82; and control of exotic vegetation within the corridor. The proposed northern corridor configuration will maintain a minimum core width of 400 meters (1,300 feet or 0.25 mile) over the 2-4-kilometer distance between the northern limits of the Corkscrew Regional Ecosystem Watershed (CREW) lands and the northern boundary of the HCP Area (see Figures 2-1 and 4-9). This core corridor width is consistent with the northern corridor design parameters from the FPPP Technical Review Team report (FPPPTRT 2009) and links to natural resource (preserve) areas within the Southwest Hendry County Sector Plan to the north. The corridor will be buffered from any future nearby development through a combination of berms, surface water management lakes, low-intensity land uses, and lighting. The panther is both the focal species for this corridor and is considered a “passage species” that can traverse the local corridor within hours or days (Beier et al. 2007; Beier 2009).

4.3.2 Likely Benefits of the HCP to Areas Outside of the HCP Area

4.3.2.1 Wildlife Crossings

The HCP Area does not include the existing state and county roadway network. 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 locating and constructing new wildlife crossings (FWC 2006; Smith et al. 2006; USFWS 2008a; Downs et al. 2014). The Plan will provide land preservation, through perpetual easements on both sides of key roadway segments, that will make the construction of more fenced wildlife crossings possible through the FDOT work program, the Marinelli Fund or otherwise.

The paragraphs below briefly describe the currently known planned transportation 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 to be paid for by the Marinelli Fund will be determined by the Fund’s Board of Directors, in cooperation with FWC, USFWS, and FDOT, as necessary.

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, Everglades City), 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 2040 Long Range Transportation Plan (LRTP) (<http://www.colliermopo.com/index.aspx?page=187>) was approved in

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 two major state highways that pass through eastern Collier County (SR-29 and SR-82) are designated by FDOT as Strategic Intermodal System (SIS) Highway Corridors (FDOT 2018). The SIS highway corridors are intended to facilitate interregional and statewide connectivity, and as such their capacity improvements are as much a reflection of regional and statewide transportation planning as local transportation planning.

The current FDOT Work Program covering the five-year period from 2018-2022 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 of 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, with a Financial Project Identification Number (FPID) where available:

- SR-29 from Oil Well Road to SR-82 – PD&E phase (in process); scheduled for completion in 2018 (see also at <http://sr29collier.com/>);
- SR-29 from I-75 to Oil Well Road – PD&E phase (initiated); scheduled for completion in 2021;
- SR-29 from SR-82 to Hendry County Line – Design phase (2018); Environmental Services/Permits/Mitigation (2018); Right-of-way (ROW) Acquisition scheduled for 2021; construction scheduled for Fiscal Year 2023 (FY 2023); FPID 417878-4;
- SR-82 from Hendry County Line to SR-29 – Design phase (in process) and Right-of-way Acquisition (2017/2018); construction scheduled for 2019 (see also: <http://sr82design.com/>); there are two separate road segments:
 - SR-82 from Hendry County Line to Gator Slough – right-of-way funded in FY 2019 and 2020; Construction funded in FY 2023 – includes bridge replacements at Panther Creek and Under Canal with wildlife shelves; FPID 430848-1;
 - SR-82 from Gator Slough to SR-29 (includes roundabout at SR-29) – ROW funded in FY 2018 and 2019; Construction funded FY 2019; FPID 430849-1
- SR-82 at Corkscrew Road – Add Turn Lanes Design (2018); project is currently under construction; most improvements will be replaced under FPID 430848-1.

It should also be noted that because the MPO's planning horizon is 20 years, the transportation "Needs Assessment" is based on 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.

4.3.2.2 Habitat Acquisition, Restoration, and Management

The Plan anticipates that panther conservation priorities may change at various times over the 50-year duration of the ITPs, and that conservation opportunities may arise where actions taken outside of the HCP Area may provide the most effective means for promoting panther recovery. Under these circumstances, 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 the HCP Area.

4.3.3 Relationship of the Plan to USFWS Florida Panther Recovery Actions

The Florida Panther Recovery Plan, 3rd Revision (USFWS 2008a) provides a recovery action outline and narrative that lists a number of specific recovery actions designed to facilitate the recovery of the Florida panther. Many of these recovery actions are the exclusive purview of government agencies (e.g., agency regulatory programs; public land management), but several significant recovery actions require and/or encourage the active participation of private property owners, particularly large agricultural and ranching ownerships.

Table 4-8 lists several Florida panther recovery actions (USFWS 2008a) that are addressed by the ECMSHCP Biological Goals and Objectives (section 4.3, above). The entries in the table are taken verbatim from the recovery plan. Many of the recovery actions listed in Table 4-8 are "Priority 1" actions that are central to the recovery plan and represent actions that can achieve longstanding conservation goals for the panther. The ECMSHCP will play a predominant role in achieving many of these goals.

Notably, the "Comments" column in Table 4-8 contains many references to habitat-related recovery costs, land prices, and site-specific costs related to specific actions (e.g., wildlife crossings). The major costs for the "Priority 1" actions relate to securing land, contingent upon willing property owners and land prices. The ECMSHCP provides 11 property owners who collectively will preserve 106,442 acres in perpetuity, at an estimated land value of approximately \$1.4 billion. In addition, the creation and implementation of the Marinelli Fund (Chapter 9) is expected to generate approximately \$150,000,000 over the 50-year term of the ITP, which may be dedicated for high-priority recovery actions (e.g., wildlife crossing design and construction; habitat restoration). The ECMSHCP provides the land preservation, funding, and institutional framework to achieve some of the most important goals of the Florida panther recovery plan.

Table 4-8. Florida Panther Recovery Plan (2008) Actions Addressed by the Eastern Collier Multiple Species HCP (ECMSHCP)

Florida Panther Recovery Plan Actions				
Excerpted from Florida Panther Recovery Plan, 3rd Revision (USFWS 2008); * = lead agencies				
Priority	Action Number	Recovery Action Description	Participants	Comments
2	1.1.1.2.4.4.	Initiate and encourage landscape-level HCPs where proposed non-Federal actions or projects will impact panthers or their habitat	FWS*, FWC, counties, private, local governments, NGO	Cost included in standard operating budgets of agencies.
<i>Habitat Fragmentation, Connectivity, and Spatial Extent</i>				
1	1.1.1.3.1.2.	Restore habitat in potential corridors identified by least-cost pathways analysis	FWC*, FWS*, FDEP*, NGO, private, FDOF, WMD, local governments	Cost dependent upon number of willing landowners.
1	1.1.1.3.1.3.2.	Secure Camp Keais Strand	FWC*, FWS, FDEP*, NGO, private, FDOF, WMD, local government	Cost dependent upon number of willing landowners and land prices.
1	1.1.1.3.1.3.3.	Secure a corridor between BCNP and Okaloacoochee Slough	FWC*, FWS*, FDEP*, NPS, NGO, private, FDOF, WMD, local government	Cost dependent upon number of willing landowners and land prices.
1	1.1.1.3.2.	Maintain spatial extent and arrangement of habitat	FWC*, FWS, NPS, NGO, NRCS, FDEP*, FDOF, WMD, private, counties, local governments	Cost dependent upon land prices.
<i>Negative Impacts of Roads on Panther Habitat – South Florida</i>				
1	1.1.1.4.2.	Identify current and planned roads that could affect panthers, eliminate roads where possible, and retrofit priority areas with crossings and fencing as appropriate to promote connectivity and dispersal	FWS*, FWC, NPS, FDOT, FHWA, counties, local government, NGO, COE, FDEP, DCA	Cost to retrofit priority areas will be site-specific.

Table 4-8. Florida Panther Recovery Plan (2008) Actions Addressed by the Eastern Collier Multiple Species HCP (ECMSHCP) (continued)

Florida Panther Recovery Plan Actions				
Excerpted from Florida Panther Recovery Plan, 3rd Revision (USFWS 2008); * = lead agencies				
Priority	Action Number	Recovery Action Description	Participants	Comments
1	1.1.1.4.3.	Secure habitat adjacent or contiguous to areas of high risk for panther-vehicle collisions	FDEP*, FWS, FWC*, NPS, FDOT, FHWA, counties, local government, NGO, COE, DCA	Cost will be site-specific.
<i>Habitat Restoration in Primary, Secondary, and Dispersal Zones</i>				
2	1.1.2.3.	Develop / expand funding mechanisms and other incentives for habitat restoration	NRCS, FWC, FWS, FDEP, NGO, private	
<i>Harassment, Injury, Mortality</i>				
2	1.1.5.3.3.1.2.	Secure funding for and install wildlife crossings and fencing in high risk areas	FDOT*, FWS, FWC, NPS, counties, NGO, FHWA, private	Costs will be site-specific.
<i>Human / Panther Interactions</i>				
2	3.2.5.1.	Provide education and outreach to residents living in and adjacent to panther habitat	FWS, FWC, NPS, USDA, NRCS, FDOF, WMD, State	

4.4 AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

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 the impacts of the taking of any federally-listed species as a result of activities addressed by the plan.

This section describes the measures that the Plan will implement to avoid, minimize, and mitigate impacts to the Florida panther and its habitat. Under the Plan, mitigation to offset impacts to panther will be accomplished through extensive permanent habitat preservation and maintenance. Avoidance and minimization are achieved under the Plan through landscape-level planning inherent in the design of the HCP Area.²² The applicants have also committed to following certain project-level planning measures and best management practices (BMPs) in order to further enhance the conservation value of the HCP, including the northern and southern wildlife corridors. These measures, which will be required under the HCP and ITPs, are described in section 4.4.1.2 below. In addition to these required measures, the applicants are committed to working with developers and homeowners' associations (HOAs) to employ other project-level planning measures and BMPs within the areas designated for Covered Activities to further the goals of the Plan, although these measures, which are described in sections 4.4.1.3 and 4.4.1.4 below, are not specifically required under the HCP or ITPs. The creation of the Marinelli Fund and contribution to that Fund through implementation of the HCP (discussed in Chapter 9) will also provide a means for potential habitat acquisition, enhancement, and/or creation for the Florida panther, as well as other Covered Species. The conservation measures described in this section – particularly the extensive, permanent habitat preservation and maintenance that is required under the Plan before Covered Activities can be conducted and the landscape-level planning reflected in the land designations under the Plan – will provide conservation benefits that would not otherwise be achieved through the RLSP, which is a purely voluntary program that does not require coordination or advance planning among participants.

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 permanently protecting extensive areas of interconnected panther habitats that occur within the Okaloacoochee Slough and the areas bordering the FPNWR by identifying those areas for preservation through conservation easements and directing clustered development away from these critical areas. 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,

²² We note that, although habitat restoration is not required by the Plan, the extensive, widespread preservation achieved through the Plan will make possible future habitat restoration that may be undertaken by the Marinelli Fund, a permittee, a governmental entity, or another third-party.

the preservation of these contiguous panther habitat areas was central to the Plan design and guided the delineation of areas for the Covered Activities (Figure 2-1).

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 applicants 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 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 serves to connect existing public lands on a regional scale, securing most of the regional wildlife corridor necessary for panthers to move from the BCNP, the FPNWR, and southern Hendry County to the dispersal zone. Protection of these landscape-scale connections has been a major panther conservation goal since the 1980s (Belden et al. 1988; Maehr 1990; Logan et al. 1993; Main et al. 1999; USFWS 1999; USFWS 2008a; Beier 2009; USFWS 2009a). Figures 4-5 and 4-7 highlight the importance of these same critical linkages with over 30 years of panther VHF telemetry data and GPS data collected from 28 panthers between 2005-2014.

The Plan avoids impacts to these extensive, contiguous panther habitat areas in the eastern and southern portions of the HCP Area, primarily by clustering and directing Covered Activities away from more ecologically valuable areas of interconnected native habitats and toward previously cleared areas with lower habitat support functions in the central, western, and northern portions of the HCP Area where intensive agricultural land uses predominate. In doing so, the Plan was designed to avoid impacts to the existing 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). These conservation design elements for the preservation areas align with the conservation design principles outlined in the HCP Handbook (USFWS and NMFS 2016, at 9-25).

4.4.1.2 Project-Level (Site-Specific) Planning and Best Management Practices Required Under the HCP and ITPs

The applicants have committed to following certain project-level planning measures and best management practices (BMPs) in order to further enhance the conservation value of the HCP, including the northern and southern wildlife corridors. These measures—described in the bullet points below—will be required under the HCP and ITPs.

- **Prescribed Fire and Smoke Notice.** As applicable, final development plans, associated homeowner's documents, and other documentation associated with residential and commercial development projects within the HCP Area will provide notice of the use of prescribed fire in the area, irrespective of the previous or planned use of prescribed fire on the site of the development itself. This notice will be provided and recorded in a manner such that initial and subsequent residents and owners will be made aware of the use of prescribed fire in and around

the HCP Area to manage wildland fuels and maintain fire-adapted ecological communities within preserve areas. The following notice concerning the use of prescribed fire will be provided:

- o *Periodic prescribed burning is a recognized land management tool and a recommended method of fuel management within and around the HCP Area for minimizing wildfire hazards and maintaining healthy fire-adapted ecological communities. Homeowners acknowledge that they have received notice that prescribed burning may result in the periodic occurrence of temporary smoke and ash that drifts through developed areas.*²³
- **Environmental Education and BMPs for Living with Wildlife.** The materials contained in Appendix B of the HCP document will be included with the Homeowners' Association (HOA) documents for each residential development community within the HCP Area at the time of HOA incorporation. Decisions regarding which educational materials and BMPs will be implemented within each community are left to the HOA and community residents, but the materials will be transferred to the developer(s) and HOA(s).
- **Securing and Vaccinating Pets.** HOA and/or homeowners' documents for residential developments within the HCP Area will state that pets within those developments should be kept indoors, on leash when outdoors, or secured within a secure covered kennel. Residents will be informed that vaccinating cats for feline leukemia virus (FLV) can prevent disease transmission from house cats to Florida panthers. As there is no definitive cure for FLV, community-wide vaccination of all pet cats protects homeowners' pets from illness, as well as preventing illness in Florida panthers.
- **Development Lighting Adjacent to the Northern and Southern Corridors.** Plans for commercial and residential developments within the HCP Area that are submitted to federal and state regulatory agencies will detail the lighting plans and proposed restrictions adjacent to the northern and southern wildlife corridors (Figure 4-9) in terms of (i) distance of fixtures to the corridor edge(s); (ii) fixture types; (iii) degree of fixture shielding (to limit skyglow, light trespass and glare); (iv) light sources, including low-pressure sodium (LPS), high-pressure sodium (HPS), and metal halide and light emitting diodes (LEDs); (v) brightness; (vi) correlated color temperature (in degrees Kelvin); and (vii) use of passive lighting (e.g., roadway reflectors; unlighted road signs). These lighting plan details will form a technical basis for the developer and the Service to perform a HCP/ITP consistency check as to whether the lighting plan adequately minimizes artificial light at the corridor edge(s) and maintains the functionality of the corridor for crepuscular and nocturnal wildlife movement.
- **Open Space Buffers.** Commercial and residential developments within the HCP Area will comply with Policy 4.13 of the Collier County Future Land Use Element for the RLSP, which states as follows: "Open space within or contiguous to a SRA shall be used to provide a buffer between

²³ Language adapted from *Wildfire Risk Reduction in Florida* (Florida Department of Agriculture and Consumer Services, Division of Forestry, 2010).

the SRA and any adjoining FSA, HSA, or existing public or private conservation land delineated on the Overlay Map. Open space contiguous to or within 300 feet of the boundary of a FSA, HSA, or existing public or private conservation land may include: natural preserves, lakes, golf courses provided no fairways or other turf areas are allowed within the first 200 feet, passive recreational areas and parks, required yard and set-back areas, and other natural or manmade open space. Along the west boundary of the FSAs and HSAs that comprise Camp Keais Strand, i.e., the area south of Immokalee Road, this open space buffer shall be 500 feet wide and shall preclude golf course fairways and other turf areas within the first 300 feet.” Under the RLSP, development plans must conform to this policy to gain development approvals from Collier County.

4.4.1.3 Project-Level (Site-Specific) Planning Not Specifically Required Under the HCP and ITPs

Avoidance measures were incorporated into the design of the HCP Area, and the relationship of the areas designated for Covered Activities to those designated for Preservation/Plan-Wide Activities (Figure 2-1). Although not required to mitigate for impacts under the Plan, the applicants are committed to working with developers and homeowners’ associations (HOAs) to employ project-level avoidance and minimization measures within areas designated for Covered Activities. These measures will primarily involve the configuration of residential/commercial development master plans to avoid direct impacts to potential panther habitat, and to direct the more intensive land uses away from panther habitat preservation areas, and implementation of the best management practices (BMPs) designed to further avoid impacts to Florida panther and the other Covered Species.

By design, the Covered Activities will occur within previously cleared agricultural areas that contain only small remnant patches of native panther habitat. As noted previously, the Plan requires that nearly all residential/commercial construction activities occur between sunrise and sunset, avoiding the crepuscular (dawn/dusk) and nocturnal periods when panthers are most active. The only exception to this practice is when tree clearing could potentially affect Florida bonneted bat roosts. This timing restriction minimizes the effects of human disturbance on panthers during project construction. Earth mining operations may occur onsite day and/or night, but no offsite transport of mining products may occur between sunset and sunrise.

The permittees also will coordinate with FWC and USFWS panther biologists within 30 days prior to the initiation of construction activities within a new residential/commercial development or earth mine. This coordination will allow panther biologists to alert the permittee(s) to recent panther activity in the immediate vicinity of the project boundary, especially any evidence of denning activity. The permittee(s) will adjust the timing of construction activities within specified distance of panther occurrences, if necessary, to minimize impacts to denning panthers or other notable panther activity (e.g., persistent occupancy of a specific area, as with a cached prey carcass).

At project-level scales, the goal will be to minimize impacts of the Covered Activities to panthers, panther prey base, and their habitats. Within the lands designated for Covered Activities, the techniques to be employed for minimizing 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 may 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 areas to physically separate developments from panther preservation areas, and minimizing the effects of light, noise, and human activity on preservation areas outside the project boundaries, as well as human-panther interactions;
- Designing internal road networks and roadway design elements within the lands designated for Covered Activities to minimize the potential for future panther-vehicle collisions;
- Providing a sustainable mix of residential, commercial, retail, office, civic, and recreational land uses where these 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 preservation areas are present adjacent to the mine), and limiting the offsite transport of mining products 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 will 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.

4.4.1.4 Transportation Network and Wildlife Crossings

As noted above, 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 (section 4.3.2). The Plan is expected to provide a source of funding and the necessary land preservation that will help avoid and minimize transportation-related impacts to panthers, however.

The Marinelli Fund is expected to supplement the HCP and other 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). As described in Chapter 9, at least fifty

percent of the first \$25 million deposited into the Fund by permittees through the \$350-per-acre fee and through transfer fees for homes sold within the HCP Area will be set aside for use in funding construction of large mammal wildlife crossings and associated fencing. Thus, by providing the necessary land preservation (perpetual conservation easements) where wildlife crossings may be located, the Plan will facilitate minimization and mitigation of traffic impacts to panthers, even though the existing transportation network is not included as part of the Covered Activities.

4.4.1.5 Best Management Practices Not Specifically Required Under the HCP and ITPs

The ITPs will provide incidental take coverage for Covered Activities that are under the direct control of the permittees, including the aspects of residential/commercial development and earth mining within the permittees' control (see section 2.3). Activities occurring within the HCP Area that are conducted or controlled by third parties after the project construction and/or earth mining activities have concluded are beyond the scope of the Plan and are not covered by the ITPs. However, although not required to mitigate for impacts under the Plan, the landowner-applicants are committed to working with developers and HOAs to promote and encourage the use of panther-related BMPs in the post-development phase in accordance with the FWC publication, "A guide to living with Florida panthers" (FWC; unknown date). These BMPs include the following guidelines:

- Minimize attractants for panther prey: Deer, wild hogs, raccoons, armadillos, and rabbits are panther prey. Potential wildlife food (unsecured garbage, pet food, etc.) should not be left outside where it could attract panther prey.
- Keep pets secure: Free-roaming pets, and pets that are tethered in unfenced yards, are at risk for predation, and house cats can potentially transmit feline leukemia virus to panthers. Pets should be kept indoors, and pet food should not be left outdoors.
- Landscape for safety: Choose landscaping plants that deer and other panther prey species do not like to eat (see edis.ifas.ufl.edu/UW137). Remove dense or low-lying vegetation near buildings, which could conceal panthers or other predators (bears, bobcats, coyotes).
- Consider other deterrents: Motion-activated lighting sensors can deter wildlife from encroaching into a yard.
- Avoid recreating (walking, jogging, biking, etc.) at the interface between the development boundary and preservation areas, especially at dusk/dawn or nighttime. Although residents will not have access to the Preservation/Plan-Wide Activities areas outside of developments, recreation may occur within preservation areas located within and wholly surrounded by development (where permitted).
- Report any panther sightings to FWC, the Homeowner Association (HOA), and neighbors.

The Plan will support the use of the Marinelli Fund to provide educational materials (neighborhood signs, newsletters, door hangers, etc.) to developers, HOAs, and residents in order to raise awareness and minimize the potential for human-panther interactions. Examples of the BMP materials are

provided in Appendix B. The landowners will also encourage developers and HOAs to educate future residents about the importance of vaccinating domestic cats against feline leukemia to avoid spread of that disease to the Florida panther population, which is important wherever domestic cats may come into contact with panthers throughout and beyond Southwest Florida.

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 of the Plan is the permanent preservation and maintenance of approximately 100,000 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 provide sufficient PHUs as mitigation to fully offset potential impacts to panther habitat using the standard USFWS methodology (USFWS 2012a).

The Biological Goals and Objectives (section 4.3) lists the additional conservation actions that will be implemented to benefit the Florida panther, beyond the land preservation (PHU) compensation that fully offsets habitat impacts. These actions include preservation and management of approximately 100,000 acres of existing panther habitat, and the potential enhancement of certain lands within the HCP Area; and potential provision of land, conservation easements, and funding for the construction of fenced wildlife crossings along key segments of the existing transportation network (outside of the HCP footprint).

4.4.3 Conservation Benefits for Non-Listed Species

The avoidance, minimization, mitigation measures, and BMPs that provide conservation benefits for the Florida panther will also provide ecological benefits for a wide range of species that are not listed by federal or state wildlife agencies. For example, the Florida black bear (*Ursus americanus floridanus*), a large wide-ranging mammal like the panther, will benefit directly from the landscape-scale preservation and land management of interconnected habitats protected under the Plan. The minimization techniques that provide physical separation between panther habitats and residential/commercial developments (e.g., lakes, berms, fencing, buffers) will also help to minimize bear intrusions into developments and human disturbance of other non-listed wildlife.

For the Florida black bear specifically, the Plan promotes and encourages the use of black bear-related BMPs in the post-development phase in accordance with FWC's, "Florida BearWise" program (<http://myfwc.com/wildlifehabitats/managed/bear/wise/>; see also <http://bearwise.org/bearwise-communities/>). This program works with communities, HOAs, and citizens to develop ordinances that minimize human-bear interactions and conflicts and includes a matching grant program to enable the purchase of bear-resistant trash containers. The BMPs for the Florida panther address many of the same issues that involve black bears, with the following additional guidelines:

- Use bear-resistant trash containers to secure trash;
- Wash recycling containers to remove odor attractants;
- Avoid the use of bird feeders, as bird seed is high in calories and bears are attracted by the smell;
- Clean outdoor grills thoroughly after each use, removing all fat and grease;
- Report any bear sightings to FWC, the HOA, and neighbors.

As with Florida panthers, the Plan will support the use of the Marinelli Fund to provide educational materials (neighborhood signs, newsletters, door hangers, etc.) to developers, HOAs and residents in order to raise awareness and minimize the potential for human-bear interactions. Examples of these materials are provided in Appendix B.

4.5 MONITORING AND REPORTING

The HCP Handbook (USFWS and NMFS 2016, 10-1) provides the following general guidance relative to the monitoring and reporting requirements for HCPs:

Monitoring and reporting are mandatory elements of all Habitat Conservation Plans (HCPs) (50 CFR 17.22, 17.32, and 222.307; 65 FR 35242 [June 1, 2000] (see the [HCP Handbook Toolbox](#)). When properly designed and implemented, they should provide [the Service] with the information [it needs] to determine whether or not:

- a permittee is in compliance with their incidental take permit and HCP;
- progress is being made toward meeting an HCP's biological goals and objectives;
- the HCP's conservation program is effective at minimizing and/or mitigating impacts; and
- there is a need for adjusting measures to improve the HCP's conservation strategy.

The sections below describe methods and objectives of the monitoring program with regard to the Florida panther. More specific monitoring and reporting requirements will be included in the terms and conditions of the ITPs issued by USFWS. Monitoring and reporting for HCPs and ITPs include: monitoring for baseline information; effectiveness monitoring to support ongoing conservation decisions; and monitoring to evaluate compliance with permit terms and conditions (USFWS and NMFS 2016, 10-4—10-12).

4.5.1 Compliance Monitoring

Compliance monitoring ties directly to the terms and conditions issued with the ITP (including reporting requirements), along with the measures this HCP describes for avoidance, minimization, and mitigation

of direct and indirect impacts to the Florida panther and its habitat, and the measures defined to meet the biological goals and objectives, along with any additional terms and conditions issued with the ITP. Each permittee will be responsible for ensuring that compliance monitoring is conducted and reported in accordance with that permittee's ITP. The HCP Area as a whole will also be monitored in aggregate to evaluate overall compliance. The permittees and their agents will perform the compliance monitoring activities, with monitoring results documented in the annual report. USFWS will have access to the HCP Area, monitoring data, and aerial imagery to independently monitor compliance. The sections below describe briefly the type, extent, frequency, and timing of monitoring events that will be conducted to determine compliance with these measures.

As described in section 4.5.3 below, an annual report will summarize the results of the compliance and effectiveness monitoring for the Plan, for each year of plan implementation.

4.5.1.1 Covered Activities

The monitoring program will verify that the location and extent of any implemented Covered Activities conform 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. The compliance monitoring for each project will occur during the permitting phase, construction phase(s), and when the project construction activities have been fully completed.

For the HCP Area as a whole, the character and extent of Covered Activities will be monitored for compliance on an annual basis through the use of such techniques as aerial imagery, analysis of State and Federal permits, local development orders, legal sketch and description surveys, and onsite inspections as agreed with USFWS. 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 allowed 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 (GIS metadata will meet Federal Geographic Data Committee (FGDC) or ISO 19115 metadata standards).²⁴

Projects will be in compliance with the Plan if they conform to the Covered Activities boundaries as defined on aerial imagery (allowing for scrivener's errors and scale), are implemented through State and Federal permits, have accurately quantified impacts to all land cover classes present within the project boundary, and have recorded perpetual conservation easements (prior to construction) to offset panther habitat (PHU) impacts (section 4.3.1, Objective 1, Measure 1) and offset habitat impacts to other Covered Species (sections 7.2-7.5).

²⁴ 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.

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 report 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.

4.5.1.2 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).²⁵ The monitoring will also verify that permittee actions are in compliance with the biological goals, objectives, and measures (section 4.3).

As specified in the biological goals and objectives (section 4.3.1, Objective 1, Measure 1), each permittee will record a perpetual conservation easement for each permitted project within the Covered Activities lands, prior to impacting panther habitat. Each conservation easement area will be managed in perpetuity for the control of invasive exotic vegetation, as defined by the Florida Exotic Pest Plant List Committee (FLEPPC) 2017 list for Category 1 species (FLEPPC 2017). As noted, permanent conservation easements recorded during the monitoring year within the Preservation/Plan-Wide Activities areas will be added to the GIS database. Recorded conservation easements will conform generally to the Preservation/Plan-Wide Activities boundaries as defined on aerial imagery from GIS.

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 activities and land uses that have occurred in these areas historically and are allowed under the Plan, and to ensure the general extent of native vegetation communities is maintained over the 50-year duration of the ITPs. For the HCP Area as a whole, Preservation/Plan-Wide Activities will be monitored for compliance on an annual basis through the use of aerial imagery and GIS land cover data, as compared to baseline aerial imagery acquired at or near the time of ITP issuance (section 4.3.1, Objective 1, Measures 2 and 3).

4.5.1.3 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. In addition, in order to preserve the ability of Florida panther and other Covered Species to move freely through the lands designated for Very Low Density

²⁵ As with the Covered Activities compliance monitoring, scrivener's errors may be revealed during the land survey activities and the recording of conservation easements, where small deviations exist between GIS-delineated boundaries and conservation easement boundaries as actually surveyed.

Use, no large-animal exclusionary fencing will be used within these lands. These areas will 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.

Although the Very Low Density Use areas will remain permeable to panthers (Beier 1995), and support panther prey base, the panther habitat impacts will still be assessed for the footprint of any dwelling units and associated clearing. The areas within the Very Low Density Use designation that remain in native vegetation (≥ 90 percent of the designation) will be placed under perpetual conservation easements with the same conditions as the Plan-Wide/Preservation area easements.²⁶

4.5.1.4 Base Zoning Area

As noted in Chapter 2 (Plan Description and Base Zoning Area), the Base Zoning area (Half Circle L Ranch) 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. If the property is ultimately acquired by Florida Forever or Conservation Collier, or is otherwise not included under the Plan, no monitoring will be conducted under the Plan for this area.

4.5.1.5 Panther Habitat Impacts and Mitigation

Each permittee will coordinate with USACE and USFWS during the CWA 404 permitting process to determine the number of PHUs associated with panther habitat impacts, and the required preservation area(s) necessary to fully offset those impacts. The permittees will provide a PHU ledger for the entire HCP Area with each annual monitoring report, detailing each PHU-related transaction related to the assessment of PHU impacts and the PHU credits associated with each preservation action (i.e., recorded conservation easement).

4.5.2 Effectiveness Monitoring

Preservation and Management of Contiguous Panther Habitat

As noted in Chapter 1, 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 et al. 2003; USFWS 2008a; Beier 2009). The lands designated for preservation under the Plan include lands within the HCP Area that are consistently utilized by panthers (see Figures 4-6 and 4-8).

²⁶ As with the Covered Activities compliance monitoring, scrivener's errors may be revealed during the land survey activities for the Very Low Density Use areas, where small deviations exist between GIS-delineated boundaries and field-located boundaries as actually surveyed. These areas will be in compliance with the Plan if they conform generally to the Very Low Density Use boundaries as defined on aerial imagery from GIS.

The scientific literature has repeatedly asserted that preservation and management of private lands was one of the most effective means for conserving the Florida panther. Therefore, the compliance monitoring that verifies the recording of perpetual conservation easements, and the requirement to manage lands to maintain or improve upon the ecological baseline, will also provide the means to assess the effectiveness of these measures.

The land management measures implemented to maintain ecological functions and suppress invasive exotic species (section 2.2) are well-known and are utilized throughout South Florida, including by USFWS on the FPNWR. The FPNWR is currently updating its Comprehensive Conservation Plan, which will define the goals, objectives, and strategies for managing the refuge and improving refuge conditions (https://www.fws.gov/refuge/Florida_Panther/what_we_do/ccp.html). Where practicable, the Plan will utilize insights gained from the FPNWR research and resource management programs to comparatively evaluate the effectiveness of land management measures within the HCP Area, and to determine which land management practices are best achieving Plan goals.

Surveys to Determine Florida Panther Status within the HCP Area

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 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 USFWS has noted, "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." HCP Handbook (1996, 3-27). 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 panther monitoring purposes as detailed in the ITP terms and conditions.

If the panther monitoring conducted by FWC within the HCP Area requires additional monetary support, the Marinelli Fund may provide required funds, as described in Chapter 9. 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. In the unlikely event that FWC significantly changes or discontinues its panther research and monitoring program, the permittees will coordinate with USFWS under "Changed Circumstances" procedures (see section 8.2.8).

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.

4.5.3 Reporting Requirements

The applicants will submit an annual monitoring report to USFWS by March 1 each year, covering the previous calendar year. The annual report will contain the types of information listed in the HCP Handbook (USFWS and NMFS 2016, 10-23) as agreed to by USFWS and applicants. These include the following:

1. Summaries of or a list of the Covered Activities implemented.
2. Accounting for impacts from Covered Activities.
3. Description of the extent of take for each Covered Species as a result of the Covered Activity.
4. Description how the conservation commitments of the HCP were implemented and their results.
5. Description of the monitoring results and survey information.
6. Description of any circumstances that made adaptive management actions necessary and how they were implemented.
7. Description of any changed or unforeseen circumstances that occurred and explain how they were addressed.
8. Summary of funding expenditures, balance, and accrual.
9. Summary of any minor or major amendments.
10. Description of any non-compliance issues and how they were resolved.
11. Any other information as required by the ITPs or HCP.

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 formats that meet Federal Geographic Data Committee (FGDC) or ISO 19115 metadata standards.

4.6 ADAPTIVE MANAGEMENT

For the purposes of the HCP program, USFWS defined 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 original HCP Handbook (USFWS and NMFS 1996, 3-24) stated 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 revised HCP Handbook (USFWS and NMFS 2016, 10-28, citing Williams et al. 2009) provides an expanded definition of adaptive management:

An adaptive approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions. Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable resource systems.

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 2008a), an updated 5-year review (USFWS 2009a), 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.

Given the vast amount of scientific information regarding panther ecology, habitat characteristics, and the straightforward and objectively verifiable nature of the biological goals and objectives, the applicants have planned accordingly 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 ITPs. The applicants will coordinate with USFWS, FWC, and the Board of Directors of the Marinelli Fund throughout the duration of the ITPs, to effectively respond to any opportunities for enhancing panther recovery efforts. In addition, the applicants support the formation of an oversight panel comprised of scientific experts who have published research on one or more of the Covered Species in peer-reviewed publication that would meet every three years during the 50-year term of the ITPs to assess the performance of the HCP and provide recommendations to the permittees and the Service regarding potential adaptive management measures.

Section 4.3 describes the biological goals and objectives for the Florida panther. The primary plan objective involves the perpetual preservation and management of approximately 100,000 acres of contiguous panther habitat within the HCP Area. No adaptive measures are required for the preservation actions (recording of perpetual conservation easements will occur prior to initiation of Covered Activities). The basic land management techniques that will be implemented to maintain the ecological functions of preservation areas are the same management techniques that have maintained the ecological value of the HCP Area for the last several decades. These management techniques are well known, have a long history, and have proven effective for controlling exotic invasive species, maintaining vegetative structure and fuel loads, and maintaining overall ecological functions.

The main land management practices for native habitats are expected to include: grazing; 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; and ongoing scouting and monitoring of lands on foot, horseback, or by vehicle.

Most of the other Plan objectives focus on facilitating potential enhancement, restoration, and/or establishment of panther habitat through the Marinelli Fund, either inside or outside the HCP Area, where suitable opportunities are identified and approved by the Marinelli Fund Board. These activities generally involve the same land management practices that will be utilized to maintain habitat functions within the preservation lands, with the addition of planting and early successional vegetation management where new habitats are established. Specifically, as related to the Florida panther, the land management techniques within the preservation areas may include: mechanical brush control; prescribed burning; silvicultural/forestry management; grazing; mowing; pasture plowing, disking, and/or seeding; exotic removal (mechanical; hand-cut, with/without herbicide application); berm repair and maintenance; ditch repair and maintenance).

The FPNWR is currently formulating its Comprehensive Conservation Plan (CCP; Fed. Reg. at 42349) that will identify long-range management direction and management alternatives for the refuge, with a major focus on the Florida panther. The CCP will examine the effects of management alternatives on the panther, which will provide an evolving scientific and empirical basis for the ECMSHCP to systematically evaluate and adjust management actions if needed. As the FPNWR borders the HCP Area and contains most of the native habitats that occur within the HCP Area, the recommendations generated by the CCP likely can be extrapolated, as appropriate, to the HCP Area. Although informal, the “partnerships of managers, scientists, and other stakeholders” between the FPNWR and the ECMSHCP will allow the potential for extension of CCP results into the HCP Area, and for the permittees to provide feedback to the FPNWR regarding the effectiveness of various management alternatives in a mosaic of native habitats, agricultural areas, and developed areas.

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 two species proposed for federal listing (see Chapter 1, Tables 1-1 and 1-2). It also covers eight 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” (Covered Species in addition to the Florida panther, which is addressed in Chapter 4), and serves as the primary 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 USFWS has previously issued, the species accounts were excerpted largely verbatim from Biological Opinions, 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 sources as needed for completeness. Thorough searches of scientific databases (e.g., Web of Science; Scopus; EBSCO; Google Scholar) resulted in the review and citation of the most current, applicable scientific literature for each Covered Species through early 2018 (see sections below on individual Covered Species and Chapter 11, Literature Cited). The purpose of this chapter is to provide accurate and complete baseline data for each of the Other 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.

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 and when 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). 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 in the process of 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)²⁷

The following species account is compiled from recent USFWS Biological Opinions (USFWS 2005; USFWS 2012b), and 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 large falcon with a head crest, naked face, heavy bill, elongated neck, and bright yellow-orange face and legs. It 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). A caracara's feet are also a noteworthy identification trait. The feet have talons that are flatter than those of other raptor species. This adaptation aids in foraging because it allows the caracara to walk or run on the ground more easily (USFWS 1999, 2017b).

Juveniles have a similar color pattern to adults 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 two years of age (J. Morrison, University of Florida, personal communication, 1997). 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 2009c).

²⁷ 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 2009c, 4) stated that because “the Florida [caracara] population persists in a unique ecological setting for the taxon, and loss of this population would result in a significant gap in its range, listing this species as a [Distinct Population Segment (DPS)] should be evaluated.” 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 two to three 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 June, the primary breeding season is considered to be November through April (USFWS 2017b), 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 meters 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.

Foraging typically occurs throughout the territory during both nesting and non-nesting seasons (Morrison 2001). 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 includes 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). Foraging behavior also includes regularly patrolling sections of roads for animals killed by collisions with motor vehicles (Palmer 1988). 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).

Both adult and juvenile caracaras are strong fliers and highly mobile birds that are capable of moving long distances. Morrison (2005) noted that sub-adult caracaras are nomadic. Individuals may traverse a large portion of the species' range in Florida from the time it leaves its natal territory to the time it establishes a territory. Adults will also occasionally leave their territory and travel great distances, usually outside of the breeding season. 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).

Observations and radio-telemetry monitoring have documented aggregations of caracaras within several "gathering areas" in central and southern Florida. Large groups of caracaras (up to 50) have been observed along the Kissimmee River north of State Route (SR) 98; south of Old Eagle Island Road in northern Okeechobee County; south of SR 70 and west of Fort Pierce in St. Lucie County; and south of SR 70 on the Buck Island Ranch in Highlands County. These gathering areas are regularly, but not continually, used by sub-adult and non-breeding caracaras and generally consist of large expanses of improved pasture. Morrison (2001) suggests that gathering areas may be important to caracaras before first breeding during the first three years after leaving their natal territory. However, the habitat values of these areas to caracaras have not yet been evaluated.

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 suggest a reasonable population estimate of 1,000 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 2009c).

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 central and southern 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 former habitat is no longer suitable for occupancy. In particular, encroachment of woody shrubs and trees into open dry prairies, pastures, and similar habitats have resulted in 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, which is the caracara's 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-km²) area in central and southern 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 provide shade for cattle also 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 central and southern 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, which 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 within or adjacent to the HCP Area, 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 Big Cypress National Preserve (BCNP), and adult caracaras have been observed west of the Florida Panther National Wildlife Refuge (FPNWR) (J. Morrison, Trinity College, personal communication 2007).

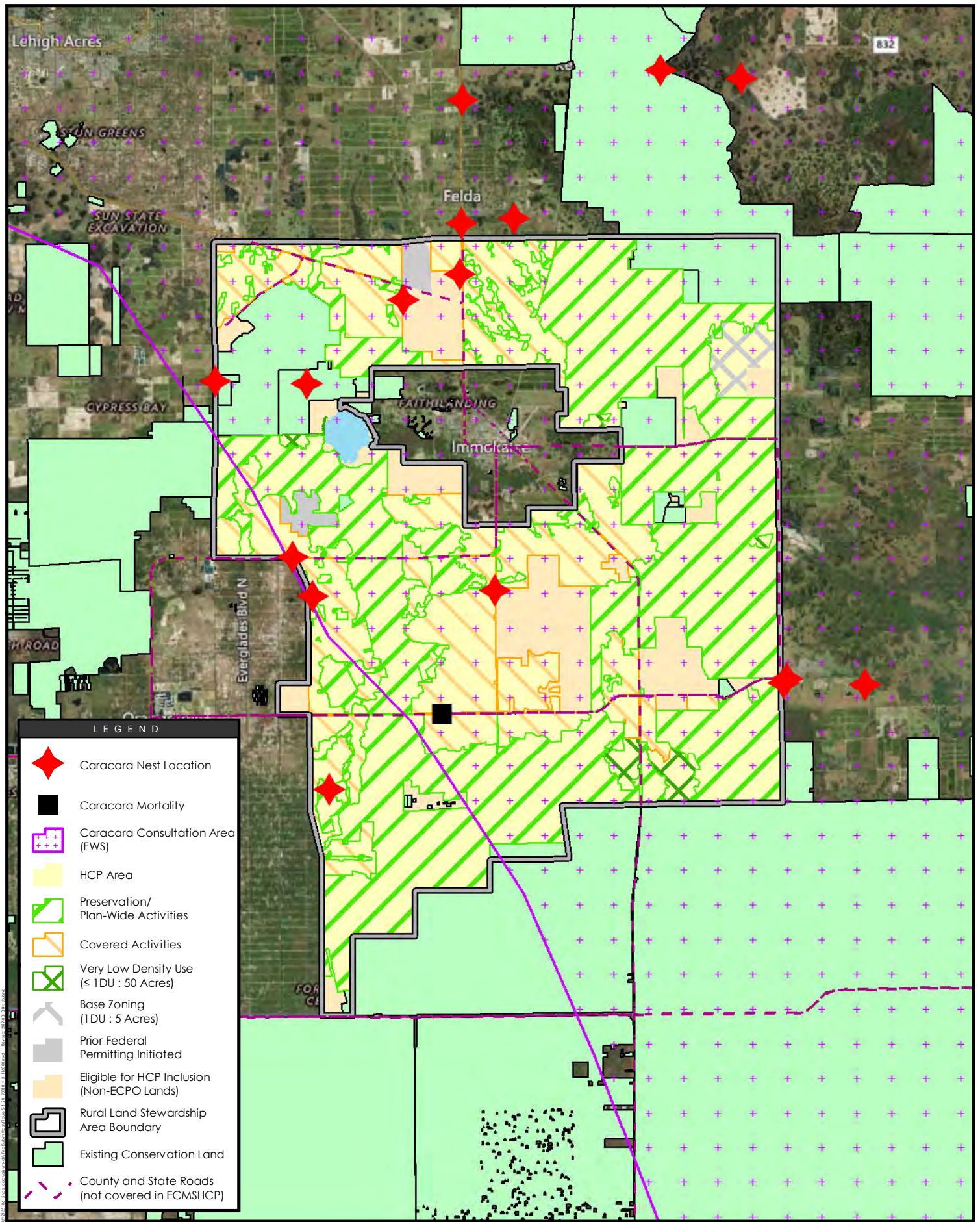
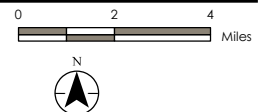


FIGURE 5-1

Caracara Consultation Area & Nest Locations
Rural Land Stewardship Area – Collier County, FL

March 2019

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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.

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 June 30, 2014 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 three 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, “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 three 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 1988, 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 Frohling 1986).

Wood storks are seasonally monogamous, probably forming a new pair bond every season. First breeding has been documented at three and four years old. Nest initiation varies geographically. 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. Wood storks can lay eggs as early as October and as late as June in Florida (Rodgers 1990, 48– 51). 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 three to four 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 northern 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, and extends 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), as well as

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 eight 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 its 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.

Ceille 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 whether 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, stormwater 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 2014a).

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 2006-2016 Map" (USFWS 2017c), showing four wood stork nesting colonies within and adjacent to the HCP Area. The USFWS data include three wood stork colonies active within the HCP Area between 2006-2016, along with a nearby active wood stork colony at Audubon Corkscrew Swamp Sanctuary (Figure 5-2). The USFWS online map displays 23 other wood stork colonies in Monroe, Miami-Dade, Lee, and Broward counties active within the 2006-2016 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 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 is therefore within at least one wood stork core foraging area.

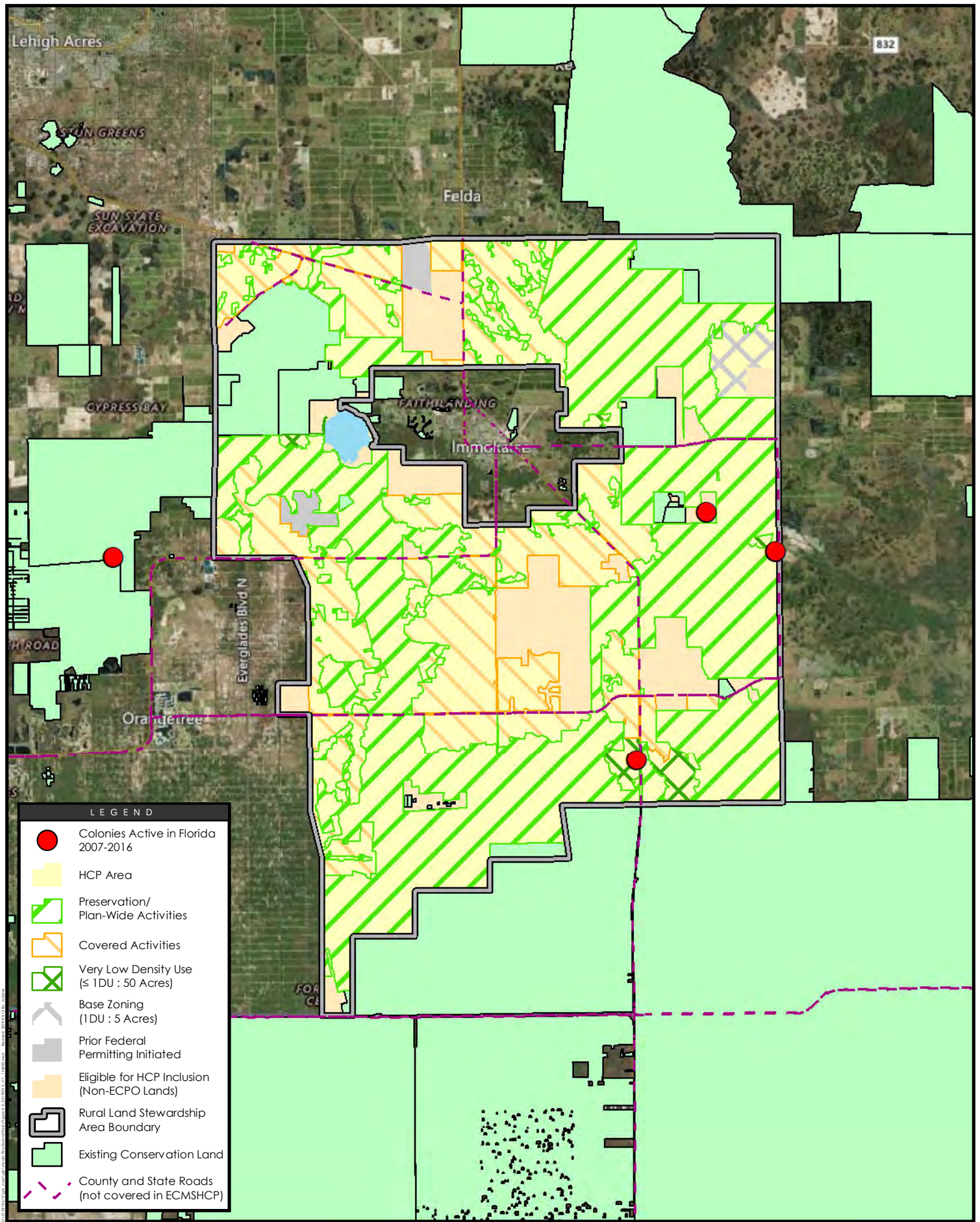


FIGURE 5-2

Wood Stork Nesting Colonies
Rural Land Stewardship Area – Collier County, FL
March 2019

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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 2009d; 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 2006a). 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 Endangered Species 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 2006a).

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 RCW 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 RCW 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 RCW is long-lived for a bird of 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 RCWs 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

RCWs 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. RCWs 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 2006a).

Primary threats to species viability for RCWs all have the same basic cause: lack of suitable habitat. RCWs 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 RCW 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

RCWs 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. RCWs 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 RCWs 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 and 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).

RCWs 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. RCWs typically forage in larger pines in pine-dominated habitat (90 percent), rather than in hardwoods (Ramey 1980; Bradshaw 1990). Male RCWs 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 RCW's range, 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 RCWs 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 RCWs 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 RCWs, 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 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.

5.2.1.4 Florida Scrub Jay

The following account for the Florida scrub-jay (*Aphelocoma coerulescens*) 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

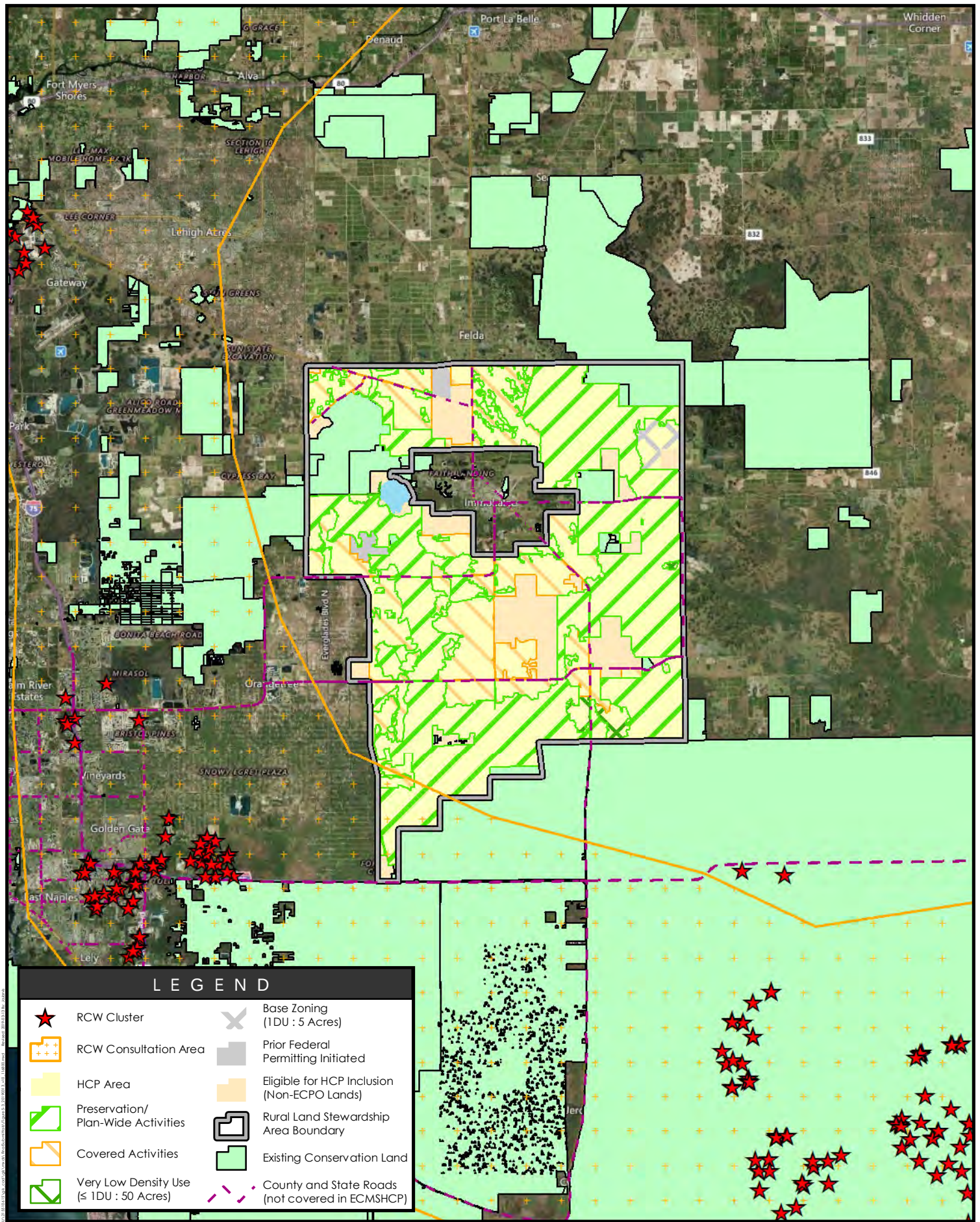


FIGURE 5-3

Red-Cockaded Woodpecker Consultation Area & Clusters
Rural Land Stewardship Area – Collier County, FL

March 2019

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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 1990). 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 six 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 one to seven years, although most individuals become breeders between two and four 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 seven to eight inches outside diameter and three to four inches inside diameter. The outer basket is bulky and built of coarse 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 two 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 six 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 five percent of scrub-jays disperse more than five 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 five 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*, *O. 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 al. 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 one and 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 seven 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 Eckl 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 mortality 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 that 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 one to three meters (three 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 (one to three m) and shorter; (iv) less than 15 percent canopy cover; and (v) greater than 300 meters (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 whether scrub-jays are currently active in the locations where they were detected during the 1992-1993 census (R. Bowman, personal communication, 2014). A 2004 survey of the Lake Trafford Restoration disposal site, just west of the Immokalee urban boundary, detected two scrub jays on multiple occasions (Conservancy of Southwest Florida 2004).

Figure 5-4 depicts the locations of scrub-jays observed during the 1992-1993 survey (Fitzpatrick et al. 1994) and the 2004 Lake Trafford disposal site survey. 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).

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 (*Pomacea paludosa*); 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-

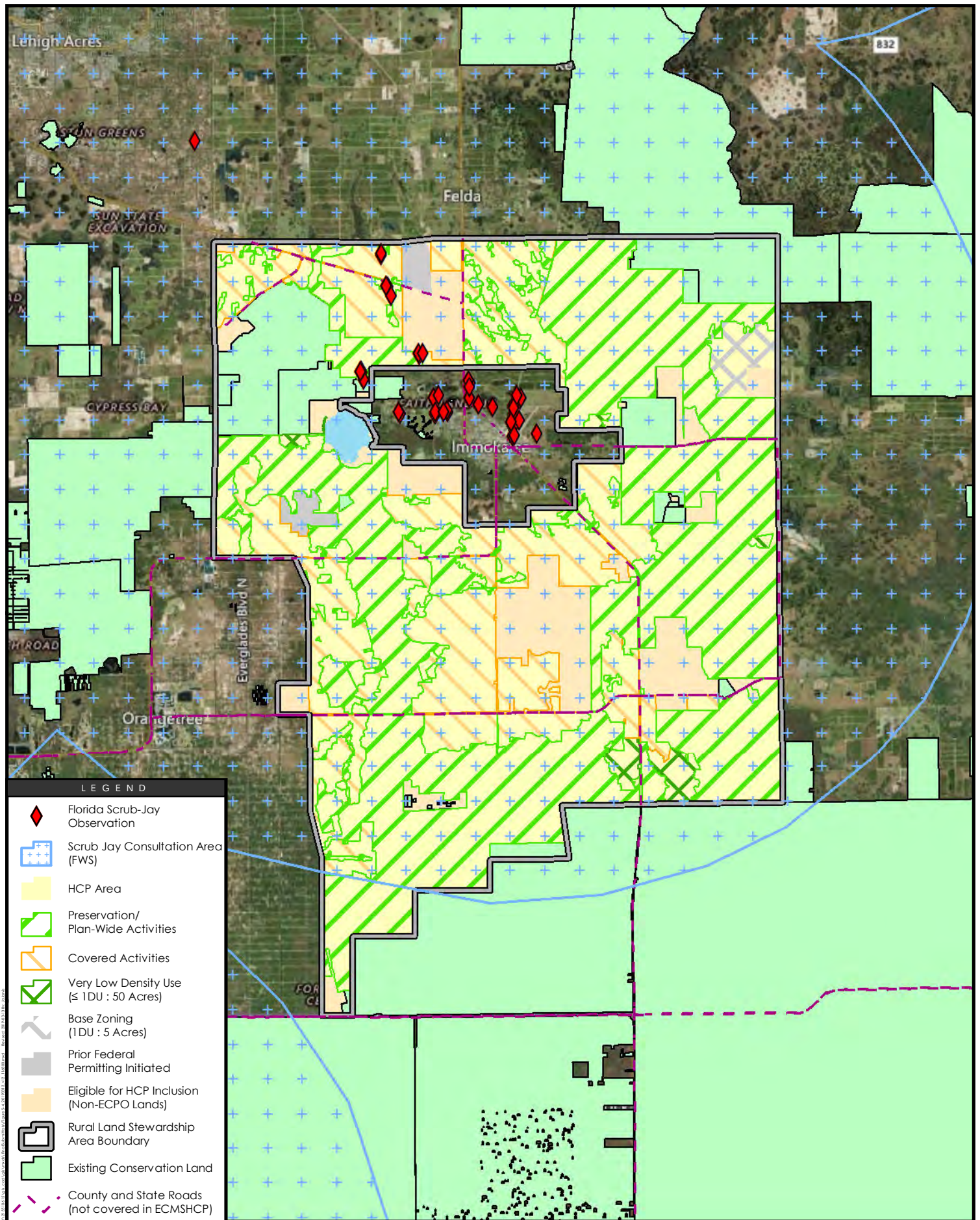


FIGURE 5-4

Florida Scrub-Jay Consultation Area & Occurrences
Rural Land Stewardship Area – Collier County, FL

March 2019

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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, has supported 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 two-day interval between laying each egg results in the laying of a three-egg clutch in about six 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 five 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 four 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 eight 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 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).

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 ≤ 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 in 2010 which updated the demographic parameters and incorporated effects of variable environmental (hydrologic) states. According to Cattau et al. (2012), the results from the 2010 PVA “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

A variety of threats have been identified that affect kite nesting, 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 we are not aware of any scientific investigations that directly relate effects of differing nutrient

concentrations to success of snail kites, snail kite habitat, apple snails, or apple snail habitat, the weight of evidence indicates that most of these lakes, and large areas of Everglades wetlands within the snail kite's range have received nutrient inputs higher than normal and at levels that require various governmental agencies to conduct habitat management.

The abundance of the snail kite's 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 that 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, which is 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). A species of invasive non-native apple snail (*Pomacea maculata*) has become established recently within the kite's range in Florida and have been used to varying degrees by snail kites. Until recently, it was hypothesized that the invasive apple snail posed a threat to the Everglade snail kite population. However, a recently published study by Cattau et al. (2016) concluded that "non-native snail populations appear to be providing Snail Kites with supplemental food resources and novel foraging opportunities. The presence of non-native snails was positively correlated with juvenile apparent survival, the number of young fledged/successful nest, nest abundance, breeding season length, and breeding rates." The predator-prey relationships between the Everglade snail kite and both the native Florida apple snail and the non-native snail are complex and may involve ecological trade-offs, requiring consideration of species interactions when addressing potential impacts and developing conservation strategies.

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 (both

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 four and 20 inches during the peak apple snail breeding period between April and June. Cattau et al. (2016) cited studies indicating that the non-native apple snails are more drought tolerant than the native snails.

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 2012-2014 recorded the presence of three adult snail kites within the HCP Area (Romañach and Gray 2014; Meyer et al. 2015). 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. 2015). Figure 5-5 depicts snail kite nest data and the consultation area within Southwest Florida (USFWS, unpublished data).

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 2014c), 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 feet (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 in 17 scale rows at mid-body. The central three to five scale rows are lightly keeled in adult males. 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 diagnosability. 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.

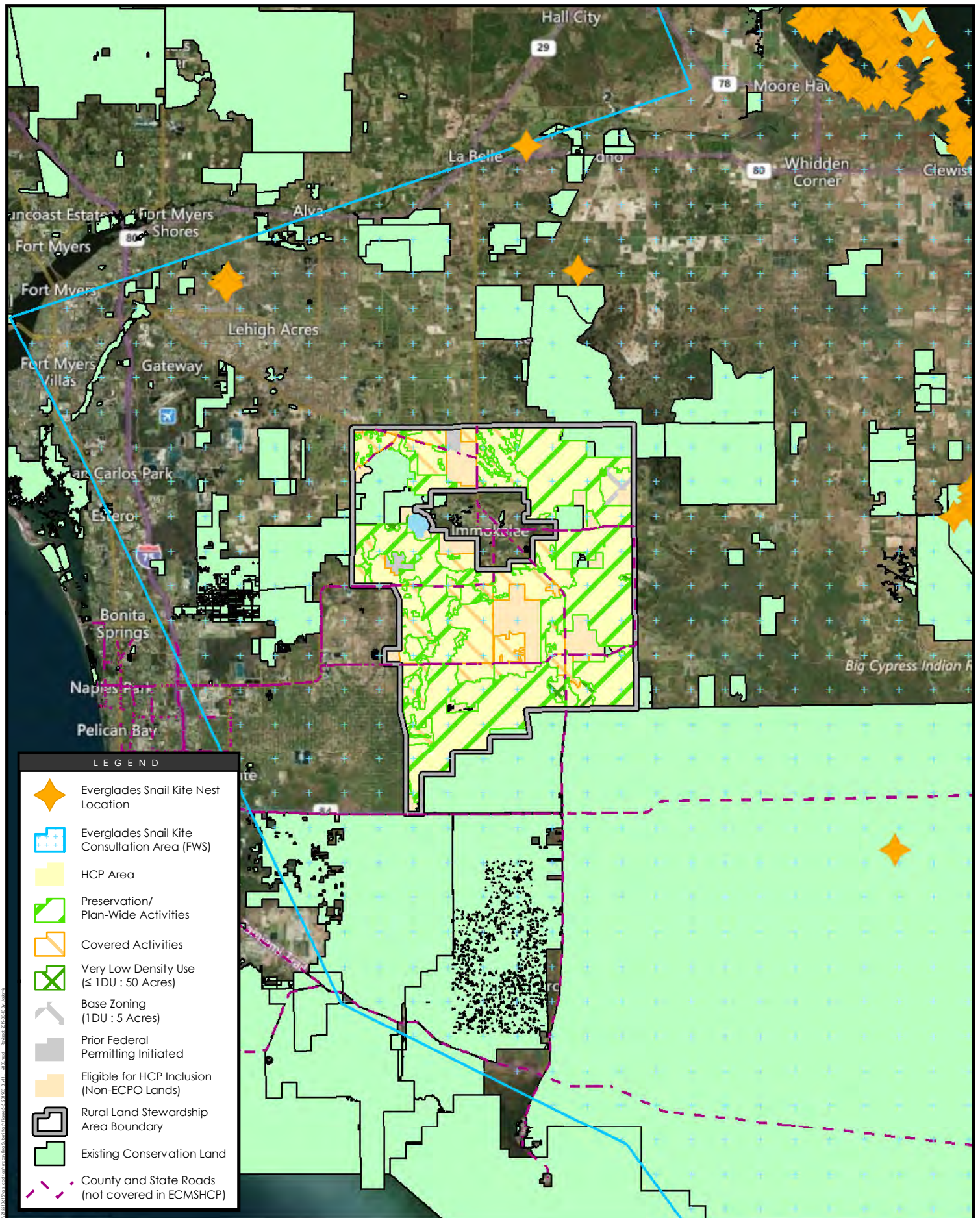
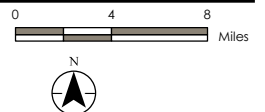


FIGURE 5-5
Everglades Snail Kite Consultation
Area & Nest Locations
 Rural Land Stewardship Area – Collier County, FL
 August 2018

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Life History

In central and southern 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 three months after egg-laying and there is no evidence of parental care. Eastern indigo snakes in captivity take three to four 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 four 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).

Bauder et al. (2016) determined that female eastern indigo snake movements and home ranges in peninsular Florida were relatively invariant year-round, but that male eastern indigo snakes increased their movements and home range sizes during the breeding season. In contrast to eastern indigo snake populations in Georgia, the peninsular Florida snakes were surface-active throughout the year, which the authors attributed to the warmer Florida climate. Eastern indigo snakes within the HCP Area should therefore be surface-active year-round, except for rare freezes when daytime temperatures remain cold.

Distribution and Population Trends

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 four to 12 eggs for captive females and estimated their sexual maturity to be reached at three to four 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 four 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 upon 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 interspersed 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 that have not experienced high density urban development. They are especially common in the hydric hammocks throughout this region (USFWS 1999). 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 that eastern indigo snakes 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

The eastern indigo snake is known to occur throughout peninsular Florida (USFWS, 2008; Krysko et al. 2011) and a revised Programmatic Effect Determination Key issued by USFWS applies to all counties within Southwest Florida, based on historic and current distribution data (USFWS 2017d).

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. Figure 5-6 depicts eastern indigo snake occurrence data within the vicinity of the HCP Area.

5.2.3 Mammals

5.2.3.1 Florida Bonneted Bat

Most of the following species account for the Florida bonneted bat (*Eumops floridanus*) is compiled directly from the 2013 USFWS Federal Register notice that listed the species as endangered under the ESA (78 Fed. Reg. 61004 (Oct. 2, 2013)), updated with information from multiple journal articles published between 2015 and 2017 (Angell and Thompson 2015; Gore et al. 2015; Braun de Torrez et al. 2016; Bailey et al. 2017a; Bailey et al. 2017b); Braun de Torrez et al. 2017; Ober et al. 2017a; Ober et al. 2017b).

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). There is no documented 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). Compared to other *Eumops* species, Ober et al. (2017b) found that the bonneted bat possesses “shorter or wider wings, with smaller wing tips” that may be advantageous for relative maneuverability through forested habitats of South Florida. Modest male-biased sexual dimorphism in wing size has been documented, suggesting that flight characteristics and use of foraging habitat may differ between the sexes (Ober et al. 2017).

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, and was considered a subspecies of *E. glaucinus* (*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

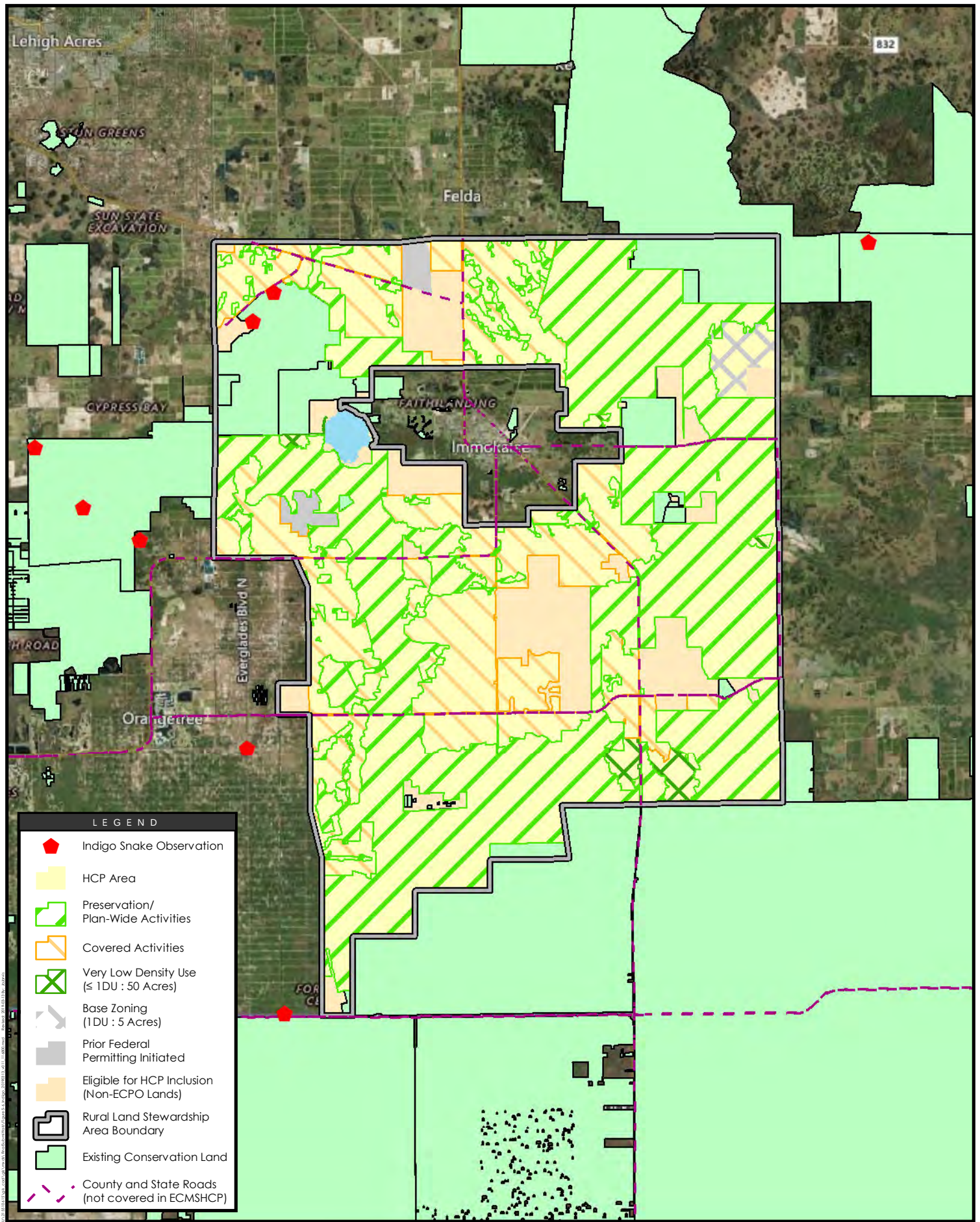
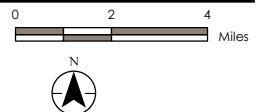


FIGURE 5-6

Eastern Indigo Snake Occurrences
 Rural Land Stewardship Area – Collier County, FL
 March 2019

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subspecies level, *E. floridanus* was raised to full species status based on morphology, and this taxonomic change was accepted by the scientific community (Timm and Genoways 2004, 852, 856, 861; McDonough et al. 2008, 1306–1315; Baker et al. 2009, 9–10). A more recent genetic study suggests that full species status may not be warranted, and that the bonneted bat may be a subspecies at the northern limit of the *E. glaucinus* range (Bartlett et al. 2013; Bailey et al. 2017a).

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. USFWS intends to publish a separate rule proposing designation of critical habitat for the Florida bonneted bat as more scientific data on home ranges and habitat affinities become available to define the physical and biological features necessary for bonneted bat conservation.

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

Basic information on roosting behavior and social organization of bonneted bats has been lacking until recently. 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). Ober et al. (2017a) collected data at six roost sites (bat houses) within the Babcock-Webb Wildlife Management Area to determine roost characteristics, social organization, and seasonality of reproduction over a one-year period. Over three capture events, they caught 103 unique individuals, and documented a harem social structure with an average of 10 individuals per roost. The authors noted that a harem social structure may necessarily result in small colonies that can be defended successfully by a dominant male, and that the availability of many small roosts within a local area may therefore enhance reproductive success more than establishing large roosting structures.

Recent research appears to confirm hypotheses that bonneted bat females are aseasonally polyestrous (i.e., the breeding season is unrestricted). Ober et al. (2017a) documented pregnant females during the April and August capture events; males with descended testicles during the April, August, and December capture events; and found non-volant (non-flying) pups eight months of the year. Collectively, the evidence supports a longer reproductive season for Florida bonneted bats than the previously estimated April-to-August timeframe, which is considered more typical of tropical bat species than temperate species.

Precise foraging 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 (G. Marks, pers. comm. 2012; H. Ober, *in litt.* 2012). Like other molossid, 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; Ober et al. 2017b). Given this, it seems likely that foraging areas could be located fairly long distances from roost sites. However, despite its capabilities, the species likely does not travel farther than necessary to acquire food needed for survival (G. Marks, pers. comm. 2012; USFWS 2013c).

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 three to five meters (10 to 16 ft) (Belwood 1992, 221). Ober et al. (2017b) suggested that the wing morphology of bonneted bats may be adapted for maneuverability in forested ecosystems, as compared to other *Eumops* species. Based upon information from G.T. Hubbell, Belwood (1992, 221) indicated that individuals leave roosts to forage after dark, seldom occur below 10 meters (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; Braun de Torrez et al. 2017). 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 random acoustical surveys for the Florida bonneted bat have been conducted in the past decade by various parties, the best scientific information previously indicated 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). Bailey et al.

(2017b) recently conducted a systematic acoustic survey of 330 points, ranging from Polk and Osceola Counties through South Florida, and expanded the known range of the bonneted bat as far north as northern Polk County.

Little information exists on historical population levels. Details are provided in the proposed listing rule (77 Fed. Reg. 60750). Based on 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 2011a, 3-4; FWC 2011b, 3, 6; R. Timm, pers. comm. 2012, *in litt.* 2012; Bailey et al. 2017a). Actual population size is not known, and no population viability analyses are available (FWC 2011b, 4). 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.

Information on reproduction and demography is sparse, but the first estimates of demographic parameters now exist from a study of bonneted bats roosting in bat houses at the Babcock-Webb Wildlife Management Area (Bailey et al., 2017a). The mark-recapture study reported that apparent annual survival estimates were lower than for most other bat species, and that recruitment was constant between sexes and over time. They reported, "Apparent survival had a greater influence on population growth rates than did recruitment, indicating that low survival rates could lead to population declines. Models of population growth rates showed a stable to potentially declining population trend, although the trend was highly variable, with estimates ranging from large declines to increases." (Bailey et al., 2017a, 551).

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). As noted previously, 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.

Bailey et al. (2017a) postulated that the Florida bonneted bat may be at the northern edge of a larger Neotropical range, and that reduced population fitness could be due to edge-of-range-effects. Their study documented depressed winter survival and noted that a 2010 cold spell resulted in the presumed mortality of one-half of the bonneted bats in a Fort Myers bat house (USFWS 2013). If true, this suggests that bonneted bat persistence may be generally higher in the more southerly portions of its range, and a climate shift to higher minimum winter temperatures in Florida could conceivably expand the range northward.

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; Bailey et al. 2017b, 1). Habitat for the Florida bonneted bat mainly consists of foraging areas and roosting sites, including artificial structures. Since the bonneted bat was listed by USFWS in 2013, at least two natural roosts have been documented, one in a longleaf pine (*Pinus palustris*; Angell and Thompson 2015), and the other in a slash pine snag (*Pinus elliotii*; Braun de Torrez et al. 2016).

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 meters (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; Ober et al. 2017a). 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; Bailey et al. 2017b).

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 number of old snags that have been hollowed by woodpeckers (C. Maehr, pers. comm. 2013c).

Bailey et al. (2017b) performed systematic acoustical surveys at 330 sites from Central to South Florida and modeled bonneted bat distribution and environmental associations. They detected bonneted bats in all land cover types within the study area, reporting that bonneted bat occupancy was negatively correlated with the amount of developed land within five km of a sample site, and positively correlated with the amount of crop-based agriculture within five km of a sample site. The authors noted that the lack of structural clutter may explain the positive correlation with crop-based agriculture, and acknowledged that the height of structures within urban areas (relative to height of bonneted bat foraging) may explain why the bats are found in some urban areas but not others (Bailey et al. 2017b, 5–6). The occupancy model also predicted higher probabilities of bat occupancy with higher 30-year means for minimum springtime temperature, and lower occupancy with increased 30-year means for springtime precipitation.

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, PSSF, CREW, and Dinner Island Wildlife Management Area protected areas, and within urban/residential areas in Naples and Everglades City (USFWS 2013c, Table 1; USFWS 2017e). The occurrence data in Collier County (unpublished) are consistent with range-wide surveys suggesting that Florida bonneted bats utilize a wide variety of habitats.

Nearly all of the HCP Area occurs within the Florida bonneted bat consultation area. Occurrence data for the bonneted bat are not publicly available. A recent acoustic survey within the western portion of the HCP Area detected bonneted bat calls, confirming their presence (USFWS, unpublished data).

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 the HCP Area had been added to Federal list of endangered and threatened wildlife and plants. The IPaC system identified two listed plant species that could potentially occur in Collier County, Garber's spurge (*Chamaesyce garberi*) and Florida prairie-clover (*Dalea carthagenensis floridana*).

Upon further review, there are only 15 known occurrences of Garber's spurge 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). USFWS is currently conducting a 5-year review of the species (81 Fed. Reg. 59650).

The IPaC system identified another plant species, Florida prairie-clover (*Dalea carthagenensis floridana*), that USFWS listed as an endangered species on October 6, 2017 (82 Fed. Reg. 46691). The final rule for this species stated, "*Dalea carthagenensis var. floridana* grows in pine rockland, rockland hammock, marl prairie, and coastal berm, and in the ecotones between these habitats...The current range of *Dalea carthagenensis var. floridana* includes BCNP (Monroe and Collier Counties), three Miami-Dade County conservation areas, and three additional unprotected lands within the Cutler Bay region of Miami-Dade County." " (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)), that 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 four to five feet (1.2 to 1.5 m) in length and average four to five lbs (1.8 to 2.3 kg) in weight. Eastern diamondbacks in the six-foot (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 two and six 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 (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, which 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 have been a variety of markets for the eastern diamondback and its parts. 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 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 2014c), 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 two 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 2012b).

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 to be added to the list of candidate species upon publication of the 12-month finding on July 27, 2011 (76 Fed. Reg. 45130).

A Candidate Conservation Agreement (CCA) for the eastern population of the gopher tortoise was developed in 2008 between federal, state, non-governmental, and private organizations, and was amended in 2012 (USFWS 2012d). The State of Florida (through FWC) is a party to the CCA, and committed to a FWC Gopher Tortoise Management Plan (September 5, 2012) that set an objective of no

net loss of gopher tortoises. The state currently administers a permitting program for relocation of gopher tortoises when a proposed project would impact resident tortoises.

The most recent USFWS “Review of Native Species That Are Candidates for Listing as Endangered or Threatened” (81 Fed. Reg. 87246) concluded that the magnitude of threats in the eastern portion of the gopher tortoise range (including Florida) was low to moderate, and assigned a “listing priority number” (LPN) of “8” (on a scale of 1-12, 1 being the highest listing priority). 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, 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 four 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 used exclusively 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 two 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; Three Lakes WMA, 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 2011c).

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 2012b) 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 (FWC 2017e) are depicted on Figure 5-7. A 2004 survey of the Lake Trafford Restoration disposal site, just west of the Immokalee urban boundary, confirmed the presence of at least 10 gopher tortoises (Conservancy of Southwest Florida 2004). 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.

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.

5.4.3 Gopher Frog

The following species account is compiled primarily from: A Species Action Plan for the Gopher Frog, *Lithobates capito* (FWC 2013a), with supporting information from the Gopher Frog Biological Status Review Report and supplement (FWC 2011d). These sources were used because they represent the most complete summary of the ecology and status of gopher frog within peninsular Florida.

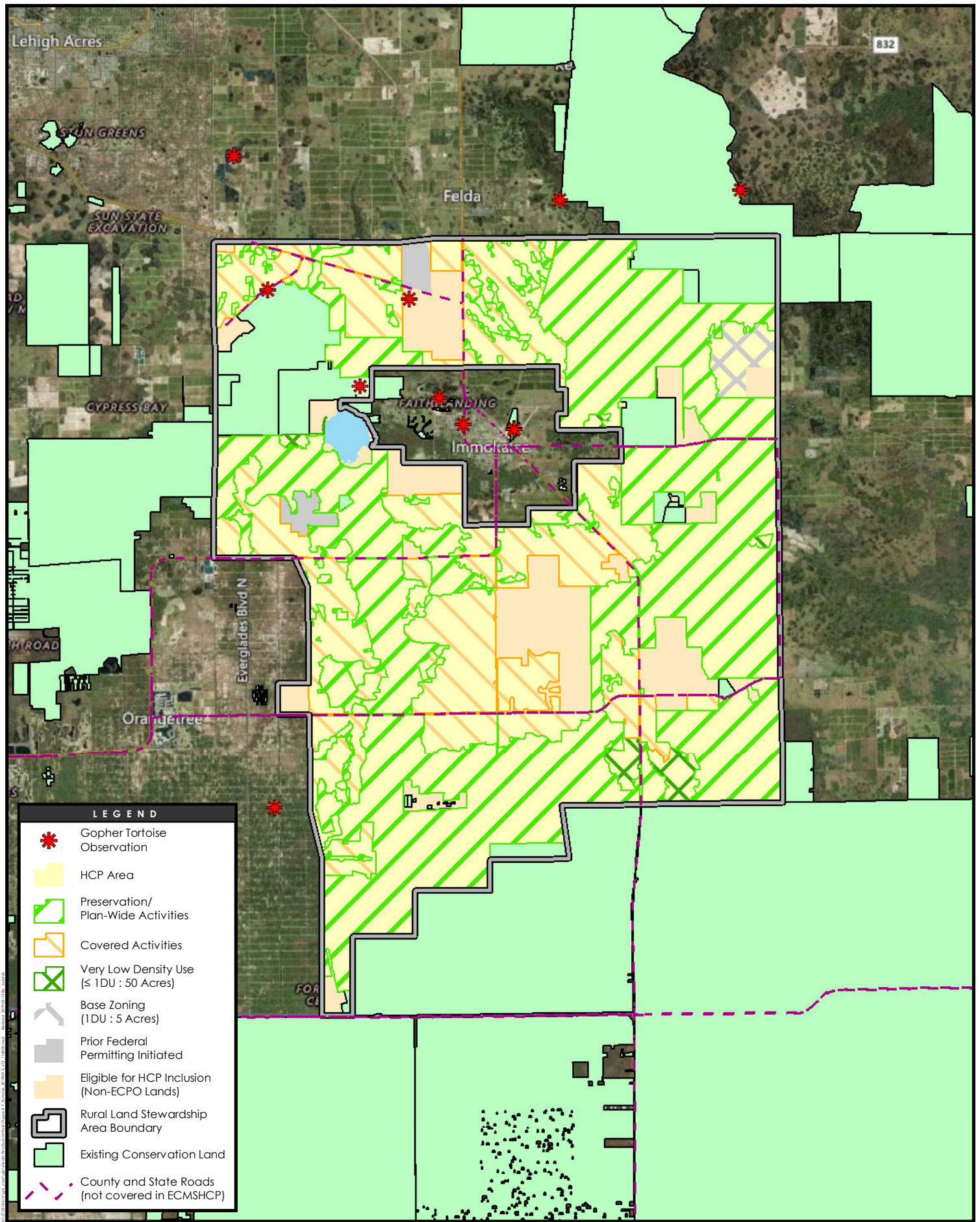
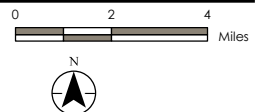


FIGURE 5-7

Gopher Tortoise Occurrences

Rural Land Stewardship Area – Collier County, FL
March 2019

Stantec Consulting Services Inc.
5801 Pelican Bay Blvd, Suite 300
Naples, FL 34108
tel 239.649.4040
fax 239.263.6449



5.4.3.1 Status and Distribution

Regulatory History

Based upon the 2011 Biological Status Review, FWC concluded that the gopher frog did not meet the criteria for state listing. FWC staff recommended that the gopher frog not be listed as Threatened, and the species was subsequently removed from the state “Species of Special Concern” list. Although no longer listed by the State of Florida, the gopher frog was included in the Imperiled Species Management Plan (ISMP; FWC 2016c).

On July 11, 2012, the USFWS received a petition from The Center for Biological Diversity, requesting the federal listing of 53 species of reptiles and amphibians, including the gopher frog. In July 2015, USFWS announced its finding that federal listing may be warranted for gopher frog. 80 Fed. Reg. 37574 (July 1, 2015). The federal listing status for the gopher frog is currently under review.

Description and Taxonomy

The gopher frog is a relatively large frog, with adults measuring between 64 and 112 mm (2.5 and 4.4 in) from snout to vent (Cash et al. 2008). Gopher frogs range in color from light tan to gray or dark brown with irregular black or dark brown blotches on the back, sides, and legs. A raised ridge (dorsolateral fold) runs down each side from behind the eye to the hind leg. Males can be distinguished from females during the breeding season by the presence of dark thumb pads called nuptial pads.

Two subspecies of gopher frog were formerly recognized in Florida: the Florida gopher frog (*Rana capito aesopus*) and the dusky gopher frog (*R. c. sevosae*). The latter subspecies was thought to occur west of the Apalachicola River (Conant and Collins 1991). However, Young and Crother (2001) analyzed allozyme data that showed no genetic divisions among populations of *Rana capito* (Le Conte, 1855), except for the population in southern Mississippi, which they recommended elevating to species status. Frost et al. (2006) removed New World frogs from the genus *Rana* and placed them in *Lithobates*, so the current name for the species occurring in Florida is the gopher frog (*Lithobates capito*).

The results of a recent range-wide genetic analysis suggest that, among gopher frog populations within Florida, substantial genetic differences exist between populations located in the Panhandle and those located elsewhere within the species’ range. However, more studies are needed to determine the exact locations of genetic breaks and the degree of genetic separation (S. Richter, Eastern Kentucky University, unpublished data).

5.4.3.2 Habitat Characteristics and Use

Range and Habitat

The gopher frog historically occurred throughout the State of Florida except for the Everglades and extreme South Florida (FWC, 2011d). A historical distribution map of gopher frogs in Florida depicts the species ranging into western Collier County, but not into eastern Collier County or Hendry County (FWC, 2013).

Jensen and Richter (2005) summarized the existing information on gopher frog life history and habitat requirements. Gopher frogs typically inhabit xeric (well-drained) upland habitats occupied by gopher tortoises that are within close proximity (< 5 km [3.1 mi]) to suitable breeding wetlands. In Florida, gopher frogs have been found in a wide variety of upland habitats, including sandhills, upland pine forests, scrub, xeric hammock, mesic and scrubby flatwoods, dry prairie, mixed hardwood-pine communities, pastures, and various other disturbed habitats that still harbor gopher tortoises (Enge 1997; K. Enge, FWC, unpublished data).

Gopher frogs spend most the year in the uplands where they shelter in underground burrows. In Florida, gopher frogs primarily use gopher tortoise burrows, although they will also use other refugia, such as pocket gopher and small mammal burrows, crayfish burrows, stump holes, leaf litter, hollow logs, and clumps of grass (FWC, 2011; FWC, 2013a).

Life History

Adult gopher frogs feed on invertebrates (primarily insects) and smaller frogs, and often hunt prey inside or near their burrows (Jensen and Richter 2005). During the breeding season, frogs migrate up to five km (3.1 mi) to breeding wetlands to mate and lay eggs (Humphries and Sisson 2012). Breeding generally occurs from September to April in northern Florida (Palis 1998, FWC 2011d), but often takes place during the summer in Central and South Florida (Godley 1992). However, breeding can occur during any time of the year with heavy rains (Jensen and Richter 2005).

Studies suggest that gopher frogs reach sexual maturity between 1.5 and two years of age (Jensen and Richter 2005). Males attract females for mating at breeding ponds by calling. Once paired with a male, females will deposit a single globular, fist-sized egg mass of 500 to 5,000 eggs attached to submerged or emergent vegetation in the wetland (Jensen and Richter 2005). Eggs hatch within four to five days and continue development as larvae (tadpoles), which take three to seven months to develop and metamorphose into froglets (Palis 1998).

Newly metamorphosed frogs leave the wetlands shortly after transforming and migrate into the uplands, where they shelter in burrows (Roznik and Johnson 2009). Adults return to the uplands after breeding and may migrate to and from breeding ponds using the same routes (Palis 1998).

Population Status

There is no quantitative information on the gopher frog population in Florida. Recent surveys suggest that healthy populations of gopher frogs exist on certain public lands in peninsular Florida. Surveys from 2006 to 2013 of historical and potential breeding sites on the peninsula have documented breeding in 208 ponds, including many previously undocumented breeding ponds on 43 public lands (K. Enge, unpublished data).

FWC is not aware of a population viability analysis for the gopher frog. However, FWC believes that it is unlikely that the species will become extinct within the next 100 years, based on: (i) the large acreage of suitable habitat contained in conservation lands throughout Florida; (ii) the gopher frog's adaptability to

some habitat alteration; and (iii) the increased security of gopher tortoise populations, due to the gopher tortoise's state listing status as "Threatened" and the concomitant Gopher Tortoise Management Plan (FWC, 2012b). The only factor that might change this scenario would be catastrophic die-offs from disease, but the isolated nature of many populations of gopher frog should keep them protected from disease vectors.

Threats

Habitat loss and alteration of xeric upland habitats have been identified as the most significant threats to the species in Florida and range-wide. Other threats identified include: (i) fire suppression and altered fire regimes in both upland and wetland habitats; (ii) wetland destruction and degradation; (iii) off-road vehicle use in pond basins; (iv) groundwater withdrawals; (v) potential impacts to wetland and upland habitat from climate change; (vi) fish introductions to breeding wetlands; and (vii) disease impacts on populations.

Intact xerophytic upland ecosystems inhabited by gopher frogs – including longleaf pine-dominated sandhill as well as scrub habitat – have suffered severe losses in Florida (Means and Grow 1985; Myers 1990; Kautz 1998; Enge et al. 2006). Losses have been especially severe along the highly developed coastal ridges of both southeastern and southwestern Florida, as well as the central ridges that have been mined, converted to agriculture, and more recently developed (Jackson 2004).

Because of their mobility, gopher frog populations can persist in fragmented landscapes, even when breeding ponds occur in unsuitable upland habitat, provided that suitable habitats are not too far apart and are not separated by busy highways or habitats lacking temporary refugia (needed during migrations). Gopher frogs do not require intact native ground cover, and dense populations can occur in pastures containing gopher tortoise burrows.

The most commonly cited management concerns for gopher frogs are altered fire regimes, resulting in the encroachment of hardwoods and shrubs into upland habitat, and the loss of gopher tortoise or pocket gopher populations that provide the primary source of upland shelters (Jensen and Richter 2005; FWC 2011d).

Degradation and destruction of wetlands also affect gopher frogs that rely on these ponds for breeding. Exclusion and suppression of fire from wetlands often leads to degradation of breeding ponds through shrub encroachment; peat buildup; and increased evapotranspiration, which shortens hydroperiods (LaClaire 2001). Loss of herbaceous vegetation decreases cover for tadpoles from predators and can discourage reproduction, as egg masses are attached to stems of herbaceous vegetation (see LaClaire 2001).

5.4.3.3 Occurrence in the HCP Area

No publicly available GIS occurrence data exist currently for the gopher frog. The gopher frog is included as a covered species within the ECMSHCP as a contingency due to its commensal relationship with the gopher tortoise; the presence of gopher tortoises within the HCP Area; and the proposed conservation

actions for the gopher tortoise under the ECMSHCP, which would also benefit the gopher frog (if present).

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, under review for listing, or unlisted by federal and state agencies.

In 2016, FWC completed a multi-year effort to produce Florida's Imperiled Species Management Plan (ISMP; FWC 2016c), representing FWC's first comprehensive approach to the management of multiple state-listed species. The ISMP identifies conservation actions directed toward individual species, habitats that support listed species, and broad integrated strategies that operate at landscape scales. FWC has actively assisted with the design and implementation of HCPs in Florida, and the ISMP provides a state-level conservation planning framework that complements the federal HCP process.

As part of the development of the ISMP, FWC 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, involving over 200 external experts and staff (including peer review). FWC staff ultimately recommended that 40 species be included on the State's Threatened list. Of these 40 species, eight species (six birds and two mammals) are known or suspected to occur within the HCP Area. These eight species are therefore included as Covered Species under the Plan (see Table 1-3).

FWC completed final draft Species Action Plans in 2013 for each state-listed species, which describe the biology, threats, and conservation needs for the individual species. FWC has also issued "Species Conservation Measures and Permitting Guidelines" for four of the state-listed Covered Species (Big Cypress fox squirrel, Everglades mink, Florida burrowing owl, and Florida sandhill crane), which provide technical assistance on conservation practices and avoiding take.

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 *Antigone canadensis pratensis* (FWC 2013b) and Final Florida Sandhill Crane Species Guidelines (FWC 2016d).

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 (*Antigone canadensis pratensis*) is non-migratory and one of two subspecies of sandhill crane occurring in Florida. The species was formerly placed in the genus *Grus*, but genetic data indicate that that *A. canadensis* is not closely related to true *Grus* (Chesser et al. 2016).

The migratory greater sandhill crane (*A. 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 four 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 one to three eggs but is usually two (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. Documented reports of sandhill crane occurrences exist for the Pepper Ranch area, and the Rural Lands West planned development. 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), and the Florida Burrowing Owl Species Guidelines 2018 (FWC 2018a).

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 two 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 two to three meters (six to nine ft) in length, up to one meter (three 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 six to eight eggs over a one-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 two weeks old. At four weeks, they are learning to fly but cannot fly well until they are six 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 animals (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 grams (3.5 oz) for males and 120 grams (4.2 oz) for females.

The southeastern American kestrel is one 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. elliotii* 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 km² (Smallwood and Bird 2002), which is equivalent to territory sizes as large as 2.5 km² (0.9 mi²) or as small as 0.6 km² (0.2 mi²). Stys (1993) suggested 0.5 km² (0.19 mi²) 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 begin in early January (Bohall-Wood and Collopy 1986). From mid-March through May three to five 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 one year old and life expectancy is estimated at two years and nine 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 five km (three 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 2001). No GIS occurrence data were available for this species, but a kestrel occurrence was documented on Pepper Ranch. 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, Tricolored Heron, and Roseate Spoonbill

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 three species (little blue heron, tricolored heron, and roseate spoonbill) are Covered Species under the ECMSHCP, 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 three species, the combined management needs for the three species are addressed in this section.

Supplemental information for these three species was also drawn from the FWC Biological Status Reviews, and from FWC species profiles.

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 (Rodgers et al. 1995). 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. The tricolored heron is a midsized member of the genus *Egretta*. This species can reach a length between 24-26 inches (61-66 centimeters) with a wingspan of approximately 36 inches (91 centimeters). The tricolored heron is named for its distinct coloration. It has a dark slate-blue colored head and upper body, a purple chest, and white underparts. This species also has a long, slender neck and bill, and is the only dark heron with light underparts. Previously, the species was placed in the monotypic genus *Hydranassa*.

The roseate spoonbill is the only spoonbill endemic (native) to the Western Hemisphere (Bjork and Powell 1996). This species can reach a length of 30-40 inches (76-102 centimeters) with a wingspan of 50-53 inches (127-135 centimeters). It has pink wings and underparts (with some red on the tops of the wings) with a white neck and back, and pinkish legs and feet. While the species looks almost entirely pink in flight, they actually have no feathers at all on their heads. As the name implies, the roseate spoonbill also has a large, spoon-shaped bill, which it sweeps back and forth in shallow water to capture prey.

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 1991, Kale et al. 1992, Rodgers et al. 1996, Mikuska et al. 1998, Rodgers et al. 1999, FWC 2003).

The roseate spoonbill is a resident breeder in South America, generally east of the Andes, and coastal areas of Central America, the Caribbean, and the Gulf of Mexico (Dumas 2000). Mangrove islands and occasionally dredge-spoil islands are the preferred nesting habitat for the species. In Florida, the largest breeding populations are in Florida Bay, with additional breeding sites in Tampa Bay on the Gulf coast and Brevard County on the Atlantic coast.

Wading birds, including these three species, 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, tricolored heron, and roseate spoonbill 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 1996a, Rodgers 1996).

The roseate spoonbill has a large, spoon-shaped bill, which it sweeps back and forth in shallow water to capture prey. The specialized bill has sensitive nerve endings which help the birds search for food in shallow water. The diet of the roseate spoonbill primarily consists of crayfish, shrimp, crabs, and small fish.

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 1996a, Rodgers 1996). Tricolored herons nest in similar conditions, though they are primarily found nesting in coastal habitat (Ogden 1996b).

Roseate spoonbills nest primarily on coastal islands in mangroves or Brazilian pepper but also are found nesting on spoil islands, especially in the Tampa Bay and Mosquito Lagoon regions (Bjork and Powell 1996, Hodgson and Paul 2010). They occasionally nest in willow heads within freshwater sites (FNAI, 2001). Roseate spoonbills are restricted to breeding sites free of raccoons (*Procyon lotor*) and depend on gradual dry-down in foraging habitat to concentrate prey (Bjork and Powell 1996). Degradation or loss of habitat due to coastal development, hydrologic alterations to wetlands, and reductions to important prey sources are of primary concern (Lorenz 1999, Lorenz et al. 2002).

Population Status

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).

Runde (1991) documented a possible decline in the little blue heron 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 noted previously. The largest colonies of little blue herons were identified in Water Conservation Areas 2 and 3 as supporting >2,000 nesting pairs in 2009 (Cook and Kobza 2009). 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 (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. 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).

Ground surveys by FWC and Audubon Society biologists determined that the roseate spoonbill population was between 550-750 pairs in Tampa Bay and Florida Bay during the late 1980s (Runde 1991) but less than 500 pairs during the 2000s (Lorenz et al. 2002, Lorenz et al. 2008). This was in comparison to an estimated 2,500 individuals in the late 1970s (Powell et al. 1989). In 1995-1996, the breeding population was estimated to be 1,000–1,100 pairs statewide (R.T. Paul, unpublished data). For the 2009 season, 316 roseate spoonbill nests were documented in Florida Bay, which was below the mean number of about 543 nests recorded each year since the 1984-1985 breeding season (Cook and Kobza 2009).

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: loss of suitable foraging and breeding areas due to human disturbance of nesting colonies; elevated populations of native and exotic predators that cause nest failure; and 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 1996a). 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 1996a). 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 (Lanz 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.

FNAI maintains occurrence records for all three species (little blue heron, tricolored heron, and roseate spoonbill) within Collier County, and these species are routinely observed within the HCP Area.

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 2013f) and the Big Cypress Fox Squirrel Species Guidelines 2018 (FWC 2018b).

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) 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 2013f). 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). *Sciurus 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 eight 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 two to three 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 six 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 2011e).

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 (Jodice and Humphrey 1992; USFWS 2002b; FWC 2005; Ditgen and Shepherd 2007;), 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; 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 2013f, 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.

5.5.2.2 Everglades Mink

The following account is comprised of excerpts primarily from: A Species Action Plan for the Everglades Mink *Neovison vison evergladensis* (FWC 2013g), with supporting information from the Everglades Mink Biological Status Review Report and supplement (FWC 2011f) and the Everglades Mink Species Guidelines 2016 (FWC 2016e).

Description and Taxonomy

The American mink was formerly included in the genus *Mustela* but was elevated to the new genus *Neovison* based on biochemical, molecular, cytogenetic, and morphological evidence (Kurose et al. 2008, Reid and Helgen 2008). When first described, the Everglades mink population was considered a separate

subspecies of American mink based on a single road-killed specimen from Big Cypress Swamp (Hamilton 1948).

A morphometric analysis of known populations of mink in Florida confirmed that those populations were distinct, but the *evergladensis* subspecies was subsumed as a disjunct population (Humphrey and Setzer 1989). That conclusion (that *evergladensis* is a disjunct population but not a subspecies) has been criticized, and some subsequent authors have accepted *evergladensis* as a distinct subspecies pending additional study (Whitaker and Hamilton 1998). Regardless of whether the Everglades mink is considered a distinct subspecies, the best available evidence suggests that the mink in South Florida are geographically isolated from other populations of mink (Humphrey 1992).

Everglades mink typically exhibit a total length (nose tip to last tail vertebra) >500 mm (19.9 in) and a weight between 630 g and 1,600 g (1.4 to 3.5 lbs) (Chapman and Felhamer 1982; Whitaker and Hamilton 1998). Pelage of the Everglades mink is uniformly dark brown, but some individuals have a white chin spot and a few have a white chest patch (Humphrey 1992; Figure 1). A slight sexual size dimorphism is exhibited in this species, with males being larger than females (Humphrey 1992; Larivière 1999).

The Everglades mink is listed as Threatened by the State of Florida; it is not federally-listed, nor is it a candidate or proposed species for federal listing.

Range and Habitat

Currently, four subspecies of mink reside in Florida: *N. v. evergladensis*, *N. v. halilimnetes*, *N. v. lutensis*, and *N. v. vulvivaga*. These four subspecies occur in at least four disjunct, peripheral populations: (i) both coastal and inland portions of Escambia, Santa Rosa, and Okaloosa Counties in the western panhandle (*N. v. vulvivaga*); (ii) the salt marshes of the Gulf Coast of northern Florida, likely from Pasco County to Bay County, although the pattern of distribution in the panhandle counties is not known (*N. v. halilimnetes*); (iii) the salt marshes of the Atlantic Coast from southern St. Johns County, Florida, northwards into Georgia and South Carolina (*N. v. lutensis*); and (iv) southern Florida freshwater marshes in the Everglades, Big Cypress Swamp, and Lake Okeechobee (*N. v. evergladensis*) (Smith 1980; Humphrey and Setzer 1989). The Everglades mink is a disjunct population of the American mink that inhabits southern Florida and, in particular, the shallow freshwater marshes of the Everglades (5,662 km² [2,186 mi²]) and Big Cypress Swamp region (29.50 km² [1,139 mi²]) (Humphrey and Setzer 1989; Humphrey 1992).

Most sightings and specimens of Everglades mink have come from either Collier County or Miami-Dade County (Smith 1980), but the Everglades mink is known to inhabit northern and eastern Monroe County as well (Humphrey 1992; Pifer et al. 2011). Although the range of the Everglades mink formerly may have extended from Lake Okeechobee south through much of the Everglades (Allen and Neill 1952; Humphrey and Setzer 1989; Humphrey 1992), mink have recently been found only in and near Fakahatchee Strand Preserve State Park (FSPSP) (D. Shindle, Conservancy of Southwest Florida, personal communication) and BCNP (Pifer et al. 2011). However, it is important to note that current knowledge of the distribution of Everglades mink is limited by the lack of systematic surveys across South Florida.

The Everglades mink was historically trapped or documented in the Everglades and Big Cypress freshwater and brackish marshes within Collier, Miami-Dade, and possibly Monroe Counties (Smith 1980; Humphrey 1992; Pifer et al. 2011). During the recent FWC Biological Status Review (BSR) for Everglades mink, the mink was documented in only one location in FSPSP (D. Shindle, personal observation as reported in FWC 2011f). Since 1971, however, FSPSP staff has made 153 sightings of Everglades mink, with 123 of these sightings occurring since 2002. Everglades mink were documented in four separate locations within the FSPSP during 2012 (M. Owens, FSPSP, personal communication). In addition, Everglades mink were also observed in BCNP in May 2007 and January 2008 (Pifer et al. 2011). No sightings of Everglades mink have been reported in the Lake Okeechobee or Everglades areas since the late 1980s and early 1990s (Humphrey 1992).

Two subsequent studies reported the trapping of Everglades mink in or near the FSPSP. One study documented that four mink were collected in 2004 and examined for canine distemper virus (Cunningham et al. 2009). A second study examined five specimens for the presence of parasitic helminth infections (Foster et al. 2007). Other sources of documented locations for Everglades mink might include published but out-of-print and unpublished reports from agencies such as the USFWS, FWC, Florida Department of Environmental Protection (DEP), and the National Park Service (NPS).

Habitat requirements and preferences of the Everglades mink are not well studied. Generally, mink select habitat along streams, swamps, permanent ponds, and in both freshwater and brackish marshes in coastal and inland locations (Larivière 1999). Mink have also been documented to occupy manmade structures such as canals and associated levees.

Everglades mink are known to use spikerush marshes and salt marshes between the mangroves and freshwater habitats during the wet season and swamp forests during the dry season. As water levels recede, the Everglades mink may relocate to more permanent ponds and concentrated food sources, particularly in March and April when young are not yet weaned (Humphrey and Zinn 1982; Humphrey 1992).

Life History

Much of the behavior and ecology of the Everglades mink is unknown, and the summary here is based largely on studies of mink outside Florida. Northern temperate populations of mink breed in early spring, but Everglades mink are believed to breed in autumn in conjunction with the late wet season, although specific months are not identified in the literature (Humphrey and Zinn 1982). Gestation for mink averages 51 days and average litter size is four.

Males have larger home ranges than females, and densities of adults vary from 0.1 to 0.7/km² (0.04 to 0.27/mi²). Densities are generally higher in coastal habitats because of smaller home ranges and greater intersexual overlap. Mink are typically solitary except during the breeding season (Larivière 1999). In FSPSP, Everglades mink have been observed together only during the months of February and March (M. Owen, FSPSP, personal communication).

During a 2007-2009 study conducted in both the BCNP and the ENP that included camera trapping, live trapping, and opportunistic surveys, only two Everglades mink were observed: one in May and one in January, both opportunistically and both in the BCNP (Pifer et al 2011). Generally, mink are known to be nocturnal and crepuscular but diurnal activity patterns have also been reported (Smith 1980; Eagle and Whitman 1987; M. Owen, FSPSP, personal communication). The Everglades mink does not seem to avoid human activity and frequently makes use of man-made structures such as canals and levees (Smith 1980).

Examination of digestive tracts from mink carcasses showed that mink feed on crayfish, snakes, fish, mammals, and birds (Smith 1980).

Population Status

This section on population status was excerpted from the Biological Status Review for the Everglades mink (FWC 2011f).

The Everglades mink is difficult to detect, and few museum specimens have been collected (Humphrey 1992). Consequently, population size and extent of occurrence are poorly known and trends can only be inferred from sparse data. Extensive systematic surveys have been limited, and some researchers have speculated that mink are locally common; several have noted that mink are more common in Big Cypress Swamp than in the Everglades (Allen and Neill 1952; Humphrey and Zinn 1982; Humphrey 1992; Pifer et al. 2011).

Observations of mink have been too limited to make precise quantitative assessments about current population status or trends. No conservation actions specific to the mink have been undertaken, although much of the potential habitat available to the mink is in public ownership. As additional research is conducted about the range and occupancy of the Everglades mink, lands under private and public ownership can be identified to assist with management.

Threats

FWC concluded, based on a recent biological assessment, that the Everglades mink met criteria for state listing (FWC, 2011f). Criteria met include: (i) limited (<20,000 km²) and declining extent of occurrence and area of occupancy which may be affected by the presence of canine distemper virus and mercury pollution; and (ii) limited and declining population size (<10,000 mature individuals; mature individuals residing in one subpopulation), which may be due to disease, pollutants, and hydrological manipulations.

The recent FWC assessment identified the following threats to the Everglades mink population: (i) changes to the natural water levels in the Everglades (Smith 1980); (ii) the conversion of natural habitats to agriculture and urban areas, and the potential impact of environmental mercury, as mink are thought to be particularly sensitive to bioaccumulation (Yates et al. 2004); (iii) disease, including canine distemper virus (Cunningham et al. 2009); and (iv) the introduction of invasive species, especially the Burmese python (*Python molurus bivittatus*).

Everglades mink may also face potential climate change impacts such as a projected decrease in wet season length and an increase in dry season interval (Aumen, et al., 2013; National Park Service, 2008; Obeysekera et al., 2011) which may alter breeding chronology and rearing of young.

Occurrence in the HCP Area

No GIS occurrence data apparently exist for the Everglades mink. The only recent documented mink occurrences were reported in the FSPSP (FWC, 2011), south of the HCP area. Although no Everglades mink occurrences have been documented in the HCP Area, the mink is included as a covered species within the ECMSHCP as a contingency due to the proximity of the FSPSP to the HCP Area, the presence of wetland habitats within the HCP Area, and the lack of knowledge regarding the mink's current population status and distribution.

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. For the other Covered Species, these same aspects are covered in three separate chapters. 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), two species under review for federal listing (eastern diamondback rattlesnake and gopher frog), and eight 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 2016, 8-3) states that “The HCP must identify the impacts likely to result from the proposed incidental take. It must include defined units to quantify impacts in terms of taking a number of individual animals or acceptable habitat surrogate units within the plan area.” The Handbook further notes that “it is not always practical to survey and count wildlife populations directly. More often, [the Service] use[s] a surrogate measure, such as acres of habitat . . . to express incidental take authorized by a permit.” HCPs range in size from small, project-level plans (where surveys and counts may be practical), to large multiple-species plans where habitat surrogate units define the units of take. Based on the general lack of occurrence data for the other Covered Species in the HCP Area, and the landscape-scale extent of the Plan, this chapter assesses potential impacts and potential incidental take using habitat acres as a surrogate. Use of habitat acres as a surrogate is especially appropriate here because the type of take expected for most of the Covered Species is harassment, which is difficult to detect or quantify.

The HCP Area comprises a landscape-scale mosaic of agricultural areas and native habitats totaling approximately 151,442 acres. The 106,442 acres of lands that will ultimately be included in areas designated for Preservation/Plan-Wide Activities and Very Low Density Use²⁸ were delineated for the

²⁸ As explained in Chapter 2, the Plan includes 97,069 acres designated as “Preservation/Plan-Wide Activities” where activities may occur but 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

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 Covered Species are sufficiently well-established that habitat characteristics and acreage can serve as a sound basis for determining potential impacts and potential take under the Plan. This is especially true with respect to the other (non-panther) 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 other Covered Species located within the lands designated for Covered Activities, and the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use can be quantified and 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 to be conserved in lands designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan.

These acreages provide a surrogate for quantifying instances of take and a means to quantify the benefits to the other Covered Species. Potential take for each of the other Covered Species is expressed in the Plan in terms of acres of suitable habitat located within the lands identified for Covered Activities that may be disturbed. And suitable habitat located within the lands identified for preservation – which offset the potential for take – are also quantified in the sections below. Potential impacts to other Covered Species habitats are based on the land cover 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 49,276-acre area delineated as Covered Activities (Figure 2-1), which over-estimates total potential 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 4,276 acres of Covered Activities lands that are not impacted at Plan completion ($49,276 - 45,000 = 4,276$) will be re-designated as

the Covered Species to move through these lands. The Plan identifies a 49,276-acre area where Covered Activities may occur. Although the Covered Activities may occur anywhere within this 49,276-acre area, the Covered Activities will be capped at 45,000 acres, and the balance (4,276 acres) will be placed into the "Preservation/Plan-Wide Activities" designation by Plan completion, bringing the total of that designation to 102,261 acres. The Plan designates 2,087 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 no more than one 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 currently for sale on the open market, and the current property owner is an applicant for the ITP. See Chapter 2, including Figure 2-1 and Table 2-1.

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 to be impacted or preserved under these analyses.

The complete assessment for the other Covered Species also considers the implementation of avoidance and minimization measures described in Chapter 7 (Conservation Plan for Other Covered Species). As described in that chapter, biological surveys for the Covered Species will be conducted at project-level scales as needed during the planning and environmental permitting phases of each project within the HCP Area, and mitigation for unavoidable impacts to Covered Species and their habitats will be specified under the terms and conditions of the ITPs.

Therefore, 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 population size of each “other Covered Species” within the HCP Area are primarily correlated with 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), generally previously fragmented and/or altered habitats, which can be accurately quantified on an acreage basis;
- The Plan will designate an extensive area 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 each project boundary, and will implement biological surveys as needed for environmental permitting and pre-construction monitoring 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, maintenance, and monitoring of the species’ habitats, will provide extensive conservation benefits for the other Covered Species that will adequately offset (or more than offset) the potential for incidental take.

6.1.1 Best Management Practices

As explained in Chapter 4 with respect to Florida panther (see section 4.4.1.4), the ITPs will provide incidental take coverage for Covered Activities that are under the direct control of the permittees, including the aspects of residential/commercial development and earth mining within the applicants’ control (see also section 2.3). Activities occurring within the HCP Area that are conducted and controlled by third parties after the project construction and/or earth mining activities have concluded are beyond the scope of the Plan and are not covered by the ITPs. However, the landowner-applicants are

committed to promoting and encouraging the use of best management practices (BMPs) in the post-development phase to minimize impacts and promote conservation benefits to the other Covered Species. These BMPs, which are described in Chapter 7 (see section 7.6.1.4), include the following components:

- Community environmental education that will engage residents in understanding and implementing natural resource conservation strategies, including minimizing attractants for wildlife by keeping unsecured garbage, pet food, and other potential food sources inside to the extent possible, and keeping pets secure and indoors
- Working with developers and homeowners' associations (HOAs) to promote xeriscaping and use of native plants for landscaping that do not attract wildlife to yards or other residential areas
- Working with developers to plan community lighting that implements dark skies practices to reduce disturbances to wildlife to the extent possible

The Plan will support the use of the Marinelli Fund to provide awareness and educational materials (neighborhood signs, newsletters, door hangers, etc.) to developers, HOAs, and residents in order to raise awareness and minimize the potential for human-panther interactions. Examples of BMP materials are provided in Appendix B.

6.2 POTENTIAL TAKE AND IMPACTS TO OTHER COVERED 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 ESA 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 unintentional "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 HCP Handbook states that "if incidental take of ESA-listed species is not anticipated from a landowner or project proponent's activities, an incidental take permit is not needed or appropriate." (USFWS and NMFS 2016, 3-2). As described in the sections below, for a number of species, take is unlikely, but the applicants prepared this HCP to comprehensively consider and address, and provide conservation benefits for, each of the species discussed below. As stated in section 4.2.3.1, the applicants therefore seek take coverage for all 19 Covered Species.

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. The Plan achieves this by configuring the Covered Activities area in a way that impacts relatively small fragmented habitat patches, located primarily within previously-disturbed agricultural areas possessing generally lower biological value, while preserving vast areas of contiguous habitat that exist within a diverse landscape context and possess high biological value.

As discussed in section 6.1 above, and as detailed for each species below, the primary potential effect on other Covered Species of implementing the Covered Activities consists of direct impacts to their habitat(s). An analysis of the current Cooperative Land Cover database (FWC and FNAI 2016) shows that approximately 35,000 acres of the land cover types 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. For many of the Covered Species (e.g., Florida scrub-jay, red-cockaded woodpecker, Everglade snail kite), 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. The Plan addresses the contingencies for new species listings and/or new designations of critical habitat in the Changed Circumstances chapter (sections 8.2.5 and 8.2.6).

Deconstructed Activities for Other Covered Species

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 49,276-acre area depicted on Figure 2-1 as "Covered Activities." The Plan limits the total area of Covered Activities at Plan completion to a maximum of 45,000 acres. The applicants also seek take coverage for land management and maintenance activities to be conducted within the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use. The sections below address potential impacts to the 18 other Covered Species that may occur while carrying out otherwise lawful activities (the Covered Activities and land maintenance activities) within the HCP Area.

USFWS utilizes an "assessment framework" that follows a series of logical steps to analyze the effects of an action (USFWS, unknown date). In this case, the action is the Service's issuance of the ITPs authorizing take that may occur incidental to the Covered Activities. Under the framework, this authorization of incidental take is "deconstructed" into its constituent elements, to a level of detail sufficient to characterize the specific biological, physical, and/or chemical stressors to which each species may be exposed as a result of potential incidental take from the Covered Activities. This characterization includes the intensity, spatial distribution, and temporal distribution (frequency/duration) of each stressor.

Spreadsheets assessing the deconstructed actions associated with the Covered Activities (Residential/Commercial Development and Earth Mining) are provided in Appendix A for the Florida panther and each of the 18 other Covered Species. These deconstructed activities provide a basis for assessing (i) the species' exposure to stressors, (ii) the species' response, and (iii) potential risk to individuals. During the Service's section 7 consultation for ITP issuance, the Service will utilize this information to complete the assessment framework in full.

6.2.1 Federally-Listed Species

6.2.1.1 Birds

6.2.1.1.1 Northern Crested Caracara

Potential Impacts to Caracara Habitat

Improved and semi-improved pastures with scattered cabbage palms constitute the core habitat areas for breeding caracara, along with native herbaceous dry prairie and wet prairie (Morrison and Humphrey 2001; Morrison et al. 2007; Smith et al. 2017). 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.

The land cover data in Table 6-1 provide separate estimates for improved and unimproved/woodland pasture areas. An estimated 5,075 acres of improved pasture, 1,057 acres of unimproved/woodland pasture, 9 acres of isolated freshwater marsh, and 2 acres of herbaceous dry prairie (6,142 acres total) occur within the Covered Activities land designation. Six 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 9,799 acres of improved pasture, 2,851 acres of unimproved pasture, 1,410 acres of isolated freshwater marsh, and 127 acres of herbaceous dry prairie (14,187 acres total).

Even if all potential core habitat areas for caracara (6,142 acres) were impacted within the Covered Activities area, more than twice that acreage (14,187 acres) of potentially suitable caracara habitat will be preserved within the lands designated for Preservation/Plan-Wide Activities and Very Low Density Use and available for mitigation activities under the Plan. As noted in section 7.2.1.1, permanent losses of caracara habitat within the Covered Activities area will be mitigated through restoration and perpetual preservation of an equal acreage of in-kind caracara habitat within the Plan-Wide/Preservation and Very Low Density Use areas, so there will be no net loss of caracara habitat within the HCP Area. The actual acreage of caracara habitat to be restored and perpetually preserved and maintained will be determined during project-level assessment and permitting, under the terms of the ITPs.

Table 6-1. Land use / land cover within the HCP Area, by CLC classes (FWC and FNAI 2016)

CLC CODE	COOPERATIVE LAND COVER (CLC) CLASS	COVERED ACTIVITIES (ACRES)*	PLAN-WIDE/ PRESERVATION (ACRES)	VERY LOW DENSITY USE (ACRES)	BASE ZONING (ACRES)**	TOTAL ACRES
1120	Mesic Hammock	417.6	1,185.1	61.3	16.3	1,680.3
1210	Scrub	0.0	9.3	0.0	0.0	9.3
1311	Mesic Flatwoods	1,007.5	6,299.2	112.2	0.0	7,418.9
1312	Scrubby Flatwoods	0.0	29.4	0.0	0.0	29.4
1340	Palmetto Prairie	1.5	127.0	0.0	0.0	128.4
1400	Mixed Hardwood-Coniferous	249.9	2,292.1	135.0	0.0	2,676.9
1500	Shrub and Brushland	394.4	916.3	138.0	0.0	1,448.7
1800	Cultural - Terrestrial	0.0	7.4	0.0	0.0	7.4
1821	Low Intensity Urban	1,183.7	52.7	0.4	0.0	1,236.8
1822	High Intensity Urban	335.7	10.4	0.0	0.0	346.1
1830	Rural (Rural Open Lands)	685.5	1,427.8	235.7	0.3	2,349.3
183311	Row Crops	14,195.1	9,391.3	0.0	568.2	24,154.6
183312	Field Crops	47.1	258.5	0.0	0.0	305.6
183313	Improved Pasture	5,074.6	9,297.6	501.8	1,211.2	16,085.1
183314	Unimproved/Woodland Pasture	1,056.5	2,845.6	5.2	0.0	3,907.2
183315	Fallow Cropland	1,011.0	373.0	0.0	0.0	1,384.0
18332	Orchards/Groves	19,695.2	8,434.1	0.0	1.2	28,130.5
18334	Nurseries	0.9	39.1	0.0	0.0	40.0
18335	Other Agriculture	0.0	1.1	0.0	0.0	1.1
1840	Transportation	303.4	89.9	13.8	3.9	411.0
1850	Communication	3.0	0.0	0.0	0.0	3.1
1860	Utilities	22.4	1.7	0.0	0.0	24.1
1870	Extractive	0.0	8.1	61.2	0.0	69.3
1880	Bare Soil/Clear Cut	0.0	7.1	0.0	0.0	7.1
2112	Mixed Scrub-Shrub Wetland	869.6	8,431.2	97.6	0.0	9,398.3
2120	Marshes	1,195.0	15,577.6	133.9	0.0	16,906.5
2121	Isolated Freshwater Marsh	9.4	1,408.3	1.7	536.4	1,955.8
2140	Floating/Emergent Aquatic Vegetation	10.2	0.4	0.0	0.0	10.6
2141	Slough (Non-Forested)	0.0	102.9	0.0	0.0	102.9
2210	Cypress/Tupelo	142.5	1,799.1	69.7	0.0	2,011.3
2211	Cypress	141.2	12,454.0	17.4	0.0	12,612.6
2213	Isolated Freshwater Swamp	190.1	3,982.9	40.4	0.0	4,213.5
22131	Dome Swamp	0.0	279.6	0.0	37.2	316.8
2214	Strand Swamp	0.0	1,754.1	0.0	1.1	1,755.2
2220	Other Coniferous Wetlands	11.0	12.7	0.0	0.0	23.7
2221	Wet Flatwoods	168.8	2,411.3	3.2	53.2	2,636.5
2230	Other Hardwood Wetlands	4.3	436.9	22.1	0.0	463.3
2232	Hydric Hammock	0.0	117.8	0.0	1.8	119.6
2233	Mixed Wetland Hardwoods	51.8	2,429.8	83.0	0.0	2,564.6
2240	Other Wetland Forested Mixed	40.4	1,588.2	274.1	0.0	1,902.7
2242	Cypress/Pine/Cabbage Palm	21.3	408.0	0.0	0.0	429.3
3000	Lacustrine	0.0	48.4	9.3	0.0	57.7
3100	Natural Lakes and Ponds	0.0	20.8	1.2	0.0	22.1
3200	Cultural - Lacustrine	332.0	61.2	647.1	0.0	1,040.3
4200	Cultural - Riverine (Canals/Ditches)	32.6	92.5	0.0	0.0	125.1
7000	Exotic Plants	370.5	547.2	1.9	0.0	919.6
TOTALS		49,275.6	97,068.6	2,667.2	2,430.9	151,442.3

* The actual acreage of Covered Activities at Plan completion will be 45,000 acres. The balance (4,275.6 acres) will be placed in Preservation/Plan-Wide Activities.

** 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.

*** Acreage data entries in this table were rounded to the nearest 0.1 acre. The sub-totals reflect the total acreage of each Plan land designation as calculated by GIS.

The pasture areas located within the Covered Activities land designation are generally small, fragmented, and occur near existing roadways (a potential source of caracara mortalities). Conversely, 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 diverse mix of native and agricultural habitats, and a large proportion of pastures are located away from roadways. Sustained habitat management is a major factor for caracara occurrence and 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. Therefore, under the Plan, potentially thousands of acres of caracara habitat would be preserved and maintained in perpetuity within the southern limit of its Florida range that would not be preserved and maintained otherwise.

Potential Take of Northern Crested Caracara

Incidental take of northern caracara in the form of harassment may occur, as a result of direct impacts to up to 6,142 acres of caracara habitat; activities associated with in-kind restoration of an equivalent acreage of habitat; and human disturbances during the implementation of Covered Activities or land management activities.²⁹ 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, but later relocated approximately 1.2 miles away during the non-breeding season after the start of permitted development activities during the non-breeding season (USFWS 2005). After they moved, the pair was monitored annually and successfully produced offspring through five years of monitoring, shifting their nest trees within a 1-2 mile distance away from the development.

Six caracara nest trees occur within or directly adjacent to the Covered Activities areas (Figure 5-1), including the nest site north of Ave Maria (described above). 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 ITPs, 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.

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.

²⁹ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for caracara, and their spatial and temporal extent. Morrison (2001) reported that breeding caracaras may flush from nests when disturbances occur within 300 m of a nest tree, and this distance has been utilized by USFWS to evaluate caracara habitat impacts for section 7 consultations (USFWS 2004a). Therefore, a distance of 300 m from a nest tree was used in Appendix A to define the spatial extent of potential disturbance effects for caracara.

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 be provided within the areas designated for Plan-Wide Activities and Very Low Density Use, where a heterogeneous mosaic of pastures, native habitats, water features and a general lack of roads provide valuable conservation areas for caracaras in perpetuity.

6.2.1.1.2 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; Endries et al., 2009). 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).

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 (Figure 5-2). Moreover, although much of the HCP Area, including lands designated for Covered Activities, is located within an 18.6-mile radius core foraging acre (CFA) surrounding a wood stork colony as established under the Corps's Wood Stork Key, the vast majority of potentially suitable wood stork habitats occur within areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, providing extensive opportunities for the implementation of wood stork conservation measures. For example, two colonies, Corkscrew Marsh and Sadie Cypress are located outside 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 excepting hydric hammock and wet flatwoods (Table 6-1, CLC codes 2112, 2120, 2121, 2140, 2141, 2141, 2210, 2211, 2213, 22131, 2214, 2220, 2230, 2233, 2240, and 2242) is estimated to be 2,687 acres. By contrast, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 51,406 acres of native wetlands. Although these acreage estimates do not provide information regarding habitat suitability, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain approximately 19 times the area of potential wood stork habitat as compared to the Covered Activities areas. The permittees will coordinate with USACE during

federal permitting to replace short-hydroperiod wetlands with an equivalent acreage of in-kind short-hydroperiod wetlands.

Moreover, within the estimated 2,687 acres of native wetlands located 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 this native wetland acreage will 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

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys a wood stork to such an extent that the wood stork's normal behavioral patterns are significantly disrupted.³⁰ 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 118 m (Rodgers and Schwikert 2002). 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, take of wood storks in the form of harassment is possible but unlikely.

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 (51,406 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 may 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).

³⁰ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for wood stork, and their spatial and temporal extent. Rodgers and Schwikert (2002, Table 2) determined a mean flushing distance of 118 m for wood storks when they were subjected to a fast, direct approach by a personal watercraft, and recommended 118 m as a minimum buffer-zone distance. Therefore, a distance of 118 m was used in Appendix A to define the spatial extent of potential disturbance effects for wood stork. This distance is considered a conservative estimate for disturbance effects, because a) disturbances from Covered Activities will not generally involve a fast, direct approach of machines toward wood storks; b) wood stork foraging areas along the edges of Covered Activities areas are typically buffered by vegetation that reduces the visual and noise disturbance effects; and c) wood storks are routinely observed in native habitats directly adjacent to current agricultural operations that involve large machinery and human activity.

6.2.1.1.3 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 from the boundary of the land designated for Covered Activities, with RCW clusters located in Golden Gate Estates and Big Cypress National Preserve (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 over the 50-year permit term. 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 savannah habitats within the areas designated for Plan-Wide Activities and Very Low Density Use will be managed in the future to benefit the Florida panther and other Covered Species, and this land management may 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 1,176 acres of pine flatwoods habitat. Approximately 8,826 acres of pine flatwoods are estimated to occur within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use — seven times the acreage present in the Covered Activities areas. Even assuming that the Covered Activities resulted in the permanent loss of all 1,176 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 Red-Cockaded Woodpecker

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, the likelihood of incidental take in the form of harm and/or harassment is anticipated to be low for the RCW within the HCP Area.³¹ However, the combination of existing RCW clusters in BCNP and Belle Meade (southwest of the HCP Area), with long-term fire and habitat management plans for FPNWR and FSSP, provide future opportunities for recolonization and/or reintroduction of RCW colonies on nearby state and federal lands over the 50-year term of the ITPs. Such efforts would increase the probability of RCW dispersal events into the HCP Area, for which take coverage may be required before the ITP terms expire. If one

³¹ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for RCW, and their spatial and temporal extent. Delaney et al. (2011) evaluated the effects of military training exercises on reproductive success and productivity of RCWs, and distance thresholds for noise disturbances. They found that RCWs did not flush from nests when 50-caliber blank machine-gun fire and artillery simulators were more than 152 m from RCW nests. Therefore, a distance of 152 m was used in Appendix A to define the spatial extent of potential disturbance effects for RCW.

or more RCW occurrences are documented within a project boundary, the permittee(s) will coordinate with USFWS. For these reasons, take coverage in the form of harassment is requested for RCW.

6.2.1.1.4 Florida Scrub Jay

Potential Impacts to Florida Scrub Jay Habitat

Figure 5-4 depicts six 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 within areas designated for Covered Activities. Most of the observations were recorded over 25 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. A 2004 survey of the Lake Trafford Restoration disposal site, just west of the Immokalee urban boundary, detected two scrub jays on multiple occasions (Conservancy of Southwest Florida 2004). A recent FDOT study for the SR 29 corridor documented 6-10 scrub-jays within the Immokalee Urban Boundary, in an area of scrubby flatwoods, mesic flatwoods, and palmetto prairies (FDOT 2014). These observations collectively define 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 (USFWS 2015). Land cover mapping at planning scales reveals no map units of xeric oak communities and a very limited extent of scrubby flatwoods within the HCP Area (Table 6-1). Within the areas designated for Covered Activities, zero acres of scrub or scrubby flatwoods are mapped, while only 9 acres of scrub and 29 acres of scrubby flatwoods are mapped in the Plan-Wide/Preservation areas. 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 or scrubby flatwood patches) within or adjacent to 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 suitable 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 as needed 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 potential habitats (including marginal habitats) are identified, according to USFWS survey protocols.

Based on current land cover mapping, no suitable scrub jay habitat areas are known to exist within the area designated for Covered Activities. The 1992-1993 survey data recorded three of the six scrub jay occurrences within the HCP Area on scrub remnants north of Immokalee, but the current conditions within these small areas are unknown.

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys a scrub jay to such an extent that the scrub jay's normal behavioral patterns are significantly disrupted.³² 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 area designated for Covered Activities. However, incidental take in the form of harassment has potential to occur if scrub jays use marginal habitats as refugia near the Immokalee Urban Boundary and the Covered Activities disturb the birds. If one or more scrub jays are documented within a project site, the permittee(s) will coordinate with USFWS to determine the appropriate conservation measures (see section 7.2.1.4). For these reasons, take coverage in the form of harassment is requested for scrub jays.

6.2.1.1.5 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). Using satellite telemetry, Meyer et al. (2015) documented snail kite utilization of "peripheral wetlands" outside the focal areas for management and population monitoring, including some wetlands within the HCP Area.

Because the snail kite forages only within a subset of freshwater marsh habitat conditions, the total acreage of freshwater marsh within the area designated for Covered Activities 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 1,215 acres. By contrast, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 17,225 acres of freshwater

³² Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the Florida scrub-jay, and their spatial and temporal extent. An extensive literature review found no published data that characterized disturbance distance thresholds for scrub-jays. Therefore, a 50 m distance threshold was used to define the spatial extent of potential disturbance effects from low-impact activities (e.g., pedestrian transects), while a 100 m distance was used for activities involving machinery.

marsh. These acreage estimates do not provide information regarding habitat suitability, but do indicate that the area designated for Plan-Wide Activities and Very Low Density Use under the Plan contain over 14 times the area of potential snail kite habitat as compared to the Covered Activities areas, in a landscape context with larger, unfragmented habitat patches.

Of the estimated 1,215 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 the 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

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys a snail kite to such an extent that the snail kite's normal behavioral patterns are significantly disrupted.³³ 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 limited area of potential freshwater marsh foraging habitats, and that extensive freshwater marsh habitats exist near the Covered Activities, take of snail kites is unlikely. Snail kite surveys will be performed as needed according to USFWS protocols (USFWS 2004b) during the planning and environmental permitting phases of each project within the HCP Area to minimize potential disturbances. If snail kite nesting is detected within or near a proposed project boundary, avoidance and minimization measures will be employed to keep construction activity >131 meters away from active breeding sites (data from Rodgers and Schweikert 2003). Mitigation for unavoidable impacts to snail kite habitat will occur within the Plan-Wide Activities and Very Low Density Use areas, where an estimated 17,225 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.

The Plan's general avoidance of impacts to an estimated 17,225 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

³³ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for Everglade snail kite, and their spatial and temporal extent. Rodgers and Schwikert (2003) determined a mean flushing distance of 49 m for snail kites when they were subjected to a fast, direct approach by an airboat, and recommended 130 m as an appropriate buffer-zone distance to minimize disturbance for snail kite foraging and roosting. Therefore, a distance of 130 m was used in Appendix A to define the spatial extent of potential disturbance effects for Everglade snail kite. This distance is considered a conservative estimate for disturbance effects, because disturbances from Covered Activities will not generally involve a fast, direct approach of machines (similar in noise levels to an airboat) toward snail kites.

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 potentially 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 wetland edges, wetlands with dry-season drawdowns, 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 (CLC codes 1120, 1210, 1311, 1312, 1340, 1400, and 1500) within the areas designated for Covered Activities comprise an estimated 2,071 acres, and occur within a predominantly agricultural landscape fragmented by existing roads. By contrast, an estimated 11,305 acres of native upland habitats will be preserved within the 106,442 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.

FWC produced a draft MaxEnt model for eastern indigo snake in 2015 (FWC unpublished), which models species distributions based upon presence-only species data and environmental correlates, and provides spatially explicit probabilities of species occurrence (Elith et al. 2011). The model is especially useful for species that are difficult to detect, such as eastern indigo snakes. The MaxEnt model for South Florida assigned probabilities of 67-100% for eastern indigo snake occurrence within the native upland habitats of the HCP Area, but very low to low probabilities (0-11%; 11-25%; 25-35%) within deeper wetlands and the large agricultural areas (active row crop fields and active citrus groves). These greatly differing occurrence probabilities show that the take assessment for sub-optimal habitats should not be a raw acreage calculation, but should be adjusted in keeping with probabilities of species occurrence.

Although the eastern indigo snake is considered a habitat generalist that can utilize most habitats within the HCP Area, the species requires a mosaic of habitats to complete its life cycle. The vast size of the row crop fields and citrus groves within the HCP do not generally provide suitable habitat mosaics for this species. Furthermore, row cropping involves 2-3 cropping cycles per year and several months where fields exist as bare soil (with or without shallow flooding to suppress weeds), which are current

conditions that are highly unfavorable to the snake and make its occurrence in these areas unlikely. Within the area designated for Covered Activities (49,276 acres), row crops comprise 14,195 acres, citrus groves comprise another 19,695 acres, and pastures and other rural uses comprise 7,876 acres. A minimum of 24,375 acres of these same agricultural land uses will be preserved under the Plan.

Within the Covered Activities area, native wetlands that also provide partial habitat support for eastern indigo snakes comprise 2,856 acres. An estimated 53,938 acres of native wetlands will be preserved under the Plan.

USFWS Biological Opinions for the eastern indigo snake in Florida emphasize that preserving extensive areas of largely undeveloped land, such as the Plan-Wide Activities and Very Low Density Use areas, is important for conserving this species (USFWS 2014b). 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)." Under the Plan, the extensive, the contiguous landscape preserved in perpetuity will provide these habitat mosaics for the eastern indigo snake.

Potential Take of Eastern Indigo Snake

The Covered Activities, as well as land management activities within the areas designated for Preservation/Plan-Wide Activities, 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 habitat conversion or land management activities 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 (USFWS 2017d), incidental take of the eastern indigo snake in the form of harm is possible, but the number of individual snakes potentially harmed is indeterminable. The Service noted that indigo snakes have limited detectability due to many factors, including their use of burrows or holes, and potential use of cryptic sheltering areas created during construction (e.g., brush piles, earth mounds), all of which make it difficult to detect and quantify take (USFWS 2017f). The primary estimate of take is therefore based on the 2,071 acres of native uplands located within the area designated for Covered Activities that serve as a surrogate unit, where there is the highest probability of eastern indigo snake occurrence. The take estimates for less optimal habitats will be determined in cooperation with the Service, utilizing the MaxEnt model and field verification of sub-optimal habitat conditions.

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys an eastern indigo snake to such an extent that the snake's normal behavioral patterns are significantly disrupted.³⁴ Potential impacts may include human activity, vibration and noise

³⁴ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the Eastern indigo snake, and their spatial and temporal extent. An extensive literature review found no published

associated with construction activities, earth mining, and other human activities while the Plan is being implemented. For the same reason as described above, take in the form of harassment is indeterminable, but estimated by the acres of potential habitat impacts.

The applicants therefore seek take coverage in the form of harm and harassment for 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 106,442 acres for Preservation/Plan-Wide Activities and Very Low Density Use, which includes an estimated 11,305 acres of native upland habitats, provides the type of large-scale eastern indigo snake conservation recommended by Breining 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 (USFWS 2013b; Bailey et al. 2017b). 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. Results from a study at Florida Panther NWR conducted in 2013 reported 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, non-forested wetlands, and shrub communities within the HCP Area. The draft consultation guidelines for the bonneted bat (USFWS 2017e) characterize roosting habitats as forest and other areas with tall, mature trees. Foraging habitats are characterized as relatively open areas where prey can be located and caught, with available sources of drinking water. This includes open freshwater, freshwater wetlands, wetland and upland forest, and wetland and upland shrub communities. Open forests may provide dual support as roosting and foraging habitat, depending on forest structure. The role of agricultural areas for bonneted bat ecology are not yet well-established (Bailey et al. 2017b).

Using data from Table 6-1, the Florida bonneted bat habitats would include CLC codes 1120, 1210, 1311, 1312, 1340, 1400, 1500, 2112, 2120, 2121, 2140, 2141, 2210, 2211, 2213, 22131, 2214, 2220, 2221, 2230, 2232, 2233, 2240, and 2242. Open water features (ponds, reservoirs) were not included explicitly in the habitat acreage calculations because these features were either included with other land cover types in the existing land cover mapping (e.g., Sunniland mine), and/or because they are generally finer-

data that characterized disturbance distance thresholds for indigo snakes, which is unsurprising given their cryptic behaviors. Therefore, a 50 m distance threshold was used to conservatively define the spatial extent of potential disturbance effects from low-impact activities (e.g., pedestrian transects), while a 100 m distance was used for activities involving machinery.

scale features that were not mapped at a planning scale. The combined acreage of these CLC land cover classes within the Covered Activities areas comprise an estimated 4,926 acres, approximately half of which is potential roosting habitat (2,446 acres). The same habitat types within the Plan-Wide Activities and Very Low Density Use areas total 65,243 acres. Notably, these preservation areas include an estimated 38,308 acres of native forest communities that the consultation guidelines define as “high quality potential roosting areas” (forest patches >50 acres in size). Many 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, as well as land management activities, 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 habitat conversion or land management activities actually killed or injured a Florida bonneted bat. Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys Florida bonneted bat to such an extent that the bat’s normal behavioral patterns are significantly disrupted.³⁵ 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.

The Service noted in a recent biological opinion that “incidental take of FBB will be difficult to detect and quantify for the following reasons: 1) FBB roost sites are difficult to identify; 2) tree cavities used by the FBB as roost sites are not easily located or examined; 3) the small size of individual FBB make finding an injured or dead specimen unlikely; and 4) FBB are patchily distributed within suitable habitat.” (USFWS 2016a). Incidental take under the Plan is therefore quantified by the acreage of bonneted bat habitat potentially lost through implementation of the Covered Activities (4,926 acres). Take is possible in the form of harassment or harm due to habitat loss and disturbance. Roosting habitat loss is estimated at 2,446 acres (out of 4,926 acres total), and these losses will generally result from impacts to small, fragmented, low-quality habitats within large agricultural areas.

In contrast, the 65,243 acres preserved in perpetuity under the Plan for Florida bonneted bat are comprised of large contiguous forested systems (roosting habitat), interspersed with open areas that include an estimated 25,754 acres of freshwater herbaceous wetlands (foraging habitats).

USFWS recently issued draft consultation guidelines for the FBB, which contain protocols for full acoustic/roost surveys, limited roost surveys, and best management practices (BMPs) for development projects (USFWS 2018b). The permittees will coordinate with USFWS during the USACE permitting phase for projects that may impact potential FBB roost areas to determine the level of FBB surveys required, and BMPs or other measures that will be required to minimize the potential for take.

³⁵ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the Florida bonneted bat, and their spatial and temporal extent. An extensive literature review found no published data that characterized disturbance distance thresholds for bonneted bats. Therefore, a 50 m distance threshold was used to conservatively define the spatial extent of potential disturbance effects from low-impact activities (e.g., pedestrian transects), while a 100 m distance was used for activities involving machinery.

6.3 FEDERALLY-LISTED PLANT SPECIES

The HCP Handbook states, “Although take prohibitions do not apply to listed plant species in the ESA, plants can and often should be included in HCPs as covered species.”” (USFWS and NMFS 2016, 7-13). 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 (see section 5.3). No potential impacts or incidental take of plant species are therefore anticipated, and no take coverage is sought.

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 (CLC codes 1120, 1210, 1311, 1312, 1340, 1400, and 1500) within the areas designated for Covered Activities comprise an estimated 2,071 acres. By contrast, an estimated 11,305 acres of native upland habitats will be included in the 106,442 acres of lands designated for Plan-Wide Activities and Very Low Density Use under the Plan, including extensive interconnected habitat mosaics. The preserved native upland habitat acreage is therefore 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, as well as land management activities in the lands designated for Preservation/Plan-Wide Activities, could potentially result in take of the eastern diamondback rattlesnake in the form of harm and/or harassment.³⁶ Take could occur in the form of harm if habitat

³⁶ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the eastern diamondback rattlesnake, and their spatial and temporal extent. An extensive literature review found no published data that characterized disturbance distance thresholds for eastern diamondback rattlesnakes, which is unsurprising given their cryptic behaviors. Therefore, a 50 m distance threshold was used to conservatively define

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. The estimate of take is therefore based primarily on the 2,071 acres of native uplands located in the area designated for Covered Activities that serve as a surrogate unit.

Take in the form of harassment has the potential to occur if a Covered Activity or land management 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. For the same reason as described above, take in the form of harassment is indeterminable, but estimated by the acres of potential habitat impacts. 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, as the same standard protection measures can be employed for the eastern diamondback rattlesnake. The Plan's designation of 106,442 acres for Preservation/Plan-Wide Activities and Very Low Density Use, which includes an estimated 11,305 acres of native upland habitats, provides extensive conservation for both snake species.

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 (i.e., disturbed or atypical) habitats that provide the conditions necessary to support gopher tortoises (Auffenberg and Franz 1982). Ruderal 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. Regarding South Florida, the FWC Gopher Tortoise Management Plan (FWC 2012b) 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

the spatial extent of potential disturbance effects from low-impact activities (e.g., pedestrian transects), while a 100 m distance was used for activities involving machinery.

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 (CLC codes 1120, 1210, 1311, 1312, 1340, 1400, and 1500) within the areas designated for Covered Activities comprise an estimated 2,071 acres, and occur within a predominantly agricultural landscape fragmented by existing roads. By contrast, an estimated 11,305 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, as well as land management activities in the lands designated for Preservation/Plan-Wide Activities, 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 on the characteristics of gopher tortoise ecology, FWC gopher tortoise permitting requirements (FWC 2017f), 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. Typically, all gopher tortoise burrows and individual tortoises are accounted for during the surveys and relocations, but undetected burrows from adjacent offsite areas, and/or tortoises wandering onsite can infrequently result in unintended incidental take.

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys gopher tortoise to such an extent that the tortoise’s normal behavioral patterns are significantly disrupted.³⁷ 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. Although relocations of individual gopher tortoises will limit incidental take to a minimal extent, the current total population and densities of gopher tortoises within the Covered Activities area is not known. The estimate of take is therefore based on the 2,071 acres of native uplands located in the

³⁷ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the gopher tortoise, and their spatial and temporal extent. An extensive literature review found no published data that characterized disturbance distance thresholds for gopher tortoises. Therefore, a 50 m distance threshold was used to conservatively define the spatial extent of potential disturbance effects from low-impact activities (e.g., pedestrian transects), while a 100 m distance was used for activities involving machinery.

lands designated for Covered Activities that serve as a surrogate unit. 106,442 acres for Preservation/Plan-Wide Activities and Very Low Density Use will be permanently preserved and maintained, which includes an estimated 11,305 acres of native upland habitats that provide extensive conservation lands for gopher tortoise.

6.4.3 Gopher Frog

Potential Impacts to Gopher Frog Habitat

Gopher frogs typically inhabit xeric (well-drained) upland habitats occupied by gopher tortoises that are within close proximity (< 5 km [3.1 mi]) to suitable breeding wetlands. In Florida, gopher frogs have been found in a wide variety of upland habitats, including sandhills, upland pine forests, scrub, xeric hammock, mesic and scrubby flatwoods, dry prairie, mixed hardwood-pine communities, pastures, and various other disturbed habitats that still harbor gopher tortoises (Enge 1997; K. Enge, FWC, unpublished data; FWC 2013a). Gopher frogs spend most of the year in the uplands where they shelter in underground burrows. In Florida, gopher frogs primarily use gopher tortoise burrows, although they will also use other refugia, such as pocket gopher and small mammal burrows, crayfish burrows, stump holes, leaf litter, hollow logs, and clumps of grass (FWC, 2011; FWC, 2013a). The current FWC range map for the gopher frog depicts most of the HCP Area occurring just outside (south and east) of the frog's known range (FWC 2016c).

As the gopher frog is a commensal species of gopher tortoise, the potential impacts to gopher frog habitats were estimated on the basis of the extent of native uplands within the HCP Area. Native upland habitats (CLC codes 1120, 1210, 1311, 1312, 1340, 1400, and 1500) within the areas designated for Covered Activities comprise an estimated 2,071 acres, and occur within a predominantly agricultural landscape fragmented by existing roads. By contrast, an estimated 11,305 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 Frog

The Covered Activities, as well as land management activities in the lands designated for Preservation/Plan-Wide Activities, could potentially result in take of the gopher frog in the form of harm and/or harassment.³⁸ Take could occur in the form of harm if habitat conversion or land management activities actually killed or injured a gopher frog. Based on the characteristics of gopher frog ecology, the HCP Area occurring near the limit of its range, FWC gopher tortoise permitting requirements (FWC 2017f) (which include gopher frog relocations, where necessary), and information on documented

³⁸ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the gopher frog, and their spatial and temporal extent. An extensive literature review found no published data that characterized disturbance distance thresholds for gopher frogs. Therefore, a 50 m distance threshold was used to conservatively define the spatial extent of potential disturbance effects from low-impact activities (e.g., pedestrian transects), while a 100 m distance was used for activities involving machinery.

causes of gopher frog injury and mortality, incidental take of the gopher frog 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 also cover commensal species, and ensure that any potential harm to gopher frogs is minimized. Typically, all gopher tortoise burrows, individual tortoises, and detected commensal species are accounted for during the surveys and relocations, but undetected burrows from adjacent offsite areas, and/or gopher frogs moving onsite can infrequently result in unintended incidental take.

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys a gopher frog to such an extent that the frog'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, and the guidelines provides for relocation of commensals captured incidentally during tortoise relocation activities.

Although relocations of individual gopher tortoises will limit incidental take of gopher frogs to a minimal extent, the current total population and densities of gopher tortoises and gopher frogs (if present) within the Covered Activities area is not known. The estimate of take is therefore based on the 2,071 acres of native uplands located in the lands designated for Covered Activities that serve as a surrogate unit. 106,442 acres for Preservation/Plan-Wide Activities and Very Low Density Use will be permanently preserved and maintained, which includes an estimated 11,305 acres of native upland habitats that provide extensive conservation lands for gopher tortoises and gopher frogs.

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 2016, 15-5) states the following with regard to the treatment of unlisted species within a HCP: "HCPs may include conservation measures for non-listed species. Typically, the HCP applicant, with technical assistance from the Services, considers non-listed species that might become listed during the term of the proposed incidental take permit so they can be covered under the HCP. A non-listed species covered in the HCP must be treated as if it were already listed and all conservation measures described in the HCP for that species must be fully implemented. If it is adequately addressed in the HCP, and [the Services] determine that section 10 issuance criteria have been met for the species, it is included on the incidental take permit and becomes effective if and when the species is listed." As Covered Species under the Plan, these state-listed species are subject to "no Surprises" assurances as long as the permittee is properly implementing the HCP and the ITPs. FWC has advised the applicants that FWS staff will work with the

applicants to develop a separate incidental take permit that will provide coverage under state law for potential take of the state-listed Covered Species.

The Plan-Wide Activities and Very Low Density Use areas under the Plan (106,442 acres at Plan completion) protect the extensive habitat areas and landscape context that provide major conservation benefits for the Florida panther and the other federally-listed Covered Species. All of the eight 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, state-listed wading birds, 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 FWC's comprehensive statewide Imperiled Species Management Plan (FWC 2016c).

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; FWC 2016d). 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.

The land cover data in Table 6-1 provide separate estimates for improved and unimproved/woodland pasture areas. An estimated 5,075 acres of improved pasture, 1,057 acres of unimproved pasture, 1 acre of dry prairie, and 9 acres of isolated freshwater marshes (6,142 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 9,799 acres of improved pasture, 2,851 acres of unimproved pasture, 1,410 acres of isolated freshwater marshes, and 127 acres of palmetto prairie (14,187 acres total).

Therefore, if all potential habitat areas for the Florida sandhill crane (6,142 acres) were impacted within the Covered Activities area, more than twice that acreage (14,187 acres) of potentially suitable Florida sandhill crane habitat will be preserved and available for mitigation activities under the Plan. As noted in

section 7.2.1.1, permanent losses of caracara habitat within the Covered Activities area will be mitigated through restoration and perpetual preservation and maintenance of an equal acreage of in-kind caracara habitat within the Plan-Wide/Preservation and Very Low Density Use areas, so there will be no net loss of caracara habitat within the HCP Area. Since sandhill cranes utilize the same habitats as caracara, potential impacts to sandhill cranes will be fully mitigated. The actual acreage of Florida sandhill crane habitat to be perpetually preserved and managed will be determined during project-level assessment and permitting, under the terms of the ITPs and the FWC permit for the HCP Area.

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). Conversely, 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 diverse mix of native and agricultural habitats, and a large proportion of pastures are located away from roadways. As with caracara, sustained habitat management is a major factor for Florida sandhill crane occurrence, and existing conditions within the HCP Area do not require property owners to manage lands for caracara or Florida sandhill crane, except as the result of prior permitting commitments. Therefore, under the Plan, potentially thousands of acres of Florida sandhill crane habitat would be preserved and maintained in perpetuity that would not be preserved and maintained otherwise.

Potential Take of Florida Sandhill Crane

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.³⁹

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 agricultural fields, pastures, suburban yards and golf courses (FWC 2013b; FWC 2016d). Therefore, incidental take of Florida sandhill crane is possible in the form of harassment as a result of potential impacts to up to 6,142 acres of sandhill crane habitat and in-kind restoration of an equivalent acreage of habitat (i.e., caracara mitigation), and human disturbances during the implementation of Covered Activities.

6.5.1.2 Florida Burrowing Owl

Potential Impacts to Florida Burrowing Owl Habitat

³⁹ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the Florida sandhill crane, and their spatial and temporal extent. FWC (2016d) recommended a buffer distance of 125 m (400 ft) from nest sites during the nesting season (January – August) to minimize disturbance for breeding sandhill cranes. Therefore, a distance of 125 m was used in Appendix A to define the spatial extent of potential disturbance effects. This distance is considered a conservative estimate for disturbance effects, because it incorporates reported flushing distances (75 m) plus an “awareness zone” of 50 m (Stys 1997).

As stated in the FWC species action plan (FWC 2013c), 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, dry prairie, and wet prairie. The land cover data in Table 6-1 provide separate estimates for improved and unimproved/woodland pasture areas. An estimated 5,075 acres of improved pasture, 1,057 acres of unimproved pasture, and 1 acre of dry prairie (6,133 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 9,799 acres of improved pasture, 2,851 acres of unimproved pasture, and 127 acres of dry prairie (12,777 acres total).

Therefore, if all potential habitat areas for the Florida burrowing owl (6,133 acres) were impacted within the Covered Activities areas, more than twice that acreage (12,777 acres) of potentially suitable Florida burrowing owl habitat will be preserved and available for mitigation activities under the Plan. As noted in section 7.2.1.1, permanent losses of caracara habitat within the Covered Activities area will be mitigated through restoration and perpetual preservation and maintenance of an equal acreage of in-kind caracara habitat within the Plan-Wide/Preservation and Very Low Density Use areas, so there will be no net loss of caracara habitat within the HCP Area. Since burrowing owls utilize the same habitats as caracara, potential impacts will be fully mitigated. 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 ITP and the FWC permit for the HCP Area.

As noted for the caracara and the Florida sandhill crane, sustained habitat management is a major factor for Florida burrowing owl occurrence, and 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. Therefore, 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

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys a Florida burrowing owl to such an extent that the owl's normal behavioral patterns are significantly disrupted.⁴⁰ Potential impacts may include human activity and noise associated with

⁴⁰ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the Florida

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 2013c). Therefore, incidental take of Florida burrowing owl is possible in the form of harassment as a result of potential impacts to up to 6,133 acres of burrowing owl habitat; activities associated with in-kind restoration of an equivalent acreage of habitat (i.e., caracara mitigation); and human disturbances during the implementation of Covered Activities or land management activities.

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. elliotii* 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 HCP Area included pine flatwoods, improved pasture, unimproved pasture, and dry prairie. The land cover data in Table 6-1 provide separate estimates for improved and unimproved/woodland pasture areas. An estimated 5,075 acres of improved pasture, 1,009 acres of unimproved pasture, 1,176 acres of pine flatwoods, and 1 acre of (7,309 acres total) occur within the Covered Activities land designation. No areas of scrub or scrubby flatwoods were mapped 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 9,799 acres of improved pasture, 8,714 acres of pine flatwoods, 2,851 acres of unimproved pasture, and 127 acres of dry prairie (21,603 acres total).

Therefore, if all potential habitat areas for the southeastern American kestrel (7,309 acres) were impacted within the Covered Activities areas, more than nearly three times that area (21,603 acres) of potentially suitable southeastern American kestrel habitat will be preserved and available for mitigation activities under the Plan. As noted in section 7.2.1.1, permanent losses of caracara habitat within the Covered Activities area will be mitigated through restoration and perpetual preservation and maintenance of an equal acreage of in-kind caracara habitat within the Plan-Wide/Preservation and Very Low Density Use areas, so there will be no net loss of caracara habitat within the HCP Area. Since

burrowing owl, and their spatial and temporal extent. FWC (2013c) recommended a buffer distance of 125 m (400 ft) from nest sites during the nesting season (January – August) to minimize disturbance for breeding sandhill cranes. Therefore, a distance of 125 m was used in Appendix A to define the spatial extent of potential disturbance effects. This distance is considered a conservative estimate for disturbance effects, because it incorporates reported flushing distances (75 m) plus an “awareness zone” of 50 m (Stys 1997).

southeastern American kestrels utilize nearly the same habitats as caracara (with the exception of pine flatwoods, which kestrels utilize), potential impacts to the open habitats will be fully mitigated. The actual acreage of southeastern American kestrel habitat to be perpetually preserved and managed will be determined during project-level assessment and permitting, under the terms of the ITPs and the FWC permit for the HCP Area.

Potential Take of Southeastern American Kestrel

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys a southeastern American kestrel to such an extent that the kestrel's normal behavioral patterns are significantly disrupted.⁴¹ 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." Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Therefore, incidental take of southeastern American kestrel is possible in the form of harassment as a result of potential impacts to up to 7,309 acres of kestrel habitat and in-kind restoration of an equivalent acreage of habitat (i.e., caracara mitigation), and human disturbances during the implementation of Covered Activities or land management activities.

6.5.1.4 Little Blue Heron, Tricolored Heron, and Roseate Spoonbill

Potential Impacts to Little Blue Heron, Tricolored Heron, and Roseate Spoonbill Habitat

In light of the significant overlap in habitat, distribution and geographic range, as well as shared threats faced by the little blue heron, the tricolored heron, and the roseate spoonbill, the combined potential habitat impacts and take assessments for these three species are addressed together in this section (Endries et al. 2009, 79; FWC 2013e).

Wading birds, including the little blue heron, tricolored heron, and roseate spoonbill, depend on healthy wetlands, mangrove and other islands, and vegetated areas suitable for resting and breeding that are near foraging habitat. These wading birds 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 HCP Area provide gross estimates of potential impacts to wading bird habitat, and similar estimates of the potential for habitat conservation

⁴¹ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the southeastern American kestrel, and their spatial and temporal extent. Stys (1993) recommended a buffer distance of 150 m from nest sites during the nesting season (January – August) to minimize disturbance for breeding kestrels, although no data or literature were cited to support the recommendation. No data are available regarding disturbance distances for foraging kestrels. Therefore, a distance of 150 m was used in Appendix A to define the spatial extent of potential disturbance effects.

measures (Table 6-1). Within the areas designated for Covered Activities, the total acreage of native wetlands excepting wet flatwoods (CLC codes 2112, 2120, 2121, 2140, 2141, 2210, 2211, 2213, 22131, 2214, 2220, 2230, 2233, and 2240) is estimated to be 2,687 acres. By contrast, the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 51,406 acres of native wetlands (excepting hydric hammocks and wet flatwoods). 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 19 times the area of potential wading bird habitat as compared to the Covered Activities areas.

Potential Take of Little Blue Heron, Tricolored Heron, and Roseate Spoonbill

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys a little blue heron, tricolored heron, and/or roseate spoonbill to such an extent that the species' normal behavioral patterns are significantly disrupted.⁴² 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, tricolored herons, and roseate spoonbills 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 1995; FWC 2013e). 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, take of little blue herons, tricolored herons, or roseate spoonbills in the form of harassment is possible but unlikely.

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

⁴² Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for the little blue heron, tricolored heron, and the roseate spoonbill, and their spatial and temporal extent. A number of studies have quantified disturbance distances for these species, from a variety of disturbance sources (Rodgers and Smith 1995; Rodgers and Smith 1997; Rodgers and Schwikert 2002; Rodgers and Schwikert 2003). Rodgers and Smith (1995) recommended a set-back distance of 100 m from mixed wading bird colonies for human disturbance that is most consistent with the Covered Activities, a recommendation echoed by FWC (FWC 2013e). Therefore, a distance of 100 m was used in Appendix A to define the spatial extent of potential disturbance effects for these species. This distance is considered a conservative estimate for disturbance effects, because a) disturbances from Covered Activities will not generally involve a fast, direct approach of machines toward birds; b) wading bird foraging and potential nesting areas along the edges of Covered Activities areas are typically buffered by vegetation that reduces the visual and noise disturbance effects; and c) these wading birds are routinely observed in native habitats directly adjacent to current agricultural operations that involve large machinery and human activity, and may be habituated to disturbances.

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; CLC codes 1120, 1311, 1312, 2210, 2211, 2213, 22131, 2214, 2220, 2221, 2230, 2232, 2233, 2240, and 2242.). An estimated 2,446 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 38,299 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 over 15 times the area of potential BCFS native habitat as compared to the Covered Activities areas.

Potential Take of Big Cypress Fox Squirrel

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys a BCFS to such an extent that the squirrel's normal behavioral patterns are significantly disrupted.⁴³ 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 2013g). 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, take of BCFS in the form of harassment is possible but unlikely.

6.5.2.2 Everglades Mink

Potential Impacts to Everglades Mink Habitat

Limited data are available for habitat utilization by the Everglades mink, but the species has been documented in a variety of wetland environments (FWC 2016e). Wetlands that hold standing water are

⁴³ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for BCFS, and their spatial and temporal extent. FWC (2013g) noted that current guidelines recommend a buffer distance of 38 m from nest trees. The same publication noted that buffers up to 250 m from nest sites may be warranted, based on a recent study by Kellam et al. (2016), but that buffer distance was calculated from home-range estimates rather than observed responses of BCFS to human disturbance. No observational data are available regarding disturbance distances for BCFS. Therefore, a distance of 38 m was used in Appendix A to define the spatial extent of potential disturbance effects.

essential for feeding and raising young, and maintaining connectivity between wetlands is important for facilitating movement between wetland habitats.

The habitat impact assessment for the Everglades mink within the HCP Area included all wetland types, and natural lakes/ponds (Table 6-1; CLC codes 2112, 2120, 2121, 2140, 2141, 2210, 2211, 2213, 22131, 2214, 2220, 2221, 2230, 2232, 2233, 2240, 2242, 3000, and 3100). An estimated 2,856 acres of wetland habitats occur within the Covered Activities land designation, occurring primarily as isolated remnant wetland areas. The areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan contain an estimated 54,018 acres of wetland habitats, many of which are large, unfragmented and interconnected wetland systems. 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 over 17 times the area of potential Everglades mink native habitat as compared to the Covered Activities areas.

Potential Take of Everglades Mink

Take in the form of harassment has the potential to occur if a Covered Activity or land management activity annoys an Everglades mink to such an extent that the mink's normal behavioral patterns are significantly disrupted.⁴⁴ Potential impacts may include human activity and noise associated with construction activities, earth mining, and other human activities while the Plan is being implemented. Everglades mink are cryptic by nature and may not be detected during the course of surveys or construction activities. Given that the Covered Activities areas contain a low proportion of wetland habitats, which typically exist as smaller isolated wetlands, and that the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use possess extensive interconnected areas of native wetland habitats, take of Everglades mink in the form of harassment is possible but unlikely.

6.6 Migratory Birds

The Plan seeks take coverage under the Endangered Species Act for the Covered Species, including federally-listed and state-listed bird species, that have been documented to consistently occur within or near the HCP Area. Several bird species that occur within the HCP Area are not federally-listed, but are subject to the Migratory Bird Treaty Act (MBTA). The FWS "Information for Planning and Consultation" (IPaC) website identifies up to 26 non-listed bird species that may occur within the HCP Area and may be subject to the MBTA. Many of these species primarily utilize coastal habitats (e.g., beaches, mangroves) and occur infrequently in the HCP Area. Other birds, such as the swallow-tailed kite, limpkin, and red-headed woodpecker, occur consistently in the area and could potentially be impacted by HCP-related activities.

⁴⁴ Appendix A includes two spreadsheets that deconstruct the Covered Activities (residential/commercial development and earth mining) into sub-activities that characterize the nature of potential stressors for Everglades mink, and their spatial and temporal extent. FWC (2016e) recommends that potentially occupied habitats should be buffered by a minimum distance of 25-35 ft (7-11 m) from disturbances, and that disturbance should be avoided within 200 meters of a known den site. Therefore, a distance of 11 m was used in Appendix A to define the spatial extent of potential disturbance effects near wetland habitats, while 200 meters was used for known den sites.

The HCP Handbook (USFWS and NMFS 2016, 7-7) notes that the Service cannot authorize incidental take for MBTA-protected species that are not listed under the ESA,⁴⁵ but identifies several approaches for addressing potential impacts to these birds. Under the Plan, the applicants propose to implement avoidance measures from the FWS “Nationwide Standard Conservation Measures” (USFWS 2016b) and include these with the ITP terms and conditions under “Other Measures as Required.” Based on the large scale of Covered Activities under the Plan, each project require flexibility to establish appropriate avoidance measures tailored to the project (e.g., timing of impacts within a project boundary). The relatively low proportion of native habitats within the areas designated for Covered Activities under the Plan minimizes the potential for impacts.

6.7 Bald Eagle

Although the bald eagle (*Haliaeetus leucocephalus*) was removed from the endangered species list in 2007, it remains protected under federal law by the MBTA and the Bald and Golden Eagle Protection Act (BGEPA), and under Florida state law (68A-16.002, F.A.C.) Applicants may choose to include bald eagles as a Covered Species in an ITP application (USFWS and NMFS 2016, 7-8).

At least two bald eagle nests are currently documented within the HCP Area, both within areas to be permanently preserved, and another five eagle nests are documented within a mile of the HCP Area boundary. However, the applicants are not seeking incidental take coverage for bald eagle for the following reasons. First, bald eagle nests typically have not occurred within the Covered Activities areas, presumably due to the general lack of suitable nesting sites in previously cleared agricultural areas (and extensive areas of suitable nesting sites nearby). Second, should bald eagles nest within an individual project area when Covered Activities are being implemented, the permittees can almost certainly avoid incidental take by adhering to the FWS guidelines, and providing a minimum 200-meter (660-foot) buffer between construction activities and the eagle nest. Finally, if it is impractical to observe a 200-meter buffer around a nest tree, the permittee can coordinate with the Service and apply for an eagle take permit.

⁴⁵ On December 22, 2017, the Solicitor’s Office for the U.S. Department of the Interior issued a legal opinion concluding that the MBTA take prohibition applies only to “direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control,” and does not apply to a take that is incidental to an otherwise lawful action that results – even directly and foreseeably – in the death of a protected bird. U.S. Department of Interior. 2017. The Migratory Bird Treaty Act Does Not Prohibit Incidental Take. Solicitor’s Opinion M-37050. Issued December 22, 2017. Available at: <https://www.doi.gov/sites/doi.gov/files/uploads/m-37050.pdf>.

7. CONSERVATION PLAN FOR OTHER COVERED SPECIES

The HCP Area comprises 151,442 acres, of which 106,442 acres will ultimately be preserved under the Plan. (See Chapter 2, including Figure 2-1 and Table 2-1, and footnote 1 in section 6.1 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 (the conservation plan for the panther). Chapter 5 (Other Covered Species) described the natural history and current status of the 18 other Covered Species, and Chapter 6 provided potential habitat impact estimates and incidental take assessments for each of the 18 other Covered Species.

This chapter describes the conservation plan for the 18 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 and maintenance of large, interconnected, and ecologically important blocks of habitat mosaics within the HCP Area.

Through the permanent preservation and maintenance 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. The conservation actions described in this chapter fully offset anticipated impacts to the 18 other Covered Species within the Covered Activities areas, where relatively small, isolated native habitat patches within extensive agricultural areas generally exhibit altered ecology due to edge effects, exotic plant infestations, water table fluctuations, and other disturbances. The HCP Handbook (USFWS and NMFS 2016, 9-3) notes the conservation benefits of large-scale plans like this one:

The HCP planning process can be used to develop plans that enhance connectivity and protect larger blocks of land that have value beyond the acres protected: these areas can be large enough to sustain species, and/or can connect areas needed to maintain genetic diversity and sustain metapopulation dynamics. For example, larger scale plans can provide a landscape scale conservation vision and programmatic approach which can confer a net benefit to conservation by their scale and strategic approach to conservation design.

7.1 APPROACH TO BIOLOGICAL GOALS AND OBJECTIVES

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 revised HCP Handbook (USFWS and NMFS 2016, Chapter 9) provides more detailed guidance related to the “Five Point” Policy and the development of biological goals and objectives for HCPs.

Pursuant to the Plan, the ITPs will require preservation of the vast, interconnected lands designated for Preservation/Plan-Wide Activities and Very Low Density Use through conservation easements. The conservation easements will be held by a State of Florida agency (FWS, FDACS FDEP, or SFWMD), with USFWS retaining full third-party enforcement rights (see section 2.2). Implementation of the Plan will generate funds that will be deposited to the Marinelli Fund and used to pay all costs of implementing the Plan. As described in more detail in chapter 9, the Marinelli Fund is projected to receive approximately \$150 million during the 50-year term of the ITPs, far in excess of what will be required to implement the Plan. These additional funds will be used for additional conservation initiatives, which will be undertaken at the discretion of the Fund’s Board of Directors – comprised of representatives of each of the four conservation organizations that are members of the FPPP (Audubon Florida, Audubon of the Western Everglades, Defenders of Wildlife, and Florida Wildlife Federation), two representatives of the landowner members of the FPPP, and one at-large member who will serve at the invitation of the other six members of the Board – in coordination with the Service and FWC, where appropriate.

The general biological goals and objectives for the other Covered Species under the Plan include the following:

- Preserving and maintaining a landscape mosaic of native habitats, pastures, and rural open space within the lands designated under the Plan for Preservation/Plan-Wide Activities and Low Density Use that provides major conservation benefits to the Covered Species, including the regional wildlife corridors that provide landscape-scale linkages between existing public conservation lands (Figure 2-1);
- Providing in-kind mitigation for permanent losses of other Covered Species habitat associated with implementation of the Covered Activities, including habitat preservation, and habitat restoration, enhancement, and/or creation; and
- Contributing to the Marinelli Fund, which will be used to fund initiatives and activities that provide conservation benefits to the Florida panther and the other Covered Species (see Chapter 9).

Implementation of the conservation actions for many of the other Covered Species will occur concurrently with the recording of conservation easements for panther mitigation, and subsequent land management and monitoring activities. In general, the panther mitigation will preserve and maintain larger blocks of varied habitat types that will also mitigate for unavoidable impacts to other Covered Species habitats. This is also true for wetland-dependent species such as wading birds, although direct wetland impacts may be mitigated through other means under the USACE 404(b)(1) permitting guidelines.

As described in the biological goals and objectives for the Florida panther (section 4.3.1), the permittees will maintain the lands to be preserved within existing land cover types, preserving the overall ecological

functions that exist at the time of ITP issuance (see section 2.2, Management of Preserved Lands, for a description of typical land management activities). The baseline conditions of the HCP Area will be documented through the use of publicly available and/or commercial orthorectified aerial imagery, acquired during the first dry season after ITP permit issuance. The baseline conditions documented in the imagery will provide the primary dataset for compliance monitoring of land cover types, extents, conditions, and land management throughout the 50-year term of the ITP.

Biological surveys for all of the Covered Species will be conducted at project-level scales during the planning and environmental permitting phases of each individual project, and during pre-construction activities as required. Detailed land cover mapping will also be conducted 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 determine whether Covered Species occur 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.” Under the Plan, the overall benefits of the conservation actions are underscored by the fact that nearly all (96 percent) of the lands slated for preservation will remain interconnected in perpetuity, facilitating species occupancy and movement across the HCP Area and the surrounding region.

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.

Note that the primary conservation objectives and measures described in the following sections for preserving extensive areas of habitat do not include any habitat acreages from the Base Zoning land designation (Half Circle L Ranch property; see section 2.5). The status of that property relative to the Plan will be finalized by the conclusion of the ITP review and NEPA processes. State and county conservation acquisition programs (Florida Forever and Conservation Collier) have targeted the property for potential acquisition. Therefore, the habitat preservation acreages reported in sections 7.2-7.5 below are minimum estimates of eventual preservation extents that do not include any Half Circle L Ranch (Base Zoning) acreages.

Regardless of the eventual status of the Half Circle L Ranch property under the HCP, or whether the property remains within the HCP at all, the Plan as described will still be robust and viable in terms of its overall design, conservation value, and regulatory compliance. This remains true because a) there is an excess of PHUs within the Plan-Wide/Preservation land designation alone relative to panther habitat impacts (see section 4.2.2.3); and b) the Plan-Wide/Preservation and Very Low Density Use habitat acreage preservation areas and/or specific habitat restorations (e.g., caracara habitat) fully offset or exceed the mitigation required for habitat impacts occurring within the Covered Activities areas.

7.2 BIOLOGICAL GOALS, OBJECTIVES, AND MEASURES FOR OTHER COVERED SPECIES (FEDERALLY-LISTED SPECIES)

7.2.1 Birds

7.2.1.1 Northern Crested Caracara

Objective 1: Preserve and maintain caracara habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Each permittee will record one or more perpetual conservation easement(s) prior to the initiation of a Covered Activity (Residential/Commercial Development and/or Earth Mining) that impacts caracara habitat. The lands placed under conservation easement(s) will be maintained in perpetuity to fully offset functional losses from permanent caracara habitat impacts.

An estimated 14,187 acres of core habitat areas for caracara (see section 6.2.1.1.1) 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 isolated freshwater marsh habitats. These habitats also provide multiple species benefits for Florida sandhill crane, Florida burrowing owl, and southeastern American kestrel.

Objective 2: Restore, as needed, suitable caracara core habitat areas to mitigate for permanent caracara habitat losses associated with the Covered Activities.

Measure 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 core habitat areas as needed, resulting in no net loss of caracara habitat acreage within the HCP Area.

Within the estimated 14,187 acres of caracara core habitat areas that are included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, some existing habitat areas may be sub-optimal for caracara utilization due to grazing rotations, vegetation structure (overgrowth), and community composition (e.g., encroachment by shrubs). Restoration and perpetual maintenance of these areas will be designed to achieve no net loss for habitat that may be utilized by caracaras. Perpetual maintenance includes maintaining short-stature grasses (<12" high) through a combination of grazing, mowing, and/or prescribed burns;

planting/maintaining cabbage palms as nesting trees; and preventing over-encroachment of shrubs.

Objective 3: Time the implementation of Covered Activities to avoid and minimize impacts to caracara nesting where breeding caracara pairs are present.

Measure 3.1: Caracara nest surveys will be conducted during project permitting and prior to commencement of construction activities, according to USFWS caracara survey protocols.

Measure 3.2: Construction activities will not occur within a caracara nest tree primary zone (300 meters/984 feet radius) during the caracara nesting season (November through April).

In addition to the conservation objectives and measures described above, the permittees will implement many of the recommended management practices described in Morrison (2001) to benefit caracara within the Preservation/Plan-Wide Activities and Very Low Density Use areas. The permittees already implement many of these management activities as part of their general land management practices, which benefit the multiple species that utilize caracara habitat (e.g., Florida sandhill crane; burrowing owl; and southeastern American kestrel).

See sections 7.6.1.2 through 7.6.1.4 for additional best management practices (BMPs) that may benefit multiple species under the Plan.

7.2.1.2 Wood Stork

Objective 1: Preserve and maintain wood stork foraging and roosting habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Each permittee will record one or more perpetual conservation easement(s) prior to the initiation of a Covered Activity (Residential/Commercial Development and/or Earth Mining) that impacts wood stork habitat. The lands placed under conservation easement(s) will be maintained in perpetuity to fully offset functional losses from permanent wood stork habitat impacts.

An estimated 51,406 acres of native wetland habitats (Table 6-1, CLC codes 2112, 2120, 2121, 2140, 2141, 2210, 2211, 2213, 22131, 2214, 2220, 2230, 2233, 2240, and 2242) 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.

Objective 2: Preserve, restore, enhance, and/or create suitable wood stork habitat to mitigate for permanent wood stork habitat losses associated with the Covered Activities.

Measure 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 in-kind wood stork habitat to fully offset functional losses. These activities will typically occur in conjunction with the USACE 404 permitting process.

Measure 2.2: Where feasible, in-kind wetland mitigation will be directed toward enhancement and/or restoration of suitable short-hydroperiod foraging habitats (shallow open marshes, wet prairies) for wood storks, that function across a range of hydrologic conditions to concentrate prey during pre-nesting and fledging periods. These specific habitat conditions also provide nesting habitat for the Florida sandhill crane.

Measure 2.3: Where feasible, 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).

The USFWS habitat management guidelines for wood stork (Ogden 1990b) remain the primary reference for wood stork conservation practices. The most recent 5-year review (USFWS 2007a) recommended an update to the guidelines and recommended that mitigation procedures consider replacing impacted wood stork foraging wetlands with wood stork foraging wetlands of similar or better quality and quantity. This recommendation is consistent with conservation measure 2.2 above.

7.2.1.3 Red-Cockaded Woodpecker (RCW)

Objective 1: Determine presence/absence of RCW within lands designated for Covered Activities on a project-by-project basis.

Measure 1.1: As RCW occurrence has not been documented within the HCP Area, RCW surveys will be performed within RCW potential habitat (pine flatwood) areas that are located within the Covered Activities land designation. Surveys will be conducted according to USFWS protocols (USFWS 2003a, Appendix 4) during project permitting to determine presence/absence of RCW within a project area.

Objective 2: Preserve potential RCW habitat within areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 2.1: An estimated 8,826 acres of potential RCW habitat (pine flatwoods) are included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use. These potential habitat areas will be placed under conservation easements as part of the mitigation for impacts to Florida panther habitat.

Objective 3: Maintain 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).

Measure 3.1: Maintain pine flatwoods as suitable RCW habitat (e.g., open understory) if RCWs are present. This land management also maintains suitable habitat for Florida panther, panther prey base, eastern indigo snake, gopher tortoise, and Big Cypress fox squirrel (BCFS).

The RCW recovery plan (USFWS 2003a, Appendix 5) advised that “frequent prescribed burning of foraging habitat, especially during the growing season, is strongly recommended. Development and protection of herbaceous groundcovers facilitates prescribed burning and benefits red-cockaded woodpeckers.” Where practicable within preserved pine flatwood areas, frequent prescribed burns would benefit any RCW individuals that dispersed into the area, in addition to other Covered Species such as the gopher tortoise, eastern indigo snake, eastern diamondback rattlesnake, and Big Cypress fox squirrel. If RCWs are found within preserved pine flatwood areas during the term of the ITP, the permittee will coordinate with USFWS on habitat management plans.

7.2.1.4 Florida Scrub Jay

Objective 1: Determine presence/absence of Florida scrub jay within the area designated for Covered Activities on a project-by-project basis.

Measure 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 (USFWS 2007d) to determine presence/absence of scrub jays within a project area.

Objective 2: Translocate any isolated individual Florida scrub jays or family groups located within the Covered Activities areas to viable populations, to the extent possible.

Measure 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).

Objective 3: Provide mitigation for unavoidable impacts to potential scrub jay habitat areas if Florida scrub jays are documented within a project area.

Measure 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

Measure 3.2: Deposit funding into the Florida Scrub-jay Conservation Fund (USFWS 2009e), according to a formula to be determined by USFWS and the applicants.

No suitable patches of Florida scrub jay habitat are known to exist within the HCP Area. Therefore, management actions are limited to scrub jay surveys, with mitigation for impacts, and/or potential

translocation of scrub jays to occur if any individuals are detected. If scrub jays are documented within a project boundary during the nesting season, the permittee will observe a 50-meter (164-foot) buffer around the occupied habitat/nest until any young have fledged.

7.2.1.5 Everglade Snail Kite

Objective 1: Preserve extensive and varied wetland systems in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use that serve as potential snail kite foraging and roosting habitats within those areas.

Measure 1.1: Each permittee will record one or more perpetual conservation easement(s) prior to the initiation of a Covered Activity (Residential/Commercial Development and/or Earth Mining) that impacts snail kite habitat. The lands placed under conservation easement(s) will be maintained in perpetuity to fully offset functional losses from permanent snail kite habitat impacts.

An estimated 17,225 acres of freshwater marsh habitats for snail kite (CLC codes 2120, 2121, 2140, and 2141) are included in the areas designated for Preservation/Plan-Wide Activities and Very-Low Density Use.

Objective 2: Preserve, and potentially restore, enhance, and/or create suitable snail kite foraging and/or nesting habitat to mitigate for permanent snail kite habitat losses associated with the Covered Activities.

Measure 2.1: Permanent habitat losses to native snail kite habitat associated with the Covered Activities will be mitigated through preservation, and potentially restoration, enhancement and/or creation of an equal acreage of in-kind snail kite habitat. These activities will typically occur in conjunction with the USACE 404 permitting process.

Recommendations for maintaining and enhancing snail kite foraging and roosting habitat are provided in the USFWS Draft Snail Kite Management Guidelines (USFWS 2006b). The management actions focus on maintaining apple snail populations in wetlands, controlling exotic/nuisance wetland and aquatic plant species, and buffering nest areas from human activities. The permittees will coordinate with the Service to identify snail kite foraging and nesting areas in the vicinity of a project, and coordinate management actions with USACE permitting.

7.2.2 Reptiles

7.2.2.1 Eastern Indigo Snake

Objective 1: Preserve and maintain native eastern indigo snake habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Each permittee will record one or more perpetual conservation easement(s) prior to the initiation of a Covered Activity (Residential/Commercial Development and/or Earth

Mining) that impacts eastern indigo snake habitat. The lands placed under conservation easement(s) will be maintained in perpetuity to offset losses from permanent indigo snake habitat impacts. In most cases, these potential habitat areas will be placed under conservation easements as part of the mitigation for impacts to Florida panther habitat.

An estimated 11,305 acres of native upland habitats (CLC codes 1120, 1210, 1311, 1312, 1340, 1400, and 1500) for the eastern indigo snake are 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 2009f): “Extensive tracts of wild land (not fragmented by roads) are the most important refuge for eastern indigo snake populations.”

As with habitat management for RCW, gopher tortoise, eastern diamondback rattlesnake, and BCFS, frequent prescribed burning of pine flatwoods and other upland forest types and exotic plant removal will help to maintain an open understory that benefits the eastern indigo snake.

7.2.3 Mammals

7.2.3.1 Florida Bonneted Bat

Objective 1: Preserve a wide extent of Florida bonneted bat potential roosting and foraging habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Measure 1.1: Each permittee will record one or more perpetual conservation easement(s) prior to the initiation of a Covered Activity (Residential/Commercial Development and/or Earth Mining) that impacts Florida bonneted bat habitat. The lands placed under conservation easement(s) will be maintained in perpetuity to offset losses from permanent bonneted bat habitat impacts. In most cases, these potential habitat areas will be placed under conservation easements as part of the mitigation for impacts to Florida panther habitat.

An estimated 65,243 acres of upland forest, wetland forest, and herbaceous wetlands habitats (CLC codes 1120, 1210, 1311, 1312, 1340, 1400, 1500, 2112, 2120, 2121, 2140, 2141, 2210, 2211, 2213, 22131, 2214, 2220, 2221, 2230, 2232, 2233, 2240, and 2242) for the Florida bonneted bat will be included within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Objective 2: Document Florida bonneted bat occurrence within Covered Activities areas during project permitting.

Measure 2.1: Document the occurrence of Florida bonneted bats within Covered Activities areas during project permitting through implementation of the *Draft Florida Bonneted Bat Consultation Guidelines* (USFWS 2018b). This objective aims to gain sufficient occurrence data for the applicants to avoid and minimize potential impacts to the Florida bonneted bat within the Covered Activities areas. This information will also contribute to what is known about the Florida bonneted bat and will be useful to species conservation as a whole.

Objective 3: Retain 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: The “Ecological Land Management BMPs” prescribed in the *Draft Florida Bonneted Bat Consultation Guidelines* (USFWS 2018b) will be implemented by the permittees for land management activities within preserved forest areas.

If an active roost is detected within a project boundary prior to submittal of the 404 permit application, the permittee will consult with the Service on site design avoidance and minimization measures. If an active roost is discovered during pre-construction surveys in an area where impacts are proposed, the 250-foot buffer will be observed while the permittee consults with the Service on site design modifications or other conservation measures.

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, OBJECTIVES, AND MEASURES FOR CANDIDATE SPECIES AND SPECIES UNDER REVIEW FOR FEDERAL LISTING

7.4.1 Eastern Diamondback Rattlesnake

Objective 1: Preserve and maintain native eastern diamondback rattlesnake habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Measure 1.1: Each permittee will record one or more perpetual conservation easement(s) prior to the initiation of a Covered Activity (Residential/Commercial Development and/or Earth Mining) that impacts eastern diamondback rattlesnake habitat. The lands placed under conservation easement(s) will be maintained in perpetuity to offset losses from permanent rattlesnake habitat impacts. In most cases, these potential habitat areas will be placed under conservation easements as part of the mitigation for impacts to Florida panther habitat.

An estimated 11,305 acres of native upland habitats (CLC codes 1120, 1210, 1311, 1312, 1340, 1400, and 1500) for the eastern diamondback rattlesnake will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

As with habitat management for RCW, gopher tortoise, eastern indigo snake, and BCFS, frequent prescribed burning of pine flatwoods and other upland forest types and exotic plant removal will help to maintain an open understory that benefits the eastern diamondback rattlesnake.

7.4.2 Gopher Tortoise

Objective 1: Determine presence/absence of gopher tortoise within the Covered Activities areas on a project-by-project basis.

Measure 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 2017f). Berms, spoil areas, and other non-native habitats that may be occupied by gopher tortoises will be included in the surveys.

Objective 2: Preserve and maintain native gopher tortoise habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use

Measure 2.1: Each permittee will record one or more perpetual conservation easement(s) prior to the initiation of a Covered Activity (Residential/Commercial Development and/or Earth Mining) that impacts gopher tortoise habitat. The lands placed under conservation easement(s) will be maintained in perpetuity to offset losses from permanent gopher tortoise impacts. In most cases, these potential habitat areas will be placed under conservation easements as part of the mitigation for impacts to Florida panther habitat.

An estimated 11,305 acres of native upland habitats (CLC codes 1120, 1210, 1311, 1312, 1340, 1400, and 1500) for the gopher tortoise will be included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Objective 3: Relocation of gopher tortoises located during surveys, as needed to suitable recipient sites within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan.

Objective 3.1: Relocate gopher tortoises from Covered Activities areas to long-term protected recipient sites within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use, according to the FWC Gopher Tortoise Permitting Guidelines (FWC 2017f) and associated permit(s).

As with habitat management for RCW, eastern indigo snake, eastern diamondback rattlesnake, and BCFS, frequent prescribed burning of pine flatwoods and other upland forest types and exotic plant removal will help to maintain an open understory and groundcover vegetation that benefits the gopher tortoise (FWC 2012b).

7.5 BIOLOGICAL GOALS, OBJECTIVES, AND MEASURES FOR STATE-LISTED SPECIES

7.5.1 Birds

7.5.1.1 Florida Sandhill Crane

Objective 1: Preserve and maintain Florida sandhill crane habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Preserve and maintain sandhill crane habitat in accordance with the terms of the FWC state permit for the HCP Area.

An estimated 14,187 acres of habitat areas (CLC codes 1340, 183313, 183313, and 2121) for the Florida sandhill crane 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 caracara, Florida burrowing owl, and southeastern American kestrel.

Objective 2: Preserve, and potentially restore, enhance, and/or create suitable Florida sandhill crane habitat to mitigate for permanent Florida sandhill crane habitat losses associated with the Covered Activities.

Measure 2.1: Mitigate permanent losses of Florida sandhill crane habitat associated with the Covered Activities through preservation, and possibly restoration, enhancement and/or creation of an equal acreage of in-kind Florida sandhill crane habitat. These activities could occur as part of similar conservation actions for caracara, burrowing owl, southeastern American kestrel, and other Covered Species.

Objective 3: Potentially enhance and/or restore short-hydroperiod wetlands for Florida sandhill crane nesting habitat.

Measure 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 (FWC 2016d). These specific habitat conditions also provide foraging habitat for wood stork.

The FWC Sandhill Crane Species Guidelines (FWC 2016d) provide a list of recommended conservation practices that are addressed by the conservation measures listed above, and/or are already being practiced by the applicants during their routine land management activities. These habitat management practices are consistent with the Plan's conservation measures for caracara and Florida burrowing owl.

7.5.1.2 Florida Burrowing Owl

Objective 1: Preserve and maintain Florida burrowing owl habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Preserve and maintain Florida burrowing owl habitat in accordance with the terms of the FWC state permit for the HCP Area.

An estimated 14,187 acres of habitat areas for Florida burrowing owl 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 caracara, Florida sandhill crane, and southeastern American kestrel.

Objective 2: Preserve, and potentially restore, enhance, and/or create suitable Florida burrowing owl habitat to mitigate for permanent Florida burrowing owl habitat losses associated with the Covered Activities.

Measure 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. These activities could occur as part of similar conservation actions for caracara, Florida sandhill crane, southeastern American kestrel, and other Covered Species.

Objective 3: Time Covered Activities to avoid and minimize impacts to Florida burrowing owl nesting.

Measure 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 (FWC 2018a).

Measure 3.2: Construction activities will maintain a minimum 33-foot buffer near burrows during the breeding season (15 February – 10 July) and a minimum 10-foot buffer near burrows during the non-breeding season (10 July through 15 February) (FWC 2018a).

The FWC Florida Burrowing Owl Species Guidelines (FWC 2018a) provide a list of recommended conservation practices that are addressed by the conservation measures listed above, and/or are already being practiced by the applicants during their routine land management activities. These habitat management practices are consistent with the Plan's conservation measures for caracara and Florida sandhill crane.

7.5.1.3 Southeastern American Kestrel

Objective 1: Preserve and maintain southeastern American kestrel habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Preserve and maintain southeastern American kestrel habitat in accordance with the terms of the FWC state permit for the HCP Area.

An estimated 21,603 acres of habitat areas for southeastern American kestrel are 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, and herbaceous dry prairie habitats. The herbaceous habitats also provide multiple species benefits for caracara, Florida sandhill crane, and Florida burrowing owl.

Objective 2: Preserve, and potentially restore, enhance, and/or create suitable southeastern American kestrel habitat to mitigate for permanent habitat losses associated with the Covered Activities.

Measure 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.

The FWC Species Action Plan for the Southeastern American Kestrel (FWC 2013d) provides information for recommended conservation practices that are addressed by the conservation measures listed above, and/or are already being practiced by the permittees during their routine land management activities. These habitat management practices are consistent with the Plan's conservation measures for caracara, Florida sandhill crane, and Florida burrowing owl. In addition, kestrel nest boxes may be installed where existing habitat within preservation lands provides suitable kestrel habitat.

7.5.1.4 Little Blue Heron, Tricolored Heron, and Roseate Spoonbill

Objective 1: Preserve and maintain little blue heron, tricolored heron, and roseate spoonbill foraging and roosting habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Preserve and maintain habitats for little blue heron, tricolored heron, and roseate spoonbill in accordance with the terms of the FWC state permit for the HCP Area.

An estimated 51,406 acres of native wetland habitats (CLC codes 2112, 2120, 2121, 2140, 2141, 2210, 2211, 2213, 22131, 2214, 2220, 2230, 2233, 2240, and 2242) for little blue heron, tricolored heron, roseate spoonbill and other wading birds 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.

Objective 2: Preserve, and potentially restore, enhance, and/or create suitable little blue heron, tricolored heron, and roseate spoonbill habitat to mitigate for permanent little blue heron, tricolored heron, and roseate spoonbill habitat losses associated with the Covered Activities.

Measure 2.1: Permanent habitat losses to native little blue heron, tricolored heron, and roseate spoonbill habitat associated with the Covered Activities will be mitigated through preservation, and potential restoration, enhancement and/or creation of an equal acreage of in-kind little blue heron and tricolored heron habitat.

The FWC provides a series of recommended management practices to benefit imperiled wading birds (FWC 2013e, Appendix I). Many of these management actions are already being practiced by the

permittees during their routine land management activities. These habitat management practices are consistent with the Plan's conservation measures for wood stork, and the mitigation requirements for USACE permitting.

7.5.2 Mammals

7.5.2.1 Big Cypress Fox Squirrel (BCFS)

Objective 1: Preserve and maintain native BCFS habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Preserve and maintain BCFS habitat in accordance with the terms of the FWC state permit for the HCP Area.

An estimated 38,299 acres of upland and wetland forested habitats (CLC codes 1120, 1311, 1312, 1400, 2210, 2211, 2213, 22131, 2214, 2220, 2221, 2230, 2232, 2233, 2240, and 2242) for the BCFS are included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

As with habitat management for RCW, gopher tortoise, eastern indigo snake, and eastern diamondback rattlesnake, frequent prescribed burning of pine flatwoods and other upland forest types and exotic plant removal will help to maintain an open understory that benefits the BCFS (FWC 2018b). Exotic removal and understory control within transitional and wetland forested systems may also benefit BCFS.

7.5.2.2 Everglades Mink

Objective 1: Preserve and maintain native Everglades mink habitats within the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

Measure 1.1: Preserve and maintain Everglades mink habitat in accordance with the terms of the FWC state permit for the HCP Area.

An estimated 54,018 acres of wetland forested habitats (CLC codes 2112, 2120, 2121, 2140, 2210, 2211, 2213, 22131, 2214, 2220, 2221, 2230, 2232, 2233, 2240, 2242, 3000, and 3100) for the Everglades mink are included in the areas designated for Preservation/Plan-Wide Activities and Very Low Density Use.

The extensive wetland preservation areas (54,018 acres) provided under the Plan are consistent with the recommended conservation practices for Everglades mink (FWC 2016e). These large, interconnected wetland systems maintain a variety of hydrologic conditions throughout the year.

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 HCP Handbook (USFWS and NMFS 2016, 9-13) states, “Conservation measures implemented in HCPs usually take one of the following forms:

- avoiding the impact through project design
- minimizing the impact through best management practices
- minimizing the impacts of the taking by reducing or eliminating other threats
- mitigating (offsetting) impacts, by:
 - a. restoration of degraded habitat
 - b. enhancement of functional habitat
 - c. preservation of habitat
 - d. creation of new habitat
 - e. translocating or repatriating species”

Under the Plan, mitigation to offset impacts will be accomplished primarily through extensive permanent habitat preservation and maintenance, along with restoration of degraded habitat for certain species (e.g., caracara), as described previously in sections 7.1-7.5.⁴⁶ Avoidance and minimization (the first three bullets listed above) are achieved through the landscape-level planning inherent in the design of the HCP Area. The applicants have also committed to following certain project-level planning measures and best management practices (BMPs) in order to further enhance the conservation value of the HCP, including the northern and southern wildlife corridors. These measures, which will be required under the HCP and ITPs, are described in section 7.6.1.2 below. In addition to these required measures, the applicants are committed to working with developers and homeowners associations (HOAs) to employ other project-level planning measures and BMPs within areas designated for Covered Activities to further the goals of the Plan, although these measures, which are described in sections 7.6.1.3 and 7.6.1.4 below, are not specifically required under the HCP or ITPs. The creation of the Marinelli Fund and contribution to that Fund through implementation of the HCP (Chapter 9) will also provide a means for potential habitat acquisition, enhancement and/or creation for the Florida panther and other Covered Species. The conservation measures described in this section – particularly the extensive, permanent habitat preservation and maintenance that is required under the Plan before Covered Activities can be conducted and the landscape-level planning reflected in the land designations under the Plan – will provide conservation benefits that would not otherwise be achieved through the RLSP, which is a purely voluntary program that does not require coordination or advance planning among participants.

⁴⁶ We note that, although habitat restoration in general is not required by the Plan, the extensive, widespread preservation achieved through the Plan will make possible future habitat restoration that may be undertaken by the Marinelli Fund, a permittee, a government entity, or another third-party.

The avoidance and minimization strategies described below generally overlap with those presented in Chapter 4 (Florida Panther, section 4.4.1), because the overall 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 (i.e., landscape-scale habitat connectivity), 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 on panther habitat 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 impacts to, and permanently protecting, the extensive areas of interconnected habitats that occur within the Okaloacoochee Slough and the areas directly north of the Florida Panther National Wildlife Refuge (FPNWR). These areas are characterized by vast open spaces, 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 consolidating and directing Covered Activities away from more ecologically valuable areas of interconnected native habitats and toward previously cleared areas with lower habitat support functions in the central, western, and northern portions of the HCP Area where intensive agricultural land uses and existing development (primarily Golden Gate Estates, to the west of the HCP Area) predominate and native habitats are more highly fragmented and limited in extent. By directing the Covered Activities to these actively used and already-disturbed 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 the preservation lands will serve 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 and Best Management Practices Required Under the HCP and ITPs

The applicants have committed to following certain project-level planning measures and best management practices (BMPs) in order to further enhance the conservation value of the HCP, including the northern and southern wildlife corridors. These measures—described in the bullet points below—will be required under the HCP and ITPs.

- **Prescribed Fire and Smoke Notice.** As applicable, final development plans, associated homeowner's documents, and other documentation associated with residential and commercial development projects within the HCP Area will provide notice of the use of prescribed fire in the area, irrespective of the previous or planned use of prescribed fire on the site of the

development itself. This notice will be provided and recorded in a manner such that initial and subsequent residents and owners will be made aware of the use of prescribed fire in and around the HCP Area to manage wildland fuels and maintain fire-adapted ecological communities within preserve areas. The following notice concerning the use of prescribed fire will be provided:

- *Periodic prescribed burning is a recognized land management tool and a recommended method of fuel management within and around the HCP Area for minimizing wildfire hazards and maintaining healthy fire-adapted ecological communities. Homeowners acknowledge that they have received notice that prescribed burning may result in the periodic occurrence of temporary smoke and ash that drifts through developed areas.*⁴⁷
- **Environmental Education and BMPs for Living with Wildlife.** The materials contained in Appendix B of the HCP document will be included with the Homeowners' Association (HOA) documents for each residential development community within the HCP Area at the time of HOA incorporation. Decisions regarding which educational materials and BMPs will be implemented within each community are left to the HOA and community residents, but the materials will be transferred to the developer(s) and HOA(s).
- **Securing Pets.** HOA and/or homeowners' documents for residential developments within the HCP Area will state that pets within those developments should be kept indoors, on leash when outdoors, or secured within a secure covered kennel.
- **Development Lighting Adjacent to the Northern and Southern Corridors.** Plans for commercial and residential developments within the HCP Area that are submitted to federal and state regulatory agencies will detail the lighting plans and proposed restrictions adjacent to the northern and southern wildlife corridors (Figure 4-9) in terms of (i) distance of fixtures to the corridor edge(s); (ii) fixture types; (iii) degree of fixture shielding (to limit skyglow, light trespass and glare); (iv) light sources, including low-pressure sodium (LPS), high-pressure sodium (HPS), and metal halide and light emitting diodes (LEDs); (v) brightness; (vi) correlated color temperature (in degrees Kelvin); and (vii) use of passive lighting (e.g., roadway reflectors; unlighted road signs). These lighting plan details will form a technical basis for the developer and the Service to perform a HCP/ITP consistency check as to whether the lighting plan adequately minimizes artificial light at the corridor edge(s) and maintains the functionality of the corridor for crepuscular and nocturnal wildlife movement.
- **Open Space Buffers.** Commercial and residential developments within the HCP Area will comply with Policy 4.13 of the Collier County Future Land Use Element for the RLSP, which states as follows: "Open space within or contiguous to a SRA shall be used to provide a buffer between the SRA and any adjoining FSA, HSA, or existing public or private conservation land delineated on the Overlay Map. Open space contiguous to or within 300 feet of the boundary of a FSA, HSA,

⁴⁷ Language adapted from *Wildfire Risk Reduction in Florida* (Florida Department of Agriculture and Consumer Services, Division of Forestry, 2010).

or existing public or private conservation land may include: natural preserves, lakes, golf courses provided no fairways or other turf areas are allowed within the first 200 feet, passive recreational areas and parks, required yard and set-back areas, and other natural or manmade open space. Along the west boundary of the FSAs and HSAs that comprise Camp Keais Strand, i.e., the area south of Immokalee Road, this open space buffer shall be 500 feet wide and shall preclude golf course fairways and other turf areas within the first 300 feet.” Under the RLSP, development plans must conform to this policy to gain development approvals from Collier County.

7.6.1.3 Project-Level (Site-Specific) Planning Not Specifically Required Under the HCP and ITPs

Avoidance measures were incorporated into the design of the overall HCP Area, and the relationship of the areas designated for Covered Activities to the Preservation/Plan-Wide Activities areas (Figure 2-1). Although not required to mitigate for impacts under the Plan, the applicants are committed to working with developers and homeowners’ associations (HOAs) to employ project-level avoidance and minimization measures within areas designated for Covered Activities to further the goals of the Plan. These measures will primarily involve the configuration of master plans to avoid impacts to other Covered Species habitat, and to direct more intensive land uses (e.g., residential neighborhoods and commercial centers) away from habitat preservation areas.

At project-level scales where avoidance measures have already been employed to the extent practicable, the goal will be 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 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 surface water management (lakes), to project boundaries and project perimeter buffers);
- 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 roadway networks and roadway elements to minimize the potential for wildlife-vehicle collisions within the lands designated for Covered Activities. These elements may include strategic selection of key road segments for wildlife crossing structures such as box culverts, small animal culverts, wildlife pipes, amphibian tunnels; the use of landscaping, curbs,

fencing, and other barriers to direct wildlife to safe road crossing areas; wide, open road shoulders near crossings to maximize visibility for wildlife and motorists; and wildlife crossing signage (Kautz et al. 2010);

- Providing a sustainable mix of residential, commercial, retail, office, civic, and recreational land uses where these 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 (where present adjacent to the mine), and limiting offsite transport of mining products to daylight hours.

While the Plan achieves avoidance through the designation of large areas of interconnected habitat 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 will serve to refine avoidance and minimization of impacts at project-level scales (See Figure 2-1.) The combined application of these strategies will serve to avoid and minimize impacts to panthers and the Other Covered Species, and to spatially separate Covered Activities from the Preservation/Plan-Wide Activities and Very Low Density Use areas.

7.6.1.4 Best Management Practices (BMPs) for Other Covered Species Not Specifically Required Under the HCP and ITPs

In addition to species-specific management actions listed in sections 7.2-7.5, although not required to mitigate for impacts under the Plan, the applicants are committed to working with developers and HOAs to promote a series of general BMP guidelines, provided below, that will be implemented within the Covered Activities areas where appropriate to further minimize potential wildlife impacts and/or provide wildlife conservation benefits. These BMPs are not intended to comprise an exhaustive list. Sample BMPs are provided in Appendix B.

The applicants will work with developers and contractors to raise public awareness of the importance of wildlife conservation and promote the use of these BMPs within the HCP Area. The applicants will also provide information, education, and resources to future residents through HOAs and otherwise that will avoid impacts to Covered Species and other wildlife and promote biodiversity conservation within developed environments.

Community Environmental Education

<http://www.buildgreen.ufl.edu/enveducation.htm> - This University of Florida program promotes residential environmental education that engages homeowners in understanding and implementing natural resource conservation strategies. Research has demonstrated that engaging residents improves environmental attitudes, knowledge, and behaviors (Hostetler et al. 2008).

Environmental Covenants, Codes, and Restrictions for Homeowner Associations (HOAs)

<http://edis.ifas.ufl.edu/pdf/files/UW/UW24800.pdf> - This publication provides sample language for the development of HOA covenants, codes, and restrictions (CCRs) that relate to wildlife within residential development communities and environmental management in general (Hoestetler 2006).

Landscaping

<http://www.floridayards.org/> - “Florida-Friendly Landscaping” promotes the use of native plants, efficient watering and fertilizing, xeriscaping, integrated pest management, and similar strategies to attract birds, butterflies, and beneficial insects to residential yards.

Community Lighting and “Dark Skies”

The mission of the International Dark-Sky Association “is to preserve and protect the nighttime environment and our heritage of dark skies through environmentally responsible outdoor lighting.” Light pollution (the inappropriate use of light at night) can affect wildlife and ecosystems, human health, energy consumption, and the aesthetics of viewing the night sky. The Association notes that, “A dark sky does not necessarily mean a dark ground. Smart lighting that directs light where it is needed creates a balance between safety and starlight.”

The International Dark-Sky Association webpage (<http://www.darksky.org/>) provides links to numerous resources for planning and implementing appropriate outdoor lighting within residential/commercial developments. These resources include the use of five outdoor lighting zones within communities (<http://www.darksky.org/lighting/model-lighting-laws-policy/recommended-lighting-zones/>), outdoor lighting basics (<http://www.darksky.org/lighting/lighting-basics/>), and practical guidelines for energy-efficient LED lighting (<http://www.darksky.org/lighting/led-guide/>). Implementation of “dark skies” practices can reduce disturbances to wildlife within and adjacent to development areas.

FWC also maintains a “Wildlife Lighting” webpage that provides basic information and links to outdoor lighting resources (<http://myfwc.com/conservation/you-conserve/lighting/>).

Living with Wildlife

The applicants plan to employ and promote a series of community design elements that advance wildlife conservation and minimize the potential for human-wildlife interactions within development areas, especially for large mammals (e.g., Florida panther; bear; deer; feral hogs), nocturnal species (e.g., Florida bonneted bat), and species that may pose human health risks (e.g., Eastern diamondback rattlesnake). These project-level design elements were described in section 4.4.1.2 for the Florida panther, and in section 7.6.1.3 for the other Covered Species.

FWC has published educational brochures for HOAs and residents living in proximity to Florida wildlife species such as the Florida panther, black bear, and various bats, birds, and reptiles (<http://myfwc.com/conservation/you-conserve/wildlife/>). Links for these wildlife brochures and/or webpages are provided below:

- A Guide to Living with Florida Panthers (<http://myfwc.com/media/152454/LivingWithPanthers.pdf>)
- Florida Panther Safety Tips (<http://myfwc.com/media/152457/PantherSafetyTipsFlyer.pdf>)
- Florida's BearWise (<http://myfwc.com/wildlifehabitats/managed/bear/wise/> and bearwise.org)
- A Guide to Living in Bear Country (<http://myfwc.com/media/1333887/LivinginBearCountryBrochure.pdf>)
- Living with Bats (<http://myfwc.com/media/3031963/LivingWithBats.pdf>)
- Sandhill Cranes (<http://myfwc.com/conservation/you-serve/wildlife/sandhill-cranes/>)
- Everglade Snail Kite (<http://myfwc.com/media/152978/kitesbrochure.pdf>)
- A Guide to Living with Alligators (<http://myfwc.com/media/152524/Alligator-Brochure.pdf>)
- Getting Along with Snakes (<https://www.floridamuseum.ufl.edu/herpetology/fl-snakes/getting-along/>)
- A Guide to Living with Gopher Tortoises: (http://myfwc.com/media/1329739/GopherTortoise_LivingWithBrochure.pdf)
- A Guide to Living with Urban Coyotes (<http://myfwc.com/media/2675483/Living-With-Urban-Coyotes.pdf>)
- Plants for Birds. The National Audubon Society provides an online database for selecting native plant species (by zip code) that support bird species (<http://www.audubon.org/plantsforbirds>).

7.6.2 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 other Covered Species that may result from the Plan's implementation. The major mitigation element of the Plan is the permanent preservation and maintenance of extensive interconnected habitat within the area designated for Preservation/Plan-Wide Activities and Very Low Density Use (Figures 2-1 and 2-2).

The Biological Goals and Objectives (section 7.1) lists the additional conservation actions that will be implemented to benefit the other Covered Species, beyond the land preservation that fully offsets habitat impacts. These actions include preservation and management of 106,442 acres of native habitats, pastures, and rural open space, including regional wildlife corridors that provide landscape-level linkages between existing public conservation lands, providing in-kind mitigation for permanent losses of habitat, including habitat restoration, enhancement, and/or creation, and contributing to the Marinelli Fund, which will be used to fund initiatives and activities that provide benefits to the other Covered Species.

7.7 OTHER COVERED SPECIES MONITORING AND REPORTING

The HCP Handbook (USFWS and NMFS 2016, 10-1) provides the following general guidance relative to the monitoring and reporting requirements for HCPs:

Monitoring and reporting are mandatory elements of all Habitat Conservation Plans (HCPs) (50 CFR 17.22, 17.32, and 222.307; 65 FR 35242 [June 1, 2000] (see the [HCP Handbook Toolbox](#)). When properly designed and implemented, they should provide [the Service] with the information [it needs] to determine whether or not:

- a permittee is in compliance with their incidental take permit and HCP;
- progress is being made toward meeting an HCP's biological goals and objectives;
- the HCP's conservation program is effective at minimizing and/or mitigating impacts; and
- there is a need for adjusting measures to improve the HCP's conservation strategy.

The sections below describe 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). More specific monitoring and reporting requirements will be included in the terms and conditions to the ITPs issued by USFWS. Monitoring and reporting for HCPs and ITPs include: monitoring for baseline information; monitoring to evaluate compliance with permit terms and conditions; and effectiveness monitoring to support ongoing conservation decisions (USFWS and NMFS 2016, 10-4—10-12).

7.7.1 Baseline and Compliance Monitoring

As described in section 4.3.1 for the Florida panther, the baseline land cover and land use conditions of the HCP Area will be documented through the use of publicly available or commercial orthorectified aerial imagery. The HCP Area baseline conditions documented in the imagery will provide the primary dataset for compliance monitoring of land cover types and conditions throughout the 50-year term of the ITPs.

Other baseline data may include updated species data from the Service, FWC, and/or other state and federal agencies; species occurrence data from independent researchers (e.g., avian telemetry data); and any additions to public conservation land boundaries or conservation easements that are available at the time of ITP issuance.

Compliance monitoring ties directly to the terms and conditions issued with the ITP (including reporting requirements), along with the measures the applicants described in the HCP for avoidance, minimization, and mitigation of direct and indirect impacts to the other Covered Species and their habitats. Compliance monitoring also assesses and reports on progress being made toward the biological goals and objectives as described in the HCP. Each permittee will be responsible for ensuring

that compliance monitoring is conducted and reported with the permittee's ITP. The HCP Area as a whole will also be monitored in aggregate to evaluate overall compliance. The sections below describe briefly the type, extent, frequency, and timing of monitoring events that will be conducted to determine compliance with these measures.

Covered Activities

The monitoring program will verify that the location and extent of any implemented Covered Activities conform 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. The compliance monitoring for each project will occur during the permitting phase, construction phase(s), and when the project construction activities have been fully completed.

For the HCP Area as a whole, the character and extent of Covered Activities will be monitored for compliance on an annual basis through the use of such techniques as aerial imagery, analysis of State and Federal permits, local development orders, legal sketch and description surveys, and onsite inspections as agreed with USFWS. 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 allowed 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 (GIS metadata will meet Federal Geographic Data Committee (FGDC) or ISO 19115 metadata standards).⁴⁸

Projects will be in compliance with the Plan if they conform to the Covered Activities boundary (allowing for scrivener's errors and scale), are implemented through State and Federal permits, have accurately quantified impacts to all land cover classes present within the project boundary, and have recorded perpetual conservation easements (prior to construction) to offset impacts to habitat of the other Covered Species.

In accounting for take, the annual monitoring will summarize the GIS acreage of other Covered Species habitat impacts that occurred during the monitoring year, by CLC land cover codes and/or aerial imagery interpretation. The boundaries of any permanent conservation easements will be added to the GIS database. The annual monitoring report will also include an estimate of the total acreage constructed

⁴⁸ Because the boundaries for Covered Activities were digitized in a GIS originally at planning-level scales, 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.

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).⁴⁹

Each permittee will record a perpetual conservation easement for each permitted project within the Covered Activities lands, prior to impacting Covered Species habitat (as described in sections 7.2-7.5). Each conservation easement area will be managed in perpetuity for the control of invasive exotic vegetation, as defined by the Florida Exotic Pest Plant List Committee (FLEPPC) 2017 list for Category 1 species (FLEPPC 2017). Exotic vegetation control will be required to maintain the land in its current state, or better, based upon the documentation of baseline conditions at the time of ITP issuance. As noted, permanent conservation easements recorded during the monitoring year within the Preservation/Plan-Wide Activities areas will be added to the GIS database. Recorded conservation easements will be in compliance with the Plan if they conform generally to the Preservation/Plan-Wide Activities boundaries as defined on aerial imagery from GIS.

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 activities and land uses that have occurred in these areas historically and are allowed under the Plan, and to ensure the general extent of native vegetation communities is maintained over the 50-year duration of the ITPs. For the HCP Area as a whole, Preservation/Plan-Wide Activities will be monitored for compliance on an annual basis through the use of aerial imagery and GIS land cover data, as compared to baseline aerial imagery acquired at or near the time of ITP issuance.

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. In addition, in order to preserve the ability of Florida panther and other Covered Species to move freely through the lands designated for Very Low Density Use, no large-animal exclusionary fencing will be used within these lands. These areas will 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.

⁴⁹ As with the Covered Activities compliance monitoring, scrivener's errors may be revealed during the land survey activities and the recording of conservation easements, where small deviations exist between GIS-delineated boundaries and conservation easement boundaries as actually surveyed.

As with the Covered Activities compliance monitoring, scrivener's errors may be revealed during the land survey activities for the Very Low Density Use areas, where small deviations exist between GIS-delineated boundaries and field-located boundaries as actually surveyed. These areas will be in compliance with the Plan if they conform generally to the Very Low Density Use boundaries as defined on aerial imagery from GIS.

Base Zoning Area

As noted in Chapter 2 (Plan Description and Base Zoning Area), the Base Zoning area (Half Circle L Ranch) is for sale on the open market at the time of this writing and is also on the acquisition lists for the Florida Forever and Conservation Collier conservation land programs. 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. If the property is ultimately acquired by Florida Forever or Conservation Collier, or is otherwise not included under the Plan, no monitoring will be conducted under the Plan for this area.

7.7.2 Effects and Effectiveness Monitoring

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 on 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 conducted as appropriate for the other Covered Species within the Covered Activities areas during the environmental permitting phase of each project and as part of any species-specific pre-construction surveys. 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 conducted post-activity to document the status of each species on the project site, and the extent of land cover (habitat) types.

Reliance on 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 conducted for areas to be placed under perpetual conservation easements, to document baseline conditions at the time of easement recording. Habitat assessments will be conducted on an annual basis to document the current 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 7.7.4 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 submit an annual monitoring report, to be submitted to USFWS on a date to be agreed to by USFWS and applicants. The annual report will contain the types of information listed in the HCP Handbook (USFWS and NMFS 2016, 10-23) as agreed to by USFWS and applicants, for each permittee and for the Plan area as a whole. These include the following:

1. Summaries of or a list of the Covered Activities implemented.
2. Accounting of impacts from Covered Activities.
3. Description of the extent of take for each Covered Species as a result of the Covered Activity.
4. Description of how the conservation commitments of the HCP were implemented and their results.

5. Description of the monitoring results and survey information, including the results of habitat assessments conducted on an annual basis to document the current habitat quality of the preserved areas relative to baseline conditions, and ensure that biological goals are being met.
6. Documentation of the extent of landcover within the lands designated for preservation that consists of native habitats and the proportion of landcover within the lands designated for preservation that consists of lands used for agricultural purposes, and a demonstration that these proportions remain within 95 percent of the proportions that existed at the time the ITPs were issued and in the previous annual report.⁵⁰
6. Description of any circumstances that made adaptive management actions necessary, and how the actions were implemented.
7. Description of any changed or unforeseen circumstances that occurred, and explanations of how they were addressed.
8. An accounting of the the year-end balance of the Marinelli Fund, along with a summary of all accruals to the fund and all expenditures from the Fund for (i) monitoring and reporting that is required by the HCP and ITPs and goes beyond the monitoring, reporting, and other obligations associated with individual projects (which will be paid for by individual permittees), and (ii) discretionary expenditures to initiate and support conservation activities that go beyond the requirements of the HCP and ITPs . See Chapter 9 at section 9.4.
9. Summary of any minor or major amendments.
10. Description of any non-compliance issues and how they were resolved.
11. Any other information as required by the ITPs or HCP.

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 formats that meet Federal Geographic Data Committee (FGDC) or ISO 19115 metadata standards.

7.8 ADAPTIVE MANAGEMENT

For the purposes of the HCP program, USFWS has defined 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 original HCP Handbook (USFWS and NMFS 1996, 3-24) stated 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.”

⁵⁰ While the permittees’ goal will be to maintain 100 percent of native land cover, a 95 percent standard is employed to allow a degree of flexibility in accomplishing restoration of land cover as needed.

The revised HCP Handbook (USFWS and NMFS 2016, 10-28, citing Williams et al. 2009) provides an expanded definition of adaptive management:

An adaptive approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions. Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable resource systems.

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 for Preservation/Plan-Wide Activities and Very Low Density Use under the Plan, and the varied habitat types present within 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 HCP Handbook (USFWS and NMFS 2016, 10-27) 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.”

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 roosting habitats for the Florida bonneted bat include forested areas, while open freshwater and wetlands constitute prime foraging habitats (Marks and Marks 2008c, 4; USFWS 2014d). These native habitats are limited in extent and fragmented within the areas designated for the Covered Activities, and few significant 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.

For most bat species, the availability of suitable roosts is an important, limiting factor (Humphrey 1975, 341–343; Ober et al. 2016), and the Plan ensures that extensive areas of forested habitats will be preserved and maintained in proximity to extensive areas of foraging habitats.

In keeping with the purpose and intent of a multiple species HCP, the applicants will work with USFWS throughout the development of the Plan and issuance of the ITPs to determine what adaptive management strategies and triggers may be appropriate for the Florida bonneted bat and/or any of the other Covered Species within the HCP Area. In addition, as described in section 4.6 above, the applicants support the formation of an oversight panel comprised of scientific experts who have published research on one or more of the Covered Species in peer-reviewed publication that would meet every three years during the 50-year term of the ITPs to assess the performance of the HCP and provide recommendations to the permittees and the Service regarding potential adaptive management measures.

8. CHANGED AND UNFORESEEN CIRCUMSTANCES AND PLAN IMPLEMENTATION

8.1 “NO SURPRISES” ASSURANCES

The HCP Handbook (USFWS and NMFS 2016, 9-38) provides a useful summary of “No Surprises” assurances:

Federal No Surprises Assurances (codified at 50 CFR 17.3, 17.22(b)(5), 17.32(b)(5); 50 CFR 222.307(g))...provide assurances to Section 10 permit holders that, as long as the permittee is properly implementing the HCP and the ITP, no additional commitment of land, water, or financial compensation will be required with respect to covered species, and no restrictions on the use of land, water, or other natural resources will be imposed beyond those specified in the HCP without the consent of the permittee. The No Surprises rule has two major components: changed circumstances and unforeseen circumstances. Changed and unforeseen circumstances must be considered and are typically required to be included in HCPs.

8.2 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 a conservation plan or agreement that can reasonably be anticipated by plan or agreement developers and [USFWS] and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events).” 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;
- Flooding;
- Fires;
- Invasive Species, Pests, and Diseases;
- New Listings for Species Not Covered by the Plan;
- Designation of Critical Habitat;
- Climate Change;
- Changes to the FWC Panther Research and Management Program;
- Withdrawal of an ITP Permittee; and
- Economic Downturn

These potential changed circumstances are addressed in the sections below. Given the size of the HCP Area, the variety of landcover that exists within that landscape, and the 50-year term of the ITPs sought by the applicants, the planned response to many of these circumstances involves evaluation of the specific circumstance encountered and coordination with USFWS to formulate an appropriate response. In addition to this coordination, as described in Chapters 4 and 7 above, the applicants support the formation of an oversight panel comprised of scientific experts who have published research on one or more of the Covered Species in peer-reviewed publication that would meet every three years during the 50-year term of the ITPs to assess the performance of the HCP and provide recommendations to the permittees and the Service regarding when adaptive management may be needed under the Plan. Advice from such an oversight panel could potentially anticipate and lessen the impacts of many of the potential changed circumstances described herein.

8.2.1 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. In South Florida and the HCP Area, hurricanes, as well as floods and natural fires (addressed in subsequent sections), are recurring events that are an integral part of the natural history and landscape ecology of the region.

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). These return periods would indicate that, on average, 4-6 standard hurricanes would occur in Southwest Florida within the 50-year ITP term, and 2-3 major hurricanes would occur over the same timeframe.

The duration of immediate impacts from hurricanes can range from a few hours to a week or more. Immediate impacts to habitats and wildlife result from high winds, flying debris, and potential flooding. Direct impacts to 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 located approximately 15 miles inland, at a minimum elevation of 12 feet above mean sea level, and therefore, storm surges from hurricanes are not anticipated to impact the HCP Area directly.

A review of NOAA historic hurricane data (<https://coast.noaa.gov/hurricanes/>) reveals that the centers of four hurricanes have tracked through Collier County since the National Hurricane Center began naming Atlantic storms in 1953. Those hurricanes were Donna (1960); Isbell (1964); Wilma (2005); and Irma (2017). The storms all made landfall as Category 3 (major) hurricanes with winds between 111-129 mph. Two other hurricane eyes have tracked within 50 nautical miles of Immokalee since 1953: Hazel (1953) and Charley (2004). The most recent hurricane, Hurricane Irma, made landfall near Marco Island on September 10, 2017 as a Category 3 hurricane with sustained winds of 112 mph. Within the HCP

Area, weather stations at Immokalee and Ave Maria recorded sustained winds of 64-66 mph, with gusts reaching 89 mph (Cangialosi et al. 2018). These wind speeds are consistent with the wind speeds for Hurricane Donna in 1960 (Dunion et al. 2003), Hurricane Isbell (Dunn 1965), and Hurricane Wilma (Pasch et al. 2006) measured or interpolated within the HCP Area. Although hurricane-force winds may extend >100 miles from the hurricane eye, based on the NOAA data, the HCP Area has not experienced sustained hurricane-force winds since 1953. These hurricane events have not demonstrably compromised the long-term ecological functions of the native vegetation communities within the HCP Area from 1960-2017.

Natural communities in Southwest Florida, including those in the HCP Area, have adapted to periodic hurricane occurrences and typically recover from the immediate impacts of hurricanes within days to several weeks following events as winds diminish and flood waters subside. 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 to 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 can lessen the impact of flooding during and immediately following hurricane events.

Planned Response to Hurricanes

Property owner responses to previous hurricane events in Southwest Florida have generally consisted of managing water-control infrastructure on their property, debris removal, removal of downed trees from farm roads and trails, removal of dead trees from managed forests, and similar cleanup efforts. These responses require no coordination with USFWS.

Should a hurricane generate sustained winds greater than 74 mph within the HCP Area, that event will be considered an unforeseen circumstance (see section 8.3.1).

8.2.2 Flooding

Risk Assessment

The frequency and intensity of flooding events are well-documented in South Florida, due to the need for SFWMD to manage water levels and mitigate flood events. SFWMD compiles hourly and daily data from a regional network of meteorological and surface-water gages into a massive database that guides

water-management decisions. The NOAA Atlas 14 (Perica et al. 2013) analyzed the database to produce precipitation frequency estimates for the stations in the database, including the Immokalee station.

Precipitation and flooding frequencies are typically expressed in terms of precipitation duration (in hours or days) and recurrence interval (in years). The standard “design storm” for engineering purposes in Florida is a 3-day storm event with a 25-year recurrence interval, which for Immokalee corresponds to 10.1 inches of rainfall over 3 days (Perica et al. 2013). A 3-day storm producing 11.7 inches of rain would be expected to recur once every 50 years, and a 3-day storm with 13.4 inches of rain would be expected to recur once every 100 years.

Hurricane Irma (2017) provided useful empirical data for Southwest Florida. The hurricane dumped 14.6 inches of rain at Immokalee within 48 hours, which exceeded the 200-year recurrence interval for a 1-day or 2-day storm, and also exceeded the 100-year recurrence interval for a 3-day storm. The 14.6 inches set a new 2-day rainfall record for the basin (de Lestang, 2017). The event did cause flooding, but the following (2017-2018) dry season has not revealed significant changes in vegetation patterns or land cover that would require a change in land management under the Plan.

Preventative Measures

No measures are available to prevent storm events that deliver excessive precipitation within a given time period. However, the SFWMD operates the regional flood control system (major canals and control structures), and prior to major storm events, the SFWMD will draw down surface water levels based on weather predictions as ambient conditions allow. These flood control measures can lessen the impact of flooding during and immediately following storm events.

Planned Response to Flooding

A storm event that does not exceed 14.6 inches of rainfall (1-day or 2-day; 200-year storm) or 15.2 inches (3-day event; 200-year storm) does not require a specific response. Historically, such events have not altered the ecology of the HCP Area beyond the normal cycles of flooding, drought, and normal hydrologic conditions. Storm events exceeding these thresholds are addressed in section 8.3.2.

8.2.3 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. The U.S. Geological Survey characterized natural wildfire over the 1978-2010 period in BCNP, finding that natural fires occurred on only 1.5% of the 729,000-acre preserve over 32 years (Smith et al. 2015). A model by Prestemon et al. (2016) projects that the risk of lightning-induced wildfire would increase 5% by 2060. Fires, including prescribed fires that become uncontrolled or lightning-induced fires, that burn greater than 1,000 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. In unaltered upland landscapes, natural fire frequency exhibits 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).

Based on Florida Division of Forestry database records from 1981-2000, approximately 15 percent of wildfires in Florida started from lightning strikes, while human-caused fires (e.g., trash burning, cigarettes, arson) accounted for the vast majority of wildfires (Holmes et al. 2004). In a study of BCNP fires over the period 1978-2010, Smith III et al. (2015, Table 6) found that 22 percent of fires in BCNP were natural fires, averaging 18 natural fires per year, with an average size of 183 acres (standard deviation 423 acres, skewed heavily toward many smaller fires). Natural fires burned approximately 1.5 percent of the land area from 1978-2010.

In comparison, the land area within the HCP Area is approximately one-fifth of the BCNP area. Approximately half of the HCP Area land cover is comprised of agricultural land uses (row crops, citrus, pasture) and other land uses that will not carry wildfire and/or would allow for quick fire suppression.

In practice, the applicants do not recall any major wildfire affecting the native habitats within HCP Area for the last several decades. It is not known whether this lack of fire is due to infrequent natural ignition, failure of fire to carry in agricultural areas, and/or suppression. While the majority of wildfires within BCNP from 1978-2010 were caused by humans (Smith III et al. 2015), the private lands under the permittees' control – including future preservation lands – are not open to the public, reducing that source of risk.

Preventative Measures

The applicants have successfully implemented land management practices throughout the HCP Area for many decades, reducing forest fuel loads where needed through such methods as prescribed burning and mechanical vegetation control, and installing fire breaks where needed. Implementation of best management practices for forested areas is the most effective method to reduce the potential for adverse impacts from unplanned burning. Although lightning-induced fires are a natural occurrence and no methods are reasonably available to directly prevent such fires, reduction of fuel loads may limit fire frequency and intensity. The applicants will continue to implement land management practices to prevent impacts due to fire and will work with developers and homeowners' associations to educate new residents within the HCP Area regarding wildfire risk and prevention.

Planned Response to Fires

Wildfires that are suppressed and affect 1,000 or fewer acres will require no coordination with USFWS. Wildfires affecting an area greater than 1,000 acres are considered as unforeseen circumstances (section 8.3.3).

8.2.4 Invasive Species, Pests, and Diseases

Southwest Florida, including the HCP Area, has long been subject to the effects of invasive species, pests, and diseases. 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 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 bivittatus*). The Burmese python is reproducing rapidly and disrupting the ecological food web in the Everglades system, altering the population distribution of prey species such as the marsh rabbit (Sovie et al. 2016) and potentially mammals as large as white-tailed deer (Boback et al. 2016). Over 200 Burmese python occurrences have been documented within Collier County, including at least seven occurrences within the HCP Area (EDDMapS 2017; Rodgers et al. 2017).

Although a variety of pests and diseases occur throughout Southwest Florida and the HCP Area, few currently threaten the general ecology of the region. One major agricultural disease, citrus greening, remains a threat to citrus groves. This disease is caused by the plant pathogenic bacteria *Candidatus Liberibacter spp.*, which are carried by psyllid vectors. In natural systems, laurel wilt is a deadly fungal disease affecting red bay (*Persea borbonia*) and swamp bay (*Persea palustris*) that was detected in BCNP by 2013 (Snyder 2014). The fungus (*Raffaelea lauricola*) infects trees via introduction by the redbay ambrosia beetle (*Xyleborus glabratus*). These pests and diseases are cited as only two examples of many potential biological stressors that can affect agricultural and natural ecosystems within the HCP Area.

Feline leukemia virus is one disease that may affect the Florida panther wherever domestic cats may come into contact with panthers, throughout and beyond Southwest Florida. FWC currently vaccinates panther kittens and older unvaccinated panthers (FWC 2017a).

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. Invasive species are typically detected during the normal course of agricultural operations, land management activities, and during environmental permitting fieldwork for specific projects. Rapid responses to initial reports of new invasive species are the most effective means for preventing disruptive invasive species occurrences.

Similarly, the permittees will be vigilant for new occurrences of pests and/or diseases within the HCP Area and will work with the appropriate agencies to identify and contain these occurrences.

In the case of feline leukemia virus, the permittees will encourage developers and HOAs to educate residents to keep house cats vaccinated and indoors (see section 4.4.1.4).

Planned Response to Invasive Species, Pests, and Disease

The permittees will coordinate as needed with USFWS, FWC, FFS, the Florida Department of Agriculture and Consumer Services (FDACS), and other agencies and experts operating under the Southwest Florida Cooperative Invasive Species Management Area (CISMA) (Rodgers et al. 2017) 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, the threat it poses to the Covered Species, 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 and potential adaptive management.

Similarly, if new pests and/or diseases are detected within the HCP Area, the permittees will coordinate with the appropriate agencies to assess the potential for damage to agricultural and/or natural ecosystems, and to devise control strategies (as necessary) for limiting damage.

Detailed planned responses to invasive species, pests, and/or diseases are not practicable, given the wide variety in the nature, extent, intensity, and potential threat posed by a given plant, animal, or disease agent. Unforeseen circumstances related to these potential threats are addressed in section 8.3.4.

8.2.5 New Listings of Species Not Covered by the Plan

It is possible that a species not covered by the Plan may be subsequently listed as endangered or threatened under the Act during the 50-year term of the ITPs. The applicants have included federal candidate species, species under review, and state-listed species as Covered Species under the Plan, to minimize the probability of a new listed species occurring within the HCP Area.

In the event that a non-covered species occurs within the HCP Area and is newly listed under the Act, the Section 10 permit will be reevaluated by USFWS and the Covered Activities may be modified, as necessary, to ensure that the Covered Activities are not likely to jeopardize or result in the take of the newly-listed species. The permittees shall implement the modifications to the Covered Activities agreed to with USFWS (if any) 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 (i) the permittees have applied for and USFWS has approved any necessary amendment(s) to the ITP, in accordance with applicable statutory and regulatory requirements, to cover the newly-listed species or (ii) USFWS notifies the permittees in writing that the modifications to the Covered Activities are no longer required.

If the permittees seek take coverage for newly listed species, the HCP and ITP will require an amendment. The permittees will implement reasonable efforts to avoid impacts to any newly-listed species until the HCP and ITPs are amended to include them.

8.2.6 New Critical Habitat Designations within the HCP Area

This sub-section contains excerpts from the HCP Handbook (USFWS and NMFS 2016, 7-15 and 7-16).

On February 11, 2016, the Services jointly issued a policy regarding implementation of ESA section 4(b)(2) (81 FR 7226) that USFWS describes in the HCP Handbook as “provid[ing] predictability, transparency, and consistency regarding exclusions from critical habitat designations.” As the Handbook describes, “[u]nder section 4(b)(2) of the ESA, all discretionary decisions to exclude areas from a critical habitat designation, including areas covered by a permitted HCP, must be based on a case-by-case analysis to determine whether the benefits of exclusion outweigh the benefits of inclusion and will not result in the extinction of the species.” In making this determination, “[u]nderstanding the value of the approved plan area to covered species is necessary” because it allows USFWS to evaluate “how both the impacts and conservation of the HCP will affect the overall species’ status.”

The Handbook explains that USFWS “will give great weight and consideration to the conservation benefits provided through conservation plans, programs and partnerships before designating critical habitat” and “will generally exclude areas from critical habitat designation when those areas are covered by approved and implemented plans or programs, and involve demonstrated partnerships that provide a benefit to the species and its habitat.” The Service notes that “designation of critical habitat in a permitted HCP should not be needed if the plan provides a benefit to the species and its habitat” (USFWS and NMFS 2016, 7-16). Current scientific knowledge demonstrates that the Plan provides conservation benefits to all of the Covered Species. As scientific research advances and the monitoring program during the Plan’s implementation proceeds, the conservation benefits can be assessed relative to critical habitat.

Currently, no critical habitat for any of the Covered Species is designated within the HCP Area. If critical habitat is designated for one of the Covered Species, but USFWS excludes the critical habitat designation within the HCP Area, the Plan will continue to be implemented as described herein and in the ITPs. If critical habitat is designated on lands within the HCP Area during the 50-year ITP term (i.e., the HCP Area is not excluded), USFWS will be required to reinitiate consultation to analyze the effects of implementing the plan on critical habitat. If the Service finds that newly-designated critical habitat is likely to be adversely modified, the Service will consider options consistent with regulatory assurances, including:

- working with the permittees to develop reasonable and prudent alternatives so they can voluntarily adjust implementation of covered activities to avoid adverse modification to critical habitat, and
- revoking the permits or coverage for those activities that are expected to adversely modify critical habitat.

The response contemplated by this Plan is a commitment by the applicants to consult with the Service to determine whether any designation of critical habitat may require adjustments to the location, type, and intensity of Covered Activities. More specific responses cannot be proposed in the Plan at this time, since it is unknown whether any critical habitat might be proposed within the HCP Area over the 50-year ITP term, which species might be subject to a critical habitat designation, and how the areas proposed for critical habitat might interact with the Plan. The applicants will work closely with the Service to avoid adverse modification to any newly-designated critical habitat within the HCP Area.

8.2.7 Climate Change

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. A recent NOAA technical report that evaluated global and regional sea-level rise scenarios recommended that assumptions for a best-case scenario of a 0.3m (1.0 ft.) and a worst-case scenario of 2.5m (8.2 ft.) be used for planning purposes through the year 2100 (Sweet et al. 2017). These changes would not require a response by the permittees, as the lowest elevation within the HCP Area is 12 feet above mean sea level (see section 3.3), and the term of the ITPs will expire by 2070 (30 years before even the worst-case scenario could be realized). The likely ecological effects of climate change on a local or regional scale cannot be accurately projected by current climate change models over the 50-year term of the Plan. Overall, however, climate change models predict sea-level rise, increased wildfire activity, and more volatile weather patterns (including the potential for more frequent and/or intense hurricanes) for southern Florida. The permittees will respond to hurricane or wildfire events as described in sections 8.2.1 and 8.2.2.

Reece et al. (2013) applied a vulnerability assessment to 300 species in Florida based on climate change, projected human land-use patterns (Zwick and Carr 2006), and sea level rise by the year 2100. They concluded that several of the Covered Species (panther, sandhill crane, scrub jay, snail kite, and RCW) were among 40 species consistently evaluated as most vulnerable to these combined threats. In eastern Collier County, the Plan greatly reduces potential impacts from projected land-use patterns (see section 1.8, Figure 1-2, and Figure 1-3), and protects the major habitat elements for all 19 Covered Species (including those cited by Reece et al. (2013)).

The most likely scenario due to the combined effects of climate change and sea-level rise is a human population shift from coastal areas to inland areas, as inundation of coastal areas and hurricane-related storm surges become more frequent and/or severe. In this regard, the Plan itself is a proactive response to changed circumstances due to climate change and sea-level rise. The Plan exemplifies conservation-based regional development, as opposed to unplanned sprawl and habitat fragmentation that may accompany a relatively rapid inland migration after a major coastal flooding event (the recent Hurricane Irma nearly realized this scenario). As Noss (2011) noted, "Recognize that human displacement from sea level rise will impinge on inland natural communities unless managed carefully. Biologically important inland areas, which might serve as sea level rise refugia, should be identified and protected as soon as possible, before development for human uses occurs." The Plan and ITPs will do just that, by protecting 106,442 acres of biologically important inland habitats within eastern Collier County.

8.2.8 Changes to the FWC Panther Research and Management Program

As noted in section 4.5.2, FWC maintains a longstanding panther research and management program that monitors multiple aspects of panther ecology, and based on FWC's experience and existing infrastructure the applicants propose that FWC be responsible for monitoring panthers within the HCP Area. If the panther monitoring conducted by FWC within the HCP Area requires additional monetary support, the Marinelli Fund may provide required funds, as described in Chapter 9. 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 as the Plan is implemented.

In the unlikely event that FWC significantly changes or discontinues its panther research and monitoring program, the permittees will coordinate with USFWS to ensure that qualified biologists conduct monitoring of panther occurrence, movements, and other relevant panther information. If FWC can no longer perform panther monitoring, the permittees will engage with USFWS to identify USFWS personnel, academic researchers, and/or contractors with the appropriate section 10(a)(1)(A) permit to continue the monitoring.

8.2.9 Withdrawal of an ITP Permittee

In the unlikely event that an ECPO member relinquishes or abandons their ITP, and as a result the amount of Plan-Wide/Preservation and Very Low Density Use habitat acreage is not sufficient to fully offset take or exceed the mitigation required for the Florida panther and the other Covered Species (which is not expected), the ECPO members will work with USFWS to proportionally reduce the amount of acreage available for Covered Activities under this Plan.

Because the Plan is structured in a manner where each permittee must minimize impacts and mitigate for impacts prior to the initiation of a covered activity, it is likely that the result of any taking would be fully offset if a permit were relinquished or abandoned. As stated in the Handbook (USFWS and NMFS 2016, 17-14), the permittee must meet with USFWS to determine appropriate actions and ensure that outstanding obligations (e.g., reporting) have been satisfied.

8.2.10 Economic Downturn

Economic downturns are cyclical and are expected to occur several times over the 50-year term of the ITPs. A severe economic downturn may affect the overall timelines for covered activities and associated conservation measures under the Plan, but it would not affect the sequencing where mitigation must be provided prior to the initiation of impacts and any potential taking(s). This phased approach ensures that overall impacts and mitigation are in balance if/when a severe economic downturn occurs. Therefore, no additional actions will be required by the permittees or USFWS to address an economic downturn.

This scenario unfolded for the Ave Maria development under regular section 7 procedures, where the "Great Recession" of 2007-2009 essentially halted residential/commercial construction and sales in Southwest Florida for several years. Although it took many years for construction to resume, the

conservation easements for listed species mitigation were officially recorded shortly after the USACE permit was issued. The recession did not affect the conservation action, or the continuing land management of those areas.

8.3 UNFORESEEN CIRCUMSTANCES

Unforeseen circumstances are defined in 50 CFR § 17.3 as “changes in circumstances that affect a species or geographic area covered by a conservation plan or agreement that could not reasonably have been anticipated by plan or agreement developers and the Service at the time of the conservation plan’s or agreement’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.

As the HCP Handbook explains (USFWS and NMFS 2016, 9-39 and 9-40),

The Services bear 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); 50 CFR 222.307(g)(3)(iii))....

In deciding whether unforeseen circumstances exist, the Services shall consider, but not be limited to, the following factors (50 CFR 17.22(b)(5)(iii)(C) and 17.32(b)(5)(iii)(C); 50 CFR 222.307(g)(3)(iii)):

1. The size of the current range of the affected species;
2. The percentage of the range adversely affected by the covered activities;
3. The percentage of the range that has been conserved by the HCP;
4. The ecological significance of that portion of the range affected by the HCP;
5. The level of knowledge about the affected species and the degree of specificity of the conservation program for that species under the HCP; and
6. Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the species in the wild.

The Handbook further explains (USFWS and NFMS 2016, 9-40),

“[i]n 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 HCP 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 HCP is being properly implemented only if such measures are limited to modifications within conserved habitat areas, if any, or to the HCP'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)). If unforeseen circumstances are found, the permittee is not *required* to come up with additional resources or funds to remedy unforeseen circumstances, but [USFWS] and the permittee should work together to determine an appropriate response within the original resources commitments of the HCP."

8.3.1 Unforeseen Hurricane Conditions

Hurricane conditions will be considered as unforeseen circumstances when sustained winds within the HCP Area exceed 74 mph. If the hurricane intensity exceeds this threshold, the permittees will coordinate with USFWS to assess hurricane-related damages to preservation areas. The permittees and USFWS will then determine if additional land management and/or conservation measures are required, beyond the measures already provided for under the Plan.

Following a hurricane event where sustained winds exceed 74 mph, 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 constitute a changed circumstance. These assessments may include extrapolating damage assessments from surrounding federal and/or state lands; aerial reconnaissance of the HCP Area; and/or site visits to areas of interest within the HCP Area.
- If hurricane impacts are considered a changed circumstance, prepare a damage estimate report with a focus on lost canopy vegetation (for forested communities), defoliation, and lost denning, nesting, or cavity nesting sites. The report should include estimates of wind and/or flooding damage and potential long-term effects on habitats (if any), including forested and herbaceous (non-forested) habitats.
- Determine whether and which actions, are 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 as appropriate to determine whether any flood-related damage can be prevented or attenuated in the future through drainage improvements.

8.3.2 Unforeseen Flooding Conditions

A rainfall event that exceeds 14.6 inches of rainfall (1-day or 2-day; 200-year storm) or 15.2 inches (3-day event; 200-year storm), will be considered an unforeseen circumstance, and the USFWS and permittees will coordinate action on the following activities:

- Determine whether the degree and/or extent of the flooding impacts rise to the level of a “changed circumstance.” These assessments may include analysis of rainfall and stream gage data (and comparisons to Hurricane Irma data), extrapolating damage assessments from surrounding federal and/or state lands; aerial reconnaissance of the HCP Area; and/or site visits to areas of interest within the HCP Area.
- If flooding impacts are considered an unforeseen circumstance, prepare a flood damage estimate report with an immediate focus on impacts to Covered Species, and any potential long-term effects on the habitat, including forested and herbaceous (non-forested) habitats.
- Determine which and whether actions are necessary to ameliorate the effects of the flooding damage. Such actions may include maintenance to stormwater infrastructure on permittee’s land, 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.

8.3.3 Unforeseen Wildfire Conditions

For fire events that are not the result of properly implemented prescribed burns, the permittees will first coordinate with local and state (Florida Forest Service, or FFS) firefighting teams to control and completely extinguish the fire. For wildfires which result in over 1,000 acres of fire damage to biological resources, the permittees will then coordinate with USFWS to undertake the following actions:

- Assess burned areas to evaluate need for timber salvage/removal;
- Consult with foresters from FFS to assess fire damage and the probability of natural recovery;
- Monitor the area for the rate of natural recruitment of tree canopy species; and
- Determine whether supplemental plantings of tree canopy species and/or other forest management practices are needed for successful forest regeneration.

8.3.4 Unforeseen Circumstances for Invasive Species, Pests, and Diseases

Should the ecological impacts of any existing or new invasive species, pests and/or diseases become severe enough to significantly compromise the stability of covered species populations within the HCP Area, or their habitat support, those impacts will be considered as an unforeseen circumstance and the permittees will coordinate with USFWS to develop responses. By their nature, the emergence of these potential threats is not known, nor is the probability of occurrence.

8.4 AMENDMENTS

This section includes excerpts from the HCP Handbook (USFWS and NMFS 2016, 17-6 and 17-7).

The HCP Handbook explains that changes in HCP implementation may require amendments to the HCP or the ITPs. Although “[e]ither party can initiate amendments, . . . it is up to the Service to decide the level of review needed to satisfy ESA statutory and regulatory requirements.”

“Amendments might be approved by an exchange of formal correspondence, addenda to the HCP, revisions to the HCP, or permit amendments. However, as the scale or scope of any amendment increases, it becomes more likely that [the Service] will need to publish public notice and amend the NEPA and section 7 analyses.”

The Service notes that it “usually will not need to advertise an amended HCP when levels of incidental take do not increase and the activity does not expand in ways not analyzed in the original NEPA or section 7 documents. Changes to an HCP of this level will need to be reflected in an amended permit.” The Handbook lists the following types of activities that require permit amendment:

- addition of new species, either listed or unlisted;
- increased level or different form of take for Covered Species;
- changes to funding that affect the ability of the permittees to implement the HCP;
- changes to covered activities not previously addressed;
- changes to covered lands; and
- significant changes to the conservation strategy, including changes to the mitigation measures.

The Handbook notes (USFWS and NMFS 2016, 17-7) that “if [an ITP] has been written to reference or incorporate HCP provisions, this will minimize the need to amend the permit as it is implemented.” The Handbook lists the following as examples of HCP and permit changes where the take levels and project activities are not substantively altered:

- correcting insignificant mapping errors;
- slightly modifying avoidance and minimization measures;

- modifying annual reporting protocols;
- making small changes to monitoring protocols;
- making changes to funding sources; and
- changing the names or addresses of responsible officials.

8.5 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).

8.6 RENEWAL OF THE SECTION 10(A)(1)(B) PERMIT

An ITP may be renewed without the issuance of a new permit, if so stated in the original permit terms and conditions, and provided that the 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 permit 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.

8.7 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. As the Handbook describes, “[t]he transferee must meet all of the qualifications required to receive an incidental take permit, which means demonstrating the capacity to implement the HCP or that portion they are assuming responsibility for, the legal ability to perform the authorized project, and providing funding assurances” (USFWS and NMFS 2016, 17-9).

As stated in the Handbook, “[a]n assumption agreement is a key component of such a transaction. It outlines the roles and responsibilities of all the parties including the Service. The assumption agreement addresses any outstanding obligations and how they will be completed. An assumption agreement, at its simplest, is a joint submittal by the transferor and transferee as prescribed by 50 CFR 13.25 . . . , or it can resemble a memorandum of understanding.” (USFWS and NMFS 2016, 17-8) Any permit issued by the Service as a result of a partial or full transfer will retain the original permit expiration date. The permittee/transferee is required to request renewal to alter the expiration date.

9. FUNDING

The ESA and the Service’s implementing regulations (50 CFR § 17) require HCPs to specify the measures that applicants will adopt to ensure adequate funding for the HCP. In this case, the most economically and ecologically valuable aspect of the Plan – the 106,442 acres of privately owned, otherwise developable lands that will be preserved in perpetuity as habitat for the Covered Species and that will provide vital connections among existing public preservation lands – is already owned by the applicants, and requires no additional funding. Indeed, the Plan reflects a commitment by the applicants to restrict the future use and economic value of their privately-held lands identified for preservation. The current value of these preservation lands is estimated to total approximately \$1.4 billion, based on purchase prices for two comparable properties located within the RLSP that were purchased in recent years.

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 substantial revenue and increase the economic value of the lands.

9.1 CREATION OF THE MARINELLI FUND

The remainder of the costs associated with implementing the Plan – which will be minimal compared to the value of the preservation lands – will be paid through a private fund that will be created under the Florida Panther Protection Program (FPPP), the funding of which will be assured by contributions tied to the conduct of Covered Activities. That is, as explained in section 9.2, the landowners will each deposit \$2,000 into the Fund within 90 days following the issuance of the ITPs, and in subsequent years if necessary, to cover the costs of monitoring and reporting that may be incurred prior to the initiation of Covered Activities. Thereafter, monetary contributions into the Fund as a pre-condition of undertaking the Covered Activities, and additional monies will be deposited into the Fund as Covered Activities are completed (through payment of residential transfer fees).

A Memorandum of Understanding (MOU) between the applicants (referred to as the “Rural Landowners” in the MOU) and their conservation partners, Audubon Florida, Collier County Audubon Society, Inc.,⁵¹ 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.⁵² The MOU explained that framework at that time 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

⁵¹ Collier County Audubon Society, Inc. is currently known as Audubon of the Western Everglades.

⁵² A copy of the MOU is available at <http://www.floridapantherprotection.com/>.

and management within the Enhanced Protection Area based upon a technical review and analysis of available data . . . (MOU at 7.)

The MOU acknowledged that a dedicated funding source will be required to achieve FPPP objectives. The FPPP therefore committed to the establishment of the “Paul J. Marinelli Florida Panther Protection Fund” (Marinelli Fund or Fund), named in honor of the late Paul Marinelli – former President and Chief Executive Officer of the Barron Collier Companies – for his vision in bringing the FPPP 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 by providing a contiguous range of preserved panther habitat,” MOU at 7, which aligns with the overall goals and conservation activities of the Plan. Certain refinements to the Fund mechanisms, uses, administration, and assurances have been developed over the years. For example, as described in previous chapters, the FPPP has elected to allow the Marinelli Fund to be used for activities and initiatives that conserve species in addition to the Florida panther. These refinements are memorialized in the Plan, and in this chapter of the Plan in particular. Additional refinements are possible in concert with the Service’s review of the Plan and issuance of the ITPs.

9.2 CONTRIBUTIONS TO THE MARINELLI FUND

Implementation of the HCP will generate revenue for the Marinelli Fund through two separate mechanisms. First, the applicants will contribute \$350 per acre to the Fund as Covered Activities are initiated. The per-acre fee will be deposited into the Fund on a lump sum basis no later than 90 days after the closing of the first dwelling unit sold within a new development project, and/or 90 days after the first extraction product leaves the site for earth mining activities. Second, the Fund will receive a per-unit fee of \$200 (adjusted periodically to account for adjustments in the Consumer Price Index) each time a home within the HCP Area is sold (including both initial sales and re-sales). The landowners will each pay \$2,000 into the Fund within 90 days following the issuance of the ITPs to cover the costs of monitoring and reporting that may be incurred prior to the initiation of Covered Activities.⁵³ The landowners will deposit the same amount into the Fund in subsequent years in the event that there has been no contribution to the Fund based on implementation of Covered Activities, in order to ensure that adequate funding will be available to pay for monitoring and reporting required under the HCP and ITPs. These initial contributions will be available for use only to pay for monitoring and reporting required under the HCP and ITPs, and will not be available for support of conservation activities. All initial contributions made by each permittee will be credited against that permittee’s per-acre contribution requirements of the Fund. The precise value of the revenue stream to be generated through these mechanisms over the 50-year term of the ITPs is unquantifiable at this time. Based on the 45,000-acre cap of Covered Activities and the number of residential units expected to be constructed within the lands designated for Covered Activities under the Plan, however, applicants estimate that the revenue stream produced by the dual funding mechanisms described above will deposit approximately \$150

⁵³ See section 9.4 below for a description of which costs will be paid for through the Marinelli Fund, and which will be paid by individual permittees.

million into the Marinelli Fund during the 50-year term of the ITPs. As described in section 9.4, the Marinelli Fund will be used as necessary to pay all non-project out-of-pocket expenses of implementing the overall Plan. These expenses include those expenses tied to the Plan as a whole, including the costs of compliance and effectiveness monitoring that is required for implementation of the HCP through the ITPs and the cost of annual reporting. The proceeds remaining in the Marinelli Fund after paying for implementation of the Plan will be available to sponsor or conduct additional conservation activities selected at the discretion of the Board of Directors of the Marinelli Foundation, as described below.

9.3 THE MARINELLI FOUNDATION

The FPPP will create a nonprofit foundation – the Marinelli Foundation – with tax exempt status under section 501(c)(3) of the Internal Revenue Code to oversee the day-to-day implementation of the HCP, including discretionary expenditures from the Marinelli Fund, and to serve as a point of contact for USFWS, FWC, and the public. The Marinelli Foundation will be governed by a Board of Directors, which will be comprised of seven members: two representatives of the landowner-applicants, one representative of each of the applicants' four conservation partners, and one at-large member who will serve at the invitation of the other six members of the Board. The Foundation is anticipated to raise funds in addition to those generated through implementation of the Covered Activities to be used for conservation initiatives, through grants as well as fundraising. The landowners and their conservation partners will each assist in raising additional funds in a manner consistent with each partner's individual capacity and organizational policies.

9.4 DISTRIBUTION OF COSTS BETWEEN APPLICANTS AND THE MARINELLI FUND

As described in the sections below, applicants will continue to pay all expenses associated with the ongoing management of their lands, both before and after those lands are dedicated for perpetual preservation through environmental conservation easements, and for all project-level costs associated with implementing the Covered Activities that applicants would otherwise incur if they elected to develop their lands in the absence of the Plan. The only expenses associated with Plan implementation that the Marinelli Fund will be called upon to pay are the non-project-level costs of Plan implementation, which the applicants would *not* incur if they elected to develop their lands the absence of the Plan. As described in section 9.5, the remainder of the Marinelli Fund's resources will be used at the discretion of the Foundation's Board of Directors to initiate and support conservation activities that go beyond the Plan.

9.4.1 Applicants To Pay For Ongoing Land Management Costs and All Project-Level Costs that Would Exist Outside the Plan

The applicants already own the lands designated for preservation under the Plan and have been managing their lands within the HCP Area for multiple decades through ongoing agricultural activities, and through such activities as removal of exotic vegetation, and prescribed burning. Under the Plan, the applicants will continue to manage their own lands, and will each be responsible for the cost of all activities that would be associated with such continued management of their own lands (including, for example, the cost of exotic vegetation removal and prescribed burning).

The individual applicants will also each be responsible for all costs associated with conducting Covered Activities within their lands that would also be incurred from conducting residential and commercial development and/or earth mining in the absence of the Plan. These project-level costs are expected to include, for example, the costs of all project level permitting and associated mitigation requirements and conservation measures; performance bonds;⁵⁴ and monitoring required by state and federal agencies through project-level permitting processes (including, for example, pre-construction clearance surveys).

9.4.2 Plan Implementation Costs To Be Paid For Through the Marinelli Fund

The *only* implementation costs that the Marinelli Fund will be used to pay for will include the minimal number of non-project-level costs associated with the Plan that would *not* be incurred in the absence of the Plan. These costs include costs associated with (i) monitoring that is required for implementation of the HCP through the ITPs—including compliance monitoring and effectiveness monitoring for the HCP as a whole—and (ii) the annual reporting requirements of the HCP and ITPs. These non-project-level HCP monitoring and reporting costs are expected to be relatively modest and will result in expenditure of only a small percentage of the revenue available in the Marinelli Fund.

9.5 ADDITIONAL CONSERVATION ACTIVITIES TO BE INITIATED BY THE MARINELLI FOUNDATION

Because the Marinelli Fund is expected to receive funds well in excess – at least tens of millions of dollars in excess – of what will be required to implement the Plan, the same Fund is also expected to be used for conservation initiatives that go beyond the Plan, such as construction of wildlife crossings and fencing, habitat acquisition and restoration, corridor enhancement, public education and outreach focused on the importance of wildlife conservation, and scientific research relevant to species conservation. These additional conservation activities will be initiated at the discretion of the Marinelli Foundation Board of Directors, with advice and technical assistance from the Service.

The conservation initiatives undertaken by the Marinelli Foundation will be selected through a careful, science-based approach aimed at furthering the landscape-level planning and preservation provided through the Plan, and are expected to complement the Plan. These initiatives, however, represent additional conservation benefits of the Plan that are not needed in order to fully offset the projected impacts of incidental take (because other elements of the Plan – primarily the permanent preservation and maintenance of the 106,442 acres of lands providing valuable habitat for the Covered Species and other wildlife⁵⁵ – fully offset those impacts), and therefore the funded conservation initiatives are not prescribed or specifically required elements – as mitigation or otherwise – under the Plan or the ITPs. Instead, these initiatives will be undertaken at the discretion of the Foundation’s Board of Directors, and

⁵⁴ The landowners routinely provide performance bonds that provide financial assurances for mitigation associated with development, and expect to provide such bonds with respect to development that occurs within the HCP Area.

⁵⁵ Although the permanent preservation and maintenance of 106,442 acres under the Plan will serve as mitigation that fully offsets the impacts from the Covered Activities, the Plan includes specific requirements for conservation of specific species (e.g., restoration of degraded habitat for caracara).

in coordination with the Service and FWC, where appropriate. The Service will have the opportunity to provide advice and technical assistance to the Board regarding expenditures from the Fund , and will be able to attend Board meetings when conservation priorities and conservation activities will be determined. As described in Chapter 7, the annual report prepared on behalf of the permittees and submitted to the Service will provide an accounting of the year-end balance of the Marinelli Fund, along with a summary of all accruals to and expenditures from the Fund. See section 7.7.3.

The Foundation's bylaws will provide that the first priority for use of funding is implementation of the non-project-level elements of the Plan (as described above). In order to "ensure funding for the [P]lan will be provided," as required under ESA section 10(a)(2)(B), the expenditure of funds for implementation of non-project-level elements of the Plan will be non-discretionary and therefore will not require approval by the Board. Thereafter, funding will be used for targeted conservation initiatives to be selected and/or designed by the Marinelli Foundation Board of Directors. Although the precise conservation activities to be undertaken by the Marinelli Foundation will be left to the Board's discretion, the members of the FPPP (who will comprise the Marinelli Foundation Board) have agreed that the following principles will be used to guide the allocation of funds:

- Conservation activities within the HCP Area will be prioritized over potential activities that would occur outside the HCP Area;
- Priority for conservation activities that address roadway impacts to species (such as fencing along roadways and construction of wildlife underpasses) will go to local and private roadways before federal and state roadways, while also prioritizing maximum benefit to the Florida panther and other Covered Species; and
- Conservation activities benefitting the Florida panther will be prioritized over those that benefit other species but do not also benefit the panther.

The Marinelli Foundation will act where possible as a facilitator to incentivize, leverage, and advance collaborative solutions to wildlife impacts, and will seek partnerships with academia. In addition, the Marinelli Foundation will provide support for science-based solutions to wildlife impacts, as well as public education regarding conservation solutions. The Foundation's public outreach may include, for example, an in-situ wildlife resource center for current and future residents of eastern Collier County. The Foundation will also coordinate access to lands within the HCP Area for research by federal and state agencies, as well as privately funded researchers, subject to landowner approval. Research conducted within the HCP Area is expected to add substantially to the data available on the Covered Species, as well as the regional ecology.

In addition, the members of the FPPP have agreed that the Marinelli Foundation will prioritize conservation activities that provide solutions to wildlife impacts in the following order:

- Reducing roadway impacts;
- Habitat restoration;

- Land acquisition to be undertaken only in strategic instances where such acquisition will complement other solutions;
- Support for a wide-ranging species biology and impact reduction institute;
- Initiatives to reduce conflicts between human activities and species needs; and
- Matching grants for the solutions above.

Although the covered activities are not the cause of third party collisions with species on external roadways, based on the high priority placed on reducing roadway impacts the members of the FPPP have determined that at least fifty percent of the first \$25 million deposited into the Fund by permittees through the \$350-per-acre fee and through transfer fees for homes sold within the HCP Area will be set aside for use in funding construction of large mammal wildlife crossings and associated fencing. Additional detail regarding the priorities that will guide the Board's allocation of monies from the Fund will be provided in the Marinelli Foundation's bylaws. Based on ongoing conversations among FPPP members – representatives of which will comprise the majority of the Foundation's Board of Directors – the following sections provide specific illustrative examples of how the Marinelli Fund may be used.

9.5.1 Initiatives to Reduce Roadway Impacts

As noted above, the Marinelli Foundation will prioritize conservation initiatives designed to lessen roadway impacts to panthers and other wildlife, and at least fifty percent of the first \$25 million deposited into the Fund by permittees through the \$350-per-acre fee and through transfer fees for homes sold within the HCP Area will be set aside for use in funding construction of large mammal wildlife crossings and associated fencing. FPPP members have discussed investing the Marinelli Fund's resources in the following specific projects, based on the August 2017 report of the Transportation Sub-Team of the Florida Panther Recovery Implementation Team (FPRIT) on "Southwest Florida Road Hot Spots" (FPRIT 2017):⁵⁶

- Installation of a multi-use overpass on Oil Well Road (CR-858) on the west side of Camp Keais Strand;
- Elevation of several strategically-located Collier County bridges east of SR-29 on Immokalee Road (CR-846) and Oil Well Road (CR-858);
- Replacement of gates in wildlife fencing along SR-29 with a new type of gate (e.g., solar-powered sliding gates) that eliminates the gaps present in the current gates, which allow wildlife to gain access to the roadway;
- Installation of wildlife crossings and fencing along CR-846 and CR-858;⁵⁷ and

⁵⁶ Please see Chapter 4, at section 4.1.4, for a discussion of FPRIT's August 2017 report.

⁵⁷ Locations for crossings and fencing were identified in the 2006 Eastern Collier Wildlife Movement Study (Smith et al. 2006) and the 2009 Panther Review Team Report (FPPPTRT 2009).

- Implementation of the forthcoming recommendations of Dr. Dan Smith of the University of Central Florida (potentially including installation of one or more wildlife underpasses), based on the results of an ongoing study of panther movement on Corkscrew Road (CR-850) in Collier County.⁵⁸

9.5.2 Initiatives Focused on Habitat Restoration, Enhancement, and Acquisition

The Plan provides for the permanent preservation and maintenance of 106,442 acres of privately held land worth an estimated \$1.4 billion that could otherwise be developed. These lands are strategically located to preserve landscape-scale connectivity – including existing regional wildlife corridors – and provide valuable interconnected habitat for the Florida panther, the eighteen other Covered Species, as well as other wildlife, in their current state. See, e.g., Figures 4-5 through 4-8 (depicting Florida panther radio telemetry and GPS data within and surrounding the HCP Area).

The Marinelli Foundation is expected to fund additional conservation initiatives focused on habitat restoration, enhancement, and acquisition to amplify the effect of the large-scale conservation already provided through the Plan. Specific examples of these sorts of initiatives include the following:

- Enhancement of the documented wildlife corridor located west of SR-29 and north of CR-858 (see Figure 4-9, southern corridor) through a combination of site design and buffers from Covered Activities, including establishment of high-value habitat conducive to wildlife movement and utilization (e.g., mesic pine flatwoods) where gaps in native cover occur, establishment of high-value habitat cover adjacent to future wildlife crossing locations along SR-29 and CR-858, and control of exotic vegetation within the corridor;
- Establishment of a wildlife corridor in the northern portion of the HCP Area (see Figure 4-9, northern corridor) by creating high-value habitat conducive to wildlife movement and utilization (e.g., mesic pine flatwoods), intersecting a future FDOT wildlife crossing for SR-82 that is currently in the design and permitting phase, and control of exotic vegetation within the corridor;
- Habitat restoration and management in other areas within the HCP Area, including in areas around existing and future wildlife crossings and where higher-quality habitat would enhance utilization; and
- Preservation of any important habitat within or immediately bordering the HCP Area that is offered for sale through direct purchase or through brokerage of another conservation mechanism.

9.5.3 Public Education, Best Management Practices, and Scientific Research

The Marinelli Foundation is expected to provide funding for public education regarding how to appreciate, understand, and live alongside wildlife. The Foundation is expected to conduct some public

⁵⁸ Dr. Smith has indicated that he anticipates the results of this ongoing study will be released during 2019.

education initiatives independently and through partnerships with wildlife researchers and university faculty.

The Foundation is also expected to support and enhance efforts of the applicants to promote and encourage the implementation of best management practices (BMPs) within the HCP Area by providing educational materials (e.g., neighborhood signs, newsletters, and door hangers) to developers, homeowners associations (HOAs), and residents. Examples of BMP materials are provided in Appendix B. Implementation of BMPs will assist in protecting the Covered Species and other wildlife, and in minimizing the potential for human-wildlife interactions within development areas, especially interactions between humans and large mammals (e.g., Florida panther; bear; deer; feral hogs), nocturnal species (e.g., Florida bonneted bat), and species that may pose human health risks (e.g., Eastern diamondback rattlesnake). BMPs are addressed in chapter 4 (section 4.4.1.4) with respect to Florida panther and in chapter 7 (section 7.6.1.4) with respect to the other Covered Species.

The Marinelli Foundation is also expected to pursue opportunities to fund or otherwise support scientific research relevant to conservation of the species addressed by the HCP, as well as the local ecology. Subject to landowner approval (to be reasonably provided on a case-by-case basis), the Foundation's support for scientific research may include access and funding for HCP Area-wide studies. The FPPP members also anticipate that the Marinelli Foundation will provide funding for field inventories and studies of native plants and wildlife within the HCP Area, in conjunction with university-affiliated faculty.

10. ALTERNATIVES

ESA section 10(a)(2)(A)(iii) and USFWS regulations at 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 considered in this section account for the applicants' land ownership and, therefore, would occur within the same 151,442-acre HCP Area described herein and depicted in Figure 2-1. Under current Collier County base zoning laws, all lands within the HCP Area are zoned for and subject to development at a density of one dwelling unit per five acres. An example of the type of development that is possible under these base zoning laws is the development within Golden Gate Estates, immediately west of the HCP Area (see grid-like pattern of development on Figure 2-1, at the western boundary of the HCP Area).

As Figure 2-1 indicates, the HCP Area is located within the approximately 195,000-acre area⁵⁹ covered by Collier County's Rural Land Stewardship Plan (RLSP).⁶⁰ The RLSP, which is described in greater detail in Chapter 1 (see section 1.7), is a voluntary program that allows participants to develop certain lands within the RLSA (Stewardship Receiving Areas, or SRAs) at densities higher than base zoning allows, in exchange for placing restrictions on the use of other lands within the RLSA (Stewardship Sending Areas, or SSAs).

The restrictions placed on SSAs under the RLSP vary, as landowners are permitted to restrict (or "remove") land uses in "layers," such that land uses of varying intensity remain as layers are removed. Landowners who choose to participate in the RLSP decide which layers to remove and which to retain. Each layer is assigned a value in terms of stewardship credits, and the more layers that are removed, the more credit is generated. Participating landowners can exchange stewardship credits for the right to develop lands within the RLSA at densities higher than the one-dwelling-unit-per-five-acre density that exists under base zoning.

The RLSP identifies approximately 93,100 acres within the RLSA as "Open" to and suitable for future development. These "Open" lands consist primarily of previously-converted agricultural areas. Approximately 71,275 acres of these "Open" lands are within the HCP Area and owned by the applicants. Under the RLSP and local zoning laws, and absent the HCP, the applicants could pursue residential or commercial development activities anywhere throughout these 71,275 acres of "Open" areas that are under the applicants' ownership. Under the proposed HCP, only 45,000 acres of these lands could be developed (over 26,000 acres less than the applicants could develop within the HCP Area under the voluntary RLSP). Moreover, the 45,000 acres of land available for development under the

⁵⁹ The RLSA includes approximately 182,400 acres of privately-held lands; the balance consists of public lands (Collier County 2009a).

⁶⁰ The Collier County Land Development Code, which implements the RLSP, utilizes the acronym "RLSA" to refer to the Rural Land Stewardship Area, the geographic area within which the County's RLSP policies and codes apply.

HCP would be located within areas that have relatively lower habitat values, and areas of higher habitat values would be preserved. Participation in the RLSP for county zoning and permit purposes remains an option for applicants under all four alternatives.

Among the four alternatives discussed in this chapter, the No-Action Alternative is the only alternative that 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, including development of all or part of the 151,442-acre HCP Area under base zoning (effectively extending Golden Gate Estates throughout the HCP Area), or development at greater densities within the 71,275 acres of RLSP “Open” lands within the HCP Area. 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. Each of these four alternatives is addressed in the following sections.

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 occurred historically throughout the HCP Area could continue indefinitely throughout the 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, applicants would be free to pursue residential or commercial development activities under base zoning (one dwelling unit per five acres) anywhere within the HCP Area, or development at greater densities within the 71,275 acres of RLSP “Open” lands located within the HCP Area. The applicants would also be free to pursue earth mining activities anywhere within the HCP Area, since the RLSP does not place any restriction on where earth mining can occur.⁶¹

⁶¹ Proposed amendments to the Collier County comprehensive plan would place a 45,000-acre cap on development within the RLSA (Collier County 2009b). The proposed amendments would also allow for the voluntary restoration of panther corridors as a means to generate stewardship credits. These proposed

As compared to HCP alternatives, the No-Action Alternative would leave open the option to develop portions of the HCP Area – under base zoning or the RLSP – without requiring ecological monitoring (except for restoration activities undertaken pursuant to the RLSP), provisions for changed or unforeseen circumstances, or other elements required for HCPs. Critically, the No-Action Alternative would allow for this development without the landscape-level planning and conservation that the HCP provides by directing development to certain areas of lower habitat value and setting aside 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). Projects would likely require federal permits, including under section 404 of the Clean Water Act for discharges of dredged or fill material to waters of the U.S., 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 federally listed species potentially affected. However, because USFWS would be issuing biological opinions on a project-by-project basis, the degree of certainty regarding the configuration, location and impacts of future actions would be significantly reduced as compared to the HCP alternatives, where future actions and their effects are well-defined.

10.2 PROPOSED HCP

The Proposed HCP (described in Chapters 1-9) involves an HCP and ITPs with 50-year durations 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).

Eleven 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 eighteen other Covered Species.

The applicants have designated 49,276 acres of land for Covered Activities, within which up to 45,000 acres of residential/commercial development and/or earth mining could occur. The Plan was designed to work in concert with the current RLSP and would also work with the proposed RLSP amendments.

106,442 acres would be preserved under the Plan, and would be placed under perpetual preservation in 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, two species under review for federal listing, and eight state-listed species. The primary biological goal of the Plan is to preserve and maintain in perpetuity the extensive interconnected habitat mosaics within the HCP Area, which provide habitats and movement corridors for the Florida panther and the 18 other Covered

amendments were not adopted during the last comprehensive planning cycle, but are currently undergoing a county restudy in 2018 and could be adopted thereafter.

Species. The preservation and maintenance of these vast areas and habitats benefit multiple species and create 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, in coordination with state and federal wildlife agencies, 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.

As described in section 4.3.3 and summarized in Table 4-8, the Proposed HCP addresses no fewer than 10 recovery actions listed in the Florida Panther Recovery Plan, 3rd Revision (USFWS 2008a). Most of these 10 recovery actions are considered essential for the recovery of the species, and require willing cooperation between private property owners, multiple federal and state agencies, local government, and NGOs. Under the Plan, these recovery actions can be implemented across the RLSA.

The HCP reflects and furthers the goals of the Florida Panther Protection Plan (“FPPP”). The FPPP is a collaborative effort between four leading conservation organizations (Audubon Florida, Audubon the Western Everglades, 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, primarily 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 adjacent conservation lands in the region and the panther Dispersal Zone.

In addition to the activities undertaken through the Plan, the Marinelli Fund, founded by the FPPP and funded through implementation of the Plan (see Chapter 9), is expected to supplement the Plan by undertaking additional conservation activities within and around the HCP Area. The Marinelli Fund was originally intended to 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). The FPPP has since expanded the mission of the Fund to include conservation actions to benefit the eighteen other Covered Species, in addition to the Florida panther, as well as other wildlife.

10.3 PANTHER-ONLY HCP ALTERNATIVE

The Panther-Only HCP Alternative is similar to the proposed HCP, but addresses only the Florida panther. Under this alternative, the Florida panther would be the only species covered under the ITPs. Although an integrated long-term plan would be provided for Florida panther conservation, any additional 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 HCP, 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 eighteen 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.

In 2008, the FPPP 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 PRT conducted 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 any future 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 [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 of areas designated for Covered Activities. Figure 10-1, which was taken from the PRT report (FPPPTRT 2009, Figure 13), depicts the PRT recommendations in relation to the RLSA. Figure 10-2 depicts the lands designated under the HCP for Preservation/Plan-Wide Activities, Covered 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 under the HCP and the locations left open for

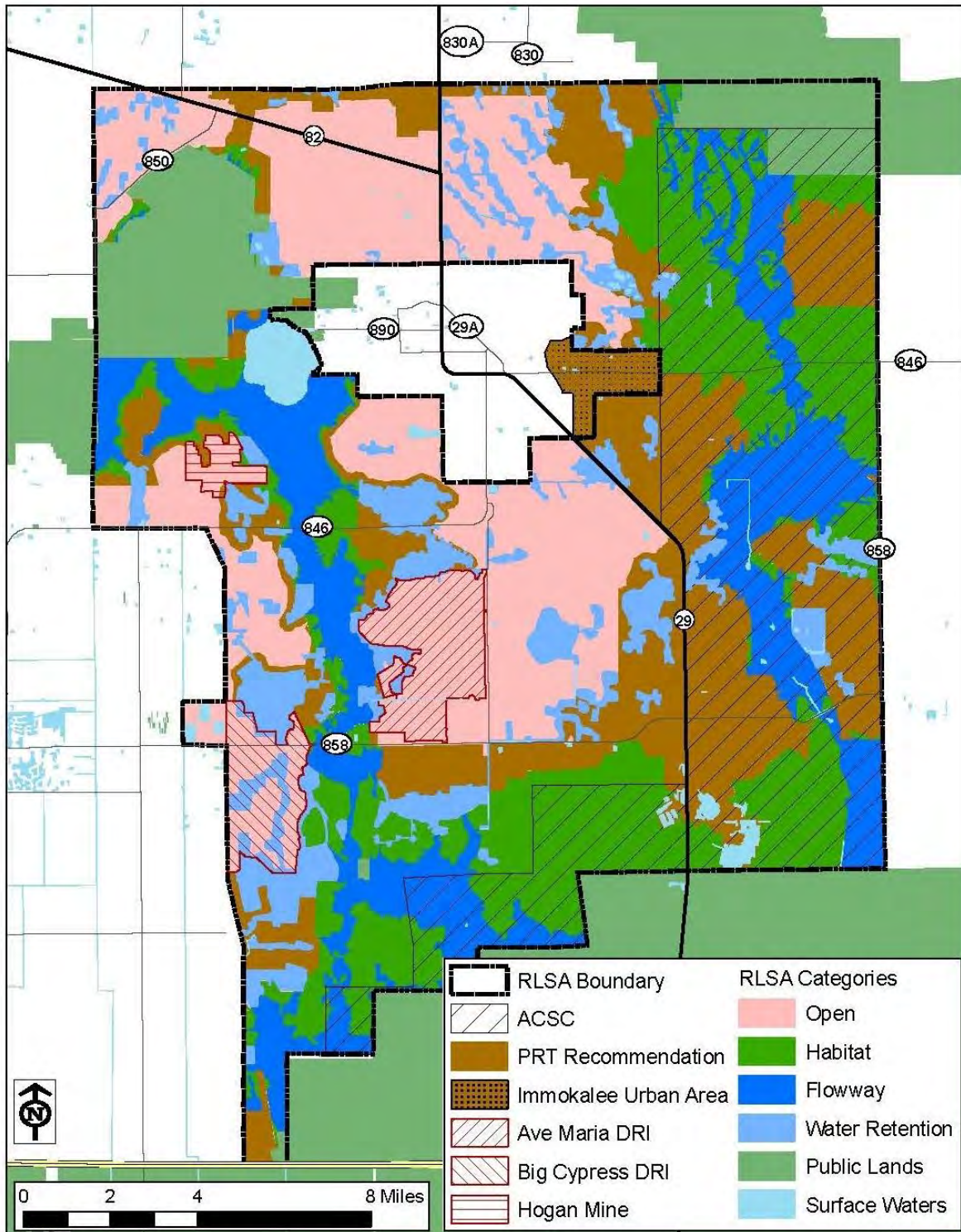


Figure 13. RLSA lands for which the Panther Review Team (PRT) recommends that land uses should be maintained at no greater than existing uses. Natural area restoration may be appropriate for some areas to enhance them as functional habitats for Florida panthers. It is the PRT's understanding that the Parties are recommending that RLSA Open Lands within the ACSC should be dedicated to Agricultural Preservation.

Figure 10-1: PRT Recommendations for the RLSA (from FPPPTRT 2009, Figure 13)

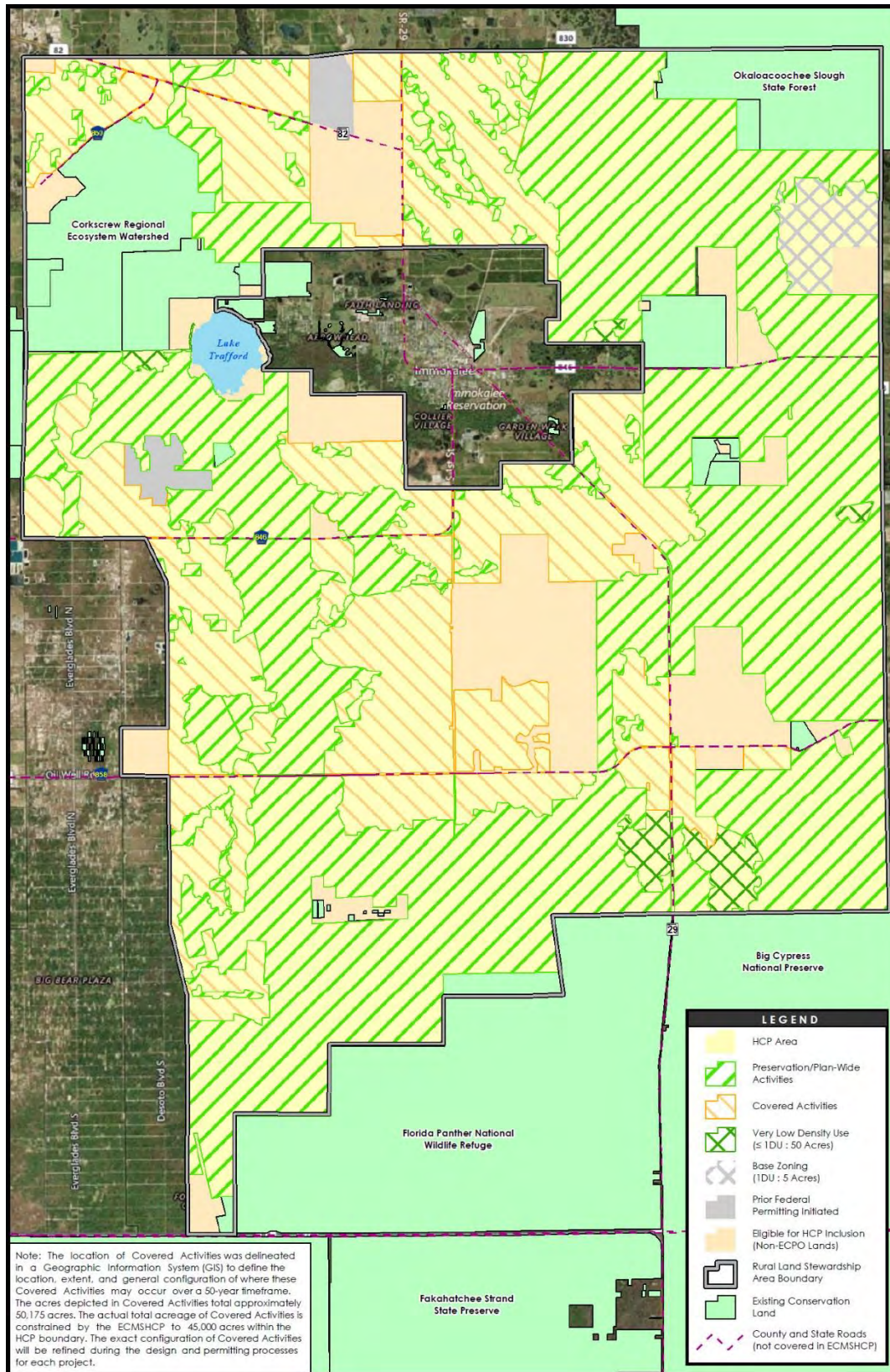


Figure 10-2: Land Designations under the Plan (from Chapter 2, Figure 2-1)

potential future development under the PRT Configuration Alternative (see pink-shaded areas in Figure 10-2). 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.

Although both the PRT Configuration Alternative and the Proposed HCP would provide substantial benefits to the Florida panther and the other Covered Species, the applicants selected the Proposed HCP over the PRT Configuration Alternative for several reasons. First, the PRT configured the 45,000 acres of potential future development without regard to property ownership within the RLSP “Open” areas. This was reasonable given that, as proposed by the FPPP, the PRT was exploring various scenarios for enhancing panther conservation under the RLSP. However, approximately 13,000 acres mapped by the PRT for potential future development are not owned or controlled by the applicants, and the owners of those lands have not elected to be included in the Proposed HCP (see Figure 2-1, legend item “Eligible for HCP Inclusion (Non-ECPO Lands)”).⁶² Therefore, the PRT Configuration Alternative did not provide a practicable alternative that would allow for 45,000 acres of Covered Activities.

Second, considering only the applicants and their holdings, some of the PRT’s recommendations are not economically feasible, or are not logistically feasible based on land ownership configurations. Some applicants maintain holdings only in areas that the PRT recommended for preservation, yet those applicants possess property and zoning rights that allow for development whether or not the Proposed HCP is implemented. Adopting the PRT Configuration Alternative would eliminate the interests of some of the applicants, causing them to withdraw from the HCP to pursue their interests, and therefore would not achieve the result intended by the PRT.

Third, the PRT’s recommendations are outdated in a number of respects. Some of the recommendations are no longer available due to planning and permitting activities that have occurred during the years since the PRT recommendation was made. Therefore, the PRT Configuration Alternative would eliminate the interests of some applicants, and is not practicable or viable.

On balance, the Proposed HCP provides benefits similar to those proposed by the PRT in 2009. Unlike the PRT Configuration Alternative, however, the Proposed HCP reflects years of negotiation among the eleven landowner applicants that account for land ownership patterns, making the Proposed HCP practicable and both economically and logistically viable.

10.5 ALTERNATIVE SELECTED

The applicants selected the Proposed HCP, which represents the culmination of many years of work and coordination among the applicants, wildlife agencies, conservation partner organizations, Collier County,

⁶² For the lands that are “Eligible for Inclusion (Non-ECPO Lands),” and located outside the 151,442-acre HCP Area, land ownership factors (e.g., fragmented holdings; smaller parcel sizes; legal encumbrances) render it unlikely that many of these areas are practically suited to higher-density development under the RLSP. These land holdings include over 400 parcels with over 250 unique ownership entities, with an average parcel size of 50 acres (Collier County Property Appraiser, 2017).

and citizens, and strikes a careful balance between wildlife conservation, economic development, and the individual private land ownership rights and interests of the applicants.

The No-Action Alternative would not require any preservation of lands for use by the panther or the eighteen other Covered Species. Under the No-Action Alternative, residential development at the level of one dwelling unit per five acres would be allowed throughout the HCP Area under current zoning laws. If applicants chose to participate in the voluntary RLSP, they would be free to pursue development at greater densities than are permitted under base zoning throughout the 71,275 acres of RLSP “Open” lands located within the HCP Area, and to pursue earth mining activities anywhere within the RLSA. All of this could be done without coordination among landowners, and without the landscape-level planning, monitoring, and mitigation that the HCP would provide.

The panther-only alternative would advance conservation goals for the Florida panther, and although other species would likely benefit from a panther-only HCP, the panther-only alternative would not include biological goals and objectives tailored to the eighteen other Covered Species, and would not require monitoring for those species.

The PRT Configuration Alternative does not provide the balance of interests among the eleven applicants that is essential for plan viability, and includes approximately 13,000 acres of land that the applicants do not control. The applicants navigated several years of collaborative discussions, differences of opinion, balancing of individual interests, and final compromises that resulted in the Proposed HCP. Each applicant requires that the chosen plan be economically and logistically feasible for its 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 eleven separate entities, are reasons that developing a viable HCP covering such a large area of diverse private property ownership takes years to complete.

The applicants 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 eighteen other Covered Species within eastern Collier County, linking large areas of existing public lands and private lands to provide regional conservation benefits.

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