United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

March 9, 2005

Colonel Robert M. Carpenter
District Engineer
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Log No.: 4-1-01-F-607
Corps Application No.: 200001926 (IP-SB)
Date: May 25, 2001
Applicant: J.D. Nicewonder, Jr.
County: Collier

Dear Colonel Carpenter:

This document transmits the Fish and Wildlife Service's (Service) biological opinion for the construction and operation of the above referenced project and its effects on the endangered Florida panther (*Puma concolor coryi*) and the endangered wood stork (*Mycteria americana*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). The project site is located in Sections 10, 11, 15, 16, 21, and 22, Township 48 South, Range 26 East, Collier County, Florida (Figure 1).

This biological opinion is based on information provided in the May 25, 2001, U.S. Army Corps of Engineers' (Corps) Public Notice; information provided by Turrell and Associates, Incorporated (Turrell) on October 12, 2001, January 14, 2002, April 26, 2002, and October 25, 2004; the Corps' December 2, 2004, letter to the Service, which transmitted project information prepared by Turrell; information provided by Agnolli Barber and Brundage (ABB); information provided by Johnson Engineering; information provided by WilsonMiller; and meetings, telephone conversations, email, and other sources of information. A complete administrative record of this consultation is on file at the Service's South Florida Ecological Services Office (SFESO), Vero Beach, Florida.

The Corps has received an application for fill and excavation in 587.10 acres of wetlands and other surface waters and to alter 119.33 acres of uplands on a 1,713.53-acre site. The purpose of the project is to construct a residential and golf course community in the northern Collier County vicinity (Figure 2). The project also includes the construction of a 4-foot deep by 200-foot wide flow-way, which will help alleviate upstream flooding in the Bonita Springs community and return the local water levels to more historic norms. The flow-way, which is approximately 3 miles in length, will be constructed from the northeast corner of the project to the Cocohatchee Canal.

The 1,713.53-acre project site is comprised of 1,486.02 acres of jurisdictional wetlands, and 227.51 acres of uplands. Land use and habitat cover types include 219.49 acres of pine flatwoods uplands, 8.02 acres of Brazilian pepper (*Schinus terebinthifolius*) uplands, 4.29 acres of wet prairie, 0.27 acre of cattle pond, 1.43 acres of flag pond, 3.67 acres of Brazilian pepper wetlands, 1.40 acres of mixed hardwood forest, 383.77 acres of melaleuca (*Melaleuca quinquenervia*), 822.56 acres of pine flatwood wetlands, 151.61 acres of cypress, and 117.02 acres of cypress/pine flatwoods mix. The invasive exotic, melaleuca, has encroached into the entire project site, with portions of the site supporting densities greater than 75 percent coverage.

The project is bounded on the north by agricultural (row crop) fields and a recently permitted residential development known as Bonita Beach Road RPD, on the east by natural area and an active mining operation known as Mule Pen Quarry which is still active but is slowly being converted into a residential development known as Heritage Bay, on the west by two proposed developments known as Parklands and Terafina, and by an existing development called Olde Cypress, and on the south by Immokalee Road (SR 846) and the Cocohatchee Canal (Figure 2).

In the Public Notice dated May 25, 2001, the Corps determined the Mirasol project "may affect" the endangered Florida panther, the endangered wood stork, the endangered red-cockaded woodpecker (*Picoides borealis*), and the threatened eastern indigo snake (*Drymarchon corais couperi*). The Corps provided a listed species analysis composed by Turrell and a revised determination by letter dated March 11, 2002, that the project "may affect, but is not likely to adversely affect" the Florida panther, the wood stork, the red-cockaded woodpecker, and the eastern indigo snake. By email response to the Corps dated April 29, 2002, the Service did not concur with these determinations. After reviewing information received from the Corps and the applicant's agent, Turrell, the Service provided the Corps with a letter dated July 11, 2002, concurring with the Corps' revised determination of "may affect, but is not likely to adversely affect" for the red-cockaded woodpecker and eastern indigo snake but not concurring with the Corps' revised determination of "may affect, but not likely to adversely affect" for the wood stork or the Florida panther. By letter dated January 22, 2003, the Service stated it had received all information necessary to initiate formal consultation on both the endangered Florida panther and the endangered wood stork and stated a biological opinion would be provided to the Corps.

As compensation for wetland impacts and impacts to the Florida panther, the applicant proposes to preserve and enhance 914 acres of uplands and wetlands onsite (Figure 2), purchase 10 wetland credits from the Panther Island Mitigation Bank (PIMB), which equates to 47 acres of land in PIMB and 423 panther habitat units (see definition in the Effects of the Action), and purchase, enhance, and preserve sufficient acreage of lands off-site within the vicinity of the Cocohatchee flow-way to provide an additional 32.74 wetland credits and 777 panther habitat units. Total development footprint, including both wetlands and uplands, will be 800 acres on the Mirasol development site. The project is within the boundaries of the primary zone (Kautz et al. In Review) (Figure 3). The project is within the Service's consultation area for the Florida panther (Figure 4) and provides habitat suitable for use for foraging and dispersal. The applicant has proposed to provide compensation for project effects to panther habitat through the

enhancement and preservation of onsite and off-site preserves as well as the restoration of more normal historic local water levels within the Cocohatchee drainage basin.

The proposed onsite compensation is in northern Collier County and is located in the primary zone (Kautz et al In Review) (Figure 3). This 851.42-acre preserve is currently a mixture of hydric and mesic pine (*Pinus elliottii*) and pine/cypress (*Taxodium distichum*) flatwoods, with extensive levels of infestation of the invasive exotic melaleuca. It is situated to the south and west of the National Audubon Society Corkscrew Swamp Sanctuary (Corkscrew) and is connected through other preservation lands to the Corkscrew Regional Ecosystem Watershed (CREW) project (Figure 3). Restoration of wetlands and uplands in this preserve will consist of the restoration of more natural hydrology (water levels) and removal of exotic vegetation, ranging from 5 to 100 percent coverage, averaging 65 to 70 percent.

Two off-site compensation areas are proposed, both in northern Collier County and both in the primary zone. The proposed PIMB compensation site, a 2,778-acre wetlands mitigation bank, historically was a mixture of agricultural fields, hydric and mesic pine flatwoods, and cypress domes and sloughs, with various levels of infestation of the invasive exotics melaleuca and Brazilian pepper. It is situated on the northern and western borders of the Corkscrew. Compensation for panther habitat will be in Phase VI of PIMB, which consists primarily of cypress swamp and pine forest. Restoration of wetlands and uplands in this phase, which have been completed, will consist of the removal of exotic vegetation, ranging from 0 to 25 percent coverage, averaging 14 percent. The 47 acres will provide 423 panther habitat units.

The second site, although the exact location is yet to be determined, will be an area of lands within the CREW watershed that provides the outstanding balance of 32.74 wetland credits and 777 panther habitat units. Habitats in the CREW watershed, in the area of the proposed compensation site, generally are vegetated by a mixture of hydric and mesic pine and pine/cypress flatwoods, with extensive levels of infestation of the invasive exotic melaleuca (exotoc estimates range from 25 to 75 percent coverage) of the sites.

Use of Best Scientific and Commercial Information by the Service

The Service will use the most current and up-to-date scientific and commercial information available. The nature of the scientific process dictates that information is constantly changing and improving as new studies are completed. The scientific method is an iterative process that builds on previous information. As the Service becomes aware of new information, we will ensure it is fully considered in our decisions, evaluations, reviews, and analyses as it relates to the base of scientific knowledge and any publications cited in our documents.

Specifically, there is one such document cited in the biological opinion the Service acknowledges has been affected in its cited form by new scientific information. The Service has taken these new sources of information into account when using this document to help guide our analysis and decisions. This document is the Multi-Species Recovery Plan (MSRP) of 1999. In addition, the Service has examined Kautz et al. (In Review) for its scientific

validity, specifically with regards to comments and recommendations by other reviewers as discussed below.

South Florida Multi-Species Recovery Plan

The MSRP was designed to be a living document and it was designed to be flexible to accommodate the change identified through ongoing and planned research and would be compatible with adaptive management strategies. These principals are set forth in both the transmittal letter from the Secretary of the Interior and in the document itself. As predicted, this is what indeed occurred in the intervening years since the MSRP was published. The Service uses the MSRP in the context it still presents useful information when taken in conjunction with all the new scientific information developed subsequent to its publication.

Kautz et al. (In Review)

The Florida Panther Subteam was charged with developing a landscape-level strategy for the conservation of the Florida panther population in south Florida. The Subteam produced the Landscape Conservation Strategy for the Florida Panther in South Florida in December 2002 and provided it to the Service. Upon receipt, the Service began to use the information in the Landscape Conservation Strategy in its decision making processes and documents. Since then some portions of the science and findings in the Landscape Conservation Strategy have been challenged. Many, but not all, of the Subteam members have refined the methodology, further analyzed the data, and better defined the results of the Landscape Conservation Strategy into a draft article, referred to here as Kautz et al. (In Review), for submission to a professional peer-reviewed journal, Biological Conservation. To date, the authors have responded to two sets of edits on their draft article and are waiting to hear from the journal editor regarding acceptance of the manuscript for publication. In addition, the authors have considered the comments provided by Beier (2003) on the Landscape Conservation Strategy and the recommendations provided by the SRT (Beier et al. 2003) as discussed below. Dr. Jane Comiskey, one of the authors of Kautz et al. (In Review) has expressed some concerns about the manuscript and we have addressed her concerns below as well. We have also addressed issues relating to the ESA and the Information Quality Act.

Beier (2003) Comments on the Draft Landscape Conservation Strategy

Beier provided 37 comments on the Subteam's Landscape Conservation Strategy. Kautz et al. (In Review) addressed all of Beier's comments except those discussed below.

1. Include a statement that when analyses using nighttime data are available, this picture probably will change.

This statement is not in the manuscript, but in this and other Biological Opinions, the Service acknowledges that nighttime and 24-hour data are generally not readily available at this time. Data from GPS collars will be considered when found to be reliable and available.

Availability of nighttime or 24-hour data may possibly change some conclusions about panther habitat in the future. In analyses of puma habitat in California, Beier found that puma show markedly broader habitat use and selection at night compared to daytime (Beier 2003). We expect that when GPS-collar data becomes available, there may be a shift to broader habitat use at night. However, the Service does not solely rely on daytime telemetry in making its decisions regarding panther habitat. The Service considers panther habitat to include all areas required for the panther to live out its full life-cycle, including areas providing food and shelter and supporting characteristic movement such as hunting, breeding, dispersal, and territorial behavior.

2. Explain the witch's finger jutting eastward from the Primary Zone. No panther is going to have a home range 10 miles long and 400 meters wide. Buffer this so that it is at least 1 mile wide at its narrowest points, and 4-5 miles wide in most areas. I support the idea of making this primary habitat, but strongly feel that it does not make sense to make it so narrow.

This was not addressed. This comment relates to the slender portion of the Primary Zone that protrudes eastward at the border of Palm Beach and Broward Counties and the recommendation by Beier that it be buffered to be more inclusive. While Kautz et al. (In Review) did not make this requested modification, this omission has little bearing in this Biological Opinion, which is located in Collier County. The Service considers Primary, Dispersal, and Secondary Zones and other panther habitat along with the best available scientific and commercial data in our analyses and evaluations.

3. Secondary Zone: Overall the approach is *reasonable*, but not *rigorous*. We will probably never have data to make this a rigorous analysis, so it would be unreasonable to demand that. However, if you ran a cursory sensitivity analysis, you can determine how the map varies under different assumptions about cutoff points and relative weights.

According to Kautz et al. (In Review), the Secondary Zone is defined as natural and disturbed lands adjacent to the Primary Zone that may have potential to support an expanding panther population, especially if habitat restoration were possible. A preliminary boundary of a Secondary zone was originally drawn on a hard copy map by the MERIT Panther Subteam. The landscape context of the draft Secondary Zone was evaluated by combining a set of 30-m pixel grids created to measure three habitat-related variables (i.e., proximity to Primary Zone, proximity to a forest plus buffer patch, forest plus buffer patch size) and three land-use variables (i.e., proximity to urban lands, intensity of land use, and road type and density). Pixels in the six data layers were assigned scores of 1-10, with 10 representing the best case for panthers. Equal interval or progressively increasing or decreasing increment functions were applied to each data layer as deemed appropriate. The Secondary Zone boundary was finalized by adjusting the preliminary boundary to conform to results of the landscape context analysis and to land use changes as indicated by recent satellite imagery. To our knowledge, a cursory sensitivity analysis varying the scores assigned to the different variables within each data layer was not run. Therefore, we do not know how a map of the Secondary Zone would vary under different assumptions about cutoff points and relative weights. However, as a group, the Subteam reviewed the draft Secondary Zone boundaries in relation to the results of

the context analyses and recent satellite imagery, and achieved consensus on the adjusted boundaries that best met the definition of the Secondary Zone. Therefore, the Service does not believe the lack of this cursory sensitivity analysis affects the scientific validity of a Secondary Zone nor the Service's ability to use it in Biological Opinions.

4. A density of 1 panther per 11,000 ha is a strange inference from this simple descriptive statistic. The 11,000 ha is simply total area divided by the number of panther home ranges in the area. This is not a sound approach toward estimating minimum forest area for use by panthers.

In the Landscape Conservation Strategy, the MERIT Panther Subteam attempted to identify lands north of the Caloosahatchee River for their capacity to support one or more groups of reproducing panthers. In that process, they assumed that large forest patches, at least 11,000 ha in size, would be needed. This assumption was based on an estimate of population density in optimal habitat given by Maehr et al. (1991).

In conducting a compositional analyses, Kautz et al. (In Review) determined that panther use of forest patches within fixed kernel home ranges south of the Caloosahatchee River differed significantly from random. The smallest forest patch size classes occurred within home ranges in higher proportions relative to their availability than larger forest patch sizes. With this new knowledge, Kautz et al. (In Review) did not repeat the erroneous assumption that forest patches at least 11,000 ha in size are required by panthers. Kautz et al. (In Review) did use 1 panther per 11,000 ha as a rough density estimate along with a density estimate derived from their own analysis (1 panther per 12,919 ha) to provide estimated ranges for the potential number of panthers that could be accommodated by the current configuration of the Primary, Dispersal, and Secondary Zones.

5. Habitat Capacity, "defined as areas with pixel values >3". This definition, it seems, would result in a region with Swiss-cheese holes and outlier bubbles of habitat. Was there a step that involved smoothing to create a "smooth" map? If so, describe that step. If not, acknowledge and describe the nature of the resulting map.

For the purposes of their study, the Subteam developed an estimate of panther population density. Minimum convex polygons of panther home ranges were generated for all Florida panthers by year based on telemetry records through early in 2000 (n=49,889 telemetry locations, 1981-2000). Each polygon was converted to a 100 m pixel grid, and the resulting grids were summed. The region of most consistent panther occupancy for the period of record was defined as areas with pixel values ≥3. This step excluded areas used only once or twice by transient animals. To estimate population density, the total land area within the resulting region of panther occupancy was divided by 62, the estimated size of the panther population in 2000 (McBride 2000). Using this method, the region of most consistent panther occupancy from 1981 through early 2000 covered 800,951 ha. Based on the estimated panther population of 62 individuals (McBride 2000), population density was one panther per 12,919 ha in 2000. Kautz et al. (In Review) did not address the shape or character of the resulting map, nor whether its creation involved "smoothing." However, the resulting size of area of occupancy and

population density they report are consistent with other published information and are considered the most current and up-to-date scientific information available to the Service.

6. "Region of panther occupancy was divided by 62, the estimated size of the panther population in 2000". Need to be specific about whether this refers to resident adults, resident breeding adults, adults plus independent juveniles, or total panthers, including kittens. McBride's estimate, I believe, was "adults plus independent juveniles" and is thus analogous to the estimated density provided by Maehr et al (1991).

This was partially addressed. Kautz et al. (In Review) state that "....estimates place the population at 80-100 adults and subadults (Land and Lacy, 2000; McBride, 2001, 2002, 2003)." Later, where Kautz et al. (In Review) use the estimate of 62 panthers, McBride is cited. According to Kautz et al. (In Review), "To estimate population density, the total land area within the resulting region of panther occupancy was divided by 62, the estimated size of the panther population in 2000 (McBride, 2000)." McBride (2000) clearly indicates that 62 panthers "....includes collared and uncollared, adult and subadult, part-Texas and pure Florida panthers. It does not include kittens at the den site, nor does it include extrapolations." The Service understands that the panther population of 62 in 2000 included adults + subadults and not kittens at the den.

7. "A population of this size would have Ne of ~ 50 breeding adults." This statement needs explanation based on published data, otherwise delete it. Ne is a notoriously difficult parameter to estimate.

No similar statement is in Kautz et al. (In Review) and Ne is not mentioned in the text. However, Ne is in Table 5 of Kautz et al.(In Review). The presence of Ne in Table 5 does not affect the scientific validity of document nor the Service's ability to use it. The effective population size (Ne) is the number of adults in a population contributing to offspring in the next generation. Although we understand that Ne is difficult to estimate, we believe use of it is helpful in the population guidelines given in Kautz et al. (In Review). The Service realizes that the effective population size is generally smaller than the census size and is often much smaller than the census size. Although not specifically discussed in our biological opinions, we factor this into our analyses.

8. It is hard to believe that we cannot "rank agricultural lands as panther habitat" with data already in hand. Don't we already know that unimproved pasture > improved pasture > citrus > row crops?

This has been addressed to some degree. Table 1 of Kautz et al. (In Review) does rank some agriculture lands but not to the level of detail in the comments. The Service has factored the relative value of cover types / habitat types into our analyses and decision-making process during project evaluations and reviews.

9. Please change "long-term survival of the Florida panther" to "long-term survival of the existing population of the Florida panther."

This was not addressed in Kautz et al. (In Review). However, the Service realizes that a single Florida panther population exists in south Florida. Our decision in this Biological Opinion and others are based upon ensuring the survival of the panther population in south Florida while working toward what is needed for recovery throughout the panther's historic range.

Scientific Review Team Report

1. Beier et al. (2003) state that "Telemetry data have been collected for Florida panthers over a long time period (since 1981), but in some analyses of habitat use, the vegetation maps may not have been updated and ground-truthed to stay current with analyses of telemetry data. The SRT has insufficient information to know to what degree this may be a problem, but recommends attention to this potential problem in future analyses."

Kautz et al. (In Review) state that "While researchers have continued to collect telemetry data for radio-collared panthers through the date of this writing, we are reporting the results of the only telemetry data that were available at the time of our collaborative work, and the telemetry data we used were closer in time to the date of the land cover data sets used for habitat analysis." In relation to how this point was addressed in the Kautz et al. (In Review) manuscript, Randy Kautz (FWC, pers. comm. 2004) stated that he "spent several hours at one point zooming in on panther telemetry against a backdrop of recent land cover data, and . . . found very few obvious examples of this being a problem. My own take was that the volume of telemetry data of over 55,000 records was so huge that any currency problems comprised a very small error factor." The Service concurs with Randy Kautz's conclusion and believes that currency errors in such a large sample size would not be significant.

2. Beier et al. (2003) strongly recommends the use of compositional analyses (Aebischer et al. 1993) or another statistically appropriate method to compare the distributions of forest patch sizes available to panthers to those used by panthers.

Kautz et al. (In Review) used compositional analysis to assess the effect of forest patch size on panther habitat use within the study area south of the Caloosahatchee River. This was accomplished by reclassifying upland and wetland forest types into one forest class, determining patch size, and assigning individual forest patches to size classes according to an equal area increment function. Differences in proportions of forest patches within each home range relative to the entire study area were then tested. Kautz et al. (In Review) found that forest patches of all sizes are important to panthers and that the smallest classes of forest patches are especially important.

3. Beier et al. (2003) state "The estimate of 84% to 87% kitten survival (Maehr and Caddick 1995) is indefensible for several reasons."

Randy Kautz (FWC, pers. comm. 2004) stated that "Our PVA models used more recent and realistic survival rates of 0.62."

4. Beier et al. (2003) state "The SRT recommends that any future PVA models should be built from scratch and explicitly consider parameter uncertainty, variation (demographic, environmental) in parameters, and uncertainty in key functional relationships such as density dependence and the effects of inbreeding."

Randy Kautz (FWC, pers. comm. 2004) stated that "We used RAMAS, and I believe we are happy with the results. Our use of RAMAS preceded the SRT report. I personally think that enough PVAs have been done to give us a pretty good picture of the survival potential of the population, but no doubt the next generation of PVA modelers will improve on past work." The Service concurs with this statement and believes that Kautz et al. (In Review) should be considered among the most current and up-to-date scientific and commercial information available and will use this information in our Biological Opinions until new, scientifically peer reviewed and verified data are present.

Dr. Jane Comiskey's February 2005 Comments on Kautz et al. (In Review)

Taken as a whole, Dr. Comiskey's concerns dealt primarily with the addition of text and explanation to Kautz et al. (in review) if it was to be used as a substitute for the Conservation Strategy. The Service agrees that Kautz et al. (In review) is not a stand alone document and must be used in conjunction with the body of scientific literature regarding the panther, including the work of the Panther Subteam.

1. Kautz et al. (In Review) lacks the needed ecological and environmental context to replace the full Landscape Conservation Strategy.

This may be correct in some instances. However, where the Service has cited this document in place of the Landscape Conservation Strategy we have ensured that the information is indeed included in Kautz et al. (In Review) and not part of the larger, more detailed Landscape Conservation Strategy. We believe that Kautz et al. (In Review) captures the major findings of the Landscape Conservation Strategy. Additional ecological and environmental context that is specific to an individual proposed project and proposed project site is included in this and other biological opinions.

2. "The best we know given the current science at hand" indicates that some model assumptions are violated in the existing population and that parameter value estimates for reproductive rates and kitten survival are likely too optimistic. We need to acknowledge that in using model results.

Some parameter value estimates for reproductive rates and kitten survival may be too optimistic. Some estimates of kitten survival have been too high (e.g., 0.80) while others may be too low. It would have been our preference to see a range of kitten survival rates used in the model between the Conservative, Moderate, and Optimistic scenarios as was done with other reproductive parameters used in Kautz et al. (In Review). To our knowledge and that of the authors, the kitten survival rate of 0.62 is the most recent and, as far as we know, most reliable; we do not have a more reliable rate for kitten survival to use.

Sensitivity analyses conducted by Karen Root of the Panther Subteam showed that juvenile survival was the most important variable of those used within the PVA (K. Root, Bowling Green State University, personal communication, 2003). Therefore, we are aware that uncertainty within this parameter may have the greatest consequences on the projected population performance or trajectory. We acknowledge that uncertainties exist, and that we are aware of them, however, we consider the 0.62 kitten survival rate the best available at this time. The Service and the FWC along with our partners will continue to monitor the panther population and the south Florida landscape and incorporate any new information and changes into our decision-making process.

We recognize that model parameters such as this can have effects on model outcomes. The Service is mindful of the limitations that could exist and when making decisions, we ensure through various means that the well being of the species is accounted for.

3. Kautz et al. (in Review) does not include a definition of habitat.

We agree that specifically stating what constitutes panther habitat would be beneficial, however we do not agree that lack of a definition should prevent use of Kautz et al. (In Review). Most biologists have an understanding of what habitat means. We believe that the Service and our counterparts understand what constitutes panther habitat. However, the Service considers panther habitat to be all areas required for the panther to live out its full life-cycle, including areas providing food and shelter and supporting characteristic movement such as hunting, breeding, dispersal, and territorial behavior.

4. We agreed on the Florida Panther Subteam on the importance of ranking land use categories on a scale of adverse to beneficial effects on panthers and evaluating proposed land use changes in the context of this scale. Randy Kautz felt that it would be redundant to include an explicit statement about this approach toward evaluating the impact to panthers of intensification of disturbance within Zones.

The Service believes that ranking land use categories on a scale of adverse to beneficial effects on panthers and evaluating proposed land use changes in the context of this scale would be helpful, but is not necessarily needed to be part of Kautz et al. (In Review).

5. RAMAS PVA Assumptions: we need more discussion of the assumptions associated with the PVA and the degree to which we know these assumptions to be violated in the existing landscape and population.

We are aware of the assumptions used in the PVA analyses and consider these in our decisions. We will acknowledge the degree to which we believe any assumptions are being violated in our documents.

According to Kautz et al (In Review), "All models assumed a 1:1 sex ratio, a stable age distribution, 50% of females breeding in any year, and an initial population of 41 females (82

individuals including males), the approximate population size in 2001-2002 (McBride 2001, 2002). The basic version of each model incorporated no catastrophes or epidemics, no change in habitat quality or amount, and a ceiling type of density dependence. The basic versions of the models incorporated a carrying capacity of 45 females (90 individuals) based on estimated population sizes likely to be supported by the Primary and Secondary Zones (see Sections 4.1 and 4.3)."

The Service acknowledges that some of these assumptions are violated and tries to factor the degrees to which assumptions may be violated into our decisions. For example, the Service is aware that the Panther Subteam had attempted to address the effects of habitat loss by assuming a 25 percent loss of panther habitat over the first 25 years (i.e., one percent per year) of the 100-year model simulation during their analyses. Although the probability of extinction only increases approximately one percent under this scenario, the mean final abundance of panthers was reduced by 26 percent to 31-38 females. The actual likelihood of population declines and extinction can be much higher than the guidelines suggest, depending upon the number of and severity of assumptions violated. The Service realizes that habitat loss is occurring at an estimated 0.8 percent loss of habitat per year (R. Kautz, personal communication, 2003). The Service has tried to account for habitat loss and changes in habitat quality within its regulatory program and specifically through its habitat assessment methodology. For example, we have increased the base ratio used within this methodology to account for unexpected increases in habitat loss. Similarly, we consider changes in habitat quality and encourage habitat restoration wherever appropriate.

With regard to the assumption of no catastrophes, the Service has considered the recent outbreak of feline leukemia in the panther population at Okaloacoochee Slough as a potential catastrophe. However, the FWC is carefully monitoring the situation and it appears to be under control at this time due to a successful vaccination program. However, if the outbreak spreads into the population, the Service will consider this as a catastrophe, and factor this into our decisions.

6. All 3 of the RAMAS PVA model scenarios (conservative, moderate, optimistic) estimate the first year kitten survival rate at 62%, based on the Land/Linda kitten survival analysis from FWC annual panther reports (Shindle et al. 2001, repeated in 2002, 2003, 2004). However, the selective Land/Linda analysis omits without explanation many failed litters documented in denning tables in these same annual reports, resulting in estimates of survival rates that are too optimistic, especially for the purebred Florida component of the population where most failed litters occurred. Even when reliable rates are computed, PVA scenarios should incorporate a range of survival rates, since the high survival rate among introgressed litters in part reflects expansion into unoccupied areas of the range where there is less competition for space and prey. As such, rates could decrease as the range becomes saturated and as inbreeding effects may reappear in the population.

Per Tim O'Meara (FWC pers. comm. 2005) this does include litters that failed. The FWC annual report does include all litters for which FWC was able to get into the den and determine outcome of litters six months later; if litters were not included it was because they

did not meet those criteria (T. O'Meara, pers. comm. 2005). We agree that incorporating a range of kitten survivals into various PVA models would be beneficial in the future. To our knowledge, the kitten survival rate of 0.62 is the most recent and most reliable estimate to use at this time. We will continue to use this estimate until a more reliable estimate is available.

7. We should include a statement acknowledging that the SRT has found serious errors in panther science and has recommended reanalysis of baseline data for the population. We should acknowledge that as a result of errors PVA parameter values may have been overestimated, leading to PVA results that may be too optimistic. In the meantime, decisions should err on the side of the panther.

The Service agrees that the SRT has found serious errors in the scientific literature related to the panther and that reanalysis of baseline demographic data for the population should be done. The SRT has made numerous recommendations, and the FWC and the Service are in the process of prioritizing these based upon need and importance to panther recovery. We realize that PVAs, like any model or analyses, are only as good as the assumptions, parameters, and data used. We believe that Kautz et al. (In Review) used the best available estimates for the parameters within the PVA. We realize that there is a possibility that the PVA results may be too optimistic. We agree that our decisions should err on the side of the panther.

Endangered Species Act/Information Quality Act

1. The ESA states that the Service "shall use the best scientific and commercial data available". However, the vegetation data and land use/land cover maps, as well as the panther telemetry points are several years old.

Most information must be analyzed before it is of use to us. Due to the time for analysis and the extensive and lengthy peer review and publication process, it is not possible for an article to be published in a professional journal before the data becomes a several months to a few years old as is the case in this instance. We believe that Kautz et al. (In Review) constitutes the "best scientific and commercial data available", however, part of the base data and maps are not necessarily the most current.

2. The Information Quality Act Challenge states "The estimate of an 80% pre-introgression kitten survival rate in Maehr et al. (1999, 2002) was based on an indefensible estimate Maehr and Caddick (1995) that was unsupported by data (Beier et al. 2003:47, 49, 143-144)."

Kautz et al. (In Review) used the more current and realistic survival rate of 0.62.

Summary

After carefully reviewing Kautz et al. (In Review) and considering the above recommendations and standards, we believe that Kautz et al. (In Review) should be considered among the best scientific and commercial data available. Therefore, Kautz et al. (In Review) and the analyses

contained therein, along with all other best scientific and commercial data available, is referred to in this document and will be used in our decision making process until or unless new information suggests revisions are necessary.

CONSULTATION HISTORY

On May 27, 1999, the Service met with the applicant's consultants, Turrell and PMS, Incorporated to discuss the proposed development of a 1,558.5-acre tract, containing 115 acres of uplands, into a residential golf course community. The Service identified the Florida panther, wood stork, red-cockaded woodpecker, and eastern indigo snake as species of concern for this project site. The northern two-thirds of the tract are in the CREW, *Save Our Rivers* acquisition boundary. The Service recommended the applicant utilize the southern third of the tract for development.

On November 20, 2000, the Service, the U.S. Environmental Protection Agency (EPA), the Florida Fish and Wildlife Conservation Commission (FWC), and Turrell conducted a site visit of the proposed project. Turrell identified the site plan called for about 600 acres of wetland impacts and construction of a flow-way to relieve flooding in Bonita Springs, Florida.

On February 14, 2001, the Service met with Turrell in Vero Beach, Florida, to discuss the status of *Mirasol* and four other unrelated projects.

On May 25, 2001, the Corps issued a Public Notice for permit application 200001926 (IP-SB) for proposed impacts to 739 acres of jurisdictional wetlands. The applicant proposed to preserve and enhance 611 acres of forested wetlands onsite, preserve and enhance 85 acres of uplands onsite, create 36 acres of marsh onsite, and provide funds sufficient to purchase, preserve, and enhance 205 acres off-site. The Corps provided a determination of "may affect" for the Florida panther, wood stork, red-cockaded woodpecker, and the eastern indigo snake.

On June 22, 2001, the Service transmitted comments to the Corps stating the Service had not received all the information necessary to concur or initiate formal consultation on the proposed action, if necessary, as required in the regulations governing interagency consultations (50 CFR 402.14). The Service requested an alternative site analysis; a detailed narrative of the extent and causes of flooding problems in the Cocohatchee Canal Basin; an analysis of less environmentally damaging, practicable alternatives to alleviate flooding problems in the Cocohatchee Canal Basin; a hydrological analysis of the impacts of the project to wetlands preserved onsite; year-round water levels in Corkscrew Swamp; regional ground water levels; an analysis of the effects to the Cocohatchee River during storm events that exceed design standards; and interagency review of a wetland functional analysis for the project site and any proposed mitigation site. The Service recommended eliminating the golf course or reducing the number of golf course holes from 36 to 18 and clustering all proposed housing units on 31.6 acres of uplands adjacent to Immokalee Road in order to further minimize wetland impacts. The Service notified the Corps, in accordance with the procedural requirements of the 1992 404 (q) Memorandum of Agreement, Part IV, 3(a), that the proposed work may affect aquatic resources of national importance and recommended denial.

On July 17, 2001, the Service transmitted a letter to the Corps, stating that in accordance with the procedural requirements of the 1992 404 (q) Memorandum of Agreement, Part IV, 3(b) the proposed work may affect aquatic resources of national importance and recommended mutual resolution of wetland and wildlife concerns at the field level prior to any decision to issue the permit.

On July 23, 2001, the Service received a request from Turrell for information on the location of current and historical red-cockaded woodpecker colonies in the immediate area of *Mirasol* and *Terrafina*. On August 20, 2001, the Service transmitted the requested red-cockaded woodpecker colony information to Turrell.

On October 12, 2001, Turrell transmitted to the Corps and the Service a revised project description, reducing proposed wetland impacts to 664 acres and increasing the onsite preserve to 933 acres. Turrell also included the following: a Wetland Rapid Assessment Procedure (WRAP) summary for *Mirasol*; an ecological assessment; an alternative sites map; an eastern indigo snake management plan; an integrated pest management plan; a project location map; a vegetative cover map; a listed species survey; a mitigation plan; a monitoring and maintenance plan; a Cocohatchee flow-way report; *a Mirasol* flow-way hydrologic and vegetative report; a letter of project support from the CREW Land and Water Trust; and a hydrologic modeling report. The transmittal also included panther telemetry data, deer census information, rainfall model data, and aerial photographs of the project site. The information on South Florida slash pine (*Pinus elliotti* var. *densa*) basal area and a groundwater study report were referenced in the ecological assessment but not included in the package.

On January 10, 2002, the FWC transmitted a letter to the South Florida Water Management District (District) stating the revised project addressed their wildlife issues and concerns. The FWC requested the applicant prepare a flow-way preserve management plan as a condition of the District permit.

On January 14, 2002, Turrell and the applicant's legal representation, Lewis, Longman and Walker, P.A. (LLW), transmitted a January 2002 *Biological Assessment* to the Corps and the Service. The biological assessment evaluated the direct, indirect, and cumulative effects to the Big Cypress fox squirrel (a State-listed species), the eastern indigo snake, the wood stork, the red-cockaded woodpecker, and the Florida panther, and concluded there would be no direct "take" of these species, the indirect effects of the project were either neutral or beneficial to these species, and the proposed project would not jeopardize these species.

On February 6, 2002, the Service met with the applicant's engineer, ABB, Turrell, and LLW in Bonita Springs, Florida.

On March 11, 2002, the Corps transmitted a letter to the Service containing a February 2002 *Listed Species Analysis* prepared by Turrell evaluating the direct, indirect, and cumulative effects to the Big Cypress fox squirrel, the eastern indigo snake, the wood stork, the red-cockaded woodpecker, and the Florida panther. The analysis concluded there would be no direct "take" of these species, the indirect effects of the project were either neutral or beneficial to these species and concluded the proposed project would not jeopardize these species. The Corps provided a

revised determination of "may affect, not likely to adversely affect" for the eastern indigo snake, the wood stork, the red-cockaded woodpecker, and the Florida panther and requested concurrence with the revised determination.

On April 26, 2002, Turrell transmitted, to the Service, a color copy of the October 2001 *Ecological Analysis*, the May 1999 *South Lee County Watershed Plan*, and the June 1999 *Cocohatchee Canal Phase 4 Improvements Hydrologic-Hydraulic Assessment.*

On April 29, 2002, the Service transmitted an email to the Corps, stating the Service could not concur with the revised determination of "may affect, not likely to adversely affect" for the eastern indigo snake, the wood stork, the red-cockaded woodpecker, and the Florida panther. The Service also informed the Corps the hydrological data for the project were being reviewed by the Service's staff hydrologist.

On May 1, 2002, Turrell transmitted an email to the Service requesting an explanation as to what had changed since the February 6, 2002, meeting in Bonita Springs, Florida, when the Service stated the primary concerns were about Section 404 issues and the Florida panther and concurrence with a "may affect, not likely to adversely affect" for the eastern indigo snake, wood stork, and the red-cockaded woodpecker were possible.

On May 6, 2002, ABB transmitted a regional flow-ways map and a generalized contour map keyed to the area covered by the South Lee County Watershed Plan to the Service.

On May 7, 2002, the Service transmitted an email to the District, Corps, EPA, and FWC, concerning the possible effects of the proposed project's interbasin transfer of water from the Imperial watershed to the Cocohatchee River, Naples Bay, and South Golden Gate Estates. The Service requested information from the District on how this project would affect ongoing watershed conservation and restoration efforts.

On May 31, 2002, Turrell transmitted a letter to Congressman Goss, the Corps, the Service, LLW, ABB, and the applicant. A chronology of applicant-agency interactions was attached.

On June 3, 2002, the Service, via telephone, spoke with ABB about the Sheet 2D model and the 10-acre cell vegetation map prepared by Boylan Environmental Consultants, Incorporated. The Service requested information concerning the Mirasol boundary conditions added to the *South Lee County Watershed Plan* hydrological analysis, the rate of flows in the flow-way, and the factors influencing the rate of flow. The Service also requested daily stage hydrographs for Sections 10, 11, 12, 15, 16, and 21, Township 48 South, Range 26 East, Collier County, Florida.

On June 3, 2002, the Service, via telephone, spoke with Turrell to request additional information concerning potential effects to the Florida panther, red-cockaded woodpecker, wood stork, and eastern indigo snake. The Service informed Turrell formal consultation on the wood stork was likely and consultation would not be initiated until hydrological questions about upstream impacts on the wood stork colony were addressed.

On June 6, 2002, Turrell transmitted to the Service the groundwater study report inadvertently omitted from the October 2001 *Ecological Analysis*.

On June 11, 2002, the Service transmitted an email to ABB requesting they be prepared to discuss the hydrological analysis in technical detail at the June 25, 2002, meeting, in order to ascertain the effects of the flow-way on the Corkscrew wood stork colony.

On June 13, 2002, the Service transmitted an email to ABB, listing 17 detailed questions concerning the hydrological analysis to be discussed at the upcoming June 25, 2002, meeting.

On June 24, 2002, ABB submitted a CD to the Service containing some raw data from their hydrological analysis.

On June 25, 2002, the Service hosted a meeting with Turrell, ABB, and LLW in Vero Beach, Florida, to discuss the effects of the flow-way on the Corkscrew wood stork colony. ABB did not prepare a response to the Service's list of questions transmitted on June 13, 2002.

On July 1, 2002, Turrell transmitted a letter to the Service confirming the additional information requested by the Service at the June 25, 2002, meeting in Vero Beach, Florida.

On July 8, 2002, the Service met with the District to discuss the water budget for the Cocohatchee watershed and the proposed Mirasol project. Concern was raised over the amount of flow the proposed Mirasol flow-way could accept versus the amount of potential flow proposed by the South Lee County Watershed Plan. The proposed Mirasol flow-way addressed District concerns about peak 25-year storm events. The Service maintained a preference for wetland preservation and restoration to maintain and increase water storage capacity.

On July 11, 2002, the Service transmitted a letter to the Corps providing concurrence with the Corps' March 11, 2002, revised determination of "may affect, not likely to adversely affect" for the red-cockaded woodpecker and the eastern indigo snake. The Service did not concur with the revised determination of "may affect, not likely to adversely affect" for the Florida panther and the wood stork. Information provided to date indicated the proposed project would increase peak water levels and duration in Corkscrew Swamp during 1-in-25 year and 1-in-100 year, 3-day extreme rainfall events. The ecological integrity of onsite wetlands would be compromised by a delay in the onset of rainy season water levels and an acceleration of the dry season drawdown. The Service requested a rainy season site visit and stated it was working with the applicant to complete an initiation package.

On July 18, 2002, Turrell transmitted a letter to the Service providing the information requested at the June 25, 2002, meeting. Specifically, Turrell provided topographic information gathered during the permitting process, Hydrologic Engineering Centers River Analysis System station maps, elevation information used for the vegetative analysis, aquifer drawdown information calculated for the District permit, a summary of the methodology used in derivation of the synthetic wet season rainfall data set, and a table of water elevations and durations used for the vegetative analysis.

On July 23, 2002, the Service transmitted an email to Turrell stating the Service had concurred with the Corps' March 11, 2002, revised determination of "may affect, not likely to adversely affect" for the eastern indigo snake and red-cockaded woodpecker but it could not concur with the revised determination of "may affect, not likely to adversely affect" for the wood stork and Florida panther. The Service indicated the project site was large, comprised of suitable panther habitat, adjacent to an area used by panthers, and was therefore likely being used by panthers. The Service also indicated the consultation initiation package was complete for the panther but not for the wood stork and offered dates for the next meeting and a rainy season site visit, and requested the Corps and EPA be invited to attend.

On July 25, 2002, Turrell transmitted a table to the Service indicating the Habitat Evaluation Hydrological Parameters used in the models for the proposed project.

On August 1, 2002, Turrell transmitted a letter to the Service requesting a meeting to resolve remaining wood stork concerns.

On August 5, 2002, the Service transmitted an email to Turrell stating the applicant had not fully addressed the information requested at the June 25, 2002, meeting. The Service requested a recorded history of observed changes in regional water levels, a complete record of topographic information gathered during the permit process (the data provided did not extend to the western property boundary), and an explanation of how the proposed nine-tenths foot drawdown, allowed by the District consumptive use permit, would effect forage fish, wading birds, and wood storks.

On August 8, 2002, the Service transmitted a facsimile to the EPA stating the permit application was not consistent with State and Federal ecosystem restoration programs, the State water supply planning process, or Minimum Flows and Levels legislation, and did not properly balance flood control objectives with fish and wildlife concerns.

On August 9, 2002, the Service and the EPA transmitted a co-authored letter to the Corps. The letter complemented the Corps for coordinating the information exchange on a complex multi-party project. The Service and the EPA expressed continued concern about the direct, secondary, and cumulative impacts of the project in conjunction with several others proposed in the same watershed to fish and wildlife species, including endangered species, and the appropriateness of the project purpose in the context of regional, State and Federal restoration efforts.

On August 12, 2002, the Service transmitted a letter to the Corps stating the Service must fully understand the local and regional impacts of the proposed changes in hydrology on the wood stork before formal consultation could be initiated. The Service indicated much of the information requested in the Service's June 13, 2002, email still had not been provided. The Service also indicated, per model outputs provided, decreased water levels in onsite and adjacent wetlands combined with a shorter hydroperiod would reduce the numbers and diversity of macro-invertebrates, thus providing less prey for wading birds and the wood stork. The Service stated since the surface and groundwater models had not been integrated, the cumulative effects

to fish and wildlife resources could not be evaluated. The Service expressed concern about the use of 1995 rainfall and water level data for the South Lee County Watershed Plan surface water model and 1998 synthetic wet season rainfall data for the Mirasol surface water model and how the two data sets were integrated. Finally, the Service expressed concern that a contradiction in the use of actual field data or synthetic data to determine onsite hydrology could compound errors in the WRAP results.

On August 12, 2002, Congressman Porter Goss transmitted a letter to the Service inquiring about the status of the Service's review of the project. Attached to the letter was a chronology of events constructed by Turrell who expressed frustration at the "lack of progress" in the review of the project. Congressman Goss referred to a similar request dated June 13, 2002, which the Service determined had been lost in the mail during the switch from a post office to a street address.

On August 16, 2002, the EPA transmitted an email to the Corps and the Service. The EPA expressed concern the property did not exhibit any sign of runoff, despite 25 inches of rain in May through July and suggested infiltration rates may exceed precipitation rates during years of average rainfall and the hydrological model inputs and outputs should therefore be more closely examined. The EPA indicated hydrological data requested to date had not yet been received and the onsite water table depth data were crucial to calculating pre-development versus post-development pollutant loading rates. The EPA asked a series of questions about how the offsite flow rates were calculated and about how "average" rainfall conditions were determined. The EPA stated the post-development discharge rate should equal the pre-development discharge rate and the post-development aquifer recharge rate should equal or exceed the pre-development rate in order to reduce impacts to aquatic resources onsite and downstream. The EPA also asked a series of questions regarding impervious areas, onsite water retention parameters, daily water budgets, and the interaction of groundwater and surface water.

On August 22, 2002, Congressman Porter Goss transmitted a third inquiry to the Service stating the applicant had received approval from the District regarding the flow-way, the applicant had in good faith met the demands of the Service, and wondered why the modeling data were being questioned for the first time since May 2000.

On August 28, 2002, the Service transmitted a letter to Congressman Porter Goss apologizing for the loss of the June 13, 2002, letter. The Service pointed out Turrell's chronology documented at least 19 interactions between October 2001 and August 2002. The Service also indicated information requested from the Corps on June 22, 2001, July, 11, 2002, and August 12, 2002, as well as from ABB on June 13, 2002, had not yet been received.

On August 30, 2002, the Service transmitted an email to the Corps, requesting the raw data provided on a CD dated June 24, 2002, be portrayed as charts, graphs, etc., and stated the Service had not yet received a copy of the June 25, 2002, power point presentation, or LLW's notes promised to participants in the June 25, 2002.

On September 19, 2002, LLW transmitted a letter to the Corps providing the requested power point presentation and a typed summary of the June 25, 2002, meeting.

On September 24, 2002, the Corps hosted a meeting with the Service in Fort Myers, Florida to discuss the proposed Mirasol flow-way and hydrological analysis.

On October 4, 2002, LLW transmitted a letter to the Corps in response to the joint Service and EPA letter dated August 9, 2002, and the Service letter dated August 12, 2002. LLW stated the flow-way was an improvement the District required in order to permit the project and the Service and EPA misunderstood the purpose of the flow-way which was designed to reduce unnaturally high water levels onsite due to a regional loss of water storage and conveyance. The letter then responded to each of the points raised in the August 9 and August 12, 2002, letters.

On October 7, 2002, Turrell transmitted a letter to the Corps indicating the initial model output, showing an increase in stages at Corkscrew [cell 25, 12] during a 25-year, 3-day event and during the wet season was due to the input of a faulty rainfall data set. Having corrected the error, the model now showed pre-project and post-project stages at Corkscrew [cell 25, 12] were identical during a 25-year, 3-day event and during the wet season. The letter also provided an Exhibit C showing the revised 25-year, 3-day event stages at Corkscrew [cell 25, 12] intended to correct results shown in the South Lee County Watershed Plan at Appendix pages A-63 through A-70.

On October 7, 2002, ABB transmitted a memorandum to the Corps providing a graphical representation of the data submitted by CD dated June 24, 2002. Turrell submitted the same information to the Service on October 22, 2002.

On December 10, 2002, Turrell transmitted a letter to the Service providing their June 2001 Pine Forest Analysis.

On December 13, 2002, the Corps transmitted a letter to the Service reiterating their determination of "may affect, not likely to adversely affect" for the wood stork and requesting initiation of formal consultation for the Florida panther. The Corps provided a revised project description. The Mirasol project had been expanded to include 155.05 acres, which were added to the wetland preserve and enhancement area.

On January 7, 2003, ABB transmitted a letter to the Corps and the Service providing corrections to the South Lee County Watershed Study, specifically addressing the Corkscrew cells.

On January 22, 2003, the Service transmitted a letter to the Corps, initiating formal consultation and indicating a final biological opinion would be provided to the Corps on or before February 21, 2003.

On February 14, 2003, the Service provided its draft biological opinion to the applicant, finding the Mirasol project was not likely to jeopardize the continued existence of the Florida panther and wood stork.

On February 21, 2003, the Service provided its final biological opinion to the Corps, finding the Mirasol project was not likely to jeopardize the continued existence of the Florida panther and wood stork.

On December 16, 2003, the Service transmitted via facsimile to the Corps, the Service's hydrological analysis for the Mirasol project upon which the Service's take analysis for wood storks was based.

On September 15, 2004, the Corps requested the Service reinitiate consultation concerning the Florida panther for several projects in southwest Florida, including the Mirasol project.

On October 18, 2004, the Service acknowledged the Corps' request for reinitiation and requested additional information to facilitate their analysis.

On October 25, 2004, the applicant transmitted to the Service information requested by the Service to provide an updated environmental baseline for the Mirasol project and to better assess the direct, indirect, and cumulative effects to listed species from the project.

On November 4, 2004, the Service requested, via email, additional information regarding the most recent project description and updated hydrological analysis of the project.

On December 2, 2004, the Corps forwarded the information requested on November 4, 2004, to the Service.

On January 26, 2004, the Service hosted a meeting with Turrell and LLW in Vero Beach, Florida, to discuss the status of the revised biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Proposed Action

The applicant proposes to develop a 1,713.5-acre site into an 800-unit, 36-hole, residential golf community to be known as Mirasol (Figure 2). The site consists of 227.51 acres of uplands and 1,486.02 acres of jurisdictional wetlands. Specifically, the site consists of 219.49 acres of pine flatwoods uplands, 8.02 acres of Brazilian pepper uplands, 4.29 acres of wet prairie, 0.27 acre of cattle pond, 1.43 acres of flag pond, 3.67 acres of hydric Brazilian pepper wetlands, 1.40 acres of mixed hardwood forest, 383.77 acres of melaleuca, 822.56 acres of pine flatwoods wetlands, 151.61 acres of cypress, and 117.02 acres of cypress/pine flatwoods mix. The invasive exotic, melaleuca, has encroached into the entire project site, with portions of the site supporting densities greater than 75 percent coverage.

The site development plan has gone through several iterations since the Corps issued the public notice on May 25, 2001. The initial site plan proposed direct impacts to 739 acres of wetlands. The October 12, 2001, final site development plan proposes to directly impact 587 acres of

wetlands and secondarily impact 72 acres of wetlands. Total wetland impacts have been reduced by 11 percent, and direct wetland impacts have been reduced by 21 percent. In addition, the applicant has expanded the project site from the originally proposed 1,558.48 acres to 1,713.53 acres by purchasing an additional 155.05 acres on the northeast corner of the project site, immediately adjacent to the CREW, for preservation. The plan also proposes to construct a flow-way that will help alleviate upstream flooding, predominately in the Bonita Springs community, and return regional water levels to more historic norms. The flow-way was identified by the District as a needed water conveyance system in the Cocohatchee basin necessary to relieve peak seasonal high water stages in adjacent upstream urban communities and range and agricultural lands. Historical drainages and flow-ways within the Cocohatchee basin, which have been altered through these land conversions, no longer provide the same level of drainage and volumes historically present in this basin. The documented results of this restrictive flow are: increased peak flood events in the urban communities; frequent flooding of agricultural fields, which were historically only seasonally flooded; and a vegetative community change from a mixed, open grassland/saw palmetto (*Serenoa repens*) community, which was only seasonally flooded, to one flooded frequently.

The majority of the flow-way direct impacts will be concentrated in the heavily disturbed wetlands, which contain exotic vegetation and altered hydrology. The flow-way will be 4 feet deep and 200 feet wide, except in two areas, which are proposed for an 8-foot depth. The additional depth was designed in response to comments from the FWC and the Service to provide a year-round open water source to serve as refugia for aquatic organisms during the dry season. In order to minimize impacts to CREW all residential and golf course development is planned within the southern portion of the project site.

According to the Corps' May 25, 2001, public notice, the proposed flow-way continues off the project site onto two neighboring projects, Terafina and Olde Cypress Golf Club. Permit applications have been received to construct the downstream segment of the flow-way; however, the applicant for Mirasol has obtained authorization to construct the entire flow-way if permitting for the other segments is proposed. Therefore, according to the public notice, the downstream segments of the flow-way, including any required mitigation, are being evaluated as part of the Mirasol development. The Terafina portion of the flow-way will be located within a 217-acre tract consisting of 212.15 acres of wetlands and 4.87 acres of uplands. The 23.41-acre flow-way will be excavated from 23.35 acres of wetlands and 0.06 acre of uplands. The remaining area will be enhanced and placed under a conservation easement as part of the Terafina permit. The Olde Cypress Golf Club portion of the flow-way will be located within an existing 177.4-acre preserve under a conservation easement. Approximately 29.2 acres of forested wetlands will be excavated. No mitigation was discussed in the public notice for wetland impacts from construction of the off-site portions of the flow-way. However, as part of this project, the applicant is providing mitigation for wetland impacts from the construction of the flow-way through off-site properties.

As mitigation for onsite wetland impacts, the applicant will preserve and enhance 47.33 acres of wetlands within the development, and 745.47 acres of wetlands within the flow-way preserve for a total of 792.8 acres of wetland preservation and enhancement. Four wetlands will be preserved

within the development, ranging from 8 to 18 acres in size, totaling 48.05 acres with the uplands also preserved. All exotic vegetation will be removed and the preserved wetlands will be incorporated into the onsite water management plan to ensure a proper hydrologic regime is maintained. Approximately 71 acres of wetlands will be retained within the development as buffers along the golf course. Although these wetlands are secondarily impacted and will not be placed under conservation easement, they may serve as important wildlife corridors within the development.

The flow-way preserve contains 745.47 acres of forested wetlands, 105.95 acres of uplands, and 36.5 acres of marsh flow-way conveyance. Vegetation communities within the flow-way preserve include cypress swamp, hydric and upland pine flatwoods, and wet prairie. An extensive exotic eradication program will be implemented within the flow-way preserve to remove melaleuca. All clearing will be done by hand in order to preserve as much existing native vegetation as possible. Following initial clearing, the flow-way will be maintained at a density of less than 4 percent exotic and nuisance plant cover for perpetuity.

In addition to the onsite mitigation summarized above, the applicant is proposing additional conservation measures to minimize direct and indirect effects to the panther and panther habitat and direct and indirect effects to the wood stork and wood stork habitat. The applicant will purchase 10 credits from PIMB, which equates to 423 panther habitat functional units and equates to 47 acres of land in PIMB; and purchase, enhance, and preserve sufficient lands within the vicinity of the Cocohatchee flow-way to provide an additional 32.74 wetland credits and 777 panther habitat functional units (estimated to be approximately 98 acres, based on existing habitat values of onsite preserve lands). Flow-way marsh areas will be planted with appropriate native vegetation to provide foraging habitat for the wood stork and littoral shelves have been incorporated into the design of the flow-way to provide foraging habitat for wading birds.

All preserved areas will be placed under a conservation easement granted to the District. However, the lands in the flow-way preserve will be donated to CREW. Two wildlife displays featuring "Cypress Domes of Southwest Florida" and "Pine Flatwoods of Southwest Florida" will be placed on 3-foot by 4-foot displays installed in several prominent locations throughout the development. Additional 8.5 inch by 11 inch copies will be available in the clubhouse. Once the restoration and enhancement activities within the flow-way preserve areas are deemed successful, the vegetated portion of the flow-way preserve areas will be donated to CREW and an escrow account will be set up to pay for the perpetual maintenance of the area when CREW accepts the property.

The proposed project is bounded on the north by agricultural land and the recently permitted BBR residential project, on the east by Broken Back Road and Mule Pen Quarry (aka *Heritage Bay*, a proposed residential golf course community), on the south by Immokalee Road (CR 846), and on the west by a residential golf course community known as *Olde Cypress*. The site is located in Sections 10, 11, 15, 16, 21, and 22, Township 48 South, Range 26 East, Collier County, Florida.

Action Area

Florida Panther

Movements of Florida panthers are much larger than the project site; and therefore, the action area is larger than the proposed action area identified by the Corps' public notice. The action area, which is a subset of the current panther range, includes those lands the Service believes may experience direct and indirect effects from the proposed development. Maehr et al. (1990a) monitored five solitary panthers continuously for 130-hour periods seasonally from 1986 to 1989, rarely observing measurable shifts in location during the day, but nocturnal shifts in location exceeding 20 kilometers (km) (12.4 miles) were not unusual. Maehr et al. (2002) in a later report documents a "mean maximum dispersal distance" of 42.3 miles (68.4 km) for subadult males and 12.6 miles (20.3 km) for subadult females. In the same report Maehr et al. (2002) documents a "mean dispersal distance" of 37.3 km for subadult males. Dispersal patterns tend to be circular and of insufficient length to ameliorate inbreeding. Comiskey et al. (2002) documents a "mean dispersal distance" for subadult male panthers as an average distance of 40.1 km (24.8 miles) from their natal range, which is similar to the dispersal distance referenced by Maehr et al. (2002), and is the basis of the Service's action area determination.

Therefore, for both direct and indirect effects, the action area (Figure 5) is defined as all lands within a 25-mile radius of the Mirasol development. This action area does not include urban lands, lands west of Interstate 75 (I-75), and lands outside the Service's panther consultation area. This action area includes areas anticipated to sustain direct and indirect effects, such as roadways experiencing increased traffic, areas with increased human disturbance (project area and periphery of project), and areas in which habitat fragmentation and intraspecific aggression may be felt.

Wood Stork

The Service has determined the action area for the wood stork is larger than the proposed action area identified in the Corps' public notice. We note the project site is located within 18 miles of three active wood stork nesting colonies. Two of these colonies are located within the Corkscrew approximately 5.5 miles and 6.6 miles northeast of the project site. The third wood stork nesting colony is located approximately 16.5 miles east of the project site, just north of the Fakahatchee Strand State Preserve. Coulter and Bryan (1993) found that 85 percent of wood stork foraging occurs within 12.5 miles of the nesting colony. Furthermore, the FWC considers the area within 18.6 miles of the nesting colony as the Core Foraging Area (CFA) for wood storks. For the purposes of this biological opinion, the action area is considered to include the project site and the CFAs of the three wood stork nesting colonies described above. The action area encompasses 1,621.1 square miles of Collier, Lee, and Hendry Counties (Figure 6).

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE

Florida Panther

The State of Florida declared the panther a game species in 1950, gave it complete protection in 1958, although not an official designation, and closed the hunting season. The Federal government listed the panther as endangered in 1967 (32 FR 4001). Heavy hunting and trapping, an inability to adapt to changes in the environment, and land development were cited as reasons for the species decline. Critical habitat has not been designated for the Florida panther; therefore, none will be affected.

Species Description

The Florida panther was first described by Charles B. Cory in 1896 as *Felis concolor floridana* based on a specimen he collected in Sebastian, Florida (Hall and Kelson 1959). Bangs (1899); however, noted *Felis floridana* had previously been used for a bobcat and, believing the panther was restricted to peninsular Florida and could not breed with any other form, assigned it full specific status as *Felis coryi.* The taxonomic classification of the *Felis concolor* group was revised by Nelson and Goldman (1929), and the panther was assigned subspecific status as *Felis concolor coryi.* This designation also incorporated *Felis arundivaga*, which had been classified by Hollister (1911) from specimens collected in Louisiana. Detailed descriptions of each of the subspecies are provided in Young and Goldman (1946) [30 subspecies] and Hall (1981) [27 Subspecies]. The genus *Felis* was recently revised so all mountain lions, including the Florida panther, were placed in the genus *Puma* (Nowell and Jackson 1996).

The Florida panther is a medium-sized mammal described as dark tawny in color, with short, stiff hair (Bangs 1899), and having longer legs and smaller feet (Cory 1896) than other puma subspecies. Adult males reach a length of 2.15 m (7 feet) from their nose to the tip of their tail and may reach or exceed 68 kilograms (kg) (150 pounds) in weight, but typically average around 54.5 kg (120 pounds). They stand approximately 60 to 70 centimeters (cm) (23 to 27 inches) at the shoulder. Adult females are smaller with an average weight of 34 kg (75 pounds) and length of 1.85 m (6 feet). The skull of the Florida panther has been described as having a broad, flat, frontal region, and broad, high-arched or upward-expanded nasals (Young and Goldman 1946).

The coat of an adult Florida panther is unspotted and typically rusty reddish-brown on the back, tawny on the sides, and pale gray underneath. The long cylindrical tail is slender compared to some of the other subspecies of *Puma concolor* (Belden 1989). Florida panther kittens are gray with dark brown or blackish spots and five bands around the tail. The spots 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 turn to the light-brown straw color of the adult (Belden 1989).

Three external characteristics are often observed in Florida panthers that are not found in combination with other subspecies of *Puma concolor.* These characteristics are 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, light flecking on the head, nape, and shoulders (Belden 1986). The light flecking may be a result of scarring from tick bites (Maehr 1992a; Wilkins 1994). The kinked tail and cowlicks are considered manifestations of inbreeding (Seal et al. 1994).

Life History

Panthers are essentially solitary. Interactions between adult females and their kittens are most frequent. Interactions between adult male and female panthers are second in frequency, last from 1 to 7 days, and usually result in pregnancy. Conflicts between males are common and often result in serious injury or death to some individuals. Between October 1984 and June 2004, there were 36 known deaths attributed to intraspecific aggression (FWC 2004). While most of those were between males, one-third occurred between male and female panthers resulting in 12 deaths of females (FWC 2004). Overall, the amount of mortality from intraspecific aggression appears to be increasing with a total of 13 mortalities during the first 10 years of study and nearly double that in the second 10 years (FWC 2004). In addition, the extant of mortality in female panthers from intraspecific aggression appears to be increasing. Since 1995, 10 of the 23 known deaths from intraspecific aggression were female panthers, whereas in previous years only 2 of 13 such deaths were females (FWC 2004). Densities of Florida panthers have increased in the last decade. Higher densities may lead to increases in panther interactions and aggressive conflicts between male panthers, and male and female panthers. However, aggressive encounters between females have not been documented (Maehr et al. 1991a).

Panther activity levels peak around sunrise and sunset. The lowest activity levels occur during the middle of the day. Females at natal dens follow a similar pattern with less difference between high and low activity periods. Although some travel occurs during the day, panthers are mostly crepuscular (Maehr et al. 2004). There are no known differences in seasonal movements, wet and dry season habitat use, seasonal variation in diet, or effects of season on road crossings. Responses to fluctuations in water levels are believed to be not significant (Maehr et al. 1989; Maehr et al. 1990b, 1991a).

Habitat: Maehr (1990a) estimated the occupied range of the panther in 1990 to be 2.2 million acres (880,000 ha) in south Florida. Logan et al. (1993) estimated the range to be 3.1 million acres (1,254,500 ha), which is roughly 5 percent of its historic range. The area of most consistent panther occupancy from 1981 through early 2000 was estimated by Kautz et al. (In Review) to be 2 million acres (800,951 ha). Native landscapes within the Big Cypress Swamp region of south Florida, within occupied panther range, are dominated by slash pine, cypress, and freshwater marshes, interspersed with mixed-swamp forests, hammock forests, and prairies. Private lands represent about 25 percent of the primary, secondary, and dispersal zones in south Florida (Kautz et al. In Review). The largest contiguous tract of panther habitat is the Big Cypress/Everglades ecosystem in Collier, Monroe, and Miami-Dade Counties. Suitable habitat also extends into Lee, Hendry, Charlotte, Glades, Broward, Palm Beach, Highlands, Sarasota, Polk, Osceola, Hardee, and Desoto Counties. Some researchers are of the belief the low nutrient, frequently saturated soils prevalent south of I-75 in south Florida do not produce the quality or quantity of forage required to support large herds of white-tailed deer (*Odocoileus virginianus*), a dominant prey species for panthers (see below), and believe it is

unlikely habitat in Big Cypress National Park (BCNP) and Everglades National Park (ENP) is as productive as habitat on private lands in northern and western Collier County in terms of panther health, reproduction, and density (Maehr 1992a). However, more recent reports provide contradictory information (McBride 2002 and 2003). In addition, according to Beier et al. (2003), the conclusion that ENP and BCNP are poor habitats for panthers is not scientifically supported.

Forests provide important diurnal habitat for panthers. Belden et al. (1988) reported Florida panthers use hardwood forests and mixed swamps more than would be expected based on their occurrence in the landscape. While panthers may seek upland forests for daytime resting, as indicated by telemetry data, Kautz et al. (In Review) confirmed that panthers also utilize non-forest cover types interspersed in landscapes of forest patches, including freshwater marsh, prairie and shrub lands, agricultural lands, and pasture lands.

Telemetry data are the best available information about daytime panther habitat use. However, there are limitations and assumptions that should be stated about any conclusions based on telemetry data. Beier et al. (2003) points out several biases in research by Maehr and Cox (1995) in relating the importance of forests as panther habitat. These biases are stated to result from the use of daytime telemetry locations to describe habitat use, the selective use of telemetry data, and using location of telemetry versus panthers as a sampling unit. First, the panther telemetry data is collected in the morning, which creates a disjuncture between the time of data collection (beginning shortly after 7:00 am) and the times of peak panther activity (dawn and dusk). Habitat selection by panthers may be considerably broader at dawn and dusk (Beyer and Haufler 1994; Rettie and McLoughlin 1999). Second, the majority of panthers that have been radio-collared were on public lands. Telemetry research began in the Fakahatchee Strand State Preserve in 1981 (Belden et al. 1988) and gradually expanded to include BCNP, ENP, Florida Panther National Wildlife Refuge (Florida Panther NWR), Picayune Strand State Forest, Okaloacoochee Slough State Forest, and CREW. It also expanded to include some telemetry data research on private lands in Collier, Hendry, Glades, and Lee Counties. Lastly, tests of the accuracy of some of the telemetry locations revealed the difference between the actual location of the transmitter and the recorded location averaged 77 m (Dees et al. 2001) and can be as large as 230 m (Belden et al. 1988). These results were obtained by placing test transmitters in known locations in the field, plotting transmitter locations from the air, and then determining the error of actual versus observed locations.

A more recent analysis (Maehr et al. 2004) suggests some likelihood daytime telemetry locations are not dissimilar to areas used by panthers at night. However, 24-hour telemetry has not returned enough data to fully address this question. Maehr et al. (1990b) found panthers were very active around sunrise, a time of day well represented by aerial telemetry data, but that Comiskey et al. (2002) claims is missing from previous analyses of panther habitat use. Although it is not known exactly what behavior each animal was engaged in at the time these data were collected, it likely included a variety of activities, *e.g.*, walking, hunting, feeding, grooming, and resting. However, Maehr et al. (2004) believes daytime telemetry data include periods during which panthers are quite active. Although Maehr et al. (2002) did not compare habitats recorded by observers during periods of activity (as indicated by mercury tip switches or radio-collars) to habitats available to the panther.

The Florida panther SRT, commissioned by the Service and the FWC to do an independent critical review of literature related to ecology and management of the panther, published their findings in Beier et al. 2003. Included in these findings, the SRT (1) encourages the acquisition and analysis of nighttime telemetry data to provide a more complete picture of Florida panther habitat use; (2) urges researchers to fully disclose and explain reasoning for selective use of data; (3) believes panthers rather than individual panther locations should be the sampling unit for determining habitat use; (4) believes vegetation maps used in habitat analysis be current with the data being analyzed; and (5) recommends to cease using a 90-m distance from forest cover, minimum sizes of forest patches, and the Panther Habitat Evaluation Model in making decisions about habitat mitigation and acquisition.

Maehr and Cox (1995) studied 10 female and 13 male panthers and found the home ranges included 6 percent freshwater marsh, 5 percent grass and agriculture, 3 percent dry prairie, 3 percent shrub swamp, 1 percent barren land, and concluded panthers can remain part of the native fauna in areas where agricultural activities exist. The above cover types, which represent open habitat, totaled 18 percent of the panther's home range. Maehr et al. (1991a) states panthers may travel through agricultural areas at night. Panthers currently in ENP have home ranges less than 10 percent forest cover (Comiskey et al. 2002). Maehr et al. (2002) found three panthers that crossed the Caloosahatchee River all went through areas with limited forest cover, and dispersing males wander widely through unforested and disturbed areas (Maehr 1992a). Beier et al. (2003) reported Comiskey et al. (2002) made a credible case that no significant relationship exists between home range size and percent forest cover.

Reproduction and Demography

Male panthers are polygynous and maintain large home ranges mutually exclusive of other males but overlapping that of several females. Breeding peaks in fall and winter (Maehr 1992b). Gestation lasts 90 to 96 days. Parturition is distributed throughout the year with the majority of births occurring between March and July. Prenatal litters range from three to four. Postnatal litters range from one to four kittens (FWC 2001). Litters surviving to 6 months of age average 2.2 kittens. Female panthers losing their litters generally produce replacement litters within the same breeding season. Intervals between litters range from 19 to 22 months (FWC 2004). Den sites are usually located in dense, understory vegetation, typically saw palmetto (Maehr 1990a). Den sites are used for up to 2 months and may be used again in subsequent years.

Historical records of den sites and birth rates for the past 5 years for the Florida panther, based on data provided by the FWC (2004), were: 7 dens, 18 kittens in 2003/2004; 6 dens, 17 kittens in 2002/2003; 12 dens, 26 kittens in 2001/2002; 8 dens, 21 kittens in 2000/2001; and 6 dens, 17 kittens in 1999/2000. Based on 2.5 kittens per den and an understanding a female panther will generally produce kittens every other year, the female population is estimated to include an average of 14 to 16 producing females with 7 to 8 females-per-year producing18 to 20 kittens-per-year.

Early estimates of infant mortality varied and were in conflict. For example, Roelke et al. (1993) characterized infant mortality as relatively high with fewer than half of all births resulting in offspring that survive beyond 6 months of age. Land (1994) estimated the kitten survival rate between age 6 months and 1 year at 0.895, based on a sample of 15 radio-instrumented kittens. More recently; however, the FWC has been visiting den sites of female Florida panthers and Texas puma females since 1992 and has documented the number of kittens that survived to 6 months-of-age for 38 of these litters (FWC 2004). Florida panther and Texas puma kitten survival to 6 months-of-age were estimated to be 52 and 72 percent, respectively, but were not significantly different (P=0.2776) (FWC 2004). Average kitten survival; therefore, was 62 percent from birth to 6 months-of-age (FWC 2004). The FWC (2004) determined the survival of kittens greater than 6 months of age by following the fates of 55 radio-collared dependent-aged kittens, including 17 Texas puma descendants from 1985 to 2004. They found only 1 of these 55 kittens died before reaching independence (a 98.2 percent survival rate) (FWC 2004). Twenty-three of 24 female panthers, first captured as kittens, became residents and 18 (78.3 percent) produced litters. One female was too young to determine residency status (FWC 2004). Female panthers were considered as adult residents if they were older than 18 months-of-age, established home ranges, and bred or if they were older than 3 years-of-age and established a home range (Maehr et al. 1991b). Twenty-eight of the 31 male panthers became residents; three males were too young to determine residency status (FWC 2004). Male panthers were considered residents if they were older than 3 years-of-age and established a home range that overlapped with females (FWC 2004).

Females are readily recruited into the population as soon as they are able to breed (Maehr et al. 1991a). Age at first reproduction has been documented as early as 18 months for females (Maehr et al. 1989). However, 50 percent of known panther dens were initiated by females aged 2 to 4 years. Females aged 5 to 11 years initiated the remaining 50 percent.

The first sexual encounters for males have occurred at about 3 years of age (Maehr et al. 1991a). Dispersing females are quickly assimilated into the resident population, typically establishing home ranges less than 1 home range width from their natal ranges (Maehr et al. 2002), while males usually go through a period as transient (non-resident) subadults, moving through the fringes of the resident population and often occupying suboptimal habitat until an established range becomes vacant (Maehr 1997). Maehr (1990a) believes there is a lack of unoccupied suitable habitat for dispersing subadult Florida panthers, which may increase fighting among males, and successful male recruitment appears to depend on the death or home range shift of a resident adult male (Maehr et al. 1991a). Turnover in the breeding population is low and documented mortality in radio-collared panthers is greatest in subadult and non-resident males (Maehr et al. 1991b).

Natural genetic exchange with other panther populations ceased when the Florida panther became geographically isolated over a century ago (Seal et al. 1994). Isolation, reduced population size, and inbreeding resulted in loss of genetic variability and diminished health. Data on polymorphism and heterozygosity, along with records of multiple physiological abnormalities, suggest the panther population has experienced inbreeding depression (Roelke et al. 1993; Barone et al. 1994). Inbreeding depression has been related to decreased semen

quality, lowered fertility, reduced neonatal survival, and congenital heart defects in a variety of domesticated and wild species (Lasley 1978; Ralls and Ballou 1982; Wildt et al. 1982; O'Brien et al. 1985; Roelke 1991). Congenital heart defects have been shown to be related to diminished panther survival and reproduction (Roelke 1991; Dunbar 1993; Barone et al. 1994). The Florida panther exhibits diminished male reproductive characteristics compared to other populations of Puma *concolor* in, North and Latin America (Barone et al. 1994). In a comparison of 16 male Florida panthers and 51 males from Puma *concolor* populations in Texas, Colorado, Latin America, and North American zoos, Wildt (1994) found a much higher rate of unilateral cryptorchidism (43.8 versus 3.9 percent), lower testicular and semen volumes, diminished sperm motility, and a greater percentage of morphologically abnormal sperm in the Florida panther samples.

Measured heterozygosity levels indicate the Florida panther has lost 60 to 90 percent of its genetic diversity (Culver et al. 2000). Measured levels of mDNA variation are the lowest reported for any similarly studied feline population, including leopards, cheetahs, and other Puma *concolor* subspecies. Electrophoretic analyses also indicated the Florida panther has less genetic variation than any other Puma *concolor* subspecies. Panther DNA fingerprint variation is nearly as low as in the small, isolated population of Asiatic lions of the Gir Forest Sanctuary in India (Roelke et al. 1993).

A genetic restoration program was initiated for the Florida panther in 1995. FWC (2001, 2003, and 2004) indicated representation of Texas cougar genes in the south Florida population is probably close to the goal of 20 percent (Seal et al. 1994), although two of the eight Texas females are over-represented. The occurrence of kinked tails and cowlicks has been reduced in intercross progeny. Information on other morphological traits associated with genetic isolation and inbreeding such as cryptorchidism sperm deformities, atrial septal heart defects, and skull morphology cannot be collected until the intercross progeny mature or pass away. However, the fecundity of the intercross progeny would seem to indicate sperm deformities have been reduced. For example, one first-generation male captured and examined in the field by Smithsonian Theriogenologist, Dr. Jo Gayle Howard, had a sperm count 3 times that of a Florida panther, a sperm motility rate twice as high, a percentage of normal sperm 4 times greater, and a sperm concentration 10 times higher (McBride 2001). Since the genetic restoration program was initiated in 1995, the number of panthers monitored annually has increased, highway mortality has increased, and panthers have moved into formerly unoccupied niches on public land in south Florida (McBride 2002). This may indicate a more robust population that varies dramatically from population parameters prior to 1995. However, Maehr and Lacy (2002) recommended caution in claiming success through genetic management. They state it is likely local prey populations cannot support the increased number of panthers over the long term, and as long as the panthers are restricted to south Florida, the problems of inbreeding and genetic variation that led to the genetic restoration program will return. Still, McBride (2002) states panther recovery continues to benefit from genetic restoration and an existing State land acquisition program (for large tracts of land) north of BCNP will provide additional benefits.

Food Habits

Florida panther food habit studies indicate commonly consumed prey include feral hog (*Sus scrofa*), white-tailed deer, raccoon (*Procyon lotor*), nine-banded armadillo (*Dasypus novemcinctus)*, and alligator (*Alligator mississippiensis*) (Maehr et al 1990c; Dalrymple and Bass 1996). Adult panthers generally consume one deer or hog per-week, supplemented by opportunistic kills of smaller prey (Maehr 1997). A female with kittens may need the equivalent of two such kills per-week. The high caloric intake needed to sustain successful reproduction and rearing of kittens is best achieved when a dependable supply of large prey is available (Roelke 1990). Deer and hogs accounted for 85.7 percent of consumed biomass north of I-75 and 66.1 percent south of I-75 (Maehr et al. 1990a). Differences in prey abundance and availability were indicated by an eight-fold greater deer abundance north of I-75 versus south of I-75, although the estimated number of deer consumed did not differ between the north and south portions of the study area. Hog numbers were lower south of I-75. Hogs dominated the diet of panthers in the north in terms of both estimated biomass and numbers. In the south, deer accounted for the greatest estimated biomass consumed, whereas raccoons were the highest estimated number of prey items consumed. Domestic livestock were found infrequently in scats or kills, although cattle were readily available north of I-75 (Maehr et al. 1990c). However, the number of deer consumed did not differ between the north and south portions of the study. There appears to be a consensus among land managers and Federal biologists that white-tailed deer and wild hogs are the dominant prey for panther, while rabbits, raccoon, and armadillos are of secondary importance (Beier et al. 2003).

Movements and Dispersal

Adult Florida panthers occupy available habitat in a pattern similar to western cougars (Land 1994). More than 7,000 telemetry locations on 26 radio-collared panthers between 1985 and 1990 indicated home range size varied from 21 to 461 square miles (53 to 1,183 square km), averaging 200 square miles (519 square km) for resident males and 75 square miles (193 square km) for resident females. Beier et al. (2003) found estimates of panther home ranges varying from 74 to 153 square miles (193 to 396 square km or 47,359 to 97,920 acres) for females and 168 to 251 square miles (435 to 650 square km or 107,520 to 160,639 acres) for males to be reliable. The most current estimate of home-range sizes (minimum convex polygon method) for established, non-dispersing adult panthers, based on radio-collared panthers monitored during the 2003-2004 genetic restoration and management annual monitoring report (n = 37), averaged 60.3 square-miles (156.1 square km or 38,572 acres) for females (n = 22) and 160.6 square-miles (416 square km or 102,794 acres) for males (n = 10) (FWC 2004). Home ranges of resident adults were stable unless influenced by the death of other residents and home range overlap was extensive among resident females and limited among resident males (Maehr et al. 1991a).

Maehr et al. (1990a) monitored five solitary panthers continuously for 130-hour periods seasonally from 1986 to 1989, rarely observing measurable shifts in location during the day, but nocturnal shifts in location exceeding 20 km (12.4 miles) were not unusual. Maehr et al. (2002) in a later report documents a "mean maximum dispersal distance" of 42.3 miles (68.4 km) for subadult males and 12.6 miles (20.3 km) for subadult females. In the same

report Maehr et al. (2002) documents a "mean dispersal distance" of 37.3 km for subadult males. Dispersal patterns tend to be circular and of insufficient length to ameliorate inbreeding. Comiskey et al. (2002) documents a "mean dispersal distance" for subadult male panthers as an average distance of 40.1 km (24.8 miles) from their natal range, which is similar to the dispersal distance reference by Maehr et al. (2002). Subadult dispersal typically occurs around 1.5 to 2 years of age, but may occur as early as 1 year of age. Dispersing males wander widely through unforested and disturbed areas (Maehr 1992a).

Status

Of the 27 recognized subspecies of *P. concolor* described by Hall (1981), the Florida panther is the sole remaining subspecies in the eastern United States. Historically, the panther was distributed from eastern Texas or western Louisiana and the lower Mississippi River Valley east through the southeastern states in general, intergrading to the north with *P. c. cougar*, and to the west and northwest with *P. c. stanleyana* and *P. c. hippolestes* (Young and Goldman 1946). The Florida panther had been eliminated from most of the historic range by 1950. Occasional sightings and signs were reported throughout the rural southeast between 1950 and 1980 (Anderson 1983). The only confirmed panther population was found in south Florida (Anderson 1983).

Distribution

A variety of human activities contributed to the decline of the Florida panther. The first bounty on Florida panthers was passed in 1831. An 1887 Florida law authorized a payment of $5 for scalps (Tinsley 1970). Panthers were also shot on sight, hunted, poisoned, and trapped. Agricultural land clearing in the southeastern United States between 1850 and 1909 totaled 31.6 million acres (12.8 million ha). Lumbering reduced the original southern forest nearly 40 percent from 300 million acres (121.4 million ha) to 178 million acres (72.0 million ha) by 1919 (Williams 1990). Meanwhile the white-tailed deer, primary prey of the panther, was reduced from a range-wide population of about 13 million in 1850, to under 1 million by 1900 (Halls 1984). Over a 100-year period, bounty hunting, land clearing, lumbering, and market hunting of deer contributed to the range-wide decline of the panther.

At the beginning of the 20th century, the Florida panther population may have numbered as many as 500 (Seal et al. 1989). The State of Florida declared the panther a game species in 1950 and in 1958 totally protected the animal. In the 1970s, the FWC established a Florida Panther Record Clearinghouse to ascertain the status of the panther. The first field searches were made in 1972. The Florida Panther Act, a State law enacted in 1978, made killing the panther a felony. Telemetry investigations began in 1981, primarily on public lands in southwest Florida. Maehr et al. (1991a) estimated the average density of panthers in southwest Florida between February and July 1990 to be one panther per 42.9 square-miles (47 square km or 27,456 acres). When extrapolated over a 1,965.6 square mile (5,040 square km or 1,257,979 acre) area thought to be occupied by radio-collared panthers in southwest Florida, the estimated population of the area was 46 adults (9 resident males, 28 resident females, and 9 transient males) between December 1985 and October 1990. This estimate assumed homogeneous density and similar age and sex composition over time and space. Maehr et al.

(1991a) considered the actual population to be higher because the estimation technique excluded panthers in ENP, eastern BCNP, and areas north of the Caloosahatchee River. The Florida Panther Interagency Committee, comprised of the Service, National Park Service, Florida Department of Environmental Protection, and the FWC, estimated the population in 1993 at 30 to 50 adults (Logan et al. 1993). More recent estimates show a panther population (adults and subadults) of 62 in 2000 (McBride 2000), 78 in 2001 (McBride 2001), 80 in 2002 (McBride 2002), and 87 in 2003 (FWC 2003). No documented population number has been provided by FWC for 2004 to date. However, D. Land (FWC, personal communication, November 2004) estimates the population to be between 70 and 100 panthers.

Human persecution over a 100-year period, along with bounty hunting, land clearing, lumbering, and market hunting of deer, resulted in a range-wide decline of the panther, and as a result panthers now occupy just 5 percent of their former range. The remaining breeding population is in south Florida, south of the Caloosahatchee River. Dispersing males occasionally cross the Caloosahatchee River and have been observed in rural habitats of south-central Florida.

In the south Florida breeding population, habitat loss, habitat fragmentation, habitat degradation, and increased human disturbance resulting from agricultural and residential development are now considered among the primary threats to long-term panther persistence. Continued development associated with the expansion of Florida's urbanized east coast, urban development on the west coast, and the spread of agricultural development in the south Florida interior, have placed increasing pressure on panthers and panther habitat (Maehr 1990b; Maehr et al. 1991a; Maehr 1992b). Past land use activity, hydrologic alterations, road construction, and lack of fire management (Dees et al. 1999) have also affected the quality and quantity of panther habitat.

In southwest Florida, agriculture development between 1986 and 1990 resulted in a row crop acreage increase of 8,990 acres (3,640 ha) or 21 percent; a sugarcane increase of 16,000 acres (6,475 ha) or 21 percent; and a citrus increase of 54,000 acres (21,850 ha) or 75 percent. Rangeland, much of it suitable for panther occupation, decreased by 160,000 acres (64,750 ha) or 10 percent. In a more current analysis, (B. Stys, FWC, unpublished data 2002) performed a change detection analysis for Collier, Lee, Hendry, Charlotte, and Glades Counties, and found the area of disturbed lands in these five counties increased 31 percent between 1986 and 1996. Most (66 percent) of the land use change over the 10-year period was due to conversion to agricultural. Forest cover types accounted for 42 percent of land use conversions, dry prairies accounted for 37 percent, freshwater marsh accounted for 9 percent, and shrub/brush lands accounted for 8 percent.

Residential, commercial, and industrial development projects may have an adverse direct effect on the Florida panther through: (1) the permanent loss and fragmentation of panther habitat; (2) the permanent loss and fragmentation of habitat that supports panther prey; (3) the loss of available habitat for foraging, breeding, and dispersing panthers; and (4) a reduction in the geographic distribution of the species. Indirect effects may include: (1) an increased risk of roadway mortality to panthers traversing the area due to the increase in vehicular traffic; (2) increased disturbance to panthers in the project vicinity due to human activities; (3) the

reduction in panther prey; (4) the reduction in value of panther habitat adjacent to the project due to habitat fragmentation; and (5) a potential increase in intraspecific aggression between panthers (and an increase in mortality of subadult male panthers) due to reduction of the geographic range of the panther.

Panther prey density, especially deer, is an important factor in evaluating panther habitat. The type and number of prey available affects the health and distribution of panthers, as well as their ability to breed and support young. Environmental factors, specifically the availability of high quality forage, affect the prey density and influence the carrying capacity and population dynamics of the prey species, especially deer herds (Fleming et al. 1993). In the Everglades region, deer inhabit a variety of landscape types, including pinelands, high ridges, and adjacent periphery wetlands, which include the mosaic of sawgrass and wet prairie savannahs and sloughs that comprise the interior freshwater marshes and coastal mangrove forest.

Deer are ruminants, with small stomach capacities, and are selective for high quality forage to meet their nutritional needs. To meet these high quality forage needs, deer selectively move through the mosaic of habitat types taking advantage of the seasonal forage that provide the most benefit to the deer. Water management practices have reduced habitat heterogeneity and the sequence of seasonal and successional patterns of plant growth and appear to have affected deer abundance (Fleming et al. 1993).

Other adverse changes in habitat characteristics that affect deer density include the invasion of exotics into native uplands, over drainage of marshes, and the establishment of monotypic stands of unpalatable plant species, generally resulting from nutrient enrichment related to agricultural and urban runoff. The replacement of these native plant communities reduces important habitat heterogeneity and the ability of deer to meet their critical dietary needs. For example, deer densities on over-drained, exotic species infested private lands being developed in northwest Lee County averaged one deer-per 591 acres (Turrell 2001) to one deer-per 534 acres (Passarella and Associates, Incorporated 2004). As another example, in monotypic stands of cattail (*Typha* spp.) communities in the Everglades Wildlife Management Areas, historical deer densities in the mid-to-late 1950s averaged one deer-per 100 acres (40 ha) when the vegetative community was a mosaic of native species, whereas more recent surveys (1993) showed a 67 to 76 percent decrease (one deer-per 300 to one deer-per 475 acres) of the 1959 population estimate (Fleming et al.1993).

As a comparison to higher quality habitat communities, deer densities in wildlife management areas in the BCNP's Corn Dance Unit were predicted to be between one deer-per 165 acres and one deer-per 250 acres (Steelman et al. 1999). Predictions of deer density in Fakahatchee Strand were estimated to be higher than one deer-per 18.2 acres (McCown 1991). Deer densities in the Mullet Slough area of BCNP yielded an estimated density range of one deer-per 93 acres and one deer-per 250 acres. The Stairsteps Unit of BCNP support densities of one deer-per 190 acres to one deer-per 218 acres from track count estimates. Aerial surveys for the same units used after 1982 estimated deer densities between one deer-per 60 acres and one deer-per 2,643 acres (Steelman et al. 1999). Harlow (1959) predicted deer density in wet prairie habitat in Florida to be one deer-per 115 acres.

To counteract the threat of exotic species invasion and monotypic stands of unpalatable plant species, all public land and most private land managers pursue exotic and invasive species management and habitat improvement through fire management and eradication programs. However, these actions are restricted by available funds to implement these programs

Panthers, because of their wide-ranging movements and extensive spatial requirements are also particularly sensitive to habitat fragmentation (Harris 1985). Habitat fragmentation can result from road construction, urban development, and agricultural land conversions within migratory patterns of panther prey species and affect the ability of panthers to move freely throughout their home ranges. Construction of highways in wildlife habitat typically results in loss and fragmentation of habitat, traffic related mortality, and avoidance of associated human development. Roads can also result in habitat fragmentation, especially for females who are less likely to cross them.

Kautz et al. (In Review) estimated approximately 25 percent of panther habitat within primary, secondary, and dispersal zones, is on private land. Maehr (1990a) indicated development of private lands may limit panther habitat to landscapes under public stewardship. From March 1984 through February 2004 the Service concluded formal consultation on 49 projects involving the panther. The minimum expected result of these projects is impacts to 84,692 acres of panther habitat and the preservation of 25,748 acres (Appendix). Of the 84,692 acres of impacts, 39,918 are due to agricultural conversion and 44,774 acres to development and mining. The non-agriculture impacts are permanent land losses, whereas the agricultural conversions may continue to provide some habitat functional value to panthers, depending on the type of conversion. However, these land conversions provide less functional value than native habitats. The 44,774 acres of expected impacts from development and mining included a mixture of agricultural fields consisting of row crops and citrus groves and natural lands with varying degrees of exotic vegetation. Management actions on the lands preserved include exotic species removal, fire management, wetland hydrology improvement, improved forest management practices, and recreational benefit improvements.

Habitat Management

Prescribed burning is probably the single most important habitat management tool available to public land stewards. Dees et al. (1999, 2001) examined panther use of habitat in response to prescribed burning at Florida Panther NWR and BCNP between 1989 and 1998. The greatest temporal response by panthers to burning in pine was within 1 year followed by a decline in subsequent years and is likely due to the rapid regrowth of vegetation, which attracted prey (Dees et al. 2001). Temporal analysis demonstrated notable selection only for pine stands that had been burned within 1 year relative to older burns. Compositional analysis showed that panthers were more likely to position their home ranges in areas that contained pine. Dees et al. (2001) suggest that panthers were attracted to <1-year-old burns because of white-tailed deer and other prey responses to vegetation and structural changes caused by prescribed fire. According to Dees et al. (2001), it was the effect of burning in pine, rather than the pine per se, which most influenced habitat selection by panthers. However, they caution that the effects of shorter burning intervals on vegetation composition and landscape-level changes be determined before burning rotations are reduced.

Land Conservation Trends

The 1.4 million-acre ENP was established in 1947 more than 2 decades before the Florida panther was listed as endangered. The 577,000-acre BCNP was established in 1974, just 1 year after passage of the ESA. Additional State and Federal acquisitions since the establishment of ENP and BCNP include Fakahatchee Strand Preserve State Park (58,373 acres), Florida Panther NWR (26,400 acres), Picayune Strand State Forest (55,200 acres), Collier-Seminole State Park (7,271 acres), Okaloacoochee Slough State Forest (34,962 acres), and CREW (24,028 acres). As of April 2001, non-profit organizations, local governments, State and Federal agencies, and Tribes have protected approximately 2.21 million acres of panther habitat south of the Caloosahatchee River within the primary, secondary, and dispersal zones (Kautz et al. In Review). These protected lands are the cornerstones for the Service's continuing effort to work in tandem with the private sector and State and county government, to preserve and manage panther habitat. These lands are protected by conservation easements or transferred by title to public entities to manage.

Mortality, Trauma, and Disturbance

Records of mortality on uncollared panthers have been kept since February 13, 1972, and records of mortality on radio-collared panthers have been kept since February 10, 1981. A total of 143 panther mortalities have been documented through June 2004, with 59 (41 percent) known deaths occurring in the past 4 years (FWC 2001, 2002, 2003, 2004). Overall, documented mortality (n = 99) of radio-collared and uncollared panthers averaged 3.4 per-year through June 2001. However, from July 2001 through June 2004, documented mortality (n = 48) increased with an average of 16.0 per-year during these years (FWC 2002, 2003, 2004). Eighty-four free roaming, radio-collared panthers have died since 1981, and intraspecific aggression was the leading cause accounting for 41 percent of these mortalities (FWC 2004).

Unknown causes and collisions with vehicles accounted for 24 percent and 19 percent of mortalities, respectively. Other factors (7 percent), infections (5 percent), and diseases (4 percent) caused the remaining mortalities (FWC 2004). The causes of mortality were found to be independent of gender (FWC 2004). It is likely some causes, such as road mortality, are more likely to be found, and therefore, are over represented in the above total.

Between February 13, 1972, and June 30, 2004, Florida panther vehicular trauma (n = 73), averaged 2.3 panthers per-year (FWC 2004). Thirty-four incidents of trauma (47 percent) have occurred in the past 5 years (average 6.8 panthers per year during 2001 to 2004). From June 30, 2003, through October 2004, we are aware of seven additional vehicular mortalities, including several near CREW, one on Interstate 4 near Tampa, one just east of the intersection of I-75 and Alligator Alley, one on I-75 at mile marker 93, one on I-75 near mile marker 98, and one several miles north of CR 858 on SR 29. Although the relative significance of vehicular trauma to other sources of mortality is not entirely known, it has been the most often documented source of mortality (Maehr 1989; Maehr et al. 1991b) because the death of

uncollared panthers, due to other causes (*e.g.*, intraspecific aggression, old age, disease, etc.) often goes undetected.

There are presently 34 wildlife underpasses with associated fencing suitable for panther use along I-75 and to date, no panthers have been killed by vehicles in areas protected with wildlife underpasses (FWC 2003). There are two underpasses suitable for panther use currently existing, and two additional underpasses presently proposed by the Florida Department of Transportation (FDOT) along U.S. Highway 29 (US 29) (Department of the Army Public Notice SAJ-2004-778). However, vehicular trauma still occurs on outlying rural roads and the FWC is conducting a study to determine the impacts of vehicular collisions to panthers and studying ways to minimize panther vehicle collisions. Several additional panther/wildlife crossings are proposed along roadways in rural Lee and Collier Counties in addition to the proposals along US 29 (FWC 2001). In addition, Collier County, in cooperation with the National Wildlife Federation and the Florida Wildlife Federation, is coordinating a study of the segment of CR 846 east of Immokalee by Dr. Reed Noss and Dr. Daniel Smith to determine the optimum location for wildlife crossing construction (email, WilsonMiller 2005).

Florida panthers were hunted for bounty during the 1800s and for sport up until the 1950s (Tinsley 1970). Seven panther shootings, six fatal, and one non-fatal, were documented between 1978 and 1986. A female Texas puma introduced for genetic restoration was shot in 1998 (FWC 1999). Education, self-policing among hunters, and regulation are the tools by which shootings are minimized. All free-ranging pumas in Florida are protected by a "similarity of appearance" provision in the ESA (56 FR 40265-40267; August 14, 1991).

Janis and Clark (1999) compared the behavior of panthers before, during, and after the recreational deer and hog-hunting season (October through December) in areas opened (BCNP) and closed (Florida Panther NWR, Fakahatchee Strand State Preserve) to hunting. The variables examined were: (1) morning activity rates; (2) movement rates; (3) predation success; (4) home range size; (5) home range shifts; (6) habitat selection; (7) distance from panther locations to trails; and (8) frequency of panther use in the Bear Island Unit of BCNP. The authors failed to detect any relationship between hunting and the first six variables. Of the last two variables they determined the distance of panther locations from trails increased an average of 0.31 mile (180 m) and the frequency of panther use in the Bear Island Unit decreased from 30 up to 40 percent during the hunting season. An analysis of movement rates, a measure of energy expenditure, predation success, and energy intake do not indicate any direct, negative energetic responses to increased human activity during the hunting season. However, the increase in average distance from trails and decrease in panther use of the Bear Island Unit are indicative of a behavioral change. Janis and Clark (1999) surmise the increase in the distance of panther locations from trails is "biologically minor" and probably related to prey behavior (*i.e.*, white-tailed deer moving deeper into the forest to avoid hunters). The decrease in panther use of the Bear Island Unit is balanced by an increase in use of private lands north of BCNP as "refugia." However, Beier et al. (2003) finds this and other studies of hunting impacts to panthers to be inconclusive.

Population Dynamics

Population Viability Analyses (PVA) have emerged as key components of endangered species conservation. This process is designed to incorporate demographic information into models that predict if a population is likely to persist in the future. PVA incorporates deterministic and stochastic events including demographic and environmental variation, and natural catastrophes. PVA has also been criticized as being overly optimistic about future population levels (Brook et al. 1997) and should be viewed with caution; however, they are and have been shown to be surprisingly accurate for managing endangered taxa and evaluating different management practices (Brook 2000). They are also useful in conducting sensitivity analyses to determine where more precise information is needed (Hamilton and Moller 1995; Beissinger and Westphal 1998; Reed et al. 1998; Fieberg and Ellner 2000).

As originally defined by Shaffer (1981, p.132), "a minimum viable population for any given species in any given habitat is the smallest isolated population having a 99 percent chance of remaining extant for 1,000 years despite the foreseeable effects of demographic, environmental and genetic stochasticity, and natural catastrophes." However, the goal of 95 percent probability of persistence for 100 years, is the standard recommended by population biologists used in management strategies and conservation planning, particularly for situations where it is difficult to accurately predict long-term effects.

We believe the spatially explicit model; based on probability of persistence for 100 years, developed by Kautz et al. (In Review) represents the best insight into population viability for the panther at this time. Kautz et al. (In Review) built their own spatially explicit or habitat-based models using RAMAS Geographic Information System (GIS) software. The basic versions of these models assumed no catastrophes or epidemics, no change in habitat quality or amount, and a ceiling type of density dependence (Kautz et al. In Review). Variations of these models had different density dependence, various levels of habitat loss, or intermittent catastrophes or epidemics (Kautz et al. In Review).

Kautz et al. (In Review) suggested a set of population guidelines for use in management and recovery of the Florida panther based upon results of PVAs: (1) populations of less than 50 individuals are likely to become extinct in less than 100 years; (2) populations of 60 to 70 are barely viable and expected to decline by 25 percent over 100 years; (3) populations of 80 to 100 are likely stable but would still be subject to genetic problems (*i.e.*, heterozygosity would slowly decline); and (4) populations greater than 240 have a high probability of persistence for 100 years and are demographically stable and large enough to retain 90 percent of original genetic diversity.

Population guidelines for populations of panthers between 50 and 60 individuals and between 70 and 80 individuals were not specifically provided in Kautz et al. (In Review). However, the Service views the guidelines in Kautz et al. (In Review) as a continuum. Therefore, we consider populations of 50 to 60 individuals to be less than barely viable or not viable with declines in population and heterozygosity. Similarly, we consider populations of 70 to 80 to be more than barely viable or somewhat viable with some declines in population and heterozygosity. Like

other population guidelines presented in Kautz et al. (In Review), these assume no habitat loss or catastrophes.

In September 2003, the documented south Florida panther population was 87 adults and subadults, not including kittens at the den (FWC 2003). The south Florida panther population has shown an increase in the survivability of young and juveniles (McBride 2003) and an increase in the population estimates from 62 in 2000 (McBride 2000) to 78 in 2001 (McBride 2001) to 80 in 2002 (FWC 2002) to 87 in 2003 (FWC 2003). No documented population number has been provided by FWC for 2004; however, D. Land (FWC, personal communication, November 2004) estimates the population to be between 70 and 100 panthers. McBride (Livestock Protection Company, personal communication, November 2004) plans to provide a verified population count in early 2005 and expects, due to the extent of mortalities this year, the population estimate may be lower than last year. However, minor fluctuations in the number of panthers within any given year are expected and are not the determining factors in the jeopardy analysis for biological opinions in which all take would be due to habitat loss.

Based on the PVA of Kautz et al. (In Review), a population of 80 to 100 panthers is needed for stability over a 100-year period and is the basis of the Service's goal to identify and protect sufficient lands for this size population. However, according to Kautz et al (In Review), "All models assumed a 1:1 sex ratio, a stable age distribution, 50 percent of females breeding in any year, and an initial population of 41 females (82 individuals including males), the approximate population size in 2001-2002 (McBride 2001; 2002). The basic version of each model incorporated no catastrophes or epidemics, no change in habitat quality or amount, and a ceiling type of density dependence. The basic versions of the models incorporated a carrying capacity of 45 females (90 individuals) based on estimated population sizes likely to be supported by the Primary and Secondary Zones."

The Service acknowledges that some of these assumptions are violated and tries to factor the degrees to which assumptions may be violated into our decisions. For example, the Service is aware that the Panther Subteam had attempted to address the effects of habitat loss by assuming a 25 percent loss of panther habitat over the first 25 years (*i.e.,* one percent per year) of the 100-year model simulation during their analyses. Although the probability of extinction only increases approximately one percent under this scenario, the mean final abundance of panthers was reduced by 26 percent to 31 to 38 females. The actual likelihood of population declines and extinction can be much higher than the guidelines suggest, depending upon the number of and severity of assumptions violated. The Service realizes that habitat loss is occurring at an estimated 0.8 percent loss of habitat per year (R. Kautz, FWC, personal communication, 2003). The Service has tried to account for habitat loss and changes in habitat quality within its regulatory program and specifically through its habitat assessment methodology (discussed below). For example, we have increased the base ratio used within this methodology to account for unexpected increases in habitat loss. Similarly, we consider changes in habitat quality and encourage habitat restoration wherever possible.

With regard to the assumption of no catastrophes, the Service has considered the recent outbreak of feline leukemia in the panther population at Okaloacoochee Slough as a potential

catastrophe. However, the FWC is carefully monitoring the situation and it appears to be under control at this time due to a successful vaccination program. However, if the outbreak spreads into the population, the Service will consider this as a catastrophe and factor this into our decisions.

We acknowledge that uncertainties exist, assumptions can be violated, and catastrophes can occur. However, the Service and the FWC along with our partners will continue to monitor the panther population and the south Florida landscape and incorporate any new information and changes into our decision-making process.

Panther Conservation Efforts

Previous recovery plans for the Florida panther have called for the establishment of additional populations within the historic range of the Florida panther (Service 1987, 1995). The PVA models discussed in the previous section and in detail in Kautz et al. (In Review) support this goal and predict a population of 80 to 100 individuals is needed for stability over a 100-year period and a population greater than 240 is needed to retain 90 percent of original genetic diversity. Kautz et al. (In Review) assessed the available habitat south of the Caloosahatchee River and determined that primary, secondary, and dispersal zone lands were not sufficient to sustain a population of 240 individuals south of the Caloosahatchee River. However, Kautz et al. (In Review) determined sufficient lands were available south of the Caloosahatchee River to support a population of 79 to 94 individuals (although all lands are not protected). A high priority for recovery and conservation of the Florida panther is to ensure the survival of the existing breeding population south of the Caloosahatchee River. The Service's goal is to achieve this priority and concurrently identify lands north of the Caloosahatchee River that can be the recipient area for the expansion of the South Florida panther population from south of the Caloosahatchee River to other parts of its historic range. We believe sufficient lands may be found north of the Caloosahatchee River and possibly elsewhere throughout the southeast (Thacher et al. 2003) to, in conjunction with the lands conserved south of the river, support a population of greater than 240 individuals.

In the early 1990s, two plans for the protection of Florida panther habitat in south Florida were developed (Logan et al. 1993 and Cox et al. 1994). Both of these plans identified privately owned lands that contained habitats important to the long-term conservation of the Florida panther. Logan et al. (1993) identified specific parcels of land by section, township, and range as Priority 1 and 2 preservation areas. However, this plan has been criticized as being too general (*i.e.*, targeted lands perceived as including too many areas not truly panther habitat [active rock and sand mines]) and for not having been available for public review and comment prior to publication. Cox et al. (1994) identified specific lands based on their habitat features and the likelihood they could support a minimally viable population of panthers for the next 200 years.

The lands identified in each of these planning studies, although referred to in the studies as essential to the survival and recovery of the Florida panther, were intended to be guides for land acquisition planning purposes, because of their inclusion of lands containing urban developments and other lands not considered truly panther habitat (*i.e.*, active rock and sand

mines). These land preservation recommendations have been used by Federal, State, and county resource agencies as guides for public land acquisition programs, local land-use planning, and, in a few cases, compensation for land-use conversion projects proposed for lands identified by the plans.

Figure 7 provides a representative view of the land preservation efforts within the southwest Florida landscape that not only benefits the Florida panther, but also provides benefits to the mosaic of other species important to the south Florida ecosystem. Table 1 provides a summary of the targeted and acquired acreages of the Conservation Lands in southwest Florida. Based on the table, total lands targeted for acquisition to date are 3,588,749 acres.

To further refine the land preservation needs of the Florida panther and to specifically develop a landscape-level strategy for the conservation of the Florida panther population in south Florida, the Service, in February 2000, appointed a Florida Panther Subteam. This subteam is part of the overarching MERIT. MERIT includes more than 30 members representing Federal, State and local governmental agencies, the Seminole Tribe of Florida, the Miccosukee Tribe of Indians of Florida, academia, industry, and the private sector, and was created with the purpose of overseeing the implementation of the recovery and restoration tasks identified in the MSRP.

The Florida Panther Subteam was charged with developing a landscape-level strategy for the conservation of the Florida panther population in south Florida. The results of this collaborative effort are partially presented in Kautz et al. (In Review). One of the primary goals of this effort was to identify a strategically located set of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the Florida panther (Figure 8). Kautz et al. (In Review) focused their efforts on the area south of the Caloosahatchee River, where the reproducing panther population currently exists.

Kautz et al. (In Review) created an updated Florida panther potential habitat model based on the following criteria: (1) forest patches greater than 4.95 acres (2 ha); (2) non-urban cover types within 656 feet (200 m) of forest patches; and (3) exclusion of lands within 984 feet (300 m) of urban areas. The potential habitat map was reviewed in relation to telemetry data, recent satellite imagery (where available), and panther home range polygons. Boundaries were drawn around lands defined as the primary zone (Figure 8), defined as the most important area needed to support a self-sustaining panther population.

Kautz et al. (In Review) referred to these lands as essential; however, as observed in the two previous plans (Logan et al. 1993 and Cox et al. 1994), lands within the boundaries of the primary zone included some urban areas and other lands not considered to be truly panther habitat (*i.e.*, active rock and sand mines).

The landscape context of areas surrounding the primary zone was modeled and results were used to draw boundaries of the secondary zone (Figure 8), defined as the area capable of supporting the panther population in the primary zone, but where habitat restoration may be needed (Kautz et al. In Review).

Table 1.* Targeted and Acquired Acreage Totals of Conservation Lands in South Florida Directly Affecting the Panther

Name	Targeted[1] Acreage	Acquired Acreage	Indian Reservation
Federal Conservation Lands			
Everglades National Park	1,508,537	1,508,537	--
Big Cypress National Preserve	720,000	720,000	--
Florida Panther National Wildlife Refuge	26,400	26,400	--
Subtotal	**2,254,937**	**2,254,937**	--
State of Florida: Florida Forever Program			
Belle Meade	28,505	19,107	--
Corkscrew Regional Ecosystem Watershed	69,500	24,028	--
Twelvemile Slough	15,653	7,530	--
Panther glades	57,604	22,536	--
Devil's Garden	82,508	0	--
Caloosahatchee Ecoscape	18,497	2,994	--
Babcock Ranch	91,361	0	--
Fisheating Creek	176,760	59,910	--
Subtotal	**540,388**	**136,105**	**--**
State of Florida: Other State Acquisitions			
Water Conservation Area Number 3	491,506	491,506	--
Holey Land Wildlife management Area	33,350	33,350	--
Rotenberger Wildlife Management Area	25,019	20,659	--
Fakahatchee Strand State Preserve	74,374	58,373	--
Picayune Strand State Forest	55,200	55,200	--
Okaloacoochee Slough State Forest and WMA	34,962	34,962	--
Babcock-Webb Wildlife Management Area	79,013	79,013	--
Subtotal	**793,424**	**773,063**	**--**
Indian Reservations[2]			
Miccosukee Indian Reservation	--	--	81,874
Big Cypress Seminole Indian Reservation	--	--	68,205
Brighton Seminole Indian Reservation	--	--	37,447
Subtotal	**--**	**--**	**187,526**
GRAND TOTALS	**3,588,749**	**3,164,105**	**187,526**

[1] Targeted acres not available for all lands. In Such cases, targeted equals acquired acreage.

[2] Indian lands are included due to their mention in the MSRP. Acreages taken from GIS data.

* Table 1 was excerpted from the Brief of Amicus (2003). However, the lands shown as acquired in this table may include some private in-holdings and may include lands currently under sales negotiations or condemnation actions.

Kautz et al. (In Review) also identified, through a least cost path model, the route most likely to be used by panthers dispersing out of south Florida, crossing the Caloosahatchee River, and dispersing into south-central Florida. The lands within the boundaries of the least cost model

prediction were defined as the dispersal zone (Figure 8). The preservation of lands within this zone is important for the survival and recovery of the Florida panther, as these lands are the dispersal pathways for expansion of the south Florida panther population.

The primary zone covers 2,270,590 acres (918,895 ha); the secondary zone covers 812,104 acres (328,654 ha); and the dispersal zone covers 27,883 acres (11,284 ha); providing a total of 3,110,578 acres (1,258,833 ha) (Kautz et al. In Review). Kautz et al. (In Review) also estimated the present average density, based on telemetry and other occurrence data, to average 1 panther per 31,923 acres (12,919 ha). Based on this average density, the primary zone could support 71 to 84 panthers; the secondary zone 8 to 10 panthers without habitat restoration and 25 to 30 panthers with habitat restoration; and the dispersal zone 0 panthers. Taken together, the 3 zones in their current condition apparently have the capacity to support approximately 79 to 94 Florida panthers (Kautz et al. In Review). Kautz et al.'s (In Review) PVA model suggest that a population of 80 to 100 individuals is likely to be stable, and although subject to genetic problems, is likely to survive through 100 years provided the model assumptions are met.

To evaluate the effects of a project such as this one, which involves habitat loss rather than direct taking through killing, on the Florida panther, the Service considers the contribution the project lands provide to the Florida panther, recognizing not all habitats provide the same functional value. Kautz et al. (In Review) also recognized not all habitats provide the same functional value to the Florida panther and developed cost surface values for various habitat types, based on use by dispersing panthers. Habitat types were assigned a cost surface value from zero (0) to ten (10), with lower values indicating higher likely use by dispersing Florida panthers. In Kautz et al. (In Review), these values were used in a least-cost base analysis to determine panther usage.

The Service chose to evaluate project effects to the Florida panther through a similar process. However, our analysis is the reverse and evaluates habitats from zero (0) to ten (10) with low values reflecting low habitat value to the Florida panther. We incorporated many of the same habitat types chosen by Kautz et al. (In Review) with several adjustments to the assigned habitat values reflecting consolidation of similar types of habitats and the inclusion of Everglades Restoration water treatment and retention areas, as the basis for habitat evaluations and the recommended compensation values to minimize project effects to the Florida panther (Table 2).

In August 2000, the Service, to assist the Corps in assessing project effects to the Florida panther, developed the Florida panther final interim SLOPES (Service 2000). The Florida panther SLOPES provide guidance to the Corps in assessing project effects to the Florida panther, and recommends actions to minimize these effects. The Florida panther SLOPES also include a consultation area map (Figure 4) that identifies an action area where the Service believes land alteration projects may affect the Florida panther. The acreage in the consultation area map (Figure 4) (4,717,152 acres [1,909,031 ha]) includes lands north of the Caloosahatchee, lands within the three zones and "other" lands. The lands in the "other" zone

include a mixture of lands, both north and south of the Caloosahatchee River (1,606,640 acres [650,198 ha]), including urban lands.

Table 2. Habitat suitability values for use in assessing habitat value to the Florida panther

Land Cover Type	Value	Land Cover Type	Value	Land Cover Type	Value
Water	0	STA	4.5		
Urban	0	Shrub swamp	5	Cypress swamp	9
Coastal strand	1	Shrub and brush	5	Sand pine scrub	9
Reservoir	1.5	Dry prairie	6	Sandhill	9
Mangrove swamp	2	Grassland/pasture	7	Hardwood-Pine forest	9
Salt marsh	2	Freshwater marsh	9	Pine forest	9
Exotic plants	3	Bottomland hardwood	9	Xeric oak scrub	10
Cropland	4	Bay swamp	9	Hardwood forest	10
Orchards/groves	4	Hardwood swamp	9		

As stated previously, the Service's goal for south Florida is to locate and preserve sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of a population of 80 to 100 individuals (adults and subadults) south of the Caloosahatchee River. The Service proposes to achieve this goal through land management partnerships with private landowners, through coordination with private landowners during review of development proposals, and through sensitive land management and acquisition programs with Federal, State, local, private, and Tribal partners. The acreages of lands necessary to achieve this goal, based on the average density of 31,923 acres (12,919 ha) per panther is 2,551,851 acres (1,032,720 ha) for 80 panthers or 3,189,813 acres (1,290,900 ha) for 100 panthers.

The acreage of lands within the panther consultation area as defined in the Florida panther SLOPES (Service 2000) (Figure 4) is 4,717,152 acres (1,909,031 ha), understanding that all these lands do not provide the same value to the Florida panther. The combined acreage of lands within the primary, dispersal, and secondary zones is 3,110,577 acres (1,258,833 ha) (Kautz et al. In Review). With the premise the Service's goal is to focus habitat conservation in the primary, secondary, and dispersal zones, the Service believes lands are available within the consultation area to meet the Service's goal for the Florida panther in south Florida, provided panther habitat fragmentation is discouraged.

Both the 1995 and 1999 recovery objectives for the panther were to achieve three viable, self-sustaining populations within the historic range of the animal. In 2001, a new Florida Panther Recovery Team was appointed to revise the recovery plan. Although preliminary, the revised recovery objectives established in 2004 continue to be to achieve at least three self-sustaining, viable populations of panthers within the historic range. The Panther Subteam recommended that a population of 80 to 100 panthers be maintained since this is the minimum number needed to serve as a stable base for conservation of the panther in south Florida. The Service believes a population of 80 to 100 panthers in south Florida will serve as the founder population for the

recovery of the Florida panther throughout its historic range. The panthers in south Florida will be used to further overall recovery goals.

Wood Stork

The wood stork was federally listed under the ESA as endangered on February 28, 1984. No critical habitat has been designated for the wood stork; therefore, none will be affected.

Species Description

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

Life History

Wood storks use mangroves as low as 1 m (3 feet [ft]), cypress as tall as 30.5 m (100 ft), and various other shrubs or trees located in standing water (swamps) or on islands surrounded by relatively broad expanses of open water (Palmer 1962; Rodgers et al. 1987; Ogden 1991) for nesting. The same site will be used for many years as long as the colony is undisturbed, and sufficient feeding habitat remains in surrounding wetlands. Natural wetland nesting sites may be abandoned if surface water is removed from beneath the trees. In response, wood storks may abandon that site and establish a breeding colony in managed or impounded wetlands (Ogden 1991). Wood storks that abandon a colony early in the nesting season due to unsuitable hydrological conditions, may re-nest in other nearby areas (Borkhataria et al. 2004; Crozier and Cook 2004). Between breeding seasons, or while foraging, wood storks may roost in trees over dry ground, on levees, or large patches of open ground. Wood storks may also roost within wetlands while foraging far from nest sites and outside of the breeding season (Gawlik 2002).

Wood storks forage in a wide variety of wetlands, where prey densities are high and the water shallow and open enough to hunt successfully (Ogden et al. 1978; Browder 1984; Coulter 1987). Calm water, about 5 to 40 cm (2 to 16 in) in depth, and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993). Typical foraging sites include freshwater marshes and stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments, depressions in cypress heads, and swamp sloughs. Wood storks feed almost entirely on fish between 2 and 25 cm (1 to 10 in) in length (Kahl 1964; Ogden et al. 1976; Coulter 1987) but may occasionally consume crustaceans, amphibians, reptiles, mammals, birds, and arthropods. Wood storks use a specialized feeding behavior called tactilocation, or grope feeding, and wade through the water with the beak immersed and open about 7 to 8 cm (2.5 to 3.5 in). When the wood stork encounters prey with its bill, the mandibles snap shut, the

head is raised, and the food 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).

Wood storks generally forage in wetlands within 50 km (31 mi) of the colony site. Maintaining this wide range of feeding site options ensures sufficient wetlands of all sizes and varying hydroperiods are available, during shifts in seasonal and annual rainfall and surface water patterns, to support wood storks. Adults feed furthest from the nesting site prior to laying eggs, forage in wetlands closer to the colony site during incubation and early stages of raising the young, and then further away again when the young are able to fly. Wood storks generally use wet prairie ponds early in the dry season then shift to slough ponds later in the dry season thus following water levels as they recede into the ground (Browder 1984).

Gawlik (2002) characterized wood storks as "searchers" that employ a foraging strategy of seeking out areas of high density prey and optimal (shallow) water depths, and abandoning foraging sites when prey density begins to decrease, but while prey was still sufficiently available that other wading bird species were still foraging in large numbers (Gawlik 2002). Wood stork choice of foraging sites was significantly related to both prey density and water depth (Gawlik 2002). Because of this strategy, wood stork foraging opportunities are more constrained (Gawlik 2002).

Breeding wood storks are believed to form new pair bonds every season. First age of breeding has been documented in 3 to 4-year-old birds but the average first age of breeding is unknown. Eggs are laid as early as October in south Florida and as late as June in north Florida (Rodgers 1990). A single clutch of two to five (average three) eggs is laid per breeding season but a second clutch may be laid if a nest failure occurs early in the breeding season. The average clutch size may increase during years of favorable water levels and food resources. Egg laying is staggered and incubation, which lasts about 30 days, begins after the first egg is laid. Therefore the eggs hatch at different times and the nestlings vary in size. The younger birds are first to die during times of scarce food. The young fledge in about 9 weeks but will stay at the nest for 3 to 4 more weeks to be fed. Adults feed the young by regurgitating whole fish into the bottom of the nest about three to ten times per day. Feedings are more frequent when the birds are young. Feedings are less frequent when wood storks are forced to fly great distances to locate food. The average wood stork family requires 201 kg (443 lbs) of fish during the breeding season (Kahl 1964). Receding water levels are necessary in south Florida to concentrate suitable densities of forage fish (Kahl 1964; Kushlan et al. 1975).

Population Dynamics - The United States breeding population of wood storks declined from an estimated 20,000 pairs in the 1930s to about 10,000 pairs by 1960 (49 FR 7332). The total number of nesting pairs in 1995 was 7,853 with 11 percent in South Carolina, 19 percent in Georgia, and 70 percent in Florida (Service 1997).

Since the 1960s, the wood stork population has declined in southern Florida and increased in northern Florida, Georgia, and South Carolina (Ogden et al. 1987). The number of nesting pairs in the Everglades and Big Cypress ecosystems (southern Florida) declined from 8,500 pairs in 1961 to 969 pairs in 1995. During the same period, nesting pairs in Georgia increased from 4 to 1,501 and nesting pairs in South Carolina increased from 11 to 829 (Service 1996). The number

of nesting pairs in northern and central Florida doubled between 1976 and 1986 (Ogden 1991). Although Ogden (1991) attributed this to an increase in the availability of altered wetland and artificial wetland nesting sites, the regional increase coincided with the northward shift of the wood stork breeding population center and the overall population decline in the southeastern United States.

Both the size and success of a wood stork colony varies from year to year based on availability of suitable wetland foraging areas, which can be affected by local rainfall patterns, regional weather patterns, and anthropogenic hydrologic management (Service 1996). The colony site may be vacant in years of drought due to inadequate foraging conditions in the surrounding area. Traditional colony nesting sites may be abandoned completely by storks when hydrological changes occur, removing surface water from beneath the colony trees. Conversely, nesting failures and colony abandonment may occur if unseasonable rainfall causes waters to rise when they are normally receding, thus dispersing rather than concentrating forage fish.

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).

Population stability is dependent upon maintenance of suitable nesting sites, and on the extent and productivity of wetland feeding sites (Ogden and Nesbitt 1979). So it appears that stability in the Central-North region of the wood stork's range is in part due to geographical spread in colonies (Ogden and Nesbitt 1979).

Between 1958 and 1985, the wood stork breeding population center shifted north from Lake Okeechobee to Polk County, a distance of about 132 km (82 miles). The 1976 breeding season was the last year when more pairs nested in south Florida than in central-north Florida. Productivity is generally higher in central-north Florida than south Florida. Whereas the number of colonies in south Florida has remained relatively stable, the number of colonies in central-north Florida region continues to increase (Ogden et al. 1987). The increase in central-north Florida is associated with an increase in colony numbers and not colony size. Colonies in the north are smaller than colonies in the south. Historically colonies in the south were associated with extensive wetlands and food was abundant. The implication is that food resources may be limiting colony sizes in central-north Florida (Ogden et al. 1987). Ogden et al. (1987) suggested the population shift is the result of deteriorating feeding conditions in south Florida and better nesting success rates in central-north Florida compound population growth in that area.

Concurrent with the population center shift to the north, wood storks began to use altered wetlands and artificial wetlands as nesting sites more than they used natural wetlands. Drought conditions in natural wetlands and an increase in the availability of altered and artificial wetland sites contributed to this behavioral adaptation. Altered wetlands are comprised of native wetland vegetation maintained by manipulated water levels. Stable water levels provide increased

protection against predators during periods of drought. Artificial wetlands are comprised of native upland vegetation killed by the impounding of water, generally as a result of phosphate mining. The life span of these colonies is limited to the period of time it takes rot to set in and render the dead trees and limbs too weak to support a wood stork nest (Ogden 1991).

Status and Distribution - The wood stork is found from northern Argentina, eastern Peru, and western Ecuador north to central America, Mexico, Cuba, Hispaniola, and the southeastern United States (AOU 1983). Population declines have been documented in Mexico and Belize (Luthin 1987), only one stable population has been reported from Costa Rica, and the status of the wood stork elsewhere in Central America is unknown (Service 1996). Wood storks in South America are threatened by development. The enormous colonies of the Pantanal in Brazil are threatened by agriculture, water pollution, and a massive project to drain, dike, and channelize the world's largest wetland (Alho et al. 1988). Mexico listed the wood stork as endangered in 1991.

In the United States, wood storks were historically known to nest in all coastal states from Texas to South Carolina (Wayne 1910; Bent 1926; Howell 1932; Oberholser 1938; Dusi and Dusi 1968; Cone and Hall 1970; Oberholser and Kincaid 1974). Currently, wood stork nesting is known to occur in Florida, Georgia, and South Carolina and may disperse as far north as North Carolina, and as far west as Mississippi and Alabama in coming years (Billy Brooks, Service, personal communication, 2003). Breeding colonies of wood storks occur in all southern Florida counties.

The decline in the U.S. population of the wood stork is thought to be related to one or more of the following factors: (1) reduction in the number of available nesting sites; (2) lack of protection at nesting sites; and/or (3) loss of an adequate food base during the nesting season (Ogden and Nesbitt 1979). Ogden and Nesbitt (1979) indicate a reduction in nesting sites is not the cause in the population decline, because the number of nesting sites used from year to year is relatively stable. They suggest loss of an adequate food base is a cause of wood stork declines. Changes in remaining wetland systems in Florida, including drainage and impoundment, may be a larger problem for wood storks than loss of foraging habitat (Ogden and Nesbitt 1979).

The primary cause of the wood stork population decline in the United States is loss of wetland habitats or loss of wetland function resulting in reduced prey availability. Almost any shallow wetland depression where fish become concentrated, either through local reproduction or receding water levels, may be used as feeding habitat by the wood stork. Wood storks historically occurred in all coastal states from Texas to South Carolina. Dahl (1990) estimates these states lost about 38 million acres, or 45.6 percent, of their historic wetlands between the 1780s and the 1980s. However, it is important to note wetlands and wetland losses are not evenly distributed in the landscape. Hefner et al. (1994) estimated 55 percent of the 2.3 million acres of the wetlands lost in the southeastern United States between the mid-1970s and mid-1980s were located in the Gulf-Atlantic Coastal Flats. These wetlands were strongly preferred by wood storks as nesting habitat.

Browder et al. (1976; 1978) documented the distribution and the total acreage of wetland types occurring south of Lake Okeechobee, Florida, for the period 1900 through 1973. We combined their data for habitat types known to be important foraging habitat for wood storks (cypress domes and strands, wet prairies, scrub cypress, freshwater marshes and sloughs, and saw grass marshes) and found these habitat types have been reduced by 35 percent since 1900.

The alteration of wetlands and the manipulation of wetland hydroperiods to suit human needs have also reduced the amount of habitat available to wood storks. The decrease in wood storks nesting on Cape Sable was related to the construction of the drainage canals during the 1920s. Water level manipulation can facilitate raccoon predation of wood stork nests when water is kept too low (alligators deter raccoon predation when water levels are high). Artificially high water levels may retard nest tree regeneration since many wetland tree species require periodic droughts to establish seedlings. Water level manipulation may decrease food productivity if the water levels and length of inundation do not match the breeding requirements of forage fish. Dry-downs of wetlands may selectively reduce the abundance of the larger forage fish species that wood storks tend to utilize, while still supporting smaller prey fish.

Since the 1970s, wood storks have also been observed to shift their nest sites to artificial impoundments or islands created by dredging activities (Ogden 1991). The percentage of nests in artificial habitats in central and north Florida has increased from approximately 10 percent of all nesting pairs in 1959 to 1960 to 60 to 82 percent between 1976 and 1986 (Ogden 1991). Nest trees in these artificially impounded sites often include exotic species such as Brazilian pepper (*Schinus terebinthifolius*) or Australian Pine (*Casuarina* spp.). Ogden (1996a) has suggested the use of these artificial wetlands indicates wood storks are not finding suitable conditions within natural nesting habitat or they are finding better conditions at the artificial wetlands. The long-term effect of these nesting areas on wood stork populations is unclear.

Human disturbance is a factor known to have a detrimental affect on wood stork nesting (Service 1996). Wood storks have been known to desert nests when disturbed by humans, thus exposing eggs and young birds to the elements and to predation by gulls and fish crows. The role of chemical contamination in the decline of the wood stork is unclear. Pesticide levels high enough to cause eggshell thinning have been reported in wood storks but decreased productivity has not yet been linked to chemical contamination (Ohlendorf et al. 1978; Fleming et al. 1984). Burger et al. (1993) studied heavy metal and selenium levels in wood storks from Florida and Costa Rica. Adult birds generally exhibited higher levels of contaminants than young birds. The authors attribute this to bioaccumulation in the adults who may be picking up contaminants at the colony nesting site and while foraging at other locations during the non-breeding season. There were higher levels of mercury in young birds from Florida than young birds or adults from Costa Rica. Young birds from Florida also exhibited higher levels of cadmium and lead than young birds from Costa Rica. The authors recommended the lead levels in Florida be monitored. Burger et al. (1993) drew no conclusions about the potential health effects to wood storks.

In 2002, more wood stork nesting was recorded in the southeastern U.S. than in any other year on record (since 1976), and a total of as many as 10,126 nests were reported (Service 2004). In 2003, the number of nests was comparable, with as many as 9,416 nests reported (Service 2004). The number of colonies also continues to rise; and in 2003, 78 nesting colonies were reported

(Service 2004), which is the highest to date in any one year. Data on the 2004 nesting season for the entire southeastern U.S. have not yet been compiled. The Florida wood stork population mirrors the total population, with a record number of nests reported in 2002. Since 2002, nesting has declined slightly each year, and in 2004, 5,216 nests were reported in 58 colonies (Meyer and Frederick 2004). Despite the decrease in total nest numbers, the number of colonies increased, which is again consistent with a continued reduction in average colony size (Meyer and Frederick 2004).

Recovery goals - Measuring the biological aspect of the recovery of the wood stork is outlined in the Service's 1997 recovery plan. The plan's recovery criteria state that reclassification from endangered to threatened could be considered when there are 6,000 nesting pairs and annual regional productivity is greater than 1.5 chicks per nest/year (calculated over a 3-year average). Delisting could be considered when there are 10,000 nesting pairs calculated over a 5-year period beginning at the time of reclassification and annual regional productivity is greater than 1.5 chicks per nest/year (calculated over a 5-year average). As a subset of the 10,000 nesting pairs, a minimum of 2,500 nesting pairs must occur in the Everglades and Big Cypress systems in south Florida. Nesting data for the wood stork population in the southeast averaged 7,495 in 1999 and 8,995 in 2002 (Service 2003). Nesting data for 2000 and 2001, although recorded for many of the historical colonies, were not considered comparable data sets for nesting trend comparisons. To provide a more recent data set for trend evaluation, the Service in 2001 reinitiated another 5-year synoptic aerial survey effort for wood stork colonies throughout the southeast range of the species (Service 2003). Preliminary data from 2004 suggest that the population size threshold of 6,000 nesting pairs for 3 consecutive years that is cited for downlisting wood storks may have been met, though productivity estimates are still lacking.

In south Florida, wood stork colonies occur on both the west and east coast, from Pelican Island National Wildlife Refuge on the east coast to Corkscrew Sanctuary in southwest Florida. Table 3 summarizes wood stork nesting data for some of the principal wood stork nesting areas in south Florida that were intensively monitored from 2001 to 2004.

Table 3. South Florida Wood Stork Nesting Data

	2001	**2002**	**2003**	**2004**
Everglades National Park	1,585	835	735	540
Water Conservation Areas 2 and 3 and Loxahatchee National Wildlife Refuge	465	626	415	325
Big Cypress Preserve	0	25	0	0
Corkscrew Sanctuary	0	1,240	1,100	520
Pelican Island National Wildlife Refuge	10	176	120	150
Palm Beach County Solid Waste Authority	267	213	140	240
Total	**2,327**	**3,115**	**2,510**	**1,855**

The Everglades and Big Cypress system is generally considered to include those colonies within Everglades National Park, Water Conservation Areas 2 and 3, and Loxahatchee National Wildlife Refuge. Nesting pairs for these colonies totaled 2,050 in 2001; 1,486 in 2002; 1,150 in

2003; and 865 in 2004 (Crozier and Gawlik 2003; Service 2003; Crozier and Cook 2004), which is a decreasing trend. However, the nesting data from the more widely-distributed colonies within south Florida show a relatively stable trend for the same time period, though substantial fluctuations were recorded. These observed fluctuations in the nesting between years and nesting sites has been attributed primarily to variable hydrologic conditions during the nesting season (Crozier and Gawlik 2003; Crozier and Cook 2004). Frequent heavy rains during nesting can cause water levels to increase rapidly multiple times during the breeding cycle. The changes in water levels during nesting, termed reversals (Crozier and Gawlik 2003), may cause nest abandonment, re-nesting, late nest initiation, and poor fledging success. An example of these effects is evident in the number of nests for the Corkscrew Sanctuary, *i.e.,* 0 in 2001; 1,240 in 2002; 1,100 in 2003; and 520 in 2004. The significance of this variability in the wood stork nesting is being evaluated as a component of the recovery goals established for wading birds by the Comprehensive Everglades Restoration Plan (Crozier and Gawlik 2003).

ENVIRONMENTAL BASELINE – FLORIDA PANTHER

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions, which occur simultaneously with the consultation in progress.

Status of the Species within the Action Area

As stated previously, for the purposes of this consultation, the action area includes the Corps' project area and surrounding lands visited by panthers. The action area is a subset of the current geographic range of the panther and includes those lands the Service believes may experience direct and indirect effects from the proposed development. Therefore, for both direct and indirect effects, the action area is defined as all lands within a 25-mile radius of the project. This action area does not include urban lands, lands west of I-75, and lands outside the Service's panther consultation area. The proposed action may have direct and indirect effects on the ability of panthers to breed, feed, find shelter, and to disperse within the population.

The Service used current and historical radio-telemetry data, information on habitat quality, prey base, and evidence of uncollared panthers to evaluate panther use in the action area. Panther telemetry data are collected 3 days per week from fixed-wing aircraft, usually in early to midmorning. However, researchers have shown that panthers are most active between dusk and dawn (Maehr et al. 1990a, Beier 1995) and are typically at rest in dense ground cover during daytime monitoring flights (Land 1994). Therefore, telemetry locations may present an incomplete picture of panther activity patterns and habitat use (Comiskey et al. 2002). In addition, telemetry data alone may be misleading since less than half the panther population is currently monitored.

Although telemetry data may not provide a complete picture of panther activity patterns, telemetry locations are a good indicator, due to the extensive data set, of the approximate boundaries of home ranges and the range of Florida panthers south of the Caloosahatchee River.

The FWC also uses telemetry data to assess the yearly breeding activity of radio-collared panthers. Female panthers accompanied by kittens or male panthers within close proximity of an adult female were assumed to have engaged in breeding activity during that year. Documentation by McBride (FWC 2003) shows that between July 2002 and June 2003, 12 collared panthers, 4 uncollared females, and 3 uncollared males had home ranges in or home ranges that overlapped the same survey unit as the Mirasol project. In addition, 8 other panthers that used this same survey unit previously, died during this time period (FWC 2003). This unit, designated as Unit 5, includes the Florida Panther NWR, Corkscrew Swamp Sanctuary, and CREW.

Within the action area, the 25-mile radius, at least 8 radio-collared panthers have overlapping known home ranges. These panthers are FP 59 (male), FP 60 (male), FP 65 (male), FP 75 (female), FP 83 (female), FP 107 (female), FP 113 (female), and FP 131 (male). Panther FP 66, a female, was documented within 5 miles of the project site in 1998. In addition, McBride (2003) notes previous use of the action area by other panthers prior to their mortality. According to telemetry data, radio-collared Florida panther 92 was recorded on the project site in 2001. The status and activities of uncollared Florida panthers within the action area is unknown.

The project site is located within the western portion of the geographic range of the panther in Florida. There have been a total of 4 male panthers recorded within 5 miles of the project site on 87 occasions from 1989 through 2002. The Service believes the project site may be used by panthers because it contains habitat types used by panthers and their prey. The project vicinity has been used historically by panthers as indicated by telemetry locations over a 14-year period.

Past and ongoing Federal and State actions affecting panther habitat in the action area include the issuance of Corps permits and State of Florida Environmental Resource permits authorizing the filling of wetlands for development projects and other purposes. Since 1982, the Corps and the State have had a joint wetland permit application process, where all permit applications submitted to the State are copied to the Corps and vice versa. Within the 25-mile action area, the Service, since January 14, 1992, has formally consulted on 32 projects regarding the panther that were a result of Federal actions (database entries for formal consultations prior to 1992 are incomplete for projects in the action area). These projects have impacted or are expected to impact approximately 41,671 acres of panther habitat. These projects have also incorporated a total of 17,355 acres of preservation and restoration of panther habitat. The impacted lands generally are: (1) on the western fringe of occupied panther habitat; (2) vegetated with dense stands of exotic species, which may adversely affect the density of the panther prey base; and/or (3) support agricultural enterprises, *i.e.*, row crops, citrus, etc., which provide a lower quality habitat value to the Florida panther. The preserved lands, which are generally proximate to larger tracts of Federal, State, and other preserves, provide a higher quality habitat value for the Florida panther. The Service has determined in the biological opinions issued for these Federal actions, that individually and cumulatively these projects do not jeopardize the survival and recovery of the Florida panther.

From July 2000 through September 2004, the Service also engaged in informal consultation within the Florida panther consultation area with the Corps for approximately 314 projects

affecting approximately 420 acres in Collier County (primarily Northern Golden Gate Estates) and 26 acres in Lee County (primarily Lehigh Acres) (database entries for informal consultations prior to 2000 are incomplete for projects in the consultation area). Almost all of these projects involved the construction of single-family residences in partially developed areas, each involving less than an acre of direct impact. Although panthers have been known to cross these areas to other parts of their range, prey base and denning utilization of these areas have been affected by the level of development and the additions of these residences is not expected to significantly further impact these habitat functions. For these actions, the Service concurred with the Corps' determination of "may affect, but is not likely to adversely affect" for these individual projects. These projects have been incorporated into the Service's environmental baseline for the Florida panther and the Service has determined that individually and cumulatively these projects do not jeopardize the survival and recovery of the Florida panther.

We have received information that within the action area, the Corps has, between January 1, 2004, and September 30, 2004, issued non-jurisdictional wetland determinations (isolated wetlands) for 2 projects, totaling 38.2 acres in Collier County, and for 3 projects, totaling 236 acres in Lee County. These additional determinations were issued per jurisdictional guidance provided recently in the Supreme Court decision, *Solid Waste Agency of Northern Cook County vs. U.S. Army Corps of Engineers,* 531 U.S. 159 (2001), and therefore, they will require no Federal Clean Water Act 404 wetland permit. These projects have been incorporated in the Service's environmental baseline for the Florida panther in this biological opinion and the Service has determined, based on the location of these projects (generally in the western fringe of the panther's geographic range), the quality of the habitat present on these project sites, and the overall status of the Florida panther, these projects individually and cumulatively do not jeopardize the survival and recovery of the Florida panther. However, since loss of panther foraging habitat may occur from construction of these projects and no Corps' wetland permit is required, the Service is requesting the applicants pursue Habitat Conservation Plans in cooperation with the Service.

Panther mortality related to traffic within the 25-mile action area from 1985 through August 2004 totals 30 documented panther-vehicle collisions (Table 4 and Figure 9). Two recent road mortalities are east of the project area on CR 846, the location of which is being evaluated for construction of a panther crossing (FWC 2003).

Activities within the action area have also benefited panthers. The issuance of Corps and State of Florida Environmental Resource permits has preserved 17,355 acres of panther habitat for permitted impacts to 41,671 acres of panther habitat. Additional benefits have resulted from the acquisition of high quality habitat through acquisition programs by the other Federal, State, and County resource agencies. Table 5 provides a summary of the State and County acquisitions within the action area during the last 5 years.

Moreover, the management of public lands, including prescribed fire and eradication of exotic vegetation in the Picayune Strand State Forest, Fakahatchee Strand State Preserve, Florida Panther NWR, ENP, and other conservation areas, is intended to improve habitat for panther prey species, which benefits panthers within these areas.

Table 4. Panther-Vehicle Collisions Within Mirasol Panther Consultation Area

Distance from Project	Roadway	Date	Result
23.9 miles southeast	State Road 29	1979	Death
22.1 miles southeast	State Road 29	1980	Death
21.4 miles southeast	State Road 84	1983	Death
19.8 miles southeast	State Road 84	1984	Death
19.9 miles southeast	State Road 84	1985	Death
20.9 miles southeast	State Road 84	1985	Death
14.2 miles southeast	County Road 951	1985	Injury
20.1 miles southeast	State Road 84	1986	Death
22.9 miles northeast	County Road 858	1987	Injury
22.2 miles southeast	State Road 29	1987	Death
18.1 miles north	Daniels Road	1988	Injury
16.7 miles east	County Road 850	1989	Death
23.7 miles southeast	State Road 29	1990	Death
22.3 miles southeast	State Road 29	1991	Death
14.5 miles north	Alico Road	1992	Injury
22.2 miles southeast	State Road 29	1992	Death
17.8 miles north	Daniels Road	1993	Death
24.8 miles northeast	County Road 846	1993	Death
22.2 miles southeast	State Road 29	1994	Death
23.2 miles northeast	County Road 846	1995	Death
22.4 miles southeast	State Road 29	1998	Injury
22.5 miles southeast	State Road 29	1998	Death
20.6 miles east	County Road 858	2000	Death
21.2 miles northeast	County Road 846	2000	Death
23.8 miles northeast	County Road 846	2000	Death
22.1 miles southeast	State Road 29	2001	Death
22.2 miles southeast	State Road 29	2002	Death
22.1 miles northeast	County Road 846	2002	Death
6.7 miles northeast	County Road 846	2002	Death
13.5 miles northeast	County Road 846	2003	Death
22.0 miles southeast	State Road 29	2003	Death
22.0 miles northeast	State Road 29	2003	Death
22.1 miles northeast	State Road 29	2003	Death
14.1 miles northeast	County Road 846	2003	Death
20.7 miles east	County Road 858	2003	Death
10.8 miles southeast	Interstate 75 MM 99	2004	Death
14.1 miles southeast	Interstate 75 MM 93	2004	Death
11.2 miles southeast	Interstate 75 MM 98	2004	Death

Table 5. County and State Acquisitions within the Action Area (Acres)

Year	County	State
1998	1,723	*
1999	315	*
2000	1,237	*
2001	700	*
2002	369	767
2003	2,291	60
Totals	6,635	827

Acreages per-year data are under request from the State of Florida.

Factors Affecting Species Environment within the Action Area

Factors that affect the species environment (positive and negative) within the action area include, but are not limited to, highway, urban, agriculture, resource extraction, public lands management (prescribed fire, public use, exotic eradication, etc.), hydrological restoration projects, public and private land protection efforts, effects of genetic inbreeding, and genetic restoration. Development activities may result in avoidance or limited use of remaining suitable habitat by panthers as well as habitat loss, habitat fragmentation, habitat degradation, and also an increase in risk of vehicular collision (*e.g.*, injury or death).

Public and private land management practices can have a positive, neutral, or negative effect, depending on the management goals. Land protection efforts will help to stabilize the extant population. Hunting of the panther is no longer sanctioned, although there still may be instances of intentional or unintentional shooting of individuals for various reasons.

EFFECTS OF THE ACTION – FLORIDA PANTHER

This section analyzes the direct and indirect effects of the proposed action and interrelated and independent actions on the Florida panther and Florida panther habitat.

Factors to be Considered

Residential, commercial, and industrial development projects may have a number of direct and indirect effects on the Florida panther and panther habitat. Direct impacts, which are primarily habitat based, may include: (1) the permanent loss and fragmentation of panther habitat; (2) the permanent loss and fragmentation of habitat that supports panther prey; (3) the loss of available habitat for foraging, breeding, and dispersing panthers; and (4) a reduction in the geographic distribution of the species. Indirect effects may include: (1) an increased risk of roadway mortality to panthers traversing the area due to the increase in vehicular traffic; (2) increased

disturbance to panthers in the project vicinity due to human activities; (3) the reduction in panther prey; (4) the reduction in value of panther habitat adjacent to the project due to habitat fragmentation; and (5) a potential increase in intraspecific aggression between panthers (and an increase in mortality of subadult male panthers) due to reduction of the geographic range of the panther. These indirect effects are habitat based with the exception of vehicular mortality, which could result in lethal "take." Intraspecific aggression, though habitat based, could also result in lethal "take." However, based on our analysis (see below), neither vehicular mortality nor mortality through intraspecific aggression are likely to occur as a result of this project.

This project site contains panther habitat and is located within the western portion of the geographic range of the Florida panther. The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. Panthers may be found on and adjacent to the proposed construction footprint year-round. The project will be constructed in a single, disruptive event, and result in permanent loss and alteration of a portion of the existing ground cover on the project site. The time required to complete construction of the project is not known, but it is likely that land clearing associated with the development could be undertaken in phases over several years. The disturbance associated with the project will be permanent and result in a loss of habitat currently available to the panther; however, fragmentation of habitat will not occur due to the proposed project's position in the landscape of existing development.

Analyses for Effects of the Action

The 1,714-acre Mirasol project site, of which 914 acres will be preserved, currently provides habitat of various quality for the Florida panther. The project site is located on the extreme western edge of the primary zone as designated by Kautz et al. (In Review), and is located inside the Panther consultation area as defined by the Service (2000). The project site is located on the western fringe of occupied habitat and is adjacent to urban development. The project will result in the conversion of 800 acres of poor quality panther habitat onsite into a residential/golf course development. Compensation for loss of 800 acres of poor quality panther habitat will be through the perpetual preservation and restoration to 914 acres of high quality panther habitat onsite and 145 acres of high quality panther habitat off-site. High quality panther habitat borders this onsite preserve area to the east and northeast. Restoration of wetlands and uplands onsite will consist of the removal of exotic vegetation, ranging from 25 to 100 percent coverage, averaging over 65 percent. The onsite preserve area is within the primary zone designated by Kautz et al. (In Review). The onsite preserve area will be protected by a conservation easement granted to the District, with enforcement rights to the Corps, and maintained in perpetuity. The off-site lands include 47 acres in PIMB and approximately 98 acres in the Cocohatchee drainage basin, both of which are in primary zone habitat. Combined project preservation lands total approximately 1,059 acres.

Habitat Assessment: To assess a project's effects to the Florida panther, the Service evaluates the project's effects through application of the Service's habitat suitability values as a direct calculation per acre with a base ratio (2.5) to compensate for unavoidable project effects to the Florida panther.

The base ratio is determined from the habitat acreage needs of a population of 90 panthers, which is the mid-point in Kautz et al.'s (In Review) PVA model predictions that a population of 80 to 100 panthers is likely to be stable, although subject to genetic problems, through 100 years. The Service, based on the average panther population density of 31,923 acres per panther (Kautz et al. In Review), determined 2,871,894 acres of primary zone equivalent lands need to be protected and managed. The available non-urban primary zone equivalent lands in the core area (Figure 10) are estimated at 3,272,493 acres (actual acreage is 4,486,364 acres), with 2,094,988 acres of primary zone equivalent lands (actual acreage is 2,605,046 acres) of non-urban lands preserved. The remaining non-urban private lands are estimated at 1,177,506 acres of primary zone equivalent lands (actual acreage is 1,881,318 acres). To meet the protected and managed lands goal, an additional 776,906 acres of primary zone equivalent lands need to be secured, leaving approximately 400,600 acres of primary zone equivalent non-urban lands at risk (1,177,506 minus 776,906 equals 400,600). A base ratio of 1.94 (rounded to 2) is necessary to achieve this goal. However, not all lands provide the same functional value to the Florida panther and not all lands will be subject to Service consultation reviews. Therefore, to provide a margin of conservatism in the Service's assessment goal to protect and manage lands for the Florida panther, an additional 0.5 was added to the ratio of 2.0, providing a base ratio of 2.5. The Service intends to re-evaluate this base ratio periodically (every 2 to 3 years) and adjust as needed to achieve the Service's conservation goal for the Florida panther.

The Service also believes a landscape multiplier is necessary to compensate for landscape location and importance of project lands in the consultation area to the Florida panther. For example, as discussed previously, lands in the other zone provide less functional value to the Florida panther than lands in the primary zone. The Service is applying landscape multipliers of 0.33 where the loss of other zone lands is being compensated for in the primary zone, 0.5 for loss in other zone lands when compensation is in the secondary zone, 0.67 for loss of secondary zone lands when compensation is in the primary zone, and 1.5 for loss of primary zone lands when compensation is in the secondary zone.

The Service had previously agreed, prior to the reinitiation of formal consultation with the Corps, that a base ratio of 2.0 would be the multiplier for recommended compensation for project functional habitat evaluations. For the Mirasol project, which is in the primary zone with compensation proposed in the primary zone, the habitat functional value for the project site is 3,756 panther habitat units (PHU), which is defined as the acres of each type of habitat multiplied by the habitat value (Table 6). Therefore, to determine the compensation needs for the project, the PHU is multiplied by the base ratio of 2.0, resulting in a compensation need of 7,512 PHUs (3,756*2 = 7,512). The PHUs for the compensation site are determined in the same manner, *i.e.*, the acres of each type of habitat multiplied by the habitat value. In this instance, the onsite preserve offered by the applicant consists of 914 acres. The onsite preserve provides 4,674 PHUs, without enhancement and 7,953 PHUs with enhancement, a lift of 3,279 PHUs.

However, since enhancement actions generally require a period of time to achieve full functional value of the enhanced habitat value (temporal lag), the Service credits this value at one-half the difference between pre- and post-functional values. For example, the onsite preserve has an existing functional value of 4,674 PHUs, once enhancement actions meet their full potential habitat value, the onsite preserve will have a functional value of 7,953 PHUs. However, because of the temporal lag in achieving full habitat values, the Service credits the compensation site with one-half of the difference (lift), which for the onsite preserve is 1,640 PHUs ([7,953-4,674]/2 = 1,640). This lift credit is added to the existing habitat value of 4,674 PHUs, providing a compensation site functional value of 6,314 PHUs.

In addition to the 6,314 PHUs of panther habitat from the onsite preserve, the applicant will purchase 10 wetland mitigation credits from the PIMB. The Service analyzed information on the habitat types at the PIMB following successful restoration and enhancement and determined each wetland mitigation credit equates to 42.3 PHUs of panther habitat. Therefore, the purchase of 10 wetland mitigation credits from the PIMB will provide 423 PHUs of panther habitat (10*42.3=423), which equates to 47 acres of habitat. The applicant will also provide PHUs through the purchase, enhancement, and preservation of sufficient lands within the Cocohatchee drainage basin to provide 32.74 wetland credits and 777 PHUs. Lands in this area are known to contain pine flatwoods impacted by melaleuca. Based on the habitat assessment technique described above, the Service estimates 777 PHUs equate to approximate 98 acres for a total off-site compensation of 145 acres. Based on the onsite preserve (914 acres), the 10 wetland credits purchased from the PIMB (which represents approximately 47 acres), and the 777 PHUs purchased in the vicinity of the Cocohatchee flow-way (which is estimated at 98 acres), the applicant will provide a total of 7,514 PHUs of panther habitat compensation for the project (6,314+423+777=7,514), which equates to the purchase, enhancement, and preservation of approximately 1,059 acres.

Based on these functional comparisons, the Service believes the habitat values lost by the proposed 800-acre development will be more than offset by the preservation and compensation actions proposed by the applicant. While the lands proposed for development are in the far western limits of the primary zone, they are heavily impacted by elevated water levels and melaleuca infestation and are adjacent to a major roadway and existing and proposed urban areas. The project lands proposed for preservation are also in the primary zone, are adjacent to other larger tracts of preserved lands, including CREW and the Corkscrew, and are consistent with the Service's panther goal to strategically locate and preserve sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the Florida panther population south of the Caloosahatchee River.

Wildlife Assessment: A protected species survey was conducted by Turrell from June 1999 to March 2000 utilizing belt transects and drift fence and bucket trap arrays. Ecologists with Turrell & Associates, Incoporated have also provided more recent observations. During these assessments, wood storks were observed foraging in the Cocohatchee Canal and in a pasture adjacent to the site. Several other State-listed wading birds were also observed both on and adjacent to the site. A survey for white-tailed deer and feral hog (*Sus scrofa*) tracks was also conducted. Eight sets of white-tailed deer tracks were observed and no feral hog tracks were observed. Based on the track surveys, the applicant calculated a deer density of 1 deer per 591

Table 6
Florida Panther Habitat Matrix
Panther Habitat Units

Land Cover Types	Habitat Values	Project Development 800 acres	Onsite Preserve 914 acres	Off-site Preserve PIMB 47 acres	Off-site Preserve CREW 98 acres
		Functional Units Needed 7512	Functional Units Provided 6314*	Functional Units Provided 423*	Functional Units Provided 777*

		Pre	Post	Pre	Post	Pre	Post	Pre	Post

		Acres	PHU	Acres	PHU	Acres	PHU	Acres	PHU	Acres	PHU	Acres	PHU	Acres	PHU	Acres	PHU
Water/Urban	0	0	0	800	0	1	0	30	0					0	0	0	0
Exotic Plants	3	573	1719			590	1770	0	0					34	102	0	0
Hardwood Swamp	9	1	9			1	9	1	9					1	9	10	90
Cypress Swamp	9	45	405			99	891	116	1044	25	225	0	0	7	63	15	135
Pine Forest	9	179	1611			221	1989	758	6822	22	198	0	0	54	486	71	639
Freshwater Marsh	9	0	0			1	9	8	72					1	9	1	9
Dry Prairie	6	2	12			1	6	1	6					1	6	1	6
Subtotal		800	3756	800	0	914	4674	914	7953	47	423	0	0	98	675	98	879

* Functional Units provided is one-half of the difference between pre and post enhancement values added to the pre value.

acres. Evidence of armadillo, bobcat, and raccoon was observed during the surveys. Bear tracks were observed on one occasion along Broken-Back Road to the east of the project site. Other small mammals, also constituting panther prey, may utilize the site.

As discussed previously, white-tailed deer densities and other prey species are influenced by the quality of the foraging habitat present in an area. Monotypic stands of poor quality foraging plant species and the invasion of a site by exotic plants provide lower habitat foraging values and affect the utilization by and density of foraging species. The habitats in the project area have also experienced similar vegetation changes. Historical vegetation on the property included a mosaic of upland and wetland habitats that provided a seasonal pattern of plant growth. However, past agricultural practices and the invasion of the habitats by the exotics, melaleuca and Brazilian pepper, have resulted in the growth of dense stands of monotypic, unpalatable plant species that provide poor quality foraging needs for resident deer populations. While the enhancement area, with its growth of invasive exotic plant species and altered hydrology, also displays similar foraging restrictions, the proposed enhancements will result in a more diverse mosaic of plant species, which will provide an increased foraging value to resident deer populations.

Conservation Measures: The beneficial effects of the project include the preservation and enhancement of 914 acres of "primary" zone panther habitat onsite, which is outside of the development footprint of the project site and the preservation and restoration of 145 acres from a combination of the purchase of wetland mitigation credits from PIMB and the acquisition of approximately 98 acres of additional lands within the Cocohatchee basin, for a total preservation acreage of approximately 1,059 acres. Although the project will result in a net loss in the number of acres of habitat, habitat will be preserved and enhanced for the Florida panther. Enhancement consists of eradication of exotic vegetation, primarily melaleuca, and to a small degree, Brazilian pepper. The eradication of exotics, in conjunction with the lowering of artificially elevated water levels across the site, will improve suitability for the panther primarily through the resultant improvement in panther prey base. The preserve lands will be protected by a conservation easement granted to the State of Florida and, once the success criteria are met for the enhancement, the preserve lands will be granted to CREW.

Direct Effects

Direct effects are those effects caused by the proposed action at the time of construction, are primarily habitat based, are reasonably certain to occur and include: (1) the permanent loss and fragmentation of panther habitat; (2) the permanent loss and fragmentation of habitat that supports panther prey; (3) the loss of available habitat for foraging, breeding, and dispersing panthers; and (4) a reduction in the geographic distribution of the species. Panthers may also be subject to harassment by construction activities. The direct effects this project will have on the Florida panther within the action area are discussed below.

Permanent Loss of Habitat: The project will result in the loss of 800 acres of panther habitat located within the "primary" zone. The land will be converted to support a residential and golf course community. Habitat quality is generally poor, as it is primarily disturbed flatwoods supporting an average of 65 percent exotics. Prey surveys documented only minimal site usage

by white-tailed deer, a primary panther prey species. Therefore, we believe the loss of the habitat associated with these lands is not significant and this action is not expected to result in jeopardy to the Florida panther.

Fragmentation of Habitat: The project site is located on the western fringe of occupied habitat, is adjacent to urban development, and is not located within known dispersal corridors; therefore, fragmentation of panther habitat is not expected to result from project implementation. The project site is also bordered on the north, west, and south by disturbed and/or other agricultural and urban lands, which provide marginal quality foraging habitat for prey species; therefore, fragmentation of panther prey species habitat is not expected.

Construction: The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. However, it is likely all land clearing associated with the development will occur in phases over a couple of years. There are no known den sites within the project boundaries and the quality and quantity of the foraging prey base is low. Therefore, we believe panther usage of the property is limited and do not believe project construction will result in direct panther mortality.

Compensation: The Service believes the habitat values lost by the development will be offset by the preservation and compensation actions proposed by the applicant. The lands proposed for development are primarily hydrologically disturbed and exotic infested on the fringe of the currently occupied range of the Florida panther, and are adjacent to CR 846 and existing urban areas. The lands proposed for preservation are adjacent to the development and are connected to other larger tracts of preserved lands and are consistent with the Service's panther goal to locate and preserve sets of lands containing sufficient area and appropriate cover types to ensure the long-term survival of the Florida panther south of the Caloosahatchee River.

Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

Indirect Effects

Indirect effects are those effects that result from the proposed action and are reasonably certain to occur. The indirect effects this project will have on the Florida panther within the action area are discussed below and in the assessment of functional habitat values previously discussed. They include: (1) an increased risk of roadway mortality to panthers traversing the area due to the increase in vehicular traffic; (2) increased disturbance to panthers in the project vicinity due to human activities; (3) the reduction in panther prey; (4) the reduction in value of panther habitat adjacent to the project due to habitat fragmentation; and (5) a potential increase in intraspecific aggression between panthers due to reduction of the geographic range of the panther.

Increased Risk of Roadway Mortality: The project will result in minor increased vehicular traffic in the project vicinity during construction and operation. However, vehicular mortality data (see Table 4 and Figure 9) provided by the FWC indicate collisions with motor vehicles are not an important source of panther mortality in the project vicinity. According to traffic studies by Vanasse and Daylor, Incorporated, construction traffic will be coming from CR 846 and CR 951, which are south of the project site. The access is along major roadways already heavily traveled. It is projected approximately 65 percent of the project traffic will be to/from the west of the project on Immokalee Road (CR 846), 25 percent will be to/from the south of the project on CR 951, and 10 percent will be to/from the east of CR 951 on Immokalee Road. From a project average, daily traffic volume standpoint, 3,663 vehicles per day are projected on Immokalee Road to the west of the project, 1,409 vehicles per day are projected on CR 951 south of Immokalee Road, and 564 vehicles per day are projected on Immokalee Road to the east of CR 951. The projected project traffic estimated as a percentage of existing traffic represents an increase by about 9 percent of the existing traffic of Immokalee Road to the west of the project, by about 7 percent of the existing traffic on CR 951 south of Immokalee Road, and by about 3 percent of the existing traffic of Immokalee Road to the east of CR 951. From a percentage basis, the project traffic is projected to be 7 percent of the capacity of Immokalee Road to the west of the project, 3.1 percent of the capacity on CR 951 south of Immokalee Road, and 1 percent of the capacity of Immokalee Road to the east of CR 951.

Although there will be some traffic increase east of the project site, the traffic flow pattern to and from the proposed development will be generally to the west and south into urban areas and not east into the more rural lands of Collier County. Considering this information and the distances from the project site to documented collisions, it is unlikely the traffic generated by this project will significantly increase the risk of roadway mortality to panthers.

Habitat Fragmentation: The project site is located on the western fringe of occupied habitat, is adjacent to urban development, and is not located within known dispersal or connection corridors; therefore, fragmentation of panther habitat is not expected to result from project implementation.

Panther and Prey Disturbance and Intraspecific Aggression: Potential increase in intraspecific aggression and disturbance to the Florida panther was evaluated. However, the Service believes, as previously discussed, the habitats on the property provide marginal quality foraging for prey species, which directly affects the frequency and duration of use of the property by panthers. Also, the project site is not part of a documented panther movement or dispersal corridor. Therefore, the Service believes it is unlikely the loss of the limited use of the site by panthers will significantly increase the risk of mortality from intraspecific aggression between panthers and increase disturbance to panthers in the project action area due to human activities, or result in a reduction of panther prey. As documented in the prior section, development of the project site is not expected to result in habitat fragmentation or a reduction in the habitat value of adjacent property.

CUMULATIVE EFFECTS – FLORIDA PANTHER

Cumulative effects include the effects of future State, Tribal, local, or private actions reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions unrelated to the proposed action but located in the action area are not considered in this section because they require separate consultations pursuant to section 7 of the ESA. As discussed in the environmental baseline, the Service identified a variety of actions that may have a beneficial and/or an adverse effect on the Florida panther and has developed a mechanism to distinguish between those actions both likely and not likely to be future Federal actions, and thus meet the cumulative effects definition. The cumulative effects assessment action area for the Mirasol project is similar in size, location, and scope as the Bonita Springs Utilities (BSU) action area and is within a relatively similar time frame of analysis (mid January 2005 for BSU and mid February 2005 for Mirasol). Therefore, the Service is referencing the identified future State, Tribal, local, or private actions referenced in the BSU Biological Opinion (January 18, 2005) for cumulative effects as the basis of our cumulative effects evaluation for Mirasol.

Within the action area, past and ongoing State and County actions affecting panther habitat include the issuance of Development of Regional Impact Orders (2001–2004), Comprehensive Plan Amendments (2003–2004), Zoning Amendments (2003–2004), Planned Unit Developments (2001–2004), and Environmental Resource Permits (2003–2004). To evaluate these effects, the Service incorporated the Florida Land Use, Cover and Forms Classification System (FLUCCS) mapping to determine properties that may be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps. For listing purposes, properties with less than 5 percent wetlands were considered by the Service to be generally exempt from regulatory review as these quantities of wetlands could be avoided by project design. The Service cross-referenced the boundaries and approximate locations of the listed projects on recent aerial photographs (Figure 11). Table 7 provides a list of those projects, size in acres, year approved, and designation if wetlands are present. According to FLUCCS mapping, approximately 2,627 acres could be expected to be subject to development in the action area without Federal permit involvement through the Clean Water Act section 404. According to the most current home range estimates of the Florida panther (FWC 2004), this level of development represents 9.8 percent of a female panther home range and 2.7 percent of a male panther home range.

State and County land alteration permits not part of those actions listed above, generally included single-family residential developments within Northern Golden Gate Estates and Lehigh Acres. Vacant lands within the area of Northern Golden Gate Estates (north of I-75) total approximately 34,028 acres as of September 2004 (Figure 12). To evaluate these effects, the Service overlaid the plat boundaries on 2004 aerials, queried the parcel data from Collier County Property Appraisers Office, noted lots with developments, compared those to 2003 aerils, and noted the changes. Vacant lands within the area of Northern Golden Gate Estates (north of I-75) total approximately 35,768 acres as of August 2003. The breakdown of acres for August 2003 is: (1) wetlands, approximately 17,572 acres; (2) uplands, approximately 17,990 acres; and (3) water, approximately 210 acres. These changes were overlain on the National Wetlands Inventory (NWI) maps for presence of wetlands. This evaluation was used to estimate the percentage of properties that may be exempt from Federal Clean Water Act section 404 wetland

Table 7. Mirasol – Florida Panther Consultation Area Project List

Less than 5 percent Wetland Acres	Permits Issued								
Project Name	**Total Acres**	**Wetland Acres**	**% Wetland Acres**	**City**	**Comp Plan**	**DRI**	**PUD**	**Rezoning**	**District**
Schuman Insurance	0.25	0.00	0.00%					2003	
Gunnery Road Commercial	0.26	0.00	0.00%					2003	
HMB Rezoning	0.47	0.00	0.00%					2004	
Sellstate Associates R	0.50	0.00	0.00%					2004	
Il Rezoning	0.52	0.00	0.00%					2004	
Sunbelt Realty Sales C	0.56	0.00	0.00%					2003	
Djans Embroidery Design	0.75	0.00	0.00%					2003	
707 Canterbury Circle	0.81	0.00	0.00%					2004	
Gunnery Rd Residential	1.24	0.00	0.00%					2003	
Wanda Hall Rezone	1.30	0.00	0.00%					2003	
Florida Landmark Community	1.93	0.00	0.00%					2004	
Coffey Discount Furniture	4.88	0.00	0.00%					2004	
Charter School	5.82	0.00	0.00%		2003				
Colonades at Santa Barbara	6.82	0.00	0.00%				0		
Immokalee Senior Housing	7.39	0.00	0.00%				0		
Summer Glen Apartments	7.58	0.00	0.00%				0		
GGFD	9.08	0.00	0.00%				0		
Egret Isles	9.99	0.00	0.00%				0		
Talavera Estates	10.12	0.00	0.00%					2004	
Bonus Density Woodward	16.34	0.00	0.00%					2003	
Bristol Pines	17.67	0.00	0.00%				2003		
Delacruz 19 Acre	18.98	0.00	0.00%					2003	
Dominion Video Satellite	21.81	0.00	0.00%						2004
Veterans Park Rezoning	36.04	0.00	0.00%					2003	
New Hope Ministries	39.99	0.00	0.00%				0		
ASGM Business Center of Naples	40.77	0.00	0.00%				2001		
Santa Barbara Landings	42.61	0.00	0.00%				0		
Collier County Gov't Center	59.78	0.00	0.00%			2004	2004		
ASGM Business Park	128.12	0.00	0.00%						2004
Glen Eagle Golf & Cntry Club/Bretonne Park	300.91	0.00	0.00%			2001			
Parklands West	304.04	0.00	0.00%			2001	2001		
Orange Blossom Ranch	641.84	0.00	0.00%				0		2004
Serengeti Subdivision	29.60	0.02	0.07%						2003
Airside Plaza	121.81	0.15	0.12%			2003	2004		
Village Walk at Bonita Springs	649.40	0.87	0.13%						2004
The Brooks of Bonita Springs	18.60	0.06	0.32%			2002	1997		
Eastwood Professional Center	158.09	2.81	1.78%						2004
River Pointe	38.75	0.74	1.91%						2004
TOTALS:	2,627.3	4.65							

regulatory reviews by the Corps (Figure 12). A comparison of the 2003 and 2004 data for Northern Golden Gate Estates indicates approximately 1,740 acres of land were converted from vacant to developed with the breakdown as: (1) wetlands, approximately 696 acres; and (2) uplands, approximately 1,044 acres. Therefore, using NWI mapping, approximately 1,050 acres could be expected to be subject to development each year in this area without Federal permit involvement.

Vacant lands within the area of Lehigh Acres total approximately 34,852 acres as of April 2003 (Figure 13). The breakdown of acres is: (1) wetlands, approximately 1,057 acres; (2) uplands, approximately 33,592 acres; and (3) water, approximately 202 acres. A review of aerial photography and Lee County building permit data for Lehigh Acres from the 1-year period prior to April 2003 indicates approximately 441 acres of land was converted from vacant to occupied during the 1-year period. The breakdown of converted acres is estimated as: (1) wetlands, 66 acres; (2) uplands, 375 acres; and (3) water, 0 acres. For the non-exempt projects, where permits were required by the Corps, the Service concurred with the Corps' determination of "may affect, but is not likely to adversely affect" for these individual projects. Therefore, using NWI mapping, approximately 375 acres could be expected to be subject to development each year in this area without Federal permit involvement.

The evaluation process discussed previously for both of these subdivisions provided an estimate of 423 lots totaling 1,044 acres for Northern Golden Gate Estates and 1,764 lots totaling 375 acres for Lehigh Acres. Therefore, using NWI mapping for the Northern Golden Gate Estates and Lehigh areas, a total of approximately 1,419 acres could be expected to be subject to development each year in these areas without Federal permit involvement. Based on historical records for wetland permits issued by the Corps for these areas, most of these projects will involve the construction of single-family residences in partially developed areas and will involve less than an acre of impact. This level of development represents 3.7 percent of a female panther home range and 1.4 percent of a male panther home range.

In conclusion, the Service's cumulative effect analysis has identified approximately 4,046 acres within the action area that could be developed without Federal wetland permit involvement. This level of development is reasonably certain to occur, will not involve a Federal action, and therefore, meets the definition of a cumulative effect. This level of development represents 14.3 percent of a female panther home range, 5.4 percent of a male panther home range, and 0.22 percent of the private non-urban lands at risk in the core area. As previously discussed, these lands are generally on the fringes of occupied panther habitat, vegetated with exotics or in row crops, are in partially developed areas, and represent less than 1 percent of the private lands at risk in the core area. Therefore, we believe the loss of the habitat associated with these lands is not significant.

SUMMARY OF EFFECTS – FLORIDA PANTHER

The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. However, it is likely that all land clearing associated with the development will be completed in phases over a couple of years. There are no known den sites within the project

boundaries and the quality and quantity of the foraging prey base is low. Therefore, we believe panther usage of the property is limited and we do not believe project construction will result in direct panther mortality.

Although there will be some traffic increase east of the project site, the traffic flow pattern to and from the proposed development will be generally to the west and south into urban areas and traffic is not directed into the more rural lands of Collier County. Considering this information and the distances from the project site to documented collisions, we believe it is unlikely that the traffic generated by this project will result in direct road mortality of panthers.

The Service, based on the habitat evaluations discussed previously, believes that the project will result in the loss of 800 acres of panther habitat within the primary zone. Habitat types are primarily disturbed and infested flatwoods with average exotic vegetation coverage in excess of 65 percent. Wildlife utilization of the property shows limited foraging values to panther prey species. The loss of these 800 acres of panther habitat represents 0.042 percent of the 1,881,318 acres of available non-urban private lands in the core area. The Service believes that this small loss (0.042 percent) of panther habitat on the western fringe of the panther's range will not adversely affect the Service's recovery and land conservation/preservation goals.

On the other hand, the project will also provide for the preservation and enhancement of 914 acres of "primary" zone habitat associated with the project site, purchase of 10 credits and preservation of the mitigation bank acreages associated with those credits, and purchase, enhancement and preservation of additional off-site lands also within the "primary" zone. The mitigation bank credit and the additional off-site land purchases are estimated at 145 acres for a total purchase, enhancement, and preservation acreage of 1,059 acres. Enhancement on the project site will be in the form of removing exotics from all habitat types, restoration of more natural water levels, and fostering growth of native species in replacement of the exotics. Enhancement of off-site lands will be in the form of exotic vegetation removal and fostering growth of native species in replacement. The preservation of these lands in the panther core preservation area represents at least 0.25 percent of the 443,399 acres of private lands still needed for the population of 80 individuals and at least 0.10 percent of the 1,086,361 acres of private lands still needed for 100 individuals. Therefore, we believe the preservation of the 1,059 acres of panther habitat in the panther core preservation area will have a beneficial effect on the panther, and in association with the other proposed mitigation activities, will offset the habitat lost and further the Service's goal in panther conservation.

The project site is also located on the western fringe of occupied habitat and is adjacent to other existing and proposed development; therefore, fragmentation of panther habitat is not expected to result from project implementation.

The project may increase intraspecific aggression and disturbance to the Florida panther. However, the Service believes that, as previously discussed, the habitats on the property provide marginal quality foraging for prey species, which directly affects the frequency and duration of use of the property by panthers. Therefore, the Service believes it is unlikely the loss of this site

by panthers will increase the risk of mortality from intraspecific aggression between panthers and increase disturbance to panthers in the project action area due to human activities.

In the cumulative analysis, the Service identified the potential loss of approximately 4,046 acres within the action area that could be developed without Federal wetland permit involvement. The 4,046 acres represent a small percentage (0.22 percent of the 1,881,318 acres) of available non-urban private lands in the core area. In general, these lands are primarily within previously impacted areas or are in the western more urbanized portion of the Florida panther's consultation area. Although this small percentage of lands will be lost from the core area of private lands available for panther conservation, the Service believes sufficient lands are available to meet the needs of the Service's recovery goal and land conservation/ preservation goals.

Conversely, the State and County land acquisition programs have acquired within the last year 2,351 acres of lands, which represent 0.53 percent of the 443,399 acres of private lands still needed for the population of 80 individuals and 0.22 percent of the 1,086,361 acres of private lands still needed for 100 individuals. These lands are generally located within the core preservation area of the Florida panther and are intended to be actively managed for the benefit of many wildlife species including the Florida panther. The preservation of these lands in the panther core preservation area will have a beneficial effect on the panther and further the Service's goal in panther conservation.

CONCLUSION – FLORIDA PANTHER

In summary, the Service believes there will be no direct take of the Florida panther resulting from this project. The loss of habitat from implementing the project, taking into consideration the status of the species, remaining habitat, and other factors considered by this biological opinion, such as the overall recovery objectives and other cumulative effects from actions in the action area, will be offset by the conservation of other, superior habitat. Therefore, the proposed construction of the Mirasol development project is not likely to jeopardize the continued existence of the Florida panther. No critical habitat has been designated for this species; therefore, none will be affected.

ENVIRONMENTAL BASELINE – WOOD STORK

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions, which occur simultaneously with the consultation in progress.

Status of the Species within the Action Area

As stated previously, the Service has determined, for the purposes of this biological opinion, the action area is considered to include the project site and the CFAs of the three wood stork nesting

colonies described previously (Figure 6). The action area for both direct and indirect effects encompasses 1,621.1 square-miles of Collier, Lee, and Hendry Counties, Florida. The proposed action may have direct and indirect effects on the ability of wood storks to breed, feed, and find shelter within the action area.

A census of the wood storks currently using the action area has not been conducted. However, three active nesting colonies are known to occur within the action area. Two of these colonies are located within the Corkscrew, approximately 5.5 miles and 6.6 miles northeast of the project site. The third wood stork nesting colony is located approximately 16.5 miles east of the project site, just north of the Fakahatchee Strand State Preserve. Wood stork nest surveys have been conducted annually at these nesting colonies through aerial surveys (Meyer and Frederick 2004) and ground-based monitoring of stork numbers and reproductive success (J. Lauritsen, Corkscrew, personal communication, 2004). Data for the two colonies located in Corkscrew indicate 1,722 nests were constructed in 2000 and 1,240 nests were reported in 2002. Additional data collected by the National Audubon Society indicate 2,538 wood storks fledged during 2000 and 3,160 fledged during 2002. In 2003 and 2004, 462 and 600 stork nests were counted at the Corkscrew colony, and they fledged 780 and 450 young, respectively (Audubon 2004). On average over the last 44 years, 1,654 nests are initiated yearly, producing an average of 2,161 fledged young, or 1.3 young fledged per nest. However, the 44-year average is somewhat misleading. Prior to 1968, as many as 5,000 wood stork nests were initiated annually. Nesting activity peaked in 1961 when 6,000 nests were initially producing a record 17,000 young fledged, or 2.8 fledged young per nest.

The production of wood stork colonies varies considerably between years and locations, apparently in response to differences in food availability; colonies limited by food resources may fledge an average of 0.5 to 1.0 young per active nest; colonies not limited by food resources may fledge between 2.0 and 3.0 young per active nest (Ogden 1996a). The 44-year average indicates, at least for the two colonies at Corkscrew, these colonies are generally limited by food resources. During the year 2002, these colonies were not limited by food resources. No data on nest productivity is available for the colony north of Fakahatchee Strand State Preserve; however, based on the overlapping CFAs, it is likely these birds face many of the same foraging conditions as the storks nesting within Corkscrew.

Historical data on colony locations identifies the Everglades basin colonies and the Corkscrew colonies as the primary nesting locations for wood storks in south Florida (Ogden and Nesbitt 1979). In the late 1950s and early 1960s, the Corkscrew colonies accounted for 51 percent of the Florida population, and supported approximately 6,000 nesting pairs (J. Lauritsen, Corkscrew, personal communication, 2002). Survey data collected between 1991 to 1995, indicate the Corkscrew colonies represent approximately 12 percent of the Florida population of nesting storks and is consistently one of the largest nesting colonies in Florida. The original listing recognized the relationship between the declining wood stork population, the loss of suitable foraging habitat, and colony nesting failures, particularly in the breeding colonies in south Florida where human actions had reduced wetland areas by about 35 percent (Ogden and Nesbitt 1979). Although the Corkscrew colonies currently account for 12 percent of the Florida nesting population, these colonies continue to occasionally produce large numbers of young in south

Florida (Service 1999). The acquisition and preservation of these colonies' habitat, and recovery of more natural hydropatterns within the foraging grounds surrounding these colonies, are recognized as critical to the recovery of wood storks in south Florida (Service 1997; 1999).

The wood stork is known to forage within suitable wetland habitats located throughout the 1,621 square mile action area. Suitable wood stork foraging habitat consists of shallow wetlands with water depths of 2 to 15 inches. Data obtained from the NWI indicate approximately 473,462 acres of wetlands containing potentially suitable habitat for wood stork foraging occur within the action area (Figure 14). However, the inventory was last updated in 1984 and increasing development in Lee, Collier, and Hendry Counties has impacted some of these potential foraging areas.

Factors Affecting Species Environment within the Action Area

The primary factors affecting wood stork environment (positive and negative) within the action area include, but are not limited to, the loss and alteration of wetlands due to development and agriculture, hydrological restoration projects, public lands management (public use, exotic eradication, etc.), and both public and private land protection efforts. Development activities may result in avoidance or limited use of foraging areas. Secondary factors such as weather (freezes and hurricanes), parasites, disease, and chemical contamination may affect wood storks but there is insufficient information available to discuss the effects of these factors on the wood stork.

Public and private lands management can have positive, neutral, or negative effects depending on the management goals. Hydrological restoration of over-drained lands such as that proposed in the Comprehensive Everglades Restoration Plan (CERP) will create additional foraging areas for wood storks.

Alteration of hydrology and historical flow-ways resulting in restrictive flows and drainage, as demonstrated for the Cocohatchee basin, can also negatively influence wetlands and other surface water systems important to wood storks through increased seasonal flooding and extended periods of unusually high water, resulting in changes in the vegetative community from a mixed open forest canopy with a herbaceous component to a closed canopy, dense forest without a herbaceous component.

Canals which are also common in the action area, may influence the hydrology of wetlands and other surface waters important to wood storks. Numerous studies have documented the environmental impacts of canals. Wang and Browden (1983) conducted a study in southwest Florida in the area of southern and northern Golden Gate Estates and found the water table dropped about 1.5 to 2 feet after construction of canals. Another southwest Florida study found the water table dropped about 2 feet as far as 6,000 feet from the canal (Swayze and McPherson 1977). Black et al. (1974) estimated, after construction of the canals, annual runoff from South Golden Gate Estates increased to about 17 inches. To correct the effects of over-drainage and other hydrological problems associated with water management activities over the last 50 years, the Federal and State governments have entered into an eight billion dollar initiative, the Comprehensive Everglades Restoration Project.

Wetland alteration on private lands, although regulated, is relatively common in the action area. The Service's GIS analysis of NWI data indicates the function of 31,969 acres of wetlands in the CFA of the Corkscrew nesting colonies has been diminished by ditching and draining, excavation, and impoundment (11 percent of total wetlands). Another 24,272 acres have been lost to development (8 percent of total wetlands). It is important to note that although many wetlands remain unaltered, changes in land use patterns around these wetlands have isolated them from larger systems and diminished their value to forage fish and wood storks.

An analysis of information in the GIS database at the SFESO indicates the 30 km (18.6 miles) CFA around the Corkscrew wood stork colonies is about 695,593 acres in size and comprised of 58 percent uplands and 42 percent wetlands. Twenty-one percent of the CFA wetlands are located on public lands and the remaining 79 percent are located on private lands. These wetlands are generally considered secure from alteration due to management practices on adjacent public lands, whereas alterations on private lands are less secure.

EFFECTS OF THE ACTION – WOOD STORK

Factors to be Considered

Development pressures due to ongoing population growth in Collier and Lee Counties continue to threaten wetlands in the action area. Data from the U.S. Census Bureau indicate during the period of 1968 to 2000 the populations of Collier, Hendry, and Lee Counties have increased by 94, 78, and 88 percent, respectively. The population of this three-countywide area was estimated at 731,675 during the 2000 census, and is expected to continue to grow, with a concomitant increase in the filling of wetlands due to development.

Residential, commercial, and industrial development projects may have a number of direct and indirect effects on the wood stork and wood stork habitat. Direct impacts which are primarily habitat based may include: (1) the permanent loss and fragmentation of wood stork habitat; (2) the permanent loss and fragmentation of habitat that supports wood stork prey; (3) the loss of available habitat for foraging, breeding, and dispersing wood storks; and (4) a reduction in the geographic distribution of the species. Indirect effects may include: (1) an increased risk of mortality to wood storks using the area due to the increase in feral or escaped pets; (2) increased disturbance to wood storks in the project vicinity due to human activities; (3) the reduction in wood stork prey; and (4) the reduction in value of wood stork habitat adjacent to the project due to hydrological alterations. These indirect effects are habitat based with the exception of mortality due to escaped or inadequately controlled pets, which could result in lethal "take."

This project site contains wood stork foraging habitat and is located within the CFA of three wood stork colonies. The timing of construction for this project, relative to sensitive periods of the wood stork's lifecycle, is unknown. Wood storks may be found on and adjacent to the proposed construction footprint year-round. The project will be constructed in a single, disruptive event, and result in permanent loss and alteration of a portion of the existing ground

cover on the project site. The time required to complete construction of the project is not known, but it is likely land clearing associated with the development could be undertaken in phases over several years. The disturbance associated with the project will be permanent and result in a loss of habitat currently available to the wood stork; however, fragmentation of habitat will not occur due to the proposed project's position in the landscape of existing development.

Analyses for Effects of the Action

Wetlands in the 1,714-acre Mirasol project site currently provide marginal foraging habitat for the wood stork. The invasive exotic melaleuca has encroached into the entire project site. Approximately 1,400 acres of the project site (81 percent) contain at least 25 percent melaleuca. About 845 acres (49 percent) contain densities of melaleuca greater than 75 percent. Melaleuca, which is a dense-stand growth plant species, effectively produces a closed canopy and dense understory growth pattern that generally limits a site's accessibility to foraging by wading birds.

Wood storks, as previously discussed, forage most efficiently and effectively in habitats where prey densities are high, and the water shallow and open enough to hunt successfully (Ogden et al. 1978; Browder 1984; Coulter 1987). Calm water, about 5 to 40 cm (2 to 16 in) in depth, and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993). Typical foraging sites include freshwater marshes and stock ponds, shallow seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments, depressions in cypress heads, and swamp sloughs.

The project site is located within the CFA of three known wood stork colonies. The project will result in the conversion of 587.1 acres of poor quality wetlands onsite into a residential/golf course development. Compensation for this loss of 587 acres of poor quality habitat will be through the perpetual preservation and restoration to higher quality wetland habitat of 827 acres onsite (806 in flow-way preserves and 21 in internal preserves) and 145 acres off-site (47 acres in PIMB and 98 in Cocohatchee drainage basin). Quality wood stork habitat is located to the east of this onsite preserve area in CREW and Corkscrew. Restoration of wetlands and uplands onsite will consist of the removal of exotic vegetation, ranging from 25 percent to 100 percent coverage, averaging over 65 percent. The onsite preserve areas will be protected by conservation easements granted to the District, with enforcement rights to the Corps, and they will be maintained in perpetuity. The 145 acres of off-site compensation lands will also provide foraging benefit to the wood stork, as these lands will also receive exotic vegetation removal.

Wildlife Assessment: As discussed earlier in this biological opinion, a protected species survey was conducted by Turrell from June 1999 to March 2000 utilizing belt transects, drift fence, and bucket trap arrays. Ecologists with Turrell have also provided more recent observations based on ongoing field work and studies conducted on the project site. During these assessments, wood storks were observed foraging in the Cocohatchee Canal and in a pasture adjacent to the site. Several other State-listed wading birds were also observed both on and adjacent to the site. Over the course of 4 years in the field on the project site conducting various surveys, Turrell ecologists have not documented any wood storks on the project site.

Loftus and Eklund (1994) showed typical wet season densities of fish range from 50 fish/m^2 in long-hydroperiod wetlands to 10 fish/m^2 in short-hydroperiod wetlands. Onsite density studies conducted by Turrell and Associates, Incorporated show fish density of 0 to 8 fish/m^2, which is consistent with data collected by Duever et al. (1979) at Corkscrew in 1979.

Conservation Measures: The beneficial effects of the project include the preservation and enhancement of 21 acres of wetlands within the development footprint and 806 acres of wetlands within the remainder of the property adjacent to the project flow-way, for a total of 827 acres of onsite wetland enhancement and preservation. All exotic vegetation will be removed and the preserved wetlands will be incorporated into the onsite water management plan to ensure a proper hydrologic regime is maintained. The applicant is also proposing to purchase 10 wetland credits from PIMB and sufficient lands in the Cocohatchee drainage basin to provide for an additional 32.74 wetland credits. Based on habitat evaluations in the project area, these additional acquisitions are estimated at 47 acres in PIMB and 98 acres in the Cocohatchee drainage basin. Total compensation acreage that provides benefit to the wood stork is estimated at 1,034 acres.

The project also proposes to create an 89.1-acre flow-way conveyance/marsh system. The proposed 3-mile long flow-way will contain 25-foot wide littoral shelves approximately 12 to 18 inches deep along approximately two-thirds of its length. These littoral regions will provide increased habitat for small fish, amphibians, and invertebrates used as forage by the wood stork. The footprint of the flow-way currently contains wetlands heavily infested with melaleuca and provides very little, if any, foraging habitat. The littoral zones are designed to concentrate forage fish during the dry-down period and offer a better opportunity for successful wood stork foraging. Accordingly, the littoral areas will provide significantly more and better wood stork foraging habitat than currently exists within the flow-way footprint.

As mentioned previously, the Mirasol site is within the CFAs of three area colonies. However, the project site currently is severely infested with melaleuca and experiences unnaturally high water levels. The existing flat topography, altered hydrological site conditions, and extensive exotic vegetation infestation severely limit use of the site by area wood storks. Removal of exotics, restoration of historical hydroperiods and patterns, and creation of foraging zones within the proposed flow-way, may yield increases in foraging habitat available for area wood storks that currently does not exist onsite.

Direct Effects: Direct effects are those effects caused by the proposed action at the time of construction, are primarily habitat based, are reasonably certain to occur, and include: (1) the permanent loss and fragmentation of wood stork habitat; (2) the permanent loss and fragmentation of habitat that supports wood stork foraging; (3) the loss of available habitat for foraging, breeding, and dispersing wood storks; and (4) a reduction in the geographic distribution of the species. Wood storks are not expected to be subject to harassment by construction activities. The direct effects this project will have on the wood stork within the action area are discussed below.

Permanent Loss of Habitat: The project will result in the loss of approximately 587 acres of wetlands on the site. The land will be converted to support a residential/golf course community. Habitat quality is generally poor, as it is primarily disturbed flatwoods supporting an average of 65 percent exotics. This loss represents approximately 0.2 percent of the available foraging area within each of the three colonies whose CFAs overlap the project (Table 8). Based on the previous analyses of the level of exotic infestation within the project wetlands and their availability as foraging habitat for the wood stork, we believe the loss of the poor quality foraging habitat associated with these lands is not significant and this action is not expected to result in jeopardy to or a reduction in the geographic distribution of the wood stork.

Table 8. Wetlands information for CFA A, B, and C.

	Total Wetland Acres	Project Wetland Impacts	% of Total CFA Wetlands Impacted
CFA A	285,256	587	0.20 %
CFA B	292,149	587	0.20 %
CFA C	394,040	587	0.15 %
		Flow-way Wetland Impacts	
CFA A	285,256	375	0.13 %
CFA B	292,149	375	0.13 %
CFA C	394,040	375	0.10 %
		Cumulative Wetland Impacts	
CFA A	285,256	202	0.07 %
CFA B	292,149	202	0.07 %
CFA C	394,040	202	0.05 %

Fragmentation of Habitat: Fragmentation of habitat is not as big an issue with aerial species as it is with land based species due to the aerial species ability to fly over intervening development to reach distant foraging areas. The project site is located adjacent to urban development and is in an area of intense development pressure; therefore, fragmentation of wood stork habitat is not expected to result from project implementation. The project site proposes a large preserve area that connects existing and proposed preserve areas to the west with existing and proposed preserved lands to the east. For these reasons, fragmentation of wood stork foraging habitat is not expected.

Construction: The timing of construction for this project, relative to sensitive periods of the wood stork's lifecycle, is unknown. However, it is likely all land clearing associated with the development will occur in phases over a couple of years. There are no known roosting or colony sites within the project boundaries and the quality and quantity of the foraging prey base is low. Therefore, we believe wood stork usage of the property is limited and we do not believe project construction will result in direct wood stork mortality.

Compensation: The Service believes the 587 acres of wood stork habitat lost by the development will be offset by the preservation and enhancement of 827 acres of wetlands onsite and the acquisition and enhancement of approximately 145 acres of wetland enhancements off-site for a total of 1,034 acres. The off-site acreage estimate is based on the acres of land associated with the 10 wetland credits from PIMB and the 32.74 wetland credits to be secured through land acquisition in the Cocohatchee drainage basin. The lands proposed for development are primarily hydrologically disturbed, exotic infested, and are adjacent to CR 846 and existing urban areas. The lands proposed for preservation are adjacent to the development and are connected to other larger tracts of preserved lands and are consistent with the Service's wood stork goal regarding the acquisition, enhancement, preservation, and recovery of natural hydropatterns within foraging habitat of the wood stork.

Interrelated and Interdependent Actions: An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

Indirect Effects: Indirect effects are those effects that result from the proposed action, and are reasonably certain to occur. The indirect effects this project will have on the wood stork within the action area are discussed below. They include: (1) an increased risk of mortality to wood storks using the area due to the increase in feral or escaped pets; (2) increased disturbance to wood storks in the project vicinity due to human activities; (3) the reduction in wood stork prey; and (4) the reduction in value of wood stork habitat adjacent to the project due to hydrological alterations.

Mortality from Feral Pet Predation: The project may result in an increase in feral pets released or escaping into the proposed preserve area. Feral animals can result in lethal "take" of wood storks foraging in project wetlands. However, the applicant has agreed to produce a homeowner's awareness pamphlet and to incorporate pet control procedures and requirements into the project's homeowner documents. Based on this and the fact an adult wood stork is much larger than most escaped pets and generally of little risk to injury from them, it is unlikely the project will result in increased risk to wood storks as a result of feral animals.

Increased Disturbance and Reduction in Wood Stork Prey Base: This project site contains wood stork foraging habitat and is located within the CFAs of three wood stork colonies. The timing of construction for this project, relative to sensitive periods of the wood stork's lifecycle, is unknown. Wood storks may be found on and adjacent to the proposed construction footprint year-round. The project will be constructed in a single, disruptive event, and result in permanent loss and alteration of a portion of the existing ground cover on the project site. The time required to complete construction of the project is not known, but it is likely land clearing associated with the development could be undertaken in phases over several years.
Habitat quality is generally poor, as it is primarily disturbed flatwoods supporting an average of 65 percent exotics. Based on the previous analyses of the level of exotic infestation within the project wetlands and their availability as foraging habitat for the wood stork, we believe the loss of the poor quality foraging habitat associated with these lands is not likely to increase

disturbance to wood storks or appreciably reduce the wood stork prey base. Conversely, we believe the enhancements actions proposed to the onsite and off-site preserves (1,059 acres) may provide an increase in the availability of prey for the wood stork.

The onsite wetland preserves, which provide a foraging prey base for wood storks in a suburban setting, may increase the likelihood of harassment and disturbance to the species. However, this is a common occurrence throughout the species range and is not expected to adversely affect the wood stork.

Off-site Hydrological Effects: The proposed Mirasol project includes the construction of a flow-way. The primary objective of the proposed flow-way, as stated by the applicant, is to reverse cumulative impacts within the vicinity of, as well as on, the project site caused by the lack of a regional water management plan for this area. The degraded condition of a majority of the wetlands on the site is the direct result of increased upstream flows and downstream impediments. Flows and water levels on the site have increased dramatically over the past 20 years. Former uplands and transitional areas have been converted to wetlands and exotic infestation of these drowned areas has proliferated.

The flow-way will be constructed from the northeast corner of the project to the Cocohatchee Canal, a distance of approximately 3 miles. The flow-way will be approximately 200 feet wide with a maximum depth of 4 feet and would be constructed through the proposed Terafina preserve (undeveloped) and through the existing wetland preserve at Olde Cypress. It will end at a water control weir approximately 327 feet north of the Cocohatchee Canal and would drain into the canal via three 72-inch culverts.

By creating a meandering shallow conveyance, this flow-way proposal seeks to restore some measure of the historic flow capacity of an original drainage area over 2 miles wide. In order to assess the potential upstream impacts resulting from the Mirasol flow-way, the applicant examined two important points: (1) runoff from the upstream watershed represents the single most significant factor in this site's hydrology; and (2) the downstream wetlands, *i.e.,* the wetlands on the Mirasol site, would only experience standing water conditions after upstream runoff conditions have been reached. The applicant's modeling results predict that the limits of the flow-way influence during the normal year extends no further than three-fourths of a mile from the start of the flow-way and approximately halfway into Section 11. Hydrological effects to Corkscrew and other upstream wetlands beyond those predicted by the model are not expected, due in most part to the fact these locations are separated by over 2 miles of hydraulically restrictive overland flow pathways through upstream portions of Sections 11 and 12.

In order to maintain the natural cycle of wet season wetland inundation, the flow-way will be equipped with two weirs set at ground elevation. These will have the desirable effects of forcing runoff into upstream pools and encouraging longer detention times necessary for aquifer recharge. These weirs will also prevent over-drainage of the upstream wetlands because water can not flow through the flow-way until the water is above the ground surface, and water is not above ground surface on the project site until it starts flowing onto the site from upstream sources.

Under dry season conditions when the water table drops 4 to 6 feet below ground, it is anticipated the relatively shallow 4-foot deep channel would go dry in much the same way as the wetlands in the footprint of the proposed flow-way currently do. It is also expected the shallow aspect of the channel and its gently sloping banks would encourage marshy conditions and increase the forage areas currently available to wading bird species such as the wood stork.

In order to determine the extent of the influence the flow-way has on the surrounding hydrology, two series of grid cell model results were examined. The first set of cells run in a diagonal line from the flow-way in a northeasterly direction approximately 1.5 miles. The second set of cells run in an east-west direction along the northern boundary of the project through Sections 11 and 12.

These results predict the limit of influence of the flow-way during the normal year falls approximately three-fourths of a mile from the start of the flow-way and approximately halfway into Section 11 from the western edge of the section. These results indicate that halfway into Section 11, the effects of the flow-way are only minimal (0.1 foot drop) and further away from the project, there are no discernable effects from the flow-way. Graphical presentation of the model results (Figure 15) shows a shallow water (short hydroperiod) change in approximately 375 acres of wetlands that may be influenced by the flow-way. Although these sites are expected to retain their wetland characteristics, the hydroperiod could be altered, which could adversely affect the foraging value these systems provide to the wood stork. The deeper water, longer hydroperiod wetlands, based on the model predictions, will retain their seasonal surface-water wetland hydrology because of elevated flow restrictions from adjacent uplands, although at a lower water level than previously and loss of foraging value to the wood stork is not projected.

The 375-acre shallow water wetland loss represents approximately 0.13 percent of the available foraging area within each of the three colonies whose CFAs overlap the project (Table 8). Although these wetlands may be adversely affected by the flow-way and productivity as a foraging prey base for wood storks may be affected, we believe based on the status of the species discussed previously and the status of the species in the action area, the loss/reduction of foraging value to the wood stork associated with these systems is not significant (0.13 percent) and is not expected to result in jeopardy to or a reduction in the geographic distribution of the wood stork.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

To determine the cumulative effects of the project on the wood stork, the Service has analyzed future actions reasonably certain to occur within an action area. For evaluation purposes, the Service is considering the action area for the wood stork to be the same action area as used in the

Florida panther cumulative effects analysis, which is a 25-mile radius. As discussed in the Florida panther cumulative effects analysis, approximately 4,046 acres of native habitat, consisting of both uplands and wetlands, may be developed without Federal review. To determine the acreage of native habitats that are wetlands, the Service relied on FLUCCS land use mapping and NWI maps and set a threshold that if the project site had less than 5 percent wetlands, the property would most likely be developed without Federal review. In evaluating cumulative effects to wood storks from the loss of wetlands from these non-federally reviewed site developments, the Service is considering the 5 percent threshold as the acreage of the project site that is a wetland. For these project sites, 5 percent represents 202 acres (4,046 acres times 5 percent). The Service believes these 202 acres of wetlands may be developed without Federal review. As shown in Table 8, cumulative wetland impacts within the action area constitute less than 0.07 percent of all wetlands available to wood storks in each of the three CFAs.

Although these wetlands may be adversely affected by non-federally reviewed actions and the productivity as a foraging prey base for wood storks may be affected, we believe based on the status of the species discussed previously and the status of the species in the action area, the loss/ reduction of foraging value to the wood storks associated with these systems is not significant (0.07 percent) and is not expected to result in jeopardy to or a reduction in the geographic distribution of the wood stork.

SUMMARY OF EFFECTS – WOOD STORK

The project will result in the direct loss of 587 acres of wetlands on the site. However, due to extensive exotic infestation, these wetlands currently are not being used as wood stork foraging habitat. Any loss of potential wood stork foraging habitat attributable to the project will be offset by the preservation and enhancement of 21 acres of wetlands within the development footprint and 806 acres of wetlands within the preserve. Although some of the wetlands in the 806-acre preserve may be hydrologically affected by the flow-way, the foraging value lost associated with the change in hydrology is offset by the enhancements proposed through exotic species removal, resulting in a positive net benefit. Moreover, the construction of the proposed flow-way and the associated littoral shelves will provide wood stork foraging habitat not currently available. The applicant is also proposing to purchase 10 wetland credits from PIMB and sufficient lands in the Cocohatchee drainage basin to provide for an additional 32.74 wetland credits. Based on habitat evaluations in the project area, these additional acquisitions are estimated at 47 acres in PIMB and 98 acres in the Cocohatchee drainage basin. Total compensation acreage that provides benefit to the wood stork is estimated at 1,034 acres.

CONCLUSION – WOOD STORK

After reviewing the status of the wood stork, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion the development of Mirasol by J.D. Nicewonder, Jr., as proposed, is not likely to jeopardize the continued existence of the wood stork. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct." "Harm" is further defined by the Service 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 by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior 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. Under the terms of section 7(b)(4) and section 7(o)(2) taking, that is incidental to and not intended as part of the agency action, is not considered to be prohibited taking under the ESA provided such taking is in compliance with the terms and conditions of this Incidental Take Statement.

AMOUNT OR EXTENT OF TAKE

Florida Panther

Although there will be a traffic increase from the project, the traffic flow pattern to and from the proposed project will be generally to the west and south into urban areas. Considering this information, distances from the project site to documented collisions, and the small number of vehicles expected to travel east into potential panther lands; the Service believes no direct mortality of Florida panthers is expected from the proposed action. Accordingly, the Service is not authorizing any direct take or mortality.

However, the Service anticipates incidental take of panthers in the form of harm and harassment associated with the direct loss of 800 acres of habitat within the primary zone and is authorizing take which results from such loss.

Effect of the Take

In the biological opinion, the Service determined this level of anticipated take is not likely to result in jeopardy to the species. The amount of panther habitat affected by the proposed action is approximately 0.04 percent of an estimated 2 million acres of habitat occupied by the panther. Based on a density of 1 panther per 31,923 acres (Kautz et al. In Review), the amount of habitat affected by the proposed action would represent 0.03 panther.

The proposed action will result in the preservation and enhancement of 914 acres of panther habitat onsite, as well as the purchase of additional acreage off-site to meet an outstanding 34.7 wetland mitigation credits and acreages associated with the off-site purchase of 10 wetland mitigation credits in PIMB. The off-site preservation is estimated at 145 acres, for a total compensation of 1,059 acres. The proposed action will increase the preservation and

enhancement acreage of panther habitat through permitted Federal actions by at least 4.1 percent, from 24,689 acres to at least 25,748 acres (Appendix). The cumulative increase in the preservation and enhancement of panther habitat to permitted Federal actions will be from 700 acres in 1990 to 25,748 acres following issuance of a permit, if issued, by the Corps.

The proposed action will result in the loss of 800 acres of mostly poor quality panther habitat. The proposed action will increase the impacts from direct and indirect effects to panther habitat from residential and commercial developments, mining, and agriculture by about 0.095 percent, from 83,892 acres to 84,692 acres. Of the 84,692 acres of impacts, 39,918 acres are due to agricultural conversion and 44,774 acres to development and mining. The 44,774 acres impacted by development and mining included a mixture of agricultural fields consisting of row crops and citrus groves, and natural lands with varying degrees of exotic vegetation. The non-agricultural impacts are permanent land losses, whereas the agricultural conversions may continue to provide some habitat functional value to panthers, although of less value than native habitats.

The lands proposed for compensation/preservation from the proposed take of panther habitat are lands adjacent to other larger tracts of preserved lands and are consistent with the Service's panther goal to locate and preserve sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the Florida panther south of the Caloosahatchee River. Therefore, based on the evaluations provided above for the project's direct, indirect, and cumulative effects, the status of the species, and the compensation proposed by the applicant, the Service believes the proposed construction and operation of the Mirasol Development will not jeopardize the survival and recovery of the Florida panther.

REASONABLE AND PRUDENT MEASURES

The Service believes the Corps and the applicant have incorporated all reasonable and prudent measures necessary and appropriate to minimize impacts of incidental take of Florida panthers into the design of the proposed action. In summary, the Corps and the applicant will ensure no more than 800 acres of panther habitat will be lost as a result of implementation of the proposed action and a minimum of 914 acres onsite in addition to subsequent purchase of an estimated 145 acres off-site lands will be preserved and managed to benefit the Florida panther and its prey.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions which implement the reasonable and prudent measures described above and outline reporting/monitoring requirements. The terms and conditions described below are non-discretionary and must be undertaken by the Corps so they become binding conditions of any grant or permit issued to J.D. Nicewonder, Jr., as appropriate, for the exemption in section 7(o)(2) to apply.

The Corps has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to

require J.D. Nicewonder, Jr., to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms added to the permit or grant document, the protection coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or the permit holder must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement [50 CFR § 402.14(i)(3)].

(1) The Corps will include, as special conditions to the permit instrument, the conservation measures listed below and in the description of the proposed action that commits the applicant to purchase, preserve, and manage high quality panther habitat, which is necessary and appropriate to minimize incidental take of panthers by the proposed action. Specifically, to compensate for impacts to 800 acres of Florida panther habitat, the applicant proposes to preserve and enhance 914 acres of panther habitat onsite. In addition, the applicant will purchase 10 credits from the PIMB, estimated at 47 acres, and preserve, enhance, and restore sufficient lands within the Cocohatchee drainage basin to provide an additional 34.7 wetland mitigation credits and 777 panther habitat functional units, estimated at 98 acres for a total compensation of 1,059 acres. All habitats to be preserved and restored are in the primary zone;

(2) The Corps will provide a copy of the final permit to the Service upon issuance. The Corps will monitor the permit conditions regarding conservation measures to minimize incidental take of panthers by providing the Service a report on implementation and compliance with the conservation measure within 1 year of the issuance date of the permit;

(3) The Corps will provide documentation to the Service for completion of the proposed onsite restoration and verification of the execution and terms of the conservation easement;

(4) Upon locating a dead, injured, or sick panther specimen, initial notification must be made to the nearest Service Law Enforcement Office; Fish and Wildlife Service; 9549 Koger Boulevard, Suite 111; St. Petersburg, Florida 33702; 727-570-5398. secondary notification should be made to the FWC; South Region; 3900 Drane Field Road; Lakeland, Florida 33811-1299; 800-282-8002; and

(5) Care should be taken in handling sick or injured specimens to ensure effective treatment and care or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured panthers or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure evidence intrinsic to the specimen is not unnecessarily disturbed.

Wood Storks

The Service anticipates incidental take of wood storks will be difficult to detect for the following reasons: (1) wood storks forage over a wide area; (2) the CFA includes all wetlands within 18.6 miles of the colony site; and (3) losses in nesting productivity may be masked by seasonal fluctuations in numbers based on other natural causes affecting food availability, such as drought

or flooding, which will also affect foraging efficiency and nesting success. However, the following level of take of this species can be anticipated by the loss of 962 acres of wetlands (587 direct and 375 indirect), which could result in diminished wood stork productivity.

The 587 acres of wetland losses from direct effects and the 375 acres of wetland losses from indirect effects are impacts to mainly short-hydroperiod wetlands. In our previous opinion, we referenced a study by Loftus and Eklund (1994), which showed typical wet season densities of fish range from 50 fish/m^2 in long-hydroperiod wetlands (marshes) to 10 fish/m^2 in short-hydroperiod wetlands (wet prairies). However, onsite density studies in primarily forested wetlands, conducted by the Turrell and Associates, Inc. show fish density in the range of 0 to 8 fish/m^2, which is consistent with data collected by Duever et al. (1979) at Corkscrew in 1979.

To quantify the effect of the wetland foraging value loss to wood storks, the Service averaged the fish densities of the two short hydroperiod studies providing an average fish density of 7 fish/m^2, as both types of habitats are present. Therefore, the 962 acres of short-hydroperiod wetlands have an average carrying capacity during the wet season of 27,252,498 fish (962 acres equals 3,893,214 m^2 * 7 fish/m^2). Fleming et al. (1994) designed an individual-based model of wood stork reproduction, in which they modeled prey availability by density and water depth. Water depth varies throughout the landscape, and wood stork foraging efficiency is dependent on prey density, availability, and interspecific competition. Based upon the effects of other wading birds, and variations within the landscape, Fleming et al. (1994) assumed 10 percent of prey in a system is available to wood storks. Therefore, of the 27,252,498 fish within the impacted wetlands, only 2,725,250 are available to foraging storks. The average weight of freshwater fish is 1.73 grams (Ogden et al. 1980). Therefore, the minimum productivity of the impacted wetlands available to wood stork foraging is 10,396 pounds (4,714,682 grams) of fish. Kahl (1964) calculated an average wood stork family (two adults and two nestlings) requires 443 pounds of fish during a breeding season. Based on that calculation, impacts to 962 acres of wetlands could lead to harm of approximately 23.5 wood stork nests. Significant modification of foraging habitat within the CFA of a wood stork colony will impair the stork's essential behavioral foraging pattern during the nesting season, resulting in injury or death to nestlings. Assuming an average of 2 nestlings per nest, as many as 47 nestlings may be taken per year.

This analysis presumes, however, that all 962 acres of wetland to be impacted were available to wood storks for foraging. Exotic density over most of the property severely limits open views and foraging opportunities favored by wood storks. Relatively flat topography and lack of deeper water refugia also limits the efficiency of potential foraging activities because forage fish are not concentrated during dry down periods.

The above take analysis also does not consider improvements to foraging habitat that will result from the enhancement activities proposed within the preserve areas. It also does not calculate any improvement to forage fish densities or foraging efficiency as a result of the construction of the flow-way and associated littoral shelves. The flow-way will create deeper water refugia for forage fish that will provide foraging opportunities over a much longer time frame than currently occurs. Forage fish will be trapped and concentrated into the littoral areas as initial dry down occurs and foraging efficiency will be increased. As water levels drop further, foraging will be

possible in the main portion of the flow-way itself. In wetter years, foraging will be possible within the flow-way on a year-round basis.

As discussed above, the best available data shows minimal use of the site by wood storks. Additionally, the enhancement of the preserve areas through the removal of exotic vegetation and the creation of the flow-way and associated littoral areas will provide additional foraging opportunities for wood storks that are currently not available.

The Service anticipates incidental take of wood storks in the form of harm and harassment from the direct loss of 962 acres of wetlands resulting in the loss of 47 nestlings per year throughout the life of the project and is authorizing take which results from such loss.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize take of wood storks: collect hydrological data to ensure hydrological impacts do not occur to area onsite and off-site wetlands.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measure, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Monitor hydrological effects throughout the project area:

   Water Levels and Rainfall

   The applicant will place three water level data loggers (Global Water Instrumentation WL15 or similar) and two logging type rain gauges within the project boundaries. The water level loggers will be placed inside of 2 inch PVC pipe wells and sunk to a depth of approximately 8 feet below ground level. This will place the loggers below the water table and will allow for continuous monitoring of the water levels, above and below ground, experienced on the site. The rain gauges will be set to collect and record rainfall events on a daily basis so comparisons can be made with the onsite rainfall and water levels experienced. Locations for the loggers for both the rainfall and water level are shown as an exhibit in the site monitoring plan.

   In addition to the onsite data collection, additional information will be included in the data comparisons from stations already set up within the Service identified action area for the storks. The District, the U.S. Geological Survey, and the National Resource Conservation Service all have data collection stations set up within this area. The information collected by these agencies is currently available via the internet. The information is presented on the District's website at http://www.sfwmd.gov/org/ema/dbhydro/index.html.

The surface water levels and rainfall data will be included in a report that will be given to the Corps and the Service on an annual basis. This monitoring will be done in conjunction with the vegetative and exotic removal monitoring conducted for the project. The reports will be produced annually for 5 years after the construction of the flow-way conveyance. The report will summarize the results of the hydrological modeling and provide an evaluation of the observed seasonal hydrological changes and the predicted hydrological changes. If the difference in observed hydrological changes and predicted hydrological changes indicate an adverse effect from the construction and operation of the flow-way not addressed in this biological opinion, corrective action and reinitiation of consultation is necessary with the Service.

2. Monitor Wood Stork Productivity:

In conjunction with the rainfall and water level data collection, the applicant will monitor the productivity of storks utilizing the Corkscrew colony. The Corkscrew staff already monitors the productivity of the colony in the form of the number of nests constructed as well as the number of young fledged. This information is available and will be included in the annual reports presented to the Corps and the Service.

3. Monitor Forage Fish Productivity:

Since the Service estimated potential incidental take based of forage production, the project will implement a monitoring program to estimate the forage fish production on the project site. The project will also document the utilization of the preserve and flow-way areas by wood storks. This information will be useful in conjunction with the available productivity and hydrological data to determine if the project design serves to increase or decrease foraging opportunities.

Sampling sites will be established along transects that will incorporate all of the different wetland communities on the site. The proposed transect locations are shown as an exhibit in the site monitoring plan. The four main habitats to be sampled are hydric pine flatwoods, hypericum prairie, cypress, and the flow-way channel. The sampling device will be a 1 m^2 Wegener ring or similar throw trap. The ring will be thrown at various points along the transect to cover a representative portion of the habitat area. All fish caught inside the ring will be identified and counted. Results will be presented in the annual report to the agencies.

4. Annual Report:

An annual report will be presented to the Corps and to the Service in order to comply with 50 CFR part 402.14(i)(3) which states "In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement." The report will contain the following information:

(a) The current status of the construction of the project as well as any construction phases or milestones that have been completed;

(b) A summary of the rainfall data collected onsite as well as data from the other agency rainfall monitoring stations identified in the report;

(c) A summary of the onsite water level data as well as the off-site data available from the other agency monitoring stations;

(d) Current status of the exotic removal and regeneration of the native vegetation throughout the preserve area;

(e) Ongoing results of the forage fish sampling including species diversity and densities broken down by habitat types and water depths; and

(f) Any observed on-site foraging by wood storks. Included in this information will be number of storks observed, habitat or general area observed, number of days or duration of observation, and estimated foraging efficiency.

5. Care must be taken in handling any dead specimens of proposed or listed species that are found in the project area to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead specimen, notify the Service at the address provided.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service is not proposing any conservation recommendations at this time.

REINITIATION NOTICE

This concludes formal consultation on the Mirasol Development project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; (3) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; or (4) a new

species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your cooperation and effort in protecting fish and wildlife resources. If you have any questions regarding this project, please contact Allen Webb at 772-562-3909, extension 246.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Fort Myers, Florida (Skip Bergman)
District, Fort Myers, Florida
EPA, West Palm Beach, Florida (Richard Harvey)
FWC, Punta Gorda, Florida (Jim Beever)
FWC, Naples, Florida (Darrell Land)
FWC, Tallahassee, Florida
Service, Florida Panther NWR, Naples, Florida (Layne Hamilton)
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LITERATURE CITED

Aebischer, N.J., P.A. Robertson, and R.E. Kenward. 1993. Compositional analysis of habitat use from animal radio-tracking data. Ecology 74:1313-1325.

Alho, C.J.R., T.E. Lacher, Jr., and H.C. Gonstalves. 1988. Environmental degradation in the Pantanal ecosystem. BioScience 38:164-171.

American Ornithologists Union [AOU]. 1983. Checklist of North American birds. Sixth Edition. American Ornithologists Union; Baltimore, Maryland.

Anderson, A.E. 1983. A critical review of literature on puma (*Felis concolor*). Special report number 54. Colorado Division of Wildlife Research Section.

Bangs, O. 1899. The Florida Puma. Proceedings of the Biological Society of Washington 13:15-17.

Barone, M.A., M.E. Roelke, J. Howard, J.L. Brown, A.E. Anderson, and D.E. Wildt. 1994. Reproductive characteristics of male Florida panthers: Comparative studies from Florida, Texas, Colorado, Latin America, and North American zoos. Journal of Mammalogy 75(1):150-162.

Beier, P. 1995. Dispersal of juvenile cougars in fragmented habitat. Journal of Wildlife Management 59(2):228-237.

Beier, P., M.R. Vaughan, M.J. Conroy, and H. Quigley. 2003. An analysis of scientific literature related to the Florida panther. Final Report. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. 203 pp.

Beissinger, S.R. and M.I. Westphal. 1998. On the use of demographic models of population viability in endangered species management. Journal Wildlife Management 62:821-841.

Belden, R.C. 1986. "Florida Panther Recovery Plan Implementation - A 1983 Progress Report", pp. 159-172 *in* S.D. Miller and D.D. Everett (eds.), Cats of the world: Biology, Conservation and Management, Proceedings of the Second International Cat Symposium. Caesare Kleberg Wildlife Reserarch Institute. Kingsville, Texas.

Belden, R.C. 1989. The Florida Panther. Pages 515-532 in Audubon wildlife Report 1988-1989. National Audubon Society, New York, New York, USA.

Belden, R.C., W.B. Frankenberger, R.T. McBride, and S.T. Schwikert. 1988. Panther habitat use in southern Florida. Journal Wildlife Management. 52(4):660-663.

Bent, A.C. 1926. Life histories of North American marsh birds. U.S. National Museum Bulletin 135; Washington, D.C.

Beyer Jr., D.E. and J.B. Haufler. 1994. Diurnal versus 24-hour sampling of habitat use. Journal of Wildlife Management 58:178-180.

Black, Crow, and Eidsness, Incorporated. October 1974. Hydrologic Study the GAC Canal Network. Gainesville, Florida. Project No. 449-73-53.

Borkhataria, R., P. Frederick, and B. Hylton. 2004. Nesting success and productivity of South Florida wood storks in 2004. Unpublished report to the U.S. Fish and Wildlife Service, Jacksonville, Florida.

Brief of Amicus Curiae Association of Florida Community Developers, Incorporated, National Wildlife Federation v. Brownlee, No. 03-1392 (D.D.C. filed June 6, 2003).

Brook, B. 2000. Pessimistic and optimistic bias in population viability analysis. Biology Conservation. 14:564-566.

Brook, B.W., L. Lim, R. Harden, and R. Frankham. 1997. Does population viability analysis software predict the behaviour of real populations? A restrospecitve study of the Lord Howe Island Woodhen tricholimnas sylvestris (Sclater). Biology Conservation. 82:119-128.

Browder J.S. 1978. A modeling study of water, wetlands, and wood storks. In Wading Birds. A. Sprunt IV, J.C. Ogden, and S. Winckler (Eds). National Audubon Society. Research Report Number 7: 325-346.

Browder, J.S. 1984. Wood stork feeding areas in southwest Florida. Florida Field Naturalist 12:81-96.

Browder J.S., C. Littlejohn, and D. Young. 1976. The Florida Study. Center for Wetlands, University of Florida, Gainesville, and Bureau of Comprehensive Planning, Florida Department of Administration, Tallahassee.

Burger, J., J.A. Rodgers, Jr. and M. Gochfeld. 1993. Heavy metal and selenium levels in endangered woods storks *Mycteria americana* from nesting colonies in Florida and Costa Rica. Arch. Environ. Contam. Toxicol. 24:417-420.

Comiskey, E.J., O.L. Bass, Jr., L.J. Gross, R.T. McBride, and R. Salinas. 2002. Panthers and forests in south Florida: an ecological perspective. Conservation Ecology 6(1):18. [online] URL: http://www.consecol.org/vol6/iss1/art18.

Cone, W.C. and J.V. Hall. 1970. Wood ibis found nesting in Okeefenokee Refuge. Oriole 35:14.

Cory, C.B. 1896. Hunting and fishing in Florida. Estes and Lauriat. Boston, Massachusetts.

Coulter, M.C. 1987. Foraging and breeding ecology of wood storks in east-central Georgia. Pages 21-27 *in* R.R. Odom, K.A. Riddleberger, and J.C. Ozier, eds. Proceedings of the third southeastern nongame and endangered wildlife symposium. Georgia Department of Natural Resources; Atlanta, Georgia.

Coulter, M.C. and A.L. Bryan, Jr. 1993. Foraging ecology of wood storks (*Mycteria americana*) in east-central Georgia: Characteristics of foraging sites. Colonial Waterbirds 16:59-70.

Cox, J., R. Kautz, M. MacLaughlin, and T. Gilbert. 1994. Closing the gaps in Florida's wildlife habitat conservation system. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida. 239 pp.

Crozier, G.E. and D.E. Gawlik. 2003. South Florida Wading Bird Report, Volume 9. Unpublished report, South Florida Water Management District. November 2003.

Crozier, G.E. and M.I. Cook. 2004. South Florida Wading Bird Report, Volume 10. Unpublished report, South Florida Water Management District. November 2004.

Culver, M., W.E. Johnson, J. Pecon-Slattery, and S.J. O'Brien. 2000. Genomic ancestry of the American puma (*Puma concolor*). Journal of Heredity 91(3): 186-197.

Dahl, T.E. 1990. Wetlands losses in the United States 1780s to 1980s. U.S. Department of the Interior, Fish and Wildlife Service; Washington, D.C.

Dalrymple, G.H. and O.L. Bass, Jr. 1996. The diet of the Florida panther in Everglades National Park. Bulletin of the Florida Museum of Natural History. 39(5):173-194.

Dees, C.S., J.D. Clark, and F.T. Van Manen. 1999. Florida panther habitat use in response to prescribed fire at Florida Panther National Wildlife Refuge and Big Cypress National Preserve. Final Report. University of Tennessee, Knoxville, Tennessee.

Dees, C.S., J.D. Clark, and F.T. Van Manen. 2001. Florida panther habitat use in response to prescribed fire. Journal of Wildlife Management 65(1):141-147.

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.F. Myers, and D.P. Spangler. 1979. Resource Inventory and Analysis of the Big Cypress National Preserve. Ecosystem Research Unit, National Audubon Society, Naples, FL and Center for Wetlands, University of Florida, Gainesville. 1225 p. (Final report to the National Park Service).

Dunbar, M.R. 1993. Florida panther biomedical investigation. Annual performance report, July 1, 1992 to June 30, 1993. Study Number 7506, Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Dusi, J.L. and R.T. Dusi. 1968. Evidence for the breeding of the wood stork in Alabama. Alabama Birds 16:14-16.

Fieberg, J. and S.P. Ellner. 2000. When it is meaningful to estimate and extinction probability? Ecology 81:2040-2047.

Fleming, D.M., J. Schortemeyer, and J. Ault. 1993. Distribution, abundance, and demography of white-tailed deer in the Everglades. National Park Service, Everglades National Park, Homestead, Florida.

Fleming, D.M., W.F. Wolff, D.L. DeAngelis. 1994. Importance of landscape heterogeneity to wood storks in Florida everglades. Environmental Management. 18(5): 743-757.

Fleming, W.J., J.A. Rodgers, Jr., and C.J. Stafford. 1984. Contaminants in wood stork eggs and their effects on reproduction, Florida, 1982. Colonial Waterbirds 7:88-93.

Florida Fish and Wildlife Conservation Commission (FWC). 1999. Land, E.D., M. Lotz, D. Shindle, and S.K. Taylor. Florida panther genetic restoration and management. Annual report, Study Number 7508; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 2001. Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. Florida panther genetic restoration and management. Annual report, Study Number 7500; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 2002. Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. Florida panther genetic restoration and management. Annual report, Florida Panther Research Number 93112503002; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 2003. Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. Florida panther genetic restoration and management. Annual report, Florida Panther Research Number 93112503002; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 2004. Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. Florida panther genetic restoration and management. Annual report, Florida Panther Research Number 93112503002; Tallahassee, Florida.

Gawlik, D.E. 2002. The effects of prey availability on the numerical response of wading birds. Ecological Monographs 72(3): 329-346.

Hall, E.R. 1981. The mammals of North America Volume II. The Ronald Press Company; New York, New York.

Hall, E.R. and K.R. Kelson. 1959. The mammals of North America. Volume II. The Ronald Press Company; New York, New York.

Halls, L.K., ed. 1984. White-tailed deer, ecology and management. The Wildlife Management Institute; Washington, D.C.

Hamilton, S. and H. Moller. 1995. Can Population Viability Analysis models using computer packages offer useful conservation advice? Sooty shearwaters Puffinus griseus in New Zealand as a case study. Biology Conservation 73:107-117.

Harlow, R.F. 1959. An evaluation of white-tailed deer habitat in Florida. Florida Game and Fresh Water Fish Commission technical bulletin 5:1-64; Tallahassee, Florida.

Harris, L.D. 1985. The fragmented forest. University of Chicago Press; Chicago, Illinois.

Hefner, J.M., B.O. Wilen, T.E. Dahl and W.E. Frayer. 1994. Southeast wetlands; status and trends, mid-1970s to mid-1980s. U.S. Department of the Interior, Fish and Wildlife Service; Atlanta, Georgia.

Hollister, N. 1911. The Louisiana puma. Proceedings of the Biological Society of Washington 24:175-178.

Howell, A.H. 1932. Florida bird life. Coward-McCann; New York, New York.

Janis, M.W. and J.D. Clark. 1999. The effects of public use on the behavior of Florida panthers at Big Cypress National Preserve. University of Tennessee, Knoxville, Tennessee.

Kahl, M.P., Jr. 1964. Food ecology of the wood stork (Mycteria americana) in Florida. Ecological Monographs 34:97-117.

Kautz, R., R. Kawula, T. Hoctor, J. Comiskey, D. Jansen, D. Jennings, J. Kasbohm, F. Mazzotti, R. McBride, L. Richardson, and K. Root. In Review. How Much Is Enough? Landscape-scale Conservation for the Florida Panther. Biological Conservation.

Kushlan, J.A. 1979. Prey choice by tactile foraging wading birds. Proceedings of the Colonial Waterbird Group 3:133-142.

Kushlan, J.A., J.C. Ogden, and A.L. Higer. 1975. Relation of water level and fish availability to wood stork reproduction in the southern Everglades, Florida. U.S. Geological Survey open file report 75-434. U.S. Government Printing Office; Washington, D.C.

Land, E.D. 1994. Response of the wild Florida panther population to removals for captive breeding. Final Report, Study Number 7571. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Lasley, M.F.W. 1978. Genetics of livestock improvement. Third Edition, Prentice-Hall; Englewood Cliffs, New Jersey.

Loftus, W.F. and A.M. Ecklund. 1994. Long-term dynamics of an Everglades small-fish assemblage. *In* S. Davis and J. Ogden (eds.), Everglades: The ecosystem and its restoration. St. Lucie Press, Delray Beach, Florida.

Logan, T.J., A.C. Eller, Jr., R. Morrell, D. Ruffner, and J. Sewell. 1993. Florida panther habitat preservation plan - south Florida population. Prepared for the Florida Panther Interagency Committee.

Luthin, C.S. 1987. Status of and conservation priorities for the world's stork species. Colonial Waterbirds 10:181-202.

Maehr, D.S. 1989. Florida panther road mortality prevention. Final Performance Report, Study Number 7502. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1990a. Florida panther movements, social organization, and habitat utilization. Final Performance Report, Study Number 7502. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1990b. The Florida panther and private lands. Conservation Biology 4(2):167-170.

Maehr, D.S. 1992a. Florida panther. In Rare and Endangered Biota of Florida. Volume I: Mammals. S.R. Humphrey, (ed.). University Press of Florida; Gainesville, Florida.

Maehr, D.S. 1992b. Florida panther distribution and conservation strategy. Final Report, Study Number 7572. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Maehr, D.S. 1997. The Florida panther: life and death of a vanishing carnivore. Island Press, Washington D.C. 259 pp.

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1989. Early maternal behavior in the Florida panther (*Felis concolor coryi*). America Midlands Naturalist. 122:34-43.

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1990b. Day beds, natal dens, and activity of Florida panthers. Proceedings of the Annual Conference of Southeast Fish and Wildlife Agencies 44:310-318.

Maehr, D.S., E.D. Land, and J.C. Roof. 1991a. Social ecology of Florida panthers. National Geographic Research and Exploration 7(4):414-431.

Maehr, D.S., E.D. Land, and M.E. Roelke. 1991b. Mortality patterns of panthers in southwest Florida. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 45:201-207.

Maehr, D.S., E.D. Land, D.B. Shindle, O.L. Bass, and T.S. Hoctor. 2002. Florida panther dispersal and conservation. Biological Conservation 106:187-197.

Maehr, D.S. and G.B. Caddick. 1995. Demographics and Genetic Introgression in the Florida Panther. Conservation Biology 9:1295-1298.

Maehr, D.S. and J.A. Cox. 1995. Landscape features and panthers in Florida. Conservation Biology: 9(5):1008-1019.

Maehr, D.S., J.L. Larkin, and J.J. Cox. 2004. Shopping centers as panther habitat: inferring animal locations from models. Ecology and Society 9(2): 9. [online] URL: http://www.ecologyandsociety.org/vol9/iss2/art9.

Maehr, D.S. and J.P. Deeson. 2002. Wide-ranging carnivores and development permits: constructing a multi-scale model to evaluate impacts on the Florida panther. Clean Technolgy and Environmental Policy 3:398-406.

Maehr, D.S., R.C. Belden, E.D. Land, and L. Wilkins. 1990a. Food habits of panthers in southwest Florida. Journal of Wildlife Management 54:420-423.

Maehr, D.S., R.C. Belden, E.D. Land, and L. Wilkins. 1990c. Food habits of panthers in southwest Florida. Journel of Wildlife Management 54:420-423.

Maehr, D.S. and R.C. Lacy. 2002. Avoiding the lurking pitfalls in Florida panther recovery. Wildlife Society Bulletin 30:971-978.

Maehr, D.S., R.C. Lacey, E.D. Land, O.L. Bass, and T.S. Hoctor. 1999. A reassessment of Florida panther population viability analysis and recovery efforts from multiple perspectives. Paper presented at Population Viability Analysis: Assessing Models for Recovering Endangered Species. University of California, Berkeley and The Wildlife Society. San Diego, California. March 15-16, 1999.

McBride, R.T. 2000. Current panther distribution and habitat use. A review of field notes: fall 1999 – winter 2000. Livestock Protection Company; Alpine, Texas.

McBride, R.T. 2001. Current panther distribution, population trends, and habitat use. Report of field work: fall 2000 – winter 2001. Livestock Protection Company; Alpine, Texas.

McBride, R.T. 2002. Current verified population, distribution and highlights of field work. Report of field work: fall 2001 – winter 2002. Livestock Protection Company; Alpine, Texas.

McBride, R.T. 2003. Documented panther population and its current distribution. Appendix IV, Annual Report: Florida Panther Genetic Restoration and Management. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

McCown, J.W. 1991. Big Cypress Deer/Panther Relationships: Deer Herd Health and Reproduction. Final Report. Study Number: 7508. Bureau of Wildlife Research, Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Meyer, K. D. and P. C. Frederick. 2004. Survey of Florida's wood stork (*Mycteria Americana*) nesting colonies, 2004. Unpublished report to the U.S. Fish and Wildlife Service, Jacksonville, Florida.

National Audubon Society (Audubon). 2004. Wood Stork Nesting Data. Web site address - http://www.audubon.org/local/sanctuary/corkscrew/Wildlife/Birds/Nesting_Data.html#anchor152898. Accessed February 26, 2005.

Nelson, E.W. and E.A. Goldman. 1929. List of the pumas with three described as new. Journal of Mammalogy 10:345-350.

Nowell, K. and P. Jackson. 1996. Status survey and conservation action plan: Wild cats. International Union for Conservation of Nature and Natural Resources. Burlington Press; Cambridge, United Kingdom.

O'Brien, S.J., M.E. Roelke, L. Marker, A. Newman, C.A. Winkler, D. Meltzer, L. Colly, J.F. Evermann, M. Bush, and D.E. Wildt. 1985. Genetic basis for species vulnerability in the cheetah. Science 227:1428-1434.

Oberholser, H.C. 1938. The bird life of Louisiana. Louisiana Department of Conservation, Bulletin 28.

Oberholser, H.C. and E.B. Kincaid, Jr. 1974. The bird life of Texas. University of Texas Press; Austin, Texas.

Ogden, J.C. 1991. Nesting by wood storks in natural, altered, and artificial wetlands in central and northern Florida. Colonial Waterbirds 14:39-45.

Ogden, J.C. 1996. Wood Stork *in* J.A. Rodgers, H. Kale II, and H.T. Smith, eds. Rare and endangered biota of Florida. University Press of Florida; Gainesville, Florida.

Ogden, J.C. and S.A. Nesbitt. 1979. Recent wood stork population trends in the United States. Wilson Bulletin. 91(4): 512-523.

Ogden, J.C., C.H.K. Kale, III, and S.A. Nesbitt. 1980. The influence of annual variation in rainfall and water levels on nesting by Florida populations of wading birds. Transactions of the Linnean Society, N.Y. 9:115-126.

Ogden, J.C., D.A. McCrimmon, Jr., G.T. Bancroft and B.W. Patty. 1987. Breeding populations of the wood stork in the southeastern United States. Condor. 89:752 - 759.

Ogden, J.C., J.A. Kushlan, and J.T. Tilmant. 1976. Prey selectivity by the wood stork. Condor 78(3):324-330.

Ogden, J.C., J.A. Kushlan, and J.T. Tilmant. 1978. The food habits and nesting success of wood storks in Everglades National Park in 1974. U.S. Department of the Interior, National Park Service, Natural Resources Report No. 16.

Ohlendorf, H.M., E.E. Klass, and T.E. Kaiser. 1978. Environmental pollutants and eggshell thinning in the black-crowned night heron. *In* Wading Birds. A. Sprunt IV, J.C. Ogden, and S. Winckler (Eds). National Audubon Society. Research Report Number 7:63-82.

Palmer, R.S. 1962. Handbook of North American birds, Volume 1, Loons through Flamingos. Yale University Press; New Haven, Connecticut.

Passarella and Associates, Incorporated. 2004. White-Tailed Deer Census Report. Terafina Development. Passarella and Associates, Incorporated; Fort Myers, Florida.

Ralls, K. and J. Ballou. 1982. Effects of inbreeding on infant mortality in captive primates. International Journal of Primatology 3:491-505.

Rand, A.L. 1956. Foot-stirring as a feeding habit of wood ibis and other birds. American Midland Naturalist 55:96-100.

Reed, J.M., D.D. Murphy, and P.F. Brussard. 1998. Efficacy of population viability analysis. Wildlife Social Bulletin. 26:244-251.

Rettie, J.W. and P.D. McLoughlin. 1999. Overcoming radiotelemetry bias in habitat-selection studies. Canadian Journal of Zoology 77:1175-1184.

Rodgers, J.A., Jr. 1990. Breeding chronology and clutch information for the wood stork from museum collections. Journal of Field Ornithology 61(1):47-53.

Rodgers, J.A., Jr., A.S. Wenner, and S.T. Schwikert. 1987. Population dynamics of wood storks in north and central Florida. Colonial Waterbirds 10:151-156.

Roelke, M.E. 1990. Florida panther biomedical investigations. Final Performance Report, July 1, 1986 - June 30, 1990. Study Number 7506. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Roelke, M.E. 1991. Florida panther biomedical investigation. Annual performance report, July 1, 1990 to June 30, 1991, Study Number 7506. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Roelke, M.E., J.S. Martenson, and S.J. O'Brien. 1993. The consequences of demographic reduction and genetic depletion in the endangered Florida panther. Current Biology 3:340-350.

Schemnitz, S.D. 1972. Distribution and abundance of alligator, bear, deer, and panther in the Everglades Region of Florida. Report to the Florida Game and Fresh Water Fish Commission; Fort Lauderdale, Florida in fulfillment of contract Number 14-16-0004-308.

Seal, U.S. and Workshop Participants. 1994. A plan for genetic restoration and management of the Florida panther (*Felis concolor coryi*). Report to the Florida Game and Fresh Water Fish Commission, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN; Apple Valley, Minnesota.

Seal, U.S., R.C. Lacy, and Workshop Participants. 1989. Florida panther viability analysis and species survival plan. Report to the U.S. Fish and Wildlife Service, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN; Apple Valley, Minnesota.

Shaffer, M.L. 1981. Minimum population sizes for species conservation. BioScience 31:131-134.

Smith, G. 1970. Mystery cat. Florida Wildlife 24(3):4-6.

Steelman, H.G., J.A. Bozzo, and J.L. Schortemeyer. 1999. Big Cypress National Preserve Deer and Hog Annual Report.

Swayze, L.J. and B.F. McPherson. 1977. The effects of the Faka Union Canal System on water levels in the Fakahatchee Strand, Collier County, Florida. United States Geological Survey Water Resources Investigations 77-61.

Thatcher, C., F.T. van Manen, and J.D. Clark. 2003. Habitat assessment to identify potential sites for Florida panther reintroduction in the southeast. Final Report to U.S. Fish and Wildlife Service. University of Tennessee, Knoxville, Tennessee.Turrell and Associates, Incorporated. 2001. White-Tailed Deer Census Report. Mirasol Development. Turrell and Associates, Incorporated; Naples, Florida.

Tinsley, J.B. 1970. The Florida panther. Great Outdoors Publishing Company; St. Petersburg, Florida.

Turrell and Associates, Incorporated. 2001. White-Tailed Deer Census Report. Mirasol Development. Turrell and Associates, Incorporated; Naples, Florida.

U.S. Department of the Interior (DOI). 1969. Environmental impact statement of the Big Cypress Swamp jetport. Washington, D.C.

U.S. Fish and Wildlife Service (Service). 1987. Florida panther recovery plan. June 1987. Prepared by the Technical Subcommittee of the Florida Panther Interagency Committee. U.S. Fish and Wildlife Service; Atlanta, Georgia.

U.S. Fish and Wildlife Service (Service). 1995. Florida panther recovery plan: second revision. March 1995. Prepared by the Florida Panther Recovery Team. U.S. Fish and Wildlife Service; Atlanta, Georgia.

U.S. Fish and Wildlife Service (Service). 1997. Revised recovery plan for the U.S. breeding population of the wood stork. U.S. Fish and Wildlife Service; Atlanta, Georgia.

U.S. Fish and Wildlife Service (Service). 1999. Multi-species recovery plan (MSRP) for south Florida. U.S. Fish and Wildlife Service; Vero Beach, Florida.

U.S. Fish and Wildlife Service (Service). 2000. Florida panther final interim standard local operating procedures (SLOPES) for endangered species. U.S. Fish and Wildlife Service; Vero Beach, Florida.

U.S. Fish and Wildlife Service (Service). 2003. Wood Stork Report. Volume 2, Number 1. March 2003. U.S. Fish and Wildlife Service, Jacksonville, Florida.

U.S. Fish and Wildlife Service (Service). 2004. Wood stork report. Volume 3, Number 1, April 2004. U.S. Fish and Wildlife Service; Jacksonville, Florida.

Wang, J.D., and J. Browden. 1983. Anal discharge impacts of Faka Union Bay. *In* Hydraulics and hydrology in the small computer age. Volume 1. Waldrop, W.R. Editor. American Society of Civil Engineers. New York, New York. Pages 141-146.

Wayne, A.T. 1910. Birds of South Carolina. Contributions to the Charleston Museum No.1.

Wildt, D.E. 1994. Endangered species spermatozoa: Diversity, research and conservation. Pages 1-24 *in*: A. Bartke, edition, Function of somatic cells in the testes. Springer-Verlag; New York.

Wildt, D.E., E.J. Baas, P.K. Chakraborty, T.L. Wolfle, and A.P. Stewart. 1982. Influence of inbreeding on reproductive performance, ejaculate quality and testicular volume in the dog. Theriogenology 17:445-452.

Wilkins, L. 1994. Practical cats: Comparing *coryi* to other cougars: An analysis of variation in the Florida panther, *Felis concolor coryi*. Pages 14-41 *in*: D.B Jordan, edition, Proceedings of the Florida panther conference. U.S. Fish and Wildlife Service; Atlanta, Georgia.

Williams, M. 1990. Americans and their forests, a historical geography. Cambridge University Press; New York, New York.

WilsonMiller. 2005. Email message to the Fish and Wildlife Service, South Florida Ecological Services Office, dated February 11, 2005.

Young, S.P. and E.A. Goldman. 1946. The Puma - Mysterious American Cat. Dover Publications, Incorporated. New York, New York.

Appendix. Biological opinions prepared by the Service for projects affecting Florida panther habitat from March 1984 through March 2005.

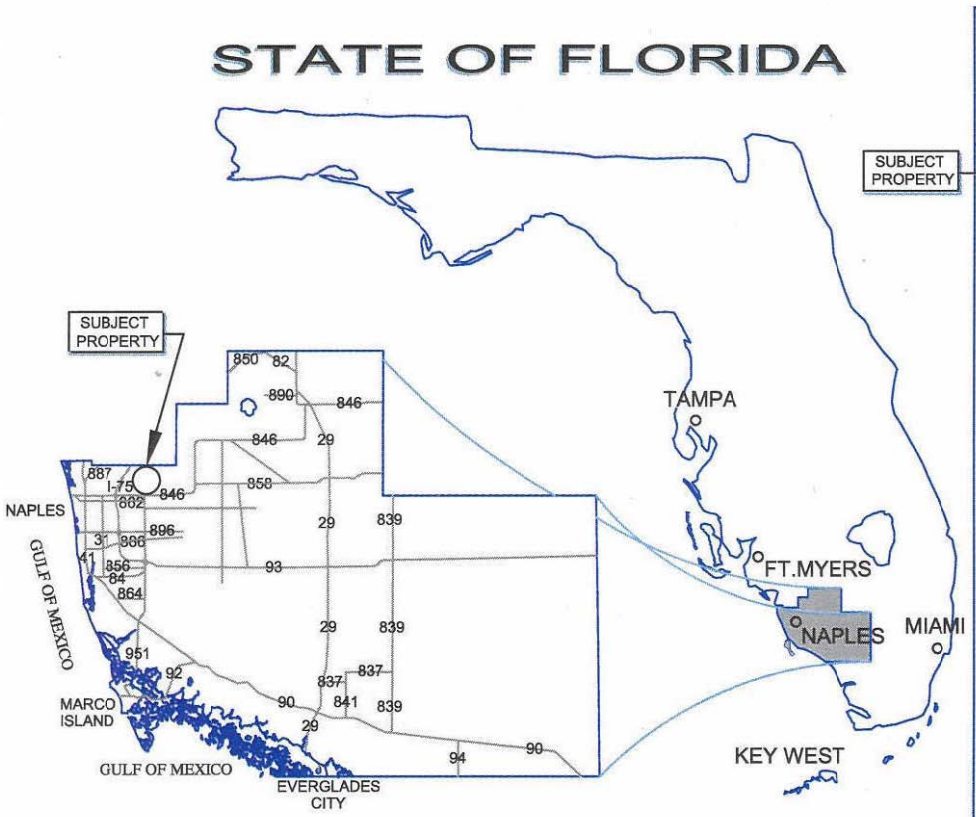
Biological Opinion Date	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved Onsite (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
03/29/84	83M-1317	Ford Test Track	Collier	530	0	0	0
02/21/85	Unknown	I-75	Collier/ Broward	1,517	0	0	0
10/17/86	Unknown	Exxon Master Plan	Collier	9	0	0	0
1/07/86	861PM-20130	Collier Enterprises (Citrus Grove)	Collier	11,178	0	0	0
01/11/88	Unknown	NERCO - Clements Energy	Collier	3	0	0	0
02/23/88	Unknown	Shell Western E&P	Collier/ Monroe	0	0	0	0
02/10/89	FAP IR-75-4(88)81	SR 29/I-75 Interchange	Collier	350	0	0	0
08/15/90	Unknown	I-75 Recreational Access	Collier	150	0	0	0
09/24/90	89IPD-20207	U.S. Sugar Corporation	Hendry	28,740	700	0	700
03/12/91	90IPD-02507	Lourdes Cereceda	Miami-Dade	97	0	0	0
01/14/92	199191279	Dooner Gulf Citrus	Collier	40	40	0	40
09/25/92	Unknown	BIA, STOF, BCSIR	Hendry	1,995	0	0	0
06/18/93	199300393	Corkscrew Road	Lee	107	0	0	0
02/25/94	199301131	Daniels Road Extension	Lee	65	0	0	0
05/09/94	199202019	Corkscrew Enterprises	Lee	563	437	0	437
10/27/94	199302371 199400807 199400808	Florida Gulf Coast University Treeline Boulevard	Lee	1,088	526	0	526
05/24/95	199302130	Turner River Access	Collier	1,936	0	0	0
08/07/95	199405501	Bonita Bay Properties	Collier	509	491	0	491
08/15/95	199301495	SW Florida Airport Access Road	Lee	14	0	0	0
09/19/96	199302052 199301404	I-75 Access Points	Broward	116	0	0	0
03/10/98	L30(BICY)	Calumet Florida	Collier/ Broward/ Miami-Dade	0	0	0	0
03/27/98	199604158	Willow Run Quarry	Collier	359	190	0	190
09/27/99	199130802	Daniels Parkway	Lee	2,093	0	94	94
06/11/99	199800622	STOF	Hendry	1,091	0	0	0

Appendix. (continued)

Biological Opinion Date	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved Onsite (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
12/08/99	199607574	Cypress Creek Farms	Collier	239	0	24	24
04/17/00	199507483	Miromar	Lee	1,323		194	194
06/09/00	199900619	Naples Reserve	Collier	833	0	320	320
02/21/01	199803037	Wortzel and Landl	Lee	106	0	0	0
04/17/01	200001436	WCI	Lee	1,183	0	408	408
07/30/01	199003460	Naples Golf Estates	Collier	439	175	0	175
08/31/01	199900411	Colonial Golf Club	Lee	1,083	0	640	640
12/14/01	199301156	Southwest Florida Airport	Lee	8,058	0	6,986	6,986
01/30/02	199402492	Florida Rock	Lee	5,269	802	0	802
03/07/02	199901251	Southern Marsh Golf	Collier	121	75	80	155
04/24/02	199901378	Hawk's Haven	Lee	1,531	267	0	267
09/24/02	200001574	Verandah	Lee	1,456	0	320	320
10/08/02	199602945	Winding Cypress	Collier	1,088	840	1,030	1,870
01/27/03	200003795	Walnut Lakes	Collier	157	21	145	166
02/21/03 03/09/05R	200001926	Mirasol	Collier	800	914	145	1,059
05/19/03	200200970	Apex Center	Lee	95	10	18	28
06/18/03	199701947	Twin Eagles Phase II	Collier	593	57	98	155
06/23/03	199905571	Airport Technology	Lee	116	55	175	230
07/02/03	199507483	Miromar	Lee	342	158	340	498
10/06/03	200102043	Bonita Beach Road	Lee	1,117	145	640	785
09/01/03	200206725	SR 80	Lee	33	2	12	14
12/29/03	200202926	The Forum	Lee	650	0	310	310
06/14/04	199603501	Terafina	Collier	436	210	261	471
01/18/05	199702288	Bonita Springs Utilities	Lee	79	0	108	108
02/22/05	20030946	Ava Maria DRI	Collier	4,995	0	7,285	7,285
			Totals	84,692	6,155	19,633	25,748

Figure 1

Map of the “Mirasol” development project site



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NOTES:

THESE DRAWINGS ARE FOR PERMITTING PURPOSES ONLY AND ARE NOT INTENDED FOR CONSTRUCTION USE.

DRIVING DIRECTIONS:
FROM I75 TAKE EXIT 111 (CR 846) EAST APPROXIMATELY 2.5 MILES JUST PAST ROSE LN. PROJECT ACCESS IS OFF OF CR 846 TO THE NORTH.

Turrell & Associates, Inc.
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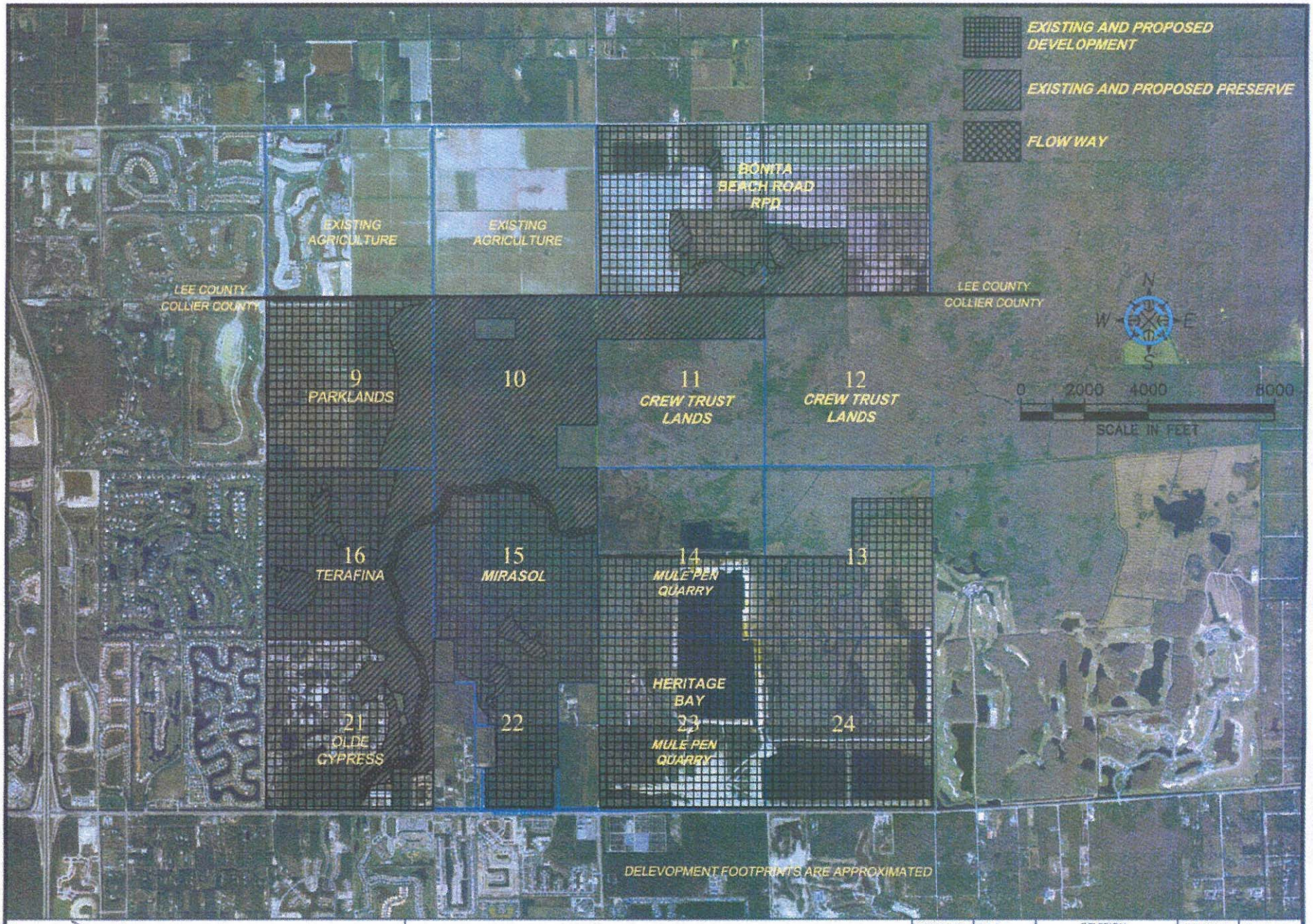
MIRASOL

PROJECT LOCATION MAP

DESIGNED	T.T.T.	REVISION	DWG NAME	Location
DRAWN	SAS	04-18-04	SHEET	A-1
DATE	09-08-03	N/A	SCALE	N.T.S.
JOB NO.	9418	N/A	Location Map.dwg	
SECTION-	TOWNSHIP-		RANGE-	

Figure 2

Proposed “Mirasol” development



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MIRASOL

DEVELOPMENT MAP - 2003 AERIAL

DESIGNED	T.T.T.	REVISION	TAB NAME	Contiguous
DRAWN	SS	N/A	SHEET	
DATE	02-14-05	N/A	SCALE	1"= 4000'
JOB NO.	9418	N/A		

SECTION- 10,11,15,22 TOWNSHIP- 48 S RANGE- 26 E

Figure 3

Mirasol Development in relation to panther primary and secondary zones and telemetry

PANTHER TELEMETRY DATA WITHIN 1 MILE AND 5 MILE RADIUS

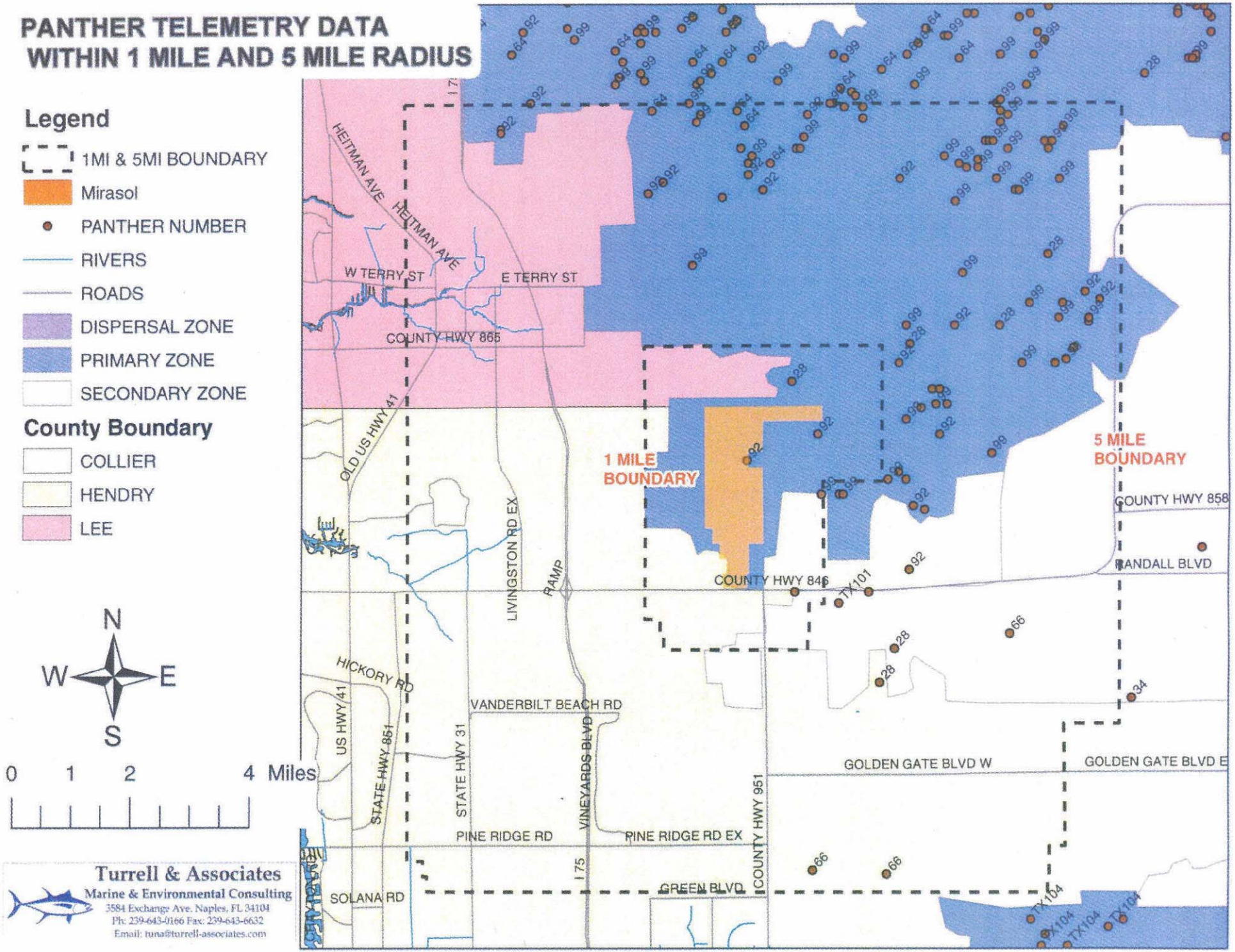

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Figure 4

Florida panther consultation area

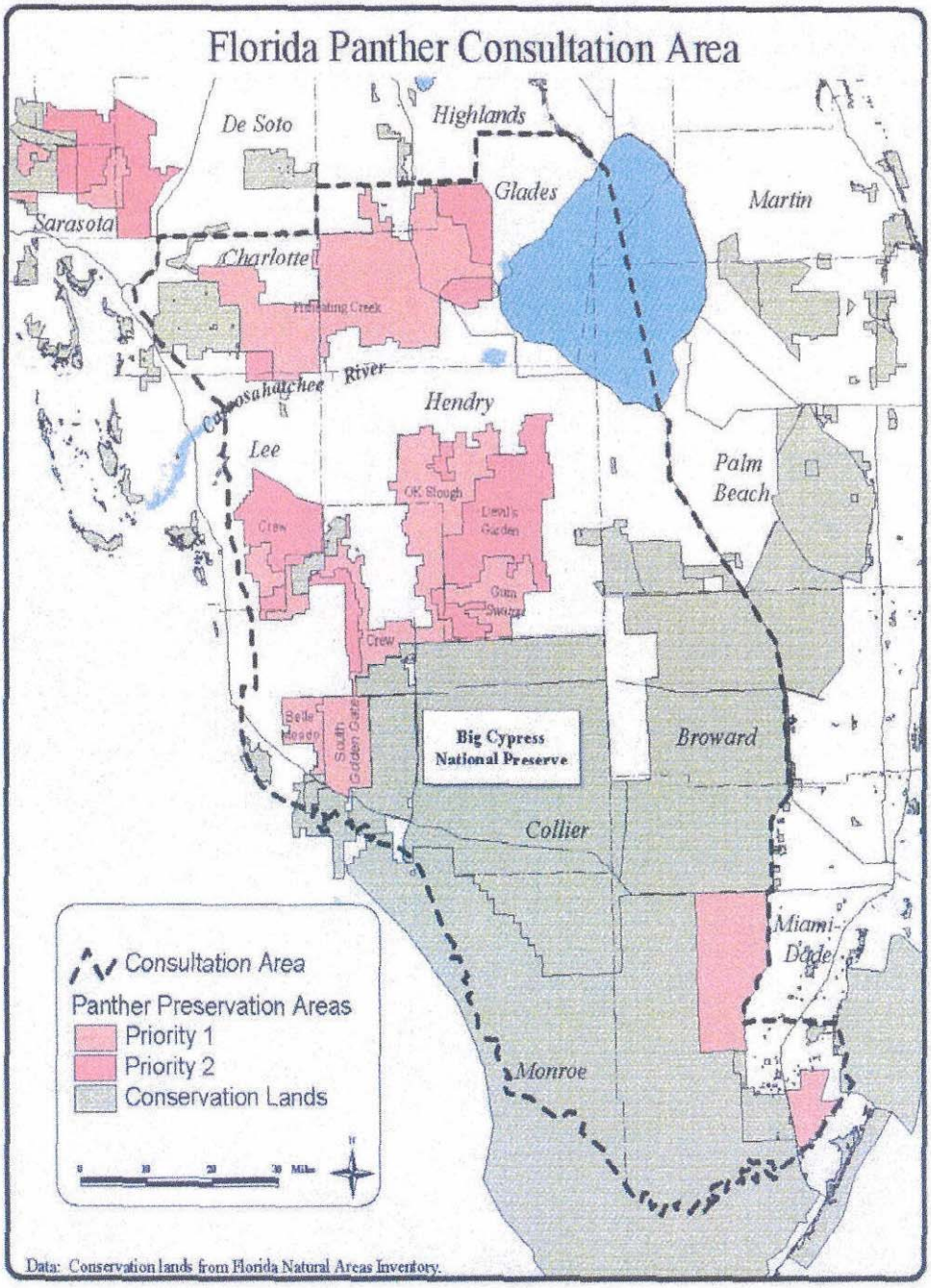
Florida Panther Consultation Area
De Soto
Highlands
Glades
Martin
Sarasota
Charlotte
Hendry
Lee
Palm Beach
Big Cypress National Preserve
Broward
Collier
Miami-Dade
Monroe
Consultation Area
Panther Preservation Areas
Priority 1
Priority 2
Conservation Lands
Data: Conservation lands from Florida Natural Areas Inventory.

Figure 5

Regional aerial map showing 25-mile action area for the panther

PANTHER ACTION AREA

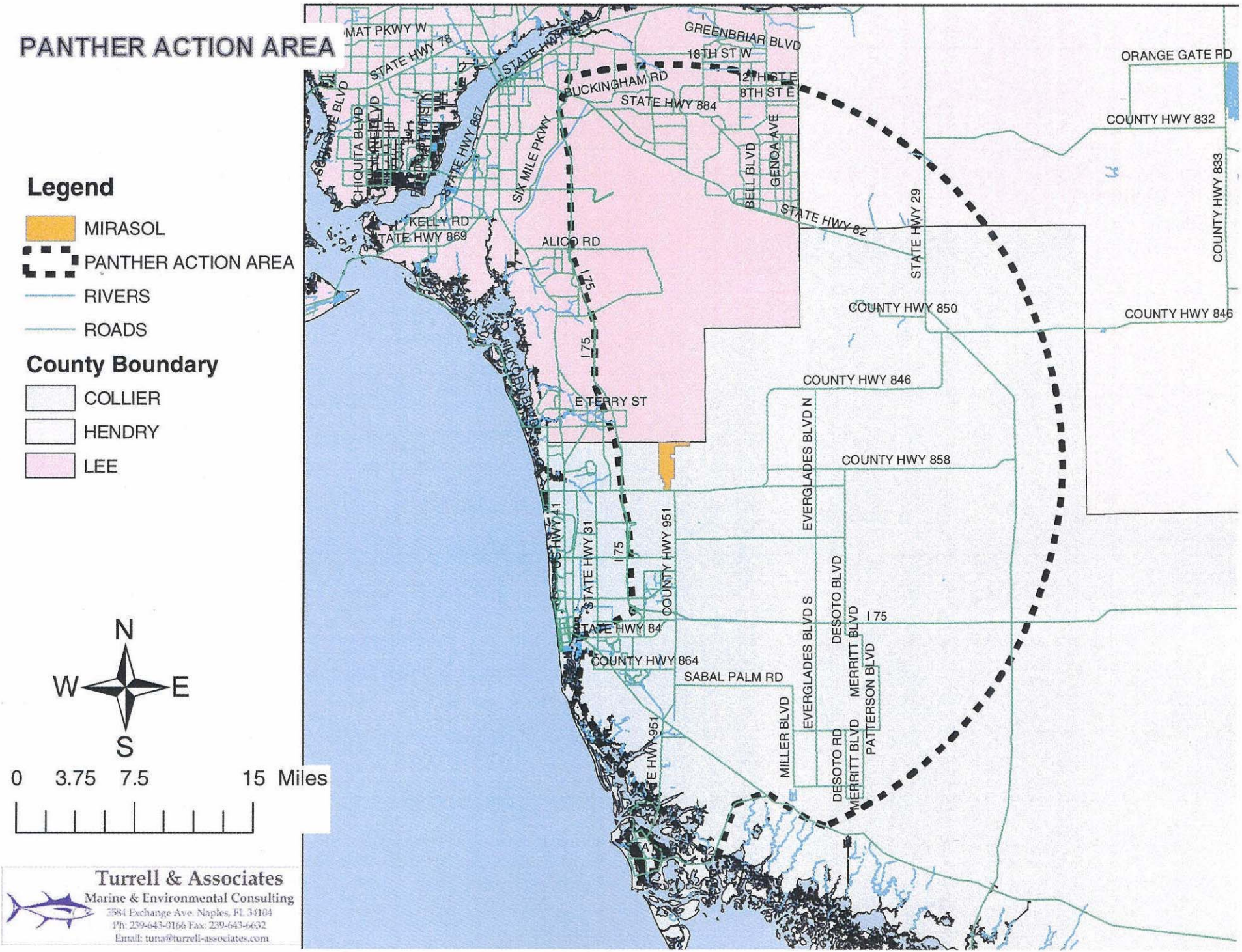

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Figure 6

Action area for the wood stork

WOOD STORK ACTION AREA

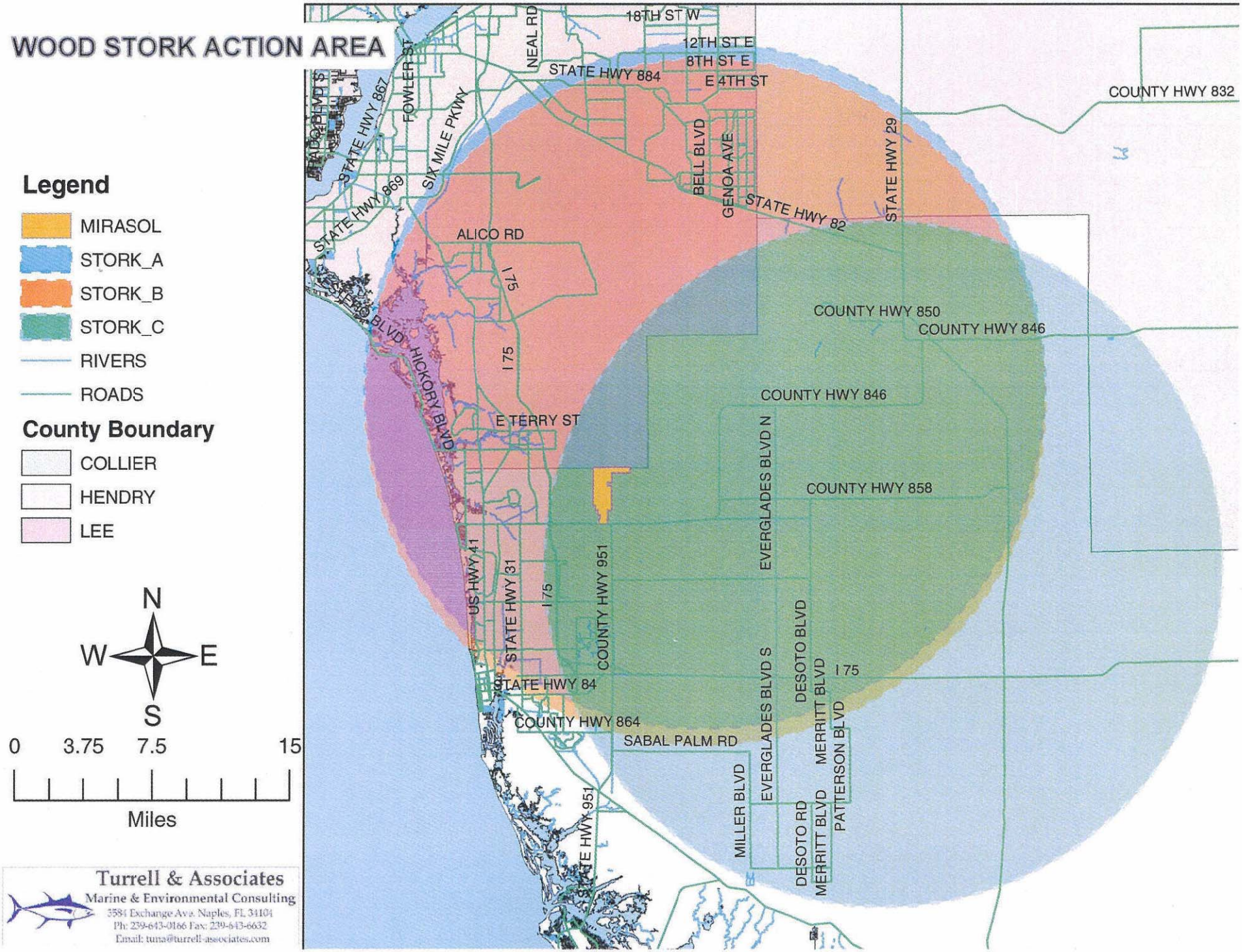

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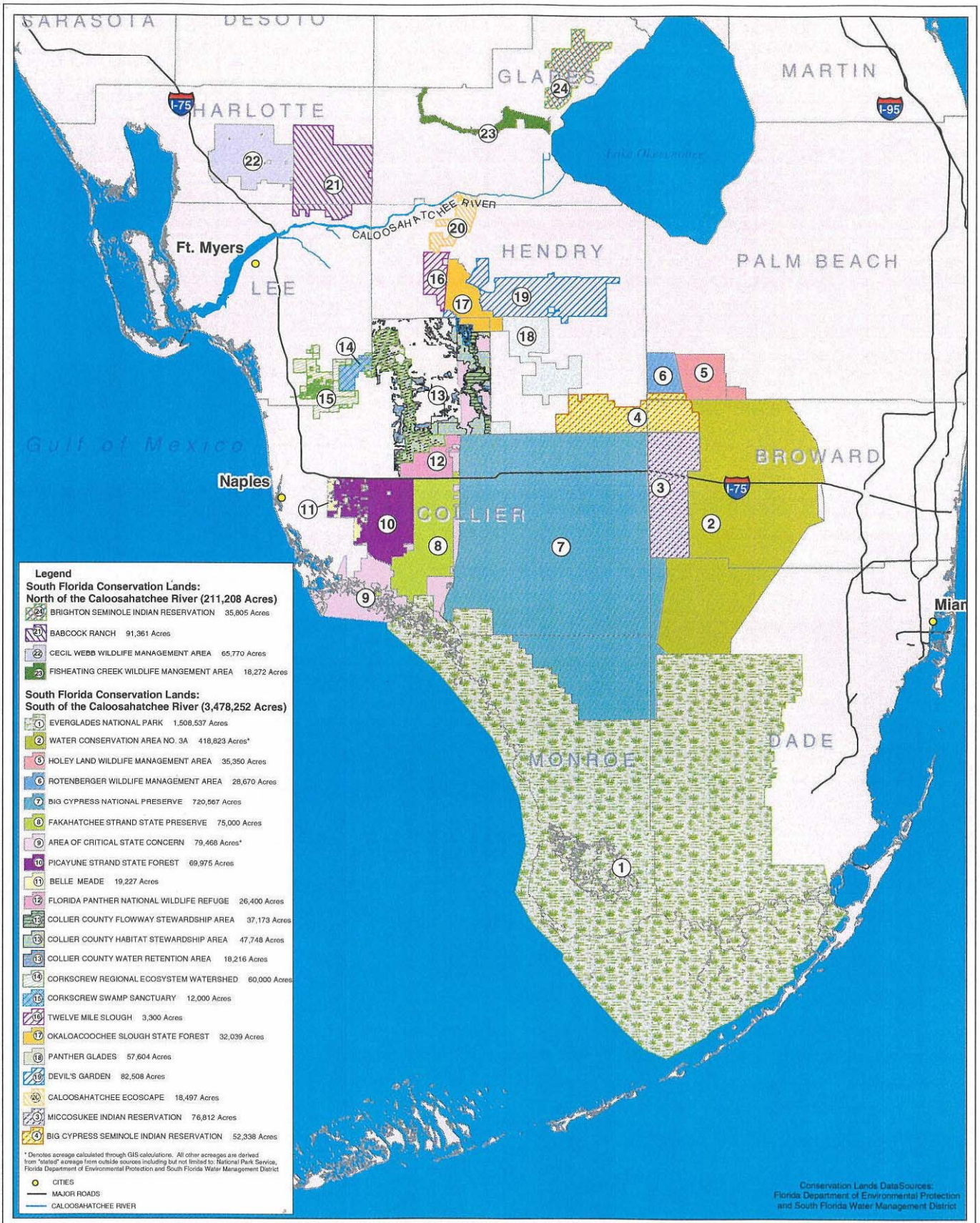
Figure 7

Southwest Florida conservation lands



South Florida Conservation Lands

N W E S

1 inch equals 10 miles

0 5 10 20 30 40 Miles

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Figure 8

Primary, Secondary, and Dispersal Zones

Kautz et al (In Review)

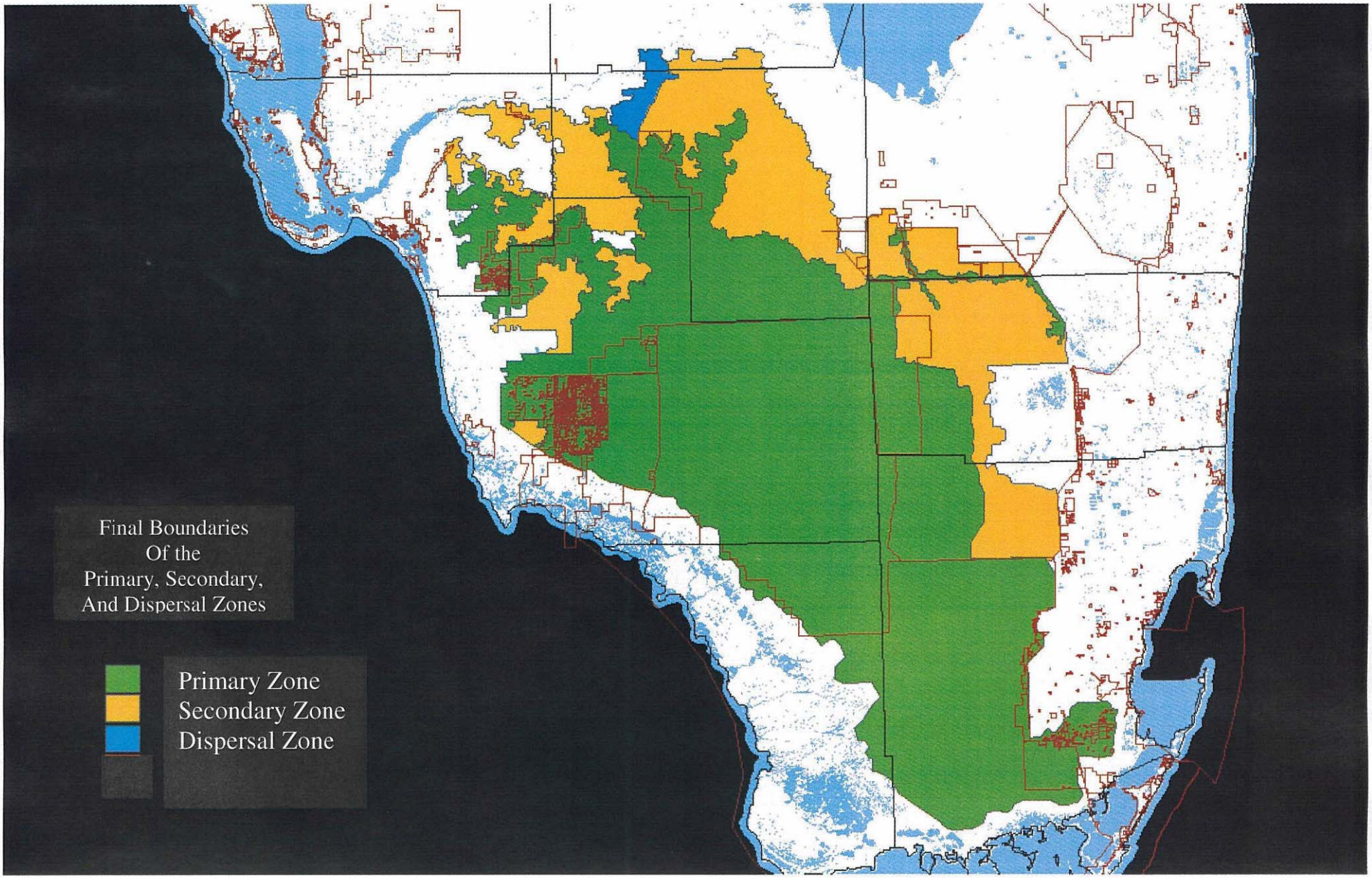

Final Boundaries
Of the
Primary, Secondary,
And Dispersal Zones
Primary Zone
Secondary Zone
Dispersal Zone

Figure 9

Panther – Vehicle Collisions within Action Area

PANTHER VEHICLE MORTALITY / INJURY LOCATION MAP

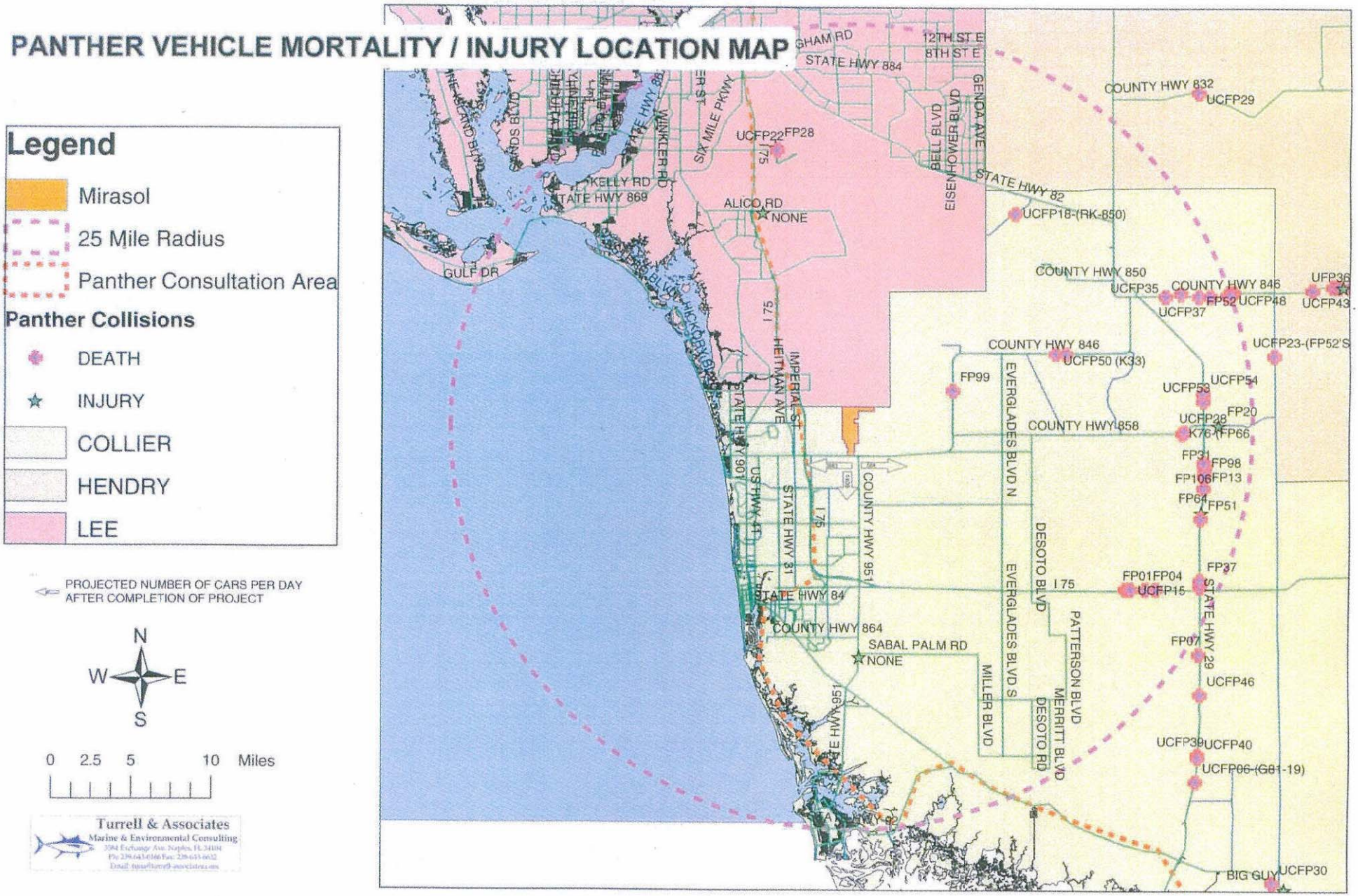


Figure 10

Panther Core Area

Figure 10 Core Area and Expansion Area within Consultation Area.

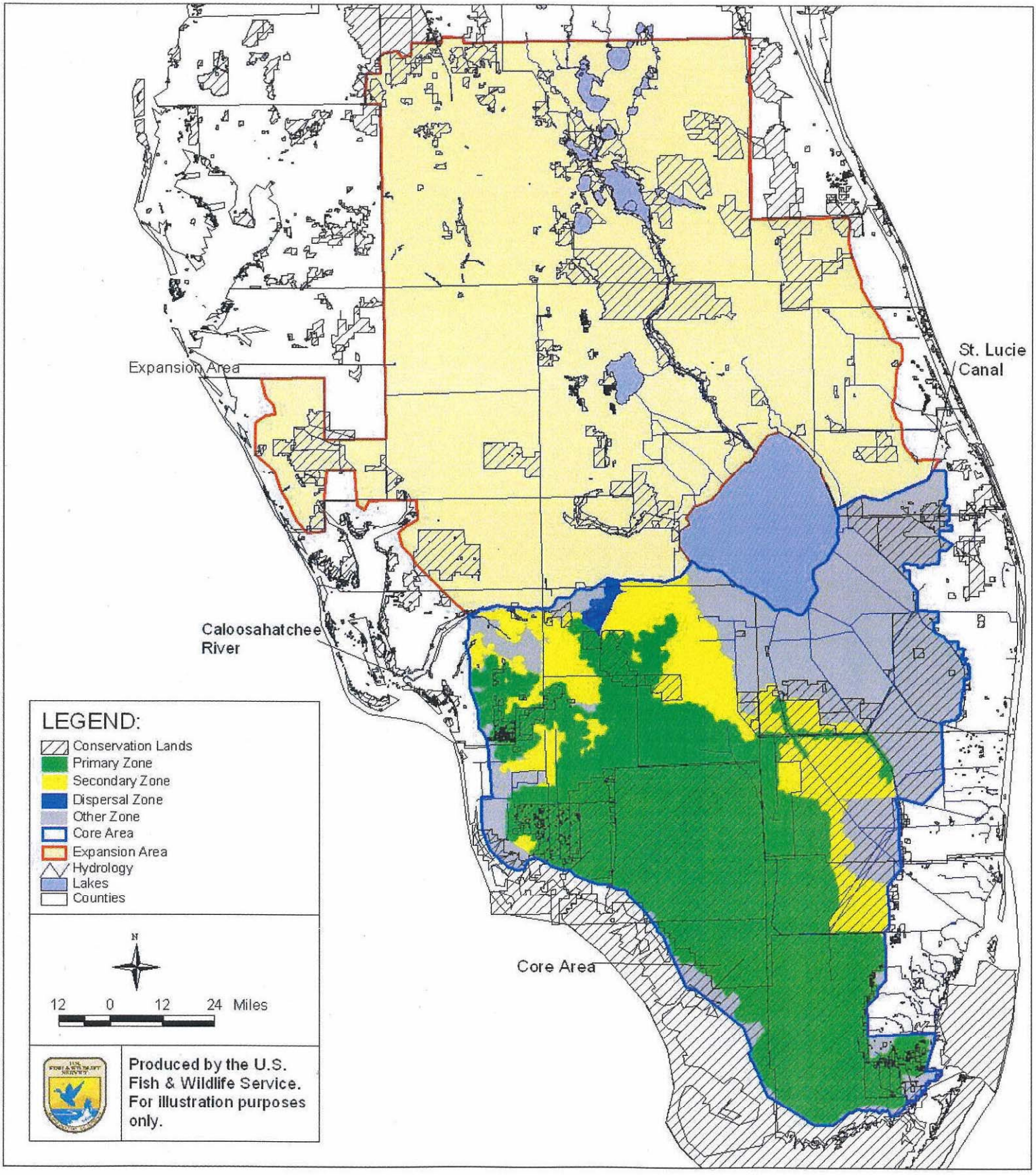
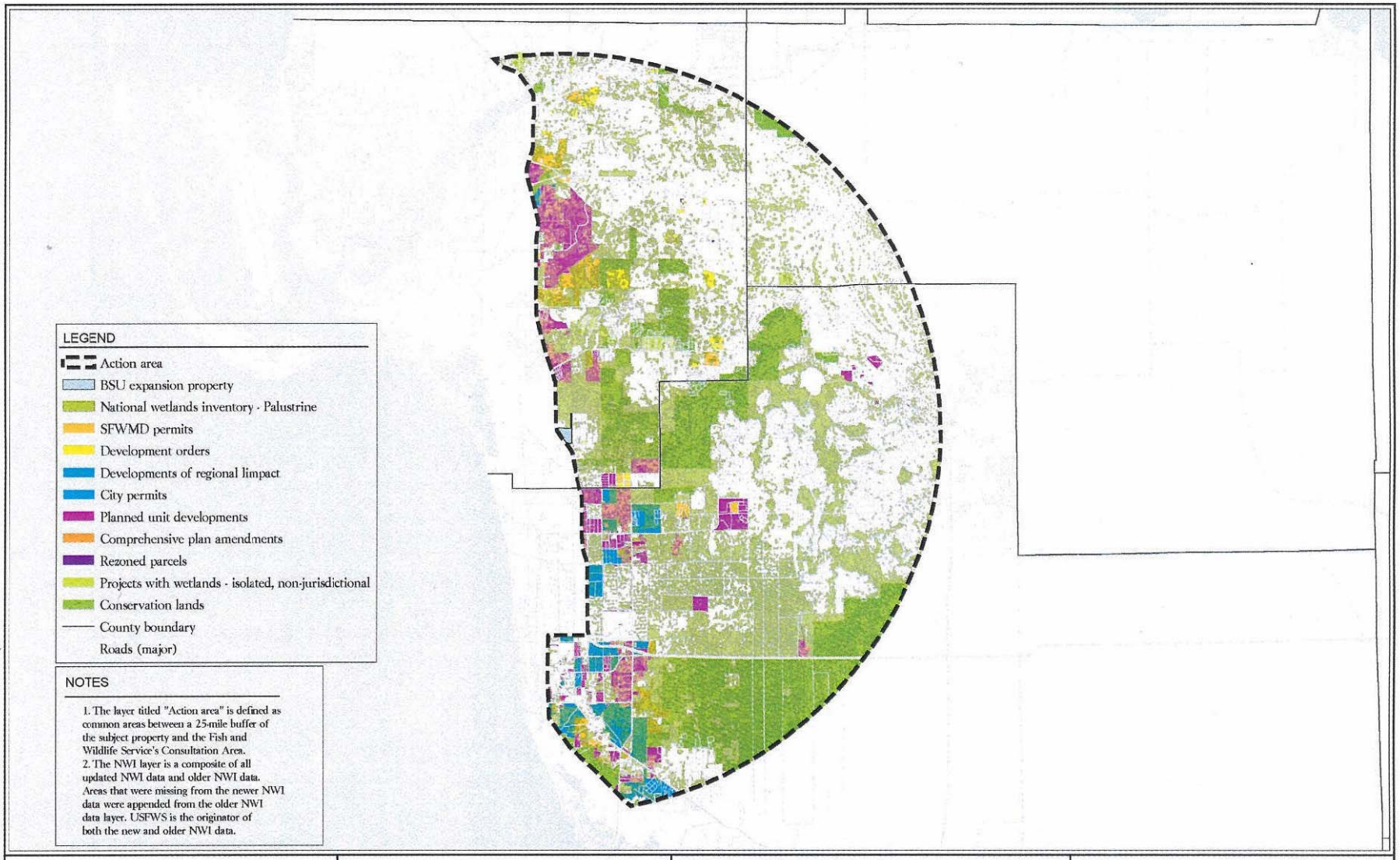


Figure 11

Combined project overlay with National Wetlands Inventory map



Bonita Springs Utilities
Lee County, Florida

JOHNSON ENGINEERING
2158 JOHNSON STREET
P.O. BOX 1550
FORT MYERS, FLORIDA 33902-1550
PHONE (941) 334-0046
FAX (941) 334-3661
E.B. #642 & L.B. #642

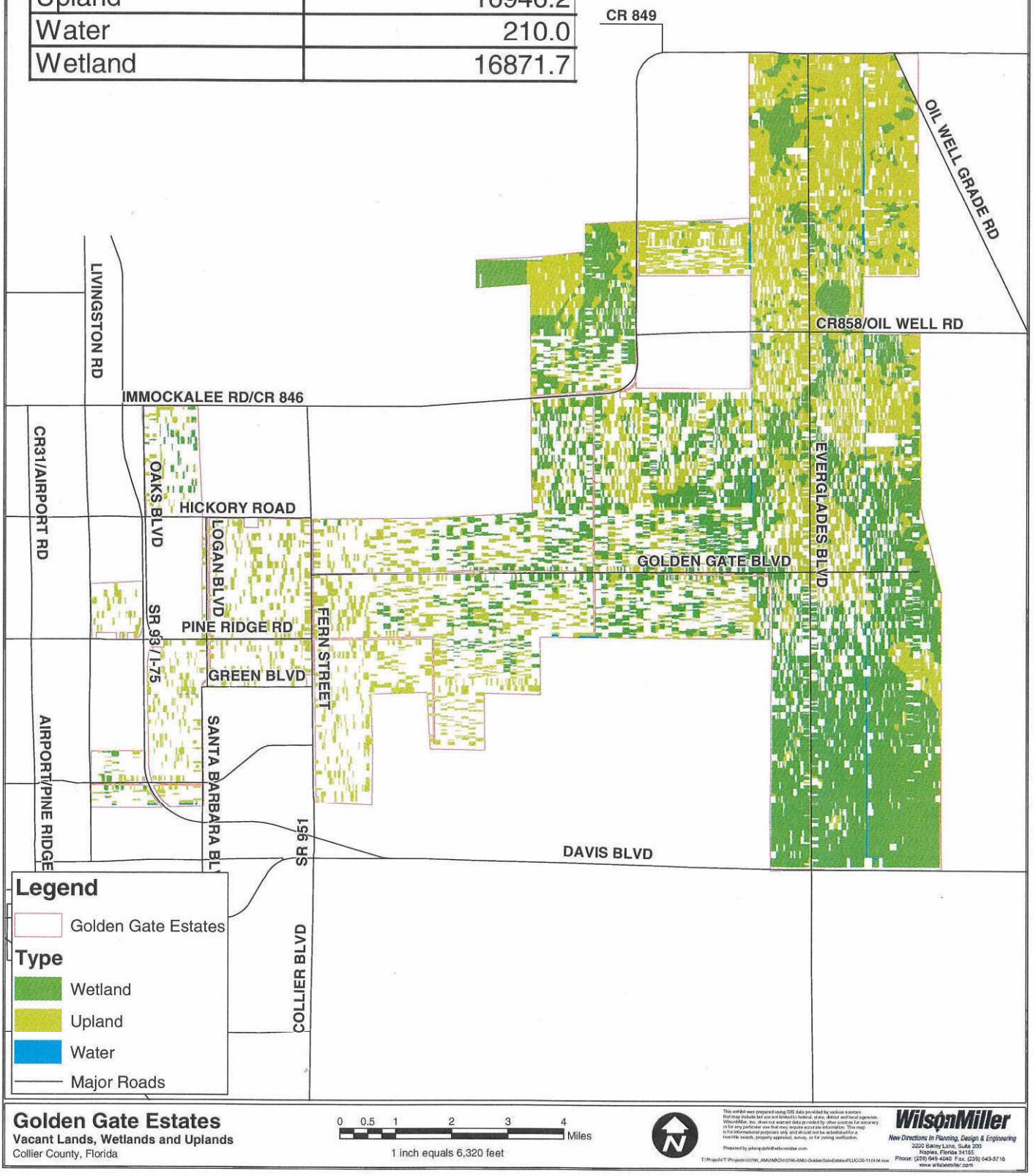
Combined Overlay

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
Sept. of 2004	19991835		As Shown	Figure 9

Figure 12

Northern Golden Gate Estates vacant lots

Golden Gate Estates Vacant Lands: Wetland Type (FLUCCS)	
Type	**Acres**
Upland	16946.2
Water	210.0
Wetland	16871.7



Golden Gate Estates
Vacant Lands, Wetlands and Uplands
Collier County, Florida

0 0.5 1 2 3 4 Miles

1 inch equals 6,320 feet

This exhibit was prepared using GIS data provided by various sources that may include but are not limited to federal, state, district and local agencies. WilsonMiller, Inc. does not warrant data provided by other sources for accuracy or for any particular use that may require accurate information. This map is for informational purposes only and should not be substituted for a true title search, property appraisal, survey, or for zoning verification.

Prepared by jakonpicki@wilsonmiller.com

T:\Projects\T:\Projects\03796_AMU\MXD\03796-AMU-GoldenGateEstatesFLUCCS-11x14.mxd

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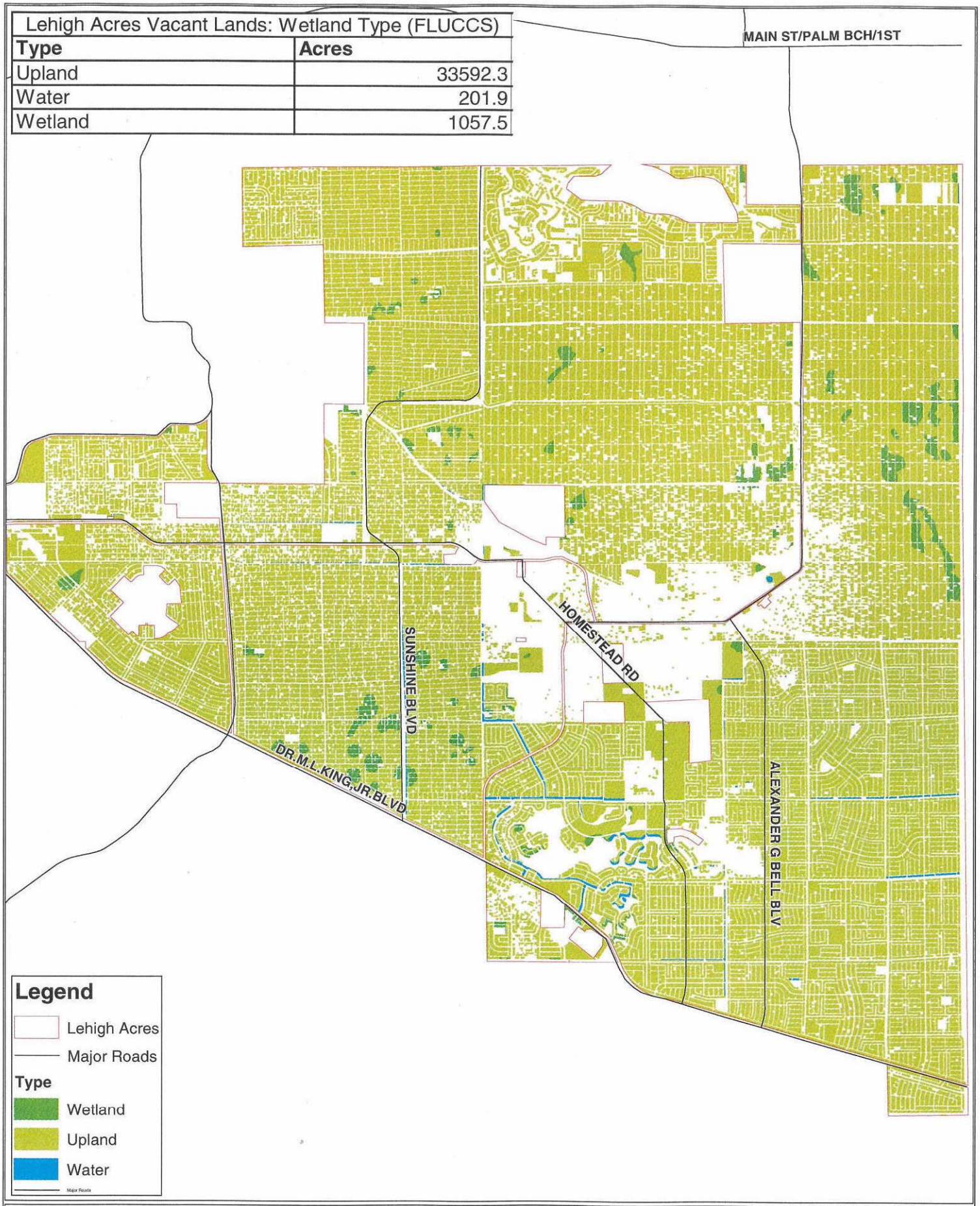
Figure 13

Lehigh Acres vacant lands

Lehigh Acres Vacant Lands: Wetland Type (FLUCCS)	
Type	**Acres**
Upland	33592.3
Water	201.9
Wetland	1057.5



Lehigh Acres
Vacant Lands, Wetlands and Uplands
Lee County, Florida

0 0.375 0.75 1.5 2.25 3 Miles

1 inch equals 3,955 feet

Prepared by jakeopdahl@wilsonmiller.com
T:\Projects\T:\Projects\69766_AMU\MXD\69766-AMU-LehighAcresFLUCCS-110104.mxd

WilsonMiller
New Directions in Planning, Design & Engineering
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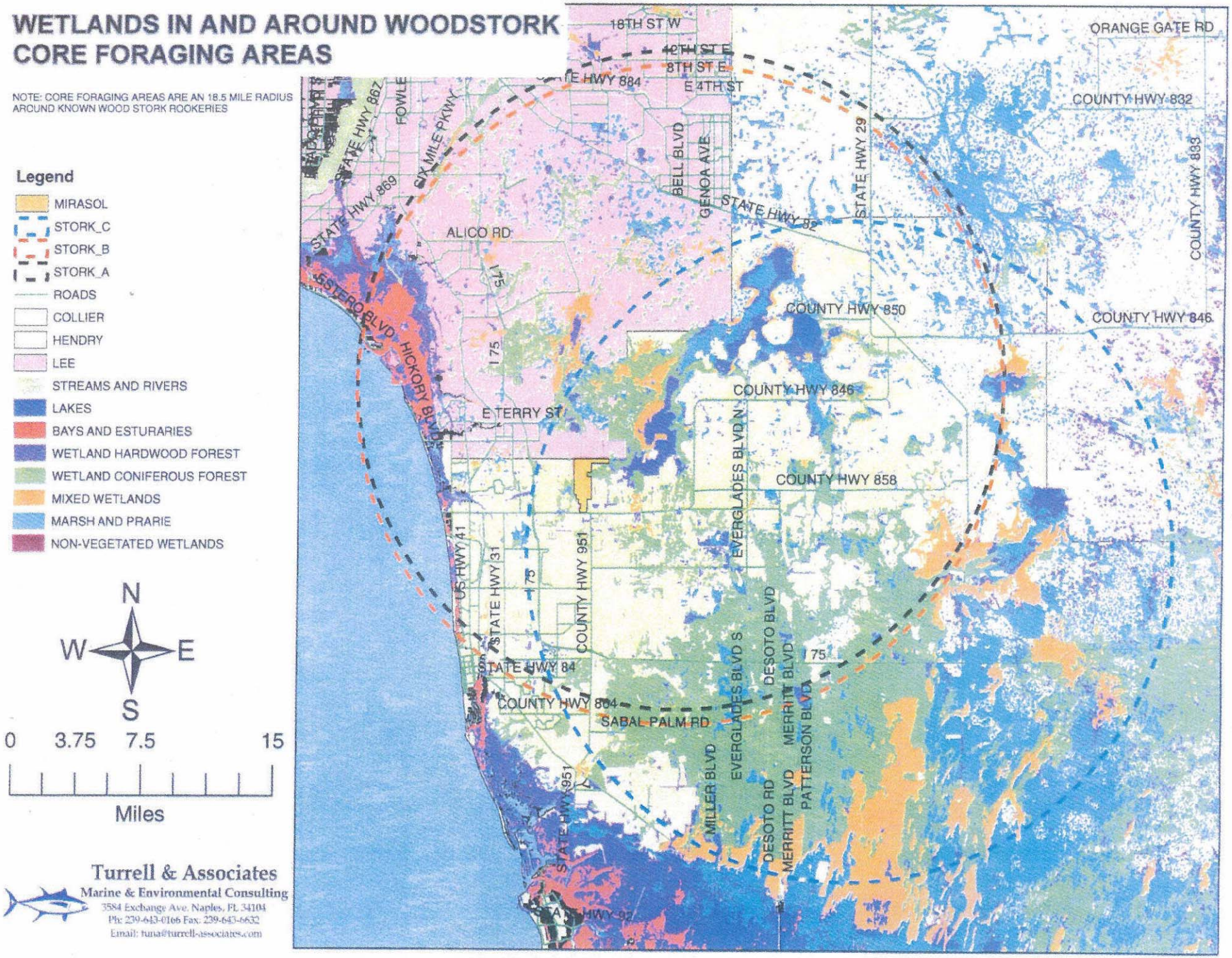
Naples, Florida 34105
Phone: (239) 645-4040 Fax: (239) 643-5716
www.wilsonmiller.com

Figure 14

Wetlands in and around Wood Stork Core Foraging Area

WETLANDS IN AND AROUND WOODSTOCK CORE FORAGING AREAS

NOTE: CORE FORAGING AREAS ARE AN 18.5 MILE RADIUS AROUND KNOWN WOOD STORK ROOKERIES



Turrell & Associates
Marine & Environmental Consulting
3584 Exchange Ave. Naples, FL 34104
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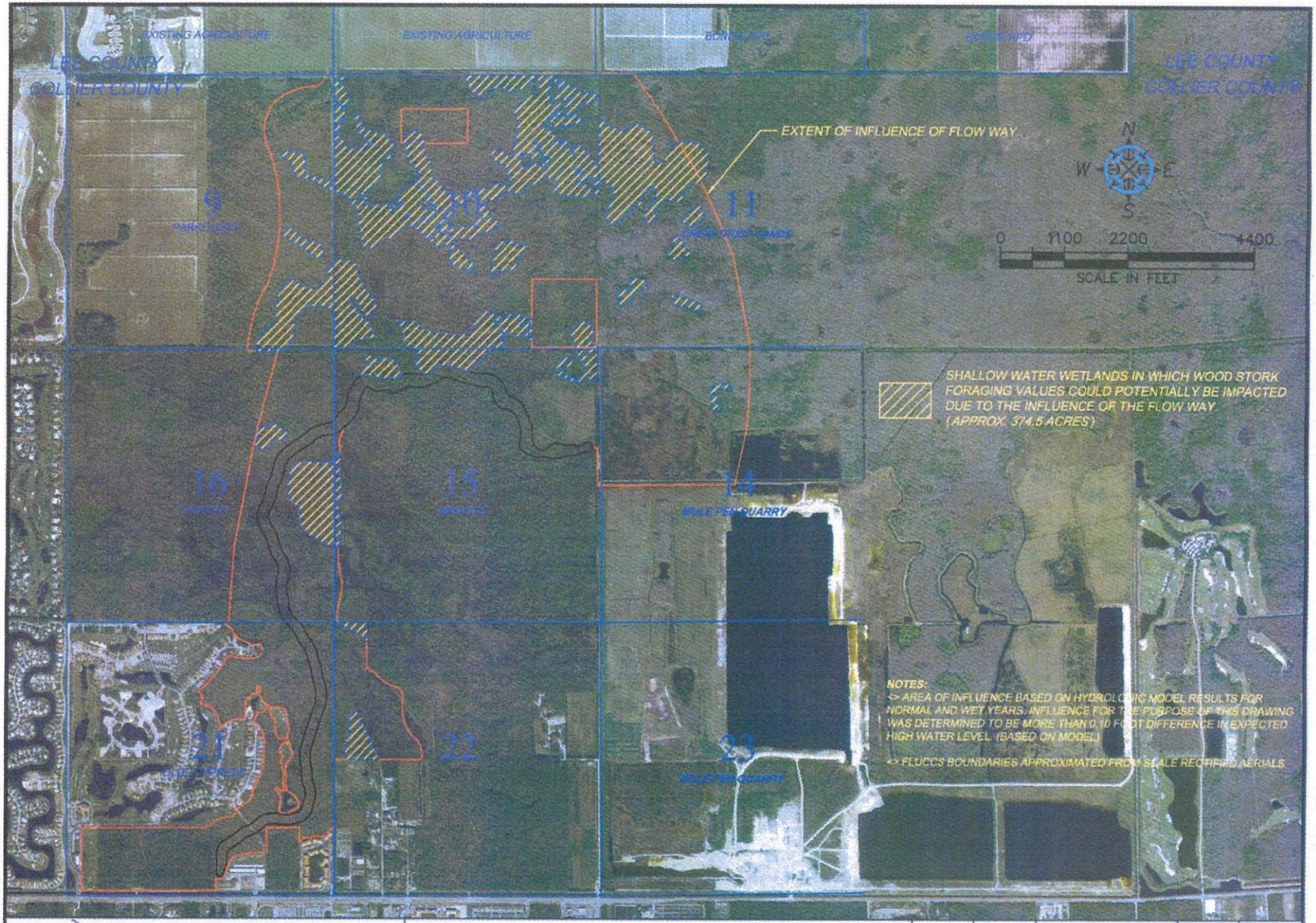
Email: tuna@turrell-associates.com

Figure 15

Flow-way Wetland Impacts



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MIRASOL

SHALLOW WATER WETLAND AREAS

DESIGNED	T.T.T.	REVISION	TAB NAME	Contiguous
DRAWN	KD	N/A	SHEET	
DATE	02-17-05	N/A	SCALE	1"=2200'
JOB NO.	9418	N/A		

SECTION- 10,11,15,22 TOWNSHIP- 48 S RANGE- 26 E