Wood Stork *(Mycteria americana)* Foraging Habitat Assessment

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Prepared For:

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1.0 Introduction

In support of site development for the Sunrise Residential Project, Aquatic Research Monitoring, Equipment and Deployment, LLC (Aquatic Research FL), completed a Wood Stork (*Mycteria americana*) Foraging Habitat Assessment. The Sunrise Residential Project is a ±520-acre portion of the currently permitted ±733-acre project named Willow Lakes LLC, Midway Properties LLC, Red River LLC, the Provences, dated March 16, 2006, under South Florida Water Management District (SFWMD) Application Number 060323-13 and Permit Number 56-02838-P.

The subject property specifically consists of two (2) parcels located at 9850 W Midway Road, City of Fort Pierce within St. Lucie County FL. It is further identified by the St. Lucie County Property Appraiser as Parcel Identification Numbers 2334-340-0000-000-7 & 2334-410-0000-000-1, within Section 34, Township 35 South, and Range 39 East. Please see Appendix A, Figure 1 for the Location Map. Habitat was reviewed in accordance with the United States Fish and Wildlife Service (USFWS) Foraging Analysis within the Habitat Management Guidelines for the Wood Stork in the Southeast Region.

The subject property is currently an active cattle operation. The northern border is adjacent to Ten Mile Creek Stormwater Treatment Area (STA) owned by South Florida Water Management District (SFWMD), Creekside Residential Subdivision and Okeechobee Road/SR 70. The southern perimeter is adjacent to a reclaimed sand mine, an active cattle operation owned by Willow Lakes LLC, followed by West Midway Road, inactive agriculture, and a Florida Power & Light Field Station. The east is bordered by Interstate 95 (I-95) further east is land owned by St. Lucie County (Landfill) and Tropicana Manufacturing Company. To the west are agricultural lands and single-family homes. Land uses within the general vicinity of the subject property include agriculture (north, south, and west), residential (low to high density), and scattered commercial, municipal, and industrial services. Please see Appendix A, Figure 2 for the Site Map.

The onsite habitat consists of uplands, wetlands, and other surface waters. Upland areas consist of pine flatwoods, an abandoned citrus grove, improved pasture areas, disturbed lands, and areas impacted with non-native Brazilian peppertrees. Wetland types include wet prairies, hydric pine flatwoods, mixed wetland hardwoods, and freshwater marshes. The other surface waters (OSW) located throughout the subject property are associated with the previous use as groves and current use as an active cattle operation. These OSWs include two (2) farm ponds and stormwater conveyances ditches.

As outlined in the USFWS Guidance Procedures, wetlands and other surface waters and associated transitional/upland areas of the subject property were assessed for wood stork suitability.

Specifics regarding habitat suitability along with calculations of forage biomass loss and gained in association with site development are described in the Sections below.

2.0 Wetland and Other Surface Water (OSW) Descriptions and Landuse Codes:

The subject property is part of an approved SFWMD permit covering ±733 acres. During the permitting process all wetlands within the ±733-acre project area, which includes those on the subject property (±520 acres), were delineated and assessed for habitat type and ecological condition. This permit is still active and therefore relevant and approved data with regards to proposed impacts, hydrology and ecological function were utilized where appropriate.

Furthermore, Aquatic Research FL conducted site reconnaissance to verify site conditions and gather any additionally required ecological information on all wetlands indicated in the approved SFWMD permit that are located within the portions of the property proposed for development. See Appendix A, Figure 3 for Existing Habitat/CLC Map and Figure 4 for the SFWMD approved jurisdictional wetland maps. Rainfall totals were also obtained from SFWMD for 2005-2023 to assist with determination of hydrological conditions of onsite wetlands, other surface waters and upland transitional areas. See Appendix C for Rainfall Totals.

Wetland types located within the assessment areas are as follows:

641 FLUCCS/212 CLC: Freshwater Marsh (Wetlands 1A, 1B, 2 and 17)

Representative Vegetation:
Torpedograss *(Panicum repens)* – non-native
Broomsedge *(Andropogon virginicus var. glaucus)* – native
Creeping Jenny *(Lysimachia nummularia)* – native
Pickerelweed *(Pontederia cordata)* – native
Pipewort *(Eriocaulon spp.)* – native
Southern swamp-lily *(Crinum Americanum)* – native
Orange milkwort *(Polygala lutea L)* – native
Marsh pink *(Sabatia stellaris)* – native

643 FLUCCS/2111 CLC: Wet Prairie (Wetlands 7, 8, 9, 10, 11, 12, and 20)

Representative Vegetation:
Torpedograss *(Panicum repens)* – non-native
Broomsedge *(Andropogon virginicus var. glaucus)* – native

Creeping Jenny *(Lysimachia nummularia)* – native
Pickerelweed *(Pontederia cordata)* – native
Pipewort *(Eriocaulon decangulare)* – non-native
Torrey's rush, *(Juncus torreyi)* – native
Many-spiked flatsedge *(Cyperus polystachyos)* – native
Cowbane *(Oxypolis rigidior)* – native
Southern swamp-lily *(Crinum Americanum)* – native
Marsh pink *(Sabatia stellaris)* – native
Yellowed eyed grass *(Xyris spp)* – native

Other Surface Water (OSW) located within the assessment areas are as follows:

530 FLUCCS/321 CLC: Artificial Farm Pond (Ponds 1 & 2)

Representative Vegetation:
Open water 95%
Common spikerush *(Eleocharis palustris)* – native
Pickerelweed *(Pontederia cordata)* – native

511 FLUCCS/422 CLC: Artificial Ditches (Assessment Areas 1, 2, & 3)

Representative Vegetation:
Common spikerush *(Eleocharis palustris)* – native
Pickerelweed *(Pontederia cordata)* – native

2.0 Proposed Project Area Description

This assessment was conducted in conjunction with an application for site development and maintenance of the existing SFWMD permit. As part of the proposed site development twelve (12) wetlands and multiple other surface waters are to be impacted. Proposed impacts are as follows:

ID #	Wetland Type	Acres
W-1A	6410: Freshwater Marshes / Graminoid Prairie - Marsh	3
W-1B	6410: Freshwater Marshes / Graminoid Prairie - Marsh	4
W-2	6410: Freshwater Marshes / Graminoid Prairie - Marsh	0.4
W-7	6430: Wet Prairie	2.59

W-8	6430: Wet Prairie	2.21
W-9	6430: Wet Prairie	3.8
W-10	6430: Wet Prairie	3.58
W-11	6430: Wet Prairie	4.22
W-12	6430: Wet Prairie	4.59
W-17	6410: Freshwater Marshes / Graminoid Prairie - Marsh	2.33
W-20	6410: Freshwater Marshes / Graminoid Prairie - Marsh	0.39
OSW ID	**Other Surface Waters (OSW) Type**	**Acres**
P-1	5240: Artificial Farm Pond (Lakes less than 10 acres)	TBD
P-2	Artificial Farm Pond (Lakes less than 10 acres)	TBD
Assessment Area 1	5100: Ditches/Furrows	TBD
Assessment Area 2	5100: Ditches	TBD
Assessment Area 3	5100: Ditches	TBD

Table 3.0: Summary of Descriptions of the Proposed Wetland & Ditch/Furrows Impacts.

Aquatic Research FL therefore completed this foraging analysis based on these proposed impacts to determine potential loss and gain of biomass for wood storks associated with site development.

Wetlands referred to as 1A, 1B, 2, 7, 8, 9, 10, 11, 12, and 17 met the wood stork foraging habitat criteria, consumption rates vary as with the hydroperiod. Based on the assessment Wetland 20 and the onsite ditches/furrows did not meet wood stork foraging habitat criteria, therefore no actual consumption is yielded for wetland 20 nor the onsite ditches/furrows.

It was determined that within the proposed impact area ±30.7 acres of wetlands provide suitable foraging habitat (SFH) for the wood stork. Utilizing the formulas provided in the USFWS guidance document, the anticipated total impacts to wood stork foraging habitat are 124,319.48 m², which would result in a biomass loss of 39.2 kilogram in prey. To provide mitigation for the loss of wood stork forage ±8.8 acres of littoral shelves shall be constructed around the proposed onsite stormwater lakes.

Based on ±8.8 acres of created littoral shelves, 39.2 kilograms of wood stork forage biomass shall be provided, offsetting the estimated loss of 39.2 kilograms forage biomass. Therefore, it would appear that adverse impacts to wood stork foraging areas could be offset completely onsite via the creation of onsite lakes and littorals.

3.0 Foraging Habitat Assessment & Methodology

A Wood Stork (*Mycteria americana*) Foraging Habitat Assessment was conducted on November 17, 2023, by the qualified biologists with Aquatic Research Monitoring Equipment, & Deployment, LLC (Aquatic Research FL). The assessment area includes wetlands and other surface waters and associated transitional/uplands proposed to be impacted as part of the Sunrise Development Project.

The project area was assessed in accordance with the United States Fish and Wildlife Service (USFWS) Foraging Habitat Analysis within the Habitat Management Guidelines for the Wood Stork in the Southeast Region, herein referred to as the USFWS guidance document (See Appendix B, Attachment 1). The habitat was analyzed using 4 parameters: hydroperiod, prey availability, vegetation type, and vegetation density. The USFWS guidance document procedures and formulas were applied to the data collected with regards to onsite visual observations of vegetation type/densities, estimated hydroperiods, and published data. To assess current site conditions, Aquatic Research FL established linear transects along each side of wetlands, ponds, and interior ditches, orientated so that the entire ecosystem being examined could be reviewed. Data collection points were then established in 4 cardinal directions within each feature for determination of any significant ecological changes throughout the system. See Appendix A Figure 5 for Overview of Wood Stork Assessment Areas and Figures 6 -11 for depictions by assessment area.

See below schematic for depiction of transects and data point orientation.

Across each established transect visual observations for wood storks/evidence, vegetation type and density, as well as water levels were documented. At each data collection point established, dip netting was performed to determine presence and estimate density of organisms relative to prey suitability for wood storks. The assessment as described above was conducted throughout all twelve (12) wetlands as well as other surface waters proposed for impacts. On the day of the site visit the wetlands, ponds, and ditches/furrows had varying water levels, vegetation densities, canopy coverage, and prey availability.

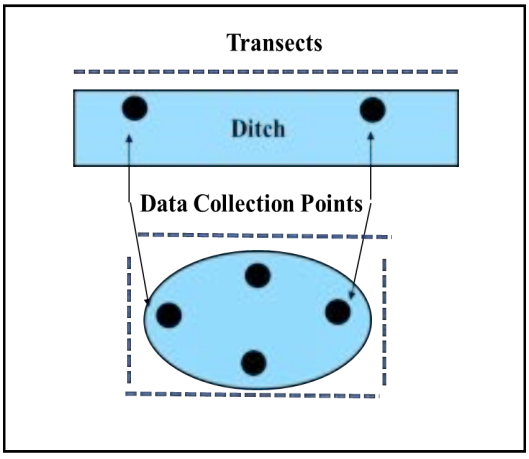

Table 3.0: Overview of Typical Transects and Data Collection Points.

3.1 Hydroperiod, Prey Availability, Water Levels & Site-Specific Species

The USFWS guidance document states hydroperiod can affect prey densities for the wood stork. The assessment included a review of aerials, outlining the months water was observed within each water body assessed (wetland, ditches, ponds). During the onsite habitat analysis current water level measurements were collected at established data points 30.5 centimeters (12 in) waterward from the lands edge. When available, high-water marks and normal pools levels were measured to the nearest centimeter. In addition, dip netting was performed three (3) times within the data collection point to observe species present.

3.1.1 Water Levels & Prey Availability

Water levels are considered when assessing potential foraging habitat, as 2 to 15 inches of littoral depth is suitable for wood storks. The percentage of suitable depth in relation to the entire waterbody determines the prey availability. This information is utilized when Rating Indices for Foraging Habitat Variables in the United States Army Corp of Engineer's Wood Stork Key for impact mitigation, herein referred to as USACE rating indices (Appendix B, Attachment 2).

See table below for assessed wetlands, ponds, and ditches/furrows average water levels at the data collection points. Littoral shelves were absent and therefore not measured for Wetland 20, the artificial ponds (P-1, P-2), and ditch and furrow areas (Assessment Areas 1-3). The ditches and ponds specifically have an average 45-degree angle slope, providing little to no littoral shelf. Therefore, within the excluded systems active foraging is highly limited and would be dependent on achievement of very specific conditions/water levels.

ID#	Waterbody Type	Littoral Depth (cm)	Normal Pool (cm)	High Water Mark (cm)
W-1A	6410: Freshwater Marshes / Graminoid Prairie - Marsh	~15	19.8	Rim Level
W-1B	6410: Freshwater Marshes / Graminoid Prairie - Marsh	~11	19.8	Rim Level
W-2	6410: Freshwater Marshes / Graminoid Prairie - Marsh	~18	TBD	Rim Level
W-7	6430: Wet Prairie	~5	20.8	Rim Level
W-8	6430: Wet Prairie	~10	20.8	~43
W-9	6430: Wet Prairie	N/A	20.8	Rim Level
W-10	6430: Wet Prairie	N/A	20.8	Rim Level

W-11	6430: Wet Prairie	N/A	20.8	Rim Level
W-12	6430: Wet Prairie	~20	TBD	Rim Level
W-17	6410: Freshwater Marshes / Graminoid Prairie - Marsh	~26	TBD	Rim Level
W-20	6410: Freshwater Marshes / Graminoid Prairie - Marsh	N/A	TBD	Rim Level
OSW ID	**Other Surface Waters (OSW) Type**	**Acres**	TBD	20 ft (permit)
P-2	Artificial Farm Pond (Lakes less than 10 acres)	N/A	TBD	20 ft (permit)
Assessment Area 1	5100: Ditches/Furrows	N/A	TBD	Top of Bank
Assessment Area 2	5100: Ditches/Furrows	N/A	TBD	Top of Bank
Assessment Area 3	5100: Ditches/Furrows	N/A	TBD	Top of Bank

Table 3.1.1: Onsite wetlands & ditches/furrows average water levels at the data collection points.

3.1.2 Hydroperiod

No specific wetland and/or ditch hydroperiods have been recorded for the subject property. Therefore, to conservatively estimate the hydroperiod, aerial images were reviewed from 2000 to 2023, noting months of observed water. The estimated days of inundation were then compared to the USFWS guidance document's South Florida Water Management District (SFWMD) hydroperiod classes. The estimated days of inundation were then compared to the USFWS guidance document's South Florida Water Management District (SFWMD) hydroperiod classes. **Wetlands referred to as 1A, 1B, 2, 7, 8, 9, 10, 11, 12, and 17 met the wood stork foraging habitat criteria, consumption rates vary as with the hydroperiod.**

ID#	Waterbody Type	SFWMD Hydroperiod Class
W-1A	6410: Freshwater Marshes / Graminoid Prairie - Marsh	7
W-1B	6410: Freshwater Marshes / Graminoid Prairie - Marsh	7
W-2	6440: Emergent Aquatic Vegetation	5
W-7	6430: Wet Prairie	4
W-8	6430: Wet Prairie	4
W-9	6430: Wet Prairie	2
W-10	6430: Wet Prairie	2
W-11	6430: Wet Prairie	2

W-12	6430: Wet Prairie	7
W-17	6410: Freshwater Marshes / Graminoid Prairie - Marsh	7

Table 3.1.2.A: SFWMD hydroperiod class descriptions and related wood stork actual consumption for Wetlands W-1A, W-1B, W-2, W-7, W-8, W-9, W-10, W-11, W-12, and W-17.

3.1.3 Site Specific Species

During the assessment dip netting was performed three (3) times within each data collection point to observe species present. Organisms observed were recorded and compared to the primary fish species consumed by wood storks. The majority of the locations yielded grass shrimp (*Palaemonetes spp.*), mosquitofish (*Gambusia affinis*), rams horn snails (*Helisoma spp*.), insect larvae/nymphs, crayfish, and water beetles. None of the primary species associated with wood stork forage were observed or collected. See table below for a list of Ogden's primary fish species consumed by wood storks.

Ogden et al: Primary Fish Species consumed by Wood Storks			
Common Name	**Scientific Name**	**Percent Individuals**	**Percent Biomass**
Sunfish	*Centrarchidae*	N/A	N/A
Yellow bullhead	*Intalurus natalis*	N/A	N/A
Marsh killifish	*Fundulus confluentus*	N/A	N/A
Flagfish	*Jordenella floridae*	N/A	N/A
Sailfin molly	*Poecilia latipinna*	N/A	N/A

Table 3.1.3: Ogden et al. Primary Fish Species consumed by Wood Storks

Although, none of the primary fish species consumed by wood storks were collected, it is likely that one or more of these species are present.

3.2 Vegetation & Foraging Suitability

The USFWS guidance document states foraging suitability for wood storks is partially dependent on vegetation type and vegetation density. Establishment of transects and data points therefore also accounted for observations of vegetative density as relates to wood stork forage suitability. During the onsite evaluation, each suitable system was visually assessed to determine percent coverage of dominant vegetation species as well coverage by exotic species of vegetation. Analysis consisted of vegetation density and type of both the tree canopy and

groundcover/aquatic plants. Wetland 20 as well as the onsite artificial ponds and ditches (P1, P2, Assessment Areas 1-3) which were determined to have unsuitable littoral depth for wood stork forage, also had dense aquatic vegetation and canopy coverages further making these areas unsuitable for wood stork utilization. Thereby these areas were omitted from the Vegetation and Foraging Index Table. See table 3.2.A for vegetation and foraging suitability index numbers.

ID#	Waterbody Type	% Exotic Vegetation Density	% Foraging Suitability	% Canopy Coverage	Dominate Vegetation
W-1A	6410: Freshwater Marshes / Graminoid Prairie - Marsh	40	64	0	broomsedge *(Andropogon virginicus var. glaucus)* - native, Pickerelweed *(Pontederia cordata)* - native, *creeping* Jenny *(Lysimachia nummularia)*- native, pipewort *(Eriocaulon decangulare)* - non-native, and torpedograss (*Panicum repens)* - non-native
W-1B	6410: Freshwater Marshes / Graminoid Prairie - Marsh	70	37	0	torpedograss *(Panicum repens)* - non-native, pipewort *(Eriocaulon decangulare)* - non-native, broomsedge *(Andropogon virginicus var. glaucus)* - native, pickerelweed *(Pontederia cordata)* - native, orange milkwort *(Polygala lutea L)* - native, and creeping Jenny (*Lysimachia nummularia)* - native
W-2	6410: Freshwater Marshes / Graminoid Prairie - Marsh	80	37	50	water spangles *(Salvinia minima)* - non-native, pickerelweed *(Pontederia cordata)* - native, Carolina willow *(Salix caroliniana)* - native, and Brazilian peppertre*e (Schinus terebinthifolia)* - non-native
W-7	6430: Wet Prairie	70	37	0	torpedograss *(Panicum repens)* - non-native, broomsedge *(Andropogon virginicus var. glaucus)* - native, Torrey's Rush, *(Juncus torreyi)* - native, many-spiked flatsedge *(Cyperus polystachyos)* - native, and pickerelweed *(Pontederia cordata)* - native

W-8	6430: Wet Prairie	70	37	0	torpedograss *(Panicum repens)* - non-native, creeping Jenny *(Lysimachia nummularia)* - native, and pickerelweed *(Pontederia cordata)* - native
W-9	6430: Wet Prairie	50	64	0	broomsedge *(Andropogon virginicus var. glaucus)* - native, torpedograss *(Panicum repens)* - non-native, smutgrass *(Sporobolus indicus)* - non-native, and non-decript pasture grasses
W-10	6430: Wet Prairie	50	64	0	slender goldentop *(Euthamia caroliniana)* - native, smutgrass (*Sporobolus indicus)* - non-native, many-spiked flatsedge *(Cyperus polystachyos)* - native, and tall flatsedge *(Cyperus eragrostis Lam.)* - non-native
W-11	6430: Wet Prairie	70	37	0	broomsedge *(Andropogon virginicus var. glaucus)* - native, torpedograss *(Panicum repens)* - non-native, smutgrass *(Sporobolus indicus)* - non-native, and non-decript pasture grasses
W-12	6430: Wet Prairie	70	37	0	torpedograss *(Panicum repens)* - non-native, water spangles *(Salvinia minima)* - non-native, pickerelweed *(Pontederia cordata)* - native, cowbane *(Oxypolis rigidior)* - native, many-spiked flatsedge *(Cyperus polystachyos)* - native, and Torrey's Rush, *(Juncus torreyi)* - native
W-17	6410: Freshwater Marshes / Graminoid Prairie - Marsh	50	64	0	pickerelweed *(Pontederia cordata)* - native, broomsedge *(Andropogon virginicus var. glaucus)* - native, creeping Jenny *(Lysimachia nummularia)* - native, and torpedograss *(Panicum repens)* - non-native

Table 3.2.A: Wetlands 1A, 1B, 2, 7, 8, 9, 10, 11, 12, & 17 vegetation and foraging suitability.

Exotic Percentage	% Foraging Suitability
0-25	100
25-50	64
50-75	37
75-90	3
90-100	0

Table 3.2.B: USFWS Table 4: Foraging Suitability Percentages

4.0 Summary of Foraging Habitat Assessment

The onsite wetlands, ditches/furrows and ponds proposed for impact associated with the Sunrise Development Project were assessed for wood stork foraging suitability utilizing the USFWS guidance document. The parameters analyzed were hydroperiod, water levels, prey availability, species specific prey, vegetation type and vegetation density.

Based on the evaluation wetlands referred to as 1A, 1B, 2, 7, 8, 9, 10, 11, 12, and 17 meet the wood stork foraging habitat criteria, consumption rates vary as with the hydroperiod. Wetland 20, the farm ponds, and the onsite ditches/furrows did not meet wood stork foraging habitat criteria, therefore no actual consumption was yielded for these systems. See table below for a summary of parameters collected at each data point.

ID#	Littoral Depth (cm)	Normal Pool (cm)	High Water Mark (cm)	Suitable Wood Stork Foraging Littoral Water Depth Yes or No	% Open Water	% Exotic Vegetation Density	% Foraging Suitability (Utilized for calculation to determine biomass lost.)	% Canopy Coverage	Acceptable Canopy Coverage for Wood Stork Foraging (Based on the wood stork's ability to view predators and flight-escape easily during the on-site assessment).	SFWMD Hydroperiod Class (Utilized for calculation for impacts and restoration.)	Actual Consumption grams/m²	Dominate Vegetation
W-1A	~15	19.8	Rim Level	**Yes**	10%	40%	64%	0%	**Yes**	7	1.10	broomsedge *(Andropogon virginicus var. glaucus)* - native, Pickerelweed *(Pontederia cordata)* - native, *creeping* Jenny *(Lysimachia nummularia)*- native, pipewort *(Eriocaulon decangulare)* - non-native, and torpedograss (*Panicum*

												repens) - non-native
W-1B	~11	19.8	Rim Level	**Yes**	25	70	37	0	**Yes**	7	1.10	torpedograss *(Panicum repens)* - non-native, pipewort *(Eriocaulon decangulare)* - non-native, broomsedge *(Andropogon virginicus var. glaucus)* - native, pickerelweed *(Pontederia cordata)* - native, orange milkwort *(Polygala lutea L)* - native, and creeping Jenny (*Lysimachia nummularia)* - native
W-2	~18	TBD	Rim Level	**Yes**	5	80	30	50	**Yes**	5	0.88	water spangles (Salvinia minima) - non-native, pickerelweed *(Pontederia cordata)* - native, Carolina willow *(Salix caroliniana)* - native, and Brazilian peppertree *(Schinus terebinthifolia)* - non-native

W-7	~5	20.8	Rim Level	**Yes**	10	70	37	0	**Yes**	4	0.71	torpedograss *(Panicum repens)* - non-native, broomsedge *(Andropogon virginicus var. glaucus)* - native, Torrey's Rush, *(Juncus torreyi)* - native, many-spiked flatsedge *(Cyperus polystachyos)* - native, and pickerelweed *(Pontederia cordata)* - native
W-8	~10	20.8	~43	**Yes**	10	70	37	0	**Yes**	4	0.71	torpedograss (Panicum repens) - non-native, creeping Jenny *(Lysimachia nummularia)* - native, and pickerelweed *(Pontederia cordata)* - native
W-9	N/A	20.8	Rim Level	**Yes**	N/A	50	64	0	**Yes**	2	0.17	broomsedge *(Andropogon virginicus var. glaucus)* - native, torpedograss *(Panicum repens)* - non-native, smutgrass *(Sporobolus indicus)* - non-native, and non-decript pasture grasses
W-10	N/A	20.8	Rim Level	**Yes**	N/A	50	64	0	**Yes**	2	0.17	slender goldentop *(Euthamia caroliniana)* - native, smutgrass (*Sporobolus indicus)* - non-native, many-spiked flatsedge *(Cyperus polystachyos)* - native, and tall flatsedge *(Cyperus eragrostis Lam.)* - non-native

W-11	N/A	20.8	Rim Level	**Yes**	N/A	70	37	0	**Yes**	2	0.17	broomsedge *(Andropogon virginicus var. glaucus)* - native, torpedograss *(Panicum repens)* - non-native, smutgrass *(Sporobolus indicus)* - non-native, and non-decript pasture grasses
W-12	~20	TBD	Rim Level	**Yes**	25	70	37	0	**Yes**	7	1.10	torpedograss *(Panicum repens)* - non-native, water spangles *(Salvinia minima)* - non-native, pickerelweed *(Pontederia cordata)* - native, cowbane *(Oxypolis rigidior)* - native, many-spiked flatsedge *(Cyperus polystachyos)* - native, and Torrey's Rush, *(Juncus torreyi)* - native
W-17	~26	TBD	Rim Level	**Yes**	25	50%	64	0	**Yes**	7	1.10	pickerelweed *(Pontederia cordata)* - native, broomsedge *(Andropogon virginicus var. glaucus)* - native, creeping Jenny *(Lysimachia nummularia)* - native, and torpedograss *(Panicum repens)* - non-native
W-20	N/A	TBD	Rim Level	**No foraging due to no littoral.**	25	50	64	0	**No, the canopy exceeds preferred wood stork foraging parameters.**	N/A	N/A	pickerelweed *(Pontederia cordata)* - native, broomsedge *(Andropogon virginicus var. glaucus)* - native, creeping Jenny *(Lysimachia nummularia)* - native, and torpedograss *(Panicum repens)* - non-native
P-1	N/A	TBD	20 ft (permit)	**No foraging due to no littoral.**	100	N/A	N/A	0	N/A	N/A	N/A	N/A

P-2	N/A	TBD	20 ft (permit)	**No foraging due to no littoral.**	60	40	64	0	N/A	N/A	N/A	pickerelweed *(Pontederia cordata)* - native, broomsedge *(Andropogon virginicus var. glaucus)* - native, creeping Jenny *(Lysimachia nummularia)* - native, and torpedograss (*Panicum repens)* - non-native,
Assessment Area 1	N/A	TBD	Top of Bank	**No foraging due to no littoral.**	15	70	37	75	**No, the canopy exceeds preferred wood stork foraging parameters.**	N/A	N/A	N/A
Assessment Area 2	N/A	TBD	Top of Bank	**No foraging due to no littoral.**	0%	70	37	75	**No, the canopy exceeds preferred wood stork foraging parameters.**	N/A	N/A	pickerelweed *(Pontederia cordata)* - native,
Assessment Area 3	N/A	TBD	Top of Bank	**No foraging due to no littoral.**	0	25	37	75	**No, the canopy exceeds preferred wood stork foraging parameters.**	N/A	N/A	pickerelweed *(Pontederia cordata)* - native,

Table 4.0.A: Summary of parameters collected at each interior ditch.

Overall, the total acreage of wetlands determined to provide suitable foraging habitat (SFH) for wood storks, in accordance with implementation of the USFWS methodology, is ±30.72 acres. In association with development of the Sunrise Residential Project all 30.72 acres are to be impacted. **Based on the calculations provided in the USFWS guidance document, the anticipated total impacts to wood stork foraging habitat are 124,319.48m², which would result in a biomass loss of 39.2 kilograms in prey**.

See Table below for a summary of results.

Wetland ID	Proposed Impacts (m²)	Actual Consumption (grams/m²)	Forage Suitability	Biomass Loss (kilograms)
W-1A	12,140.60	1.10	0.64	8.6
W-1B	16,187.40	1.10	0.37	6.6
W-2	1,618.74	0.88	0.3	0.4
W-7	10,481.36	0.71	0.37	2.6

W-8	8,943.55	0.71	0.37	2.4
W-9	15,378.10	0.17	0.64	1.7
W-10	14,487.75	0.17	0.64	1.6
W-11	17,077.73	0.17	0.37	1.1
W-12	18,575.07	1.10	0.37	7.6
W-17	9,429.18	1.10	0.64	6.6
			Total	**39.2**

Table 4.0.B: Wood stork foraging biomass loss.

During the onsite assessment, no wood storks were observed on the subject property.

5.0 Proposed Impacts and Mitigation

The habitat assessment has determined that suitable foraging habitat (SFH) for the wood stork is present within the majority of wetlands proposed for development impacts. **The anticipated total impacts to wood stork foraging habitat are ±30.7 acres, which would result in a biomass loss of 39.2 kilograms in prey.** Therefore, compensation is required for loss of wood stork forage biomass. In addition, based on USACE permitting guidance, it is recommended to utilize the Effect Determination Key for the Wood Stork by the United States Army Corp of Engineers (Appendix B, Attachment 3) herein referred to as USACE wood stork key. The key is designed to assist in identifying potential project impacts to wood storks, and planning how best to avoid, minimize, or compensate for any identified adverse effects. The data collected during the foraging habitat assessment provided the information necessary for the completion of the wood stork key.

Aquatic Research FL Site Specific USACE Wood Stork Key			
A	Project within 2,500 feet of an active colony site	May affect	
	Project more than 2,500 feet of an active colony site	go to B	X
B	Project does no affect suitable foraging habitat (SFH)	No effect	
	Project impacts suitable foraging habitat (SFH)	go to C	X
C	Project impacts to SFH are less than or equal to 0.5 acre		
	Project impacts to SFH are greater than to 0.5 acre	go to D	X
D	Project impacts to SFH not within a Core Foraging Area (see attached map) of a colony site, and no wood storks have been documented foraging on site		
	Project impacts to SFH are within the CFA of a colony site, or wood storks have been documented foraging on a project site outside the CFA	go to E	X

E	Project provides SFH compensation within the Service Area of a Service-approved wetland mitigation bank or wood stork conservation bank preferably within the CFA, or consists of SFH compensation within the CFA consisting of enhancement, restoration or creation in a project phased approach that provides an amount of habitat and foraging function equivalent to that of impacted SFH (see Wood Stork Foraging Habitat Assessment Procedure6 for guidance), is not contrary to the Service's Habitat Management Guidelines For The Wood Stork In The Southeast Region and in accordance with the CWA section 404(b)(1) guidelines	NLAA	X
	Project does not satisfy these elements	May affect	

Table 5.0.A: U.S. Army Corp of Engineers Wood Stork Key

Based on the USACE Wood Stork Key, if the project provides compensation for loss of forage via purchase of wetland mitigation credits or via onsite compensation through enhancement, restoration, or creation of foraging habitat, the project will receive a Not Likely to Adversely Affect Determination. Such a determination is required for a project to be approved.

As it has been determined via this assessment, that the site will be impacting wetlands suitable for wood stork foraging, mitigation to offset these losses will be required. Based on a proposed ±30.7-acre total cumulative impact to existing wetlands, 39.2 kilograms of forage biomass could be lost. To offset this loss the applicant proposes to construct ±8.8 acres of littoral shelves around the required stormwater treatment ponds.

Via the creation of ±8.8 acres of created littoral shelves, 39.2 kilograms of wood stork forage biomass shall be provided as compensatory mitigation, fully offsetting the biomass loss of 39.2 kilograms of forage. Therefore, adverse impacts to wood stork foraging areas could be offset completely onsite via the creation of onsite lakes with littorals totaling 8.8 acres.

Wetland ID	Functional Assessment Score	Proposed Impacts (m^2)	Functional Units of Foraging Habitat Loss (units)
W-1A	0.81	12,140.60	2.4
W-1B	0.81	16,187.40	3.2
W-2	0.37	1,618.74	0.5
W-7	0.53	10,481.36	1.4
W-8	0.53	8,943.55	1.2
W-9	0.53	15,378.10	2.0
W-10	0.4	14,487.75	1.4

W-11	0.53	17,077.73	2.2
W-12	0.63	18,575.07	2.9
W-17	0.7	9,429.18	1.6

Table 5.0.B: Functional units of foraging habitat loss per wetland.

6.0 Conclusion

Aquatic Research Monitoring, Equipment, and Deployment LLC (Aquatic Research, FL) performed a Wood Stork (*Mycteria americana*) Foraging Habitat Assessment on a ±520-acre portion of the currently permitted ±733-acre project named Willow Lakes LLC, Midway Properties LLC, Red River LLC, the Provences, dated March 16, 2006, under South Florida Water Management District (SFWMD) Application Number 060323-13 and Permit Number 56-02838-P. It specifically consists of two (2) parcels located at 9850 W Midway Road, City of Fort Pierce within St. Lucie County. It is further identified by the St. Lucie County Property Appraiser as Parcel Identification Numbers 2334-340-0000-000-7 & 2334-410-0000-000-1, within Section 34, Township 35 South, and Range 39 East.

Habitat was reviewed in accordance with the United States Fish and Wildlife Service (USFWS) Foraging Analysis within the Habitat Management Guidelines for the Wood Stork in the Southeast Region. Based on the results of the forage assessment it was determined that **construction of the project will result in ±30.7-acres of total cumulative impacts to wetlands deemed to be suitable for wood stork forage**. Per the USFWS guidance document these 30.7 acres of impacts will result in **39.2 kilograms of forage biomass that could be lost**.

As compensatory mitigation, ±8.8 acres of littoral shelves shall be created providing 39.2 kilograms of wood stork biomass, fully offsetting the biomass loss of 39.2 kilograms. ` Therefore, adverse impacts to wood stork foraging areas could be offset completely onsite via the creation of 8.8 acres of littoral shelves.

See table below for summary of site specific calculations.

Aquatic Research FL Site Specific Calculations for Proposed Impacts and Restoration			
Proposed Impacts		**Foraging Restoration via Lake Littorals**	
Acres	**Biomass Kilograms**	**Acres**	**Biomass Kilograms**
30.7	39.2	8.8	39.2

Table 6.0: Site Specific Calculations for Proposed Impacts and Restoration.

7.0 References

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

Coulter, M. C. 1987. Foraging and breeding ecology of Wood Storks in east-central GA. Proceedings of the Third Southeastern Nongame and Endangered Wildlife Symposium. (Odom, R. R., K. A. Riddleberger, and J. Ozier, Eds.) Georgia Department of Natural Resources.

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Ogden, J. C., J. A. Kushlan, and J. T. Tilmant. 1978. The food habits and nesting success of Wood Storks in Everglades National Park, 1974. U.S. Nati. Park Serv. Nat. Resour. Publ. 16.

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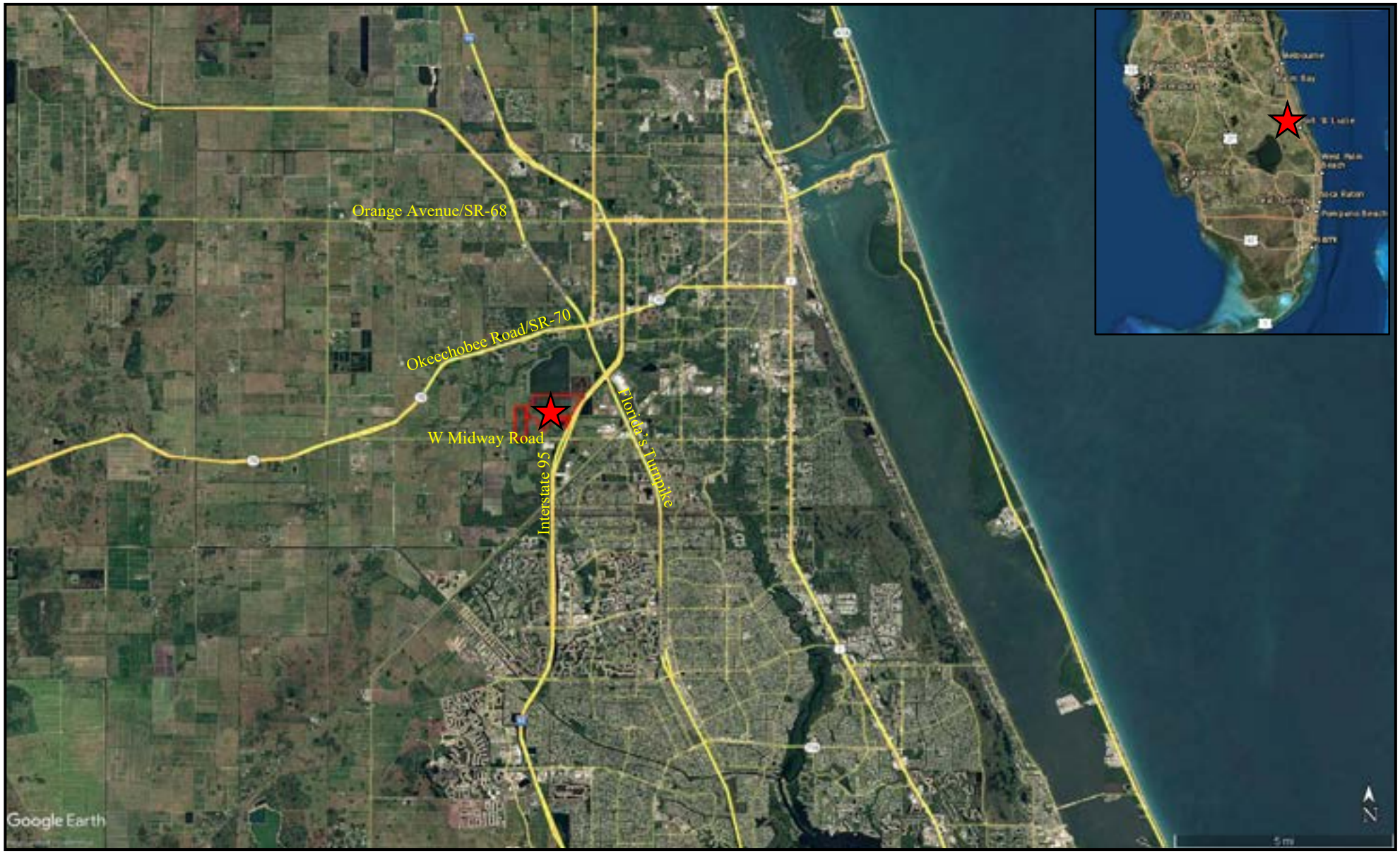
Appendix A

Maps

ENVIRONMENTAL CONSULTING DEPARTMENT
Aquatic **RESEARCH** Monitoring, Equipment, & Deployment, LLC.
CUSTOM DESIGNED RESEARCH EQUIPMENT AND CREATIVE RESEARCH SOLUTIONS



ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Location Map

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 1

Image: Google Earth Date 01/20/2021

N

ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Site Map

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 2

Image: Google Earth – Date 01/21/2021
Data: St. Lucie County Property Appraisers

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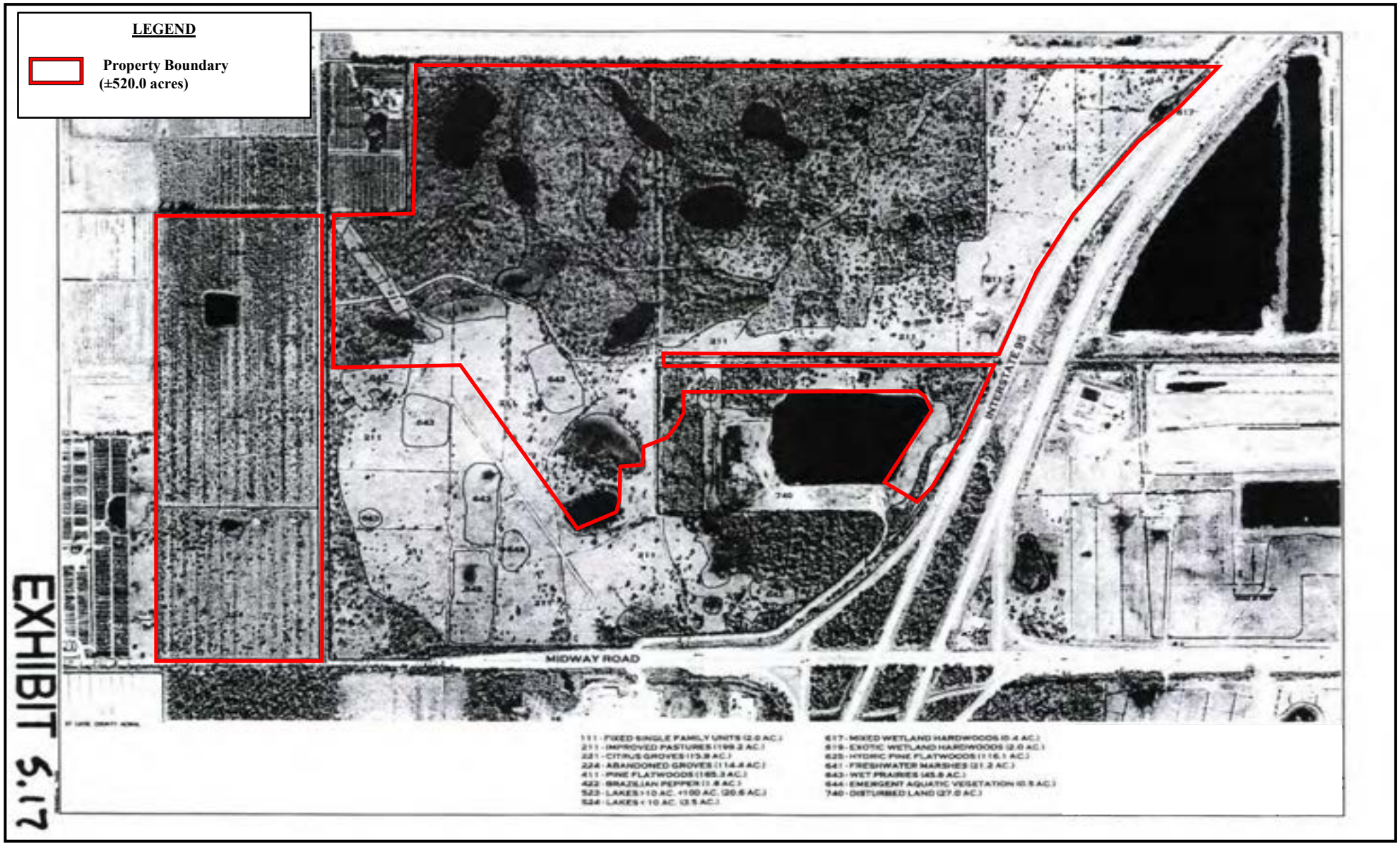

EXHIBIT 5.17

Aquatic RESEARCH
Monitoring, Equipment, & Deployment, LLC
AquaticResearchFl.com
Environmental Consulting Department

FLUCCS Codes SFWMD
Permit Number 56-02538-P

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 3

Image & Data: As created by Others

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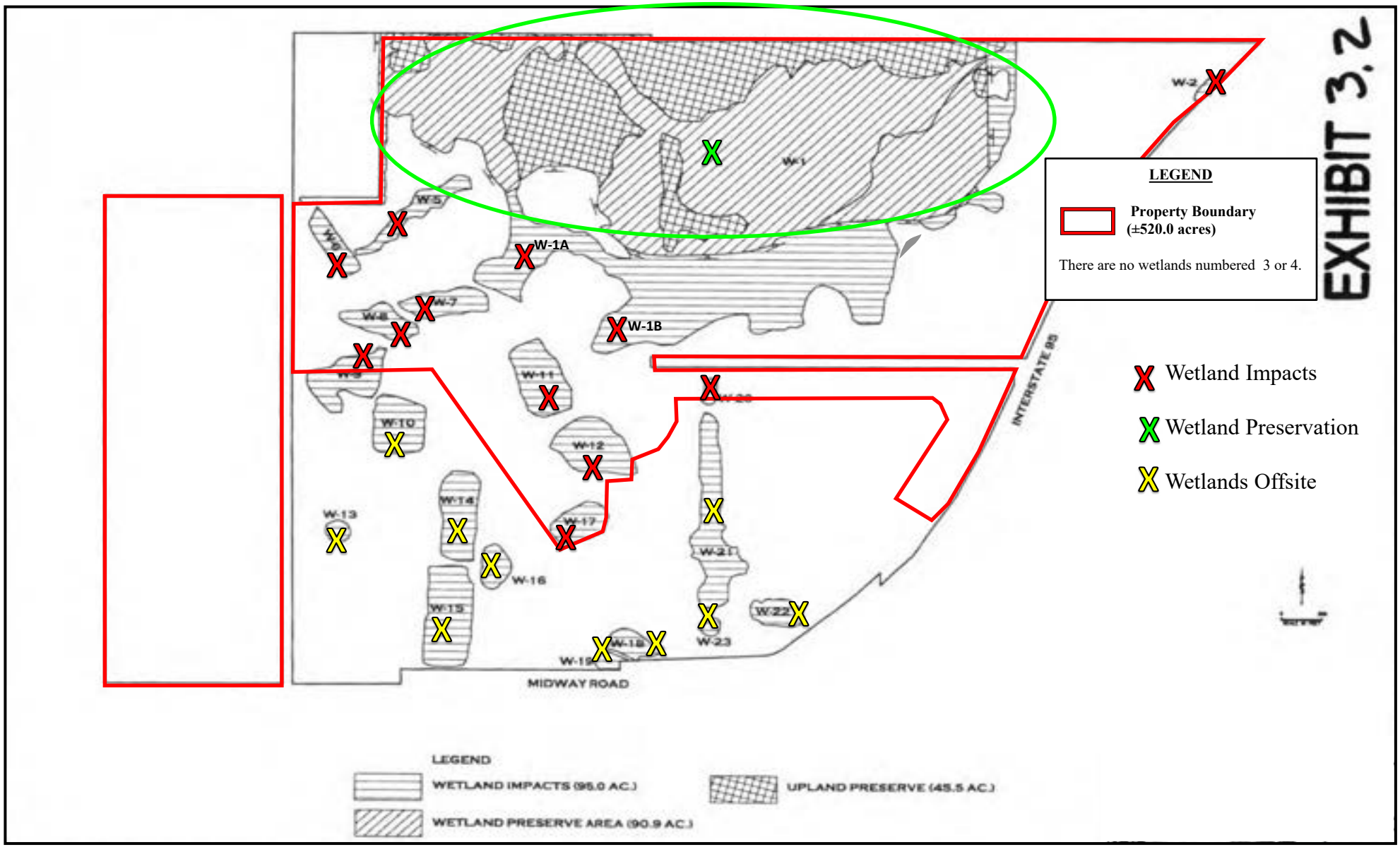

ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Proposed Wetland Impact & Preserve Area Map
Permit Number 56-02538-P

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 4

Image & Data: As created by Others

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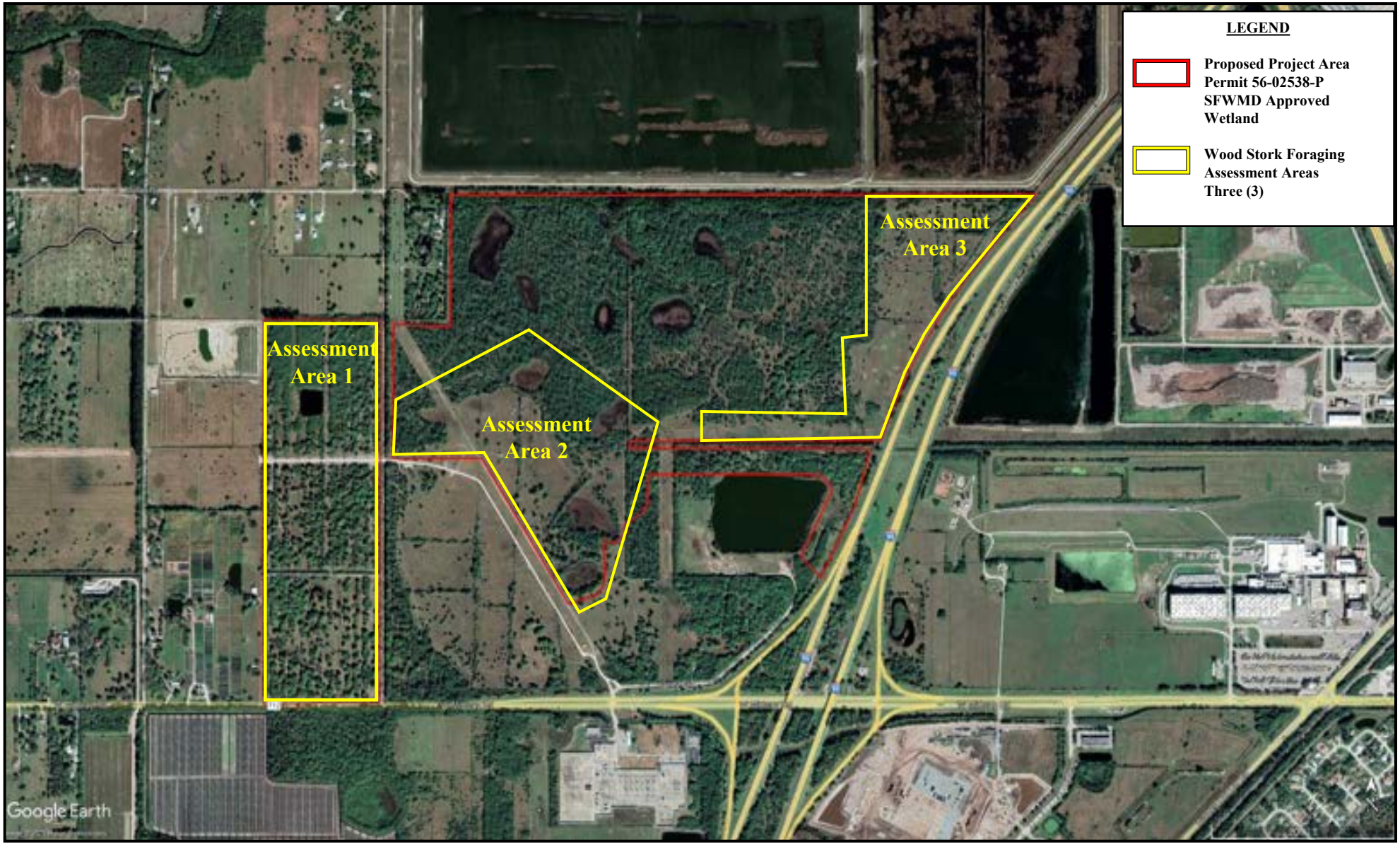

ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Overview of Wood Stork *(Mycteria americana)* Foraging Assessment Areas

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 5

Image: Google Earth – Date 01/14/2022
Data: Aquatic Research Equipment, Monitoring, & Deployment , LLC

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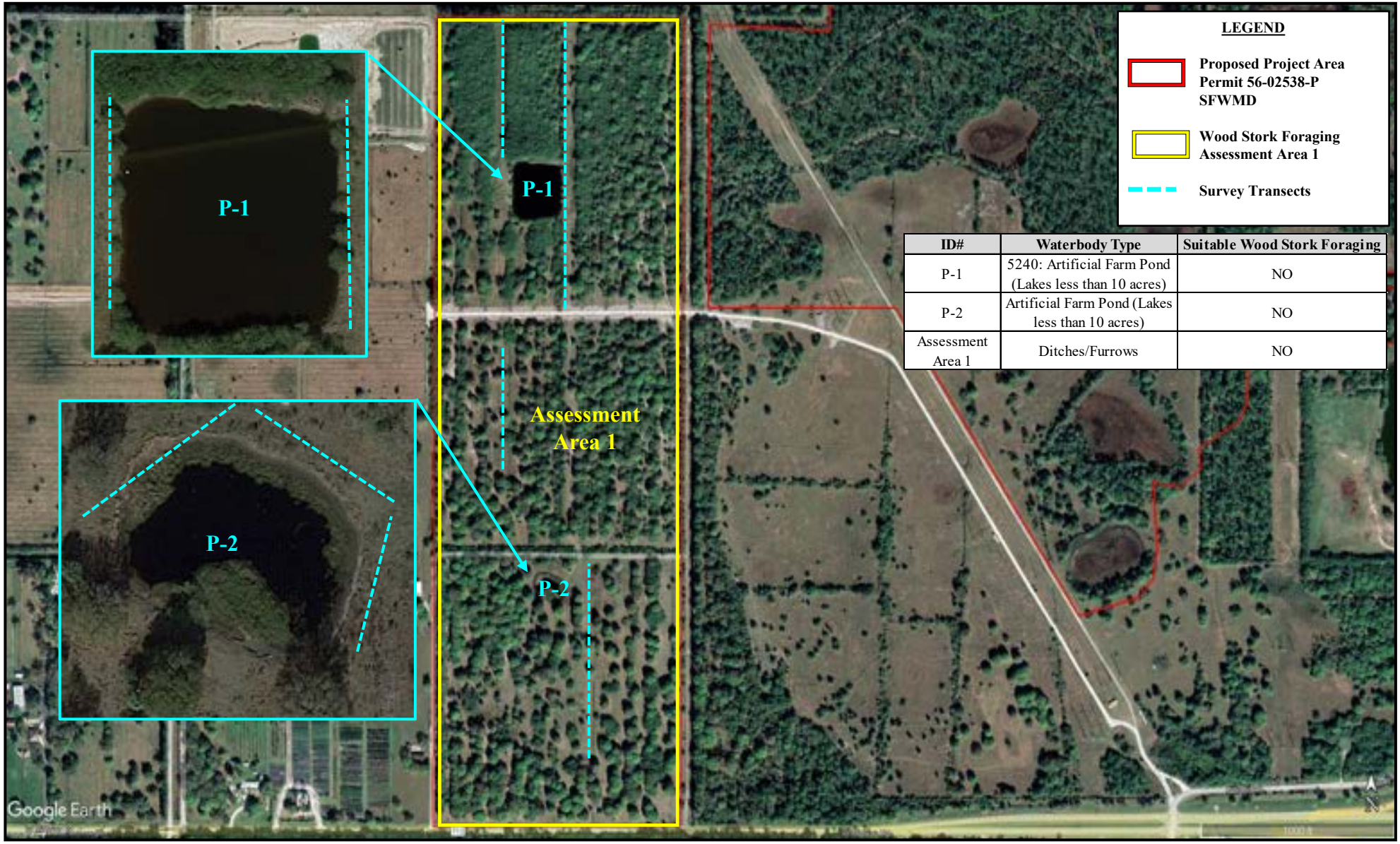

ID#	Waterbody Type	Suitable Wood Stork Foraging
P-1	5240: Artificial Farm Pond (Lakes less than 10 acres)	NO
P-2	Artificial Farm Pond (Lakes less than 10 acres)	NO
Assessment Area 1	Ditches/Furrows	NO

ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Wood Stork *(Mycteria americana)* Foraging Assessment Area 1

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 6

Image: Google Earth – Date 01/14/2022
Data: Aquatic Research Equipment, Monitoring, & Deployment , LLC

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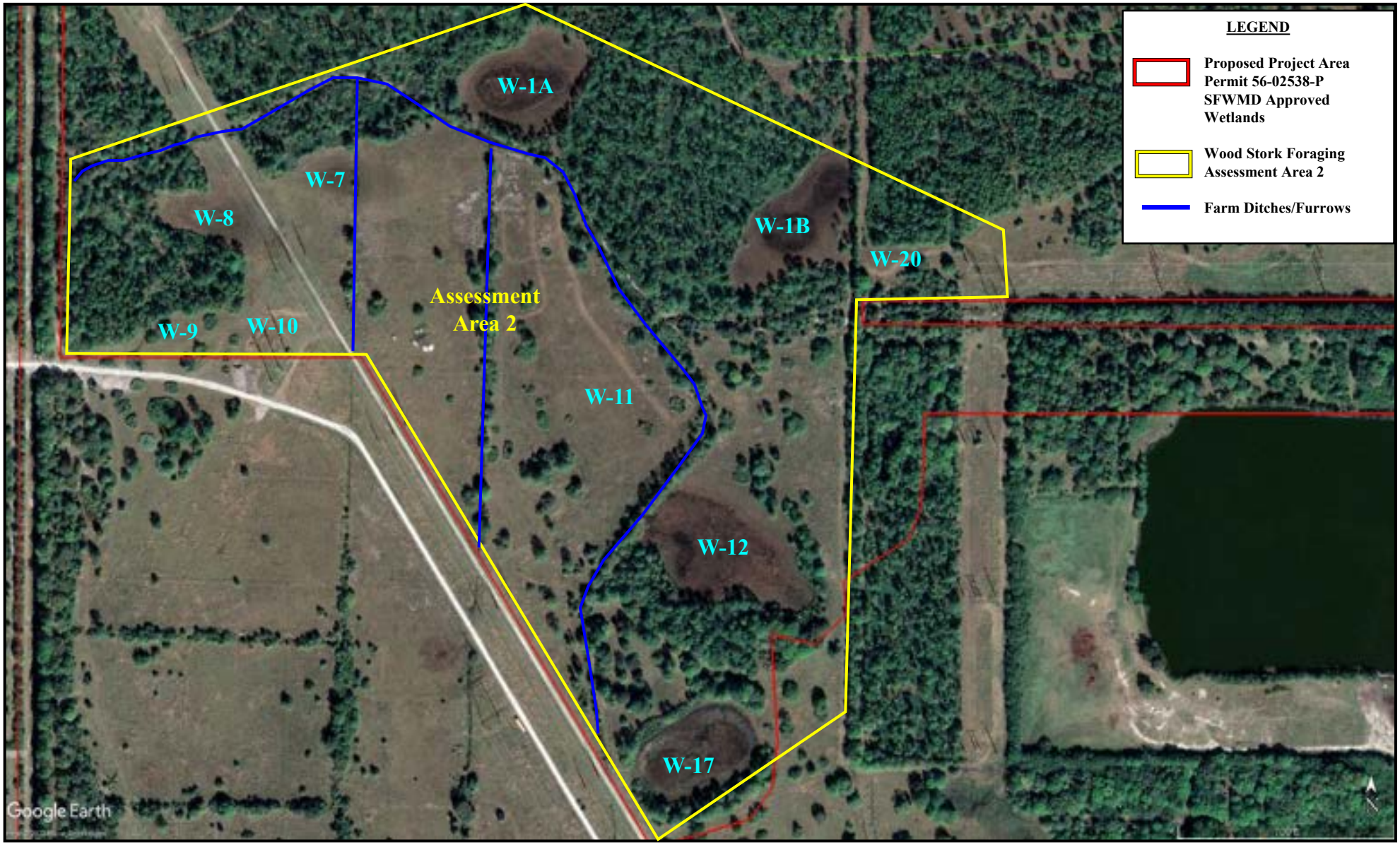

ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Wood Stork *(Mycteria americana)* Foraging Assessment Area 2

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 7

Image: Google Earth – Date 01/14/2022
Data: Aquatic Research Equipment, Monitoring, & Deployment , LLC

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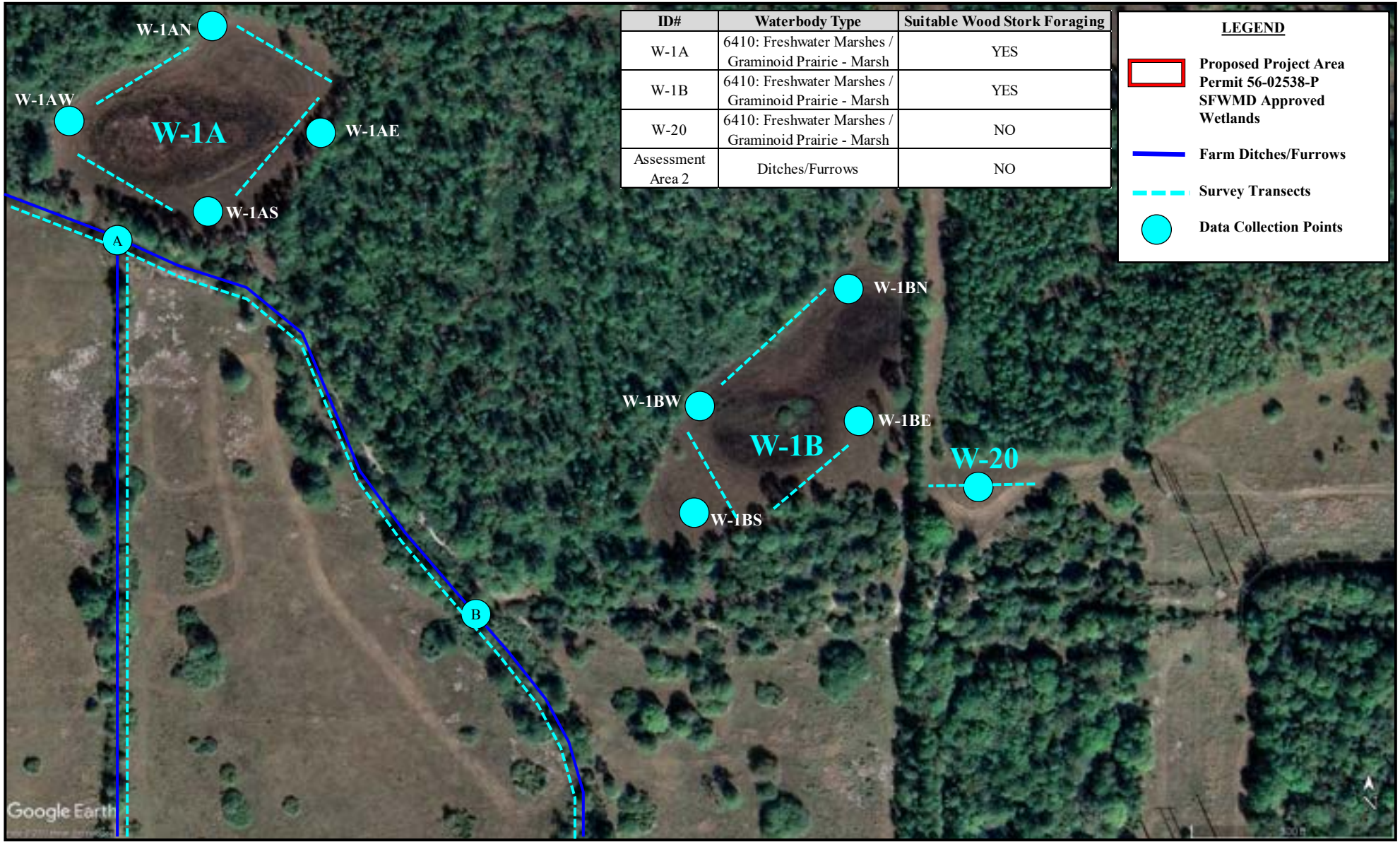

ID#	Waterbody Type	Suitable Wood Stork Foraging
W-1A	6410: Freshwater Marshes / Graminoid Prairie - Marsh	YES
W-1B	6410: Freshwater Marshes / Graminoid Prairie - Marsh	YES
W-20	6410: Freshwater Marshes / Graminoid Prairie - Marsh	NO
Assessment Area 2	Ditches/Furrows	NO

LEGEND

- Proposed Project Area Permit 56-02538-P SFWMD Approved Wetlands
- Farm Ditches/Furrows
- Survey Transects
- Data Collection Points

ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Wood Stork *(Mycteria americana)* Foraging Assessment Area 2 = Wetlands 1A, 1B, & 20

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 8

Image: Google Earth – Date 01/14/2022
Data: Aquatic Research Equipment, Monitoring, & Deployment , LLC

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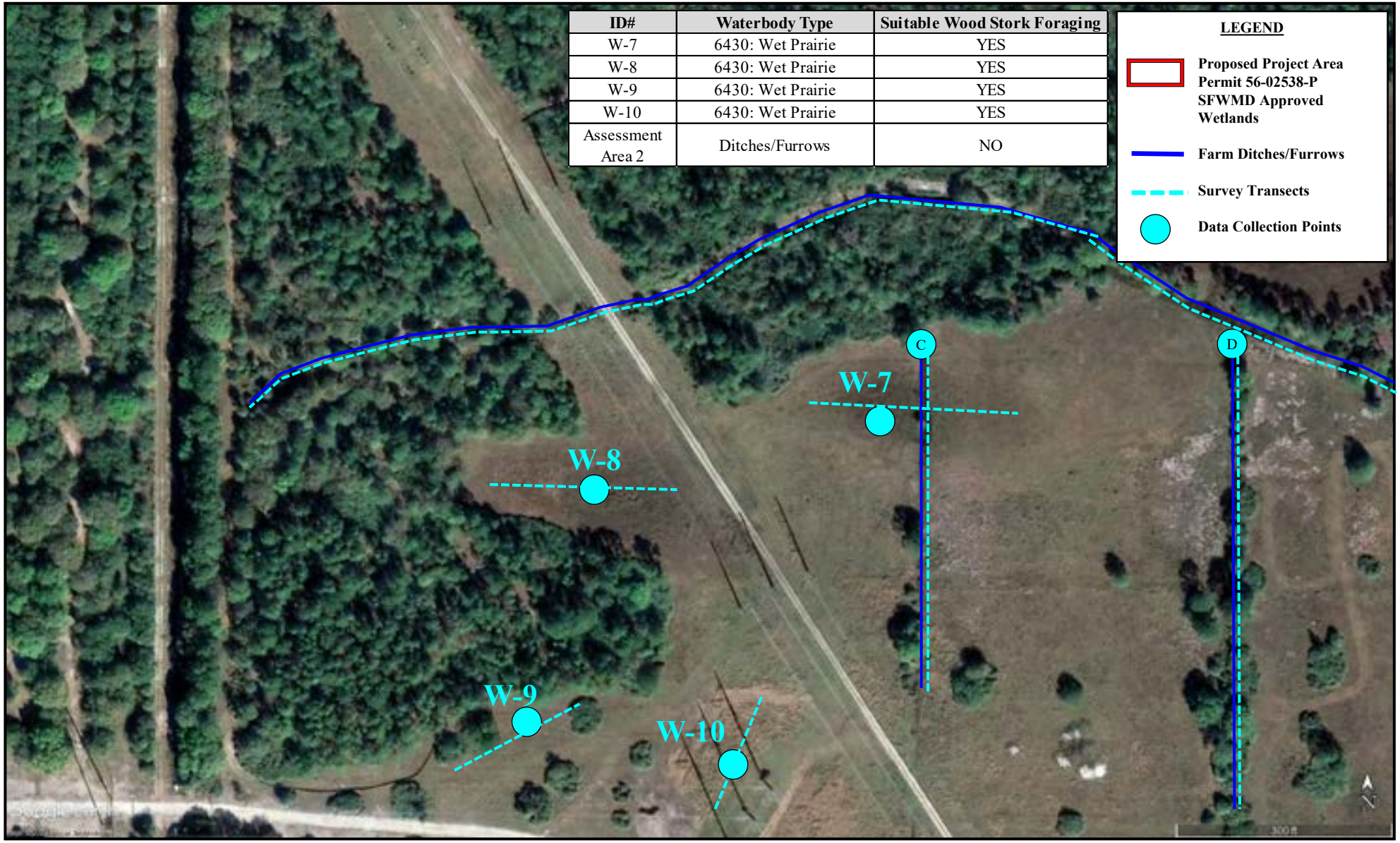

ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Wood Stork *(Mycteria americana)* Foraging Assessment Area 2 = Wetlands 7, 8, 9, & 10

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 9

Image: Google Earth – Date 01/14/2022
Data: Aquatic Research Equipment, Monitoring, & Deployment , LLC

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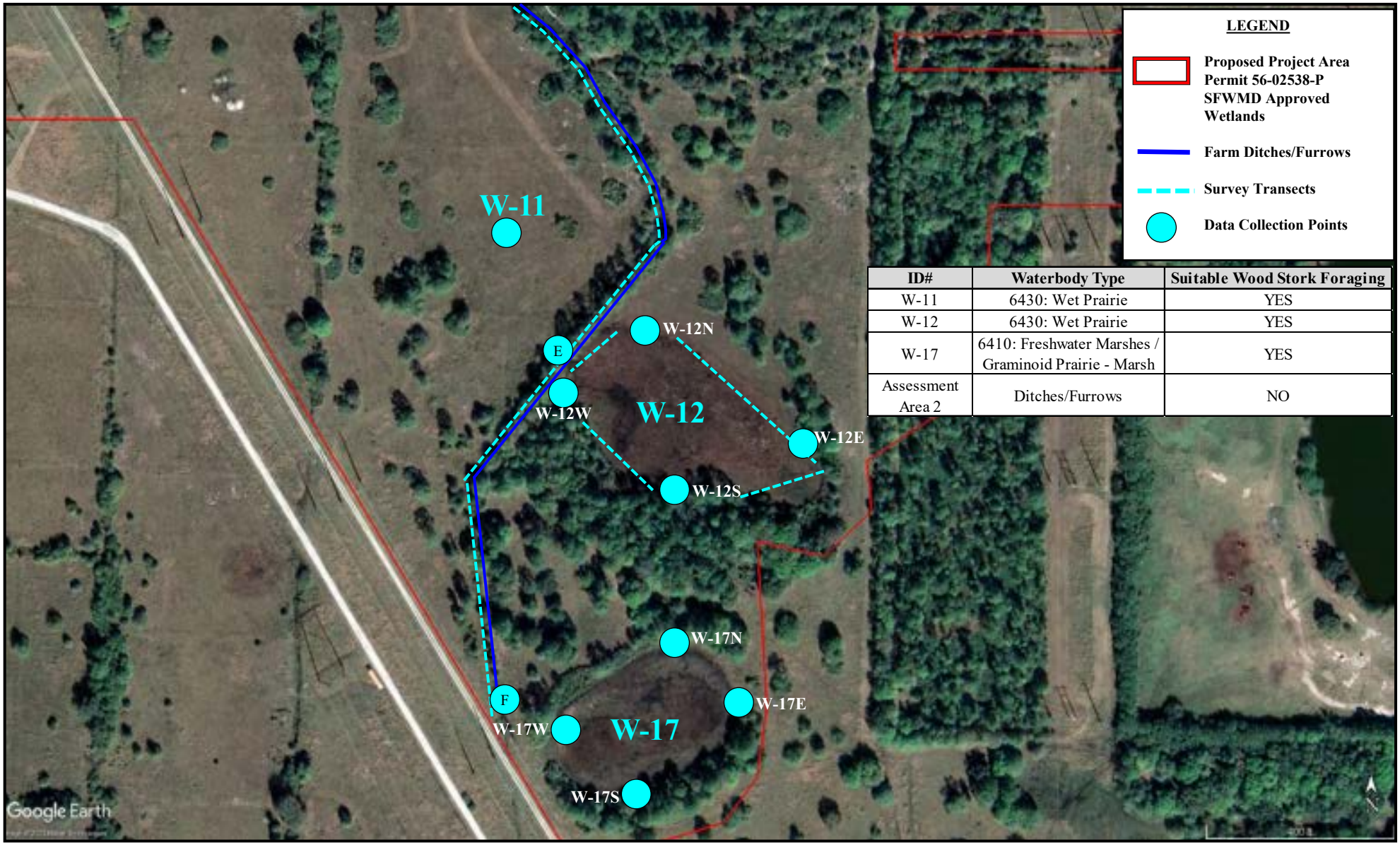

ID#	Waterbody Type	Suitable Wood Stork Foraging
W-11	6430: Wet Prairie	YES
W-12	6430: Wet Prairie	YES
W-17	6410: Freshwater Marshes / Graminoid Prairie - Marsh	YES
Assessment Area 2	Ditches/Furrows	NO

ENVIRONMENTAL CONSULTING DEPARTMENT

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Wood Stork *(Mycteria americana)* Foraging Assessment Area 2 = Wetlands 11, 12, & 17

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 10

Image: Google Earth – Date 01/14/2022
Data: Aquatic Research Equipment, Monitoring, & Deployment , LLC

N

ID#	Waterbody Type	Suitable Wood Stork Foraging
W-2	6410: Freshwater Marshes / Graminoid Prairie - Marsh	YES
Assessment Area 3	Ditches/Furrows	NO

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Aquatic RESEARCH Monitoring, Equipment, & Deployment, LLC.

Wood Stork *(Mycteria americana)* Foraging Assessment Area 3 = Wetland 2

9850 W Midway Road, City of Fort Pierce
St. Lucie County, Florida
PIN's: 2334-340-0000-000-7 & 2334-410-0000-000-1

Figure 11

Image: Google Earth – Date 01/14/2022
Data: Aquatic Research Equipment, Monitoring, & Deployment , LLC

N

Appendix B

ENVIRONMENTAL CONSULTING DEPARTMENT

Aquatic **RESEARCH** Monitoring, Equipment, & Deployment, LLC.

CUSTOM DESIGNED RESEARCH EQUIPMENT AND CREATIVE RESEARCH SOLUTIONS

Attachment 1:

United States Fish and Wildlife Service (USFWS) Foraging Habitat Analysis within the Habitat Management Guidelines for the Wood Stork in the Southeast Region

ENVIRONMENTAL CONSULTING DEPARTMENT
Aquatic **RESEARCH** Monitoring, Equipment, & Deployment, LLC.
CUSTOM DESIGNED RESEARCH EQUIPMENT AND CREATIVE RESEARCH SOLUTIONS

United States Department of the Interior

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

May 18, 2010

Donnie Kinard
Chief, Regulatory Division
Jacksonville District Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Service Federal Activity Code: 41420-2007-FA-1494
Service Consultation Code: 41420-2007-I-0964
Subject: South Florida Programmatic Concurrence
Species: Wood Stork

Dear Mr. Kinard:

This letter addresses minor errors identified in our January 25, 2010, wood stork key and as such, supplants the previous key. The key criteria and wood stork biomass foraging assessment methodology have not been affected by these minor revisions.

The Fish and Wildlife Service's (Service) South Florida Ecological Services Office (SFESO) and the U.S. Army Corps of Engineers Jacksonville District (Corps) have been working together to streamline the consultation process for federally listed species associated with the Corps' wetland permitting program. The Service provided letters to the Corps dated March 23, 2007, and October 18, 2007, in response to a request for a multi-county programmatic concurrence with a criteria-based determination of "may affect, not likely to adversely affect" (NLAA) for the threatened eastern indigo snake (*Drymarchon corais couperi*) and the endangered wood stork (*Mycteria americana*) for projects involving freshwater wetland impacts within specified Florida counties. In our letters, we provided effect determination keys for these two federally listed species, with specific criteria for the Service to concur with a determination of NLAA.

The Service has revisited these keys recently and believes new information provides cause to revise these keys. Specifically, the new information relates to foraging efficiencies and prey base assessments for the wood stork and permitting requirements for the eastern indigo snake. This letter addresses the wood stork key and is submitted in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). The eastern indigo snake key will be provided in a separate letter.

Wood stork

Habitat

The wood stork is primarily associated with freshwater and estuarine habitats that are used for nesting, roosting, and foraging. Wood storks typically construct their nests in medium to tall

trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water (Ogden 1991, 1996; Rodgers et al. 1996). Successful colonies are those that have limited human disturbance and low exposure to land-based predators. Nesting colonies protected from land-based predators are characterized as those surrounded by large expanses of open water or where the nest trees are inundated at the onset of nesting and remain inundated throughout most of the breeding cycle. These colonies have water depths between 0.9 and 1.5 meters (3 and 5 feet) during the breeding season.

Successful nesting generally involves combinations of average or above-average rainfall during the summer rainy season and an absence of unusually rainy or cold weather during the winter-spring breeding season (Kahl 1964; Rodgers et al. 1987). This pattern produces widespread and prolonged flooding of summer marshes, which maximize production of freshwater fishes, followed by steady drying that concentrate fish during the season when storks nest (Kahl 1964). Successful nesting colonies are those that have a large number of foraging sites. To maintain a wide range of foraging sites, a variety of wetland types should be present, with both short and long hydroperiods. The Service (1999) describes a short hydroperiod as a 1 to 5-month wet/dry cycle, and a long hydroperiod as greater than 5 months. During the wet season, wood storks generally feed in the shallow water of the short-hydroperiod wetlands and in coastal habitats during low tide. During the dry season, foraging shifts to longer hydroperiod interior wetlands as they progressively dry-down (though usually retaining some surface water throughout the dry season).

Wood storks occur in a wide variety of wetland habitats. Typical foraging sites for the wood stork include freshwater marshes and stock ponds, shallow, seasonally flooded roadside and agricultural ditches, narrow tidal creeks and shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs. Because of their specialized feeding behavior, wood storks forage most effectively in shallow-water areas with highly concentrated prey. Through tactolocation, or grope feeding, wood storks in south Florida feed almost exclusively on fish between 2 and 25 centimeters [cm] (1 and 10 inches) in length (Ogden et al. 1976). Good foraging conditions are characterized by water that is relatively calm, uncluttered by dense thickets of aquatic vegetation, and having a water depth between 5 and 38 cm (5 and 15 inches) deep, although wood storks may forage in other wetlands. Ideally, preferred foraging wetlands would include a mosaic of emergent and shallow open-water areas. The emergent component provides nursery habitat for small fish, frogs, and other aquatic prey and the shallow, open-water areas provide sites for concentration of the prey during seasonal dry-down of the wetland.

Conservation Measures

The Service routinely concurs with the Corps' "may affect, not likely to adversely affect" determination for individual project effects to the wood stork when project effects are insignificant due to scope or location, or if assurances are given that wetland impacts have been avoided, minimized, and adequately compensated such that there is no net loss in foraging potential. We utilize our *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Service 1990) (Enclosure 1) (HMG) in project evaluation. The HMG is currently under review and once final will replace the enclosed HMG. There is no designated critical habitat for the wood stork.

The SFESO recognizes a 29.9 kilometer [km] (18.6-mile) core foraging area (CFA) around all known wood stork colonies in south Florida. Enclosure 2 (to be updated as necessary) provides locations of colonies and their CFAs in south Florida that have been documented as active within the last 10 years. The Service believes loss of suitable wetlands within these CFAs may reduce foraging opportunities for the wood stork. To minimize adverse effects to the wood stork, we recommend compensation be provided for impacts to foraging habitat. The compensation should consider wetland type, location, function, and value (hydrology, vegetation, prey utilization) to ensure that wetland functions lost due to the project are adequately offset. Wetlands offered as compensation should be of the same hydroperiod and located within the CFAs of the affected wood stork colonies. The Service may accept, under special circumstances, wetland compensation located outside the CFAs of the affected wood stork nesting colonies. On occasion, wetland credits purchased from a "Service Approved" mitigation bank located outside the CFAs could be acceptable to the Service, depending on location of impacted wetlands relative to the permitted service area of the bank, and whether or not the bank has wetlands having the same hydroperiod as the impacted wetland.

In an effort to reduce correspondence in effect determinations and responses, the Service is providing the Wood Stork Effect Determination Key below. If the use of this key results in a Corps determination of "no effect" for a particular project, the Service supports this determination. If the use of this Key results in a determination of NLAA, the Service concurs with this determination[1]. This Key is subject to revisitation as the Corps and Service deem necessary.

The Key is as follows:

A. Project within 0.76 km (0.47 mile)[2] of an active colony site[3] ..... "*may affect*[4]"

Project impacts Suitable Foraging Habitat (SFH)[5] at a location greater than 0.76 km (0.47 mile) from a colony site..... ....."*go to* B"

---

[1] With an outcome of "no effect" or "NLAA" as outlined in this key, and the project has less than 20.2 hectares (50 acres) of wetland impacts, the requirements of section 7 of the Act are fulfilled for the wood stork and no further action is required. For projects with greater than 20.2 hectares (50 acres) of wetland impacts, written concurrence of NLAA from the Service is necessary.

[2] Within the secondary zone (the average distance from the border of a colony to the limits of the secondary zone is 0.76 km (2,500 feet, or 0.47 mi).

[3] An active colony is defined as a colony that is currently being used for nesting by wood storks or has historically over the last 10 years been used for nesting by wood storks.

[4] Consultation may be concluded informally or formally depending on project impacts.

[5] Suitable foraging habitat (SFH) includes wetlands that typically have shallow-open water areas that are relatively calm and have a permanent or seasonal water depth between 5 to 38 cm (2 to 15 inches) deep. Other shallow non-wetland water bodies are also SFH. SFH supports and concentrates, or is capable of supporting and concentrating small fish, frogs, and other aquatic prey. Examples of SFH include, but are not limited to freshwater marshes, small ponds, shallow, seasonally flooded roadside or agricultural ditches, seasonally flooded pastures, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs.

Project does not affect SFH……..…..*"no effect[1]".*

B. Project impact to SFH is less than 0.20 hectare (one-half acre)[6]……..……*NLAA[1]"*

Project impact to SFH is greater in scope than 0.20 hectare (one-half acre)....……*go to* C

C. Project impacts to SFH not within the CFA (29.9 km, 18.6 miles) of a colony site ……..…….…….…..……*go to* D

Project impacts to SFH within the CFA of a colony site …….…..…...…….*go to* E

D. Project impacts to SFH have been avoided and minimized to the extent practicable; compensation (Service approved mitigation bank or as provided in accordance with Mitigation Rule 33 CFR Part 332) for unavoidable impacts is proposed in accordance with the CWA section 404(b)(1) guidelines; and habitat compensation replaces the foraging value matching the hydroperiod[7] of the wetlands affected and provides foraging value similar to, or higher than, that of impacted wetlands. See Enclosure 3 for a detailed discussion of the hydroperiod foraging values, an example, and further guidance[8]…….. *NLAA[1]"*

Project not as above.……... *"may affect[4]"*

E. Project provides SFH compensation in accordance with the CWA section 404(b)(1) guidelines and is not contrary to the HMG; habitat compensation is within the appropriate CFA or within the service area of a Service-approved mitigation bank; and habitat compensation replaces foraging value, consisting of wetland enhancement or restoration matching the hydroperiod[7] of the wetlands affected, and provides foraging value similar

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[6] On an individual basis, SFH impacts to wetlands less than 0.20 hectare (one-half acre) generally will not have a measurable effect on wood storks, although we request that the Corps require mitigation for these losses when appropriate. Wood storks are a wide ranging species, and individually, habitat change from impacts to SFH less than one-half acre are not likely to adversely affect wood storks. However, collectively they may have an effect and therefore regular monitoring and reporting of these effects are important.

[7] Several researchers (Flemming et al. 1994; Ceilley and Bortone 2000) believe that the short hydroperiod wetlands provide a more important pre-nesting foraging food source and a greater early nestling survivor value for wood storks than the foraging base (grams of fish per square meter) than long hydroperiod wetlands provide. Although the short hydroperiod wetlands may provide less fish, these prey bases historically were more extensive and met the foraging needs of the pre-nesting storks and the early-age nestlings. Nest productivity may suffer as a result of the loss of short hydroperiod wetlands. We believe that most wetland fill and excavation impacts permitted in south Florida are in short hydroperiod wetlands. Therefore, we believe that it is especially important that impacts to these short hydroperiod wetlands within CFAs are avoided, minimized, and compensated for by enhancement/restoration of short hydroperiod wetlands.

[8] For this Key, the Service requires an analysis of foraging prey base losses and enhancements from the proposed action as shown in the examples in Enclosure 3 for projects with greater than 2.02 hectares (5 acres) of wetland impacts. For projects with less than 2.02 hectares (5 acres) of wetland impacts, an individual foraging prey base analysis is not necessary although type for type wetland compensation is still a requirement of the Key.

to, or higher than, that of impacted wetlands. See Enclosure 3 for a detailed discussion of the hydroperiod foraging values, an example, and further guidance[8]..... *"NLAA[1]"*

Project does not satisfy these elements ..... *"may affect[4]"*

This Key does not apply to Comprehensive Everglades Restoration Plan projects, as they will require project-specific consultations with the Service.

Monitoring and Reporting Effects

For the Service to monitor cumulative effects, it is important for the Corps to monitor the number of permits and provide information to the Service regarding the number of permits issued where the effect determination was: "may affect, not likely to adversely affect." We request that the Corps send us an annual summary consisting of: project dates, Corps identification numbers, project acreages, project wetland acreages, and project locations in latitude and longitude in decimal degrees.

Thank you for your cooperation and effort in protecting federally listed species. If you have any questions, please contact Allen Webb at extension 246.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

Enclosures

cc: w/enclosures (electronic only)
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EPA, West Palm Beach, Florida (Richard Harvey)
FWC, Vero Beach, Florida (Joe Walsh)
Service, Jacksonville, Florida (Billy Brooks)

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HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION

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HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION

Introduction

A number of Federal and state laws and/or regulations prohibit, cumulatively, such acts as harrassing, disturbing, harming, molesting, pursuing, etc., wood storks, or destroying their nests (see Section VII). Although advisory in nature, these guidelines represent a biological interpretation of what would constitute violations of one or more of such prohibited acts. Their purpose is to mainain and/or improve the environmental conditions that are required for the survival and well-being of wood storks in the southeastern United States, and are designed essentially for application in wood stork/human activity conflicts (principally land development and human intrusion into stork use sites). The emphasis is to avoid or minimize detrimental human-related impacts on wood storks. These guidelines were prepared in consultations with state wildlife agencies and wood stork experts in the four southeastern states where the wood stork is listed as Endangered (Alabama, Florida, Georgia, South Carolina).

General

The wood stork is a gregarious species, which nests in colonies (rookeries), and roosts and feeds in flocks, often in association with other species of long-legged water birds. Storks that nest in the southeastern United States appear to represent a distinct population, separate from the nearest breeding population in Mexico. Storks in the southeastern U.S. population have recently (since 1980) nested in colonies scattered throughout Florida, and at several central-southern Georgia and coastal South Carolina sites. Banded and color-marked storks from central and southern Florida colonies have dispersed during non-breeding seasons as far north as southern Georgia, and the coastal counties in South Carolina and southeastern North Carolina, and as far west as central Alabama and northeastern Mississippi. Storks from a colony in south-central Georgia have wintered between southern Georgia and southern Florida. This U.S. nesting population of wood storks was listed as endangered by the U.S. Fish and Wildlife Service on February 28, 1984 (*Federal Register* 49(4):7332-7335).

Wood storks use freshwater and estuarine wetlands as feeding, nesting, and roosting sites. Although storks are not habitat specialists, their needs are exacting enough, and available habitat is limited enough, so that nesting success and the size of regional populations are closely regulated by year-to-year differences in the quality and quantity of suitable habitat. Storks are especially sensitive to environmental conditions at feeding sites; thus, birds may fly relatively long distances either daily or between regions annually, seeking adequate food resources.

All available evidence suggests that regional declines in wood stork numbers have been largely due to the loss or degradation of essential wetland habitat. An understanding of the qualities of good stork habitat should help to focus protection efforts on those sites

that are seasonally important to regional populations of wood storks. Characteristics of feeding, nesting, and roosting habitat, and management guidelines for each, are presented here by habitat type.

I. Feeding habitat.

A major reason for the wood stork decline has been the loss and degredation of feeding habitat. Storks are especially sensitive to any manipulation of a wetland site that results in either reduced amounts or changes in the timing of food availability.

Storks feed primarily (often almost exclusively) on small fish between 1 and 8 inches in length. Successful foraging sites are those where the water is between 2 and 15 inches deep. Good feeding conditions usually occur where water is relatively calm and uncluttered by dense thickets of aquatic vegetation. Often a dropping water level is necessary to concentrate fish at suitable densities. Conversely, a rise in water, especially when it occurs abruptly, disperses fish and reduces the value of a site as feeding habitat.

The types of wetland sites that provide good feeding conditions for storks include: drying marshes or stock ponds, shallow roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, and depressions in cypress heads or swamp sloughs. In fact, almost any shallow wetland depression where fish tend to become concentrated, either through local reproduction or the consequences of area drying, may be used by storks.

Nesting wood storks do most of their feeding in wetlands between 5 and 40 miles from the colony, and occasionally at distances as great as 75 miles. Within this colony foraging range and for the 110-150 day life of the colony, and depending on the size of the colony and the nature of the surrounding wetlands, anywhere from 50 to 200 different feeding sites may be used during the breeding season.

Non-breeding storks are free to travel much greater distances and remain in a region only for as long as sufficient food is available. Whether used by breeders or non-breeders, any single feeding site may at one time have small or large numbers of storks (1 to 100+), and be used for one to many days, depending on the quality and quantity of available food. Obviously, feeding sites used by relatively large numbers of storks, and/or frequently used areas, potentially are the more important sites necessary for the maintenance of a regional population of birds.

Differences between years in the seasonal distribution and amount of rainfall usually mean that storks will differ between years in where and when they feed. Successful nesting colonies are those that have a large number of feeding site options, including sites that may be suitable only in years of rainfall extremes. To maintain the wide range of feeding site options requires that many different wetlands, with both relatively short and long annual hydroperiods, be preserved. For example, protecting only the larger wetlands, or those with longer annual hydroperiods, will result in the eventual loss of smaller, seemingly less important wetlands. However, these small scale wetlands are crucial as the only available feeding sites during the wetter periods when the larger habitats are too deeply flooded to be used by storks.

II. Nesting habitat.

Wood storks nest in colonies, and will return to the same colony site for many years so long as that site and surrounding feeding habitat continue to supply the needs of the birds. Storks require between 110 and 150 days for the annual nesting cycle, from the period of courtship until the nestlings become independent. Nesting activity may begin as early as December or as late as March in southern Florida colonies, and between late February and April in colonies located between central Florida and South Carolina. Thus, full term colonies may be active until June-July in south Florida, and as late as July-August at more northern sites. Colony sites may also be used for roosting by storks during other times of the year.

Almost all recent nesting colonies in the southeastern U.S. have been located either in woody vegetation over standing water, or on islands surrounded by broad expanses of open water. The most dominant vegetation in swamp colonies has been cypress, although storks also nest in swamp hardwoods and willows. Nests in island colonies may be in more diverse vegetation, including mangroves (coastal), exotic species such as Australian pine (*Casuarina*) and Brazilian Pepper (*Schinus*), or in low thickets of cactus (*Opuntia*). Nests are usually located 15-75 feet above ground, but may be much lower, especially on island sites when vegetation is low.

Since at least the early 1970's, many colonies in the southeastern U.S. have been located in swamps where water has been impounded due to the construction of levees or roadways. Storks have also nested in dead and dying trees in flooded phosphate surface mines, or in low, woody vegetation on mounded, dredge islands. The use of these altered wetlands or completely "artificial" sites suggests that in some regions or years storks are unable to locate natural nesting habitat that is adequately flooded during the normal breeding season. The readiness with which storks will utilize water impoundments for nesting also suggests that colony sites could be intentionally created and maintained through long-term site management plans. Almost all impoundment sites used by storks become suitable for nesting only fortuitously, and therefore, these sites often do not remain available to storks for many years.

In addition to the irreversible impacts of drainage and destruction of nesting habitat, the greatest threats to colony sites are from human disturbance and predation. Nesting storks show some variation in the levels of human activity they will tolerate near a colony. In general, nesting storks are more tolerant of low levels of human activity near a colony when nests are high in trees than when they are low, and when nests contain partially or completely feathered young than during the period between nest construction and the early nestling period (adults still brooding). When adult storks are forced to leave their nests, eggs or downy young may die quickly (<20 minutes) when exposed to direct sun or rain.

Colonies located in flooded environments must remain flooded if they are to be successful. Often water is between 3 and 5 feet deep in successful colonies during the nesting season. Storks rarely form colonies, even in traditional nesting sites, when they are dry, and may abandon nests if sites become dry during the nesting period. Flooding in colonies may be most important as a defense against mammalian predators. Studies of stork colonies in Georgia and

Florida have shown high rates of raccoon predation when sites dried during the nesting period. A reasonably high water level in an active colony is also a deterrent against both human and domestic animal intrusions.

Although nesting wood storks usually do most feeding away from the colony site (>5 miles), considerable stork activity does occur close to the colony during two periods in the nesting cycle. Adult storks collect almost all nesting material in and near the colony, usually within 2500 feet. Newly fledged storks, near the end of the nesting cycle, spend from 1-4 weeks during the fledging process flying locally in the colony area, and perched in nearby trees or marshy spots on the ground. These birds return daily to their nests to be fed. It is essential that these fledging birds have little or no disturbance as far our as one-half mile within at least one or two quadrants from the colony. Both the adults, while collecting nesting material, and the inexperienced fledglings, do much low, flapping flight within this radius of the colony. At these times, storks potentially are much more likely to strike nearby towers or utility lines.

Colony sites are not necessarily used annually. Regional populations of storks shift nesting locations between years, in response to year-to-year differences in food resources. Thus, regional populations require a range of options for nesting sites, in order to successfully respond to food availability. Protection of colony sites should continue, therefore, for sites that are not used in a given year.

III. Roosting habitat.

Although wood storks tend to roost at sites that are similar to those used for nesting, they also use a wider range of site types for roosting than for nesting. Non-breeding storks, for example, may frequently change roosting sites in response to changing feeding locations, and in the process, are inclined to accept a broad range of relatively temporary roosting sites. Included in the list of frequently used roosting locations are cypress "heads" or swamps (not necessarily flooded if trees are tall), mangrove islands, expansive willow thickets or small, isolated willow "islands" in broad marshes, and on the ground either on levees or in open marshes.

Daily activity patterns at a roost vary depending on the status of the storks using the site. Non-breeding adults or immature birds may remain in roosts during major portions of some days. When storks are feeding close to a roost, they may remain on the feeding grounds until almost dark before making the short flight. Nesting storks traveling long distances (>40 miles) to feeding sites may roost at or near the latter, and return to the colony the next morning. Storks leaving roosts, especially when going long distances, tend to wait for mid-morning thermals to develop before departing.

IV. Management zones and guidelines for feeding sites.

To the maximum extent possible, feeding sites should be protected by adherence to the following protection zones and guidelines:

A. There should be no human intrusion into feeding sites when storks are present. Depending upon the amount of screening vegetation, human activity should be no closer than between 300 feet (where solid vegetation screens exist) and 750 feet (no vegetation screen).

B. Feeding sites should not be subjected to water management practices that alter traditional water levels or the seasonally normal drying patterns and rates. Sharp rises in water levels are especially disruptive to feeding storks.

C. The introduction of contaminants, fertilizers, or herbicides into wetlands that contain stork feeding sites should be avoided, especially those compounds that could adversely alter the diversity and numbers of native fishes, or that could substantially change the characteristics of aquatic vegetation. Increase in the density and height of emergent vegetation can degrade or destroy sites as feeding habitat.

D. Construction of tall towers (especially with guy wires) within three miles, or high power lines (especially across long stretches of open country) within one mile of major feeding sites should be avoided.

V. Management zones and guidelines for nesting colonies.

A. Primary zone: This is the most critical area, and must be managed according to recommended guidelines to insure that a colony site survives.

1. Size: The primary zone must extend between 1000 and 1500 feet in all directions from the actual colony boundaries when there are no visual or broad aquatic barriers, and never less than 500 feet even when there are strong visual or aquatic barriers. The exact width of the primary zone in each direction from the colony can vary within this range, depending on the amount of visual screen (tall trees) surrounding the colony, the amount of relatively deep, open water between the colony and the nearest human activity, and the nature of the nearest human activity. In general, storks forming new colonies are more tolerant of existing human activity, than they will be of new human activity that begins after the colony has formed.

2. Recommended Restrictions:

a. Any of the following activities within the primary zone, at any time of the year, are likely to be detrimental to the colony:

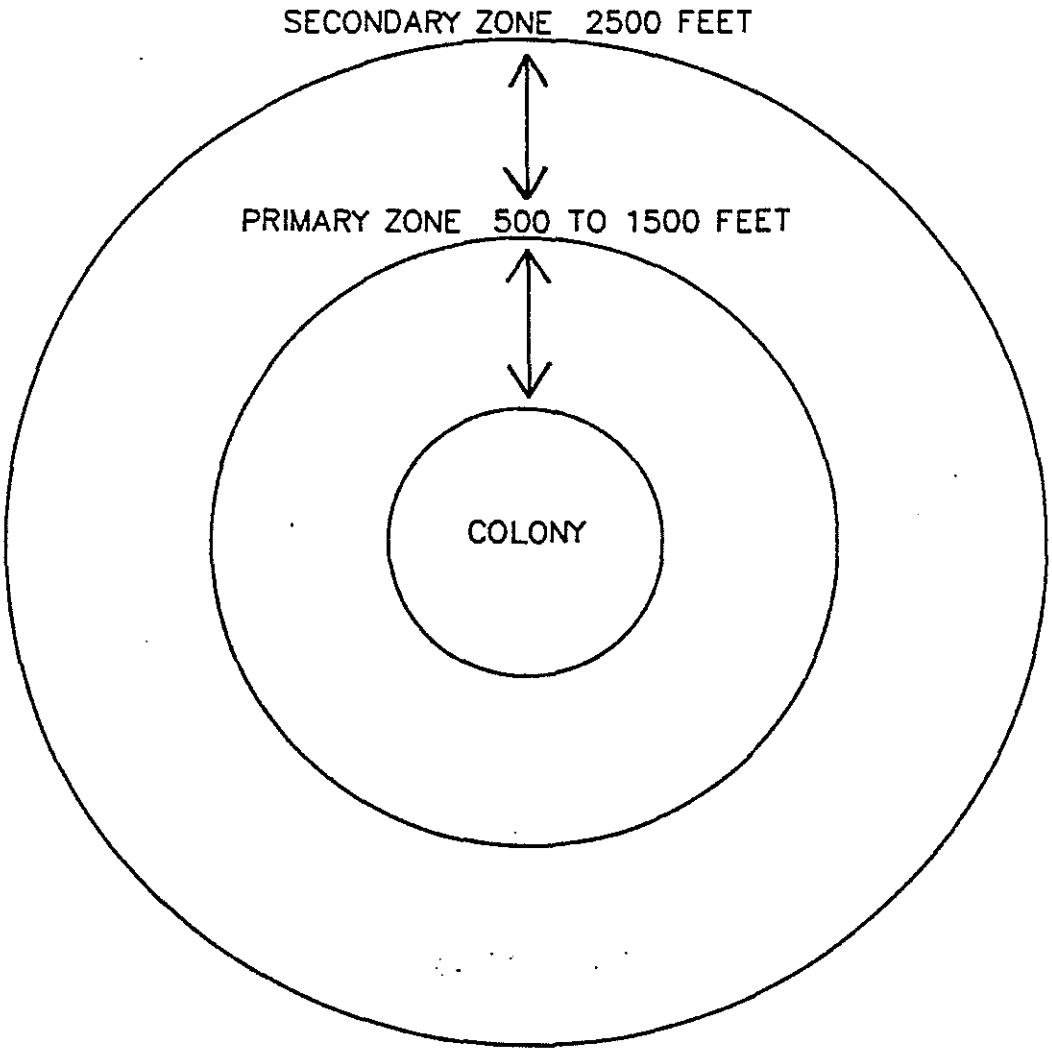
(1) Any lumbering or other removal of vegetation, and

(2) Any activity that reduces the area, depth, or length of flooding in wetlands under and surrounding the colony, except where periodic (less than annual) water control may be required to maintain the health of the aquatic, woody vegetation, and

(3) The construction of any building, roadway, tower, power line, canal, etc.

b. The following activities within the primary zone are likely to be detrimental to a colony if they occur when the colony is active:

(1) Any unauthorized human entry closer than 300 feet of the colony, and


SECONDARY ZONE 2500 FEET
PRIMARY ZONE 500 TO 1500 FEET
COLONY

(2) Any increase or irregular pattern in human activity anywhere in the primary zone, and

(3) Any increase or irregular pattern in activity by animals, including livestock or pets, in the colony, and

(4) Any aircraft operation closer than 500 feet of the colony.

B. Secondary Zone: Restrictions in this zone are needed to minimize disturbances that might impact the primary zone, and to protect essential areas outside of the primary zone. The secondary zone may be used by storks for collecting nesting material, for roosting, loafing, and feeding (especially important to newly fledged young), and may be important as a screen between the colony and areas of relatively intense human activities.

1. Size: The secondary zone should range outward from the primary zone 1000-2000 feet, or to a radius of 2500 feet of the outer edge of the colony.

2. Recommended Restrictions:

a. Activities in the secondary zone which may be detrimental to nesting wood storks include:

(1) Any increase in human activities above the level that existed in the year when the colony first formed, especially when visual screens are lacking, and

(2) Any alteration in the area's hydrology that might cause changes in the primary zone, and

(3) Any substantial (>20 percent) decrease in the area of wetlands and woods of potential value to storks for roosting and feeding.

b. In addition, the probability that low flying storks, or inexperienced, newly-fledged young will strike tall obstructions, requires that high-tension power lines be no closer than one mile (especially across open country or in wetlands) and tall trans-mission towers no closer than 3 miles from active colonies. Other activities, including busy highways and commercial and residential buildings may be present in limited portions of the secondary zone at the time that a new colony first forms. Although storks may tolerate existing levels of human activities, it is important that these human activities not expand substantially.

VI. Roosting site guidelines.

The general characteristics and temporary use-patterns of many stork roosting sites limit the number of specific management recommendations that are possible:

A. Avoid human activities within 500-1000 feet of roost sites during seasons of the year and times of the day when storks may be present. Nocturnal activities in active roosts may be especially disruptive.

B. Protect the vegetative and hydrological characteristics of the more important roosting sites--those used annually and/or used by flocks of 25 or more storks. Potentially, roosting sites may, some day, become nesting sites.

VII. Legal Considerations.

A. Federal Statutes

The U.S. breeding population of the wood stork is protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act). The population was listed as endangered on February 28, 1984 (49 Federal *Register* 7332); wood storks breeding in Alabama, Florida, Georgia, and South Carolina are protected by the Act.

Section 9 of the Endangered Species Act of 1973, as amended, states that it is unlawful for any person subject to the jurisdiction of the United States to take (defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.") any listed species anywhere within the United States.

The wood stork is also federally protected by its listing (50 CFR 10.13) under the Migratory Bird Treaty Act (167 U.S.C. 703-711), which prohibits the taking, killing or possession of migratory birds except as permitted.

B. State Statutes

1. State of Alabama

Section 9-11-232 of Alabama's Fish, Game, and Wildlife regulations curtails the possession, sale, and purchase of wild birds. "Any person, firm, association, or corporation who takes, catches, kills or has in possession at any time, living or dead, any protected wild bird not a game bird or who sells or offers for sale, buys, purchases or offers to buy or purchase any such bird or exchange same for anything of value or who shall sell or expose for sale or buy any part of the plumage, skin, or body of any bird protected by the laws of this state or who shall take or willfully destroy the nests of any wild bird or who shall have such nests or eggs of such birds in his possession, except as otherwise provided by law, shall be guilty of a misdemeanor...

Section 1 of the Alabama Nongame Species Regulation (Regulation 87-GF-7) includes the wood stork in the list of nongame species covered by paragraph (4). " It shall be unlawful to take, capture, kill, possess, sell, trade for anything of monetary value, or offer to sell or trade for anything of monetary value, the following nongame wildlife species (or any parts or reproductive products of such species) without a scientific collection permit and written permission from the Commissioner, Department of Conservation and Natural Resources,..."

2. State of Florida

Rule 39-4.001 of the Florida Wildlife Code prohibits "taking, attempting to take, pursuing, hunting, molesting, capturing, or killing (collectively defined as "taking"), transporting, storing, serving, buying, selling,

possessing, or wantonly or willingly wasting any wildlife or freshwater fish or their nests, eggs, young, homes, or dens except as specifically provided for in other rules of Chapter 39, Florida Administrative Code.

Rule 39-27.011 of the Florida Wildlife Code prohibits "killing, attempting to kill, or wounding any endangered species." The "Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida" dated 1 July 1988, includes the wood stork, listed as "endangered" by the Florida Game and Fresh Water Fish Commission.

3. State of Georgia

Section 27-1-28 of the Conservation and Natural Resources Code states that "Except as otherwise provided by law, rule, or regulation, it shall be unlawful to hunt, trap, fish, take, possess, or transport any nongame species of wildlife..."

Section 27-1-30 states that, "Except as otherwise provided by law or regulation, it shall be unlawful to disturb, mutilate, or destroy the dens, holes, or homes of any wildlife; "

Section 27-3-22 states, in part, "It shall be unlawful for any person to hunt, trap, take, possess, sell, purchase, ship, or transport any hawk, eagle, owl, or any other bird or any part, nest, or egg thereof...".

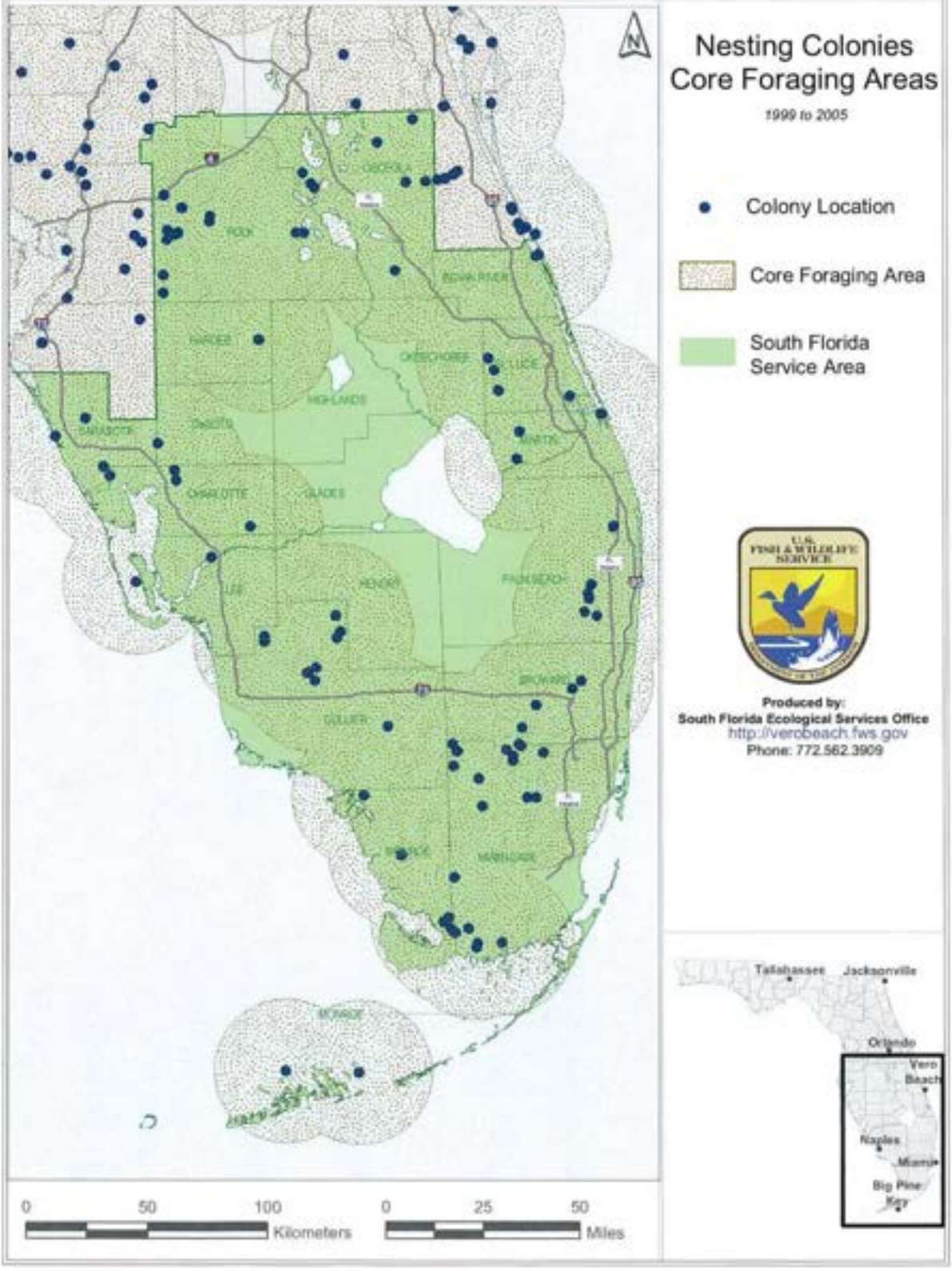
The wood stork is listed as endangered pursuant to the Endangered Wildlife Act of 1973 (Section 27-3-130 of the Code). Section 391-4-13-.06 of the Rules and Regulations of the Georgia Department of Natural Resources prohibits harassment, capture, sale, killing, or other actions which directly cause the death of animal species protected under the Endangered Wildlife Act. The destruction of habitat of protected species on public lands is also prohibited.

4. State of South Carolina

Section 50-15-40 of the South Carolina Nongame and Endangered Species Conservation Act states, "Except as otherwise provided in this chapter, it shall be unlawful for any person to take, possess, transport, export, process, sell, or offer of sale or ship, and for any common or contract carrier knowingly to transport or receive for shipment any species or subspecies of wildlife appearing on any of the following lists: (1) the list of wildlife indigenous to the State, determined to be endangered within the State...(2) the United States' List of Endangered Native Fish and Wildlife... (3) the United States' List of Endangered Foreign Fish and Wildlife ..."

5/21/2010

Wood Stock


Nesting Colonies
Core Foraging Areas
1999 to 2005
Colony Location
Core Foraging Area
South Florida
Service Area
U.S. FISH & WILDLIFE SERVICE
Produced by:
South Florida Ecological Services Office
http://verobeach.fws.gov
Phone: 772.562.3909
Tallahassee
Jacksonville
Orlando
Vero Beach
Naples
Miami
Big Pine Key
0
50
100
Kilometers
0
25
50
Miles

5/21/2010

Enclosure 3

Wood Stork Foraging Analysis: Excerpts of concepts and procedure as presented by the Service in this appendix may be viewed in detail in any one of our recent Biological Opinions for project related impacts to the wood stork. These documents can be found at the internet website address http://www.fws.gov/filedownloads/ftp%5verobeach.

Foraging Habitat

Researchers have shown that wood storks forage most efficiently and effectively in habitats where prey densities are high and the water shallow and canopy open enough to hunt successfully (Ogden et al. 1978, Browder 1984, Coulter 1987). Prey availability to wood storks is dependent on a composite variable consisting of density (number or biomass/m^2) and the vulnerability of the prey items to capture (Gawlik 2002). For wood storks, prey vulnerability appears to be largely controlled by physical access to the foraging site, water depth, the density of submerged vegetation, and the species-specific characteristics of the prey. For example, fish populations may be very dense, but not available (vulnerable) because the water depth is too deep (greater than 30 cm) for storks or the tree canopy at the site is too dense for storks to land. Calm water, about 5-40 cm (2-16 in) in depth, and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993).

Coulter and Bryan's (1993) study suggested that wood storks preferred ponds and marshes, and visited areas with little or no canopy more frequently. Even in foraging sites in swamps, the canopy tended to be sparse. They suggested that open canopies may have contributed to detection of the sites and more importantly may have allowed the storks to negotiate landing more easily than at closed-canopy sites. In their study, the median amount of canopy cover where wood stork foraging was observed was 32 percent. Other researchers (P.C. Frederick, University of Florida, personal communication 2006; J.A. Rodgers, FWC, personal communication 2006) also confirm that wood storks will forage in woodlands, though the woodlands have to be fairly open and vegetation not very dense. Furthermore, the canopies must be open enough for wood storks to take flight quickly to avoid predators.

Melaleuca-infested Wetlands: As discussed previously, wetland suitability for wood stork foraging is partially dependent on vegetation density. Melaleuca is a dense-stand growth plant species, effectively producing a closed canopy and dense understory growth pattern that generally limits a site's accessibility to foraging by wading birds. However, O'Hare and Dalrymple (1997) suggest moderate infestations of melaleuca may have little effect on some species' productivity (*i.e.*, amphibians and reptiles) as long as critical abiotic factors such as hydrology remain. They also note as the levels of infestation increase, usage by wetland dependent species decreases. Their studies also showed that the number of fish species present in a wetland system remain stable at certain levels of melaleuca. However, the availability of the prey base for wood storks and other foraging wading birds is reduced by the restriction of access caused from dense and thick exotic vegetation. Wood storks and other wading birds can forage in these systems in open area pockets (*e.g.*, wind blow-downs), provided multiple conditions are optimal (*e.g.*, water depth, prey density). In O'Hare and Dalrmyple's study (1997), they identify five cover types (Table 1) and

provide information on the number of wetland dependent bird species and the number of individuals observed within each of these vegetation classes (Table 2).

Table 1: Vegetation classes

DMM	75-100 percent mature dense melaleuca coverage
DMS or (SDM)	75-100 percent sapling dense melaleuca coverage
P75	50-75 percent melaleuca coverage
P50	0-50 percent melaleuca coverage
MAR (Marsh)	0-10 percent melaleuca coverage

The number of wetland-dependent species and individuals observed per cover type is shown below in columns 1, 2, and 3 (Table 2). To develop an estimate of the importance a particular wetland type may have (based on density and aerial coverage by exotic species) to wetland dependent species, we developed a foraging suitability value using observational data from O'Hare and Dalrymple (1997). The Foraging Suitability Value as shown in column 5 (Table 2) is calculated by multiplying the number of species by the number of individuals and dividing this value by the maximum number of species and individuals combined (12*132=1584). The results are shown below for each of the cover types in O'Hare and Dalrymple (1997) study (Table 1). As an example, for the P50 cover type, the foraging suitability is calculated by multiplying 11 species times 92 individuals for a total of 1,012. Divide this value by 1,584, which is the maximum number of species times the maximum number of individuals (12*132 = 1,584). The resultant is 0.6389 or 64 percent 11*92=1012/1584*100=63.89).

Table 2: Habitat Foraging Suitability

Cover Type	# of Species (S)	# of Individuals (I)	S*I	Foraging Suitability
DMM	1	2	2	0.001
DMS	4	10	40	0.025
P75	10	59	590	0.372
P50	11	92	1,012	0.639
MAR	12	132	1,584	1.000

This approach was developed to provide us with a method of assessing wetland acreages and their relationship to prey densities and prey availability. We consider wetland dependent bird use to be a general index of food availability. Based on this assessment we developed an exotic foraging suitability index (Table 3):

Table 3. Foraging Suitability Percentages

Exotic Percentage	Foraging Suitability (percent)
Between 0 and 25 percent exotics	100
Between 25 and 50 percent exotics	64
Between 50 and 75 percent exotics	37
Between 75 and 90 percent exotics	3
Between 90 and 100 percent exotics	0

In our assessment however, we consider DMM to represent all exotic species densities between 90 and 100 percent and DMS to represent all exotic species densities between 75 and 90 percent. In our evaluation of a habitat's suitability, the field distinction between an exotic coverage of

90 percent and 100 percent in many situations is not definable, therefore unless otherwise noted in the field reports and in our analysis; we consider a suitability value of 3 percent to represent both densities.

Hydroperiod: The hydroperiod of a wetland can affect the prey densities in a wetland. For instance, research on Everglades fish populations using a variety of quantitative sampling techniques (pull traps, throw traps, block nets) have shown that the density of small forage fish increases with hydroperiod. Marshes inundated for less than120 days of the year average ± 4 fish/m^2; whereas, those flooded for more than 340 days of the year average ± 25 fish/m^2 (Loftus and Eklund 1994, Trexler et al. 2002).

The Service (1999) described a short hydroperiod wetland as wetlands with between 0 and 180-day inundation, and long hydroperiod wetlands as those with greater than 180-day inundation. However, Trexler et al. (2002) defined short hydroperiod wetlands as systems with less than 300 days per year inundation. In our discussion of hydroperiods, we are considering short hydroperiod wetlands to be those that have an inundation of 180 days or fewer.

The most current information on hydroperiods in south Florida was developed by the SFWMD for evaluation of various restoration projects throughout the Everglades Protection Area. In their modeling efforts, they identified the following seven hydroperiods:

Table 4. SFWMD Hydroperiod Classes – Everglades Protection Area

Hydroperiod Class	Days Inundated
Class 1	0-60
Class 2	60-120
Class 3	120-180
Class 4	180-240
Class 5	240-300
Class 6	300-330
Class 7	330-365

Fish Density per Hydroperiod: In the Service's assessment of project related impacts to wood storks, the importance of fish data specific to individual hydroperiods is the principle basis of our assessment. In order to determine the fish density per individual hydroperiod, the Service relied on the number of fish per hydroperiod developed from throw-trap data in Trexler et al.'s (2002) study and did not use the electrofishing data also presented in Trexler et al.'s study that defined fish densities in catch per unit effort, which is not hydroperiod specific. Although the throw-trap sampling generally only samples fish 8 cm or less, the Service believes the data can be used as a surrogate representation of all fish, including those larger than 8 cm, which are typically sampled by either electrofishing or block net sampling.

We base this evaluation on the following assessment. Trexler et al.'s (2002) study included electrofishing data targeting fish greater than 8 cm, the data is recorded in catch per unit effort and in general is not hydroperiod specific. However, Trexler et al. (2002) notes in their assessment of the electrofishing data that in general there is a correlation with the number of fish per unit effort per changes in water depth. In literature reviews of electrofishing data by Chick et

al. (1999 and 2004), they note that electrofishing data provides a useful index of the abundance of larger fish in shallow, vegetated habitat, but length, frequency, and species compositional data should be interpreted with caution. Chick et al. (2004) also noted that electrofishing data for large fish (> 8cm) provided a positive correlation of the number of fish per unit effort (abundance) per changes in hydropeiod. The data in general show that as the hydroperiod decreases, the abundance of larger fishes also decreases.

Studies by Turner et al. (1999), Turner and Trexler (1997), and Carlson and Duever (1979) also noted this abundance trend for fish species sampled. We also noted in our assessment of prey consumption by wood storks in the Ogden et al. (1976) study (Figure 4) (discussed below), that the wood stork's general preference is for fish measuring 1.5 cm to 9 cm, although we also acknowledged that wood storks consume fish larger than the limits discussed in the Ogden et al. (1976) study. A similar assessment is reference by Trexler and Goss (2009) noting a diversity of size ranges of prey available for wading birds to consume, with fish ranging from 6 to 8 cm being the preferred prey for larger species of wading birds, particularly wood storks (Kushlan et al. 1975).

Therefore, since data were not available to quantify densities (biomass) of fish larger than 8 cm to a specific hydroperiod, and Ogden et al.'s (1976) study notes that the wood stork's general preference is for fish measuring 1.5 cm to 9 cm, and that empirical data on fish densities per unit effort correlated positively with changes in water depth, we believe that the Trexler et al. (2002) throw-trap data represents a surrogate assessment tool to predict the changes in total fish density and the corresponding biomass per hydroperiod for our wood stork assessment.

In consideration of this assessment, the Service used the data presented in Trexler et al.'s (2002) study on the number of fish per square-meter per hydroperiod for fish 8 cm or less to be applicable for estimating the total biomass per square-meter per hydroperiod for all fish. In determining the biomass of fish per square-meter per hydroperiod, the Service relied on the summary data provided by Turner et al. (1999), which provides an estimated fish biomass of 6.5 g/m^2 for a Class 7 hydroperiod for all fish and used the number of fish per square-meter per hydroperiod from Trexler et al.'s data to extrapolate biomass values per individual hydroperiods.

Trexler et al.'s (2002) studies in the Everglades provided densities, calculated as the square-root of the number of fish per square meter, for only six hydroperiods; although these cover the same range of hydroperiods developed by the SFWMD. Based on the throw-trap data and Trexler et al.'s (2002) hydroperiods, the square-root fish densities are:

Table 5. Fish Densities per Hydroperiod from Trexler et al. (2002)

Hydroperiod Class	Days Inundated	Fish Density
Class 1	0-120	2.0
Class 2	120-180	3.0
Class 3	180-240	4.0
Class 4	240-300	4.5
Class 5	300-330	4.8
Class 6	330-365	5.0

Trexler et al.'s (2002) fish densities are provided as the square root of the number of fish per square meter. For our assessment, we squared these numbers to provide fish per square meter, a simpler calculation when other prey density factors are included in our evaluation of adverse effects to listed species from the proposed action. We also extrapolated the densities over seven hydroperiods, which is the same number of hydroperiods characterized by the SFWMD. For example, Trexler et al.'s (2002) square-root density of a Class 2 wetland with three fish would equate to a SFWMD Model Class 3 wetland with nine fish. Based on the above discussion, the following mean annual fish densities were extrapolated to the seven SFWMD Model hydroperiods:

Table 6. Extrapolated Fish Densities for SFWMD Hydroperiods

Hydroperiod Class	Days Inundated	Extrapolated Fish Density
Class 1	0-60	2 fish/m^2
Class 2	60-120	4 fish/m^2
Class 3	120-180	9 fish/m^2
Class 4	180-240	16 fish/m^2
Class 5	240-300	20 fish/m^2
Class 6	300-330	23 fish/m^2
Class 7	330-365	25 fish/m^2

Fish Biomass per Hydroperiod: A more important parameter than fish per square-meter in defining fish densities is the biomass these fish provide. In the ENP and WCA-3, based on studies by Turner et al. (1999), Turner and Trexler (1997), and Carlson and Duever (1979), the standing stock (biomass) of large and small fishes combined in unenriched Class 5 and 6 hydroperiod wetlands averaged between 5.5 to 6.5 grams-wet-mass/m^2. In these studies, the data was provided in g/m^2 dry-weight and was converted to g/m^2 wet-weight following the procedures referenced in Kushlan et al. (1986) and also referenced in Turner et al. (1999). The fish density data provided in Turner et al. (1999) included both data from samples representing fish 8 cm or smaller and fish larger than 8 cm and included summaries of Turner and Trexler (1997) data, Carlson and Duever (1979) data, and Loftus and Eklund (1994) data. These data sets also reflected a 0.6 g/m^2 dry-weight correction estimate for fish greater than 8 cm based on Turner et al.'s (1999) block-net rotenone samples.

Relating this information to the hydroperiod classes developed by the SFWMD, we estimated the mean annual biomass densities per hydroperiod. For our assessment, we considered Class 7 hydroperiod wetlands based on Turner et al. (1999) and Trexler et al. (2002) studies to have a mean annual biomass of 6.5 grams-wet-mass/m^2 and to be composed of 25 fish/m^2. The remaining biomass weights per hydroperiod were determined as a direct proportion of the number of fish per total weight of fish for a Class 7 hydroperiod (6.5 grams divided by 25 fish equals 0.26 grams per fish).

For example, given that a Class 3 hydroperiod has a mean annual fish density of 9 fish/m^2, with an average weight of 0.26 grams per fish, the biomass of a Class 3 hydroperiod would be 2.3 grams/m^2 (9*0.26 = 2.3). Based on the above discussion, the biomass per hydroperiod class is:

Table 7. Extrapolated Mean Annual Fish Biomass for SFWMD Hydroperiods

Hydroperiod Class	Days Inundated	Extrapolated Fish Biomass
Class 1	0-60	0.5 gram/m^2
Class 2	60-120	1.0 gram/m^2
Class 3	120-180	2.3 grams/m^2
Class 4	180-240	4.2 grams/m^2
Class 5	240-300	5.2 grams/m^2
Class 6	300-330	6.0 grams/m^2
Class 7	330-365	6.5 grams/m^2

Wood stork suitable prey size: Wood storks are highly selective in their feeding habits and in studies on fish consumed by wood storks, five species of fish comprised over 85 percent of the number and 84 percent of the biomass of over 3,000 prey items collected from adult and nestling wood storks (Ogden et al. 1976). Table 8 lists the fish species consumed by wood storks in Ogden et al. (1976).

Table 8. Primary Fish Species consumed by Wood Storks from Ogden et al. (1976)

Common name	Scientific name	Percent Individuals	Percent Biomass
Sunfishes	*Centrarchidae*	14	44
Yellow bullhead	*Italurus natalis*	2	12
Marsh killifish	*Fundulus confluentus*	18	11
Flagfish	*Jordenella floridae*	32	7
Sailfin molly	*Poecilia latipinna*	20	11

These species were also observed to be consumed in much greater proportions than they occur at feeding sites, and abundant smaller species [*e.g.*, mosquitofish (*Gambusia affinis*), least killifish (*Heterandria formosa*), bluefin killifish (*Lucania goodei*)] are under-represented, which the researchers believed was probably because their small size did not elicit a bill-snapping reflex in these tactile feeders (Coulter et al. 1999). Their studies also showed that, in addition to selecting larger species of fish, wood storks consumed individuals that are significantly larger (>3.5 cm) than the mean size available (2.5 cm), and many were greater than 1-year old (Ogden et al. 1976, Coulter et al. 1999). However, Ogden et al. (1976) also found that wood storks most likely consumed fish that were between 1.5 and 9.0 cm in length (Figure 4 in Ogden et al. 1976).

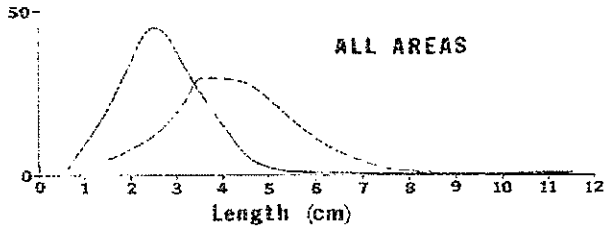


FIGURE 4. Length frequency distribution of fish available to and consumed by Wood Storks in different habitats.

In Ogden et al.'s (1976) Figure 4, the dotted line is the distribution of fish consumed and the solid line is the available fish. Straight interpretation of the area under the dotted line curve

represents the size classes of fish most likely consumed by wood storks and is the basis of our determination of the amount of biomass that is within the size range of fish most likely consumed by wood storks, which in this example is a range size of 1.5 to 9.0 cm in length.

Wood stork suitable prey base (biomass per hydroperiod): To estimate that fraction of the available fish biomass that might be consumed by wood storks, the following analysis was conducted. Trexler et al.'s (2002) 2-year throw trap data of absolute and relative fish abundance per hydroperiod distributed across 20 study sites in the ENP and the WCAs was considered to be representative of the Everglades fish assemblage available to wood storks (n = 37,718 specimens of 33 species). Although Trexler et al.'s (2002) data was based on throw-trap data and representative of fish 8 cm or smaller, the Service believes the data set can be used to predict the biomass/m^2 for total fish (those both smaller and larger than 8 cm). This approach is also supported, based on our assessment of prey consumption by wood storks in Ogden et al.'s (1976) study (Figure 4), that the wood storks general preference is for fish measuring 1.5 cm to 9 cm and is generally inclusive of Trexler et al.'s (2002) throw-trap data of fish 8 cm or smaller.

To estimate the fraction of the fish biomass that might be consumed by wood storks, the Service, using Trexler et al.'s (2002) throw-trap data set, determined the mean biomass of each fish species that fell within the wood stork prey size limits of 1.5 to 9.0 cm. The mean biomass of each fish species was estimated from the length and wet mass relationships for Everglades' icthyofauna developed by Kushlan et al. (1986). The proportion of each species that was outside of this prey length and biomass range was estimated using the species mean and variance provided in Table 1 in Kushlan et al. (1986). These biomass estimates assumed the length and mass distributions of each species was normally distributed and the fish biomass could be estimated by eliminating that portion of each species outside of this size range. These biomass estimates of available fish prey were then standardized to a sum of 6.5 g/m^2 for Class 7 hydroperiod wetlands (Service 2009).

For example, Kushlan et al. (1986) lists the warmouth (*Lepomis gulosus*) with a mean average biomass of 36.76 g. In fish samples collected by Trexler et al. (2002), this species accounted for 0.048 percent (18/37,715=0.000477) of the Everglades freshwater ichthyofauna. Based on an average biomass of 36.76 g (Kushlan et al. 1986), the 0.048 percent representation from Trexler et al. (2002) is equivalent to an average biomass of 1.75 g (36.76*0.048) or 6.57 percent (1.75/26.715) of the estimated average biomass (26.715 g) of Trexler et al.'s (2002) samples (Service 2009).

Standardizing these data to a sample size of 6.5 g/m^2, the warmouth biomass for long hydroperiod wetlands would be about 0.427 g (Service 2009). However, the size frequency distribution (assumed normal) for warmouth (Kushlan et al. 1986) indicate 48 percent are too large for wood storks and 0.6 percent are too small (outside the 1.5 cm to 9 cm size range most likely consumed), so the warmouth biomass within the wood stork's most likely consumed size range is only 0.208 g (0.427*(0.48+0.006)=0.2075) in a 6.5 g/m^2 sample. Using this approach summed over all species in long hydroperiod wetlands, only 3.685 g/m^2 of the 6.5 g/m^2 sample consists of fish within the size range likely consumed by wood storks or about 57 percent (3.685/6.5*100=56.7) of the total biomass available.

An alternative approach to estimate the available biomass is based on Ogden et al. (1976). In their study (Table 8), the sunfishes and four other species that accounted for 84 percent of the biomass eaten by wood storks totaled 2.522 g of the 6.5 g/m^2 sample (Service 2009). Adding the remaining 16 percent from other species in the sample, the total biomass would suggest that 2.97 g of a 6.5 g/m^2 sample are most likely to be consumed by wood storks or about 45.7 percent (2.97/6.5=0.4569)

The mean of these two estimates is 3.33g/m^2 for long hydroperiod wetlands (3.685 + 2.97 = 6.655/ 2 = 3.33). This proportion of available fish prey of a suitable size (3.33 g/m^2 / 6.5 g/m^2 = 0.51 or 51 percent) was then multiplied by the total fish biomass in each hydroperiod class to provide an estimate of the total biomass of a hydroperiod that is the appropriate size and species composition most likely consumed by wood storks.

As an example, a Class 3 SFWMD model hydroperiod wetland with a biomass of 2.3 grams/m^2, adjusted by 51 percent for appropriate size and species composition, provides an available biomass of 1.196 grams/m^2. Following this approach, the biomass per hydroperiod potentially available to predation by wood storks based on size and species composition is:

Table 9. Wood Stork Suitable Prey Base (fish biomass per hydroperiod)

Hydroperiod Class	Days Inundated	Fish Biomass
Class 1	0-60	0.26 gram/m^2
Class 2	60-120	0.52 gram/m^2
Class 3	120-180	1.196 grams/m^2
Class 4	180-240	2.184 grams/m^2
Class 5	240-300	2.704 grams/m^2
Class 6	300-330	3.12 grams/m^2
Class 7	330-365	3.38 grams/m^2

Wood Stork-Wading Bird Prey Consumption Competition: In 2006, (Service 2006), the Service developed an assessment approach that provided a foraging efficiency estimate that 55 percent of the available biomass was actually consumed by wood storks. Since the implementation of this assessment approach, the Service has received comments from various sources concerning the Service's understanding of Fleming et al.'s (1994) assessment of prey base consumed by wood storks versus prey base assumed available to wood stork and the factors included in the 90 percent prey reduction value.

In our original assessment, we noted that, "*Fleming et al. (1994) provided an estimate of 10 percent of the total biomass in their studies of wood stork foraging as the amount that is actually consumed by the storks. However, the Fleming et al. (1994) estimate also includes a second factor, the suitability of the foraging site for wood storks, a factor that we have calculated separately. In their assessment, these two factors accounted for a 90 percent reduction in the biomass actually consumed by the storks. We consider these two factors as equally important and are treated as equal components in the 90 percent reduction; therefore, we consider each factor to represent 45 percent of the reduction. In consideration of this approach, Fleming et al.'s (1994) estimate that 10 percent of the biomass would actually be consumed by the storks would be added to the 45 percent value for an estimate that 55 percent (10 percent plus the remaining 45 percent) of the available biomass would actually be consumed by the storks and is the factor we believe represents the amount of the prey base that is actually consumed by the stork.*"

In a follow-up review of Fleming et al.'s (1994) report, we noted that the 10 percent reference is to prey available to wood storks, not prey consumed by wood storks. We also noted the 90 percent reduction also includes an assessment of prey size, an assessment of prey available by water level (hydroperiod), an assessment of suitability of habitat for foraging (openness), and an assessment for competition with other species, not just the two factors considered originally by the Service (suitability and competition). Therefore, in re-evaluating of our approach, we identified four factors in the 90 percent biomass reduction and not two as we previously considered. We believe these four factors are represented as equal proportions of the 90 percent reduction, which corresponds to an equal split of 22.5 percent for each factor. Since we have accounted previously for three of these factors in our approach (prey size, habitat suitability, and hydroperiod) and they are treated separately in our assessment, we consider a more appropriate foraging efficiency to represent the original 10 percent and the remaining 22.5 percent from the 90 percent reduction discussed above. Following this revised assessment, our competition factor would be 32.5 percent, not the initial estimate of 55 percent.

Other comments reference the methodology's lack of sensitivity to limiting factors, i.e., is there sufficient habitat available across all hydroperiods during critical life stages of wood stork nesting and does this approach over emphasize the foraging biomass of long hydroperiod wetlands with a corresponding under valuation of short hydroperid wetlands. The Service is aware of these questions and is examining alternative ways to assess these concerns. However, until futher research is generated to refine our approach, we continue to support the assessment tool as outlined.

Following this approach, Table 10 has been adjusted to reflect the competition factor and represents the amount of biomass consumed by wood storks and is the basis of our effects assessments (Class 1 hydroperiod with a biomass 0.26 g, multiplied by 0.325, results in a value of 0.08 g [0.25*.325=0.08]) (Table 10).

Table 10 Actual Biomass Consumed by Wood Storks

Hydroperiod Class	Days Inundated	Fish Biomass
Class 1	0-60	0.08 gram/m^2
Class 2	60-120	0.17 gram/m^2
Class 3	120-180	0.39 grams/m^2
Class 4	180-240	0.71 grams/m^2
Class 5	240-300	0.88 grams/m^2
Class 6	300-330	1.01 grams/m^2
Class 7	330-365	1.10 grams/m^2

Sample Project of Biomass Calculations and Corresponding Concurrence Determination

Example 1:

An applicant is proposing to construct a residential development with unavoidable impacts to 5 acres of wetlands and is proposing to restore and preserve 3 acres of wetlands onsite. Data on the onsite wetlands classified these systems as exotic impacted wetlands with greater than 50

percent but less than 75 percent exotics (Table 3) with an average hydroperiod of 120-180 days of inundation.

The equation to calculate the biomass lost is: The number of acres, converted to square-meters, times the amount of actual biomass consumed by the wood stork (Table 10), times the exotic foraging suitability index (Table 3), equals the amount of grams lost, which is converted to kg.

Biomass lost (5*4,047*0.39 (Table 10)*0.37 (Table 3)=2,919.9 grams or 2.92 kg)

In the example provided, the 5 acres of wetlands, converted to square-meters (1 acre= 4,047 m^2) would provide 2.9 kg of biomass (5*4,047*0.39 (Table 10)*0.37 (Table 3)= 2,919.9 grams or 2.9 kg), which would be lost from development.

The equation to calculate the biomass from the preserve is the same, except two calculations are needed, one for the existing biomass available and one for the biomass available after restoration.

Biomass Pre: (3*4,047*0.39(Table 10)*0.37 (Table 3)=1,751.95grams or 1.75 kg)

Biomass Post: (3*4,047*0.39 (Table 10)*1(Table 3)=4,734.99 grams or 4.74 kg)

Net increase: 4.74 kg-1.75 kg = 2.98 kg Compensation Site

Project Site Balance 2.98 kg- 2.92 kg = 0.07kg

The compensation proposed is 3 acres, which is within the same hydroperiod and has the same level of exotics. Following the calculations for the 5 acres, the 3 acres in its current habitat state, provides 1.75 kg (3*4,047*0.39 (Table 10)*0.37 (Table 3)=1,751.95grams or 1.75 kg) and following restoration provides 4.74 kg (3*4,047*0.39 (Table 10)*1(Table 3)=4,734.99 grams or 4.74 kg), a net increase in biomass of 2.98 kg (4.74-1.75=2.98).

Example 1: 5 acre wetland loss, 3 acre wetland enhanced – same hydroperiod - NLAA

Hydroperiod	Existing Footprint		On-site Preserve Area				Net Change*	
			Pre Enhancement		Post Enhancement			
	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams
Class 1 - 0 to 60 Days								
Class 2 - 60 to 120 Days								
Class 3 - 120 to 180 Days	5	2.92	3	1.75	3	4.74	(5)	0.07
Class 4 - 180 to 240 Days								
Class 5 - 240 to 300 Days								
Class 6 - 300 to 330 Days								
Class 7 - 330 to 365 days								
TOTAL	**5**	**2.92**	**3**	**1.75**	**3**	**4.74**	**(5)**	**0.07**

*Since the net increase in biomass from the restoration provides 2.98 kg and the loss is 2.92 kg, there is a positive outcome (4.74-1.75-2.92=0.07) in the same hydroperiod and Service concurrence with a NLAA is appropriate.

Example 2:

In the above example, if the onsite preserve wetlands were a class 4 hydroperiod, which has a value of 0.71. grams/m^2 instead of a class 3 hydroperiod with a 0.39 grams/m^2 [Table 10]), there would be a loss of 2.92 kg of short hydroperiod wetlands (as above) and a net gain of 8.62 kg of long-hydroperiod wetlands.

Biomass lost: (5*4,047*0.39 (Table 10)*0.37 (Table 3)=2,919.9 grams or 2.92 kg)

The current habitat state of the preserve provides 3.19 kg (3*4,047*0.71 (Table 10)*0.37 (Table 3)=3,189.44 grams or 3.19 kg) and following restoration the preserve provides 8.62 kg (3*4,047*0.71 (Table 10)*1(Table 3)= 8,620.11 grams or 8.62 kg, thus providing a net increase in class 4 hydroperiod biomass of 5.43 kg (8.62-3.19=5.43).

Biomass Pre: (3*4,047*0.71(Table 10)*0.37 (Table 3) = 3,189.44 grams or 3.19 kg)

Biomass Post: (3*4,047*0.71 (Table 10)*1(Table 3)=8,620.11 grams or 8.62 kg)

Net increase: 8.62 kg-3.19 kg = 5.43 kg

Project Site Balance 5.43 kg- 2.92 kg = 2.51 kg

Example 2: 5 acre wetland loss, 3 acre wetland enhanced – different hydroperiod – May Affect

Hydroperiod	Existing Footprint		On-site Preserve Area				Net Change*	
			Pre Enhancement		Post Enhancement			
	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams
Class 1 - 0 to 60 Days								
Class 2 - 60 to 120 Days								
Class 3 - 120 to 180 Days	5	2.92					(5)	-2.92
Class 4 - 180 to 240 Days			3	3.19	3	8.62	0	5.43
Class 5 - 240 to 300 Days								
Class 6 - 300 to 330 Days								
Class 7 - 330 to 365 days								
TOTAL	**5**	**2.92**	**3**	**3.19**	**3**	**8.62**	**(5)**	**2.51**

In this second example, even though there is an overall increase in biomass, the biomass loss is a different hydroperiod than the biomass gain from restoration, therefore, the Service could not concur with a NLAA and further coordination with the Service is appropriate.

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Attachment 2:

Rating Indices for Foraging Habitat Variables in the Army Corp of Engineer's (USACE) Wood Stork Key

ENVIRONMENTAL CONSULTING DEPARTMENT
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APPENDIX A

RATING INDICES FORAGING HABITAT VARIABLES

1. Prey Availability

Descriptions	Score
➢ Wetland or water body provides two to 15 inches of littoral depth for foraging purposes for the majority of the forging area ➢ Wetland or water body provides relative calm fluidity and without dense coverage of aquatic vegetation ➢ Wetland contains many small depressional pockets for forage to become concentrated	3.0
➢ Wetland or water body provides two to 15 inches of littoral depth for at least half of the foraging area ➢ Wetland or water body provides a calm fluidity motion with a few patches of dense aquatic vegetation ➢ Wetland contains scattered depressional pockets for forage to become concentrated	2.0
➢ Wetland or water body provides two to 15 inches of littoral depths for at least some of the foraging area ➢ Wetland or water body provides a calm fluidity motion with scattered patches of dense aquatic vegetation ➢ Wetland contains few depressional pockets for forage to become concentrated	1.0
➢ Wetland or water body does not provide littoral foraging areas with two to 15 inches in depth ➢ Wetland or water body does not provide a calm fluidity motion or has extreme coverage of dense aquatic vegetation	0.0

2. Hydrologic Regime

Descriptions	Score
➢ Wetland or water body provides indicators indicative of longer hydroperiods for interior wetlands during the drying cycle of the dry season ➢ Wetland or water body provides indicators indicative of a short hydroperiod during the wet season to provide littoral foraging of appropriate depths when larger wetlands and water bodies are too inundated ➢ Wetland or water body has a strong hydrological connection such as ditches, swales, sheetflow, etc. that provides more permanent hydrology to make available necessary fish densities for foraging	3.0

2. Hydrologic Regime (Continued)

Descriptions	Score
➢ Wetland or water body provides evidence of very few hydrological alterations for interior wetlands during the drying cycle of the dry season ➢ Wetland or water body provides evidence of very few hydrological alterations during the wet season that will provide littoral foraging of appropriate depths when larger wetlands and water bodies are inundated ➢ Wetland or water body has an adequate hydrological connection such as ditches, swales, sheetflow, etc. that provides more permanent hydrology to make available necessary fish densities	2.0
➢ Wetland or water body provides evidence of a moderately altered hydroperiod for interior wetlands during the drying cycle of the dry season. ➢ Wetland or water body provides evidence of a moderately altered hydroperiod during the wet season that will provide some littoral foraging at appropriate depths when larger wetlands and water bodies are inundated ➢ Wetland or water body has moderate hydrological connections such as ditches, swales, sheetflow, etc. that provides adequate hydrology to make available necessary fish densities	1.0
➢ Wetland or water body provides evidence of a severely altered hydroperiod for interior wetlands during the drying cycle that provide no available foraging habitat ➢ Wetland or water body provides evidence of a severely altered hydroperiod during the wet season that provide no littoral areas when other areas have extreme inundation ➢ Wetland or water body has no hydrological connection such as ditches, swales, sheetflow, etc. that could provide adequate hydrology for necessary fish densities	0.0

3. Water Quality

Land Use Category	Score
Open Space/Natural, Undeveloped Areas	3.0
Unimproved Pasture/Rangeland	2.5
Citrus Grove	2.0
Sugar Cane	2.0
Low Density Residential	2.0
Low Density Commercial	2.0
Low Density Highway	2.0
Institutional	2.0
Single-family Residential	1.5

3. **Water Quality (Continued)**

Land Use Category	Score
Recreational	1.5
Golf Course	1.5
Moderately Intense Commercial	1.5
High Volume Highway	1.0
Industrial	1.0
Mining	1.0
Multi-family Residential	1.0
Improved Pasture	1.0
Row Crop	1.0
High Intensity Commercial	0.5
Dairy or Feed Lot	0.0
Pretreatment Category	
Natural, Undeveloped Areas	3.0
Wet Detention with Swales	2.5
Wet Detention with Dry Detention	2.5
Combination Grass Swales with Dry Detention	2.0
Grass Swales Only	1.0
Dry Detention Only	1.0
No Treatment	0.0

Attachment 2:

Rating Indices for Foraging Habitat Variables in the Army Corp of Engineer's (USACE) Wood Stork Key

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THE CORPS OF ENGINEERS, JACKSONVILLE DISTRICT, U. S. FISH AND WILDLIFE SERVICE, JACKSONVILLE ECOLOGICAL SERVICES FIELD OFFICE AND STATE OF FLORIDA EFFECT DETERMINATION KEY FOR THE WOOD STORK IN CENTRAL AND NORTH PENINSULAR FLORIDA
September 2008

Purpose and Background

The purpose of this document is to provide a tool to improve the timing and consistency of review of Federal and State permit applications and Federal civil works projects, for potential effects of these projects on the endangered wood stork (*Mycteria americana*) within the Jacksonville Ecological Services Field Office (JAFL) geographic area of responsibility (GAR see below). The key is designed primarily for Corps Project Managers in the Regulatory and Planning Divisions and the Florida Department of Environmental Protection or its authorized designee, or Water Management Districts. The tool consists of the following dichotomous key and reference material. The key is intended to be used to evaluate permit applications and Corps' civil works projects for impacts potentially affecting wood storks or their wetland habitats. At certain steps in the key, the user is referred to graphics depicting known wood stork nesting colonies and their core foraging areas (CFA), footnotes, and other support documents. The graphics and supporting documents may be downloaded from the Corps' web page at http://www.saj.usace.army.mil/permit or at the JAFL web site at http://www.fws.gov/northflorida/WoodStorks. We intend to utilize the most recent information for both the graphics and supporting information; so should this information be updated, we will modify it accordingly. **Note: This information is provided as an aid to project review and analysis, and is not intended to substitute for a comprehensive biological assessment of potential project impacts. Such assessments are site-specific and usually generated by the project applicant or, in the case of civil works projects, by the Corps or project co-sponsor.**

Explanatory footnotes provided in the key must be closely followed whenever encountered.

Scope of the key

This key should only be used in the review of permit applications for effects determinations on wood storks within the JAFL GAR, and not for other listed species. Counties within the JAFL GAR include Alachua, Baker, Bradford, Brevard, Citrus, Clay, Columbia, Dixie, Duval, Flagler, Gilchrist, Hamilton, Hernando, Hillsborough, Lafayette, Lake, Levy, Madison, Manatee, Marion, Nassau, Orange, Pasco, Pinellas, Putnam, St. Johns, Seminole, Sumter, Suwannee, Taylor, Union, and Volusia.

The final effect determination will be based on project location and description, the potential effects to wood storks, and any measures (for example project components, special permit conditions) that avoid or minimize direct, indirect, and/or cumulative

impacts to wood storks and/or suitable wood stork foraging habitat. Projects that key to a "no effect" determination do not require additional consultation or coordination with the JAFL. Projects that key to "NLAA" also do not need further consultation; however, the JAFL staff will assist the Corps if requested, to answer questions regarding the appropriateness of mitigation options. Projects that key to a "may affect" determination equate to "likely to adversely affect" situations, and those projects should not be processed under the SPGP or any other programmatic general permit. For all "may affect" determinations, Corps Project Managers should request the JAFL to initiate formal consultation on the Wood stork.

Summary of General Wood Stork Nesting and Foraging Habitat Information

The wood stork is primarily associated with freshwater and estuarine habitats that are used for nesting, roosting, and foraging. Wood storks typically nest colonially in medium to tall trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water (Ogden 1991; Rodgers et al. 1996). Successful breeding sites are those that have limited human disturbance and low exposure to land based predators. Nesting sites protected from land-based predators are characterized as those surrounded by large expanses of open water or where the nest trees are inundated at the onset of nesting and remain inundated throughout most of the breeding cycle. These colonies have water depths between 0.9 and 1.5 meters (3 and 5 feet) during the breeding season.

In addition to limited human disturbance and land-based predation, successful nesting depends on the availability of suitable foraging habitat. Such habitat generally results from a combination of average or above-average rainfall during the summer rainy season, and an absence of unusually rainy or cold weather during the winter-spring breeding season (Kahl 1964; Rodgers et al. 1987). This pattern produces widespread and prolonged flooding of summer marshes that tends to maximize production of freshwater fishes, followed by steady drying that concentrate fish during the season when storks nest (Kahl 1964). Successful nesting colonies are those that have a large number of foraging sites. To maintain a wide range of foraging opportunities, a variety of wetland habitats exhibiting short and long hydroperiods should be present. In terms of wood stork foraging, the Service (1999) describes a short hydroperiod as one where a wetland fluctuates between wet and dry in 1 to 5-month cycles, and a long hydroperiod where the wet period is greater than five consecutive months. Wood storks during the wet season generally feed in the shallow water of short-hydroperiod wetlands and in coastal habitats during low tide. During the dry season, foraging shifts to longer hydroperiod interior wetlands as they progressively dry down (though usually retaining some surface water throughout the dry season).

Because of their specialized feeding behavior, wood storks forage most effectively in shallow-water areas with highly concentrated prey. Typical foraging sites for the wood stork include freshwater marshes, depressions in cypress heads, swamp sloughs, managed impoundments, stock ponds, shallow-seasonally flooded roadside or agricultural ditches, and narrow tidal creeks or shallow tidal pools. Good foraging conditions are characterized by water that is relatively calm, open, and having water depths between 5 and 15 inches (5 and 38 cm). Preferred foraging habitat includes wetlands exhibiting a mosaic of submerged and/or emergent aquatic vegetation, and shallow, open-water areas subject to hydrologic

regimes ranging from dry to wet. The vegetative component provides nursery habitat for small fish, frogs, and other aquatic prey, and the shallow, open-water areas provide sites for concentration of the prey during daily or seasonal low water periods.

WOOD STORK KEY

Although designed primarily for use by Corps Project Managers in the Regulatory and Planning Divisions, and State Regulatory agencies or their designees, project permit applicants and co-sponsors of civil works projects may find this key and its supporting documents useful in identifying potential project impacts to wood storks, and planning how best to avoid, minimize, or compensate for any identified adverse effects.

A. Project within 2,500 feet of an active colony site[1]……*May affect*

Project more than 2,500 feet from a colony site……go to B

B. Project does not affect suitable foraging habitat[2] (SFH)…….*no effect*

Project impacts SFH[2]……go to C

C. Project impacts to SFH are less than or equal to 0.5 acre[3]…….....*NLAA*[4]

Project impacts to SFH are greater than or equal to 0.5 acre..……..go to D

D. Project impacts to SFH not within a Core Foraging Area[5] (see attached map) of a colony site, and no wood storks have been documented foraging on site…….....NLAA[4]

Project impacts to SFH are within the CFA of a colony site, or wood storks have been documented foraging on a project site outside the CFA ……..….go to E

E. Project provides SFH compensation within the Service Area of a Service-approved wetland mitigation bank or wood stork conservation bank preferably within the CFA, or consists of SFH compensation within the CFA consisting of enhancement, restoration or creation in a project phased approach that provides an amount of habitat and foraging function equivalent to that of impacted SFH (see *Wood Stork Foraging Habitat Assessment Procedure*[6] for guidance), is not contrary to the Service's *Habitat Management Guidelines For The Wood Stork In The Southeast Region* and in accordance with the CWA section 404(b)(1) guidelines……*NLAA*[4]

Project does not satisfy these elements.…….....……...*May affect*

[1] An active nesting site is defined as a site currently supporting breeding pairs of wood storks, or has supported breeding wood storks at least once during the preceding 10-year period.

[2] Suitable foraging habitat (SFH) is described as any area containing patches of relatively open (< 25% aquatic vegetation), calm water, and having a permanent or seasonal water depth between 2 and 15 inches (5 to 38 cm). SFH supports and concentrates, or is capable of supporting and concentrating small fish, frogs, and other aquatic prey. Examples of SFH include, but are not limited to, freshwater marshes and stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs. See above *Summary of General Wood Stork Nesting and Foraging Habitat Information*.

[3] On an individual basis, projects that impact less than 0.5 acre of SFH generally will not have a measurable effect on wood storks, although we request the Corps to require mitigation for these losses when appropriate. Wood Storks are a wide ranging species, and individually, habitat change from impacts to less than 0.5 acre of SFH is not likely to adversely affect wood storks. However, collectively they may have an effect and therefore regular monitoring and reporting of these effects are important.

[4] Upon Corps receipt of a general concurrence issued by the JAFL through the Programmatic Concurrence on this key, "NLAA" determinations for projects made pursuant to this key require no further consultation with the JAFL.

[5] The U.S. Fish and Wildlife Service (Service) has identified core foraging area (CFA) around all known wood stork nesting colonies that is important for reproductive success. In Central Florida, CFAs include suitable foraging habitat (SFH) within a 15-mile radius of the nest colony; CFAs in North Florida include SFH within a 13-mile radius of a colony. The referenced map provides locations of known colonies and their CFAs throughout Florida documented as active within the last 10 years. The Service believes loss of suitable foraging wetlands within these CFAs may reduce foraging opportunities for the wood stork.

[6]This draft document, *Wood Stork Foraging Habitat Assessment Procedure*, by Passarella and Associates, Incorporated, may serve as further guidance in ascertaining wetland foraging value to wood storks and compensating for impacts to wood stork foraging habitat.

Monitoring and Reporting Effects

For the Service to monitor cumulative effects, it is important for the Corps to monitor the number of permits and provide information to the Service regarding the number of permits issued that were determined "may affect, not likely to adversely affect." It is requested that information on date, Corps identification number, project acreage, project wetland acreage, and latitude and longitude in decimal degrees be sent to the Service quarterly.

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Appendix C

Rain Data

St. Lucie County Florida

ENVIRONMENTAL CONSULTING DEPARTMENT
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Monthly Total Precipitation for FORT PIERCE ST LUCIE COUNTY INTL AP, FL

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	1.28	1.25	2.31	2.81	0.06	4.47	9.96	2.81	6.58	M	0.47	0.94	M
2001	0.99	0.52	3.49	1.15	5.40	6.70	11.42	9.85	9.93	5.16	3.10	1.46	59.17
2002	1.47	6.55	0.32	3.08	3.77	9.06	7.76	6.10	2.31	2.12	1.96	4.47	48.97
2003	1.28	0.76	3.61	2.47	3.95	10.10	3.69	8.97	6.09	1.99	4.83	2.66	50.40
2004	3.54	2.81	0.57	1.54	1.08	2.20	2.88	11.30	M	3.39	1.34	2.62	M
2005	0.91	1.69	5.65	3.91	5.92	12.67	3.65	3.43	3.19	10.66	4.63	1.92	58.23
2006	0.36	3.29	T	4.66	1.15	7.23	2.75	3.11	5.23	0.66	1.10	3.48	33.02
2007	0.57	0.42	1.07	3.43	1.23	7.09	10.41	2.30	4.58	6.88	1.65	2.83	42.46
2008	1.44	1.35	2.78	2.72	1.80	3.64	10.26	16.01	2.86	5.34	2.19	0.42	50.81
2009	0.56	0.27	1.94	0.74	9.28	4.31	4.75	2.66	4.36	0.74	0.54	4.12	34.27
2010	0.75	2.27	5.82	2.16	0.72	7.71	4.31	4.98	5.65	0.20	1.16	0.36	36.09
2011	2.03	0.53	3.53	1.45	0.81	2.63	3.34	9.93	3.25	12.87	0.98	3.38	44.73
2012	0.05	1.40	2.06	2.98	4.06	3.76	1.51	12.93	4.20	8.92	1.64	3.54	47.05
2013	1.67	1.06	1.06	3.84	5.78	5.72	8.86	2.78	7.30	0.62	6.06	2.65	47.40
2014	9.94	2.28	1.76	2.43	2.81	7.03	7.51	4.43	10.80	3.82	1.68	2.11	56.60
2015	0.47	3.61	1.79	4.28	1.68	3.32	5.96	5.08	8.95	2.16	4.73	4.76	46.79
2016	10.56	3.35	5.08	1.98	13.86	4.14	1.55	7.17	7.39	6.91	0.72	1.06	63.77
2017	1.09	0.55	1.30	2.23	3.96	7.75	6.45	3.73	4.78	10.90	3.20	1.58	47.52
2018	2.07	0.63	1.39	4.00	9.58	7.68	7.21	5.07	4.15	1.68	2.75	2.19	48.40
2019	3.95	1.17	1.51	2.57	3.91	6.15	5.37	9.74	3.63	4.28	1.76	5.16	49.20
2020	1.43	1.72	0.02	3.34	9.08	8.83	10.48	8.69	4.96	15.34	9.03	0.79	73.71
2021	0.07	3.34	0.66	4.30	0.49	6.63	8.08	7.72	5.86	3.89	7.30	1.28	49.62
2022	1.82	0.74	2.26	3.19	0.88	13.87	0.86	3.05	12.26	2.11	5.77	2.22	49.03
2023	0.27	1.55	0.66	M	M	M	M	M	M	M	M	M	M
Mean	2.02	1.80	2.11	2.84	3.97	6.64	6.04	6.60	5.83	5.03	2.98	2.43	49.39
Max	10.56 2016	6.55 2002	5.82 2010	4.66 2006	13.86 2016	13.87 2022	11.42 2001	16.01 2008	12.26 2022	15.34 2020	9.03 2020	5.16 2019	73.71 2020
Min	0.05 2012	0.27 2009	T 2006	0.74 2009	0.06 2000	2.20 2004	0.86 2022	2.30 2007	2.31 2002	0.20 2010	0.47 2000	0.36 2010	33.02 2006

Yr\Mo	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	0.91	1.69	5.65	3.91	5.92	12.67	3.65	3.43	3.19	10.66	4.63	1.92
2006	0.36	3.29	T	4.66	1.15	7.23	2.75	3.11	5.23	0.66	1.1	3.48
2007	0.57	0.42	1.07	3.43	1.23	7.09	10.41	2.3	4.58	6.88	1.65	2.83
2021	0.07	3.34	0.66	4.3	0.49	6.63	8.08	7.72	5.86	3.89	7.3	1.28
2022	1.82	0.74	2.26	3.19	0.88	13.87	0.86	3.05	12.26	2.11	5.77	2.22
2023	0.27	1.55	0.66