JOHNSON ENGINEERING

SINCE 1946

September 24, 2012

Brandon D. Dunn, Senior Planner
Lee County – Planning Division
Department of Community Development
1500 Monroe Street
Fort Myers, FL 33902

RECEIVED
SEP 25 2012
COMMUNITY DEVELOPMENT
CPA 2011-00022

Re: HAZARDOUS WILDLIFE UPDATE
CPA2011-00022
CPT Application (Text)

Dear Mr. Dunn:

This letter is in response to your August 6, 2012 correspondence regarding the above-referenced submittal. The items below are in the same order as your correspondence.

IV A.1. General Information and Maps, Provide any proposed text changes

Please see the following comments concerning the proposed text amendments:

COMMENT 1: Please confirm whether the amendment will only impact airport properties or if the intention is to also impact nearby properties. The proposed amendments to Policy 1.2.7 and Policy 1.9.8 use the term "on or near airports."

RESPONSE 1: The intended impact is specific to airport properties. The application seeks to update Lee Plan language so it is consistent with federal and state policy and guidance as it relates to airport planning, development, and land management activities of the Lee County Port Authority.

The review of development proposals and avoidance of wildlife hazards on or near airports is already contemplated in the Lee Plan, in Objective 47.2 and Policy 47.6.4. The Port Authority will continue with the coordination efforts outlined in this Objective and Policy, which read:

> ***OBJECTIVE 47.2: DEVELOPMENT COMPATIBILITY. The county and Port Authority will evaluate development proposals for property located within the vicinity of existing aviation facilities to ensure land use compatibility, to preclude obstructions to aircraft operations, and to protect airport capacities. (Amended by Ordinance No. 99-15, 07-09)***
>
> ***POLICY 47.6.4: The safety of aircraft operators, aircraft passengers, and persons on the ground will guide the Port Authority in the operation of county airports, and hazardous wildlife attractants on or near the airports will be avoided. (Added by Ordinance No. 99-15)***

2122 Johnson Street ▪ Post Office Box 1550 ▪ Fort Myers, Florida 33902-1550
(239) 334-0046 ▪ Fax (239) 334-3661

To ensure the amendment language is not a source of confusion, changes to the amendment language have been made to eliminate reference to critical separations, eliminate reference to existing wetlands "near" airports, and clarification is added to indicate the policy statements apply to activity on airport property specifically. Please see attached Exhibit IV.A.1, Summary of Text Changes as modified.

COMMENT 2: Lee County owns several parcels that are either planned for or have potential to be used as mitigation for wetlands impacts within the critical separation perimeters A, B, and C. There is concern that the proposed language would limit use of these parcels for that purpose. Please clarify if it is the intention the Port Authority to prohibit non-airport wetland mitigation on these parcels.

Likewise, there is concern that the currently proposed Lee Plan language (if the critical separation perimeters are used to define "near") would require that all public and private development within the critical separation perimeters utilize offsite wetland mitigation as opposed to preservation or on-site mitigation options. This may increase the cost of development and leave the county exposed to litigation.

RESPONSE 2: It is not the intention of the Port Authority to prohibit non-airport wetland mitigation. The Port Authority will continue to coordinate with Lee County as outlined in Objective 47.2 and Policy 47.6.2 as stated above. To ensure the amendment language is not a source of confusion, changes to the amendment language have been made to eliminate reference to critical separations, eliminate reference to existing wetlands "near" airports, and clarification is added to indicate the policy statements apply to activity on airport property specifically. Please see attached Exhibit IV.A.1, Summary of Text Changes as modified.

COMMENT 3: The amendment proposes to delete the following language in Policy 1.2.1, "The physical design of the airport expansion will minimize any degradation of the recharge capability of land being developed." Additional data and analysis is needed to justify how the need to reduce wildlife attractants will inherently degrade the recharge capacity of developed land.

RESPONSE 3: The deletion of several sentences within Policy 1.2.1, including the deletion of the identified sentence, is to reduce redundancy. The amendment language states that development and land management practices on airport property shall be in accordance with required agency approvals, which assures that all aspects of water management, including recharge capacity, will be addressed per applicable standards and permitting procedures. Additionally, Lee Plan Policy 1.2.6 remains as added by

Ord. 04-16, and speaks more specifically to protection of groundwater resources at RSW:

> ***POLICY 1.2.6: Any future airport expansion or development of aviation-related or non-aviation related uses will provide appropriate buffer areas, as determined by Lee County, for the protection of groundwater resources in the Southeast and Northeast quadrants of the airport property. (Added by Ordinance No. 04-16)***

The issue of groundwater recharge is further addressed in Policies 47.6.2 and 47.7.3, which state that airport construction and operation will adhere to environmental regulations and all other elements of the Lee Plan, including conservation and coastal management policies, as applicable.

> ***POLICY 47.6.2: While airport facilities will be operated in conformance with applicable state and federal regulations, the Port Authority will strive to ensure that Lee County environmental and other regulations are also implemented to the greatest extent possible. (Amended by Ordinance No. 99-15)***
>
> ***POLICY 47.7.3: The Port Authority will abide by all other relevant parts of this comprehensive plan in the construction and operation of Page Field Airport and the Southwest Florida International Airport, especially the Future Land Use, Conservation and Coastal Management, and Transportation elements. (Amended by Ordinance by No. 98-09, Amended and Relocated by Ordinance No. 99-15, Amended by Ordinance No. 07-09)***

Furthermore, the expansion and future development of airport property requires AOPD amendment and is subject to the zoning review process. Per Standard 11.4 of the Future Land Use Element, the requirement for environmental assessment and associated environmental review factors similarly address natural resource protection as appropriate.

As evidenced by the various citations listed above, the proposed deletion was not intended to suggest that the need to reduce wildlife attractants will inherently degrade the recharge capacity of developed land, it is proposed only to reduce redundant policy statements.

Miscellaneous Comments

Please provide the following data / information needed to complete the review of the proposed Lee Plan amendment.

COMMENT 1: Please provide copies of the Wildlife Hazardous Assessment and the Wildlife Management Plan, which is referenced in the application.

RESPONSE 1: Attached please find a CD containing the Wildlife Hazard Assessment and Wildlife Hazard Management Plan for RSW.

COMMENT 2: Please provide copies of wildlife hazard strike data for both Page Field and RSW facilities.

RESPONSE 2: Attached please find the requested documents titled RSW Strike History and FMY Strikes containing strike data from 1995 through May 31, 2012 for both facilities. As indicated on the documents, this bird strike data is from the FAA Birdstrike Database which is an inventory of strike incidents that are reported on voluntary basis by aircraft operators and airport personnel. Strikes are incidents defined according to the *Wildlife Control Procedures Manual*, Technical Publication 11500E, 1994:

> **Aircraft-wildlife strike. An aircraft-wildlife strike is deemed to have occurred when:**
> **1. A pilot reports that an aircraft struck 1 or more birds or other wildlife;**
> **2. Aircraft maintenance personnel identify aircraft damage as having been caused by an aircraft-wildlife strike;**
> **3. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;**
> **4. Bird or other wildlife remains, whether in whole or in part, are found within 200 feet of a runway centerline, unless another reason for the animal's death is identified; or**
> **5. The animal's presence on the airport had a significant, negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, aircraft left pavement area to avoid collision with animal)**

COMMENT 3: Please provide clarification about the measurement of the critical separation perimeters A, B and C. Are the distances to be measured from the aircraft operations area or the airport property? Provide a map depicting the line that is to be used for this measurement overlaid on the most recently available aerial image.

RESPONSE 3: The reference to critical separations has been removed from the proposed amendment. This amendment is intended to impact on-airport development and land management practices only.

ADDITIONAL RESPONSE: We have also attached an updated Exhibit IV.C.RSW.5.2 that reflects current Lee County Future Land Use Map designations, as a replacement for the originally submitted Exhibit IV.C.RSW.5.2 in the Environmental Impact Analysis.

Thank you for the opportunity to provide additional information to support this application. If you have any further questions or comments, please feel free to contact me.

Sincerely,

JOHNSON ENGINEERING, INC.

Laura DeJohn, AICP
Director of Planning & Landscape Architecture

Enclosure
LD/ljm
20129000-000

Exhibit IV.A.1
Summary of Text Changes
for
Lee County Port Authority
Hazardous Wildlife Comprehensive Plan Amendment

Amendments to Lee Plan Policies 1.2.1, 1.2.9, and 1.9.8 are proposed in order to align the Lee Plan with Federal and state policy as it relates to avoidance of wildlife hazards and hazardous wildlife attractants. The amendments are proposed as follows (**underline** indicates additions, ~~**strikethrough**~~ indicates deletions), and further explanation is provided on the following pages of this summary.

POLICY 1.2.1: Airport Lands includes the existing facility and projected growth areas for the Southwest Florida International Airport and Page Field General Aviation Airport through the year 2030. The Airport Lands comprising the Southwest Florida International Airport includes airport and airport-related development as well as non-aviation land uses as proposed in the approved 2003 Airport Master Plan update and as depicted on the Airport Layout Plan sheet (Map 3F) and the Southwest Florida International Airport Proposed Development Schedule (Table 5(a)). This mix of uses is intended to support the continued development of the Southwest Florida International Airport. Future development at the Southwest Florida International Airport will also include non-aviation related land uses such as hotels/motels, light industrial, service stations, retail/shopping, and office development. Any future airport expansion or development of aviation-related and non-aviation uses at Southwest Florida International Airport will offset environmental impacts through the Airport Mitigation Lands Overlay (Map 3M) or other appropriate mitigation. ~~**acceptable to the permitting agencies and to Lee County. The physical design of the airport expansion will minimize any degradation of the recharge capability of land being developed.**~~ **Wetland mitigation for any future expansion or development of aviation and non-aviation uses on Airport Lands must be designed so it does not create a wildlife hazard. Development and land management practices on airport property shall be in accordance with FAA directives and other required agency approvals.** Airport expansion beyond the present boundaries will be subject to necessary amendments to the Lee Plan.

All development on Airport Lands comprising Southwest Florida International Airport must be consistent with Map 3F and Table 5(a). Map 3F depicts the planned expansion of the Southwest Florida International Airport through 2020.

Future development on Airport Lands comprising Page Field General Aviation Airport must be consistent with Objective 1.9 and related policies as well as Map 3G and Table 5(b).

If the airport master planning process precipitates a substantive change to the Airport Layout Plan (Map 3F or Map 3G), then the Port Authority must amend Map 3F or Map 3G, as appropriate, prior to obtaining local development approval. The non-aviation related development areas have been depicted on the approved Airport Layout Plan sheets (Maps 3F and 3G). These uses will be constructed upon Airport lands with long term leases.

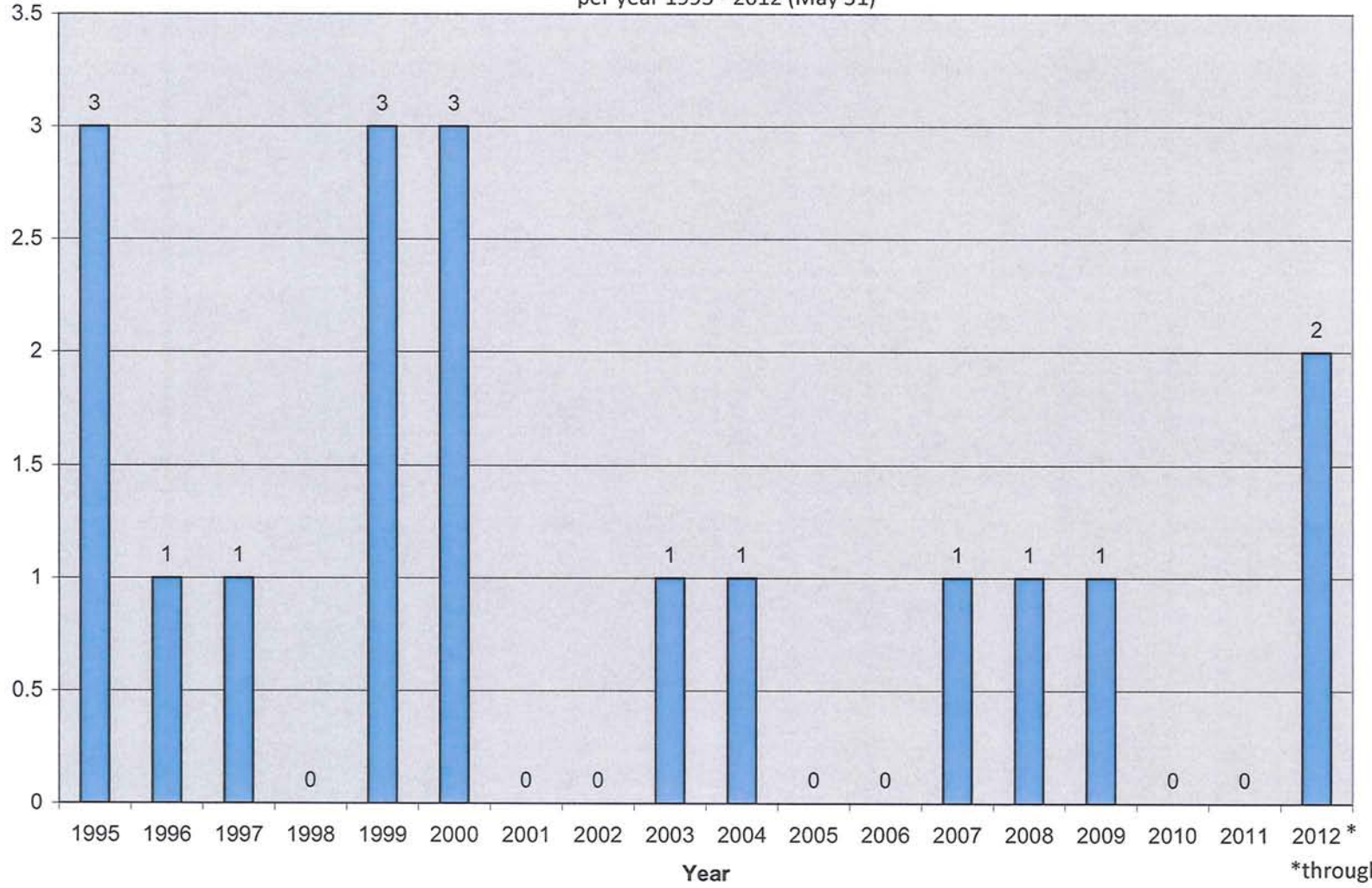
~~All development within the non-aviation land use areas will be subject to mitigation requirements for wetland impacts. Mitigation of wetland impacts will be in accordance with the U.S. Army Corps of Engineers and South Florida Water Management District requirements. To the greatest extent reasonably possible, development of non-aviation land use areas must avoid wetland impacts. All non-aviation land use development will meet the indigenous vegetation requirements set forth in the Lee County Land Development Code.~~ (Amended by Ordinance No. 94-30, 00-22, 04-16, 07-12, 09-14, 11-16).

POLICY 1.2.7: ~~**Future non-aviation areas depicted on the Airport Layout Plan (Map 3F) will be developed, to the greatest extent possible, only within existing upland areas. Impacts to wetlands in the future non-aviation areas will be minimized by site design, wherever possible, in compliance with the Lee County Land Development Code.**~~ **In cooperation with local, state and Federal regulatory agencies, the Port Authority will work to minimize and correct any wildlife hazards arising from existing wetlands located on airport property. Site improvements on airport property will be designed to minimize attractiveness to wildlife of natural areas and man-made features on airport property such as detention/retention ponds, landscaping, and wetlands, which can provide wildlife with the ideal locations for feeding, loafing, reproduction, and escape.** Development within the future non-aviation area, as designated on Map 3F, is limited to a maximum of 300 acres north of runway 6-24 and approximately 52 acres within the midfield terminal area. All development must be in compliance with Map 3F and the intensities outlined in Table 5(a). Development of additional acreage will require prior Lee Plan amendment approval. (Added by Ordinance No. 04-16, Amended by Ordinance No. 11-16)

POLICY 1.9.8: ~~**Future non-aviation areas depicted on the Airport Layout Plan (Map 3G) will be developed, to the greatest extent possible, within existing upland areas. Impacts to wetlands in the future non-aviation areas will be minimized by site design whenever possible in compliance with the Lee County Land Development Code.**~~ **In cooperation with local, state and Federal regulatory agencies, the Port Authority will work to minimize and correct any wildlife hazards arising from existing wetlands located on airport property. Site improvements on airport property will be designed to minimize attractiveness to wildlife of natural areas and man-made features on airport property such as detention/retention ponds, landscaping, and wetlands, which can provide wildlife with ideal locations for feeding, loafing, reproduction, and escape.** (Added by Ordinance No. 09-14).

FMY Strikes

Number of Reported Wildlife Strikes
per year 1995 - 2012 (May 31)



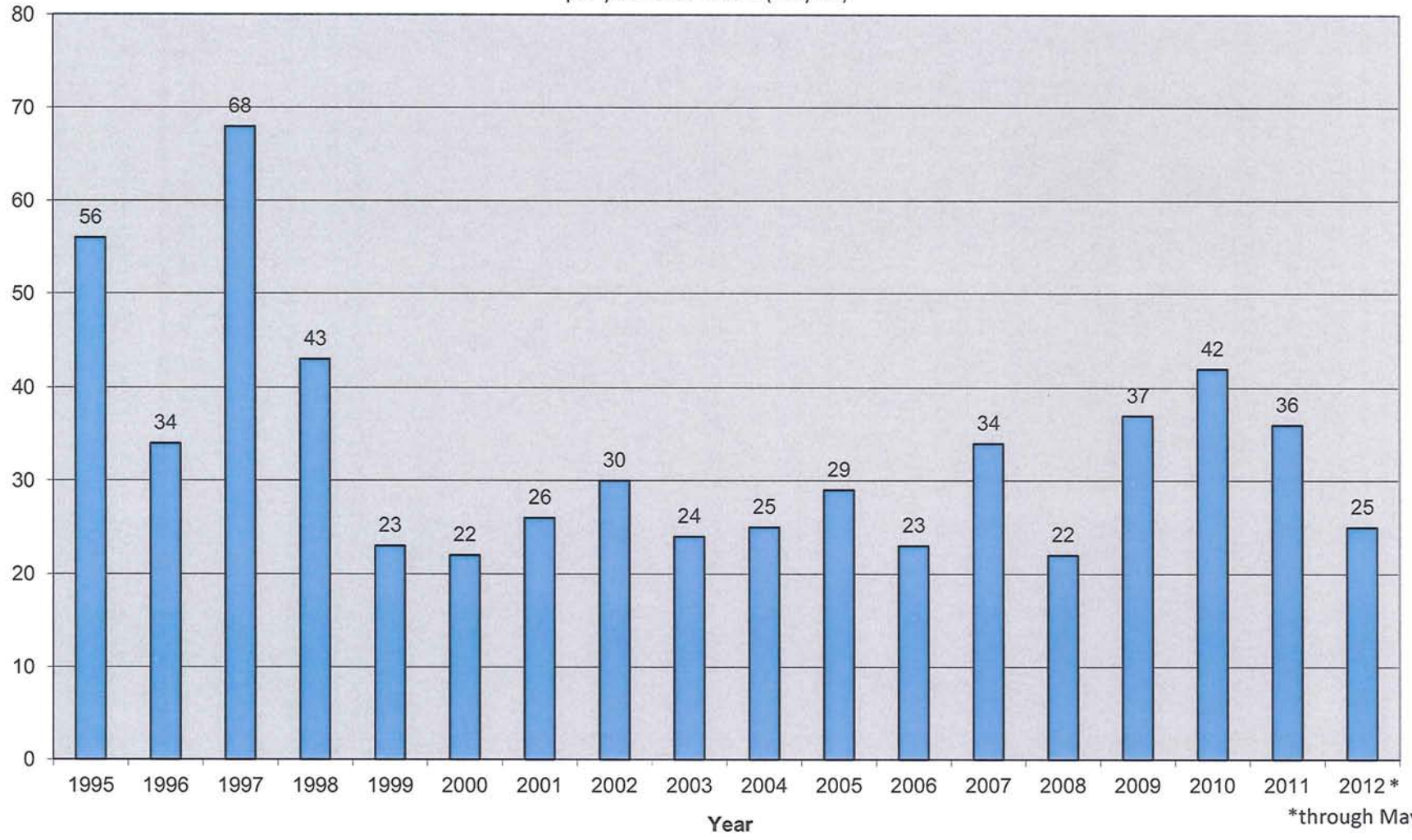
*through May 31, 2012

This bird strike data is from the FAA Birdstrike Database which is an inventory of strike incidents that are reported on voluntary basis by aircraft operators and airport personnel.

Source: Lee County Port Authority
September 2012

RSW Strike History

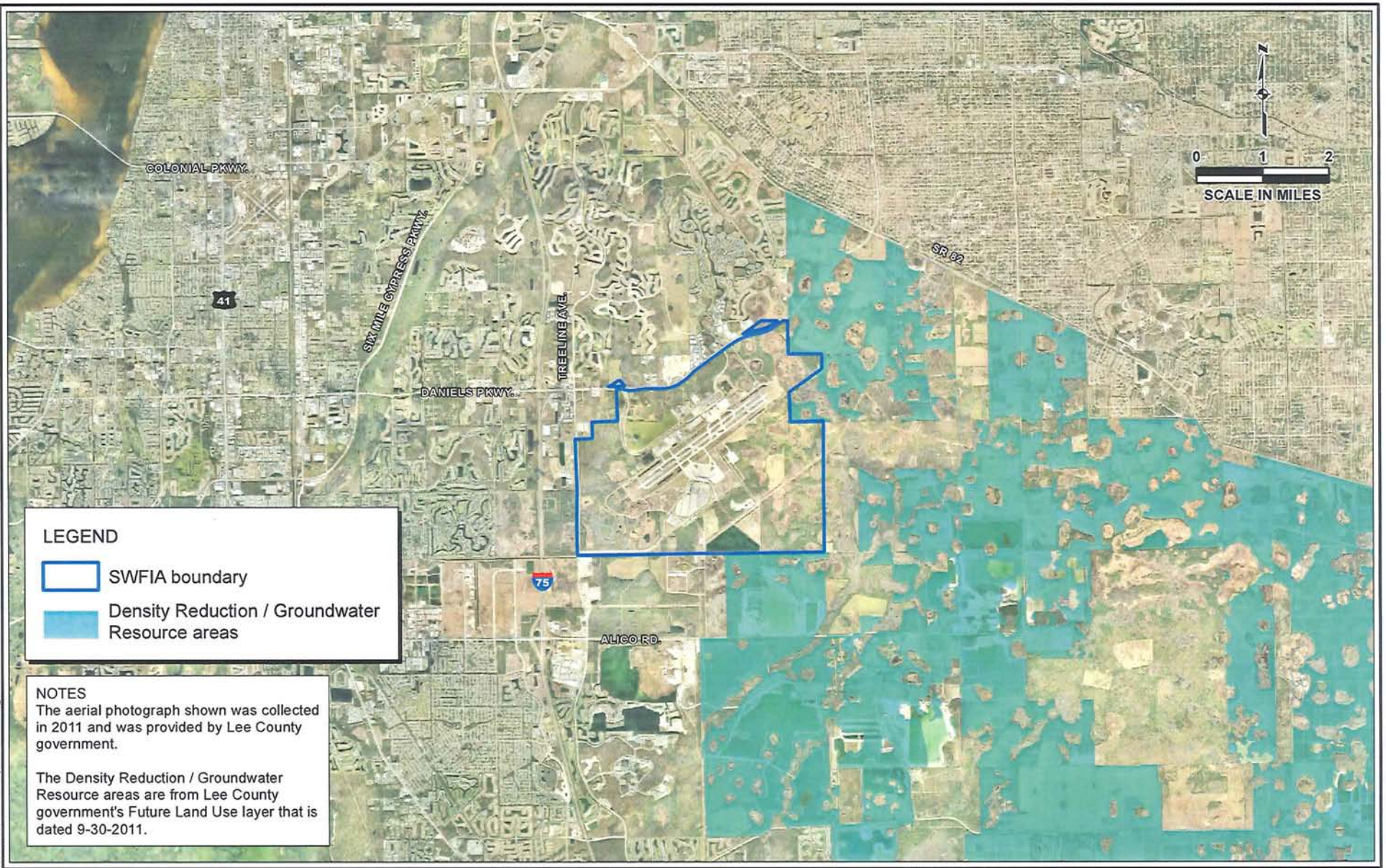
Number of Reported Wildlife Strikes
per year 1995 - 2012 (May 31)



*through May 31, 2012

This bird strike data is from the FAA Birdstrike Database which is an inventory of strike incidents that are reported on voluntary basis by aircraft operators and airport personnel.

Source: Lee County Port Authority
September 2012



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Comprehensive Plan Amendment
Lee County, Florida

JOHNSON ENGINEERING

2122 JOHNSON STREET
P.O. BOX 1550
FORT MYERS, FLORIDA 33902-1550
PHONE (239) 334-0046
FAX (239) 334-3661
E.B. #642 & L.B. #642

Aquifer Recharge Areas
Exhibit IV.C.RSW.5.2

DATE	PROJECT NO.	FILE NO.	SCALE	SHEET
June 2012	20087500-079	–	As Shown	IV.C.RSW.5.2

WILDLIFE HAZARD ASSESSMENT

For

SOUTHWEST FLORIDA INTERNATIONAL AIRPORT

2008-2009

LEE COUNTY PORT AUTHORITY

JOHNSON ENGINEERING

WILDLIFE HAZARD ASSESSMENT

For

SOUTHWEST FLORIDA INTERNATIONAL AIRPORT

2008 - 2009

Presented to: Lee County Port Authority

Prepared by: Johnson Engineering, Inc.
ESA Airports
Fehér Environmental Consulting, Inc.

Senior Technical Advisor: BASH, Inc.

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LIST OF ACCRONYMS APPEARING IN THIS DOCUMENT

AC	Advisory Circular
AOA	Air Operations Area
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FWC	Florida Fish and Wildlife Conservation Commission
GIS	Geographic Information Systems
LCPA	Lee County Port Authority
PWHA	Preliminary Wildlife Hazard Assessment
RSW	Southwest Florida International Airport
USFWS	US Fish and Wildlife Service
WHA	Wildlife Hazard Assessment
WHMP	Wildlife Hazard Management Plan

LIST OF PREPARERS AND QUALIFICATIONS

The Wildlife Hazard Assessment was completed under the guidelines of Federal Aviation Regulations (FAR) Part 139.337(c) and FAA AC 150/5200-36 "Qualifications for Wildlife Biologist Conducting Wildlife Hazard Assessments and Training Curriculums for Airport Personnel Involved in Controlling Wildlife Hazards on Airports." The five leading prepares were:

Anik Smith, Johnson Engineering - WHA Project Manager & Airport Wildlife Biologist

Ms. Smith holds a BS in Environmental Biology and has over 14 years of experience in the environmental field. Anik completed the FAA approved Wildlife Hazard Management course through Embry-Riddle Aeronautical University in 2006 and attended the Joint Bird Strike Committee–USA/Bird Strike Committee–Canada Annual Meeting in 2006 and 2008. Her experience includes three years of ornithological field research experience for the University of Memphis, Dartmouth College, Bird Studies Canada and the Wildlife Conservation Society, and 11 years of experience in conservation lands management including writing and implementing land management plans and protected species' management plans, GPS/GIS mapping, wildlife surveys, and monitoring reports. For the last four years Anik has worked with the Lee County Port Authority consulting on environmental projects at Southwest Florida International Airport and Page Field General Aviation Airport, and is also a member of their Hazardous Wildlife Working Group.

Kendra Willett, Johnson Engineering - WHA Team Airport Wildlife Biologist

Kendra Willett holds a BS in Wildlife and Fisheries and a MS in Ecology. Kendra joined Johnson Engineering in May 2006 and has 13 years experience as a wildlife biologist. Kendra completed the FAA approved Wildlife Hazard Management course through Embry-Riddle Aeronautical University in 2008. Her duties with Johnson Engineering, Inc. include obtaining environmental permits from local, state and federal regulatory agencies and writing management plans. Prior to her employment with Johnson Engineering, Kendra worked for 10 years with the U.S. Fish and Wildlife Service (GS-0486 series) developing management plans, annual work plans, implementing wildlife inventory and monitoring plans, and designing and coordinating research for various avian species, mammals, reptiles and amphibians, fisheries, invertebrates and their habitats.

Dr. Russell P. DeFusco, BASH Incorporated – WHA Team Senior Advisor

Dr. DeFusco, Lt Col, USAF (retired) holds a BS in Biology, a MS in Wildlife Biology, and a PhD in Environmental, Population and Organismic Biology and has over 30 years of experience in the environmental field. He specializes in minimizing Bird Aircraft Strike Hazards (BASH) to civil and military aviation. He is a member of the Steering Committee for the Bird Strike Committee USA/Canada. Dr. DeFusco has been the principle investigator on the United States Bird Avoidance Model (BAM) and has been involved in development of bird detection and forecasting systems using Geographic Information Systems, satellite imagery, radars, and other technologies. He has worked with US and Canadian civil and military agencies to develop

the Strategic Plan for the North American Bird Strike Advisory System. He has also worked with the FAA in developing wildlife hazard assessments and management plans for active and proposed new airports and is an instructor for the FAA approved Wildlife Hazard Management course offered through Embry-Riddle Aeronautical University.

Sarah Brammell, ESA Airports – WHA Team Airport Wildlife Biologist

Ms. Brammell holds a BA in Biology and an MPA in Environmental Policy and has over 10 years of experience in the environmental field. Sarah completed the FAA approved Wildlife Hazard Management course through Embry-Riddle Aeronautical University in 2007 and attended the Joint Bird Strike Committee–USA/Bird Strike Committee–Canada Annual Meeting in 2007 and 2008. She was previously the senior manager of Environmental Compliance and Planning for Lee County Port Authority. In her role with ESA, she provides aviation environmental services to numerous FAR Part 139 airport facilities and general aviation facilities including wildlife hazard assessments, design review for wildlife hazard attractants, NEPA documentation, environmental mitigation strategies, and environmental policy review.

George Fehér, Fehér Environmental Consulting, Inc – WHA Team Airport Wildlife Biologist

Mr. Fehér holds a Bachelor of Science degree (1970) and has over 30 years of experience in the environmental field. Mr. Fehér completed the FAA approved Wildlife Hazard Management course through Embry-Riddle Aeronautical University in 2006 and attended the Joint Bird Strike Committee–USA/Bird Strike Committee–Canada Annual Meeting in 2005 and 2008. He has a broad range of practical expertise in the fields of environmental science, permitting, habitat restoration, monitoring and has a thorough understanding of the environmental regulatory framework. As the principle of his company, he has provided Key West International Airport and Tampa International Airport with wildlife hazard services including wildlife hazard assessments, wildlife hazard management plans and training of airport personnel in the implementation of wildlife hazard management plans.

ACKNOWLEDGEMENTS

Many people became involved in this study in one form or another and we would like to thank them for their important contributions. As part of the WHA team and acting reviewer, Dr. Russell DeFusco presented at the WHA project kick-off meeting to provide LCPA staff better understanding of the process and set the scene for the study. At the start of the study, LCPA staff created a review committee with individuals from three departments that we presented to on a monthly basis. The committee included Emily Underhill, Bobby Orick, Ellen Lindblad, Scott Davis, and Renée Kwiat. These meetings allowed for hazardous wildlife issues that were encountered to be addressed as soon as possible and allowed the WHA team to respond to LCPA questions throughout the process. The Operations staff was always helpful in coordinating field visits and providing information for this assessment. Sarah Brammell (ESA) and George Fehér (Fehér Environmental Consulting, Inc.), in addition to being part of this WHA team and having prepared sections of this assessment, also collected the bulk of the data for the landside observation sites. We appreciated Dr. Jerry Jackson's expert advice on the current condition of the airfield and remaining airport property with relation to hazardous wildlife issues. Our aerial survey of the airport and surrounding lands was possible due to the Lee County Mosquito Control District, particularly Wayne Gayle, Director, and Gene Sutton, pilot. At Johnson Engineering, our team of ecologists assisted with some of the data collection; Anthony Myers (formerly with Johnson Engineering) and Benjamin Pople from our GIS Department were instrumental in developing the GIS methodology utilized in this study for analysis and presentation of the data; Kendra Willett and Church Roberts assisted with the data analysis; and Amanda Martin entered the field data and provided formatting assistance with this report.

EXECUTIVE SUMMARY

The Southwest Florida International Airport (RSW) is a certificated airport as established by the Federal Aviation Administration (FAA) under Federal Aviation Regulation (FAR) Part 139 – Certification of Airports; as such the airport must comply with FAA regulations. FAR Part 139.337 Wildlife Hazard Management requires airports to conduct Wildlife Hazard Assessments (WHA) if certain criteria are met. The last WHA at RSW was conducted in 1997-1998. At that time, the FAA did not require the submission of a Wildlife Hazard Management Plan (WHMP). Even in the absence of a WHMP, RSW has continually adapted and improved onsite and offsite wildlife management since the 1997-98 WHA was developed.

In 2005 Johnson Engineering Inc., with assistance from Fehér Environmental Consulting Inc., conducted a Preliminary Wildlife Hazard Assessment (PWHA) for RSW. The study area for the PWHA was limited to the Air Operations Area (AOA); and the wildlife observation data analyzed for the PWHA was gathered within the AOA by airport staff. The PWHA "recommended that the LCPA (Lee County Port Authority) consider conducting a Wildlife Hazard Assessment that would include the entire airport property and surrounding areas" as well as providing short-term and long-term options for reducing hazardous wildlife attractants. Then in 2007, upon completion of the FAA Certification Inspection of the airport, the Inspector requested a Wildlife Hazard Assessment be performed at RSW. As a result, LCPA retained Johnson Engineering to conduct this WHA.

The various hazardous wildlife management activities conducted at RSW are outlined in the LCPA's Airport Certification Manual and summarized in this Assessment. The LCPA monitors the environment on and near the airport for identification and location of features that attract wildlife. The LCPA has made addressing hazardous wildlife issues a daily operation and addresses them in the following ways: airfield management, wildlife monitoring, Border collie program, various other wildlife deterrent activities, Hazardous Wildlife Working Group, and land use planning with local agencies.

During this assessment, standardized sampling of wildlife took place from March 2008 through February 2009 in locations on and off airport property. There are six (6) sampling locations airside and ten (10) located landside. These sixteen (16) observation sites were selected based on approach and departure corridors for runway 6/24, areas known to attract hazardous wildlife and areas suspected of attracting hazardous wildlife. The observation sites also represent the various habitats located on airport property. General wildlife observations during the course of the study were recorded and an aerial survey of the airport out to 5 miles from the AOA was conducted. Nighttime spotlight surveys of the AOA, a small mammal trapping event within the AOA, and a wildlife attractant survey of airside structures were also conducted.

GIS (geographic information system) tools were used to create location map sheets for field data collection, and a GIS database was designed to store all field observations made during the course of this study. This process allowed locational information to be obtained from wildlife observations and stored alongside the data that describe the sightings in a geodatabase.

The observation sites located within and around the Southwest Conservation Area show the highest and most frequent relative risk. The high quality diverse habitats within the Southwest Conservation Area are attractive to a variety of wildlife; unfortunately many of those species are large and are a hazard to aviation.

Fall is the most active season for hazardous wildlife at RSW followed by spring and summer with winter being the least active. Based on monthly aircraft movements, peak hazardous wildlife activity (fall) at RSW over all does not coincide with peak aircraft movements (winter - spring) with the exception of some overlap in spring.

Vultures appear to contribute to the most relative risk at RSW. A vulture roost exists within the Southwest Conservation Area. Habitat modifications to the Southwest Conservation Area are recommended in order to diminish the quality of the attractant, not only for vultures, but for any potential hazardous bird species looking for a roost or nesting site.

Another species found to be hazardous at RSW are Cattle Egrets. They are attracted to the mowing activities and are roosting onsite in two confirmed locations. These areas could also act as rookeries and have the potential to accommodate larger numbers of birds and species than was observed. Mottled Ducks, also a hazardous species, are more numerous in the AOA in the canal adjacent to observation site 8 (known as Lake 4); with the majority of sightings made in winter. White-tailed deer are considered one of the most hazardous species to aircraft. Although white-tailed deer were observed throughout airport property, they were not observed within the AOA. Currently white-tailed deer do not appear to pose a risk to aircraft utilizing the AOA.

The final outcome of a WHA is a list of recommendations. The prominent recommendations resulting from this Assessment center on the Southwest and Northeast Conservation Areas located at either end of runway 6/24. The LCPA will need to confirm with the jurisdictional agencies the extent to which the airport is presently able to conduct necessary wildlife harassment and habitat modifications within the conservation areas to reduce the hazardous wildlife attractant. These activities may require a modification in the conservation easement language, or the possible removal of the conservation easement, over a portion of or the entire conservation areas. Other recommendations involve habitat modifications inside and outside the AOA, the removal of two confirmed Cattle Egret roosts, additional airfield management techniques, additional training of wildlife control personnel, modifications in the way airport wildlife occurrence data is collected and stored, additional wildlife monitoring on airport property, and updating the existing Wildlife Hazard Management Program to include these recommendations.

A summary of this WHA has been prepared in the form of a PowerPoint presentation, which is included in this document as Appendix V.

1.0 INTRODUCTION

Southwest Florida International Airport (RSW) is located approximately seven miles southwest of the City of Ft. Myers, in Lee County, Florida (Figure 1-1). The airport was certificated for commercial operation in 1983 and a new terminal was added in 2005. The airport operated in the original terminal, situated north of runway 6/24, until 2005 when the midfield terminal opened south of runway 6/24. In 2007, RSW served more than 8 million passengers and had 92,008 operations (movements). It is one of the top 50 airports in the U.S. for passenger traffic with more than 20 airline partners serving the airport.

RSW is a certificated airport as established by the Federal Aviation Administration (FAA) under Federal Aviation Regulation (FAR) Part 139 – Certification of Airports; as such the airport must comply with FAA regulations. FAR Part 139.337 Wildlife Hazard Management, requires airports to conduct Wildlife Hazard Assessments (WHA), if certain criteria are met. Historically and currently, Lee County Port Authority (LCPA) conducts numerous management actions to address hazardous wildlife concerns. However, the number and type of wildlife strikes occurring at an airport dictates when a WHA is conducted. According to paragraph (b) of §139.337 a certificate holder must conduct a wildlife hazard assessment when any of the following events occurs on or near the airport:

(1) An air carrier aircraft experiences multiple wildlife strikes;
(2) An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component;
(3) An air carrier aircraft experiences an engine ingestion of wildlife;
(4) Wildlife of a size, or in numbers, capable of causing an event described in paragraphs (b)(1), (b)(2), or (b)(3) of this section is observed to have access to any airport flight pattern or aircraft movement area.

Once a certificated airport has determined it must conduct a WHA, paragraph (c) of §139.337 provides the following guidance:

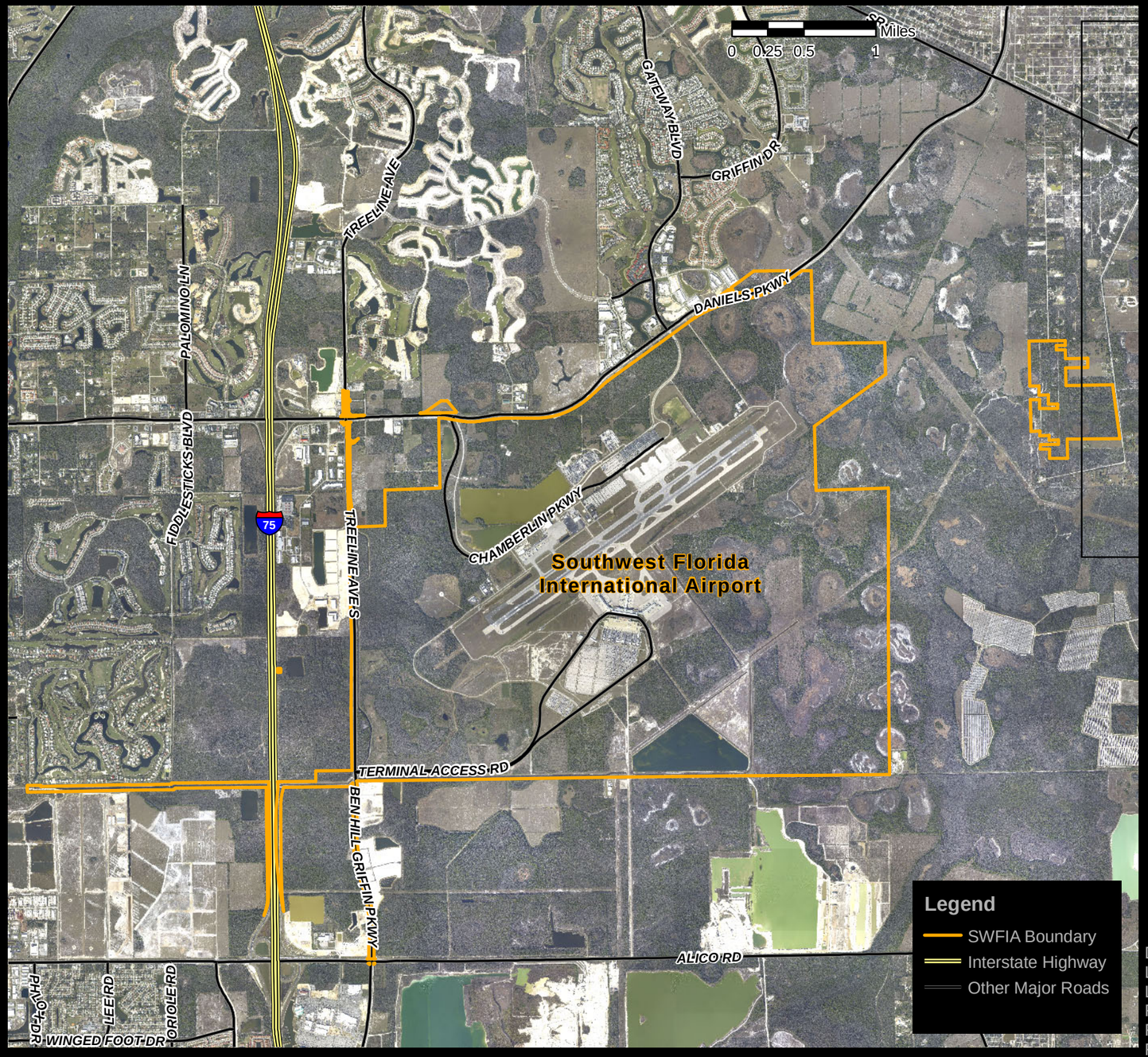
(c) The wildlife hazard assessment required in paragraph (b) of this section must be conducted by a wildlife damage management biologist who has professional training and/or experience in wildlife hazard management at airports or an individual working under direct supervision of such and individual. The wildlife hazard assessment must contain at least the following:

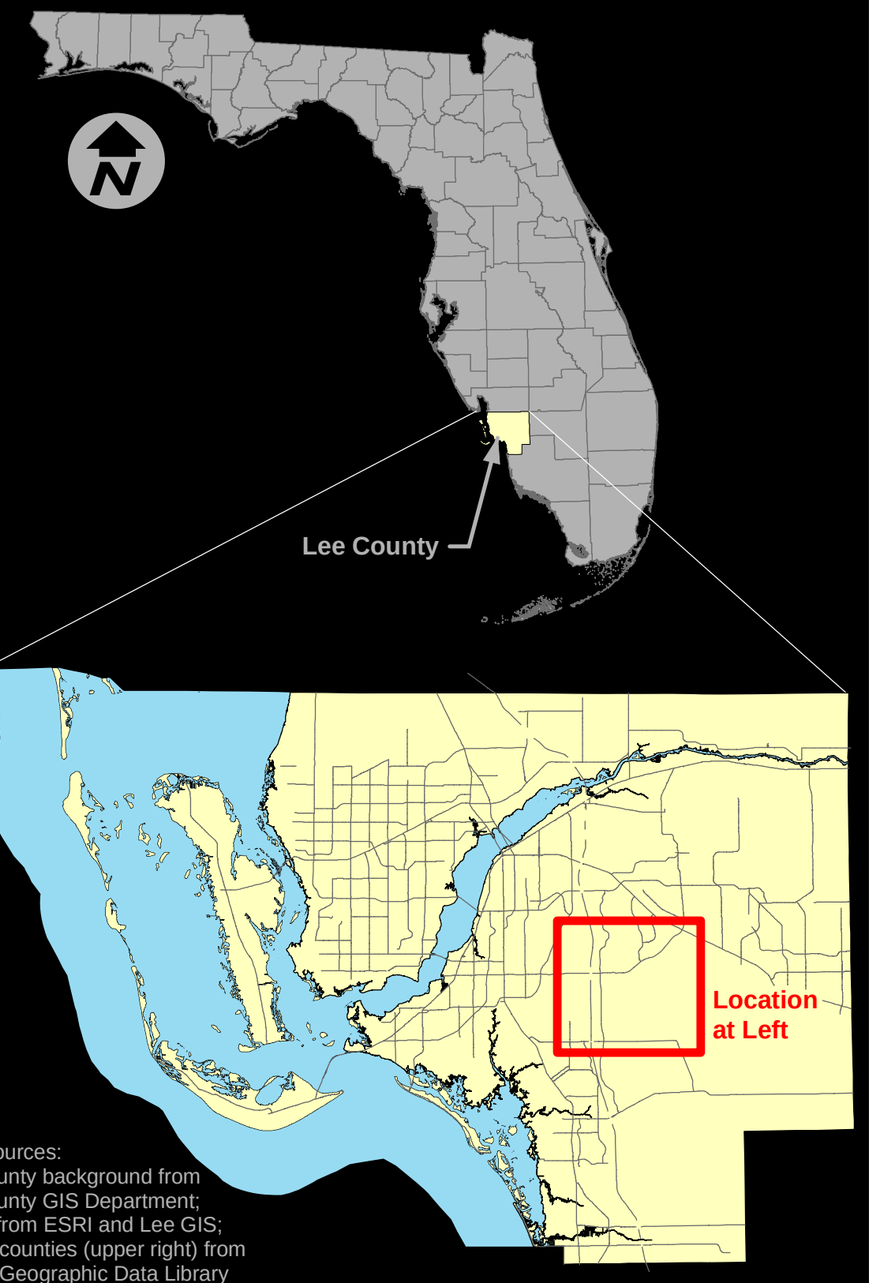
(1) An analysis of the events or circumstances that prompted the assessment.
(2) Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences.
(3) Identification and location of features on and near the airport that attract wildlife.
(4) A description of wildlife hazards to air carrier operations.

(5) Recommended actions for reducing identified wildlife hazards to air carrier operations.

The objective of this WHA is to meet the FAA requirements as outlined in FAR Part 139.337 (c) (1) through (5) Wildlife hazard management as listed above.

Beyond the guidelines set forth in FAR Part 139, this assessment was designed and implemented to provide a repeatable protocol, objective results, and to quantify the relative risk associated with the wildlife hazards at RSW by incorporating wildlife hazard rankings (Dolbeer et al. 2003). Specifically, this assessment can be used by airport staff as a guide to species-specific management at RSW to minimize future risk as is being proposed in the bird strike community (Dolbeer 2009).





Data Sources:
Lee County background from Lee County GIS Department;
Roads from ESRI and Lee GIS;
Florida counties (upper right) from Florida Geographic Data Library

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Figure 1-1 General Location

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046
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2.0 AN ANALYSIS OF EVENTS OR CIRCUMSTANCES THAT PROMPTED THE ASSESSMENT [FAR PART 139.337 (C) (1)]

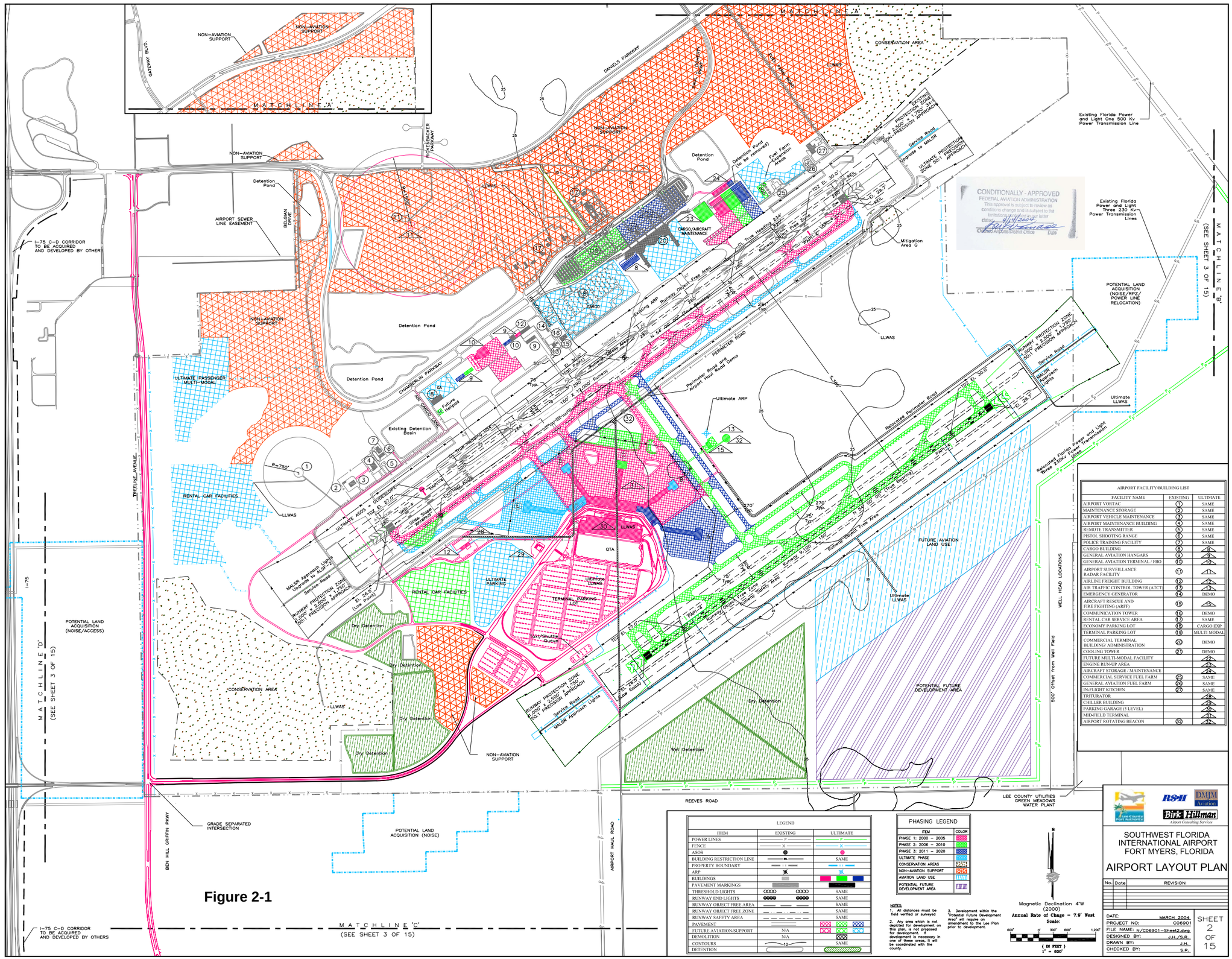
The following events prompted the WHA at RSW. The last WHA at RSW was a one-year study conducted in 1997-1998 by USDA Wildlife Services (WS 1998). At that time, the FAA did not require the submission of a Wildlife Hazard Management Plan (WHMP). In 2005 Johnson Engineering Inc., with assistance from Fehér Environmental Consulting Inc., conducted a Preliminary Wildlife Hazard Assessment (PWHA) for RSW (Johnson Engineering). The study area for the PWHA was limited to the Air Operations Area (AOA) and the analyzed wildlife observation data that was generated by airport staff. The PWHA "recommended that the LCPA consider conducting a Wildlife Hazard Assessment that would include the entire airport property and surrounding areas" as well as providing short-term and long-term options for reducing hazardous wildlife attractants (Johnson Engineering 2005). The former recommendation was made due to RSW meeting, at that time, the criteria set forth in FAR Part 139.337 (b) (1) through (4) requiring a WHA be conducted.

Since the completion of the PWHA, RSW constructed and is now operating out of a new 800,000 square foot terminal building that accommodates 28 gates. The midfield terminal is located south of the existing runway. The old terminal building, located to the north of the existing runway, was removed in the spring of 2006. Accompanying the new terminal building airside is a parallel taxiway, an aircraft circulation area, and a parking apron (See Figure 2-1 – RSW ALP). All of the new facilities and associated storm water management were designed and constructed in accordance with best management practices outlined in FAA Advisory Circular (AC) 150/5200-33B.

In 2007, upon completion of RSW's Annual Certification Inspection, the FAA inspector requested the following:

"Although the airport continues to control wildlife and has good control procedures in place, we feel it is time to reevaluate current conditions at the airport. We suggest a qualified wildlife biologist conduct a new assessment and it should determine if an official Wildlife Hazard Management Plan is required at this time."

Appendix A provides a full copy of the FAA Annual Certification letter. As a result of this correspondence, LCPA retained Johnson Engineering to conduct this WHA. The completed WHA will be submitted to the FAA as required in FAR Part 139.337 (d) which states "The wildlife hazard assessment required under paragraph (b) of this section must be submitted to the Administrator for approval and determination of the need for a wildlife hazard management plan…" The FAA will then make the determination of the need for a wildlife hazard management plan.



AIRPORT FACILITY/BUILDING LIST		
FACILITY NAME	EXISTING	ULTIMATE
AIRPORT VORTAC	1	SAME
MAINTENANCE STORAGE	2	SAME
AIRPORT VEHICLE MAINTENANCE	3	SAME
AIRPORT MAINTENANCE BUILDING	4	SAME
REMOTE TRANSMITTER	5	SAME
PISTOL SHOOTING RANGE	6	SAME
POLICE TRAINING FACILITY	7	SAME
CARGO BUILDING	8	8
GENERAL AVIATION HANGARS	9	9
GENERAL AVIATION TERMINAL / FBO	10	10
AIRPORT SURVEILLANCE RADAR FACILITY	11	11
AIRLINE FREIGHT BUILDING	12	12
AIR TRAFFIC CONTROL TOWER (ATCT)	13	13
EMERGENCY GENERATOR	14	DEMO
AIRCRAFT RESCUE AND FIRE FIGHTING (ARFF)	15	15
COMMUNICATION TOWER	16	DEMO
RENTAL CAR SERVICE AREA	17	SAME
ECONOMY PARKING LOT	18	CARGO EXP
TERMINAL PARKING LOT	19	MULTI MODAL
COMMERCIAL TERMINAL BUILDING/ ADMINISTRATION	20	DEMO
COOLING TOWER	21	DEMO
FUTURE MULTI-MODAL FACILITY		22
ENGINE RUN-UP AREA		23
AIRCRAFT STORAGE / MAINTENANCE		24
COMMERCIAL SERVICE FUEL FARM	25	SAME
GENERAL AVIATION FUEL FARM	24	SAME
IN-FLIGHT KITCHEN	27	SAME
TRITURATOR		28
CHILLER BUILDING		29
PARKING GARAGE (5 LEVEL)		30
MID-FIELD TERMINAL		31
AIRPORT ROTATING BEACON	32	32

LEGEND		
ITEM	EXISTING	ULTIMATE
POWER LINES	P	P
FENCE	X	X
ASOS		
BUILDING RESTRICTION LINE		SAME
PROPERTY BOUNDARY		
ARP		
BUILDINGS		
PAVEMENT MARKINGS		
THRESHOLD LIGHTS		SAME
RUNWAY END LIGHTS		SAME
RUNWAY OBJECT FREE AREA		SAME
RUNWAY OBJECT FREE ZONE		SAME
RUNWAY SAFETY AREA		SAME
PAVEMENT		
FUTURE AVIATION/SUPPORT	N/A	
DEMOLITION	N/A	
CONTOURS	10	SAME
DETENTION		

PHASING LEGEND	
ITEM	COLOR
PHASE 1: 2000 – 2005	
PHASE 2: 2006 – 2010	
PHASE 3: 2011 – 2020	
ULTIMATE PHASE	
CONSERVATION AREAS	
NON-AVIATION SUPPORT	
AVIATION LAND USE	
POTENTIAL FUTURE DEVELOPMENT AREA	

NOTES:
1. All distances must be field verified or surveyed
2. Any area which is not depicted for development on this plan, is not proposed for development. If development is necessary in one of these areas, it will be coordinated with the county.
3. Development within the "Potential Future Development Area" will require an amendment to the Lee Plan prior to development.

Magnetic Declination 4°W (2000)
Annual Rate of Change = 7.9' West
Scale:
600' 0' 300' 600' 1,200'
(IN FEET)
1" = 600'

Airport Consulting Services

SOUTHWEST FLORIDA INTERNATIONAL AIRPORT
FORT MYERS, FLORIDA

AIRPORT LAYOUT PLAN

No.	Date	REVISION

DATE: MARCH 2004
PROJECT NO: C06901
FILE NAME: N:\C06901-Sheet2.dwg
DESIGNED BY: J.H./S.R.
DRAWN BY: J.H.
CHECKED BY: S.R.

SHEET 2 OF 15

Figure 2-1

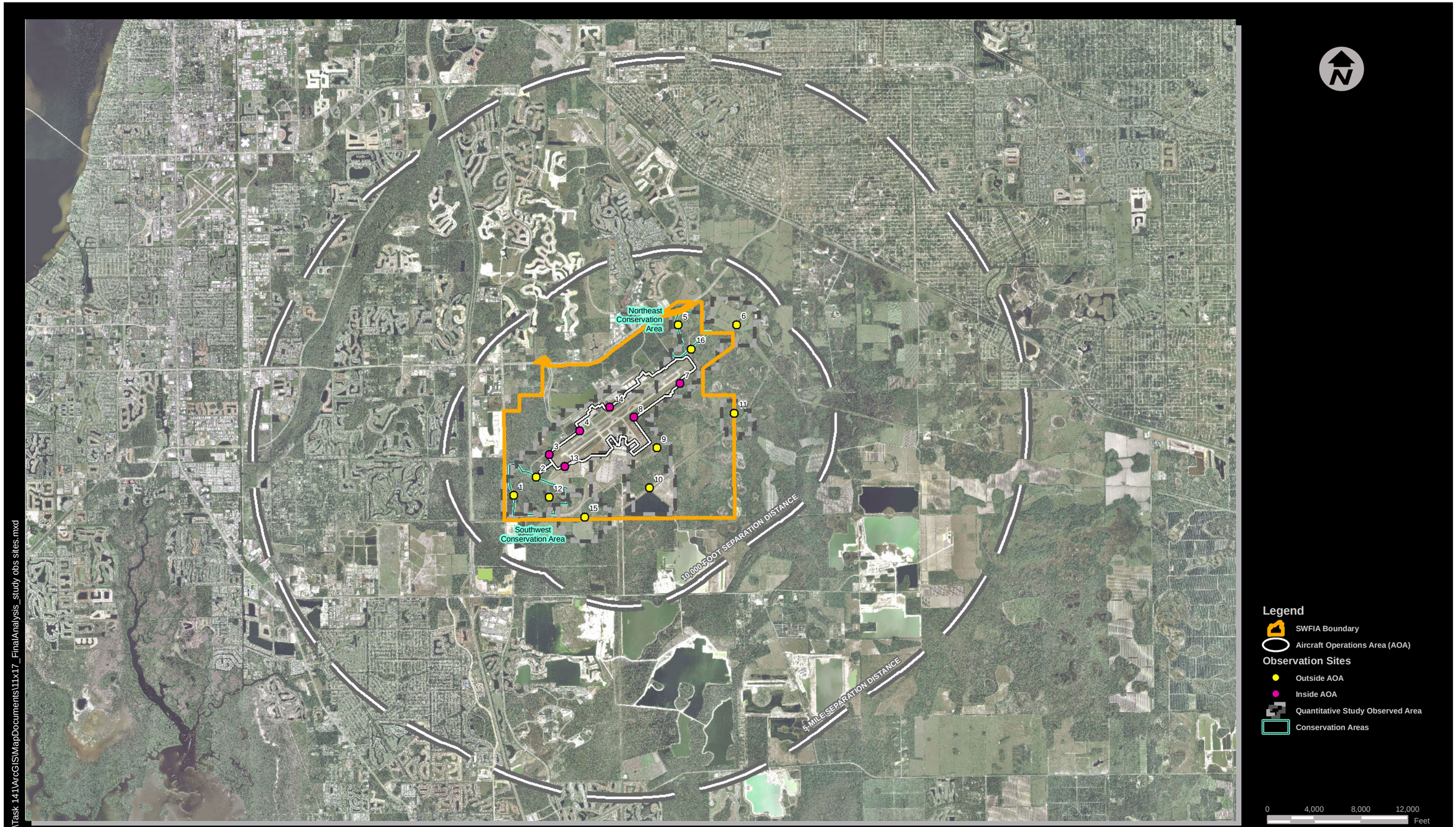
3.0 IDENTIFICATION OF THE WILDLIFE SPECIES OBSERVED, THEIR NUMBERS, LOCATIONS, LOCAL MOVEMENTS, AND DAILY AND SEASONAL OCCURRENCES [FAR PART 139.337 (C) (2)]

3.1 Study Site

Total airport property consists of 6,366.4 acres, of which 854.1 acres falls within the AOA. In general the airport is surrounded by a mosaic of land uses: transportation corridors, residential and commercial developments, golf courses, agriculture, remnant native habitats, and large tracts of preservation areas. Cover types for native habitats include pine flatwoods, herbaceous and forested wetlands, and mixed hardwoods. In addition, there are large scale open water storm water detention facilities.

Out of the approximately 6,366 acres that make up the airport property, approximately 1,136 acres represent the terminal, taxiways, runway, roads, parking lots, fixed base operators, and all other support facilities. The remaining 5,230 acres are comprised of canals, detention ponds, fallow farm fields, and undeveloped land in its natural state (refer to Appendix B for an airport-wide land use and cover map). There are 1,569 acres of natural wetlands on airport property. There are also two onsite preserves totaling 475 acres. These preserves were mitigation for wetland impacts from the runway 6/24 extension project conducted in 1993 and are under a conservation easement granted to the Florida Department of Environmental Protection.

Sixteen (16) observation sites were selected for the WHA at RSW. For the purposes of this assessment, the standardized sampling locations on and off airport property were divided into airside and landside portions. There are six (6) sampling locations airside and the remaining ten (10) are landside (see Figure 3-1 Study Area map). These sites were selected based on approach and departure corridors for runway 6/24, areas known to attract hazardous wildlife, and areas suspected of attracting hazardous wildlife (see Figure 3-1b Study Area Overlaid with Lee County Future Land Use Designations map). The observation sites also represent the various habitats located on airport property. There was one sampling location located off airport property, observation site 6, which was located on a Florida Power and Light easement. This site was selected to access the area off the extended runway centerline of runway 6. A detailed description and photos for each sampling location is provided in Appendix C.



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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Figure 3-1 Study Area Showing Observation Sites

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

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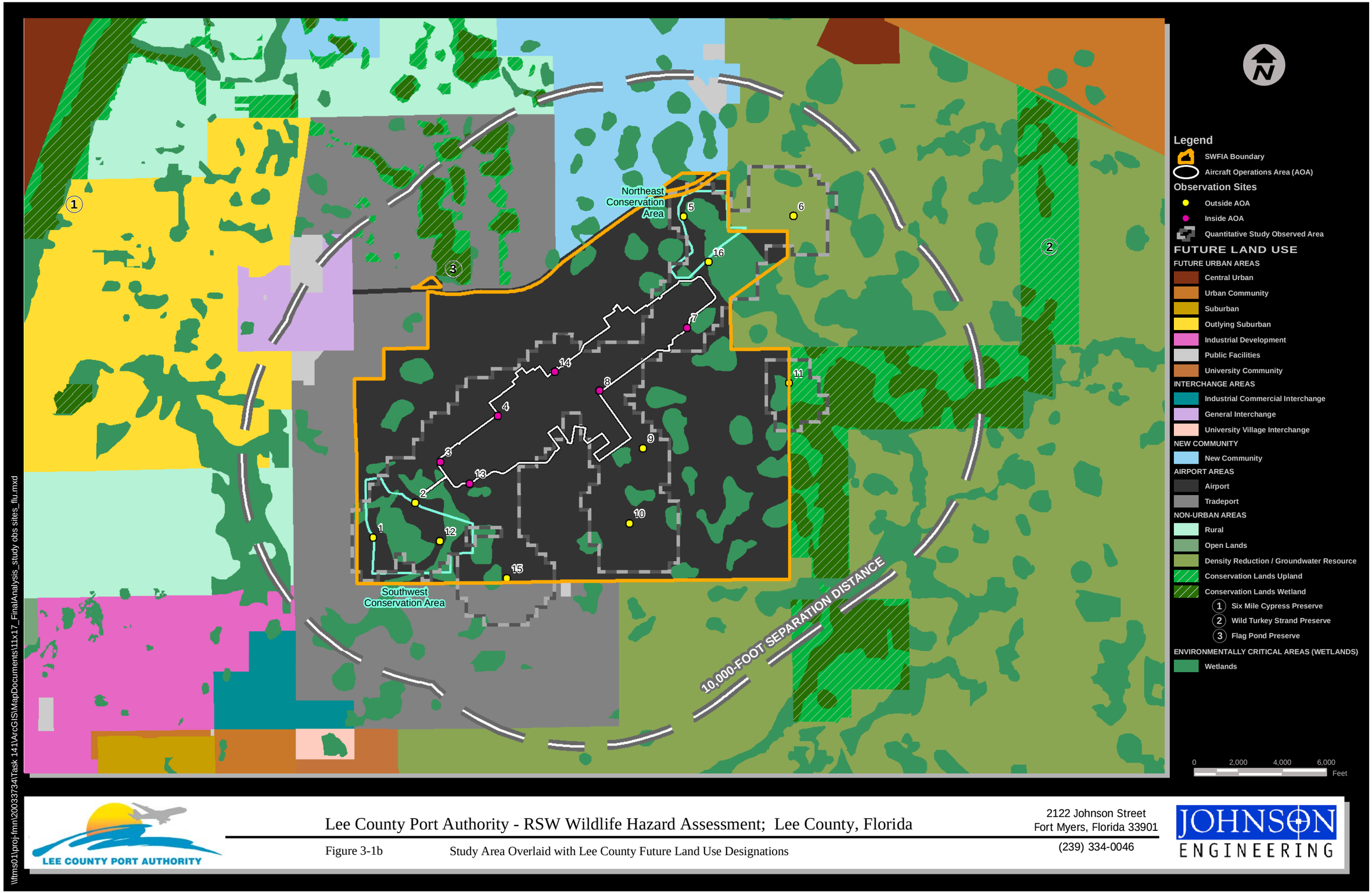

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Figure 3-1b Study Area Overlaid with Lee County Future Land Use Designations

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

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3.2 Study Methodology

3.2.1 Standardized Sampling - Airside And Landside Observation Sites

Each of the sixteen (16) observation sites, or stations, were visited once a month for each of the three time periods, dawn, midday, and dusk. Surveys were completed for 12 consecutive months; March 2008 through February 2009. Each of the six (6) sampling locations within the AOA were also visited a total of 9 separate times for nighttime observations during the study period. At the completion of the study, there were a total of 630 total observation site visits completed.

Wildlife observations were made at each station for 5 minutes and a timer or stop watch was utilized to keep track of time. Each wildlife sighting was recorded on a data sheet and corresponding data map specific to the station. The information recorded included the following: date, observation period, season, observer(s), sunrise/sunset times, weather, station number, time observation began, species observed, number of individuals, activity, location, flight direction, and any comments. Flight direction was determined from the symbols recorded on the data maps. A sample datasheet and data map is included in Appendix D.

The observation time periods were defined as follows: dawn – 3 hours from sunrise, midday – 1100-1400, dusk – 3 hours prior to sunset, and nighttime – at least one half hour after sunset. The seasons were defined using equinox and solstice dates: fall – 09/22 through 12/20, winter – 12/21 through 03/19, spring – 03/20 through 06/20, and summer – 06/21 through 09/21. The sky and wind (Beaufort Wind Scale) codes established for the Frog Watch monitoring program (2008) were utilized to described weather conditions; these codes are defined in Appendix D. Wildlife species recorded included: all birds by sight and sound, large, medium and small mammals, alligators, turtles, other reptiles. During the nighttime observations, frog species were recorded based on call recognition, simply to record their presence or absence.

Codes were established for each species, activity, location, and flight direction. The 4-letter English name codes utilized for birds are the ones established by Pyle and DeSante (2007) from the Institute for Bird Populations. The codes utilized for all other wildlife observations were developed specifically for this project using the same 4-letter standardized principles as established by Pyle and DeSante. A full list of wildlife species codes is included in Table 3-3.

3.2.2 General Observation Area Surveys

A general observation map, 24-by-36-inch map, was created to capture qualitative or non-standardized sampling data for wildlife sightings outside of the five-minute regular observation periods (see sample qualitative observations map in Appendix E). This map simply showed the boundaries of the airport property, overlaid by a 400’ by 400’ grid, the aerial imagery, and the locations of the sampling stations. Wildlife observations were recorded on this map anytime when traveling on airport property, between stations, and while traveling on the sections of Treeline Avenue and Daniels Parkway that are adjacent to airport property. The general observations included all wildlife species visible (i.e., mammals and birds), including

birds in flight. Methodology for the general observations was identical to the standardized sampling (i.e. codes, times, and seasons) with one exception: flight location was not recorded for observations of birds in flight.

3.2.3 Aerial Survey

An aerial survey was conducted with assistance from the Lee County Mosquito Control District on March 12, 2009 to document wildlife habitat use within the 10,000 foot and 5 mile separation distances from the RSW AOA perimeter (FAA 2007) and locate potential wildlife attractants. Two observers recorded observations from a Bell 407 helicopter flying at an elevation ranging from 300-500 feet between the hours of 1600 and 1700. The flight path was chosen to sample areas that were not surveyed during the standardized and general sampling (see aerial survey map in Appendix F). Congregations of birds were GPS located, estimated count, and identified to species when possible.

3.2.4 Spotlight Surveys

Spotlight surveys were conducted once a month from April through December 2008 on the AOA perimeter road covering approximately 4.7 miles by traveling a predefined route at approximately 10 miles per hour. Stops were made at the six AOA observation sites (3, 4, 7, 8, 13, & 14, see study area map Figure 3-1) for a period of five minutes; observers listened for three minutes and shone the spot light in a 360 degree rotation for the remaining two minutes. Surveys began one half hour after sunset and were not conducted in inclement weather. All species observed by sight and/or sound were recorded and identified if possible. Observations were recorded in the same manner, i.e. on an aerial photo and data sheet, as the standardized observations.

3.2.5 Small Mammal Trapping

Small mammal trapping was conducted in the AOA using Sherman live traps placed on a transect spaced approximately 10 meters apart. Ten traps were set at dusk in three locations (by observation sites 4, 7, & 13) and checked the following morning. Traps were set near the water's edge of storm water canals and ponds under herbaceous cover to maximize capture. The traps were baited with rolled oats. Small mammals captured were identified to species and released.

3.3 Data Collection And Analysis

GIS (geographic information system) tools were used to create location map sheets to use in the field, and a GIS database was designed to store field observations made by qualified wildlife biologists during the course of the WHA study. This process allowed locational information to be obtained from wildlife observations and stored alongside the data that describe the sightings in a geodatabase. The geodatabase is the data storage and data management framework for ArcGIS. It acts as an organizational tool to store and manage data, and is also the gateway into advanced GIS capabilities (ESRI 2008). Wildlife data in the geodatabase were then

able to be analyzed and visually displayed in map exhibits at various points throughout the assessment.

A spatial grid was created to cover an area which included the entire airport property as well as adjacent areas within approximately 2,000 feet of the outer observation sites. A grid composed of squares 400 feet on each side was chosen as having the optimal resolution for this study. This grid was used as the basis for all of the standardized data collection conducted throughout the assessment as well as for the data analysis and graphical presentation as shown in section 3.4. Further details on the GIS methodology used in the WHA are located in Appendix G.

3.3.1 Relative Hazard Score And Relative Risk

A value was generated for each quadrant of the airport-wide spatial grid based on the standardized wildlife observations made in each grid. The algorithm applied to each quadrant is summarized in the equation below:

$$\Sigma\ [(N)\ (RHS)\ (\text{frequency of } N)] = \text{risk value}$$

Where Σ represents the total sum, N is the total number of individuals for each species, and RHS is the relative hazard score (Dolbeer et al. 2003). The frequency of N was the number of times each species was observed at that station divided by the total number of visits to that station for a specific time period (dawn, midday, dusk, nighttime).

The final result maps as shown in section 3.4 created for this analysis indicate relative risk by multiplying probability and hazard. Allan (2000) defines hazard as "a situation that, in particular circumstances, could lead to harm. Hazard describes only the situation that exists not the probability of possible severity of any outcome". In this study, the hazard was the species observed and their numbers in a specific time period (dawn, midday, dusk or nighttime) in each season. The probability relates to the likelihood of a species or species group being struck and causing damage. The relative hazard score and frequency of a species observed at the observation site were multiplied to obtain the probability. According to the Bird Strike Committee USA (2008), "a common definition of risk is that it is the combination of a specific hazard and the likelihood that the hazard occurs." The algorithm described above to obtain the risk value for each grid quadrant was developed based on the general equation from Bird Strike Committee USA as illustrated below.

RISK = PROBABILITY x HAZARD

In this study, the risk value is relative because the algorithm does not consider the actual aircraft movements at this airport. The location of quadrants relative to aircraft movement, and the risk value of each quadrant were however considered when presenting the recommendations for specific locations on the airport.

The grid quadrants were classified on a relative scale into four categories: low, moderately low, moderate, and high risk. The divisions, or breaks, between these categories

were obtained using a nested means methodology (for a full explanation of a nested means classification methodology see Appendix G – GIS). The division of risk scores is illustrated in Table 3-1 below.

Table 3-1 – Division of Relative Risk Scores

Relative risk level	Risk score range	Color value on the result maps
Low	0.1 – 177.60	Light green
Moderately low	179.34 – 316.10	Dark green
Moderate	321.21 – 1061.38	Yellow
High	1084.63 – 3855.06	Red

Species observed were classed as high, medium, or low hazard based on the relative hazard scores attributed to each species or species group from Dolbeer et al. (2003). The reason for the hazard classes or guilds was to help summarize the results and group species by similar hazard level. In developing the relative hazard score, Dolbeer et al. (2003) found a strong correlation between size of a species and risk level, therefore the hazard guild breaks are based on size of the species or species groups. Table 3-2 below lists the species and species groups having a relative hazard score and the risk class they were grouped into.

Table 3-2 – Species Groups, Their Relative Hazard Score And Guild Split

Species group	Relative hazard score	Hazard guild
Deer	100	HIGH
Vultures	64	
Cormorants/pelicans	54	
Cranes	47	
Eagles	41	
Ducks	39	
Osprey	39	
Turkey	33	
Herons	27	
Hawks	25	
Gulls	24	MEDIUM
Rock Pigeon	23	
Owls	23	
Crows	16	
Coyote	14	
Mourning Dove	14	
Shorebirds	10	LOW
Blackbirds/starling	10	
American Kestrel	9	
Meadowlarks	7	
Swallows	4	
Sparrows	4	
Nighthawks	1	

3.4 Wildlife Species Numbers, Locations, Local Movements, and Daily and Seasonal Occurrences

3.4.1 Wildlife Species Observed

Table 3-3 provides a listing of all wildlife species recorded during the standardized and general sampling throughout the course of this WHA. The table also includes the legal status for those species listed with the US Fish and Wildlife Service (USFWS) and the Florida Fish and Wildlife Conservation Commission, the total number of each species observed, the species code utilizing for recording on data sheets, the flock size utilized in the data analysis (explained in Appendix G), the relative hazard score (Dolbeer 2003), the hazard guild as explained below in section 3.4.2, the species guild and size. The species guild and size were utilized during the wildlife strikes analysis of this WHA to group and categorize species (see section 5.1).

Table 3-3 Summary of All Species Observed During Standardized and General Sampling, their Numbers and Additional Attribute Information

SPECIES NAME	legal status USFWS[1]	legal status FWC[2]	Total Observed	# of Sightings	Species Code	Flock Size	RHS	Hazard Guild	Species Guild	Size
BIRDS										
AMERICAN BITTERN			2	2	AMBI		27	High Hazard	wadingbird	large
AMERICAN COOT			95	21	AMCO		0		waterfowl	medium
AMERICAN CROW			51	28	AMCR		16	Medium Hazard	corvid	medium
AMERICAN KESTREL			83	78	AMKE		9	Low Hazard	raptor	small
AMERICAN ROBIN			41	2	AMRO		0		grassland bird	small
ANHINGA			119	106	ANHI		0		wadingbird	large
AMERICAN WHITE PELICAN			77	3	AWPE		54	High Hazard	wadingbird	large
BARRED OWL			5	5	BADO		23	Medium Hazard	raptor	large
BALD EAGLE	Threatened	Threatened	12	10	BAEA		41	High Hazard	raptor	large
BARN SWALLOW			3	2	BARS	21	4	Low Hazard	passerine	small
BLACK-BELLIED WHISTLING-DUCK			7	1	BBWD		0		waterfowl	large
BLACK-CROWNED NIGHT-HERON			5	4	BCNH		27	High Hazard	wadingbird	large
BELTED KINGFISHER			15	13	BEKI		0		shorebird	medium
BLUE-GRAY GNATCATCHER			45	39	BGGN		0		passerine	small
BLUE JAY			10	9	BLJA		0		corvid	small
BLACK VULTURE			462	197	BLVU		64	High Hazard	raptor	large
BLACK-NECKED STILT			30	17	BNST		0		shorebird	medium
BOAT-TAILED GRACKLE			106	27	BTGR	2	10	Low Hazard	blackbird	medium
BLUE-WINGED TEAL			76	8	BWTE		39	High Hazard	waterfowl	medium
CATTLE EGRET			1,714	192	CAEG		27	High Hazard	grassland bird	large
CAROLINA WREN			42	40	CARW		0		passerine	small
COMMON GROUND-DOVE			27	17	COGD		0		grassland bird	small
COMMON GRACKLE			1,672	258	COGR	4	10	Low Hazard	blackbird	medium
COMMON MOORHEN			212	92	COMO		0		waterfowl	medium
COMMON NIGHTHAWK			55	17	CONI		1	Low Hazard	goatsucker	small
COMMON YELLOWTHROAT			2	2	COYE		0		passerine	small
CHUCK-WILL'S-WIDOW			6	6	CWWI		1	Low Hazard	goatsucker	small
DOUBLE-CRESTED CORMORANT			25	24	DCCO		54	High Hazard	waterfowl	large
DOWNY WOODPECKER			12	8	DOWO		0		woodpecker	small
EASTERN MEADOWLARK			115	100	EAME	3	7	Low Hazard	grassland bird	small
EURASIAN COLLARED-DOVE			4	3	EUCD		0		grassland bird	medium
EUROPEAN STARLING			121	12	EUST	5	10	Low Hazard	blackbird	small
GREAT BLUE HERON			83	82	GBHE		27	High Hazard	wadingbird	large
GREAT CRESTED FLYCATCHER			3	3	GCFL		0		passerine	small
GREAT HORNED OWL			5	5	GHOW		23	Medium Hazard	raptor	large
GLOSSY IBIS			253	32	GLIB		27	High Hazard	wadingbird	large
GRAY CATBIRD			45	35	GRCA		0		passerine	small
GREAT EGRET			478	334	GREG		27	High Hazard	wadingbird	large
GREEN HERON			6	6	GRHE		27	High Hazard	wadingbird	medium
GREATER YELLOWLEGS			3	2	GRYE	2	10	Low Hazard	shorebird	medium
KILLDEER			207	72	KILL	4	10	Low Hazard	shorebird	small
LITTLE BLUE HERON		Species of Special Concern	168	134	LBHE		27	High Hazard	wadingbird	large
LEAST TERN		Species of Special Concern	35	10	LETE		0		shorebird	small
LESSER YELLOWLEGS			5	3	LEYE	5	10	Low Hazard	shorebird	small
LIMPKIN			4	2	LIMP		0		wadingbird	large
LOGGERHEAD SHRIKE			30	28	LOSH		0		passerine	small
MALLARD			5	2	MALL		39	High Hazard	waterfowl	large
MIXED FLOCK			146	5	MIX		0			
MOURNING DOVE			441	201	MODO	3	14	Medium Hazard	grassland bird	small
MOTTLED DUCK			501	179	MODU		39	High Hazard	waterfowl	large
NORTHERN BOBWHITE			1	1	NOBO		0		grassland bird	small
NORTHERN CARDINAL			111	104	NOCA		0		passerine	small
NORTHERN FLICKER			1	1	NOFL		0		woodpecker	medium
NORTHERN HARRIER			10	10	NOHA		25	High Hazard	raptor	large
NORTHERN MOCKINGBIRD			33	29	NOMO		0		passerine	small
NORTHERN ROUGH-WINGED SWALLOW			4	2	NRWS	28	4	Low Hazard	passerine	small
OSPREY			15	15	OSPR		39	High Hazard	raptor	large
PALM WARBLER			26	12	PAWA		0		passerine	small
PIED-BILLED GREBE			60	38	PBGR		0		waterfowl	medium
PINE WARBLER			10	10	PIWA		0		passerine	small
PILEATED WOODPECKER			12	11	PIWO		0		woodpecker	medium
PURPLE MARTIN			16	5	PUMA	7	4	Low Hazard	passerine	small
RED-BELLIED WOODPECKER			61	60	RBWO		0		woodpecker	small
RING-NECKED DUCK			41	9	RNDU		39	High Hazard	waterfowl	medium
ROCK PIGEON			27	2	ROPI	1	23	Medium Hazard	grassland bird	medium
ROSEATE SPOONBILL			8	6	ROSP		27	High Hazard	wadingbird	large
ROYAL TERN			3	3	ROYT		0		shorebird	medium
RED-SHOULDERED HAWK			210	190	RSHA		25	High Hazard	raptor	large

Table 3-3 Summary of All Species Observed During Standardized and General Sampling, their Numbers and Additional Attribute Information

SPECIES NAME	legal status USFWS[1]	legal status FWC[2]	Total Observed	# of Sightings	Species Code	Flock Size	RHS	Hazard Guild	Species Guild	Size
BIRDS (continued)										
RED-TAILED HAWK			3	3	RTHA		25	High Hazard	raptor	large
RED-WINGED BLACKBIRD			108	76	RWBL	7	10	Low Hazard	blackbird	small
SANDHILL CRANE[3]		Threatened	56	33	SACR		47	High Hazard	grassland bird	large
SAVANNAH SPARROW			2	2	SAVS	18	4	Low Hazard	passerine	small
SNOWY EGRET		Species of Special Concern	89	37	SNEG		27	High Hazard	wadingbird	large
SOLITARY SANDPIPER			1	1	SOSA	8	10	Low Hazard	shorebird	small
SPOTTED SANDPIPER			1	1	SPSA	9	10	Low Hazard	shorebird	small
SHARP-SHINNED HAWK			5	3	SSHA		0		raptor	large
SWALLOW-TAILED KITE			60	43	STKI		0		raptor	large
TREE SWALLOW			3,122	46	TRES	19	4	Low Hazard	passerine	small
TRICOLORED HERON		Species of Special Concern	101	84	TRHE		27	High Hazard	wadingbird	large
TUFTED TITMOUSE			1	1	TUTI		0		passerine	small
TURKEY VULTURE			355	210	TUVU		64	High Hazard	raptor	large
UNIDENTIFIED LARUS GULL			5	4	ULGU		24	Medium Hazard	shorebird	
UNIDENTIFIED BIRD			83	16	UNBI		0			
UNIDENTIFIED BLACKBIRD			719	14	UNBL	4	10	Low Hazard	blackbird	small
UNIDENTIFIED DUCK			7	2	UNDU		39	High Hazard	waterfowl	
UNIDENTIFIED SANDPIPER			43	6	UNSD	3	10	Low Hazard	shorebird	
UNIDENTIFIED SPARROW			15	4	UNSP	14	4	Low Hazard	passerine	small
UNIDENTIFIED TERN			12	6	UNTR		0		shorebird	
UNIDENTIFIED VULTURE			856	214	UNVU		64	High Hazard	raptor	large
UNIDENTIFIED WARBLER			26	14	UNWA		0		passerine	small
WHITE-EYED VIREO			17	17	WEVI		0		passerine	small
WHITE IBIS		Species of Special Concern	963	126	WHIB		27	High Hazard	wadingbird	large
WILSON'S SNIPE			5	5	WISN		10	Low Hazard	shorebird	small
WILD TURKEY			36	10	WITU		33	High Hazard	grassland bird	large
WINTER WREN			2	2	WIWR		0		passerine	small
WOOD DUCK			10	6	WODU		39	High Hazard	waterfowl	medium
WOOD STORK	Endangered	Endangered	29	16	WOST		27	High Hazard	wadingbird	large
YELLOW-RUMPER WARBLER			2	1	YRWA		0		passerine	small
MAMMALS										
ARMADILLO			5	5	DILLO		0		medium mammal	
BOBCAT			2	2	BOB		0		medium mammal	
DEER			136	57	DEER		100	High Hazard	large mammal	
FERAL CAT			2	2	CAT		0		medium mammal	
FERAL HOG			73	26	HOG		0		large mammal	
GREY SQUIRREL			1	1	GSQU		0		small mammal	
RACOON			11	6	COON		0		medium mammal	
RABBIT			3	3	RABB		0		medium mammal	
RIVER OTTER			7	7	OTTER		0		medium mammal	
REPTILES										
ALLIGATOR		Species of Special Concern	44	40	ALLI		0		herp	
TURTLE			28	12	TURT		0		herp	
AMPHIBIANS										
BRONZE FROG			2	2	BRFR		0		herp	
BARKING TREE FROG			1	1	BTFR		0		herp	
CRICKET FROG			77	55	CRFR		0		herp	
CUBAN TREE FROG			17	13	CTFR		0		herp	
EASTERN NARROWMOUTH TOAD			3	3	ENMT		0		herp	
GREEN TREE FROG			16	15	GTFR		0		herp	
OAK TOAD			4	4	OATO		0		herp	
PIG FROG			9	10	PIFR		0		herp	
PINE WOODS TREE FROG			2	2	PWTF		0		herp	
SOUTHERN TOAD			1	1	SOTO		0		herp	
Total:	**2**	**9**	**15,496**							

NOTES:

1. USFWS - U.S. Fish and Wildlife Service
2. FWC - Florida Fish and Wildlife Conservation Commission
3. Their observed breeding at RSW confirms them as the Florida Sandhill Crane.

3.4.2 Standardized Sampling Results

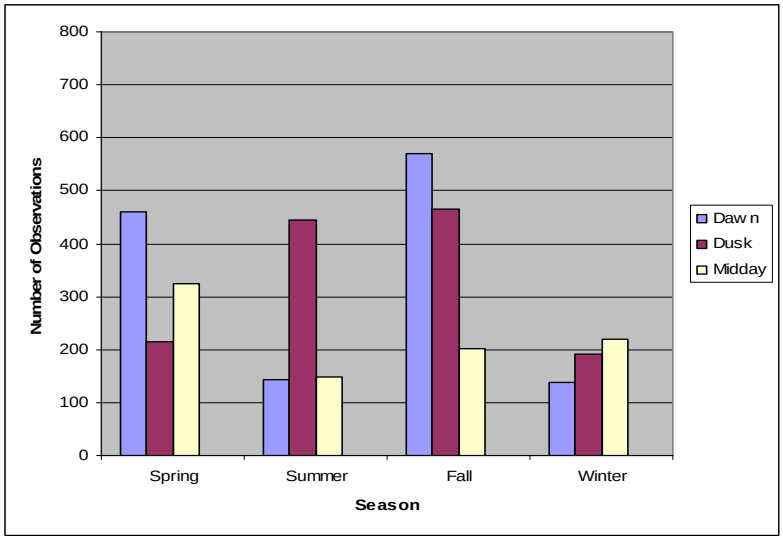
The results of the wildlife observation data collected over the 12-month (03/2008 – 02/2009) assessment is presented here in tabular and graphical form first, and then followed by seasonal cumulative hazard maps. For each season, we describe the wildlife species observed, their numbers, locations, local movements, and daily occurrences. The maps and results for the standardized sampling are also referred to as the quantitative results.

There were 3,520 total bird observations (see section 3.4.7 for results of mammal observations) recorded for the duration of the study during the standardized observations. They are summarized by season and time period in Table 3-4 and Figure 3-2.

Table 3-4 Total Number of Birds Observed During Standardized Observations, by Season and Time Period

Season	Quantitative			
	Dawn	Midday	Dusk	**Total**
Spring	460	325	215	**1,000**
Summer	142	149	445	**736**
Fall	569	201	466	**1,236**
Winter	137	219	192	**548**
Total	**1,308**	**894**	**1,318**	***3,520***

Figure 3-2 Total Number of Birds Observed During Standardized Observations, by Season and Time Period



Observations were recorded by time period, i.e. dawn, midday, and dusk. The dusk observations (n=1,318) and dawn observations (n=1,308) were about equal, with midday (n=894) being the least active time period.

The fall season (n=1,236) had the highest number of observations, followed by spring (n=1,000). Summer (n=736) and winter (n=548) had the lowest number of observations. Wading birds were the most common guild observed in the fall (n=325), followed closely by raptors (271). Other common guilds observed in the fall include passerines (n=170) and blackbirds (n=157). The most common species observed in the fall included White Ibis (*Eudocimus albus*) (n=199) and Tree Swallows (*Tachycineta bicolor*) (n=170). However, Black Vultures (*Coragyps atratus*) and Turkey Vultures (*Cathartes aura*) together totaled 253 of the fall observations.

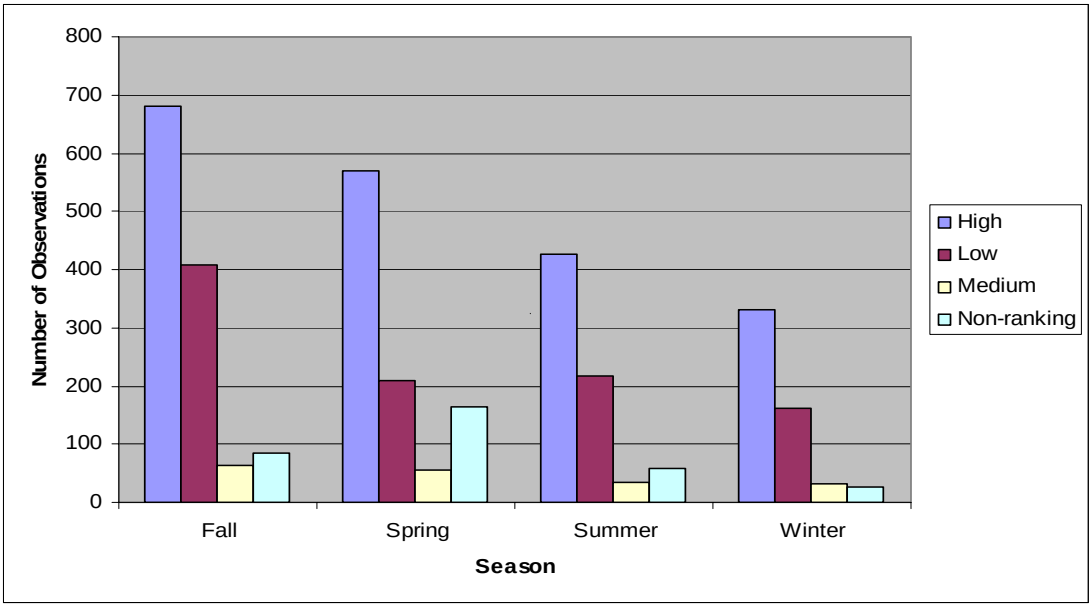
The most common guild observed in the spring was raptors (n=379) followed by blackbirds (n=145) and wading birds (n=116). The most common species observed included Black and Turkey Vultures (n=335) collectively, and Common Grackles (*Quiscalus quiscula*) (n=115). Wading birds were the most common guild observed in the summer season (n=208) and raptors were the most common guild (n=204) in the winter season.

Table 3-5 and Figure 3-3 show the observation data classified by hazard guild. The species and species groups belonging to these hazard guilds are listed in Table 3-2 in section 3.3.1. The highest number of observations (n=2,006) were birds in the high hazard guild, followed by the low hazard guild (n=997), non-ranking species (i.e. no associated hazard score, n=332), and medium hazard (n=185).

Table 3-5 Total Number of Birds Observed During Standardized Observations, by Hazard Guild

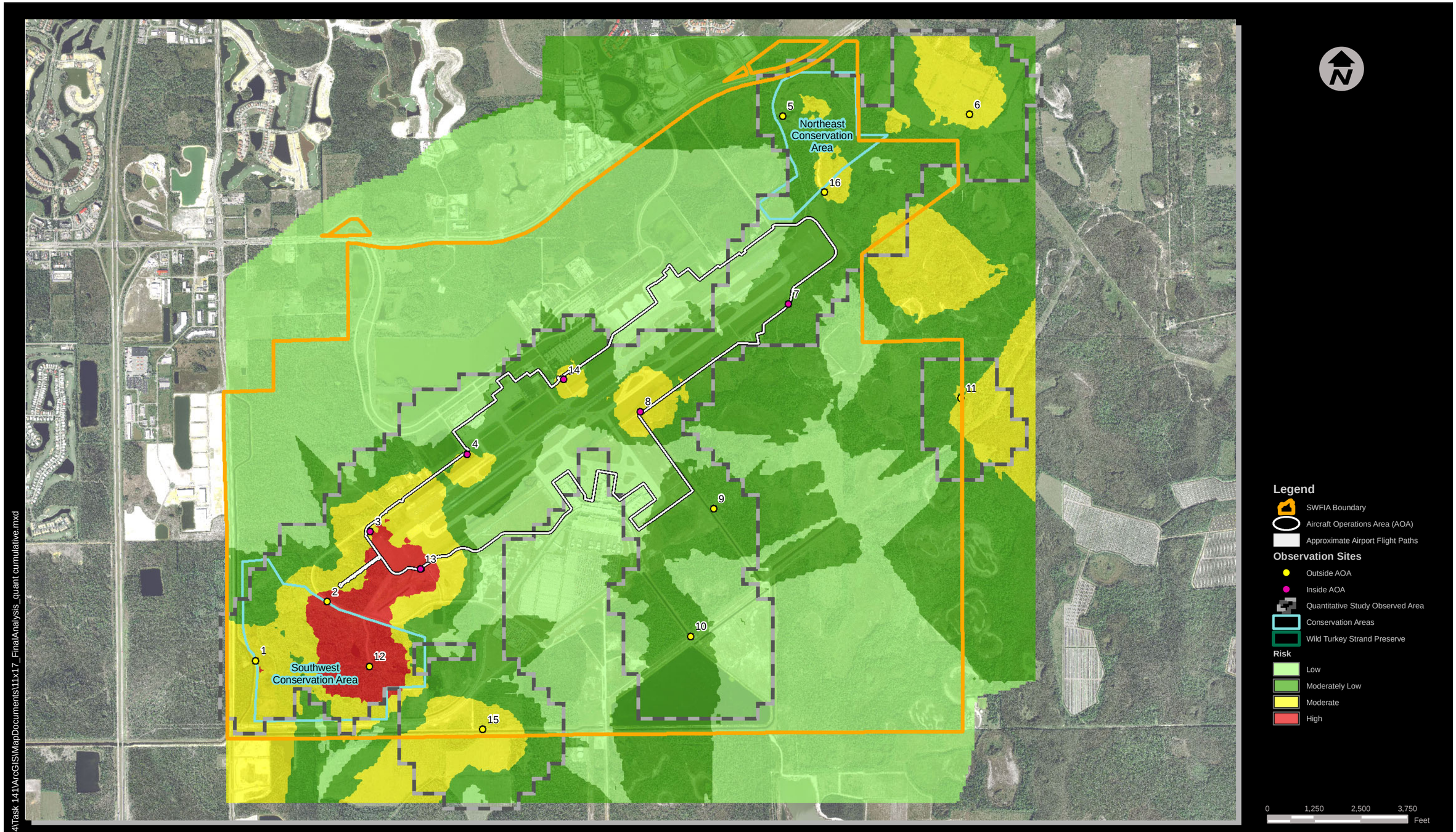
	Quantitative				
Season	Low	Medium	High	Non-ranking species	**Total**
Spring	210	56	570	164	**1,000**
Summer	218	34	426	58	**736**
Fall	408	64	680	84	**1,236**
Winter	161	31	330	26	**548**
Total	**997**	**185**	**2,006**	**332**	***3,520***

Figure 3-3 Total Number of Birds Observed During Standardized Observations, by Hazard Guild



The overall and seasonal cumulative hazard maps provide a way to compare activity between stations and seasons, respectively. However, the cumulative scores should not be used to determine what time of day and or location that relative risk occurs on RSW, since the results are cumulative for the entire season.

The overall cumulative map, created using the ArcGIS Spatial Analyst tool, is helpful in showing the areas at RSW that are most consistently attracting hazardous wildlife species through an entire year (see Figure 3-4). Additional cumulative quantitative maps were created for each season (see Figures 3-5 through 3-8). These maps show the seasonal trends of hazardous wildlife at RSW. Fall is the most active season for hazardous wildlife followed by spring then summer, and winter being the least active.



\\fmsv01\proj-fmn\20033734\Task 141\ArcGIS\MapDocuments\11x17_FinalAnalysis_quant cumulative.mxd

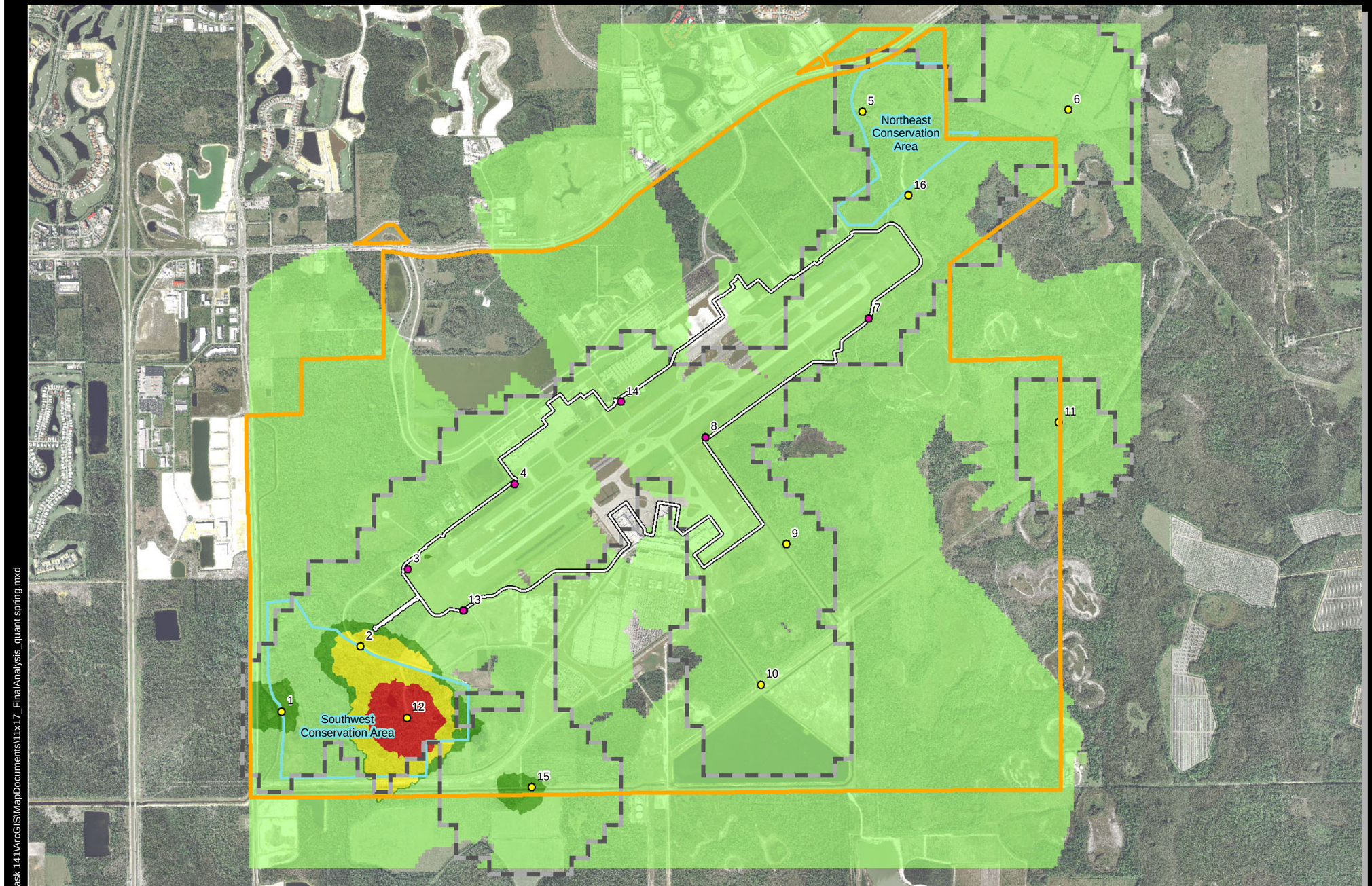
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Figure 3-4 Quantitative Hazard Scores - Cumulative

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



\\ftms01\proj-fmm\20033734\Task 141\ArcGIS\MapDocuments\11x17_FinalAnalysis_quant spring.mxd

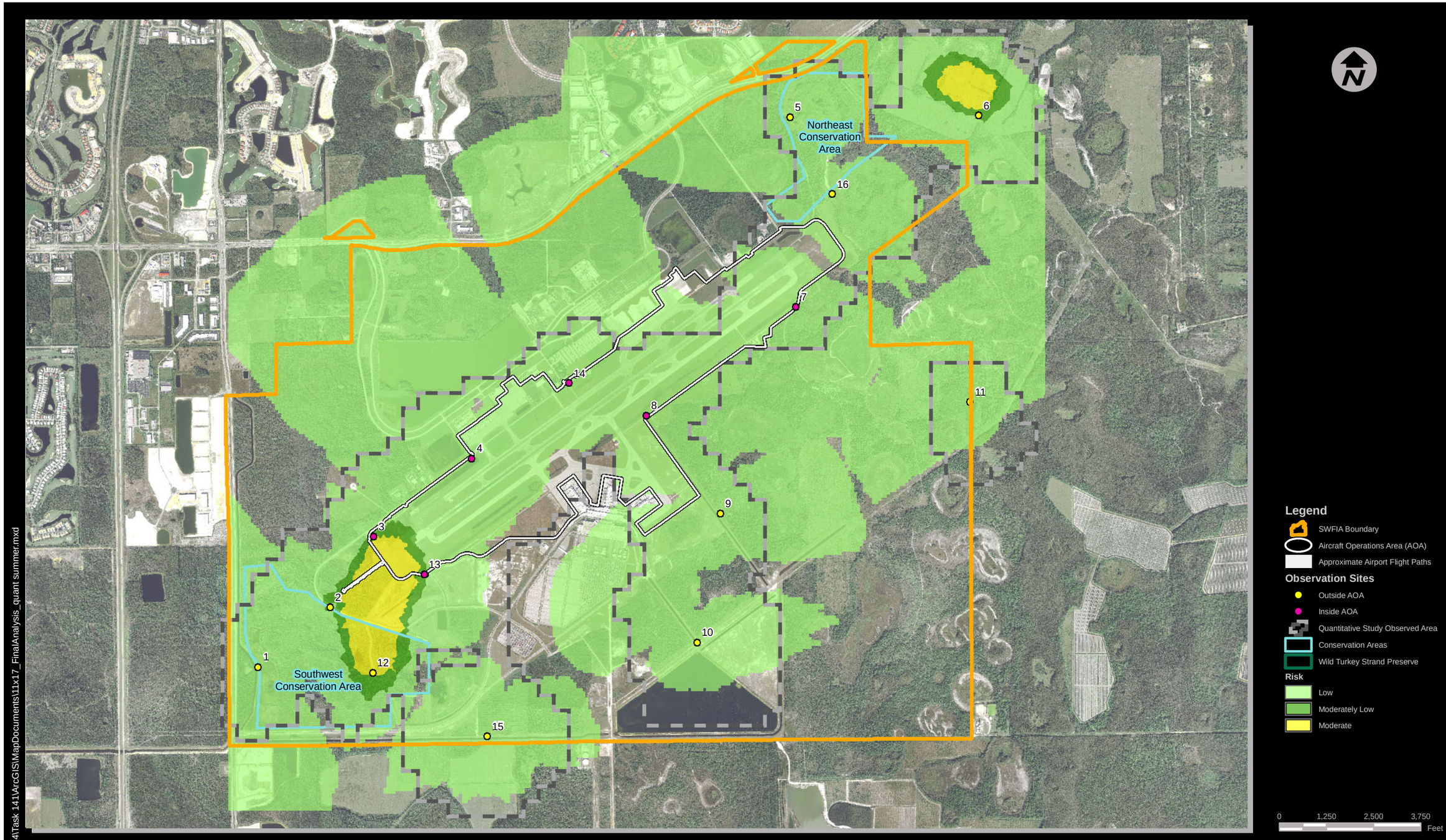
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Figure 3-5 Quantitative Hazard Scores - Spring

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



\\ftms01\proj-fmn\20033734\Task 141\ArcGIS\MapDocuments\11x17_Final\Analysis_quant summer.mxd

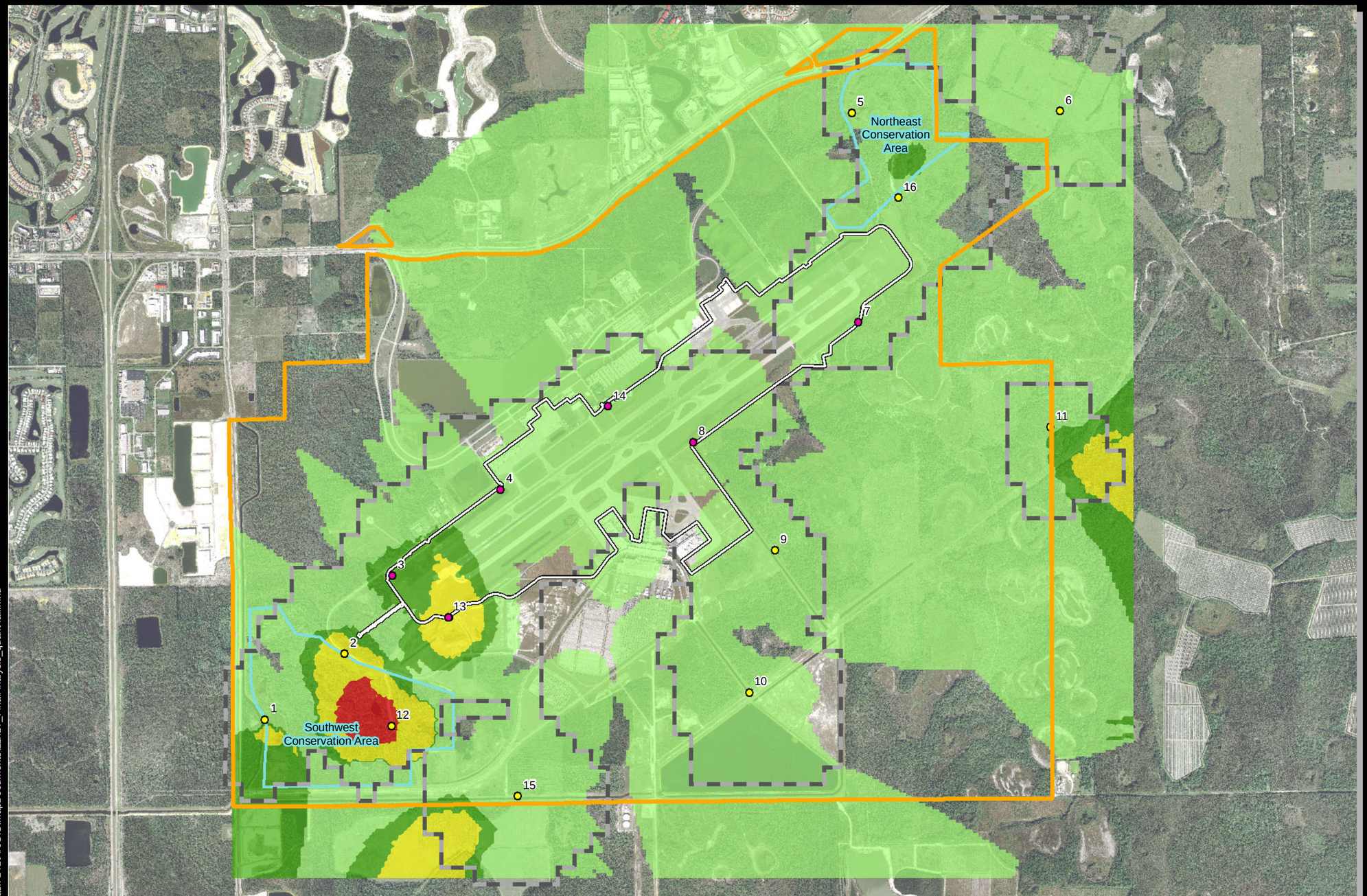
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Figure 3-6 Quantitative Hazard Scores - Summer

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)
- Approximate Airport Flight Paths

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas
- Wild Turkey Strand Preserve

Risk

- Low
- Moderately Low
- Moderate
- High

0 1,250 2,500 3,750 Feet

\\ftms01\proj-fmm\20033734\Task 141\ArcGIS\MapDocuments\11x17_FinalAnalysis_quant fall.mxd

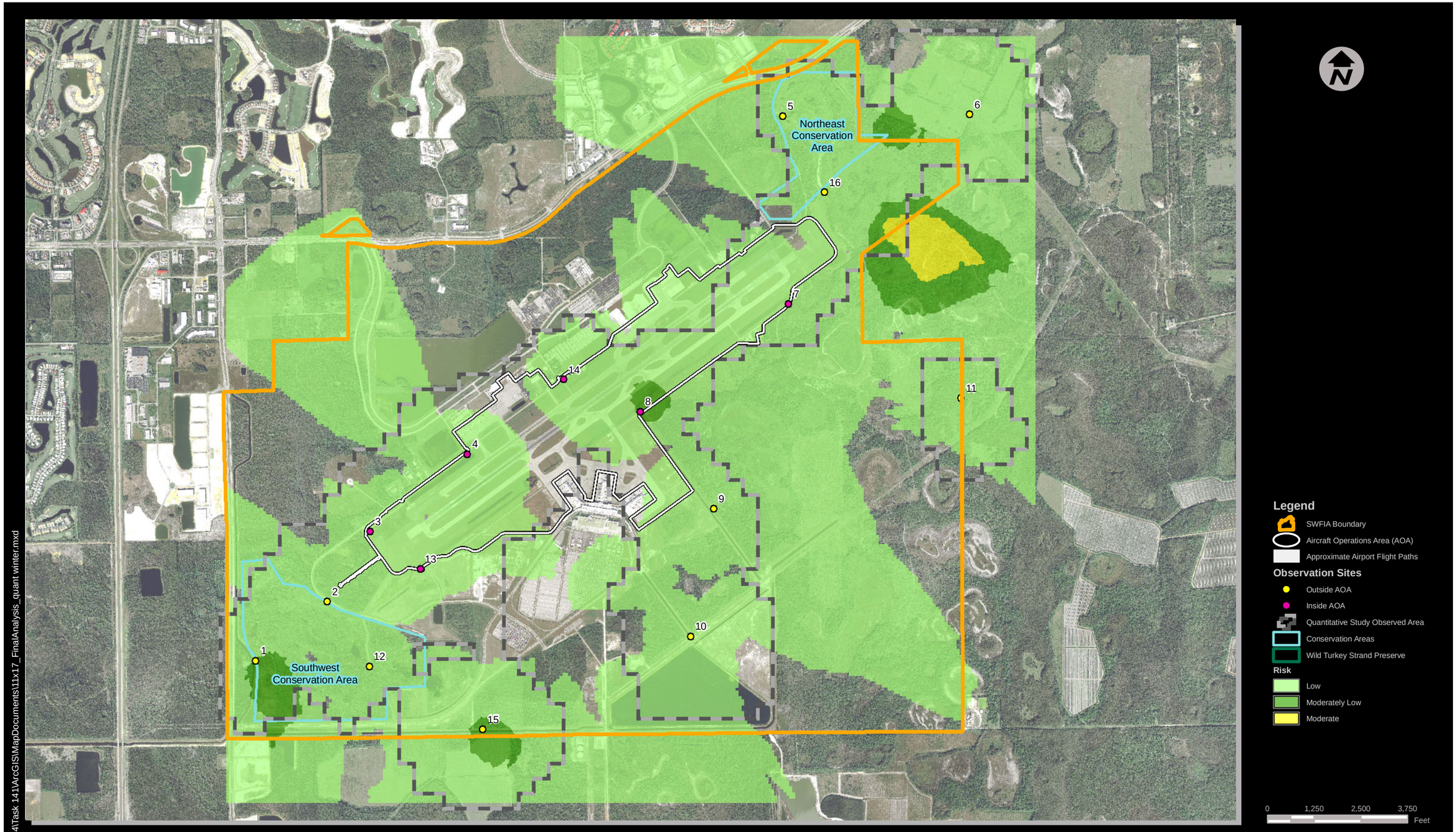
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Figure 3-7 Quantitative Hazard Scores - Fall

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



\\ftms01\proj-fmn\20033734\Task 141\ArcGIS\MapDocuments\11x17_FinalAnalysis_quant winter.mxd

LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Figure 3-8 Quantitative Hazard Scores - Winter

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING

The LCPA keeps track of aircraft movements on a monthly basis (see Appendix H for table showing RSW total aircraft movements). The months with the most movements in 2008 were December (n=8,490), January (n=9,109), February (n=8,945), March (n=11,074), and April (n=9,305). These five months span the end of fall through the first part of spring, with the two highest movement months (January and March) being almost entirely in winter. Peak hazardous wildlife activity (fall) at RSW over all does not coincide with peak aircraft movements (winter - spring) with the exception of some overlap in spring.

Results on the location of relative risk for each time period in each season were also presented. Quantitative maps were created for each time period when observations were made, dawn, midday, dusk, and nighttime, for each season, and by hazard guild, low, medium, and high hazard species. These additional 40 maps show the type of situation an aircraft is likely to fly into at RSW because they are showing risk for a particular time of day in a season. This detailed discussion and the 40 quantitative result maps are presented in Appendix I – time period and seasonal data analysis by hazard guild.

During the standardized sampling the directional movement of birds in flight was collected, including the extent of the flight as far as the observer could see. The intent was to capture local movement of birds and to identify any movement patterns and/or problem areas. Vector maps showing these local movements were created with cumulative data for each season (Appendix J). Birds were observed crossing the runway, taxiways, other movement areas, and flying within designated flight paths. However, there were no patterns of flight observed that add to the relative risk already identified from the quantitative results presented above.

3.4.3 General Sampling Results

The focus of this assessment is placed on the standardized sampling and those results. The results presented in this section are to supplement the quantitative data and highlight any additional areas of concern. The cumulative results from the general sampling (qualitative) are summarized on a map in Appendix K. The Spatial Analyst tool was utilized to interpolate the qualitative data over the entire study area (a detailed explanation of that tool is included in Appendix I). There were no areas of high risk on this map but several areas of potential moderate risk. Summaries by season and time of day were not created for the qualitative data; therefore minimal conclusions can be drawn from this data set.

Qualitative sampling was conducted from March 2008 through February 2009. There were 9,107 total bird observations (see results of mammal observations in section 3.4.7 below) recorded for the duration of the study for the general sampling. They are summarized by season and time period in Table 3-6 and Figure 3-9. The fall season (n=4,785) had the highest number of observations, followed by winter (n=2,319). Spring (n=1,250) and summer (n=753) had the lowest number of observations. Even though total observations were high in winter, those observations were dominated by low hazard species and thus this does not change the conclusion in section 3.4.2 that winter is the least active season for hazardous wildlife at RSW. Observations were recorded by time period, i.e. dawn, midday and dusk. The dawn period was the most active (n=3,324), followed by the midday observations (n=2,948) with dusk (n=2,835) being the least active time period (all nighttime observations are addressed later in this section).

Table 3-6 Total Number of Birds Observed During General Observations, by Season and Time Period

Season	Qualitative			
	Dawn	Midday	Dusk	**Total**
Spring	367	508	375	**1,250**
Summer	280	300	173	**753**
Fall	2,307	749	1,729	**4,785**
Winter	370	1,391	558	**2,319**
Total	**3,324**	**2,948**	**2,835**	***9,107***

Figure 3-9 Total Number of Birds Observed During General Observations, by Season and Time Period

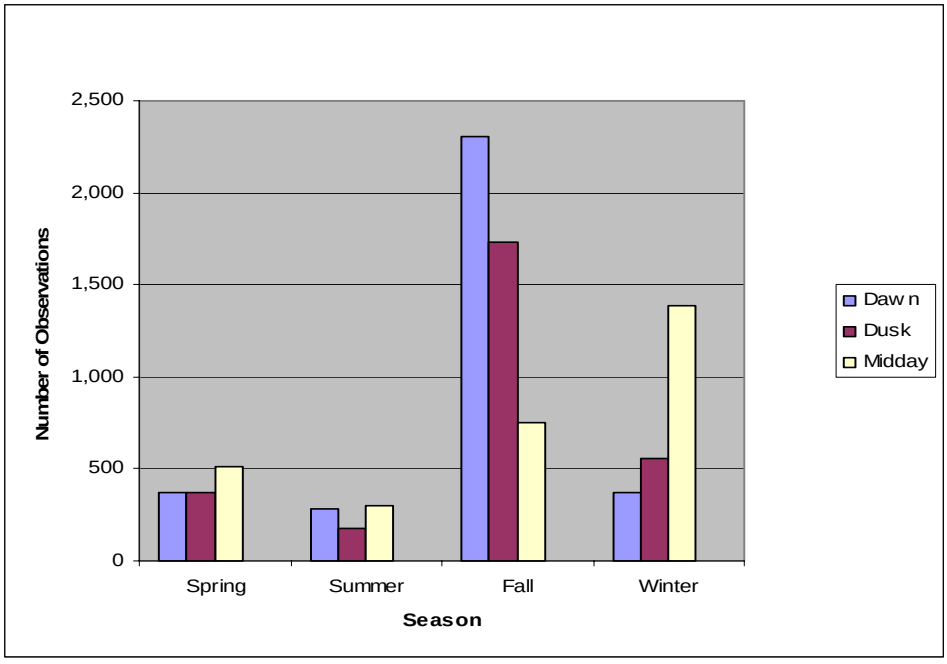


Table 3-7 and Figure 3-10 also show the qualitative observation data classified by hazard guild. The highest number of observations (n=4,743) were birds in the low hazard guild, followed by the high hazard guild (n=3,539), non-ranking (i.e. no associated hazard score, n=667) and medium hazard (n=202). The total number of observations here includes nighttime observations.

Table 3-7 Total Number of Birds Observed During General Observations, by Hazard Guild

Season	Qualitative				
	Low	Medium	High	Non-ranking	**Total**
Spring	272	29	734	221	**1,256**
Summer	168	48	469	83	**768**
Fall	2,583	102	1,887	229	**4,801**
Winter	1,720	23	449	134	**2,326**
Total	**4,743**	**202**	**3,539**	**667**	***9,151***

Figure 3-10 Total Number of Birds Observed During General Observations, by Hazard Guild

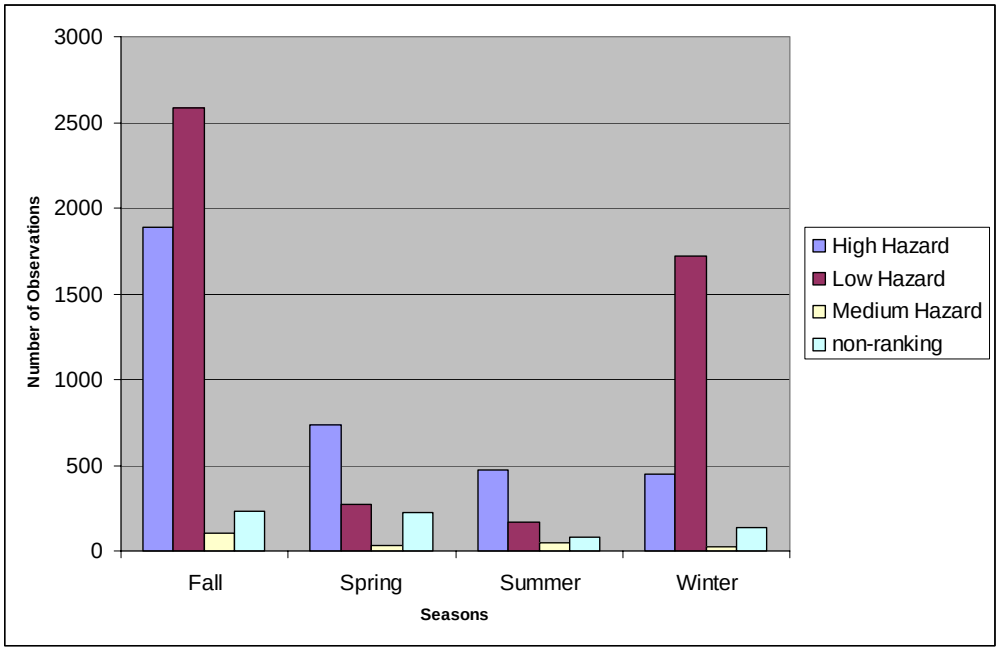
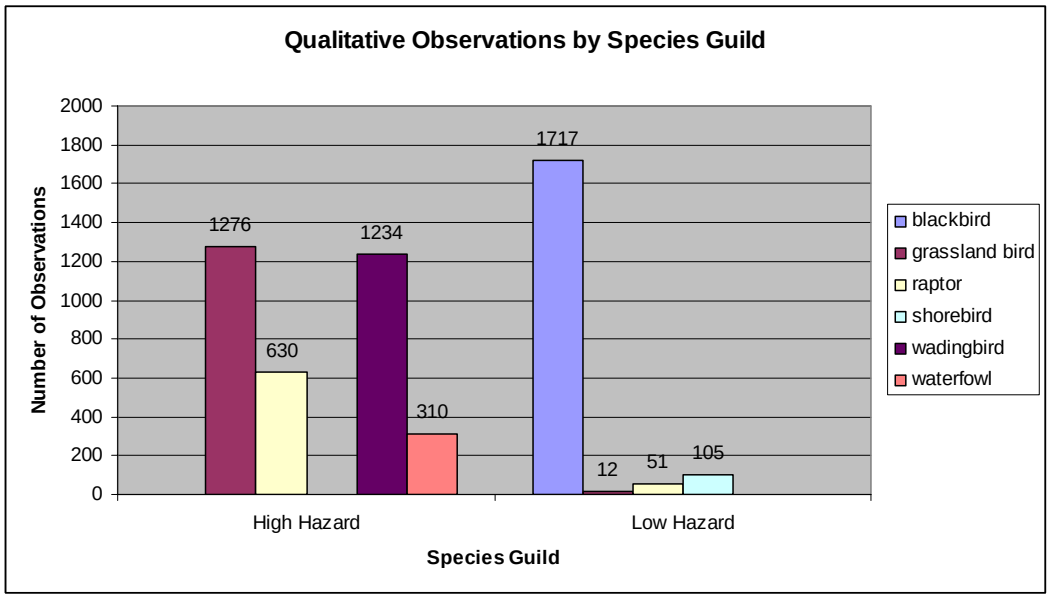


Figure 3-11 summarizes the species guilds that comprised the majority of the qualitative observations from the high and low hazard species groups.

Figure 3-11 – Qualitative Observations by Species Guild



Blackbirds (n=1717) were the most common species observed during qualitative observations; Common Grackles comprising approximately 62% of those observations. Grassland birds (n=1276) were the second most common comprised almost entirely of Cattle Egrets (95%). Next were the wading birds (n=1234) and the White Ibis made up 40% of those observations. The raptors (n=630) were dominated by Turkey and Black Vultures (78%) and the waterfowl guild (n=310) was dominated by Mottled Ducks (89%).

The following are additional noteworthy observations from the general sampling. South of the Southwest Conservation Area and just north of the outbound portion of Terminal Access Road, approximately 4,295 feet south of the end of runway 6, there is a wetland system that contains large mature Carolina willows. On four separate occasions in the fall, groups of fifty or more Cattle Egrets were observed roosting in these willows. These observations were made at dawn, midday and dusk. Another potential Cattle Egret roost was observed located in a stand of native and exotic shrubs on the berm that divides two large storm water lakes (29 and 105 acres) east of outbound Chamberlain Parkway, located approximately 3,680 feet north of the end of runway 6. On two separate occasions in the fall, over fifty Cattle Egrets were observed at dawn and dusk perched in this group of shrubs. These two Cattle Egret roosts are shown on a map in Appendix L.

We documented over seventy-five Cattle Egrets foraging in the vicinity of mowers during mowing events. Most maintenance mower operators carry pyrotechnics but only use them when Operations agents are not immediately available to conduct deterrent activities. During a Hazardous Wildlife Working Group meeting Operations agents and Maintenance staff discussed that coordinating mowing activities with deterring Cattle Egrets that are following the mowers can be logistically difficult (Hess 2009).

The large storm water lake (160 acres) by observation site 10 was designed and constructed in accordance with FAA AC 150/5200-33B criteria with rip rapped 2:1 side slopes

and no littoral zone plantings. During the course of the study minimal wildlife observations were documented on the lake itself. The observations were limited to a few terns (6), Pied-billed Grebes (*Podilymbus podiceps*) (2) and one gull were observed foraging on this lake. These numbers do not add up to a risk for this area. It is possible the lake is used for loafing, however it could also indicate that fish populations in the lake may be starting to attract these species. Three Osprey (*Pandion haliaetus*) observations were also made in this area during the standardized sampling.

3.4.4 Aerial Survey Results

Six wetland areas were identified during the aerial survey on March 12, 2009 where at least twenty large wading birds could be observed (see Appendix F for aerial survey map). This survey was purposefully conducted during the dry season when wading bird prey is concentrated to identify areas that could attract large numbers of potentially hazardous bird species year round. The six wetlands were cypress dome systems with an open marsh center, offering perching, roosting, possibly nesting and foraging opportunities for the large wading birds observed. The water table was above ground at all six wetlands and due to the timing of the survey in mid-spring, these are long hydroperiod wetlands, i.e. the water table remains above natural ground greater than 180 consecutive days (U.S. Fish and Wildlife Service 1999). The species likely observed were Great Egrets and other white wading birds; the flying altitude did not always allow for identification to species. Roseate Spoonbills (*Ajaia ajaja*) were observed at waypoint 6 (Appendix F). Table 3-8 lists the six wetlands identified during the aerial survey and the species or species group and their numbers observed at each wetland (observation waypoint).

Table 3-8 – Bird Species and Quantity Found at Each Observation Waypoint

Observation Waypoint	Species	Quantity
1	egrets	20-30
2	egrets	20-30
3	Wood Storks	20-30
4	egrets	20-30
5	egrets	20-30
6	Roseate Spoonbills	20-30

Three of the six waypoints (2, 3, and 6) collected during the aerial survey are within the 10,000 foot separation distance from the perimeter of the AOA. Waypoint 6 is on airport property, waypoints 1, 2, and 3 are located on Wild Turkey Strand Preserve, and waypoints 4 and 5 are located in the Six Mile Cypress Slough Preserve, outside the 10,000 foot and within the 5 mile separation distance.

3.4.5 Spotlight Survey Results

A total of seventy-seven (77) observations of sixteen (16) species (excluding frogs) were recorded during the nighttime surveys. Of these sixteen species, four (4) were mammals including a domestic cat (*Felis domesticus*), raccoon (*Procyon lotor*), white-tailed deer, and

Eastern cottontail rabbit (*Sylvilagus floridanus*). The deer were not observed on the AOA proper, but were observed just outside the fence. The deer observations (n=6) were predominantly in the fall (n=5) with one observation in the summer.

A total of 24 American alligator (*Alligator mississippiensis*) observations were also recorded during the nighttime surveys all of which were inside the AOA. One observation included an adult alligator with four (4) young alligators. Observations were evenly distributed throughout the year.

The hazard score maps for the seasonal nighttime observations identified a few areas of low relative risk mainly in the spring and summer (see Appendix M for the nighttime hazard score results maps).

3.4.6 Small Mammal Trapping Results

During the one sampling event on May 13, 2008, only two house mice (*Mus musculus*) were captured; one near sampling location 4 and the other at sampling location 13. Many of the traps when checked the following day were missing the rolled oats used as bait and there were some ants in the traps. It is possible the ants gathered the rolled oats before rodents were attracted to the traps. Towards the end of the study (February 2009) it was decided that a second small mammal trapping event would not be conducted due to the low number of hawk observations within the AOA. There were twenty-eight (n=28) raptor (specifically those that prey on small mammals) observations in the AOA during the entire study versus 126 vulture observations within the same area during the same time frame. The latter appeared to pose a greater relative risk.

3.4.7 Mammal Observations

Mammal observations were recorded during standardized and general sampling. The location of all mammal sightings is presented on a map in Appendix N. Deer (n=136) were the most common mammal observed, followed by feral hogs (*Sus scrofa*) (n=73), raccoons (n=11), river otters (*Lontra canadensis*) (n=7), armadillos (*Dasypus novemcinctus*) (n=5), bobcats (*Lynx rufus*) (n=2), and domestic cats (n=2) (see Table 3-1). In addition to being the most common mammals, deer and hogs were also found throughout the study area, but never observed within the AOA.

4.0 IDENTIFICATION AND LOCATION OF FEATURES ON AND NEAR THE AIRPORT THAT ATTRACT WILDLIFE

4.1 Wildlife Hazard Attractant Field Surveys

In addition to the wildlife observations conducted as described in section 3.2, three (3) surveys were conducted at RSW during the course of this WHA to identify potential wildlife hazard attractants on or near the airport. Two (2) surveys were conducted within the AOA and one (1) was conducted landside.

4.1.1 May 2008 Airside Survey

The following observations were made on May 8, 2008 by George Fehér, accompanied by Johnson Engineering, Inc. and a LCPA Operations Agent, during the airside structures survey for potential wildlife attractants. The report produced by Fehér Environmental Consulting, Inc. is summarized here and provided in full in Appendix O.

The USDA/FAA Manual, Wildlife Hazard Management at Airports Second Edition (2005), was used as a guideline for the survey. The inspection team traversed, on-foot, the entire perimeter of all three concourse buildings. Time spent on-site was approximately four hours. RSW Operations and Maintenance staff was interviewed as to past or current wildlife problems, toured the facilities and took representative photographs.

The terminal concourse has relatively few openings where birds can nest or congregate. Although most of the roof structure is of sloped metal construction, there is one area of flat-decking (not inspected) which, if gravel surfaced, could potentially serve as nesting sites for terns. Exhaust ductwork was covered with industrial gauge screens.

Some of the outside overhangs of the terminal concourse contain exposed, horizontal, overhead piping coming from the Terminal. Although free of nesting material during inspection, these could provide nesting sites and should be periodically inspected for any nesting activity.

Due to on-going construction, most of the electrical junction boxes located under the Terminal's overhangs were left open. One box under Concourse D had the remains of a bird's nest, but no bird. The horizontal tops of roll-up service doors could provide potential nesting opportunities, but nesting material was not observed. These appeared to be of minimal significance as an attractant. The articulated jetways are well engineered with few opportunities for nesting. In addition, their constant movement precludes nests staying in place.

Overall maintenance of jet parking ramps, tug parking areas, and trash bins associated with remodeling activities appeared good; large construction debris bins were covered with tarpaulins. No attractants observed.

A few small trash cans outside service personnel eating areas were noted having food remains, but no lids. Since these could provide foraging opportunities for grackles, crows, gulls,

and other trash scavenging birds, lids should be added. Trash compactors located adjacent to the terminal concourse appeared in good working order and the surrounding areas were kept free of trash fall-out. There are 1-2 compactors per concourse; they are emptied around 6:00 AM daily. Observed trash disposal; all trash was contained in plastic bags before being thrown into the compactor and processed; doors were then closed and thus minimal potential as an attractant.

Rat traps have been used adjacent to the back of the concourses for several years. These are serviced regularly by an outside company.

4.1.2 June 2008 Airside And Landside Surveys

A similar survey was conducted airside and landside on June 27, 2008 with Dr. Jerry Jackson, professor of ornithology at Florida Gulf Coast University. Dr. Jackson has worked as a consultant to Orlando International Airport (MCO) on hazardous wildlife issues prior to the construction of their new runway in the 1990's. The purpose of his visit was to give insight and/or recommendations on the management of hazardous wildlife at RSW, landside and airside. All standardized sampling locations for this WHA were visited by vehicle and comments made by Dr. Jackson between and at each sampling location were recorded. The results of this survey are summarized below and the full memorandum prepared by Johnson Engineering is included as Appendix P.

Overall Dr. Jackson felt the airfield looked good in comparison to the many airports he's traveled through. The bottom line: the more diverse the vegetation is, the more diverse the forage base will be, and therefore the greater the diversity of wildlife species utilizing the area will be. A large diversity of vegetation attracts a lot of insects.

Dr. Jackson thought that based on some of the broadleaf vegetation present that cotton rats (*Sigmodon* sp.) were likely present, possibly up to 100/ac. Of course there is no evidence to support this other than the vegetation present. Our trapping efforts although limited to one event, did not capture any cotton rats. We have seen very few hawks and owls utilizing the AOA in the time we have been conducting the Assessment, therefore it is likely the rodent population may not be an issue.

Dr. Jackson's opinion on the Least Terns (*Sterna antillarum*) that nested on the old terminal pad was that it was a residual affect of them having nested on the roof of the old building. Whether they come back next year is largely based on the success they had this year, and since we only observed 4 pairs, it is very likely that they will not nest there again next year. We did not see any least terns during this visit. Interestingly, Loggerhead Shrikes (*Lanius ludovicianus*) readily prey on least tern chicks and RSW has a healthy population of shrikes on and around the AOA. Shrikes are a beneficial species to have around the AOA because they do not pose a threat to aviation operations and they eat a lot of grasshoppers, therefore competing with other grassland species that might be a threat to aviation operations such as grackles.

According to Dr. Jackson, Barred Owls (*Strix varia*) prey on crayfish, thus their presence may increase around the AOA when water levels are low. We only observed five Barred Owls through the course of the study and none were observed within the AOA.

Dr. Jackson commented that the large canal northeast of the apron, which has filled in with cattails and other wetland vegetation, is providing food and cover for prey species for hawks and owls. It is also great nesting habitat for Common Moorhens (*Gallinula chloropus*) and American Coots (*Fulica americana*).

Dr. Jackson's main concern with the Southwest Conservation Area was the presence of vultures. Currently the vultures are utilizing the large pine trees with long horizontal branches that can support several birds, located at the edge of the created wetland. As the planted cypress within this wetland mature they will make those pine trees less desirable to the vultures because they will no longer have the open space to take flight, which they need as they are large birds.

He is more concerned that the maturing cypress mentioned above will provide a perfect heronry particularly for cattle egrets. It is possible that one problem could be traded for another. He was of the opinion that the conservation easement over this area either be released or at least modified to allow the LCPA to appropriately manage the area and prevent the establishment of a major heronry, or any other wildlife hazard. Of course the establishment of a heronry may not happen, but it is a management consideration to keep in mind.

His comment on landscape trees was that trees with a thick composition of leaves such as the oaks and olive trees that are planted throughout the landscaped areas at the airport provide good nesting habitat for potentially hazardous species. The boots on the cabbage palms provide good nesting habitat for Mourning Doves (*Zenaida macroura*), Common Ground Doves (*Columbina passerina*) and Common Grackles.

4.2 GENERAL OBSERVATIONS

Other locations of potential concern on the airport include the two Cattle Egret roost sites identified during the general sampling. These areas could also act as rookeries and have the potential to accommodate larger numbers of birds and species than was observed. Because these areas are currently attracting large numbers of hazardous species and they are outside of any conservation area, it is recommended that permits be obtained from the appropriate agencies to remove the trees and shrubs providing the attractant. It is likely only a vegetation removal permit would be required depending on how the work is carried out. Timing of any removal activities will be important to avoid potential nesting birds. The airport's USFWS Depredation permit allows for the taking of eggs/nests, but only as a last resort.

While there were only minimal observations of wildlife documented in the large storm water management lake (160 acres) along the southern boundary of the airport property, the water management lake does appear to be attracting fish eating birds such as terns, Pied-billed Grebes, gulls, and Ospreys. Due to the size of the lake it is recommended that the airport include the lake in their wildlife observations to monitor its use by hazardous birds and other wildlife to document any changes in wildlife use and implement deterrent activities if needed.

The trash collection station located immediately southwest of the security gate to the movement area was inspected on several occasions during the field observations. Often the

doors to the trash containers were left open and trash was on the ground which attracted blackbirds and crows. This is an issue that the Operations Department is addressing with their tenants (Nichols 2009). The Operations Department has also installed a mobile bird decoy to discourage birds from perching. Even though blackbirds and crows were not identified as high risk species during the standardized sampling, blackbirds were the most common species contributing to the hazard identified during the general sampling. Common Grackles especially are common throughout airport property and should not be given any additional opportunity to forage within the AOA. It is therefore recommended that periodic inspections of the trash collection station be made in order to prevent the creation of a hazardous wildlife attractant here.

5.0 A DESCRIPTION OF WILDLIFE HAZARDS TO AIR CARRIER OPERATIONS [FAR PART 139.337 (C) (4)]

An analysis of wildlife strikes at RSW (as obtained from the National Wildlife Strike Database), a comparison of the strike data to annual air operations at RSW, and a discussion of specific wildlife species that pose a potential risk to aviation are provided in this section.

5.1 Analysis of Wildlife Strike Data

The National Wildlife Strike Database is generated by the FAA with assistance from the USDA using FAA Form 5200-7 (Bird/Other Wildlife Strike Report) and various other sources, such as airline reports, engine manufacturers, the National Transportation Safety Board, and others. These incident reports are submitted to the FAA either as a hard-copy or in electronic format. Form 5200-7 uses a series of check-boxes and comment lines that are filled out by pilots, airline maintenance personnel, or airport staff, such as operations personnel. The FAA/USDA extracts, compiles, and analyzes strike information from these forms; consequently, the completeness of the database is limited in accuracy by the person filling out the original report. The FAA estimates that less than 20 percent of all wildlife strikes involving aircraft are reported to the FAA (FAA USDA 2005). Consequently, strike data obtained from the National Wildlife Strike Database should not be regarded as absolute numbers but only as general indicators of hazardous wildlife incidents.

For the purposes of this assessment, the wildlife strike data for RSW was analyzed by extracting all strike records for RSW from the online database maintained by the FAA, USDA, and with assistance from Embry-Riddle Aeronautical University (2009). At the time of analysis, the data available was from May 1990 through August 2008. The online database also generates an annual Wildlife Strike Summary and Risk Analysis Report (2008) for each airport for which it has data. This report spans a 5 year period. The 2003-2007 report for RSW, generated by the online database, was also utilized to evaluate wildlife strikes at RSW. A copy of this report is included as Appendix Q.

5.1.1 Strike Reports by Year

Figure 5-1 (Bird Strike Reports by Year) provides a long-term overview of bird strike incidents reported for RSW between May 1990 and August 2008. However, 1990 and 2008 represent years with only partial data. If the partial data years are dropped and years 1991-2007 are analyzed, the bird strike incident reports show the following trends: incidents remained relatively even from 1991 through 1994, between 9 – 14 reports per year; climbed to between 30-50 reports per year from 1995 through 1997; dropped to 23 in 1999 and remained between 23-35 reports per year from 2000 through 2007. Looking at the data using a moving average - with 2 years as unit values – provides a more even distribution of the trend-line, with peak reports (40-45) occurring between 1996 to 1998.

If the above data (1991-2007) is evaluated for similar patterns in the number of incidents reported, it appears there were three time periods which had an apparently significant variation. Analysis of these time periods for average incidents reported by grouped years is provided in the table below.

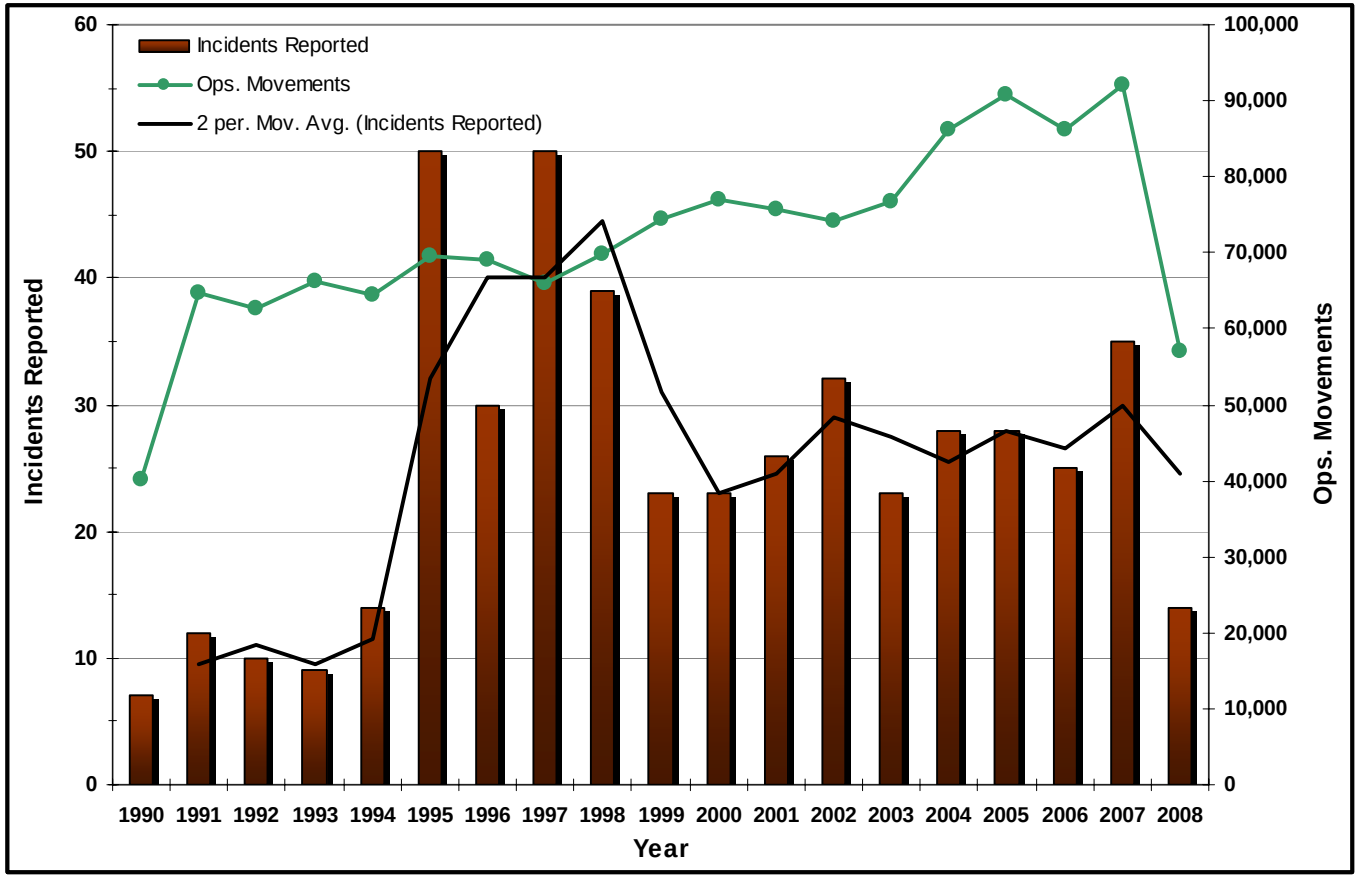
Table 5-1 - Average Incidents Reported (1991-2007)

Grouped Years	Number of Years Included	Total Incidents Recorded	Average Incidents Per Year
1991-1994	4	45	11.25
1995-1998	4	169	42.25
1999-2007	9	243	27.00

When the above average incidents are compared, the four-year period from 1995-1998 had approximately 3.75 (42.25/11.25) times more incidents reported than the preceding four years. Airport staff indicated that due to the Elmendorf accident (9/23/95, fatal AWACS crash from geese strike) there was a concerted effort to report all strikes at RSW. This could explain the dramatic increase in reported strikes, but in comparison, on a national average the same trend was not observed. According to the FAA's Wildlife Strikes to Civil Aircraft Report (2006) an approximately 1 fold increase in incidents reported nationwide did not occur until 1999 (97.5% increase in reporting from 1995).

However, when the 1995-1998 peak is compared to the following nine years (1999-2007), there was approximately 1.75 (42.25/27.00) times fewer average incidents reported; indicating a possible improvement in hazardous wildlife management techniques at the airport. In February 1999 RSW implemented the Border collie program for bird deterrence, supporting the latter statement.

Figure 5-1 - Bird Strike Reports By Year (May 1990 – August 2008)



ANALYSIS OF BIRD STRIKE REPORTS		
Year	**Incidents Reported**	**Ops. Movements**
1990	7	40,063*
1991	12	64,641
1992	10	62,740
1993	9	66,190
1994	14	64,327
1995	50	69,621
1996	30	69,104
1997	50	65,994
1998	39	69,730
1999	23	74,502
2000	23	77,042
2001	26	75,779
2002	32	74,152
2003	23	76,614
2004	28	86,086
2005	28	90,833
2006	25	86,170
2007	35	92,008
2008	14	56,958*
Total	**478**	**1,362,554**

Note: Numbers reflect reports filed, not individual birds struck.

Notes:

1) Analysis developed from FAA database period of record for RSW (May 7, 1990 - August 12, 2008).
2) Number of operations movements were provided by RSW. The 1990 total is from May 1 – December 31, 1990, and the 2008 total is from January 1 – July 31, 2008, to match the timeframe of the strike report database, and as data was provided in month increments.
3) Non-bird strike reports were excluded.

5.1.2 Aircraft Movements

Another useful tool for looking at long-term trends is to compare the number of incidents reported to the number of aircraft movements to see if strikes reported parallel an increase or decrease in aircraft movements. Since years 1990 and 2008 do not have full-year strike data from the FAA, these years were dropped for the purposes of this analysis.

Based on aircraft operation movements received from RSW (copy of the data included in Appendix H), the airport had a total of 64,641 movements in 1991, while in 2007 there were 92,008 movements; yielding an increase of 27,367 movements, or 42.34 percent for that period. In comparison there was a 140 percent (27.00/11.25) increase in average incidents per year for the same period, as derived from Table 5-1 in section 5.1.1. Hence, during the 1991-2007 time period, reported strikes at RSW increased 3 times more than did the number of movements. A very similar trend was observed nationally from 1991-2005; 230 percent increase in incidents reported compared to 20 percent increase in movements (FAA USDA 2006). Therefore, what took place at RSW during the 1991-2007 time period appears to be in line with what happened nationally regarding the increase in strikes reported versus increase in movements.

The FAA uses a rate of incidents reported per 10,000, and sometimes 100K, aircraft movements to compare incidents at airports on a nationwide basis. From 1991 through 2007, RSW had a total of 1,265,533 movements, and a total of 457 incidents were recorded by the FAA. When viewed as total incidents recorded per 100,000 movements the results yield 36.11 incidents/100,000 movements. The RSW strike rate was 230 percent above the FAA's national strike rate average of 10.85 strikes/100,000 movements for the years 1990-2005 (their period of analysis) as published in Wildlife Strikes to Civil Aircraft (2006).

More recent comparisons can be found in FAA's Wildlife Strike Summary and Risk Analysis Report published on their web site (copy of the report is included in the Appendix Q). Said report states that the "Strike rate [all strikes] at RSW in 2007 (37.65) was 21% above Group 2 [Airports] for the region (31.02)."

Based on the analysis presented in section 5.1.1 on the average strikes reported for grouped years, we compared the number of incidents at RSW prior to the implementation of the Border collie program and post implementation, using the rate of incidents reported per 10,000 aircraft movements.

Table 5-2 Average Incidents Reported Pre and Post Border Collie Program Implementation

Grouped Years	Average Incidents Recorded / Average Movements	Average Incidents Reported per 10,000 Movements
1991-1998 (pre collie)	26.75 / 66,668.38	4.01
1999-2007 (post collie)	30.38 / 91,648.25	3.31
	Change	- 0.70
	Percent Change	- 17%

In looking at Table 5-2 above, the average number of incidents reported per 10,000 movements decreased by 17 percent when comparing the eight (8) years prior to the implementation of the Border collie program to the subsequent nine (9) years after the program's implementation.

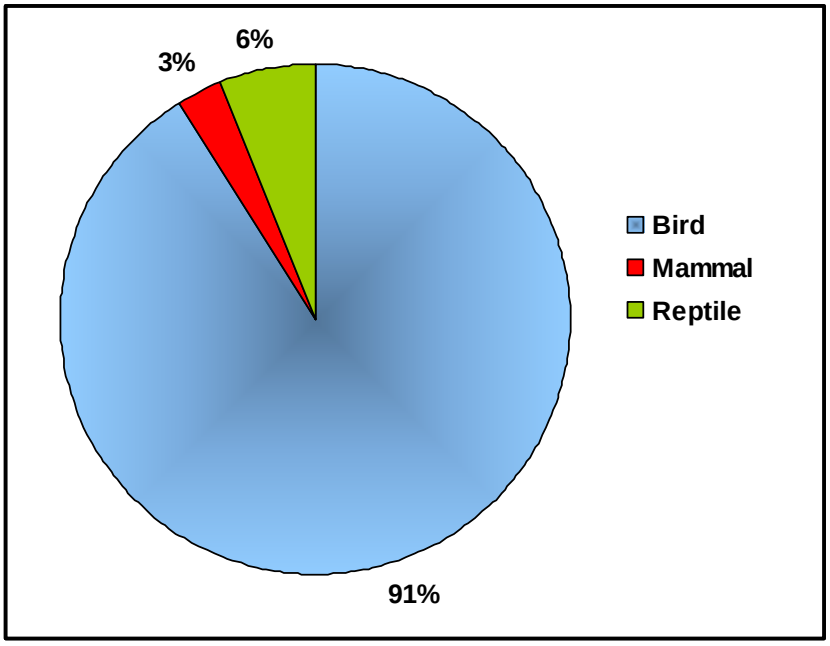
In summary, the average records of bird strike incidents from 1991 through 2007 at RSW increased by 140 percent, while aircraft operation movements increased by approximately 42 percent. Nationwide from 1991-2005 incidents reported increased by 230 percent while movements increased by 20 percent. Possibly during this time frame there was a nationwide increased effort to report strikes. Compared to the historical national average (1990-2005), the total strike rate for RSW was approximately 230 percent higher than at other airports. However, for 2007, strike rates were only 21% above similar sized airports in the region, which appears to be a significant improvement over historical records for RSW. In addition, the average strike rate at RSW decreased by 17 percent after the implementation of their Border collie program.

5.1.3 Strike Reports by Animal Groups

Wildlife incident reports were obtained from the FAA National Wildlife Strike Database and analyzed for potential long-term trends for the period May 7, 1990 through August 12, 2008; a period of approximately 219.5 months. [It should be noted that "incidents reported" is not the same as species (individuals) struck. Also, August 2008 potentially represents only one-half month of data.] During this period of record for RSW, a total of 525 incidents were recorded by FAA, of which 91percent (478 incidents) involved birds, three percent mammals and six percent reptiles. This distribution of incidents by animal group (class) is shown in Figure 5-2. In general, when compared to the 15-year period analyzed by the FAA (2006) for the types of animals involved in strikes, birds were involved in approximately 6.5 percent less strikes at RSW (91% RSW vs. 97.5% Nationwide), terrestrial mammals were involved in 0.8 percent more strikes (3 % RSW vs. 2.2% Nationwide), and 5.9 percent more strikes involved reptiles (6% RSW vs. 0.1% Nationwide). The latter is probably due to the extensive wetlands surrounding RSW, versus fewer wetlands around airports nationwide, as well as less diversity and fewer reptiles in other parts of the nation.

In summary, birds accounted for the greatest number of wildlife incidents involving aircraft at RSW from May 1990 through August 2008. The distribution of different animal groups involved in reported strikes generally follows long-term nationwide trends reported by the FAA.

Figure 5-2 - Strike Reports by Animal Group (May 7, 1990 – August 12, 2008)



ANALYSIS OF STRIKE REPORTS		
Animal Group	**Incidents Reported**	**Percentage**
Bird	478	91%
Mammal	15	3%
Reptile	32	6%
Total	**525**	**100%**

Note: Numbers reflect reports filed, not individual birds struck.

Note: 1) Analysis developed from FAA database for RSW (May 7, 1990 - August 12, 2008).

5.1.4 Analysis of Strike Data Since The PWHA

In August 2005, a Preliminary Wildlife Hazard Assessment (PWHA) was conducted for RSW (Johnson Engineering, Inc. 2005). The PWHA analyzed strike data obtained from the FAA National Wildlife Strike Database for the period from April 5, 2004 through May 29, 2005. As part of the development of this WHA, strike data was obtained from the FAA Wildlife Hazard Strike Database covering the period subsequent to the PWHA; from June 6, 2005 through August 12, 2008, which was the last entry at the time this Assessment Report was initiated.

A total of 92 entries were downloaded, which became the database for subsequent analysis. Of this, 90 are related to birds, and two involved alligators. For purposes of this WHA the two alligator incidents were considered non-essential for this report and have been dropped from further analysis. Subsequently, efforts were concentrated on the 90 bird strikes.

The following seven parameters were analyzed to provide an understanding of the strikes recorded for RSW and the effects they had on aircraft operations:

- Bird Strike Reports by Species Guilds
- Number of Birds Reported in Strikes
- Bird Strike Reports by Bird Size
- Bird Strike Reports by Season
- Bird Strike Reports by Time of Day

- Effects of Bird Strikes on Flight

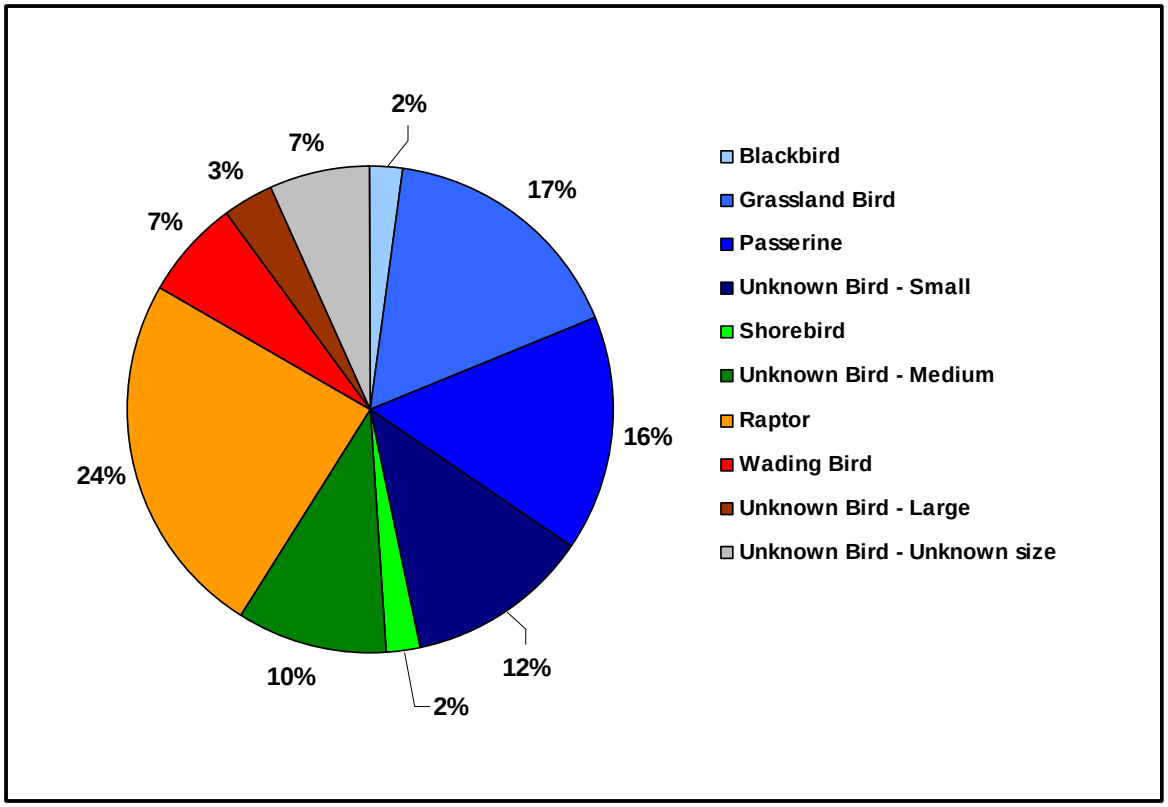
Each of the following pie-charts and graphs is presented along with its associated data set in tabular format to aid in understanding the graphic. Although most of the graphics are self explanatory, short overviews are provided.

5.1.4.1 Bird Strike Reports by Species Guild

Figure 5-3 represents the distribution of strikes by grouping species into guilds. Guilds represent groups of species that use the same resources in a similar manner. These traits generally reflect habitat use, feeding or foraging behavior, or other similar patterns. The FAA's database does not include guilds; therefore, the guilds shown in Figure 5-3 were developed by Johnson Engineering for this specific study (the species guilds are included in Table 3-3 of this assessment). Grouping individual bird species into guilds helps consolidate the analysis into a more holistic approach.

Of the 90 strike reports involving birds, approximately 32 percent were reported as "unidentified." Of those identified, raptors were the most prominent; comprising almost 25 percent of the data. This group includes vultures, Bald Eagles, hawks, Osprey, and other birds-of-prey. Wading birds, such as egrets, ibises, and herons represent only 6.7 percent of the strikes. This is somewhat unexpected because of the extensive acreage of wetlands around the airport that is utilized by wading birds.

Figure 5-3 - Bird Strike Reports by Species Guild (June 6, 2005 – August 12, 2008)



1) Analysis developed from FAA database for RSW (June 6, 2005 - August 12, 2008).
2) Non-bird strike reports were excluded.

BIRD STRIKE REPORTS		
Guild	**Total**	**Percentage**
Raptor	22	24.4%
Grassland Bird	15	16.7%
Passerine	14	15.6%
Unknown Bird - Small	11	12.2%
Unknown Bird - Medium	9	10.0%
Wading Bird	6	6.7%
Unknown Bird - Unknown size	6	6.7%
Unknown Bird - Large	3	3.3%
Blackbird	2	2.2%
Shorebird	2	2.2%
Total	**90**	**100.0%**

Notes:
1) Analysis developed from FAA database for RSW (June 6, 2005 - August 12, 2008).
2) Bird guild categories provided by Johnson Engineering, Inc.
3) Non-bird strike reports were excluded.

Notes:

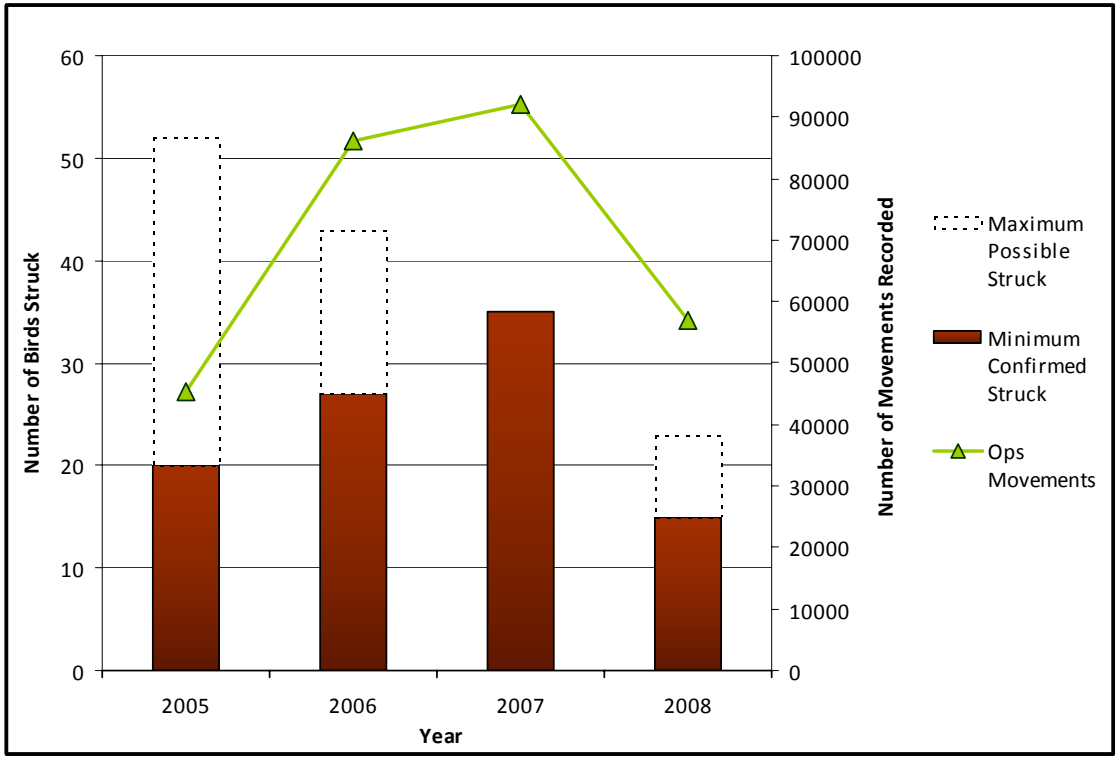
5.1.4.2 Number of Birds Reported in Strikes

Figure 5-4 represents the approximate total number of individual birds struck per year as reported in the FAA database. Data used for this analysis comes from the checkboxes in Form 5200-7, which records strikes as 1, 2-10, 11-100, and more than 100. Consequently, this data set has two components; the lower number of each checkbox represents the number of confirmed strikes, while the upper range represents the maximum possible strikes. Using this assumption, a stacked bar graph was developed to represent the range of bird strikes obtained from the FAA database. There were no counts of birds struck above the 2-10 range for the period being analyzed. Year 2005 begins in June where the PWHA left off and Year 2008 has data available only through August. The table accompanying the bar graph details how the range of numbers for the graph was developed. The number of aircraft movements was added for comparison, but adjusted for the period of analysis.

In summary, the number of minimum confirmed birds struck increased from 12-35 between June 2005 and December 2007, while the number of maximum possible struck decreased from 52 to 35. In 2007 the minimum and maximum values were the same. In 2008 the minimum struck further decreased to 15 through August, while the maximum possible decreased to 23.

While it is possible to look at trends in these numbers – rising for “Minimum Confirmed Struck” and falling for “Maximum Possible Struck” – the reader is advised to take into account the human factor in the reporting process (i.e. accuracy in estimating the numbers struck) and the wide latitude of strikes allowed in the check-boxes beyond “1”.

Figure 5-4 - Number Of Birds Reported In Strikes (June 6, 2005 – August 12, 2008)



Year	Count of Birds Struck	
	Count of 1 Struck Individual Reported	Count of 2-10 Struck Individuals Reported
2005	12	4
2006	23	2
2007	35	0
2008	13	1

Notes:

1) Analysis developed from FAA database for RSW (June 6, 2005 - August 12, 2008).
2) Non-bird strike reports were excluded.
3) Number of operations movements provided by RSW.

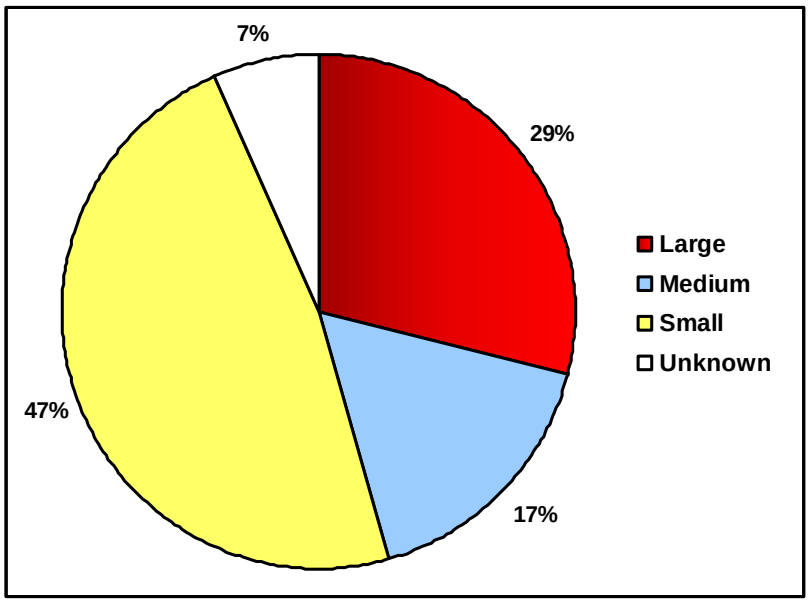
Year	Minimum Confirmed Struck	Maximum Possible Struck	Ops Movements
2005	12 + (2x4) = 20	12 + (10x4) = 52	45,449*
2006	23 + (2x2) = 27	23 + (10x2) = 43	86,170
2007	35 + (2x0) = 35	35 + (10x0) = 35	92,008
2008	13 + (2x1) = 15	13 + (10x1) = 23	56,958*

5.1.4.3 Bird Strike Reports by Bird Size

Figure 5-5 depicts the size of birds recorded in FAA's strike database using the designations found in the data set. The Size of Bird checkbox in Form 5200-7 is filled out by the person filing the strike report.

In summary, it appears that nearly one-half of all birds struck were in the "small" category, while large birds comprised less than one-third.

Figure 5-5 - Bird Strike Reports by Bird Size (June 6, 2005 – August 12, 2008)



ANALYSIS OF BIRD STRIKE REPORTS		
Bird Size	**Incidents Reported**	**Percentage**
Large	26	29%
Medium	15	17%
Small	43	48%
Unknown	6	7%
Total	**90**	**100%**

Note: Numbers reflect reports filed, not individual birds struck.

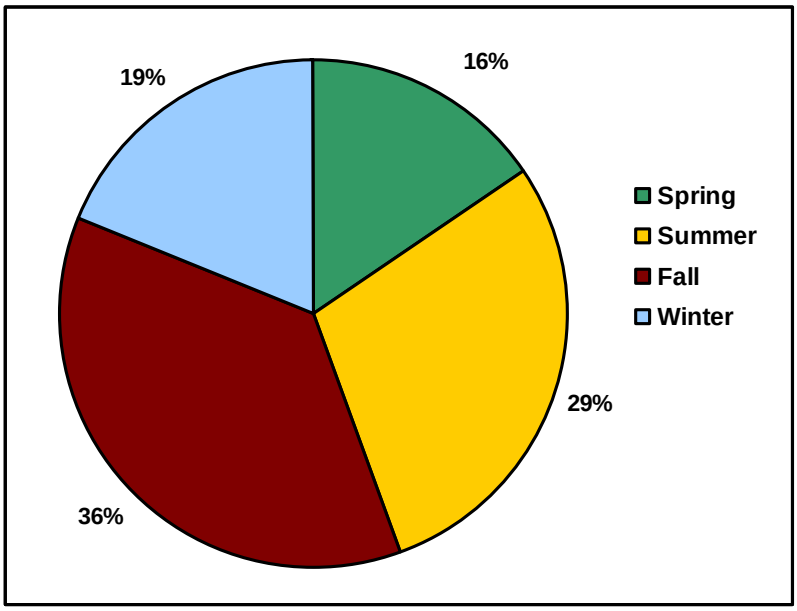
Note: 1) Analysis developed from FAA database for RSW (June 6, 2005 - August 12, 2008)

5.1.4.4 Bird Strike Reports by Season

Figure 5-6 depicts the seasonal distribution of bird strikes based on the following time frames: spring (3/20 through 6/20), summer (6/21 through 9/21), fall (9/22 through 12/20), and winter (12/21 through 3/19). The seasonal spread of the data set was generated by using the actual incident dates reported by FAA.

In summary, fall (37%) and summer (29%) had the most strikes, followed by winter (19%) and spring (16%). Although the FAA does not track bird strikes by season, they have analyzed historical records by month. July through October had the highest percent of total strikes in FAA's database with an average of 12.75 percent per month for the 15-year period 1990-2004 (FAA USDA 2006). These would fall within the summer and fall designations used in this WHA.

Figure 5-6 - Bird Strike Reports by Season (June 6, 2005 – August 12, 2008)



ANALYSIS OF BIRD STRIKE REPORTS		
Season	**Incidents Reported**	**Percentage**
Spring	14	16%
Summer	26	29%
Fall	33	37%
Winter	17	19%
Total	**90**	**100%**

Note: Numbers reflect reports filed, not individual birds struck.

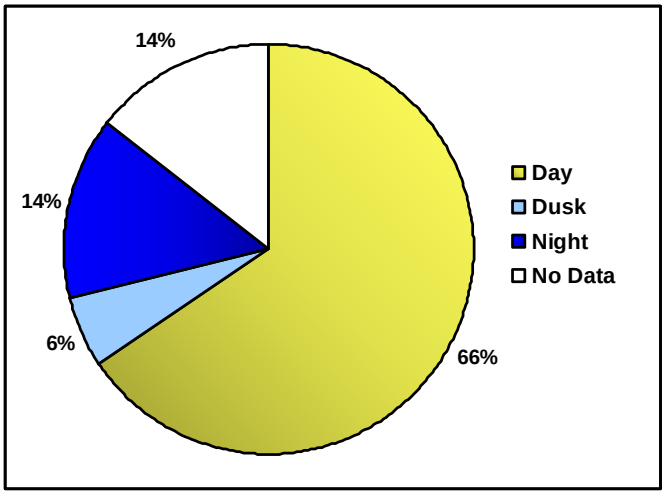
Note: 1) Analysis developed from FAA database for RSW (June 6, 2005 - August 12, 2008).

5.1.4.5 Bird Strike Reports by Time of Day

Figure 5-7 depicts the distribution of strikes by time of day. This is based on data obtained from the checkbox in FAA Form 5200-7. Although there are four choices; dawn, dusk, day, and night, there were no "dawn" entries in the data set and fourteen percent did not have the checkbox filled in at all.

In summary, two-thirds (66%) of all strikes occurred during the day. This is most likely due to more aircraft movements during that time period and a greater probability of confirming that a strike had occurred. This tracks the FAA's analysis of the 15-year historical data (1990-2004) which indicates that 63 percent of bird strikes occurred during the "Daytime" designation (p.19, *Wildlife Strikes to Civil Aircraft*).

Figure 5-7 - Bird Strike Reports by Time of Day (June 6, 2005 – August 12, 2008)



ANALYSIS OF BIRD STRIKE REPORTS		
Time of Day	**Incidents Reported**	**Percentage**
Day	59	66%
Dusk	5	6%
Night	13	14%
No Data	13	14%
Total	**90**	**100%**

Note: Numbers reflect reports filed, not individual birds struck.

Notes:
1) No strikes were reported for "Dawn" for the analysis period.
2) Analysis developed from FAA database for RSW (June 6, 2005 - August 12, 2008).

5.1.4.6 Effects of Bird Strikes on Flight

Figure 5-8 represents how bird strikes may have affected aircraft operations. There are five checkbox choices in the FAA's strike report form: None, Aborted Take-off, Precautionary Landing, Engine Shut Down, and Other *(Specify)*. Of these, four were found in the FAA database for this period of analysis (6/6/2005 – 8/12/2008) and appear in the accompanying figure (table and pie-chart). In addition, "No Data" was assigned by the analyst for spaces left blank in the FAA database.

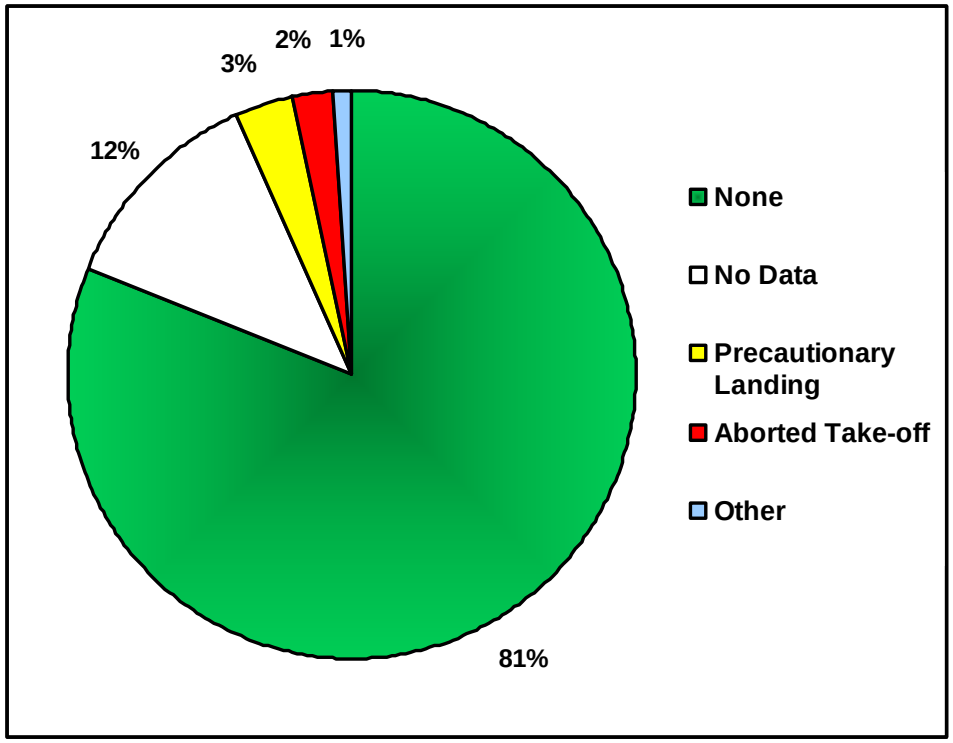
Of the 90 bird strike incidents analyzed, 73 (81%) had no effect-on-flight, while 11 (12%) had no data entered. Since it would be incorrect to assume that "no data" means "no effect", the above two values (73 and 11) were not added together. The remainder six incidents combined indicates that six percent of strikes had an effect-on-flight from the following birds; one Red-shouldered Hawk (medium size), one unknown bird (medium), one Great Egret (large), one unknown bird (small), one Sandhill Crane (large), and one Osprey (large).

In addition to effects-on-flight, FAA tracks "Damage" reported on Form 5200-7. The FAA's Wildlife Strike Summary and Risk Analysis Report for KRSW 2003-2007 (2008) indicates there were fifteen "Wildlife Strikes Causing Damage" in 2003 – 2007, with six of those strikes occurring in 2007. For more in-depth analysis see the above cited report in Appendix Q.

In summary, approximately 81% of strikes had no-effect-on flight; this is similar to FAA's analysis of the 15-year historical data (1990-2004) which indicates that 86 percent of bird strikes had no effect-on-flight (p.26, *Wildlife Strikes to Civil Aircraft*). Six percent of incidents had an effect on aircraft operations that required a precautionary landing, an aborted take-off, or other actions.

The FAA indicates there were 15 strikes at RSW between 2003 and 2007 that caused some form of damage to aircraft. Since not all strikes produce damage to aircraft, possibly due to the interpretation of what is "damage", the analysis of effect-on-flight vs. damage may not always correlate as a one-to-one ratio.

Figure 5-8 – Effects of Bird Strikes On Flight (June 6, 2005 – August 12, 2008)



ANALYSIS OF BIRD STRIKE REPORTS		
Effect on Flight	**Incidents Reported**	**Percentage**
None	73	81%
No Data	11	12%
Precautionary Landing	3	3%
Aborted Take-off	2	2%
Other	1	1%
Total	**90**	**100%**

Note: Numbers reflect reports filed, not individual birds struck.

Note: 1) Analysis developed from FAA database for RSW (June 6, 2005 - August 12, 2008).

5.2 Potential Wildlife Hazards - Specific Species

This assessment has identified the species contributing to the areas of highest relative risk at RSW; those being vultures, White Ibis, Cattle Egrets, and Mottled Ducks. When correlating this information with the strike data presented earlier, three of these species caused damaging strikes at RSW between the years 2003-2007 (vultures=4, Cattle Egret=1, Mottled Duck=1). This is not to say that these and/or other species have not been involved in non-damaging strikes, but an emphasis is being placed on species that are occurring in numbers capable of causing a damaging strike. Three of the vulture strikes and the Cattle Egret strike all occurred in 2007. This supports a conclusion of this assessment that these three species are of a size and are occurring in numbers capable of creating a risk at RSW. Other damaging strikes at RSW within the same 5-year time frame include Bald Eagle (n=1), Bank Swallow (n=1), Great Egret (n=1), hawk (n=1), Red-tailed Hawk (n=1) and Sandhill Crane (n=1). Hawks, specifically Red-shouldered Hawks, and Great Egrets also contributed to risk at RSW. This does not mean that other species present are not posing a risk at RSW, they have either not recently (since 2003) caused a damaging strike, they caused a damaging strike but it was not reported, or they caused a damaging strike but it was reported as "unknown bird".

By far the vultures dominate the raptor guild at RSW followed by Red-Shouldered Hawks and Swallow-tailed Kites. White Ibis dominate the wading birds found at the airport, as do Cattle Egrets for the grassland species guild. Mottled Ducks are the most common waterfowl followed by Common Moorhens and Blue-winged Teal. Following is a discussion of what is attracting these dominant bird species for each guild mentioned above, as well as a discussion on the mammal and reptilian species identified in the assessment that are also part of the hazardous wildlife risk at RSW.

5.2.1 Vultures

According to the results of this assessment, vultures appear to contribute to the most relative risk at RSW. A vulture roost exists on airport property within the Southwest Conservation Area. Open pond edges, as occur within the Southwest Conservation Area, are particularly attractive as feeding and sunning sites for vultures (Jackson 2001). The roost is active year round but the total number of vultures observed by season varies. In 2001, while analyzing strike data for RSW for a paper presented at the Bird Strike Committee U.S.A./Canada Meeting, Jackson noted then that Ciconiiform birds, those being herons, egrets, ibis, and storks, as well as Turkey and Black Vultures were a problem for RSW. Based on the findings in this assessment those particular species are still a problem at RSW and it is our belief they will continue to be so long as the attractant (habitat or resource) remains intact.

The highest number of vultures observed at RSW was in the spring (n=335), followed by fall (n=253), winter (n=182), and summer (n=77). Black Vultures are resident birds as are Turkey Vultures but the more northern populations of Turkey Vultures migrate south in the winter; therefore creating an influx of vultures in Florida during the winter (Kale and Maehr 1990). We did not observe the increase in vulture population in the winter. The increase in

numbers in the spring and fall could be attributed to migratory Turkey Vultures passing through and/or nesting activity onsite by potentially both species.

There is probably another factor(s) attracting vultures to RSW in the spring; likely food and/or nesting habitat. Both vulture species are ground nesters, nesting under dense vegetation such as a palmetto thicket (Kale and Maehr 1990). Jackson in 2001 suspected that Turkey and Black Vultures nested and roosted at RSW due to the presence of the right habitat and judging by the high number of strikes (21) during the time frame for which he analyzed strike data (1990-2000). Further investigation should be made into whether vultures are nesting within the Southwest Conservation Area. Also the roost site should be modified to reduce its attractiveness to vultures.

If food was the attracting factor for the higher number of vultures in the spring, it may have been due to the water draw down after the rainy season with an associated abundance of dying fish and other aquatic prey to forage on.

5.2.2 White Ibis

White Ibis were observed at dusk in the summer from site 13, flying low southwesterly in large flocks; likely towards the Southwest Conservation Area. Their nesting in Florida usually takes place from March through May therefore they were probably coming in to roost rather than nest. The same phenomena was repeated at dusk in the fall from site 12; confirming the presence of a wading bird roost within the Southwest Conservation Area. Habitat modifications to the Southwest Conservation Area are recommended in order to diminish the quality of the attractant, not only for White Ibis, but for any potential wading bird species looking for a roost site. This will likely require a revision to the existing conservation easement for this area.

5.2.3 Cattle Egret

Cattle Egrets at RSW are attracted to the mowing activities and are roosting onsite in two confirmed locations. Mowing regimes on North American airfields is a controversial issue according to the FAA/USDA Wildlife Hazard Management at Airports Manual (Cleary and Dolbeer 2005). Based on U.S. Air Force studies, maintaining grass height in the range of 7-14" is commonly cited as the best approach to deterring many species of birds from loafing and feeding. However, the manual states that "the limited studies conducted in North America have not provided a consensus of opinion on the utility of tall-grass management for airports." And for that reason the manual purposefully does not give any general guidelines on grass height or vegetation type for airside ground cover.

Mowing in taller grass creates mats of decaying vegetation that provide increased food, cover, and breeding sites for grasshoppers, crickets, other invertebrates, small mammals, reptiles and amphibians. This increased animal diversity provides optimal foraging habitat for Cattle Egrets, Sandhill Cranes, hawks, and other birds (Jackson 2001). According to Jackson, closely mowed grass at RSW would likely reduce bird strike potential because of the bird communities present and the climatic regime (2001). However, closely mowed grass also attracts loafing

birds such as blackbirds, gulls, doves, and others. To avoid trading one hazard for another it is recommended that the mowing height and rotation remain as it is presently, as described below.

According to Scott Davis (2009), Airfield/Grounds Manager in the Maintenance Department at RSW, mowing during the growing season is a continuous rotational effort for the entire airfield. In other words, as soon as the crews have completed mowing the entire field they begin again at their original starting point, taking approximately 10 working days to complete the rotation. If sections of the airfield at RSW ever reach the 14" height it is not for a long duration. Mower decks are currently set at 4 ½" during the summer and at 5" in the winter. That height should be raised to 6" all year long. The comment was made by both Dr. DeFusco at the commencement of this project and by Dr. Jackson during his visit to RSW during the study, that the mowed areas of the airfield look good in terms of their limited attractiveness to hazardous wildlife. Dr. DeFusco also indicated that periodically modifying the mowing pattern can avoid rutting, which can happen when mowers always take the same path. Water can accumulate in the ruts, which can be attractive to wildlife and potentially allow for the growth of wetland vegetation, which can also attract wildlife. This alternative mowing technique was mentioned at the kickoff meeting for this assessment with details in a follow-up email from Anik Smith (see Appendix R for meeting minutes and email). Since Cattle Egrets are attracted to the airfield at RSW for the food source made available during mowing events, it is recommended that mowing activities at RSW continue as they have, periodically modifying the mowing pattern, and that the focus be placed on deterrent activities during mowing. When pyrotechnics are not an option for Ops or Maintenance to utilize during mowing activities, the Border collie should be utilized. Just as some birds have habituated to the "white truck" as a potential predator through the use of the Border collie, Cattle Egrets may associate mowers with the dog when these activities are conducted jointly.

5.2.4 Mottled Duck

Mottled Duck numbers overall are highest in the AOA in the canal adjacent to site 8; with the majority of the observations made in winter. Other resident waterfowl such as Common Moorhens and American Coots are also attracted to this area in the winter; as are the migratory Blue-winged Teal. This canal differs from others within the AOA in that it is wider, side slopes are more gradual, littoral vegetation present and it holds water year round; hence the attraction is not only to resident and migratory waterfowl but also to numerous species of wading birds. This is the original outfall canal (known as Lake 4), created when the airport was initially built in 1983. However, with the advent of the Midfield Terminal Permit (SFWMD 2001, permit number 36-00080-S), the LCPA is now allowed to steepen slopes and deepen the lake as water quality is accounted for within the newly constructed surface water management system. Lake 4 is now considered other surface waters. The LCPA Maintenance Department has worked in previous years to steepen side slopes, deepen the flowway, and remove emergent vegetation and has maintained culverts annually. The LCPA continues to implement these activities as funding allows. Since the attractant as described above is currently present, the LCPA should evaluate the design options, including a cost/benefit analysis, for modifying this system in order to reduce the bird attractant permanently.

5.2.5 White-Tailed Deer

White-tailed deer are considered one of the most hazardous species to aircraft (Dolbeer 2003) and the nighttime surveys were in part conducted to document their presence and abundance within the AOA, in addition to documenting other potentially hazardous nocturnal species. Although white-tailed deer were observed during nighttime and daytime surveys, they were not observed within the AOA. Therefore, at the time this assessment was conducted white-tailed deer did not appear to pose a risk to aircraft utilizing the AOA.

However, deer were commonly observed utilizing the airport property, outside of the AOA (Appendix N) and airport staff have reported an increasing number of road-killed deer on airport roads (Orick 2009). This increase may be attributed to an increase in the deer presence at the airport and/or to an increase in traffic at RSW. As the landscape is developed around the airport property, less habitat will be available for deer, and the airport may continue to provide a significant amount of green space. Therefore, as the landscape develops and less habitat is available to the white-tailed deer, the green space available at the airport may be attractive to more deer and the estimated risk with this species may change.

Even though deer are not currently contributing to the wildlife risk at RSW in the AOA, based on data presented in this assessment, they may in the future as described above. Periodic monitoring of deer populations will assist RSW in providing documentation for management actions that may need to be initiated in the future, and in working with adjacent landowners to address any potential future problems with deer. The airport must continue to ensure, through periodic inspections, that the AOA fence is adequate in keeping deer and feral hogs out of the AOA

5.2.6 American Alligator

The other animal commonly observed during the nighttime surveys was the American alligator. The majority of the alligators observed averaged 4 to 6 feet in length, which is large enough to pose a risk even to large commercial airplanes. The hazard risk maps do not include the alligators as they were not assigned a risk score (Dolbeer 2003), therefore, the risk scores for the nighttime surveys may be slightly low. However, the airport is actively managing alligators with the use of an alligator trapper. Alligators were rarely observed during the quantitative AOA surveys. Nighttime spotlight surveys may be the best method to monitor alligator populations on the AOA. The airport should continue to remove all alligators from the AOA.

6.0 RECCOMENDED ACTIONS FOR REDUCING IDENTIFIED WILDLIFE HAZARDS TO AIR CARRIER OPERATIONS [FAR PART 139.337 (C) (5)]

Currently the LCPA maintains an effective wildlife hazard management program at RSW. This Wildlife Hazard Assessment identified several areas where additional mitigating efforts may result in more positive controls over hazardous wildlife. Therefore, it is suggested that the LCPA incorporate the recommendations presented here into their wildlife hazard management program to the extent practicable for the LCPA. As the LCPA considers the implementation of the recommendations made below, they should first continue to implement their current wildlife hazard management program and then prioritize the following recommendations giving higher priority to those that reduce/remove the attractant to hazardous species.

6.1 Continue Current Hazardous Wildlife Management Actions

The various hazardous wildlife management activities conducted at RSW are outlined within the airport's FAR Part 139 Airport Certification Manual and summarized here. The LCPA monitors the environment on or near the airport for identification and location of features that attract wildlife. The LCPA has made addressing hazardous wildlife issues a daily operation and addresses them in several ways.

6.1.1 Hazardous Wildlife Working Group

In 2005 the LCPA formed a Hazardous Wildlife Working Group (HWWG) to better coordinate hazardous wildlife management efforts conducted by the various departments of the LCPA. The HWWG is comprised of LCPA staff and wildlife experts from its General Planning & Environmental Consultant team. The group meets bi-monthly and/or after wildlife related events to analyze hazardous wildlife circumstances, species, and related initiatives.

6.1.2 Border Collie Program

Beginning February 10, 1999, RSW became the Nation's first commercial service airport to use a Border collie for wildlife deterrence activities. The LCPA continues to utilize a Border collie dog as the principal direct bird deterrent activity as part of an integrated control program that includes pyrotechnics and other methods, within the AOA at RSW. Currently the LCPA is working with their third Border collie named Sky. This effort, conducted by a full-time dog handler, appears to have reduced the resident bird population since the program was implemented, based on observations made by RSW Operations staff and supported by the reduction in bird strikes as illustrated in Section 5.1 of this Assessment.

6.1.3 Additional Wildlife Deterrent Activities

The following is a list of additional current wildlife deterrent activities implemented by the RSW Operations Department to reduce the potential risk, posed by wildlife, to air operations.

6.1.3.1 LCPA conducts daily patrols of the airfield for presence of wildlife; initiates corrective harassment or depredation measures when necessary; ensures appropriate NOTAM ("Notice To Airmen") system is current; and inputs data into a wildlife control log.

6.1.3.2 LCPA purchased and placed into service three propane canons for deterrent use on the airfield and purchased 100 feet of bird spikes for trial use on airfield headwalls, as well as ten bird spikes to deter roosting on streetlights.

6.1.3.3 LCPA maintains the necessary wildlife harassment and depredation permits as outlined in Appendix T – Legal Discussion Relating to Deterrence of Wildlife at RSW.

6.1.4 Current Airfield Management

The following is a list of current airfield management activities implemented by the RSW Maintenance Department to reduce the potential risk, posed by wildlife, to air operations.

6.1.4.1 Airfield grass heights are maintained between 6 to 12".

6.1.4.2 The AOA fence is periodically surveyed and holes filled in as necessary to keep out wildlife.

6.1.4.3 LCPA conducts spraying on nuisance vegetation, and cooperatively works with the LCHCD to spray emergent and submerged vegetation from storm water management areas.

6.1.4.4 A "Drought Management and Maintenance Plan" is under development for current and future lake maintenance in times of drought. The goal of the plan is to conduct maintenance activities during drought conditions when the water levels are low enough that vegetation can be removed; as well as conducting other activities that will deter wildlife use, while remaining within allowable activities under existing South Florida Water Management District (SFWMD) permits.

6.1.4.5 LCPA continues to look at project possibilities to fill in stormwater treatment areas within the AOA. LCPA staff has researched SFWMD permits and has determined that steepening side slopes, deepening canals and lake-bottom scraping within the AOA water bodies is allowable under existing state and federal permits. The LCPA plans to continue these activities as funding allows.

6.1.5 Wildlife Monitoring

The following is a list of current wildlife monitoring activities implemented at RSW to document and reduce the potential risk, posed by wildlife, to air operations.

6.1.5.1 In the past, LCPA staff conducted twice weekly wildlife surveys of the AOA and documented the observations in AIRMAN, a wildlife tracking software. These efforts were suspended during the official WHA survey activities. Since the completion of the official WHA surveys, LCPA staff has resumed surveying and documenting wildlife observations on a weekly basis.

6.1.5.2 LCPA has an alligator/feral hog trapping & monitoring program.

6.1.5.3 Operations agents at RSW keep daily records, in a Microsoft Access® Database, of all wildlife deterrent activities and wildlife species observed during their surveys of the AOA.

6.1.6 Land Use Planning

The LCPA has been and continues to be active in regard to coordinating with local agencies making land use decisions and this section details the various actions the LCPA has taken to limit the creation of additional wildlife hazards on and surrounding RSW.

6.1.6.1 LCPA continues to remain diligent in ensuring that all Airport Improvement Projects within the airport's Capital Improvement Program include steep side slopes and rip-rapped slopes and meet other criteria set forth in AC 150/5200-33B. To achieve this goal, LCPA strives to avoid, to the greatest extent practicable, the addition, creation or enhancement of hazardous wildlife attractants on or near airports. See Appendix S for an example of a Biological Assessment/Design Review that was completed, at the request of the FAA, for a proposed non-aviation, on-airport project.

6.1.6.2 LCPA remains committed to using the offsite 7,000-acre Mitigation Park as a cornerstone for airport mitigation to provide a safer airport operational environment. Through local comprehensive planning and re-zoning, LCPA's future development will strive for environmental mitigation required by local, state, and federal agencies to be accomplished off-site in order to meet the FAA requirements for wildlife attractants.

6.1.6.3 Through recent RSW re-zoning efforts, a deviation for aviation uses was approved to allow slopes for lake excavation at slopes of 2:1 versus slopes for lake excavation at 4:1. Prior to local development order approval, the plans must show slopes for any lake stabilization in accordance with FAA prescribed guidelines.

6.1.6.4 Through recent RSW re-zoning efforts, a deviation for aviation uses was approved to seek relief from the requirement to provide certain plantings around storm water ponds and furthermore to allow for fewer plantings. The proposed ponds/excavations will be shown on the local development order plans and the planting plans will be approved by the county's Environmental Sciences staff prior to local development order issuance.

6.1.6.5 LCPA staff has worked to educate Lee County Environmental Sciences staff on the AC 150/5200-33B and have successfully had them agree to administrative exemptions within the 10,000 ft separation distance of the RSW AOA. This includes a reduction in

number the of littoral plant species along the shoreline of new storm water management ponds to decrease diversity, clumping of littorals and removal of new littoral growth, and created a landscape list of species that are less attractive to wildlife.

6.2 Additional Recommendations Based On WHA

The recommendations below are organized in three categories: habitat management, wildlife deterrence, and general recommendations. Nothing set forth in these recommendations should be construed as authorization to implement the recommendation if it is not in compliance with existing permits and their conditions. Implementing some of these recommendations may require consultation with permitting agencies and obtaining approval of the recommended action. Each recommended action should be evaluated on a case-by-case basis. A summary of the legal setting for wildlife hazard management activities at RSW and protected species that were identified in the WHA is provided in Appendix T.

6.2.1 Habitat Management

6.2.1.1 Airfield management activities:

a. Mowing the airfield following the current rotational schedule, but raise mower decks to six inches, and periodically modify the mowing pattern;
b. Implementation of the drought maintenance plan for all lakes and canals within the AOA to reduce/remove wetland vegetation within these areas that are attractive to hazardous wildlife;

6.2.1.2 Habitat modifications inside the AOA:

a. Continue to steepen slopes, deepen water depth and remove emergent vegetation along the canal (known as Lake 4) as practicable. Evaluate future options for piping canal system underground.

6.2.1.3 Develop a comprehensive plan and coordinate with the Florida Department of Environmental Protection and possibly other regulatory agencies such as the South Florida Water Management District, to allow the LCPA the opportunity to conduct harassment activities as necessary within the Southwest and Northeast Conservation Areas, and modify the habitat to reduce the wildlife hazard attractant within these areas. These activities may require amending the language of the conservation easement recorded, as depicted in Appendix U. The following habitat modifications are recommended for the Southwest Conservation Area:

a. Removing the snags being utilized as roosts by vultures;
b. Trimming the lower branches from the live pine trees being used as roosts by vultures and other potential habitat modifications may need to be considered to reduce the attractiveness to vultures;
c. Possible habitat modifications, such as the removal of cypress and other wetland trees and shrubs, will need to be explored to diminish the quality of the attractant to White Ibis and other potential roosting/nesting wading bird species.

6.2.1.4 Additional habitat modifications outside the AOA:

a. Removal of the trees and shrubs in the two identified Cattle Egret roosting locations (see map in Appendix L). As this work is being carried out, the Operations Department will need to be watchful of Cattle Egrets establishing a roost somewhere else on airport property; likely places could include the Southwest and Northeast Conservation Areas. It is recommended that daily surveys of these areas be conducted at dusk to verify that new roosts are not being established. These surveys should be conducted during the roost removal process and for two weeks after the completion of the work.

6.2.2 Wildlife Deterrence

6.2.2.1 As the species contributing to the most risk at RSW, the Operations Department should consider the depredation of vultures, as a last resort, if other deterrent measures and/or habitat modifications do not alleviate the potential risk these birds are creating, especially near the 6 end of the runway.

6.2.2.2 Continue current wildlife deterrent activities, as described in section 6.1, with the exception of the use of methyl anthranilate (MA). According to Dr. DeFusco, MA is generally very expensive and marginally effective; the airport should consider discontinuing its use;

6.2.2.3 Continue to ensure that training and equipment is available for wildlife control personnel who use pyrotechnics and other deterrent devices;

6.2.2.4 Continue to ensure that depredation permits are renewed and that wildlife control personnel are trained to conduct lethal control measures as necessary;

6.2.2.5 Continue to use the Border collie during mowing activities to deter Cattle Egrets;

6.2.2.6 Continue monitoring the terminal, jetways, concourses, rooftops and adjacent areas for signs of nesting. Inspections should be conducted every six months as a minimum, more frequently if increased bird activity is observed in the area;

6.2.2.7 Continue to conduct periodic (possibly in conjunction with bi-weekly wildlife observations) inspections of the trash collection station, record status of the area (container doors open, wildlife presence, etc.) and report any problems to the department responsible and/or to the HWWG;

6.2.2.8 Add lids to open trash containers located by the airside baggage handling area, especially those receiving food scraps;

6.2.2.9 Consider posting signs, in appropriate languages, in the airside baggage handling area, where trash containers are located, and at the trash collection station to inform users of the risks of attracting hazardous wildlife;

6.2.2.10 Conduct frequent inspections of vulture roost and harass vultures coming in to roost when it is safe to do with respect to aircraft operations;

6.2.2.11 Conduct vulture surveys in the Southwest Conservation Area, once a month, during their nesting season (January – August) to determine if there is any nesting activity taking place. If vultures are nesting in this area discuss and evaluate the next course of action with the Hazardous Wildlife Working Group;

6.2.2.12 Continue to install new and maintain existing anti-perching devices on lights, poles, culvert headwalls, and other structures acting as bird attractants where they have shown to be effective.

6.2.3 General

6.2.3.1 Coordinate with all stakeholders at the airport on hazardous wildlife issues:

a. Continue the Hazardous Wildlife Working Group, meeting on a regular basis;
b. Meet regularly with airlines and other users to ensure reporting of all wildlife strikes to the Operations Department and FAA;
c. Ensure FAA Air Traffic Control procedures are monitored and in compliance with FAA directives to provide aircrews and ground personnel with access and information regarding real-time wildlife hazards.

6.2.3.2 The wildlife deterrence data being collected by the Operations Agents is very valuable to the management of hazardous wildlife at the airport. With a few modifications the data being collected could become a fully quantifiable database, with the ability to query all data fields that could be utilized to make management decisions; similar to the database created for this study. These proposed modifications include:

a. Changing the grid system to the one utilized in this WHA or a similar GIS based grid;
b. Clearly noting whether an action taken or sighting made was within or outside the AOA;
c. Record each species as a separate entry so it is clear how many of each species was observed;
d. Continue to record all incidences of deer road-kill on airport property;
e. As funding allows the LCPA should consider combining the Ops database and the wildlife observation data, recorded by airport staff from the Department of Planning and Environmental Compliance, into one data managing software such as Airman®. This would help correlate deterrence activities with wildlife usage of the AOA.

6.2.3.3 The Operations Department should also consider reviewing the Best Management Practices for Airport Wildlife Control, adopted by the Bird Strike Committee USA (Cleary 2007), and compare them to their current wildlife hazard management program, and incorporate the BMP's that are not presently part of their program, to the greatest extent practicable.

6.2.3.4 In addition, the Operations Department should hold annual, but preferably semi-annual, bird identification training for their staff. Annual training will be beneficial for new

employees, a refresher for existing employees, and also will allow for consistency in regards to identification of wildlife utilizing the airport property. Semi-annual training would address species that occur only seasonally at RSW. It is also important for wildlife control personnel to be trained in bird identification due to the potential presence of federally threatened or endangered species on or near the RSW AOA (FAA 2005), as well as state listed species. Additional authorization from the USFWS is required to harass federally listed species, and additional authorization from FWC is required to take state listed species.

6.2.3.5 LCPA Planning and Environmental Compliance staff should continue to conduct airfield wildlife observations at a minimum frequency of bi-weekly, including dawn, mid-day and dusk observations. Dawn and dusk observations will help to identify potential roosting activity by hazardous bird species.

a. Extend those observations to the Southwest Conservation Area to monitor, year-round, the presence of vultures, Cattle Egrets and White Ibis since they comprise some of the most hazardous species at RSW;
b. Another observation point should be added adjacent to the large storm water management lake at the south end of airport property, to monitor wildlife usage on the lake by potentially hazardous species;
c. LCPA Operations Department should continue to conduct periodic, at least once per year, nighttime spotlight surveys of the AOA for deer and other potentially hazardous wildlife activity, following the same methodology as utilized in this assessment. A survey form for submission to Planning and Environmental Compliance should be developed for documentation purposes.

6.2.3.6 The LCPA should prepare, via the Hazardous Wildlife Working Group, a summary of the year's hazardous wildlife activity at RSW, to include but not limited to such items as: reported wildlife strikes, wildlife monitoring results, and data from the Operations Department wildlife logs on deterrence activities. This annual summary could be used as an adaptive management tool to assist with the implementation of the recommendations from this assessment and help to reduce the wildlife hazard at RSW.

6.2.3.7 The Department of Planning and Environmental Compliance should continue its current efforts to coordinate with surrounding land owners and local governments to prevent the creation of additional bird attractants near the airport, including reviewing and commenting on any new proposed mitigation/restoration activity occurring within the 10,000' separation distance of the airport's AOA.

6.2.3.8 The LCPA should continue to conduct on-site design review for aviation and non-aviation development – including a technical review memo for projects that have the potential to create wildlife hazard attractants. This information could be kept on file and if necessary, it could be used to supplement the RSW wildlife hazard management program.

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APPENDIX A

FAA Annual Certification Letter (2007)

Xc: Ellen
Renee
Deb L
Juliet I.

U.S. Department of Transportation
Federal Aviation Administration

Southern Region
Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, Puerto Rico, South Caroline, Tennessee, Virgin Islands

P.O. Box 20636
Atlanta, Georgia
30320-0636

June 01, 2007

Mr. Robert M. Ball
Executive Director
Southwest Florida International Airport
11000 Terminal Access Rd.
Fort Myers, Florida 33913

Dear Mr. Ball:

Southwest Florida International Airport, Fort Myers, Florida
Annual Certification Inspection Close-Out

The annual certification inspection of Southwest Florida International Airport was conducted on 5/11/2007. The inspection revealed that the airport is being operated in compliance with Federal Aviation Regulation Part 139, the Airport Certification Manual, and the Airport Operating Certificate.

You are to be commended for the procedures that you are using in the day-to-day operation of the airport. The appearance of the airport indicates that they are effective.

I have only one recommendation to make after this year's inspection. Although the airport continues to control wildlife and has good control procedures in place, we feel it is time to reevaluate current conditions at the airport. We suggest a qualified wildlife biologist conduct a new assessment and it should determine if an official Wildlife Hazard Management Plan is required at this time.

Thank you for your cooperation over the last three years. The construction projects at the airport have been a challenge to say the least. It was a pleasure working with people who have such a great sense of professionalism and dedication to their job.

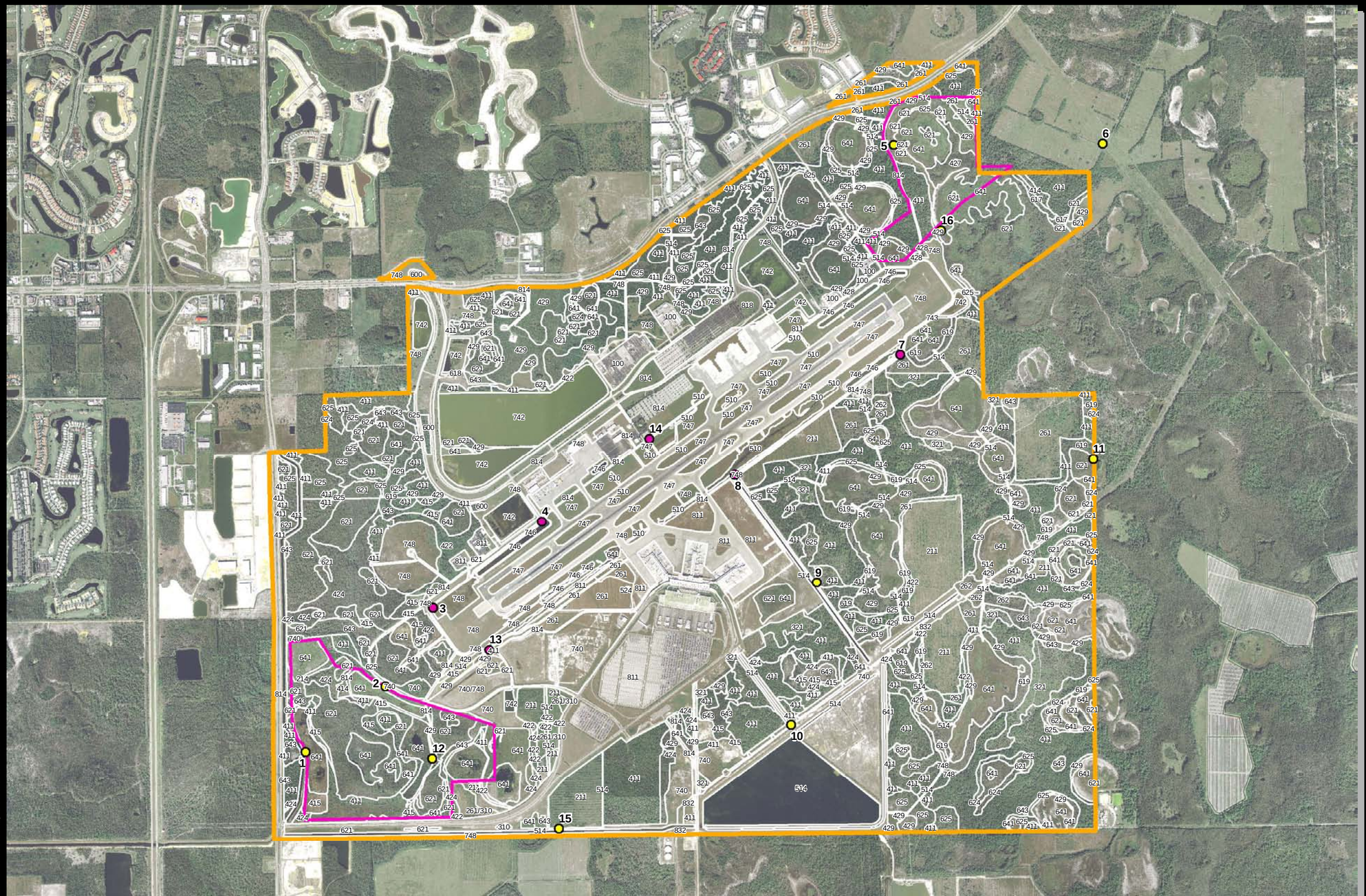
Sincerely,

Linda Gerlowski

for Jack E. McSwain
Airport Certification Safety Inspector

APPENDIX B

FLUCFCS Map



FLUCFCS Code	Area Acres	FLUCFCS Code Description
100	42.13	Urban and Built-Up
211	217.25	Improved Pasture
214	15.29	Row Crops
261	203.97	Fallow Crop Land
261/310	18.48	Fallow Crop Land/Herbaceous (Dry Prairie)
262	16.00	Fallow Crop Land - Hydric
310	0.51	Herbaceous Rangeland (Dry Prairie)
321	86.23	Palmetto Prairie
411	1,040.26	Pine Flatwoods
414	5.82	Pine - Mesic Oak
415	51.68	Mixed Pine
422	50.08	Brazilian Pepper
424	113.87	Melaleuca
427	0.45	Live Oak
428	2.06	Cabbage Palm
429	399.12	Wax Myrtle - Willow
510	33.52	Streams and Waterways
514	195.56	Canal
524	0.14	Lakes less than 10 acres
600	8.70	Wetlands (general)
617	5.07	Mixed Wetland Hardwoods
618	0.60	Willow and Elderberry
619	41.68	Exotic Wetland Hardwoods
621	495.01	Cypress
624	21.41	Cypress - Pine - Cabbage Palm
625	233.59	Hydric Pine Flatwoods
641	669.74	Freshwater Marsh
643	92.73	Wet Prairie
740	347.47	Disturbed Land
740/748	24.96	Disturbed Land / Maintained Grass Areas
742	205.60	Borrow Area
743	2.66	Spoil Area
746	30.24	Abandoned Railway
747	166.53	Dry Detention
748	433.56	Maintained Grass Areas
811	737.23	Airport
814	286.98	Roads and Highways
818	52.46	Auto Parking Facilities
832	17.67	Electrical Power Transmission Lines

Legend

- SWFIA Boundary

Observation Sites

- Outside AOA
- Inside AOA
- Northeast & Southwest Conservation Areas
- FLUCFCS areas

0 1,250 2,500 3,750 Feet

\\Flms01\proj-fmn\20033734\Task 141\ArcGIS\Map Documents\WetlandHabitat.mxd

LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

FDOT-based land Use Classifications (FLUCFCS)

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING

APPENDIX C

Sampling Location Descriptions

SAMPLING LOCATION DESCRIPTIONS

Airside

The Airside contains the AOA, which includes the runway and its associated taxiways, along with the new midfield terminal and its associated tarmacs. In addition, several large storm water detention systems and their interconnecting canals and drainage ways are present within the Airside portion.

Observation Site #3

Location

Observation site #3 (site #3) is located within the AOA, north of Runway 6/24 just beyond the 6 end of the runway (see Appendix F – study area map). Site #3 is located at the southwestern extent of the AOA.

Habitat Description

The eastern portion of the observation area for site #3 is comprised of an active airfield including; paved runway, taxiway, perimeter road, FAA aviation equipment, barbed wire fence, mowed airfield areas, and airfield signage. The dominant ground cover grass species for the mowed airfield area is Bahia grass (*Paspalum notatum*). Site #3 observation area includes a dry detention area within the airfield mowed area, northwest of runway end 6 and west of taxiway connector A1. There are various species of wetland plants in the dry detention area that are maintained at less then 7" through mowing activities (during the wet season the grass heights may be in excess of 7" due to the inability to use mowing equipment in certain areas).

Figure 1 – Observation Site #3

Outside of the AOA to the north and northwest are natural areas that consist of cypress (*Taxodium distichum*) infested with melaleuca (*Melaleuca quinquenervia*), cleared areas with shrubby vegetation including Brazilian pepper (*Schinus terebinthifolius*) , melaleuca, cypress, cabbage palm (*Sabal palmetto*), and Carolina willow (*Salix caroliniana*). The Airport Loop Road is north of site #3 and has roadway lighting fixtures that provide perching areas (some of the lighting fixtures to the west of this site, more in line with the runway end 6 have bird deterrent fixtures installed on the tops of the lights).

Observation Site #4

Location

Observation site #4 (site #4) is located within the AOA, north of Runway 6/24 near the 6 end of the runway (see Appendix F – study area map). Site #4 is located near the airport cargo facility, west of taxiway connector A3 and north of Taxiway A (see Figure 2).

Figure 2 – Observation Site #4

Habitat Description

Site #4 observation area is comprised of active airfield to the south and northeast including; paved runway, taxiway, perimeter road, ramp areas, barbed wire fence, mowed airfield areas, and airfield signage. The dominant ground cover grass species for the mowed airfield area is Bahia grass. There is a linear wet detention area (approximately 7.5 acres) within the AOA adjacent to the observation site to the south. The wet detention area is inundated with water the majority of the year. There are various littoral zone plants around the edge of the detention area that include cattails (*Typha domingensis*), duck potato (*Sagittaria lancifolia*), and grasses (see Figure 3).

Figure 3 – Observation site #4

Outside of the AOA, to the north, there is an airplane viewing area with picnic tables for the public and an approximately 18-acre wet detention area, with a wide littoral zone comprised mainly of spike rush (*Eleocharis* sp.), located just north of the Airport Loop Road. The Airport Loop Road has tall roadway lighting fixtures that provide perching areas. Further north there are two large wet detention areas that are approximately 29 and 105 acres. To the west of the site, outside the AOA, is the airport training center facility and maintenance facilities.

Observation Site #7

Location

Observation site #7 (site #7) is located within the AOA south of runway end 24 (see Appendix F – study area map). Site #7 is located adjacent to the airfield perimeter road at the northwest end of the drainage canal that runs parallel to Taxiway F.

Habitat Description

North and west of Site # 7 is comprised of active airfield area (AOA) including; paved runway, taxiway, perimeter road, and ramp areas, mowed infield areas, barbed wire fence, and airfield signage. The dominant ground cover grass species for the mowed airfield area is Bahia grass. The drainage canal in this area has eroded side slopes and sedimentation areas that have created undulating side walls with shallow side slopes that create fill areas within the canal channel. The fill areas provide wildlife with resting areas and the undulating side walls create line of sight barriers for wildlife within the canal littoral zone and open water area (see Figure 4). Littoral zone plants in the drainage canal include torpedograss (*Panicum repens*), duck potato, spike rush, and pickerel weed

(*Pontederia cordata*). Submerged aquatic vegetation is also present in the drainage canal. The drainage canal is inundated with water the majority of the year.

Figure 4 – Observation site #7

To the north/northeast of the site, outside of the AOA fenced area, there is an approximately 4-acre storm water management/detention feature that has standing water the majority of the year and has limited littoral zone vegetation. Habitat south of the site is comprised of natural areas that include melaleuca infested (>90%) pine flatwoods habitat and marsh areas further to the south.

Observation Site #8

Location

Observation site #8 (site #8) is located within the AOA south of Runway 6/24 (see Appendix F – study area map). Site #8 is centrally located within the AOA. From this observation point, the mid section of the active runway and its associated taxiways can be viewed.

Habitat Description

Site #8 is predominately surrounded by the active airfield area including; paved runway, taxiway, perimeter road, and ramp areas, mowed airfield areas, barbed wire fence, and airfield signage. The dominant ground cover grass species for the mowed airfield area is Bahia grass. Adjacent to the site and parallel to Taxiway F, is a drainage canal that is approximately 70 feet wide. The drainage canal contains littoral zone areas that include torpedo grass, duck potato, pickerel weed, submerged vegetation and scattered areas of spike rush. Figure 5 (site) depicts the airfield area and drainage canal feature from the site looking north. The drainage canal is inundated with water the majority of the year.

Figure 5 – Observation site #8

South of Site #8 there is a rip-rap lined drainage canal that flows southeast. Southeast of the site, outside of the AOA, is a mowed grass area and pine flatwoods that consists of slash pine (*Pinus elliottii*), saw palmetto (*Serenoa repens*), melaleuca, and cabbage palms. Figure 6 shows the rip-rap lined canal to the south of the site and the pine flatwoods area to the southeast of the site.

Figure 6 – Observation site #8

Observation Site #13

Location

Observation site #13 (site #13) is located within the AOA, south of Runway 6/24 near the 6 end of the runway (see Appendix F – study area map). Site #3 is located on the airport perimeter road just north of the southwest Airfield Access Gate.

Habitat Description

North and east of site #13, the observation area is within the AOA. This area is comprised of active airfield including; paved runway, taxiway, perimeter road, FAA aviation equipment, barbed wire fence, mowed airfield areas, and airfield signage. The dominant ground cover grass species for the mowed airfield area is Bahia grass. To the northeast of the site, within the AOA, a vehicle check point (small building) is located on the airfield perimeter road and the trash collection station (consisting of fenced area with four compactors for solid waste, one each for co-mingled, cardboard, and fiber (paper), and one open top dumpster for wood) is located on the southeast side of the airfield perimeter road.

Running parallel to Runway 6/24, south of Taxiway F, is a drainage canal that is approximately 65 feet wide. The drainage canal is over 90% covered with vegetation in this area. Vegetation includes alligator flag (*Thalia geniculata*), duck potato, and various grasses. The drainage canal is inundated with water during the wet season (see Figure 7). The drainage canal flows to the west (off of the AOA) through a culvert under the perimeter road. The culvert has a metal grid over it and has a cement structure (headwall) where the culvert begins. There is also a storage pile of rock near the cement headwall structure (see Figure 8).

Figure 7 – Observation site #13

Figure 8 – Observation site #13

Outside of the AOA to the south of the site, there is a disturbed area (southeast) that has sporadic vegetation (grasses and shrubs) and open ground areas. There is an approximately 19-acre dry detention area southwest of the site that contains a drainage canal lined with rip-rap. During the wet season, this dry detention area holds water for long periods of time and supports dense wetland vegetation growth including spike rush. The wooded wetland area within the RPZ, between the Airport Loop Road and the AOA is located west/northwest of the site, outside of the AOA. This area includes a canopy of Brazilian pepper, melaleuca, cypress, cabbage palms, and Carolina willow.

Observation Site #14

Location

Observation site #14 (site #14) is located within the AOA, north of Runway 6/24 approximately at the mid point of the runway (see Appendix F – study area map). Site # 14 is located in the mowed grass airfield area north of Taxiway A in front of the Aircraft Rescue Fire Fighting (ARFF) station and south of the airfield perimeter road.

Habitat Description

The southern portion of Site #14 observation area is comprised of an active airfield (AOA) including; paved runway, taxiway, perimeter road, ramp areas, mowed airfield areas, and airfield signage. The dominant ground cover grass species for the mowed airfield area is Bahia grass. North of the site consists predominately of developed areas including buildings, the Air Traffic Control Tower (ATCT), hangars, ramp, parking lots, and mowed/landscaping areas around these features (see Figure 9). Northeast of the site, adjacent to the airfield perimeter road, is an approximate 3-acre dry detention area that includes various wetland species that are periodically mowed for maintenance.

Figure 9 – Observation site #14

The airfield observation area for this site includes a drainage ditch (approximately 50 feet wide) that runs parallel to Taxiway A (see Figure 10). The drainage ditch is culverted at the taxiway connectors and has headwall structures (concrete) that provide wildlife loafing and perching areas. Vegetation in the drainage ditch includes various grasses and scattered cattails. The drainage ditch is usually dry during the dry season and inundated during the wet season.

Figure 10 – Observation site #14

Landside

The Landside consists of all areas outside the AOA perimeter fence. Most of the Landside is made up of remnant native habitats, fallow cropland, large scale detention ponds and ancillary airport services buildings. The Landside also includes the Terminal Parking Lot, the Cell Phone Lot and a taxicab/limo staging area.

Observation Site #1

Location

Observation site #1 (site #1) is located on airport property approximately 4,300 feet from the AOA, southwest of runway end 6 (see Appendix F – study area map). Site #1 is situated under the final approach flight path to Runway 6 and under the departure corridor for Runway 24. The observation site is located on a manmade berm that was constructed as part of a surface water management system for a bypass canal. This site is located on the western boundary of the airport's southwest conservation area. Site # 1 is approximately 1,700 feet north of Terminal Access Road and 600 feet east of the Ben Hill Griffin Parkway/Treeline Avenue.

Habitat Description

Site #1 is situated on the berm of a rip-rap lined canal feature. The berm of the canal is vegetated with various grass species and ground cover and shows evidence of frequent vehicle use. The canal is approximately 60 feet wide with 2:1 side slopes and holds water throughout the year. Figure 11 depicts the area from Site #1 looking north.

Figure 11 – Observation site #1

East of the canal berm, there are upland and wetland natural areas that are currently under a conservation easement. To the east, adjacent to the canal berm, there is a narrow area of shrubby vegetation including wax myrtle (*Myrica cerifera*) and dog fennel (*Eupatorium capillifolium*) with scattered slash pine and cabbage palm. East of this shrubby vegetation is a marsh wetland system with a depressional area comprised of alligator flag and open water. This open water area is visible from the observation point. The eastern boundary of the mash system is fringed with a slash pine/shrub area which borders a large cypress wetland system (see Figure 12**)**.

Figure 12 – Observation site #1

West of the canal is an approximately 17-acre isolated natural area between the canal and Ben Hill Griffin Parkway/Treeline Avenue. This area's dominant canopy and mid canopy includes slash pine, melaleuca, red maple (*Acer rubrum*), and dahoon holly (*Ilex cassine*). Ben Hill Griffin Parkway, a four lane divided roadway with landscaping, is located west of this natural area.

The canal system provides an aquatic habitat with submerged vegetation and scattered emergent vegetation associated with the rip rap areas. Aquatic vegetation includes hydrilla (*Hydrilla verticillata*) and bladderwort (*Utricularia* sp.).

Observation Site #2

Location

Observation site #2 (site #2) is located on airport property approximately 1,800 feet from the AOA, southwest of runway end 6 (see Appendix F – study area map). Site #2 is located directly under the final approach flight path to Runway 6 and in the departure corridor for Runway 24. The observation site is located adjacent to the airport's Perimeter Road and on the northeast boundary of the airport's southwest conservation area.

Habitat Description

Site # 2 is adjacent to the paved, two-lane Perimeter Road, which bisects a natural area. The natural area directly to the north-northeast of the site is comprised of melaleuca, pond cypress (*Taxodium ascendens*), wax myrtle, Carolina willow, with scattered slash pine and Brazilian pepper (see Figure 13). Beyond this natural area to the northeast is the AOA and to the east is a surface water management facility comprised of dry detention, canals, and wet detention.

Figure 13 – Observation site #2

The areas to the south and southwest of the site are within the airport's southwest conservation area and include marsh and cypress wetland systems and pine flatwoods. Directly to the west of the observation site is a marsh/pond system bounded to the southwest by a slash pine fringe and a larger pond cypress system. Within the slash pine fringe area, near the western fringe of the marsh/pond system is an area of 10-15 large pine snags. The pine flatwoods extend south of the marsh/pond area.

Observation Site #5

Location

Observation site #5 (site #5) is located on airport property within the Northeast Conservation Area (a wetland mitigation area). Site #5 is approximately 3,000 feet from the AOA north of runway end 24 (see Appendix F – study area map). This site is located directly south of the Low Level Windshear Alert System (LLWAS).

Habitat Description

Site #5 is located in a natural area that includes pine flatwoods, wet prairie, marsh, cypress dome and strand systems. Figure 14 (site 5 prairie area) depicts the wet prairie area south and east of the observation point. The wet prairie area has various wetland and facultative wetland plant species including bushy broomsedge (*Andropogon glomeratus*), beak rush (*Rhynchosopra sp*.) yellow-eyed grass, (X*yris sp*.), scattered cabbage palms, and wax myrtle. To the west of the site is a pine flatwoods. The pine flatwoods has dense slash pines, cabbage palms, smilax, and wax myrtle (see Figure 14). Adjacent to the observation point is a small (less then 1 acre) cypress dome that includes, swamp bay (*Persea palustris*), and cabbage palm. Further west of the observation point, within sight, is the eastern boundary of a larger cypress strand system. (The cypress strand area can be seen in the distance in Figure 15**)**.

Figure 14 – Observation site #5

Figure 15 – Observation site #5

Observation Site #6

Location

Observation site #6 (site #6) is located off airport property on a Florida Power and Light Company (FPL) utility easement (see Appendix F – study area map). Site # 6 is approximately 5,000 feet from the AOA northeast of runway end 24. This site is located under the arrival path of Runway 24 and one of the non-primary departure paths of Runway 6.

Habitat Description

Site #6 is surrounded by fallow agricultural fields that are currently being utilized for grazing cattle. The pastures are dominated by various grasses used for grazing and dense areas of dog fennel. There are also areas of scattered Brazilian pepper, cabbage palm, and saw palmetto within and along the boundaries of the pastures (see Figure 16 and Figure 17 - Site 6 Look NE and Site 6 SW). Pine flatwoods are located to the southwest of the site adjacent to the pasture areas. There are also scattered cypress and marsh systems located to the south, north, and east of the pastures.

Figure 16 – Observation site #6

Figure 17 – Observation site #6

There is a free flowing water well located northeast of site #6 adjacent to the FPL power line easement (see Figure 18 – site 6 well area) This area has wetland vegetation and standing water that provides an aquatic habitat feature. There are swales on both sides of the FPL power line, approximately 20-30 feet wide, consisting of herbaceous vegetation that are inundated during the wet season. The FPL power line structure and wires are also prominent features in the area.

Figure 18 – Observation site #6

Observation Site #9

Location

Observation site #9 (site #9) is located on airport property east of the terminal ramp area for concourse B (see Appendix F – study area map). Site #9 is located on a manmade berm approximately 700 feet from the AOA. This site is oriented perpendicular to Runway 6/24 approximately 4,000 feet southeast of the runway.

Habitat Description

The area to the north-northeast of the site is comprised of natural areas and fallow agricultural fields. Directly adjacent to Site #9, to the north-northeast, there is a pine flatwoods area that includes slash pine, melaleuca, Brazilian pepper, saw palmetto and open areas of that include wire grass (*Aristida stricta* var. *beyrichiana*).

Directly west of site #9, across the canal, is a fallow agricultural field, that is periodically mowed, and the ramp for concourse B (see Figure 19 – Site 9 Look at AOA). Within the field there is a wetland area that consists of a limited number of pond cypress, ringed by Carolina willow, wax myrtle, and Brazilian pepper. To the south of the site, on both sides of the canal, there are pine flatwoods that include species such as slash pine, saw palmetto, and melaleuca (see Figure 20). Figure 20 also depicts cattails along the rip-rap side slopes of the canal. Submerged aquatic vegetation is also present within the canal.

Figure 19 – Observation site #9

Figure 20 – Observation site #9

Observation Site #10

Location

Observation site #10 (site #10) is located on airport property on a FPL utility easement (see Appendix F – study area map). Site # 10 is approximately 3,200 feet from the AOA south of Runway 6/24 and the terminal building complex.

Habitat Description

Site # 10 is located on a box culvert area southeast of a canal structure. The canal bisects a pine flatwoods community comprised of slash pine, saw palmetto, Brazilian pepper, cabbage palm, and various grass species (see Figure 21). Located further north of this pine flatwoods community are the terminal facilities, surface parking, parking garage and road way facilities of the airport. The canal provides aquatic habitat and there is scattered emergent vegetation along the rip-rap lined side slopes.

The FPL easement is comprised of various grass species, dirt trail from vehicular traffic, and the associated power line structures. To the south of the site is a 160-acre water management lake (wet detention) surrounded by a man-made berm with various grass species and a chain link fence with barbed wire (see Figure 22 Site 10 big lake). The side slopes (2:1) of the lake are lined with rip-rap and scattered patches of cattails are present. Adjacent to the 160-acre lake, there is a 70-acre dry detention area that is also encircled with chain link fence with barbed wire. The dry detention area is primarily comprised of grass species and has a canal system on the northwest and eastern boundaries. Each of these canals has rip-rap side slopes with scattered cattails present. The dry detention area is periodically mowed.

Figure 21 – Observation site #10

Figure 22 – Observation site #10

Observation Site #11

Location

Observation site #11 (site #11) is located east-southeast of Runway 6/24 approximately 5,000 feet from the AOA (see Appendix F – study area map). Site #11 is located on the property boundary between LCPA and Lee County Conservation 20/20 Wild Turkey Strand Preserve. This site is located 900 feet north of the FPL utility easement.

Habitat Description

Site # 11 is located along a barbed wire fence line adjacent to a borrow pit that is approximately 0.35 acres in size. The disturbed area around the borrow pit includes mounded earth material with slash pine, Brazilian pepper and other vegetation growing atop (see Figure 23 – Site 11 water). The rest of the surrounding area is mainly mixed cypress wetland to the west of the site and marsh and hydric pine flatwoods to the east. The cypress area to the west includes melaleuca, pond cypress, dahoon holly and scattered red maple. To the east are slash pine, open grass, melaleuca saplings, and wax myrtle.

Figure 23 – Observation site #11

Observation Site #12

Location

Observation site #12 is located south of runway end 6 approximately 2,500 feet from the AOA (see Appendix F – study area map). Site #12 is located within the airport's southwest conservation area and next to the FAA's Low Level Windshear Alert System (LLWAS) tower structure (see Figure 25).

Figure 24 – Observation site #12

Habitat Description

The area to the west of the site is comprised of created wetland areas (predominantly pond cypress) and marsh system (see Figure 25). Further west of the cypress and marsh areas are pine flatwoods dominated by slash pine and saw palmetto. To the south of the site is primarily pine flatwoods with saw palmetto and Brazilian pepper. The Terminal Access Road is approximately 1,500 feet south of the site.

To the southwest of the site, partially visible through a trail cut through the pine flatwoods, is a fallow agriculture field with predominately grass and shrubby species. To the north-northeast of the site is a cypress system that is comprised of pond cypress, melaleuca, and scattered dahoon holly.

Figure 25 – Observation site #12

Observation Site #15

Location

Observation site #15 is located south of Runway end 6 approximately 4,800 feet from the AOA (see Appendix F – study area map). Site #15 is located on a manmade berm adjacent to a canal located approximately 800 feet southwest of Terminal Access Road.

Habitat Description

The area to the north of site #15 is fallow agriculture fields with predominately dense, shrubby vegetation. Species in this area include Brazilian pepper, wax myrtle, and salt bush (*Baccharis* sp.). There are areas of the fallow agriculture fields that are also maintained through mowing activities by LCPA which have herbaceous species and open ground/sand areas (see Figure 26).

Figure 26 – Observation site #15

The canal is approximately 50 feet wide with rip rap slopes. Figure 27 (Site 15) depicts dense littoral vegetation along the rip-rap slopes of the canal. Littoral species include cattails, primrose willow (*Ludwigia peruviana*), and various rush species. To the south of the canal there is a small cypress area adjacent to the canal berm that is surrounded to the south by an agricultural field and recently cleared areas.

Figure 27 – Observation site #15

Observation Site #16

Location

Observation site #16 (site #16) is located on airport property within the Northeast Conservation Area (see Appendix F – study area map). Site # 16 is located approximately 800 feet from the AOA and 1,800 feet from runway end 24. This site is the closest observation point outside of the AOA to runway end 24.

Habitat Description

Site #16 is situated within a natural area and in close proximity to a mowed grass area just outside of the AOA, within the runway protection zone for Runway 24. Figure 28 depicts the mowed grass area and the chain link fence of the AOA boundary. The surrounding habitat includes the mowed grass area with clusters of cabbage palms, pine flatwoods, cypress strand, wet prairie, and marsh. This area also has dense stands of shrubby, immature melaleuca (less then 5 acres).

Figure 28 – Observation site #16

APPENDIX D

Wildlife Observation Sample Data Sheet and Data Map

Southwest Florida International Airport - Wildlife Hazard Assessment
Wildlife Observations - Field Data Sheet

Date: _____ Observation Period: _____ Sheet: _____ of _____ Season: _____

Observer(s): _____ Sunrise: _____ Sunset: _____ Weather: sky: _____ wind/direction: _____

Observations			Species		Behavior / Location			Comments
Seq. No.	Station	Time	Abreviation	No. Indiv.	Activity	Location	Flight Dir.	

datasheet unique ID:(sampling location #, first two letters of observation period, date. Ex.: 15mi032608):_____

Legend

0 200 400

Scale at Right - Feet

OBSERVATION SITES

AOA

- Inside AOA - night/day surveys
- Outside AOA - day surveys
- 400-ft Observation Grid
- Airport property boundary

Observer Notes:

Southwest Florida International Airport Wildlife Hazard Observations

JOHNSON ENGINEERING

2122 JOHNSON STREET
P.O. BOX 1550
FORT MYERS, FLORIDA 33902-1550
PHONE (941) 334-0046
FAX (941) 334-3661
E.B. #642 & L.B. #642

OBSERVER		
DATE	OBSERVATION PERIOD	SITE NO. 12

Fms01\Proj-jel\20033734Env\ArcGIS\BirdHazObserv_Landscape.mxd

DATASHEET CODES

Weather	
sky code:	
0	few clouds
1	Partly cloudy (scattered) or variable sky
2	Cloudy (broken) or overcast
3	Fog or smoke
4	Drizzle
5	Showers
Beaufort Wind Scale	
wind code:	
0	CALM – Wind speed <1 mph – Smoke rises vertically
1	LIGHT AIR – Wind speed 1-3 mph – Rising smoke drifts
2	LIGHT BREEZE – Wind speed 4-7 mph – Leaves rustle; calm wind on face
3	GENTLE BREEZE – Wind speed 8-12 mph – Leaves and trees in constant motion
4	MODERATE BREEZE – Wind speed 13-18 mph – Moves some branches (too windy to monitor)
5	FRESH BREEZE – Wind speed 19-24 mph – Small trees begin to sway (way too windy to monitor)

Activity	CODE	MAP symbol
loafing	LOAF	• 1
foraging	FOR	• 1
flying:		
flushed	FLY-1	o→ 1
fly over	FLY-2	→ 1
circling	FLY-3	1
fly/perched	FLY-4	—→o 1
flushed/perched	FLY-5	o—→o 1
fly back/forth	FLY-6	←→ 1
vocalizing	VOC	• 1

Location	CODE
tree	T
ground	G
other	O

APPENDIX E

Sample Qualitative Observations Map

REVISIONS		

Lee County Port Authority
Lee County, Florida

JOHNSON ENGINEERING
2122 JOHNSON STREET
P.O. BOX 1550
FORT MYERS, FLORIDA 33902-1550
PHONE (239) 334-0046
FAX (239) 334-3661
E.B. #642 & L.B. #642

Bird Hazard Observation Sites

DATE	PROJECT	FILE NO.	SCALE	SHEET
03/24/08	20033734	00-00-00	As Shown	1 OF 1

\\Fims01\proj-fmn\20033734\Task 141\ArcGIS Map Documents\BirdHazObserv_QuadNotes2x3.mxd

APPENDIX F

Aerial Survey Map

5-MILE SEPARATION DISTANCE

10,000-FOOT SEPARATION DISTANCE

Wild Turkey Strand Preserve

PRESERVES	
Map ID	Name of preserve
1	Six Mile Cypress Preserve
2	Wild Turkey Strand Preserve
3	Flag Pond Preserve
4	Airport Mitigation Park
5	Gator Hole Preserve

2x3_Wetlandhabitat_preserve_table.xls

0 4,000 8,000 12,000 Feet

Legend

- SW Florida International Airport Boundary
- Runways

Observation Sites
- Outside AOA
- Inside AOA
- Flight Path
- Observation Waypoints
- Separation Distances
- Northeast & Southwest Conservation Areas

FUTURE LAND USE

FUTURE URBAN AREAS
- Intensive Development
- Central Urban
- Urban Community
- Suburban
- Outlying Suburban
- Industrial Development
- Public Facilities
- University Community

INTERCHANGE AREAS
- Industrial Interchange
- Industrial Commercial Interchange
- General Interchange
- University Village Interchange

NEW COMMUNITY
- New Community

AIRPORT AREAS
- Airport
- Tradeport

NON-URBAN AREAS
- Rural
- Rural Community Preserve
- Open Lands
- Density Reduction / Groundwater Resource
- Conservation Lands Upland
- Conservation Lands Wetland

ENVIRONMENTALLY CRITICAL AREAS (WETLANDS)
- Wetlands

\\fms01\proj-fmn\2003734\Task 141\ArcGIS\MapDocuments\2x3_WetlandHabitat.mxd

LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Aerial Survey and Observation Points

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING

APPENDIX G

GIS Methodology

GIS METHODOLOGY

The WHA includes a general description of the GIS tools that were utilized to capture, analyze and present data. In this section provides additional details on how those tools were applied.

Study Database Design

A spatial grid was created to cover an envelope which included the entire airport property as well as adjacent areas within approximately 2,000 feet of the outer observation sites. Grid polygon feature classes with differing grid unit sizes were created using the Hawth's Analysis Tools extension (2007) to ArcGIS, and were evaluated by ecologists in the field. A grid composed of squares 400 feet on each side was chosen as having the optimal resolution for this study, and each square was given a unique identifier based on the furthest southwest square being "N1E1" and increasing numerically north and east through "N54E64." This grid was used as the basis for all of the standardized data collection used in the study.

Map sheets on letter-sized paper were created for the ecologists to use during observation site visits. These consisted of a reference frame showing a 2,000-foot buffer ring, centered on the station, superimposed over the airport grid and aerial photographic imagery. A larger frame showed the same grid and imagery for an area within approximately 1,300 feet of the station at a scale of 1 inch to 400 feet. A sample data map sheet is included in Appendix G. A larger, 24-by-36-inch map was also created to capture "qualitative" data for wildlife sightings outside of the five-minute regular observation periods. This map simply showed the boundaries of airport property, the grid, the aerial imagery, and the locations of the sampling stations.

The database tables for the wildlife observations were created to contain fields (columns) for all of the criteria collected by ecologists in the field: observer(s), station number, date, season, sunrise/sunset times, observation period, weather, time observation began, code for species observed, number of individuals, activity, location, flight direction, and comments. Fields for the sequence number (line on the ecologists' observation sheet), species guild, species size, species relative hazard score from Dolbeer et al. (2003), observation sheet ID, and hazard guild (relative hazard ranking of low, medium, and high) were also specified. Additionally, a field for the grid in which the observation occurred, a field for the total hazard of all individuals comprising a single observation (sequence), and a hyperlink field for the completed observation sheet PDF were created. This database table structure (schema) was used for both a Microsoft Access (Access) database and an ESRI ArcGIS personal geodatabase.

Data Entry / Digitization

In Access, additional database tables containing valid field entries and a form utilizing combo boxes, select queries, and visual basic functions to automatically populate related values for database entry were created. The form was used to enter wildlife sighting data from the sampling stations on a monthly basis. Using Access allowed administrative staff who did not have ESRI software installed on their workstations to perform the data entry, and having database fields automatically populated based on valid field entries reduced opportunities for data entry errors.

The parallel database table schema in ArcGIS allowed the non-spatial data to be imported from Access directly into the geodatabase. Observation records (rows) in the geodatabase were then edited to draft, or digitized, the locational component of each wildlife sighting as recorded by ecologists on the data sheets. While maintaining an accurate visual and spatial representation of the sightings was desirable, primary emphasis was placed on assuring that features were drafted in the grid squares as identified by the marks on the maps.

Once the wildlife observation data had been entered and drafted, the "grid" field was populated for each observation record with the unique grid identifier for the grid square it occupied. Initially, this was done manually, but later in the study, the Intersect geoprocessing tool standard to ArcGIS was used to obtain the grid values for each feature, and earlier features were reviewed for accuracy. The Intersect tool also prevented observation features such as a bird in a circling flight pattern from impacting the same grid square more than once per sighting.

Data Analysis

A cumulative analysis was performed on a monthly basis during the study. Hazard statistics were summarized for each grid square using the ArcGIS Summary Statistics tool and the summarize function in ArcMap-displayed attribute tables. The summed observation hazard data were exported to database tables in the aggregate and also separately for species classed as high, medium, and low hazard. These tables were then joined to the grid feature class to calculate the grid total hazard values and for visual display of the differing hazard across the airport property.

A site observation matrix was also created that showed whether any wildlife was observed for each site visit. The number of observations made and recorded was divided by the number of site visits to obtain a frequency (percent) of observation for each site. This frequency modifier was applied to the quantitative observation hazards at the grid level, keeping the raw observation data intact.

A final round of statistics export and analysis was undertaken after observations in the field had been completed. Observations for each day part (dawn, midday, dusk) in each season were summarized separately by grid quadrant for the high- through low-

hazard species classes, and nighttime observations were summarized for all species in each season.

Interpolation over Airport Property

Because wildlife observations were not made in every part of the airport property, the Spatial Analyst extension to ArcGIS was used to interpolate the wildlife risk beyond the observed areas. Interpolate derives its meaning from *inter* meaning between and *pole* being the points (Wikipedia 2009). Any means of calculating a value for a point between two or more existing data points is interpolation.

Grid quadrants observed during the quantitative portion of the study were converted into point features with matching hazard scores, and the Kriging tool was used to generate a raster-based coverage of the airport. Kriging is a group of geostatistical techniques utilized to interpolate the value of a random field at an unobserved location from observations of its value at nearby locations (Wikipedia 2009b). Kriging is a preferred interpolation technique where there is a directional component to the sampled data. The process was repeated for quantitative spring, summer, fall, and winter observations as well as for general, qualitative observations.

APPENDIX H

Southwest Florida International Airport (RSW)
Total Aircraft Movements

SOUTHWEST FLORIDA INTERNATIONAL AIRPORT (RSW) TOTAL AIRCRAFT MOVEMENTS

Source: Lee County Port Authority Department of Public Relations

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1983					*1,544	2,436	3,709	3,680	3,251	3,379	3,364	3,731	25,094
1984	4,064	3,852	4,345	*4,063*	3,579	3,279	3,153	3,247	2,786	3,542	3,308	3,988	43,206
1985	4,191	3,752	4,188	*4,426*	4,037	3,546	3,679	3,437	3,534	3,479	3,887	4,196	46,352
1986	4,555	4,119	*4,541*	5,025	3,397	3,624	3,207	3,192	3,715	4,826	4,735	5,077	50,013
1987	5,504	5,585	6,868	*6,377*	5,095	4,620	4,597	4,526	4,225	5,550	5,214	5,770	63,931
1988	5,965	5,440	6,518	*5,679*	5,217	4,922	4,433	5,284	4,070	4,766	4,288	5,459	62,041
1989	6,313	5,026	*5,368*	4,483	4,609	3,939	4,132	4,712	4,332	4,555	4,557	5,237	57,263
1990	5,949	6,188	6,858	*6,917*	6,549	5,332	5,637	5,474	5,632	6,104	5,570	6,314	72,524
1991	5,847	5,658	*6,508*	6,025	5,488	4,462	5,119	4,734	4,792	5,233	5,517	5,258	64,641
1992	5,651	5,776	6,446	*6,023*	4,932	4,488	4,752	4,188	4,314	4,924	5,143	6,103	62,740
1993	6,439	6,297	6,863	*6,851*	5,173	4,637	4,527	4,571	4,476	4,821	5,415	6,120	66,190
1994	6,468	6,100	7,012	*6,268*	5,242	4,367	4,393	4,526	4,117	4,479	5,279	6,076	64,327
1995	6,349	6,069	7,177	*6,836*	5,331	4,709	4,887	5,019	4,815	5,278	6,203	6,948	69,621
1996	6,984	7,028	7,774	*6,908*	5,333	4,800	4,831	5,019	4,125	4,497	5,426	6,379	69,104
1997	6,934	6,436	*7,622*	6,367	5,343	4,478	4,358	4,392	4,093	4,908	5,101	5,962	65,994
1998	6,335	6,301	7,302	*6,829*	5,373	4,824	5,004	5,131	4,221	5,436	6,069	6,905	69,730
1999	6,969	6,941	8,310	*7,282*	5,971	5,327	5,106	5,063	4,795	5,598	6,747	6,393	74,502
2000	6,840	7,411	8,418	*7,586*	5,944	5,006	5,537	5,664	5,019	6,008	6,523	7,086	77,042
2001	7,907	7,994	8,240	*7,387*	6,247	5,078	5,193	5,688	4,265	5,160	6,068	6,552	75,779
2002	7,152	7,206	*8,303*	7,624	5,802	5,076	5,002	4,899	4,652	5,520	6,059	6,857	74,152
2003	7,509	7,792	8,727	*7,854*	5,930	4,858	4,710	4,981	4,589	5,894	6,519	7,251	76,614
2004	8,100	8,679	9,303	*8,199*	6,538	5,745	5,668	5,499	4,993	6,698	8,109	8,555	86,086
2005	8,624	9,341	*10,654*	9,552	7,213	6,051	5,819	5,754	5,016	6,223	8,120	8,466	90,833
2006	8,791	8,165	10,148	9,137	6,652	5,508	5,588	5,471	5,060	5,896	7,175	8,579	86,170
2007	9,331	9,070	11,135	10,181	6,827	5,946	5,895	5,975	5,179	6,182	7,914	8,373	92,008
2008	9,109	8,945	11,074	9,305	6,778	5,813	5,934	5,419	4,992	6,219	7,225	8,490	89,303

*Commercial air carrier operations moved from Page Field to Southwest Florida Regional Airport on May 14, 1983. On May 14, 1993, the airport became Southwest Florida International Airport. On Sept. 9, 2005, all operations moved to a new terminal complex.

APPENDIX I

Time Period and Seasonal Data Analysis by Hazard Guild

and

Quantitative Hazard Score Maps by Season, Time of Day and Hazard Guild

TIME PERIOD AND SEASONAL DATA ANALAYSIS

This section provides an in depth analysis and discussion of the quantitative results maps, provided at the end of this section, that show the location of the relative risk at RSW for each season, time period, and species hazard guild.

Results

Table 1 provides the cumulative hazard classification for each observation station for each season and for the overall study. For purposes of this summary, risk is defined as any area that is classified as moderate or high risk as calculated and shown in the results maps provided at the end of this section. The data in Table 1 is a summary of the quantitative maps provided at the end of this section. The quantitative results maps were summarized in this fashion to make a quantifiable comparison of risk between each observation station. To determine which species were contributing to the risk in these maps, a pivot table was generated with the raw data.

Walking through an example of how Table 5 was utilized, station 2 showed a moderate risk on the seasonal cumulative maps for spring and fall; but when breaking down the risk by time of day for each season, station 2 showed a high risk only at dusk in the fall caused by the high hazard guild species.

Table 1 – Cumulative hazard classification for all observation stations, by season and time period

Obs. Sites	Cumulative Risk (all seasons combined)	SPRING							SUMMER							FALL							WINTER							TOTAL RISK/ TIME PERIOD	%
			Time Period							Time Period								Time Period								Time Period								
		Seasonal Cumulative Risk	Dawn		Midday		Dusk		Seasonal Cumulative Risk	Dawn		Midday		Dusk		Seasonal Cumulative Risk	Dawn		Midday		Dusk		Seasonal Cumulative Risk	Dawn		Midday		Dusk			
			Risk	hazard guild	Risk	hazard guild	Risk	hazard guild		Risk	hazard guild	Risk	hazard guild	Risk	hazard guild		Risk	hazard guild	Risk	hazard guild	Risk	hazard guild		Risk	hazard guild	Risk	hazard guild	Risk	hazard guild		
1	M	ML	ML	H	L	HM	L	H	L	L	H	L	H	L	H	M	L	LH	ML	H	L	H	ML	L	H	L	H	L	H	0	0%
2	H	M	ML	HM	ML	H	ML	HM	ML	L	H	L	H	ML	H	M	L	H	L	H	H	H	L	L	HL	L	H	L	H	1	8%
3	M	L	L	H	L	HM	L	H	M	L	H	L	H	ML	H	ML	L	HM	L	H	ML	H	L	L	M	ML	H	L	HL	0	0%
4	M	L	L	HL	L	HM	L	S	L	L	H	L	H	L	HL	L	L	HM	L	H	L	H	L	L	HL	L	L	L	H	0	0%
5	L	L	L	H	L	H	L	M	L	L	H	M	H	L	H	L	0	0	L	H	L	H	L	L	H	L	H	L	H	1	8%
6	M	L	L	HL	L	H	L	H	M	L	HL	L	H	ML	H	L	M	H	L	HL	L	HL	L	L	HL	L	HL	L	H	1	8%
7	ML	L	0		L	H	L	HL	L	L	H	L	H	L	L	L	L	S	L	HL	L	HM	L	L	H	L	HM	L	HL	0	0%
8	M	L	L	HL	L	HM	L	HL	L	L	HM	L	M	L	M	L	L	HL	L	HL	L	S	ML	L	HL	ML	HL	L	HL	0	0%
9	ML	L	L	H	L	S	L	HL	L	0	—	0	—	0	—	L	L	S	L	H	L	S	L	L	S	L	H	L	H	0	0%
10	ML	L	L	HL	L	HL	L	HL	L	0	—	0	—	L	H	L	L	HL	L	S	L	HM	L	L	H	L	M	L	H	0	0%
11	M	L	L	HL	L	H	L	HL	L	L	H	ML	H			ML	L	S	L	H	L	H	L	L	H	L	HL	L	H	0	0%
12	H	H	H	H	M	H	H	H	M	L	HL	ML	H	ML	HL	H	ML	H	ML	H	H	H	L	L	H	ML	H	L	H	4	33%
13	H	L	L	H	L	S	L	L	ML	L	H	L	H	ML	H	M	M	HL	L	M	L	HL	L	L	H	ML	HL	L	H	1	8%
14	M	L	L	HL	L	H	L	HL	L	L	H	L	HL	L	S	L	ML	M	L	HL	L	H	L	L	M	L	H	L	H	0	0%
15	M	ML	ML	HL	L	H	L	H	L	L	HL	L	H	L	HL	L	ML	HL	L	H	L	H	ML	ML	H	ML	S	L	H	0	0%
16	M	L	L	H	L	H	L	H	L	L	H	L	H	0		ML	L	H	L	H	ML	H	L[1]	L	H	ML	H	L	H	0	0%
HIGH	3	1	1		0		1		0	0		0		0		1	0		0		2		0	0		0		0			
MOD	9	1	1		1		0		3	0		1		1		3	2		0		0		1	0		0		0			
TOTAL	12	2	2		1		1		3	0		1		1		4	2		0		2		1	0		0		0			
	75%	13%	13%		6%		6%		19%	0%		6%		6%		25%	13%		0%		13%		6%	0%		0%		0%			

The overall cumulative score for each observation site shows risk (i.e. high in red or moderate in yellow, as shown on the maps) occurs at 12 of the 16 stations (highlighted in yellow in Table 1), or 75% of the stations. However, the cumulative score combines all data collected for each season and time period.

A more accurate summary of the data is provided by utilizing the results for each season, and ultimately each time period per season. Overall, the most active season was fall, where risk occurred at four (25%) of the observation sites in the fall, compared to 3 sites (19%) in the summer, 2 sites in the spring (13%) and no sites in the winter. However, there is one area of moderate risk southwest of site 16 for the winter season. Only site 12 was classified as high risk for the fall season. Stations with moderate risk included sites 1, 2, and 13. For the summer season, no sites were classified as high risk, and sites 3, 6, and 12 were classified as moderate risk. Site 12 was also classified as high risk during the spring season, with site 2 classified as moderate risk. The winter season only had one site with risk, site 16, classified as moderate risk. Therefore, summarizing the risk by season, the number of sites that exhibit risk, drops to six (sites 1, 2, 3, 6, 12, and 13) sites or 38% (seasonal risk highlighted in blue in Table 1).

Risk was also associated with each observation time period within each season. Five sites exhibited risk during the individual time periods for each season. During the spring season, site 12 was classified as high risk during the dawn and dusk observation period and moderate risk during midday. Site 12 also was classified as high risk during the fall dusk time period. Four other sites (2, 5, 6, and 13) were classified as either moderate or high risk. Site 2 was classified as high risk during the fall dusk time period, and sites 5 and 13 were classified as moderate risk during the summer midday time period and fall dawn time period, respectively. When comparing station risk, (i.e., the number of time periods each station was classified as moderate or high risk per season for each station), site 12 was classified as having the most risk. In other words, site 12 had risk associated with it for approximately 33% (4/12) of the sampling periods. Other sites only had risk associated with them for approximately 8% (1/12) of the sampling periods and they included sites 2, 5, 6, and 13. Therefore, summarizing the risk by time period, the number of sites that exhibit risk drops to five sites, or 31% (5/16), and all sites with the exception of 12 only exhibited a risk during one of the sampling periods for all four seasons.

Figure 1 summarizes the guilds which contributed to the high and moderate risk scores of observation sites 2, 5, 6, 12, and 13. The high hazard guild overwhelmingly accounted for the risk scores at these stations with 86% of total quantitative bird observations belonging to this guild. The low and medium hazard guilds accounted for 12% and 2% of the risk scores, respectively.

Figure 1 – Total number of birds observed at stations with risk, by hazard guild

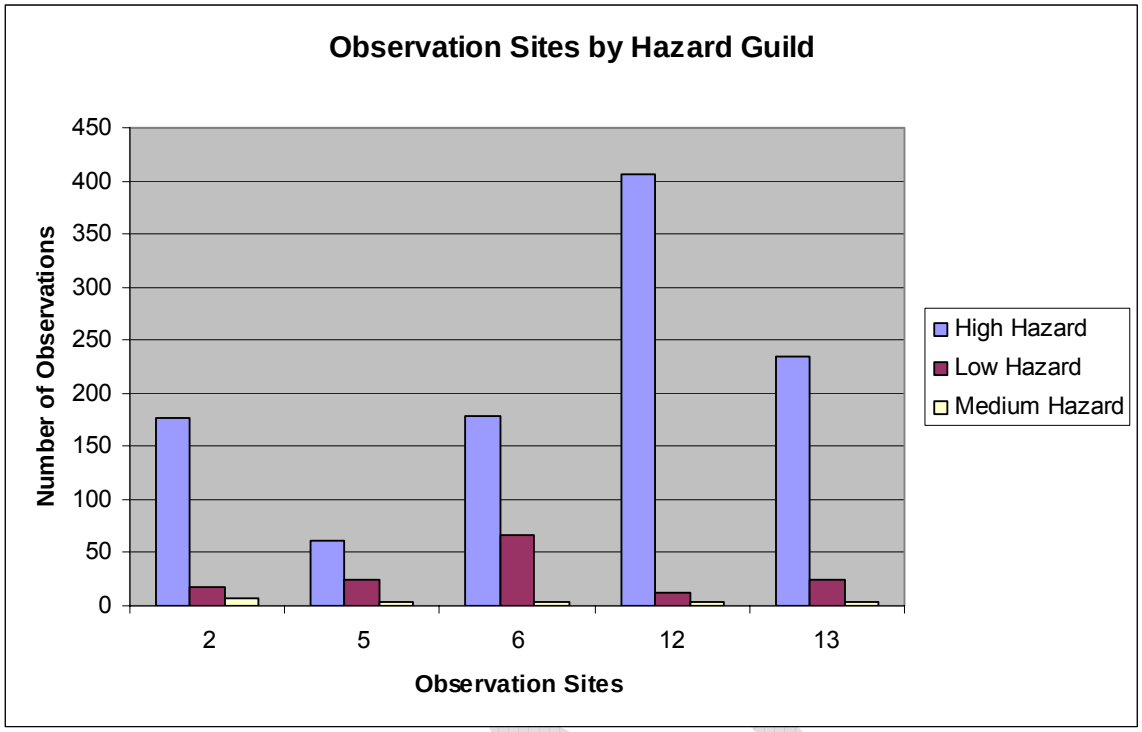
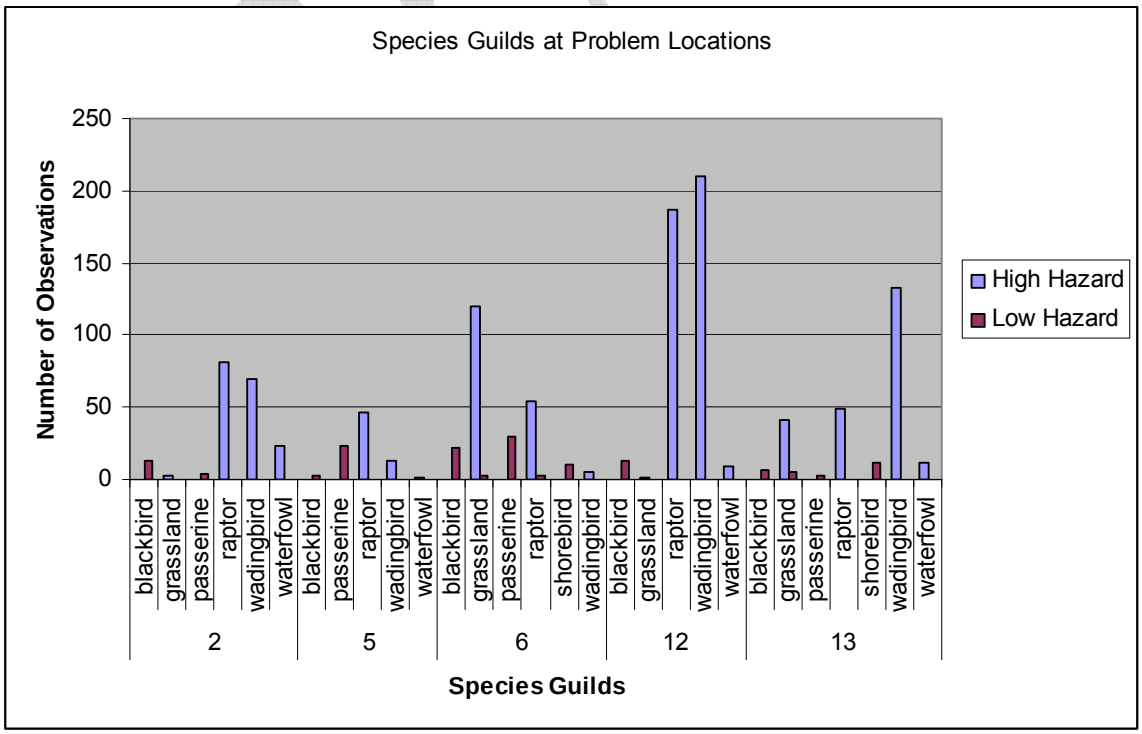


Figure 2 summarizes the species guilds within the high and low hazard guilds that contributed to the risk scores for observation sites 2, 5, 6, 12, and 13.

Figure 2 - Total number of birds observed at stations with risk, by species guild



At these stations with risk, wading birds (36%) and raptors (35%) were more numerous, followed by grassland birds (14%), blackbirds (5%), passerines (5%), waterfowl (3%), and shorebirds (2%).

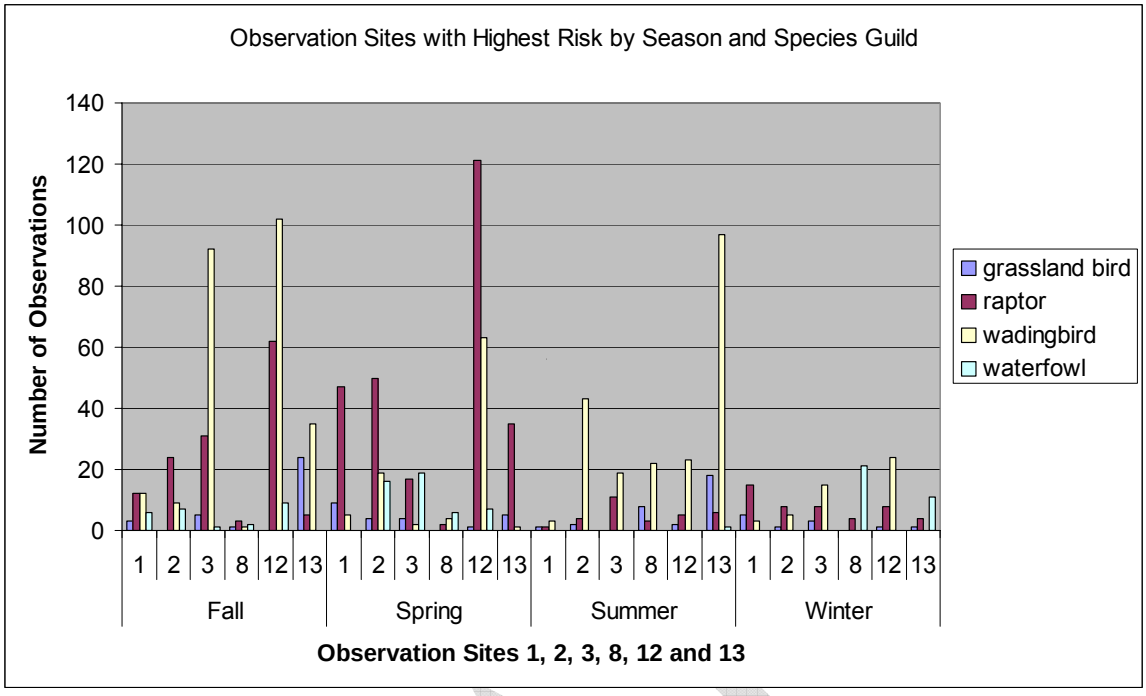
In looking at these stations with risk and the specific time of day where risk occurred, the following species contributed to that risk. The risk at site 2 in the fall at dusk was from vultures (15), White Ibis (3), and Mallards (*Anas platyrhynchos*) (2). The risk at site 5 in the summer during midday was from vultures (12) and a Red-shouldered Hawk (*Buteo lineatus*). Upon review of the species and their numbers occurring at site 6 in the fall at dawn there was no significant risk, but during the summer large numbers of Cattle Egrets (*Bubulcus ibis*) (84) were observed. The risk at site 12 in the spring at dawn was from American White Pelicans (*Pelecanus erythrorhynchos*) (56), vultures (71), Red-shouldered Hawk (1), and Great Egrets (*Ardea alba*) (2); spring during midday vultures (27), Cattle Egret (1), Red-shouldered Hawks (8) and Wood Stork (*Mycteria americana*) (1); spring at dusk vultures (29), white-tailed deer (*Odocoileus virginianus*) (1), Great Egret (1), Red-shouldered Hawk (1), Tricolored Herons (*Egretta tricolor*) (3); and fall at dusk vultures (60), Black-crowned Night-Heron (*Nycticorax nycticorax*) (1), Great Egrets (4), Little Blue Herons (*Egretta caerulea*) (7), Tricolored Herons (6), White Ibis (76), Red-shouldered Hawk (1), and Wood Duck (*Aix sponsa*) (1). The risk at site 13 in the fall at dawn was from Cattle Egrets (38), Glossy Ibis (*Plegadis falcinellus*) (3), White Ibis (7) Great Blue Heron (*Ardea herodias*) (1), and Great Egret (1).

Not only is the total count of birds observed during these time periods identified as risk higher at site 12 than at any of the other stations listed here, but the species diversity of high hazard species is greater as well.

In reviewing the results maps, provided at the end of this section, stations 1, 8, 11, 15, and 16 also showed either moderate or high risk during a particular time of day and season. Station 1 in the fall and winter, both during midday, is attracting a variety of species of wading birds and Turkey and Black Vultures. In the winter, during midday, station 8 attracted large numbers of migratory waterfowl such as Blue-winged Teal (*Anas discors*) (44) and Ring-necked Ducks (*Aythya collaris*) (15). At dawn in the spring and fall a variety of wading birds were observed at station 15 in association with the canal. The high risk shown for site 15 at dusk in the fall was due to vulture activity offsite. Vultures were also the reason for the moderate risk observed at site 16 in the winter during midday and at site 11 in the fall, at dusk.

Figure 3 summarizes the seasonal occurrence of the species guilds, within the high hazard guild, that contributed to the sites with the highest risk (stations 1, 2, 3, 8, 12, and 13).

Figure 3 – Observation sites with highest risk by season and species guild



Turkey and Black Vultures comprised approximately 87% of the raptor observations. Vultures were commonly observed throughout airport property but predominantly at site 12 (n=177). Cattle Egrets were the most common grassland bird comprising 50% of the observations. White Ibis comprised approximately 57% of the wading bird observations for these stations with the highest numbers observed at site 12 (n=105) and 13 (n=129). Mottled Ducks (*Anas fulvigula*) made up approximately 38% of the waterfowl observations.

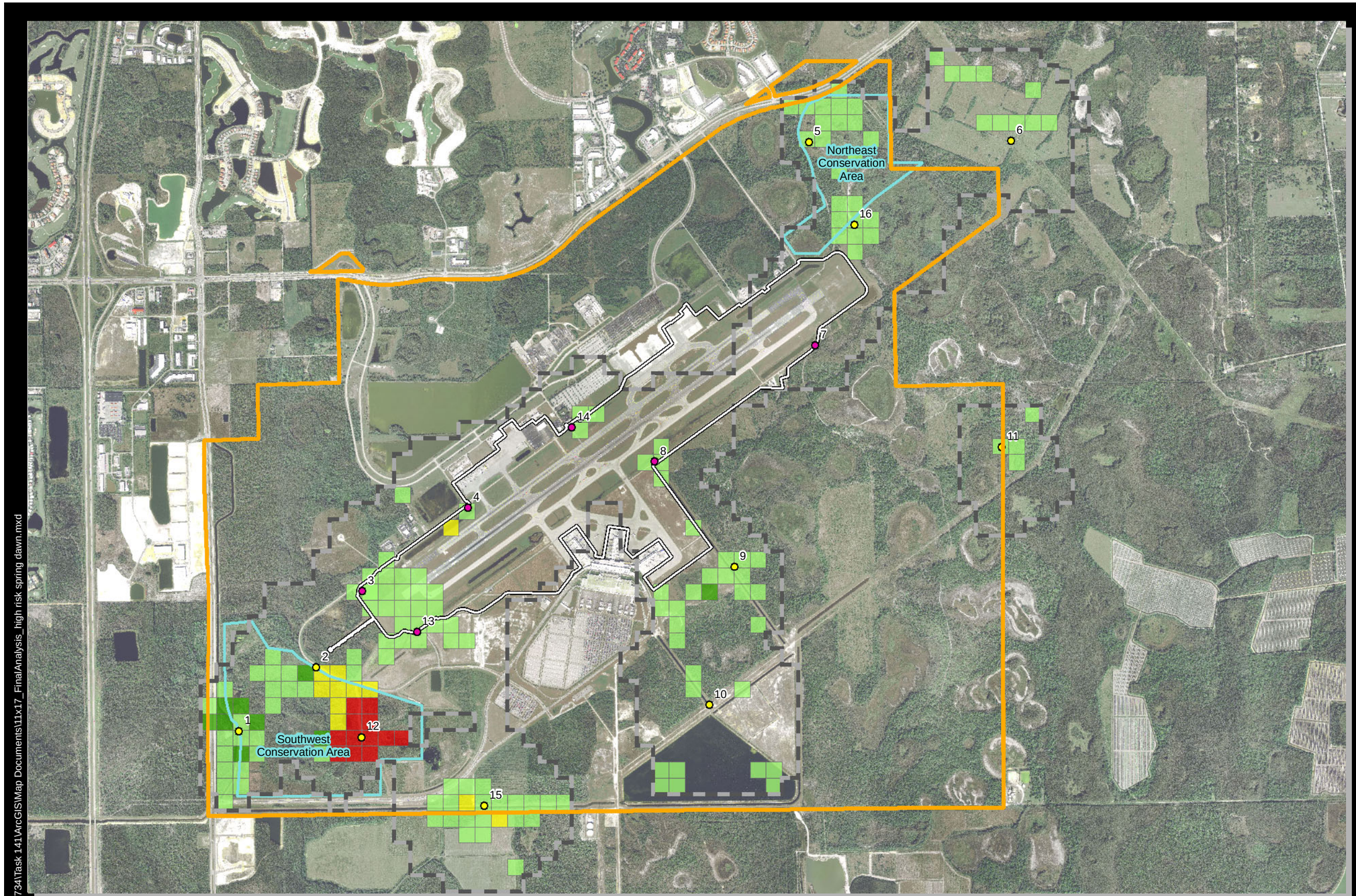
Discussion

The observation sites located within and around the Southwest Conservation Area (1, 2, 3, 12, and 13) show the highest and most frequent risk. The high quality diverse habitats within the Southwest Conservation Area are attractive to a variety of wildlife; unfortunately many of those species are large and are a hazard to aviation (Dolbeer 2003). The created wetlands within the Southwest Conservation Area are long hydroperiod wetlands and therefore provide habitat for many species year round. Sites 5 and 16, located within the Northeast Conservation Area, overall exhibited minimal risk but still attracted large numbers of vultures midday in the winter. The canal by site 8 (known as Lake 4) certainly has the capacity to attract hazardous wildlife but the risk appears to be in winter only. Risk was identified at station 6 but because this site is approximately 5,000 feet from the northeast end of the AOA and the species contributing to the risk were primarily low flying Cattle Egrets, the risk to air operations at RSW is likely indirect. The habitat surrounding site 6 is open pasture land with active cattle grazing. The Cattle Egrets observed at this location could potentially contribute to the onsite Cattle Egret problems.

Observation site 11 was selected due to its proximity to Wild Turkey Strand Preserve, and the concern that the high quality long hydroperiod wetlands could attract large quantities of potentially hazardous wildlife. Even though the aerial survey identified three wetlands within Wild Turkey Strand Preserve, with groups of 20-30 wading birds, quantitative data collected at site 11 did not show a risk. A one-time aerial survey is not enough information to conclude whether the wetlands identified are contributing to the number of wading birds using the AOA at RSW or if these birds are even flying to the AOA. Since observation data did not a direct link been the wading birds using the long hydroperiod wetlands at Wild Turkey Strand Preserve, identified during the aerial survey (Appendix F), no direct action to these wetlands is recommended at this time.

Moderately low risk was observed around site 15, likely associated with the diversity of habitats surrounding this site. Even though some of the habitats are disturbed, such as the fallow farm land on and offsite, they still attract a variety of hazardous species, namely vultures and grackles. The canal adjacent to this site was constructed in accordance with FAA AC 150/5200-33B criteria with rip-rapped 2:1 side slopes but it still attracted six different species of wading birds and one duck species. Since the risk was moderately low and the area surrounding this site, on and off airport property is slated for development, no direct action to this area is recommended at this time.

As established above, the highest risk stations on airport are in and around the Southwest Conservation Area. Peak activity for hazardous species at these stations is predominately in the fall and then in the spring, which is consistent with overall cumulative seasonal activity. It follows to say then that the most hazardous species occurring at the airport are most active in the fall and spring. Specifically, raptors (represented mainly by the vultures) are present year round but their numbers peak in the spring, low in the summer, back up in the fall, and low again in the winter. Wading birds are also present year round; their numbers are high in the spring and summer, peak in the fall and are relatively low in the winter. Grassland bird numbers are fairly constant year round with a spike in the summer and fall. Waterfowl are virtually absent in the summer; numbers go up in the fall and winter, then peak in the spring.



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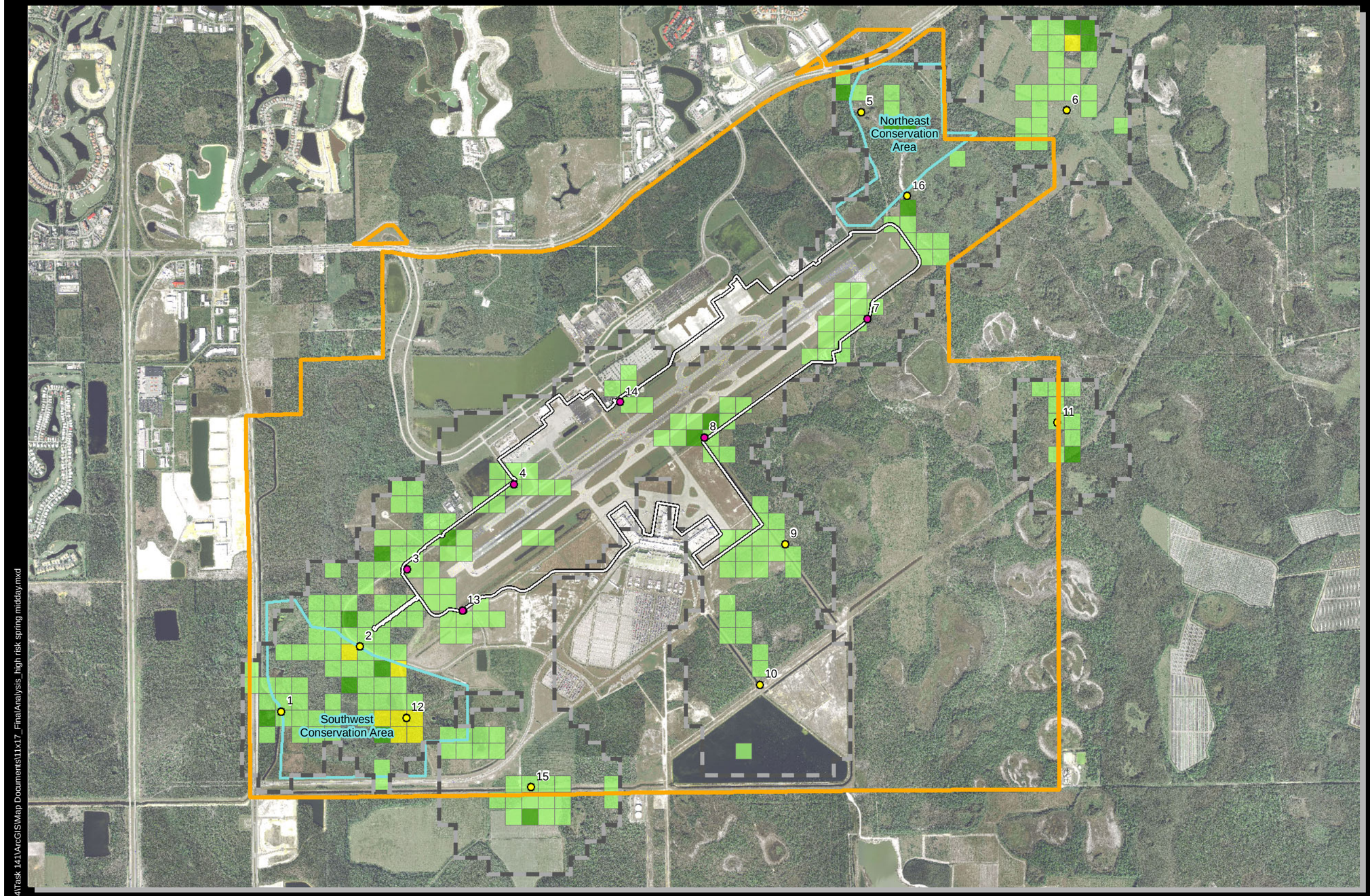
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Guild Scores - Spring Dawn

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



N

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

High-hazard Spring Mid-day

- Low
- Moderately Low
- Moderate

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Guild Scores - Spring Mid-day

2122 Johnson Street
Fort Myers, Florida 33901
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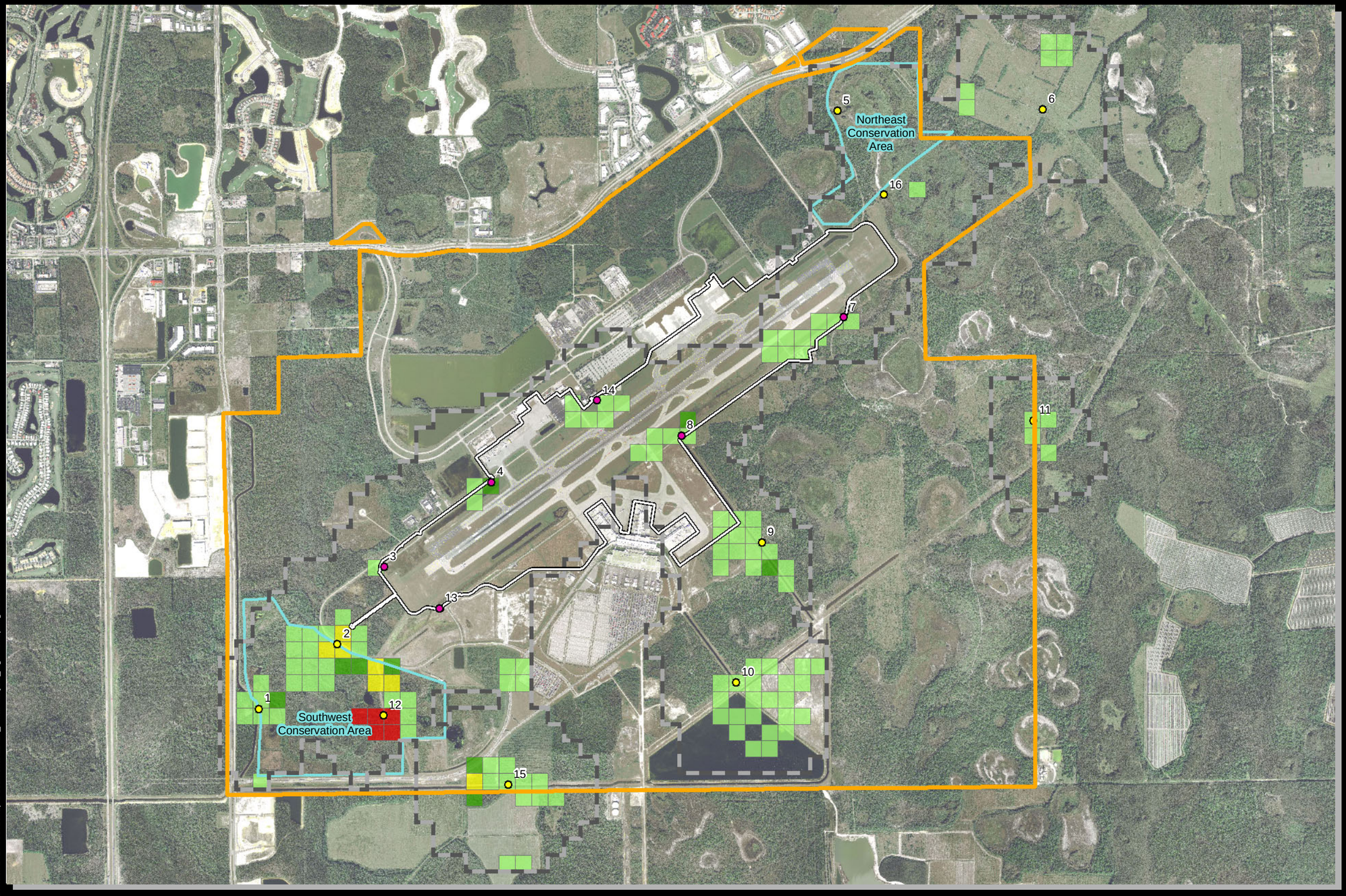
JOHNSON ENGINEERING



Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

High-hazard Spring Dusk

- Low
- Moderately Low
- Moderate
- High

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Scores - Spring Dusk

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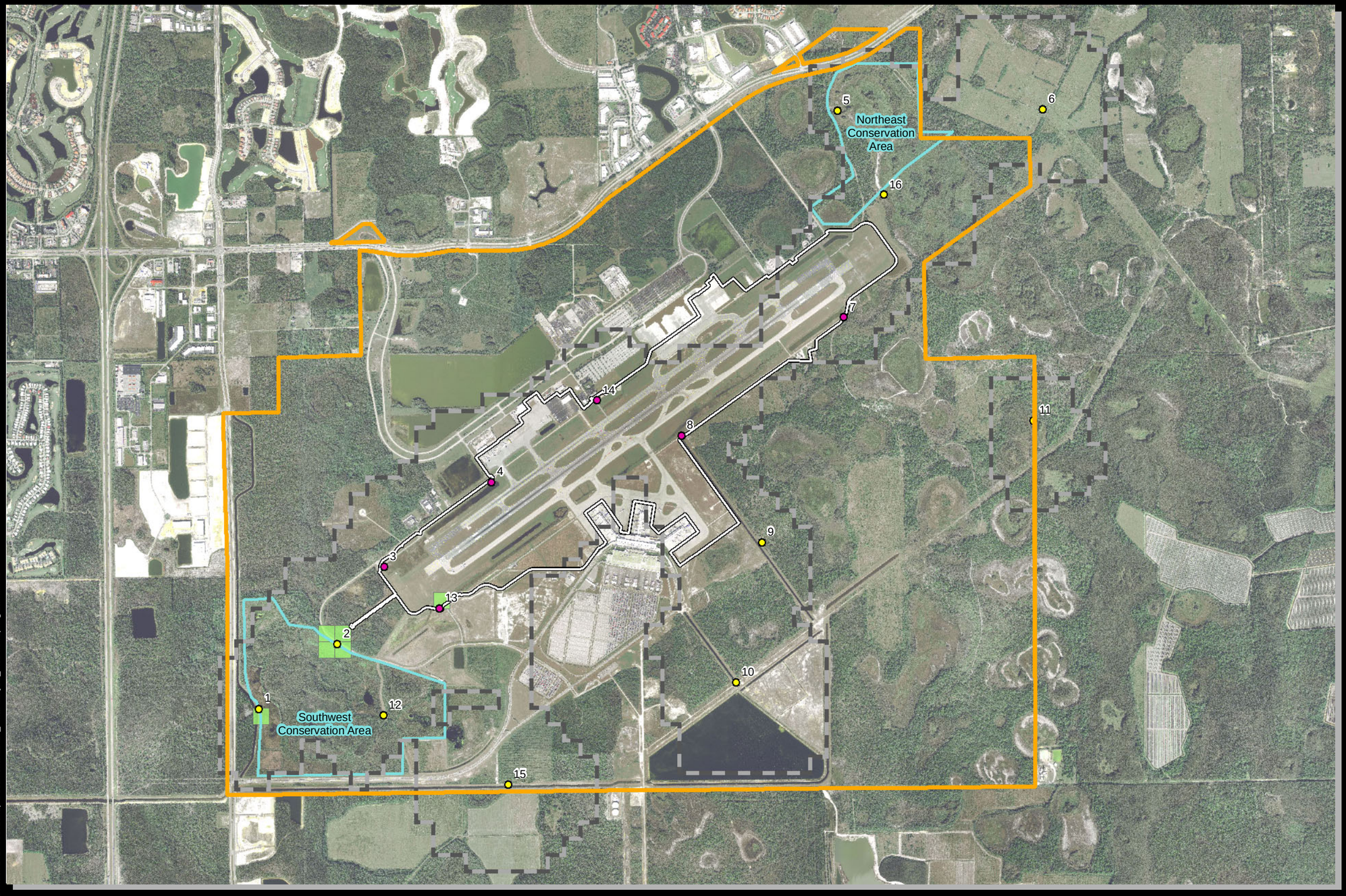
JOHNSON ENGINEERING



Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Approximate Airport Flight Paths

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

Medium-hazard Spring Dawn Sightings

Low

0 1,250 2,500 3,750

Feet

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LEE COUNTY PORT AUTHORITY

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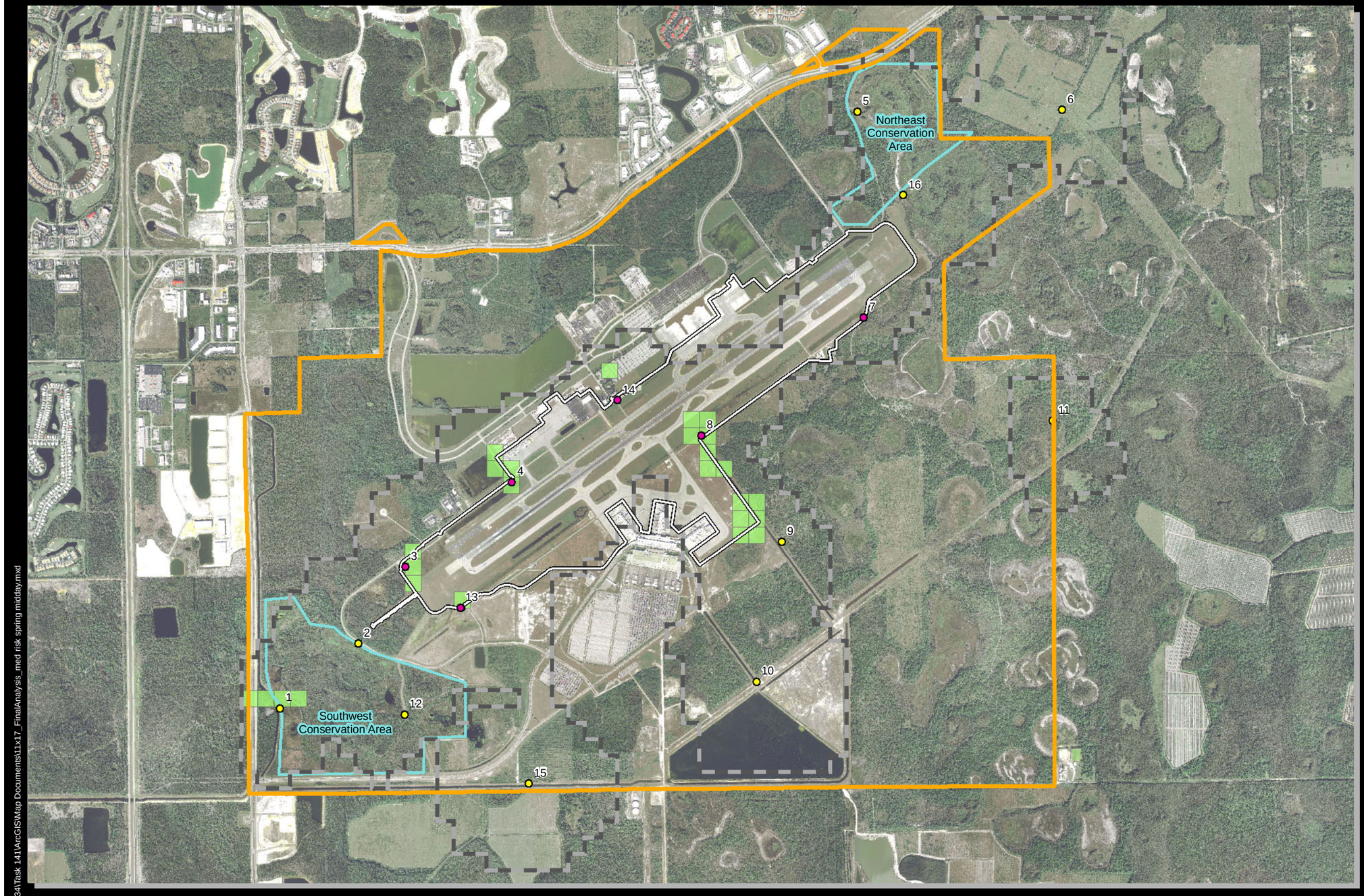
Quantitative Medium Hazard Guild Scores - Spring Dawn

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Medium-hazard Spring Mid-day

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

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Quantitative Medium Hazard Guild Scores - Spring Mid-day

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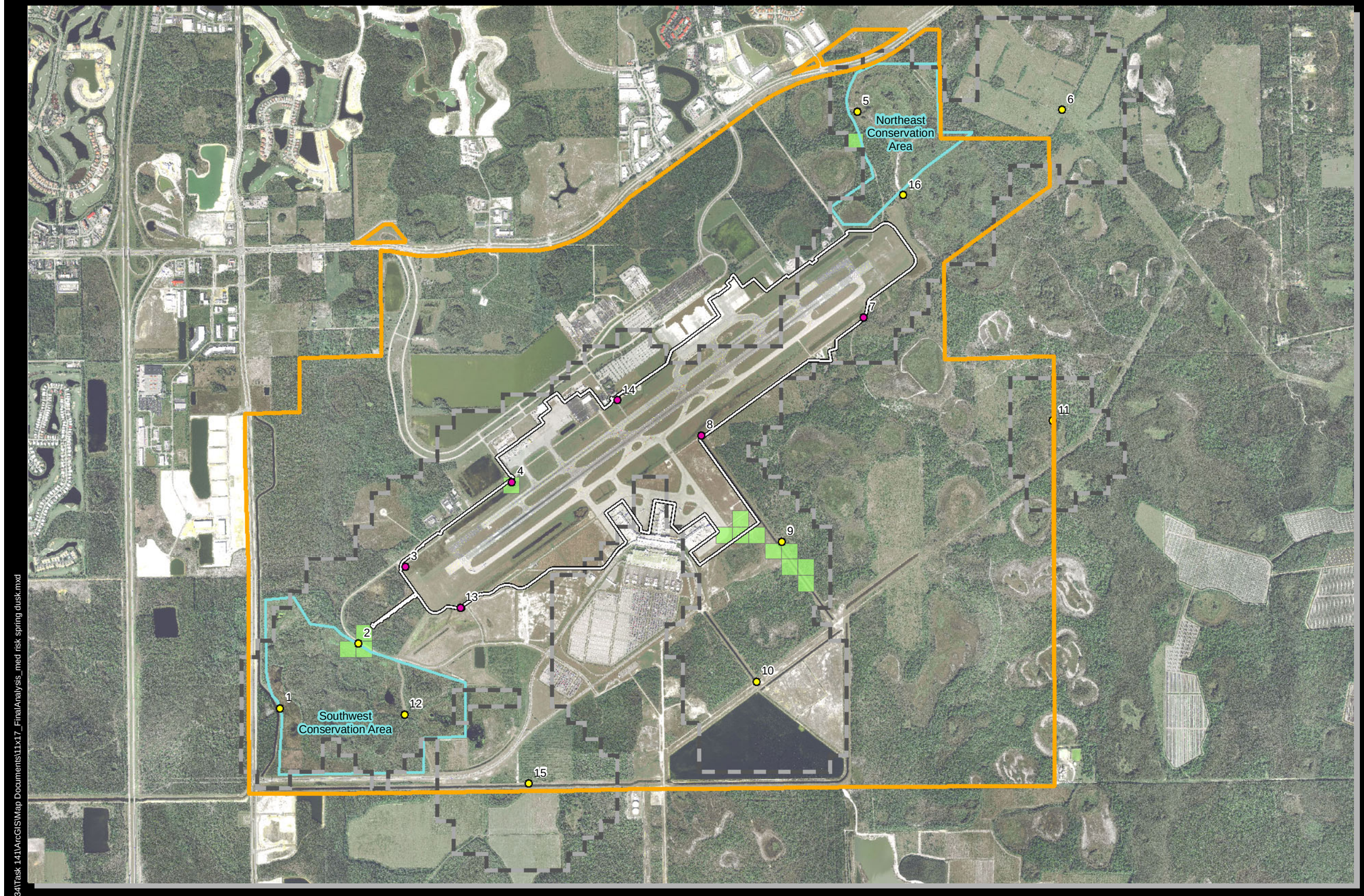

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Medium-hazard Spring Dusk

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

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Quantitative Medium Hazard Guild Scores - Spring Dusk

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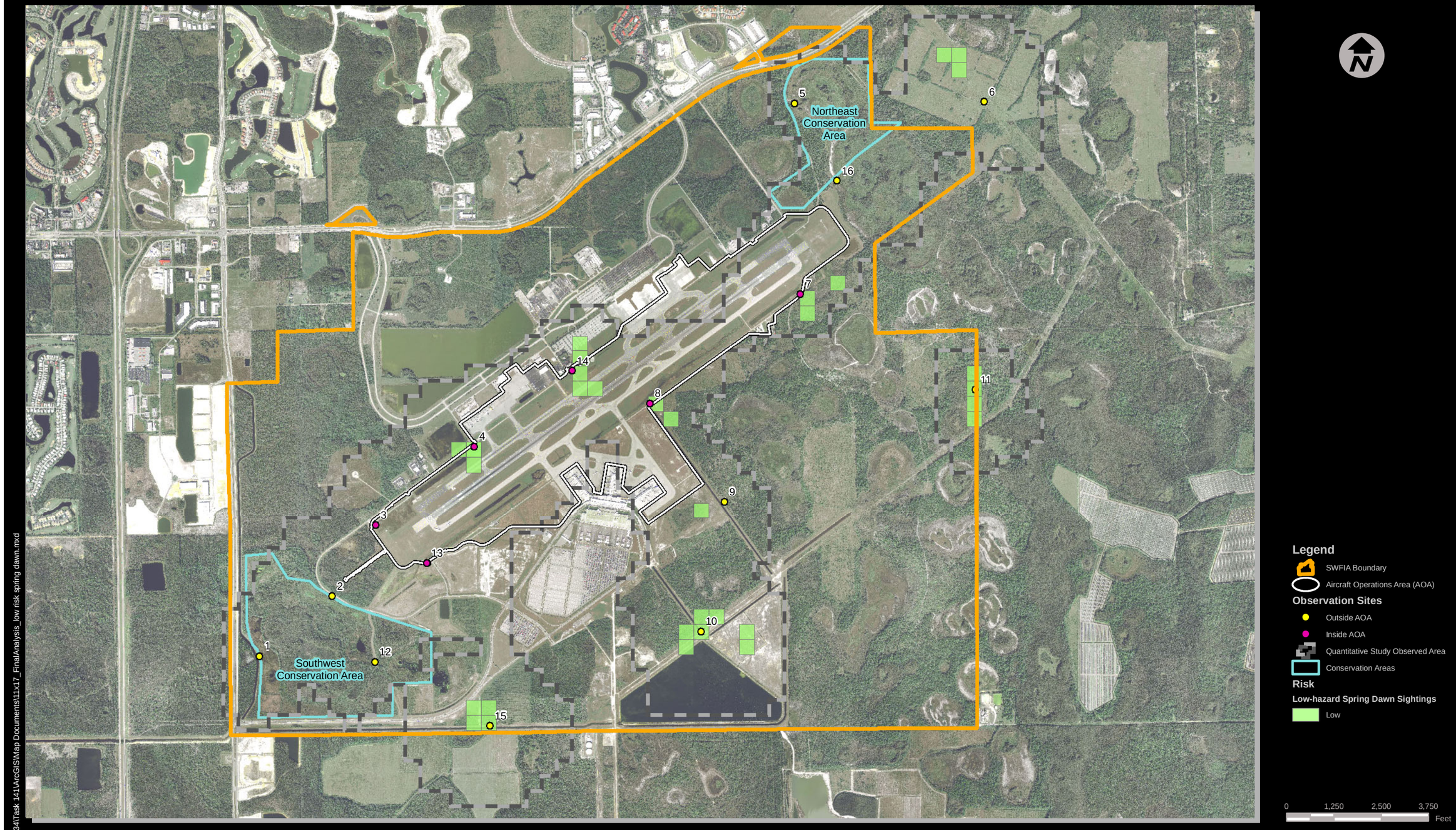
JOHNSON ENGINEERING



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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Guild Scores - Spring Dawn

2122 Johnson Street
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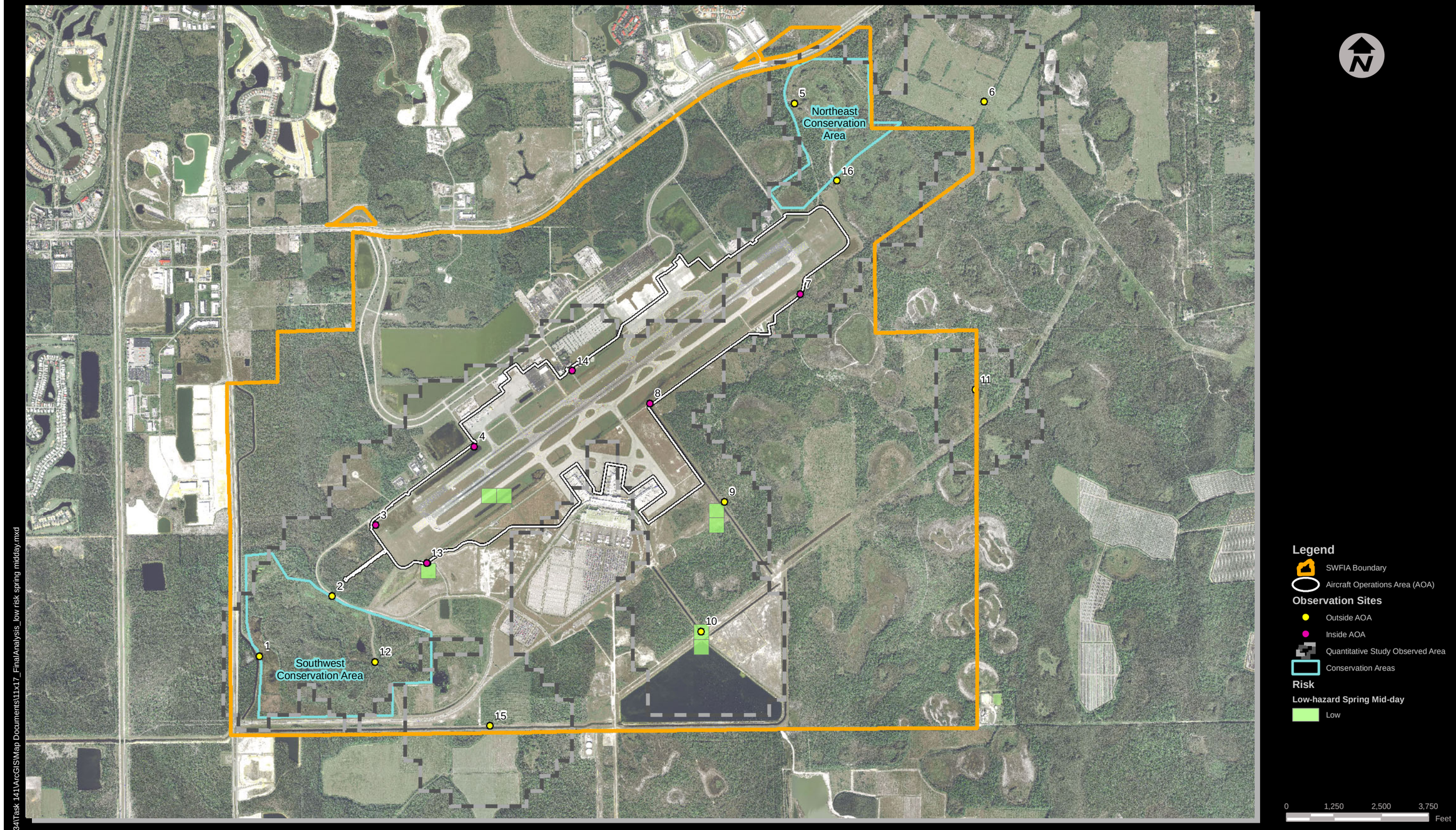
JOHNSON ENGINEERING



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LEE COUNTY PORT AUTHORITY

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Quantitative Low Hazard Guild Scores - Spring Mid-day

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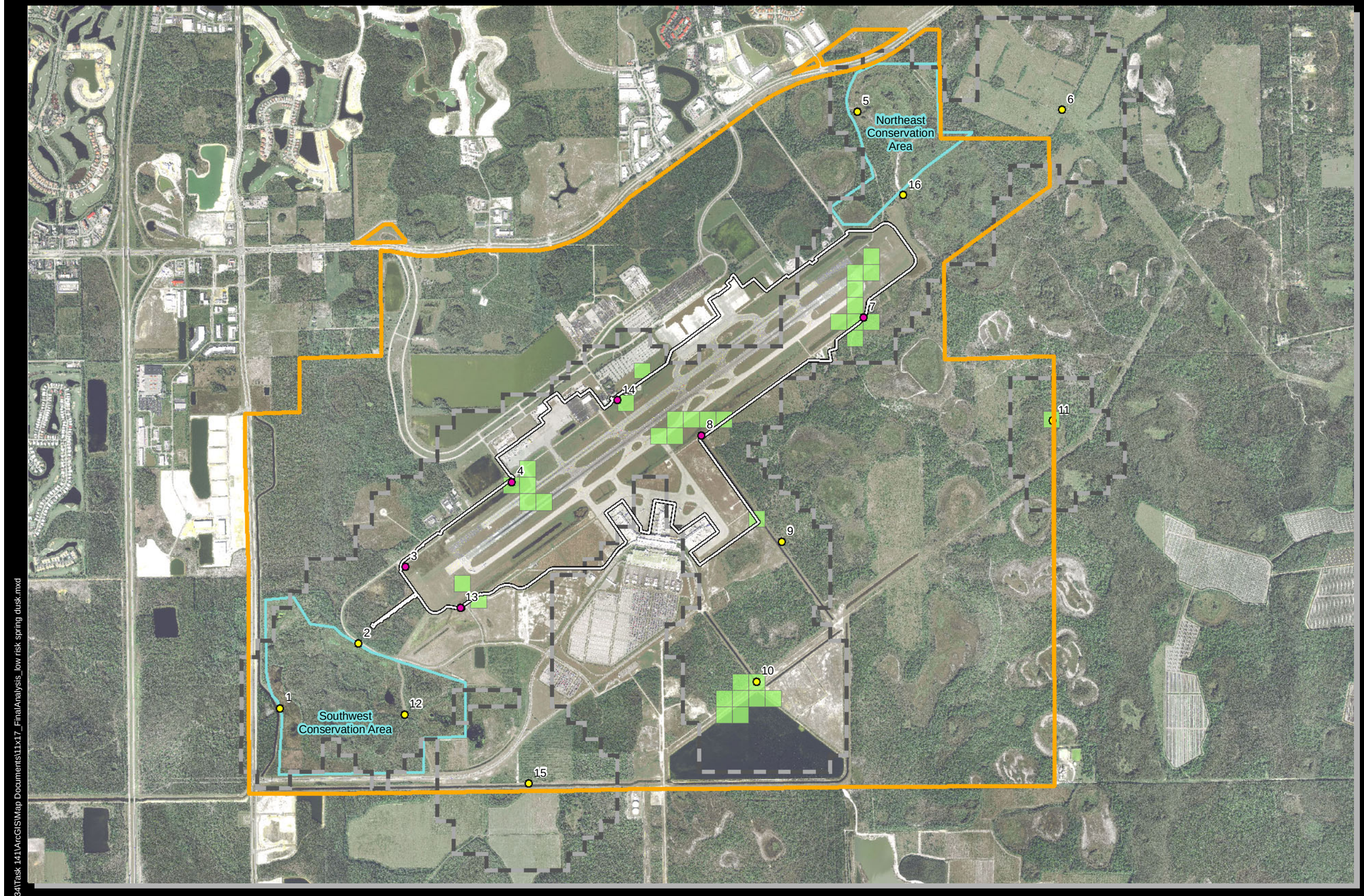

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Low-hazard Spring Dusk

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Scores - Spring Dusk

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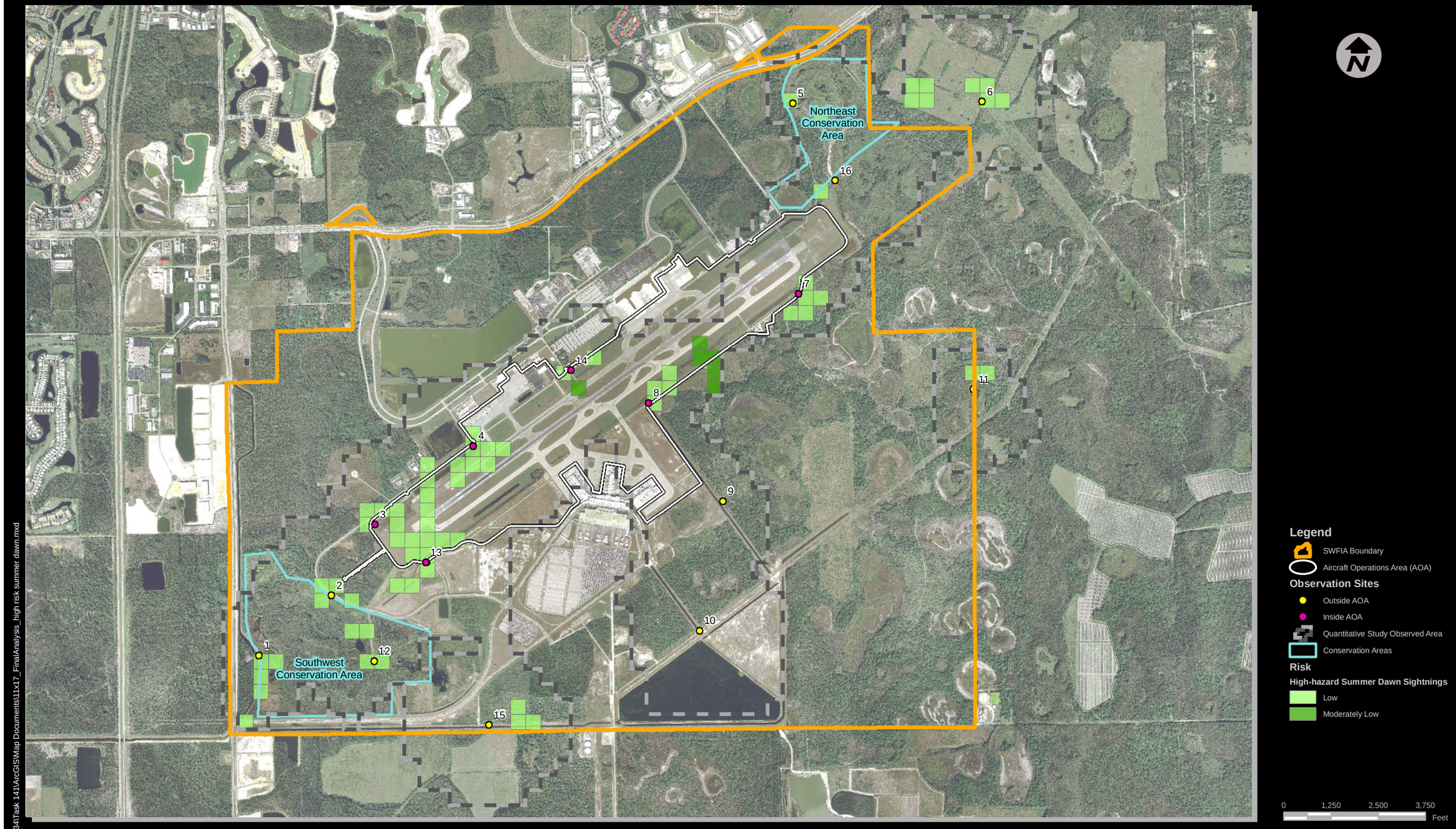

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Scores - Summer Dawn

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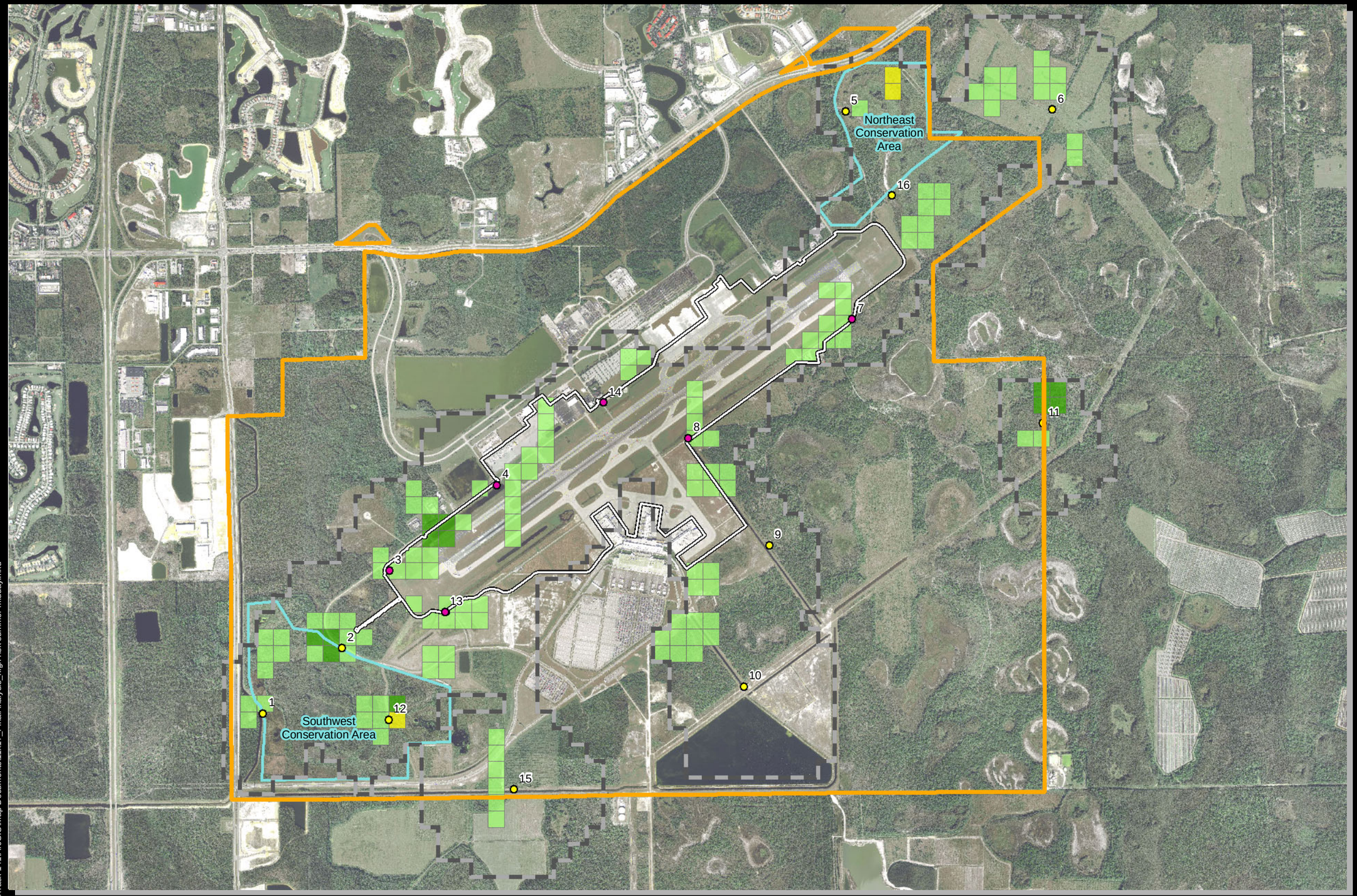
JOHNSON ENGINEERING



N

Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

High-hazard Summer Mid-day

Low

Moderately Low

Moderate

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Scores - Summer Mid-day

2122 Johnson Street
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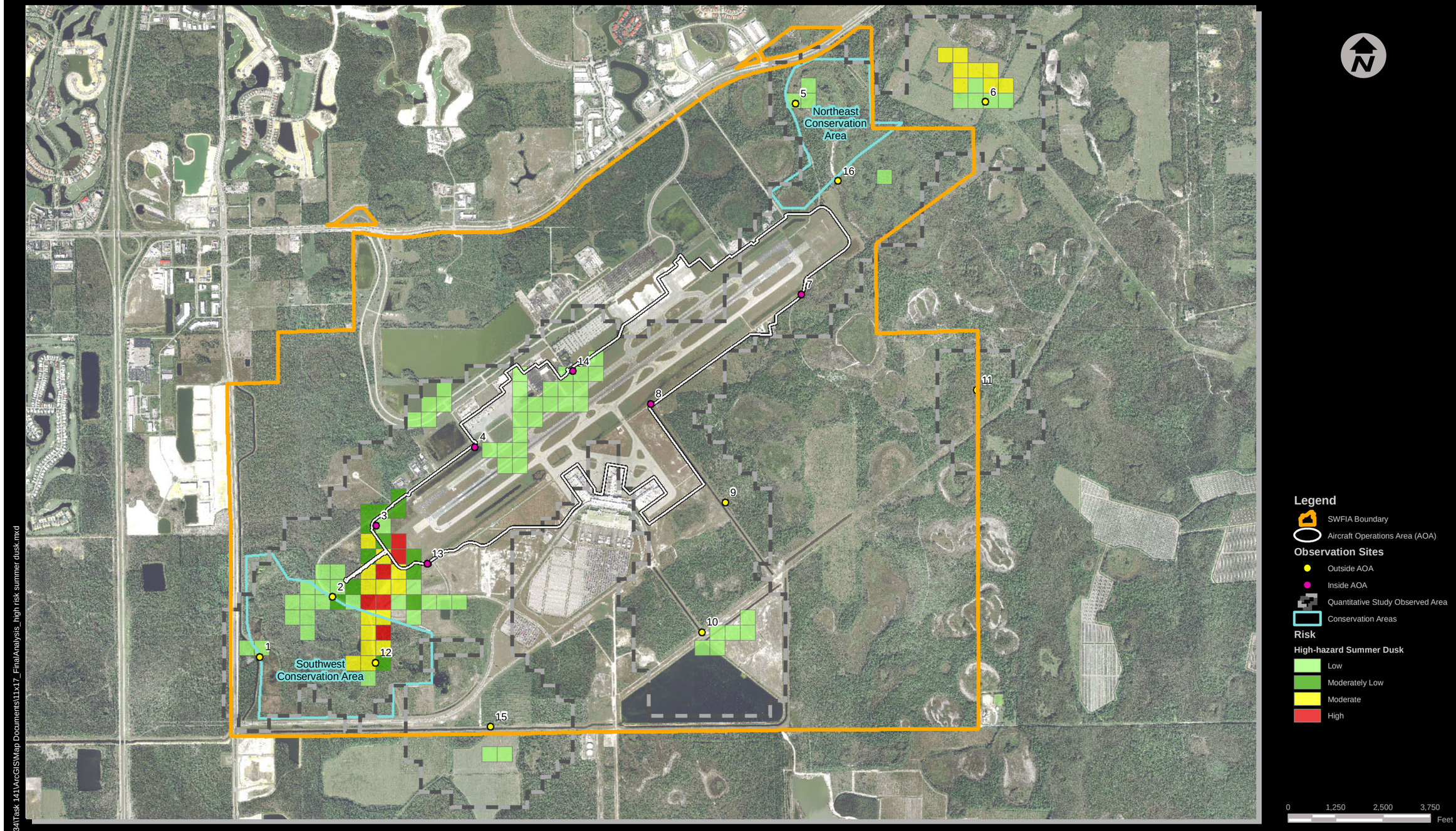
JOHNSON ENGINEERING



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LEE COUNTY PORT AUTHORITY

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Quantitative High Hazard Guild Scores - Summer Dusk

2122 Johnson Street
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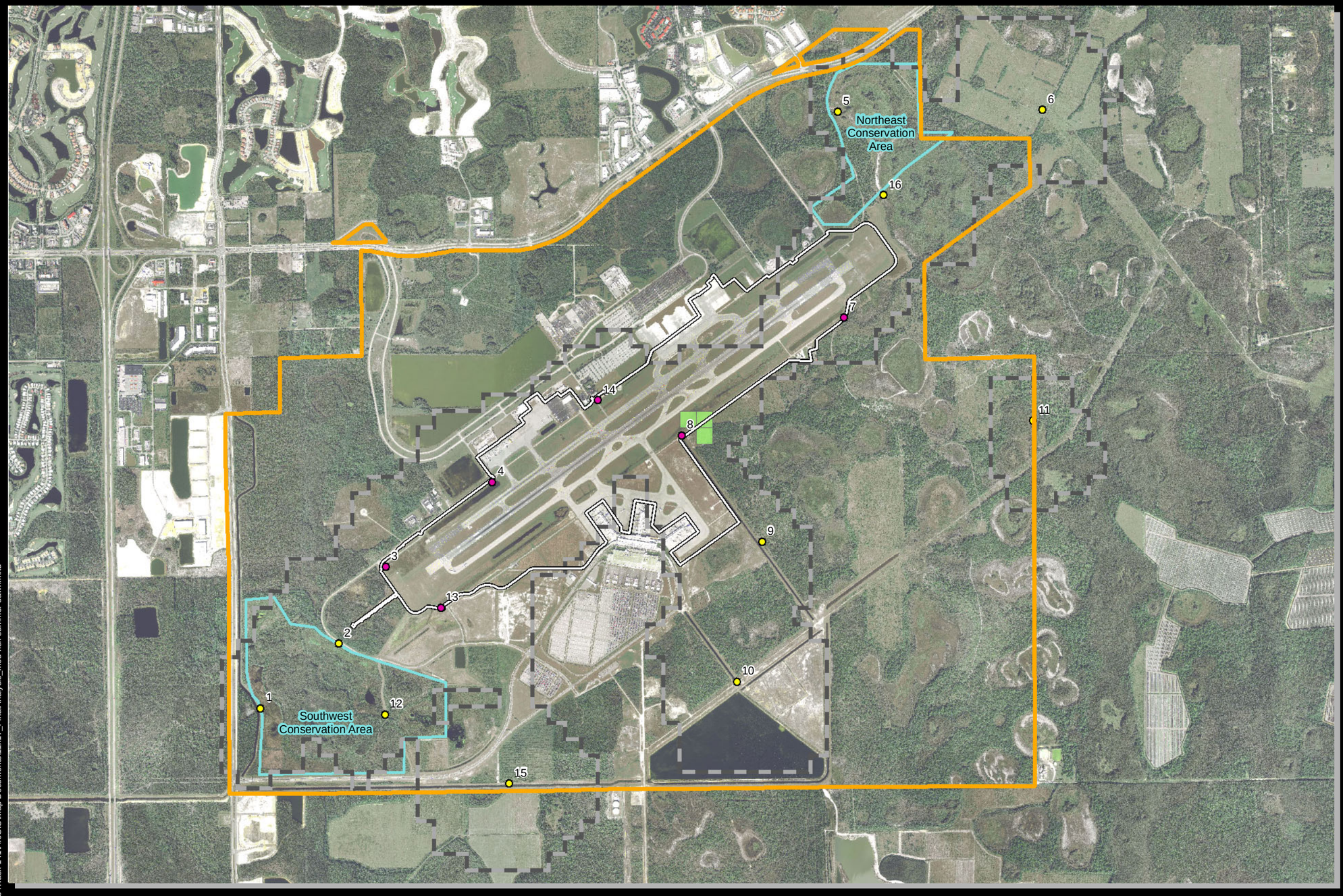
JOHNSON ENGINEERING



Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Medium-hazard Summer Mid-day

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

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Quantitative Medium Hazard Guild Scores - Summer Dawn

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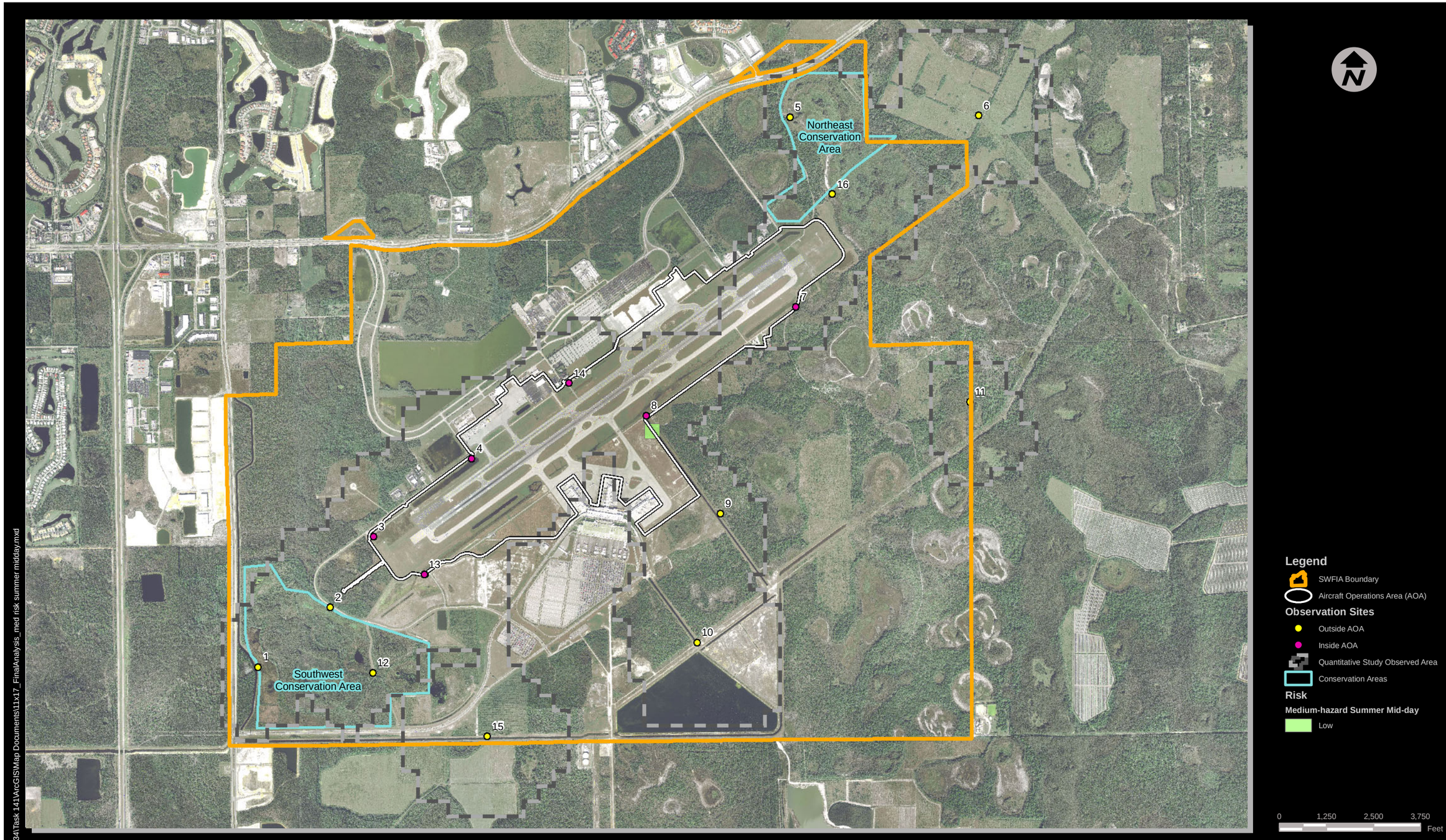

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Medium Hazard Guild Scores - Summer Mid-day

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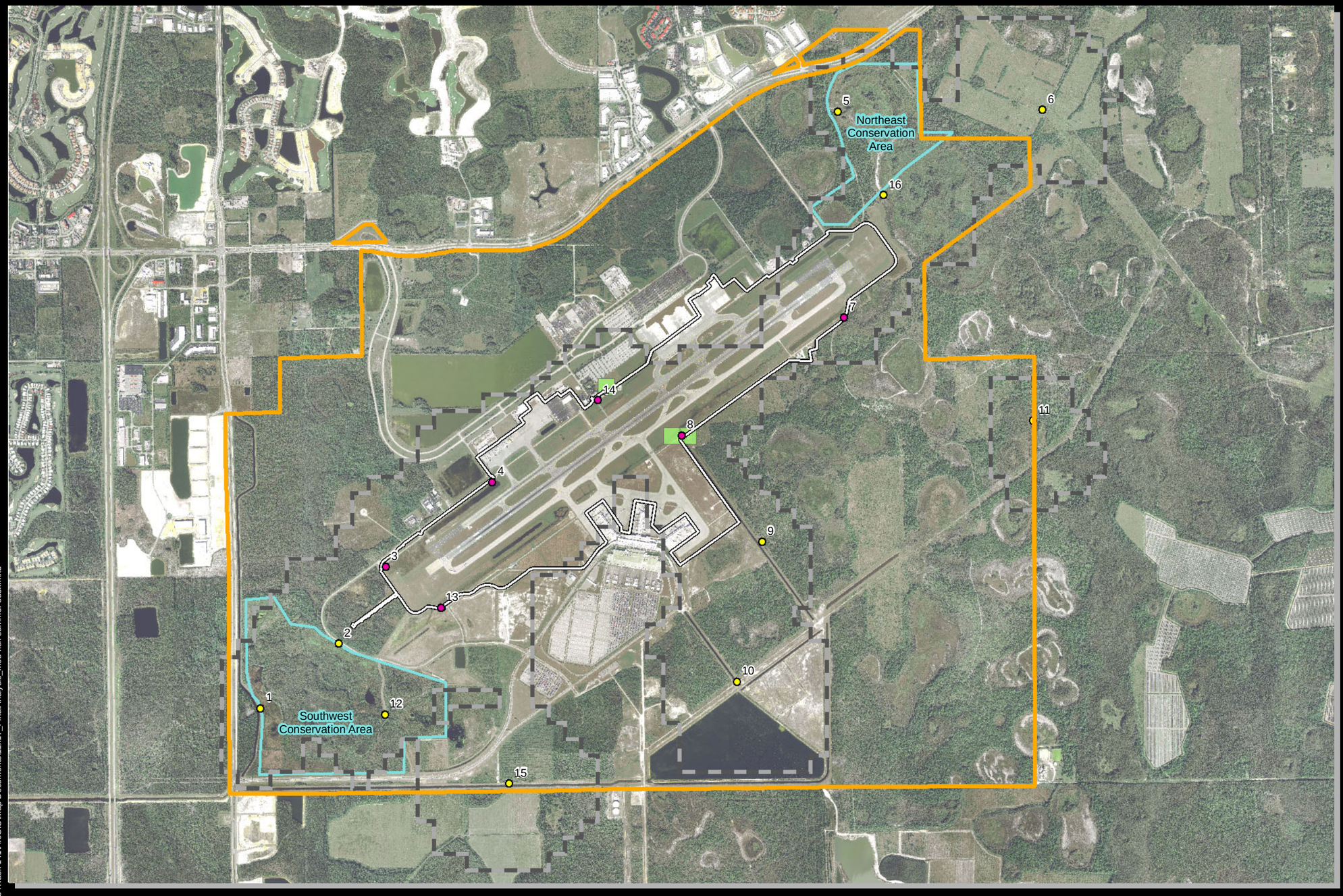

N

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Medium-hazard Summer Dusk

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

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Quantitative Medium Hazard Guild Scores - Summer Dusk

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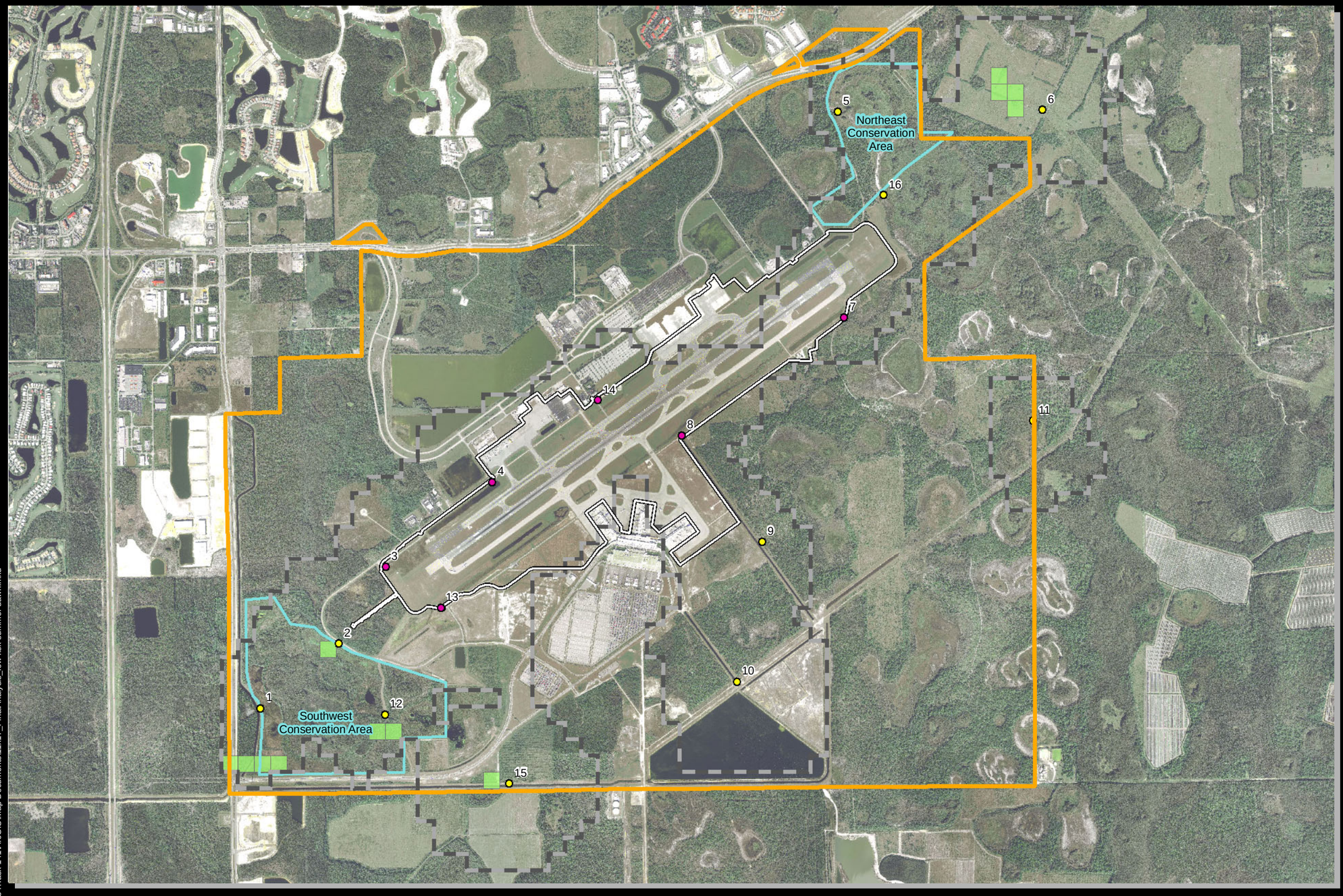

Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

Low-hazard Summer Dawn Sightnings

Low

0 1,250 2,500 3,750

Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Guild Scores - Summer Dawn

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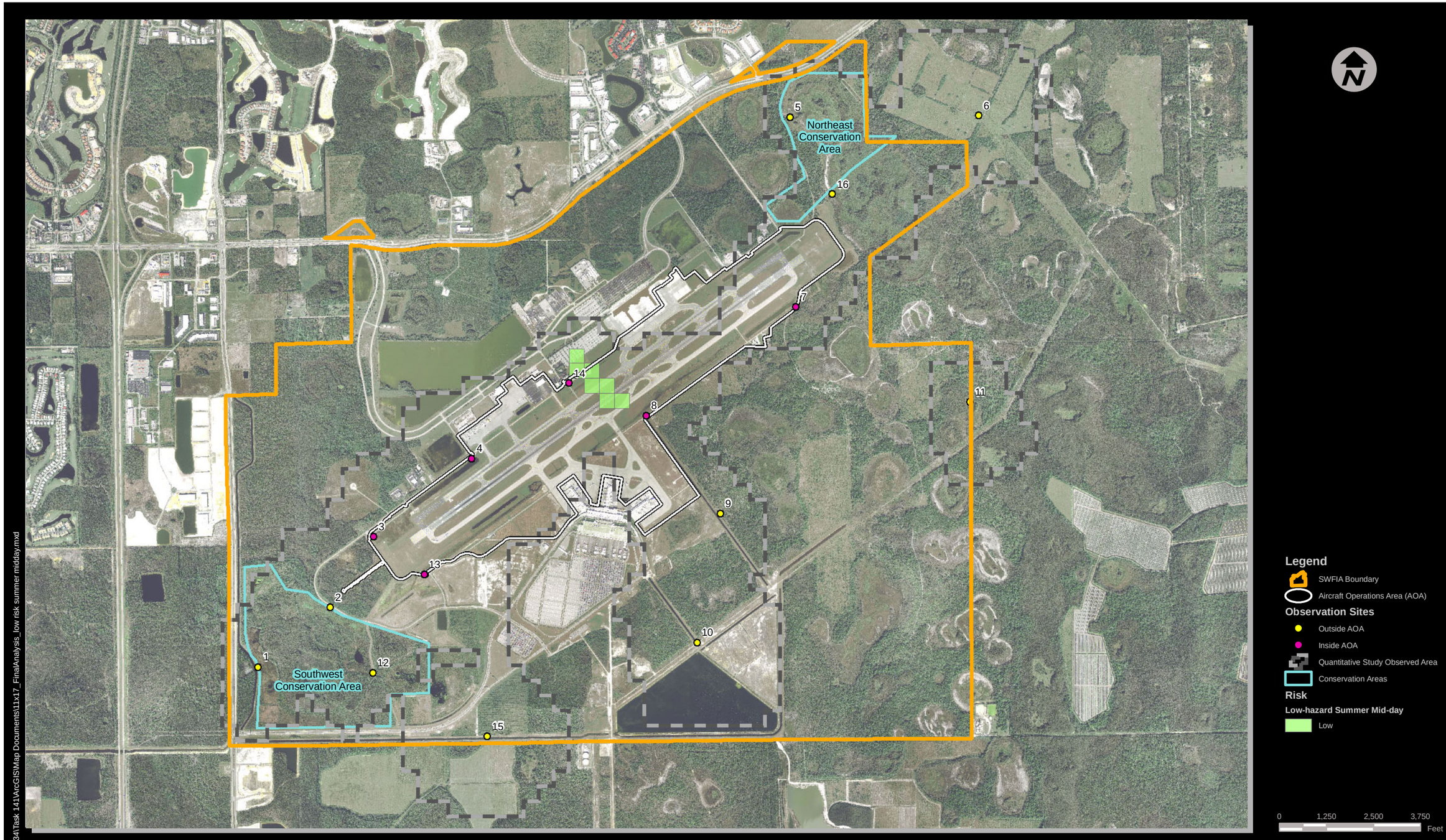
JOHNSON ENGINEERING



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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Guild Scores - Summer Mid-day

2122 Johnson Street
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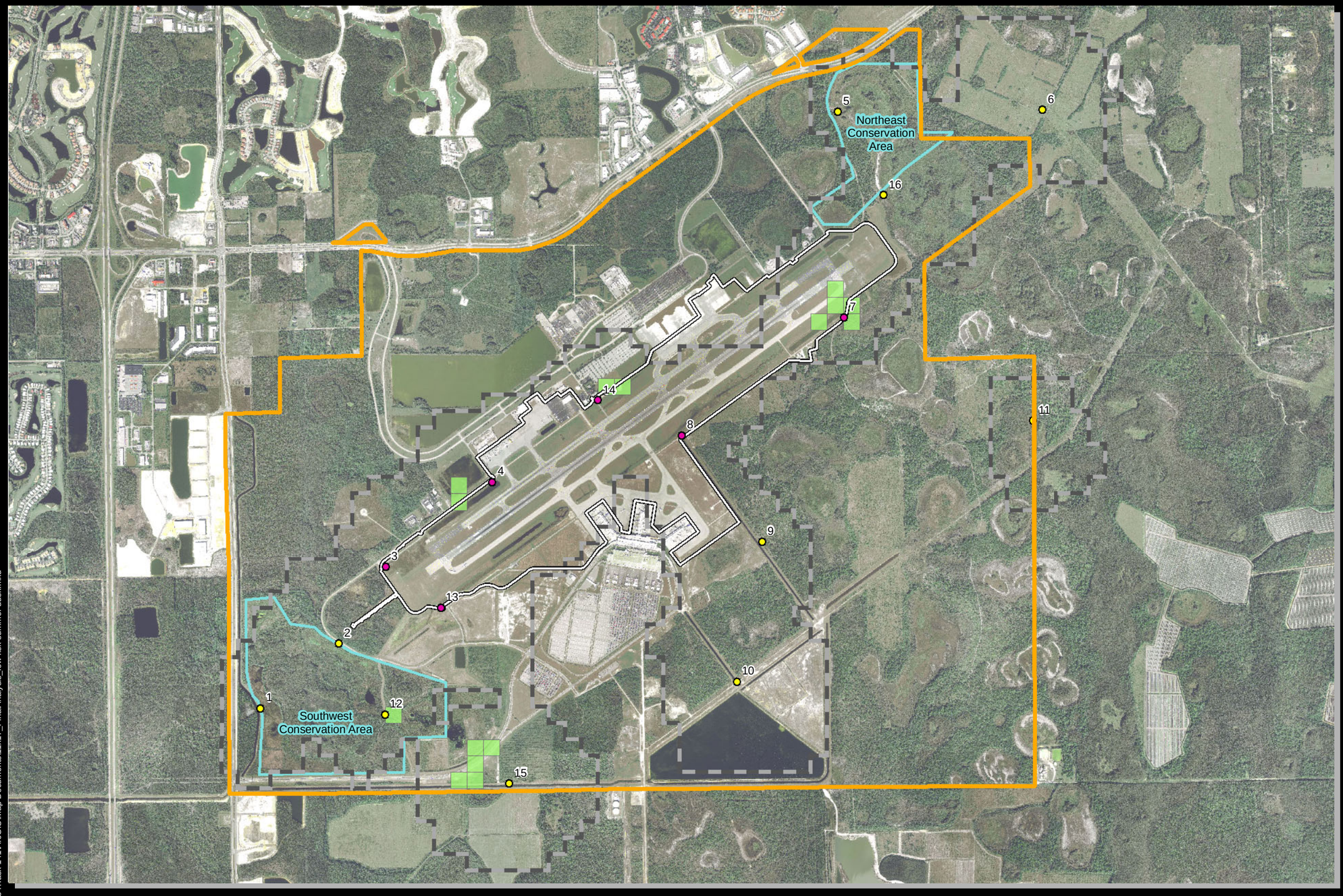
JOHNSON ENGINEERING



Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Low-hazard Summer Dusk

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Scores - Summer Dusk

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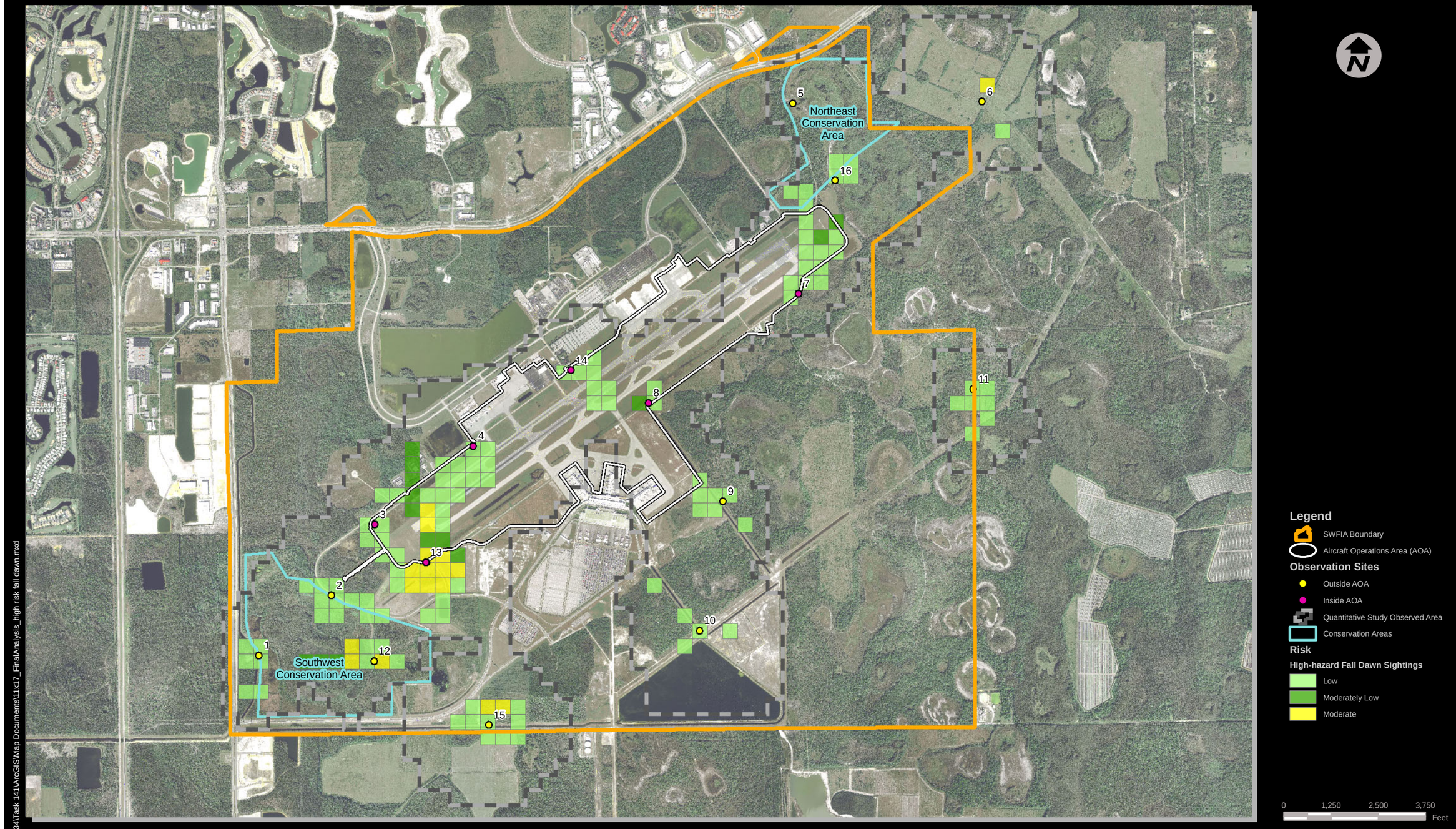

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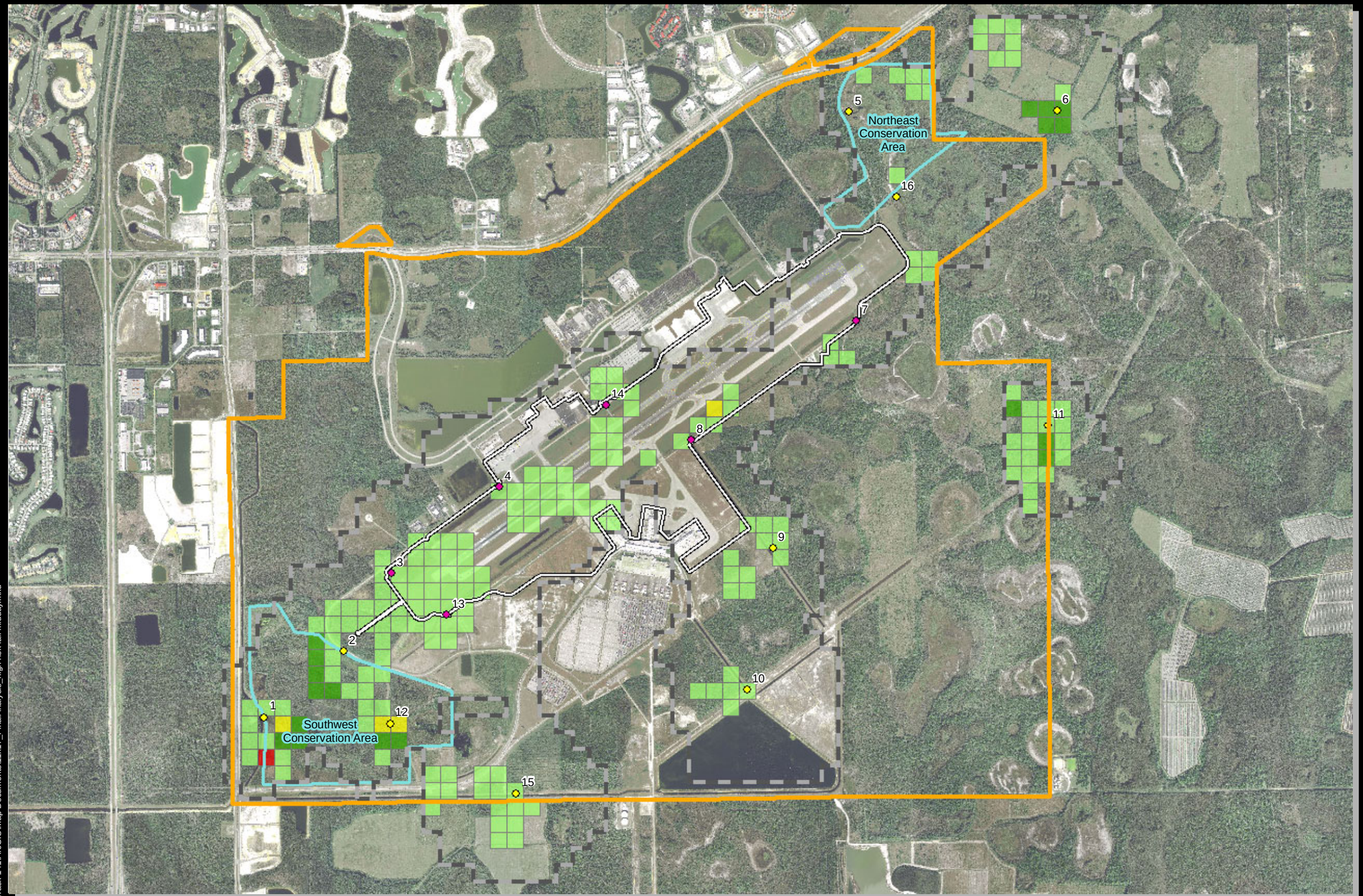
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Guild Scores - Fall Dawn

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

High-hazard Fall Mid-day

Low

Moderately Low

Moderate

High

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Guild Scores - Fall Mid-day

2122 Johnson Street
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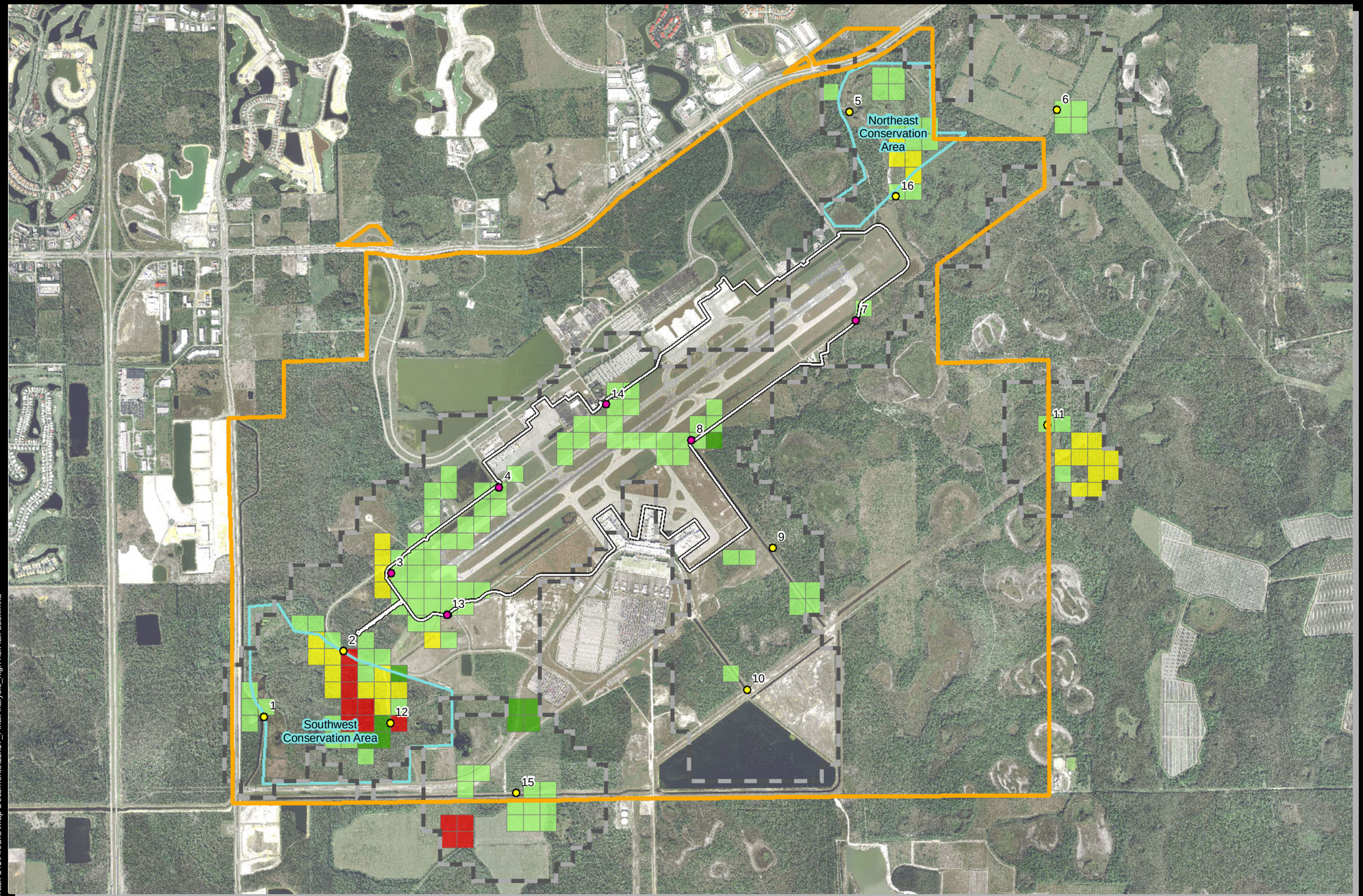
JOHNSON ENGINEERING



Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

High-hazard Fall Dusk

Low

Moderately Low

Moderate

High

0 1,250 2,500 3,750

Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Guild Scores - Fall Dusk

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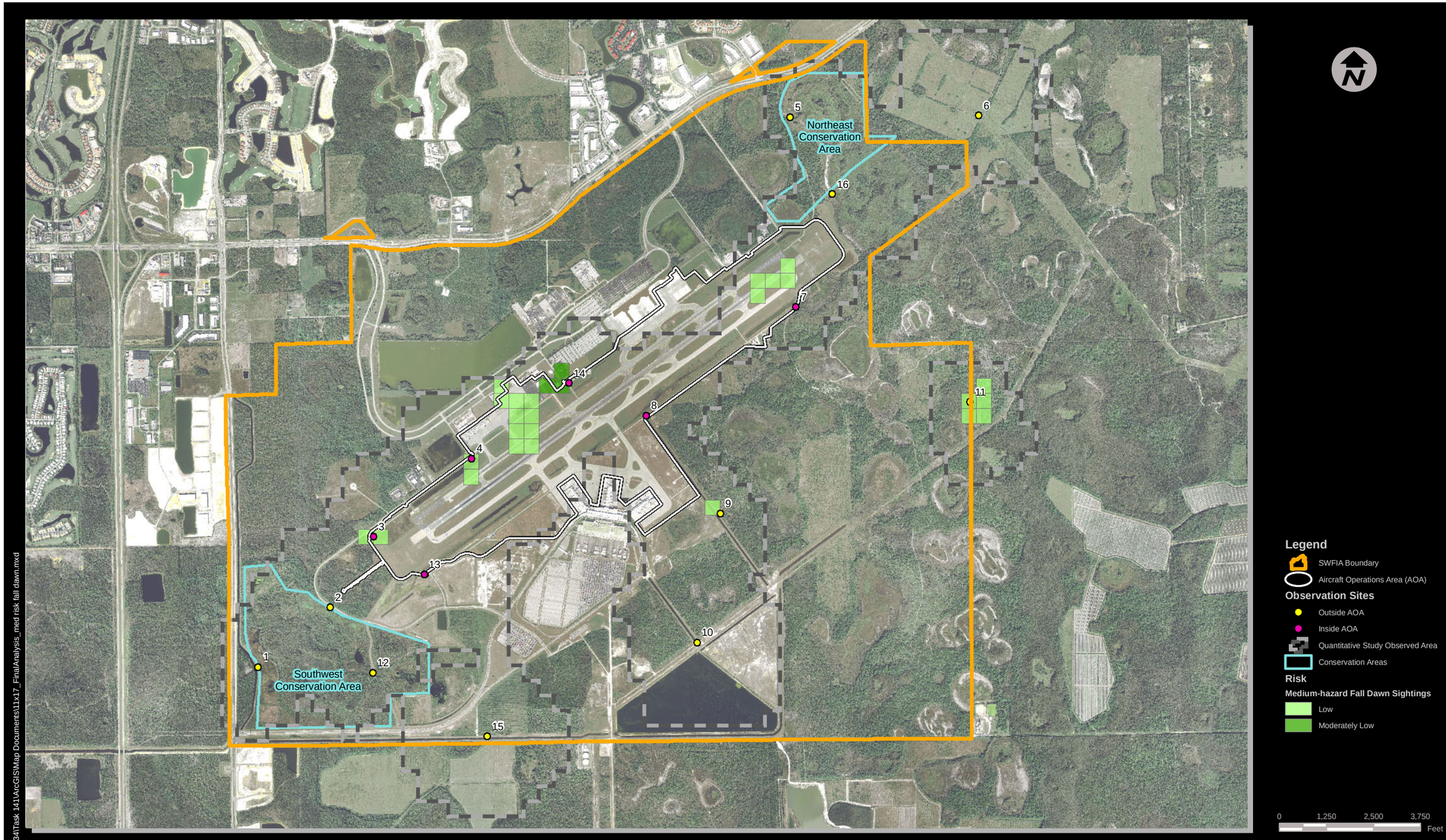

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Medium Hazard Guild Scores - Fall Dawn

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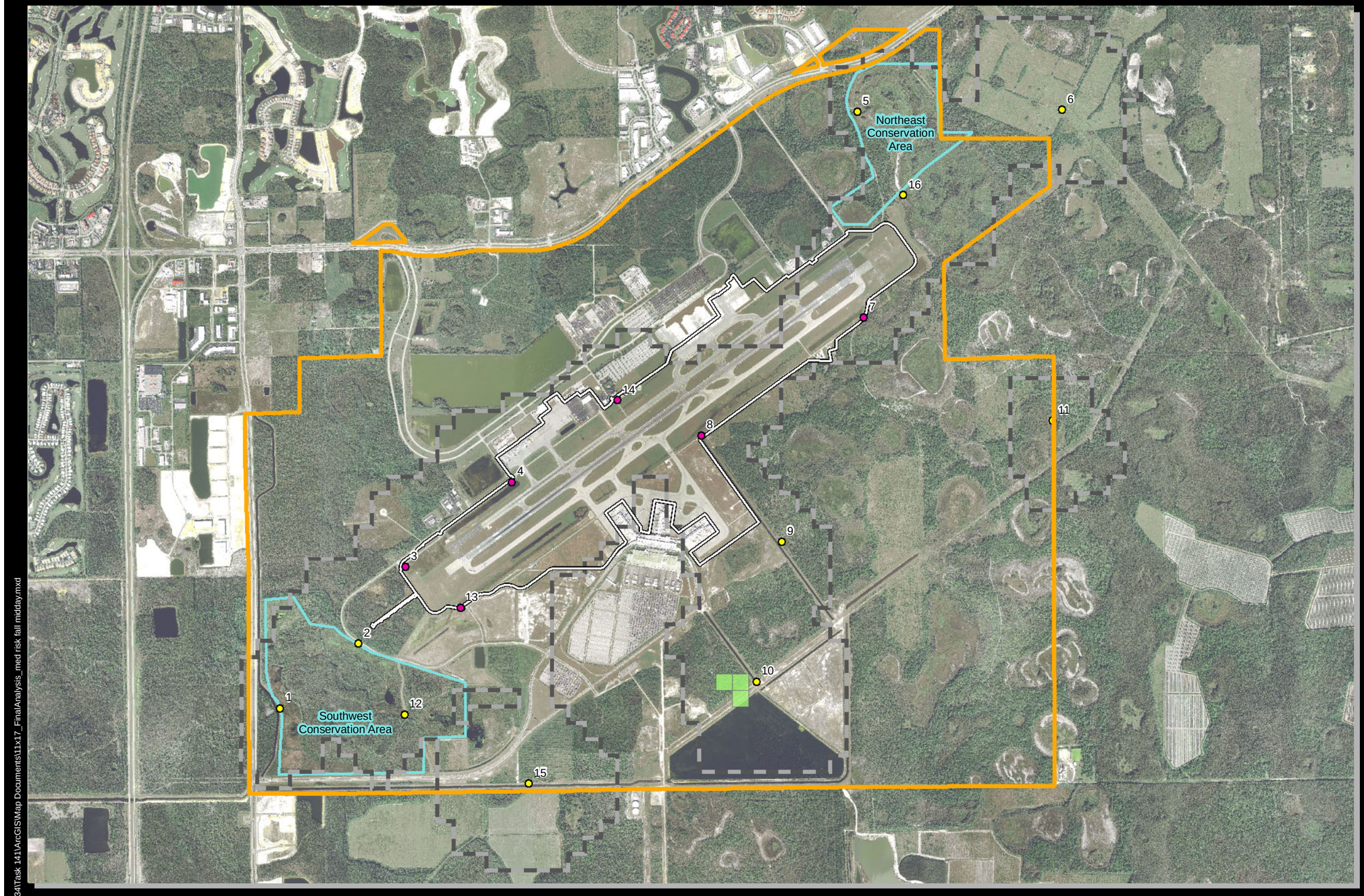

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Medium-hazard Fall Mid-day

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Medium Hazard Guild Scores - Fall Mid-day

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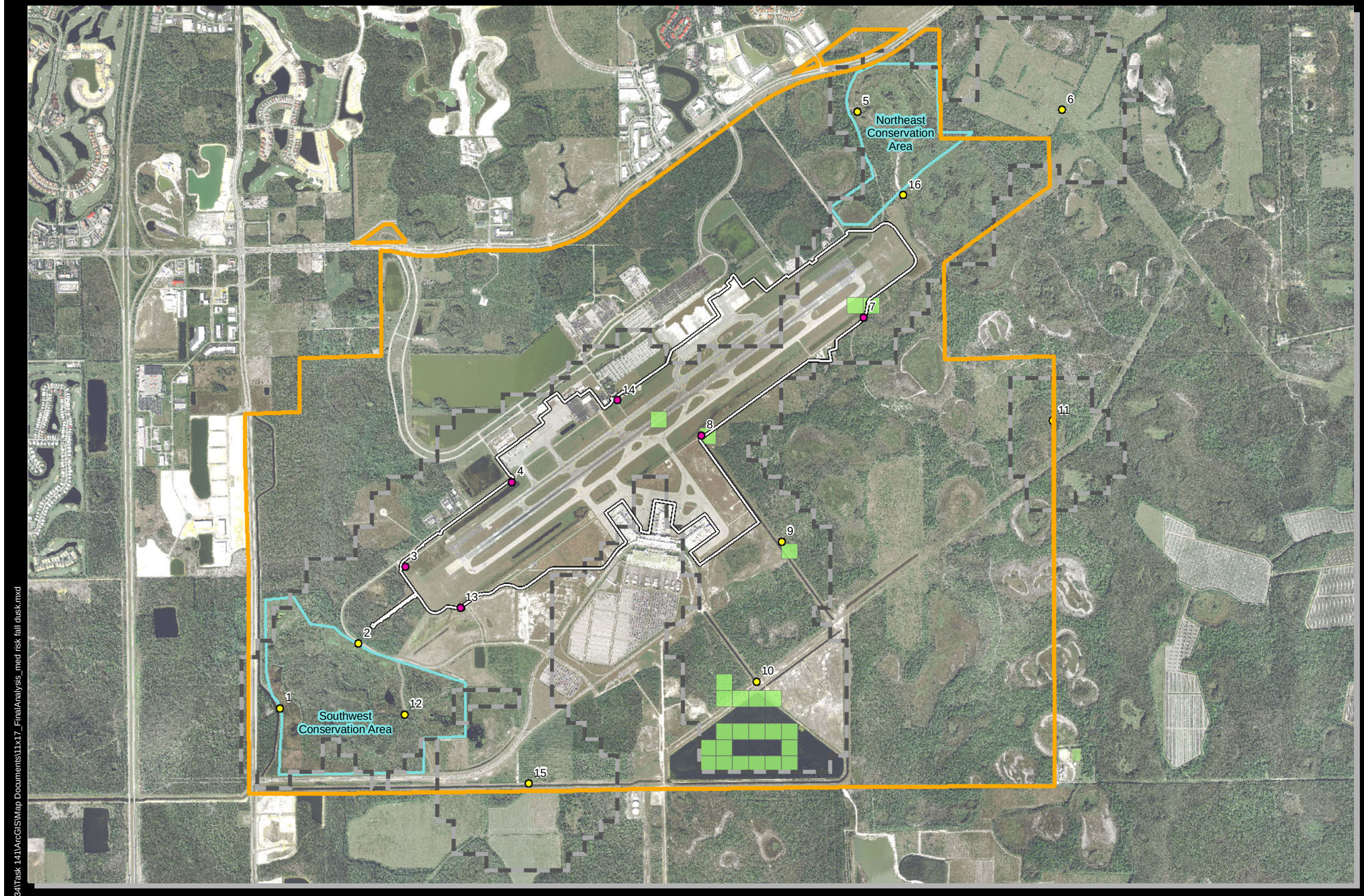

Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

Low-hazard Fall Dusk

Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Medium Hazard Guild Scores - Fall Dusk

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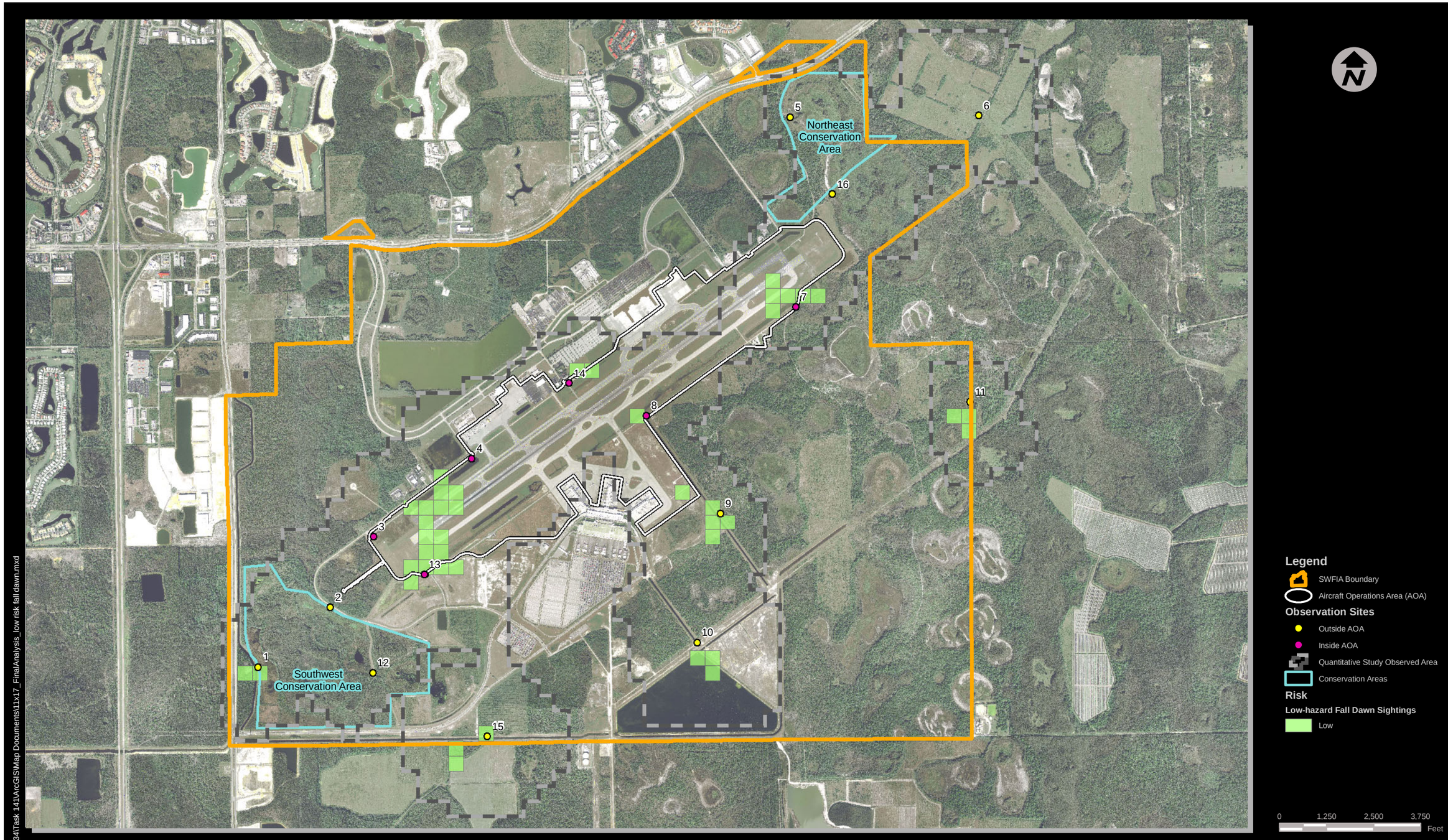

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LEE COUNTY PORT AUTHORITY

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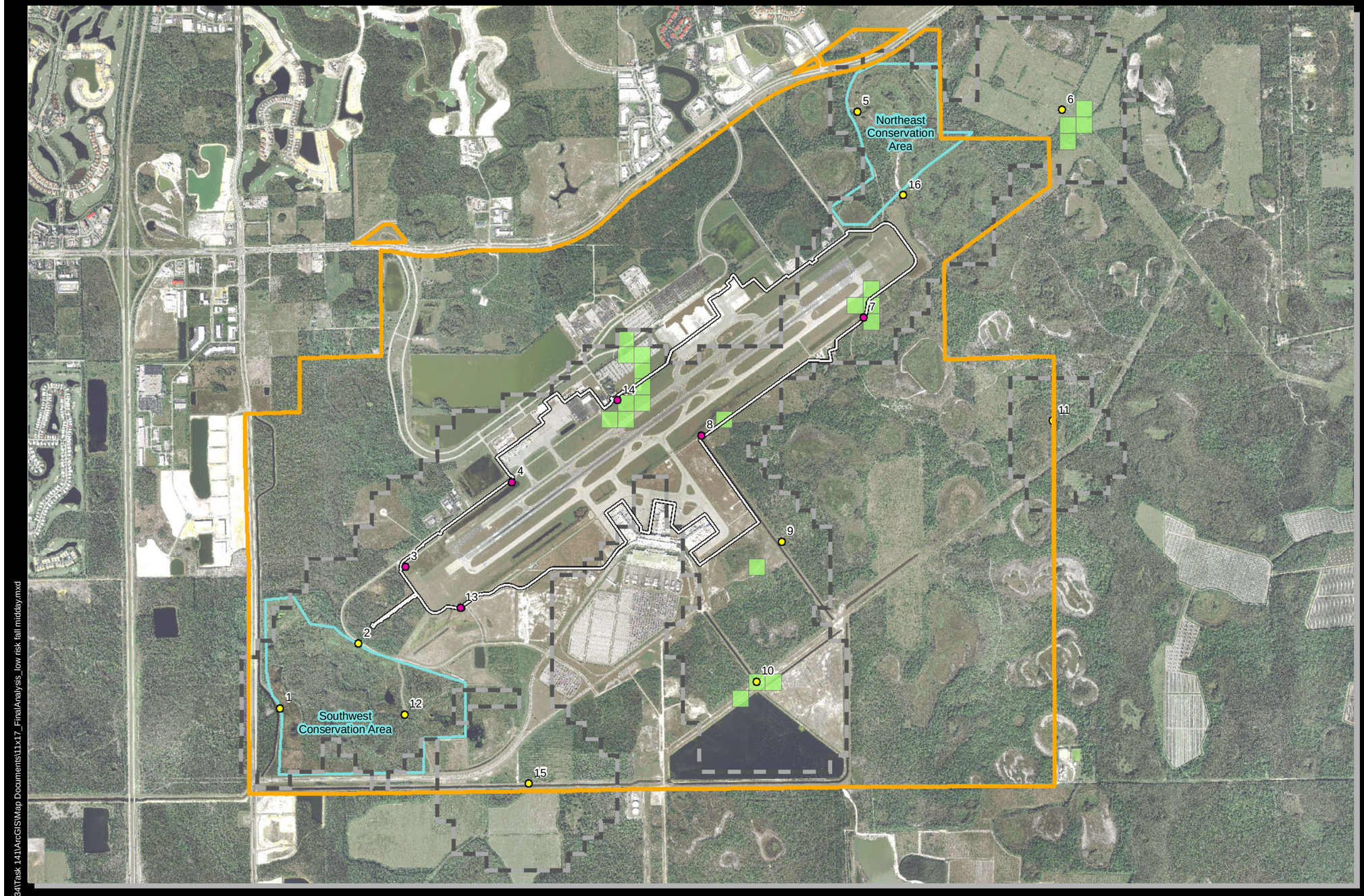

N

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Low-hazard Fall Mid-day

- Low

0 1,250 2,500 3,750 Feet

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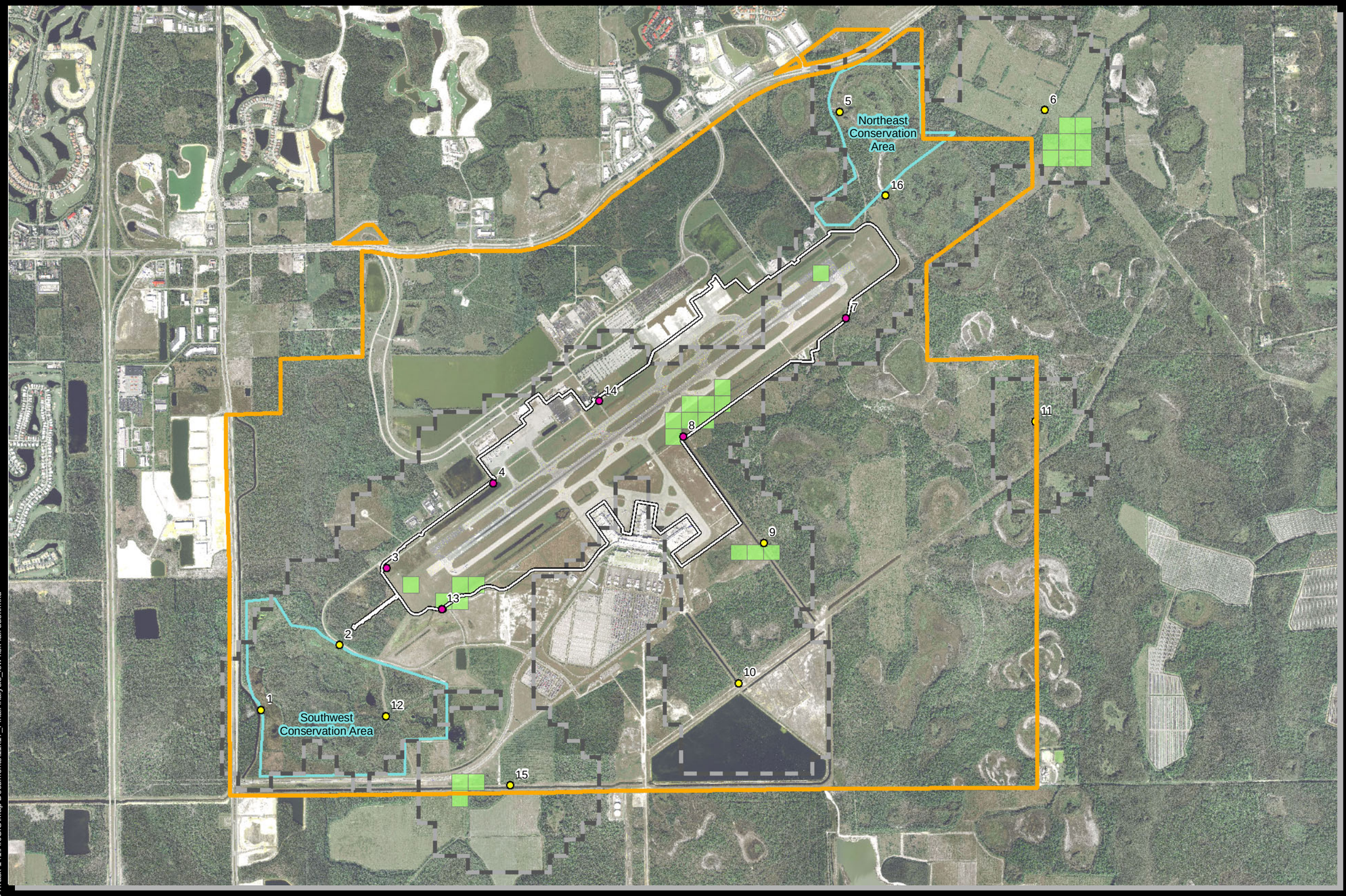
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Guild Scores - Fall Mid-day

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

Low-hazard Fall Dusk

Low

0 1,250 2,500 3,750

Feet

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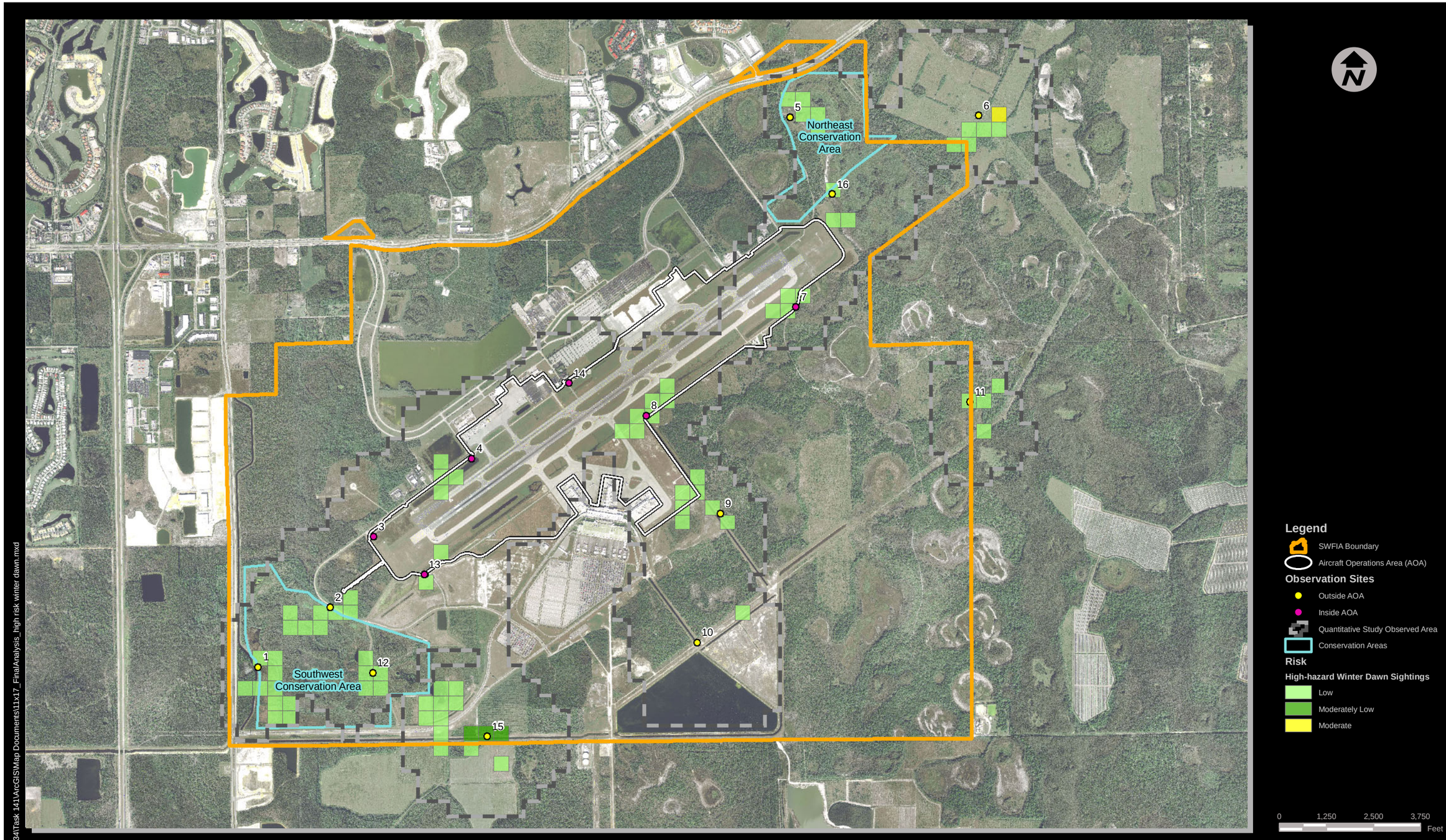
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Guild Scores - Fall Dusk

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



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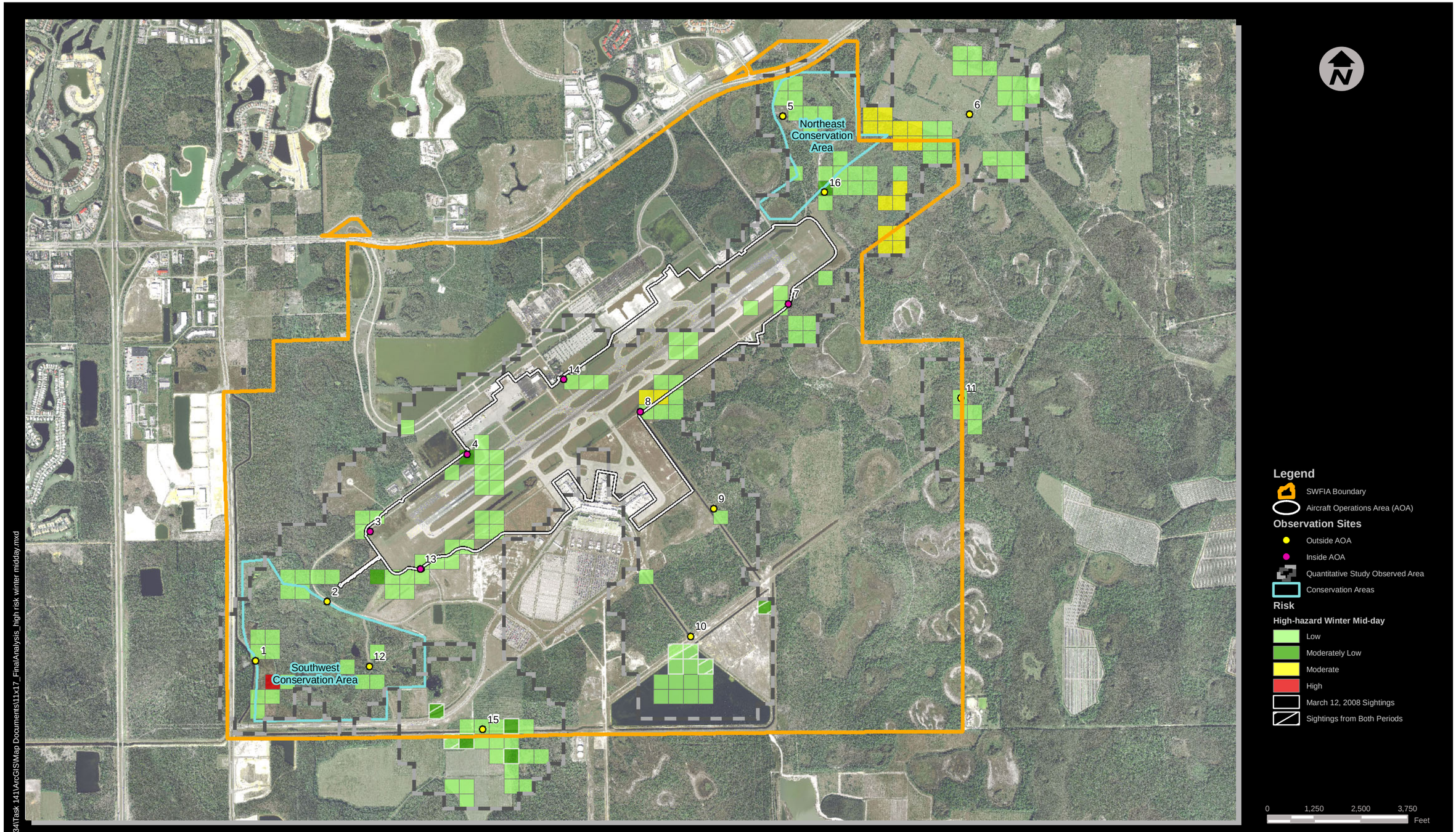
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Guild Scores - Winter Dawn

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



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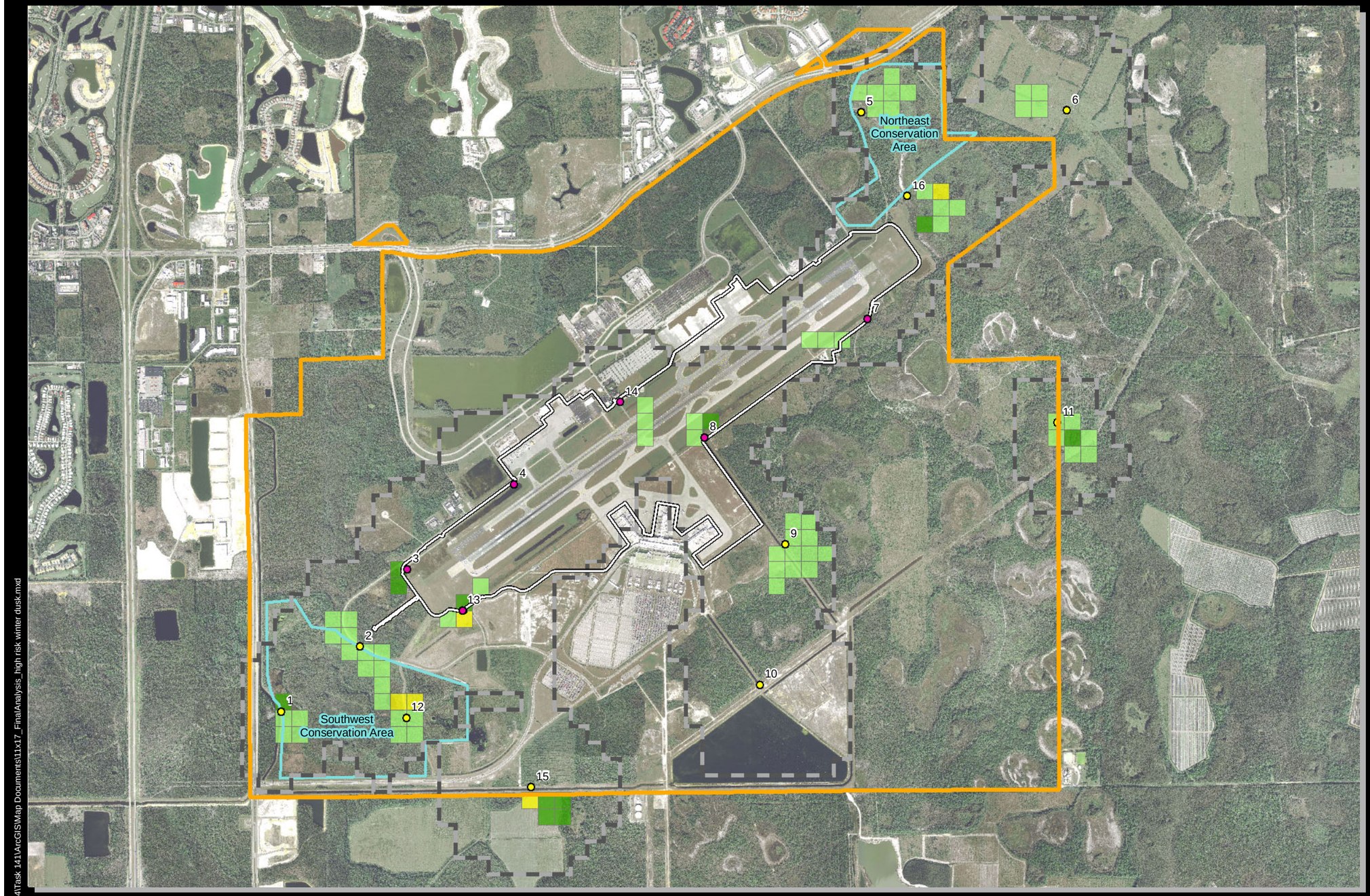
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Scores - Winter Mid-day

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

High-hazard Winter Dusk

Low

Moderately Low

Moderate

0 1,250 2,500 3,750

Feet

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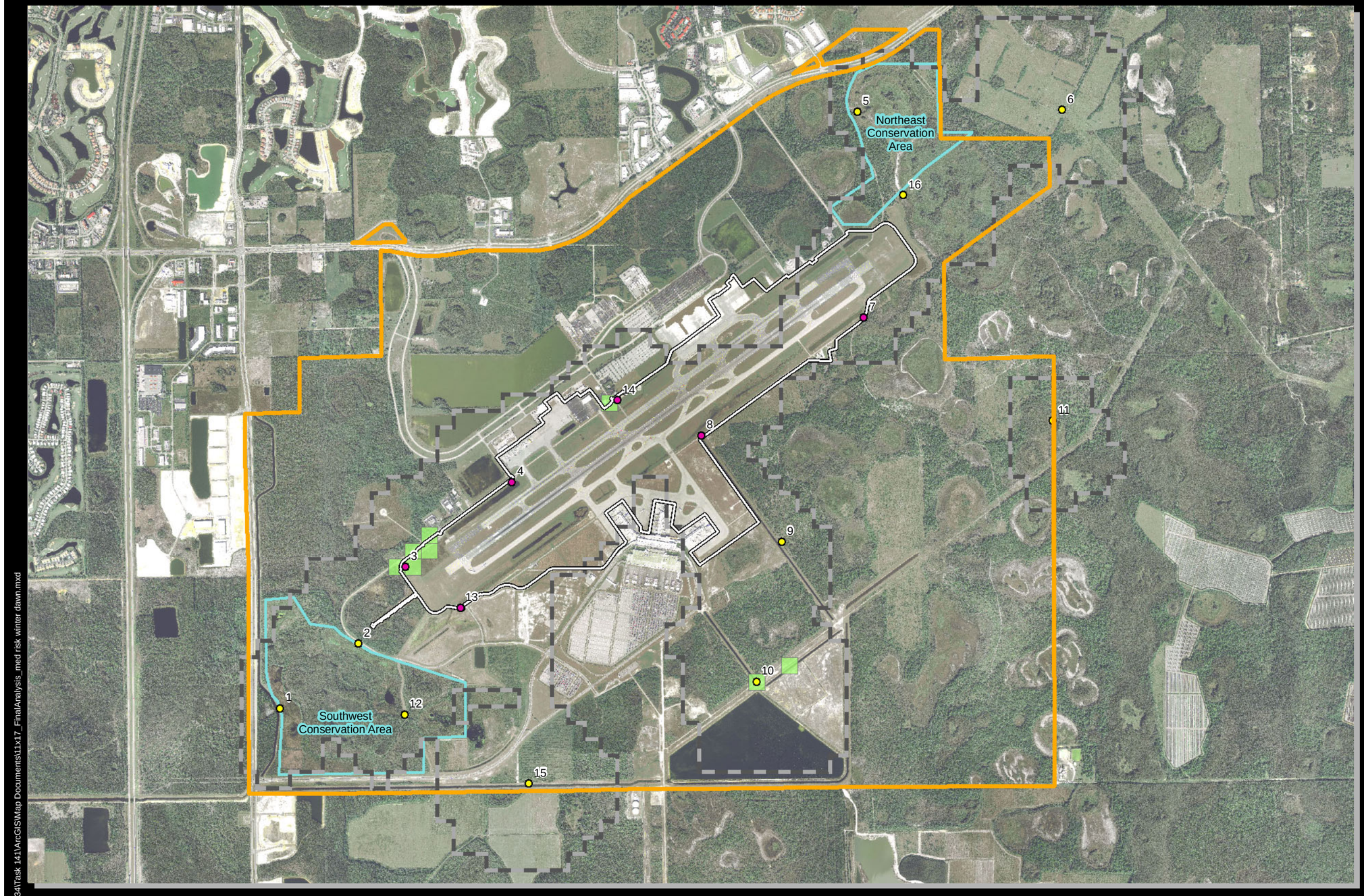
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative High Hazard Scores - Winter Dusk

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

Medium-hazard Winter Dawn Sightings

Low

0 1,250 2,500 3,750

Feet

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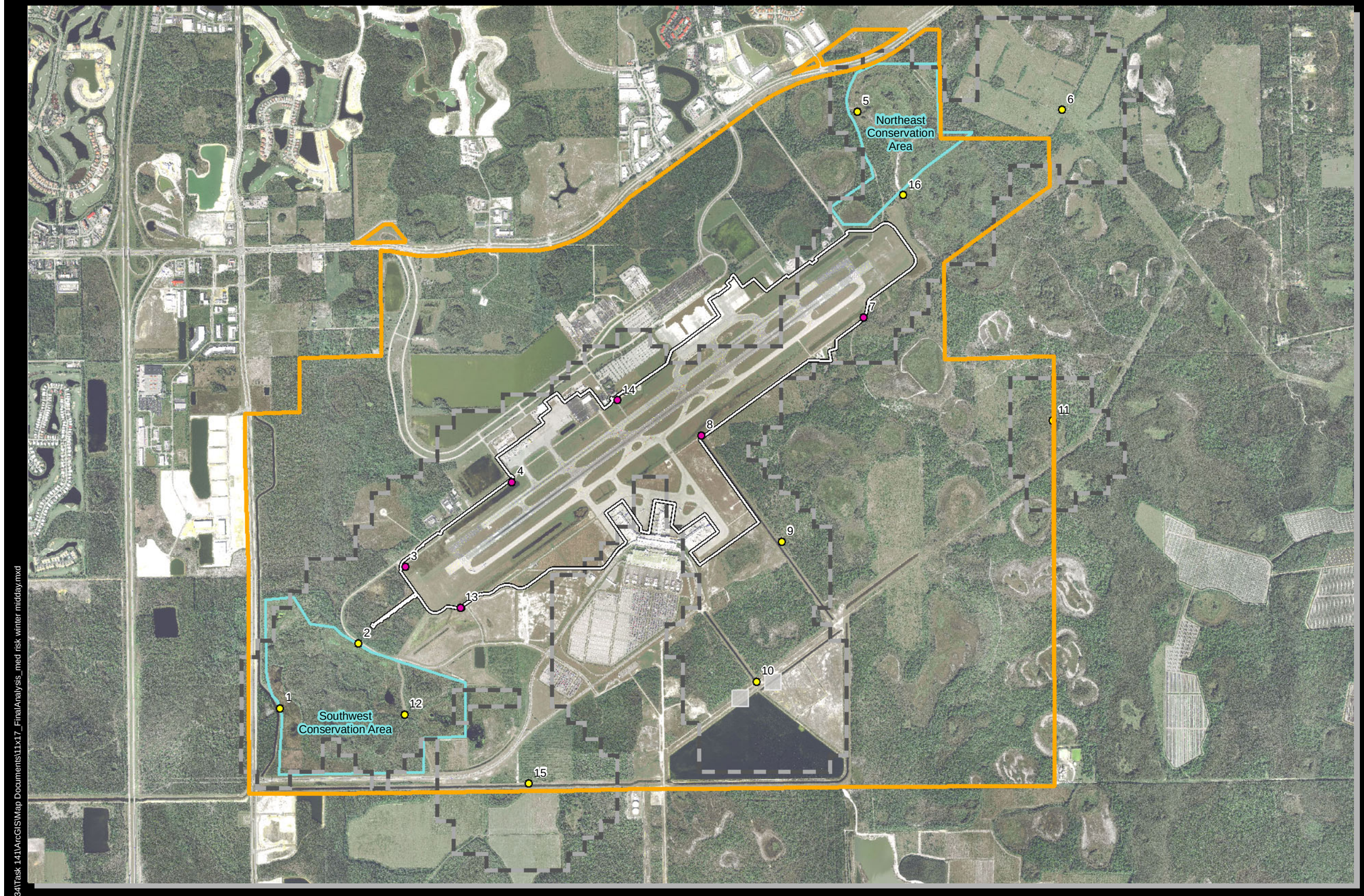
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Medium Hazard Scores - Winter Dawn

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



N

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Medium-hazard Winter Mid-day

- None observed
- March 12, 2008 Sightings

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Medium Hazard Scores - Winter Mid-day

2122 Johnson Street
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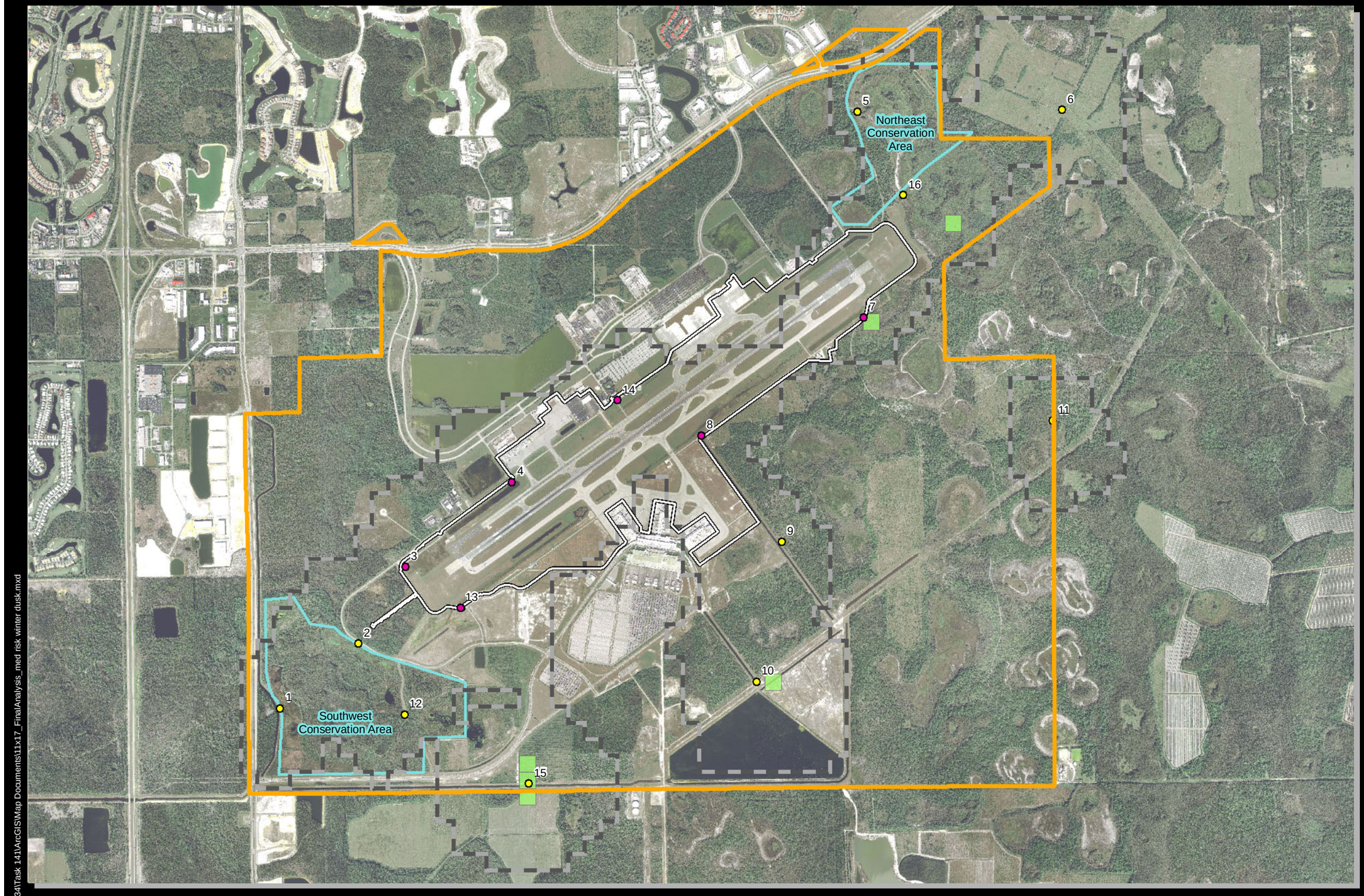
JOHNSON ENGINEERING



Legend

SWFIA Boundary

Aircraft Operations Area (AOA)

Observation Sites

Outside AOA

Inside AOA

Quantitative Study Observed Area

Conservation Areas

Risk

Medium-hazard Winter Dusk

Low

0 1,250 2,500 3,750

Feet

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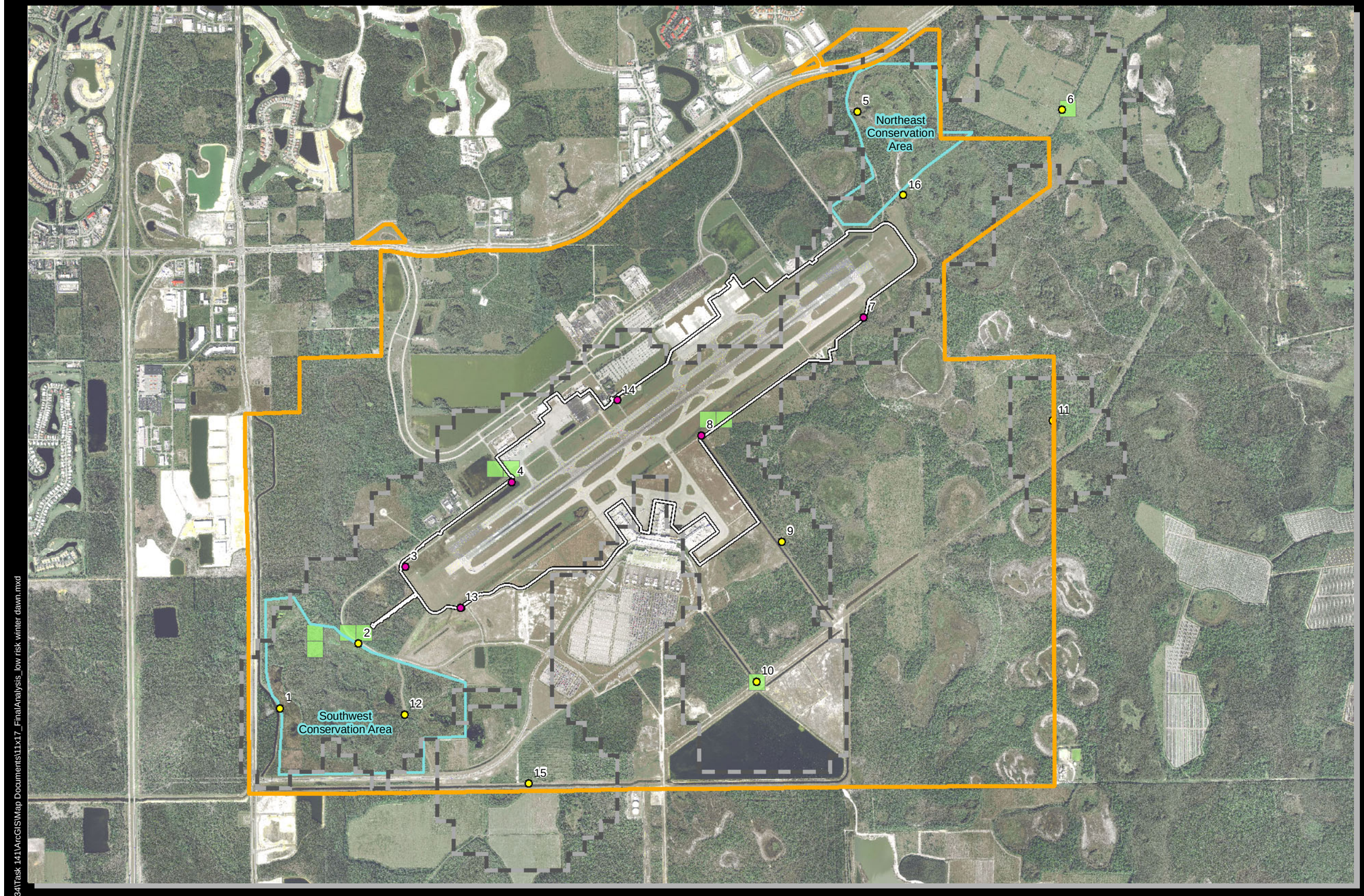
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Medium Hazard Guild Scores - Winter Dusk

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



N

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Low-hazard Winter Dawn Sightings

- Low

0 1,250 2,500 3,750 Feet

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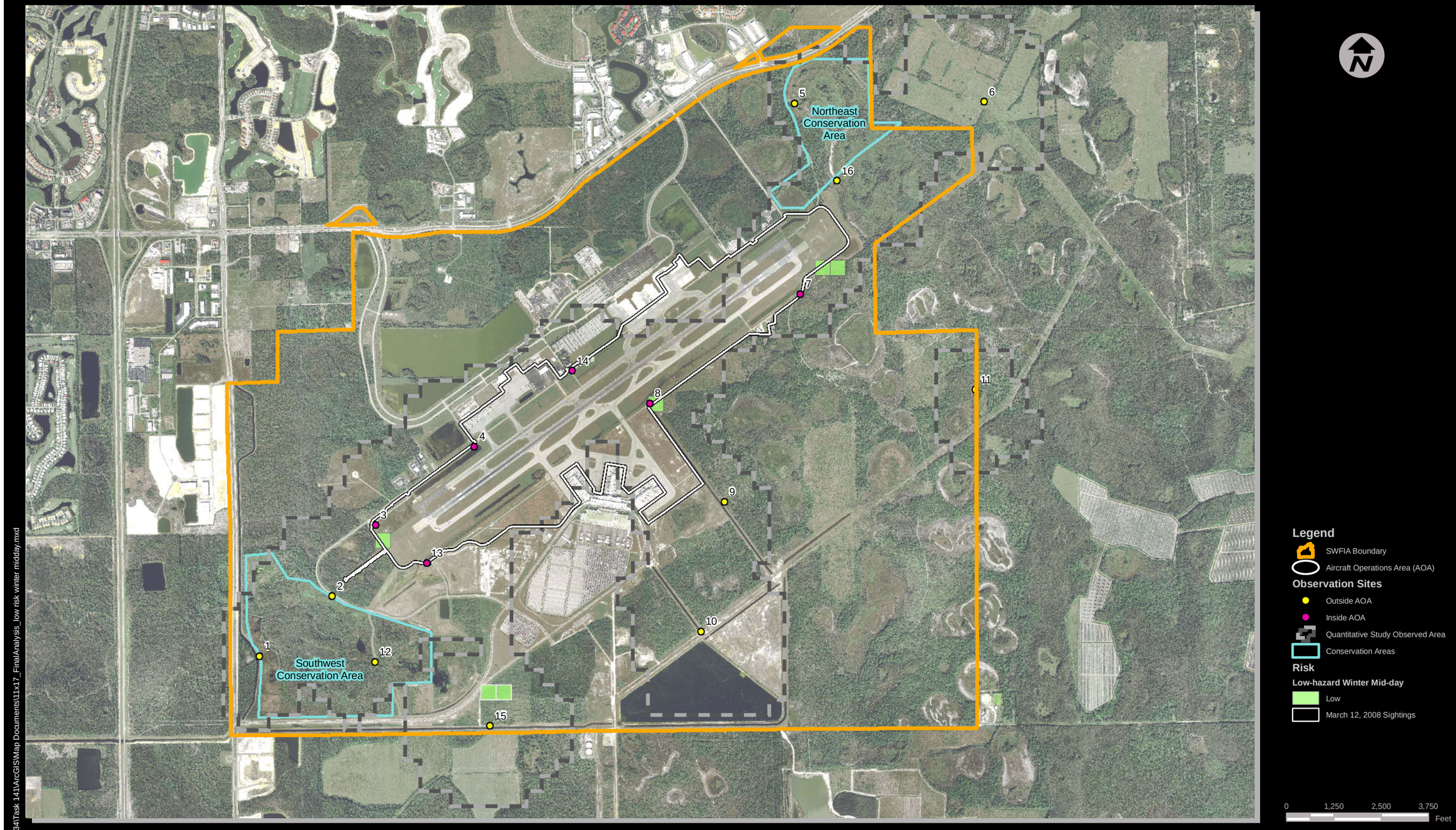
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Guild Scores - Winter Dawn

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



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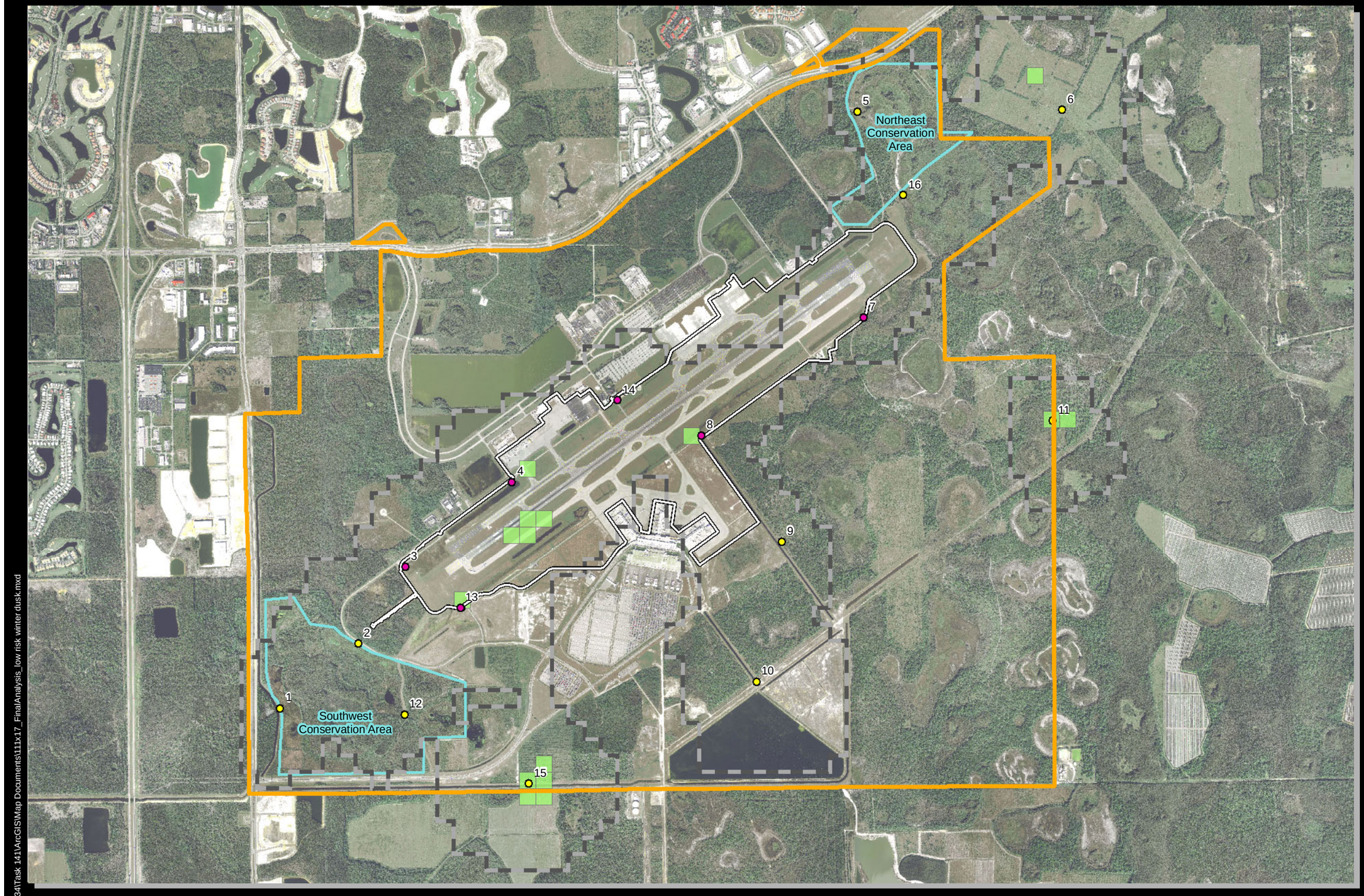
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Low Hazard Guild Scores - Winter Mid-day

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Low-hazard Winter Dusk

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

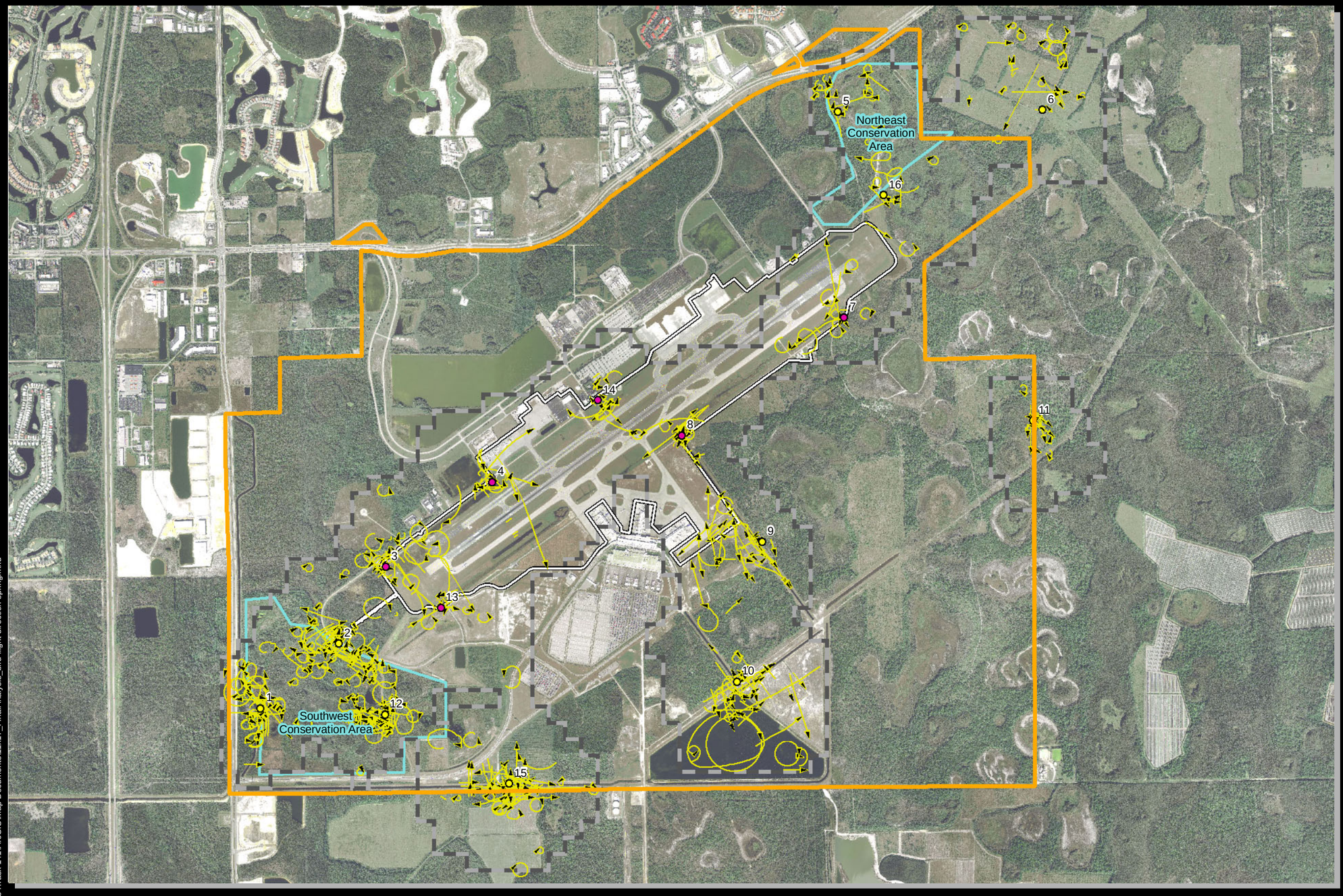
Quantitative Low Hazard Guild Scores - Winter Dusk

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING

APPENDIX J

Seasonal Vector maps



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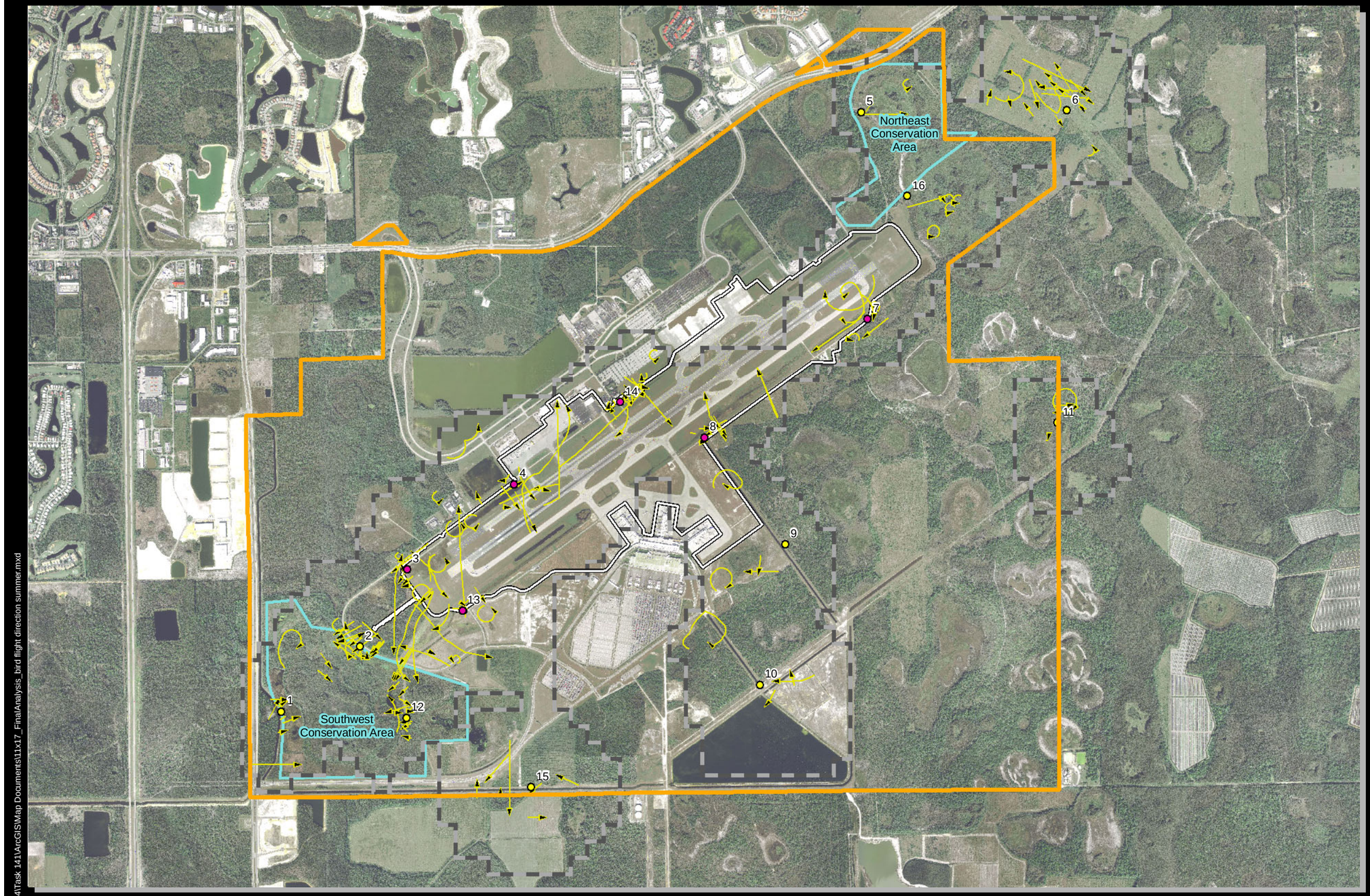
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Local Bird Flight Directionality - Spring

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



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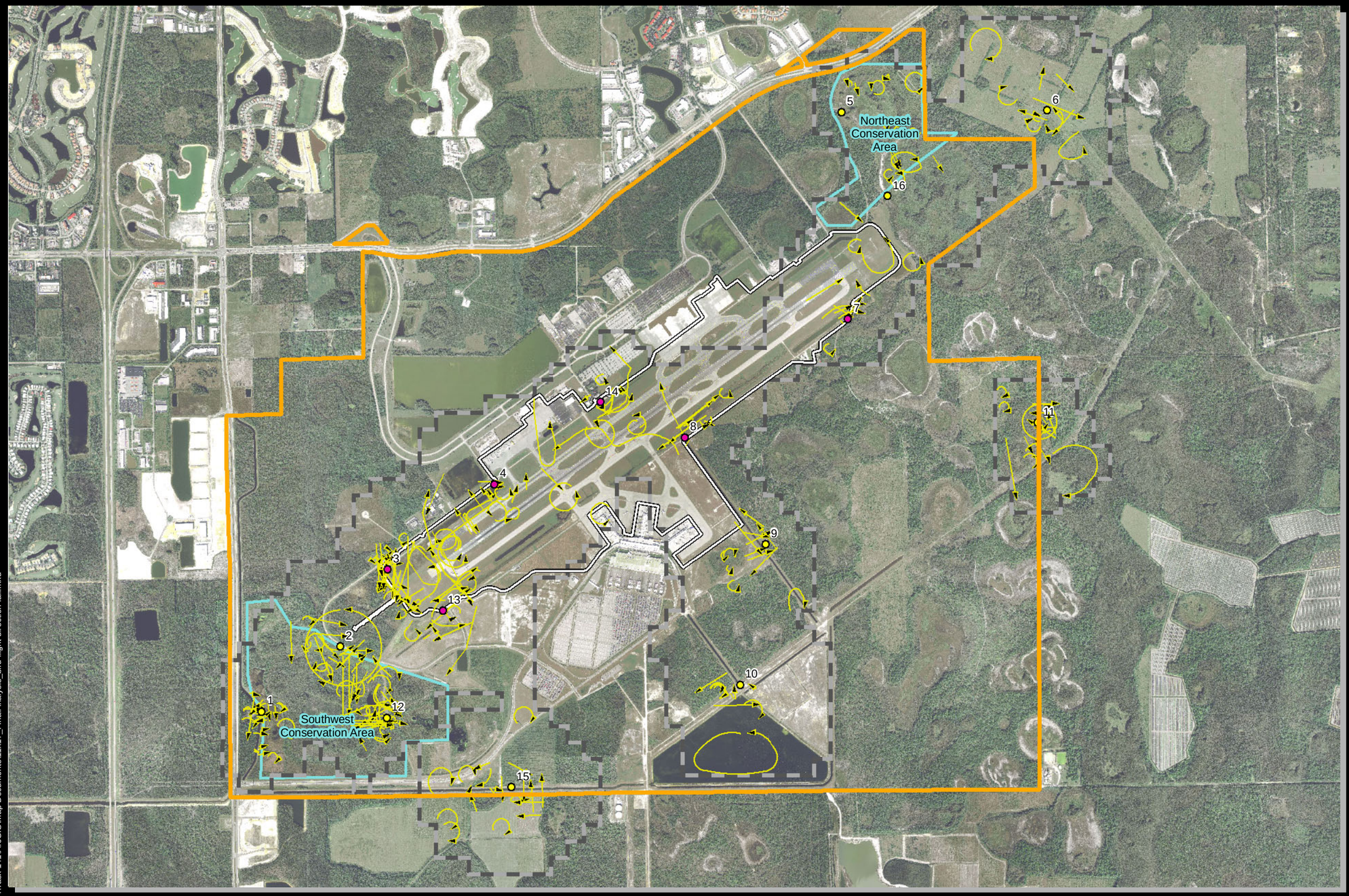
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Local Bird Flight Directionality - Summer

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas
- Flight Observation Vectors

0 1,250 2,500 3,750 Feet

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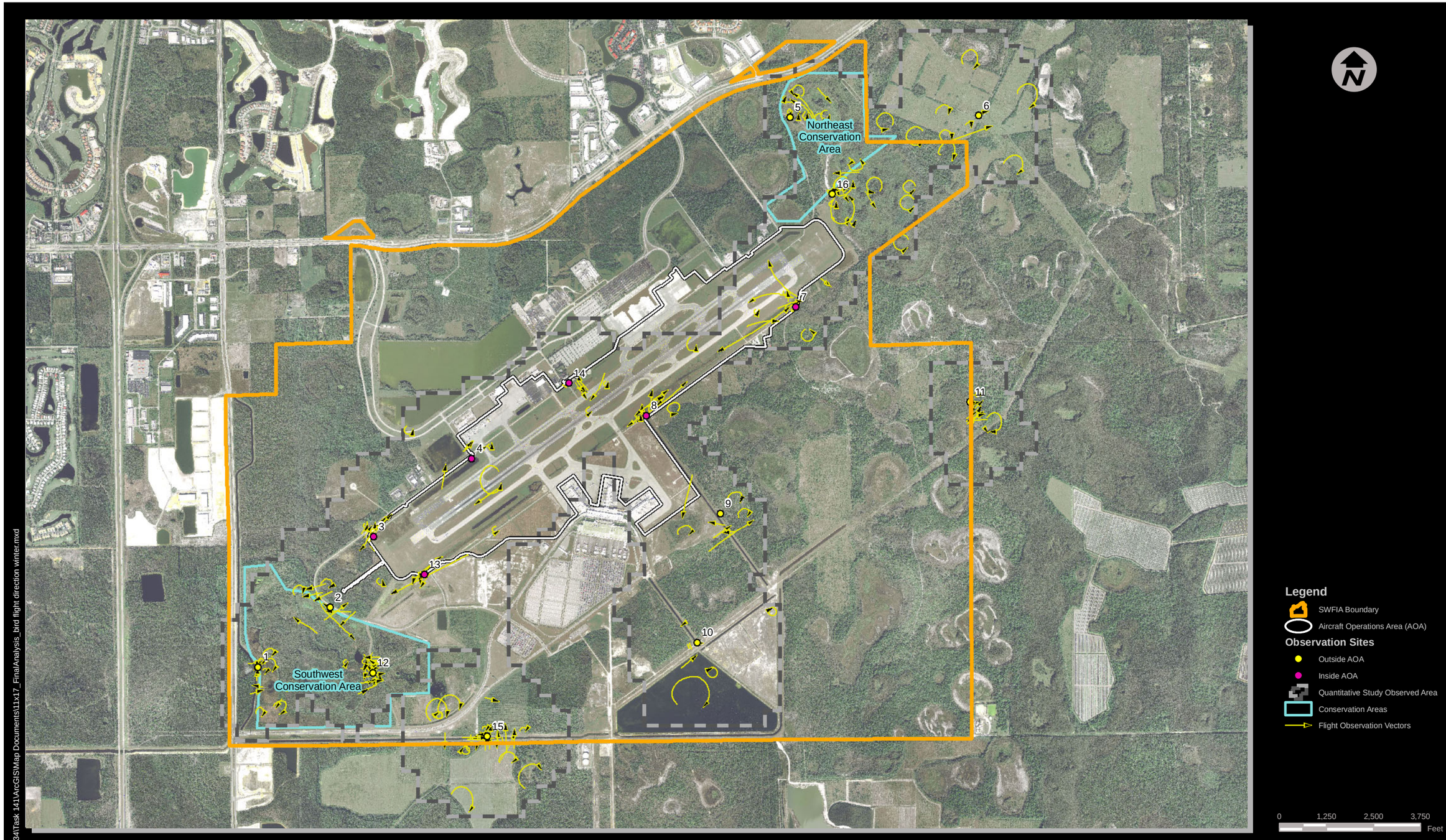
LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Local Bird Flight Directionality - Fall

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING



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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

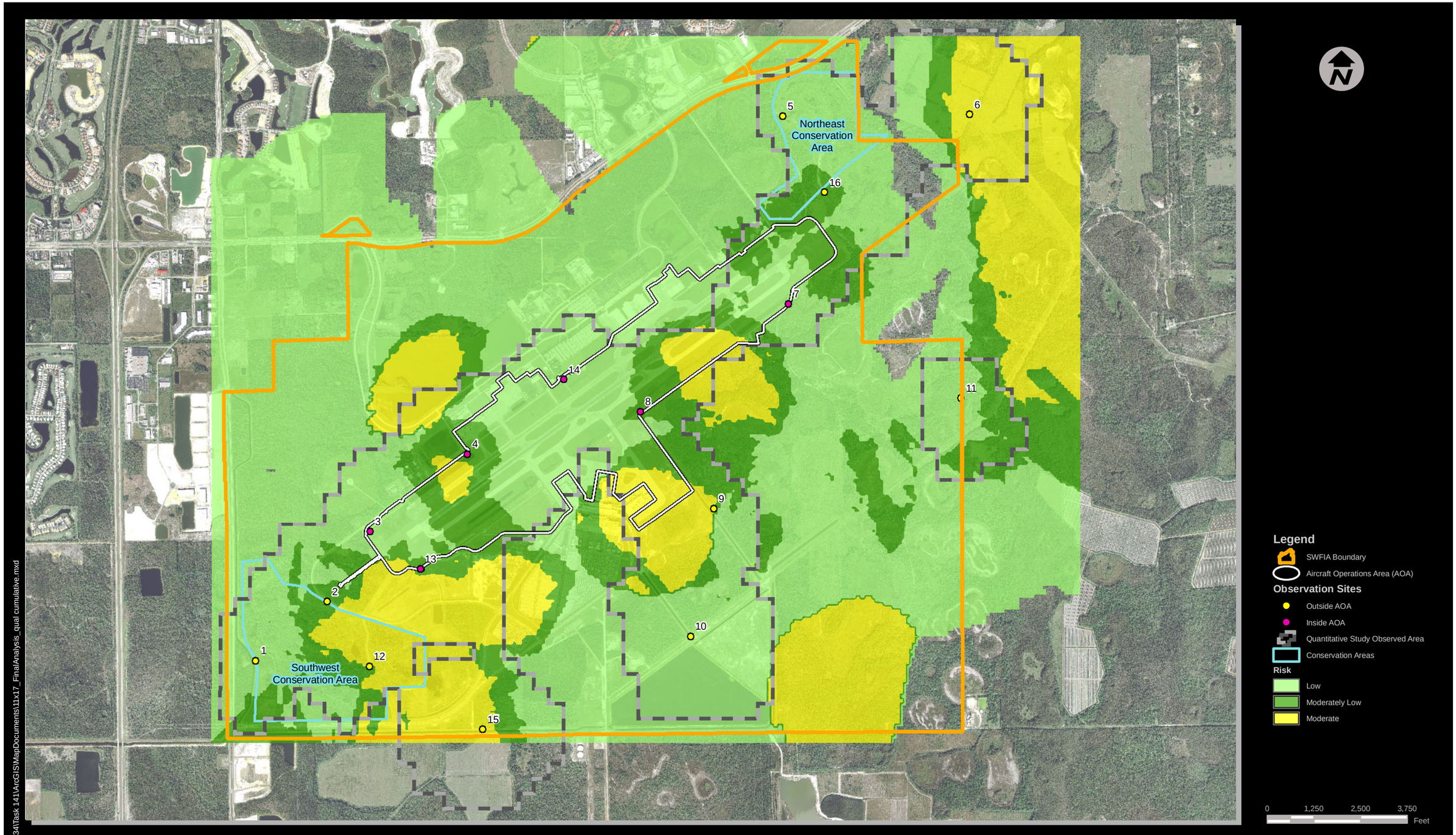
Local Bird Flight Directionality - Winter

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING

APPENDIX K

Qualitative Hazard Scores Overall Cumulative Map



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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

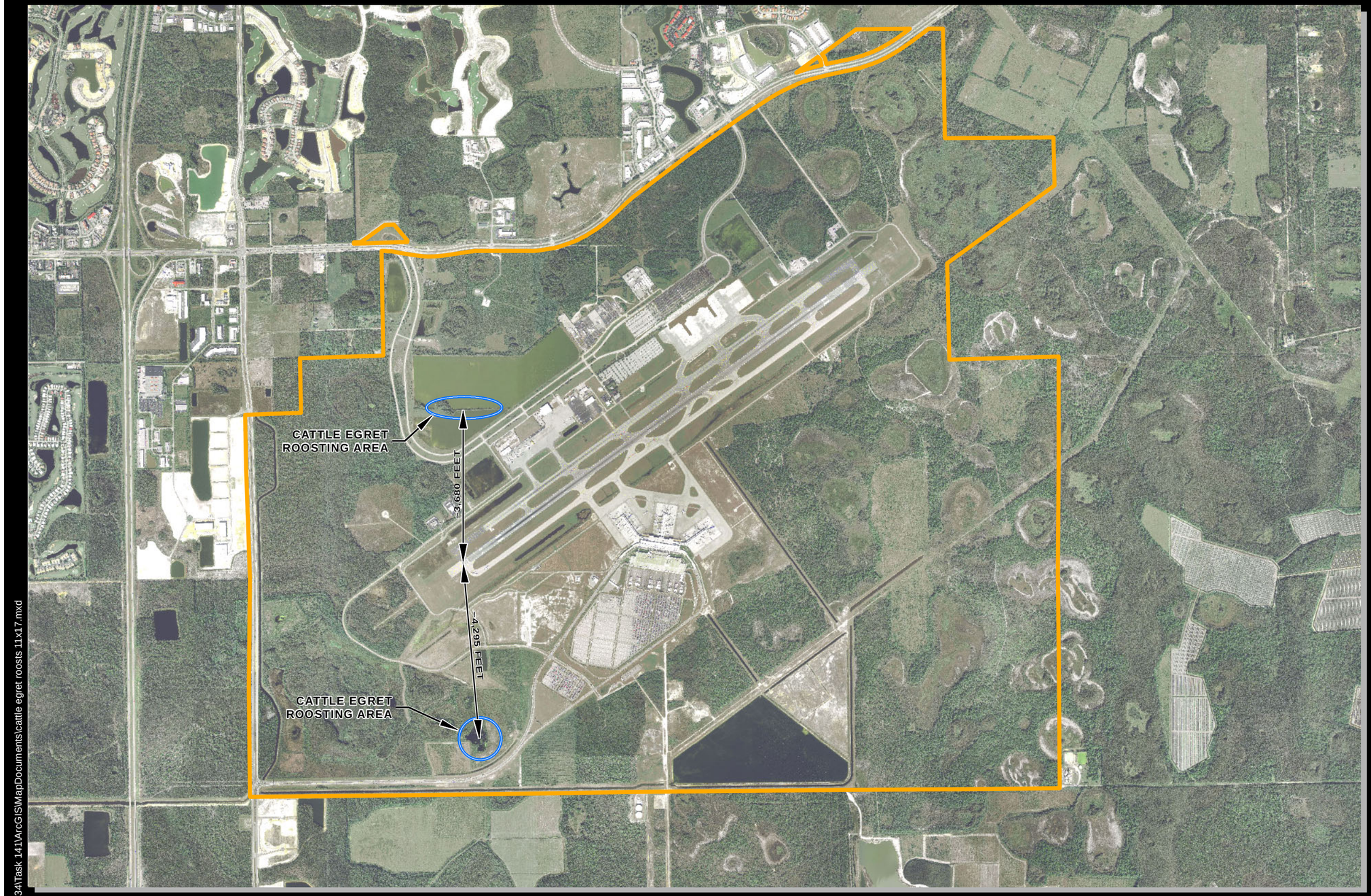
Qualitative Hazard Scores - Cumulative

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING

APPENDIX L

Cattle Egret Roosts Map



N

Legend

SWFIA Boundary

Cattle Egret Roosting Areas

0 1,250 2,500 3,750

Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Cattle Egret Roost Sites

2122 Johnson Street
Fort Myers, Florida 33901
(239) 334-0046

JOHNSON ENGINEERING

APPENDIX M

Quantitative Hazard Scores Nighttime Results Maps

Northeast Conservation Area

Southwest Conservation Area

Night-time	
Hazard Group	Observations
High Hazard	
Cranes	1
Ducks	1
Medium Hazard	
Owls	1
Low Hazard	
Shorebirds	1
Nighthawks	3

Legend

- SWFIA Boundary
- Aircraft Operations Area (AOA)

Observation Sites

- Outside AOA
- Inside AOA
- Quantitative Study Observed Area
- Conservation Areas

Risk

Spring Night-time Hazard (All Guilds)

- Low

0 1,250 2,500 3,750 Feet

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LEE COUNTY PORT AUTHORITY

Lee County Port Authority - RSW Wildlife Hazard Assessment; Lee County, Florida

Quantitative Hazard Scores - Spring Night-time

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