FLORIDA BONNETED BAT (EUMOPS FLORIDANUS)
ACOUSTIC SURVEY

Neptune Road Project Development & Environment (PD&E) Study

From Partin Settlement Road to US 192
Financial Project Number: 445415-1

Osceola County, Florida

Prepared by:

Inwood Consulting Engineers
3000 Dovera Drive, Suite 200
Oviedo, FL 32765

July 2020

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1.0 Introduction

Osceola County is conducting a Project Development and Environment (PD&E) Study to evaluate the proposed widening of Neptune Road from Partin Settlement Road to US 192 in Osceola County, Florida. The project corridor is approximately four miles in length and is located in Section 25, Township 25S, Range 29E; Sections 30, 31, and 32, Township 25S, Range 30E; and Sections 4 and 5, Township 26S and Range 30E.. The **Project Location Map** is shown on **Figure 1.**

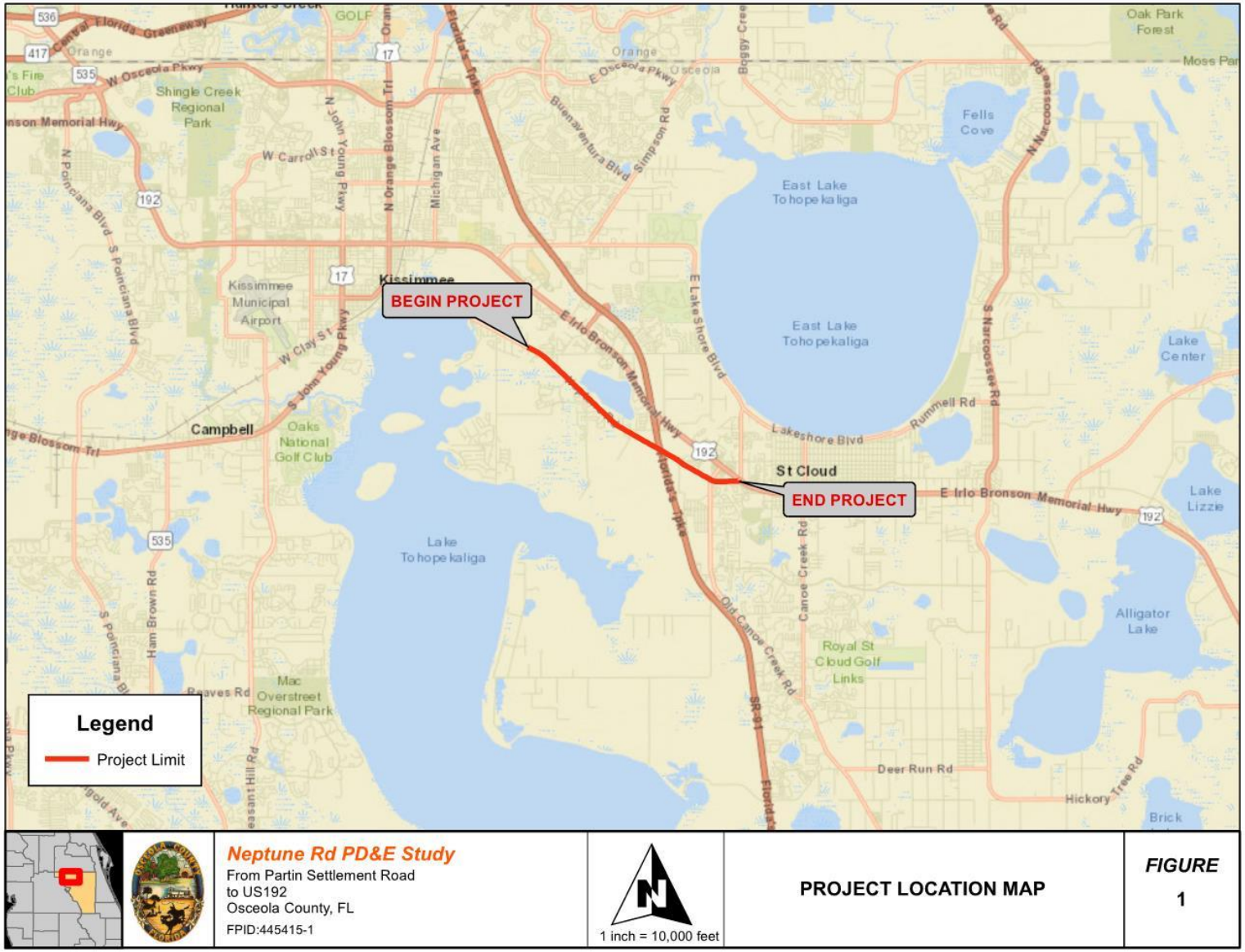
The project is located within the United States Fish and Wildlife Service's (USFWS) Consultation Area (CA) for the Florida bonneted bat (*Eumops floridanus*). Potential roosting and foraging habitat occurs within the project corridor. As a result, Inwood Consulting Engineers, Inc. (Inwood) conducted an assessment to determine the potential effects from the proposed project to the Florida bonneted bat. The assessment is prepared in accordance with Section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.). The assessment included a full acoustic survey and roosting survey of the project corridor. The surveys were conducted from May through July 2020 and in accordance with the current Florida Bonneted Bat Consultation Guidelines (October 2019) (guidelines).

This report provides the methodology, results, and conclusions of the 2020 Florida bonneted bat survey conducted for the Neptune Road PD&E Study along with the anticipated effect determination and is intended to supplement the Natural Resource Evaluation report prepared as part of the PD&E study.

2.0 Project Description

The project includes widening approximately four miles of Neptune Road from Partin Settlement Road to US 192. The proposed improvements include widening the existing two-lane roadway to four-lane lanes with the addition of sidewalks. Additionally, five proposed pond sites were evaluated. Both the mainline and proposed pond sites were included in the survey efforts.

Figure 1: Project Location Map



3.0 Status, Life History and Habitat

3.1 Federal Status

The Florida bonneted bat is a member of the Molossidae family and is the largest bat found in Florida. Previously known as the Florida mastiff bat, Wagner's mastiff bat, and mastiff bat (*Eumpos glaucinus floridanus*), the Florida bonneted bat was found to be a separate species in 2004 (Timm and Genoways 2004). The USFWS listed the Florida bonneted bat as endangered in October 2013 (USFWS 2013). The basis for this listing is due to habitat loss, degradation, and modification, as well as other manmade and natural factors including a small population size with few colonies, restricted range, slow reproductivity and low fecundity. The Florida bonneted bat was also listed because the existing regulatory mechanisms did not adequately protect it from these threats (USFWS 2013).

3.2 Life History

The Florida bonneted bat has short glossy fur consisting of bicolored hairs with a white base. The color is highly variable and ranges from black to brown, to brownish gray or cinnamon brown with the ventral fur paler than the dorsal fur (Belwood 1992, Timm and Genoways 2004). It has large broad ears that project over the eyes and are joined at the midline of the head. This identifying characteristic, along with its larger size, distinguishes it from the Brazilian free-tailed bat (*Tadarida brasiliensis*).

The Florida bonneted bat is a subtropical species that does not hibernate and is active year round. It is thought to have a fairly extensive breeding season during summer months with data suggesting the species might be polyestrous, with a second birthing season in January and February (Timm and Genoways 2004). Females give birth to one offspring per maternity season (USFWS 2013).

This species relies on speed and agility while foraging in open spaces to detect prey roughly 3 to 5 meters (10 to 16 ft) away (Belwood 1992). Bonneted bats are high-flyers, rarely flying below 10 meters (33f ft) (Belwwod 1992) and feed on flying insects including beetles (Coleoptera), flies (Diptera), true bugs (Hemiptera), and moths (Lepidoptera) (Belwood 1981).

3.3 Habitat

Habitat for the Florida bonneted bat consists of foraging areas and roosting sites, including artificial structures. Roosting and foraging varies with species occurring in forested, suburban, and urban areas (Timm and Arroyo-Cabrales 2008).

The guidelines define foraging habitat as relatively open areas that provide sources of prey and drinking water including open fresh water, permanent or seasonal freshwater wetlands, wetland and upland forests, wetland and upland shrub, and agricultural areas. In urban areas, suitable foraging can be found at golf courses, parking lots, and parks.

Potential roosting habitat defined by the guidelines includes forests or other areas with tall or mature trees or other areas with potential roost structures including utility poles and artificial roosts. This includes habitat in which suitable structural features for breeding and sheltering are present. Roosting habitat contains one or more of the following structures: tree snags, and trees with cavities, hollows, deformities, decay, crevices, or loose bark.

4.0 Methodology

4.1 Preliminary Analysis

Prior to conducting the acoustic and roosting surveys, a preliminary analysis of publicly available documentation and geographic information systems (GIS) data were reviewed to determine the potential occurrence of the Florida bonneted bat within the project corridor. Inwood biologists conducted a field review on May 6, 2020 to identify habitats within the project corridor that provide suitable roosting and/or foraging habitat for the Florida bonneted bat and identify optimal acoustic sites.

The guidelines currently require a minimum of five detector nights per 0.06 miles for linear projects. Based on the approximate four-mile proposed project length, a minimum of 35 detector nights were required. A total of 11 acoustic monitoring sites were identified to sufficiently cover the survey requirements based on project length, proposed pond site locations and existing habitats along the project corridor. The monitoring site locations were determined by the surrounding habitats observed during the pre-survey field review. These sites were chosen to survey habitats most suitable for foraging and roosting, while being placed in areas with limited clutter to maximize the effectiveness of the equipment. Based on the preliminary analysis, Inwood developed a Florida Bonneted Bat Survey Methodology for the Neptune Road PD&E Study that was submitted to the USFWS on May 7, 2020 (Appendix A). This methodology was approved by the USFWS on May 8, 2020.

The acoustic and roosting surveys, as well as the call data analysis were conducted by a qualified biologist with the required acoustic survey course training.

4.2 Acoustic Survey

The acoustic survey was conducted from May 19, 2020 through June 22, 2020. The survey was conducted in multiple deployments to accommodate weather conditions and

equipment utilization as a total of 4 detectors were utilized for the survey. Photographs of detector deployment and representative habitat are included in Appendix B. Detector Deployment Data Forms are provided in Appendix C. **Table 1** provides the details of the detector deployment. **Figure 2** provides the location for each acoustic site.

Table 1. Detector Deployment Summary

Site	Detector Number		Latitude	Longitude
FBB1	11535	11536	28°16'47"N	-81°21'52"W
FBB2	11537	11534	28°16'33"N	-81°21'51"W
FBB3	11536	11535	28°16'28"N	-81°21'32"W
FBB4	11534		28°16'15"N	-81°21'17"W
FBB5	11535		28°15'45"N	-81°20'36"W
FBB6	11534		28°20'21"N	-81°20'21"W
FBB7	11537	11536	28°15'24"N	-81°19'56"W
FBB8	11537		28°15'17"N	-81°18'40"W
FBB9	11536		28°15'02"N	-81°19'11"W
FBB10	11534		28°14'57"N	-81°18'58"W
FBB11	11535	11537	28°14'59"N	-81°14'59"W

Figure 2: Acoustic Survey Station Location Map

Each site consisted of one full spectrum detector (Pettersson DX500) with an omnidirectional microphone and directional cone. The microphones were mounted approximately 20 feet above the ground on metal poles to elevate the microphone above the shrub level. The poles were placed in a four foot tall pvc pipe holder that was hammered into the ground or attached to vegetation to provide stability. The detectors were preset to automatically record at least ½ hour before sunset and ½ hour after sunrise. Each detector and microphone were calibrated in accordance with manufacturer and USFWS guidelines. The equipment was checked daily to ensure proper functioning of the detector and microphone. Survey Data forms are included in Appendix D. Each detector was deployed for a minimum of five nights.

Inwood monitored the weather utilizing the nearest National Oceanic Atmospheric Administration (NOAA) National Weather Service Station to ensure the weather conditions complied with the USFWS criteria. The nearest NOAA weather station for the project is located at the Kissimmee Gateway Airport (Station KISM) and is approximately 6.5 miles west of the project center. Additionally, biologists document weather conditions during the daily equipment checks and were occasionally on site during survey commencement times. Supporting weather documentation is included in Appendix E.

Acoustic sampling efforts were repeated for nights when the weather conditions did not meet the following criteria:

- Temperatures fall below 65°F;
- Precipitation (rain and/or fog) exceeding 30 minutes or continues intermittently; and
- Sustained winds greater than 9 mph for 30 minutes or more.

4.3 Acoustic Data Analysis

Full spectrum data were recorded on 32 gigabyte (GB) SanDisk memory cards. The data were downloaded and analyzed utilizing SonoBat software, version 4.4.5. All calls were analyzed to determine the presence and subsequent identification of species, including the Florida bonneted bat. All calls are vetted to determine the potential of being a Florida bonneted bat.

4.4 Roost Survey

During the initial field analysis, detector deployments and daily equipment checks, biologists surveyed the area for potential roosts. A 100% pedestrian roost survey was conducted on July 1, 2020 by two Inwood biologists in accordance with the roost survey protocol outlined in the guidelines. Pedestrian transects were spaced in order to view potential roost structures from multiple angles. All trees/structures with cavities and/or crevices were documented via GPS location. Areas around each cavity were inspected for

evidence of bat activity including guano, staining, chirping. Additionally, potential roosting cavities and crevices were inspected using a wireless camera when possible.

5.0 Results

5.1 Acoustic Survey

Acoustic surveys were conducted from May 19, 2020 through June 22, 2020. Eleven acoustic monitoring sites collected data for a total of 55 detector nights. A total of 166,254 files were collected. The SonaBat analysis resulted in a total of 10,502 bat call sequences from eight bat species. Bat species identified during the data analysis include:

- Big brown bat (*Eptesicus fuscus*)
- Brazilian free-tailed bat (*Tadarida brasiliensis*)
- Eastern red bat (*Lasiurus borealis*)
- Evening bat (*Nycticeius humeralis*)
- Northern yellow bat (*Lasiurus intermedius*)
- Rafinesque's big-eared bat (*Corynorhinus rafinewquii*)
- Southestern Myotis (*Myotis lucifugus*)
- Tri-colored bat (*Perimyotis subflavus*)

No Florida bonneted bat calls were identified as a result of the acoustic survey. SonaBat analysis identified 28 calls as Florida bonneted bat calls. Manual vetting resulted in none of the calls being identified as Florida bonneted bat calls. The 28 calls identified by SonaBat were found to be either noise, other taxa or bat species.

Nightly weather conditions were recorded for each deployment. The survey efforts were repeated for nights that the weather criteria were not met. Weather data is included in Appendix E.

5.2 Roost Survey

The 100% roost survey conducted on July 1, 2019 identified four potential roosts consisting of three natural and one artificial structure. The location of each structure is provided on **Figure 3**. Each structure was inspected for evidence of roosting such as staining, guano and chirping. **Table 2** provides a summary of the observed structures.

Figure 3: Potential Roost Location Map

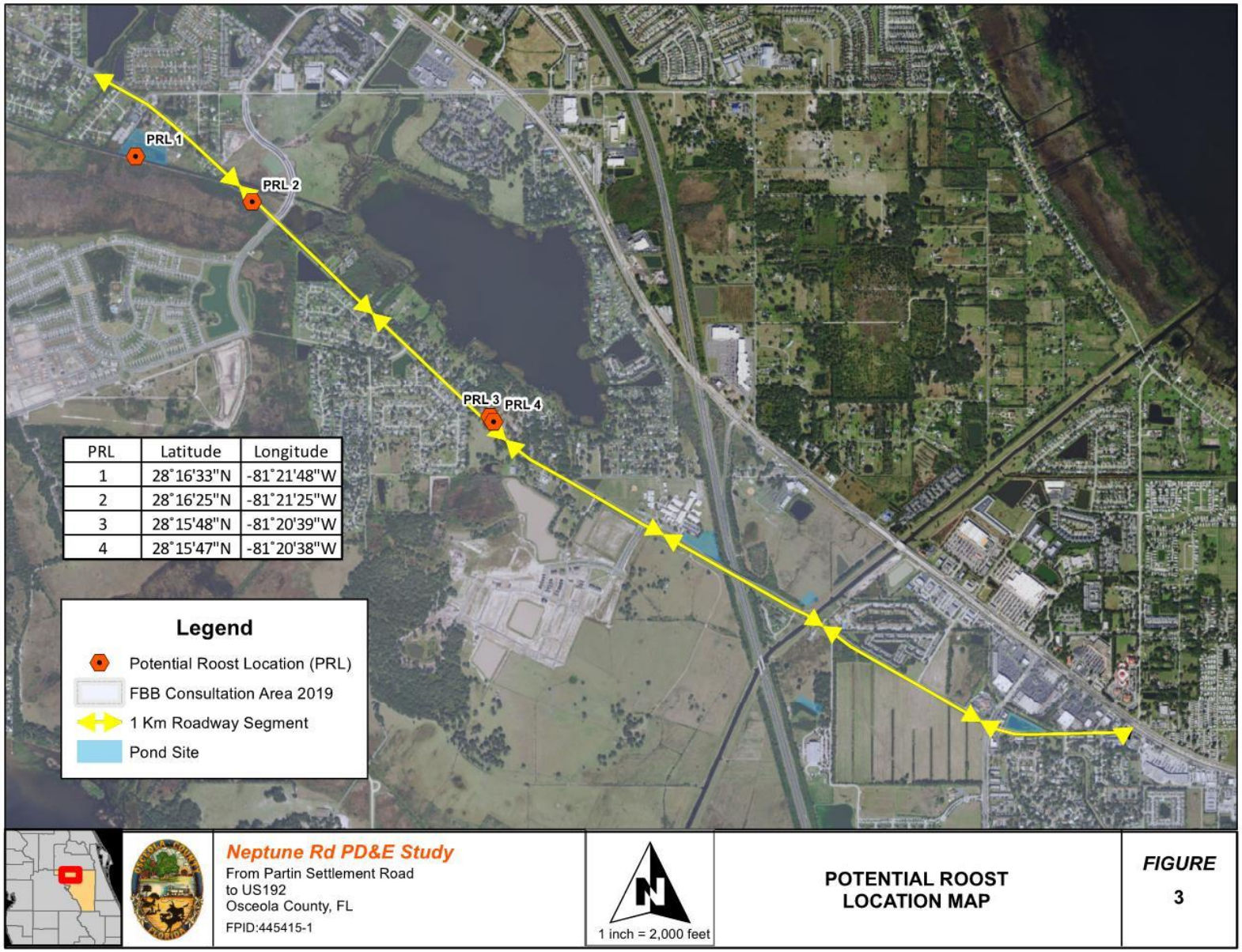


Table 2. Potential Roost Survey Data

Potential Roost Location	Structure Type	Health	Approximate Diameter	Approximate Height of Cavity	Latitude	Longitude	Staining Observed	Guano Observed	Auditory Chirping
1	Red Maple	Good	10"	15'	28˚16'33"N	-81˚21'48"W	No	No	No
2	Utility Pole	N/A	16"	40'	28˚16'25"N	-81˚21'25"W	No	No	No
3	Water Oak	Poor	23"	15'	28˚15'48"N	-81˚20'39"W	Yes	No	No
4	Pine	Poor	18"	30'	28˚15'47"N	-81˚20'38"W	No	No	No

Cavities 1, 3, and 4 were inspected using a wireless camera. The camera scoping of these cavities did not identify bat roosting. Inspection of Cavity 2 via wireless camera was not possible due to it being a utility pole, however, no evidence of roosting was identified during the visual inspection. Photo documentation of the potential roost cavities are provided in Appendix B.

Based on the roost assessment, no evidence of roosting by Florida bonneted bats or other bats was observed.

6.0 Conclusion

Based on the guidelines, it was determined that potential Florida bonneted bat roosting and foraging habitat occurs within the project corridor. The corridor is highly developed, and the majority of this habitat is adjacent to the project footprint, particularly potential roosting habitat. As a result of the roost and acoustic surveys, no evidence of roosting or foraging was observed.

No Florida bonneted bat calls were detected as a result of the acoustic survey. A "**No Effect**" determination was made utilizing the Florida Bonneted Bat Consultation Key (USFWS 2019) (Appendix F). This effect determination was made using the following sequence from the key: **1a-2a-3b-6b**.

Based on the results of the roost and acoustic surveys, no evidence of roosting or foraging by the Florida bonneted bat within the project corridor was detected. Due to the absence of Florida bonneted bat activity, this project is expected to have "**No Effect**" on the Florida bonneted bat.

7.0 References

Belwood, J.J. 1981. Wagner's mastiff bat, *Eumops glaucinus floridanus* (Molossidae) in southwestern Florida. Journal of Mammalogy 62:411-413.

Belwood, J.J. 1992. Florida mastiff bat *Eumops glaucinus* floridanus. Pages 216-233 in S.R. Humphrey (ed), Rare and endangered biota of Florida. Vol. I. Mammals. University Press of Florida. Gainsville, Florida.

Timm, R. and J.Arroyo-Cabrales. 2008. Eumops floridanus. In:IUCN 2011, IUCN Red List of Threatened Species. Version 2011.2 http://iucnredlist.org/.

Timm, R. M. and H. H. Genoways. 2004. The Florida bonnet bat, *Eumops floridanus* (Chiroptera: Molossidae): distribution, morphometrics, systematics, and ecology. Journal of Mammology 85:852-865.

USFWS. 2013. Endangered and threatened wildlife and plants; endangered species status for the Florida bonneted bat; Final Rule. Federal Register 78:61004.

USFWS, South Florida Ecological Services Office. 2019. Florida Bonneted Bat Consultation Guidelines.

Appendix A

Agency Coordination Approved Florida Bonneted Bat Survey Methodology

TRANSPORTATION
WATER RESOURCES
PLANNING / PD&E
ECOLOGY
STRUCTURES
UTILITIES

May 7, 2020

Mr. John Wrublik
Planning and Resource Conservation
U.S. Fish and Wildlife Service
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960
john_wrublik@fws.gov

Subject: Neptune Road Project Development and Environment (PD&E) Study
from Partin Settlement Road to US 192
Florida Bonneted Bat Acoustic Survey Methodology Memorandum
Financial Project Number: 445415-1
Osceola County, Florida

Dear Mr. Wrublik,

Osceola County is conducting a Project Development and Environment (PD&E) Study to evaluate improvements to Neptune Road. This project involves a segment of Neptune Road extending from Partin Settlement Road to US 192 and is located within Section 25, Township 25S, Range 29E; Sections 30, 31, and 32, Township 25S, Range 30E; and Sections 4 and 5, Township 26S and Range 30E. A project location map (**Figure 1**) is included as part of this correspondence.

The project area is located within the U.S. Fish and Wildlife Service's (USFWS) Consultation Area (CA) for the Florida bonneted bat (FBB) (*Eumops floridanus*). Inwood Consulting Engineers, Inc. (Inwood) is preparing to conduct a FBB acoustic bat survey in the project area. The current survey protocol for linear projects requires 5 detector nights per 0.6 mile (1 Km). Based on a preliminary field review of the project area, Inwood is proposing 11 survey sites to accommodate the linear survey requirement, including pond sites, for a total of 55 survey nights. The survey sites are shown on **Figure 2** and match the sites discussed during the April 9, 2020 coordination meeting. These sites have been selected and ground-truthed based on existing habitats within the project area that provide suitable roosting and/or foraging habitat for the FBB. Potential roosting habitat for the FBB includes forests or other areas with tall or mature trees or other areas with potential roost structures including utility poles and artificial roosts. Potential foraging habitat consists of relatively open areas that provide sources of prey and drinking water including open fresh water, permanent or seasonal freshwater wetlands, wetland and upland forests, wetland and upland shrub, and agricultural areas. Photographs of survey site locations are provided with this correspondence.

3000 Dovera Drive
Suite 200
Oviedo, FL 32765

P: 407-971-8850
F: 407-971-8955
www.inwoodinc.com

Inwood will conduct the survey in accordance with current USFWS Florida Bonneted Bat Consultation Guidelines (October 2019). The survey will be conducted by a qualified biologist who has taken the required acoustic survey course. The survey will be conducted in May and June 2020. A full spectrum detector (Pettersson DX500) with an omnidirectional microphone mounted a minimum of 10 feet above the ground will be deployed at each survey site. The detectors will be preset to automatically record at least ½ hour before sunset and ½ hour after sunrise. Each detector will be deployed for five consecutive nights. Inwood will monitor the weather utilizing the nearest NOAA National Weather Service Station to ensure the weather conditions meet the USFWS criteria. Additional survey nights may be necessary if any of the following weather conditions occur within the first five hours of the survey:

- Temperatures fall below 65°F;
- Precipitation (rain and/or fog) exceeding 30 minutes or continues intermittently; and
- Sustained winds greater than 9 mph for 30 minutes or more.

SonoBat software will be utilized to analyze the recordings. Additionally, these files will be visually reviewed and manually vetted by experienced personnel. All data will be provided to USFWS upon completion of the study.

Finally, per the discussion during the April 9, 2020 coordination meeting, the County is requesting that the FBB survey be valid for 2 years, following completion of the survey, assuming no significant changes to the project footprint or impact areas.

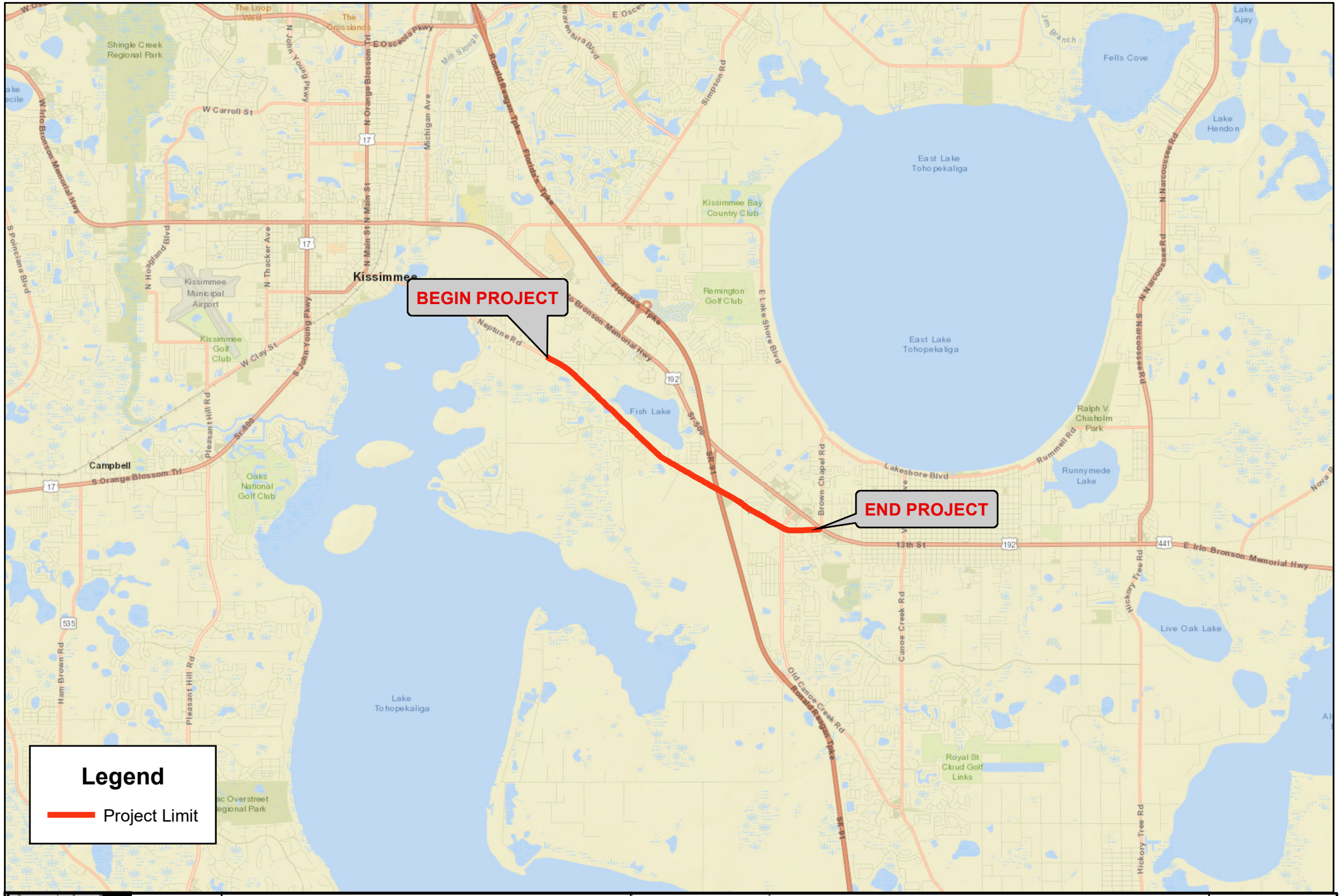
Please review the proposed FBB acoustic survey, above, and the attached figures, and provide concurrence that these are acceptable to USFWS. We appreciate your cooperation and look forward to working with you on this project.

Sincerely,

Jason Houck, GISP, PWS
Associate Principal – Ecological Services Manager

cc: Joshua Devries, Abra Horne, David Graeber, Heather Chasez, Clif Tate, Sarah Johnson, Jada Barhorst

Enclosures: Figures and Photo Document


BEGIN PROJECT
END PROJECT
Kissimmee
Campbell
Legend
Project Limit
Neptune Rd
From Partin Settlement Road
to US192
1 inch = 8,333 feet
PROJECT LOCATION MAP
FIGURE
1

Neptune Rd

From Partin Settlement Road
to US192

1 inch = 2,000 feet

FLORIDA BONNETED BAT ACOUSTIC SURVEY STATION LOCATION MAP

FIGURE

2

SITE1 1

SITE 2

SITE 3

SITE 4

SITE 5

SITE 6

SITE 7

SITE 8

SITE 9

SITE 10

SITE 11

From: Wrublik, John <john_wrublik@fws.gov>
Sent: Friday, May 8, 2020 6:30 AM
To: Jason Houck
Cc: Joshua DeVries; Abra Horne; Tate, Clif; Graeber, David; Chasez, Heather; Johnson, Sarah; Jada Barhorst
Subject: Re: [EXTERNAL] FPID 445415-1: Neptune Road PD&E - FBB Survey Methodology Memo

Jason,

I have reviewed the Florida bonneted bat survey information provided for the Nepture Road project, and it is acceptable to the Service.

Sincerely,

John M. Wrublik
U.S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960
Office: (772) 469-4282
Fax: (772) 562-4288
email: John_Wrublik@fws.gov

From: Jason Houck <jhouck@inwoodinc.com>
Sent: Thursday, May 7, 2020 1:38 PM
To: Wrublik, John <john_wrublik@fws.gov>
Cc: Joshua DeVries <Joshua.Devries@OSCEOLA.ORG>; Abra Horne <Abra.Horne@OSCEOLA.ORG>; Tate, Clif <Clif.Tate@kimley-horn.com>; Graeber, David <David.Graeber@dot.state.fl.us>; Chasez, Heather <Heather.Chasez@dot.state.fl.us>; Johnson, Sarah <Sarah.Johnson@kimley-horn.com>; Jada Barhorst <jbarhorst@inwoodinc.com>
Subject: [EXTERNAL] FPID 445415-1: Neptune Road PD&E - FBB Survey Methodology Memo

John,

Good afternoon and I hope you are well. This email is a follow up to our April 9, 2020 coordination meeting for the Neptune Road PD&E study in Osceola County (FPID 445415-1).

Since the meeting, Inwood has been contracted by Osceola County via the prime consultant, Kimley Horn, to conduct the Florida bonneted bat survey for this project. We conducted a field review yesterday to finalize the stations following the linear survey protocol in the October 2019 guidance. We were able to access all of them and, as a result, we did not change anything from what was presented to you on April 9. I would appreciate it if you would review the attached proposed methodology. Please indicate whether the approach is satisfactory to the Service or if you have any questions, concerns, or need any additional information. We would like to begin the acoustic data collection no later than May 18th.

As always, please let me know if you have any questions and I look forward to working with you on this project.

Thanks,

Jason

Jason Houck, GISP, PWS
ASSOCIATE PRINCIPAL - ECOLOGICAL SERVICES MANAGER
FWC Authorized Gopher Tortoise Agent

INWOOD CONSULTING ENGINEERS
3000 Dovera Dr., Suite 200, Oviedo, FL 32765
O: 407-971-8850
D: 407-906-1853
F: 407-971-8955
C: 321-202-3907
www.inwoodinc.com

Appendix B

Photographs

Photo 1: FBB Site 1 Deployment

Photo 2: FBB Site 1 Representative Habitat

Photo 3: FBB Site 2 Deployment

Photo 4: FBB Site 2 Representative Habitat

Photo 5: FBB Site 3 Deployment

Photo 6: FBB Site 3 Representative Habitat

Photo 7: FBB Site 4 Deployment

Photo 8: FBB Site 4 Representative Habitat

Photo 9: FBB Site 5 Deployment

Photo 10: FBB Site 5 Representative Habitat

Photo 11: FBB Site 6 Deployment

Photo 12: FBB Site 6 Representative Habitat

Photo 13: FBB Site 7 Deployment

Photo 14: FBB Site 7 Representative Habitat

Photo 15: FBB Site 8 Deployment

Photo 16: FBB Site 8 Representative Habitat

Photo 17: FBB Site 9 Deployment

Photo 18: FBB Site 9 Representative Habitat

Photo 19: FBB Site 10 Deployment

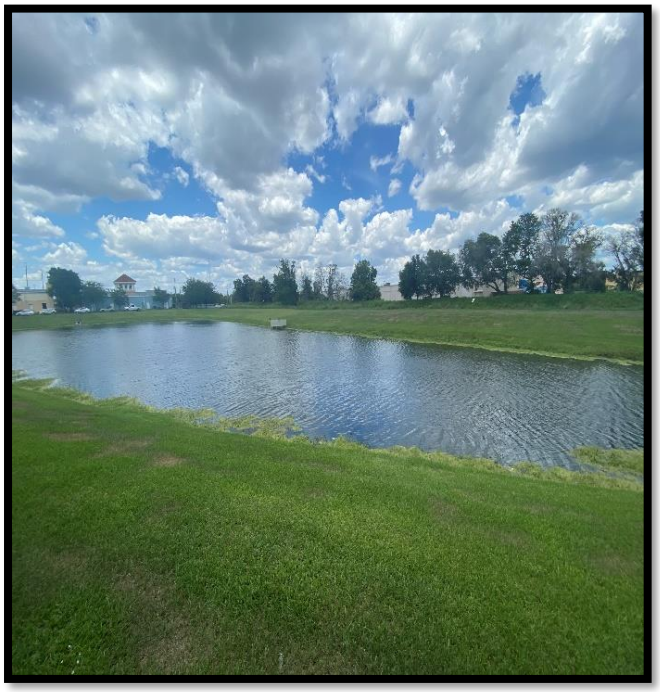


Photo 20: FBB Site 10 Representative Habitat

Photo 21: FBB Site 11 Deployment

Photo 22: FBB Site 11 Representative Habitat

Photo 23: Potential Roost 1 Cavity

Photo 24: Potential Roost 1 Tree, (cavity location circled in red)

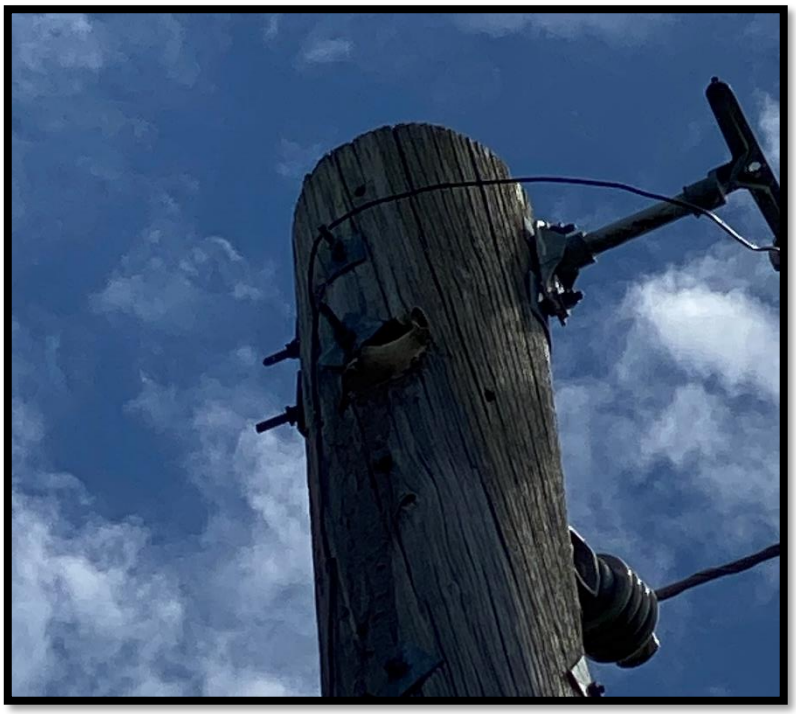


Photo 25: Potential Roost 2 Cavity

Photo 26: Potential Roost Utility Pole

Photo 27: Potential Roost 3 Cavity

Photo 28: Potential Roost 3 Tree

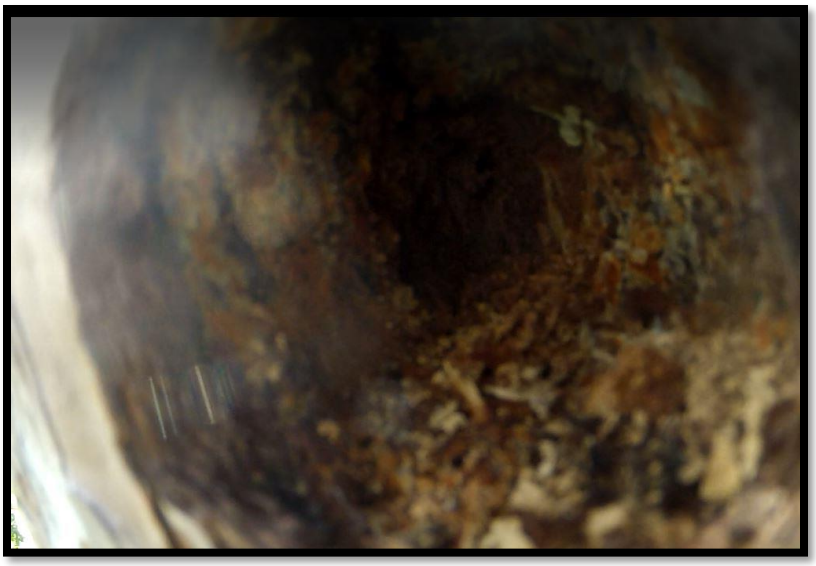


Photo 29: Potential Roost 4 Cavity

Photo 31: Potential Roost 4 Tree (cavity location circled in red)

Appendix C

Detector Deployment Data Forms

Detector Deployment Data Form

Project: Neptune Rd	State: FL	County: Osceola	Site: FBB1	Date: 5.19.2020
Biologist: J. Barhorst + J. Hauch		GPS ID: Jada's Phone		Camera ID: Jada's Phone

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11535	Pettersson	DX500	DX500 external	Omnidirectional	20 ft.	Horizontal

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28° 16' 47" N	-81° 21' 52" W	✓	Else 40	45	Med	NO	19:44	7:06

DETECTOR CHECKLIST: Time 15:50 ~~16:50~~ Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: #2 Waypoint #/ID: ~~3~~ 2-FBB1

Detector Placement/Site Description:

Placed near edge of brazilian pepper over looking retention pond, just N of Neptune Rd.

Remarks:

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Wapture Rd	State: FL	County: Osceola	Site: FBS 2	Date: 5.19.2020
Biologist: J. Barkhorst, J. Houck		GPS ID: Jada iPhone	Camera ID: Jada iPhone	

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11537	Pettersson	D500X	Pettersson D500X external	omnidirectional	20 ft.	horizontal

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28° 16' 33N	-81° 21' 51" W	✓	Edge open canal	45	Med	NO	19:44	7:06

DETECTOR CHECKLIST: Time 4:33 ~~PM~~ 16:33 Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: Photo 3 Waypoint #/ID: 3: FBS2

Detector Placement/Site Description:

Placed on the N side of Partin Canal, facing East down canal

Remarks:

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Neptune Rd	State: FL	County: Osceola County	Site: FBB 3	Date: 5.19.2020
Biologist: J. Bathorst, J. Houch		GPS ID: JADA's iPhone		Camera ID: Jada's iPhone

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11536	Petterson	D501x	Petterson 550i x External	omnidirectional	20 ft.	Horizontal

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28°16' 28"N	81° 21' 32"W	✓	Edge Low	45	Med	NO	19:45	6:35

DETECTOR CHECKLIST: Time ~~[illegible]~~ 17:0 Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: 4 Waypoint #/ID: 4 : FBB 3

Detector Placement/Site Description:

Placed on S. side of Partin Canal facing E - overlooking cleared berm + canal

Remarks:

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Neptune Road	State: FL	County: Osceola	Site: FBS 4	Date: 5.19.2020
Biologist: J. Barkley J. Hench	GPS ID: Jacks iPhone	Camera ID: Jacks iPhone		

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11534	Pettersson D	D500x	Pettersson D500x External	Omnidirectional	20 ft	Horizontal

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28°16'15"N	-81°21'17W	Yes	Low edge	45	MED	NO	19:42	7:03

DETECTOR CHECKLIST: Time 17:38 Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: # 5 Waypoint #/ID: 5: FBS4

Detector Placement/Site Description:

Detector placed near edge of retention pond on west side of pond near edge habitat and clear row around pond. Facing East S. of Neptune Rd.

Remarks:

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Neptune Road PD&E	State: FL	County: Osceola	Site: FBB #5	Date: 5/26/2020
Biologist: J. Barhorst, A. Burke		GPS ID: Jada's iPhone	Camera ID: iphone	

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11535	Pettersson	D500X	Pettersson	omnidirectional	20 ft	Horizontal west

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28.15.45N	-81 20 36 W	✓	Low/Med	45 ✓	Very low	NO	19:47	7:02

DETECTOR CHECKLIST: Time 5:32 Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: 009 Waypoint #/ID: 009: FB135

Detector Placement/Site Description:

on 20 foot pole; facing west across open land adjacent to Neptune Rd.

Scattered oak/pines

Remarks: changed sensitivity to very low due to road noise

Site sketch/photo (label to match BD# above)

Biologists were in the project area and noted rain at 7:15pm that ended at 7:40pm (1940)

Detector Deployment Data Form

Project: Neptune Road PD&E	State: FL	County: Osceola	Site: FBB6	Date: 5.26.2020
Biologist: J. Garhart, A. Burke		GPS ID: Jake's iPhone	Camera ID: Jake's iPhone	

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11534	Pettersson	D500X	Pettersson	Omnidirectional	20 ft pole	1 for: South

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28.15' 31"N	81° 20' 21" W	✓	Edge	45	Very low	No	1946	7:01

DETECTOR CHECKLIST: Time 6:02 Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: 007 Waypoint #/ID: 007.FBB6

Detector Placement/Site Description:

pole 20 feet facing South
over retention pond
open field behind pond

Remarks: Biologists were in project area when Rain shower started @ approximately 7:15pm ended @ 7:40 before recording

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Neptune Road PD&E	State: FL	County: Osceola	Site: FBB 7	Date: 5.26.2020
Biologist: J. Barhorst, A. Burke		GPS ID: Jake's iPhone	Camera ID: Jake's iPhone	

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11537	Pettersson		Pettersson	omnidirectional	20 feet	Horizontal Northwest

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28° 15' 24"N	81° 15' 56"W	✓	Low Edge	45	very Low	NO	19:48	7:03

DETECTOR CHECKLIST: Time 6:33 Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: 8 Waypoint #/ID: 8, FBB7

Detector Placement/Site Description:

pole 20ft high, mic facing North-West over dry pond and adjacent to Neptune Rd. (North of Nyne) Brazillian pepper lining road. Just West of Turnpike

Remarks: Biologists were in the project area and noted rain @ approximately 7:15 that stopped @ 7:40 (19:40)

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Neptune Road PD&E	State: FL	County: Osceola	Site: FRB 8	Date: 6-11-2020
Biologist: J. Barhorst T. McPherson		GPS ID: iphone	Camera ID: J.B iphone	

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11537	Pettersen	D500	Pettersen External mic	omnidirectional	20 ft	Horizontal

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28° 15' 17"N	-81° 19' 40"W	Yes			M & D	Yes	1955h	0700 h

DETECTOR CHECKLIST: Time 5:20 pm Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: 10 Waypoint #/ID: FRB8

Detector Placement/Site Description:

North of Neptune Rd, just west of the Saint Cloud Canal. Placed on fenceline facing NW toward open pasture/wet prairie

Remarks:

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Neptune Road PD&E	State: FL	County: Osceola	Site: FBB 9	Date: 6/2/20
Biologist: J. Barbosa B. Shepherd		GPS ID: JB iphone		Camera ID: JB iphone

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11536	Pettersson	D500x	Pettersson External mic	Omnidirectional	20 ft.	Horizontal

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28°15' 02"N	81° 19' 11"W	Yes	Low	45	Med	NO	19:53	6:58

DETECTOR CHECKLIST: Time 12:17pm Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: Photo 12 Waypoint #/ID: Photo 12: BB12

Detector Placement/Site Description:

N. of Neptune Rd, just east of Sergeant Graham Pl. Placed near edge of treeline facing open pasture, mic facing NNE.

Remarks:

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Neptune Road PD&E	State: FL	County: Osceola	Site: FBB 10	Date: 6-14-20
Biologist: J. Burkhart, G. Huddle		GPS ID: J.B. iphone	Camera ID: J.B. iphone	

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11534	Pettersson	D500X	Pettersson Extended Mic	omnidirectional	20 ft.	Hor. Zontal

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28°15'58"N	81°18'58"W	Yes	Edge	45	Med	NO	1957	7:01

DETECTOR CHECKLIST: Time 7:41 Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: 13 Waypoint #/ID: Photo 13: FBB11

Detector Placement/Site Description:

Placed on the North bank of the canal North of the retention pond behind the Plaza @ the corner of Neptune & Old Canoe Creek Rd. Placed on upper bank/canal berm, facing SE

Remarks:

Site sketch/photo (label to match BD# above)

Detector Deployment Data Form

Project: Neptune Road PD&E	State: FL	County: Osceola	Site: FBS11	Date: 6.12.20
Biologist: J. Barhurst B. Shepherd		GPS ID: FBS iphone	Camera ID: J.B. iphone	

DETECTOR DATA

Detector ID	Detector Make	Detector Model	Microphone Make	Microphone Type	Microphone Height	Microphone Orientation
11535	Pettersson	D500	Pettersson D500 external	omnidirectional	20 ft.	Horizontal

Latitude	Longitude	Horn	Clutter	Gain	Trigger Sensitivity	HP filter	Start Time	Stop Time
28°14' 59" N	81° 14' 55" W	Yes	Low	45	MED	NO	19:55	0700 h

DETECTOR CHECKLIST: Time 11:40 Mic Test ✓ Mic Placement ✓ Battery Check ✓ CF Card ✓ Weatherproof ✓

Detector/Gear Working and Armed ✓ Photo #/ID: Photo 11 Waypoint #/ID: Photo 11 FBS11

Detector Placement/Site Description:

Phone on 20 ft Pole N of Neptune Elementary. East N of the irrigation pond, facing W over mowed bank and cattle pasture

Remarks:

Site sketch/photo (label to match BD# above)

Appendix D

Survey Data Forms

Bat Survey Data

Project: Neptune Road PD&E						State: FL			County: Osceola			
Date	Time	Site #	Detector #	Start Time	End Time	Mic Test	Mic Placement	CF Card	Battery	Detector/Gear working/armed	Weather	Biologist
5.19.20	3:50pm	FBB1	11535	19:44	7:06	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houch
5.19.20	4:40pm	FBB2	11537	19:44	7:06	✓	✓	✓	✓	✓	✓	" "
5.19.20	5:07pm	FBB3	11536	19:45	7:05	✓	✓	✓	✓	✓	✓	" "
5.19.20	5:49pm	FBB4	11534	19:42	7:03	✓	✓	✓	✓	✓	✓	" "
5.20.20	5:15pm	FBB1	11535	19:45	7:05	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
↓	5:40pm	FBB2	11537	19:45	7:05	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
↓	6:27pm	FBB3	11536	19:46	7:05	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
↓	6:51pm	FBB4	11534	19:42	7:03	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
5.21.20	5:05pm	FBB1	11535	19:45	7:05	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
↓	5:38pm	FBB2	11537	19:45	7:05	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
↓	6:02pm	FBB3	11536	19:46	7:04	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
↓	6:34pm	FBB4	11534	19:42	7:03	— Pulled Equipment Due to Weather/Storm						
5.22.20	12:55pm	FBB1	11535	19:46	7:04	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5.22.2020	3:16pm	FBB2	11537	19:46	7:04	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5-22-2020	3:49pm	FBB3	11536	19:47	7:04	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5.22.2020	4:15pm	FBB4	11534	19:43	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5/23/2020	1:06pm	FBB2	11537	19:46	7:04	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
5/23/2020	1:40	FBB1	11535	19:46	7:04	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
5/23/2020	1:58	FBB3	11536	19:47	7:03	✓	✓	✓	✓	✓	✓	

add Check dessicant
add faceplate?

Bat Survey Data

Project: Neptune Road PD&E						State: FL			County: Osceola			
Date	Time	Site #	Detector #	Start Time	End Time	Mic Test	Mic Placement	CF Card	Battery	Detector/Gear working/armed	Weather	Biologist
5/23/2020	2:13pm	FBB4	11534	19:44	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
5/24/2020	5:55pm	FBB1	11535	19:47	7:04	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5/24/2020	6:08pm	FBB2	11537	19:47	7:04	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5/24/2020	6:31pm	FBB3	11536	19:48	7:03	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5/24/2020	7:11pm	FBB4	11534	19:45	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5/26/2020	5:32	FBB5	11535	19:47	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
5/26/2020	6:02	FBB6	11534	19:46	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
5/26/2020	6:33	FBB7	11537	19:48	7:03	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
5/27/2020	6:03p	FBB5	11535	19:47	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
5/27/20	6:26p	FBB6	11534	19:46	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
5/27/20	6:46p	FBB7	11537	19:49	7:03	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
5.29.20	2:02 pm	FBB6	11534	19:47	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
5.29.20	1:52	FBB7	11537	1949	0703	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
5.29.20	2:28	FBB5	11535	1948	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
5.29.20	9:54 AM	FBB5	11535	1949	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst T. McPherson
5.29.20	10:31a	FBB6	11534	1948	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst T. McPherson
5/29/20	11:00a	FBB7	11537	1950	702	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
5/30/2020	10:07am	FBB5	11535	1949	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5/30/2020	10:23am	FBB6	11534	1948	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle

Bat Survey Data

Project: Neptune Road PD&E						State: FL			County: Osceola			
Date	Time	Site #	Detector #	Start Time	End Time	Mic Test	Mic Placement	CF Card	Battery	Detector/Gear working/armed	Weather	Biologist
5-30-2020	10:39	FBB7	11537	19:50	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
5-31-2020	11:12	FBB5	11535	19:50	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
5-31-2020	11:29	FBB6	11534	19:49	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
5-31-2020	11:52	FBB7	11537	19:51	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst A. Burke
6/1/20	12:16a	FBB5	11535	19:50	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/1/20	12:29	FBB6	11534	19:49	6:59	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/1/20	12:41	FBB7	11537	19:51	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/2/20	3:41p	FBB2	11536	19:52	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/2/20	4:12p	FBB5	11535	19:51	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/2/20	4:23p	FBB6	11534	19:50	6:59	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/2/20	4:43p	FBB7	11537	19:52	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/8/20	5:05pm	FBB5	11535	19:55	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
6/8/20	5:25p	FBB6	11534	19:55	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
6/8/20	5:36pm	FBB7	11536	19:55	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
6/9/20	12:08p	FBB6	11534	19:56	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
6/9/20	12:14p	FBB7	11536	19:56	7:10	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
6/10/20	11:41	FBB2	11536	19:55	7:01	✓	✓	✓	✓	✓	✓	J Barhorst T Mueller
6/10/20	12:10	FBB2	11534	19:55	7:01	✓	✓	✓	✓	✓	✓	J Barhorst T. Mueller
6/10/20	12:37	FBB3	11535	19:54	6:59			✓	✓		✓	J. Barhorst J. Mueller

Bat Survey Data

Project: Neptune Road PD&E						State: FL			County: Osceola			
Date	Time	Site #	Detector #	Start Time	End Time	Mic Test	Mic Placement	CF Card	Battery	Detector/Gear working/armed	Weather	Biologist
6/11/20	6:03	FBB1	11536	19:56	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mather
6/11/20	6:25	FBB2	11534	19:56	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mather
6/11/20	7:03	FBB3	11535	19:54	6:57	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mather
6/12/20	10:35	FBB2	11534	19:56	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst B. Shepherd
6/12/20	11:15	FBB8	11537	19:55	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst B. Shepherd
6/13/20	10:01 pm	FBB2	11534	19:56	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst J. Hauch
6/13/20	10:16 pm	FBB8	11537	1955	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst J. Hauch
6/13/20	10:29 pm	FBB9	11536	1953	6:58	✓	✓	✓	✓	✓	✓	J. Barhorst J. Hauch
6/13/20	10:44 pm	FBB11	11535	1955	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst J. Hauch
6-14-20	5:39 pm	FBB8	11537	1956	700	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
6-14-20	6:06 pm	FBB11	11535	1955	700	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
6-14-20	7:41 pm	FBB10	11534	1957	701	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
6-14-20	7:53 pm	FBB9	11536	1954	658	✓	✓	✓	✓	✓	✓	J. Barhorst G. Haddle
6/15/20	3:39 pm	FBB8	11537	1956	700	✓	✓	✓	✓	✓	✓	J. Barhorst T. McPherson
6/15/20	3:52 pm	FBB9	11536	1954	6:58	✓	✓	✓	✓	✓	✓	J. Barhorst T. McPherson
6/15/20	4:11 pm	FBB11	11535	1956	700	✓	✓	✓	✓	✓	✓	J. Barhorst T. McPherson
6/15/20	5:19 pm	FBB10	11534	1957	7:01	✓	✓	✓	✓	✓	✓	J. Barhorst T. McPherson
6/16/20	12:41	FBB8	11537	1956	7:00	✓	✓	✓	✓	✓	✓	J. Barhorst T. McPherson
6/16/20	12:56	FBB9	11536	1954	6:58	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mather

Bat Survey Data

Project: Neptune Road PD&E						State: FL			County: Osceola			
Date	Time	Site #	Detector #	Start Time	End Time	Mic Test	Mic Placement	CF Card	Battery	Detector/Gear working/armed	Weather	Biologist
6/16/20	1:55	FBB10	11534	1957	701	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/16/20	2:15	FBB11	11535	1956	7:00	⊗	took down station due to mic				✓	J. Barhorst T. Mueller
6/17/20	10:23 AM	FBB8	11537	1957	700	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
6/17/20	10:34	FBB9	11536	1955	659	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
6/17/20	10:43	FBB10	11534	1958	702	✓	✓	✓	✓	✓	✓	J. Barhorst J. Houck
6/18/20	11:00	FBB9	11536	1955	659	✓	✓	✓	✓	✓	✓	J Barhorst T. Mueller
6/18/20	11:11 AM	FBB11	11537	1958	7:02	✓	✓	✓	✓	✓	✓	J Barhorst T Mueller
6/18/20	11:41	FBB10	11534	1958	7:02	✓	✓	✓	✓	✓	✓	J Barhorst T Mueller
6/19/20	11:19	FBB9	11536	1955	6:59	✓	✓	✓	✓	✓	✓	J Barhorst T Mueller
6/19/20	11:39	FBB11	11537	1958	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/19/20	12:16	FBB10	11534	1958	7:02	✓	✓	✓	✓	✓	✓	J Barhorst T Mueller
6/20/20	10:03	FBB11	11537	1958	7:02	✓	✓	✓	✓	✓	✓	J Barhorst T Mueller
6/20/20	10:28	FBB10	11534	1958	7:02	✓	✓	✓	✓	✓	✓	J Barhorst T Mueller
6/21/20	11:55	FBB11	11537	1958	7:02	✓	✓	✓	✓	✓	✓	J. Barhorst T. Mueller
6/21/20	12:19	FBB10	11534	1959	7:02	✓	✓	✓	✓	✓	✓	J Barhorst T Mueller

Appendix E

Weather Documentation

weather.gov

Weather observations for the past three days

Kissimmee Gateway Airport

Enter Your "City, ST" or zip code Go

metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
22	07:56	Calm	10.00	Fair	CLR	78	72	78	74	82%	NA	80	30.12	1019.9			
22	06:56	Calm	10.00	Fair	CLR	74	72			94%	NA	NA	30.11	1019.7			
22	05:56	Calm	10.00	Fair	CLR	74	72			94%	NA	NA	30.09	1019.0			
22	04:56	Calm	10.00	Fair	CLR	74	72			94%	NA	NA	30.08	1018.5			
22	03:56	Calm	10.00	Fair	CLR	76	72			88%	NA	76	30.09	1018.7			
22	02:56	Calm	10.00	Fair	CLR	76	72			88%	NA	76	30.09	1018.7			
22	01:56	W 5	10.00	Fair	CLR	76	72	89	76	88%	NA	76	30.10	1019.1			
22	00:56	Calm	10.00	Fair	CLR	78	72			82%	NA	80	30.08	1018.6			
21	23:56	SW 5	10.00	Fair	CLR	78	71			79%	NA	80	30.07	1018.1			
21	22:56	SW 7	10.00	A Few Clouds	FEW050	80	70			71%	NA	83	30.06	1017.9			
21	21:56	S 6	10.00	Mostly Cloudy	BKN048	82	71			69%	NA	86	30.06	1017.8			
21	20:56	S 5	10.00	Mostly Cloudy	BKN120	87	75			67%	NA	96	30.04	1017.0			
21	19:56	S 3	10.00	Mostly Cloudy	BKN055	89	74	93	89	61%	NA	98	30.02	1016.5			
21	18:56	SW 3	10.00	Partly Cloudy	SCT060	91	71			52%	NA	98	30.02	1016.5			
21	17:56	W 3	10.00	Partly Cloudy	SCT055	93	71			49%	NA	100	30.01	1016.3			
21	16:56	SW 6	10.00	Partly Cloudy	SCT049	93	71			49%	NA	100	30.04	1017.0			
21	15:56	SW 6	10.00	Partly Cloudy	SCT049	92	71			51%	NA	99	30.05	1017.5			
21	14:56	W 7	10.00	Partly Cloudy	SCT050	91	71			52%	NA	98	30.06	1018.0			
21	13:56	Vrbl 6	10.00	Partly Cloudy	SCT045	91	73	91	76	56%	NA	100	30.08	1018.4			
21	12:56	SW 6	10.00	Fair	CLR	89	72			57%	NA	96	30.09	1018.9			
21	11:56	Vrbl 6	10.00	Fair	CLR	87	73			63%	NA	94	30.09	1019.0			
21	10:56	Vrbl 3	10.00	Fair	CLR	86	71			61%	NA	91	30.10	1019.2			
21	09:56	NW 5	10.00	Fair	CLR	84	71			65%	NA	89	30.09	1019.0			
21	08:56	NW 7	10.00	Fair	CLR	82	73			74%	NA	87	30.09	1019.0			
21	07:56	W 3	10.00	A Few Clouds	FEW002	76	74	76	73	94%	NA	76	30.07	1018.3			
21	06:56	Calm	10.00	Fair	CLR	73	73			100%	NA	NA	30.05	1017.6			
21	05:56	Calm	10.00	Fair	CLR	73	73			100%	NA	NA	30.04	1017.2			
21	04:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.02	1016.6			
21	03:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.03	1016.7			
21	02:56	Calm	10.00	Fair	CLR	75	74			96%	NA	NA	30.05	1017.3			
21	01:56	W 5	10.00	Fair	CLR	75	73	79	75	94%	NA	NA	30.04	1017.3			
21	00:56	Calm	10.00	Fair	CLR	76	73			91%	NA	76	30.05	1017.4			

20	23:56	SW 7	10.00	A Few Clouds	FEW049	76	73			91%	NA	76	30.05	1017.5
20	22:56	S 6	10.00	A Few Clouds	FEW050	77	73			88%	NA	78	30.06	1017.8
20	21:56	SE 7	10.00	Light Rain	SCT060 SCT090 BKN110	78	75			90%	NA	80	30.05	1017.5
20	20:56	E 8	10.00	A Few Clouds	FEW075	79	71			77%	NA	82	30.03	1016.7
20	19:56	SE 12	10.00	Thunderstorm	BKN055	78	72	93	77	82%	NA	80	30.01	1016.0
20	18:56	NW 3	10.00	A Few Clouds	FEW049	91	70			50%	NA	97	29.99	1015.5
20	17:56	Calm	10.00	Partly Cloudy	SCT049	92	71			51%	NA	99	29.99	1015.5
20	16:56	Vrbl 5	10.00	A Few Clouds	FEW050	93	71			49%	NA	100	29.99	1015.6
20	15:56	Vrbl 3	10.00	Fair	CLR	90	72			56%	NA	98	30.02	1016.6
20	14:56	NW 6	10.00	Mostly Cloudy	BKN040	90	74			59%	NA	99	30.05	1017.4
20	13:56	Vrbl 5	10.00	A Few Clouds	FEW048	90	74	90	75	59%	NA	99	30.07	1018.1
20	12:56	S 5	10.00	Mostly Cloudy	BKN032	87	74			65%	NA	95	30.09	1018.8
20	11:56	SW 5	10.00	A Few Clouds	FEW025	85	75			72%	NA	93	30.10	1019.1
20	10:56	SW 6	10.00	Mostly Cloudy	BKN019 BKN026	83	75			77%	NA	90	30.10	1019.1
20	09:56	S 7	10.00	Overcast	OVC007	81	76			85%	NA	87	30.10	1019.2
20	08:56	SW 5	10.00	Overcast	OVC005	77	76			96%	NA	78	30.10	1019.1
20	07:56	S 5	10.00	Overcast	OVC005	75	74	75	73	96%	NA	NA	30.09	1018.8
20	06:56	S 5	10.00	Overcast	OVC009	74	74			100%	NA	NA	30.07	1018.1
20	05:56	S 3	10.00	Overcast	OVC007	73	73			100%	NA	NA	30.06	1017.7
20	04:56	E 5	10.00	Overcast	OVC007	74	73			97%	NA	NA	30.05	1017.6
20	03:56	Calm	10.00	Partly Cloudy	SCT005	74	73			97%	NA	NA	30.05	1017.3
20	02:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.05	1017.4
20	01:56	Calm	10.00	Fair	CLR	74	73	78	74	97%	NA	NA	30.06	1017.7
20	00:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.07	1018.2
19	23:56	S 5	10.00	Fair	CLR	75	73			94%	NA	NA	30.08	1018.4
19	22:56	SE 5	10.00	Fair	CLR	75	73			94%	NA	NA	30.08	1018.6
19	21:56	SE 5	10.00	Overcast	FEW008 OVC110	76	74			94%	NA	76	30.07	1018.1
19	20:56	SE 9	10.00	Overcast	FEW008 OVC110	77	75			94%	NA	78	30.06	1017.9
19	19:56	E 8	10.00	Overcast	BKN012 OVC037	78	74	88	76	87%	NA	80	30.06	1017.9
19	18:56	SW 5	10.00	A Few Clouds	FEW110	77	72			85%	NA	78	30.04	1017.2
19	17:56	Calm	10.00	Mostly Cloudy	FEW010 BKN016 BKN022	77	72			85%	NA	78	30.03	1016.9
19	16:56	S 10	10.00	Mostly Cloudy	BKN055 BKN070	76	73			91%	NA	76	30.05	1017.6
19	15:56	S 13	10.00	Thunderstorm in Vicinity	FEW060 SCT075	77	74			90%	NA	78	30.05	1017.5
19	14:56	SE 14 G 17	6.00	Thunderstorm in Vicinity Rain Fog/Mist	SCT030 BKN040 OVC070	79	77			94%	NA	83	30.06	1017.8

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max.	Min.	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
								6 hour									
						Temperature (ºF)							Pressure		Precipitation (in.)		
19	13:56	Vrbl 3	10.00	Mostly Cloudy	BKN033	87	74	87	77	65%	NA	95	30.06	1017.8			
19	12:56	N 5	10.00	Mostly Cloudy	BKN021 BKN048	86	74			67%	NA	94	30.07	1018.1			
19	11:56	W 3	10.00	Mostly Cloudy	BKN021 BKN048	83	74			74%	NA	90	30.10	1019.1			
19	10:56	W 5	10.00	Fair	CLR	82	74			77%	NA	88	30.11	1019.5			
19	09:56	Calm	10.00	Fair	CLR	79	75			88%	NA	83	30.10	1019.3			
19	08:56	W 3	10.00	Partly Cloudy	SCT007	77	75			94%	NA	78	30.09	1018.7			

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metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
20	07:56	S 5	10.00	Overcast	OVC005	75	74	75	73	96%	NA	NA	30.09	1018.8			
20	06:56	S 5	10.00	Overcast	OVC009	74	74			100%	NA	NA	30.07	1018.1			
20	05:56	S 3	10.00	Overcast	OVC007	73	73			100%	NA	NA	30.06	1017.7			
20	04:56	E 5	10.00	Overcast	OVC007	74	73			97%	NA	NA	30.05	1017.6			
20	03:56	Calm	10.00	Partly Cloudy	SCT005	74	73			97%	NA	NA	30.05	1017.3			
20	02:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.05	1017.4			
20	01:56	Calm	10.00	Fair	CLR	74	73	78	74	97%	NA	NA	30.06	1017.7			
20	00:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.07	1018.2			
19	23:56	S 5	10.00	Fair	CLR	75	73			94%	NA	NA	30.08	1018.4			
19	22:56	SE 5	10.00	Fair	CLR	75	73			94%	NA	NA	30.08	1018.6			
19	21:56	SE 5	10.00	Overcast	FEW008 OVC110	76	74			94%	NA	76	30.07	1018.1			
19	20:56	SE 9	10.00	Overcast	FEW008 OVC110	77	75			94%	NA	78	30.06	1017.9			
19	19:56	E 8	10.00	Overcast	BKN012 OVC037	78	74	88	76	87%	NA	80	30.06	1017.9			
19	18:56	SW 5	10.00	A Few Clouds	FEW110	77	72			85%	NA	78	30.04	1017.2			
19	17:56	Calm	10.00	Mostly Cloudy	FEW010 BKN016 BKN022	77	72			85%	NA	78	30.03	1016.9			
19	16:56	S 10	10.00	Mostly Cloudy	BKN055 BKN070	76	73			91%	NA	76	30.05	1017.6			
19	15:56	S 13	10.00	Thunderstorm in Vicinity	FEW060 SCT075	77	74			90%	NA	78	30.05	1017.5			
19	14:56	SE 14 G 17	6.00	Thunderstorm in Vicinity Rain Fog/Mist	SCT030 BKN040 OVC070	79	77			94%	NA	83	30.06	1017.8			
19	13:56	Vrbl 3	10.00	Mostly Cloudy	BKN033	87	74	87	77	65%	NA	95	30.06	1017.8			
19	12:56	N 5	10.00	Mostly Cloudy	BKN021 BKN048	86	74			67%	NA	94	30.07	1018.1			
19	11:56	W 3	10.00	Mostly Cloudy	BKN021 BKN048	83	74			74%	NA	90	30.10	1019.1			
19	10:56	W 5	10.00	Fair	CLR	82	74			77%	NA	88	30.11	1019.5			
19	09:56	Calm	10.00	Fair	CLR	79	75			88%	NA	83	30.10	1019.3			
19	08:56	W 3	10.00	Partly Cloudy	SCT007	77	75			94%	NA	78	30.09	1018.7			
19	07:56	W 3	10.00	Fair	CLR	77	75	77	75	94%	NA	78	30.07	1018.3			
19	06:56	S 3	10.00	Fair	CLR	75	74			96%	NA	NA	30.06	1017.9			

19	05:56	S 3	10.00	A Few Clouds	FEW014	75	74			96%	NA	NA	30.04	1017.1
19	04:56	SE 6	10.00	Overcast	FEW009 OVC018	76	75			97%	NA	75	30.03	1016.8
19	03:56	SE 3	10.00	Overcast	OVC024	76	75			97%	NA	75	30.03	1016.8
19	02:56	E 5	10.00	A Few Clouds	FEW120	76	75			97%	NA	75	30.04	1017.1
19	01:56	Calm	10.00	Fair	CLR	76	75	76	75	97%	NA	75	30.05	1017.4
19	00:56	E 3	10.00	Fair	CLR	75	75			100%	NA	NA	30.06	1017.9
18	23:56	Calm	10.00	Fair	CLR	75	75			100%	NA	NA	30.06	1018.0
18	22:56	Calm	10.00	Fair	CLR	75	75			100%	NA	NA	30.07	1018.3
18	21:56	NE 3	10.00	A Few Clouds	FEW100	76	75			97%	NA	75	30.06	1017.9
18	20:56	Calm	10.00	A Few Clouds	FEW110	76	75			97%	NA	75	30.05	1017.5
18	19:56	SE 8	10.00	Overcast	FEW065 SCT080 OVC120	76	74	91	72	94%	NA	76	30.03	1016.9
18	18:56	SE 8	10.00	Thunderstorm Light Rain	FEW013 BKN038 OVC065	73	72			96%	NA	NA	30.06	1017.9
18	17:56	E 21	0.50	Thunderstorm in Vicinity Heavy Rain Fog and Breezy	BKN027 OVC037	75	73			94%	NA	NA	30.03	1017.0
18	16:56	E 10	10.00	Thunderstorm in Vicinity	SCT046	87	73			63%	NA	94	29.99	1015.3
18	15:56	E 14	10.00	Fair	CLR	87	75			67%	NA	96	30.00	1015.8
18	14:56	E 3	10.00	Mostly Cloudy	SCT049 BKN070	89	70			53%	NA	94	30.02	1016.4
18	13:56	NW 5	10.00	Fair	CLR	88	71	89	77	57%	NA	94	30.03	1016.9
18	12:56	Calm	7.00	Mostly Cloudy	BKN034	87	71			59%	NA	93	30.05	1017.7
18	11:56	Calm	10.00	Partly Cloudy	SCT029	85	72			65%	NA	91	30.08	1018.5
18	10:56	SW 5	10.00	Fair	CLR	84	73			70%	NA	90	30.08	1018.4
18	09:56	Calm	10.00	Fair	CLR	82	73			74%	NA	87	30.08	1018.4
18	08:56	Calm	10.00	Fair	CLR	80	72			76%	NA	84	30.08	1018.5
18	07:56	Calm	10.00	Fair	CLR	77	72	77	72	85%	NA	78	30.07	1018.0
18	06:56	Calm	9.00	A Few Clouds	FEW100	73	72			96%	NA	NA	30.05	1017.5
18	05:56	Calm	10.00	Fair	CLR	72	71			97%	NA	NA	30.05	1017.4
18	04:56	Calm	10.00	Fair	CLR	73	71			94%	NA	NA	30.03	1017.0
18	03:56	Calm	10.00	Fair	CLR	74	71			91%	NA	NA	30.03	1016.8
18	02:56	SE 3	10.00	Fair	CLR	74	71			91%	NA	NA	30.03	1016.9
18	01:56	S 6	10.00	Partly Cloudy	SCT065	75	71	82	75	88%	NA	NA	30.05	1017.6
18	00:56	SE 5	10.00	Mostly Cloudy	BKN065	76	72			88%	NA	76	30.08	1018.5
17	23:56	SE 7	10.00	Overcast	BKN060 OVC075	77	72			85%	NA	78	30.08	1018.7
17	22:56	SE 8	10.00	Overcast	FEW026 BKN050 OVC070	77	73			88%	NA	78	30.09	1018.9
17	21:56	NE 6	4.00			77	74			90%	NA	78	30.07	1018.1

				Heavy Rain Fog/Mist	FEW031 BKN050 OVC070											
17	20:56	SE 6	10.00	Mostly Cloudy	BKN070	81	72			74%	NA	85	30.04	1017.2		
17	19:56	SE 8	10.00	Overcast	BKN065 OVC090	82	72	89	82	72%	NA	87	30.03	1016.7		
17	18:56	SE 7	10.00	Mostly Cloudy	BKN070 BKN080	84	72			67%	NA	90	30.02	1016.4		
17	17:56	S 3	10.00	Partly Cloudy	SCT065	87	66			50%	NA	89	30.02	1016.6		
17	16:56	S 6	10.00	A Few Clouds	FEW090	88	65			46%	NA	90	30.03	1016.9		
17	15:56	S 6	10.00	Fair	CLR	87	67			51%	NA	90	30.04	1017.3		
17	14:56	S 9	10.00	A Few Clouds	FEW045	88	68			52%	NA	92	30.06	1017.8		
17	13:56	NE 5	10.00	Mostly Cloudy	SCT049 BKN065	86	68	86	74	55%	NA	89	30.08	1018.4		
17	12:56	SE 9	10.00	Mostly Cloudy	BKN035	84	70			63%	NA	88	30.09	1018.8		
17	11:56	E 6	10.00	Partly Cloudy	SCT030	82	70			67%	NA	86	30.10	1019.2		
17	10:56	S 7	10.00	A Few Clouds	FEW025	81	69			67%	NA	84	30.10	1019.2		
17	09:56	E 7	10.00	Fair	CLR	79	70			74%	NA	82	30.10	1019.3		
17	08:56	E 7	10.00	Fair	CLR	77	69			77%	NA	79	30.10	1019.3		
Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max. 6 hour	Min. 6 hour	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
						Temperature (ºF)							Pressure		Precipitation (in.)		

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Weather observations for the past three days

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Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
18	12:56	Calm	7.00	Mostly Cloudy	BKN034	87	71			59%	NA	93	30.05	1017.7			
18	11:56	Calm	10.00	Partly Cloudy	SCT029	85	72			65%	NA	91	30.08	1018.5			
18	10:56	SW 5	10.00	Fair	CLR	84	73			70%	NA	90	30.08	1018.4			
18	09:56	Calm	10.00	Fair	CLR	82	73			74%	NA	87	30.08	1018.4			
18	08:56	Calm	10.00	Fair	CLR	80	72			76%	NA	84	30.08	1018.5			
18	07:56	Calm	10.00	Fair	CLR	77	72	77	72	85%	NA	78	30.07	1018.0			
18	06:56	Calm	9.00	A Few Clouds	FEW100	73	72			96%	NA	NA	30.05	1017.5			
18	05:56	Calm	10.00	Fair	CLR	72	71			97%	NA	NA	30.05	1017.4			
18	04:56	Calm	10.00	Fair	CLR	73	71			94%	NA	NA	30.03	1017.0			
18	03:56	Calm	10.00	Fair	CLR	74	71			91%	NA	NA	30.03	1016.8			
18	02:56	SE 3	10.00	Fair	CLR	74	71			91%	NA	NA	30.03	1016.9			
18	01:56	S 6	10.00	Partly Cloudy	SCT065	75	71	82	75	88%	NA	NA	30.05	1017.6			
18	00:56	SE 5	10.00	Mostly Cloudy	BKN065	76	72			88%	NA	76	30.08	1018.5			
17	23:56	SE 7	10.00	Overcast	BKN060 OVC075	77	72			85%	NA	78	30.08	1018.7			
17	22:56	SE 8	10.00	Overcast	FEW026 BKN050 OVC070	77	73			88%	NA	78	30.09	1018.9			
17	21:56	NE 6	4.00	Heavy Rain Fog/Mist	FEW031 BKN050 OVC070	77	74			90%	NA	78	30.07	1018.1			
17	20:56	SE 6	10.00	Mostly Cloudy	BKN070	81	72			74%	NA	85	30.04	1017.2			
17	19:56	SE 8	10.00	Overcast	BKN065 OVC090	82	72	89	82	72%	NA	87	30.03	1016.7			
17	18:56	SE 7	10.00	Mostly Cloudy	BKN070 BKN080	84	72			67%	NA	90	30.02	1016.4			
17	17:56	S 3	10.00	Partly Cloudy	SCT065	87	66			50%	NA	89	30.02	1016.6			
17	16:56	S 6	10.00	A Few Clouds	FEW090	88	65			46%	NA	90	30.03	1016.9			
17	15:56	S 6	10.00	Fair	CLR	87	67			51%	NA	90	30.04	1017.3			
17	14:56	S 9	10.00	A Few Clouds	FEW045	88	68			52%	NA	92	30.06	1017.8			

17	13:56	NE 5	10.00	Mostly Cloudy	SCT049 BKN065	86	68	86	74	55%	NA	89	30.08	1018.4
17	12:56	SE 9	10.00	Mostly Cloudy	BKN035	84	70			63%	NA	88	30.09	1018.8
17	11:56	E 6	10.00	Partly Cloudy	SCT030	82	70			67%	NA	86	30.10	1019.2
17	10:56	S 7	10.00	A Few Clouds	FEW025	81	69			67%	NA	84	30.10	1019.2
17	09:56	E 7	10.00	Fair	CLR	79	70			74%	NA	82	30.10	1019.3
17	08:56	E 7	10.00	Fair	CLR	77	69			77%	NA	79	30.10	1019.3
17	07:56	E 7	10.00	Fair	CLR	74	69	74	71	85%	NA	NA	30.09	1019.0
17	06:56	Calm	10.00	Fair	CLR	71	69			94%	NA	NA	30.09	1018.8
17	05:56	NE 3	10.00	Fair	CLR	71	69			94%	NA	NA	30.08	1018.4
17	04:56	E 3	10.00	Fair	CLR	72	69			91%	NA	NA	30.07	1018.3
17	03:56	NE 3	10.00	Overcast	OVC060	73	69			87%	NA	NA	30.08	1018.6
17	02:56	NE 6	10.00	Light Rain	SCT060 OVC070	73	69			87%	NA	NA	30.08	1018.6
17	01:56	E 5	10.00	Overcast	OVC065	74	68	79	73	82%	NA	NA	30.10	1019.1
17	00:56	NE 5	10.00	Overcast	OVC070	74	68			82%	NA	NA	30.11	1019.6
16	23:56	E 7	10.00	Fair	CLR	74	68			82%	NA	NA	30.11	1019.4
16	22:56	E 8	10.00	Fair	CLR	74	68			82%	NA	NA	30.10	1019.2
16	21:56	E 9	10.00	Fair	CLR	75	68			79%	NA	NA	30.08	1018.5
16	20:56	E 12	10.00	Fair	CLR	77	68			74%	NA	79	30.06	1017.9
16	19:56	E 9	10.00	Partly Cloudy	SCT110	79	68	89	79	69%	NA	81	30.05	1017.4
16	18:56	E 10	10.00	Overcast	FEW050 OVC065	81	69			67%	NA	84	30.03	1016.8
16	17:56	Vrbl 3	10.00	Overcast	OVC100	86	63			46%	NA	87	30.03	1016.8
16	16:56	NW 6	10.00	Mostly Cloudy	BKN070	86	63			46%	NA	87	30.04	1017.0
16	15:56	Calm	10.00	A Few Clouds	FEW055	87	64			46%	NA	88	30.05	1017.4
16	14:56	Vrbl 7	10.00	Mostly Cloudy	FEW050 BKN110	87	64			46%	NA	88	30.06	1017.9
16	13:56	N 10	10.00	Mostly Cloudy	BKN048	86	65	86	74	49%	NA	88	30.08	1018.5
16	12:56	Vrbl 7	10.00	Mostly Cloudy	BKN042	85	64			50%	NA	86	30.09	1019.0
16	11:56	Vrbl 3	10.00	A Few Clouds	FEW030	82	65			56%	NA	84	30.11	1019.5
16	10:56	N 9	10.00	A Few Clouds	FEW028	81	65			58%	NA	83	30.11	1019.6
16	09:56	NE 9	10.00	A Few Clouds	FEW026	79	67			67%	NA	81	30.12	1019.7
16	08:56	NE 7	10.00	Fair	CLR	76	67			74%	NA	77	30.11	1019.5
16	07:56	NE 6	10.00	Fair	CLR	74	68	74	68	82%	NA	NA	30.09	1019.0
16	06:56	Calm	10.00	Fair	CLR	69	68			96%	NA	NA	30.08	1018.7
16	05:56	S 3	10.00	Fair	CLR	69	67			93%	NA	NA	30.06	1017.9
16	04:56	Calm	10.00	Fair	CLR	70	68			93%	NA	NA	30.06	1017.7

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max. 6 hour	Min. 6 hour	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
						Temperature (ºF)							Pressure		Precipitation (in.)		
16	03:56	Calm	10.00	Fair	CLR	71	68			90%	NA	NA	30.05	1017.5			
16	02:56	Calm	10.00	Fair	CLR	72	68			87%	NA	NA	30.06	1017.7			
16	01:56	Calm	10.00	Fair	CLR	73	69	81	71	87%	NA	NA	30.07	1018.2			
16	00:56	NE 3	10.00	Fair	CLR	74	68			82%	NA	NA	30.08	1018.7			
15	23:56	NE 5	10.00	Fair	CLR	75	67			76%	NA	NA	30.09	1019.0			
15	22:56	NE 6	10.00	Fair	CLR	76	67			74%	NA	77	30.10	1019.2			
15	21:56	NE 9	10.00	Fair	CLR	77	66			69%	NA	79	30.09	1018.9			
15	20:56	NE 10	10.00	Fair	CLR	79	67			67%	NA	81	30.08	1018.4			
15	19:56	NE 16	10.00	Fair	CLR	81	66	91	81	61%	NA	83	30.05	1017.6			
15	18:56	NE 15	10.00	Partly Cloudy	SCT055	84	67			57%	NA	87	30.03	1016.7			
15	17:56	NE 14	10.00	Mostly Cloudy	FEW042 BKN060	87	69			55%	NA	91	30.02	1016.3			
15	16:56	NE 9	10.00	Partly Cloudy	SCT065	90	61			38%	NA	90	30.01	1016.2			
15	15:56	N 13 G 16	10.00	Fair	CLR	91	58			33%	NA	90	30.02	1016.5			
15	14:56	N 13	10.00	Fair	CLR	90	59			35%	NA	89	30.03	1016.9			
15	13:56	N 10	10.00	Fair	CLR	89	65	89	76	45%	NA	91	30.05	1017.4			

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metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
17	12:56	SE 9	10.00	Mostly Cloudy	BKN035	84	70			63%	NA	88	30.09	1018.8			
17	11:56	E 6	10.00	Partly Cloudy	SCT030	82	70			67%	NA	86	30.10	1019.2			
17	10:56	S 7	10.00	A Few Clouds	FEW025	81	69			67%	NA	84	30.10	1019.2			
17	09:56	E 7	10.00	Fair	CLR	79	70			74%	NA	82	30.10	1019.3			
17	08:56	E 7	10.00	Fair	CLR	77	69			77%	NA	79	30.10	1019.3			
17	07:56	E 7	10.00	Fair	CLR	74	69	74	71	85%	NA	NA	30.09	1019.0			
17	06:56	Calm	10.00	Fair	CLR	71	69			94%	NA	NA	30.09	1018.8			
17	05:56	NE 3	10.00	Fair	CLR	71	69			94%	NA	NA	30.08	1018.4			
17	04:56	E 3	10.00	Fair	CLR	72	69			91%	NA	NA	30.07	1018.3			
17	03:56	NE 3	10.00	Overcast	OVC060	73	69			87%	NA	NA	30.08	1018.6			
17	02:56	NE 6	10.00	Light Rain	SCT060 OVC070	73	69			87%	NA	NA	30.08	1018.6			
17	01:56	E 5	10.00	Overcast	OVC065	74	68	79	73	82%	NA	NA	30.10	1019.1			
17	00:56	NE 5	10.00	Overcast	OVC070	74	68			82%	NA	NA	30.11	1019.6			
16	23:56	E 7	10.00	Fair	CLR	74	68			82%	NA	NA	30.11	1019.4			
16	22:56	E 8	10.00	Fair	CLR	74	68			82%	NA	NA	30.10	1019.2			
16	21:56	E 9	10.00	Fair	CLR	75	68			79%	NA	NA	30.08	1018.5			
16	20:56	E 12	10.00	Fair	CLR	77	68			74%	NA	79	30.06	1017.9			
16	19:56	E 9	10.00	Partly Cloudy	SCT110	79	68	89	79	69%	NA	81	30.05	1017.4			
16	18:56	E 10	10.00	Overcast	FEW050 OVC065	81	69			67%	NA	84	30.03	1016.8			
16	17:56	Vrbl 3	10.00	Overcast	OVC100	86	63			46%	NA	87	30.03	1016.8			
16	16:56	NW 6	10.00	Mostly Cloudy	BKN070	86	63			46%	NA	87	30.04	1017.0			
16	15:56	Calm	10.00	A Few Clouds	FEW055	87	64			46%	NA	88	30.05	1017.4			
16	14:56	Vrbl 7	10.00	Mostly Cloudy	FEW050 BKN110	87	64			46%	NA	88	30.06	1017.9			
16	13:56	N 10	10.00	Mostly Cloudy	BKN048	86	65	86	74	49%	NA	88	30.08	1018.5			
16	12:56	Vrbl 7	10.00	Mostly Cloudy	BKN042	85	64			50%	NA	86	30.09	1019.0			
16	11:56	Vrbl 3	10.00	A Few Clouds	FEW030	82	65			56%	NA	84	30.11	1019.5			
16	10:56	N 9	10.00	A Few Clouds	FEW028	81	65			58%	NA	83	30.11	1019.6			
16	09:56	NE 9	10.00	A Few Clouds	FEW026	79	67			67%	NA	81	30.12	1019.7			
16	08:56	NE 7	10.00	Fair	CLR	76	67			74%	NA	77	30.11	1019.5			

16	07:56	NE 6	10.00	Fair	CLR	74	68	74	68	82%	NA	NA	30.09	1019.0
16	06:56	Calm	10.00	Fair	CLR	69	68			96%	NA	NA	30.08	1018.7
16	05:56	S 3	10.00	Fair	CLR	69	67			93%	NA	NA	30.06	1017.9
16	04:56	Calm	10.00	Fair	CLR	70	68			93%	NA	NA	30.06	1017.7
16	03:56	Calm	10.00	Fair	CLR	71	68			90%	NA	NA	30.05	1017.5
16	02:56	Calm	10.00	Fair	CLR	72	68			87%	NA	NA	30.06	1017.7
16	01:56	Calm	10.00	Fair	CLR	73	69	81	71	87%	NA	NA	30.07	1018.2
16	00:56	NE 3	10.00	Fair	CLR	74	68			82%	NA	NA	30.08	1018.7
15	23:56	NE 5	10.00	Fair	CLR	75	67			76%	NA	NA	30.09	1019.0
15	22:56	NE 6	10.00	Fair	CLR	76	67			74%	NA	77	30.10	1019.2
15	21:56	NE 9	10.00	Fair	CLR	77	66			69%	NA	79	30.09	1018.9
15	20:56	NE 10	10.00	Fair	CLR	79	67			67%	NA	81	30.08	1018.4
15	19:56	NE 16	10.00	Fair	CLR	81	66	91	81	61%	NA	83	30.05	1017.6
15	18:56	NE 15	10.00	Partly Cloudy	SCT055	84	67			57%	NA	87	30.03	1016.7
15	17:56	NE 14	10.00	Mostly Cloudy	FEW042 BKN060	87	69			55%	NA	91	30.02	1016.3
15	16:56	NE 9	10.00	Partly Cloudy	SCT065	90	61			38%	NA	90	30.01	1016.2
15	15:56	N 13 G 16	10.00	Fair	CLR	91	58			33%	NA	90	30.02	1016.5
15	14:56	N 13	10.00	Fair	CLR	90	59			35%	NA	89	30.03	1016.9
15	13:56	N 10	10.00	Fair	CLR	89	65	89	76	45%	NA	91	30.05	1017.4
15	12:56	NE 7	10.00	Fair	CLR	87	66			50%	NA	89	30.07	1018.0
15	11:56	NE 8	10.00	Mostly Cloudy	BKN037	85	68			57%	NA	88	30.08	1018.7
15	10:56	N 8	10.00	Mostly Cloudy	BKN028	84	68			59%	NA	87	30.09	1018.8
15	09:56	N 10	10.00	Mostly Cloudy	BKN018 BKN026	81	72			74%	NA	85	30.09	1018.8
15	08:56	N 8	10.00	Partly Cloudy	SCT011	79	73			82%	NA	82	30.09	1018.8
15	07:56	N 6	10.00	Fair	CLR	76	73	76	74	91%	NA	76	30.08	1018.4
15	06:56	N 8	10.00	Fair	CLR	74	73			97%	NA	NA	30.06	1017.7
15	05:56	NE 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.04	1017.1
15	04:56	N 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.04	1017.0
15	03:56	N 3	10.00	Fair	CLR	75	73			94%	NA	NA	30.04	1017.0
15	02:56	Calm	10.00	Fair	CLR	75	73			94%	NA	NA	30.03	1016.8
15	01:56	NE 3	10.00	Fair	CLR	76	73	77	74	91%	NA	76	30.05	1017.3
15	00:56	Vrbl 3	10.00	Fair	CLR	76	73			91%	NA	76	30.07	1018.0
14	23:56	N 6	10.00	Fair	CLR	77	75			94%	NA	78	30.08	1018.5
14	22:56	NE 5	10.00	Fair	CLR	77	75			94%	NA	78	30.08	1018.5
14	21:56	E 6	10.00	Fair	CLR	77	75			94%	NA	78	30.07	1018.3
14	20:56	NE 3	10.00	Fair	CLR	76	73			91%	NA	76	30.06	1017.7
14	19:56	E 5	10.00	Partly Cloudy	FEW030 SCT090	74	72	89	73	94%	NA	NA	30.05	1017.6
14	18:56	E 14	10.00			75	72			90%	NA	NA	30.05	1017.4

				Thunderstorm in Vicinity	SCT016 BKN036 OVC060											
14	17:56	E 14 G 25	1.50	Thunderstorm Heavy Rain Fog/Mist	OVC040	74	71			91%	NA	NA	30.03	1017.0		
14	16:56	E 8	10.00	Mostly Cloudy	BKN060	86	70			59%	NA	91	30.01	1016.1		
14	15:56	E 10	10.00	Mostly Cloudy	BKN049	84	73			70%	NA	90	30.01	1016.3		
14	14:56	Vrbl 3	10.00	Mostly Cloudy	BKN050	88	68			52%	NA	92	30.03	1016.7		
14	13:56	E 5	10.00	Mostly Cloudy	SCT043 BKN055	88	69	88	77	54%	NA	93	30.04	1017.2		

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF) Air	Dwpt	6 hour Max.	6 hour Min.	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure altimeter (in.)	Pressure sea level (mb)	Precipitation (in.) 1 hr	3 hr	6 hr

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Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
15	12:56	NE 7	10.00	Fair	CLR	87	66			50%	NA	89	30.07	1018.0			
15	11:56	NE 8	10.00	Mostly Cloudy	BKN037	85	68			57%	NA	88	30.08	1018.7			
15	10:56	N 8	10.00	Mostly Cloudy	BKN028	84	68			59%	NA	87	30.09	1018.8			
15	09:56	N 10	10.00	Mostly Cloudy	BKN018 BKN026	81	72			74%	NA	85	30.09	1018.8			
15	08:56	N 8	10.00	Partly Cloudy	SCT011	79	73			82%	NA	82	30.09	1018.8			
15	07:56	N 6	10.00	Fair	CLR	76	73	76	74	91%	NA	76	30.08	1018.4			
15	06:56	N 8	10.00	Fair	CLR	74	73			97%	NA	NA	30.06	1017.7			
15	05:56	NE 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.04	1017.1			
15	04:56	N 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.04	1017.0			
15	03:56	N 3	10.00	Fair	CLR	75	73			94%	NA	NA	30.04	1017.0			
15	02:56	Calm	10.00	Fair	CLR	75	73			94%	NA	NA	30.03	1016.8			
15	01:56	NE 3	10.00	Fair	CLR	76	73	77	74	91%	NA	76	30.05	1017.3			
15	00:56	Vrbl 3	10.00	Fair	CLR	76	73			91%	NA	76	30.07	1018.0			
14	23:56	N 6	10.00	Fair	CLR	77	75			94%	NA	78	30.08	1018.5			
14	22:56	NE 5	10.00	Fair	CLR	77	75			94%	NA	78	30.08	1018.5			
14	21:56	E 6	10.00	Fair	CLR	77	75			94%	NA	78	30.07	1018.3			
14	20:56	NE 3	10.00	Fair	CLR	76	73			91%	NA	76	30.06	1017.7			
14	19:56	E 5	10.00	Partly Cloudy	FEW030 SCT090	74	72	89	73	94%	NA	NA	30.05	1017.6			
14	18:56	E 14	10.00	Thunderstorm in Vicinity	SCT016 BKN036 OVC060	75	72			90%	NA	NA	30.05	1017.4			
14	17:56	E 14 G 25	1.50	Thunderstorm Heavy Rain Fog/Mist	OVC040	74	71			91%	NA	NA	30.03	1017.0			
14	16:56	E 8	10.00	Mostly Cloudy	BKN060	86	70			59%	NA	91	30.01	1016.1			
14	15:56	E 10	10.00	Mostly Cloudy	BKN049	84	73			70%	NA	90	30.01	1016.3			
14	14:56	Vrbl 3	10.00	Mostly Cloudy	BKN050	88	68			52%	NA	92	30.03	1016.7			
14	13:56	E 5	10.00	Mostly Cloudy	SCT043 BKN055	88	69	88	77	54%	NA	93	30.04	1017.2			
14	12:56	E 3	10.00	Fair	CLR	86	69			57%	NA	90	30.06	1017.7			
14	11:56	SE 6	10.00			85	69			59%	NA	89	30.08	1018.4			

				Mostly Cloudy	SCT032 BKN043 BKN055									
14	10:56	Calm	10.00	Partly Cloudy	FEW024 SCT075	83	71			67%	NA	88	30.09	1018.7
14	09:56	E 5	10.00	Partly Cloudy	SCT020 SCT027	81	72			74%	NA	85	30.07	1018.3
14	08:56	E 6	10.00	Fair	CLR	79	73			82%	NA	82	30.06	1017.7
14	07:56	N 5	10.00	Fair	CLR	77	72	77	73	85%	NA	78	30.04	1017.3
14	06:56	N 3	10.00	Fair	CLR	74	72			94%	NA	NA	30.02	1016.6
14	05:56	N 3	10.00	Fair	CLR	74	72			94%	NA	NA	30.01	1016.3
14	04:56	Calm	10.00	Fair	CLR	74	72			94%	NA	NA	30.01	1016.1
14	03:56	Calm	10.00	Fair	CLR	74	72			94%	NA	NA	30.01	1016.2
14	02:56	Calm	10.00	Fair	CLR	75	73			94%	NA	NA	30.01	1016.3
14	01:56	NE 6	10.00	Fair	CLR	75	73	79	75	94%	NA	NA	30.03	1016.8
14	00:56	NE 3	10.00	Fair	CLR	76	73			91%	NA	76	30.03	1016.9
13	23:56	Vrbl 3	10.00	Fair	CLR	77	73			88%	NA	78	30.02	1016.6
13	22:56	E 6	10.00	Fair	CLR	77	73			88%	NA	78	30.02	1016.6
13	21:56	E 7	10.00	Fair	CLR	78	73			85%	NA	80	30.01	1016.2
13	20:56	E 3	10.00	Fair	CLR	78	73			85%	NA	80	30.00	1015.9
13	19:56	E 3	10.00	Fair	CLR	79	73	88	78	82%	NA	82	29.99	1015.6
13	18:56	SE 3	10.00	Light Rain	SCT055 BKN075 BKN090	79	74			85%	NA	83	29.98	1015.2
13	17:56	S 5	10.00	Light Rain	BKN055 BKN070 OVC110	79	73			82%	NA	82	29.98	1015.0
13	16:56	SE 6	7.00	Overcast	SCT065 OVC110	82	72			72%	NA	87	29.98	1015.0
13	15:56	NE 10	10.00	Mostly Cloudy	SCT060 BKN110	83	71			67%	NA	88	29.98	1015.0
13	14:56	E 15	10.00	Partly Cloudy	SCT060	84	72			67%	NA	90	29.98	1015.0
13	13:56	S 6	10.00	Partly Cloudy	SCT050	87	68	87	77	53%	NA	90	29.99	1015.5
13	12:56	SE 8	10.00	Partly Cloudy	SCT035	86	67			53%	NA	89	30.00	1015.9
13	11:56	Calm	10.00	Mostly Cloudy	SCT028 BKN070	84	68			59%	NA	87	30.02	1016.3
13	10:56	SE 6	10.00	Partly Cloudy	FEW028 SCT070	82	70			67%	NA	86	30.02	1016.4
13	09:56	E 6	10.00	Partly Cloudy	SCT015	81	71			72%	NA	85	30.02	1016.4
13	08:56	SE 6	10.00	Partly Cloudy	SCT015	80	72			76%	NA	84	30.01	1016.2
13	07:56	NE 6	10.00	Fair	CLR	77	73	77	75	88%	NA	78	29.99	1015.5
13	06:56	Calm	10.00	Light Rain	BKN100	76	73			91%	NA	76	29.96	1014.6
13	05:56	S 7	10.00	Fair	CLR	76	72			88%	NA	76	29.96	1014.3
13	04:56	Calm	10.00	Fair	CLR	75	73			94%	NA	NA	29.97	1014.9
13	03:56	SW 3	10.00	Fair	CLR	76	72			88%	NA	76	29.98	1015.0
13	02:56	S 3	10.00	Fair	CLR	76	73			91%	NA	76	29.98	1015.2
13	01:56	Calm	10.00	Fair	CLR	77	72	83	76	85%	NA	78	30.01	1016.3
13	00:56	E 6	10.00	Fair	CLR	77	72			85%	NA	78	30.02	1016.4

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max. 6 hour	Min. 6 hour	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
						Temperature (ºF)							Pressure		Precipitation (in.)		
12	23:56	E 6	10.00	Fair	CLR	78	73			85%	NA	80	30.03	1017.0			
12	22:56	E 9	10.00	Fair	CLR	79	72			79%	NA	82	30.03	1016.9			
12	21:56	E 9	10.00	Fair	CLR	79	71			77%	NA	82	30.02	1016.6			
12	20:56	E 13	10.00	Fair	CLR	81	70			69%	NA	84	30.01	1016.1			
12	19:56	E 13	10.00	Fair	CLR	83	68	89	83	61%	NA	86	30.00	1015.7			
12	18:56	E 15	10.00	Fair	CLR	86	69			57%	NA	90	29.98	1015.0			
12	17:56	SE 10	10.00	Fair	CLR	88	69			54%	NA	93	29.97	1014.9			
12	16:56	E 8	10.00	A Few Clouds	FEW044	88	69			54%	NA	93	29.99	1015.6			
12	15:56	SE 6	10.00	Fair	CLR	88	70			55%	NA	93	30.01	1016.2			
12	14:56	SE 6	10.00	Fair	CLR	87	71			59%	NA	93	30.03	1016.8			
12	13:56	SE 10	10.00	A Few Clouds	FEW045	86	73	87	77	65%	NA	93	30.06	1017.7			

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metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF) Air	Dwpt	6 hour Max.	6 hour Min.	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure altimeter (in)	Pressure sea level (mb)	Precipitation (in.) 1 hr	3 hr	6 hr
12	14:56	SE 6	10.00	Fair	CLR	87	71			59%	NA	93	30.03	1016.8			
12	13:56	SE 10	10.00	A Few Clouds	FEW045	86	73	87	77	65%	NA	93	30.06	1017.7			
12	12:56	SE 8	10.00	Fair	CLR	86	69			57%	NA	90	30.07	1018.3			
12	11:56	E 8	10.00	Partly Cloudy	SCT030	83	69			63%	NA	87	30.09	1018.7			
12	10:56	SE 7	10.00	Partly Cloudy	SCT029	84	71			65%	NA	89	30.09	1019.0			
12	09:56	E 8	10.00	Mostly Cloudy	BKN025	82	71			69%	NA	86	30.10	1019.1			
12	08:56	E 6	10.00	Fair	CLR	80	71			74%	NA	83	30.10	1019.2			
12	07:56	Calm	10.00	Fair	CLR	77	72	77	73	85%	NA	78	30.09	1018.9			
12	06:56	Calm	10.00	Fair	CLR	74	71			91%	NA	NA	30.08	1018.6			
12	05:56	Calm	10.00	Fair	CLR	73	71			94%	NA	NA	30.07	1018.2			
12	04:56	Calm	10.00	Fair	CLR	73	72			96%	NA	NA	30.06	1017.8			
12	03:56	Calm	10.00	Fair	CLR	74	71			91%	NA	NA	30.07	1018.3			
12	02:56	SE 3	10.00	Fair	CLR	75	71			88%	NA	NA	30.08	1018.4			
12	01:56	Calm	10.00	Fair	CLR	76	70	82	76	82%	NA	77	30.09	1018.9			
12	00:56	E 5	10.00	Fair	CLR	76	71			85%	NA	77	30.10	1019.1			
11	23:56	SE 5	9.00	Fair	CLR	77	71			82%	NA	79	30.11	1019.7			
11	22:56	SE 6	10.00	Fair	CLR	78	71			79%	NA	80	30.12	1019.9			
11	21:56	E 6	10.00	Fair	CLR	79	72			79%	NA	82	30.12	1019.7			
11	20:56	E 10	10.00	A Few Clouds	FEW080	80	72			76%	NA	84	30.09	1018.9			
11	19:56	E 9	10.00	Mostly Cloudy	BKN070	82	74	90	77	77%	NA	88	30.08	1018.5			
11	18:56	E 10	10.00	Fair	CLR	84	75			74%	NA	92	30.06	1017.8			
11	17:56	Calm	10.00	Fair	CLR	79	74			85%	NA	83	30.05	1017.5			
11	16:56	S 7	10.00	Thunderstorm Light Rain	BKN027 BKN031 OVC065	79	75			88%	NA	83	30.07	1018.1			
11	15:56	NE 8	10.00	Partly Cloudy	SCT037	88	74			63%	NA	97	30.07	1018.2			
11	14:56	SE 6	10.00	Thunderstorm in Vicinity	SCT035 BKN075	88	75			66%	NA	98	30.09	1018.7			
11	13:56	SE 7	10.00	Thunderstorm in Vicinity	CLR	88	74	89	77	63%	NA	97	30.09	1018.9			
11	12:56	Vrbl 6	8.00	A Few Clouds	FEW029	87	76			70%	NA	98	30.10	1019.1			
11	11:56	SE 7	10.00	Overcast	BKN024 OVC040	85	76			75%	NA	95	30.11	1019.7			
11	10:56	SE 7	10.00	A Few Clouds	FEW018	85	76			75%	NA	95	30.11	1019.6			
11	09:56	S 3	10.00	Fair	CLR	83	76			79%	NA	91	30.12	1019.8			
11	08:56	Calm	10.00	Fair	CLR	81	73			77%	NA	86	30.11	1019.7			

11	07:56	E 3	10.00	Partly Cloudy	SCT018	77	75	77	73	94%	NA	78	30.11	1019.5
11	06:56	Calm	10.00	Partly Cloudy	SCT018	74	74			100%	NA	NA	30.09	1018.9
11	05:56	Calm	10.00	Partly Cloudy	SCT016	74	74			100%	NA	NA	30.07	1018.3
11	04:56	Calm	9.00	Fair	CLR	73	73			100%	NA	NA	30.05	1017.6
11	03:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.05	1017.7
11	02:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.06	1017.8
11	01:56	Calm	10.00	Fair	CLR	75	73	76	74	94%	NA	NA	30.06	1018.0
11	00:56	Calm	10.00	Fair	CLR	74	74			100%	NA	NA	30.09	1018.8
10	23:56	Calm	10.00	Partly Cloudy	SCT120	75	74			96%	NA	NA	30.10	1019.1
10	22:56	Calm	10.00	Fair	CLR	75	74			96%	NA	NA	30.10	1019.0
10	21:56	Calm	10.00	Fair	CLR	75	74			96%	NA	NA	30.09	1018.7
10	20:56	SE 5	10.00	A Few Clouds	FEW095	75	74			96%	NA	NA	30.07	1018.2
10	19:56	S 5	10.00	Light Rain	OVC090	76	74	93	72	94%	NA	76	30.07	1018.2
10	18:56	SW 5	6.00	Thunderstorm in Vicinity Light Rain Fog/Mist	FEW042 OVC055	74	72			94%	NA	NA	30.07	1018.1
10	17:56	NW 14 G 31	1.50	Thunderstorm Heavy Rain Fog/Mist	FEW042 BKN050 OVC095	72	70			94%	NA	NA	30.09	1018.7
10	16:56	E 12	10.00	Thunderstorm in Vicinity	FEW055 BKN085	86	74			67%	NA	94	30.01	1016.3
10	15:56	E 21	10.00	Mostly Cloudy and Breezy	BKN090	90	74			59%	NA	99	30.01	1016.2
10	14:56	Vrbl 5	10.00	Fair	CLR	92	72			52%	NA	100	30.03	1016.8
10	13:56	Vrbl 5	10.00	Mostly Cloudy	BKN085 BKN110	91	72	91	79	54%	NA	99	30.04	1017.2
10	12:56	Vrbl 5	10.00	A Few Clouds	FEW030	89	75			63%	NA	99	30.05	1017.7
10	11:56	S 7	10.00	Partly Cloudy	SCT025	88	76			68%	NA	99	30.06	1017.8
10	10:56	S 8	10.00	A Few Clouds	FEW020	87	72			61%	NA	93	30.06	1018.0
10	09:56	SE 5	10.00	Fair	CLR	85	77			77%	NA	96	30.06	1018.0
10	08:56	S 3	10.00	Fair	CLR	82	77			85%	NA	90	30.06	1017.9
10	07:56	Calm	10.00	Fair	CLR	79	76	79	75	90%	NA	83	30.04	1017.2
10	06:56	E 3	10.00	Fair	CLR	76	75			97%	NA	75	30.03	1016.7
10	05:56	Calm	10.00	A Few Clouds	FEW048	75	74			96%	NA	NA	30.01	1016.3
10	04:56	Calm	10.00	Fair	CLR	76	74			94%	NA	76	30.00	1015.8
10	03:56	Calm	10.00	Fair	CLR	76	74			94%	NA	76	30.00	1015.8
10	02:56	Calm	10.00	Fair	CLR	76	74			94%	NA	76	30.01	1016.1
10	01:56	Calm	10.00	Mostly Cloudy	BKN060	76	74	83	76	94%	NA	76	30.03	1016.7
10	00:56	Calm	10.00	Fair	CLR	77	73			88%	NA	78	30.03	1016.7
09	23:56	Calm	10.00	Fair	CLR	77	73			88%	NA	78	30.03	1017.0
09	22:56	Calm	10.00	A Few Clouds	FEW120	79	71			77%	NA	82	30.04	1017.1
09	21:56	NE 5	10.00	Fair	CLR	79	71			77%	NA	82	30.04	1017.2
09	20:56	NE 9	10.00	Fair	CLR	80	70			71%	NA	83	30.02	1016.6
09	19:56	NE 16 G 21	10.00	Partly Cloudy	SCT100	83	75	91	82	77%	NA	90	30.01	1016.0

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max.	Min.	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
						Temperature (ºF)		6 hour					Pressure		Precipitation (in.)		
09	18:56	S 9	10.00	Partly Cloudy	SCT040	86	77			75%	NA	97	29.98	1015.2			
09	17:56	NW 3	10.00	Partly Cloudy	FEW030 SCT070	89	74			61%	NA	98	29.97	1014.8			
09	16:56	W 9	10.00	Rain	FEW043 BKN070 OVC085	85	79			82%	NA	98	29.97	1014.8			
09	15:56	S 5	10.00	Partly Cloudy	SCT050	90	73			58%	NA	99	29.99	1015.3			

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metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
10	08:56	S 3	10.00	Fair	CLR	82	77			85%	NA	90	30.06	1017.9			
10	07:56	Calm	10.00	Fair	CLR	79	76	79	75	90%	NA	83	30.04	1017.2			
10	06:56	E 3	10.00	Fair	CLR	76	75			97%	NA	75	30.03	1016.7			
10	05:56	Calm	10.00	A Few Clouds	FEW048	75	74			96%	NA	NA	30.01	1016.3			
10	04:56	Calm	10.00	Fair	CLR	76	74			94%	NA	76	30.00	1015.8			
10	03:56	Calm	10.00	Fair	CLR	76	74			94%	NA	76	30.00	1015.8			
10	02:56	Calm	10.00	Fair	CLR	76	74			94%	NA	76	30.01	1016.1			
10	01:56	Calm	10.00	Mostly Cloudy	BKN060	76	74	83	76	94%	NA	76	30.03	1016.7			
10	00:56	Calm	10.00	Fair	CLR	77	73			88%	NA	78	30.03	1016.7			
09	23:56	Calm	10.00	Fair	CLR	77	73			88%	NA	78	30.03	1017.0			
09	22:56	Calm	10.00	A Few Clouds	FEW120	79	71			77%	NA	82	30.04	1017.1			
09	21:56	NE 5	10.00	Fair	CLR	79	71			77%	NA	82	30.04	1017.2			
09	20:56	NE 9	10.00	Fair	CLR	80	70			71%	NA	83	30.02	1016.6			
09	19:56	NE 16 G 21	10.00	Partly Cloudy	SCT100	83	75	91	82	77%	NA	90	30.01	1016.0			
09	18:56	S 9	10.00	Partly Cloudy	SCT040	86	77			75%	NA	97	29.98	1015.2			
09	17:56	NW 3	10.00	Partly Cloudy	FEW030 SCT070	89	74			61%	NA	98	29.97	1014.8			
09	16:56	W 9	10.00	Rain	FEW043 BKN070 OVC085	85	79			82%	NA	98	29.97	1014.8			
09	15:56	S 5	10.00	Partly Cloudy	SCT050	90	73			58%	NA	99	29.99	1015.3			
09	14:56	Calm	10.00	Partly Cloudy	SCT060	89	74			61%	NA	98	29.99	1015.6			
09	13:56	Vrbl 5	10.00	A Few Clouds	FEW035	90	74	90	79	59%	NA	99	30.01	1016.1			
09	12:56	SE 5	10.00	Fair	CLR	87	74			65%	NA	95	30.03	1016.7			
09	11:56	SE 5	10.00	Fair	CLR	86	74			67%	NA	94	30.03	1016.7			
09	10:56	S 6	10.00	Fair	CLR	86	76			72%	NA	96	30.03	1016.7			
09	09:56	Calm	10.00	Fair	CLR	82	78			88%	NA	91	30.02	1016.5			
09	08:56	SE 3	10.00	Fair	CLR	80	77			90%	NA	86	30.02	1016.4			
09	07:56	E 5	10.00	Fair	CLR	79	76	79	76	90%	NA	83	30.00	1016.0			
09	06:56	Calm	9.00	Fair	CLR	77	76			96%	NA	78	29.99	1015.5			
09	05:56	Calm	10.00	Fair	CLR	76	75			97%	NA	75	29.98	1015.0			
09	04:56	Calm	10.00	Fair	CLR	78	76			93%	NA	81	29.97	1014.8			

09	03:56	Calm	10.00	Fair	CLR	77	76			96%	NA	78	29.97	1014.7
09	02:56	Calm	10.00	Fair	CLR	78	77			97%	NA	81	29.98	1015.1
09	01:56	Calm	10.00	Fair	CLR	78	77	85	77	97%	NA	81	29.99	1015.5
09	00:56	Calm	10.00	Fair	CLR	78	76			93%	NA	81	30.00	1015.8
08	23:56	Calm	10.00	Fair	CLR	79	76			90%	NA	83	30.01	1016.1
08	22:56	SE 5	10.00	Fair	CLR	79	76			90%	NA	83	30.01	1016.1
08	21:56	E 7	10.00	Fair	CLR	80	76			87%	NA	85	30.00	1015.9
08	20:56	E 7	10.00	Fair	CLR	81	77			88%	NA	88	30.00	1015.7
08	19:56	E 5	10.00	Fair	CLR	84	78	92	84	82%	NA	95	29.98	1015.0
08	18:56	Calm	10.00	Fair	CLR	87	76			70%	NA	98	29.98	1015.0
08	17:56	Calm	10.00	Fair	CLR	86	76			72%	NA	96	29.97	1014.8
08	16:56	Calm	10.00	A Few Clouds	FEW070	85	76			75%	NA	95	29.98	1015.2
08	15:56	N 3	10.00	A Few Clouds	FEW120	84	77			80%	NA	94	30.00	1015.7
08	14:56	NW 12	10.00	Mostly Cloudy	SCT055 BKN095	87	77			72%	NA	99	30.00	1015.7
08	13:56	SW 12 G 21	10.00	Fair	CLR	92	72	92	78	52%	NA	100	29.99	1015.6
08	12:56	S 15	10.00	Mostly Cloudy	BKN040 BKN049	91	74			57%	NA	100	30.00	1015.6
08	11:56	S 13 G 16	10.00	A Few Clouds	FEW026	90	75			62%	NA	101	30.01	1016.1
08	10:56	S 10	10.00	A Few Clouds	FEW014	87	78			75%	NA	100	30.01	1016.2
08	09:56	S 7	10.00	Mostly Cloudy	BKN011	84	80			88%	NA	97	30.01	1016.3
08	08:56	S 7	10.00	A Few Clouds	FEW080	81	79			94%	NA	89	30.01	1016.0
08	07:56	SE 5	7.00	Overcast	OVC060	78	78	78	76	100%	NA	81	30.00	1015.6
08	06:56	E 3	4.00	Fog/Mist	SCT070	77	77			100%	NA	78	29.99	1015.3
08	05:56	SE 3	7.00	Fair	CLR	77	77			100%	NA	78	29.96	1014.4
08	04:56	Calm	9.00	Fair	CLR	77	77			100%	NA	78	29.93	1013.6
08	03:56	S 6	10.00	Fair	CLR	77	76			96%	NA	78	29.94	1013.6
08	02:56	S 6	10.00	Overcast	OVC110	77	76			96%	NA	78	29.93	1013.6
08	01:56	S 6	10.00	Fair	CLR	76	76	78	76	100%	NA	75	29.94	1013.9
08	00:56	SE 5	10.00	Fair	CLR	76	75			97%	NA	75	29.96	1014.3
07	23:56	SE 5	10.00	Partly Cloudy	SCT110	77	76			96%	NA	78	29.97	1014.8
07	22:56	E 5	10.00	Partly Cloudy	FEW055 SCT070	77	76			96%	NA	78	29.98	1015.2
07	21:56	Vrbl 3	10.00	Overcast	BKN050 OVC065	77	76			96%	NA	78	29.98	1015.2
07	20:56	SW 7	3.00	Heavy Rain Fog/Mist	BKN048 BKN060 OVC085	76	75			97%	NA	75	29.97	1014.9
07	19:56	E 5	10.00	Mostly Cloudy	FEW055 SCT075 BKN100	77	76	88	76	96%	NA	78	29.94	1013.9
07	18:56	Calm	10.00	Light Rain	BKN055 OVC075	77	74			90%	NA	78	29.95	1014.1
07	17:56	SE 8	9.00	Light	SCT085	86	76			72%	NA	96	29.93	1013.6

				Rain										
07	16:56	SE 10	10.00	Partly Cloudy	SCT050	86	77			75%	NA	97	29.93	1013.5
07	15:56	SE 8	10.00	Mostly Cloudy	FEW040 BKN120	85	77			77%	NA	96	29.94	1013.7
07	14:56	SE 12	10.00	Mostly Cloudy	BKN120	85	78			80%	NA	97	29.96	1014.4
07	13:56	SE 7	10.00	A Few Clouds	FEW021	84	79	84	78	85%	NA	96	29.97	1014.9
07	12:56	S 9	10.00	A Few Clouds	FEW015	83	78			85%	NA	93	29.98	1015.0
07	11:56	S 12	10.00	Fair	CLR	83	78			85%	NA	93	29.97	1014.8
07	10:56	S 9	10.00	Partly Cloudy	SCT017 SCT021	81	78			91%	NA	89	29.97	1014.9
07	09:56	S 10	9.00	Partly Cloudy	SCT008	81	79			94%	NA	89	29.96	1014.5

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	Max. 6 hour	Min. 6 hour				altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr

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Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
05	11:56	SE 8	10.00	Fair	CLR	83	77			82%	NA	92	30.08	1018.5			
05	10:56	Calm	10.00	Fair	CLR	80	75			85%	NA	85	30.09	1018.8			
05	09:56	Vrbl 3	10.00	Partly Cloudy	SCT120	77	75			94%	NA	78	30.07	1018.2			
05	08:56	Calm	10.00	Fair	CLR	76	74			94%	NA	76	30.06	1017.8			
05	07:56	Calm	10.00	NA	NA	74	73	74	72	97%	NA	NA	30.05	1017.5			
05	06:56	NA	10.00	Overcast	OVC110	72	72			100%	NA	NA	30.04	1017.4			
05	05:56	Calm	10.00	Overcast	OVC100	72	72			100%	NA	NA	30.03	1017.1			
05	04:56	Calm	10.00	Light Rain	SCT100 BKN120	72	72			100%	NA	NA	30.03	1017.0			
05	03:56	Calm	10.00	Light Rain	FEW055 BKN110	72	72			100%	NA	NA	30.03	1016.8			
05	02:56	S 5	10.00	Partly Cloudy	SCT110	72	72			100%	NA	NA	30.03	1016.8			
05	01:56	Calm	10.00	Fair	CLR	72	72	73	72	100%	NA	NA	30.02	1016.6			
05	00:56	S 5	10.00	Fair	CLR	72	72			100%	NA	NA	30.02	1016.7			
04	23:56	S 6	10.00	Fair	CLR	72	72			100%	NA	NA	30.02	1016.5			
04	22:56	S 3	10.00	Fair	CLR	72	72			100%	NA	NA	30.01	1016.3			
04	21:56	S 3	10.00	A Few Clouds	FEW004	72	72			100%	NA	NA	30.01	1016.2			
04	20:56	S 3	10.00	Fair	CLR	73	72			96%	NA	NA	30.02	1016.4			
04	19:56	SW 5	10.00	Mostly Cloudy	BKN008	73	72	74	73	96%	NA	NA	30.01	1016.1			
04	18:56	SE 8	10.00	Mostly Cloudy	FEW005 SCT033 BKN070	73	72			96%	NA	NA	30.01	1016.1			
04	17:56	SE 6	10.00	Light Rain	BKN047 OVC065	73	73			100%	NA	NA	30.02	1016.4			
04	16:56	S 6	9.00	Light Rain	FEW003 OVC013	73	72			96%	NA	NA	30.02	1016.4			
04	15:56	S 6	4.00	Heavy Rain Fog/Mist	FEW018 BKN028 OVC033	74	74			100%	NA	NA	30.02	1016.6			
04	14:56	SE 3	2.50	Rain Fog/Mist	OVC055	74	74			100%	NA	NA	30.03	1016.8			
04	13:56	Calm	9.00	Rain	FEW013 SCT031 OVC041	74	73	79	73	97%	NA	NA	30.04	1017.3			
04	12:56	SE 3	9.00	Light Rain	FEW008 BKN049 OVC055	74	73			97%	NA	NA	30.05	1017.6			
04	11:56	SE 9	1.75	Heavy Rain Fog/Mist	FEW007 BKN028 OVC036	73	72			96%	NA	NA	30.04	1017.2			
04	10:56	SE	7.00	Thunderstorm	BKN012	74	73			97%	NA	NA	30.02	1016.5			

		20 G 29		in Vicinity Light Rain	OVC020									
04	09:56	E 9	4.00	Light Rain Fog/Mist	FEW006 SCT010 OVC024	78	75			90%	NA	80	30.02	1016.4
04	08:56	E 7	10.00	Mostly Cloudy	FEW005 SCT022 BKN060	77	75			94%	NA	78	30.01	1016.3
04	07:56	Calm	10.00	Mostly Cloudy	SCT005 BKN095	76	75	76	75	97%	NA	75	29.99	1015.6
04	06:56	Calm	10.00	Overcast	FEW065 OVC090	75	75			100%	NA	NA	29.98	1015.2
04	05:56	Calm	7.00	Light Rain	FEW003 OVC085	75	74			96%	NA	NA	29.97	1014.8
04	04:56	E 3	10.00	Light Rain	FEW003 OVC090	75	75			100%	NA	NA	29.98	1015.1
04	03:56	E 3	8.00	Light Rain	SCT055 SCT090 OVC110	75	75			100%	NA	NA	29.98	1015.2
04	02:56	Calm	10.00	Light Rain	OVC003	75	75			100%	NA	NA	29.98	1015.2
04	01:56	E 3	8.00	Light Rain	FEW055 SCT075 OVC095	75	75	76	75	100%	NA	NA	30.00	1015.8
04	00:56	Calm	9.00	Light Rain	FEW002 OVC100	75	75			100%	NA	NA	30.02	1016.4
03	23:56	SE 3	10.00	Light Rain	BKN006 BKN016 OVC026	76	75			97%	NA	75	30.02	1016.6
03	22:56	Calm	10.00	Light Rain	OVC110	75	75			100%	NA	NA	30.02	1016.4
03	21:56	E 5	10.00	Mostly Cloudy	BKN120	76	75			97%	NA	75	30.01	1016.3
03	20:56	SE 3	10.00	Light Rain	SCT090 BKN110	76	75			97%	NA	75	30.01	1016.2
03	19:56	SE 5	10.00	Light Rain	CLR	76	75	84	76	97%	NA	75	30.02	1016.3
03	18:56	E 6	10.00	Light Rain	FEW050 SCT060	78	73			85%	NA	80	30.00	1015.6
03	17:56	SE 7	10.00	Mostly Cloudy	BKN042	80	72			76%	NA	84	29.99	1015.6
03	16:56	E 8	10.00	Fair	CLR	80	72			76%	NA	84	30.00	1015.7
03	15:56	E 10	10.00	Mostly Cloudy	SCT022 SCT028 BKN039	81	72			74%	NA	85	29.99	1015.6
03	14:56	SE 13	10.00	Overcast	FEW022 BKN029 OVC070	82	73			74%	NA	87	30.02	1016.5
03	13:56	SE 9	10.00	Mostly Cloudy	FEW025 SCT041 BKN070	83	71	84	76	67%	NA	88	30.04	1017.2
03	12:56	SE 10 G 18	10.00	A Few Clouds	FEW028	83	72			70%	NA	88	30.06	1017.7
03	11:56	E 9	10.00	Overcast	FEW024 OVC065	82	73			74%	NA	87	30.07	1018.3
03	10:56	E 10	10.00	Overcast	SCT025 BKN070 OVC085	80	72			76%	NA	84	30.09	1018.7
03	09:56	E 9	10.00	Overcast	BKN060	79	72			79%	NA	82	30.08	1018.7

					OVC075										
03	08:56	E 6	10.00	Overcast	OVC070	78	72			82%	NA	80	30.10	1019.1	
03	07:56	E 7	10.00	Overcast	BKN065 OVC085	76	72	76	75	88%	NA	76	30.08	1018.7	
03	06:56	NE 3	10.00	Overcast	OVC065	75	72			90%	NA	NA	30.06	1018.0	
03	05:56	E 6	10.00	Overcast	BKN065 OVC085	75	72			90%	NA	NA	30.06	1018.0	
03	04:56	E 6	10.00	Overcast	BKN070 OVC080	76	72			88%	NA	76	30.06	1017.7	
03	03:56	E 5	10.00	Overcast	OVC070	76	72			88%	NA	76	30.07	1018.0	
03	02:56	E 6	10.00	Overcast	OVC070	76	72			88%	NA	76	30.08	1018.4	
03	01:56	E 7	10.00	Overcast	OVC075	76	72	77	76	88%	NA	76	30.10	1019.1	
03	00:56	E 7	10.00	Overcast	OVC080	76	72			88%	NA	76	30.13	1020.1	
02	23:56	E 5	10.00	Overcast	FEW021 BKN065 OVC080	76	72			88%	NA	76	30.13	1020.3	
02	22:56	E 6	10.00	Overcast	FEW055 OVC070	76	73			91%	NA	76	30.13	1020.3	
02	21:56	E 9	10.00	Overcast	OVC055	77	72			85%	NA	78	30.12	1019.8	
02	20:56	E 8	10.00	Overcast	BKN043 OVC065	77	73			88%	NA	78	30.11	1019.6	
02	19:56	SE 9	10.00	Overcast	FEW030 OVC060	77	73	81	76	88%	NA	78	30.10	1019.2	
02	18:56	E 13	10.00	Overcast	FEW032 SCT039 OVC060	77	73			88%	NA	78	30.09	1018.9	
02	17:56	E 10 G 20	4.00	Light Rain Fog/Mist	SCT017 BKN049 OVC100	77	74			90%	NA	78	30.09	1018.8	
02	16:56	E 12	10.00	Mostly Cloudy	SCT015 BKN020 BKN090	80	74			82%	NA	85	30.10	1019.1	
02	15:56	SE 10	10.00	Overcast	BKN009 OVC080	78	74			87%	NA	80	30.12	1019.7	
02	14:56	E 13	10.00	Overcast	FEW010 OVC080	76	74			94%	NA	76	30.14	1020.4	
02	13:56	E 13	3.00	Light Rain Fog/Mist	FEW016 OVC070	76	74	79	75	94%	NA	76	30.15	1021.0	
02	12:56	E 17	10.00	Overcast	FEW016 SCT022 OVC080	78	73			85%	NA	80	30.16	1021.1	

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF) Air	Dwpt	Max. 6 hour	Min. 6 hour	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure altimeter (in.)	Pressure sea level (mb)	Precipitation (in.) 1 hr	3 hr	6 hr

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Weather observations for the past three days

Kissimmee Gateway Airport

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metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
02	10:56	E 13	10.00	Overcast	BKN010 OVC065	77	73			88%	NA	78	30.17	1021.5			
02	09:56	E 13	5.00	Light Rain Fog/Mist	FEW010 BKN029 OVC055	76	74			94%	NA	76	30.17	1021.5			
02	08:56	E 12	10.00	Mostly Cloudy	BKN038 BKN090	76	73			91%	NA	76	30.15	1021.0			
02	07:56	E 8	10.00	Mostly Cloudy	BKN045	75	73	76	75	94%	NA	NA	30.14	1020.4			
02	06:56	E 12	10.00	Overcast	FEW011 OVC024	75	73			94%	NA	NA	30.12	1019.9			
02	05:56	E 9	10.00	Overcast	BKN011 OVC030	75	73			94%	NA	NA	30.10	1019.3			
02	04:56	E 8	10.00	Fair	CLR	76	73			91%	NA	76	30.10	1019.2			
02	03:56	E 7	10.00	Overcast	SCT011 OVC055	75	73			94%	NA	NA	30.10	1019.2			
02	02:56	E 10	10.00	Mostly Cloudy	BKN013 BKN022 BKN032	76	73			91%	NA	76	30.12	1019.8			
02	01:56	NE 10	10.00	Overcast	SCT012 OVC055	76	74	82	76	94%	NA	76	30.14	1020.4			
02	00:56	E 9	10.00	Overcast	FEW012 BKN025 OVC029	77	74			90%	NA	78	30.15	1020.8			
01	23:56	NE 9	10.00	Mostly Cloudy	BKN018	78	75			90%	NA	80	30.15	1021.0			
01	22:56	E 8 G 18	7.00	Light Rain	SCT022 SCT043	78	74			87%	NA	80	30.15	1020.8			
01	21:56	E 10	10.00	Fair	CLR	79	73			82%	NA	82	30.12	1020.0			
01	20:56	E 10	10.00	Fair	CLR	80	73			79%	NA	84	30.10	1019.3			
01	19:56	E 15	10.00	Fair	CLR	82	72	90	82	72%	NA	87	30.09	1019.0			
01	18:56	E 18 G 24	10.00	Partly Cloudy	SCT040	84	72			67%	NA	90	30.07	1018.3			
01	17:56	E 15	10.00	Overcast	FEW035 BKN065 OVC085	86	73			65%	NA	93	30.06	1018.0			
01	16:56	E 16	10.00	Partly Cloudy	SCT040	87	72			61%	NA	93	30.07	1018.1			
01	15:56	E 18 G 22	10.00	A Few Clouds	FEW041	89	71			55%	NA	95	30.07	1018.3			
01	14:56		10.00	Partly Cloudy	SCT038	88	71			57%	NA	94	30.08	1018.6			

		NE 16 G 23												
01	13:56	NE 12 G 21	10.00	Mostly Cloudy	SCT036 BKN048	89	72	89	78	57%	NA	96	30.09	1018.9
01	12:56	E 13	10.00	Partly Cloudy	SCT029	87	73			63%	NA	94	30.10	1019.2
01	11:56	E 13	10.00	Fair	CLR	86	73			65%	NA	93	30.11	1019.5
01	10:56	NE 12	10.00	Fair	CLR	84	71			65%	NA	89	30.10	1019.3
01	09:56	E 8	10.00	Fair	CLR	82	75			79%	NA	89	30.10	1019.1
01	08:56	E 9	10.00	Fair	CLR	80	76			87%	NA	85	30.09	1018.8
01	07:56	E 8	10.00	Fair	CLR	78	75	79	77	90%	NA	80	30.06	1017.9
01	06:56	E 7	10.00	Fair	CLR	77	75			94%	NA	78	30.04	1017.3
01	05:56	NE 7	10.00	Fair	CLR	78	75			90%	NA	80	30.03	1016.9
01	04:56	Calm	10.00	Fair	CLR	78	75			90%	NA	80	30.02	1016.4
01	03:56	E 3	10.00	Fair	CLR	78	75			90%	NA	80	30.02	1016.4
01	02:56	SE 3	10.00	Fair	CLR	78	75			90%	NA	80	30.01	1016.2
01	01:56	SE 5	10.00	Fair	CLR	79	76	87	79	90%	NA	83	30.02	1016.6
01	00:56	SE 6	10.00	Fair	CLR	79	75			88%	NA	83	30.04	1017.2
31	23:56	SE 7	10.00	Partly Cloudy	SCT055 SCT095	81	75			82%	NA	87	30.04	1017.3
31	22:56	SE 6	10.00	Overcast	OVC060	82	75			79%	NA	89	30.05	1017.5
31	21:56	E 8	10.00	Mostly Cloudy	BKN060	83	75			77%	NA	90	30.02	1016.6
31	20:56	E 9	10.00	Overcast	OVC095	83	76			79%	NA	91	30.01	1016.0
31	18:56	W 7	10.00	A Few Clouds	FEW070	91	69			49%	NA	96	29.96	1014.5
31	17:56	NW 7	10.00	Fair	CLR	92	69			47%	NA	97	29.96	1014.4
31	16:56	SW 7	10.00	A Few Clouds	FEW050	93	70			47%	NA	99	29.97	1014.9
31	15:56	W 7	10.00	Mostly Cloudy	BKN060	92	68			46%	NA	96	29.99	1015.5
31	14:56	W 7	10.00	A Few Clouds	FEW047	91	69			49%	NA	96	30.01	1016.1
31	13:56	W 9	10.00	Mostly Cloudy	SCT038 BKN045	90	72	90	73	56%	NA	98	30.03	1016.7
31	12:56	Vrbl 6	10.00	A Few Clouds	FEW025	88	73			61%	NA	96	30.04	1017.2
31	11:56	W 6	10.00	Partly Cloudy	SCT025	86	73			65%	NA	93	30.06	1017.8
31	10:56	NW 6	10.00	Mostly Cloudy	BKN017	84	74			72%	NA	91	30.07	1018.0
31	09:56	NW 5	10.00	Partly Cloudy	SCT013	81	74			79%	NA	86	30.06	1018.0
31	08:56	Calm	10.00	Fair	CLR	78	73			85%	NA	80	30.06	1017.8
31	07:56	Calm	10.00	Fair	CLR	73	72	73	70	96%	NA	NA	30.03	1016.8
31	06:56	Calm	10.00	Fair	CLR	71	70			96%	NA	NA	30.02	1016.4
31	05:56	Calm	10.00	Fair	CLR	71	70			96%	NA	NA	30.02	1016.4
31	04:56	Calm	10.00	Fair	CLR	71	70			96%	NA	NA	30.01	1016.0
31	03:56	Calm	10.00	Fair	CLR	70	69			97%	NA	NA	30.00	1015.9
31	02:56	W 3	10.00	Fair	CLR	70	69			97%	NA	NA	30.01	1016.0
31	01:56	Calm	10.00	Fair	CLR	70	69	81	70	97%	NA	NA	30.03	1016.7

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max. 6 hour	Min. 6 hour	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
						Temperature (ºF)							Pressure		Precipitation (in.)		
31	00:56	Calm	10.00	Fair	CLR	71	70			96%	NA	NA	30.04	1017.2			
30	23:56	Calm	10.00	Fair	CLR	71	69			94%	NA	NA	30.05	1017.5			
30	22:56	SW 5	10.00	Fair	CLR	73	71			94%	NA	NA	30.05	1017.6			
30	21:56	S 9	10.00	Overcast	FEW044 BKN070 OVC080	71	70			96%	NA	NA	30.04	1017.2			
30	20:56	NW 7 G 20	10.00	Thunderstorm Rain	FEW007 BKN020 OVC055	71	70			96%	NA	NA	30.06	1018.0			
30	19:56	S 9	10.00	Thunderstorm	CLR	81	75	93	81	82%	NA	87	29.97	1014.9			
30	18:56	S 10	10.00	Mostly Cloudy	BKN050	82	75			79%	NA	89	29.95	1014.2			
30	17:56	SE 9	10.00	Fair	CLR	85	74			70%	NA	93	29.96	1014.5			
30	16:56	N 6	10.00	A Few Clouds	FEW060	92	70			49%	NA	98	29.96	1014.5			
30	15:56	NW 5	10.00	Fair	CLR	91	71			52%	NA	98	29.98	1015.1			
30	14:56	Vrbl 6	10.00	Fair	CLR	91	72			54%	NA	99	29.99	1015.6			
30	13:56	NW 8	10.00	Mostly Cloudy	BKN029	88	75	90	77	66%	NA	98	30.01	1016.3			
30	12:56	Vrbl 5	10.00	Mostly Cloudy	BKN029	90	74			59%	NA	99	30.03	1017.0			
30	11:56	SW 7	10.00	Mostly Cloudy	BKN019	86	75			70%	NA	95	30.05	1017.4			

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Southern Region Headquarters
Fort Worth, Texas

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Weather observations for the past three days

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metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
01	14:56	NE 16 G 23	10.00	Partly Cloudy	SCT038	88	71			57%	NA	94	30.08	1018.6			
01	13:56	NE 12 G 21	10.00	Mostly Cloudy	SCT036 BKN048	89	72	89	78	57%	NA	96	30.09	1018.9			
01	12:56	E 13	10.00	Partly Cloudy	SCT029	87	73			63%	NA	94	30.10	1019.2			
01	11:56	E 13	10.00	Fair	CLR	86	73			65%	NA	93	30.11	1019.5			
01	10:56	NE 12	10.00	Fair	CLR	84	71			65%	NA	89	30.10	1019.3			
01	09:56	E 8	10.00	Fair	CLR	82	75			79%	NA	89	30.10	1019.1			
01	08:56	E 9	10.00	Fair	CLR	80	76			87%	NA	85	30.09	1018.8			
01	07:56	E 8	10.00	Fair	CLR	78	75	79	77	90%	NA	80	30.06	1017.9			
01	06:56	E 7	10.00	Fair	CLR	77	75			94%	NA	78	30.04	1017.3			
01	05:56	NE 7	10.00	Fair	CLR	78	75			90%	NA	80	30.03	1016.9			
01	04:56	Calm	10.00	Fair	CLR	78	75			90%	NA	80	30.02	1016.4			
01	03:56	E 3	10.00	Fair	CLR	78	75			90%	NA	80	30.02	1016.4			
01	02:56	SE 3	10.00	Fair	CLR	78	75			90%	NA	80	30.01	1016.2			
01	01:56	SE 5	10.00	Fair	CLR	79	76	87	79	90%	NA	83	30.02	1016.6			
01	00:56	SE 6	10.00	Fair	CLR	79	75			88%	NA	83	30.04	1017.2			
31	23:56	SE 7	10.00	Partly Cloudy	SCT055 SCT095	81	75			82%	NA	87	30.04	1017.3			
31	22:56	SE 6	10.00	Overcast	OVC060	82	75			79%	NA	89	30.05	1017.5			
31	21:56	E 8	10.00	Mostly Cloudy	BKN060	83	75			77%	NA	90	30.02	1016.6			
31	20:56	E 9	10.00	Overcast	OVC095	83	76			79%	NA	91	30.01	1016.0			
31	18:56	W 7	10.00	A Few Clouds	FEW070	91	69			49%	NA	96	29.96	1014.5			
31	17:56	NW 7	10.00	Fair	CLR	92	69			47%	NA	97	29.96	1014.4			
31	16:56	SW 7	10.00	A Few Clouds	FEW050	93	70			47%	NA	99	29.97	1014.9			
31	15:56	W 7	10.00	Mostly Cloudy	BKN060	92	68			46%	NA	96	29.99	1015.5			
31	14:56	W 7	10.00	A Few Clouds	FEW047	91	69			49%	NA	96	30.01	1016.1			
31	13:56	W 9	10.00	Mostly Cloudy	SCT038 BKN045	90	72	90	73	56%	NA	98	30.03	1016.7			
31	12:56	Vrbl 6	10.00	A Few Clouds	FEW025	88	73			61%	NA	96	30.04	1017.2			
31	11:56	W 6	10.00	Partly Cloudy	SCT025	86	73			65%	NA	93	30.06	1017.8			
31	10:56	NW 6	10.00		BKN017	84	74			72%	NA	91	30.07	1018.0			

				Mostly Cloudy										
31	09:56	NW 5	10.00	Partly Cloudy	SCT013	81	74			79%	NA	86	30.06	1018.0
31	08:56	Calm	10.00	Fair	CLR	78	73			85%	NA	80	30.06	1017.8
31	07:56	Calm	10.00	Fair	CLR	73	72	73	70	96%	NA	NA	30.03	1016.8
31	06:56	Calm	10.00	Fair	CLR	71	70			96%	NA	NA	30.02	1016.4
31	05:56	Calm	10.00	Fair	CLR	71	70			96%	NA	NA	30.02	1016.4
31	04:56	Calm	10.00	Fair	CLR	71	70			96%	NA	NA	30.01	1016.0
31	03:56	Calm	10.00	Fair	CLR	70	69			97%	NA	NA	30.00	1015.9
31	02:56	W 3	10.00	Fair	CLR	70	69			97%	NA	NA	30.01	1016.0
31	01:56	Calm	10.00	Fair	CLR	70	69	81	70	97%	NA	NA	30.03	1016.7
31	00:56	Calm	10.00	Fair	CLR	71	70			96%	NA	NA	30.04	1017.2
30	23:56	Calm	10.00	Fair	CLR	71	69			94%	NA	NA	30.05	1017.5
30	22:56	SW 5	10.00	Fair	CLR	73	71			94%	NA	NA	30.05	1017.6
30	21:56	S 9	10.00	Overcast	FEW044 BKN070 OVC080	71	70			96%	NA	NA	30.04	1017.2
30	20:56	NW 7 G 20	10.00	Thunderstorm Rain	FEW007 BKN020 OVC055	71	70			96%	NA	NA	30.06	1018.0
30	19:56	S 9	10.00	Thunderstorm	CLR	81	75	93	81	82%	NA	87	29.97	1014.9
30	18:56	S 10	10.00	Mostly Cloudy	BKN050	82	75			79%	NA	89	29.95	1014.2
30	17:56	SE 9	10.00	Fair	CLR	85	74			70%	NA	93	29.96	1014.5
30	16:56	N 6	10.00	A Few Clouds	FEW060	92	70			49%	NA	98	29.96	1014.5
30	15:56	NW 5	10.00	Fair	CLR	91	71			52%	NA	98	29.98	1015.1
30	14:56	Vrbl 6	10.00	Fair	CLR	91	72			54%	NA	99	29.99	1015.6
30	13:56	NW 8	10.00	Mostly Cloudy	BKN029	88	75	90	77	66%	NA	98	30.01	1016.3
30	12:56	Vrbl 5	10.00	Mostly Cloudy	BKN029	90	74			59%	NA	99	30.03	1017.0
30	11:56	SW 7	10.00	Mostly Cloudy	BKN019	86	75			70%	NA	95	30.05	1017.4
30	10:56	SW 9	10.00	Overcast	SCT019 BKN023 OVC032	84	75			74%	NA	92	30.05	1017.6
30	09:56	S 9	10.00	Mostly Cloudy	BKN015 BKN021	83	75			77%	NA	90	30.05	1017.6
30	08:56	S 9	10.00	Partly Cloudy	SCT009	80	75			85%	NA	85	30.06	1018.0
30	07:56	S 7	10.00	Fair	CLR	77	74	77	73	90%	NA	78	30.06	1017.9
30	06:56	E 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.05	1017.6
30	05:56	Calm	10.00	A Few Clouds	FEW021	75	73			94%	NA	NA	30.04	1017.1
30	04:56	Calm	10.00	Fair	CLR	74	73			97%	NA	NA	30.03	1017.0
30	03:56	E 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.05	1017.4
30	02:56	SE 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.06	1017.7
30	01:56	SE 6	10.00	Fair	CLR	75	73	80	75	94%	NA	NA	30.07	1018.0
30	00:56	E 6	10.00	A Few Clouds	FEW024	75	72			90%	NA	NA	30.08	1018.4
29	23:56	E 5	10.00	Fair	CLR	76	71			85%	NA	77	30.09	1018.8

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max. 6 hour	Min. 6 hour	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
						Temperature (ºF)							Pressure		Precipitation (in.)		
29	22:56	E 5	10.00	Mostly Cloudy	BKN065	78	72			82%	NA	80	30.10	1019.1			
29	21:56	NE 9	10.00	Partly Cloudy	SCT024	78	72			82%	NA	80	30.08	1018.4			
29	20:56	N 7	9.00	Thunderstorm in Vicinity	FEW095	78	73			85%	NA	80	30.08	1018.4			
29	19:56	NW 13	10.00	Thunderstorm in Vicinity	FEW060 BKN085	80	72	91	80	76%	NA	84	30.05	1017.5			
29	18:56	SE 9	10.00	Fair	CLR	83	74			74%	NA	90	30.02	1016.5			
29	17:56	E 10	10.00	Partly Cloudy	SCT050	86	74			67%	NA	94	30.00	1015.9			
29	16:56	E 12	10.00	A Few Clouds	FEW001	87	71			59%	NA	93	30.00	1015.7			
29	15:56	S 7	10.00	A Few Clouds	FEW041	90	73			58%	NA	99	30.01	1016.1			

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Southern Region Headquarters
Fort Worth, Texas

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Weather observations for the past three days

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metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
28	16:56	NW 12 G 23	10.00	Thunderstorm	BKN050	83	69			63%	NA	87	30.04	1017.0			
28	15:56	S 7	10.00	Fair	CLR	90	73			58%	NA	99	30.01	1016.0			
28	14:56	S 10	10.00	Fair	CLR	90	75			62%	NA	101	30.02	1016.3			
28	13:56	S 5	10.00	Partly Cloudy	SCT040	89	75	89	75	63%	NA	99	30.06	1017.8			
28	12:56	SE 8	9.00	Partly Cloudy	SCT022 SCT028	85	77			77%	NA	96	30.08	1018.7			
28	11:56	S 6	10.00	Mostly Cloudy	SCT015 BKN022 BKN027	85	77			77%	NA	96	30.10	1019.2			
28	10:56	S 7	10.00	Mostly Cloudy	SCT008 BKN015	82	78			88%	NA	91	30.10	1019.3			
28	09:56	SW 3	9.00	Overcast	OVC006	79	77			94%	NA	83	30.10	1019.3			
28	08:56	S 6	2.00	Fog/Mist	OVC002	76	76			100%	NA	75	30.09	1018.9			
28	07:56	S 3	0.50	Fog	OVC002	75	75	75	72	100%	NA	NA	30.07	1018.1			
28	06:56	S 3	0.50	Fog	OVC004	73	73			100%	NA	NA	30.05	1017.6			
28	05:56	Calm	10.00	Fair	CLR	73	72			96%	NA	NA	30.04	1017.2			
28	04:56	Calm	10.00	A Few Clouds	FEW023	73	72			96%	NA	NA	30.03	1017.0			
28	03:56	Calm	10.00	Fair	CLR	73	72			96%	NA	NA	30.04	1017.2			
28	02:56	SW 5	10.00	Fair	CLR	72	72			100%	NA	NA	30.04	1017.1			
28	01:56	Calm	10.00	Fair	CLR	73	72	76	73	96%	NA	NA	30.04	1017.2			
28	00:56	S 3	10.00	Fair	CLR	73	72			96%	NA	NA	30.05	1017.4			
27	23:56	SE 8	10.00	Fair	CLR	73	72			96%	NA	NA	30.03	1016.9			
27	22:56	S 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.02	1016.3			
27	21:56	S 3	10.00	Fair	CLR	74	73			97%	NA	NA	30.01	1016.0			
27	20:56	S 10	10.00	Fair	CLR	75	73			94%	NA	NA	30.01	1016.1			
27	19:56	S 3	10.00	Light Rain	BKN065 BKN080	75	74	83	75	96%	NA	NA	29.99	1015.4			
27	18:56	N 7	6.00	Thunderstorm in Vicinity Rain Fog/Mist	FEW018 BKN040 OVC055	75	74			96%	NA	NA	30.01	1016.0			
27	17:56	SE 8	10.00	Overcast	FEW026 BKN046 OVC075	81	74			79%	NA	86	29.96	1014.5			
27	16:56	E 9	10.00	Fair	CLR	83	72			70%	NA	88	29.97	1014.7			
27	15:56	SE 10	10.00	Fair	CLR	81	70			69%	NA	84	29.94	1013.8			

27	14:56	Vrbl 3	10.00	Fair	CLR	78	71			79%	NA	80	29.95	1014.2
27	12:56	Calm	10.00	Light Rain	FEW060 BKN075	75	71			88%	NA	NA	29.97	1014.7
27	11:56	SW 12	9.00	Thunderstorm in Vicinity	BKN024 BKN030	85	74			70%	NA	93	29.96	1014.6
27	10:56	S 12 G 18	10.00	Thunderstorm in Vicinity	FEW018 BKN041 OVC090	85	75			72%	NA	93	29.97	1014.7
27	09:56	SW 8	10.00	Mostly Cloudy	SCT014 BKN023	82	76			82%	NA	89	29.98	1015.0
27	08:56	SW 8	10.00	Mostly Cloudy	BKN010	80	76			87%	NA	85	29.97	1014.7
27	07:56	SW 7	10.00	Mostly Cloudy	FEW004 BKN018	77	76	77	74	96%	NA	78	29.95	1014.1
27	06:56	Calm	9.00	Mostly Cloudy	BKN055	75	75			100%	NA	NA	29.94	1013.9
27	05:56	Calm	10.00	Thunderstorm	FEW006 OVC022	76	75			97%	NA	75	29.93	1013.5
27	04:56	S 5	10.00	Overcast	OVC012	76	74			94%	NA	76	29.93	1013.3
27	03:56	Calm	10.00	Overcast	OVC010	74	73			97%	NA	NA	29.91	1012.7
27	02:56	Calm	10.00	A Few Clouds	FEW016	76	73			91%	NA	76	29.89	1012.2
27	01:56	SW 5	10.00	Mostly Cloudy	FEW020 BKN028	76	74	85	76	94%	NA	76	29.91	1012.8
27	00:56	W 7	10.00	A Few Clouds	FEW050	76	73			91%	NA	76	29.92	1013.1
26	23:56	Calm	10.00	Mostly Cloudy	FEW030 SCT036 BKN047	77	74			90%	NA	78	29.91	1012.8
26	22:56	Vrbl 3	10.00	Partly Cloudy	SCT029 SCT043	77	73			88%	NA	78	29.92	1013.2
26	21:56	Calm	10.00	A Few Clouds	FEW036	77	72			85%	NA	78	29.91	1012.7
26	20:56	Calm	10.00	Mostly Cloudy	BKN041	79	71			77%	NA	82	29.89	1012.2
26	19:56	N 5	10.00	Thunderstorm in Vicinity	SCT049 BKN055	84	75	88	84	74%	NA	92	29.88	1011.8
26	18:56	E 5	10.00	Thunderstorm in Vicinity	SCT036 SCT045	86	75			70%	NA	95	29.84	1010.5
26	17:56	SE 5	10.00	A Few Clouds	FEW042	87	74			65%	NA	95	29.84	1010.3
26	16:56	S 6	7.00	A Few Clouds	FEW050	87	74			65%	NA	95	29.83	1010.2
26	15:56	W 9	10.00	Partly Cloudy	SCT030	85	74			70%	NA	93	29.85	1010.7
26	14:56	SW 9	10.00	Mostly Cloudy	BKN033	86	73			65%	NA	93	29.87	1011.2
26	13:56	SW 6	10.00	Overcast	BKN028 OVC038	86	74	86	76	67%	NA	94	29.88	1011.7
26	12:56	W 7	10.00	Mostly Cloudy	BKN024	85	74			70%	NA	93	29.89	1012.1
26	11:56	W 9	10.00	Mostly Cloudy	SCT019 BKN028	84	73			70%	NA	90	29.89	1012.1
26	10:56	W 10	10.00	Mostly Cloudy	BKN017 BKN028	82	74			77%	NA	88	29.88	1011.9
26	09:56	W 7	10.00	Overcast	OVC011	80	74			82%	NA	85	29.88	1011.7
26	08:56	W 5	10.00	Overcast	OVC010	77	75			94%	NA	78	29.87	1011.4

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max. 6 hour	Min. 6 hour	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
						Temperature (ºF)							Pressure		Precipitation (in.)		
26	07:56	NW 5	10.00	Overcast	OVC007	76	75	76	74	97%	NA	75	29.87	1011.4			
26	06:56	Calm	10.00	Overcast	FEW009 BKN016 OVC031	75	74			96%	NA	NA	29.86	1010.9			
26	05:56	E 7	10.00	Overcast	BKN009 OVC013	75	74			96%	NA	NA	29.85	1010.8			
26	04:56	E 6	10.00	Overcast	SCT009 OVC016	74	73			97%	NA	NA	29.85	1010.7			
26	03:56	NE 7	10.00	Mostly Cloudy	BKN009	74	73			97%	NA	NA	29.86	1010.9			
26	02:56	E 8	10.00	Mostly Cloudy	BKN029 BKN090	75	73			94%	NA	NA	29.86	1011.2			
26	01:56	E 9	10.00	Overcast	FEW011 BKN019 OVC090	74	73	74	73	97%	NA	NA	29.89	1012.1			
26	00:56	E 13	10.00	Overcast	SCT009 BKN026 OVC037	74	72			94%	NA	NA	29.90	1012.6			
25	23:56	E 13	10.00	Overcast	BKN011 BKN042 OVC060	74	72			94%	NA	NA	29.92	1013.2			
25	22:56	E 13	10.00	Light Rain	FEW043 OVC055	73	72			96%	NA	NA	29.93	1013.5			
25	21:56	E 13	10.00	Overcast	BKN010 OVC095	73	71			94%	NA	NA	29.92	1013.2			
25	20:56	E 14	10.00	Overcast	OVC010	73	71			94%	NA	NA	29.91	1012.9			
25	19:56	E 14	10.00	Light Rain	OVC010	73	72	76	73	96%	NA	NA	29.90	1012.4			
25	18:56	E 15	10.00	Light Rain	BKN012 OVC016	75	73			94%	NA	NA	29.90	1012.4			
25	17:56	E 14	7.00	Light Rain	OVC012	76	73			91%	NA	76	29.90	1012.5			

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Weather observations for the past three days

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Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
26	13:56	SW 6	10.00	Overcast	BKN028 OVC038	86	74	86	76	67%	NA	94	29.88	1011.7			
26	12:56	W 7	10.00	Mostly Cloudy	BKN024	85	74			70%	NA	93	29.89	1012.1			
26	11:56	W 9	10.00	Mostly Cloudy	SCT019 BKN028	84	73			70%	NA	90	29.89	1012.1			
26	10:56	W 10	10.00	Mostly Cloudy	BKN017 BKN028	82	74			77%	NA	88	29.88	1011.9			
26	09:56	W 7	10.00	Overcast	OVC011	80	74			82%	NA	85	29.88	1011.7			
26	08:56	W 5	10.00	Overcast	OVC010	77	75			94%	NA	78	29.87	1011.4			
26	07:56	NW 5	10.00	Overcast	OVC007	76	75	76	74	97%	NA	75	29.87	1011.4			
26	06:56	Calm	10.00	Overcast	FEW009 BKN016 OVC031	75	74			96%	NA	NA	29.86	1010.9			
26	05:56	E 7	10.00	Overcast	BKN009 OVC013	75	74			96%	NA	NA	29.85	1010.8			
26	04:56	E 6	10.00	Overcast	SCT009 OVC016	74	73			97%	NA	NA	29.85	1010.7			
26	03:56	NE 7	10.00	Mostly Cloudy	BKN009	74	73			97%	NA	NA	29.86	1010.9			
26	02:56	E 8	10.00	Mostly Cloudy	BKN029 BKN090	75	73			94%	NA	NA	29.86	1011.2			
26	01:56	E 9	10.00	Overcast	FEW011 BKN019 OVC090	74	73	74	73	97%	NA	NA	29.89	1012.1			
26	00:56	E 13	10.00	Overcast	SCT009 BKN026 OVC037	74	72			94%	NA	NA	29.90	1012.6			
25	23:56	E 13	10.00	Overcast	BKN011 BKN042 OVC060	74	72			94%	NA	NA	29.92	1013.2			
25	22:56	E 13	10.00	Light Rain	FEW043 OVC055	73	72			96%	NA	NA	29.93	1013.5			
25	21:56	E 13	10.00	Overcast	BKN010 OVC095	73	71			94%	NA	NA	29.92	1013.2			
25	20:56	E 14	10.00	Overcast	OVC010	73	71			94%	NA	NA	29.91	1012.9			
25	19:56	E 14	10.00	Light Rain	OVC010	73	72	76	73	96%	NA	NA	29.90	1012.4			
25	18:56	E 15	10.00	Light Rain	BKN012 OVC016	75	73			94%	NA	NA	29.90	1012.4			
25	17:56	E 14	7.00		OVC012	76	73			91%	NA	76	29.90	1012.5			

				Light Rain										
25	16:56	NE 13	10.00	Overcast	OVC008	75	72			90%	NA	NA	29.91	1012.7
25	15:56	NE 12	10.00	Overcast	OVC010	74	72			94%	NA	NA	29.90	1012.5
25	14:56	NE 14 G 21	10.00	Overcast	BKN012 OVC028	76	72			88%	NA	76	29.93	1013.5
25	13:56	E 16	10.00	Light Rain	OVC010	75	73	76	71	94%	NA	NA	29.96	1014.3
25	12:56	E 16 G 23	10.00	Overcast	BKN010 OVC022	75	73			94%	NA	NA	29.97	1014.8
25	11:56	E 10	9.00	Light Rain	FEW012 BKN034 OVC050	75	74			96%	NA	NA	29.97	1014.8
25	10:56	E 8	10.00	Overcast	SCT012 OVC040	75	73			94%	NA	NA	29.97	1014.7
25	09:56	SE 6	3.00	Rain Fog/Mist	SCT010 BKN016 OVC040	73	73			100%	NA	NA	29.97	1014.9
25	08:56	Calm	3.00	Rain Fog/Mist	FEW014 BKN021 OVC048	72	72			100%	NA	NA	29.97	1014.8
25	07:56	SE 10	2.00	Rain Fog/Mist	SCT005 BKN011 OVC018	71	70	76	71	96%	NA	NA	29.96	1014.4
25	06:56	E 7	3.00	Rain Fog/Mist	SCT025 BKN039 OVC110	75	72			90%	NA	NA	29.94	1013.6
25	05:56	NE 8	10.00	Overcast	BKN025 OVC030	75	71			88%	NA	NA	29.92	1013.2
25	04:56	E 7	10.00	Light Rain	FEW025 OVC100	75	71			88%	NA	NA	29.93	1013.6
25	03:56	E 8	10.00	Overcast	OVC110	76	71			85%	NA	77	29.93	1013.4
25	02:56	E 9	10.00	A Few Clouds	FEW110	76	72			88%	NA	76	29.93	1013.5
25	01:56	E 7	10.00	Mostly Cloudy	BKN110	76	72	77	76	88%	NA	76	29.95	1014.1
25	00:56	E 8	10.00	Light Rain	CLR	76	73			91%	NA	76	29.97	1014.7
24	23:56	E 9	10.00	Partly Cloudy	SCT120	76	73			91%	NA	76	29.98	1015.1
24	22:56	E 10	10.00	Light Rain	OVC110	76	73			91%	NA	76	29.99	1015.4
24	21:56	E 8	10.00	Light Rain	OVC100	76	74			94%	NA	76	29.98	1015.1
24	20:56	E 9	10.00	Partly Cloudy	SCT120	77	74			90%	NA	78	29.97	1014.9
24	19:56	E 9	10.00	Light Rain	BKN021 OVC031	77	74	87	77	90%	NA	78	29.97	1014.9
24	18:56	E 10	10.00	Light Rain	SCT024 BKN120	79	73			82%	NA	82	29.98	1015.0
24	17:56	E 12	10.00	Mostly Cloudy	BKN024	81	72			74%	NA	85	29.98	1015.0
24	16:56	E 16	10.00			82	72			72%	NA	87	29.99	1015.4

				Mostly Cloudy	FEW024 BKN034										
24	15:56	E 13	10.00	Partly Cloudy	SCT030	83	72			70%	NA	88	30.00	1015.8	
24	14:56	E 12 G 20	10.00	A Few Clouds	FEW034	85	70			61%	NA	90	30.01	1016.2	
24	13:56	E 15 G 21	10.00	Fair	CLR	86	71	86	77	61%	NA	91	30.03	1016.8	
24	12:56	E 13	10.00	Partly Cloudy	FEW033 SCT041	85	71			63%	NA	90	30.06	1017.8	
24	11:56	E 13	10.00	Mostly Cloudy	BKN023 BKN029	83	71			67%	NA	88	30.06	1017.9	
24	10:56	E 10	10.00	Mostly Cloudy	SCT021 BKN029	82	73			74%	NA	87	30.06	1017.8	
24	09:56	E 10	10.00	A Few Clouds	FEW019	80	73			79%	NA	84	30.06	1017.8	
24	08:56	E 9	10.00	Fair	CLR	80	73			79%	NA	84	30.05	1017.4	
24	07:56	NE 7	10.00	Partly Cloudy	SCT019	77	73	77	76	88%	NA	78	30.05	1017.4	
24	06:56	NE 6	10.00	Partly Cloudy	SCT019	76	72			88%	NA	76	30.03	1016.8	
24	05:56	NE 5	10.00	Fair	CLR	76	72			88%	NA	76	30.01	1016.2	
24	04:56	Calm	10.00	Fair	CLR	76	72			88%	NA	76	30.01	1016.3	
24	03:56	SE 5	10.00	Fair	CLR	76	72			88%	NA	76	30.01	1016.1	
24	02:56	SE 5	10.00	Fair	CLR	76	72			88%	NA	76	30.02	1016.6	
24	01:56	SE 6	10.00	Fair	CLR	77	72	83	77	85%	NA	78	30.04	1017.2	
24	00:56	SE 7	10.00	Fair	CLR	77	73			88%	NA	78	30.06	1017.8	
23	23:56	SE 5	10.00	Fair	CLR	77	73			88%	NA	78	30.08	1018.4	
23	22:56	SE 7	10.00	Fair	CLR	78	73			85%	NA	80	30.08	1018.5	
23	21:56	SE 9	10.00	Fair	CLR	79	73			82%	NA	82	30.07	1018.2	
23	20:56	E 13	10.00	Fair	CLR	81	73			77%	NA	86	30.05	1017.4	
23	19:56	E 12 G 21	10.00	Partly Cloudy	SCT040	83	72	90	83	70%	NA	88	30.03	1016.8	
23	18:56	E 10	10.00	Fair	CLR	86	71			61%	NA	91	30.01	1016.0	
23	17:56	SE 10	10.00	Fair	CLR	89	68			50%	NA	93	29.99	1015.6	
23	16:56	SE 9	10.00	A Few Clouds	FEW045	90	68			48%	NA	94	30.02	1016.4	
23	15:56	E 12 G 20	10.00	Fair	CLR	90	69			50%	NA	95	30.03	1016.8	
23	14:56	E 12 G 21	10.00	Fair	CLR	90	68			48%	NA	94	30.05	1017.5	

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	Max. 6 hour	Min. 6 hour				altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr

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Weather observations for the past three days

Kissimmee Gateway Airport

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metric

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (ºF)				Relative Humidity	Wind Chill (°F)	Heat Index (°F)	Pressure		Precipitation (in.)		
						Air	Dwpt	6 hour Max.	6 hour Min.				altimeter (in)	sea level (mb)	1 hr	3 hr	6 hr
22	10:56	S 6	10.00	Fair	CLR	84	72			67%	NA	90	30.09	1018.9			
22	09:56	S 9	10.00	Fair	CLR	81	70			69%	NA	84	30.10	1019.1			
22	08:56	S 9	10.00	Fair	CLR	79	72			79%	NA	82	30.09	1018.9			
22	07:56	Calm	10.00	Fair	CLR	75	72	75	68	90%	NA	NA	30.08	1018.5			
22	06:56	SE 8	10.00	Fair	CLR	71	70			96%	NA	NA	30.07	1018.3			
22	05:56	SE 3	10.00	Fair	CLR	70	69			97%	NA	NA	30.08	1018.5			
22	04:56	Calm	10.00	Fair	CLR	69	68			96%	NA	NA	30.08	1018.6			
22	03:56	Calm	10.00	Fair	CLR	70	68			93%	NA	NA	30.09	1019.0			
22	02:56	SE 6	10.00	Fair	CLR	70	68			93%	NA	NA	30.11	1019.4			
22	01:56	S 5	10.00	Fair	CLR	71	67	74	70	87%	NA	NA	30.11	1019.4			
22	00:56	E 9	10.00	Fair	CLR	71	67			87%	NA	NA	30.09	1019.0			
21	23:56	N 6	10.00	Partly Cloudy	SCT110	71	68			90%	NA	NA	30.09	1018.7			
21	22:56	NW 3	10.00	Light Rain	SCT070 OVC100	71	67			87%	NA	NA	30.10	1019.3			
21	21:56	SW 10	10.00	Light Rain	SCT050 BKN065 BKN085	72	66			82%	NA	NA	30.11	1019.4			
21	20:56	W 8	10.00	Light Rain	FEW060 OVC085	71	68			90%	NA	NA	30.08	1018.6			
21	19:56	SE 13 G 26	10.00	Light Rain	FEW049 BKN070 OVC085	73	66	96	73	79%	NA	NA	30.06	1017.7			
21	18:56	S 24 G 38	10.00	Thunderstorm and Breezy	FEW065	77	69			77%	NA	79	30.05	1017.7			
21	17:56	N 8	10.00	Thunderstorm in Vicinity	CLR	93	68			44%	NA	97	29.96	1014.6			
21	16:56	Vrbl 3	10.00	Fair	CLR	94	66			40%	NA	97	29.95	1014.1			
21	15:56	SW 8	10.00	Partly Cloudy	SCT060	94	67			41%	NA	98	29.97	1014.9			
21	14:56	Vrbl 7	10.00	A Few Clouds	FEW050	92	68			46%	NA	96	30.00	1015.9			
21	13:56	SW 9	10.00	A Few Clouds	FEW044	91	69	91	74	49%	NA	96	30.02	1016.5			
21	12:56	SW 9	10.00	Mostly Cloudy	BKN040	89	71			55%	NA	95	30.03	1016.9			
21	11:56	W 9	10.00	Partly Cloudy	SCT031	86	73			65%	NA	93	30.05	1017.3			
21	10:56	SW 7	10.00	Mostly Cloudy	BKN020	84	74			72%	NA	91	30.04	1017.1			
21	09:56	W 6	10.00	A Few Clouds	FEW012	82	74			77%	NA	88	30.03	1016.8			
21	08:56	SW 3	10.00	Fair	CLR	79	74			85%	NA	83	30.02	1016.4			

21	07:56	Calm	10.00	Fair	CLR	74	70	74	67	88%	NA	NA	30.00	1015.9
21	06:56	Calm	10.00	Fair	CLR	68	66			93%	NA	NA	29.99	1015.3
21	05:56	Calm	10.00	Fair	CLR	68	66			93%	NA	NA	29.97	1014.7
21	04:56	Calm	10.00	Fair	CLR	69	66			90%	NA	NA	29.96	1014.6
21	02:56	SW 3	10.00	Fair	CLR	71	67			87%	NA	NA	29.95	1014.2
21	01:56	S 3	10.00	Fair	CLR	72	66	87	72	82%	NA	NA	29.96	1014.5
21	00:56	W 3	10.00	Fair	CLR	74	66			76%	NA	NA	29.97	1014.9
20	23:56	W 5	10.00	Fair	CLR	76	65			69%	NA	78	29.97	1014.9
20	22:56	W 7	10.00	Fair	CLR	78	66			67%	NA	80	29.96	1014.5
20	21:56	SW 5	10.00	Fair	CLR	80	66			62%	NA	82	29.94	1013.9
20	20:56	W 6	10.00	Fair	CLR	83	66			57%	NA	85	29.93	1013.4
20	19:56	W 6	10.00	A Few Clouds	FEW090	87	65	92	87	48%	NA	89	29.92	1013.0
20	18:56	SW 7	10.00	A Few Clouds	FEW001	89	64			43%	NA	90	29.89	1012.1
20	17:56	SW 10	10.00	Mostly Cloudy	FEW002 BKN070	90	64			42%	NA	91	29.90	1012.2
20	16:56	SW 7	10.00	A Few Clouds	FEW060	90	64			42%	NA	91	29.91	1012.7
20	15:56	W 10 G 18	10.00	Mostly Cloudy	BKN060	91	63			39%	NA	92	29.91	1012.7
20	14:56	W 12	10.00	A Few Clouds	FEW055	90	64			42%	NA	91	29.93	1013.5
20	13:56	W 6	10.00	Partly Cloudy	SCT048	88	64	88	71	45%	NA	89	29.96	1014.3
20	12:56	W 7 G 16	10.00	A Few Clouds	FEW046	85	64			50%	NA	86	29.96	1014.4
20	11:56	W 10 G 17	10.00	Partly Cloudy	SCT040	84	65			53%	NA	86	29.96	1014.4
20	10:56	W 13	10.00	A Few Clouds	FEW030	82	66			58%	NA	84	29.95	1014.2
20	09:56	SW 10	10.00	Partly Cloudy	SCT035	80	68			67%	NA	83	29.94	1013.9
20	08:56	S 7	10.00	Fair	CLR	76	69			79%	NA	77	29.94	1013.9
20	07:56	W 7	10.00	Fair	CLR	71	67	71	65	87%	NA	NA	29.93	1013.5
20	06:56	SW 5	10.00	Fair	CLR	66	65			96%	NA	NA	29.91	1012.7
20	05:56	Calm	10.00	Fair	CLR	67	66			97%	NA	NA	29.90	1012.3
20	04:56	SW 3	10.00	Fair	CLR	67	66			97%	NA	NA	29.88	1011.8
20	03:56	W 3	10.00	Fair	CLR	67	65			93%	NA	NA	29.88	1011.8
20	02:56	SW 3	10.00	Fair	CLR	68	65			90%	NA	NA	29.90	1012.4
20	01:56	W 7	10.00	Fair	CLR	69	65	82	69	87%	NA	NA	29.91	1012.7
20	00:56	W 6	10.00	Fair	CLR	70	64			82%	NA	NA	29.91	1012.8
19	23:56	W 6	10.00	Fair	CLR	71	63			76%	NA	NA	29.90	1012.6
19	22:56	W 6	10.00	Fair	CLR	71	62			73%	NA	NA	29.91	1012.6
19	21:56	W 6	10.00	Fair	CLR	75	62			64%	NA	NA	29.91	1012.6
19	20:56	W 6	10.00	Fair	CLR	78	61			56%	NA	80	29.88	1011.9
19	19:56	W 8	10.00	Fair	CLR	82	61	92	82	49%	NA	83	29.86	1011.1
19	18:56	W 12	10.00	Fair	CLR	86	55			35%	NA	85	29.83	1010.2
19	17:56	W 13 G 21	10.00	Fair	CLR	89	54			30%	NA	87	29.82	1009.7
19	16:56	W 16	10.00	Fair	CLR	90	56			32%	NA	88	29.81	1009.3
19	15:56	W 13	10.00	Fair	CLR	91	59			34%	NA	90	29.83	1010.0

Date	Time (edt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Air	Dwpt	Max.	Min.	Relative Humidity	Wind Chill (°F)	Heat Index (°F)	altimeter (in.)	sea level (mb)	1 hr	3 hr	6 hr
						Temperature (ºF)		6 hour					Pressure		Precipitation (in.)		
19	14:56	W 12	10.00	A Few Clouds	FEW065	91	59			34%	NA	90	29.84	1010.4			
19	13:56	SW 17 G 24	10.00	A Few Clouds	FEW035	90	65	91	71	44%	NA	92	29.84	1010.5			
19	12:56	SW 17 G 23	10.00	A Few Clouds	FEW036	88	70			55%	NA	93	29.86	1011.1			
19	11:56	SW 15 G 22	10.00	Partly Cloudy	SCT025 SCT029 SCT036	85	72			65%	NA	91	29.88	1011.9			

National Weather Service
Southern Region Headquarters
Fort Worth, Texas

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Last Modified: Febuary, 7 2012

Appendix F

Florida Bonneted Bat Programmatic Key 2019

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960
October 22, 2019

Shawn Zinszer
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Subject: Consultation Key for the Florida bonneted bat; 04EF2000-2014-I-0320-R001

Dear Mr. Zinszer:

This letter replaces the December 2013, Florida bonneted bat guidelines provided to the U.S. Army Corps of Engineers (Corps) to assist your agency with effect determinations within the range of the Florida bonneted bat (*Eumops floridanus*). This October 2019 revision supersedes all prior versions. The enclosed *Florida Bonneted Bat Consultation Guidelines* and incorporated *Florida Bonneted Bat Consultation Key* (Key) are provided pursuant to the U.S. Fish and Wildlife Service's (Service) authorities under the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C.1531 *et seq.*). This letter, guidelines, and Key have been assigned Service Consultation Code: 41420- 04EF2000-2014-I-0320-R001.

The purpose of the guidelines and Key is to aid the Corps (or other Federal action agency) in making appropriate effect determinations for the Florida bonneted bat under section 7 of the Act, and streamline informal consultation with the Service for the Florida bonneted bat when the proposed action is consistent with the Key. There is no requirement to use the Key. There will be cases when the use of the Key is not appropriate. These include, but are not limited to: where project specific information is outside of the scope of the Key, applicants do not wish to implement the identified survey or best management practices, or if there is new biological information about the species. In these cases, we recommend the Corps (or other Federal action agency) initiate traditional consultation pursuant to section 7 of the Act, and identify that consultation is being requested outside of the Key.

This Key uses type of habitat (*i.e*, roosting or foraging), survey results, and project size as the basis for making determinations of "may affect, but is not likely to adversely affect" (MANLAA) and "may affect, and is likely to adversely affect" (LAA). The Key is structured to focus on the type(s) of habitat that will be affected by a project. When proposed project areas provide features that could support roosting of Florida bonneted bats, it is considered roosting habitat. If evaluation of roosting habitat determines that roosting is not likely, then the area is subsequently evaluated for its value to the species as foraging habitat.

Roosting habitat

The guidelines describe the features of roosting habitat. When a project is proposed in roosting habitat, the likelihood that roosting is occurring is evaluated through surveys (*i.e.*, full acoustic or limited roost). When a roost is expected and the proposed activity will affect that roost, formal consultation is required. This is because the proposed activity is expected to take individuals through the destruction of the roost and the appropriate determination is that the project may affect, and is likely to adversely affect (LAA) the species. When roosting is expected, but all impacts to the roost can be avoided, and only foraging habitat (without roost structure) will be affected, the Service finds that it is reasonable to conclude that the proposed action is not likely to impair feeding, breeding, or sheltering. Thus, the proposed project may affect, but is not likely to affect the Florida bonneted bat (MANLAA).

The exception to this logic path is if the proposed action will affect more than 50 acres of foraging habitat in proximity to the roost. Under this scenario, we anticipate that the loss of the larger amount of foraging habitat near the roost could significantly impair feeding of young and overall breeding (*i.e.*, LAA). Consequently, these projects would require formal consultation to analyze the effect of the incidental take.

If the roost surveys demonstrate that roosting is not likely, the project is then evaluated for its effects to foraging habitat. Our evaluation of these actions is described below. The exception is for projects less than or equal to 5 acres if a limited roost survey is conducted. Limited roost surveys rely on peeping and visual surveys to determine whether roosting is likely. On these small projects, this survey strategy is believed to be more economical and is considered a reasonable effort to evaluate the potential for roosting. The Service acknowledges that this approach is less reliable in evaluating the likelihood of roosting when it is not combined with acoustic surveys. Therefore, when limited roost surveys are conducted for projects that are less than or equal to 5 acres in size and the determination is that roosting is not likely, we conclude that the proposed project may affect, but is not likely to adversely affect the species (MANLAA).

Foraging habitat

The guidelines describe the features of foraging habitat. Data informing the home range size of the Florida bonneted bats is limited. Global Positioning System (GPS) and radio-telemetry data for Florida bonneted bats documents that they move large distances and likely have large home ranges. Data from recovered GPS satellite tags on Florida bonneted bats tagged at Babcock-Webb Wildlife Management Area (BWWMA) found the maximum distance detected from a capture site was 24.2 mi (38.9 km); the greatest path length travelled in a single night was 56.3 mi (90.6 km) (Ober 2016; Webb 2018a-b). At BWWMA, researchers found that most individual locations were within one mile of the roost (point of capture) (Ober 2015). Additional data collected during the month of December documented the mean maximum distance Florida bonneted bats (n=8) with tags traveled from the roost was 9.5 mi (Webb 2018b).

The Service recognizes that the movement information comes from only one site (BWWMA and vicinity), and data are from small numbers (n=20) of tagged individuals for only short periods of time (Webb 2018a-b). We expect that across the Florida bonneted bat's range differences in

habitat quality, prey availability, and other factors will result in variable habitat use and home range sizes between locations. Foraging distances and home range sizes in high quality habitats are expected to be smaller while foraging distances and home range sizes in low quality habitat would be expected to be larger. Regardless, we use these studies as our best available information to evaluate when changes to foraging habitat may have an effect on the species ability to feed, breed, and shelter and subsequently result in incidental take. When considering where most of the nightly activity was observed, we calculate a foraging area centered on a roost with a 1 mile radius would include approximately 2,000 acres, and a foraging area centered on a 9.5 mile radius would encompass approximately 181,000 acres, on any given night.

Given the Service's limited understanding of how the Florida bonneted bat moves throughout its home range and selects foraging areas, we choose to use 50 acres of habitat as a conservative estimate to when loss of foraging habitat may affect the fitness of an individual to the extent that it would impair feeding and breeding. Projects that would remove, destroy or convert less than 50 acres of Florida bonneted bat foraging habitat are expected to result in a loss of foraging opportunities; however, this decrease is not expected to significantly impair the ability of the individual to feed and breed. Consequently, projects impacting less than 50 acres of foraging habitat that implement the identified best management practices in the Key would be expected to avoid take, and the appropriate determination is that the project may affect, but is not likely to adversely affect the species (MANLAA).

Next, the Service incorporated the level of bat activity into our Key to evaluate when a foraging area may have greater value to the species. When surveys document high bat activity, we deduce that this area has increased value and importance to the species. Thus, when high bat activity is detected in parcels with greater than 50 acres of foraging habitat, we anticipate that the loss, destruction, or conversion of this habitat could significantly impair the ability of an individual to feed and breed (*i.e.*, LAA); thus formal consultation is warranted.

If surveys do not indicate high bat activity, we anticipate that loss of this additional foraging habitat may affect, but is not likely to adversely affect the species (MANLAA). This is because although the acreage is large, the area does not appear to be important at the landscape scale of nightly foraging. Therefore, its loss is not anticipated to significantly impair the ability of an individual to feed or breed.

The exception to this approach is for projects greater than 50 acres when they occur in potential roosting habitat that is not found to support roosting or high bat activity. Under this scenario, the Service concludes that the loss of the large acreage of suitable roosting habitat has the potential to significantly impair the ability of an individual to breed or shelter (*i.e.*, LAA) because the species is cavities for roosting are expected to be limited range wide and the project will impair these limited opportunities for roosting.

Determinations

The Corps (or other Federal action agency) may reach one of several determinations when using this Key. Regardless of the determination, when acoustic bat surveys have been conducted, the Service requests that these survey results are provided to our office to increase our knowledge of

the species and improve our consultation process. Surveys results and reports should be transmitted to the Service at FBBsurveyreport@fws.gov or mail electronic file to U.S. Fish and Wildlife Service, Attention Florida bonneted bat surveys, 1339 20th Street, Vero Beach, Florida 32960. When formal consultation is requested, survey results and reports should be submitted with the consultation request to verobeach@fws.gov.

No effect: If the use of the Key results in a determination of "no effect," no further consultation is necessary with the Service. The Service recommends that the Corps (or other Federal action agency) documents the pathway used to reach the determination in the project record and proceeds with other species analyses as warranted.

May Affect, Not Likely to Adversely Affect (MANLAA): In this Key we have identified two ways that consultation can conclude informally, MANLAA-P and MANLAA-C.

> **MANLAA-P**: If the use of the Key results in a determination of "MANLAA- P," the Service concurs with this determination based on the rationale provide above, and no further consultation is necessary for the effects of the proposed action on the Florida bonneted bat. The Service recommends that the Corps (or other Federal action agency) documents the pathway used to reach the determination in the project record and proceeds with other species analyses as warranted.
>
> **MANLAA-C**: If the use of the Key results in a determination of MANLAA-C, further consultation with the Service is required to confirm that the Key has been used properly, and the Service concurs with the evaluation of the survey results. Survey results should be submitted with the consultation request.

May Affect, Likely to Adversely Affect (LAA) - When the determination in the Key is "LAA" technical assistance with the Service and modifications to the proposed action may enable the project to be reevaluated and conclude with a MANLAA-C determination. Under other circumstance, "LAA" determinations will require formal consultation.

Working with the Fish and Wildlife Foundation of Florida, the Service has established a fund to support conservation and recovery for the Florida bonneted bat. Any project that has the potential to affect the Florida bonneted bat and/or its habitat is encouraged to make a voluntary contribution to this fund. If you would like additional information about how to make a contribution and how these monies are used to support Florida bonneted bat recovery please contact Ashleigh Blackford, Connie Cassler, or José Rivera at 772-562-3909.

This revised Key is effective immediately upon receipt by the Corps. Should circumstances change or new information become available regarding the Florida bonneted bat and/or implementation of the Key, the determinations herein may be reconsidered and this Key further revised or amended. We have established an email address to collect comments on the Key and the survey protocols at: FBBguidelines@fws.gov.

Thank you for your continued cooperation in the effort to conserve fish and wildlife resources. If you have any questions regarding this Key, please contact the South Florida Ecological Services Office at 772-562-3909.

Sincerely,

Roxanna Hinzman
Field Supervisor
South Florida Ecological Services

Enclosure

Cc: electronic only
Corps, Jacksonville, Florida (Dale Beter, Muriel Blaisdell, Ingrid Gilbert, Alisa Zarbo, Melinda Charles-Hogan, Susan Kaynor, Krista Sabin, John Fellows)

LITERATURE CITED

Ober, H. 2015. Annual report to USFWS for calendar year 2015. Permit number TE23583B-1. University of Florida, Department of Wildlife Ecology and Conservation, North Florida Research and Education Center. Quincy, Florida.

Ober, H. 2016. Annual report to USFWS for calendar year 2016. Permit number TE23583B-1. University of Florida, Department of Wildlife Ecology and Conservation, North Florida Research and Education Center. Quincy, Florida.

Webb, E.N. 2018a. Email to Paula Halupa *et al.* University of Florida, Department of Wildlife Ecology and Conservation. Gainesville, Florida. April 1, 2018.

Webb, E.N. 2018b. Presentation given at Florida bonneted bat working group meeting at The Conservancy of Southwest Florida. University of Florida, Department of Wildlife Ecology and Conservation. Gainesville, Florida. May 24, 2016.

U.S. Fish and Wildlife Service
South Florida Ecological Services Office

FLORIDA BONNETED BAT CONSULTATION GUIDELINES

October - 2019

The U.S. Fish and Wildlife Service's South Florida Ecological Services Field Office (Service) developed the Florida Bonneted Bat Consultation Guidelines (Guidelines) to assist in avoiding and minimizing potential negative effects to roosting and foraging habitat, and assessing effects to the Florida bonneted bat (*Eumops floridanus*) from proposed projects. The Consultation Key within the Guidelines assists applicants in evaluating their proposed projects and identifying the appropriate consultation paths under sections 7 and 10 of the Endangered Species Act of 1973 (Act), as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). These Guidelines are primarily for use in evaluating regulatory projects where development and land conversions are anticipated. These Guidelines focus on conserving roosting structures in natural and semi-natural environments. The following Consultation Area map (Figure 1 and Figure 2, Appendix A), Consultation Flowchart (Figure 3), Consultation Key, Survey Framework (Appendices B-C), and **Best Management Practices (BMPs)** (Appendix D) are based upon the best available scientific information. As more information is obtained, these Guidelines will be revised as appropriate. If you have comments, or suggestions on these Guidelines or the Survey Protocols (Appendix B and C), please email your comments to FBBguidelines@fws.gov. These comments will be reviewed and incorporated in an annual review.

Terms in **bold** are further defined in the Glossary.

Wherever possible, proposed development projects within the Consultation Area should be designed to avoid and minimize take of Florida bonneted bats and to retain their habitat. Applicants are encouraged to enter into early technical assistance/consultation with the Service so we may provide recommendations for avoiding and minimizing adverse effects. Although these Guidelines focus on the effects of a proposed action (*e.g.*, development) on natural habitat, (*i.e.*, non-urban), Appendix E also provides Best Management Practices for Land Management Projects.

If you are renovating an existing artificial structure (*e.g.*, building) within the urban environment with or without additional ground disturbing activities, these Guidelines do not apply. The Service is developing separate guidelines for consultation in these situations. Until the urban guidelines are complete, please contact the Service for additional guidance.

The final listing rule for the Florida bonneted bat (Service 2013) describes threats identified for the species. Habitat loss and degradation, as well as habitat modification, have historically affected the species. Florida bonneted bats are different from most other Florida bat species because they are reproductively active through most of the year, and their large size makes them capable of foraging long distances from their roost (Ober *et al.* 2016). Consequently, this species is vulnerable to disturbances around the roost during a greater portion of the year and considerations about foraging habitat extend further than the localized roost.

Use of Consultation Area, Flowchart, and Key

Figure 1 shows the Consultation Area for the Florida bonneted bat where this consultation guidance applies. For information on how the Consultation Area was delineated see Appendix A. The Consultation Flowchart (Figure 3) and Consultation Key direct project proponents through a series of couplets that will provide a conclusion or determination for potential effects to the Florida bonneted bat. *Please Note: If additional listed species, or candidate or proposed species, or designated or proposed critical habitat may be affected, a separate evaluation will be needed for these species/critical habitats.*

Currently, the Consultation Flowchart (Figure 3) and Consultation Key cannot be used for actions proposed within the urban development boundary in Miami-Dade and Broward County. The urban development boundary is part of the Consultation Area, but it is excluded from these Guidelines because Florida bonneted bats use this area differently (roosting largely in artificial structures), and small natural foraging areas are expected to be important. Applicants with projects in this area should contact the Service for further guidance and individual consultation.

Determinations may be either "no effect," "may affect, but is not likely to adversely affect" (**MANLAA**), or "may affect, and is likely to adversely affect" (**LAA**). An applicant's willingness and ability to alter project designs could sufficiently minimize effects to Florida bonneted bats and allow for a **MANLAA** determination for this species (informal consultation). The Service is available for early technical assistance/consultation to offer recommendations to assist in project design that will minimize effects. When take cannot be avoided, applicants and action agencies are encouraged to incorporate compensation to offset adverse effects. The Service can assist with identifying compensation options (*e.g.,* conservation on site, conservation off-site, contributions to the Service's Florida bonneted bat conservation fund, *etc*.).

Using the Key and Consultation Flowchart

- "No effect" determinations do not need Service concurrence.
- "May affect, but is not likely to adversely affect" **MANLAA**. Applicants will be expected to incorporate the appropriate BMPs to reach a **MANLAA** determination.
    - **MANLAA-P** (in blue in Consultation Flowchart) have programmatic concurrence through the transmittal letter of these Guidelines, and therefore no further consultation with the Service is necessary unless assistance is needed in interpreting survey results.
    - **MANLAA-C** (in black in Consultation Flowchart) determinations require further consultation with the Service.
- "May affect, and is likely to adversely affect" (**LAA**) determinations require consultation with the Service. Project modifications could change the **LAA** determinations in numbers 5, 8, 9, 11, 12, and 17 to **MANLAA**. When take cannot be avoided, **LAA** determinations will require a biological opinion.
- The Service requests copies of surveys used to support all determinations. If a survey is required by the Consultation Key and the final determination is "no effect" or "MANLAA-P", send the survey to FBBsurveyreport@fws.gov , or mail electronic file to U.S. Fish and Wildlife Service, Attention Florida bonneted bat surveys, 1339 20th Street, Vero Beach, Florida 32960. If a survey is required by the Consultation Key and the determination is "MANLAA-C" or "LAA", submit the survey in the consultation request.

For the purpose of making a decision at Couplet 2: If any potential roosting structure is present, then the habitat is classified as **potential roosting habitat**, and the left half of the flowchart should be followed (see Figure 3). We recognize that roosting habitat may also be used by Florida bonneted bats for foraging. If the project site only consists of **foraging habitat** (*i.e.*, no suitable roosting structures), then the right side of the flowchart should be followed beginning at step 13.

For couplets 11 and 12: **Potential roosting habitat** is considered **Florida bonneted bat foraging habitat** when a determination is made that roosting is not likely.

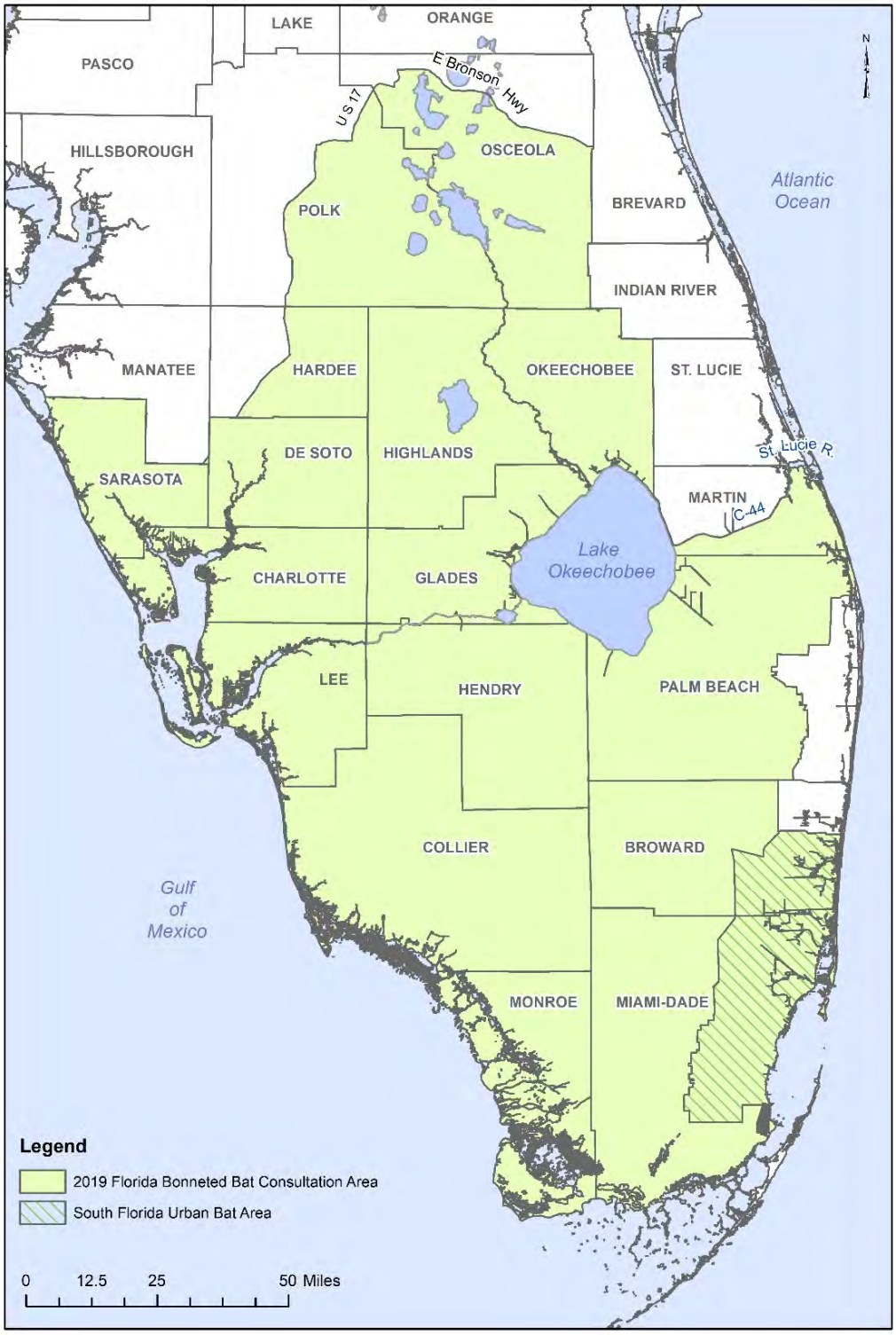

Figure 1. Florida Bonneted Bat Consultation Area. Hatched area (Figure 2) identifies the urban development boundary in Miami-Dade and Broward County. Applicants with projects in this area should contact the Service for specific guidance addressing this area and individual consultation. The Consultation Key should not be used for projects in this area.

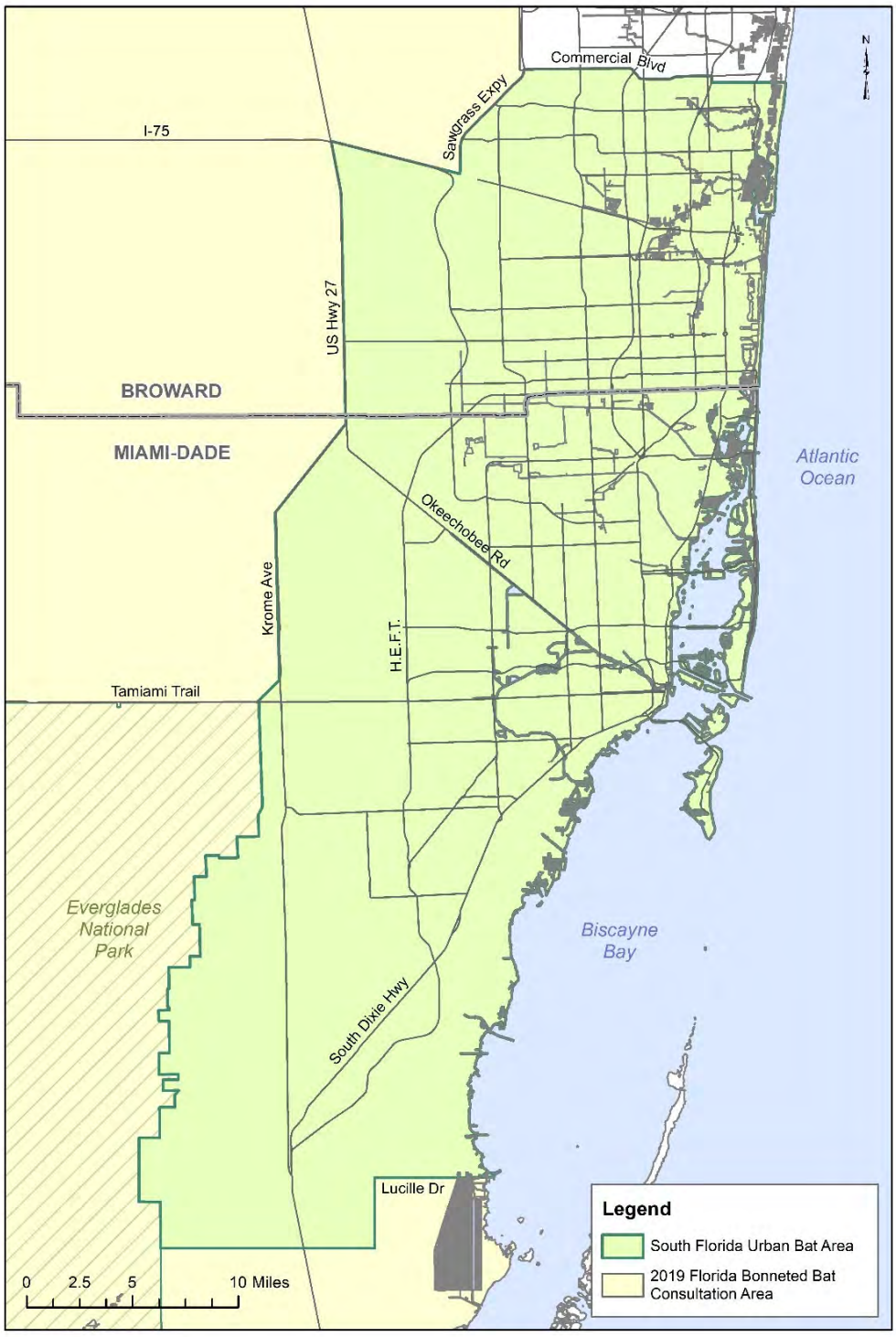

Figure 2. Urban development boundary in Miami-Dade and Broward County. The Consultation Key should not be used for projects in this area. Applicants with projects in this South Florida Urban Bat Area should contact the Service for specific guidance addressing this area and individual consultation.

Florida Bonneted Bat Consultation Key[#]

Use the following key to evaluate potential effects to the Florida bonneted bat (FBB) from the proposed project. Refer to the Glossary as needed.

1a. Proposed project or land use change is partially or wholly within the Consultation Area (Figure 1).....**Go to 2**
1b. Proposed project or land use change is wholly outside of the Consultation Area (Figure 1).....**No Effect**

2a. Potential FBB roosting habitat exists within the project area.....**Go to 3**
2b. No potential FBB roosting habitat exists within the project area.....**Go to 13**

3a. Project size/footprint* ≤ 5 acres (2 hectares)..... **Conduct Limited Roost Survey (Appendix C)** then **Go to 4**
3b. Project size/footprint* > 5 acres (2 hectares).....**Conduct Full Acoustic/Roost Surveys (Appendix B)** then **Go to 6**

4a. Results show FBB roosting is likely .....**Go to 5**
4b. Results do not show FBB roosting is likely.....**MANLAA-P if BMPs (Appendix D) used and survey reports are submitted. Programmatic concurrence.**

5a. Project will affect roosting habitat.....**LAA[+] Further consultation with the Service required.**
5b. Project will not affect roosting habitat..... **MANLAA-C with required BMPs (Appendix D). Further consultation with the Service required.**

6a. Results show some FBB activity.....**Go to 7**
6b. Results show no FBB activity.....**No Effect**

7a. Results show FBB roosting is likely.....**Go to 8**
7b. Results do not show FBB roosting is likely.....**Go to 10**

8a. Project will not affect roosting habitat.....**Go to 9**
8b. Project will affect roosting habitat.....**LAA[+] Further consultation with the Service required.**

9a. Project will affect* > 50 acres (20 hectares) (wetlands and uplands) of foraging habitat.....**LAA[+] Further consultation with the Service required.**
9b. Project will affect* ≤ 50 acres (20 hectares) (wetlands and uplands) of foraging habitat..... **MANLAA-C with required BMPs (Appendix D). Further consultation with the Service required.**

10a. Results show high FBB activity/use.....**Go to 11**
10b. Results do not show high FBB activity/use.....**Go to 12**

11a. Project will affect* > 50 acres (20 hectares) (wetlands and uplands) of FBB habitat (roosting and/or foraging).....**LAA[+] Further consultation with the Service required.**
11b. Project will affect* ≤ 50 acres (20 hectares) (wetlands and uplands) of FBB habitat (roosting and/or foraging)..... **MANLAA-C with required BMPs (Appendix D). Further consultation with the Service required.**

12a. Project will affect* > 50 acres (20 hectares) (wetlands and uplands) of FBB habitat.....**LAA[+] Further consultation with the Service required.**
12b. Project will affect* ≤ 50 acres (20 hectares) (wetlands and uplands) of FBB habitat..... **MANLAA-P if BMPs (Appendix D) used and survey reports are submitted. Programmatic concurrence.**

13a. FBB foraging habitat exists within the project area and foraging habitat will be affected…..……..**Go to 14**

13b. FBB foraging habitat exists within the project area and foraging habitat will not be affected **OR** no FBB foraging habitat exists within the project area…..……..**No Effect**

14a. Project size* > 50 acres (20 hectares) (wetlands and uplands) ……..…….....**Go to 15**

14b. Project size* ≤ 50 acres (20 hectares) (wetlands and uplands) ……...….. **MANLAA-P if BMPs (Appendix D) used. Programmatic concurrence.**

15a. Project is within 8 miles (12.9 kilometers) of high quality potential roosting areas^……..……**Conduct Full Acoustic Survey (Appendix B) and Go to 16**

15b. Project is not within 8 miles (12.9 kilometers) of high quality potential roosting area^…….....….**MANLAA-P if BMPs (Appendix D) used. Programmatic concurrence.**

16a. Results show some FBB activity……...…….....**Go to 17**

16b. Results show no FBB activity……..…….…....**No Effect**

17a. Results show high FBB activity/use……...…...…....**LAA[+] Further consultation with the Service required.**

17b. Results do not show high FBB activity/use……..……... **MANLAA-P if BMPs (Appendix D) used and survey reports submitted. Programmatic concurrence.**

[#] If you are within the urban environment and you are renovating an existing artificial structure (with or without additional ground disturbing activities), these Guidelines do not apply. The Service is developing separate guidelines for consultation in these situations. Until the urban guidelines are complete, please contact the Service for additional guidance

*****Includes wetlands and uplands that are going to be altered along with a 250- foot (76.2- meter) buffer around these areas if the parcel is larger than the altered area.

[+]Project modifications could change the **LAA** determinations in numbers 5, 8, 9, 11, 12, and 17 to **MANLAA** determinations.

^Determining if **high quality potential roosting areas** are within 8 mi (12.9 km) of a project is intended to be a desk-top exercise looking at most recent aerial imagery, not a field exercise.

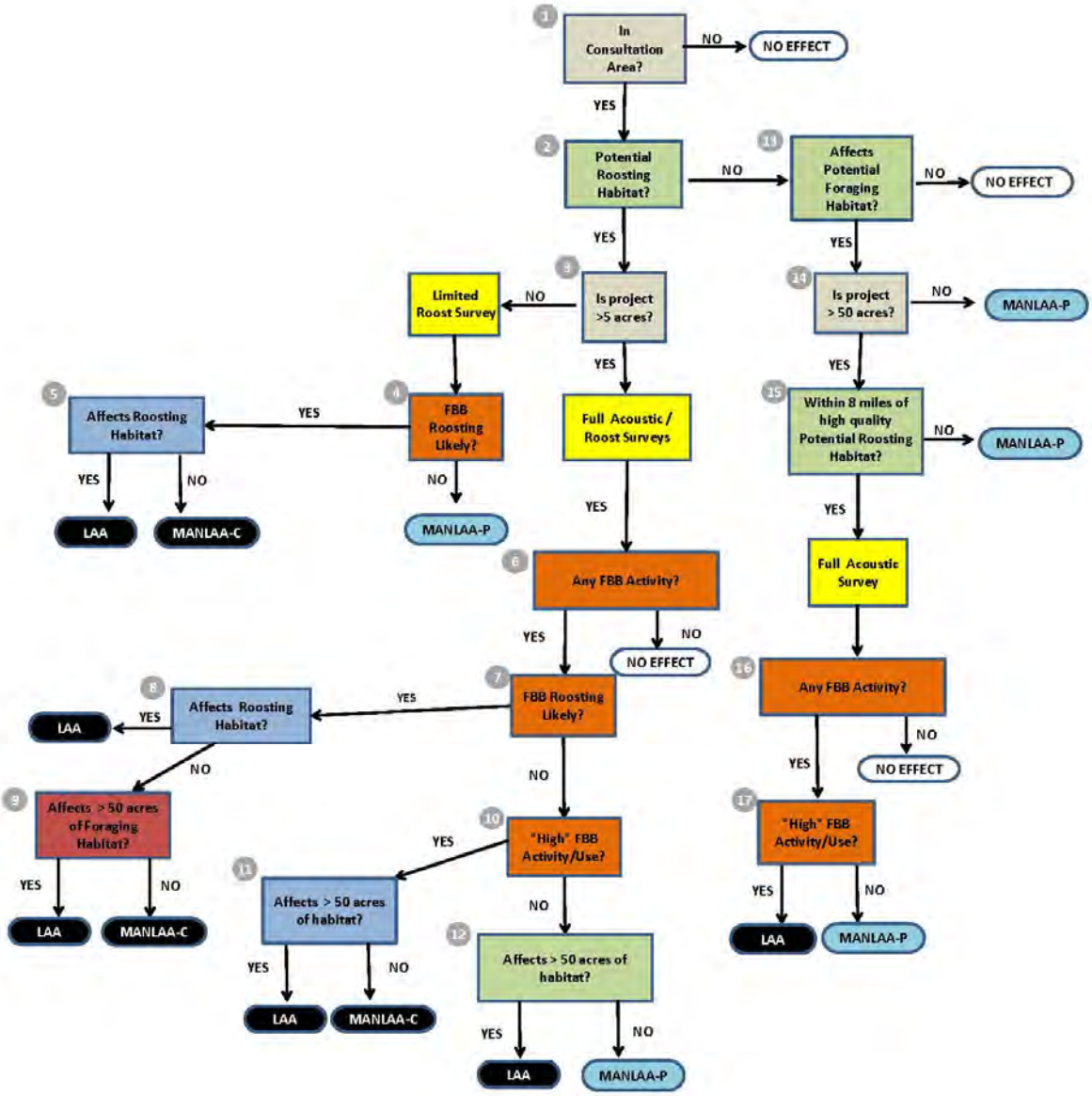

Figure 3. Florida bonneted bat Consultation Flowchart. "**No effect**" determinations do not need Service concurrence. "May affect, but not likely to adversely affect", **MANLAA-P,** in blue have programmatic concurrence through the transmittal letter of these Guidelines, and therefore no further consultation with the Service is necessary unless assistance is needed in interpreting survey results. **MANLAA-C** determinations in black require further consultation with the Service. Applicants are expected to incorporate the appropriate **BMPs** to reach a **MANLAA** determination. "May affect, and is likely to adversely affect", **LAA, (**also in black) determinations require consultation with the Service. Further consultation with the Service may identify project modifications that could change the **LAA** determinations in numbers 5, 8, 9, 11, 12, and 17 to **MANLAA** determinations. The Service requests Florida bonneted bat survey reports for all determinations.

GLOSSARY

BMPs – Best Management Practices. Recommendations for actions to conserve roosting and foraging habitat to be implemented before, during, and after proposed development, land use changes, and land management activities.

FBB Activity – Florida bonneted bat (FBB) activity is when any Florida bonneted bat calls are recorded during an acoustic survey or human observers see or hear Florida bonneted bats on a site.

FORAGING HABITAT - Comprised of relatively open (*i.e.,* uncluttered or reduced numbers of obstacles, such as fewer tree branches and leaves, in the flight environment) areas to find and catch prey, and sources of drinking water. In order to find and catch prey, Florida bonneted bats forage in areas with a reduced number of obstacles. This includes: open fresh water, permanent or seasonal freshwater wetlands, within and above wetland and upland forests, wetland and upland shrub, and agricultural lands (Bailey *et al.* 2017). In urban and residential areas drinking water, prey base, and suitable foraging can be found at golf courses, parking lots, and parks in addition to relatively small patches of natural habitat.

FULL ACOUSTIC/ROOST SURVEY - This is a comprehensive survey that will involve systematic acoustic surveys (*i.e.,* surveys conducted 30 minutes prior to sunset to 30 minutes after sunrise, over multiple consecutive nights). Depending upon acoustic results and habitat type, targeted roost searches through thorough visual inspection using a tree-top camera system or observations at emergence (*e.g.,* looking and listening for bats to come out of tree cavities around sunset) or more acoustic surveys may be necessary. See Appendix B for a full description.

HIGH FBB ACTIVITY/USE - High Florida bonneted bat (FBB) activity/use or importance of an area can be defined using several parameters (*e.g*., types of calls, numbers of calls). An area will be considered to have high FBB activity/use if **ANY** of the following are found: (a) multiple FBB feeding buzzes are detected; (b) FBB social calls are recorded; (c) large numbers of Florida bonneted bat calls (9 or more) are recorded throughout one night. Each of these parameters is considered to indicate that an area is actively used and important to FBBs, however, the Service will further evaluate the activity/use of the area within the context of the site (*i.e.,* spatial distribution of calls, site acreage, habitat on site, as well as adjacent habitat) and provide additional guidance.

HIGH QUALITY POTENTIAL ROOSTING AREAS - Sizable areas (>50 acres) [20 hectares] that contain large amounts of high-quality, natural roosting structure – (*e.g.,* predominantly native, mature trees; especially pine flatwoods or other areas with a large number of cavity trees, tree hollows, or high woodpecker activity).

LAA - May Affect, and is Likely to Adversely Affect. The appropriate conclusion if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or

beneficial [see definition of "may affect, but is not likely to adversely affect" (**MANLAA**)]. In the event the overall effect of the proposed action is beneficial to the listed species, but also is likely to cause some adverse effects, then the proposed action is "likely to adversely affect" the listed species. If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" (**LAA**) determination should be made. An "is likely to adversely affect" determination requires the initiation of formal section 7 consultation.

LIMITED ROOST SURVEY - This is a reduced survey that may include the following methods: acoustics, observations at emergence (*e.g.,* looking and listening for bats to come out of tree cavities around sunset), and visual inspection of trees with cavities or loose bark using tree-top cameras (or combination of these methods). Methods are fairly flexible and dependent upon composition and configuration of project site and willingness and ability of applicant and partners to conserve roosting structures on site. See also Appendix C for a full description.

MANLAA - May Affect, but is Not Likely to Adversely Affect. The appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. To use these Guidelines and Consultation Key applicants must incorporate the appropriate **BMPs** (Appendix D) to reach a **MANLAA** determination.

In this Consultation Key we have identified two ways that consultation can conclude informally, **MANLAA-P and MANLAA-C**:

> **MANLAA-P**: programmatic concurrence is provided through the transmittal letter of these Guidelines, no additional consultation is required with the Service for Florida bonneted bats. All survey results must be submitted to Service.
>
> **MANLAA-C**: further consultation with the Service is required to confirm that the Consultation Key has been used properly, and the Service concurs with the evaluation of the survey results. Request for consultation must include survey results.

NO EFFECT - The appropriate conclusion when the action agency determines its proposed action will not affect listed species or designated critical habitat.

POTENTIAL ROOSTING HABITAT - Includes forest and other areas with tall, mature trees or other areas with suitable roost structures (*e.g.,* utility poles, artificial structures). Forest is defined as all types including: pine flatwoods, scrubby flatwoods, pine rocklands, royal palm hammocks, mixed or hardwood hammocks, cypress, sand pine scrub, or other forest types. (Forrest types currently include exotic forests such as melaleuca, please contact the Service for additional guidance as needed). More specifically, this includes habitat in which suitable structural features for breeding and sheltering are present. In general, roosting habitat contains one or more of the following structures: tree snags, and trees with cavities, hollows, deformities, decay, crevices, or loose bark. Structural characteristics are of primary importance.

Florida bonneted bats have been found roosting in habitat with the following structural features, but may also occur outside of these parameters:

- trees greater than 33 feet (10 meters) in height, greater than 8 inches (20 centimeters) in diameter at breast height (DBH), with cavity elevations higher than 16 feet (5 meters) above ground level (Braun de Torrez 2019);
- areas with a high incidence of large or mature live trees with various deformities (*e.g.,* large cavities, hollows, broken tops, loose bark, and other evidence of decay) (*e.g.,* pine flatwoods);
- rock crevices (*e.g.,* limestone in Miami-Dade County); and/or
- artificial structures, mimicking natural roosting conditions (*e.g.,* bat houses, utility poles, buildings), situated in natural or semi-natural habitats.

In order for a building to be considered a roosting structure, it should be a minimum of 15 feet high and contain one or more of the following features: chimneys, gaps in soffits, gaps along gutters, or other structural gaps or crevices (outward entrance approximately 1 inch (2.5 centimeters) in size or greater. Structures similar to the above (*e.g.,* bridges, culverts, minimum of 15 feet high) are expected to also provide roosting habitat, based upon the species' morphology and behavior (Keeley and Tuttle 1999). Florida bonneted bat roosts will be situated in areas with sufficient open space for these bats to fly (*e.g.,* open or semi-open canopy, canopy gaps, above the canopy, and edges which provide relatively uncluttered conditions [*i.e.,* reduced numbers of obstacles, such as fewer tree branches and leaves, in the flight environment]).

For the purpose of this Consultation Key*: Roosting habitat refers to habitat with structures that can be used for daytime and maternity roosting. Roosting at night between periods of foraging can occur in a broader range of structure types. For the purposes of this guidance we are focusing on day roosting habitat.*

ROOSTING IS LIKELY– Determining likelihood of roosting is challenging. The Service has provided the following definition for the express purpose of these Guidelines. Researchers use additional cues to assist in locating roosts. As additional indicators are identified and described we expect our Guidelines will be improved.

In this Consultation Key the Service will consider the following evidence indicative that roosting is likely nearby (*i.e.,* reasonably certain to occur) if **ANY** of the following are documented: (a) Florida bonneted bat calls are recorded within 30 minutes before sunset to 1½ hours following sunset or within 1½ hours before sunrise; (b) emergence calls are recorded; (c) human observers see (or hear) Florida bonneted bats flying from or to potential roosts; (d) human observers see and identify Florida bonneted bats within a natural roost or artificial roost; and/or (e) other bat sign (*e.g*., guano, staining, etc.) is found that is identified to be Florida bonneted bat through additional follow-up.

In addition to the aforementioned events, researchers consider roosting likely in an area when (1) large numbers of Florida bonneted bat calls are recorded throughout the night (*e.g.,* ≥ 25 files per night at a single acoustic station when 5 second file lengths are recorded); (2) large numbers of FBB calls are recorded over multiple nights (*e.g.,* an average of ≥ 20 files per night from a single detector when 5 second file lengths are recorded); or (3) social calls are recorded. Because social calls and large numbers of calls recorded over one or more nights can be indicative of high

FBB activity/use or when roosting is likely, the Service is choosing not to use these as indicators to make the determination that roosting is likely. Instead we are relying on the indicators that are only expected to occur at or very close to a roost location [(a)-(e) above].

TAKE - to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct. [ESA §3(19)] Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. [50 CFR §17.3].

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Appendix A. **Delineation and Justification for Consultation Area**

The Consultation Area (Figure 1) represents the general range of the species. The Consultation Area represents the area within which consideration should be given to potential effects to Florida bonneted bats from proposed projects or actions. Coordination and consultation with the Service helps to determine whether proposed actions and activities may affect listed species. This Consultation Area defines the area where proposed actions and activities may affect the Florida bonneted bat.

This area was delineated using confirmed presence data, key habitat features, reasonable flight distances and home range sizes. Where data were lacking, we used available occupancy models that predict probability of occurrence (Bailey *et al.* 2017). Below we describe how each one of these data sources was used to determine the overall Consultation Area.

Presence data: Presence data included locations for: (1) confirmed Florida bonneted bat acoustic detections; (2) known roost sites (occupied or formerly occupied; includes natural roosts, bat houses, and utility poles); (3) live Florida bonneted bats observed or found injured; (4) live Florida bonneted bats captured during research activities; and (5) Florida bonneted bats reported as dead. The Geographic Information Systems (GIS) dataset incorporates information from January 2003 to May 2019.

The vast majority of the presence data came from acoustic surveys. The species' audible, low frequency, distinct, echolocation calls are conducive for acoustic surveys. However, there are limitations in the range of detection from ultrasonic devices, and the fast, high-flying habits of this species can confound this. Overall, detection probabilities for Florida bonneted bats are generally considered to be low. For example, in one study designed to investigate the distribution and environmental associations of Florida bonneted bat, Bailey *et al.* 2017 found overall nightly detection probability was 0.29. Based on the estimated detection probabilities in that study, it would take 9 survey nights (1 detector per night) to determine with 95% certainty whether Florida bonneted bat are present at a sampling point. Positive acoustic detection data are extremely valuable. However, it is important to recognize that there are issues with false negatives due to limitations of equipment, low detection probabilities, difference in detection due to prey availability and seasonal movement over the landscape, and in some circumstances improperly conducted surveys (*i.e.,* short duration or in unsuitable weather conditions).

Key habitat features: We considered important physical and biological features with a focus on potential roosting habitat and applied key concepts of bat conservation (*i.e*., need to conserve roosting habitat, foraging habitat, and prey base). To date, all known natural Florida bonneted bat roosts (n=19 have been found in live trees and snags of the following types: slash pine, longleaf pine, royal palm, and cypress (Braun de Torrez 2018). Several of the recent roost discoveries are located in fire-maintained vegetation communities, and it appears that Florida bonneted bats are fire-adapted and can benefit from prescribed burn regimes that closely mimic historical fire patterns (Ober *et al.* 2018).

From a landscape and roosting perspective, we consider key habitat features to include forested areas and other areas with mature trees, wetlands, areas used by red-cockaded woodpeckers

(*Picoides borealis*; RCW), and fire-managed and other conservation areas. However, recent work suggests that Florida bonneted bats do not use pinelands more than other land cover types (Bailey *et al.* 2017). In fact, Bailey *et al.* 2017 detected Florida bonneted bats in all land cover types investigated in their study (e.g., agricultural, developed, upland, and wetland). For the purposes of these consultation guidelines, we are focusing on the conservation of potential roosting habitats across the species' range. However, we also recognize the need for comprehensive consideration of foraging habitats, habitat connectivity, and long-term suitability.

Flight distances and home range sizes: Like most bats, Florida bonneted bats are colonial central-place foragers that exploit distant and scattered resources (Rainho and Palmeirim 2011). Morphological characteristics (narrow wings, high wing-aspect ratio) make *Eumops* spp. well-adapted for efficient, low-cost, swift, and prolonged flight in open areas (Findley *et al*. 1972, Norberg and Rayner 1987). Other Eumops including Underwood's mastiff bat (*Eumops underwoodi*), and Greater mastiff bat or Western mastiff bat (*Eumops perotis*) are known to forage and/or travel distances ranging from 6.2 miles to 62 miles from the roost with multiple studies documenting flight distances approximately 15- 18 miles from the roost (Tibbitts *et al* 2002, Vaugh 1959 as cited in Best *et al*. 1996, Siders *et al.* 1999, Siders 2005, Vaughan 1959 as cited in Siders 2005.)

Like other *Eumops,* Florida bonneted bats are strong fliers, capable of travelling long distances (Belwood 1992). Recent Global Positioning System (GPS) and radio-telemetry data for Florida bonneted bats documents that they also move large distances and likely have large home ranges. Data from recovered GPS satellite tags on Florida bonneted bats tagged at Babcock-Webb Wildlife Management Area (WMA), found the maximum distance detected from a capture site was 24.2 mi (38.9 km); the greatest path length travelled in a single night was 56.3 mi (90.6 km) (Ober 2016; Webb 2018a-b). Additional data collected during the month of December documented the mean maximum distance of Florida bonneted bats (n=8) with tags traveled from the roost was 9.5 mi (Webb 2018b). The Service recognizes that the movement information comes from only one site (Babcock-Webb WMA and vicinity), and data are from small numbers (n=20) of tagged individuals for only short periods of time (Webb 2018a-b). We expect that across the Florida bonneted bat's range differences in habitat quality, prey availability, and other factors will result in variable habitat use and home range sizes between locations. Foraging distances and home range sizes in high quality habitats are expected to be smaller while foraging distances and home range sizes in low quality habitat would be expected to be larger. Consequently, because Babcock-Webb WMA provides high quality roosting habitat, this movement data could represent the low end of individual flight distances from a roost.

Given the species' morphology and habits (*e.g*., central-place forager) and considering available movement data from other *Eumops* and Florida bonneted bats discussed above, we opted to use 15 miles (24 km) as a reasonable estimate of the distance Florida bonneted bats would be expected to travel from a roost on any given night. For the purposes of delineating a majority of the Consultation Area, we used available confirmed presence point location data and extended out 15 miles (24 km), with modifications for habitat features (as described above). As more movement data are obtained and made available, this distance estimate may change in the future.

Occupancy model – Research by Bailey *et al.* (2017) indicates the species' range is larger than previously known. Their model performed well across a large portion of the previously known

range when considering confirmed Florid bonneted bat locations; thus it is anticipated to be useful where limited information is available for the species.

We used the model output from Bailey *et al.* (2017) to more closely examine areas where we are data-deficient (*i.e.,* areas where survey information is particularly lacking). We considered 0.27 probability of occurrence a filter for high likelihood of occurrence because 0.27 was the model output for Babcock-Webb WMA, an area where Florida bonneted bats are known to occupy and heavily use. Large portions of Sarasota, Martin, and Palm Beach counties were identified as having probability of occurrence of 0.27. The consultation area should include areas where the species has a high likelihood of occurring. Based on this reasoned approach, all of Sarasota County, portions of Martin County, and greater parts of Palm Beach County were included in the Consultation Area.

We recognize that there are areas in the northern portion of the range where the model is less successful predicting occurrence based on the known Florida bonneted bat locations (*i.e*., the model predicts low likelihood of occurrence on Avon Park Air Force range, where the species is known to roost). Consequently, the Service is proactively working with partners to conduct surveys in the areas added based on the model to confirm that inclusion of these portions of the aforementioned counties is appropriate. The Consultation Area may be adjusted based on changes in this information.

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Appendix B: Full Acoustic / Roost Survey Framework

Purpose: The purpose of this survey is to: (1) determine if Florida bonneted bats are likely to be actively roosting or using the site; (2) locate active roost(s) and avoid the loss of the structure, if possible; and, (3) avoid or minimize the take of individuals. In some cases, changes in project designs or activities can help avoid and minimize take. For example, project proponents may be able to retain suspected roosts or conserve roosting and foraging habitats. Changing the timing or nature of activities can also help reduce the losses of non-volant young or effects to pregnant or lactating females. If properly conducted, acoustic surveys are the most effective way to determine presence and assess habitat use. If the applicant is unable to follow or does not want to follow the Full Acoustic/Roost Survey framework when recommended according to the Key, the Corps (or other Action Agency) will not be able to use these Guidelines and will need to provide a biologically supported rational using the best available information for their determination in their request for consultation.

General Description: This is a *comprehensive survey effort*, and robust acoustic surveys (*i.e.,* surveys conducted 30 minutes prior to sunset to 30 minutes after sunrise, over multiple nights) are a fundamental component of the approach. Depending upon acoustic results and habitat type, it may also include: observations at emergence (*e.g.,* emergence surveys during which observers look and listen for bats to come out of roost structures around sunset), visual inspection of trees/snags (*i.e.,* those with cavities, hollows, and loose bark) and other roost structures with tree-top cameras, or follow-up targeted acoustic surveys. Methods are dependent upon composition and configuration of project site and willingness and ability of applicant and partners to conserve roosting and foraging habitats on site.

General Survey Protocol:

[Note: The Service will provide more information in separate detailed survey protocols in the near future. This will include specific information on: detector types, placement, orientation, verification of proper functioning, analysis, reporting requirements, etc.]

- Approach is intended for project sites > 5 acres (2 hectares).
- For sites containing roosting habitat, acoustic surveys should primarily focus on assessing roosting habitat within the project site that will be lost or modified (*i.e.,* areas that will not be conserved), and locations on the property within 250 feet (76.2 meters) of areas that will not be conserved. This will help avoid or minimize the loss of an active roost and individuals. Secondarily, since part of the purpose is to determine if Florida bonneted bats are using the site, acoustic devices should also be placed near open water and wetlands to maximize chances of detection and aid in assessing foraging habitat that may be lost.
- For sites that do not contain ANY roosting habitat, but do contain foraging habitat (see Figure 3 - Consultation Flowchart and Key, Step 2 [no], Step 13 [yes]), efforts should focus on assessing foraging habitat within the project site that will be lost or modified (*i.e.,* areas that will not be conserved).
- Acoustic surveys should be performed by those who are trained and experienced in setting up, operating, and maintaining acoustic equipment; and retrieving, saving,

analyzing, and interpreting data. Surveyors should have completed one or more of the available bat acoustic courses/workshops, or be able to show similar on-the-job or academic experience (Service 2018).

- Due to the variation in the quality of recordings, the influence of clutter, the changing performances of software packages over time, and other factors, manual verification is recommended (Loeb *et al.* 2015). Files that are identified to species from auto-ID programs must be visually reviewed and manually verified by experienced personnel.
- Acoustic devices should be set up to record from 30 minutes prior to sunset to 30 minutes after sunrise for multiple nights, under suitable weather conditions.
- Acoustic surveys can be conducted any time of year as long as weather conditions meet the criteria. If any of the following weather conditions exist at a survey site during acoustic sampling, note the time and duration of such conditions, and repeat the acoustic sampling effort for that night: (a) temperatures fall below 65°F (18.3°C) during the first 5 hours of survey period; (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale) for 30 minutes or more during the first 5 hours of the survey period (Service 2018). At a minimum, nightly weather conditions for survey sites should be checked using the nearest NOAA National Weather Service station and summarized in the survey reports. Although not required at this time, it has been demonstrated that conducting surveys on warm nights late in the spring can help maximize detection probabilities (Ober *et al.* 2016; Bailey *et al.* 2017).
- Acoustic devices should be calibrated and properly placed. Microphones should be directed away from surrounding vegetation, not beneath tree canopy, away from electrical wires and transmission lines, away from echo-producing surfaces, and away from external noises. Directional microphones should be aimed to sample the majority of the flight path/zone. Omnidirectional microphones should be deployed on a pole in the center of the flight path/zone and oriented horizontally. For monitoring possible roost sites, microphones should be directed to maximize likelihood of detection.
- To standardize recordings, acoustic device recordings should have a 2-second trigger window and a maximum file length of 15 seconds.
- The number of acoustic survey sites and nights needed for the assessment is dependent upon the overall acreage of suitable habitat proposed to be impacted by the action.
    - For non-linear projects, a minimum of 16 detector nights per 20 acres of suitable habitat expected to be impacted is recommended.
    - For linear projects (*e.g.,* roadways, transmission lines), a minimum of five detector nights per 0.6 mi (0.97 km) is recommended. Detectors can be moved to multiple locations within each kilometer surveyed, but must remain in a single location throughout any given night.
    - For any site, and in particular for sites > 250 acres, please contact the Service to assist in designing an appropriate approach.
- If results of acoustic surveys show **high Florida bonneted bat activity** or **Florida bonneted bat roosting likely** (*e.g.,* high activity early in the evening) (see definitions in Glossary), follow-up methods such as emergence surveys, visual inspection of the roosting structures, or follow-up acoustic surveys are recommended to locate potential roosts. Using a combination of methods may be helpful.

- For bat emergence surveys, multiple observers should be stationed at potential roosts if weather conditions (as above) are suitable. Surveyors should be quietly stationed 30 minutes before sunset so they are ready to look and listen for emerging FBBs from sunset to 1½ hours after sunset. When conducting emergence surveys it is best to orient observers so that the roost is silhouetted in the remaining daylight; facing west can help maximize the ability to notice movement of animals out of a roost structure.
- Visual inspection of trees with cavities and loose bark during the day may be helpful. Active RCW trees should not be visually inspected during the RCW breeding season (April 15 through June 15).
- Visual inspection alone is not recommended due to the potential for roosts to be too high for cameras to reach, too small for cameras to fit, or shaped in a way that contents are out of view (Braun de Torrez *et al.* 2016).
- If roosting is suspected on site, use tree-top cameras during the day to search those trees/snags or other structures that have potential roost features (*i.e.,* cavities, hollows, crevices, or other structure for permanent shelter). If unsuccessful (*e.g.,* cannot see entire contents within a given cavity, cannot reach cavity, cannot see full extent of cavity) OR occupied roosts are found with the tree-top camera within the area in which high Florida bonneted bat activity/likely Florida bonneted bats roosting were identified, we recommend emergence surveys and/or acoustics to verify occupancy and/or identify bat species.
- Provide report showing effort, methods, weather conditions, findings, and summary of acoustic data relating to Florida bonneted bats (*e.g.,* # of calls, time of calls, and station number) organized by the date on which the data were collected. Sonograms of all calls with signatures at or below 20kHz shall be included in the report. The report shall be provided to the Corps project manager assigned to the project for which the survey was conducted and to the Service via the email address **verobeach@fws.gov. Raw acoustic data should be provided to the Service for all surveys. Raw acoustic data should be provided as "all raw data" and "all raw data with signatures at or below 20kHz". Data can be submitted to the Service via flash drive, memory stick, or hard drive. Data can be submitted digitally to verobeach@fws.gov or via mail to U.S. Fish and Wildlife Service, Attn: Florida bonneted bat data manager, 1339 20th Street, Vero Beach, Florida 32960.**
- Negative surveys are valid for 1 year after completion of the survey.

If you have comments, or suggestions on this survey protocols, please email your comments to FBBguidelines@fws.gov. These comments will be reviewed and incorporated in an annual review.

Literature Cited – Appendix B

Bailey, A.M., H.K. Ober, A.R. Sovie, and R.A. McCleery. 2017. Impact of land use and climate on the distribution of the endangered Florida bonneted bat. Journal of Mammalogy. 98:1586-1593.

Braun de Torrez, E.C., H.K. Ober, and R.A. McCleery. 2016. Use of a multi-tactic approach to locate and endangered Florida bonneted bat roost. Southeastern Naturalist 15(2):235-242.

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Ober, H.K., E.C. Braun de Torrez, J.A. Gore, A.M. Bailey, J.K. Myers, K.N. Smith, and R.A. McCleery. 2016. Social organization of an endangered subtropical species, Eumops floridanus, the Florida bonneted bat. Mammalia 2016:1-9.

U.S. Fish and Wildlife Service. 2018. Range-wide Indiana bat survey guidelines. https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2018RangewideIBatSurveyGuidelines.pdf

Appendix C: Limited Roost Survey Framework

Purpose: The purpose of this survey is to: (1) determine if Florida bonneted bats are likely to be actively roosting within suitable structures on-site; (2) locate active roost(s) and avoid the loss of the structure, if possible; and, (3) avoid or minimize the take of individuals. In some cases, changes in project designs or activities can help avoid and minimize take. For example, applicants and partners may be able to retain the suspected roosts or conserve roosting and foraging habitats. Changing the timing of activities can also help reduce the losses of non-volant young or effects to pregnant or lactating females.

General Description: This is a *reduced survey effort* that may include the following methods: visual inspection of trees/snags (*i.e.,* those with cavities, hollows, and loose bark) and other roost structures with tree-top cameras, observations at emergence (*e.g.,* emergence surveys during which observers look and listen for bats to come out of roost structures around sunset), acoustic surveys, or a combination of these methods. Methods are fairly flexible and dependent upon composition and configuration of project site and willingness and ability of applicant and partners to conserve roosting habitat on site.

General Survey Protocol:

[Note: The Service will provide more information in separate, detailed survey protocols in the near future. This will include specific information on: detector types, placement, orientation, verification of proper functioning, analysis, reporting requirements, etc.]

- Approach is **intended only for small project sites** (*i.e.,* sites ≤ 5 acres [2 hectares]).
- Efforts should focus on assessing potential roosting structures within the project site that will be lost or modified (*i.e.,* areas that will not be conserved), or are located on the property within 250 feet (76.2 meters) of areas that will not be conserved.

Identification of potential roost structures

- This step is necessary prior to any of the methods that follow.
- Run line transects through roosting habitat close enough that all trees and snags are easily inspected. Transect spacing will vary with habitat structure and season from a maximum of 91 m (300 ft) between transects in very open pine stands to 46 m (150 ft) or less in areas with dense mid-story. Transects should be oriented north to south, to optimize cavity detectability because many RCW cavity entrances are oriented in a westerly direction (Service 2004).
- Visually inspect all trees and snags or other structures for evidence of cavities, hollows, crevices that can be used for permanent shelter. Using binoculars, examine structures for cavities, loose bark, hollows, or other crevices that are large enough for Florida bonneted bats (diameter of opening > or = to 1 inch (2.5 cm) (Braun de Torrez *et al*. 2016).
- When potential roosting structures are found, record their location in the field using a Global Positioning System (GPS) unit.

Visual Inspection of trees and snags with tree-top cameras

- Visually inspect all cavities using a video probe (peeper) and assess the cavity contents.

Active RCW trees should not be visually inspected during the RCW breeding season (April 15 through June 15).

- Visual inspection alone is valid only when the entire cavity is observed and the contents can be identified. Typically, acoustics at emergence will also be needed to definitively identify bat species, if bats are present or suspected.
- If bats are suspected, or if contents cannot be determined, or if the entire cavity cannot be observed with the video probe; follow methods for an Acoustic Survey or an Emergence Survey (below). If the Corps (or other action agency) or applicant does not wish to conduct acoustic or emergence surveys, the Corps (or other action agency) cannot use the key and must request formal consultation with the Service.
- Record tree species or type of cavity structure, tree diameter and height, cavity height, cavity orientation and cavity contents.

Emergence Surveys

- For bat emergence surveys, multiple observers should be stationed at potential roosts if weather conditions (as described below in Acoustic Surveys) are suitable.
- Surveyors should be quietly stationed 30 minutes prior to sunset so they are ready to look and listen for emerging Florida bonneted bats from sunset to 1½ hours after sunset.
- When conducting emergence surveys it is best to orient observers so that the roost is silhouetted in the remaining daylight; facing west can help maximize the ability to notice movement of animals out of a roost structure.
- Record number of bats that emerged, the time of emergence, and if bat calls were heard.

Acoustic surveys

- Acoustic surveys should be performed by those who are trained and experienced in setting up, operating, and maintaining acoustic equipment; and retrieving, saving, analyzing, and interpreting data. Surveyors should have completed one or more of the available bat acoustic courses/workshops, or be able to show similar on-the-job or academic experience (Service 2018).
- Due to the variation in the quality of recordings, the influence of clutter, and the changing performances of software packages over time, and other factors, manual verification is recommended (Loeb *et al.* 2015). Files that are identified to species from auto-ID programs must be visually reviewed and manually verified by experienced personnel.
- Acoustic devices should be set up to record from 30 minutes prior to sunset to 30 minutes after sunrise for multiple nights, under suitable weather conditions.
- Acoustic surveys can be conducted any time of year as long as weather conditions meet the criteria. If any of the following weather conditions exist at a survey site during acoustic sampling, note the time and duration of such conditions, and repeat the acoustic sampling effort for that night: (a) temperatures fall below 65°F (18.3°C) during the first 5 hours of survey period; (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale) for 30 minutes or more during the first 5 hours of the survey period (Service 2018). At a minimum, nightly weather conditions for survey sites should be checked using the nearest NOAA National Weather Service station and summarized in the survey reports. Although not required at this time, it has been demonstrated that conducting surveys on

warm nights late in the spring can help maximize detection probabilities (Ober *et al.* 2016; Bailey *et al.* 2017).

- Acoustic devices should be calibrated and properly placed. Microphones should be directed away from surrounding vegetation, not beneath tree canopy, away from electrical wires and transmission lines, away from echo-producing surfaces, and away from external noises. Directional microphones should be aimed to sample the majority of the flight path/zone. Omnidirectional microphones should be deployed on a pole in the center of the flight path/zone and oriented horizontally. For monitoring possible roost sites, microphones should be directed to maximize likelihood of detection.
- To standardize recordings, acoustic device recordings should have a 2-second trigger window and a maximum file length of 15 seconds.
- Acoustic surveys should be conducted over a minimum of four nights.
- If acoustic devices cannot be left in place for the entire night for multiple nights as above, then a combination of short acoustic surveys (from sunset and extending for 1½ hours), stationed observers for emergence surveys or visual inspection of trees/snags with tree-top cameras may be acceptable. Contact the Service for guidance under this circumstance.

Reporting

- Provide report showing effort, methods, weather conditions, findings, and summary of acoustic data relating to Florida bonneted bat by date (*e.g.*, # of calls, time of calls). Sonograms of all calls with signatures at or below 20kHz shall be included in the report. The report shall be provided to the Corps project manager assigned to the project for which the survey was conducted and to the Service via the email address **verobeach@fws.gov. Raw acoustic data should be provided to the Service for all surveys. Raw acoustic data should be provided as "all raw data" and "all raw data with signatures at or below 20kHz". Data can be submitted to the Service via flash drive, memory stick, or hard drive. Data can be submitted digitally to verobeach@fws.gov or via mail to U.S. Fish and Wildlife Service, Attn: Florida bonneted bat data manager, 1339 20th Street, Vero Beach, Florida 32960.**
- Negative surveys are valid for 1 year after completion of the survey

If you have comments, or suggestions on this survey protocols, please email your comments to FBBguidelines@fws.gov. These comments will be reviewed and incorporated in an annual review.

Literature Cited – Appendix C

Bailey, A.M., H.K. Ober, A.R. Sovie, and R.A. McCleery. 2017. Impact of land use and climate on the distribution of the endangered Florida bonneted bat. Journal of Mammalogy. 98:1586-1593.

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U.S. Fish and Wildlife Service. 2018. Range-wide Indiana bat survey guidelines. https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2018RangewideIBatSurveyGuidelines.pdf

Appendix D: Best Management Practices (BMPs) for Development Projects

Ongoing research and monitoring will continue to increase the understanding of the Florida bonneted bat and its habitat needs and will continue to inform habitat and species management recommendations. These BMPs incorporate what is known about the species and also include recommendations that are beneficial to all bat species in Florida. These BMPs are intended to provide recommendations for improving conditions for use by Florida bonneted bats, and to help conserve Florida bonneted bats that may be foraging or roosting in an area.

The BMPs required to reach a "may affect, but is not likely to adversely affect" (MANLAA) determination vary depending on the couplet from the Consultation Key used to reach that particular MANLAA. The requirements for each couplet are provided below followed by the list of BMPs. If the applicant is unable or does not want to do the required BMPs, then the Corps (or other Action Agency) will not be able to use this Guidance and formal consultation with the Service is required.

Couplet Number for MANLAA from Consultation Key	Required BMPs
4b	BMP number 1 if more than 3 months has occurred between the survey and start of the project, and any 3 BMPs out of BMPs 4 through 13
5b	BMP number 2, and any 3 BMPs out of BMPs 3 through 13
9b	BMPs number 2 and 3, and any 4 BMPs out of BMPs 5 through 13
11b	BMPs number 1 and 4, and any 4 BMPs out of BMPs 5 through 13
12b	BMP number 1, and any 3 BMPs out of BMPs 3 through 13
14b	Any 2 BMPs out of BMPs 3 through 13
15b	Any 3 BMPs out of BMPs 3 through 13
17b	Any 4 BMPs out of BMPs 3 through 13

BMPs for development, construction, and other general activities:

1. If potential roost trees or structures need to be removed, check cavities for bats within 30 days prior to removal of trees, snags, or structures. When possible, remove structure outside of breeding season (*e.g.*, January 1 – April 15). If evidence of use by any bat species is observed, discontinue removal efforts in that area and coordinate with the Service on how to proceed.
2. When using heavy equipment, establish a 250 foot (76 m) buffer around known or suspected roosts to limit disturbance to roosting bats.
3. For every 5 acres of impact, retain a minimum of 1.0 acre of native vegetation. If upland habitat is impacted, then upland habitat with native vegetation should be retained.
4. For every 5 acres of impact, retain a minimum of 0.25 acre of native vegetation. If upland habitat is impacted, then upland habitat with native vegetation should be retained..
5. Conserve open freshwater and wetland habitats to promote foraging opportunities and avoid impacting water quality. Created/restored habitat should be designed to replace the function of native habitat.

6. Conserve and/or enhance riparian habitat. A 50-ft (15.2 m) buffer is recommended around water bodies and stream edges. In cases where artificial water bodies (*i.e.,* stormwater ponds) are created, enhance edges with native plantings especially in cases in which wetland habitat was affected.
7. Avoid or limit widespread application of insecticides (*e.g.,* mosquito control, agricultural pest control) in areas where Florida bonneted bats are known or expected to forage or roost.
8. Conserve natural vegetation to promote insect diversity, availability, and abundance. For example, retain or restore 25% of the parcel in native contiguous vegetation.
9. Retain mature trees and snags that could provide roosting habitat. These may include live trees of various sizes and dead or dying trees with cavities, hollows, crevices, and loose bark. See "Roosting Habitat" in "Background" above.
10. Protect known Florida bonneted bat roost trees, snags or structures and trees or snags that have been historically used by Florida bonneted bats for roosting, even if not currently occupied, by retaining a 250 foot (76 m) disturbance buffer around the roost tree, snag, or structure to ensure that roost sites remain suitable for use in the future.
11. Avoid and minimize the use of artificial lighting, retain natural light conditions, and install wildlife friendly lighting (*i.e*., downward facing and lowest lumens possible). Avoid permanent night-time lighting to the greatest extent practicable.
12. Incorporate engineering designs that discourage bats from using buildings or structures. If Florida bonneted bats take residence within a structure, contact the Service and Florida Fish and Wildlife Conservation Commission prior to attempting removal or when conducting maintenance activities on the structure.
13. Use or allow prescribed fire to promote foraging habitat.

Appendix E: Additional Best Management Practices (BMPs) for Land Management Projects

Ecological Land Management

The Service reviews and develops Ecological Land Management projects that use land management activities to restore and maintain native, natural communities that are beneficial to bats. These activities include prescribed fire, mechanical treatments to reduce vegetation densities, timber thinning to promote forest health, trail maintenance, and the treatment of exotic vegetation. The following BMPs provide recommendations for conserving Florida bonneted bat roosting and foraging habitat during ecological land management activities. The Service recommends incorporating these BMP into ecological land management plans.

If potential roost trees need to be removed, check cavities for bats prior to removal of trees or snags. If evidence of use by any bat species is observed, discontinue removal efforts in that area and coordinate with the Service on how to proceed.

Ecological Land Management BMPs:

- Protect potential roosting habitat during ecological land management activities, if feasible. Avoid removing trees or snags with cavities.
- Rake and/or manually clear vegetation around the base of known or suspected roost trees to remove fuel prior to prescribed burning.
- If possible, use ignition techniques such as spot fires or backing fire to limit the intensity of fire around the base of the tree or snag containing the roost. The purpose of this action is to prevent the known or suspected roost tree or snag from catching fire and also to attempt to limit the exposure of the roosting bats to heat and smoke. A 250-ft (76 m) buffer is recommended.
- If prescribed fire is being implemented to benefit Florida bonneted bats, Braun de Torrez et al. (2018) noted that fire in the dry/spring season could be most beneficial.
- When creating firebreaks or conducting fire-related mechanical treatment, mark and avoid any known or suspected bat roosts.
- When using heavy equipment, establish a buffer of 250 feet (76 m) around known roosts to limit disturbance to roosting bats.
- Establish forest management efforts to maintain tree species and size class diversity to ensure long-term supply of potential roost sites.
- For every 5 acres (2 hectares) of timber that is harvested, retain a clump of trees 1-2 acres (0.4 - 0.8 hectare) in size containing potential roost trees, especially pines and royal palms (live or dead). Additionally, large snags in open canopy should be preserved.

Literature Cited – Appendix E

Braun de Torrez, E.C., H.K. Ober, and R.A. McCleery. 2018. Activity of an Endangered Bat Increases Immediately Following Prescribed Fire. The Journal of Wildlife Management.