ROADWAY CONCEPTUAL ANALYSIS
ECOLOGICAL SUMMARY REPORT

Chuluota Road
from Colonial Drive to Lake Pickett Road
Orange County Project Number: Y20-830-CH

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List of Acronyms and Abbreviations

AJD	Approved Jurisdictional Determination
BA	Biological Assessment
BE	Biological Evaluation
BRP	Biodiversity Resource Priorities
CFA	Core Foraging Area
CFR	Code of Federal Regulations
CLEAR	Conservation Lands, Easements, and Recreation
CLIP	Critical Lands and Waters Identification Project
CWA	Clean Water Act
E	Endangered
EPA	Environmental Protection Agency
ERP	Environmental Resource Permit
ESA	Endangered Species Act
ESR	Ecological Summary Report
FAC	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FL-SOLARIS	Florida State Owned Lands and Records Information System
FLUCFCS	Florida Land Use, Cover, and Forms Classification System
FNAI	Florida Natural Areas Inventory
FS	Florida Statute
FWC	Florida Fish and Wildlife Conservation Commission
FWS	U.S. Fish and Wildlife Service
GP	General Permit
ISMP	Imperiled Species Management Plan
MB	Mitigation Bank
MSE	MSE Group, LLC
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NWP	Nationwide Permit
NWPR	Navigable Waters Protection Rule
OCEPD	Orange County Environmental Protection Division
OCPW	Orange County Public Works
RCA	Roadway Conceptual Analysis
RCW	Red-Cockaded Woodpecker
RHA	Rivers and Harbors Act of 1899
RHPZ	Riparian Habitat Protection Zone
ROW	Right-of-Way
SFH	Suitable Foraging Habitat
SJRWMD	St. Johns River Water Management District
SP	Standard Permit
SR	State Road

List of Acronyms and Abbreviations (Cont'd.)

SSC	Species of Special Concern
SW	Surface Water
T	Threatened
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USC	U.S. Code
USGS	U.S. Geological Survey
WL	Wetland

Executive Summary

An Ecological Summary Report (ESR) has been prepared as part of a Roadway Conceptual Analysis (RCA) study for Chuluota Road, from Colonial Drive (SR 50) to Lake Pickett Road (study corridor). This ESR documents ecological features located within the study corridor, such as wetland and/or other surface water communities and the occurrence or potential for occurrence of federally and/ or state-protected wildlife species and their habitat, and the likelihood of involvement of such features during project implementation.

Riparian Habitat Protection Zone

The Chuluota Road study corridor lies within the Econlockhatchee River Drainage Basin and includes the Riparian Habitat Protection Zones (RHPZ) of the Econlockhatchee River and its tributaries. Wetlands contiguous with Econlockhatchee River and its tributaries and the uplands within 50 feet of the wetland limits are classified as RHPZ. Some wetland systems within the Chuluota Road RCA study corridor meet RHPZ wetlands criteria via connection with Silcox Branch and Mill Branch, both named tributaries of Econlockhatchee River.

Wetlands and Other Surface Waters

Current ecological conditions within the study corridor were evaluated to determine the potential for adverse wetland impacts, other surface water impacts, and RHPZ upland impacts to the one alignment and eight stormwater management pond locations. Wetlands and/or other surface waters were aerially interpreted and verified through ground-truthing activities; these features should be delineated during the final design and permitting phase.

A summary of impacts, by type, roadway, and stormwater pond location, is provided in **Table 1**.

Table 1: Approximate Wetland and Other Surface Water Impacts Associated with Chuluota Road RCA

Wetland/Other Surface Water ID	FLUCFCS Code	Proposed Alignment Impact (ac)*	Proposed Pond ID	Proposed Pond Impact (ac)*	RHPZ Uplands (ac)*
WL-1	6170	0.33			
WL-2	6170				
WL-3	6410	0.16			
WL-7	6210		Pond 3A	0.73	1.09
WL-7	6210		Pond 3B	0.11	0.18
WL-8	6300		Pond 2B	0.97	
WL-9	6250		Pond 1B	1.22	0.07
SW-1	5130	2.73			
Upland			FC Pond 1	0.05	
TOTAL		3.22		3.08	1.34

* Impact acreages are based on approximate limits through aerial interpretation and limited ground-truthing activities.

Wetlands and other surface waters are regulated by federal, state, and local government policies. Impacts to jurisdictional wetlands and other surface waters will require coordination with regulatory agencies during the design and permitting phase and may require mitigation to offset adverse impacts. Mitigation credits, including RHPZ credits, are available through the Orange County owned TM-Econ Mitigation Bank Phase IV mitigation bank (MB) (summary of currently available mitigation is provided in **Table 2**).

Table 2: Summary of Available Mitigation Credits from TM-Econ MB Phase IV for Chuluota Road RCA.

MB	Bank Service Area	*Credits Available
TM-Econ MB Phase IV, Orange County	(18) St. Johns River (Canaveral Marshes to Wekiva), (19) Econlockhatchee River Nested, (23) Lake Jesup, part of (20) Southern St. Johns River, Boggy Creek, Lake Hart, Lake Myrtle, and East Lake Toho	227.84 State (Includes RHPZ credits) 371.836 Federal

***Based on coordination with OCEPD personnel on May 3, 2022.

Threatened and Endangered Species

A desktop review of readily available public databases was conducted to evaluate the occurrence or potential for occurrence of federally and/or state-protected wildlife species, followed by visual observations conducted via pedestrian transects throughout suitable habitat. Wildlife observations included direct (visual observation of species, scat, nests, etc.) and audible detection. A summary of protected wildlife species with potential for involvement is provided in **Table 3**.

Table 3: Summary of Federally and/or State-Protected Wildlife Species with Potential Involvement During Project Implementation

Scientific Name	Common Name	Protection Status	Findings
Reptiles			
Gopherus polyphemus	Gopher tortoise	ST	Although no burrows were observed within suitable habitat, the area is not precluded from gopher tortoises entering the property and establishing burrows. During final design, and prior to construction, a survey in accordance with the Florida Fish and Wildlife Conservation Commission's (FWC) survey protocol is recommended.
Birds			
Polyborus plancus audubonii	Audubon's Crested Caracara	FT	No crested caracaras were observed during site review, and it is anticipated that the proposed roadway improvements will not adversely affect the crested caracara; however, additional surveys may be necessary based on final design.
Antigone canadensis pratensis	Florida sandhill crane	ST	Suitable habitat is present for foraging and nesting within and adjacent to the study corridor. It is recommended that, following FWC's survey, a survey protocol be conducted between December and August for active nest sites. If no nest sites are detected, additional coordination with FWC is not required.

Protection Status Key: ST = State-Designated Threatened, FT = Federally Designated Threatened
Data Source: U.S. Fish and Wildlife Service (FWS) ECOS (FWS 2021);
Florida's endangered species, and threatened species *(FWC 2021)*

The Florida Department of Agriculture and Consumer Services (FDACS) regulates the economic use of plant species identified as endangered, threatened, or commercially exploited. A desktop review of readily available public databases of known federally and/or state-protected, or commercially exploited flora was conducted for the study corridor, followed by ground-truthing. One commercially exploited plant was identified within the study corridor:

- Saw palmetto (*Serenoa repens*)

No federally and/or state-protected plant species were identified during the ground-truth activities. FDACS does not regulate disturbance of plant species from construction activities; therefore, the presence of these plants within the study corridor will not require coordination with regulatory agencies.

Wildlife Crossings

The potential of incorporating wildlife crossings within the Chuluota Road study corridor was evaluated using several criteria, including current ecological conditions, proximity of existing conservation lands, biodiversity matrix, and proposed future development. An evaluation was conducted for one potential wildlife crossing locations along the study corridor:

- Wildlife Crossing 1 – South of Cypress Lake Glen Boulevard

Based on the wildlife known to inhabit this area, a wildlife crossing is not justified due to the lack of sustainable natural communities and a continuous corridor for wildlife movement. A wildlife crossing in this location may be reconsidered in the future, should plans to develop the area west of Chuluota Road become necessary.

1.0 Introduction

Orange County is conducting a Roadway Conceptual Analysis (RCA) study on Chuluota Road (study corridor) from Colonial Drive (SR 50) to Lake Pickett Road, consisting of approximately 1.9 miles in length (**Figures 1** and **2**). This RCA has been initiated to assess and recommend roadway enhancements that will improve safety and traffic flow within the area. The study considers the social and environmental impacts of adding travel lanes and improving other features, including drainage conveyance and treatment, a segment of pedestrian trail (East Orange Trail), sidewalk, raised medians, lighting, landscaping, and intersections.

This Ecological Summary Report (ESR) documents ecological features within the study corridor, such as wetland and/or other surface water communities and the occurrence or potential for occurrence of federally and/ or state-protected wildlife species and their habitat, and the likelihood of such features' involvement during project implementation.

2.0 Methodology

MSE biologists conducted a desktop review followed by ground-truthing activities along the study corridor. Our assessment identified and documented the presence of natural habitats, including jurisdictional wetlands and/or other surface waters; wildlife species categorized as endangered (E), threatened (T), or species of special concern (SSC) by state and federal regulations; and such species' preferred habitats. This assessment included review and analysis of the following:

- Public records, databases, handbooks, and manuals
  - Audubon Florida EagleWatch Public Nest App Database (AEW)
  - Florida Fish and Wildlife Conservation Commission (FWC) Wildlife Databases
  - Florida Department of Environmental Protection (FDEP) Map Direct
  - FDEP Statewide Land Use Database
  - Florida Natural Areas Inventory (FNAI) Rare Species and Communities Database
  - FNAI Critical Lands and Water Identification Project (CLIP)
  - U.S. Fish and Wildlife Service (FWS) Information for Planning and Consultation (IPaC)
  - St. Johns River Water Management District (SJRWMD)
  - FWS National Wetland Inventory (NWI)
  - U.S. Army Corps of Engineers (USACE) Wetland Delineation Manual
  - U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey
  - U.S. Geological Survey (USGS) Quadrangle Topographic Map (**Figures 3-1** and **3-2**).
  - Historical aerials
- Physical settings conditions (topography, soils) within the study corridor
- Vegetative communities, including wetlands and other surface waters, within the study corridor
- Evaluation of sustainable habitat for federally and/or state-protected flora and fauna
- Review of potential wildlife crossing locations
- Review of existing permits in the corridor, permitting needs of the project, and mitigation options

2.1 Wetlands and Other Surface Waters

The jurisdictional extent of wetlands and other surface water systems were identified in general accordance with USACE's 1987 *Corps of Engineers Wetlands Delineation Manual* (Technical Report Y-87-1) and

November 2010 *Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Atlantic Gulf Coastal Plan Region*, and with the State of Florida's *Delineation of the Landward Extent of Wetlands and Surface Waters* (Chapter 62-340, Florida Administrative Code [FAC]) (State of Florida 1994). If wetland boundaries differed between the two methods, the more "wetland inclusive" extent was used to designate that wetland system's boundary. The landward extent of other surface water systems was recognized to be at the top-of-bank for ditches with side slopes of 1-foot vertical to 4-feet horizontal or steeper, or using the seasonal high for swales with side slopes flatter than 1-foot vertical to 4-feet horizontal. Wetlands and other surface waters observed were classified using FDEP land use type data and the FWS classification system as described in their Classification of Wetlands and Deepwater Habitats of the United States (Cowardin, et al. December 1979).

Wetland and/or other surface waters were aerially interpreted through available GIS databases (topographic quadrangle maps, land use data, NCRS soil survey data) and verified through ground-truthing activities. Ground-truthing activities were conducted along the study corridor in February 2022 and evaluated the following items:

- Onsite vegetative communities
- Jurisdictional wetlands and/or other surface waters

In the field, wetlands (WL) and other surface waters (SW) were generally identified from south to north along the north-bound travel lane and from north to south along the south-bound travel lane. The proposed location of the stormwater management systems was classified following the nomenclature associated with the Chuluota Road RCA study, and each was evaluated for wetlands, other surface waters, and vegetative communities.

2.2 Protected Wildlife Species and Their Habitat

Database queries were conducted to evaluate the occurrence or potential for occurrence of wildlife species identified as T, E, or SSC by governing regulatory agencies, followed by ground-truth activities in February 2022. Pedestrian transects for the occurrence or potential for occurrence of federally and/or state-protected wildlife species were conducted within the study corridor. Wildlife observations included direct (visual observation of species, scat, nests, etc.) and audible detection.

3.0 General Site Conditions

3.1 Soils

The USDA NRCS Soil Survey is a comprehensive published source of information that supplies near-surface soil and depth-to-groundwater conditions. The NRCS Soil Survey of Orange County, Florida, was available and reviewed for data of near-surface soil conditions (i.e., soil unit types) within the study corridor (**Figures 4-1** and **4-2**). Soils identified within the study corridor are listed in **Table 4**.

Table 4: NRCS Soil Data Identified within the Chuluota Road RCA Study Corridor.

Map Unit	Soil Name	Hydric Status	Depth to Water Table	Drainage
2	Archbold fine sand, 0 to 5% slopes	No	42 to 60 inches	Very poorly drained
3	Basinger fine sand, frequently ponded, 0 to 1% slopes	Yes	Surface (0 inches)	Poorly drained
34	Pomello fine sand, 0 to 5% slopes	No	24 to 42 inches	Moderately well drained
37	St. Johns fine sand	No	6 to 12 inches	Poorly drained

Map Unit	Soil Name	Hydric Status	Depth to Water Table	Drainage
40	Samsula Muck, frequently ponded, 0 to 2% slopes	Yes	Surface (0 inches)	Very poorly drained
42	Sanibel Muck	Yes	Surface (0 inches)	Very poorly drained
44	Smyrna-Smyrna, wet, fine sand, 0 to 2% slopes	No	6 to 18 inches	Poorly drained
53	Wauberg fine sand	Yes	0 to 6 inches	Poorly drained
54	Zolfo fine sand, 0 to 2% slopes	No	18 to 42 inches	Somewhat poorly drained

Source: NRCS Web Soil Survey (NRCS 2019)

3.2 Land Use

FDEP's statewide land use database (FDEP 2020a) was used to characterize land use types within the study corridor. During the following ground-truth activities, land use types were field verified and revised, if necessary, based on physical observations (**Figures 5-1** and **5-2**). The dominant land uses, which consist of residential, commercial, institutional, and undeveloped, forested, and non-forested lands, are described below.

3.2.1 Uplands – Developed

FLUCFCS 1200 – Medium Density, >2 – 5 dwelling units/acre – This land use best describes single-family residential areas located north of Long Boat Lane, west of Chuluota Road.

FLUCFCS 1300 – High Density, 6 or more dwelling units/acre – This land use best describes the single-family residential areas located east and west of Chuluota Road within the study corridor.

FLUCFCS 1400 – Commercial and Services – This land use type consist of commercial businesses located within the south end of the study corridor, east and west of Chuluota Road. Review of Google Earth indicates that this area consists of gas stations and a strip mall with a variety of business.

FLUCFCS 1700 – Institutional – This land use type best identifies two public schools within the study corridor:

- Corner Lake Middle School – located west of Chuluota Road, north of East Colonial Drive.
- Columbia Elementary – located east of Chuluota Road, south of Cypress Lake Glen Boulevard.

FLUCFCS 2500 – Specialty Farms – This land use best characterizes the horse farm located west of Chuluota Road and south of Lake Pickett Road.

FLUCFCS 8140 – Roads and Highways – This land use type includes Chuluota Road, East Colonial Drive (SR 50), Lake Pickett Road, and side roads located within the study corridor.

3.2.2 Uplands – Undeveloped

FLUCFCS 1900 – Open Land – This land use type best describes an undeveloped area located east of Chuluota Road, north of Colonial Drive.

FLUCFCS 2110 – Improved Pastures – This land use best characterizes the undeveloped, open land located within the north portion of the study corridor. This land use is comprised of scattered live oak (*Quercus* spp.) and maintained bahiagrass (*Paspalum notatum*).

FLUCFCS 4110 – Pine Flatwoods – This land use describes the following undeveloped forested areas:

- East of Chuluota Road, and south of Cypress Lake Glen Boulevard.
- West of Chuluota Road, and north of Corner Lake Drive.
- West of Chuluota Road and south of Long Boat Lane.

3.2.3 Wetlands and Other Surface Waters

The NWI and FDEP's Statewide Land Use databases were reviewed for jurisdictional wetlands and/or other surface waters within the study corridor. Each wetland and/or other surface water was field verified, and their dominant vegetative species were recorded. Wetlands were then classified using Florida Land Use Cover and Forms Classification (FLUCFCS) codes to FLUCFCS Level III for specific identification of habitat. Wetland systems and other surface waters were identified from south to north along the north-bound travel lane, and north to south along the south-bound travel lane (**Figures 6-1** and **6-2**). The wetland and surface water systems delineated are discussed below:

FLUCFCS 5130 – Streams and Waterways (Upland-Cut) – This land use type best describes an upland-cut surface water system within the study corridor. Designated as SW-1, this system is located east of Chuluota Road between Cypress Lake Glen Boulevard's north and south access. SW-1 is vegetatively comprised of bahiagrass (*Paspalum notatum*), scattered Carolina willow (*Salix caroliniana*), Virginia chain fern (*Woodwardia virginica*), swamp fern (*Blechnum serrulatum*), pennywort (*Hydrocotyle* spp.), cattail (*Typha* spp.), and greenbrier (*Smilax* spp.).

FLUCFCS 5300 – Reservoirs – This land use type best classifies stormwater management ponds located adjacent to the study corridor and designated SW 2, 2a, 3 through 6, and 10 through 16 in **Figures 6-1** and **6-2**.

FLUCFCS 6170 – Mixed Wetland Hardwoods –This land use type best describes WL-1, located south of Cypress Lake Glenn Boulevard, east of Chuluota Road. This system is vegetatively comprised of a canopy of Cypress (*Taxodium* spp.), sweet bay (*Magnolia virginiana*), wax myrtle (*Myrica cerifera*), red bay (*Persea borbonia*), southern magnolia (*Magnolia grandiflora*), pines (*Pinus* spp.), Virginia chain fern, swamp fern, and greenbrier. This wetland system was placed under conservation easement (OR Book 07308, Page 2152) in support of the Cypress Lakes subdivision.

FLUCFCS 6210 – Cypress – This land use type best describes wetlands WL-2, WL-4, WL-5, and WL-6, which are located east of Chuluota Road. These systems are vegetatively compromised of cypress, pines, wax myrtle, Australian pine (*Casuarina* spp.), sweet bay, dahoon holly, camphor tree (*Cinnamomum camphora*), Brazilian pepper (*Schinus terebinthifolia*), saltbush (*Baccharis halimifolia*), swamp fern, pennywort, and greenbrier.

FLUCFCS 6300 – Wetland Forested Mixed – This land use type best characterizes wetlands WL-7, WL-8, and WL-9. These systems are vegetatively compromised of loblolly bay (*Gordonia lasianthus*), swamp bay (*Persea palustris*), red bay, sweet bay, laurel oak (*Quercus laurifolia*), slash pine (*Pinus elliottii*), pond pine (*Pinus serotina*), red maple (*Acer rubrum*), cypress, dahoon holly (*Illex cassine*), camphor tree, wax myrtle, primrose willow (*Ludwigia peruviana*), cogon grass (*Imperata cylindrica*), elderberry (*Sambucus nigra*), Virginia chain fern, swamp fern, arrowhead (*Sagittaria* spp.), grapevine (*Vitis rotundifolia*), and greenbrier. Wetlands 7 and 8 were placed under a conservation easement (OR Book 6409, Page 5387) in support of the Corner Lake development, and a portion of

WL-9 was placed under conservation easement (OR Book 06808, Page 2737) in support of the Corner Lake Kash-n-Karry development.

FLUCFCS 6410 – Freshwater Marshes – This land use best describes wetland WL-3, located north of Cypress Lake Glen Boulevard and east of Chuluota Road. This system is vegetatively compromised of scattered sweet bay, cypress, primrose willow, and wax myrtle with waterlily (*Nymphaea* spp.), pennywort, rush (*Juncus* spp.), and open water.

4.0 Protected Flora

FNAI is a non-profit conservation organization that maintains a database of recorded occurrences of rare habitat types and imperiled plant and wildlife species. FNAI classifies imperiled species on a 5-tiered rarity ranking system, both globally and state-wide, and also includes federal and state protection statuses for such species. FNAI is not a regulatory or law enforcement agency; however, FNAI's database was consulted for this study due to their comprehensive records of species occurrence.

The Florida Department of Agriculture and Consumer Services (FDACS) lists and regulates the economic use of flora identified as endangered, threatened, or commercially exploited. Typical economic uses include gathering live wild plants for resale as ornaments or harvesting of plant material (e.g., saw palmetto berries) for resale. Incidental destruction of rare flora caused by land clearing associated with construction or agriculture is not regulated or prohibited by FDACS.

The FNAI and FDACS lists of protected and commercially exploited flora were reviewed for species known to occur within Orange County, Florida, and the potential for such species to inhabit the study corridor. Protected flora species are those categorized by FWS and/or FWC as T, E, or exploited, thereby receiving a level of protection because of their status. The potential occurrence of protected flora species identified within the study corridor is based on the type of vegetative communities present. The probability of each species occurring within the study corridor is ranked using the following requirements:

1. **No** – indicates no suitable habitat is present. Suitable habitat is defined as intact natural land that is typically used by the species under consideration.
2. **Low** – indicates that marginally suitable habitat may exist within the study corridor, but the species was not observed during field observations. "Marginal" describes natural land that has been altered from its native state due to human activity, ecological succession, or conversion; however, the species under consideration could still inhabit the area.
3. **Moderate** – indicates that suitable habitat exists within the study corridor, but the species was not observed during field observations.
4. **High** – indicates that suitable habitat exists within the study corridor and the species of interest was observed during field observations.

Table 5 lists the federally and/or state-protected flora species known to occur in Orange County, Florida, and their potential for occurrence within the study corridor.

Table 5: Federally and/or State-Protected Flora Known to Occur within Orange County, Florida, and Potential for Occurrence within the Chuluota Road RCA

Scientific Name	Common Name	FWS Status	FWC Status	Occurrence Potential	Habitat
Bonamia grandiflora	Florida bonamia	T	E	No	Openings or disturbed areas in white sand scrub on central Florida ridges, with scrub oaks, sand pine, and lichens
Calopogon multiflorus	Many-flowered grass-pink	--	T	No	Dry to moist flatwoods with longleaf pine, wiregrass, and saw palmetto
Centrosema arenicola	Sand butterfly pea	--	E	Low	Sandhill, scrubby flatwoods, and dry upland woods
Clitoria fragrans	Scrub pigeonwing	T	E	Low	Turkey oak barrens with wire grass, bluejack and turkey oak; also scrub and scrubby high pine
Coelorachis tuberculosa	Piedmont jointgrass	--	T	Low	Ephemeral ponds and margins of sandhill upland lakes or depression marshes with sandy peat or sandy muck-peat
Coleataenia abscissa	Cutthroatgrass	--	E	Low	Wet flatwoods, prairies, and seepage areas
Deeringothamnus pulchellus	Beautiful pawpaw	E	E	Low	Open slash or longleaf pine flatwoods with wiregrass and dwarf live oak understory
Eriogonum longifolium var. gnaphalifolium	Scrub buckwheat	T	E	No	Sandhill, oak-hickory scrub on yellow sands, high pineland between scrub and sandhill, turkey oak barrens
Illicium parviflorum	Star anise	--	E	No	Banks of spring-run or seepage streams, bottomland forest, hydric hammock, and baygall dominated by red maple and sweet bay
Lechea cernua	Nodding pinweed	--	T	Low	Open, unshaded white sands of scrub and scrubby flatwoods; often associated with Florida rosemary (*Ceratiola ericoides*)
Lechea divaricata	Pine pinweed	--	E	Low	Scrub and scrubby flatwoods
Lupinus aridorum	Scrub lupine	E	E	No	Openings in sand pine and rosemary scrub
Lythrum flagellare	Florida loosestrife	--	E	Low	Seasonally inundated areas, such as wet prairies, floodplain marshes, and roadside ditches, in mucky or peat muck soils
Matelea floridana	Florida spiny-pod	--	E	No	Sandhill, upland pine, and dry hammock
Najas filifolia	Narrowleaf naiad	--	T	Low	Floating annual plant, prefers dark water less than 2 meters deep
Nemastylis floridana	Celestial lily	--	E	Low	Wet flatwoods (often in cabbage palm flatwoods variant), prairies, marshes, and cabbage palm hammock edges

Scientific Name	Common Name	FWS Status	FWC Status	Occurrence Potential	Habitat
Nolina atopocarpa	Florida beargrass	--	T	Low	In grassy areas of mesic and wet flatwoods
Nolina brittoniana	Britton's beargrass	E	E	Low	Scrub, sandhill, scrubby flatwoods, and xeric hammock
Ophioglossum palmatum	Hand fern	--	E	No	Old leaf bases of cabbage palms in maritime hammocks and wet hammocks
Paronychia chartacea	Paper-like nailwort	T	E	No	Sandy openings around sandhill upland lakes and karst ponds; Lake Wales Ridge scrub
Pecluma plumula	Plume polypody	--	E	Low	Wet hammocks and swamps; epiphytes on live oaks
Pecluma ptilota	Comp polypody	--	E	Low	Rockland hammocks, strand swamps, and wet woods at the base of trees and fallen logs
Platanthera integra	Yellow fringeless orchid	--	E	Low	Open wet prairies, wet flatwoods, bogs, and seepage slopes
Polygonum dentoceras	Small's jointweed	E	E	No	Open, sandy areas within scrub, mostly white sand
Prunus geniculata	Scrub plum	E	E	No	Sandhill and oak scrub
Orthochilus ecristatus	Giant orchid	--	T	Low	Sandhill, scrub, pine flatwoods, and pine rocklands
Salix floridana	Florida willow	--	E	Low	Wet, mucky soils in bottomland forests, floodplains, hydric hammocks, swamps, edges of spring-runs, and streams
Schizachyrium niveum	Pinescrub bluestem	--	E	No	White sand patches in rosemary scrub; also, sand pine scrub and oak scrub
Stylisma abdita	Scrub stylisma	--	E	No	Dry sandy soils in scrub and sandhills
Warea amplexifolia	Clasping warea	E	E	No	Limited to sunny openings with exposed sand in longleaf pine/turkey oak/wiregrass sandhills
Zephyranthes simpsonii	Redmargin zephyrlily	--	T	Moderate	Wet flatwoods and meadows; ditches and wet pasturelands
Commercially Exploited					
Encyclia tampensis	Butterfly orchid	--	--	Moderate	Epiphytic perennial in mesic hammocks, hardwood swamps, and mangrove forests; found on old live oaks, bald cypress, mangroves, and pond apples
Epidendrum conopseum	Green-fly orchid	--	--	Moderate	On trees in moist hammocks, cypress, and hardwood swamps
Lycopodiella cernua	Staghorn clubmoss	--	--	Moderate	damp areas, on ground, in full sun to shade

Scientific Name	Common Name	FWS Status	FWC Status	Occurrence Potential	Habitat
Osmunda cinnamomea	Cinnamon fern	--	--	Moderate	Swamps and wetlands
Osmunda regalis	Royal fern	--	--	Moderate	Swamps and wetlands
Rhapidophyllum hystrix	Needle palm	--	--	No	Moist-wet sites, seepage slopes, regularly but shallowly inundated floodplains, seepage swamps (especially associated with springs), hydric seepage slopes, and at times, some of the adjacent non-hydric slope, hydric hammock, moist upland bluffs adjacent to rivers
Serenoa repens	Saw palmetto	--	--	High	Wet to dry flatwoods and hammocks

E = Endangered, T = Threatened, SSC= Species of Special Concern, T S/A = Threatened Similar in Appearance
Data Source: FNAI Tracking List Orange County, Florida (FNAI 2022) Plants Institute for Systematic Botany (Wunderlin 2021); Florida Department of Agriculture (FDA) Endangered, Threatened, and Commercially Exploited Species (Florida Department of Agriculture and Consumer Services 2020-2021);

5.0 Federally and State-Protected Wildlife Species

Literature reviews and database queries were conducted to identify federally and/or state-protected wildlife species known to occur in Orange County, Florida, and the potential occurrence of such species to inhabit the study corridor. Federally and/or state-protected wildlife species are those categorized by FWS and/or FWC as T, E, or SSC, thereby receiving a level of protection due to their listed status. The potential occurrence of protected wildlife species within the study corridor is based on the and the type and quality of vegetative communities present. The probability of each wildlife species occurring within the study corridor is ranked using the following requirements:

1. **No** – Indicates no suitable habitat is present. Suitable habitat is defined as intact natural land that is typically used by a species under consideration.
2. **Low** – Indicates marginally suitable habitat may exist within the study corridor, but the species was not observed during field observations. “Marginal” describes natural land that a species under consideration could inhabit but that has been altered from its native state due to human activity, ecological succession, or conversion.
3. **Moderate** – Indicates suitable habitat exists within the study corridor, but the species was not observed during field observations.
4. **High** – Indicates suitable habitat exists within the study corridor, and the species of interest was observed during field observations.

Table 6 provides a summary of federally and/or state-protected species known to occur in Orange County, Florida, and their potential for occurrence within the study corridor. Protected wildlife species that have moderate or high potentials to occur within the study corridor are discussed in detail in the following paragraphs, as are species whose consultation areas fall within the study corridor.

Table 6: Federally- and/or State-Protected Wildlife Species Known to Occur in Orange County, Florida, and the Potential for Occurrence within the Chuluota Road RCA.

Scientific Name	Common Name	Protection Status	Occurrence Potential	Consultation Area	Habitat
Fish					
Pteronotropis welaka	Bluenose shiner	ST	No	--	Quiet backwaters and pools of blackwater streams; rivers and spring runs, usually with thick vegetation nearby
Reptiles					
Alligator mississippiensis	American alligator	FT(S/A)	Moderate	--	Various aquatic habitats
Drymarchon corais couperi	Eastern indigo snake	FT	Low	--	Wide variety of habitats
Gopherus polyphemus	Gopher tortoise	ST	Moderate	--	Sandhills, scrub, hammocks, dry prairies, flatwoods, and mixed forests
Pituophis melanoleucus mugitus	Florida pine snake	ST	Low	--	Sandhills, scrubby flatwoods, xeric hammocks, and ruderal areas
Lampropeltis extenuate	Short-tailed snake	ST	Low		Longleaf pine and xeric oak sandhills
Plestiodon reynoldsi	Sand Skink	FT	No	No	Rosemary scrub, scrubby flatwoods, sand pine, and oak scrub
Birds					
Haliaeetus leucocephalus	*Bald eagle	--	Low	--	Forested areas adjacent to bodies of water
Polyborus plancus audubonii	Audubon's Crested Caracara	FT	Low	Yes	Open country, dry prairie, and ruderal areas
Laterallus jamaicensis	Eastern black rail	FT	Low	--	Salt and freshwater marshes
Rostrhamus sociabilis	Everglade snail kite	FE	Moderate	Yes	Freshwater marshes, vegetated fringes of shallow lakes and ponds
Athene cunicularia floridana	Florida burrowing owl	ST	Low	--	Sparsely vegetated sandhills, dry prairies, and ruderal areas
Antigone canadensis pratensis	Florida sandhill crane	ST	High	--	Shallow wetlands, freshwater marshes, and wet prairies
Aphelocoma coeruluscens	Florida scrub-jay	FT	Low	Yes	Scrub and scrubby flatwoods
Egretta caerulea	Little blue heron	ST	Moderate	--	Marshes, ponds, and rivers
Picoides borealis	Red-cockaded woodpecker	FE	Low	Yes	Open, mature pine flatwoods
Egretta tricolor	Tricolored heron	ST	Moderate	--	Marshes, ponds, and rivers
Platalea ajaja	Roseate spoonbill	ST	No	--	Coastal mangroves, Brazilian pepper on man-made dredge spoil islands, and willow heads of freshwater

Scientific Name	Common Name	Protection Status	Occurrence Potential	Consultation Area	Habitat
Mycteria americana	Wood stork	FT	Moderate	--	Fresh and brackish forested wetlands, swamps, ponds, and marshes

Occurrence Potential = No, Low, Moderate, High

Consultation Area = Identified within consultation area as depicted by FWS and/or FWC GIS Data

Code Key: FE = Federally Designated Endangered, ST = State-Designated Threatened, FT = Federally Designated Threatened, FT S/A = Federal Designated Threatened due to Similar in Appearance

Data Source: FWS ECOS (FWS 2021); FNAI (FNAI 2022)

Florida's endangered species, and threatened species (FWC 2021)

*Protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act

5.1 Bald Eagle

Although the bald eagle (*Haliaeetus leucocephalus*) is delisted, the species remains protected through the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Florida has one of the densest concentrations of nesting bald eagles in the lower 48 states, with several clustered around significant lake, river, and coastal systems throughout the state (FWC 1999-2021). Bald eagles typically nest and roost in forested habitats that consist of mature canopy trees along habitat edges, allowing an unobstructed view of surrounding areas. Daytime roosts are often found in the highest trees and adjacent to shorelines. High-quality foraging habitat for bald eagles has a diversity and abundance of prey, access to shallow water, and tall trees or structures (FWC 1999-2021).

The AEW Program monitors nest sites during nesting season. Data provided on the AEW website is updated through the 2020–2021 nesting season (Audubon Society 2021). MSE biologists queried the AEW database for known bald eagle nest sites within a 1-mile radius of the study corridor. One bald eagle nest, nest ID OR074, was identified approximately 0.5 mile west of Chuluota Road (**Figure 7**). This nest has not been monitored, and its status is unknown at this time.

No nest sites were observed during site reviews. It is anticipated that the proposed project will not adversely impact the bald eagle or nesting trees. It is recommended that the database for documented bald eagle nest sites be queried, and a site review be conducted during the design and permitting phase of this project to verify nesting statuses at that time.

5.2 Federally Protected Wildlife Species

5.2.1 American Alligator

FWS considers the American alligator (*Alligator mississippiensis*) threatened due to similarity in appearance to the federally endangered American crocodile (*Crocodylus acutus*). The American alligator inhabits fresh and brackish marshes, ponds, lakes, rivers, swamps, bayous, and large spring runs; it is found in salt marsh and estuarine habitats in some parts of the state (Scott 2004). Alligators play a vital role in creating and maintaining microhabitats (gator holes), which can offer refuge to a host of species in water source habitats. A nest consists of a mound of compacted earth and vegetation, usually 4–7 feet in diameter, with nesting season occurring in the spring (Scott 2004). The alligator has a wide variety of food sources, including fish, ducks, wading birds, raccoons, and turtles.

The American alligator is known to inhabit a wide variety of aquatic habitats, including stormwater management ponds. Although this species was not observed during ground-truth activities, there is potential for the species to cross between wetland systems under Chuluota Road through drainage culverts.

The proposed roadway improvements include widening travel lanes throughout the study corridor and maintaining hydrologic connections (culverts) to systems located east and west of Chuluota Road, thus

allowing the movement of this species. Roadway improvements within this study area are not likely to adversely affect this species or its habitat.

5.2.2 Audubon's Crested Caracara

FWS lists the crested caracara (*Polyborus plancus audubonii*) as threatened. This species is typically found in dry or wet prairies with scattered cabbage palms and improved/unimproved pasturelands (FWS 2019a). Nest sites are typically found in the tallest cabbage palm in the area or other structures free of dense vegetation. Caracara birds are opportunistic feeders, with their diets consisting of insects, fish, snakes, turtles, birds, and mammals (rabbits, skunks, prairie dogs).

The study corridor lies within the northern limits of FWS's consultation area for this species (**Figure 8**) and supports suitable habitat within the northern limits of the corridor. Although suitable habitat consisting of improved pastures and scattered cabbage palms is present, this species was not observed during site reviews. If proposed impacts to cabbage palms are identified during final design, FWS may request that a formal survey be conducted using FWC's "Recommended Management Practices and Survey Protocols for Audubon's Crested Caracaras (*Caracara cheriway audubonii*) in Florida" (FWC 2001). Surveys should be conducted between January and March, when nesting is at its peak and adults are likely to be feeding nestlings, or between March and April, when chicks have fledged the nest and adults are active.

No crested caracaras were observed during site review, and it is anticipated that the proposed roadway improvements will not adversely affect the crested caracara; however, additional surveys may be necessary based on final design.

5.2.3 Florida Scrub-Jay

FWS lists the Florida scrub-jay (*Aphelocoma coerulescens*) as threatened. This species is typically found in sand pine, xeric oak scrub, and scrubby flatwoods with sandy soils and fire-dominated habitat types. The scrub-jay's diet consists mainly of acorns, arthropods, berries, seeds, and a wide variety of insects (Woolfenden and Fitzpatrick 1996).

The study corridor lies within the consultation area for the Florida scrub-jay (**Figure 9**); however, no suitable habitat is present within the study corridor. It is anticipated that this species will not be adversely impacted, and a formal survey following FWS's protocol is not anticipated for this species.

5.2.4 Red-Cockaded Woodpecker

FWS lists the red-cockaded woodpecker (RCW) (*Picoides Borealis*) as endangered. The RCW is known to inhabit mature pine forests to bore out cavities in living pines (FWS 2020). Cavity trees can be in clusters of trees found on an average of 10 acres. The size of the RCW's territory is dependent upon habitat suitability. The RCW's diet consists primarily of insects (egg, larval, and adult stages) found on or in pine trees. Large, older pine trees are preferred, as the RCW's foraging method includes flaking away bark and probing under bark (FWS 2020).

Although the study corridor lies within the RCW consultation area (**Figure 10**), no suitable habitat was identified during site reviews. It is anticipated that this species will not be adversely impacted, and formal surveys will likely not be needed.

5.2.5 Snail Kite

FWS lists the snail kite (*Rostrhamus sociabilis plumbeus*) as endangered. The snail kite is found near extensive, open freshwater marshes and lakes with shallow water and a low density of emergent vegetation of natural and artificial systems (FWS 1986). The apple snail (*Pomacea paludosa*) is the snail

kite's primary food source, making the snail kite's survival dependent on the hydrology and water quality of watersheds associated with the Everglades, Lake Okeechobee, Kissimmee Valley, and the upper St. Johns River (FWS 1986).

The study corridor lies within the FWS consultation area for this species; however, it is outside of the FWS designated "critical habitat" (**Figure 11**). Neither the snail kite nor apple snails were observed within the study corridor. If stormwater pond locations or alignments shift during the final design, it is recommended that a site review be conducted for the species. It is anticipated that the proposed project will not adversely impact the snail kite or its habitat.

5.2.6 Wood Stork

FWS lists the wood stork (*Mycteria americana*) as threatened. This species is typically found in freshwater marshes, swamps, lagoons, ponds, flooded fields, depressions in marshes, and brackish wetlands. The core foraging areas (CFA) for this species include areas of very shallow water, generally 6–10 inches in depth, where there is an abundance of small fishes and other aquatic life. These small fishes may include mosquitofish, sailfin mollies, flagfish, and several species of sunfish. Wood storks may also prey on frogs, salamanders, snakes, crayfish, insects, and baby alligators (Scott 2004). Suitable foraging habitat is defined in "The Corps of Engineers, Jacksonville District, U.S. Fish and Wildlife Service, Jacksonville Ecological Services Field Office, and State of Florida Effect Determination Key for the Wood Stork in Central and North Peninsular Florida" (USACE, FWS, FWC 2018) as "any area containing patches of relatively open (25% aquatic vegetation), calm water, and having a permanent or seasonal water depth between 2 and 15 inches."

FWS has identified a 15-mile radius CFA around known wood stork colonies. This CFA is deemed essential for reproductive success. The study corridor is within the 15-mile CFA of two wood stork colonies (**Figure 12**):

- **Lake Mary Jane** last active 2019 (FWS 2010-2019), located approximately 12.7 miles south.
- **Orlando Wetland Park** last active 2018 (FWS 2010-2019), located approximately 8.9 miles east.

Impacts to suitable foraging habitat are not anticipated to result from the proposed project. Using the "*Effect Determination Key for the Wood Stork in Central and North Peninsular Florida"* (USACE, FWS, FWC 2018) to evaluate the project's effect on the wood stork, the following were concluded:

- The project corridor is more than 2,500 feet from a colony.
- The proposed work will not affect suitable foraging habitat.

Because of this, the proposed project received a determination of "no effect" (**Attachment A***)*.

5.3 State-Protected Wildlife Species

5.3.1 Gopher Tortoise

FWC lists the gopher tortoise (*Gopherus polyphemus*) as threatened. The gopher tortoise inhabits subterranean burrows in dry upland habitats, such as longleaf pine sandhills, xeric oak hammocks, scrub, pine flatwoods, dry prairies, and coastal dunes. Gopher tortoises can also be found in pastures, ruderal fields, and grassy roadsides. To be suitable for gopher tortoises, the habitat must have well-drained sandy soils for digging burrows, herbaceous plants, and open sunny areas for nesting and basking.

Periodic natural fires play an important role in maintaining tortoise habitat by opening the canopy and promoting growth of herbaceous plants used for forage. If natural fires are suppressed, the habitat becomes

unsuitable for gopher tortoises (Cox, Inkley and Kautz December 1987). Gopher tortoise burrows are an important habitat to many native species. It is estimated that 39 invertebrates and 42 vertebrate species use gopher tortoise burrows to some degree (Cox, Inkley and Kautz December 1987). Of those species, protected species that frequently inhabit gopher tortoise burrows include the Florida pine snake, eastern indigo snake, and burrowing owl. This commensal relationship warranted field investigation for such species within the study corridor.

Although suitable habitat for the gopher tortoise was found within the northern limits of the corridor, no burrows were identified during the site review; however, this area is not precluded from gopher tortoises entering the property and establishing burrows. During final design, and prior to construction activities, it is recommended that a survey for gopher tortoise burrows be conducted in accordance with FWC's "Gopher Tortoise Permitting Guidelines" (FWC 2008/Revised Effective July 2020). Should gopher tortoise burrows be identified, coordination with FWC will be required.

5.3.2 Florida Sandhill Crane

FWC lists the Florida sandhill crane (*Antigone canadensis pratensis*) as threatened. The Florida sandhill crane is a non-migratory bird found in freshwater marshes, prairies, and pastures. Florida sandhill cranes tend to avoid areas with taller vegetation or dense forest canopies and prefer habitat with short vegetation (e.g., less than 20 inches high in uplands) (FWC 2019). The sandhill crane is often found foraging in a variety of open habitats, including roadsides. Their diet consists of berries, seeds, insects, mice, small birds, snakes, lizards, and frogs. Shallow freshwater marshes with an average water depth of 4–13 inches are critical for nesting and roosting (FWC 2019). Additionally, uplands adjacent to nesting marshes are important for young until they are able to fly (FWC 2019).

Suitable foraging and nesting habitat was found within the study corridor, and the species was observed foraging within uplands and wetlands adjacent to Chuluota Road, but no active nest sites were observed. FWC recommends conducting a survey following the Florida Sandhill Crane Survey Protocol (**Attachment B**) between December and August for active nest sites. If no active nests are detected, no additional coordination with FWC is required. The Florida sandhill crane was observed foraging within the right-of-way and WL-3 during site reviews.

5.3.3 Wading Birds

FWC lists the little blue heron (*Egretta caerulea*) and tricolored heron (*Egretta tricolor*) as threatened. These species are typically found in marshes, ponds, lakes, meadows, mudflats, lagoons, streams, mangrove lagoons, and other bodies of shallow water. Their diet consists of various types of fish, amphibians, and invertebrates. Nesting generally occurs in both coastal and freshwater environments in swamps and mangrove forests. They share nesting sites with other wading birds to form rookery colonies (Rodgers, Jr., Kale, II and Smith 1996).

These species were not observed during ground-truth activities. Measures to mitigate impacts to wetlands can be designed to provide additional benefits to wetland dependent species potentially impacted by this project.

5.4 Non-Protected Wildlife Species

In addition to federally and/or state-protected wildlife, the study corridor supports habitat for non-protected species. Wildlife species observed during site reviews include the following: great egret (*Ardea alba*), red-shoulder hawk (*Buteo lineatus*), brown anole (*Anolis sagrei*), mockingbird (*Mimus polyglottos*), and black vulture (*Coragyps atratus*). Areas within the study corridor may provide resting, nesting, and foraging

opportunities for wetland dependent wildlife species and migratory birds.

6.0 Regulatory Requirements

Federal, state, and local government agencies are charged with protecting jurisdictional wetlands and surface waters, and protected wildlife species, and their habitats. A discussion of each agency's general requirements in protecting such features is provided below.

6.1 Federal Requirements

6.1.1 U.S. Army Corps of Engineers

The Department of the Army, through its regulatory division, regulates the discharge of dredge or fill material into waters of the United States (WOTUS) under Section 404 of the Clean Water Act (CWA), and in navigable waters of the United States under Sections 9 and 10 of the Rivers and Harbors Act of 1899 (RHA) (USACE n.d.). The term "navigable waters of the United States" is defined to include all waters that are subject to the ebb and flow of the tide, and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce (33 Code of Federal Regulations. Part 329. n.d.). Since 1970, the USACE and U.S. Environmental Protection Agency (EPA) have defined wetlands under the CWA as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" and "wetlands [that] generally include swamps, marshes, bogs, and similar areas" (EPA n.d.).

On June 22, 2020, the Navigable Waters Protection Rule (NWPR) became affective codifying the definition of "water of the United States" under the CWA. The NWPR includes four categories of jurisdictional waters and provides specific exclusions for many water features that traditionally had been regulated (Federal Register Vol. 85, No 77. April 21, 2020). In this final rule, "waters of the United States" include the following:

1. Territorial seas and traditional navigable waters
2. Perennial and intermittent tributaries that contribute surface flow to such waters
3. Certain lakes, ponds, and impoundments of jurisdictional waters (dams)
4. Wetlands adjacent to other jurisdictional waters

On August 30, 2021, the U.S. District Court for the District of Arizona ordered the June 22, 2020, definition of waters of the United States vacated and remanded the NWPR. With this ruling in place, the EPA and USACE have halted the implementation of the NWPR and are interpreting waters of the United States consistent with the pre-2015 regulatory regime until further notice (EPA 2021a). The term "waters of the U.S." pre-2015 means (EPA 2021b):

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide
2. All interstate waters including interstate wetlands
3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce including any such waters:
    a. Which are or could be used by interstate or foreign travelers for recreational or other purposes; or

b. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
c. Which are used or could be used for industrial purposes by industries in interstate commerce

4. All impoundments of waters otherwise defined as waters of the United States under this definition
5. Tributaries of waters identified in paragraphs (1) through (4) of this section
6. The territorial sea
7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (s)(1) through (6) of this section
8. Waters of the United States do not include
    - prior converted cropland
    - waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria of this definition)

To determine if a wetland system meets jurisdiction under the USACE rules and regulations, an applicant may submit for an Approved Jurisdictional Determination (AJD). USACE will review wetland and/or other surface water systems within limits of a project and verify presence/absence of waters of the United States under the NWPR. If federal jurisdiction is determined, impacts to wetland systems would require coordination with USACE to obtain one of the following three types of permits (USACE Jacksonville n.d.):

- **Nationwide Permits (NWP)** – NWPs are used to allow filling of wetlands and other jurisdictional waterbodies in situations where impacts to systems will have minimal adverse environmental effect. NWPs allow certain categorical activities to take place so long as the activity does not exceed impact thresholds.
    - **NWP 14 – Linear Transportation Projects** – This permit is available for projects such as roadways, highways, railways, trails, airport runways, and taxiways. For issuance of an NWP-14, a project must have 0.5-acre or less of impacts to USACE-regulated waters, for non-tidal waters.
- **General Permits (GP)** – GPs are issued on a nationwide or regional basis for a category of activities that are substantially similar in nature and cause only minimal individual and cumulative impacts. GPs are reviewed every 5 years and have been developed to reduce the burden of the regulatory program on the public and ensure timely issuance of permits.
- **Standard Permits (SP)** – SPs are required when the proposed project does not meet the criteria of a GP or NWP. SPs require a 21-day comment period under public notice.

In addition to direct wetland impacts, USACE considers secondary impacts (lighting, noise, trash) that may result from the upland activity. During the design phase, wetlands and other surface water systems will need to be delineated in accordance with federal regulations to accurately determine impacts. Unavoidable direct and secondary impacts to “waters of the United States” may be offset through appropriate mitigation.

During final design and permitting, it will be necessary to review federal regulations at that time to determine the appropriate regulatory agency under which this project will be jurisdictional.

6.1.2 Federal Delegation

In December 2020, the Environmental Protection Agency (EPA) approved the Florida Department of Environmental Protection’s (FDEP) application to adopt the federal 404 program, known as the “State

404 Program". State assumption over the 404 program intends to streamline permitting procedures, in which both federal and state permits are required for impacts to jurisdictional wetland and surface waters.

FDEP, under Chapter 62-331, assumed jurisdiction over dredging and filling in waters of the US regulated by the State (Section 373.4145, FS) effective December 22, 2020. Section 404 of the CWA allows for authorization of activities within certain waters (state-assumed waters) to be issued by FDEP. State-assumed waters are all waters of the US that are not retained USACE. Retained Waters are "those waters which are presently used or are susceptible to use in their natural condition or by reasonable improvement to transport interstate or foreign commerce shoreward to their ordinary high-water mark, including all waters which are subject to the ebb and flow of the tide shoreward to their mean high-water mark, including wetlands adjacent thereto. The Corps will retain responsibility for permitting for the discharge of dredged or fill material in those waters identified in the Retained Waters List, as well as all waters subject to the ebb and flow of the tide shoreward to their mean high-water mark that are not specifically listed in the Retained Waters List, including wetlands adjacent thereto landward to the administrative boundary. The administrative boundary demarcating the adjacent wetlands over which jurisdiction is retained by the USACE is a 300-foot guideline established from the ordinary high-water mark or mean high tide line of the retained water" (FDEP 2020).

If impacts to state-assumed wetland systems are proposed, coordination with FDEP would be necessary to obtain the necessary permit; however, regulations should be reviewed during final design and permitting to determine which agency will review the project under federal regulations.

During the design phase, wetlands and other surface water systems will need to be delineated in accordance with federal regulations to accurately determine impacts. Unavoidable direct and secondary impacts to "waters of the United States" may be offset through appropriate mitigation.

6.1.3 U.S. Fish and Wildlife Service

FWS regulates protected wildlife species under the Endangered Species Act (ESA) of 1973. FWS typically becomes involved during the wetland permitting process through a Section 7 Consultation with USACE. In accordance with the Fish and Wildlife Coordination Act (16 USC 661-666c), consultation with FWS and FWC is necessary when "waters of any stream or other body of water are proposed or authorized to be impounded, diverted,…or otherwise controlled or modified" under a federal permit.

Section 10 of the ESA is designed to regulate a wide range of activities affecting endangered or threatened organisms and their habitats (protected resources). With some exceptions, the ESA prohibits activities affecting these protected species and their habitats unless authorized by a permit from FWS or the National Marine Fisheries Service (NMFS). Permitted activities are designed to be consistent with the conservation of the species and this action is undertaken when USACE permitting is not required.

During consultation with FWS, the agency will evaluate the project and provide one of the following determinations for each species identified within the project area:

- **No effect** – USACE has determined that the project will not adversely impact the species and no further coordination with FWS is required.
- **May affect** – USACE has determined that the proposed project may impact a protected resource. USACE will consult with FWS to take either of the following actions:
  - Request concurrence with "may affect, but not likely to adversely affect."
  - Request initiation of formal consultation for determinations of "may affect, likely to adversely affect."

  Both requests should include written analysis explaining the determination in the form of a Biological Assessment (BA) or a Biological Evaluation (BE) (FWS 2016).

Desktop analysis and site reviews did not identify critical foraging, resting, or nesting habitat within the study corridor for federally protected wildlife; therefore, coordination with FWS is not anticipated. If proposed pond locations or alignments shift during final design, additional site reviews and surveys may be warranted.

6.2 State Requirements

6.2.1 St. Johns River Water Management District

The state of Florida defines wetlands as "those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal circumstances, do support, a prevalence of vegetation typically adapted for life in saturated soils" (Chapter 62-340.200 FAC). SJRWMD regulates impacts to wetlands and/or other surface waters, pursuant to Part IV Chapter 373 of the Florida Statute (FS), and in accordance with Chapter 62-330 FAC for area of the Chuluota Road RCA. SJRWMD requires an Environmental Resource Permit (ERP) that authorizes activities in a manner that prevents flooding, manages surface water, and protects water quality, wetlands, and other surface waters.

6.2.1.1 Direct Impacts, Elimination and Reduction of Impacts

As part of the permit process, SJRWMD rules and regulations require the applicant to evaluate the elimination or reduction of impacts to wetland and/or other surface water systems. When reviewing an application, SJRWMD considers the following:

- The degree of impact to the wetland and other surface water functions caused by a proposed activity.
- Whether the impact to these functions can be mitigated.
- The practicability of design modification that could eliminate or reduce impacts to these functions, including alignment alternatives for a proposed linear system.

6.2.1.2 Secondary Impacts

Pursuant to Section 10.1.1(f) of the ERP Applicant's Handbook (AH) (General and Environmental) Volume 1 (December 22, 2022), an applicant must ensure that a regulated activity will not cause adverse secondary impacts to the water resources. Secondary impact criterion consists of the following four parts in which an applicant must provide reasonable assurance that secondary impacts from construction, alteration, and intended or reasonable expected uses of a proposed project (Section 10.2.7 AH V1):

- will not cause violations of water quality standards or adverse impacts to the functions of wetlands or other surface waters
- will not adversely impact the ecological value of uplands to federal and/or state protected aquatic and wetland dependent wildlife species for enabling existing nesting or denning by these species (excluding areas needed for foraging or wildlife corridors)
- will not impact any significant historical or archeological resource
- will not cause adverse impacts in later phases that are very closely linked and casually related to the intended project

6.2.1.3 Cumulative Impacts

Pursuant to Section 10.1.1(g) of SJRWMD's ERP AH, an applicant must provide reasonable assurance that a regulated activity will not cause unacceptable cumulative impacts to wetlands and other surface waters within the same drainage basin. Cumulative impacts to water quality are evaluated by criterion set in Section 10.1.1(C), and by evaluating impacts to functions identified in Section 10.2.2 ERP AH. If an

applicant proposes to mitigate impacts within the same drainage basin as the impacts, and if the mitigation fully offsets these impacts, then SJRWMD will consider the regulated activity to have no unacceptable cumulative impacts on wetlands and other surface waters, and the condition for issuance in section 10.1.1(g) will be satisfied.

6.2.1.4 Riparian Habitat Protection Zone

Section 13.4.3 of SJRWMD's ERP AH states wetlands abutting the Econlockhatchee River, and its tributaries support an abundance and diversity of aquatic and wetland dependent wildlife and uplands associated with these wetlands provide protection and important habitat for these wildlife species. Section 13.4.3(a)(2) identifies uplands within 50 feet landward of the landward extent of wetlands associated with Econlockhatchee River and its' tributaries as Riparian Habitat Protection Zones (RHPZ). An applicant must provide reasonable assurance that construction, alteration, operation, maintenance, removal, or abandonment of a system within the RHPZ will not adversely affect the abundance, diversity, food source or habitat of aquatic or wetland dependent species. Section 13.4.3(a)(1), AH, identifies wetlands contiguous with Econlockhatchee River and tributaries as RHPZ. Uplands 50-feet landward of wetland systems considered contiguous to tributaries of Econlockhatchee River, as identified in the AH are considered RHPZ and require mitigation to offset impacts.

6.2.1.5 Mitigation

Adverse impacts remaining following design modifications to reduce and eliminate impacts may be offset through mitigation. Mitigation is not required for regulated activities in isolated wetlands, less than 0.5-acre in size, unless the system is used by protected wildlife species; located in an area of critical concern pursuant to Chapter 380, F.S.; or the wetland, or several isolated wetlands, are of more than minimal value to fish and wildlife. Pursuant to 10.2.2.2 alterations to wholly owned ponds constructed entirely in uplands, and less than 1-acre in size, and drainage ditches constructed in uplands will not require mitigation, unless these systems are found to provide significant habitat for protected wildlife species. Secondary impacts will not be considered adverse if an upland buffer, with a minimum of 15ft and average of 25ft, is provided around wetlands systems that will remain.

Direct and secondary wetland and RHPZ upland impacts may be offset through available mitigation options (e.g., preservation, creation, mitigation banking, etc). During the final design and permitting of the proposed project, wetlands and other surface water limits should be delineated in accordance with current regulations to accurately identify impacts. Mitigation to offset adverse wetland and/or other surface water impacts after reasonable attempts to reduce and/or eliminate impacts has been met, can be done through the purchase of mitigation credits from an approved mitigation bank. Mitigation credits to offset impacts to RHPZ wetlands and uplands must come from an approved bank with RHPZ credits.

6.2.2 Florida Fish and Wildlife Conservation Commission

Under Article IV Section 9 of the Florida Constitution, FWC has the authority to "exercise regulatory and executive powers of the state with respect to wildlife animal life and freshwater aquatic life" (FWC 2016, Ammended 2018). State-protected wildlife species, prohibitions, and permits are identified in Chapter 68A-27 FAC. FWC maintains Florida's Imperiled Species Management Plan 2016-2026 (FWC 2016, Ammended 2018), which is designed to conserve 57 fish and wildlife species over the next 10 years. FWC's Species Conservation Planning Section issue permits authorizing impacts to Florida's protected land-dwelling wildlife. Protected wildlife species are those identified as endangered, threatened, or species of special concern, as well as migratory birds and other species protected by state rules. Species Conservation Measures and Permitting Guidelines have been developed for 26 species to assist in

determining permit needs and minimizing impacts to wildlife. The guidelines are intended to provide clear information on requirements established in the FAC related to intentional and incidental take permitting, and guidance on species range, survey methodology, and recommended practices (FWC 2016, Draft Guidelines for 2021).

Desktop analysis and site review of the study corridor did not identify critical foraging, resting, or nesting state protected wildlife species; however, during final design and permitting it is recommended that the project corridor be re-evaluated for state protected wildlife species such as the gopher tortoise, as it may move into the area. Coordination with FWC should be based on surveys conducted at that time.

6.3 Local Government

6.3.1 Orange County Environmental Protection Division

The Orange County Environmental Protection Division (OCEPD) is a local government agency that regulates wetlands pursuant to Article X – Wetland Conservations Areas Section 15 (Orange County Government 2019). This ordinance classifies wetland systems by size, hydrologic connection, and use of the system by protected wildlife species. All wetland systems within unincorporated Orange County, Florida, are classified using the following criteria:

- Class I – System has a hydrologic connection to natural surface water bodies, or lake littoral zone; is 40 acres or larger in size; or provides critical habitat to federal- and/or state-protected wildlife species
- Class II – System consists of isolated wetlands or formerly isolated wetlands that have been altered to have a direct connection to other surface water drainage, and the system is greater than or equal to 5 acres or is not otherwise classified as a Class I wetland
- Class III – System is isolated wetland less than 5 acres and does not qualify as a Class I or Class II system

Class I wetland systems receive the greatest protection and may be impacted only when no alternative exists for the reasonable use of the land where there is an overriding public benefit. Class II wetland systems may be impacted except when contrary to public interest. Class III wetland systems may be impacted in every case.

OCEPD evaluates secondary impacts like that of SJRWMD with a 15-foot minimum, 25-foot average width into a system. In addition, direct and secondary impacts may be offset through appropriate mitigation.

7.0 Potential Impacts to Wetlands, Surface Waters, Wildlife, and Their Habitat

7.1 Potential Wetland and/or Other Surface Water and RHPZ Upland Impacts

Current ecological conditions within the study corridor were evaluated to determine the potential for adverse wetland and/or other surface water impacts, and RHPZ upland impacts associated with one alignment and 8 stormwater management pond locations. The potential for adverse impacts wetlands, surface waters, RHPZ, flora and fauna are described below.

7.1.1 Direct Impacts

This RCA corridor lies within the Econlockhatchee River Drainage Basin and includes RHPZ of the Econlockhatchee River and its tributaries (**Figure 13**). Section 13.4.3(a)(1), AH, identifies wetlands contiguous with Econlockhatchee River and tributaries and 50-feet landward of the wetland limits as RHPZ. Some wetland systems located within the Chuluota Road RCA study corridor are considered RHPZ wetlands via connection with Silcox Branch and Mill Branch, named tributaries of the

Econlockhatchee River. Impacts to wetland systems associated with roadway alignment and stormwater pond locations are identified in **Table 7** and depicted in **Figure 14-1** and **Figure 14-2**.

Table 7: Approximate Wetland and Other Surface Water Impacts Associated with Chuluota Road RCA

Wetland/Other Surface Water ID	FLUCFCS Code	Proposed Alignment Impact (ac)*	Proposed Pond ID	Proposed Pond Impact (ac)*	RHPZ Uplands (ac)*
WL-1	6170	0.33			
WL-2	6170				
WL-3	6410	0.16			
WL-7	6210		Pond 3A	0.73	1.09
WL-7	6210		Pond 3B	0.11	0.18
WL-8	6300		Pond 2B	0.97**	
WL-9	6250		Pond 1B	1.22**	0.07
SW-1	5130	2.73***			
Upland			FC Pond 1	0.05**	
TOTAL		3.22		3.08	1.34

* Impact acreages are based on approximate limits through aerial interpretation and limited ground-truthing activities.

** Impacts to a system or upland area under a recorded conservation easement. Additional mitigation is likely required to offset the mitigation value that was offset by the easement.

*** Upland-cut surface waters would not be jurisdictional unless inhabited by protected wildlife species.

7.1.2 Secondary Impacts

Federal, state, and local regulatory agencies with jurisdiction over the proposed wetland impacts evaluate potential secondary impacts to wetlands and wildlife during the permitting process. Secondary impacts from construction may include lighting, collisions with wildlife from vehicles, and impacts to water quality.

Generally, secondary impacts to the habitat function of wetlands will not be considered adverse if buffers, with a minimum width of 15 feet and an average width of 25 feet, are provided adjacent to the wetlands that will remain. Buffers must be maintained in their natural/undisturbed condition, provided the construction or use of these features does not adversely impact wetlands. Wetlands or other surface waters cannot be filled to create upland buffers.

Secondary impacts associated with stormwater pond locations and roadway alignment will need to be evaluated during the final design phase to ensure the proposed hydroperiod of the stormwater management system does not adversely affect the hydrology of an adjacent wetland systems.

7.1.3 Cumulative Impacts

SJRWMD requires an applicant to provide reasonable assurance that construction activities will not cause unacceptable cumulative impacts to wetlands and other surface waters in the same drainage basin as the proposed activities. During review, SJRWMD takes into consideration any potential future projects that may have environmental impacts, which, without the current project, would not otherwise be constructed.

If an applicant proposes to mitigate these adverse impacts within the same drainage basin as impacts, and if mitigation fully offsets these impacts, then the proposed construction will be considered to have no unacceptable cumulative impacts to wetlands and other surface waters. This section of Chuluota Road lies within the Econlockhatchee River Nested Basin; therefore, mitigation may be required within this basin to offset cumulative impacts.

7.1.4 Avoidance and Minimization

The proposed construction and widening of Chuluota Road will improve the level of service and enhance safety for the general public. Due to State and County roadway criteria, improvements to Chuluota Road may provide little opportunity to avoid and/or minimize adverse wetland impacts within the existing ROW. When evaluating practicable design modification to reduce or eliminate wetland impacts, regulatory agencies may not require avoidance and minimization when the following events occur:

- The ecological value the functions provide is low, and the proposed mitigation will provide greater long-term ecological value
- Proposed mitigation all or part of a plan that provides regional ecological value and provides greater long-term ecological value that the area of wetland or other surface water proposed for impacts

It is anticipated that jurisdictional wetland and/or other surface water systems within the Chuluota Road RCA study corridor will be avoided and/or minimized to the greatest extent practical while maintaining safety and function. Further avoidance and minimization efforts of wetlands should be evaluated during the final design.

7.1.5 Potential Impacts to Federally- and/or State-Protected Wildlife Species

The potential impact to federally- and/or state-protected wildlife species will be evaluated based upon occurrence determinations for Orange County, Florida, as shown in **Table 3**, and site reviews. Review of current ecological conditions within the study corridor found suitable habitat for wetland dependent species including wading birds, and the American alligator; however, impacts to wetland systems are not anticipated to adversely affect these species. Site reviews should be conducted during final design and permitting of this project to verify the presence or absence of federally and/or state protected wildlife species. If such species are observed within the corridor, coordination with FWS and/or FWC may be warranted.

8.0 Mitigation Assessments

Federal, state, and local government agencies with regulatory authority over wetlands and/or other surface waters generally require mitigation to offset unavoidable impacts as a condition of the permit. Mitigation requirements are based on a compilation of wetland parameters, including quality, type, function, and size. Impacts to wetlands and/or other surface waters will be avoided and minimized to the maximum extent possible while maintaining safe and sound engineering and construction practices. Primarily, avoidance and minimization efforts will be related to the proposed stormwater management pond locations.

A mitigation plan that adequately offsets adverse impacts should be developed and implemented during the permitting phase. Adverse wetland impacts that may result from the construction of this project will be mitigated, satisfying the requirements of Part IV, Chapter 373, FS and 33 U.S. Code (USC) 1344. Compensatory mitigation for this project will be completed through the use of mitigation banks and/or any other mitigation options that satisfy regulatory agency requirements.

Mitigation bank service areas and mitigation credit availability for Econlockhatchee River Nested Basins include Lake X Ranch, TM-Econ Phase I-III, and TM-Econ Phase IV. Orange County owned TM-Econ Phase IV is available for use, and the preferred option for required mitigation. **Table 8** provides a summary of TM-Econ Phase IV's service areas and available credits.

Table 8: Summary of Available Mitigation Credits from TM-Econ MB Phase IV for Chuluota Road RCA.

MB	Bank Service Area	*Credits Available
TM-Econ MB Phase IV, Orange County	(18) St. Johns River (Canaveral Marshes to Wekiva), (19) Econlockhatchee River Nested, (23) Lake Jesup, part of (20) Southern St. Johns River, Boggy Creek, Lake Hart, Lake Myrtle, and East Lake Toho	227.84 State (Includes RHPZ credits) 371.836 Federal

***Based on coordination with OCEPD personnel on May 3, 2022.

9.0 Wildlife Crossing

As part of the RCA ecological evaluation, the opportunity of implementing wildlife crossings within the study corridor was evaluated. Wildlife crossings are typically associated with linear projects when natural habitat is located on both sides of a proposed crossing and that habitat is protected from site conversion by having a preservation or conservation status. These crossings allow for terrestrial wildlife to move uninterrupted and safely through a roadway corridor.

9.1 Evaluation Criteria

The study corridor was analyzed for opportunities of implementing wildlife crossings. The analysis included a review of the following:

- Biodiversity Resource Priorities (BRP)
- Identification and location of conservation lands and/or public lands
- Current and future development plans

The CLIP was developed between FNAI, University of Florida GeoPlan Center and Center for Landscape Conservation Planning, and FWC. CLIP is a collection of spatial data that identifies statewide opportunities for protecting biodiversity, landscapes, and water resources in Florida. CLIP is available for use as a resource planning tool for state, regional, and local agencies in natural resource protection by providing a broad picture of natural resources to support conservation opportunities (NatureServe 2021). CLIP is organized into a set of core natural resource data layers that are combined into five resource categories, with the first three making up the Aggregated CLIP Model:

- Biodiversity
- Landscape
- Surface Water
- Groundwater
- Marine

The biodiversity matrix combines the following four core data included into the Biodiversity Resources Priorities (BRP) layer (Oetting, Hoctor and Volk 2016) :

- **Strategic Habitat Conservation Areas** – This identifies suitable habitat for one or more rare or vulnerable vertebrate species. Those species likely require this area in order to maintain viable populations in Florida for the foreseeable future. Highest priorities indicate the rarest or most vulnerable species, but all priority levels have conservation value. Priority is ranked from 1 (highest) to 5 (lowest)
- **Potential Habitat Richness** – This identifies suitable habitat for one or more rare or vulnerable vertebrate species. “Richness” refers to the number of species overlapping at any location and ranges from 1 to 13. This data layer was created by FWC to identify additional habitat areas important for conservation, beyond those areas identified in the Strategic Habitat Conservation Areas analysis

- **Rare Species Habitat Conservation Priorities** – This identifies suitable habitat for one or more rare or vulnerable species that are known to occur in the vicinity. Highest priorities could indicate a single species with very high conservation need, or multiple species with high conservation need. All priorities reflect rare species with conservation need. This layer includes occurrence-based habitat for 281 species with a high conservation need including plants, invertebrates, and vertebrates. This layer prioritizes places on the landscape that would protect both the greatest number of rare species and those species with the greatest conservation need. Priority is ranked from 1 (highest) to 6 (lowest)
- **Priority Natural Communities** – A given location features one of 12 priority natural community types: upland glades, pine rocklands, seepage slopes, scrub, sandhill, sandhill upland lakes, rockland hammock, coastal uplands, imperiled coastal lakes, dry prairie, upland pine, pine flatwoods, upland hardwood forest, or coastal wetlands. These natural communities are prioritized by a combination of their global status rank and landscape. Priority is ranked from 1 (highest) to 4 (lowest)

The BPR layer is based upon a location meeting one of the four core data layers to meet that priority class criteria. If a location meets more criteria, then the priority is moved higher for that location.

Based on a desktop review of the BPR data (**Figure 15**) areas within this RCA received a ranking between 2 and 5. Areas throughout the study corridor have been bisected through land development (e.g., roads, residential areas, commercial), suggesting a wildlife crossing location may not be feasible.

9.1.1 Conservation Lands

FDEP maintains GIS data available to the public through FDEP Map Direct. The Florida State Owned Lands and Records Information System (FL-SOLARIS) was implemented to maintain a database of property "owned, leased, rented, or otherwise occupied" by any state government agency. In 2017 FL-SOLARIS provided Conservation Lands, Easements, and Recreation (CLEAR), which contains conservation easements for federal, municipal, county, and special districts, as well as other entities as specified in 253.87, FS. This data is refreshed every 5 years (FDEP 2018).

Review of FDEP's Map Direct FL-SOLARIS CLEAR data identifies several conservation areas within the study corridor (**Figure 16-1** and **16-2**).

9.1.2 Current Corridor Condition

Chuluota Road is currently a two-lane road with sidewalks and maintained ROW. This corridor of Chuluota Road includes residential, commercial, and institutional development, stormwater management areas, and areas of natural, undeveloped forested uplands and wetlands land use types. Undeveloped lands are located east and west of Chuluota Road but are bisected by development and roadways. Continuous uninterrupted natural habitat is not present within the study corridor.

9.1.3 Future Corridor Condition

The Chuluota Road study corridor is largely developed, with undeveloped parcels located at the north limit currently in agriculture (cattle ranch) use and one parcel located at the southern limits. This parcel is identified for construction of an access roadway. Current environmental resource permits or applications identified through SJRWMD include the following (**Figure 17**):

- **Cypress Lakes Phase I (Parcel P)** – Individual Permit No. 21001-14 – Issued May 12, 2021, expires May 12, 2026.

- **Yardco 0** – **E Colonial** – Individual Permit 166225 – Issued March 30, 2021, expires March 30, 2026.

9.2 Selection of Potential Wildlife Crossing Locations

Two critical evaluation criteria are reviewed when determining the implementation and placement of wildlife crossings:

- The presence of natural habitat on both sides of the roadway that is protected from site alteration.
- The ability to construct a fence to guide wildlife to that crossing.

Therefore, if a potential wildlife crossing location currently has natural habitat on both sides of the roadway, is under private ownership, and the property owner prohibits the construction of a fence, or reserves the right to move or remove the wildlife fence in the future, the long-term viability of the location is greatly diminished.

Applying the above criteria, review of biodiversity data for the study corridor, existing natural habitat, and site reviews, one potential wildlife crossing location was evaluated south of Cypress Lake Glen Boulevard (**Figure 18**).

9.3 Application of Evaluation Criteria to Potential Wildlife Crossing Locations

Wildlife Crossing Location 1 – This location has natural habitat consisting of forested uplands and wetlands on both sides of the roadway, with the east parcel under conservation. The property located west of Chuluota Road is privately owned. Discussions with the current owners of this parcel indicate they plan to develop a portion of the site; however, this area was not identified as part of the development. In addition, the following items were noted at this location:

- **BPR** – This area is identified with a ranking of 4 west of and 3 east of Chuluota Road.
- **Conservation** – FL-SOLARIS CLEAR data indicates land under conservation easement is located east of the study corridor, with the remainder of the location not under conservation.
- **Current and Future Land Use** – This location consists of undeveloped of forested uplands and wetlands located on both sides of Chuluota Road; however, the eastern boundary of conservation area is bordered by existing development.

9.4 Wildlife Crossing Summary

Wildlife Crossing Location 1 – Based on the information and analysis presented above, and wildlife known to inhabit this area, a wildlife crossing is not justified due to the lack of sustainable natural communities and a continuous corridor for wildlife movement. A wildlife crossing in this location may be reconsidered in the future should plans to develop the area west of Chuluota Road.

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Figures

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Compensation Pond
- Alternate Pond

Lake Pickett RS
Sunnybrook Ct
Lake Drawdy Dr
Lake Pickett Ct
Sailfin Dr
Kayak Way
Lagoda Ln
Lake Drawdy
Old Lake Pickett Rd
Bella Nova Dr
Mandalay Sub
Oriskany Dr
End Study Corridor
Lake Pickett Rd
Chuluota Rd
S Leo Dr
Amalfi Dr
4A
Bithlo-Lot
FC Pond 2
4B
Corner Lake
Loop Lee Shore
Cypress Preserve Pkwy
Curving Oaks Way
3B
Columbia Elementary School
3A
Cypress Lakes
Corner Glen Dr
Corner Lake Dr
Holly Pine Cir
Cypress Lake Glen Blvd
Darlin Saxony Ln
Corner Lakes
Corner Meadow Cir
Cornerwood Dr
2B
Olive Oak Way
Cypress Lakes
Cascades Cove Dr
2A
FC Pond 1
Cornerview Ln
Corner School Dr
Corner Lake Middle School
Deer Run Dr
Hammock Moss Dr
Oak Grove
Ayshire St
Thornhill Gr
Cir
Chase Dr
Cadence St
Camargo Ln
1B
1A
Parry Ln
Masood Ln
Old Cheney Hwy
Begin Study Corridor
Grissom Rd
E Colonial Dr
Lockwood Dr
East River High School
Story Partin Rd
Carpenter Rd
Glenn Rd
Shepard Rd
Cox Dr
Fox Run Cir
Hamilton Dr
Caudel Rd
Alison Daphne Cir
3rd St N
7th

Service Layer Credits: ESRI Street Map
Study Corridor/Pond Locations (JMT 2022)

0 600 1,200 Feet

DRN: LMO	APR: KJT
DATE: 2.28.2022	OCPN: Y20-830-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Location Map
Orange County, Florida

Figure No. 1

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 1 - Chuluota RCA Location Map.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Compensation Pond
- Alternate Pond

End Study Corridor

4A

FC Pond 2

4B

3B

3A

Cypress Lake Glen Boulevard

Chuluota Road

Corner Lake Dr

2B

2A

FC Pond 1

1B

Colonial Drive/SR 50

1A

Begin Study Corridor

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)

0 450 900 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Aerial Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 2

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 2 - Chuluota RCA Aerial Map.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond

Pond 3B
Pond 3A
Pond 2B
Pond 2A
SW-15
SW-16
FC Pond 1
Pond 1B
Pond 1A
Begin Study Corridor

Chuluota Rd
Columbia Elementary School
Cypress Lakes
Corner Lake
Corner Lakes
Corner Lake Middle School
Cascades Cove Dr
Arbor Woods Ct
Oak Grove Hill Ct
Deer Run Dr
Hammock Moss Dr
Holly Pine Cir
Lily Blossom Ln
Sterling Pond Ln
Golden Leaf Ln
Cypress Lake Glen Blvd
Corner Lake Dr
Corner Glen Dr
Corner Point Ct
Cornerview Ln
Corner School Dr
Corner Hill Ct
Cornerwood Dr
Corner Meadow Cir
E Colonial Dr
John Cheney Hwy
Old Cheney Hwy
E River Falcons Way
Grissom Rd
Woodfield Hill Ct
Oak Grove Chase
Olive Oak W
Pic ke
ke Pickett Rd
1
2
419
50

Service Layer Credits: ESRI USGS Topo Map
Study Corridor/Pond Locations (JMT 2022)

0 250 500 Feet

DRN: LMO	APR: KJT
DATE: 2.28.2022	OCPN: Y20-380-CH

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Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
USGS Topographic Quadrangle Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 3-1

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 3 - Chuluota RCA USGS Topo Map.mxd

Legend

Chuluota Road RCA Study Corridor

Preferred Pond

Flood Plain Compensation Storage Pond

Alternate Pond

End Study Corridor

Pond 4A

FC Pond 2

Pond 4B

Pond 3B

Pond 3A

Cypress Lake Glen Rd

Lake Drawdy

Mandalay Sub

Bithlo Lot

Sailfin Dr

Lagoda Ln

Kayak Way

Old Lake Pickett Rd

Lake Pickett Rd

Bella Nova Dr

Chuluota Rd

Lukas Cv

Jonathan Lukas Ct

Oriskany Dr

San Leo Dr

San Lorenzo Dr

CR 13 Recreational Trail

Savannah Springs Ln

Hawks Landing Dr

Mallard Spruce Ter

Lee Shore Loop

Long Boat Ln

Cypress Preserve Pkwy

Bristol Grande Way

Curving Oaks Way

Ashford Grande Way

Cypress Lake Glen Blvd

Columbia Elementary School

Osprey Woods

419

420

0 250 500 Feet

Service Layer Credits: ESRI USGS Topo Map
Study Corridor/Pond Locations (JMT 2022)

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
USGS Topographic Quadrangle Map
Orange County, Florida

Figure No. 3-2

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 3 - Chuluota RCA USGS Topo Map.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond
- 2, Archbold fine sand, 0 to 5% slopes
- 3, Basinger fine sand, frequently flooded
- 15, Felda fine sand, 0 to 2% slopes
- 34, Pomello fine sand, 0 to 5% slopes
- 37, St. Johns fine sand
- 40, Samsula muck, frequently flooded
- 42, Sanibel muck
- 44, Smyrna-Smyrna, wet, fine sand, 0 to 2% slopes
- 46, Tavares fine sand, 0 to 5% slopes
- 53, Wauberg fine sand
- 54, Zolfo fine sand, 0 to 2% slopes
- 99, Water

Pond 3B
Pond 3A
Corner Lake Drive
Pond 2B
Chuluota Road
Pond 2A
SW-15
FC Pond 1
Pond 1B
Pond 1A
Colonial Drive/SR 50
Begin Study Corridor

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
NRCS Soil Survey (2018)

0 250 500 Feet

DRN: LMO | APR: KJT
DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
NRCS Soil Survey Map
Orange County, Florida

Figure No. 4-1

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 4 - Chuluota RCA NRCS Soil Survey Map.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond
- 2, Archbold fine sand, 0 to 5% slopes
- 3, Basinger fine sand, frequently flooded
- 15, Felda fine sand, 0 to 2% slopes
- 34, Pomello fine sand, 0 to 5% slopes
- 37, St. Johns fine sand
- 40, Samsula muck, frequently flooded
- 42, Sanibel muck
- 44, Smyrna-Smyrna, wet, fine sand, 0 to 2% slopes
- 46, Tavares fine sand, 0 to 5% slopes
- 53, Wauberg fine sand
- 54, Zolfo fine sand, 0 to 2% slopes
- 99, Water

End Study Corridor

Lake Pickett Rd

Chuluota Road

Cypress Lake Glen Rd

Pond 4A

Pond 4B

Pond 3A

Pond 3B

FC Pond 2

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
NRCS Soil Survey (2018)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
NRCS Soil Survey Map
Orange County, Florida

Figure No. 4-2

MSE Group, LLC

Legend

Chuluota Road RCA Study Corridor

Preferred Pond

Flood Plain Compensation Storage Pond

Alternate Pond

Land Use Type

1200: Medium Density, 2>5 dwelling units/acre

1300: High Density, 6 or more dwelling units/acre

1400: Commercial and Services

1490: Commercial and Services Under Construction

1550: Other Light Industrial

1700: Institutional

1860: Community Recreational Facilities

1900: Open Land (Urban)

3100: Herbaceous (Dry Prairie)

4110: Pine Flatwoods

5120: Streams and Waterways (Upland-cut ditch)

5200: Lakes

5300: Reservoirs

6170: Mixed Wetland Hardwoods

6210: Cypress

6300: Wetland Forested Mixed

6410: Freshwater Marshes

6440: Emergent Aquatic Vegetation

6460: Mixed Scrub-shrub Wetland

8140: Roads and Highways

8310: Electric Power Facilities

8370: Surface Water Collection Features

Pond 3B

Pond 3A

Corner Lake Drive

Pond 2B

Chuluota Road

Pond 2A

FC Pond 1

Pond 1B

Pond 1A

Colonial Drive/SR 50

Begin Study Corridor

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
FDEP Statewide Land Use Data (Field revised MSE Group 2022)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Land Use Map
Orange County, Florida

Figure No. 5-1

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 5 - Chuluota RCA Land Use Map.mxd

Legend

Chuluota Road RCA Study Corridor

Preferred Pond

Flood Plain Compensation Storage Pond

Alternate Pond

Land Use Type

1100: Low Density, <2 dwelling units/acre

1180: Residential, rural - one unit on 2 or more acres

1200: Medium Density, 2>5 dwelling units/acre

1700: Institutional

1860: Community Recreational Facilities

2110: Improved Pastures

2210: Citrus Groves

4110: Pine Flatwoods

5120: Streams and Waterways (Upland-cut ditch)

5130: Streams and Waterways (Wetland-cut ditch)

5200: Lakes

5300: Reservoirs

6210: Cypress

6250: Hydric Pine Flatwoods

6300: Wetland Forested Mixed

6410: Freshwater Marshes

6440: Emergent Aquatic Vegetation

6460: Mixed Scrub-shrub Wetland

8140: Roads and Highways

End Study Corridor

Pond 4A

Lake Pickett Rd

FC Pond 2

Chuluota Road

Pond 4B

Cypress Lake Glen Rd

Pond 3B

Pond 3A

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
FDEP Statewide Land Use Data (Field revised MSE Group 2022)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Land Use Map
Orange County, Florida

Figure No. 5-2

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 5 - Chuluota RCA Land Use Map.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond
- RHPZ Wetlands
- Wetlands
- Other Surface Waters

WL- 2
SW-3
Pond 3B
Pond 3A
SW-13
SW-2a
WL - 7
SW-14
Corner Lake Drive
Pond 2B
SW-1
WL - 8
Chuluota Road
SW-2
Pond 2A
SW-15
WL - 9
SW-16
FC Pond 1
WL -1
SW-17
Pond 1B
Pond 1A
Colonial Drive/SR 50
Begin Study Corridor

Source: ESRI Aerial (Orange County 2019)
Study Corridor, Pond Locations (JMT 2022)
Wetland, Surface Water (Statewide Land Use 2019, Revised via Field Review MSE Group, LLC 2022)

0 250 500 Feet

DRN: LMO | APR: KJT
DATE: 4.5.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Wetlands and Other Surface Water Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 6-1

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 6 - Chuluota RCA Wetland and Other Surface Waters.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond
- RHPZ Wetlands
- Wetlands
- Other Surface Waters

End Study Corridor
Lake Pickett Rd
Pond 4A
SW-9
SW-8
SW-7
WL - 5
WL - 6
FC Pond 2
Chuluota Road
Pond 4B
WL - 4
SW-6
SW-5
WL-6a
WL - 3
SW-11
SW-10
SW-4
Cypress Lake Glen Rd
SW-12
WL- 2
SW-3
Pond 3B
Pond 3A

Source: ESRI Aerial (Orange County 2019)
Study Corridor, Pond Locations (JMT 2022)
Wetland, Surface Water (Statewide Land Use 2019,
Revised via Field Review MSE Group, LLC 2022)

0 250 500 Feet

DRN: LMO | APR: KJT
DATE: 4.5.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Wetlands and Other Surface Water Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 6-2

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 6 - Chuluota RCA Wetland and Other Surface Waters.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond
- Bald Eagle Nest
- 330ft Primary Protection Zone
- 660ft Secondary Protection Zone

OR113

OR074

End Study Corridor

LAKE PICKETT RD

CHULUOTA ROAD/CR419

COLONIAL DR

Begin Study Corridor

4A

FC Pond 2

4B

3B

3A

2B

2A

FC Pond 1

1B

1A

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
Eagle Nest, Buffer (AEW 2021)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Bald Eagle Nest Location Map
Orange County, Florida

Figure No. 7

MSE Group, LLC

Legend

Chuluota Road RCA Study Corridor

Audubon's Crested Caracara Consultation Area

Study Corridor

Ocala National Forest
Daytona Beach
Port Orange
Deltona
Homosassa Springs
Leesburg
Eustis
Lake Apopka
Orlando
Titusville
Spring Hill
Kissimmee
Lakeland
Melbourne
Palm Bay
Tampa
St Petersburg
Sarasota
Port St Lucie
Port Charlotte
Lake Okeechobee
Jupiter
West Palm Beach
Belle Glade
Fort Myers
Cape Coral
Lehigh Acres
Immokalee
Bonita Springs
Boca Raton
Coral Springs
Pompano Beach
Naples
Plantation
Fort Lauderdale
Davie
Pembroke Pines
Hollywood
Big Cypress National Preserve
Hialeah
Miami
Miami Beach
Homestead
Everglades National Park

Service Layer Credits: ESRI World Street Map
Study Corridor (JMT 2022)
Caracara CA (FWS 2020)

0 10 20 Miles

DRN: LMO | APR: KJT

DATE: 3.4.2022 | OCPN: Y20-830-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Audubon's Crested Caracara Consultation Area Map
Orange County, Florida

Figure No. 8

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 8 - Chuluota RCA Audubon's Crested Caracara Consultation Area Map.mxd

Legend

Chuluota Road RCA Study Corridor

Florida Scrub-Jay Consultation Area

Historic Scrub-Jay Habitat

Jacksonville
Gainesville
Palm Coast
Daytona Beach
Port Orange
Ocala
Homosassa Springs
Leesburg
Eustis
Lake Apopka
Orlando
Titusville
Spring Hill
Kissimmee
Lakeland
Melbourne
Clearwater
Tampa
St Petersburg
Sarasota
Port St Lucie
Port Charlotte
Lake Okeechobee
Jupiter
West Palm Beach
Belle Glade
Fort Myers
Cape Coral
Lehigh Acres
Immokalee
Bonita Springs
Naples
Boca Raton
Coral Springs
Pompano Beach
Plantation
Fort Lauderdale
Davie
Pembroke Pines
Hollywood
Big Cypress National Preserve
Hialeah
Miami
Miami Beach
Homestead
Everglades National Park

Service Layer Credits: ESRI Street Map
Study Corridor (JMT 2022)
Scrub-Jay CA, Habitat (FWS 2020)

N

0 12.5 25 Miles

DRN: LMO | APR: KJT

DATE: 3.6.2022 | OCPN: Y20-830-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Florida Scrub-Jay Consultation Area Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 9

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 9 - Chuluota RCA Florida Scrub-Jay Consultation Area Map.mxd


Legend
Chuluota Road RCA Study Corridor
Red-Cockaded Woodpecker Consultation Area
Study Corridor
Athens
Atlanta
Birmingham
Tuscaloosa
Alabama
Georgia
Macon
Warner Robins
Columbus
Montgomery
North Charleston
Charleston
Savannah
Albany
Dothan
Valdosta
Pensacola
Tallahassee
Jacksonville
Gainesville
Palm Coast
Florida
Orlando
Melbourne
Palm Bay
Tampa
Lakeland
St Petersburg
Port St Lucie
Cape Coral
Coral Springs
Miami
Gulf of Mexico
Straits of Florida
Havana
Service Layer Credits: ESRI Street Map
Study Corridor (JMT 2021)
RCW CA (FWS 2020)
N
0 27.5 55 Miles
DRN: LMO
APR: KJT
DATE: 2.28.2022
OCPN: Y20-830-CH
DRAFT
Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Red-Cockaded Woodpecker Consultation Area Map
Orange County, Florida
Figure No. 10
MSE Group, LLC
Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 10 - Chuluota RCA Red-Cockaded Woodpecker Map.mxd

Legend

Chuluota Road RCA Study Corridor

Snail Kite Consultation Area

Snail Kite Critical Habitat (FWS designated)

Study Corridor

Palm Coast
Daytona Beach
Port Orange
Ocala
Ocala National Forest
Deltona
Homosassa Springs
Leesburg
Eustis
Lake Apopka
Titusville
Orlando
Spring Hill
Kissimmee
Lakeland
Melbourne
Palm Bay
Atlantic Ocean
Clearwater
Tampa
St Petersburg
Sarasota
Port St Lucie
Port Charlotte
Lake Okeechobee
Jupiter
West Palm Beach
Belle Glade
Fort Myers
Cape Coral
Lehigh Acres
Immokalee
Bonita Springs
Boca Raton
Pompano Beach
Naples
Fort Lauderdale
Plantation
Davie
Hollywood
Pembroke Pines
Big Cypress National Preserve
Hialeah
Miami
Miami Beach
Homestead
Everglades National Park

Service Layer Credits: ESRI Street Map
Study Corridor (JMT 2021)
Snail Kite Data (FWS)

0 12.5 25 Miles

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-830-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Snail Kite Consultation Area Map
Orange County, Florida

Figure No. 11

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 11 - Chuluota RCA Everglade Snail Kite Consultation Area Map.mxd

Legend

Chuluota Road RCA Study Corridor

Wood Stock Core Foraging Area (15-mile Buffer)

Wood Stock Colonies

Study Corridor

Orlando Wetlands Park

Lake Mary Jane

Service Layer Credits: ESRI Street Map
Study Corridor (JMT 2022)
Wood Stork Colonies, 15 Buffer (FWS 2020)

0 2.5 5 Miles

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-830-CH

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Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Wood Stork Colonies and Core Foraging Area Location Map
Orange County, Florida

Figure No. 12

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 12 - Chuluota RCA Wood Stork Colonies Location Map.mxd

Legend

Chuluota Road RCA Study Corridor

Preferred Pond Sites

Biodiversity

Priority 5

Priority 4

Priority 3

Priority 2

Pond 5

Pond 4

CYPRESS LAKE GLEN BLVD

CORNER LAKE DR

Pond 3

CHULUOTA ROAD/CR 419

Pond 12

CYPRESS LAKE GLEN BLVD

Pond 11

COLONIAL DR

Pond 1

Begin Study Corridor

Pick e

ke Pickett Rd

2

1

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
Biodiversity (FNAI CLIP 4.0)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Biodiverisy Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 13-1

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 13 - Chuluota RCA Biodiversity Map.mxd

Legend

Chuluota Road RCA Study Corridor

Preferred Pond Sites

Biodiversity

Priority 5

Priority 4

Priority 3

Priority 2

LAKE PICKETT RD

End Study Corridor

LAKE PICKETT RD

Pond 10

Pond 6

CHULUOTA ROAD/ CR419

LONG BOAT LN

CYPRESS LAKE GLEN RD

Pond 5

Pond 4

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
Biodiversity (FNAI CLIP 4.0)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Biodiveriesy Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 13-2

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road\ RCA\MXD and Shapefiles\Figure 13 - Chuluota RCA Biodiversity Map.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond
- Potential Hydrologic Connections
- Non-RHPZ Wetlands
- RHPZ Wetlands

Lake Mills
Lake Mills Park
Mills Creek
Mills Branch
Tropical Ave
Chuluota Rd
1st Ave
Lake View Ave
Lake Mills Rd
Sultan Cir
Silcox Branch
Fort Christmas Rd
Warner Dr
Mills Cree
ORANGE
Fort Chr
Lake Pickett
419
Lake Pickett Rd
Lake Louise
420
Corner Lak
Corner Lake Dr
Cypress Lake Glen Blvd
Bellmore Ave
4th St
Hewlett Rd
10th St
Hollister Rd
N 6th St
Corner Lake Middle School
Hammock Moss Dr
Belvedere Rd
State Road 13 N
Old Cheney Hwy
E Colonial Dr
50
Bithlo Head Start
East River High School
Story Partin Rd
Caudel Rd
5th Ave
Econlockhatchee River
14th Ave
13th Ave
Sunflower Trl
Bearle Rd

Service Layer Credits: ESRI/USGS Topographic Quad Map
Study Corridor and Pond Locations (JMT 2022)

0 1,200 2,400 Feet

DRN: KJT | APR: MLP
DATE: 5.4.2022 | OCPN: Y20-830

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Potential Hydrologic Connections Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 13

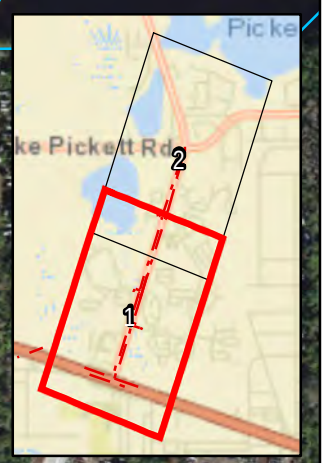
MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 13 - RHPZ Connection.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond
- RHPZ Wetlands
- Wetlands
- Other Surface Waters
- RHPZ Wetland Impacts
- RHPZ Upland Impacts
- Wetland Impact
- Surface Water Impact

WL- 2
SW-3
Pond 3B
Pond 3A
SW-13
SW-2a
WL - 7
SW-14
Corner Lake Drive
Pond 2B
SW-1
WL - 8
Chuluota Road
SW-2
Pond 2A
SW-15
WL - 9
SW-16
FC Pond 1
WL -1
SW-17
Pond 1B
Pond 1A
Colonial Drive/SR 50
Begin Study Corridor



Source: ESRI Aerial (Orange County 2019)
Study Corridor, Pond Locations (JMT 2022)
Wetland, Surface Water (Statewide Land Use 2019,
Revised via Field Review MSE Group, LLC 2022)

0 250 500 Feet

DRN: LMO | APR: KJT
DATE: 2.28.2022 | OCPN: Y20-380-CH

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Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Wetlands and Other Surface Water Impacts Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 14-1

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 14 - Wetland and Other Surface Water Impacts.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond
- RHPZ Wetlands
- Wetlands
- Other Surface Waters
- RHPZ Wetland Impacts
- RHPZ Upland Impacts
- Wetland Impact
- Surface Water Impact

End Study Corridor
Lake Pickett Rd
Pond 4A
SW-9
SW-8
SW-7
WL - 6
WL - 5
FC Pond 2
Chuluota Road
Pond 4B
WL - 4
SW-6
SW-5
WL-6a
WL - 3
SW-11
SW-10
SW-4
Cypress Lake Glen Rd
SW-12
WL- 2
SW-3
Pond 3B
Pond 3A

Source: ESRI Aerial (Orange County 2019)
Study Corridor, Pond Locations (JMT 2022)
Wetland, Surface Water (Statewide Land Use 2019, Revised via Field Review MSE Group, LLC 2022)

0 250 500 Feet

DRN: LMO | APR: KJT
DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Wetlands and Other Surface Water Impacts Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 14-2

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and ShapefilesFigure 14 - Wetland and Other Surface Water Impacts.mxd

Legend

Chuluota Road RCA Study Corridor

Preferred Pond

Flood Plain Compensation Storage Pond

Alternate Pond

Biodiversity

Priority 1 - Highest

Priority 2

Priority 3

Priority 4

3B

3A

CYPRESS LAKE GLEN BLVD

CORNER LAKE DR

2B

2A

FC Pond 1

CYPRESS LAKE GLEN BLVD

CHULUOTA ROAD/ CR419

1B

1A

COLONIAL DR

Begin Study Corridor

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
Biodiversity (FNAI CLIP 4.0)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Biodiverisy Map
Orange County, Florida

Figure No. 15-1

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 15 - Chuluota RCA Biodiversity Map.mxd

Legend

Chuluota Road RCA Study Corridor

Preferred Pond

Flood Plain Compensation Storage Pond

Alternate Pond

Biodiversity

Priority 1 - Highest

Priority 2

Priority 3

Priority 4

LAKE PICKETT RD

End Study Corridor

LAKE PICKETT RD

4A

FC Pond 2

4B

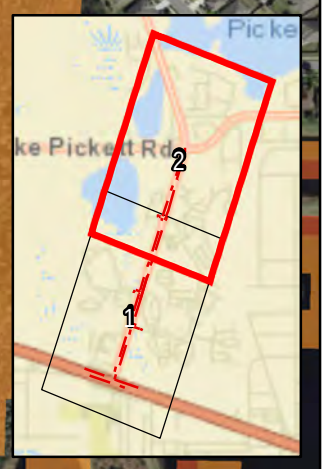
CHULUOTA ROAD/ CR419

LONG BOAT LN

3B

3A

CYPRESS LAKE GLEN RD



Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
Biodiversity (FNAI CLIP 4.0)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Biodiverisy Map
Orange County, Florida

Figure No. 15-2

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 15 - Chuluota RCA Biodiversity Map.mxd

Legend

Chuluota Road RCA Study Corridor

Preferred Pond

Flood Plain Compensation Storage Pond

Alternate Pond

Conservation Area

Corner Lake PH 1

Corner Lake PH 2

Corner Lake PH 3

Corner Lake PH 4

Corner Lakes Kash N Karry

Country Lake ESTS

Cypress Lakes - Parcels D and L

Cypress Lakes - Parcels J and K

Cypress Lakes PH 1

Lockwood Crossing

Pond 3B

Pond 3A

Corner Lake Drive

Pond 2B

Chuluota Road

Pond 2A

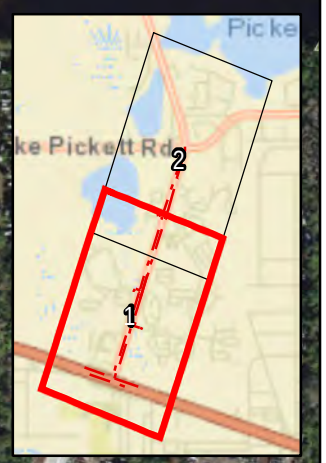
FC Pond 1

Pond 1B

Pond 1A

Colonial Drive/SR 50

Begin Study Corridor



Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
FDEP MapDirect (FL-SOLARIS); SJRWMD Database

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Conservation Areas Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 16-1

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 16- Chuluota RCA Conservation Lands Map.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Plain Compensation Storage Pond
- Alternate Pond

Conservation Area

- Country Lake ESTS
- Cypress Lakes - Parcels D and L
- Cypress Lakes - Parcels H and I
- Cypress Lakes - Parcels J and K
- ESTS at Lake Picket PH 1
- Lake Drawdy Reserve
- Lake Drawdy Reserve Conservation Easment
- Lukas ESTS

End Study Corridor

Lake Pickett Rd

Pond 4A

FC Pond 2

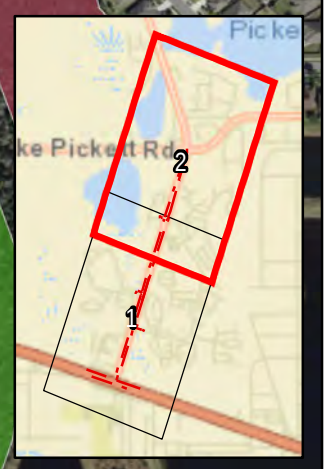
Chuluota Road

Pond 4B

Cypress Lake Glen Rd

Pond 3B

Pond 3A



Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
FDEP MapDirect (FL-SOLARIS); SJRWMD Database

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Conservation Areas Map
Orange County, Florida

Figure No. 16-2

MSE Group, LLC

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Compensation Pond
- Alternate Pond
- SJRWMD Permit 21001-14 Issued 5.12.2021
- SJRWMD Permit 166225-1 Issued 3.30.2021
- SJRWMD Permit Applcation 179943

End Study Corridor

4A

FC Pond 2

4B

3B

3A

Cypress Lake Glen Boulevard

Chuluota Road

Corner Lake Dr

2B

2A

FC Pond 1

1B

Colonial Drive/SR 50

1A

Begin Study Corridor

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
Permits and Applications (FDEP Database April 2022)

0 450 900 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Future Development Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 17

MSE Group, LLC

Document Path: T:\GIS_Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 17 - Chuluota RCA Future Development Map.mxd

Legend

- Chuluota Road RCA Study Corridor
- Preferred Pond
- Flood Compensation Pond
- Alternate Pond
- Potential Wildlife Crossing Area

Conservation Area

- Corner Lake PH 1
- Corner Lake PH 2
- Corner Lake PH 3
- Corner Lake PH 4
- Corner Lakes Kash N Karry
- Country Lake ESTS
- Cypress Lakes - Parcels D and L
- Cypress Lakes - Parcels J and K
- Cypress Lakes PH 1
- Lockwood Crossing

Biodiversity

- Priority 1 - Highest
- Priority 2
- Priority 3
- Priority 4

Wildlife Crossing 1
3B
3A
2B
2A
FC Pond 1
1B
1A
CYPRESS LAKE GLEN RD
CHULUOTA ROAD/ CR419
COLONIAL DR
Begin Study Corridor
Pic ke
ke Pickett Rd
2
1

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
Conservation Area (FDEP Map Direct)
SJRWMD Permit Search (FDEP 2022)
Biodiversity Data (FNAI CLIP 4.0)

0 250 500 Feet

DRN: LMO | APR: KJT
DATE: 2.28.2022 | OCPN: Y20-380-CH

DRAFT

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Wildlife Crossing Considerations Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 18-1

MSE Group, LLC

Document Path: T:\GIS\ Client Files\1555 - JMT\1555.001 Chuluota Road RCA\MXD and Shapefiles\Figure 18 - Chuluota RCA Wildlife Crossing Review.mxd

Legend

Chuluota Road RCA Study Corridor

Preferred Pond

Flood Compensation Pond

Alternate Pond

Potential Wildlife Crossing Area

Conservation Area

Country Lake ESTS

Cypress Lakes - Parcels D and L

Cypress Lakes - Parcels H and I

Cypress Lakes - Parcels J and K

ESTS at Lake Picket PH 1

Lake Drawdy Reserve

Lake Drawdy Reserve Conservation Easment

Lukas ESTS

Biodiversity

Priority 1 - Highest

Priority 2

Priority 3

Priority 4

LAKE PICKETT RD

End Study Corridor

LAKE PICKETT RD

4A

FC Pond 2

4B

CHULUOTA ROAD/ CR419

CYPRESS LAKE GLEN RD

Wildlife Crossing 1

3B

3A

2

1

Source: ESRI Aerial (Orange County 2019)
Study Corridor/Pond Locations (JMT 2022)
Conservation Area (FDEP Map Direct)
SJRWMD Permit Search (FDEP 2022)
Biodiversity Data (FNAI CLIP 4.0)

0 250 500 Feet

DRN: LMO | APR: KJT

DATE: 2.28.2022 | OCPN: Y20-380-CH

Chuluota Road RCA
from Colonial Drive to Lake Pickett Road
Wildlife Crossing Considerations Map
Orange County, Florida

ORANGE COUNTY FLORIDA

Figure No. 18-2

MSE Group, LLC

Appendix A – Woodstork Determination Key

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

Purpose and Background

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

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

Scope of the key

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

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

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

Summary of General Wood Stork Nesting and Foraging Habitat Information

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

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

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

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

WOOD STORK KEY

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

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

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

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

Project impacts SFH[2]……go to C

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

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

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

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

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

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

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

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

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

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

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

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

Monitoring and Reporting Effects

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

Literature Cited

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

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

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

Rodgers, J.A., Jr., S.T. Schwikert, and A. Shapiro-Wenner. 1996. Nesting habitat of wood storks in north and central Florida, USA. Colonial Waterbirds 19:1-21.

U.S. Fish and Wildlife Service. 1999. South Florida multi-species recovery plan. Fish and Wildlife Service; Atlanta, Georgia. Available from: http://verobeach.fws.gov/Programs/Recovery/vbms5.html.

Appendix B – Florida Sandhill Crane Survey Protocol

U.S. Fish and Wildlife Service
U.S. Department of the Interior

National Wildlife Refuge System

Site-specific Protocol for Monitoring Sandhill Cranes

Muleshoe and Grulla National Wildlife Refuges

Survey ID Number: FF02RTMU00-002; FF02RNGR00-005

Version 1.0 **June 2018**

ON THE COVER
Sandhill cranes leaving Paul's Lake at Muleshoe National Wildlife Refuge
Photograph by: Daniel Raleigh, Texas Tech University

National Wildlife Refuge System
Survey Protocol Signature Page

Protocol Title: Site-specific Protocol for Monitoring Sandhill Cranes: *Muleshoe and Grulla National Wildlife Refuges*

Version[1] : 1.0

Station Names:	**Authors and Affiliations:**
Muleshoe National Wildlife Refuge and Grulla National Wildlife Refuge	**Kristen M. Linner**, Texas Tech University **William P. Johnson**, USFWS-National Wildlife Refuge System **Blake A. Grisham**, Texas Tech University **Warren C. Conway**, Texas Tech University

Approvals

Action	Appropriate Signature/Name	Date
Survey Coordinator[2] Submitted by:	Jude Smith	6/14/18
Zone I&M[3] or equivalent Approval:	William P. Johnson	14 Jun 18
Regional I&M[4] Approval:	Kris Metzger	6/15/18
National I&M[5] Approval:		

Version[1]	Date	Author	Change Made	Reason for Change

[1] Version is a decimal number with the number left of decimal place indicating the number of times this protocol has been approved (e.g., first approved version is 1.0.; prior to first approval all versions are 0.x; after first approval, all minor changes are indicated as version 1. x until the second approval and signature, which establishes version 2.0, and so on).

[2] Signature of station representative designated lead in development of a site-specific survey protocol.

[3] Signature signifies approval of a site-specific survey protocol.

[4] Signature by Regional I&M Coordinator signifies approval of a protocol framework to be used at multiple stations within a Region.

[5] Signature by National I&M Coordinator signifies approval of a protocol used at multiple stations from two or more Regions.

Survey Protocol Summary

The site-specific protocol for monitoring of sandhill cranes at Muleshoe and Grulla National Wildlife Refuges is based on the national protocol framework for the Integrated Waterbird Management and Monitoring Approach for Nonbreeding Waterbirds (Loges et al. 2015). The purpose of this protocol is to estimate temporal abundance patterns of migrating and wintering sandhill cranes on the refuge and on surrounding lands. Information from this survey will contribute, in part, to determining the energetic needs of local crane populations during fall, winter and spring. Information from this survey is being incorporated into a LCD for the Southern High Plains (Daniels et al. 2017). A secondary goal of this survey is to collect information on wetland habitat conditions, which may influence crane abundance.

The survey protocol employs both visual bird counts and visual habitat assessments. Observers count sandhill cranes while the birds are on their roost sites (i.e., saline lakes) or while flying off of their roost sites. Cranes are counted from a designated observation point at eight saline lakes in and around Muleshoe and Grulla National Wildlife Refuges. Site condition surveys (habitat surveys) are completed at the time of the crane counts, and address information such as weather, water depth, vegetation and disturbance. Monitoring occurs biweekly from late-September through end of March.

Suggested citation:
Linner KL, Johnson WP, Grisham BA, Conway WC. 2018. Site-specific protocol for monitoring of sandhill cranes: Muleshoe and Grulla National Wildlife Refuges. U.S. Fish and Wildlife Service (Region 2), National Wildlife Refuge System, Muleshoe National Wildlife Refuge, Muleshoe, Texas.

This protocol is available from ServCat [https://ecos.fws.gov/ServCat/Reference/Edit/95665]

Acknowledgments

This protocol was developed with the input and cooperation of Jude Smith and Melanie Hartman of Muleshoe National Wildlife Refuge. Tim Huckaby assisted with developing the data dictionary and uploading survey units into the IWMM website. Kris Metzger provided assistance with editing this protocol. Cinthia Eichhorn assisted with setting up ServCat project files and reviewing data management elements.

National Framework followed: This site-specific protocol for monitoring of Waterbirds is based on the "National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach" (Loges et al. 2015). This framework was updated in 2017 (Loges et al. 2017), and this updated version is available at https://ecos.fws.gov/ServCat/Reference/Profile/83678.

Template used: This template was adopted from a template developed for reporting Technical Reports or Long-term Monitoring Protocols by the National Park Service. The template was initially modified and provided by Jennifer Smetzer and Bill Thompson of Region 5 of the National Wildlife Refuge System. Subsequent to drafting of the *Survey Protocol Handbook*, Sean Blomquist (Region 3 I&M) and Pat Ward (NRPC I&M) modified the template to match format suggested in that Survey Protocol Handbook (USFWS 2014), with reviews from Jana Newman and Lee O'Brien (Natural Resources Program Center, I&M, National Wildlife Refuge System).

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Narrative

Element 1: Introduction

Background

The text below has been taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitat" (Loges et al. 2015, pp 1-3), but has been modified to be site specific.

Sustaining healthy populations of waterbirds (e.g., waterfowl, shorebirds, and long-legged wading birds) that migrate long distances is a major challenge for land managers, and numerous questions remain pertaining to waterbird management and conservation. For example, how important is a single survey site in the big picture over time and across the landscape? How can multiple managers coordinate management of wetlands, farmlands, or influence conservation practices across the landscape so that the birds have the right amount and quality of habitat, at the right time, in the right places? As part of the Integrated Waterbird Management and Monitoring (IWMM) approach, managers and scientists have developed monitoring protocols, decision support models, and databases to inform waterbird management decisions at multiple spatial scales. These products will support clear and transparent decision making processes with respect to waterbird habitat management.

The Integrated Waterbird Management and Monitoring program was initiated by conducting structured decision-making workshops to develop an operational framework for management and monitoring of waterfowl, shorebirds, and wading birds, collectively referred to as waterbirds, at local, regional and flyway spatial scales (Coppen et al. 2007, Laskowski et al. 2008, Lor et al. 2008). Through these workshops the IWMM initiative provided a multi-scaled adaptive management process to inform local and regional managers about how they can best support the needs of local populations of migrating and wintering waterbirds. The program includes a monitoring component that assesses how well managers are meeting their management objectives and an adaptive feedback loop that allows strategies to be adjusted to improve management performance.

Generally, the three purposes for a refuge to adopt the IWWM protocol framework are: a) to understand how waterbirds respond to habitat conditions; b) to inform decision making in a strategic manner; and, c) to assess the efficacy of/improve conservation actions and planning (Lyons et al. 2008). In this instance, Muleshoe and Grulla National Wildlife Refuges have identified a need for a sandhill crane monitoring protocol and have stepped-down the national IWWM protocol-framework to a local, site specific approach. Data will be used for site-specific abundance, documenting migration chronology, and exploring relationships between sandhill crane numbers, landscape conditions (how many cranes can the landscape support) and threats.

The Comprehensive Conservation Plan for the two refuges calls for addressing the connection between sandhill crane numbers and local habitat availability (USFWS 2004). Sandhill cranes in the Southern High Plains typically roost on saline lakes, obtain drinking water from springs/seeps associated with saline lakes, and forage in croplands. Muleshoe NWR provides

saline lake habitat, but foraging takes place in "off-refuge" croplands. The suitability of foraging grounds near the refuge is threatened by changing agricultural practices and wind energy development. The ability to influence the landscape for sandhill cranes will require working with conservation partners and private landowners to maintain foraging grounds. As a result, Muleshoe and Grulla NWRs have developed a Landscape Conservation Design (LCD) in cooperation with the Playa Lakes Joint Venture and other partners (Daniels et al. 2017). This LCD outlines local population abundance goals as well as food resource (energetic) goals that are developed in a Strategic Habitat Conservation framework. The saline lakes covered in this survey will be used to further inform and refine objectives, and evaluate LCD performance and delivery with respect to meeting sandhill crane population objectives.

Objectives

The following is based on the Inventory and Monitoring Plan for Muleshoe NWR and Grulla NWR (USFWS 2013), and Muleshoe's biological priorities [87454], which were developed in 2017.

From 2002-2014, approximately 15% of the Mid-Continent Population of sandhill cranes wintered on Muleshoe NWR. Both Muleshoe and Grulla NWRs were created for conserving migratory birds; however, Grulla was established specifically for the conservation of sandhill cranes. Both refuges have a goal of maintaining or increasing sandhill crane abundance on the refuge and surrounding landscape. The purpose of this protocol is to monitor sandhill crane use, and thus provide the Muleshoe and Grulla NWR with information on sandhill crane abundance for the eight saline lakes identified in Figure 1.1. This abundance information will be used inform and evaluate LCD delivery.

Historic survey data (2002-2013) suggest sandhill crane use days on Muleshoe NWR total approximately 4.9 million between fall arrival and spring departure (Figure 1.2). A "use day" is defined as 1 crane for 1 day; for example 30 cranes for 5 days would equal 150 crane-use days. Use days are useful for converting crane abundance to energetic needs, or kcal, that the landscape needs to provide. Although this protocol does not address carrying capacity of the landscape, it feeds into the LCD (Daniels et al. 2017), which describes use-day and landscape carrying capacity (kcal) goals for sandhill cranes. Data from this survey effort will be used to evaluate sandhill crane response as it relates to implementation of the conservation design. Automated reported mechanisms of IWMM allow for easy conversions of survey results to use days (see Element 4: Data Management and Analysis).

Abundance data from Paul's Lake, Goose Lake, and White Lake (Muleshoe NWR) will be provided to organizations partnering in the LCD every five years, or earlier if requested. This information will be used to evaluate implementation of the LCD (Daniels et al. 2017), and for refining objectives and initiatives. The current population objective for these three lakes combined is 4.9 million sandhill crane use-days. Maintaining this abundance goal will require working with partners to implement landscape sustainability and suitability initiatives. These initiatives will be defined as the LCD moves from planning to roll out phases. Note that quantifying energetic and habitat objectives are not addressed in this protocol, only sandhill crane abundance.

Figure 1.1. Muleshoe and Grulla National Wildlife Refuge sandhill crane survey area. Survey units are labeled in bold font.

Abundance data from this survey will be used to set local crane-use day goals for the remaining saline lakes (survey units that do not occur on Muleshoe NWR). After five years of survey data have been collected, refuge staff will work with LCD partners to develop local population objectives for each saline lake. Lake-specific goals will be incorporated into the LCD (Daniels et al. 2017). The lake-specific goals will be reported as "crane use day" goals.

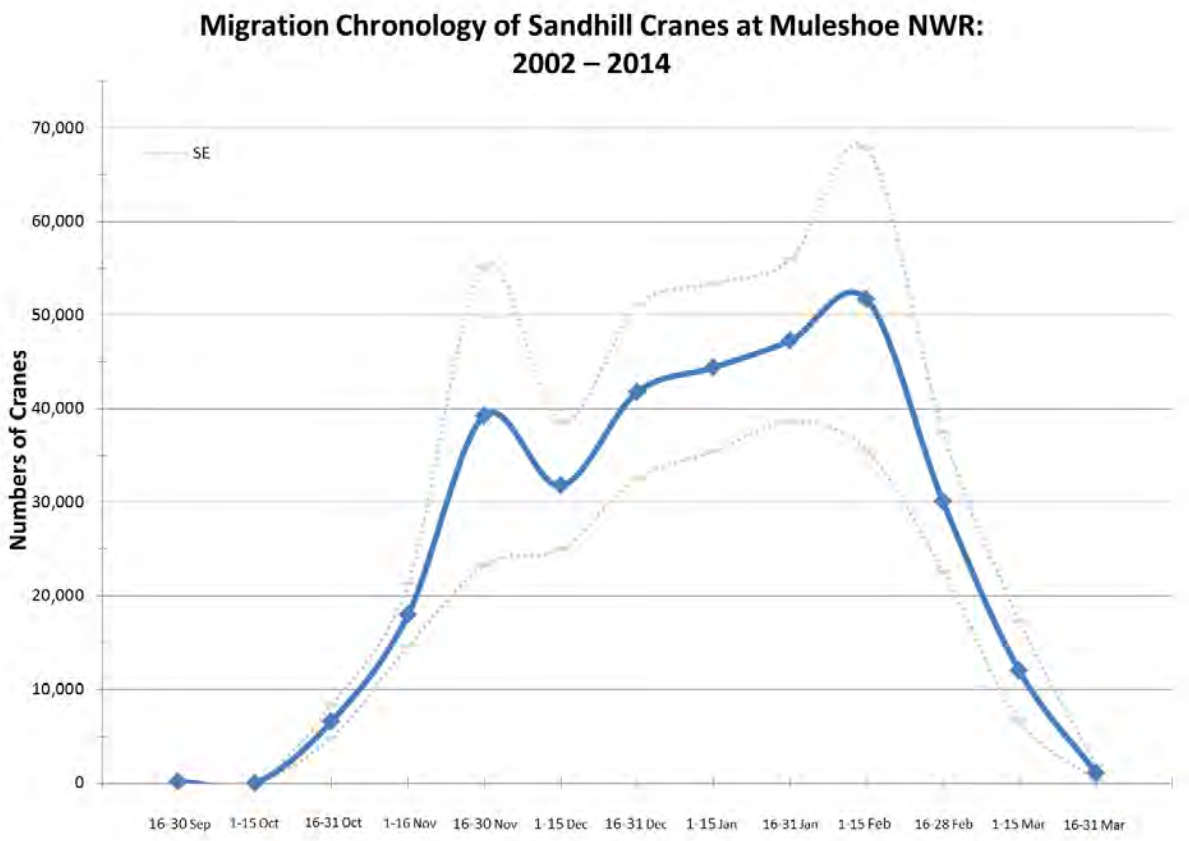


Figure 1.2. Migration chronology of sandhill cranes at Muleshoe NWR. Crane use days were calculated from 11 years of refuge-based survey data. The cross year average for each biweekly period was multiplied by the number of days in that period (14 or 15) to obtain a crane-use day estimate for that biweekly period; crane-use days for each biweekly period were then summed across the year. From 2002 - 2014, this was equivalent to about 4.9 million use days annually.

Element 2: Sampling Design

Sample design

This protocol outlines the approach to collect sandhill crane abundance data on saline lakes in and around Muleshoe and Grulla NWR's. As per the IWMM protocol framework (Loges et al. 2015), there is no spatial design. Census techniques are used to assess waterbird abundance and environmental conditions. Data are collected by survey unit.

Sampling units, sample frame, and target universe

Sampling Units

The text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges 2015), but has been modified to be site specific.

The IWMM protocol framework (Loges et al. 2015) defines a survey unit as a single managed or unmanaged wetland on a single date during the non-breeding season. All survey units addressed in this protocol are unmanaged wetlands, as recurring management actions are not applied. For purposes of this survey, a "sample unit" is equivalent to a survey unit. The IWMM protocol framework does not prescribe a theoretical design to allocate a sample of locations within a surveyed area, so the framework suggests the terminology "survey unit" instead of sample units (Loges et al. 2015). Boundaries of survey units should be fixed through the season and across years to ensure data comparability.

There are eight survey units addressed in this protocol; all are natural saline lakes. They were selected because they occur either on Muleshoe NWR or Grulla NWR, occur in proximity to the refuges, and to inform development and refinement of the landscape conversation design (Daniels et al. 2017). The survey units represent approximately 16% of all possible saline lakes in the Southern High Plains (Rosen et al. 2013), and perhaps >32% of functional saline lakes (Daniels et al. 2017. Detailed information and maps of each survey unit are included in SOPs 1 and 4. We delineated waterbird survey units by U.S. Fish and Wildlife Service (USFWS) wetland boundaries [https://www.fws.gov/wetlands/nwi/Overview.html]. The USFWS wetland boundaries represent the extent of the lake when full and the outer boundary of the wetland layers represents the survey units in ArcGIS. A shapefile (ESRI 1998) of survey units is archived on ServCat at: https://ecos.fws.gov/ServCat/Reference/Profile/95415.

Sample Frame

The comprehensive survey site includes Muleshoe NWR (Paul's Lake, Goose Lake, and White Lake), Grulla NWR (Salt Lake), and four additional saline lakes in the vicinity (Bull Lake, Baileyboro Lake, Coyote Lake, and Monument Lake). Within the site, there are eight total survey units (Figure 1.1) spanning Roosevelt County in New Mexico and Bailey and Lamb Counties in Texas.

Target Universe

The Mid-Continent Population of sandhill cranes is the target species for this survey protocol. Per the IWMM framework, census techniques are used to assess waterbird abundance and environmental conditions. Both Muleshoe and Grulla NWRs play a crucial role in the conservation of the Mid-Continent Population of sandhill cranes. From 2001–2014, annual surveys at Muleshoe NWR suggest 15% of the Mid-Continent flock may be congregated on the refuge when crane abundance peaks during winter. Sandhill cranes use the saline lakes on the refuge for roosting (night) and loafing (mid-day). This survey will target those cranes that roost on saline lakes in the western portion of the Southern High Plains from September through March. Similar to waterfowl, sandhill cranes that roost on saline lakes typically forage in surrounding croplands during the day (Iverson et al. 1985, Johnson et al. 2014)

Assigning IWMM Site, Survey Unit and Observer Codes

Site, survey unit, and observer codes were assigned by IWMM staff (Table SOP 4.1). If additional assistance is needed with IWMM codes for site, survey unit or observers, please contact the IWMM Science Coordinator (iwmmprogram@gmail.com). If observers do not know the codes, they may be left blank, but it will then be necessary to fill in name details (e.g., Paul's Lake) so that codes can be completed latter. IWMM survey unit codes can be assigned to data sheets by cross-referencing units codes with lake names (e.g., Paul's lake) using Table SOP 4.1.

Sample selection and size

All four saline lakes on Muleshoe and Grulla NWR's were included as survey units, as well as four off-refuge saline lakes. Off-refuge lakes were selected based on proximity to the refuge and importance to landscape planning (Daniels et al. 2017). The survey units represent approximately 16% of all possible saline lakes in the Southern High Plains (Rosen et al. 2013), and >32% of functional saline lakes in the Southern High Plains (Daniels et al. 2017). Survey coverage of these lakes is needed to inform LCD development and evaluation (Daniels et al. 2017).

Due to occasional personnel constraints, all survey units may not be surveyed during every survey session. The survey units on Muleshoe and Grulla NWRs have the highest priority and will be surveyed during each bi-weekly survey session. If survey personnel are limited, the Refuge Manager or his/her designee will perform a reconnaissance survey <2 days before the scheduled survey to prioritize off-refuge saline lakes. Survey units will be prioritized based on sandhill crane use and water availability. Off-refuge survey units with the most sandhill crane use will be prioritized highest. Off-refuge survey units that are dry and not-holding birds will be prioritized lowest and may not be surveyed. "Non-surveyed units will be recorded as not-surveyed, not "0" (zero) birds.

Survey timing and schedule

Seasonality

Surveys will occur annually. They will begin in the third week of September and end in the last week of March. This time period should capture both migrating and wintering sandhill cranes (Seyffert 2001).

Schedule

Sandhill crane surveys and unit condition surveys will occur bi-weekly on a consistent weekday (e.g., Wednesday). All units will be counted on the same day.

Survey time

Observers will arrive at their initial survey unit at least 45 minutes before sunrise, and begin surveying when light is sufficient to identify and count sandhill cranes. Birds must be counted either on roost sites or while exiting (flying off) roost sites. The surveys last approximately 2-3 hours from start to finish.

Observers will begin surveying units from the survey point approximately 30 minutes before sunrise, or when there is enough light to identify and count sandhill cranes. Birds must be counted either on roost sites or while exiting (flying off) roost sites. The surveys last approximately one to two hours from start to finish.

Sources of error

The text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges 2015), but has been modified to be site-specific.

Detection of sandhill cranes is likely to be imperfect, thus biasing estimates. Inaccuracy occurs when some individuals are unavailable for detection (e.g., hidden behind other birds), when individuals that are available are not perceived by the observer, or when observers underestimate or overestimate extremely large flocks. Many factors can influence detectability, including observer ability and attention, habitat conditions and weather. Unlike managed wetlands (for example, moist soil units), detectability of sandhill cranes due to changing vegetation structure throughout the season should be a minor issue, as saline lakes are largely devoid of vegetation. However, the size of flocks occurring on single survey units will likely vary by magnitudes across the survey period. In general, observers tend to underestimate flocks of large birds in excess of 2,000 (Boyd 2000), and the degree of bias (of the underestimate) increases as flock size increases. Past estimates of sandhill cranes on individual saline lakes may exceed 50,000 (Muleshoe NWR, unpubl). Training may improve the ability of observers to estimate large flocks (refer to SOP 2).

Element 3: Field Methods and Processing of Collected Materials

Pre-survey logistics and preparation

The following field equipment is required for the sandhill crane survey:

- Good optical equipment, including a spotting scope
- Thermometer (˚C)
- Map of assigned survey units (see SOP 4)
- GPS if unfamiliar with survey locations
- Waterbird Survey Form for Individual Survey Units (SM-5)

An appropriate number of vehicles will need to be secured / arranged, depending on the number of staff and volunteers, to conduct this survey.

Establishment sampling units

Sampling units are described in SOP 1 and SOP 4. GPS locations (Table SOP 4.1) and directions for navigating to each observation point are also included in SOP 4.

Data collection procedures

Measurements

The following attributes will be recorded for each survey unit (see SM-5). See SOPs 2 and 3 for data collection procedures.

- Counts of sandhill cranes
- Visibility (%)

- Wind speed (km/h class)
- Water gauge reading*
- Water depth (cm class)
- Ice (% cover class)
- Water coverage (% of survey unit with surface water)
- Habitat cover (% of cover class)
- Waterbird disturbance response (class)
- Disturbance source (class)
- Chronic human disturbance (class)

*only record if the saline lake has a staff gauge; most lakes do not have one.

Methods: site condition surveys

Detailed site condition survey methods for the measurements listed above can be found in SOP 3.

Methods: estimating sandhill crane abundance

Sandhill cranes roost on shallow saline lakes at night, disperse to feed on agricultural fields during the day, and return to the saline lakes in late afternoon or evening. Surveys are best conducted while cranes are concentrated at their roost sites (saline lakes). The survey units include eight roost sites: Baileyboro Lake, Bull Lake, Coyote Lake, Goose Lake, Paul's Lake, Monument Lake, Salt Lake and White Lake. Observers will arrive at their assigned observation point (see SOP 4, Table SOP 4.1) at least 45 minutes before sunrise. If the count is not completed before cranes begin to leave the roost site, observers may estimate crane numbers by counting cranes as they fly off the site (exit count). For more detailed count instructions see SOP 2.

Processing of collected materials

No materials/specimens are collected during this survey. Data entry is addressed in Element 4 and SOP 5.

Dead/diseased specimens observed during the survey are not to be collected as part of this effort. Notify the Refuge Manager or Refuge Biologist for instructions on how to proceed with documenting the disease/mortality event, and the Refuge Manager or Refuge Biologist will decide if specimen collection is warranted. For additional information see SM-4.

End-of-season procedures

It is strongly recommended that data entry be kept current throughout the field season to end-of-season. However, any data sheets not already turned into the Survey Coordinator (Refuge Biologist) should be submitted at this time. The Survey Coordinator is responsible for entering, (or designated someone to enter) information recorded on field data sheets into the IWMM database.

The Survey Coordinator will also archive data sheets at the end of the season. Original paper copies of the data sheets will be scanned and saved as a .pdf file. The scanned documents should

be compressed, stored in ServCat [95666], and linked to the project [95413]. Care should be taken to make sure scanned documents are readable. When building the .pdf file, scanned data sheets should be arranged (ordered) by survey date and then survey unit name. Compressed files should be named by survey year prior to archiving in ServCat.

The IWMM Science Coordinator may establish entry deadlines on an as-needed basis. See Element 5 for a detailed description of reporting procedures at the end of the season.

Element 4: Data Management and Analysis

Text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site specific.

The Survey Coordinator will enter collected data into the IWMM's centralized, online database. IWMM's database is a member of the Avian Knowledge Network (AKN). This database houses bird survey and habitat condition information. The database can also be used for managing site-specific surveys and collaboration with others. For information about the AKN, please see www.avianknowledge.net. Additional details concerning data entry are available in SOP 5.

Data entry, verification, and editing

Any edits to an original data sheet should be made with a red pen. The error should have a single line drawn through it and the correction written beside it. The researcher that corrected the data should initial and provide any necessary additional information in the margin nearest the correction. After the original data sheet has been reviewed following QA/QC procedures, data should be entered into the IWMM database within one week after the survey was completed. The link to the IWMM portal is https://data.pointblue.org/partners/iwmm/login/?returnUrl=%2Fscience%2Fiwmm-portal%2F

See SOP 5 for instructions on entering data into the online IWMM data entry portal. For additional information and tips, review the "Step by Step Database Documentation" PowerPoint available through the following link: http://iwmmprogram.org/protocols-data-forms/.

Metadata

Text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site specific.

Metadata should adhere to AKN standards and will be accessible via the IWMM's database. IWMM maintains a project record that documents administrative details regarding its national program which is available by email request to iwmmprogram@gmail.com. Muleshoe and Grulla NWRs will also maintain an online project site, as a companion to the physical documents held at the refuges. The web address for the online site is https://ecos.fws.gov/ServCat/Reference/Profile/95413; this is a ServCat site, which requires

USFWS issued credentials. See SM-3 for a visualization of the appropriate linkage structure for generated references related to this site-specific protocol.

The project site will include the site-specific protocol [95665], supporting geo-spatial records [95415], archived data sheets [95666], and annual reports [95667]. Additionally, annual IWMM/AKN records specific to this survey will be downloaded each April and backed up on ServCat project site [95833]. This back up will include records of survey dates, observer names, survey units, start time, end time, habitat conditions, bird counts, and other records specific to each survey. It is suggested that this backup be a .csv file.

Data security and archiving

IWMM Project - Overall

Text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site specific.

Point Blue Conservation Science (PBCS) will host IWMM's database on its servers. For hosted databases, PBCS provides incremental daily backups onsite, weekly offsite backups, and semi-annual backups that occur offsite at Cornell University.

Data sheets

Following the survey, data sheets will be collected from each surveyor and stored in the Refuge Biologist's office for data entry. If a surveyor is unable to transfer data sheets to the biologist, they will be given to the Refuge Manager and he/she will transfer it to the biologist as soon as possible. After the original data sheet has been reviewed following QA/QC procedure, data should be entered in the IWMM/AKN portal [https://data.pointblue.org/partners/iwmm/login/?returnUrl=%2Fscience%2Fiwmm-portal%2F].

After data entry, data sheets should be copied so that there are two sets of hard copy data sheets. Each set should be held in a three-ring binder, with pages organized by survey date (earliest to latest). The binder with the original data sheets should be housed in the office of the Refuge Biologist (Buffalo Lake NWR). The binder with copies should be transferred to Muleshoe NWR at the end of the survey season. Having hard copies of the data sheets stored in two locations will ensure long-term security and access to original data. Binders should be stored in file cabinets, which are clearly labeled, at each refuge at the end of the survey season.

In addition, at the end of each season the original paper copies of the data sheets will be scanned, and saved as a .pdf file. The scanned documents should be compressed, stored in ServCat [95666], and linked to the project [95413]. Care should be taken in scanning the documents and building the .pdf file so that data sheets are in order by survey data and then survey unit name. Compressed files should be named by survey year prior to archiving in ServCat. See SM-3 for a visualization of the appropriate linkage structure for generated references related to this site-specific protocol.

Spatial Files

GIS files associated with the surveys can be found on ServCat [95415] along with associated metadata and data dictionaries. See SM-3 for a visualization of the appropriate linkage structure for generated references related to this site-specific protocol.

Analysis methods

Text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site-specific.

Data should be analyzed using the most appropriate means to meet the sampling objectives and provide summaries that effectively inform the management objectives.
The analytical tools available through IWMM's database will be used to aid in the two refuge's management decision-making, and provided to LCD partners (Daniels et al. 2017) for revision, review and assessment of management initiatives.

To estimate temporal patterns of abundance, Muleshoe and Grulla NWRs will use the migration curve tool, which allows users to plot observed waterbird counts against date (Figure 4.1). To allow the refuge to provide partners with useful information for evaluation LCD implementation and progress, the IWMM tools and programmed analyses should be used to calculate sandhill crane use-days by individual survey units and across survey units (Figure 4.2; Farmer and Durbian 2006). This information may then be compared to estimates at the scale of the LCD or smaller (Daniels et al. 2017). Other reporting tools are available for producing customized summaries of these metrics by different time or geographic scales.

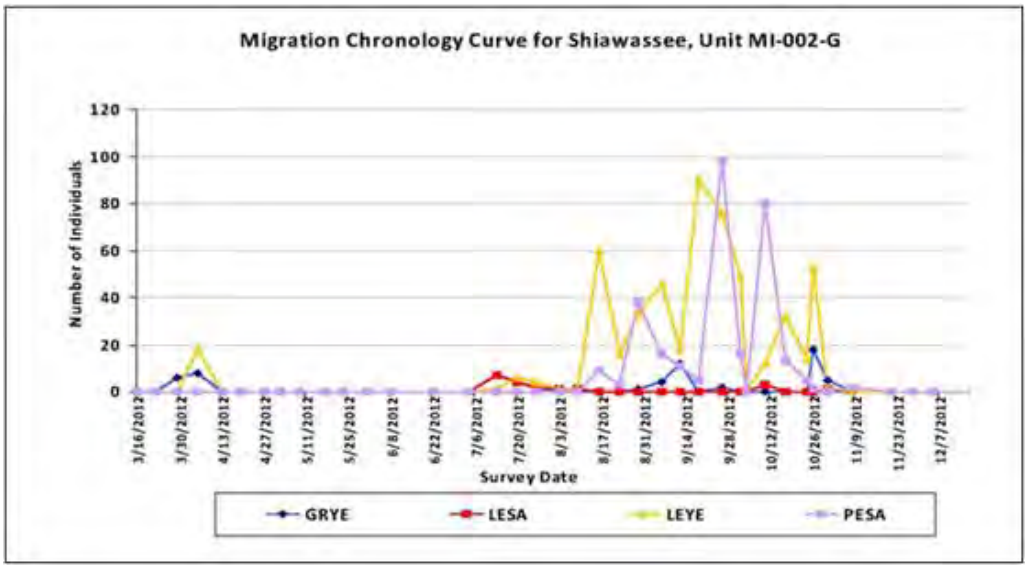
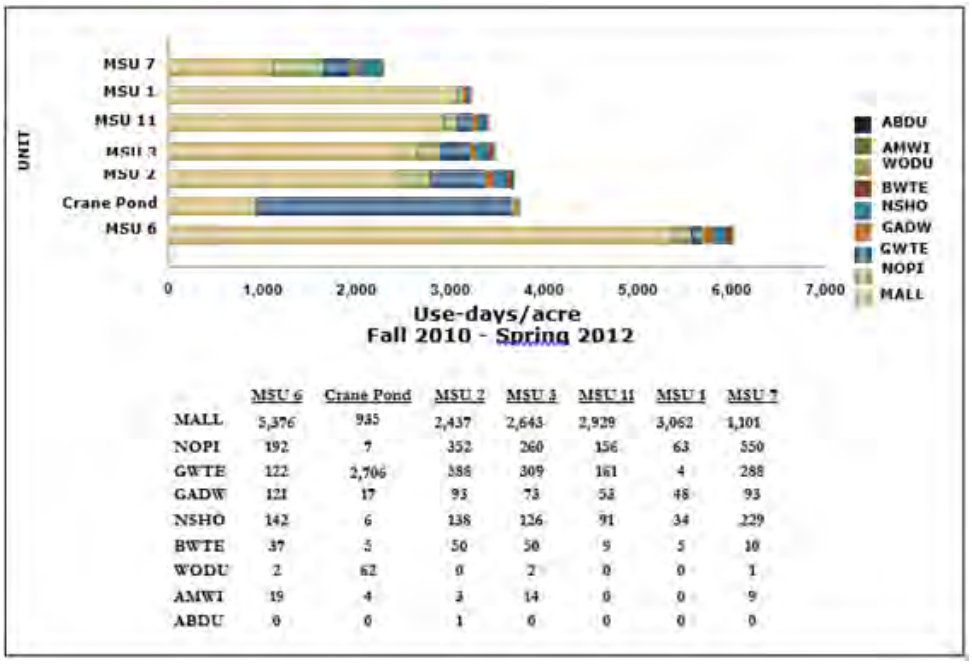


Figure 4.1. Example of migration curve. Migration chronology for greater yellowlegs (GRYE), least sandpiper, lesser yellowlegs (LESA), and pectoral sandpipers (PESA) produced from an interim version of the IWMM database. The Migration Curve for this survey would be specific to sandhill cranes. *Figure taken from Loges et al. 2015.*



	MSU 6	Crane Pond	MSU 2	MSU 3	MSU 11	MSU 1	MSU 7
MALL	5,376	935	2,437	2,643	2,929	3,062	1,101
NOPI	192	7	352	260	156	63	550
GWTE	122	2,706	388	309	161	4	288
GADW	121	17	93	73	53	48	93
NSHO	142	6	138	126	91	34	229
BWTE	37	5	50	50	9	5	10
WODU	2	62	0	2	0	0	1
AMWI	19	4	3	14	0	0	9
ABDU	0	0	1	0	0	0	0

Figure 4.2. Example of data report. Dabbling duck use-day by unit and species illustrating variation in the relative composition of dabbler use density across units of interest at Clarence Cannon NWR. Use-days may be summarized by species or guilds for individual units, user defined unit group. Use-day data from this survey would be specific to sandhill cranes. *Figure taken from Loges et al. 2015.*

Software

Because reports are generated through the online IWMM program and online AKN portal, additional software is not required for analysis. However, the Refuge Biologist and other users may use any software that is appropriate to fulfill the objectives of the survey.

Element 5: Reporting

Implications and application

Objectives and Methods

This purpose of this survey is to estimate abundance of migrating and wintering sandhill cranes at saline lakes on Muleshoe and Grulla NWRs and surrounding areas. Specifically, the survey aims to estimate numbers of birds before they depart, or as they are departing, nighttime roost sites (saline lakes) to forage in surrounding croplands. Information from this survey will contribute, in part, to estimating energetic needs of the local, wintering sandhill crane population (that is, estimating minimal carrying capacity requirements of the local population), and informing an LCD for the Southern High Plains.

Summary of Results

The text below is largely taken from the "National Protocol Framework for the Inventory and

Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but it has been modified to be site-specific.

The data summary tools provided by the IWMM database will provide a foundation for reporting. Data summaries represent common formats reported in migratory bird surveys; observation summaries, migration curves (Figure 4.1) and use-days (Figure 4.2). The spatial scale, time period, and taxon level of the data summaries will be defined by the Refuge Biologist or researcher based on need. Bird observation summaries report frequency, average abundance, average count, birds/hour, maximum count, and total count for a user-defined period, scale and taxon. Migration curves plot raw or percent of maximum counts for all surveys over a user-defined period. A data export function will also allow cooperators to summarize data outside of the IWMM database.

Summarized results will be converted to .pdf file format, stored on ServCat [95667] and linked to the project [95413].

Reporting schedule

The Survey Coordinator (Refuge Biologist) will generate end-of-season reports to summarize the data collected for the survey season. Short-term reports will initially be the primary type of report created, but as the survey continues periodic comprehensive reports may be appropriate. Ideally, these reports will be completed and submitted within one month after the conclusion of the last survey in March. The frequency of such reports may vary depending on the Refuge Biologist's need, or based on requests of partners with a vested interest in the data.

Report distribution

The text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site specific.

End-of-season reports will be distributed to the Refuge Manager and Zone Biologist. Discussion and analysis of reports will assist refuge staff in making informed management decisions that will contribute to the refuge's goals. A hard copy of the report should be filed with the data sheets/binders.

Electronic copies of reports and graphs will be converted to .pdf file format, stored on ServCat [95667] and linked to the project [95413].

Wildlife Health Reporting

The text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015).

Suspicious or unusually high-number of mortalities should be reported to the Refuge Manager or her/his designee. Contact information and instructions for reporting and collecting specimens, and wildlife health issues can be found at the Wildlife Health office's internal website:

https://sites.google.com/a/fws.gov/fws-wildlife-health/products. Additional information is available in SM-4.

Element 6: Personnel Requirements and Training

Roles and responsibilities

Refuge Biologist (Survey Coordinator) – Works with Refuge Manager to set biweekly survey schedule, ensures field equipment and data sheets are available for each surveyor, ensure data sheets are available for each surveyor, trains all surveyors, enters data from field data sheets into IWMM data entry portal within one week of the survey, responsible for proofing survey data after it is entered online, responsible for all aspects of data management (including archiving data sheets on ServCat), and produces end of year reports.

Refuge Manager – Works with Refuge Biologist to set biweekly schedule. Responsible for reconnaissance surveys and prioritizing survey units for each survey. For example, if reconnaissance surveys indicate some saline lakes are dry and not used by sandhill cranes, the Refuge Manager will prioritize those units lowest and they will only be surveyed if adequate staff are available. If reconnaissance surveys indicate all saline lakes have water and are used by substantial numbers of sandhill cranes, then the Refuge Manager will work to secure additional help/surveyors. Ensures necessary personnel are available for each survey; each survey typically requires 3-4 individuals, depending on habitat conditions and crane abundance.

Observers – Follow instructions of Survey Coordinator, fully understand all field survey procedures, read protocol, read SOPs related to collection of field data, become familiar with survey units and observation points, and give completed data sheets to Refuge Biologist after each survey. Surveyors are responsible for understanding the protocol, SOPs, and all aspects of the survey including how to complete the data sheet. Data sheets that are not completed properly may render the data, and survey effort, unusable.

Qualifications

All surveys need to be conducted by qualified individuals. Surveyors should be able to:

- Identify sandhill cranes
- Understand how to fully and accurately complete field data sheets
- Estimate large numbers of sandhill cranes using recommended techniques
- Follow survey protocols
- Utilize maps, written instructions, and/or a GPS to navigate

Training

The text below is taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site-specific.

Participants in this survey should visit the IWMM project website to become familiar with the program and access additional training resources (such as recorded webinars, downloadable presentations, and manuals). Inexperienced waterbird surveyors must practice counting and estimation techniques before participating in this survey. This can be done in the field or at a desktop computer using Wildlife Counts software: http://wildlifecounts.com/index.html.

Surveyors should also be trained for dealing with any hazards, and in case the need should arise, proper procedures for reporting dead/injured sandhill cranes or other waterbirds. Wildlife die offs should be reported to the Refuge Manager and/or Refuge Biologist at the conclusion of the survey. For instructions on how to handle and submit waterfowl carcasses for cause of death diagnosis, please see SM-4 as well as the Mortality Event Response instructions on the Wildlife Health office internal website: https://sites.google.com/a/fws.gov/fws-wildlife-health/products.

If information is needed on the IWMM program, contact the Zone Biologist or IWMM Science Coordinator. To access the IWMM Q&A forum or messaging features, a membership is required. E-mail requests to iwmmprogram@gmail.com.

For More Information:

- IWMM National Project Coordinator—For **name and contact information** see http://iwmmprogram.org/
- IWMM National Science Coordinator**—** For **name and contact information** see http://iwmmprogram.org/
- IWMM Southwest Region Representatives:
  Paige Schmidt, U.S. Fish and Wildlife Service, Zone Biologist, 9014 E. 21st Street, Tulsa, OK 74129 Paige_Schmidt@fws.gov
  Bill Johnson, U.S. Fish and Wildlife Service, NWRS-Division of Biological Services, PO Box 277, Canyon, TX 79015, bill_johnson@fws.gov, 806-499-3254
- IWMM Midwest Region Representative:
  Brian Loges, Zone Biologist, Two Rivers National Wildlife Refuge, HC 82 Box 107 Brussels, IL Brian_Loges@fws.gov

Element 7: Operational Requirements

A typical survey will usually be conducted by 3-4 individuals, including the Refuge Manager and Refuge Biologist (Survey Coordinator). The minimum equipment requirements to complete the survey include: this protocol, SOPs 1 - 4, binoculars and/or a spotting scope for each observer, a 4-wheel drive vehicle, data sheets, pencil, and something to aid navigation (i.e. map or GPS). The Survey Coordinator (Refuge Biologist) will provide data sheets to all surveyors, and training to new surveyors. Surveyors are responsible for understanding the protocol, SOPs, and asking questions to clarify any and all aspects of the survey they are uncertain about, including completion of the data sheet.

Budget

Table 7.1. Estimated cost to conduct sandhill crane surveys at Muleshoe and Grulla NWRs.

Item	Estimated Cost5
Startup Supplies	
5 pairs of binoculars[1]	$5000
5 clipboards[1]	$50
5 spotting scopes and tripods[1]	$7500 (not required, but observer preference)
5 GPS units[1]	$1000
Reoccurring Supplies	
batteries	$30
equipment replacement	$500
fuel and misc.	$500
Approximate Staff Time[2]	
protocol development[1, 3]	$7250
conducting surveys[4]	$5616 (season/annual)
data management[5]	$648
Survey costs:	
total start up	$20800 (initial equipment + protocol)
surveys	$7294 (annual recurring)

[1]Start up cost, only needs to be purchased once and replaced on an as-needed basis. Many items on this list are already held by the refuge or participating surveyors and were purchased for reasons not specific to this survey.

[2]Calculated at average employee cost of $75,000 per year ($36 per hour).

[3]Site-specific protocol development is estimated to have taken about 200 hours of staff time (narrative, unit delineation, map creation, edits, etc.)

[4]Estimate is for 4 paid employees at 2 hours each per survey day, for 13 surveys annually (Sep – Mar) (4 x 2 x 13 = total hours; total hours x $36 = staff costs). In addition, 4 hours are added to each survey (4 x 13) to allow for reconnaissance survey of off-refuge survey units. The estimate does not account for any unpaid volunteers, which if available, lesson the cost of the survey.

[5]Calclulated based on estimated 13 surveys per year: 1 hour of data management time per survey + 5 additional hours for end-of-year data management and reporting (18 hours x $36).

Staff time

Survey time will vary depending on how many sandhill cranes are roosting on survey units (saline lakes). Each survey takes 3-4 individuals about 2 hours each to complete (so 6 to 8 hours total).

Assuming 4 observers are required for each of the 13 surveys, and observers spend 2 hours each per survey (4 x 2 x 13), approximately 104 total survey hours are required per year (Sep – Mar). Additionally, 52 hours are added for reconnaissance surveys (4 hours for each of the 13 survey periods), and 18 total hours per year (Sep – Mar) are added for data management. Thus, approximately 174 total hours are required to complete this survey annually, or 0.08 of a full time employee's (FTE) time annually.

Schedule

This survey will begin during the last two week period (second half) of September and continue until the last two week period of March. The first sandhill cranes of the fall migration are typically observed in late October or early September (Seyffert 2001, USFWS unpubl.). Sandhill cranes have typically departed the Southern High Plains, including Muleshoe and Grulla NWRs, by late March (Seyffert 2001, USFWS unpubl.).

Surveyors should be at their observation points at least 45 prior to sunrise. The time needed to survey each lake will vary, but cranes tend to depart saline lakes between 15 before to 30 minutes after sunrise. If a surveyor is assigned more than one saline lake, the Refuge Manager and Refuge Biologist will make the survey unit assignments based on proximity of survey units and the number of cranes expected to be roosting on the lakes. Sandhill cranes will only be counted if roosting on the lake or during their exit flight (as they depart a saline lake). No cranes will be counted in fields. The survey will end after all assigned lakes have been surveyed, or within 1 hour after sunrise. However, inclement weather conditions may keep cranes on roost up to several hours after sunrise, in which case the Survey Coordinator may allow the survey time frame to extend longer if needed.

Coordination

Coordination among the Refuge Manager, Refuge Biologist (Survey Coordinator), and surveyors is vital. The Refuge Manager is responsible for insuring there are enough surveyors to complete the task, and the Refuge Biologist is responsible for training surveyors. Training, which includes familiarizing surveyors with the protocol, SOPs and data sheets, must take place prior to survey day. There will not be sufficient time to bring new surveyors up to speed on the morning of the survey. If logistics do not allow the Refuge Biologist to train new surveyors, training may be performed by the Refuge Manager.

During the survey, vehicle radios or cell phones may be used to communicate between surveyors. Do not utilize any communication device, including but not limited to USFWS issued cell phones or personal cell phones, while operating a moving vehicle. If communication is necessary, safely pull over to the side of the road and completely stop the vehicle before using a phone or radio.

Communication with external partners that use the survey data or results will primarily take place through distribution of end-of-year (end-of-season) reports. It may also take place when external partners make periodic, but unscheduled, requests for data or reports.

Element 8: References

Boyd WS. 2000. A comparison of photo counts versus visual estimates for determining the size of snow goose flocks. Journal of Field Ornithology 71:686-690.

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Appendices

Standard Operating Procedures (SOP)

SOP 1: Sampling Design

The text below is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site-specific.

The survey units are Paul's Lake, Goose Lake, White Lake, Salt Lake, Baileyboro Lake, Bull Lake, Coyote Lake and Monument Lake. The survey units (Figure SOP 1.1) span Roosevelt County in New Mexico to Bailey and Lamb Counties in Texas.

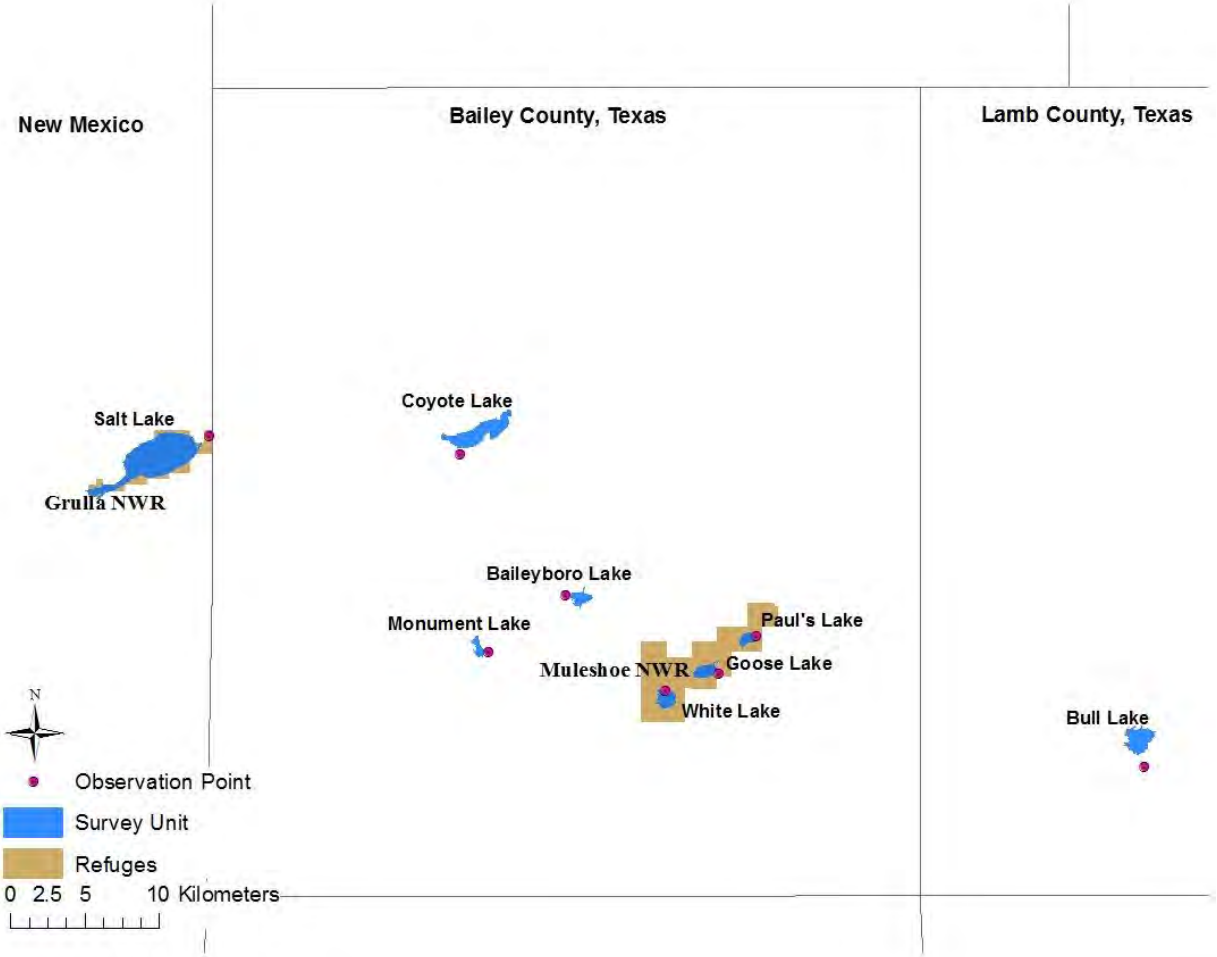

Figure SOP 1.1. Muleshoe and Grulla National Wildlife Refuge sandhill crane units.

Target Universe

Sandhill cranes are the target species for this survey protocol. Specifically, we are concerned with assessing abundance of those that occur in the western Southern High Plains from late September – March. As per the IWMM framework, census techniques are used to assess waterbird abundance and environmental conditions.

Crane counts will take place from the survey unit's designated observation point. Observation point locations are listed in Table SOP 4.1. Percent visibility of each survey unit was visually estimated by the lead author (K. Linner) from the observation point by scanning the unit with binoculars (Table SOP 4.1). Except for Coyote Lake, which is counted as an "exit count," there is > 70% visibility of each survey unit. Figure captions for Figures SOP 4.1 – SOP 4.8 (see SOP 4) contain driving directions. A shapefile (ESRI 1998) of the survey unit boundaries is available on ServCat [95415]

Assigning IWMM Site, Survey Unit and Observer Codes
Site, survey unit (Table SOP 4.1.) and observer codes were assigned by IWMM staff. If additional assistance is needed with IWMM codes for site, survey unit, or observers, please contact the IWMM Science Coordinator (iwmmprogram@gmail.com; additional contact information is available from http://iwmmprogram.org/). If observers do not know the codes, please leave them blank, but make sure that you fill in name details (for example, Paul's Lake) so that the codes can be subsequently completed by the Refuge Biologist. Any questions concerning codes by observers should be reconciled with the Refuge Biologist immediately following completion of the survey.

Sample selection and size

All saline lakes on Muleshoe and Grulla NWRs were included as survey units, as well as four off-refuge saline lakes. Due to occasional personnel constraints, all eight survey units may not be surveyed during every survey session. Muleshoe and Grulla survey units have the highest priority and will be surveyed during each survey. If survey personnel are going to be limited, the refuge manager or his/her designee will perform a reconnaissance survey units <2 days before the scheduled survey to prioritize off-refuge saline lakes. Survey units will be prioritized based on sandhill crane numbers and water availability. Off-refuge survey units holding the largest number of sandhill cranes will be prioritized highest. Off-refuge survey units that are dry and absent of cranes will be prioritized lowest and may not be surveyed. "Non-surveyed" units will be recorded as not-surveyed, not "0" (zero) birds.

Survey timing and schedule

Seasonality
Surveys will occur annually. They will begin late September and end in late March to encompass the presence of migrating and wintering sandhill cranes.

Schedule
Sandhill Crane surveys and unit condition surveys will occur bi-weekly on a consistent weekday (e.g., Wednesday). All units will be counted on the same day.

Survey time
Observers will arrive at their initial survey unit at least 45 minutes before sunrise, and begin surveys when there is enough light to identify and count sandhill cranes. Birds must be counted

either on roost sites or while exiting (flying off) roost sites. The surveys last approximately 1-2 hours from start to finish.

Sources of error

The text below is taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site-specific.

Detection of sandhill cranes is likely to be imperfect, thus biasing estimates. Inaccuracy occurs when some individuals are unavailable for detection (e.g., hidden behind other birds), when individuals that are available are not perceived by the observer, or when observers under or overestimate extremely large flocks. Many factors can influence detectability, including observer ability and attention, habitat conditions, and weather. Unlike management units (for example, moist soil units), detectability of sandhill cranes due to changing vegetation structure throughout the season should be a minor issue, as saline lakes are mostly devoid of vegetation. However, the size of flocks occurring on single survey units will likely vary tremendously across the survey period. Observers tend to underestimate flocks of large birds in excess of 2,000 (Boyd 2000), and the degree of bias (of the underestimate) increases as flock size increases. Estimates of sandhill cranes on individual saline lakes may exceed 50,000 (Iverson et al. 1985, Muleshoe NWR, unpublished). Training may improve the ability of observers to estimate large flocks; refer to SOP 2.

References

Boyd WS. 2000. A comparison of photo counts versus visual estimates for determining the size of snow goose flocks. Journal of Field Ornithology 71:686-690.

[ESRI] Environmental Systems Research Institute, Inc. 1998. ESRI shapefile technical description. Redlands, California. https://www.esri.com/library/whitepapers/pdfs/shapefile.pdf (20 January 2018).

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SOP 2: Data Collection Methods – Counting and Estimating Sandhill Cranes

Sandhill cranes roost on shallow saline lakes at night, disperse to feed on agricultural fields during the day, and return to the saline lakes in late afternoon or evening (Iverson et al. 1985). Muleshoe and Grulla NWRs conduct surveys while cranes are at their roost sites (saline lakes). The survey units include eight roost sites: Baileyboro Lake, Bull Lake Coyote Lake, Goose Lake, Monument Lake, Paul's Lake, Salt Lake and White Lake. Observers should arrive at survey units at least 45 minutes before sunrise. Surveys are conducted from designated observation points (SOP 4, Table SOP 4.1). If the count is not completed before cranes begin to leave the roost site, observers may estimate crane numbers by counting cranes as they fly off the site (exit count). All surveys conducted at Coyote Lake will be by exit counts.

The text below largely follows the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site-specific.

Counts or approximated counts of individual sandhill cranes are recorded on the Waterbird & Unit Condition Survey form (see SM-5). The four letter AOU code for sandhill cranes is SACR. Observers may use the AOU code, or spell out sandhill crane.

Be careful not to count individual sandhill cranes more than once. When in doubt about whether an individual sandhill crane was already counted, err on the side of not double-counting. If you find that no sandhill cranes are present, still record survey condition information (e.g., disturbance, depth, etc.

Visually scan the survey unit systematically, counting individual sandhill cranes. For larger sites, or sites where there are large numbers of sandhill cranes, it is often more practical to estimate numbers. A spotting scope will be required at most survey units. Estimating numbers may be necessary if sandhill cranes move around the wetland or are in very tightly packed flocks.

To survey sandhill cranes in a flock, first estimate a 'block' of sandhill cranes, e.g. 5, 10, 20, 50, 100, 500, 1000 cranes depending on the total number. To do this, count a small number of sandhill cranes (e.g., 10) to gain a sense of what a group of 10 looks like. Then count by 10s to 50s or 100 cranes to gain a sense of what 50 or 100 looks like. The block is then used as a model to measure the remainder of the flock. In the example below (Figure SOP 2.1) we use 'blocks" of 100 birds to arrive at an estimate of 800 sandhill cranes.

Figure SOP 2.1. Estimating flock size for a group of sandhill cranes. Count members within a block, for example 100 individuals, then see how many blocks there are in the group. In this example, 8 blocks x 100 individuals/block = 800 individuals in the group. Photo courtesy of Texas Tech University.

Survey Tip

If surveying sites with large numbers of sandhill cranes, it is often best to count in teams of two, one person counting while the other records the numbers on the data sheet. Alternatively, some

people like to use recording devices, so that they are not constantly interrupting counts to record information.

Additional Training and Information

Participants, particularly first-time surveyors, should visit the IWMM project website to become familiar with the program and access additional training resources (such as recorded webinars, downloadable presentations, and manuals). Inexperienced waterbird surveyors must practice their counting and estimation techniques before participating in this survey. This can be done in the field or at a desktop computer using Wildlife Counts software: http://wildlifecounts.com/index.html.

Safety

The Refuge Manager or his/her designee should information surveyors of local hazards, and data collectors should ask if there is anything they should be aware of. Although the need for communication with other surveyors may occur during the course of the survey, do not utilize communication devices while operating a moving vehicle. If communication is necessary, safely pull over to the side of the road and completely stop the vehicle before using a phone or radio.

Wildlife die-offs

Wildlife die-offs and sick cranes should be reported to the Refuge Manager and/or Refuge Biologist at the conclusion of the survey. Sandhill cranes in the Southern High Plains regularly succumb to mycotoxin and aflatoxin poisoning, non-contagious diseases resulting from eating moldy peanuts and waste grains. Cranes suffering from mycotoxin poisoning typically cannot hold their heads up or fly. The survey should not be stopped to pursue or collect such birds, but they should be reported to the Refuge Manager and/or Refuge Biologist.

Information on the proper procedures for reporting dead/injured sandhill cranes or other waterbirds is available from the National Wildlife Health Center in Madison, Wisconsin. For instructions on how to handle and submit waterfowl carcasses for cause of death diagnosis, please see SM-4 as well as the Mortality Event Response instructions on the Wildlife Health office internal website: https://sites.google.com/a/fws.gov/fws-wildlife-health/products.

Equipment

The following field equipment is required for the sandhill crane monitoring survey:

- Good optical equipment, including a spotting scope
- Thermometer (˚C)
- Map of the site and unit boundaries
- Waterbird & Unit Condition Survey form (SM-5)
- Pen / pencil

An appropriate number of vehicles will need to be secured / arranged, depending on the number of staff and volunteers, to conduct this survey.

References

Iverson CG, Vohs PA, Tacha TC. 1985. Distribution and abundance of sandhill cranes in Western Texas. Journal of Wildlife Management 49:250-255.

Loges BW, Tavernia BG, Wilson AM, Stanton JD, Herner-Thogmartin JH, Casey J, Coluccy JM, Coppen JL, Hanan M, Heglund PJ, Jacobi SK, Jones T, Knutson MG, Koch KE, Lonsdorf EV, Laskowski HP, Lor SK, Lyons JE, Seamans ME, Stanton W, Winn B, Ziemba LC. 2015. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach. U.S. Fish and Wildlife Service, Natural Resources Program Center, Fort Collins, Colorado. http://www.iwmmprogram.org/documents/IWMM_NationalProtocolFramework_Ver1.0_Approved.pdf (March 2018); https://ecos.fws.gov/ServCat/Reference/Profile/83678 (ServCat link to updated, 2017 version)

SOP 3: Data Collection Methods – Site Condition Survey

The text below is taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site-specific.

Site condition surveys

Percent Visibility
As required by the IWMM protocol framework (Loges et al. 2015), ≥70% of each survey unit is visible from observation points (vantage points); the one exception is Coyote Lake, which is counted as an exit survey. The estimated percentage of each survey unit that is visible from vantage points is in Table SOP 4.1.

Appropriate Weather
Surveys during inclement weather should be avoided. Do not survey sandhill cranes in fog and, if possible, avoid rain due to visibility and logistical reasons. The IWMM framework suggests avoiding waterbird surveys in high winds (Beaufort force ≥ 3; Loges et al. 2015); however, due to pervasiveness of high wind speeds at the survey area, surveying in higher winds is allowed if wind speeds do not impede visibility. Due to the size of the birds and the shallow nature of the wetlands, sandhill cranes roosting on saline lakes will likely not be obstructed from an observer's view due to wind driven waves or moving vegetation.

Record temperatures (˚C) at the start of the survey and also estimate Beaufort wind scale (Table SOP 3.1).

Table SOP 3.1. The Beaufort Wind Scale

KPH	Beaufort	Description	Appearance of wind effects
<2	0	Calm	Calm, smoke rises vertically
2–5	1	Light Air	Smoke drift indicates wind direction, still wind vanes
6–11	2	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
12–19	3	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
20–29	4	Moderate Breeze	Raises dust and loose paper; small branches are moved
30–39	5	Fresh Breeze	Small trees in leaf begin to sway
40–50	6	Strong Breeze	Large branches in motion; umbrellas used with difficulty

Water Gauge Reading
Record water level readings at units with a gauge each time a survey is conducted. If the survey unit has a gauge, be sure to provide the measurement units of the water level gauge.

Water Depth
Estimate the percent of the unit in each of six water depth categories (Table SOP 3.2) corresponding to waterbird guild use (Ma et al. 2010). Percent cover estimates should sum to 100% across the six depth categories.

Table SOP 3.2. Categories of water depth

Category
Dry
Saturated/mudflat
0–5 cm (0 to 2 in)
5–15 cm (2 to 6 in)
15–25 cm (6 to 10 in)
>25 cm (> 10 in)

If ice is present, do not treat it as dry – instead estimate the depth of water and ice.

Percent of ice cover
Across the entire survey unit, visually estimate and record the percent of the water surface that is covered by ice.

Water coverage
Across the entire survey unit, visually estimate and record the percent of the survey unit that is covered by water.

Habitat Cover
Visually estimate the percent of the survey unit that is water, bare ground, and emergent vegetation. Cowardin et al. (1979) classifications suggested in the IWMM protocol framework (Loges et al. 2015) poorly describe saline lakes. Categories used are consistent with Loges et al. (2015), but will be limited to water, emergent, shrub-scrub (salt cedar), and bare ground for this survey. To aid in estimating percent water coverage, maps of each lake may be carried to the field and areas of water coverage may be sketched on the lakes. Emergent and shrub-scrub components are not always found on saline lakes. If present, emergent and shrub-scrub vegetation will typically be restricted to areas strongly influenced by inflows from springs, which are dispersed along edges/margins of the lakes. Refer to Rosen et al. (2013) for images of emergent components of saline lakes.

Interspersion
The configuration of vegetation and water/bare ground patches within a survey unit can influence habitat quality. The IWMM protocol framework (Loges et al. 2015) calls for defining vegetation patches as scrub-shrub, forest, and emergent, and defining water/bare ground patches as open water, submerged aquatic vegetation, floating-leaved aquatic vegetation, and bare ground. If the pluvial saline lakes in study area have an emergent or scrub-shrub (salt cedar) component, it is likely restricted to the immediate area of the margins or immediate areas of the springs. Springs are located either along edges of the systems or in uplands near the systems. Therefore, saline lakes will typically be completely open and coverage by water and bare ground (mud/organic or cobble) will approach 100%.

IWMM uses three interspersion configuration classes (Figure SOP 3.1) based on Suir et al. (2013). The three configuration classes are:

- Class L includes large and connected patches of water/bare ground features
- Class S contains small, disconnected patches of water/bare ground

- Class M contains discernible regions of both classes L and S

These classes reflect the interspersion, or inter-mixing, of vegetation and water/bare ground patches. Assign the survey unit to one of the configuration classes as an indicator of interspersion. Note that, when water/bare ground covers >60% of a unit, the only possible configuration class is L. Saline lakes addressed in this protocol will almost always fall into the Class L category.

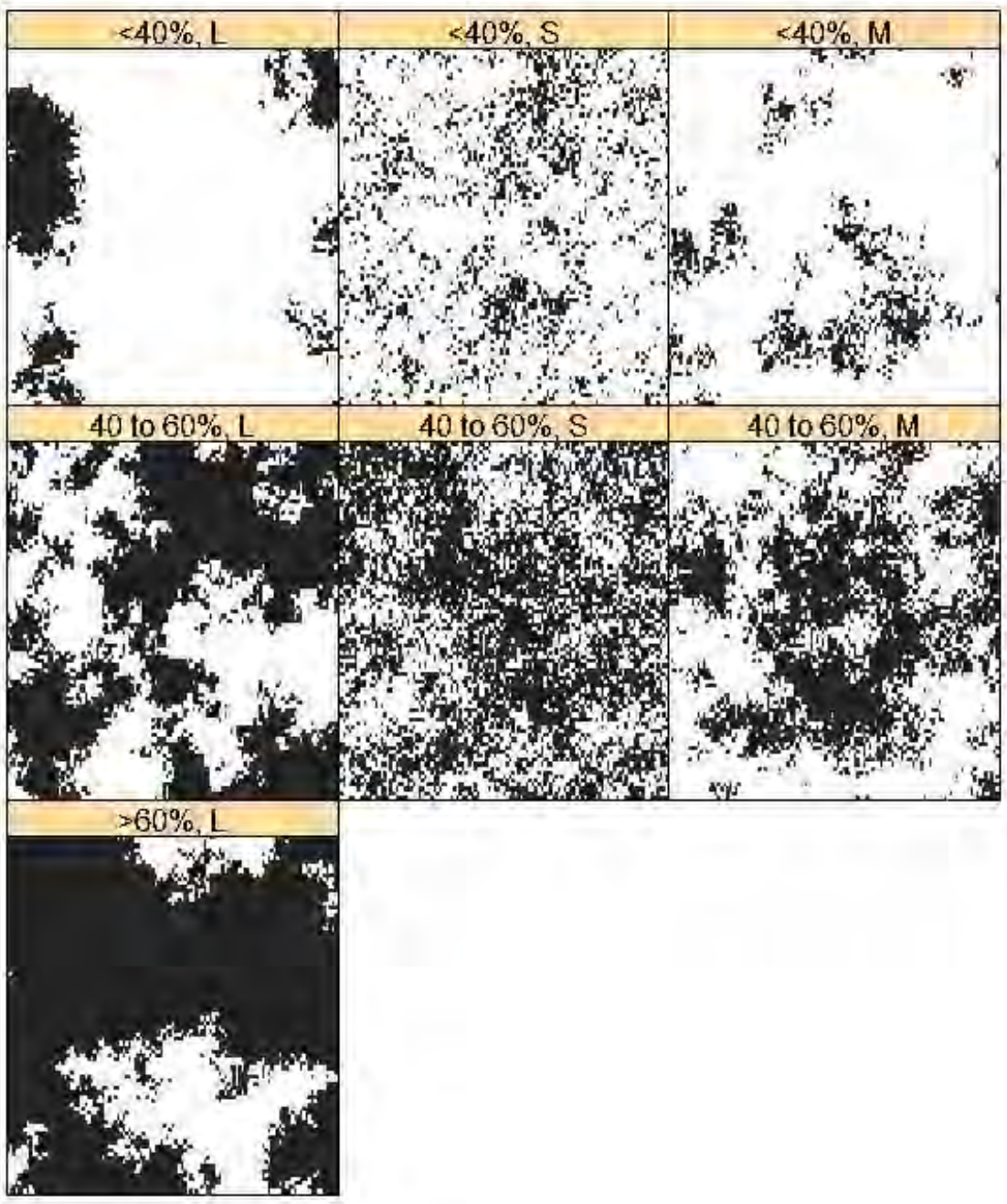

Figure SOP 3.1. Examples of three configuration categories (L; S; M). The three categories are illustrated for different levels of water/bare ground cover (<40%; 40 to 60%; >60%). Water/bare ground areas are represented in black above whereas vegetated areas are represented in white. In the case of saline lakes, which are primarily open water, the interspersion image would always be >60%, L. The open saline lakes would have even larger patches of black, representing water and bare ground.

Vegetation Height

Use ocular estimation to assess the percentage of the unit in each of seven vegetation height categories (Table SOP 3.3). Note the height being measured is the uppermost canopy, so the

percent cover estimates should sum to 100% across all categories. Note that saline lakes will mostly be in the <2.5 cm category due to bare ground and mud approaching 100% coverage.

Table SOP 3.3. Categories of vegetation height.

Category	Description
<2.5 cm	includes bare ground (e.g. mudflat) and water
2.5 to 15 cm	short vegetation, e.g. grazed grassland, sprouting crops, dwarf spikerush, etc.
15 to 30 cm	short herbaceous
30 to 60 cm	medium forbs and grasses
60 cm to 3 m	shrubs and low trees plus tall herbaceous vegetation and grasses.
3 to 6 m	shrubs, trees, tall herbaceous
>6 m	tall trees

Disturbance severity

Record any disturbance that is or has affected sandhill cranes abundance in the survey unit either during or immediately prior to surveys. Score the disturbance on a scale 1 to 4 (Table SOP 3.4).

Table SOP 3.4. Severity scale and associated definitions of sandhill crane response to disturbance.

Scale	Severity	Definition
1	Light/none	no effect on sandhill cranes
2	Moderate	some sandhill cranes move but stay within unit
3	Heavy	some sandhill cranes leave unit
4	Limiting	most/all sandhill cranes leave the unit

Disturbance source

If there is disturbance (see Disturbance Severity above), check the appropriate box to identify its source. Multiple sources can be checked. Potential sources are listed in Table SOP 3.5.

Table SOP 3.5. Types of disturbance

Code	Description
1	Pedestrian
2	Loose dog
3	Hunting
4	Fishing
5	Boats
6	Motor vehicles
7	Aircraft
8	Raptor
9	Other

Human Disturbance

Characterize each survey unit for the period between the last and the current sandhill crane survey (Table SOP 3.6). For off-refuge sites, ask the Refuge Manager if uncertain. For public lands, check site regulations or consult with refuge management.

Table SOP 3.6. Chronic disturbance classes and their definitions.

Class	Description
1	No entry into the unit for any reason.
2	Closed to all use with entry into unit by resource managers or designees for management activities, surveys, or other controlled non-hunting activities.
3	Managed access for all activities including firearms hunting. May include effort to control use levels and temporal closures (i.e. hunting units that close in the afternoon).
4	Open access via trail, viewing platforms etc. No firearms hunting allowed.
5	Open access, including firearms hunting, often with routine restrictions but without a site specific management program to control the level of authorized use.
6	Unknown

References

Cowardin LM, Carter V, Golet FC, LaRoe ET. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. https://www.fws.gov/wetlands/documents/classwet/index.html

Loges BW, Tavernia BG, Wilson AM, Stanton JD, Herner-Thogmartin JH, Casey J, Coluccy JM, Coppen JL, Hanan M, Heglund PJ, Jacobi SK, Jones T, Knutson MG, Koch KE, Lonsdorf EV, Laskowski HP, Lor SK, Lyons JE, Seamans ME, Stanton W, Winn B, Ziemba LC. 2015. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach. U.S. Fish and Wildlife Service, Natural Resources Program Center, Fort Collins, Colorado. http://www.iwmmprogram.org/documents/IWMM_NationalProtocolFramework_Ver1.0_Approved.pdf (March 2018); https://ecos.fws.gov/ServCat/Reference/Profile/83678 (ServCat link to updated, 2017 version)

Ma Z, Cai Y, Li B, Chen J. 2010. Managing wetland habitats for waterbirds: an international perspective. Wetlands 30:15–27.

Rosen D J, Caskey, AD, Conway WC, Haukos DA. 2013. Vascular flora of saline lakes in the Southern High Plains of Texas and eastern New Mexico. Journal of the Botanical Research Institute of Texas 7:595-602.

Suir GM, Evers DE, Steyer GD, Sasser CE. 2013. Development of a reproducible method for determining the quantity of water and its configuration in a marsh landscape. Journal of Coastal Research, Special Issue 63:110–117.

SOP 4: Locations of Survey Units – Driving Directions

The location of each observation point is in Table SOP 4.1, and figures below (Figures SOP 4.1 - 4.8) contain general driving directions associated with each observation point and survey unit.

Table SOP 4.1 Observation point locations* for each survey unit and estimated percent visibility

Survey Point	IWMM Survey Unit Codes	UTM Easting* (m)	UTM Northing* (m)	Approx. visibility of survey unit (%)
Salt Lake (Grulla NWR)	TX-003-SL	680372	3775200	95
Monument Lake	TX-003-ML	696225	3761060	95
Coyote Lake	TX-003-CL	694237	3774295	<50**
Baileyboro Lake	TX-003-BB	700429	3765001	95
Paul's Lake	TX-003-PL	711118	3762476	90
Goose Lake	TX-003-GL	709083	3759907	95
White Lake	TX-003-WL	706131	3758750	95
Bull Lake	TX-003-BL	733032	3754224	85

*Recorded in Universal Transverse Mercator zone 13N

**Exit count only (birds counted in flight as the depart roost site)

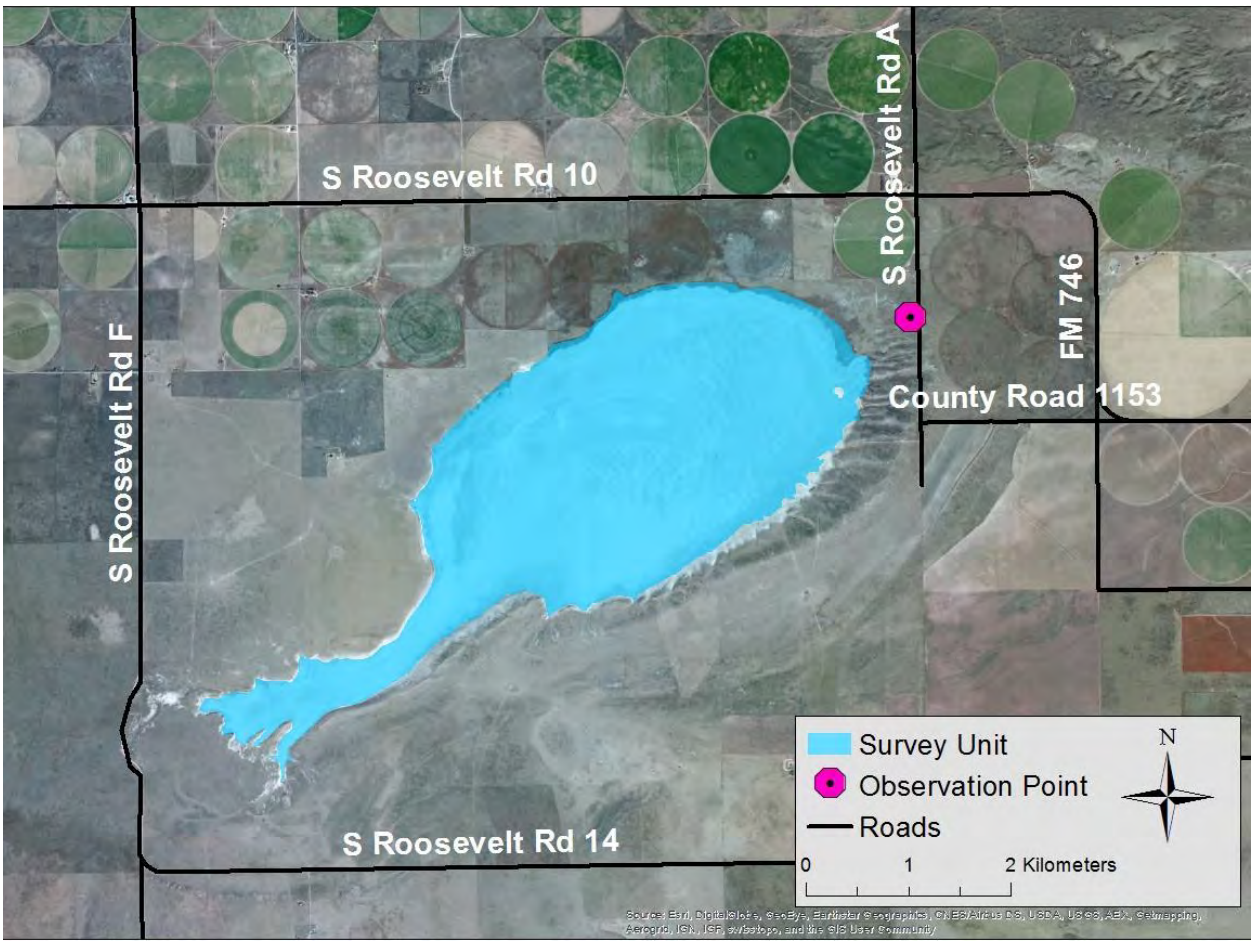

Figure SOP 4.1. Salt Lake Survey Unit: The observation point is located on Grulla NWR, approximately 29.5 km northwest of the Muleshoe NWR refuge visitor center. From the visitor center, travel east onto County Road (CR) 1248, then turn north onto HWY 214. Go west on CR 1170, then north onto CR 1510. Turn west onto Farm-to-Market (FM) 746 and continue as it curves until S Roosevelt Rd A and turn south. Enter the parking area on west side of road and walk towards Salt Lake to observation point.

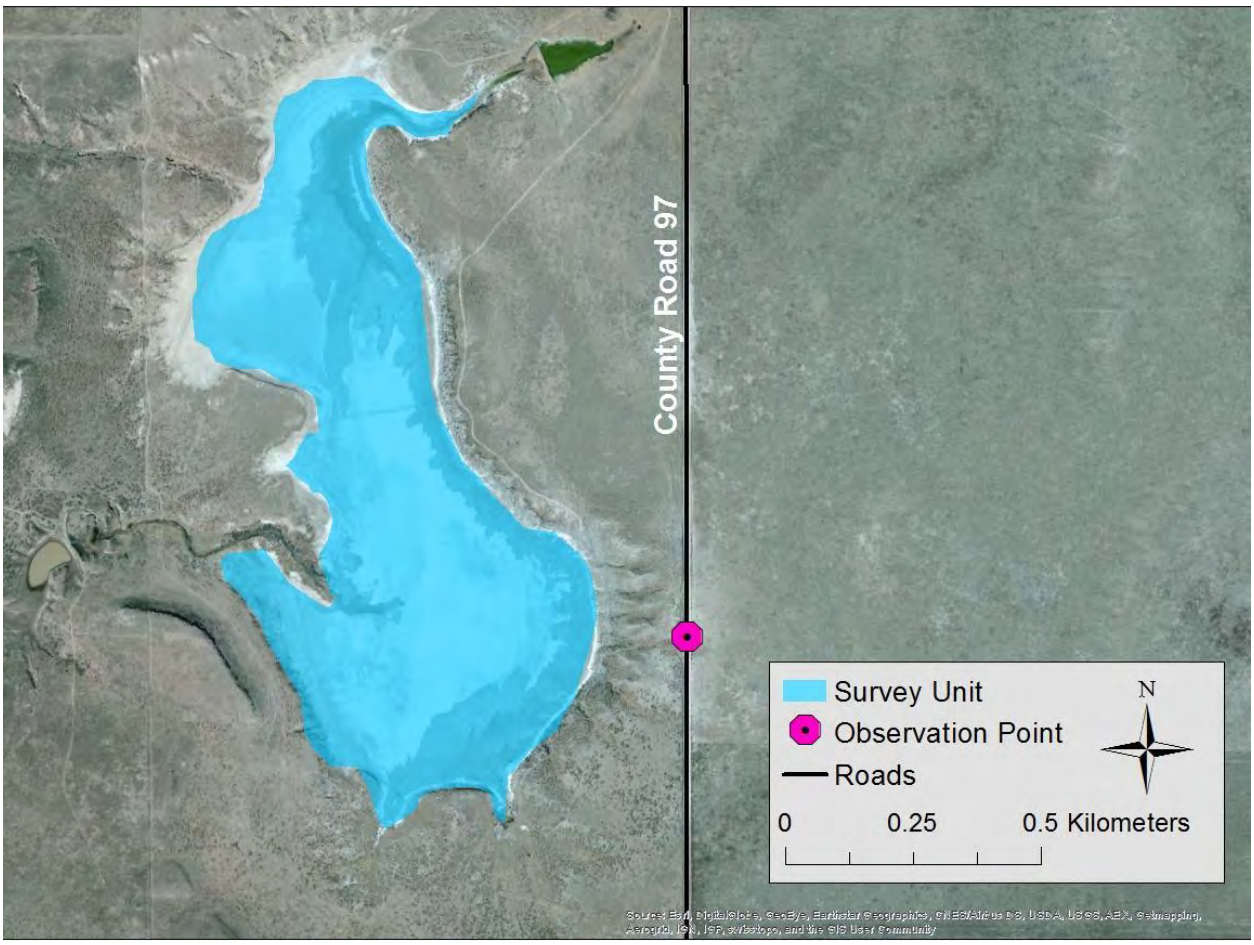

Figure SOP 4.2. Monument Lake Survey Unit: The observation point is located approximately 9.3 km west of Muleshoe NWR visitor center on County Road (CR) 97. From the visitor center, exit Muleshoe NWR on west side via CR 1248 and turn north onto CR 149. Travel on CR 149 approximately 3 km and turn west onto CR 1223, then south onto CR 139. Go west on CR 1233, then north on CR 1533, west again on CR 1223, and finally south onto CR 97 to the observation point. Alternately, from the visitor center one could travel east on CR 1248 to highway 214 and turn south. Then turn west onto CR 1272, north onto CR 1533, west onto CR 1259 and finally north onto CR 97 to observation point.

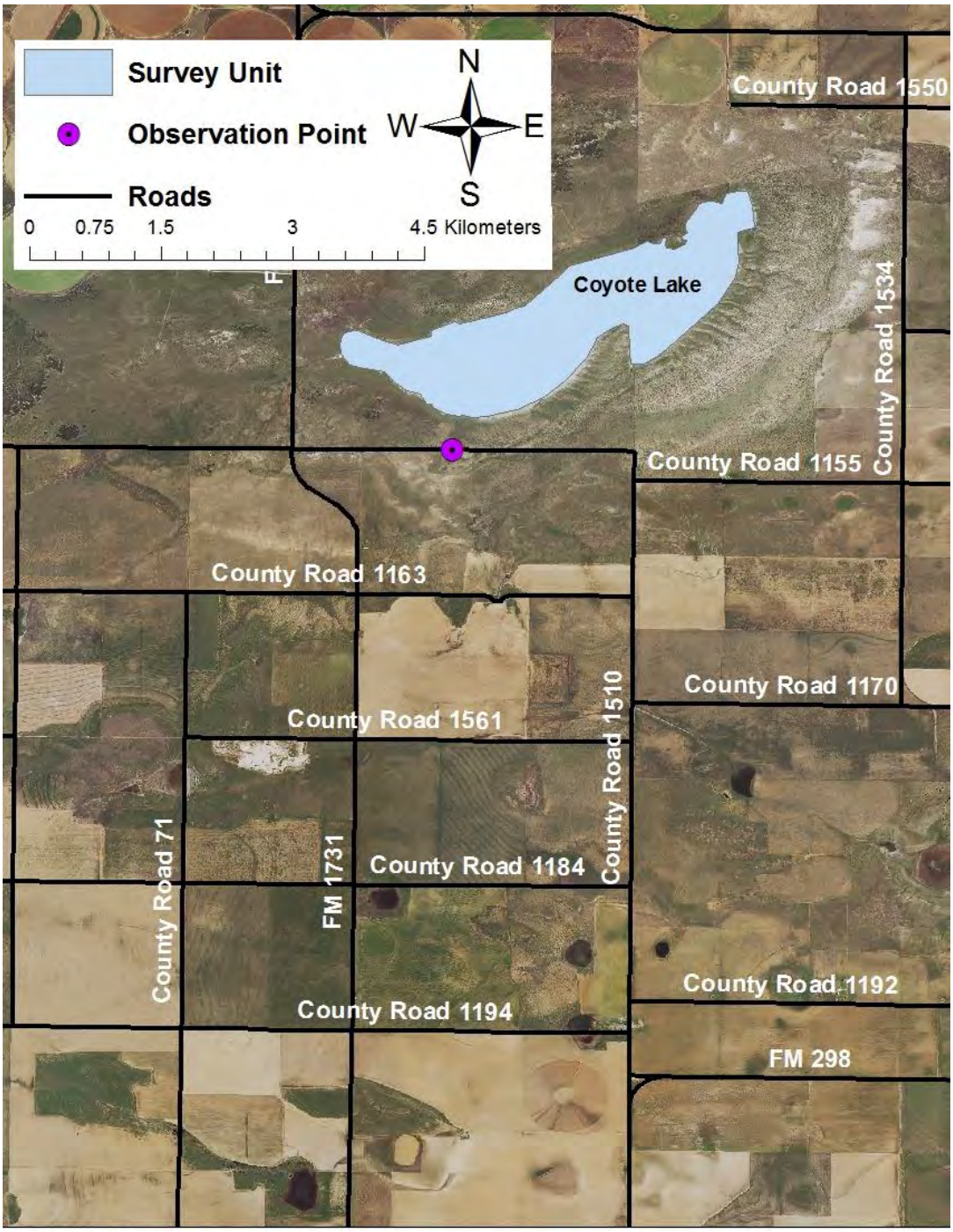

Figure SOP 4.3. Coyote Lake Survey Unit: The observation point is located approximately 18.5 km northwest of Muleshoe NWR visitor center along County Road (CR) 1153. From the visitor center, exit Muleshoe NWR on west side via CR 1248 and turn north onto CR 149. On CR 149 travel 8.2 km, and then turn west onto HWY 298. Continue on HWY 298 approximately 8.8 km, then turn north on CR 1510 (Rd 97). Drive north on CR 1510 approximately 7 km to FM 746. Travel west on CR 1153 (FM 746) approximately 1.5 km to observation point.

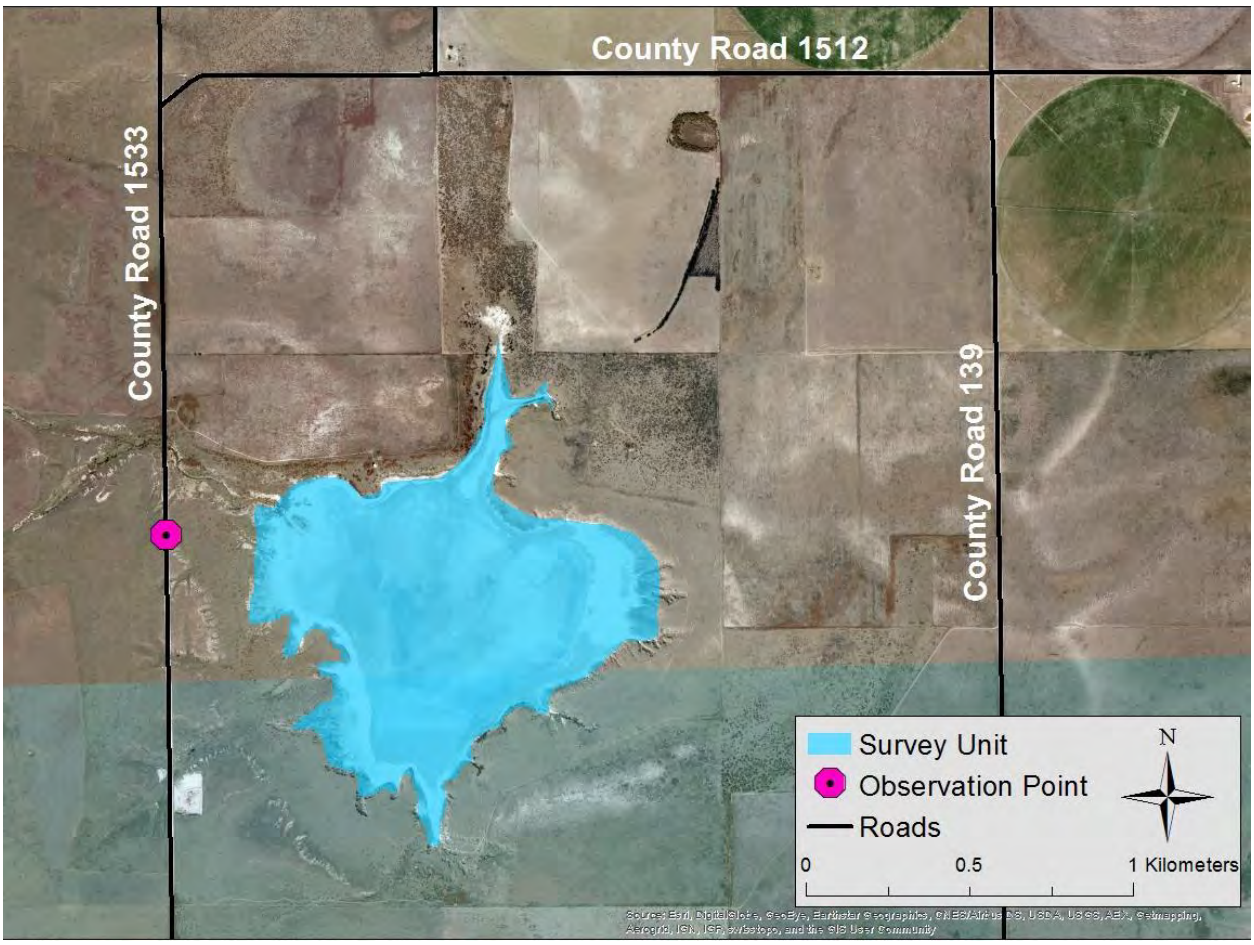

Figure SOP 4.4. Baileyboro Lake Survey Unit: The observation point is located approximately 7.2 km northwest of Muleshoe NWR visitor center on County Road (CR) 1533. From the visitor center, exit Muleshoe NWR on west side via CR 1248 and turn north onto CR 149. Continue on CR 149 until reaching CR 1512, then travel west on CR 1512 and until reaching CR 1533. Travel south on CR 1533 until you reach observation point.

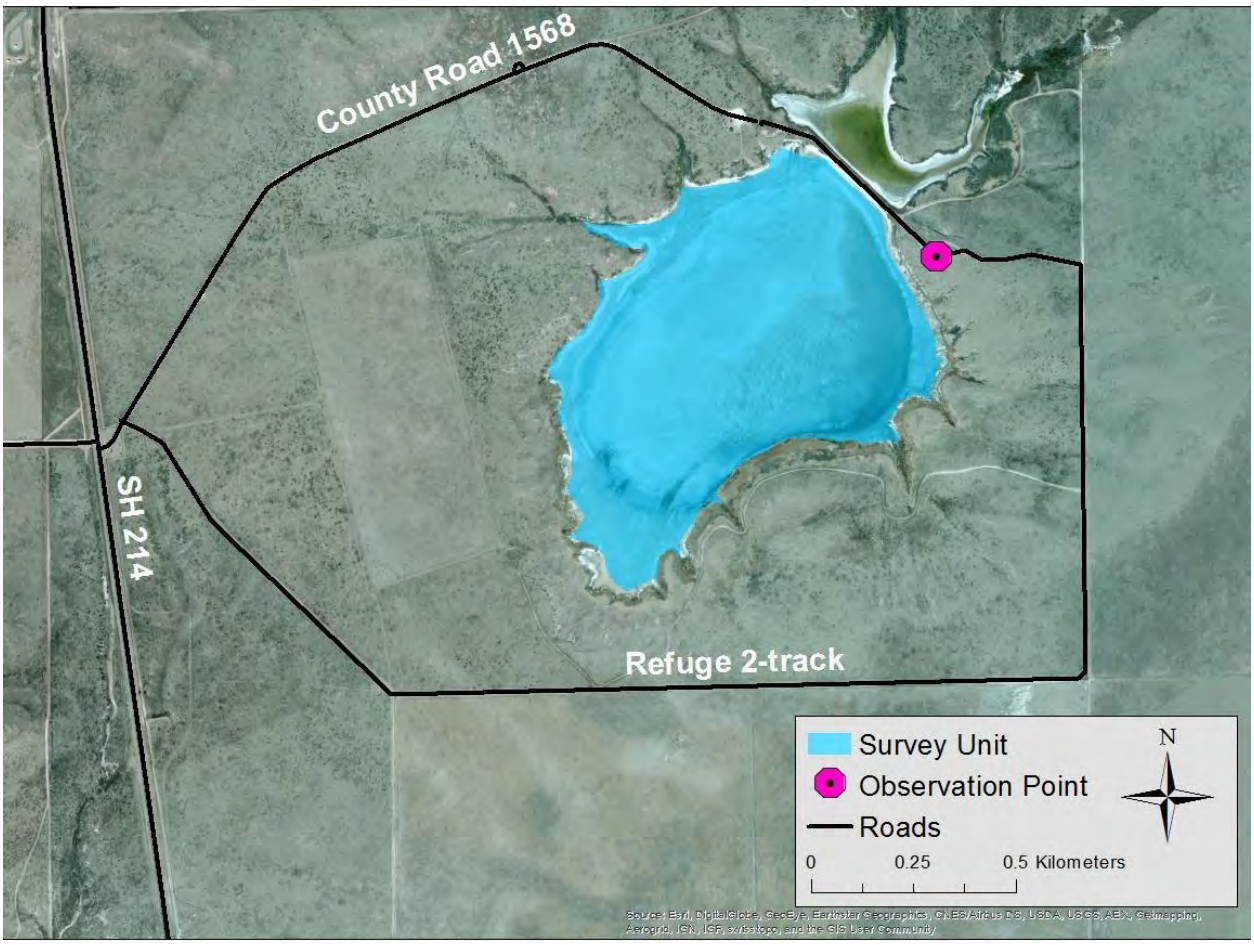

Figure SOP 4.5. Paul's Lake Survey Unit: The observation point is located on Muleshoe NWR approximately 6.5 km northwest of the Muleshoe NWR visitor center. From the visitor center, take County Road (CR) 1248 east to HWY 214, and turn north. Then turn right onto CR 1568 and almost immediately turn right onto a two-track refuge road; follow this road to observation point.

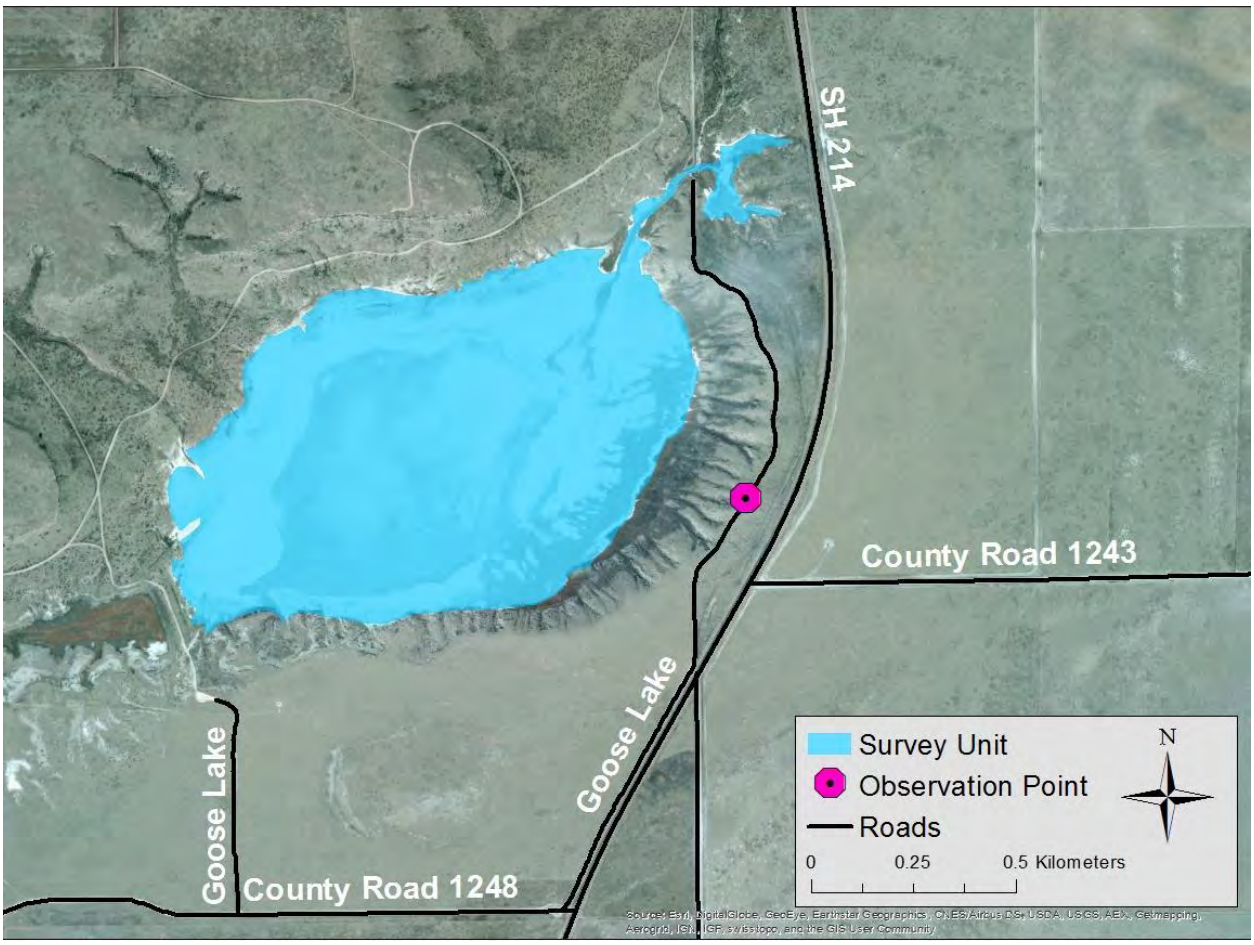

Figure SOP 4.6. Goose Lake Survey Unit: The observation point is located on Muleshoe NWR on Goose Lake Road approximately 3.7 km east of Muleshoe NWR visitor center. From the visitor center, turn north onto Goose Lake Road just before you reach HWY 214. Continue north to the observation point.

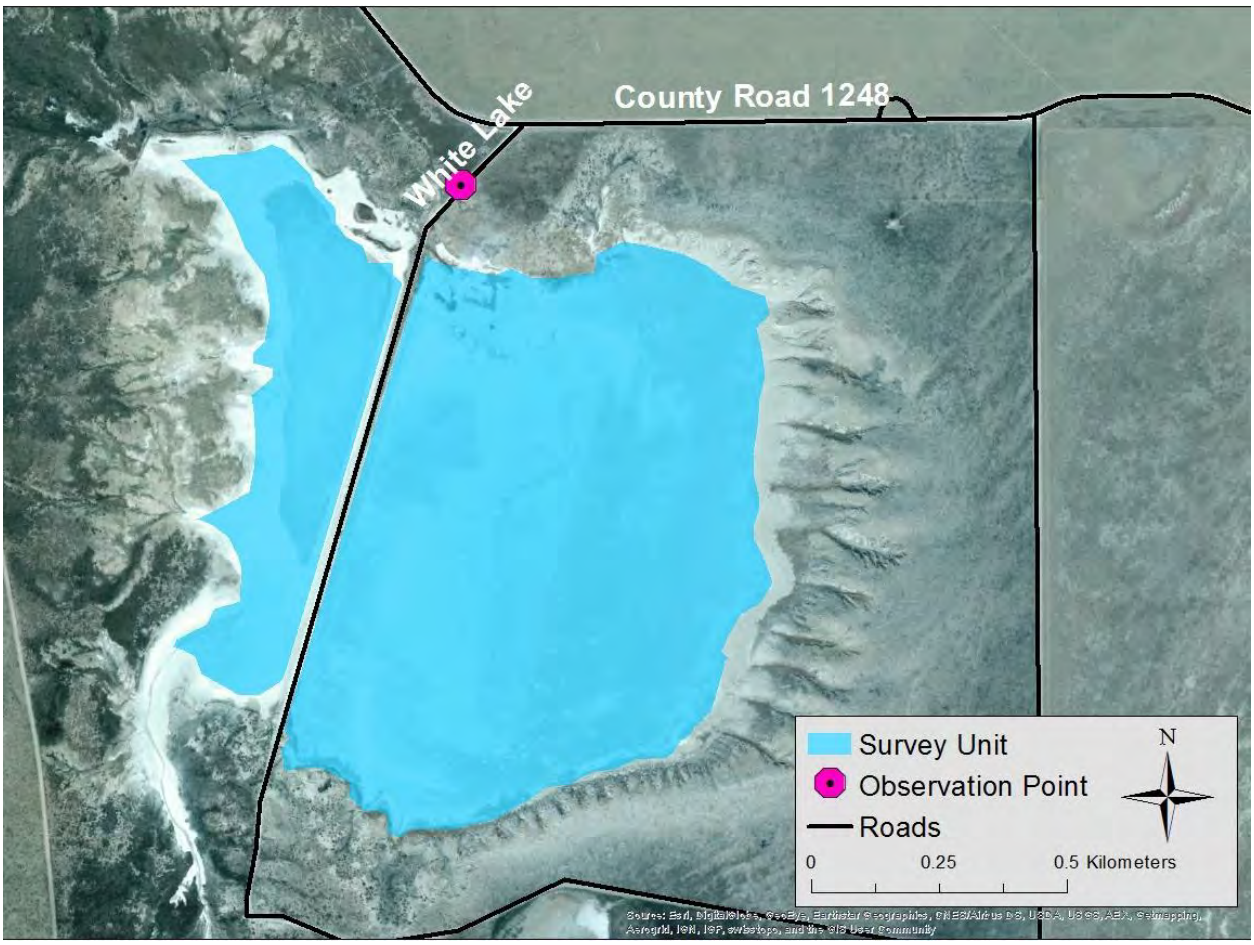

Figure SOP 4.7. White Lake Survey Unit: The observation point is located on Muleshoe NWR approximately 1.0 km southwest of the Muleshoe NWR visitor center. Travel east from the visitor center on County Road (CR) 1248, and quickly turn right onto White Lake Road to the observation point.

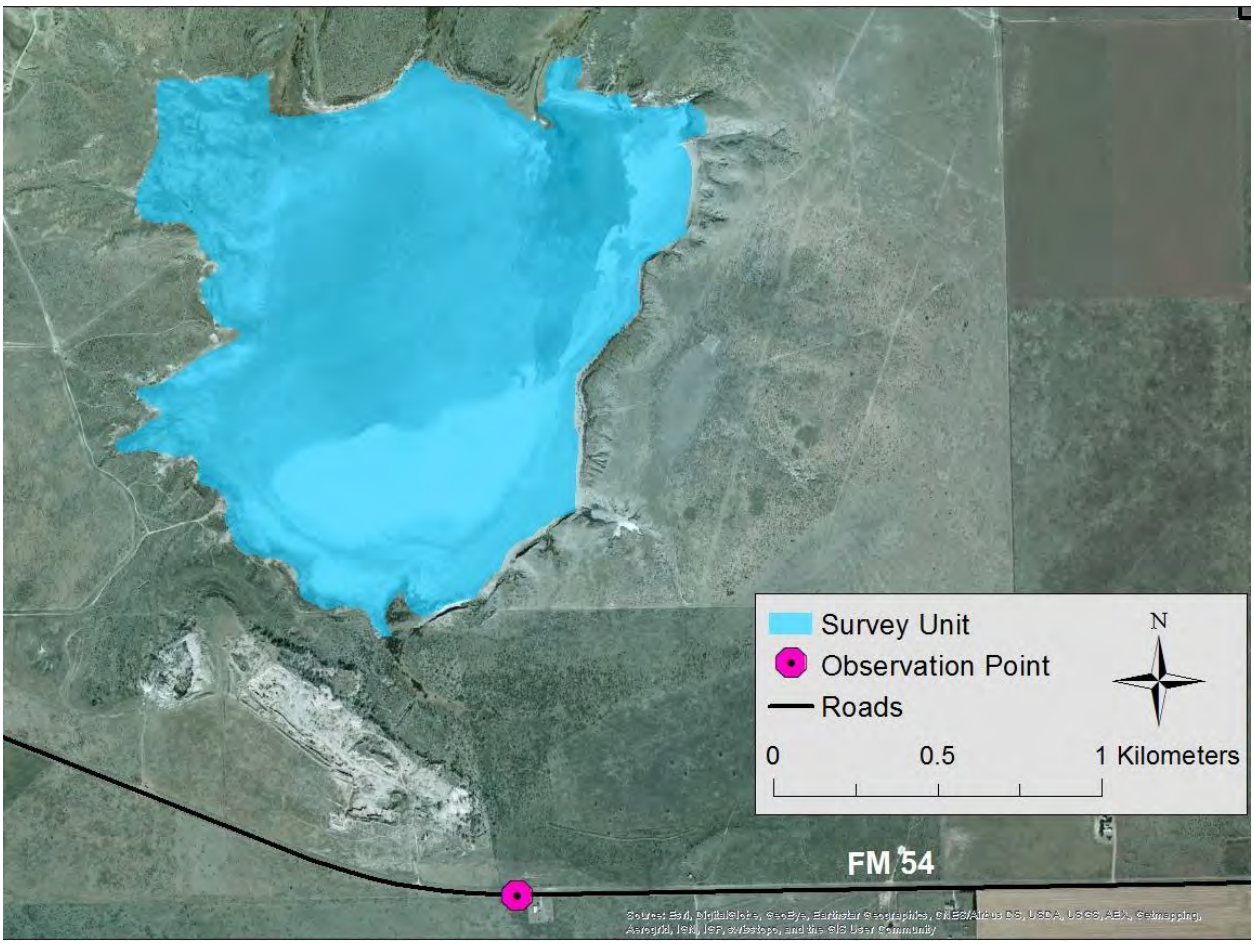

Figure SOP 4.8. Bull Lake Survey Unit: The observation point is located approximately 28.0 km east of Muleshoe NWR visitor center on Farm to Market (FM) 54. From the visitor center, travel east on County Road (CR) 1248, then turn south onto HWY 214. Turn east onto FM 37, and continue east when it turns into FM 54. The observation point is on the north side of the road at the historical marker.

SOP 5: Data Entry and Management Instructions

The text in this SOP is largely taken from the "National Protocol Framework for the Inventory and Monitoring of Nonbreeding Waterbirds and their Habitats" (Loges et al. 2015), but has been modified to be site-specific.

Data collected using this protocol must be entered into the IWMM/AKN portal [https://data.pointblue.org/partners/iwmm/login/?returnUrl=%2Fscience%2Fiwmm-portal%2F]. This SOP describes the database for waterbird counts and provides instructions for data entry, data verification, and database administration.

Terminology

Using the database to enter or manage data requires knowledge of a few salient terms. In the AKN system:

- AKN "Project Leader" = Typically a Survey Coordinator (often this individual is in a Refuge Biologist position) as defined by Natural Wildlife Refuge System I&M policy (701 FW 2) or in general a 'cooperator' using this survey protocol framework. This person can give permissions to field biologists and technicians for data entry and validation. This is the person that will be contacted if there are questions about the data and who has a commitment to the accuracy and the validity of data entered from your site. Throughout this SOP this role is referred to as the "Project Leader" to denote that this is not the Refuge Project Leader.
- Project = the name of the refuge or other area over which a survey is conducted.
- Field Observer = the person or persons collecting data via this protocol.
- Data Entry Technician = the person entering data collected. Note that one individual can have multiple roles, such as Survey Coordinator or Data Entry Technician

Gain Access to the Database

The Survey Coordinator (the Refuge Biologist at Muleshoe NWR) is the refuge lead on the survey and must have database access permission from IWMM's Science Coordinator before survey data for the refuge can be entered. The IWMM Science Coordinator will assign the Survey Coordinator permissions for project creation, project access and data entry.

Proof and Archive the Data Sheets

Data entry errors influence the quality and utility of collected data. However, many of these types of errors can be controlled through data organization, checking and entry techniques. The following steps should be used to reduce errors in the database and make original data recording materials available for future reference, back-up or checking.

1. Organize data sheets by survey unit to facilitate data upload. Proofread the data sheets ensuring that they have been filled out completely. Data should be entered within one week of the survey.
2. Mark corrections on original data sheets with red pen. Any corrected errors, or changes made by the data "proofer" (that are entered differently into the database than they appear on the data sheet) should be circled, initialed in the margins, and corrected. Notes should

be written in the margins or in the comments section to document the reason for the corrections.
3. Follow the steps in the "**Enter the Data**" section below.
4. At the end of the survey season, scan the data sheets to have a digital archive. The scanned documents should be compressed, stored in the USFWS Service Catalog (ServCat) [95666] and linked to the project [95413]. Care should be taken in scanning the documents and building the .pdf file so that data sheets are in order by survey date and then survey unit name. Compressed files should be named by survey year prior to archiving in ServCat. The Zone Biologist can assist with archiving the data sheets at the end of the survey season. The original data sheets should also be copied. The originals should be kept at Buffalo Lake NWR and the copy should be kept at Muleshoe NWR.
5. At the end of the survey season, entered data should be exported from the IWMM site as a .csv file and archived in ServCat [95833]. If the data are associated with a survey report, also include these data as an Appendix to the report, archive the report in ServCat, and link it as a product to the overall project [95413]. See SM-3 for a visualization of appropriate ServCat linkages.

Enter the Data

Prepare for data entry:

1. Organize your data and guidance materials to aid the data entry process.
2. A data form will help verify that you have all the required data entry fields for your project.
3. A description of the methods used for this survey.
4. The name and contact information of the Survey Coordinator (the person who can be contacted regarding questions about these data).

Enter the bird survey data into the AKN database:

1. Navigate through the IWMM website to the database interface and log in to the data entry web site using your email address and password [at http://data.pointblue.org/science/iwmm-portal/].
2. Make sure the Project Dashboard page (Figure SOP 5.1) shows "MULESHOENWR" as the Site (Project).

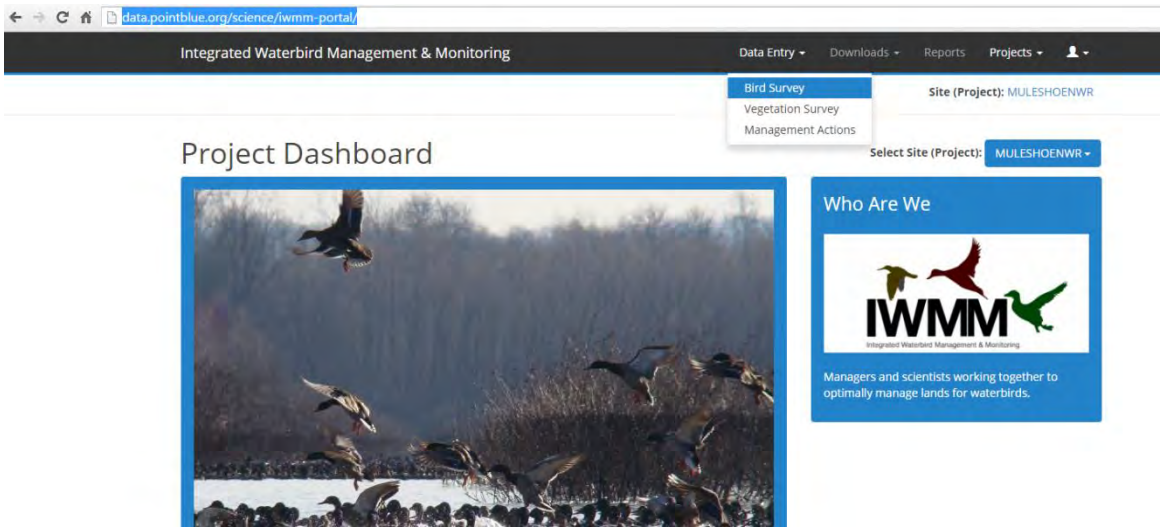

Figure SOP 5.1. Screen grab of Project Dashboard, with "MULESHOENWR" selected as project site and "Bird Survey" selected under Data Entry tab.

3. Navigate to the "Data Entry" drop-down menu and select "Bird Survey" (do this by "hovering over" Data Entry and clicking on Bird Survey)
4. Click the link for the appropriate "Survey Unit" listed on the data sheet. The options on the data entry portal will look similar to Figure SOP 5.2

Figure SOP 5.2. Screen grab of Survey Unit options; make sure the survey unit selected matches the field data sheet.

5. The only available options for the "Observation Protocol" and the "Site-condition Protocol" are pre-selected. They are "IWMM_GroundSurvey" and "IWMM_SurveySiteConditions," respectively (Figure SOP 5.3). Click the "Start" button.

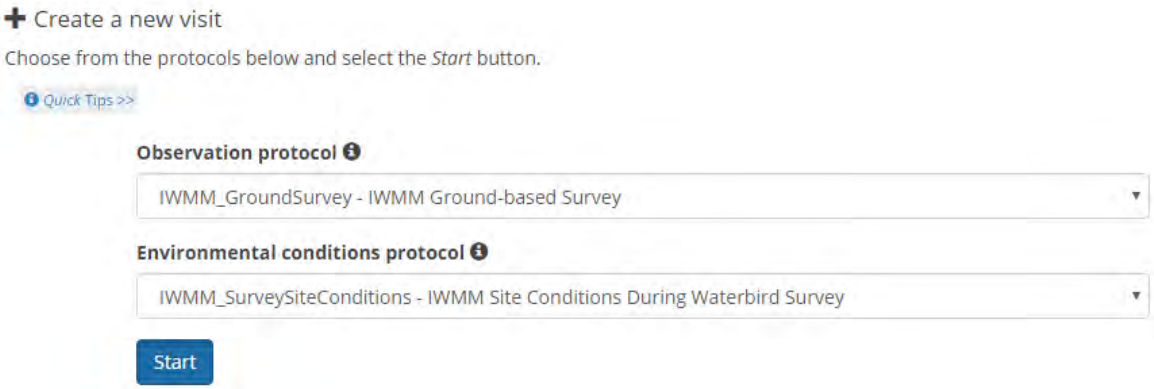

Figure SOP 5.3. Screen grab of data entry options; these should be preselected; if not, they are the only available options under the dropdown.

6. Enter all waterbird codes under species (the code for sandhill crane is SACR, Figure SOP 5.4), unit condition, and vegetation data from the data sheet into the database. Be sure that all necessary data has been collected and entered; the system does not accept blank fields.

Figure SOP 5.4. Screen grab of species entry options; the 4 letter AOU code for sandhill crane is SACR.

7. Click "Save All" at the bottom of the page when all data has been entered.

8. You can click the black “i” button to get help for each field (Figure SOP 5.5). They are available under the Ground Survey and Survey Site Condition portals. They become useful if you have questions.

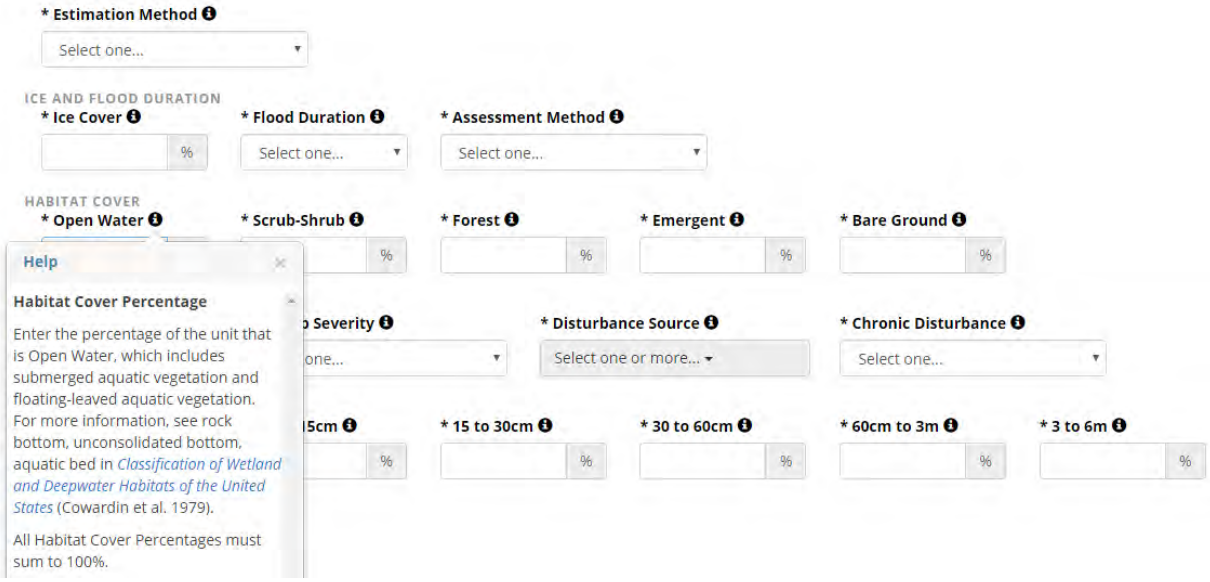

Figure SOP 5.5. Screen grab of Site Conditions data entry page; Note “i” button for the Habitat Cover has been clicked, and additional instructions and information about the field is viewable.

9. After all data from each data sheet have been entered or uploaded, proof the data in the database, review the data forms and sorting summaries (from queries) to check for errors, and blank fields. As each data sheet (or any digital file output) is proofed, date and initial that the input data were reviewed and checked against the original data records. The person performing data entry will also verify the data has been proofed in the database by changing the status of the data records from “RAW” to “CLEAN”. This is done by clicking the “Proofing completed” box (See Figure SOP 5.6).

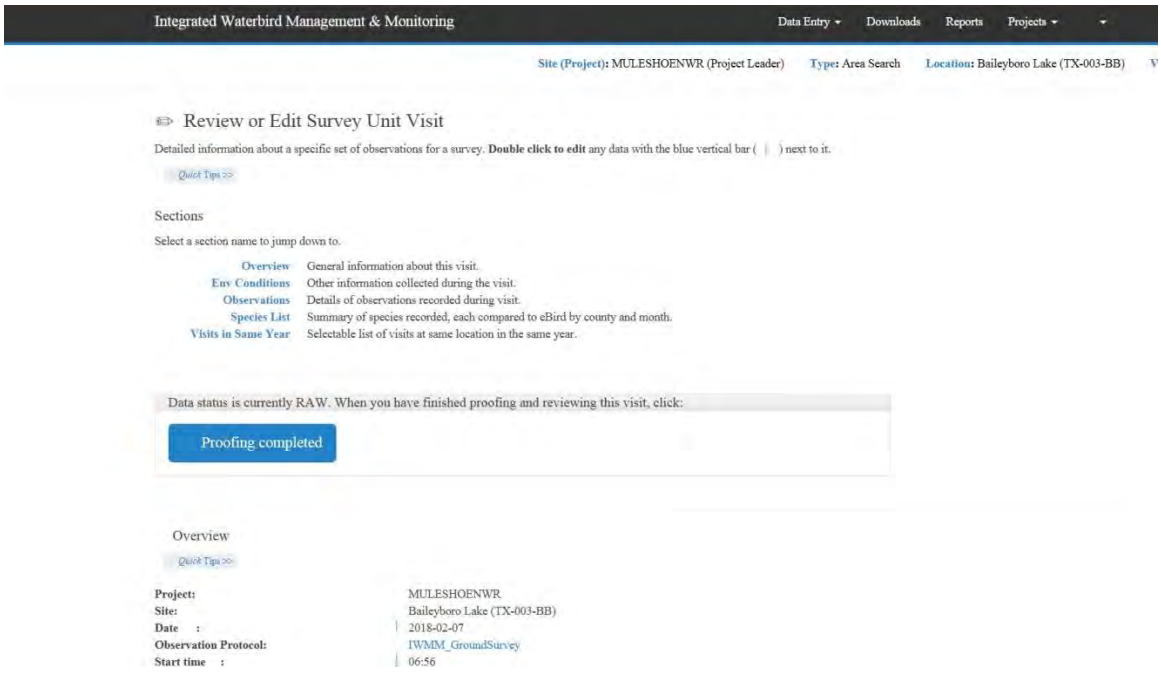

Figure SOP 5.6. Screen grab showing the "proofing completed" button; clicking the blue proofing completed button changes record status from "RAW" to "CLEAN". It should not be clicked until data have been proofed. For data saved as RAW and proofed at a later date, this screen can be pulled up by clicking the hyperlink for "date" associated with records for individual survey locations (survey units) (see Figure SOP 5.7).

Verify and Validate

AKN uses a tiered set of levels for indicating the data validation and access (see bullets below). Once the individual entering data is finished, he or she needs to notify the "Project Leader" (Refuge Biologist at Muleshoe NWR) that data are entered and ready to be proofed. The Project Leader will:

1. Ensure all data sheets have been initialed.
2. Compare the data sheets with the data records in the database and if there are no errors, then change the status of the records to the next appropriate level (see the user's manual for the database).
3. Discuss any questionable data entry or field observer errors with the Data Entry Technician and/or Field Observer. If there are errors, the Project Leader will open record(s) for editing.
4. After all errors are satisfactorily resolved in the database, set the status back. Then the Project Leader will change the status of records in the database.
5. Upon a final quality check and review of entered data, the coordinator will set the access to:
    1. Records from Goose Lake, Paul's Lake, White Lake, and Salt Lake will be assigned **LEVEL 3** (Figures SOP 5.8, and paragraph below concerning AKN's data access levels); these survey units occur on NWR lands.

2. Records from Baileyboro Lake, Bull Lake, Coyote Lake, Monument Lake will be assigned an access level of "**APPROVED**" (Figures SOP 5.8) These survey units occur off-refuge.

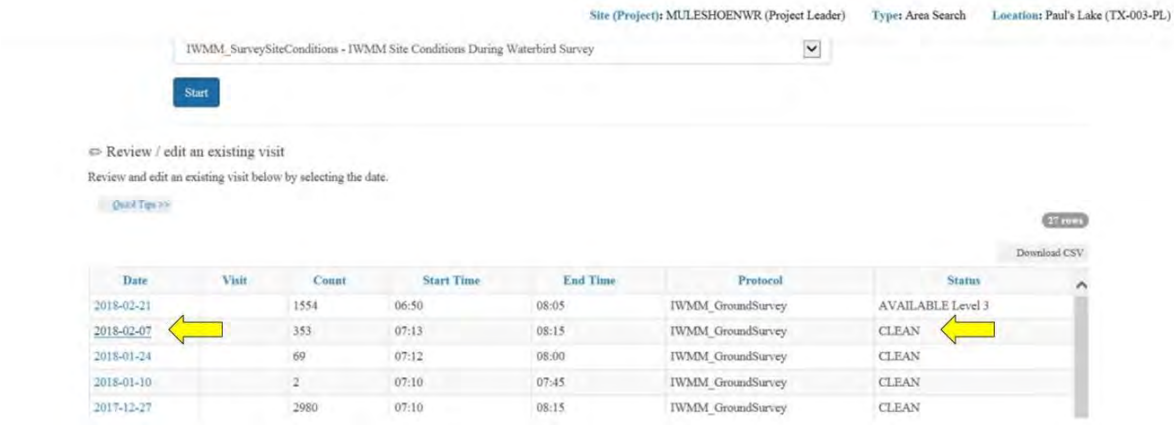

Figure SOP 5.7. Right click on the date (yellow arrow to left) to change access levels for a record (yellow arrow to right). See Figure SOP 5.8 for proceeding after the record has been opened for edit.

Figure SOP 5.8. Double click on "CLEAN" to change a proofed record to either "APPROVED" OR "LEVEL 3". Only survey units located on NWR lands should be assigned Level 3 access.

The following are AKN's data access levels. These are applicable to each record in the network individually, so that individual records may have different access levels. Data published using one of the five levels below are stored in the AKN's primary data warehouses. The warehouses serve as the primary archives of all AKN data. No applications connect directly to the warehouses, but data from a warehouse are ported to separate data views created specifically to optimize the performance of an application that connects to it. Data owners can specify how their data can be used in the data views, with the option that their data are not available to the public at all.

- *Level 1*: Some information about the data are made available to individuals other than project members. Specifically, only metadata about the datasets are made available to any application or service.
- *Level 2*: Same as Level 1 with the following addition: data can be used in certain publicly available, predefined visualizations (i.e. maps and graphs), but direct access to the data is restricted.
- *Level 3*: Data are used in publicly available, predefined visualizations (i.e. maps and graphs). Additionally, the complete Bird Monitoring Data Exchange (BMDE) data set is available upon request, subject to approval from the original data provider.
- *Level 4*: Data can be used in publicly available, predefined visualizations (i.e. maps and graphs) and also may be available upon request. Additionally, some components of the data are made available to existing bioinformatic efforts (Global Biodiversity Information Facility [GBIF] and ORNIS). These bioinformatic efforts only provide the data "marked-up" to Darwin Core, used to describe primary occurrence (location, date and species for example).
- *Level 5*: Data are used in publicly available, predefined visualizations (i.e. maps and graphs) and are available to existing bioinformatic efforts. Additionally, the complete BMDE data set is available for download directly via download tools.
- *RAW*: Data were input but no further review or processing has taken place. Data are available for project use only and not to the AKN.
- *Clean*: Data were input and reviewed by member(s) of the project team. Data are available for project use only and not to the AKN.
- *Approved*: Data were reviewed by project management, but no indication has been made of AKN data sharing levels. Data are available for project use only and not to the AKN.
- *Restricted*: Same as "Approved" and not distributed and shared to other AKN partners automatically. All access to data must come through requests to the contributing institution project management.

Database Maintenance and Archiving

AKN is responsible for performing periodic backups of the database. Editing data that has already been "verified" in the database must be made in the AKN database by the Project Leader via the interface. Contact IWMM's Science Coordinator for assistance if numerous edits are needed.

References for SOP 5

Loges BW, Tavernia BG, Wilson AM, Stanton JD, Herner-Thogmartin JH, Casey J, Coluccy JM, Coppen JL, Hanan M, Heglund PJ, Jacobi SK, Jones T, Knutson MG, Koch KE, Lonsdorf EV, Laskowski HP, Lor SK, Lyons JE, Seamans ME, Stanton W, Winn B, Ziemba LC. 2015. National protocol framework for the inventory and monitoring of nonbreeding waterbirds and their habitats, an Integrated Waterbird Management and Monitoring Initiative (IWMM) approach. U.S. Fish and Wildlife Service, Natural Resources Program Center, Fort Collins, Colorado. http://www.iwmmprogram.org/documents/IWMM_NationalProtocolFramework_Ver1.0_Approved.pdf (March 2018); https://ecos.fws.gov/ServCat/Reference/Profile/83678 (ServCat link to updated, 2017 version)

Supplemental Materials (SM)

SM-1: Data Dictionaries for supporting GIS files

The tables below pertain to the attributes in the supporting GIS files (ESRI format). These GIS files are archived on ServCat [95415].

Table SM-1.1: Attribute description (field name description) for the survey unit shapefile.

Field	Descriptor	Definition
FID	0-6	Unique number assigned by ArcMap to identify each polygon
Shape	Polygon, Polyline, Point	Geometry of the shapefile.
WetlandID	Unique identifier	Unique identifier for each wetland created by Texas Tech University, Center for Geospatial Technology.
WetType	Wetland classification	Saline Lake = large isolated wetland in contact with groundwater; classification created by Texas Tech University, based on National Wetlands Inventory and Cowardin et al. 1979[1].
Comment	Name of saline lake	Unique name for each survey unit (saline lake).
SqMeters	Numeric	Area, in square meters, of the saline lake.
Acres	Numeric	Area, in acres, of the saline lake.
StAbbr	State abbreviation	Two letter US Postal Code abbreviation of the state where survey unit is located.
CountyName	County name	Name of the county where survey unit is located.
LonNAD83	Longitude	Approximate longitude of centroid of saline lake in NAD 1983 decimal degrees.
LatNAD83	Latitude	Approximate latitude of centroid of saline lake in NAD 1983 decimal degrees.

[1] See References for SM-1 below

Table SM-1.2: Attribute descriptions (field name descriptions) for the observation point shapefile.

Field	Descriptor	Definition
FID	0-6	Unique number assigned by ArcMap to identify each point.
Shape	Point ZM	Geometry of the shape file corresponding to the FID; ZM is an artifact of importing the spatial file into ArcGIS from a GPS unit
OBJECTID	1-8	Identification number for the point.
Name	Name of Saline Lake	Name of survey unit (saline lake) associated with observation point.
Type	GPS reference type	WPT = waypoint. Set of coordinates held in a GPS unit; in this case the waypoint is the observation point. This field is carried over from importing the original spatial file from a GPS unit.
Symbol	GPS symbol type and color	Symbol type (flag) and color representing the waypoint in a GPS unit; this field is carried over from importing the original spatial file from a GPS unit.

References for SM-1

Cowardin LM, Carter V, Golet FC, LaRoe ET. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. https://www.fws.gov/wetlands/documents/classwet/index.html

SM-2: Useful navigation tools

The ServCat site below contains Google Earth files (.kmz) of the survey units and observation points. Observation points can also be downloaded in two files types that are compatible with certain GPS units (.gdb and gpx). The .gdb file is a "Garmin Format" that is typically compatible with Garmin units and the Garmin software BaseCamp™. The .gpx file is in "GPX eXchange Format" and is typically compatible with Garmin and other brands of GPS units.

The ServCat link is https://ecos.fws.gov/ServCat/Reference/Profile/95415.

SM-3. Service Catalogue(ServCat) Organization for the IWMM Project.

For the purpose of keeping track of files and facilitating data sharing, the Survey Coordinator should maintain an organized reference structure in the USFWS Service Catalogue (ServCat). See Figure SM-3.1 for the organization of references pertaining to this project. Future reports should be linked as a product of the Muleshoe-Grulla IWMM Site-specific Project (95413). The geospatial data reference (95415) should be updated with future changes to shapefiles. Scanned digital copies of data sheets (95666) should be compressed by year in a .zip file and annually uploaded into ServCat. Likewise, a spreadsheet (.csv) of the annual data (tally sheets) should be downloaded from the IWMM site and archived in ServCat (95833).

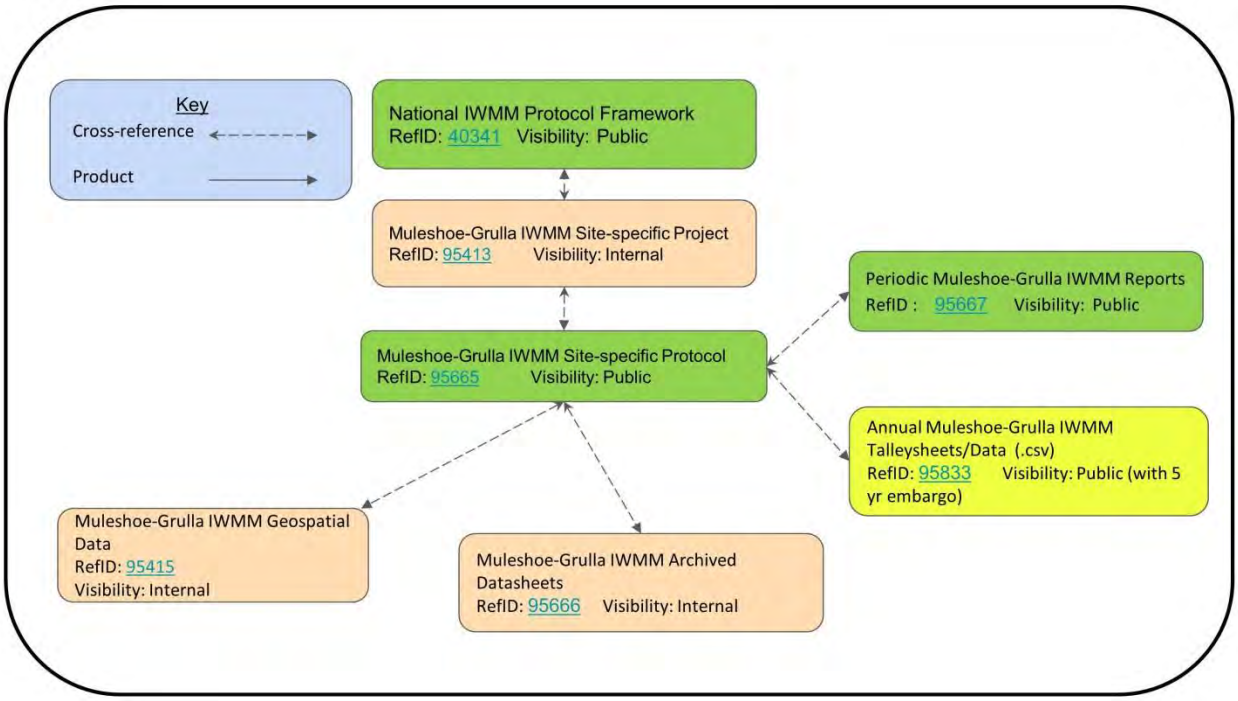

Figure SM-3.1. Linkage structure for references dealing with this site-specific IWMM project in the USFWS Service Catalogue (ServCat).

SM-4: Health and Safety Guidance for Handling Sick or Dead Wild Birds

This document provides procedures for protecting personnel while handling wild birds. Also refer to the Wildlife Health office internal website at https://sites.google.com/a/fws.gov/fws-wildlife-health/products for a more complete guide.

GUIDANCE FOR HANDLING WILD BIRDS DEPENDING ON THE CURRENT CONDITIONS:			
CONDITIONS	**ACTIVITY**	**PPE**	**WORK PRACTICE**
1.a. Zoonotic avian influenza is **not known or suspected** in wild birds within North America or the Pacific Islands.	Handling apparently healthy birds.	Follow all PPE and standard work practices recommended for normal operations at your station. Consult regional health and safety expertise regarding zoonotic disease risks in your area.	1. Wash your hands often and thoroughly for at least 30 seconds (using soap/water or alcohol-based hand sanitizer) before eating, smoking, using cell phone and touching your face, hair, or exposed skin. 2. If working indoors, work in well-ventilated areas. When working outdoors, work upwind of animals to decrease the risk of inhaling airborne particulate matter such as dust, feathers, or dander. 3. Gloves, aprons, goggles, face shields, rubber boots, and coveralls that can be easily disinfected may also be worn to prevent skin and mucous membrane contact with biological materials, and prevent movement of biological materials to other sites.
1.b. Zoonotic avian influenza is **not known or suspected** in wild birds within North America or the Pacific Islands.	Handling sick or dead birds.	Follow all PPE and standard work practices recommended for normal operations at your station. Consult regional health and safety expertise regarding zoonotic disease risks in your area.	1. Remove gloves and wash your hands often and thoroughly for at least 30 seconds (using soap/water or alcohol-based hand sanitizer) before eating, smoking, using cell phone and touching your face, hair, or exposed skin. 2. If working indoors, work in well-ventilated areas. When working outdoors, work upwind of animals to decrease the risk of inhaling airborne particulate matter such as dust, feathers, or dander. 3. Aprons, goggles, face shields, rubber boots, and coveralls that can be easily disinfected may also be worn to prevent skin and mucous membrane contact with biological materials, and prevent movement of biological materials to other sites.
2.a. Zoonotic avian influenza is **confirmed**[1] **or presumed to be present** in wild birds within North America or the Pacific Islands.	Handling, investigation, or disposal of any healthy or sick, live or dead wild birds.	• Impermeable gloves (pvc or nitrile) or heavy duty rubber work gloves • Goggles • NIOSH-approved disposable N-95 particulate respirator[2]. Workers must be fit-tested and medically cleared annually prior to wearing a respirator. • Disposable Tyvek coveralls or raingear that can be disinfected • Waders, hip-boots, rubber boots or boot covers	In addition to the work practices listed above: 1. Suppress dust at the work site using water 2. Minimize direct contact with birds and their secretions, feathers, and dander. 3. Minimize contact with carcasses when bagging birds. 4. Contact recipient laboratories prior to collection and shipping; follow their guidelines. Remove PPE in the following order: 1. Carefully remove coveralls and boot covers and discard as contaminated material if disposable. 2. Disinfect rubber boots. 3. Remove gloves and immediately wash hands thoroughly with soap and water (or an alcohol-based hand gel when soap and clean water are not available). 4. Remove eye protection and place in designated receptacle for subsequent cleaning and disinfection. 5. Remove N-95 disposable respirator and discard. 6. Immediately after all PPE has been removed, wash hands thoroughly a second time and wash face.

2.b. Zoonotic avian influenza is **confirmed**[1] **or presumed to be present** in wild birds within North America or the Pacific Islands	Cleaning and disinfecting equipment known or suspected to be contaminated with zoonotic avian influenza	• Impermeable gloves (pvc or nitrile) or heavy duty rubber work gloves • Goggles • NIOSH-approved disposable N-95 particulate respirator[2]. Workers must be fit-tested and medically cleared annually prior to wearing a respirator. • Disposable Tyvek coveralls or raingear that can be disinfected • Waders, hip-boots, rubber boots or boot covers	In addition to the work practices listed above: 1. Clean surfaces of equipment and reusable PPE with detergent and water, then disinfect with a virucide (such as Virkon®) that kills avian influenza viruses. Follow the label instructions. 2. www.epa.gov/pesticides/factsheets/avian.htm lists registered products. If a registered product is not available, use 3/4 cup of household bleach (5.25-6.00% sodium hypochlorite) per gallon of water for hard, non-porous surfaces. 3. Avoid generating mists with water sprayers during equipment decontamination procedures. 4. Do not touch any part of exposed person (especially the face) with gloved hands. Replace torn or damaged gloves immediately. 5. Additional protection (such as aprons and face shields) may be desired during equipment decontamination to prevent contact with contaminated material. 6. If there is known exposure to body fluids of the carcass (examples: knife cut, needle stick) contact your health care professional and provide a complete history of your activities. Carefully remove PPE in the order as described above in section 2a.
Key for colored conditions sections:	Green - Low risk conditions	Orange - Medium risk conditions	Red - High risk conditions

[1] Refers to situations where the National Veterinary Services Laboratory confirmed the presence of an avian influenza virus that is pathogenic for humans in a wild bird or a presumptive diagnosis of an avian influenza virus from a wild bird found dead or moribund.

[2] Use of respirators including N-95 filtering facepiece respirators requires implementing a Respiratory Protection Program as required by the Occupational Safety and Health Administration. This includes training, fit-testing, and fit-checking to ensure appropriate respirator selection and use. To be effective, respirators must provide a proper sealing surface on the wearer's face. Detailed information on respiratory protection programs is provided at: www.osha.gov/SLTC/etools/respiratory/index.html and www.cdc.gov/niosh/topics/respirators/. Under certain high risk conditions such as handling large numbers of birds in a confined area confirmed to have the HPAI virus, it may be necessary to upgrade respiratory protection to powered air purifying respirators (PAPR) or other protection options.

Opening carcasses in the field is not recommended as this may increase the risk of disease transmission and decrease the diagnostic value of the carcass. Consult DOI health and safety officers for more guidance if this activity is necessary.

Designated protective measures should be applied for at least 30 days after the date of the last detection of zoonotic avian influenza in wild birds within North America or the Pacific Islands.

SM-5: Waterbird Survey Form – Individual Units

The next two pages are the front and back of the standard IWMM form for recording waterbird surveys by individual units. In order to be certain observers have habitat condition codes, print double-sided (condition codes should be on back of form). Refer to the IWMM website for the most up-to-date form: http://iwmmprogram.org/protocols-data-forms/.

Current link (March 2018) for single sided form
http://www.iwmmprogram.org/documents/IWMM_Bird_Survey_Form_Single-unit_2017.pdf

Integrated Waterbird Management and Monitoring Approach

Waterbird & Unit Condition Survey

Project Name	Unit Code	Date __ __ / __ __ / __ __ __ __ MM/DD/YYYY	Start Time __ __ : __ __	End Time __ __ : __ __	Observer (s) :
Start Temp (°F)	Survey Type: Aerial Whole Area (ground)		Wind (Beaufort)	Visibility (> 70%)	
Local Tide Conditions[a]	Salinity		Water Gauge (units =)[b]		

Water Depth: % of unit in each category (sum to 100) *Estimation method:* *Bathymetry – gage* *Ocular other*	*Dry*	*Saturated /mud*	*0 to 5 cm ≈ 0-2"*	*5 to 15 cm ≈ 2-6"*	*15 to 25 cm ≈ 6-10"*	*>25 cm ≈ >10"*

Percent Ice Cover	Flood Duration *c*	Flood duration assessment method: *Bathymetry – gage* *1st hand info* *2nd hand info* *other*

Habitat Cover % of unit in each category (sum to 100)	Water (Include SAV[d] & Floating–Leaved)	Scrub-shrub	Forest	Emergent	Bare Ground

Interspersion[e]	Disturbance Severity[f]	Disturbance Sources[g]	Chronic Disturbance[h]

Height (%) of unit in each category (sum to 100)	*<2.5cm ≈<1"*	*2.5 to 15 cm ≈1-6"*	*15 to 30 cm ≈6-12"*	*30 to 60 cm ≈1-2'*	*60 cm to 3 m ≈2-10'*	*3 to 6 m ≈10-20'*	*>6 m ≈>20'*

Species	Count	Species	Count	Species	Count

* Please leave blank if unknown

a, tide conditions: 1 = high; 2 = almost high, rising; 3 = almost high, falling; 4 = half tide, rising; 5 = half tide, falling; 6 = almost low, rising; 7 = almost low, falling; 8 = low; 9 = not observed, not applicable, or observations made during more than one period
b, gauge units: 1=feet/tenths, 2=feet/inches, 3=meters
c, flood duration: 1 = surface water present for > 90 days; 2 = surface water present 30-90 days, 3 = surface water present < 30 days; 4 = permanent inundation; 5 = no information
d, submersed aquatic vegetation
e, interspersion: class "L" = includes large water/bare ground features with connected patches and linear edge; Class "S"= contains small, disconnected patches of water/bare ground with increased random distribution and fewer instances of connection; Class "M" = consists of patterns that contain discernible regions of both configuration classes L and S
f, disturbance severity: 1 = no effect on waterbirds; 2 = some waterbirds move but stay within unit; 3 = some waterbirds leave unit; 4 = most/all waterbirds leave unit
g: disturbance codes (may be more than one): 1=Pedestrian, 2=Loose dog, 3=Hunting, 4= Fishing, 5=Boats, 6=Motor Vehicles, 7=Aircraft, 8=Raptor
h, chronic disturbance: 1 = no entry into the unit for any reason; 2 = Closed to all use with entry into unit by resource managers or designees for management activities, surveys, or other controlled non-hunting activities; 3 = Managed access for all activities including firearms hunting. May include effort to control use levels and temporal closures; 4 = open access via trail, viewing platforms etc. No firearms hunting allowed; 5 = Open access, including firearms hunting, often with routine restrictions but without a specific management program to control the level of authorized use; 6 = unknown

Appendix

Appendix A. Appendix D. Using Digital Object Identifiers (DOIs) for ServCat Public References.

If uploading a peer-reviewed protocol, report, or dataset to ServCat that will be made publicly available on data.gov and possibly cited, request a digital object identifier (DOI) from R2 NWRS Biological Sciences. However, if your report or dataset will be available outside of ServCat/data.gov on a journal site or data repository like Dryad, those sites should assign your products a DOI.

Step	Action
1	Contact your R2 Zone Biologist to discuss what document and data products will be stored in ServCat and accessible to the public through data.gov.
2	Zone Biologist contacts R2 NWRS Regional I&M Data Manager (DM) and provides the ServCat Reference ID.
3	Once you receive the DOI from the Regional I&M DM, test the DOI in a search engine. As an example, type the following DOI into a search engine or the web address/url box of a search engine: doi:10.7944/W3159J 
4	Add the DOI to your ServCat reference abstract. See this ServCat reference as an example: https://ecos.fws.gov/ServCat/Reference/Profile/28073.
5	You can use web citation tools to help with citation formats using the DOI. The example below is found at http://crosscite.org/ 

Appendix B. Peer-review documentation form and reviewer comments and author responses

Protocol Title: Site-specific Protocol for Monitoring Sandhill Cranes: *Muleshoe and Grulla National Wildlife Refuges*

Version[1]: 1.0
Date of First Complete Draft: June 2018
Date of Approval:

Refuge Names:	**Authors and Affiliations**
Muleshoe National Wildlife Refuge Grulla National Wildlife Refuge	Kristen M. Linner, Graduate Intern, Texas Tech University William P. Johnson, Zone Biologist, National Wildlife Refuge System Blake A. Grisham, Texas Tech University Warren C. Conway, Texas Tech University

[1] See Survey Protocol Template instructions on assigning versions.

Protocol Type (Select One): A) New Survey Protocol Framework, B) Revised Survey Protocol Framework, C) New Site-specific Survey Protocol, D) Revised Site-specific Survey Protocol

Version	Date	Author	Change Made	Reason for Change

Internal review(s): List reviewer comments and describe how they were addressed or why they were not, along with each reviewer's name, date review was completed or received, organization, and contact information. If no internal review is used, please briefly describe exemption. Attach separate sheets as necessary.

We solicited internal reviews for the site-specific protocol for Muleshoe and Grulla NWRs. An internal USFWS review was completed on 30 May 2018 by Brenda Zaun, Zone Biologist, Southwest Arizona National Wildlife Refuge Complex (9300 E. 28th Street, Yuma, Arizona 85365). Comments originating from Brenda Zaun listing all suggested document changes and edits, along with replies/comments to each suggested change, follow (beginning on page XX. Comments from Brenda Zaun were incorporated to the document and addressed by William P. Johnson (co-author). In addition, Cinthia Eichhorn, Regional Data Manager for Region 2 Division of Biological Services, made comments on the data management plan for a different IWMM site-specific protocol that were incorporated into data management elements for this protocol.

External review(s): List reviewer comments and describe how they were addressed or why they were not along with each reviewer's name, date review was completed or received, organization, and contact information. If no external review is used, please briefly describe exemption. Attach separate sheets as necessary.

This site-specific protocol is based on well established, and peer reviewed national protocol framework (Loges et al. 2015). Because of this, and because of the limited geographic scope of this protocol, we did not solicit external peer-review consistent with the U.S. Fish and Wildlife Service survey protocol handbook (USFWS 2013).

US Fish and Wildlife Service. 2013. How to develop survey protocols, a handbook (Version 1.0). Fort Collins, Colorado: US Department of Interior, Fish and Wildlife Service, National Wildlife Refuge System, Natural Resource Program Center.


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