December 21, 2023

NEBRASKA PUBLIC POWER DISTRICT

R-Project

Migratory Bird Conservation Plan

Draft Migratory Bird Conservation Plan

PREPARED FOR: *NEBRASKA PUBLIC POWER DISTRICT*
PREPARED BY: *BEN BAINBRIDGE*
208-788-0391
BEN.BAINBRIDGE@POWERENG.COM

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 PROJECT BACKGROUND 1
1.2 R-PROJECT PURPOSE AND NEED 4
1.2.1 Southwest Power Pool's Notices to Construct the R-Project 4
1.2.2 Reliability Improvements 4
1.2.3 Congestion Relief 5
1.2.4 Renewable Resource Access 6
2.0 REGULATORY BACKGROUND 7
2.1 MIGRATORY BIRD TREATY ACT 7
2.2 BALD AND GOLDEN EAGLE PROTECTION ACT 7
2.3 FEDERAL ENDANGERED SPECIES ACT 8
2.4 EXECUTIVE ORDER 13186 8
2.5 NEBRASKA NONGAME ENDANGERED SPECIES CONSERVATION ACT 8
3.0 PROJECT DESCRIPTION 10
3.1 TRANSMISSION LINE DESIGN 10
3.1.1 Structure Types and Foundations 10
3.1.2 Right-of-Way 10
3.1.3 3.1.3 Conductors and Associated Hardware 13
3.1.4 Overhead Shield (Ground) Wires 13
3.1.5 Grounding Rods 14
3.1.6 Minor Additional Hardware 14
3.2 SUBSTATION DESIGN 14
3.2.1 Gerald Gentleman Station Substation 14
3.2.2 Thedford Substation 15
3.2.3 Holt County Substation 15
3.3 COMMUNICATION SYSTEM 15
3.4 TRANSMISSION LINE CONSTRUCTION 16
3.4.1 Sequence Construction 16
3.4.2 Surveying and Staking 16
3.4.3 Noxious Weed Management 16
3.4.4 ROW Tree Clearing 17
3.4.5 Access for Construction 17
3.4.6 Fly Yards/Assembly Areas and Construction Yards/Staging Areas 18
3.4.7 Batch Plants and Borrow Areas 19
3.4.8 Structure Work Areas 19
3.4.9 Pulling and Tensioning Sites 19
3.4.10 Foundation Excavation and Installation 20
3.4.11 Transmission Structure Assembly and Erection 20
3.4.12 Stringing of Conductors, Shield Wire, and Fiber Optic Ground Wire 21
3.4.13 Construction Waste Disposal 22
3.4.14 Construction Contingency 22
3.4.15 Site Restoration 23
3.5 SUBSTATION CONSTRUCTION 23
3.5.1 GGS Substation 23
3.5.2 Thedford Substation 24
3.5.3 Holt County Substation 24

3.6 SPECIAL CONSTRUCTION PRACTICES ... 25
3.6.1 Helicopter Construction ... 25
3.6.2 Distribution Power Line Relocation ... 26
3.6.3 Well Relocation ... 27
3.7 OPERATION AND MAINTENANCE ... 27
3.7.1 Permitted Users ... 27
3.7.2 Safety ... 27
3.7.3 ROW Vegetation Management Program ... 27
3.7.4 Transmission Line Inspection ... 28
3.7.5 Routine Maintenance Repairs ... 28
3.7.6 Emergency Repairs ... 28

4.0 EXISTING ENVIRONMENT ... 30

4.1 AVIAN HABITAT ... 30
4.1.1 Grassland ... 33
4.1.2 Forest ... 33
4.1.3 Wetland/Aquatic ... 33
4.1.4 Developed ... 34
4.1.5 Row-crop Agriculture ... 34
4.2 AVIAN SURVEY RESOURCES ... 34
4.3 SPECIAL STATUS AVIAN SPECIES ... 37
4.3.1 Species Protected under the ESA and BGEPA ... 37
4.3.2 USFWS Birds of Conservation Concern ... 37

5.0 R-PROJECT EFFECTS ON AVIAN SPECIES ... 40

5.1 GENERAL AVIAN EFFECTS ... 40
5.1.1 Potential Effects from Construction ... 40
5.1.2 Potential Effects from Operation and Maintenance ... 43
5.2 POTENTIAL EFFECTS ON FEDERALLY PROTECTED AVIAN SPECIES ... 47
5.2.1 Whooping Crane ... 47
5.2.2 Piping Plover ... 56
5.2.3 Bald Eagle ... 59
5.2.4 Golden Eagle ... 61
5.2.5 Rufa Red Knot ... 63
5.3 POTENTIAL EFFECTS ON USFWS BIRDS OF CONSERVATION CONCERN ... 65

6.0 AVOIDANCE AND MINIMIZATION STRATEGY ... 66

6.1 ROUTE SELECTION ... 66
6.2 INSTALLATION OF BIRD FLIGHT DIVERTERS TO MINIMIZE COLLISION ... 69
6.3 USE OF EXISTING ROAD AND TWO-TRACKS FOR ACCESS ... 73
6.4 SITING TEMPORARY WORK AREAS IN PREVIOUSLY DISTURBED AREAS ... 73
6.5 USE OF HELICAL PIER FOUNDATIONS IN THE SANDHILLS ... 73
6.6 HELICOPTER CONSTRUCTION ... 73
6.7 SEASONAL RESTRICTIONS ... 74
6.8 ADHERENCE TO APLIC DESIGN STANDARDS TO PREVENT ELECTROCUTION ... 74
6.9 WORKER ENVIRONMENTAL AWARENESS PROGRAM ... 75
6.10 HABITAT RESTORATION ... 75
6.11 OTHER BEST MANAGEMENT PRACTICES ... 75
6.12 SPECIES-SPECIFIC AVOIDANCE AND MINIMIZATION MEASURES ... 76
6.12.1 Whooping Crane ... 76
6.12.2 Piping Plover ... 78

6.12.3 Bald Eagle ... 78
6.12.4 Golden Eagle ... 79
6.12.5 Rufa Red Knot ... 79

7.0 OFF-SITE HABITAT CONSERVATION ... 80

8.0 INCIDENT REPORTING AND PERMITS ... 80

9.0 KEY RESOURCES ... 81

10.0 LITERATURE CITED ... 83

FIGURES:

FIGURE 1-1 R-PROJECT STUDY AREA AND FINAL ROUTE ... 3
FIGURE 3-1 PROPOSED STRUCTURE TYPES ... 11
FIGURE 3-2 TUBULAR STEEL MONOPOLE AND STEEL LATTICE TOWER LOCATIONS ... 12
FIGURE 4-1 AVIAN HABITAT TYPES IN STUDY AREA ... 32
FIGURE 4-2 NORTH AMERICAN BREEDING BIRD SURVEY ROUTES ... 36
FIGURE 5-1 TRANSMISSION CONDUCTOR SPACING ... 46
FIGURE 5-2 SATELLITE TRACKING AND HISTORICAL WHOOPING CRANE OBSERVATIONS ... 51
FIGURE 6-1 SPIRAL BIRD FLIGHT DIVERTER ... 71
FIGURE 6-2 WHOOPING CRANE LINE MARKING ... 72

TABLES:

TABLE 4-1 AVIAN HABITAT TYPES ... 31
TABLE 4-2 BBS AND STUDY AREA AVIAN HABITAT TYPES ... 35
TABLE 4-3 ESA- AND BGEPA-PROTECTED AVIAN SPECIES ... 37
TABLE 4-4 BIRDS OF CONSERVATION CONCERN IN THE CENTRAL MIXED-GRASS PRAIRIE REGION ... 38
TABLE 5-1 ESTIMATED TEMPORARY DISTURBANCE OF AVIAN HABITAT TYPES (ACRES) ... 41
TABLE 5-2 PERCENT OF AVIAN HABITAT TYPES IN THE STUDY AREA AND TEMPORARY DISTURBANCE AREAS ... 42
TABLE 5-3 ESTIMATED TEMPORARY AND PERMANENT DISTURBANCE OF POTENTIALLY SUITABLE WHOPPING CRANE HABITAT ... 48
TABLE 5-4 POTENTIAL HABITAT WIDTHS AT RIVER AND STREAM TRANSMISSION LINE SPAN LOCATIONS ... 49
TABLE 6-1 WMA, SRA, IBA, AND CONSERVATION PROPERTIES IN STUDY AREA AVOIDED BY R-PROJECT ... 67
TABLE 6-2 RAPTOR NEST SEASONAL AND SPATIAL RESTRICTIONS ... 74

APPENDICES:

APPENDIX A NORTH AMERICAN BREEDING BIRD SURVEY ROUTE SPECIES LISTS
APPENDIX B WHOOPING CRANE HABITAT ASSESSMENT

APPENDIX C R-PROJECT WHOOPING CRANE MORTALITY RISK ASSESSMENT
APPENDIX D WHOOPING CRANE REGION 6 GUIDANCE
APPENDIX E WHOOPING CRANE SURVEY PROTOCOL

ACRONYMS AND ABBREVIATIONS

ACSR	Aluminum Conductor Steel Reinforced
APLIC	Avian Power Line Interaction Committee
ATVs	all-terrain vehicles
BBS	Breeding Bird Survey
BCC	Birds of Conservation Concern
BCR	Bird Conservation Regions
BGEPA	Bald and Golden Eagle Protection Act
CFR	Code of Federal Regulations
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FR	Federal Register
GIS	geographic information system
GPS	global positioning system
HCP	habitat conservation plan
IBA	Important Bird Area
ITP10	10-year Integrated Transmission Plan
kcmil	circular mils
kV	kilovolt
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act of 1969
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NESCA	Nebraska Nongame and Endangered Species Conservation Act
NGPC	Nebraska Game and Parks Commission
NPPD	Nebraska Public Power District
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
OPGW	optical ground wire
Plan	Migratory Bird Conservation Plan
ROW	right-of-way
SCADA	Supervisory Control and Data Acquisition
SPCC	Spill Prevention, Control, and Countermeasure Plan
SPP	Southwest Power Pool
SRA	State Recreation Area
TVMP	Transmission Vegetation Management Program
U.S.	United States
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
Western	Western Area Power Administration
WMA	Wildlife Management Area

1.0 INTRODUCTION

Avian interactions with power lines are known to result in bird injuries and mortalities, which, in turn, may result in outages and/or violations of avian protection laws or raise concerns by employees, resource agencies, or the public. Nebraska Public Power District (NPPD) is committed to balancing its mission of providing reliable, cost-effective electrical service with the regulatory requirements that protect avian species and to make reasonable efforts to construct and operate the R-Project to avoid and minimize the incidence of avian mortality to the maximum extent practicable.

The R-Project involves the construction of a 226-mile-long 345 kilovolt (kV) transmission line in two segments. The north/south segment is 101 miles long and starts at the Gerald Gentleman Station (GGS) Substation near Sutherland, proceeds north across the South Platte and North Platte rivers, and continues north for approximately eight miles before turning east for 30 miles to United States (U.S.) Highway 83. The north/south segment then parallels U.S. Highway 83 to connect to an expansion of NPPD's existing substation east of Thedford. The east/west segment is 125 miles long and starts at the Thedford Substation and proceeds east to State Highway 7 north of Brewster. The east/west segment then proceeds north along State Highway 7 for approximately five miles then turns east to its terminus at the Holt County Substation. Figure 1-1 identifies the location of the R-Project.

This Migratory Bird Conservation Plan (Plan) describes the actions that NPPD will take to assure that avian protection measures are implemented to reduce potential avian impacts from construction and operation of the R-Project. This Plan is intended to ensure compliance with legal requirements by seeking to protect migratory, threatened, and endangered birds. NPPD Management endorses and supports this policy and will provide company personnel with necessary guidance and resources to meet the expectations of the Plan.

While, as described in Section 1.2 below, one of the stated purposes of the R-Project is to provide transmission access to renewable energy resources, this Plan only considers activities specific to the R-Project. Such future activities to develop renewable energy resources are unknown at this time. NPPD anticipates that any potential effects to migratory birds from future independent projects that may wish to utilize the R-Project for transmission access will be handled on a case-by-case basis by the project proponent.

1.1 Project Background

In 2018, NPPD finalized a Habitat Conservation Plan (HCP) in support of a previous Incidental Take Permit (ITP) application for take of the then federally endangered American burying beetle (*Nicrophorus americanus*)[1] for the R-Project. The U.S. Fish and Wildlife Service (USFWS) issued ITP #TE72710C-0 for the R-Project and associated substations to NPPD on June 12, 2019, which required compliance with that prior version of the HCP. Shortly after issuance of the ITP, the Oregon-California Trails Association, Western Nebraska Resources Council, Hanging H East, L.L.C., and Whitetail Farms East, L.L.C. (collectively, "petitioners") challenged the USFWS's action in federal district court, arguing that the USFWS's decision to issue the ITP violated the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA), and the National Historic Preservation Act.

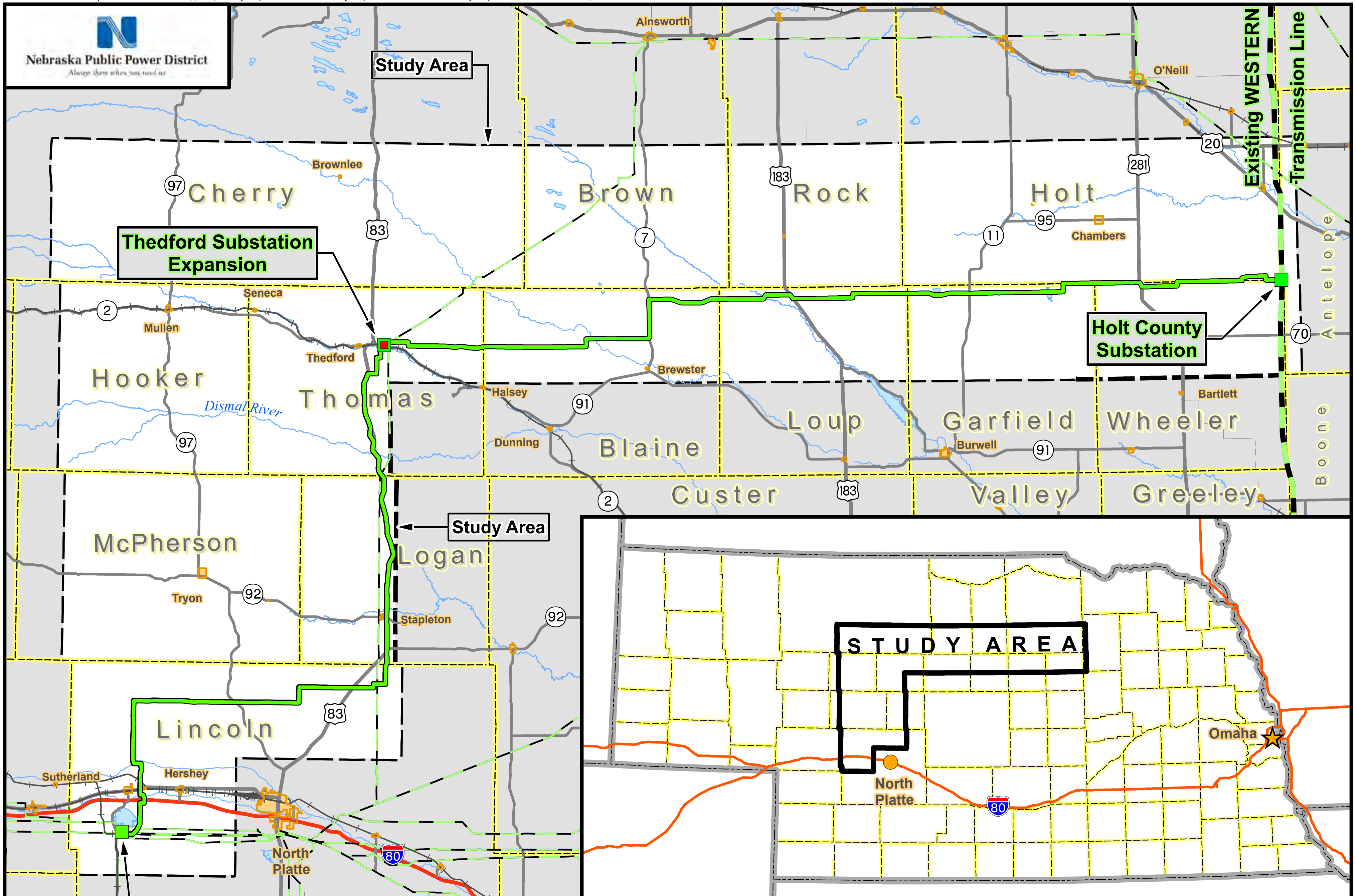
[1] Effective November 16, 2020, the American burying beetle was reclassified as threatened. 85 Fed. Reg. 65241 (Oct. 15, 2022).

After petitioners filed suit, NPPD, the USFWS, and the petitioners agreed that certain activities associated with the R-Project could be completed under a Joint Stipulation and Proposed Scheduling Order ("Joint Stipulation Agreement") while the litigation was pending. Under this Joint Stipulation Agreement, approved by the federal district court on August 14, 2019, NPPD agreed to adjust the R-Project's construction schedule to defer major construction-related activities pending the court's review on the merits, while other specific activities enumerated in the agreement could proceed.

Between June 12, 2019, and June 17, 2020, NPPD completed certain construction activities on the R-Project under ITP #TE72710C-0 and the Joint Stipulation Agreement. Actions agreed upon in the Joint Stipulation Agreement that NPPD undertook during that time included right-of-way (ROW) acquisition, relocation of distribution lines, transmission line and access staking, development of material delivery yards and fly yards as well as storage of materials in those yards, installation of fences and gates as necessary, tree clearing, and substation work and construction at GGS Substation, Thedford Substation, and Holt County Substation. In 2019, NPPD purchased in fee title 594 acres of mitigation lands to offset the impacts of all anticipated ABB take under the prior version of the HCP; that mitigation land remains in place and is being managed for ABB conservation purposes.

On June 17, 2020, the federal district court issued its opinion, which rejected some of petitioners' claims and agreed with others. *Oregon-California Trails Ass'n v. Walsh*, 467 F. Supp. 3d 1007 (D. Colo. 2020). The court vacated ITP #TE72710C-0 and remanded the matter to the USFWS for further proceedings consistent with its order.

Date: 12/8/2023 Path: G:\Projects\128143_NPPD_SPP\Apps\Reports\MigratoryBirdConservationPlan\MigratoryBirdConservationPlan_2023\MigratoryBirdConservationPlan_2023.aprx



NPPD's 345kV Transmission Line Project

FIGURE 1-1 R-PROJECT STUDY AREA AND FINAL ROUTE

1.2 R-Project Purpose and Need

1.2.1 Southwest Power Pool's Notices to Construct the R-Project

NPPD is a member of the Southwest Power Pool (SPP), a Regional Transmission Organization that is responsible for ensuring a reliable electrical grid and operating a day-ahead and real-time energy market. In 2015, the SPP region was expanded to include all or parts of 14 states throughout the Central Great Plains stretching from Texas to North Dakota. In administering its responsibilities, SPP conducts planning studies to ensure the electrical grid will continue to meet the standards set by the North American Electric Reliability Corporation (NERC), meet the needs of its member utilities and their customers, and operate in an efficient and reliable manner.

Every three years, SPP evaluates transmission facilities that will be needed within the 10- and 20-year time horizons. Projects identified in the 10-year horizon are included in the 10-year Integrated Transmission Plan (ITP10). Through this planning process, SPP identifies when and where new transmission is needed or where upgrades to the current electrical system must be conducted. When SPP identifies a need for new transmission infrastructure, it directs a Designated Transmission Owner to construct the needed infrastructure. These directives are known as Notices to Construct. Once it receives a Notice to Construct, the Designated Transmission Owner then completes the required routing, environmental studies and permitting, engineering design, ROW acquisition, construction, and construction management of the project.

Based on requirements identified in SPP's 2012 ITP10 planning study, NPPD received a conditional Notice to Construct from SPP on April 9, 2012, for a new 345 kV transmission line that will extend from NPPD's GGS Substation north to a new 345 kV substation to be located in or near Cherry County, and then extend eastward to another new 345 kV substation to be located in Holt County, which is to interconnect with Western's existing Fort Thompson to Grand Island 345 kV line that is located on the eastern border of Holt County. NPPD received a final Notice to Construct from SPP in March 2013. On May 19, 2014, as a result of SPP's High Priority Incremental Load Study, SPP issued another Notice to Construct to NPPD that required the installation of a new 345/115 kV transformer at the Thedford Substation. The issuance of this 2014 Notice to Construct resulted in the selection of the Thedford Substation as the intermediate terminal point between GGS Substation and the interconnection with the new substation located in Holt County.

On November 4, 2021, SPP issued a revised Notice to Construct the R-Project, which removed the majority of the Holt County Substation from the R-Project, allowing construction of that substation to proceed separate from and regardless of the R-Project. NPPD completed construction of the Holt County Substation in May 2022. The only portion of the substation that remains part of the R-Project is work to terminate and commission the R-Project in the substation line bay.

The SPP's ITP10 planning study identified the need date for the R-Project as January 1, 2018. The following sections describe the specific purposes and needs for the R-Project.

1.2.2 Reliability Improvements

One purpose of the R-Project is to provide for significant reliability benefits to the existing western Nebraska area transmission system by addressing the worst-case Nebraska area stability issues, taking into account extreme weather events, and providing for significant increases in west–east power transfer capability across the NPPD system. The R-Project will also address thermal and voltage issues identified in the Gentleman–Grand Island/Hastings corridor directly related to new wind power injection in Nebraska and external to Nebraska. Power flow studies conducted by NPPD and SPP have shown that, under contingency events for 345 kV lines in this area, thermal overloads occur on the parallel transmission elements. The R-Project involves a new 345 kV line that parallels the existing Gentleman–Grand Island/Hastings transmission corridor and will address these contingency overloads on the existing transmission system.

During the ice storm in December 2006, 37 different transmission circuits were out of service as they experienced physical damage due to heavy ice loads. As a result, NPPD could not deliver much power from Gerald Gentleman Station into or through the impacted area. During the summer of 2012, NPPD's wholesale service area experienced severe drought and temperature conditions that resulted in extreme transmission system loading in the north-central region. Since NPPD must plan for similar intense weather events in the future, additional high-capacity transmission feeds into the north central region are needed in order maintain the reliability for load deliveries into this region.

NPPD employed numerous local mitigation plans in the north-central Nebraska area during the summer of 2017 due to excessive load levels in that area. These local mitigation plans included a temporary undervoltage load-shedding scheme, renting mobile diesel generators, renting a mobile 115 kV capacitor bank, and temporary increases in the size of existing capacitor banks in this area. NPPD has also constructed a new substation, added new capacitor banks, and expanded the size of existing capacitor banks in the north-central Nebraska area prior to the summer of 2018. All of these actions were accelerated due to the continued delays associated with the R-Project. NPPD deployed mobile diesel generators in the north-central Nebraska region during the summer of 2021 and also utilized local undervoltage load-shedding schemes at certain critical locations as planned mitigation to survive the peak load levels projected in this area in 2021. NPPD again deployed mobile diesel generators in north-central Nebraska in 2022 and 2023, as well as utilizing additional load transfers. In addition, SPP reconfigured the transmission system and re-dispatched higher cost generation to alleviate congestion due to the R-Project not being in service. If there had been a sustained transmission outage during this period, local rotating blackouts would have been utilized to serve the load since adequate transmission would not be available due to the ongoing delay of the R-Project. The R-Project is critical to providing the source strength into this area in order to serve existing and new load additions in a reliable manner. NPPD evaluates Zone 5 mitigation strategies every year that the R-Project continues to be delayed. Further delays in the R-Project construction will create pressure to expand the local mitigation needs listed previously, which will result in local area reliability issues for customers served in this north-central Nebraska area.

1.2.3 Congestion Relief

Gerald Gentleman Station Stability is a defined NERC Flowgate limited by transient stability, transient voltage, and post-contingent thermal overloads.[2] One result of the Gerald Gentleman Station Stability Flowgate limits, which must always be maintained to meet the NERC Standards, is congestion. Likewise, the Gentleman–Red Willow 345 kV line is also a defined NERC Flowgate to protect for thermal overloads and voltage depression on underlying networked facilities following the loss of the Gentleman–Red Willow 345 kV line. The limits imposed by the Gentleman–Red Willow (or Western Nebraska–Western Kansas) Flowgate also result in congestion. Under certain system

[2] NERC defines a "flowgate" as a mathematical construct, comprised of one or more monitored transmission facilities and optionally one or more contingency facilities, used to analyze the impact of power flows upon the bulk electric system. See Glossary of Terms Used in NERC Reliability Standards, Updated December 1, 2023, available at http://www.nerc.com/pa/stand/Pages/default.aspx.

conditions, the Gerald Gentleman Station and Laramie River Station resources are required to reduce generation to maintain the established reliability limits. In addition, the transmission capacity in western Nebraska is currently fully subscribed due to transient stability limitations defined by the Gerald Gentleman Station Stability Flowgate. There is no available existing transmission capacity to interconnect any new generating resources in western Nebraska without exceeding the Gerald Gentleman Station Stability Flowgate limits. Congestion impacts have already increased costs to all of NPPD's customers because they do not have access to the lowest-cost generation resources to serve the load within the market. The GGS Stability Flowgate continues to result in excessive congestion in the Nebraska region. A recent evaluation by SPP has documented congestion costs due to the GGS Stability Flowgate in excess of $34 million over a four-year review period (SPP 2020 ITP Assessment).

In addition, the transmission capacity in western Nebraska is currently fully subscribed due to transient stability limitations defined by the GGS Stability Flowgate. There is no available existing transmission capacity to interconnect any new generating resources in western Nebraska without exceeding the GGS Stability Flowgate limits.

Thus, a second purpose of the R-Project is to reduce the significant congestion associated with NERC Flowgate constraints by providing an additional outlet path from GGS. Furthermore, in order to allow new generation interconnections in this region, additional transmission facilities must be constructed. The R-Project will allow for significant new generation resource injection in this area while still maintaining required stability margins and reliability criteria.

1.2.4 Renewable Resource Access

A third purpose of the R-Project is to provide transmission capacity and access for the future development of renewable resources in one of the main areas in Nebraska with quality wind resources. The R-Project will provide capacity and access for renewable project development across a large area of Nebraska and is not biased to favor any specific wind development or developer. The R-Project will be designed to meet or exceed the minimum capacity requirements that are defined in any Notice to Construct received from SPP. The minimum capacity requirements for the R-Project defined in the SPP Notice to Construct received by NPPD on March 11, 2013, are 1,792 mega volt amps. When the R-Project line is constructed and in service, future renewable project development in this area will be determined by extensive detailed study work that addresses all current and future generation interconnection projects that would impact the R-Project. The capacity for generation interconnection into the R-Project line is governed by the entire transmission system and cannot be determined by the capacity of only one line, such as the R-Project. The interconnection of all of the transmission lines in the interconnected grid system would need to be carefully studied to determine the available interconnection capacity on the R-Project line. As time goes on, and new projects request generation interconnection on or adjacent to the R-Project line, capacity is used, and there may be system limitations that would prevent new interconnection capacity until new network upgrades are considered in the interconnected grid system to address the limitations identified.

2.0 REGULATORY BACKGROUND

Laws, regulations, and guidance that provide protection to migratory birds in Nebraska include:

- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- Federal Endangered Species Act
- Executive Order 13186
- Nebraska Nongame Endangered Species Conservation Act

2.1 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA), 16 United States Code (U.S.C.) §§ 702-713, is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties between the United States and other countries that provide for international protection of migratory birds.

The MBTA states, "Unless and except as permitted by regulations . . . it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, . . . possess, offer for sale, sell, . . . purchase, . . . ship, export, import, . . . transport or cause to be transported . . . any migratory bird, any part, nest, or eggs of any such bird . . . ." 16 U.S.C. § 703. The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." 50 Code of Federal Regulations (CFR) § 10.12. Removal or destruction of active nests (i.e., nests that contain eggs or young) constitutes a violation on the MBTA.

The USFWS maintains a list of all species protected by the MBTA at 50 CFR § 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. The MBTA's take prohibition applies to individual migratory bird species and does not afford protection to migratory bird habitat in general.

2.2 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) prohibits the take; possession; sale; purchase; barter; offer of sale, purchase, or barter; transport; export; or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. 16 U.S.C. § 668. BGEPA and its implementing regulations define "take" to include pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest or disturb. 16 U.S.C. § 668c; 50 CFR § 22.6. Disturb means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." 50 CFR § 22.6. Under BGEPA, the fines for the first violation can be up to $100,000 for individuals and $200,000 for corporations; fines for subsequent violations (with each take deemed to be a separate violation) can be up to $250,000 for individuals and $500,000 for corporations.

Upon delisting of the bald eagle from the Endangered Species Act (ESA) in 2007, the USFWS issued the National Bald Eagle Management Guidelines, which were intended to publicize the continued protection for bald eagles, advise the public about the possibility of disturbing bald eagles, and to encourage land management activities that benefit bald eagles. Federal regulations set forth in 50

CFR § 22.80 provide for issuance of permits to take bald eagles and golden eagles where the take (1) is compatible with the preservation of the bald eagle and the golden eagle, (2) is necessary to protect an interest in a particular locality, (3) is associated with but not the purpose of the activity and (4) cannot practicably be avoided. As discussed further in Sections 5.2.3 and 5.2.4, no eagle take permit is requested for the R-Project.

2.3 Federal Endangered Species Act

The federal ESA, 16 U.S.C. §§ 1531-1544, affords protection to fish, wildlife, and plants listed as endangered or threatened. The ESA makes it unlawful to import, export, take, transport, sell, purchase, or receive in interstate or foreign commerce any fish or wildlife species listed as endangered. The ESA defines "take" as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The USFWS has defined "harm" to include significant habitat modification or degradation that actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Federal regulations generally extend these prohibitions to fish and wildlife species listed as threatened. The complete listing of threatened and endangered species is contained in 50 CFR §§ 17.11 and 17.12.

2.4 Executive Order 13186

On January 10, 2001, President Clinton signed Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds." The order directs executive departments and agencies to take actions to protect and conserve migratory birds. Under the order, each federal agency is required to enter into a Memorandum of Understanding with the USFWS outlining how the agency will promote conservation of migratory birds. Other activities called for in the Executive Order include support of various conservation planning efforts, such as the Partners-in-Flight initiative and North American Waterfowl Management Plan; incorporating bird conservation considerations into agency planning, including NEPA analyses; reporting annually on the level of take of migratory birds; and generally promoting the conservation of migratory birds without compromising the agency mission.

2.5 Nebraska Nongame Endangered Species Conservation Act

The intent of the Nebraska Nongame and Endangered Species Conservation Act (NESCA) (Nebraska Revised Statutes §§ 37-801 to -811) is to conserve plant and animal species in the state of Nebraska for human enjoyment and scientific purposes and to ensure their perpetuation as viable components of their ecosystems. Under NESCA, the Nebraska Game and Parks Commission (NGPC) has created a list of species that are protected as either threatened or endangered within the state of Nebraska. Any species that occurs in Nebraska and is federally listed as threatened or endangered under the ESA is automatically listed under NESCA. Under NESCA, state agencies are required to ensure actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered or threatened species or result in the destruction or modification of habitat of such species that is determined by the NGPC to be critical.

Unlike Section 10(a)(1)(B) of the ESA, NESCA has no formal process for issuing an incidental take permit. Under NESCA, take can only be allowed if mitigation for such take will ultimately enhance the survival of the species. For this reason, NPPD worked with NGPC individually and through development of its HCP to ensure actions taken by NPPD first avoided and minimized impacts to listed species to the maximum extent practicable and then mitigated unavoidable impacts in compliance with the provisions of NESCA. Following a review of potential project impacts, NGPC issued a letter to the Nebraska Power Review Board on September 11, 2014, which stated the R-Project "may affect but is not likely to adversely affect" species protected under NESCA, so long as avoidance, minimization, and mitigation measures outlined in that letter were followed. NPPD has agreed to follow the measures described in the September 2014 letter to ensure compliance with NESCA.

3.0 PROJECT DESCRIPTION

Following is a description of activities that will be undertaken during R-Project construction, operation, and maintenance. Construction of the R-Project will likely take 21 to 24 months. The life of the project is anticipated to be 50 years.

3.1 Transmission Line Design

3.1.1 Structure Types and Foundations

Two types of structures will be used for this transmission line: tubular steel monopoles and steel lattice towers (Figure 3-1). Tubular steel monopoles are typically employed on most NPPD projects but require large equipment to install and will be used along the transmission line route where major access roads exist, including U.S. Highway 83. Tubular steel monopole structures will be placed approximately 1,350 feet apart (average ruling span) with a nominal structure height of 150 feet. The average ruling span means the “standard, typical, or expected” span distance while specific spans may be increased or decreased depending on a specific situation or condition.

Steel lattice towers will be used in areas of the Sandhills where existing access roads are limited or do not exist, due to construction advantages in transportation and installation of these structures. Lattice towers can be constructed with less overall impact to the surrounding area with the use of smaller equipment and helicopter construction. Span lengths between lattice towers will be the same as monopoles with a nominal structure height of 130 feet. Figure 3-2 identifies the locations along the R-Project transmission line where tubular steel monopoles and steel lattice towers will be used.

Both tubular steel monopoles and lattice towers can be designed for angles or dead-ends (where line changes direction) to withstand the increased lateral stress of conductors pulling in two different directions.

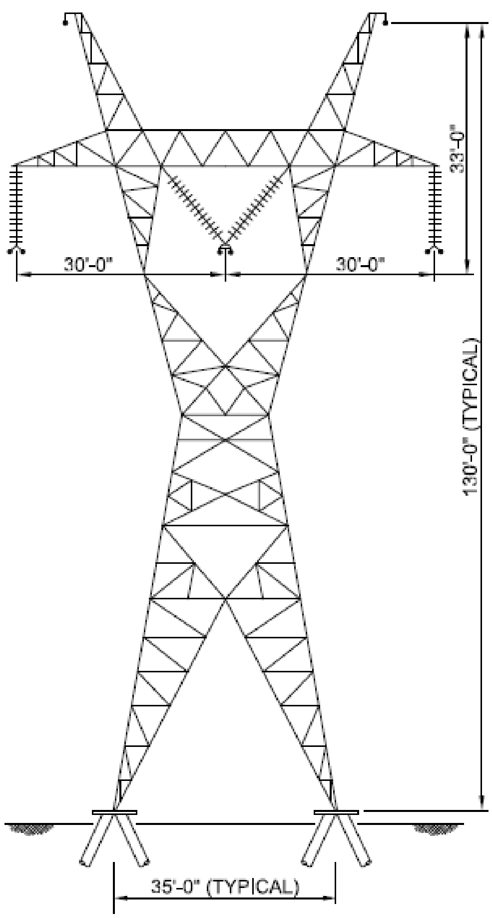
Tubular steel monopoles require cast-in-place concrete foundations. In areas where sloughing or water-compromised soils are present, underground temporary steel casings may be used to hold excavated walls for monopole foundations. Cast-in-place concrete foundations are typically seven feet in diameter and will include one foundation per structure. Lattice tower foundations will employ the use of helical pier foundations that do not require concrete or temporary casings. The purpose of a helical pier foundation is to transfer the load of a structure through the pier to a suitable depth of soil. A helical pier foundation is an extendable deep-foundation system with helical plates welded or bolted to a central hollow shaft. Load is transferred from the shaft to the soil through the bearing plates. Each lattice tower will require several helical piers per leg of the structure. Once installed, the helical piers will be cut off at ground level, and a square metal plate will be welded to the top of the piers. In total, the portion of the helical pier foundations above ground will include four 16-square-foot plates, one plate for each leg of the structure.

3.1.2 Right-of-Way

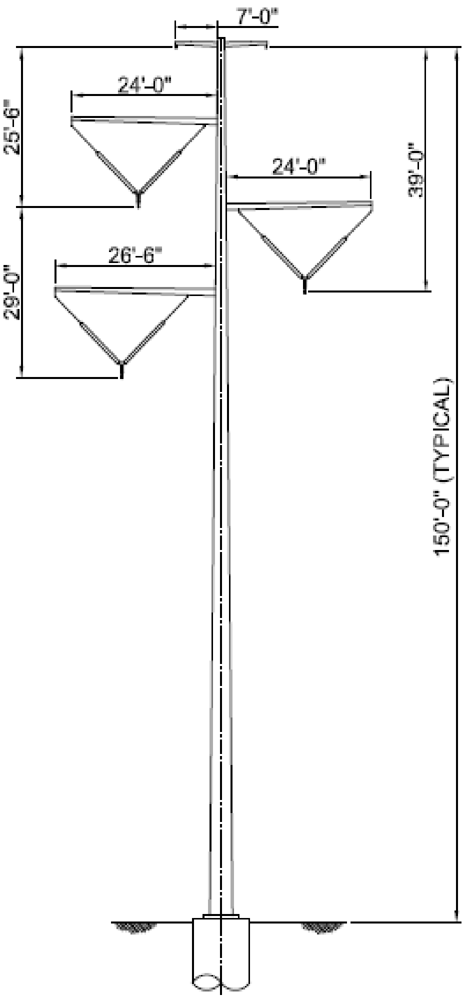
ROW width will be 200 feet (100 feet each side of centerline) for the entire transmission line unless otherwise specified.

FIGURE 3-1 PROPOSED STRUCTURE TYPES

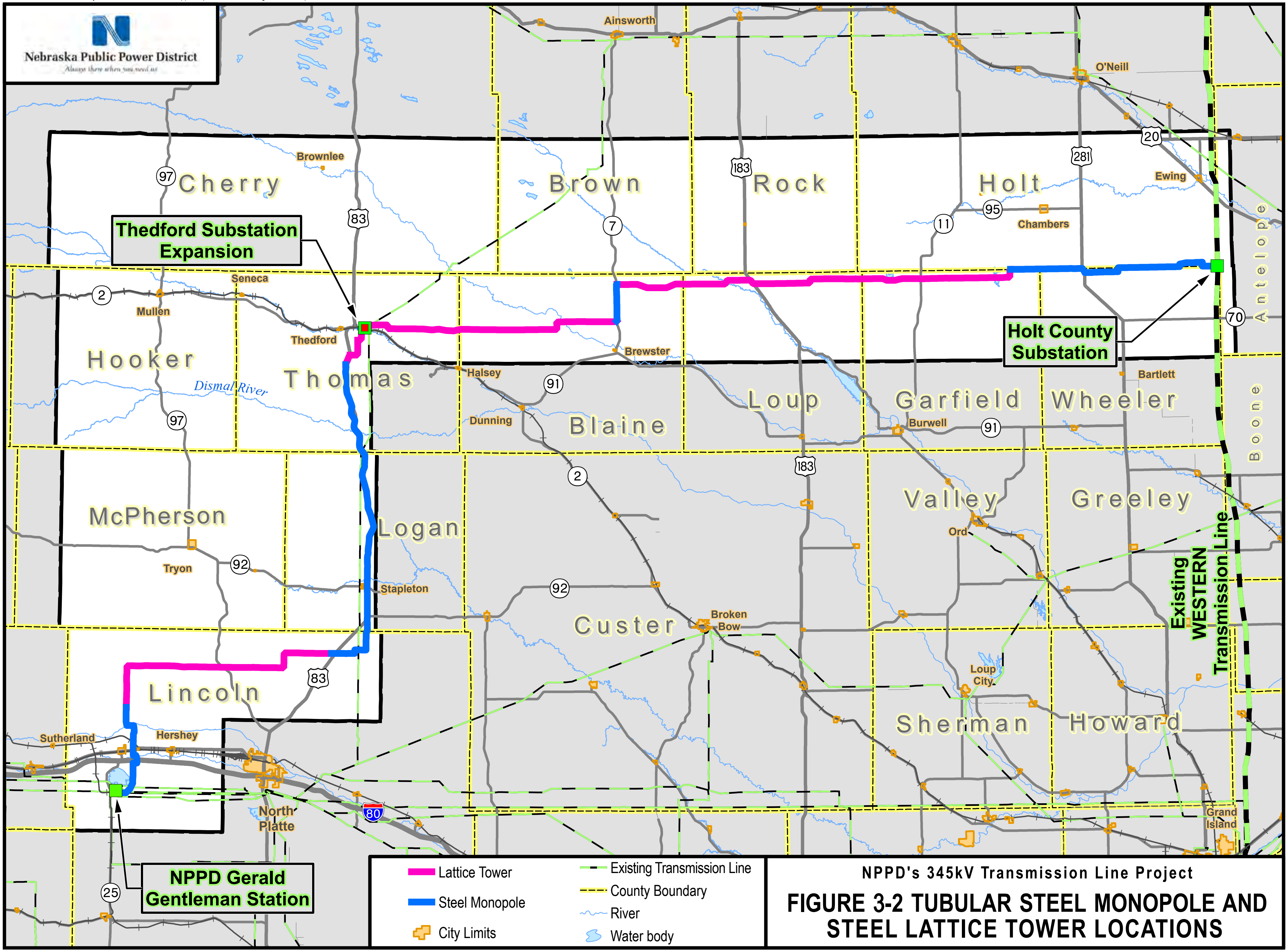
Lattice Tower



Tubular Steel Monopole



Date: 4/22/2022 Path: G:\Projects\128143_NPPD_SPP\Apps\Reports\HCP\HCP_Figures_2022.aprx



NPPD's 345kV Transmission Line Project

FIGURE 3-2 TUBULAR STEEL MONOPOLE AND STEEL LATTICE TOWER LOCATIONS

3.1.3 3.1.3 Conductors and Associated Hardware

Selection of the conductor's mechanical strength primarily is dictated by the ice and wind loading expected to occur in the region where the transmission line is built. There is a risk of extreme icing events and severe weather in Nebraska and, due to this risk, the conductor will be Aluminum Conductor Steel Reinforced (ACSR), which is common for many power lines in the state. The conductor's strength in a steel-reinforced stranding is a function of the percentage of steel within the conductor area. The aluminum carries most of the electrical current, and the steel provides tensile strength to support the aluminum strands. The conductors being considered for the R-Project are a 1.405-inch-equivalent diameter, bundled conductor (T2-ACSR 477 kcmil "T2-Hawk" conductor), which consists of two twisted conductors, each having 26 strands of aluminum and seven strands of steel, and a 1.196-inch-diameter, bundled conductor (ACSR 954 kcmil 54/7 "Cardinal" conductor), which consists of 54 strands of aluminum and seven strands of steel. T2-ASCR has been designated for use in conjunction with the monopoles due to the propensity for galloping to occur along the line during Nebraska ice and wind events. Galloping on a transmission line is the oscillation or wave motion of conductors and shield wires during low to moderate winds when ice has accumulated on the wire. T2-ASCR mitigates this phenomenon, which is of paramount importance on monopole structures where structural geometry makes galloping unacceptable.

The conductor system will consist of three electrical phases, with two bundled conductors for each phase. Minimum conductor height above ground will be approximately 28 to 33 feet, which exceeds the National Electrical Safety Code (NESC) standards. Greater clearances may be required in areas accessible to oversized vehicles or over center-pivot irrigation systems. Minimum conductor clearance will dictate the exact height of each structure based on topography and safety clearance requirements. Minimum conductor clearances in some instances may be greater based on specific NESC requirements (e.g., minimum clearance above a roadway, trees in forested areas, or above farm equipment in agricultural areas).

Insulator assemblies for 345 kV tangent structures[3] for each structure type will consist of insulators normally in the form of a "V" for tubular steel monopole structures and in the form of an "I" and "V" for lattice towers. These insulator strings are used to suspend each conductor bundle from the structure, maintaining the appropriate electrical clearance between the conductors, ground, and structure. The V-shaped configuration of the 345 kV insulators also restrains the conductor so that it will not swing into contact with the structure during high winds.

3.1.4 Overhead Shield (Ground) Wires

To protect the 345 kV transmission line conductors from direct lightning strikes, two lightning-protection shield wires, also referred to as ground wires, will be installed on the tops of each structure utilizing specialized shield wire connection brackets or arms. Electrical current from the lightning strikes will be transferred through the shield wires and structures into the ground.

One of the shield wires will be composed of extra-high-strength steel wire approximately 0.45 inch in diameter. The second shield wire may be an optical ground wire (OPGW) constructed of aluminum and steel, which will carry 24 glass fibers within its core. The OPGW, if used, will have a diameter of

[3] Tangent structures are also referred to as "in-line structures" and are used where little to no angle is required between structures. They are in contrast to "dead-end" structures, which are used when the transmission line turns a large angle or terminates.

approximately 0.65 inch. The OPGW will be used to facilitate internal NPPD communications between substations.

3.1.5 Grounding Rods

A grounding system will be installed at the base of each transmission structure and will consist of copper ground rods embedded in each concrete structure foundation and connected to the structure by a buried copper lead or by use of the helical pier foundation. After the foundations have been installed, the grounding will be tested to determine the resistance to ground. If the resistance to ground for a transmission structure is excessive, then additional ground rods will be installed to lower the resistance.

3.1.6 Minor Additional Hardware

In addition to the conductors, insulators, and overhead shield wires, other associated hardware will be installed on the structures as part of the insulator assembly to support the conductors and shield wires. This hardware will include clamps, shackles, links, plates, and various other pieces composed of galvanized steel and aluminum.

Other hardware not associated with the transmission of electricity may be installed as part of the R-Project. This hardware may include large-diameter aerial marker balls near airports or aircraft warning lighting as required for the conductors or structures per Federal Aviation Administration (FAA) regulations. Aircraft warning lighting is typically only required on structures over 200 feet tall. Structure proximity to airports and structure height determine whether FAA regulations will apply based on an assessment of FAA criteria. NPPD does not anticipate that structure lighting will be required because proposed structures will be less than 200 feet tall and will be located to avoid airport impacts to the greatest extent practicable. However, if special circumstances (e.g., tall crossings) require structures taller than 200 feet, FAA regulations regarding lighting and marking will be followed.

Potential options for marking transmission lines to reduce avian collisions are described in the Avian Power Line Interaction Committee's (APLIC's) *Reducing Avian Collisions with Power Lines: State of the Art 2012* (APLIC 2012). NPPD has a substantial successful track record of working with state and federal agencies to appropriately mark transmission lines to reduce avian collisions and will continue to work proactively in this regard on the R-Project. NPPD's standard marking device implemented on previous projects is the spiral bird flight diverter, though NPPD intends to use two types of bird flight diverters for the R-Project. See Section 6.2 below for a further discussion of line marking for the R-Project, which complies with APLIC guidance.

3.2 Substation Design

The R-Project will require (1) construction of a new 345 kV bay within the existing GGS Substation footprint; (2) construction of a new 345 kV substation expansion to the existing Thedford 115 kV substation; and (3) installation of line bay terminal equipment at the Holt County Substation.

3.2.1 Gerald Gentleman Station Substation

The GGS Substation is located in Lincoln County, just south of Sutherland Reservoir State Recreation Area and north of West Power Road. The substation will be expanded within its existing footprint. Expansion will include installation of the following major equipment: 345 kV breaker, 345 kV reactor, and 345 kV dead-end structure.

3.2.2 Thedford Substation

The Thedford Substation expansion site is located in Thomas County, east of Thedford, west of the existing Thedford 115 kV Substation and north of State Highway 2. NPPD completed the groundwork for the expansion of the Thedford Substation, which encompassed approximately 13 acres, in 2020 under ITP #TE72710-C. The site currently includes a lined and graveled footprint where future substation components will be erected, a control building, a transformer, 345 kV reactors, the ground grid, an exterior chain-link security fence, and permanent all-weather access off State Highway 2. The major components of the substation include 345 kV breakers and associated disconnect switches, 345 kV dead-end structures, 345 kV bus, and associated support structures.

3.2.3 Holt County Substation

The Holt County Substation is located in Holt County on the northwest corner of the intersection of 846th Road and 510th Avenue. As noted in Section 1.2.1, SPP's November 4, 2021 Notice to Construct removed the construction of the Holt County Substation from the R-Project. The revised Notice to Construct includes adding the line bay terminal equipment necessary to connect, commission, and operate the 345 kV R-Project, which will occur within the footprint of the existing substation of the substation.

3.3 Communication System

The R-Project will require a number of critical telecommunications support systems. These systems will be configured and designed to support the overall availability and reliability requirements for the operation of the line and the supporting substations. To provide secure and reliable communications for the control system real-time requirements, protection, and day-to-day operations and maintenance needs, a mix of telecommunications systems will be used. The primary communications for protection will be Power Line Carrier over the power line. The secondary communications for protection and control are proposed to be provided via the one OPGW installed in the shield wire position on the transmission line.

In addition to protection and control, the communications system will be used for Supervisory Control and Data Acquisition (SCADA). The SCADA system is a computer system for gathering and analyzing real-time data that are used to monitor and control the transmission system (substation equipment and the line itself). A SCADA system gathers information, such as the status of a transmission line, transfers the information back to a central site, alerts the central site if the line has de-energized, carries out necessary analysis and control, such as determining if outage of the line is critical, and displays the information in a logical and organized fashion.

The secondary communications will be an all-digital fiber system utilizing the OPGW located on the transmission line structures. The optical data signal degrades with distance as it travels through the optical fiber cable. Consequently, signal-regeneration sites are required to amplify the signals if the distance between stations or regeneration sites exceeds approximately 40 to 70 miles. In total, it is anticipated that three regeneration sites will be required for the proposed R-Project. Regeneration communication sites will likely be located within the transmission line ROW. Each site will consist of a cabinet (72" high, 45" wide, 27" deep) placed within the transmission line ROW. Power will be supplied to each regeneration site by existing adjacent distribution power lines. One regeneration site will be located in Lincoln County at the intersection of U.S. Highway 83 and Auble Road. One regeneration site will be located along State Highway 7 where the R-Project proceeds east away from the road. The third regeneration site will be at the intersection of Highway 11 and the R-Project.

3.4 Transmission Line Construction

3.4.1 Sequence Construction

NPPD completed certain construction activities between July 2019 and June 2020 under ITP #TE72710C-0. Construction of the 345 kV transmission line will recommence after the ITP and Record of Decision are issued for the Revised HCP. Electrification of the transmission line would occur approximately 21 to 24 months after reinitiating of construction. The general sequence of construction for the R-Project is described below. Various phases of construction will occur at different locations throughout the construction process. This will require several crews operating at the same time at different locations.

3.4.2 Surveying and Staking

Construction survey work for the R-Project consists of determining or refining the centerline location through updated electronic and aerial survey techniques, specific pole locations (also called structure spotting), ROW boundaries, and temporary work areas (fly yards/assembly areas and construction yards/staging areas) boundaries. Centerline and final alignment design and staking will adhere to the conditions outlined in the NESC and NPPD policies and specifications. Equipment used in surveying and staking may include, but is not limited to, light vehicles and all-terrain vehicles (ATVs) and similar-type vehicles. Surveying and staking activities were completed on properties with signed ROW easement agreements in 2019. However, stakes that remain on the landscape for prolonged periods of inactivity may be damaged or knocked over by cattle or the elements. All areas will be revisited and restaked, if necessary, prior to the initiation of construction.

3.4.3 Noxious Weed Management

The Nebraska Department of Agriculture tracks noxious weeds in the state. The term “noxious” means to be harmful or destructive; it is the legal term used to denote a destructive or harmful pest for the purpose of regulation. Management of noxious weeds is addressed in the Restoration Management Plan to prevent and control the spread of noxious weeds during construction of the R-Project. Examples of noxious weed control measures that could be implemented during construction of the R-Project include avoiding driving through weed-infested areas to prevent spread; inspecting material sources used on the construction site to ensure they are weed-free before use and transport; and cleaning construction equipment and vehicles to prevent noxious weeds from spread or invasion. Large patches of noxious weeds that threaten restoration efforts may also be treated with herbicides. Any use of herbicides would be applied by a licensed applicator and would follow the specific directions for that herbicide. Restricted-use herbicides would be approved by USFWS and NGPC prior to use in restoration areas. Restricted-use herbicides are not available for purchase or use by the general public and must be applied by a certified applicator.

3.4.4 ROW Tree Clearing

Since the Sandhills landscape is primarily grassland, vegetation removal within the 200-foot-wide ROW will be minimal. Removal of mature trees under or near the conductors will be done to provide adequate electrical clearance as required by NPPD's Transmission Vegetation Management Standard No. OG-T&D-St-002. This standard is based on NERC and NESC standards for maintaining reliability of electrical facilities. Tree clearing will be completed outside of the migratory bird nesting season to the extent practicable. If clearing must be completed during the migratory bird nesting season, clearance surveys conducted by a qualified biologist will be completed prior to tree removal to identify occupied nests for avoidance. Equipment used to clear trees under or near conductors may include, but is not limited to, ATVs, brush mower/shredders, light vehicles, mechanized feller/bunchers, and grapple skidders. Feller/bunchers are motorized vehicles with an attachment that can rapidly cut and gather trees before felling them. A skidder is a vehicle used for pulling cut trees out of an area.

After the ROW boundaries are staked and pole locations are marked, trees within the ROW zone that have the potential to come into contact with the line will be cleared. In addition, danger trees will be identified and removed during initial ROW clearing. "Danger trees" are trees or tree limbs that, although located off of the transmission line ROW (and thus outside of normal clearing limits), are of such height; condition (e.g., leaning, rotted); location (e.g., side hill, proximity to transmission lines, soil characteristics); and/or species type that they represent a threat to the integrity of the transmission line conductors, pole structures, or other facilities. Tree stumps will be cut to grade and remain unless the landowner requests removal. Herbicides may be applied directly to tree stumps to prevent regeneration. Application of restricted-use herbicides would be approved by USFWS and NGPC and would be applied by a licensed applicator.

An estimated 42.1 acres of tree clearing remain necessary for the R-Project. Tree clearing was estimated using laser imaging, detection, and ranging (more commonly referred to as LIDAR) aerial imagery taken specifically for the R-Project ROW to digitize the overall crown area. The actual areas of ground disturbance associated with ROW tree clearing may be less than 42.1 acres, given the estimate is based on aerial imagery of the overall crown area and not the actual tree trunk at the ground. NPPD previously cleared approximately 6.9 acres of trees under ITP #TE72710C-0.

3.4.5 Access for Construction

The R-Project will maximize use of existing roads and two-tracks wherever available for accessing structure locations during construction to minimize ground disturbance. Large areas of the Sandhills do not have an existing road network, such as section line roads. In these areas, temporary access routes have been designated for construction access. The alignment of temporary access routes will follow the existing landform contours in designated areas where practicable, providing that such alignment does not impact other sensitive resources.

Consideration of access begins where construction equipment leaves the existing maintained road network. Access to structure locations, fly yard/assembly areas, pulling and tensioning sites, and other temporary work areas is broken down into two categories:

- **Temporary Access** – All construction-related travel off currently existing and maintained roads is included under temporary access. Temporary access includes the use of overland travel, creation of new access paths, and improvement of existing two-tracks for construction. All temporary access routes have an assumed width of 16 feet, although the final width will be dependent on terrain. All improvements will be restored at the end of construction based on the requirements specified under Effectiveness Monitoring defined in the HCP. Compacted areas may be disced or ripped to loosen soil prior to reseeding. Areas where a sidehill is flattened for safety during construction access will not be recontoured to allow future maintenance access, if necessary, but will be reseeded.

- **Permanent Access** – Permanent access includes new improvements that will be left in place and not restored and revegetated following completion of construction activities. Permanent access will be used at substation locations and specific circumstances where improvements may be left in place at the landowner's request following the completion of construction. NPPD will create no more than 26 acres of new permanent access for the entire project and no more than 19 acres of new permanent access in the Permit Area, including those left in place at the landowner's request.

Equipment used in the construction of access improvements may include, but is not limited to, bulldozers, front-end loaders, dump trucks, backhoes, excavators, graders, roller compactors, water trucks, crane trucks, and light vehicles.

Bridges and/or culverts installed for stream or wetland crossings will be removed upon completion of construction. Any temporary culverts installed will maintain the existing hydrology of the drainage and will not alter or impede flow.

Access routes used to estimate potential effects to species are based on preliminary design and may require changes based on conditions in the field. NPPD established 3.44 acres of temporary access via the placement of construction matting under ITP #TE72710C-0. These construction mats have been removed, and the area underneath has been restored to native vegetation.

3.4.6 Fly Yards/Assembly Areas and Construction Yards/Staging Areas

Temporary work areas will be required for materials and equipment storage and staging for construction activities. The construction yards/staging areas will serve as field offices, reporting locations for workers, parking space for vehicles and equipment, storage of construction materials, and fabrication and assembly. Fly yards will be used for helicopter construction where materials and equipment are loaded into slings or choker cables for transport and placement at structure locations via helicopter. Fly yards will be located within the same footprint of lattice tower assembly areas. Fly yards/assembly areas and construction yards/staging areas will be located along existing access roads and in previously disturbed areas when practicable. Grading and fill or the placement of construction matting on these sites may be required to prevent soil erosion and sediment runoff or soil compaction. Equipment used to construct and operate within fly yards/assembly areas and construction yards/staging areas may include, but is not limited to, earthmoving equipment, a heavy crane, semi-trucks, helicopters, and support vehicles. Upon completion of R-Project construction, all fill materials including gravel will be removed, soils will be decompacted (if necessary), and the area will be revegetated to the appropriate specifications.

Sixteen fly yards/assembly areas were established in 2019; however, only a small portion of these yards was used at that time. Construction matting was placed on 4.73 acres of fly yards/assembly areas in 2019 and 2020. The construction matting was removed from these yards, and the area covered by mats was revegetated in 2022. Cattle-exclusion fencing installed at these yards remains in place. The full extent of the fly yards/assembly areas will be used when construction resumes.

Four construction yards/staging areas were established in 2019. Like the fly yards/assembly areas, only a small portion of these yards was used at that time. Construction matting, overland travel, and material storage impacting approximately 11.5 acres occurred in 2019. These construction yards/staging areas remain in place currently and house construction materials such as anchor bolt cages, crane mats, and construction matting.

3.4.7 Batch Plants and Borrow Areas

Concrete batch plants may be necessary for foundation construction of steel monopole structures along existing access for a portion of the transmission line. Commercial ready-mix concrete may be used when access to structure locations is economically feasible. Existing concrete batch plants and borrow areas will be used to the maximum extent practicable. If needed, any new batch plants or borrow areas will be sited in previously disturbed locations and will not be located in environmentally sensitive areas, including threatened and endangered species habitat, wetlands, or cultural resource areas.

3.4.8 Structure Work Areas

At each structure location, a temporary work area will be needed for construction lay-down, structure assembly, and structure erection. To the extent necessary, the work area will be cleared of vegetation and bladed to create a safe working area for placing equipment, vehicles, and materials. In grassland areas, little, if any, clearing of vegetation will be needed. The ground disturbance required for lattice tower work areas is 100 feet by 100 feet and for steel monopole work areas is 200 feet by 200 feet. After line construction, all areas not needed for normal transmission line maintenance will be graded to blend as near as possible with the natural contours, then revegetated.

Equipment that may be used to prepare structure work areas varies depending on the structure type. Lattice towers can be constructed with lighter equipment and helicopters, and thus may not require a prepared structure work area. Steel monopole structures require heavier equipment in relation to lattice towers and will likely require some improvement to the structure work area, such as construction matting or leveling, to support construction. Equipment used to prepare structure work areas may include, but is not limited to, small Bobcat-sized earthmoving equipment.

3.4.9 Pulling and Tensioning Sites

Wire pulling and tensioning sites are locations where specialized equipment—including winch trucks, light crawler tractors, or excavators—is used to spool out and tension the conductors and shield wires. Along tangent sections of the line, pulling and tensioning sites will be located approximately every two to four miles for steel monopoles and four to six miles for lattice towers. Pulling and tensioning sites will require two acres of temporary disturbance. Additional pulling sites are needed where major turns in the line occur. These angle structure or point-of-intercept sites will require pulling and tensioning in two directions to allow for the angle in the line. Wire pulling and tensioning sites will be cleared and bladed only to the extent necessary to perform construction activities safely. Equipment used at pulling and tensioning sites may include, but is not limited to, semi-trucks, tensioner pullers (large machine winch), heavy cranes to move reels, and matting to level the site. The use of helicopters to support pulling and tensioning is currently being evaluated.

3.4.10 Foundation Excavation and Installation

Excavation will be required for the steel monopole structure foundations. Foundation holes will be excavated using a truck- or excavator-mounted auger. The poles will be installed on drilled pier concrete foundations to a depth of approximately 25 to 45 feet depending on load and soil characteristics. All monopole structures will utilize cast-in-place concrete footings. Cast-in-place footings will be installed by placing reinforcing steel in excavated foundation holes and encasing it in concrete. Concrete will be delivered to the site in concrete trucks. Chute debris from concrete trucks will be washed at an approved location, and the debris will be hauled offsite and disposed of in non-environmentally sensitive areas after it hardens. Equipment that may be used to excavate and install steel monopole foundations may include, but is not limited to, truck- or excavator-mounted augers, dump trucks (to remove spoils from site), concrete trucks, trucks and trailers (to drop off rebar and anchor bolt cages), heavy cranes, backhoes, water trucks (for dewatering), and light support vehicles.

Excavated holes left open or unguarded will be covered and/or fenced where needed to protect the public, livestock, and wildlife. Any remaining spoils will be stockpiled at the localized work site and used to backfill holes. All remaining spoils not used for backfill will be hauled offsite and disposed of in non-environmentally sensitive areas.

For lattice tower structures, screw-in helical pier foundations will be used in areas of the Sandhills where existing access roads do not exist. Helical pier foundations do not require excavation. Each leg of the lattice tower will require a helical pier foundation (four legs total). Final designs have not been completed, but it is anticipated that each foundation will consist of three or four 7- to 12-inch-diameter piles that are 20 to 40 feet in length. The helical piers are installed with an excavator that has a torque head where the bucket usually is located. The piers are screwed into the ground, and no spoils need to be removed from the site. Once the piers are installed, the piers are cut to the correct grade and elevation, and then a cap that connects to the tower leg is welded or bolted on. Anchor bolts or stub angles are used to secure the structure to the foundation. Due to the cutting and welding to be performed at each site, NPPD will require the construction contractor to provide fire protection. It is anticipated that the construction contractor will have a water tank and fire extinguishers onsite during these activities along with using additional prevention measures such as fireproof roll-up mats and welding tents. Equipment that may be used to install screw-in helical pier foundations may include, but is not limited to, tracked excavators, light trucks and trailers, weld trucks, water trucks (for fire suppression), and light support vehicles.

3.4.11 Transmission Structure Assembly and Erection

Generally, structures will be assembled and framed at each structure work area. For tubular steel monopoles, work areas need to be large enough to accommodate laying down the entire length of the poles while pole sections are assembled and cross-arms are mounted. Typically, insulators, strings, and stringing sheaves are then installed at each conductor and ground-wire position while the pole is on the ground. Stringing sheaves are used to guide the conductor during the stringing process for attachment onto the insulator strings. The assembled pole will then be placed on the foundations and erected into place by a crane. Equipment used to erect steel monopole structures may include, but is not limited to, heavy cranes, bulldozers, bucket trucks, semi-trucks (to deliver structure tubes), and light support vehicles.

For lattice tower construction, the typical sequence begins with delivery of the materials needed to construct the base to the structure location. Material will be delivered in bundles, and the base will be erected in place with a small crane. The remainder of the lattice tower will be assembled, in sections, at the fly yard/assembly areas. In addition, the structures will have the insulator strings and stringing sheaves pre-assembled and attached at each shield (ground) wire and conductor position. These sections will then be flown to the structure site with a helicopter. Depending on the construction contractor's work plan, two or three sections will be needed to complete the entire tower. Assembly of the lattice tower sections and hardware in a fly yard/assembly area negates the need to have a large crane and heavier equipment at each structure location. Equipment that will be used to assemble the lattice tower sections within the fly yard/assembly area may include, but is not limited to, small cranes and additional support equipment such as a forklift.

3.4.12 Stringing of Conductors, Shield Wire, and Fiber Optic Ground Wire

Once the structures are in place, a "sock-line" will be pulled (strung) from structure to structure and threaded through the stringing sheaves on each structure by helicopter. If necessary in longer, high-tension stringing sections, a second larger-diameter and stronger line will be attached to the sock-line and strung prior to the attachment of the conductor and the ground wires. This process will be repeated until the shield wire, ground wire, and conductor is pulled through all sheaves.

Shield wires, fiber optic cable, and conductors will be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end of a conductor segment. These sites may differ in size and dimensions depending on the structure's purpose (e.g., mid-span or dead-end), site-specific topography, and whether anchoring of the shield wire or conductor will be located at these sites. The tensioner, in concert with the puller, will maintain tension on the ground wires or conductor while they are fastened to the towers. Once each type of wire has been pulled in, the tension and sag will be adjusted, stringing sheaves will be removed, and the conductors will be permanently attached to the insulators.

Splicing will be required at the end of conductor and shield wire spools during stringing. Compression fittings or implosive-type fittings will be used to join the conductors and shield wires. Implosive splicing technology is a splicing technique where a small amount of explosive is placed around an aluminum sleeve. The layer of explosive is designed with the right properties of detonation velocity, pressure, and geometry so that it will create the required compression to connect two lengths of conductor or shield wire together in a controlled manner. The detonation of a compression fitting creates a flash and a loud boom similar to the sound at the end of a barrel of a 12-gauge shotgun blast or a thunderclap (about 150 decibels) with the decibel level reducing with distance (Tyburski and Moore 2008; Carlsgaard and Klegstad 2012). Implosive-type fittings are commonly used in the transmission industry. The location of implosive splicing is unknown at this time and will be determined during construction depending on the length of each conductor reel. OPGW fibers will be spliced together in an enclosure mounted on a structure. The splicing will occur at structure work areas or pulling and tensioning sites. Caution also will be exercised during construction to avoid scratching or nicking the conductor surface, which may provide points for corona to occur. Corona-generated noise in the atmosphere near the conductor can occur during operation of the transmission line, particularly if the conductor surface is damaged. Changes to local atmospheric pressure may result in a hissing or cracking sound that may be heard directly under the transmission line or within a few feet of the ROW, depending on weather, altitude, and system voltage, with the level of corona noise receding with distance.

At tangent and small-angle towers, the conductors will be attached to the insulators using clamps. At the larger-angle dead-end structures, the conductors are cut and attached to the insulator assemblies by "dead-ending" the conductors, either with a compression fitting or an implosive-type fitting. Both are industry-recognized methods. When utilizing the implosive-type fitting, private landowners and public safety organizations will be notified before proceeding with this method.

For safety and efficiency reasons, wire stringing and tensioning activities are typically performed during daylight hours and are scheduled to coincide to the extent practical with periods of least road traffic to minimize traffic disruptions. For protection of the public during stringing activities, temporary guard structures will be erected at road and overhead line crossing locations where necessary. Guard structures will consist of H-frame wood poles placed on either side of the crossing to prevent ground wires, conductors, or equipment from falling on underlying facilities and disrupting road traffic. Typically, guard structures are installed just outside of the road ROW. Although the preference is for access to each of these guard structures to be located outside the road ROW, it may be necessary for access to be within the road ROW depending on topography and access restrictions imposed by the regulatory agency (Nebraska Department of Roads, county road and bridge department, etc.). Access use within the road ROW will be performed in compliance with the stipulations of the crossing permit and regulatory agency requirements.

Part of standard construction practices prior to conductor installation will involve measuring the resistance of the ground to electrical current near the structures. If the measurements indicate a high resistance, additional ground rods will be installed.

3.4.13 Construction Waste Disposal

Construction sites, material storage yards, and access roads will be kept in an orderly condition throughout the construction period. Refuse and trash will be removed from the sites and disposed of in an approved manner. No open burning of construction trash will occur. In remote areas, trash and refuse will be removed to a construction staging area and contained temporarily until such time as it can be hauled to an approved site. Oils or chemicals will be hauled to an approved site for disposal. Potential contaminants such as oils, hydraulic fluids, antifreeze, and fuels will not be dumped on the ground, and all spills will be cleaned up. The construction contractor will prepare a Spill Prevention and Response Plan that will describe the measures that will be implemented during construction to prevent, respond to, and control spills of hazardous materials, as well as measures to minimize a spill’s effect on the environment.

3.4.14 Construction Contingency

Construction contingency is identified here because there may be instances during construction where additional work that could not have been predicted becomes necessary. The construction contingency may include any of the Covered Activities identified in the HCP and may require additional work following the initial construction effort. An example of a construction activity that would fall under the construction contingency category would be the relocation of an access route or work area developed for construction purposes that became flooded during the course of construction. Other instances that may trigger the construction contingency include, but are not limited to, unforeseen sensitive-resource discoveries, landowner changes to the existing land use that necessitate a change in the construction process, or NPPD’s accommodation of landowner requests that result in minor changes in the construction process. While the exact location of construction contingency cannot be predicted, NPPD will limit disturbance under this category of activities to a maximum of 40 acres.

3.4.15 Site Restoration

The R-Project's restoration planning team, private landowners, local Natural Resources Conservation Service (NRCS) offices, and other rangeland experts were consulted regarding the appropriate methods, seed mixes, and rates to restore vegetation in areas disturbed by construction activities. All practical means will be used to restore the land, outside the minimum areas needed for safe operation and maintenance, to its original contour and natural drainage patterns. A Restoration Management Plan has been developed that describes the methods and activities that will be executed to restore temporary disturbances.

NPPD will establish an Escrow Account to ensure the implementation and success of restoration efforts. The Escrow Agreement will be submitted to USFWS for review. The Restoration Management Plan includes stipulations for successful restoration criteria and steps that would be taken in the event restoration does not meet the stipulations. Additional details regarding restoration monitoring and milestones to identify when restoration has been achieved are fully described in the HCP.

3.5 Substation Construction

3.5.1 GGS Substation

As noted in Section 1.1, some R-Project-related activities have already occurred at the GGS Substation. These activities include the following.

- Removal of a portion of existing perimeter fence.
- Installation of rock over expansion area (approximately 1,300 square feet or 0.03 acre).
- Installation of an oil containment structure within the original substation footprint to prevent reactor oil from reaching the ground or water bodies in the event of rupture or leak.
- Installation of concrete reactor pad foundation, ground grid, and conduit.
- Delivery and installation of reactor.
- Installation of control cable for monitoring reactor.
- Delivery and staging of steel poles and other miscellaneous parts and supplies for future installation.
- Installation of perimeter chain link fence around the expansion area.

Work that remains to be completed at the GGS Substation includes the following.

- Installation of concrete piers for steel poles and anchoring structures.
- Installation of foundations for bus, switch, and metering stands.
- Installation of steel, bus, switches, breakers, arrestors, and all other associated electrical components required for substation operation.

All remaining work will be performed within the existing footprint of the GGS Substation.

3.5.2 Thedford Substation

Like the GGS Substation, some R-Project-related activities have already occurred at the Thedford Substation. Work that has been completed includes the following activities.

- Survey work and geotechnical sample drillings to determine foundation requirements and soil resistivity measurements used in the final design phases of the station.
- Grubbing and reshaping the grade to form a relatively flat (1.0% slope) working surface.
- Construction of permanent all-weather access.
- Erection of an eight-foot-tall permanent chain link fence around the perimeter of the substation to prevent unauthorized personnel from accessing the substation.
- Compaction of excavated and fill areas to the required densities to allow structural foundation installations.
- Installation of oil-containment structures to prevent oil from transformers, reactors, circuit breakers, etc., from reaching the ground or water bodies in the event of rupture or leak.
- Installation of foundations, the ground grid, transformers, reactors, and the control building.
- Placement of a crushed-rock surface on the subgrade to make for a stable driving and access platform for the maintenance of equipment.

Work that remains to be done at the Thedford Substation includes the following activities.

- Steel structure erection.
- Installation of substation components including bus, switches, breakers, arrestors, and all other associated electrical components.
- Installation of area lighting.
- Testing of the various systems.
- Energization of the facility.

The steel structure erection will overlap with the installation of the insulators and bus bar, as well as the installation of the various high-voltage apparatus typical of an electrical substation. The energization of the facility generally is timed to take place with the completion of the transmission line work and other required facilities.

3.5.3 Holt County Substation

As noted in Section 1.1, with the exception of future installation of certain equipment, the construction of the Holt County Substation is no longer part of the R-Project as a result of SPP's November 4, 2021 revised Notice to Construct. Future activities related to the R-Project at the Holt County Substation include the work associated with the line bay installation to accommodate the incoming R-Project line, including installation of a 345 kV breaker, 345 kV reactor, and 345 kV dead-end structure. All remaining work will be performed within the completed footprint of the Holt County Substation.

3.6 Special Construction Practices

3.6.1 Helicopter Construction

The type of helicopters needed and the duration that they may be used are dependent on the selected contractor's overall approach to project construction and the availability of equipment.

Helicopter construction techniques will be used for the erection of lattice towers (see Figure 3-2), stringing of conductor and shield wire sock line, and other R-Project construction activities. The use of helicopters for other structure erection is evaluated based on site- and region-specific considerations including access to structure locations, sensitive resources, permitting restrictions, construction schedule, weight of structural components, time of year, elevation, availability of heavy lift helicopters, and/or construction economics. Helicopter erection of structures is a viable option for all locations that do not prohibit or restrict helicopter use. Helicopter fly yards will be located within the same footprint of lattice tower assembly areas and will be referred to as fly yards/assembly areas.

When helicopter construction methods are employed, the structure assembly activities will be based at a fly yard/assembly area. Optimum helicopter methods of erection will be used. Optimum helicopter methods are those that are the best or most favorable for the safe and practical use of helicopters.

Prior to installation, each lattice tower will be assembled in multiple sections at the fly yard/assembly area. Bundles of steel members and associated hardware are transported to the appropriate fly yard/assembly area by truck and stored. The steel bundles are opened and laid out by component section and then assembled into structure subsections of convenient size and weight according to the helicopter's lifting capabilities.

After assembly at the fly yard/assembly area, the complete tower or tower section will be attached by cables from the helicopter to the top of the tower section and airlifted to the tower location. The lift capacity of helicopters is dependent on the elevation of the fly yard/assembly area, the tower site, local weather conditions, and the intervening terrain. The heavy lift helicopters that could be used to erect the complete towers or sections of a tower will be able to lift a maximum of 15,000 to 20,000 pounds per flight, depending on elevation.

Helicopter flights used in the construction of power lines are covered under visual flight rules and do not require the filing of formal flight plans with the FAA. However, the helicopter pilots and construction contractor will develop an internal daily flight plan for the preferred flight path of that day's activities. Daily flight plans will likely be developed one to two days prior to the placement of structures and is heavily dependent on local weather conditions and topographic features. The daily flight plan will follow the safest and most direct route possible between the fly yard/assembly area and structure locations. Sensitive features that will be avoided by the daily flight plan may include, but are not limited to, occupied homes, businesses, concentrations of cattle, active bald eagle nests, and large concentrations of waterfowl or cranes. Flight altitudes are dependent on weather conditions, topography, and the load being lifted; however, they are typically between 500 and 1,000 feet.

Upon arrival at the tower location, the section will be placed directly onto the foundation or atop the previous tower section. Guide brackets attached on top of each section will assist in aligning the stacked sections. Two to three trips will be required to complete each structure depending on the lift capacity of the helicopter. Once aligned correctly, line crews will climb the towers to bolt the sections together permanently. Current estimates are that a single helicopter could successfully erect seven to nine structures in one day. Multiple helicopters may be employed at one time to facilitate construction activities at different locations along the route. The use of multiple helicopters is dependent on the contractor and may or may not be employed.

Helicopters will use temporary work areas such as fly yards and staging areas for landing, overnight storage between flights, and refueling. Each fuel truck will be equipped with automatic shutoff valves and will carry spill kits. In addition to the required preventive spill measures, matting or the use of a water truck may be required to spray the site to reduce dust.

Other R-Project construction activities potentially facilitated by helicopters may include delivery of personnel, equipment, and materials to structure work areas, hardware installation, and pulling shield wire and conductor sock lines. Helicopters will also be used to support the inspection and management of the R-Project by NPPD. The use of helicopters for pulling shield wire and conductor sock lines is the normal and expected construction technique for wire stringing on both lattice tower and tubular steel monopole sections of the line. Helicopters used for pulling shield wire and conductor sock lines are typically much smaller than the heavy-lift helicopters used to set lattice structures. Helicopters could be used to deliver fly-in portable water tanks (large collapsible bladders) to each lattice tower during periods of active construction to assist with fire prevention.

3.6.2 Distribution Power Line Relocation

The selected route for the R-Project overlaps with approximately 28 miles of existing overhead distribution power lines owned and operated by various rural utility providers. Relocation of these distribution lines is necessary for safety reasons and can be accomplished by relocating them as an overhead or underground line. Of these 28 miles of existing distribution power lines, 19 miles were relocated under ITP #TE72710C-0, while 4.5 miles of underground and 4.5 miles of overhead distribution line relocation have yet to be completed. Due to power line spacing regulations required for maintaining facilities, the existing distribution power lines will be relocated outside the R-Project ROW or to the extreme edge of the R-Project ROW. These lines will not be moved far from their current location. For example, those lines along public roads will be moved to the other side of the road.

Distribution power line poles are much smaller than those used for transmission lines and have smaller ROW and span lengths. The average span length for distribution power poles is 200 feet. Relocation of existing overhead distribution lines will require a single line truck called a digger-derrick truck. The digger-derrick truck includes an auger to drill the hole for a three-foot-diameter wood power pole and a small crane to lift the pole into place. Each distribution structure will require a 2,400-square-foot (40 x 60 feet; 0.05 acre) work area where the digger-derrick truck will be parked and the wood pole structure and insulators will be assembled. The digger-derrick truck will move down the distribution line ROW via overland travel and will not require improvements to the access.

Installation of underground distribution lines will require a small-track trenching machine that uses a knife or vibrating plow that cuts a six-inch slit in the ground as it lays a small-diameter utility cable or pipe. The oscillation of the blade makes the excavation faster and more efficient than a static blade. No spoils are cast to the side, and all soil is replaced by the same machine. A 14-foot-wide travel path is assumed for the trenching machine to move down the underground distribution line ROW.

3.6.3 Well Relocation

NPPD will relocate four existing wells that serve livestock watering tanks and irrigation pivots along the R-Project centerline. Existing wells will be capped, and new wells will be drilled. New wells will be relocated approximately 150 feet from their current location to provide electrical clearance during installation and future maintenance by the landowner. A well drilling truck will be required for the installation of the relocated wells. Each well will require a 2,400-square-foot (40 x 60 feet; 0.06 acre) work area. A small-track trenching machine will be used to run a pipe from the relocated well to the livestock watering tank. Each pipe will be approximately 150 feet long. A 14-foot-wide travel path is assumed for the trenching machine to move along the pipe.

3.7 Operation and Maintenance

3.7.1 Permitted Users

After the transmission line has been energized, land uses compatible with safety regulations, operation, and maintenance will be allowed.

3.7.2 Safety

Safety is a primary concern in the design of this ROW and transmission line. An alternating current transmission line is protected with power circuit breakers and related line relay protection equipment. If conductor failure or grounding (tree contact) occurs, power will be automatically removed from the line. Lightning protection will be provided by overhead ground wires along the line. All fences, metal gates, pipelines, etc., that cross or are within the transmission line ROW will be grounded to prevent electrical shock. If applicable, grounding outside the ROW may also occur.

3.7.3 ROW Vegetation Management Program

NPPD has developed a Transmission Vegetation Management Program (TVMP) that directs operation and maintenance personnel on how to manage vegetation to ensure the safety of transmission lines. The TVMP is used as a program to prevent outages from vegetation located on transmission ROW, minimize outages from vegetation located adjacent to ROW, and maintain clearances between transmission lines and vegetation on and along transmission ROW. In addition to the management of vegetation, the TVMP also provides guidance on how NPPD will report vegetation-related outages of the transmission systems to the appropriate regional entity and NERC.

Woody vegetation such as trees and shrubs that may grow within or adjacent to the ROW could interfere with the continuous safe operation of the transmission line and cause outages. Woody vegetation will be removed before it reaches a height that would threaten the transmission line. These trees and shrubs will be removed by manual or mechanized clearing. NPPD will work with landowners to make arrangements for the disposal of brush and wood. Since the ROW is mainly grassland, little to no vegetation management will be required in the ROW.

ROW vegetation management may include the limited use of herbicides. Herbicides would be applied directly to cut tree stumps to prevent regeneration. Temporarily disturbed areas in the ROW will be restored, which may require treatment of noxious weeds in these areas with herbicides. Application of restricted-use herbicides would be approved by USFWS and NGPC and would be applied by a licensed applicator. Herbicide use is included in the Restoration Management Plan. Once the area restoration goals described in the Restoration Management Plan are met, NPPD will no longer be responsible for noxious weed control as that is a responsibility of the landowner.

3.7.4 Transmission Line Inspection

NPPD uses helicopter, fixed-wing aircraft, drones, or ground patrols to inspect NPPD's transmission system twice per calendar year. A calendar year is defined as beginning on January 1 and ending on December 31. Ground patrols are typically conducted using ATVs or foot patrol. Inspections are conducted by transmission line technicians for line hardware, conductor and shield wire, structural steel, vegetation management encroachments, and ROW encroachments/clearance issues.

Unscheduled aerial patrols may be required during emergency or storm conditions. Under these circumstances, an NPPD employee familiar with the lines in question will accompany the aerial patrol pilot.

3.7.5 Routine Maintenance Repairs

While NPPD will address any issues identified during the transmission line inspections as they arise, routine scheduled maintenance and repairs will not begin until 30 years after the in-service date and will occur once every 10 years for the remainder of the life of the transmission line. Routine maintenance and repairs require a detailed inspection that involves sending personnel to each structure to check the stability of the structure and hardware associated with the transmission line. Maintenance and repairs noted during the detailed inspection can be scheduled in advance and do not require an immediate response.

Routine maintenance and repairs will use ATVs and light vehicles where possible. Improvements to access paths required to reach each structure will not be required for routine maintenance and repairs. Routine maintenance and repairs will be scheduled from October through April. Routine maintenance and repairs are scheduled in advance and will avoid spring and fall whooping crane migration periods to the maximum extent practicable.

3.7.6 Emergency Repairs

Emergency repairs include those which require a timely response by NPPD personnel to ensure the safe and efficient operation of the transmission line. Emergency repairs may be required to respond to events that remove the line from service, such as severe weather events or a broken conductor. They may also include repairs to isolated damages that are identified during annual inspections but that do not take the line out of service, such as single insulators or weak points on conductors. Both types of repairs will be addressed after discovery and cannot be predicted. Repairs will be made as soon as NPPD can obtain parts and necessary equipment and ensure compliance with applicable measures in the HCP to the maximum extent practicable.

Smaller, yet essential, repairs are typically noted during the transmission line inspections described above. Equipment utilized to repair the transmission line in an emergency situation will use any means necessary to repair the line in a reasonable timeframe. Equipment may include helicopters and tracked and/or rubber-tire vehicles.

Emergency repairs may be completed at any time of the year and may include the use of any equipment necessary to complete the repair. Effects from emergency repairs, if any, will be temporary and will be restored if conditions require restoration efforts. The majority of effects from emergency repairs, if any, will result from the need to obtain access to structures. Emergency repairs will follow the same final Access Plan identified for construction in Section 3.4.5. Instances where the same access identified for construction may not be used include stream crossings that have changed due to changes in stream course during permit duration, landowner construction of a new road or two-track that is more efficient for emergency repair access, or other changes in land use that may have occurred since construction.

While the exact location of emergency repairs cannot be predicted, and thus NPPD cannot know in advance which acres might be affected, NPPD can estimate the number of the acres potentially disturbed. NPPD estimates that the acres that will be temporarily disturbed from emergency repairs will be equal to 20 percent of the total temporary disturbance that will occur during construction activities that have not yet been completed. This 20 percent estimate includes repairs to isolated damages, such as single insulators or weak points on conductors noted during annual inspection, as well as large-scale repairs following severe weather events. Data from NPPD records on lattice tower transmission lines of similar design to and in the vicinity of the R-Project were reviewed to determine the extent of past storm damage and other emergency repair needs identified during annual inspection. The records indicate that emergency repairs were required for an average of 15 percent of an overall line's length. The vast majority of storm damages requiring emergency repairs occurred to lines east of Gerald Gentleman Station. Lines west and north of Gerald Gentleman Station had minimal storm damage and required little to no emergency repairs. Storm damage maps displayed at the R-Project public meetings support this analysis. Because the R-Project is located in an area with historically lower occurrences of emergency repairs, the use of a value of 20 percent to account for temporary disturbances to complete emergency repairs is a conservative estimate. In addition to being located in areas less likely to be affected by major storms compared to other parts of the state, the R-Project is designed to have storm structures installed every eight to ten miles to further limit storm damage and emergency repairs. Storm structures are specifically designed to contain damage to the transmission line to one section and prevent damage to continue down the line. The use of storm structures is another measure that will limit the amount of emergency repairs required over the life of the R-Project.

4.0 EXISTING ENVIRONMENT

Background on the existing avian habitat and species assemblages are described at the study area level (Figure 1-1). The R-Project study area was established at the start of project development to assist in the routing process. The R-Project study area was delineated by identifying an area around the SPP-identified starting, intermediate, and end points of the transmission line that need to be connected; the area needed to be sufficiently large for NPPD to evaluate reasonable routing alternatives. The study area encompasses 4.5 million acres (7,039 square miles) of the Nebraska Sandhills. The study area is much larger than the R-Project footprint; however, it reflects the avian habitat types and species assemblages at both a regional and project-level scale. The percentages of avian habitat types found within the study area are approximately the same as that of the R-Project footprint (see Table 5-2). Additionally, the study area encompasses five North American Breeding Bird Survey routes, which are representative of available avian habitats and provide annual surveys of bird activity. See Section 4.2 for a detailed description of avian use in the study area.

4.1 Avian Habitat

The R-Project is located in the Sandhills region, which is characterized by having the largest eolian, or wind-formed, sand formation in the Western Hemisphere (Bleed and Flowerday 1998). The highly permeable sand dunes on top of sand and gravel deposits have resulted in the percolation and development of a large groundwater reservoir. This contributes to a pattern of dry topslope dune prairie habitats adjacent to wet meadows and prairies, marshes, and shallow lakes where the water table remains near the surface throughout the year (Bleed and Flowerday 1998). The eastern portion of the study area transitions away from the typical dune prairie habitats of the Sandhills into more flat and non-gravelly soils. Wooded areas are largely limited to planted shelterbelts and forested riparian areas along the rivers, although many of these rivers do not support densely forested riparian areas (Schneider et al. 2011).

LANDFIRE (USGS 2020) data were used to characterize vegetation types that provide suitable habitat to migratory birds (Figure 4-1). LANDFIRE vegetation types were grouped to create five avian habitat types within the R-Project study area: grassland, forest, wetland/aquatic, developed, and row-crop agriculture. These five habitat types provide broad groupings that encompass the avian communities that typically occupy separate habitat types. LANDFIRE data provide a more detailed breakdown of habitat types, which are typically not distinguishable between avian communities. These habitats were grouped into the five habitat classifications in Table 4-1. Grassland includes the more detailed LANDFIRE habitat classifications mixed grass prairie and dune prairie/shrubland. Forest habitat includes the more detailed LANDFIRE habitat classifications forest and floodplains. Wetland/aquatic habitat includes the more detailed LANDFIRE habitat classifications open water and valley wetlands. Developed habitat includes the more detailed LANDFIRE habitat classifications developed/barren/ruderal. Row-crop agriculture habitat includes the more detailed LANDFIRE habitat classifications agriculture. Acres of avian habitat types within the study area are provided in Table 4-1. Basic descriptions of each habitat type are provided below. A key assumption regarding habitat in this Plan is the vast majority of habitat consists of native vegetation rather than non-native vegetation that is heavily managed for cattle production.

TABLE 4-1 AVIAN HABITAT TYPES

AVIAN HABITAT TYPE	ACRES WITHIN STUDY AREA	PERCENT OF STUDY AREA
Grassland	4,201,780	93%
Forest	28,824	0.6%
Wetland/Aquatic	237,838	5%
Developed	33,451	0.7%
Row-crop Agriculture	3,009	0.1%
TOTAL	**4,504,941**	**100.0% ***

Source: LANDFIRE (USGS 2013).
*Percentages do not total 100 due to rounding.

Date: 12/8/2023 Path: G:\Projects\128143_NPPD_SPP\Apps\Reports\MigratoryBirdConservationPlan\MigratoryBirdConservationPlan_2023\MigratoryBirdConservationPlan_2023.aprx

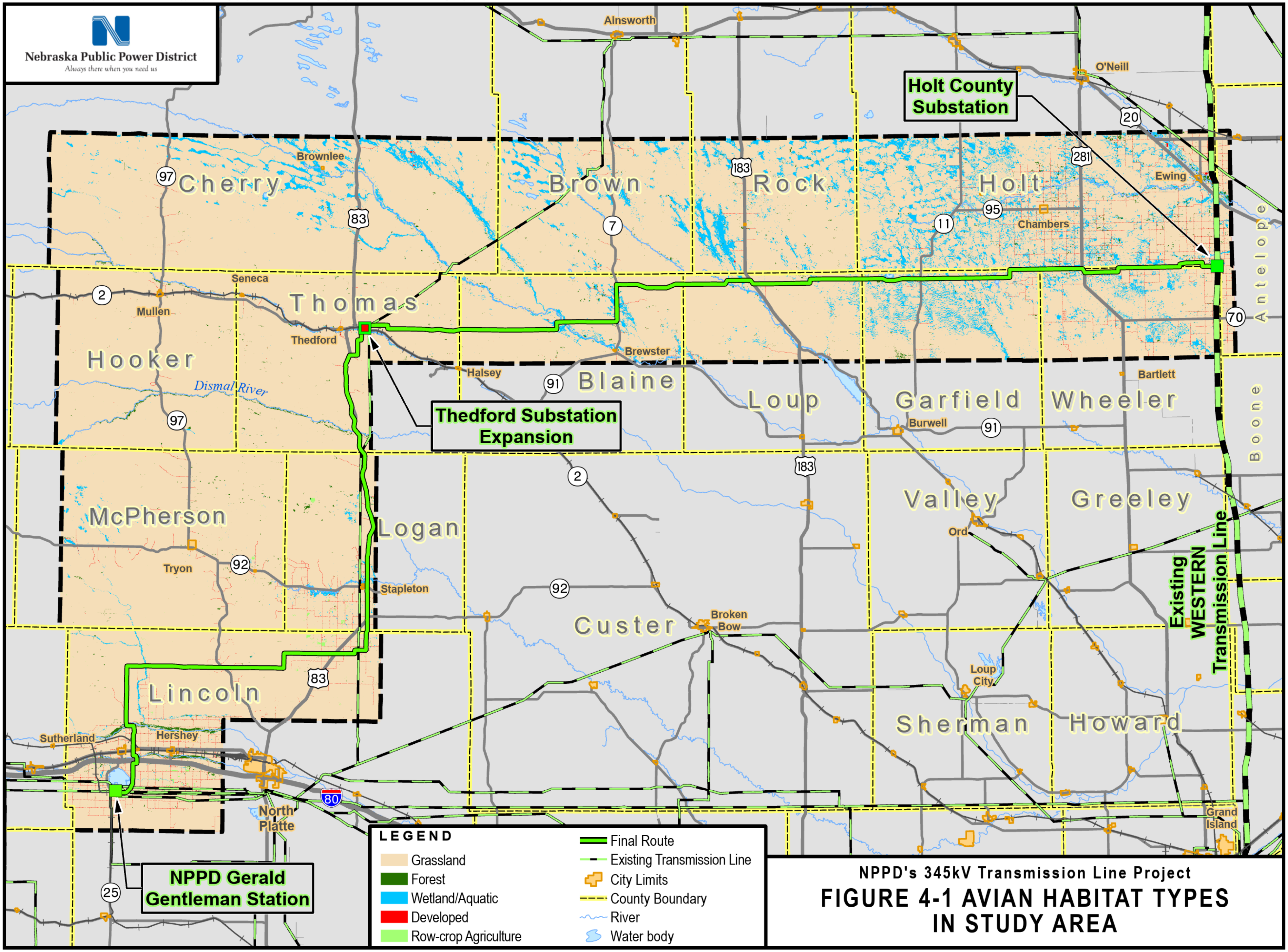


FIGURE 4-1 AVIAN HABITAT TYPES IN STUDY AREA

4.1.1 Grassland

Grasslands make up the majority of avian habitat within the study area and are predominantly used for livestock grazing. This Plan assumes that all grassland habitats consist of native vegetation rather than non-native planted grasslands intensively managed for cattle production. Vegetation within the grassland habitat type includes a mixture of grasses adapted to the sandy conditions and may include sand bluestem (*Andropogon hallii*), prairie sandreed (*Calamovilfa longifolia*), little bluestem (*Schizachyrium scoparium*), buffalo grass (*Buchloë dactyloides*), blue grama (*Bouteloua gracilis*), and hairy grama (*Bouteloua hirsuta*). Shrubs may include sand cherry (*Prunus pumila*), leadplant (*Amorpha canescens*), dwarf prairie rose (*Rosa arkansana*), and yucca (*Yucca glauca*). Common forbs that may be present are stiff sunflower (*Helianthus pauciflorus*), bush morning glory (*Ipomoea leptophylla*), gilia (*Gilia* spp.), annual wild-buckwheat (*Eriogonum annuum*), and gayfeather (*Liatris* spp.) (NatureServe 2009; Schneider et al. 2011).

4.1.2 Forest

Forested avian habitat is limited within the study area and consists of forested riparian areas and planted shelterbelts. There are no large, contiguous patches of forest within the study area; all forest habitats are narrow and linear. Trees within the forested avian habitat include plains cottonwood (*Populus deltoides*), peach-leaf willow (*Salix amygdaloides*), sandbar willow (*Salix interior*), and coyote willow (*Salix exigua*). Bur oak (*Quercus macrocarpa*), basswood (*Tilia americana*), black walnut (*Juglans nigra*), and green ash (*Fraxinus pennsylvanica*) typically occur on south-facing bluffs. Conifer species include ponderosa pine (*Pinus ponderosa*) and eastern red cedar (*Juniperus virginiana*) (Kaul et al. 2006; NatureServe 2009; Schneider et al. 2011).

4.1.3 Wetland/Aquatic

The wetland/aquatic avian habitat type is prevalent throughout the study area and the larger Sandhills ecoregion. This Plan assumes that all wetland habitats consist of native vegetation and have not been planted with non-native vegetation and intensively managed for cattle production. Wetlands in the study area include wet meadows and prairies, marshes, and shallow lakes where the water table remains near the surface throughout the year (USGS 2013; Schneider et al. 2011). These habitats are characterized by wetland vegetation devoid of trees in depressions and riparian vegetation along creeks and streams or adjacent to floodplain systems; typically have poorly drained, silty, dense clay, and hydric soils; and are often classified as Vertic Haplaquolls (NatureServe 2009). Moist prairies occur in valleys and commonly support species such as switchgrass (*Panicum virgatum*), big bluestem (*Andropogon gerardii*), Indiangrass (*Sorgastrum nutans*), white sagebrush (*Artemisia ludoviciana*), false indigo-bush (*Amorpha fruticosa*), dwarf prairie rose, western wild rose (*Rosa woodsii*), and leadplant. Wet meadows have sandy to fine sandy loam soils and support sedges (*Carex* spp.), spikerushes (*Eleocharis* spp.), prairie cordgrass (*Spartina pectinata*), switchgrass, sandbar willow (*Salix interior*), and false indigo-bush; transitioning to inland saltgrass (*Distichlis spicata*), foxtail barley (*Hordeum jubatum*), alkali sacaton (*Sporobolus airoides*), bluegrass (*Poa* spp.), and scratchgrass (*Muhlenbergia asperifolia*) where there are alkaline soils, prevalent to the west of the study area. Fens—groundwater-fed wetlands with saturated, nutrient-rich peat or muck soils, typically with meadow-like vegetation—support many sensitive plant species and are associated with stream headwaters and the upper end of lakes and marshes. Freshwater marshes are shallow waters occurring near lakes or streams, typically support ripgut sedge (*Carex lacustris*), common reed (*Phragmites australis*), smartweeds (*Polygonum* spp.), hard-stem bulrush (*Schoenoplectus acutus*), broad-leaf cattail (*Typha latifolia*), duckweeds (*Lemna* spp.), arrowheads (*Sagittaria* spp.), and hornworts

(*Ceratophyllum* spp.). Alkaline marshes have relatively less vegetation cover and are dominated by alkaline-tolerant species such as cosmopolitan bulrush (*Schoenoplectus maritimus*) (Kaul et al. 2006; NatureServe 2009; Schneider et al. 2011).

Open water habitats in the study area include rivers and Sandhills lakes. Rivers located within the study area include the South Platte River, North Platte River, Dismal River, South Loup River, Middle Loup River, North Loup River, Calamus River, Cedar River, and Birdwood Creek. The South Platte River and North Platte River originate in the Rocky Mountains of Colorado before continuing across the central plains where they join to form the Platte River and eventually flow into the Missouri River on the Nebraska–Missouri state line. The remaining rivers flow through the study area in a southeasterly direction and drain much of the central and eastern Sandhills. Flows of these rivers are supplied almost entirely by groundwater as little precipitation makes it to stream channels as runoff before soaking into the sandy soils. Because of the large influence of groundwater, flow of these rivers remains consistent for much of the year (Schneider et al. 2011).

Most of the natural lakes are small, and only a few in the study area approach 1,000 acres. Large named lakes that occur in the study area include Willow Lake, Swan Lake, and Goose Lake, which are relatively shallow depressions and no deeper than ten feet. The northern portion of the Calamus Reservoir State Recreation Area (SRA) and Wildlife Management Area (WMA) lies within the study area (approximately 170 acres of the 5,123-acre reservoir) and the Sutherland Reservoir SRA (3,017 acres) lies within the southwestern portion of the study area. Sandhill lakes and reservoirs such as these typically attract a wide variety of waterfowl during the spring and fall migration.

4.1.4 Developed

The developed avian habitat type includes low-, medium-, and high-intensity developed lands; roads; quarries, mines, and open pits; ruderal grassland and shrubland; and urban vegetation.

4.1.5 Row-crop Agriculture

The row-crop agriculture habitat type includes lands predominantly used for corn, soybeans, alfalfa, small grains, sorghum, and dry edible beans (CALMIT 2007; USGS 2013). Most of these crops are typically planted during late April to May, reach full cover by late July, and are harvested September through October (CALMIT 2007).

4.2 Avian Survey Resources

The NGPC and USFWS expressed concern in the early stages of the R-Project about potential impacts to migratory birds. Given the size of the study area, lack of access and the large number of potential route combinations, R-Project-specific surveys for migratory birds were not possible. However, five North American Breeding Bird Survey (BBS) routes occur within the study area: Ringgold, Swan Lake, Wheeler County, Brownlee, and Mullen (Ziolkowski et al. 2022) (Figure 4-2). The BBS was initiated in 1966 and is completed annually each June in coordination between USGS Patuxent Wildlife Research Center, Canadian Wildlife Services, and Mexico's Comision Nacional para el Conocimiento y Uso de la Biodiversidad.

Each BBS route is 24.5 miles long and includes 50 designated observation points, each 0.5 mile apart. Every bird seen or heard within a 0.25-mile radius of each observation point is recorded. Considering the five BBS routes within the study area, 250 observation points are recorded in the study area each year. Timing of the BBS occurs when the majority of birds are either breeding in or migrating through the study area. The BBS provides a wealth of data relating to avian habitats and the associated bird use within the study area. The results of the five BBS routes in the study area assisted in developing bird assemblages considered in this Plan.

LANDFIRE cover types are available for download for each BBS route. Table 4-2 provides a comparison of the percentage of avian habitat types along BBS routes and within the study area. The proportion of avian habitat types along the five BBS routes is comparable to the avian habitat types of the study area (Ziolkowski et al. 2022). Given the similarity of land cover types within the study area and along the BBS routes, bird assemblages and relative abundance of those birds are also representative of the study area. A complete species list of birds heard or seen along these North American BBS routes is provided in Appendix A.

TABLE 4-2 BBS AND STUDY AREA AVIAN HABITAT TYPES

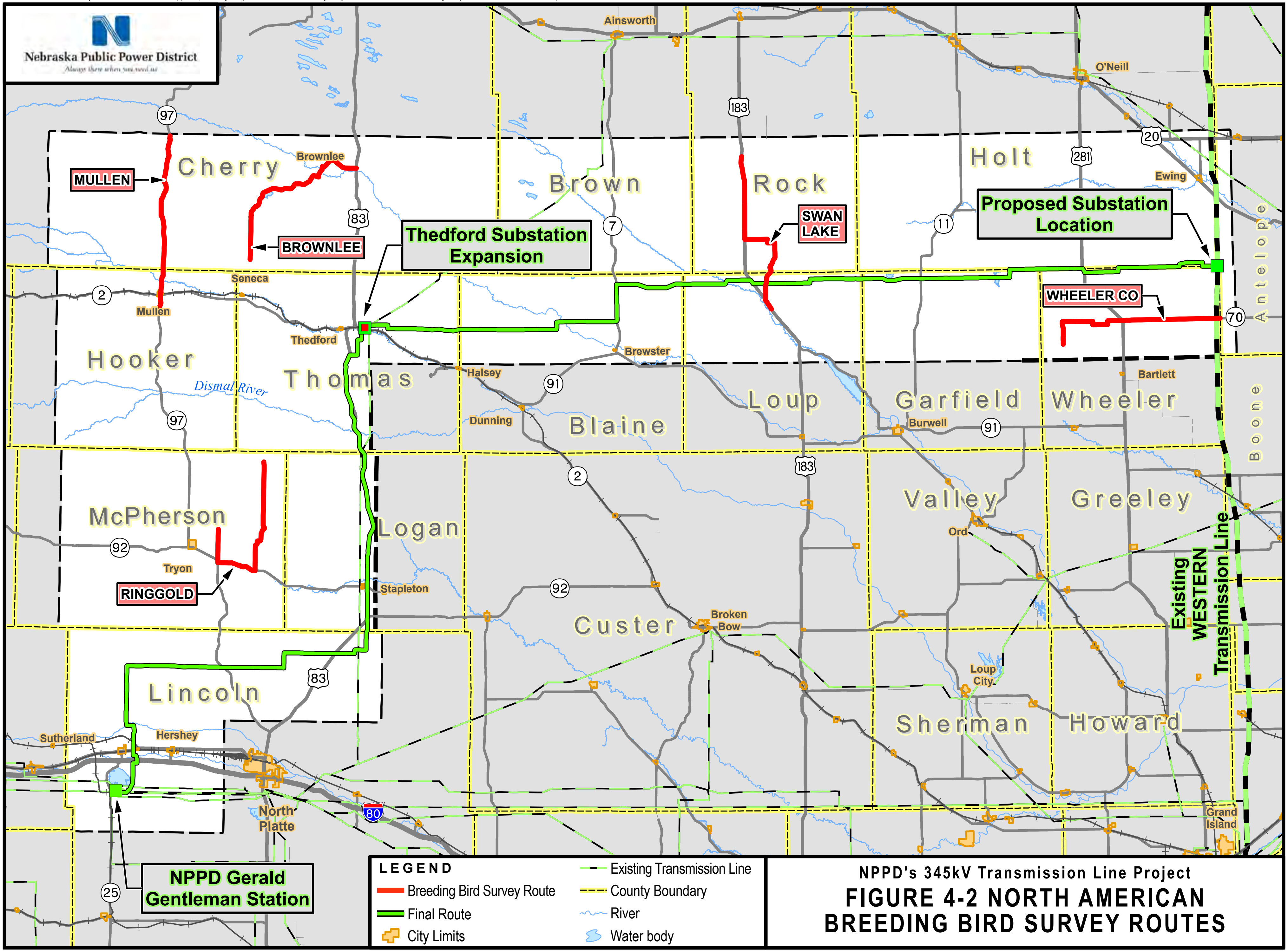
AVIAN HABITAT TYPE	PERCENT OF BBS ROUTES[1]	PERCENT OF STUDY AREA[2]
Grassland	84%	93%
Forest	0.3%	0.6%
Wetland/Aquatic	9%	5%
Developed	2%	0.7%
Row-crop Agriculture	5%	0.1%

1. Ziolkowski et al. 2022.
2. LANDFIRE (USGS 2013).

There have been 121 different bird species identified along the BBS survey routes that are within the study area (Appendix A). Forty-four of those species are associated with forest habitats, and 37 species are associated with wetland/aquatic habitats. Forest and most wetland-associated species have relatively low occurrence along the BBS routes. There are 20 grassland-associated species. The remaining species are considered habitat generalists. Western meadowlark (*Sturnella neglecta*), red-winged blackbird (*Agelaius phoeniceus*), mourning dove (*Zenaida macroura*), and grasshopper sparrow (*Ammodramus savannarum*) make up 57 percent of all birds detected on the BBS routes.

The BBS is a robust survey that includes a comparable representation of habitat types throughout the Study Area, as indicated in Table 4-2. However, BBS surveys are only conducted during the spring migration and may not account for birds outside that period. Additional sources of avian occurrence information considered in this Plan include anecdotal observations from R-Project-specific field surveys for additional environmental resources, the Nebraska Natural Heritage Program, Audubon Important Bird Area (Gracie Creek) bird lists, and local expert observations.

Date: 3/6/2023 Path: G:\Projects\128143_NPPD_SPP\Apps\Reports\MigratoryBirdConservationPlan\MigratoryBirdConservationPlan_2023\MigratoryBirdConservationPlan_2023.aprx



NPPD's 345kV Transmission Line Project

FIGURE 4-2 NORTH AMERICAN BREEDING BIRD SURVEY ROUTES

4.3 Special Status Avian Species

Special status avian species considered in this Plan are those protected by the laws and regulations described in Section 2.0 and those species included on the USFWS Birds of Conservation Concern list (USFWS 2021). Species protected under the ESA and BGEPA are fully described in the R-Project HCP. This Plan provides an abbreviated summary of those species and potential effects from construction, operation, and maintenance of the R-Project.

4.3.1 Species Protected under the ESA and BGEPA

Avian species that are protected under ESA and BGEPA, and that may occur in the study area, are described in Table 4-3. Through coordination with USFWS and NGPC, NPPD has determined that no incidental take of the avian species described in Table 4-3 is anticipated as a result of the R-Project. Thus, NPPD's HCP does not include them as Covered Species, and NPPD is not pursuing an Incidental Take Permit for the ESA-listed species or an Eagle Incidental Take Permit for the bald or golden eagle. The avian species presented in Table 4-3 are analyzed in the HCP as "Evaluated Species." Evaluated Species are those for which authorization of incidental take is not being requested as such take will be avoided through avoidance and minimization measures described in the HCP.

TABLE 4-3 ESA- AND BGEPA-PROTECTED AVIAN SPECIES

SPECIES	FEDERAL STATUS[1]	STATE STATUS[2]	HABITAT REQUIREMENTS
Whooping crane (*Grus americana*)	Endangered	Endangered	Shallow palustrine wetlands or large, shallow riverine habitat, adjacent to agricultural fields.
Piping plover (*Charadrius melodus*)	Threatened	Threatened	Shores of alkali lakes and broad river sandbars devoid of vegetation.
Bald eagle (*Haliaeetus leucocephalus*)	Bald and Golden Eagle Protection Act	None	Lakes and rivers with prominent trees for perches and open water for foraging.
Golden eagle (*Aquila chrysaetos*)	Bald and Golden Eagle Protection Act	None	Mountainous canyon land, rimrock terrain of open desert and grasslands in the western U.S.
Rufa red knot (*Calidris canutus rufa*)	Threatened	Threatened	Open saline wetlands and barren lakeshores.

[1] Federal status includes species listed as threatened, endangered, or candidate under ESA and species protected under BGEPA.
[2] State status includes species listed as threatened or endangered under the Nebraska Nongame and Endangered Species Conservation Act.

4.3.2 USFWS Birds of Conservation Concern

The Fish and Wildlife Conservation Act directs the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973". 16 U.S.C. § 2912. The USFWS's 2021 list of Birds of Conservation Concern (BCC) is the most recent effort by USFWS to carry out this mandate (USFWS 2021). Note that while BCC have been identified by the USFWS, they have no additional legal protection beyond the MBTA.

Birds of Conservation Concern 2021 identifies 27 Bird Conservation Regions (BCR) in North America and the BCC that are most likely to occur within each region. The R-Project falls mainly within Bird Conservation Region 19 – Central Mixed-grass Prairie. BCC species that are likely to occur within the Central Mixed-grass Prairie BCR are described in Table 4-4.

TABLE 4-4 BIRDS OF CONSERVATION CONCERN IN THE CENTRAL MIXED-GRASS PRAIRIE REGION

SPECIES	HABITAT REQUIREMENTS[1]	HABITAT GROUP[2]	LIKELIHOOD OF OCCURRENCE WITHIN STUDY AREA[1, 3]
Bald eagle (*Haliaeetus leucocephalus*)	Lakes and rivers with prominent trees for perches and nesting and open water for foraging.	Forest	High
Bell's vireo (*Vireo bellii*)	Riparian areas, brushy fields, young second-growth forest or woodland, scrub oak, coastal chaparral, and mesquite brushlands.	Forest	High
Black-billed cuckoo (*Coccyzus erythropthalmus*)	Large, dense woodlands and thickets.	Forest	Moderate
Black rail (*Laterallus jamaicensis*)	Salt marshes, shallow freshwater marshes, wet meadows, and flooded grassy vegetation.	Wetland/Aquatic	Low
Buff-breasted sandpiper (*Calidris subruficollis*)	Short-grass areas such as pastures, golf courses, cemeteries, airports, and lawns; damp margins of freshwater lakes, ponds, and lagoons.	Grassland	Moderate
Cassin's sparrow (*Peucaea cassinii*)	Arid grasslands with scattered shrubs, yuccas, or low trees such as mesquites (*Prosopis* spp.) and oaks (*Quercus* spp.).	Grassland	High
Chestnut-collared longspur (*Calcarius ornatus*)	Shortgrass prairies with limited vegetation, including black-tailed prairie dog towns.	Grassland	High
Harris's sparrow (*Zonotrichia querula*)	Streams, hedgerows, shelterbelts, and brushy ravines dominated by deciduous trees and shrubs. Forages in agricultural fields, weed patches, and pastures undergoing secondary succession.	Forest	Moderate
Henslow's sparrow (*Ammodramus henslowii*)	Tallgrass prairies and wet meadow.	Grassland	Low
Hudsonian godwit (*Limosa haemastica*)	Variety of inland and coastal wetland habitats: estuaries, mudflats, salt marsh, sandy shores, shell banks, lakes, freshwater marshes, brackish swamps, flooded rice fields, sewage lagoons, salt ponds, and occasionally uplands.	Wetland/Aquatic	Moderate
Lark bunting (*Calamospiza melanocorys*)	Grasslands and shrub-steppe of high plains, including agricultural areas.	Grassland	High
Lesser prairie-chicken (*Tympanuchus pallidicinctus*)	Sand sagebrush–bluestem (*Andropogon* spp.) and shinnery oak–bluestem vegetation types.	Grassland	Low
Little blue heron (*Egretta caerulea*)	Edges of shallow, marshy ponds.	Wetland/Aquatic	Low
Loggerhead shrike (*Lanius ludovicianus*)	Open country with short vegetation: pastures with fence rows, old orchards, mowed roadsides, cemeteries, golf courses, agricultural fields, riparian areas, and open woodlands.	Grassland	High

SPECIES	HABITAT REQUIREMENTS[1]	HABITAT GROUP[2]	LIKELIHOOD OF OCCURRENCE WITHIN STUDY AREA[1, 3]
Long-billed curlew (*Numenius americanus*)	Short-grass or mixed-prairie habitat with flat to rolling topography.	Grassland	High
Marbled godwit (*Limosa fedoa*)	Variety of wetland types, estuaries, salt marshes, lagoons, and sandy beaches.	Wetland/Aquatic	Moderate
Mississippi kite (*Ictinia mississippiensis*)	Mature shelterbelts (windbreaks) and in urban areas.	Forest	Moderate
Mountain plover (*Charadrius montanus*)	Open, flat, dry tablelands with low, sparse vegetation; recently tilled and fallow lands.	Grassland	Low
McCown's longspur (*Rhynchophanes mccownii*)	Sparse vegetation such as shortgrass prairie, overgrazed pastures, plowed fields, and dry lake beds.	Grassland	Moderate
Red-headed woodpecker (*Melanerpes erythrocephalus*)	Variety of forest habitats, typically with a certain degree of openness and presence of dead limbs or snags for nesting purposes.	Forest	High
Scissor-tailed flycatcher (*Tyrannus forficatus*)	Savannas with occasional trees, shrubs, and brush patches. Also in towns, agricultural fields, pastures, landscaped areas such as golf courses or parks with a mix of trees, perches, and open areas.	Forest, Developed	Low
Short-billed dowitcher (*Limnodromus griseus*)	Saltwater habitats including tidal flats, beaches, salt marshes, sewage ponds, and flooded agricultural fields.	Wetland/Aquatic	Low
Smith's longspur (*Calcarius pictus*)	Shortgrass prairies and pasture with heavy grazing pressure.	Grassland	Moderate
Snowy plover (*Charadrius nivosus*)	Open on sandy coastal beaches, barrier islands, barren shores of inland saline lakes, river bars, wastewater ponds, and reservoir margins.	Wetland/Aquatic	Low
Solitary sandpiper (*Tringa solitaria*)	Enclosed wet or muddy habitats, including inland lakes and ponds.	Wetland/Aquatic	Moderate
Sprague's pipit (*Anthus spragueii*)	Large contiguous patches of native mixed-grass and shortgrass prairies.	Grassland	Moderate
Swainson's hawk (*Buteo swainsoni*)	Open stands of grass-dominated vegetation, sparse shrublands, and small, open woodlands.	Grassland, Forest	High
Western grebe (*Aechmophorus occidentalis*)	Large freshwater lakes and marshes edged with reeds and rushes.	Wetland/Aquatic	Moderate

[1] Sibley 2003; Cornell Lab of Ornithology 2015.
[2] Habitat group based on those described in Table 4-1.
[3] High – species has been documented in Study Area through anecdotal observations from R-Project-specific field surveys for additional environmental resources, the Nebraska Natural Heritage Program, Audubon Important Bird Area (Gracie Creek) bird lists, BBS results, and local expert observations; Moderate – suitable habitat is present, but species has not been documented; Low – no suitable habitat present or is outside species known range.

5.0 R-PROJECT EFFECTS ON AVIAN SPECIES

5.1 General Avian Effects

Impacts resulting from implementation of the R-Project can either be permanent or temporary in nature. Permanent impacts to avian resources are long-term and will exist for the life of the transmission line or beyond. Temporary impacts to avian resources are short-term and are often associated with construction activities. In many cases, the effects associated with temporary impacts will be dissipated, ameliorated, or no longer measurable after construction is completed. Some temporary impacts could extend through the restoration period, and future operation and maintenance could result in additional temporary impacts after construction.

5.1.1 Potential Effects from Construction

Displacement. Construction-related activities associated with the R-Project, such as the presence of construction personnel, presence and use of construction equipment, and noise impacts related to construction activities and the use of helicopters, may result in the potential displacement (which includes both flushing and avoidance of the area) of avian species within and adjacent to construction areas. Such displacement can result in reduced productivity and increased energy expenditure (Bennett 1991); however, the magnitude of impact is often specific to the species and the extent of the displacement. Birds will likely rely on the adjacent habitat to avoid construction activities, thus limiting the effects of displacement.

Potential displacement of birds as a result of construction-related activities will be a temporary impact. The timing of construction activities relative to the natural history of the species will influence whether and the extent to which each avian species is affected. For example, a construction activity will have a lesser impact if it occurs outside of avian nesting and migration periods (see Section 6.7).

Temporary Habitat Disturbance. The use of temporary work areas including structure work areas, wire-pulling, tensioning, and splicing sites, construction yards/staging areas, fly yard/assembly areas, and temporary access will result in temporary surface disturbance. Because of the remote and sparsely populated nature of the Sandhills, the majority of surface disturbance will occur in areas that provide suitable habitat to a large suite of birds. Table 5-1 provides an estimate, based on preliminary design of the project, of temporary disturbance to the avian habitat types described above.

Note that the calculations provided in Table 5-1 are based on LANDFIRE vegetation cover data. LANDFIRE is a geographic information system (GIS)-based tool that identifies general cover types within a 30-meter pixel; it is inherently coarse regarding habitat types smaller than the 30-meter pixel. When examining large areas such as the R-Project study area and potential disturbance areas, LANDFIRE can be a valuable tool.

TABLE 5-1 ESTIMATED TEMPORARY DISTURBANCE OF AVIAN HABITAT TYPES (ACRES)

HABITAT DISTURBANCE[1, 2]	GRASSLAND	FOREST	WETLAND/AQUATIC	DEVELOPED	ROW-CROP AGRICULTURE	TOTAL
TEMPORARY						
Temporary access	436	3	15	49	24	**527**
Fly yards/Assembly areas	253	0	11	2	12	**279**
Construction yards/Staging areas	60	0	0	11	37	**108**
Temporary structure work areas	286	4	8	43	59	**400**
Wire pulling, tensioning, and splicing sites	277	4	10	27	41	**359**
Temporary Total	**1312**	**10**	**45**	**131**	**173**	**1672**

Source: LANDFIRE (USGS 2020).

[1] Acres based on Preliminary Design.

[2] Exact location of distribution power line relocation is not known at this time and is not included in Table 5-1. Location of Construction Contingency acres cannot be predicted at this time.

When possible, temporary surface disturbance associated with construction of the R-Project will be located on previously disturbed areas, such as previously established gravel lots, construction yards from previous projects, or grasslands heavily damaged by cattle production, many of which do not provide avian habitat (Section 6.4). The results of this effort are observed when the acres of disturbance for each habitat type are compared to the study area as a whole. While developed habitat makes up approximately 0.7% of the study area, 8.6% of the temporary surface disturbance associated with the R-Project will be in developed habitat. The R-Project will not have a disproportional impact on any bird species associated with a certain habitat type (Table 5-2).

TABLE 5-2 PERCENT OF AVIAN HABITAT TYPES IN THE STUDY AREA AND TEMPORARY DISTURBANCE AREAS

AVIAN HABITAT TYPE	PERCENT OF STUDY AREA[1]	PERCENT OF TEMPORARY DISTURBANCE[1]
Grassland	93%	84.21%
Forest	0.6%	0.34%
Wetland/Aquatic	5%	4.15%
Developed	0.7%	8.63%
Row-crop Agriculture	0.1%	2.67%

[1.] LANDFIRE (USGS 2020)

Note that grassland habitat makes up the largest percent of any habitat type. The majority of grassland habitat within the ROW will not be disturbed because clearing of grassland is not required between structures. Migratory birds will be able to use that habitat at any time during the construction process, though the presence of construction personnel may temporarily deter use near the structure installation sites. As noted above, migratory birds occupying habitat that will be disturbed or that is in the vicinity of construction-related activities will be displaced to adjacent available habitat. The boundary of the study area alone encompasses over 3.5 million acres of grassland habitat (Table 4-1); thus, the extent of displacement is not likely to be significant. Following completion of restoration efforts, the areas of temporary disturbance will once again be available for use by migratory birds, recognizing that there will be permanent impacts from operation and maintenance, as described below.

Permanent Habitat Loss. In addition to temporary habitat disturbance, there will be a permanent loss of habitat at pole locations, regeneration sites, substations, and permanent access roads. The total permanent habitat loss at pole foundation locations and regeneration sites is approximately one acre. Substations will result in approximately 25 acres of permanent habitat loss. The new substation at Thedford is approximately 13 acres and is located in grassland habitat. The expansion of the substation at Gerald Gentlemen Station will be located within the existing substation footprint. The location and exact amount of permanent access roads required are unknown at this time and will be dependent on site-specific conditions and landowner negotiation. Permanent habitat loss associated with access is estimated at 26 acres for the purposes of being conservative in estimating impacts. NPPD will strive to minimize permanent roads and anticipates that permanent roads will result in far less than 26 acres of permanent habitat loss.

Impacts to Nesting Birds. Birds likely nest in all of the habitat types described in this Plan. Construction-related activities have the potential to interfere with breeding behavior. However, the impacts to nesting birds will likely be minimal in light of NPPD's survey and avoidance commitments identified in Section 6.7 below.

Noxious Weeds. Construction equipment moving from site to site can facilitate the spread of noxious weeds. Noxious weeds can reduce habitat suitability by limiting potential nesting and foraging habitat. However, potential impacts from the unintended spread of noxious weeds will be avoided and minimized by commitments identified in Section 6.7 below.

Wildfire Risk. Construction activities will increase the risk of wildfire, which can be ignited by dry grass touching the undercarriage of hot vehicles or from stray sparks from welding equipment. Wildfire can eliminate large portions of migratory bird habitat; however, grasslands have evolved to co-exist with fire and quickly return to their previous state. The risk of accidental wildfire will be avoided and minimized by commitments identified in Section 6.7 below.

5.1.2 Potential Effects from Operation and Maintenance

Temporary Displacement. Displacement of avian species will likely result from increased human activity associated with operation and maintenance activities throughout the life of the transmission line. As noted above, annual inspections will occur twice a year. Routine scheduled operation and maintenance will begin at year 30 and continue every 10 years after that. Operation and maintenance activities will likely result in displacement of avian species during those activities. This type of impact to migratory birds will be temporary.

Habitat Fragmentation. Habitat fragmentation may decrease habitat connectivity and inhibit movement of some wildlife species (Knight et al. 2000). Habitat fragmentation from power lines most often occurs when the habitat within the ROW differs from the surrounding areas, such as a cleared ROW through a forested area. Habitat fragmentation of grassland habitat typically occurs as a result of conversion of native grasslands to other land cover types, such as agricultural uses. However, the USFWS has expressed concerns that presence of the R-Project on the landscape will still create habitat fragmentation, even though the vast majority of habitat disturbed by construction will be restored to suitable habitat. Scientific information regarding habitat fragmentation from transmission lines on migratory birds is lacking. Because of the lack of scientific information, and the varying responses of different species, the effect of habitat fragmentation from the R-Project cannot be fully evaluated. However, any effect from habitat fragmentation is expected to be low.

With the exception of the permanent habitat loss described above, the majority of disturbances to grassland habitat will be temporary and restored to grassland following the completion of construction activities. Grassland habitat within the majority of the R-Project ROW will not be disturbed, either permanently or temporarily, since most of it will be spanned, and thus will remain available to birds, recognizing the other impacts of transmission line described herein, such as increased nest predation and collision risk. At most, 10 percent of the temporary access improvements may be left in place as permanent access roads following completion of construction activities depending on landowner requests and requirements for operation and maintenance of the line. This will result in a maximum of 26 acres of permanent habitat loss throughout the R-Project access network. The loss of 26 acres of grassland habitat spread over the entire R-Project access network should not result in habitat fragmentation of grassland habitats, nor should the minimal permanent loss from the transmission structures or the 13 acres at the Thedford Substation.

USFWS has also expressed concern the R-Project will fragment habitat by creating a barrier that migratory birds will not cross; however, science regarding avian avoidance of transmission lines is lacking. The limited data that are available are largely focused on gallinaceous birds, such as sagegrouse and lesser prairie-chicken; gallinaceous birds are not considered migratory and are not protected under the MBTA. Neither of these species occurs in Nebraska, and the data available do not allow any firm conclusions to be drawn. The R-Project is not anticipated to present a barrier to avian species that may use the area surrounding the transmission line, because those species can readily fly over or under the line for local habitat use, are often seen perching on the line, and generally undertake long-distance migration at altitudes higher than the transmission line. By not altering native grassland habitat within the ROW and restoring temporarily disturbed areas, the R-Project's minimal permanent habitat loss and the existence of the transmission line should not fragment avian habitats.

Collision Risk. Implementation of the R-Project will present a collision hazard where birds may collide with the transmission line wires. Collision can result in avian injury or mortality. A number of biological characteristics influence the susceptibility of species to collision with power lines:

- Body size, weight, and maneuverability
- Flight behavior
- Vision
- Age and sex
- Health
- Time of day and season
- Habitat and habitat use

The APLIC document *Reducing Avian Collision with Power Lines: State of the Art 2012* (APLIC 2012) provides an in-depth discussion of each of these factors. The following is a summary of that information relating to body size, weight, and maneuverability, flight behavior, and habitat use.

Heavy birds with small wings in relation to body size are typically more at risk of avian collision. Birds that typically represent this body style include waterfowl, cranes, and shorebirds. The converse of this is that light birds with larger wings in relation to body size are less likely to collide with a power line given those birds' high degree of maneuverability. Birds that typically represent this body style include passerine songbirds and raptors. While passerine songbirds and raptors may still collide with power lines, their likelihood of collision is far smaller than waterfowl, cranes, and shorebirds.

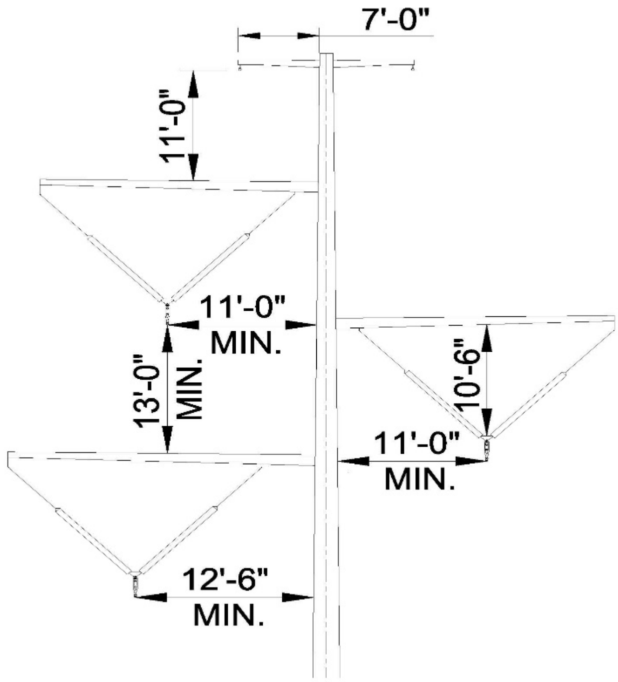
Flight behavior often influences the likelihood of collision. Flocking species, such as waterfowl and wading birds, are more vulnerable to collision than solitary species. Panicked flight, which may occur when flocks are forced to take off suddenly to escape a perceived threat, also increases the risk of collision. Other flight behaviors that can increase the likelihood of avian collision with power lines include predatory flight when a raptor is chasing prey or flight displays during courtship.

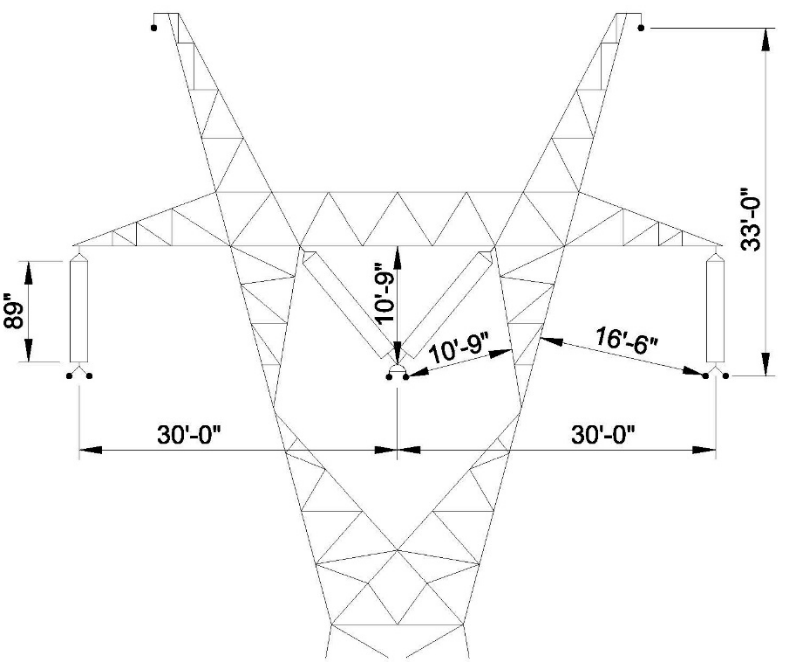
Habitat use is often a large factor in avian collision. Power lines placed near avian concentration areas, such as large waterfowl or shorebird roosts, are at a higher risk of avian collision. Additionally, power lines placed on frequent flight paths, such as between feeding and roosting areas, are at a higher risk of avian collision. See Sections 6.2 and 6.12.1 for a discussion of the avoidance and minimization measures will implement for the R-Project to reduce collision risk.

Electrocution Risk. A common concern regarding transmission lines is the possibility of raptor electrocution. Transmission lines require large spacing between conductors to prevent flashover between phases and to prevent contact during galloping events, both of which cause line outages. Also, sufficient clearance is needed to provide safe working distances for linemen to perform hot line maintenance work, which also reduces the outage events required to maintain the line. The spacing is utility specific, based on each utility's design and maintenance practices.

Electrocution of any migratory bird from the R-Project is unlikely given the spacing between energized conductors and between energized conductors and grounded portions of the structure (Figure 5-1). For the steel monopoles, the vertical separation between energized conductors is 23 feet. The separation between energized conductors and grounded portions of the structure is 11 feet. The straight-line horizontal spacing on steel monopoles is the same. The horizontal spacing on lattice towers is 30 feet. The separation between energized conductors and grounded portions of the structure on lattice towers is 10 feet 9 inches. These spacing distances are substantially greater than the 60 inches (five feet) recommended by APLIC (2006). Figure 5-1 also shows the separation of shield wire and the structure as seven feet on monopole structures. The shield wire is not energized and does not create an electrocution hazard.

FIGURE 5-1 TRANSMISSION CONDUCTOR SPACING





Predation. USFWS has expressed concern that transmission lines in prairie ecosystems provide structures from which birds of prey may perch, increasing the potential for predation on other migratory birds. There is also concern that linear projects such as roads and power lines provide travel corridors for mammalian predators, which may also increase predation on migratory birds. While these increased predatory pressures may occur, there is no available information to quantify the extent of these impacts. However, given the native grasses and habitats surrounding the R-Project that provide suitable cover for migratory birds, the potential impact of predation is expected to be minimal.

Wildfire Risk. There is a small risk that failure of the R-Project could cause a wildfire in grassland habitat. The likelihood of a line failure, such as the transmission line coming down or a bird nest on the structure catching fire, is very small. Protection measures built into the transmission system would ensure the line is de-energized during a line failure, thus eliminating the risk of fire. In the unlikely event a wildfire is caused by operation of the R-Project, the potential effects to migratory birds would be dependent on time of year, surrounding habitat conditions, and extent of the fire. Grasslands have evolved to co-exist with fire and quickly return to their previous state, minimizing the impact to migratory birds.

5.2 Potential Effects on Federally Protected Avian Species

The following information is an excerpt from Chapter 4 of the R-Project HCP. For a full review of all federally protected species, including species ecology, likelihood of occurrence, potential effects, and avoidance and minimization measures for those species, please see Chapters 3 and 4 of the R-Project HCP.

5.2.1 Whooping Crane

Beginning in 2009, a team of biologists from the U.S. Geological Survey, USFWS, Canadian Wildlife Service, Crane Trust, and Platte River Recovery Implementation Program began placing GPS trackers on whooping cranes to closely monitor locations and habitats used by cranes during all portions of their lifecycle (Headwaters 2018). GPS trackers were placed on whooping cranes of various age classes between 2009 and 2014. A total of 58 whooping cranes were tracked during at least one migration in this study, which represented approximately one-fifth of the population at the time. This study, hereafter referred to as the satellite tracking study, provided valuable information on whooping crane use and habitat selection in central Nebraska.

Phase 2 of the tracking effort was initiated by the same team of biologists in the winter of 2017. This tracking effort involved placing cellular transmitters on 17 adult whooping cranes. These cellular transmitters are programmed to collect up to 48 locations per day at equal time intervals and upload the recorded data every 24 hours. This will allow for the collection of highly detailed information on diurnal and nocturnal (roosting) habitat use during all stages of the year (Harrell and Bidwell 2020). Phase 2 of the tracking effort is currently ongoing, and results are not yet publicly available.

Potential Effects from Construction

Temporary Habitat Disturbance and Permanent Habitat Loss. A desktop whooping crane habitat assessment (Appendix B) based on parameters developed by the Watershed Institute (2013) was completed to identify where potentially suitable habitat exists within one mile of the R-Project. The potentially suitable whooping crane habitat analysis methodology developed by the Watershed

Institute was specifically designed for use on power line projects. The potentially suitable whooping crane habitat analysis is a landscape-scale analysis and is not intended to represent every conceivable potential use location within one mile of the R-Project. Data from NWI, the National Hydrologic Dataset (NHD), and NRCS hydric soils were used in the habitat assessment. The habitat assessment consists of two main steps: the Initial Analysis and the Secondary Analysis. The Initial Analysis eliminates habitat from consideration as potentially suitable whooping crane habitat based on size, visibility obstructions, and distance to disturbances. The Secondary Analysis assigns relative values to the remaining habitats based on wetland water regimes, size, proximity to food sources, natural versus man-made wetlands, and habitat density.

Whooping cranes will utilize a wide range of land cover types to meet their habitat needs. This is true of migrating waterbirds in general throughout the Great Plains due to the highly dynamic nature of wetlands in the Great Plains (Albanese et al. 2012). The satellite tracking study examined 504 roost sites associated with satellite-tracked birds and supports this concept. That analysis looked at the frequency distribution of certain characteristics of roost habitat. While there was a wide range, it found that 90% of all wetlands used were greater than 0.25 acre (Pearse et al. 2017). While NPPD recognizes that whooping cranes may utilize a wide range of conditions, use is much more likely if a certain set of conditions are present and believes that the Watershed Institute approach represents a viable means to identify where whooping cranes and the R-Project have a reasonable expectation of interacting in the next 50 years.

Based on the results of the desktop habitat assessment, out of the 289,280 acres within one mile of the R-Project, there are approximately 8,969 acres (3.1% of the total) of potentially suitable whooping crane stopover habitat as determined by NPPD's analysis and consistent with Pearse et al. (2017) as described above. Table 5-3 provides an estimate of temporary and permanent disturbance to potentially suitable stopover whooping crane habitat.

TABLE 5-3 ESTIMATED TEMPORARY AND PERMANENT DISTURBANCE OF POTENTIALLY SUITABLE WHOPPING CRANE HABITAT

PROJECT ACTIVITY[1]	POTENTIALLY SUITABLE WHOOPING CRANE HABITAT TEMPORARY DISTURBANCE (ACRES)	POTENTIALLY SUITABLE WHOOPING CRANE HABITAT PERMANENT DISTURBANCE (ACRES)
Temporary Access	11.0	--
Fly Yards/Assembly Areas	0.7	--
Construction Yards/Staging Areas	0	--
Temporary Structure Work Areas	8.3	--
Pulling and Tensioning Sites	8.3	--
Distribution Relocation	0.6	--
Well Relocation	0	
Helical piers – lattice tower	--	0.007
Standard foundation – steel monopole	--	0.006
TOTAL	**28.9**	**0.013**

[1.] Distribution line and well relocations do not occur in potentially suitable whooping crane habitat.

Construction activities associated with the R-Project will result in the total temporary disturbance of 28.9 acres of potentially suitable whooping crane habitat or 0.3% of such habitat within one mile of the R-Project. Structure foundations located within potentially suitable whooping crane habitat will result in the permanent loss of 0.013 acre of habitat. Temporary and permanent disturbance areas, such as construction yards/staging areas, fly yards/assembly areas, structure work areas, temporary access, and structure locations were sited to avoid potentially suitable whooping crane habitat to the maximum extent practicable. Further refinement of the siting of these work areas will be conducted in the field during final design. NPPD will coordinate work areas with USFWS and NGPC; however, final design must account for engineering, technical, legal, and economic considerations. The existing road network and two-tracks will be used to the maximum extent practicable during construction to reduce the need for new access. Rivers, streams, and wetlands were avoided by temporary access during the preliminary design phase; however, an estimated 11.0 acres of potentially suitable whooping crane habitat could not be avoided in order to provide access to all work areas. Disturbance of potentially suitable whooping crane habitat will be temporary, and disturbed areas will be restored following completion of construction activities. Disturbance in potentially suitable whooping crane habitat will be avoided where possible using measures such as construction matting and overland travel. These measures will reduce ground disturbance and accelerate restoration of habitat. The need for permanent access roads is dependent on landowner requests and requirements for operation and maintenance of the line but would not exceed 26 acres throughout the entire length of the Project. Permanent access roads will not create any additional disturbance beyond that incorporated under temporary access. Permanent access will avoid potentially suitable whooping crane habitat.

Stahlecker (1997) completed an assessment of wetlands mapped under the National Wetlands Inventory (NWI) program in Nebraska in an effort to assess the availability of suitable stopover habitat throughout the state. His results suggested that whooping cranes migrating through Nebraska have multiple options for roost sites during migration due to the “large number and wide distribution of wetlands within the whooping crane migration corridor in Nebraska.” Potentially suitable whooping crane habitat prevalent in the Sandhills includes large wetlands in the higher elevation areas of the western Sandhills, the headwaters of major rivers and streams, and major rivers flowing eastward through the region (Stahlecker 1997). Pearse et al. (2015 and 2020) quantified whooping crane use throughout the Central Flyway, including central Nebraska, using data from the satellite tracking study. Pearse et al. (2015 and 2020) identified low-intensity-use, core-intensity-use, and core-intensity-extended-use cells throughout central Nebraska, indicating that suitable habitat is abundant throughout the state. The temporary and permanent disturbance of 28.9 and 0.013 acres, respectively, of potentially suitable whooping crane habitat from the R-Project will have little effect on migrating whooping cranes when considering the availability of habitat throughout the state and Sandhills region, as reported by Stahlecker (1997), Pearse et al. (2015 and 2020), and as identified by the desktop habitat assessment.

Displacement. Riverine habitat is commonly used by whooping cranes in Nebraska and makes up 59 percent of all roost sites examined in Austin and Richert (2005). Riverine habitat used by whooping cranes may vary throughout the state. The average river width used by whooping cranes is between 179 and 227 meters, but the narrowest river corridor used was only 36 meters (Austin and Richert 2005; Pearse 2016). The widths of all rivers and streams spanned by the R-Project are provided in Table 5-4. River and stream widths were interpreted using detailed aerial imagery.

TABLE 5-4 POTENTIAL HABITAT WIDTHS AT RIVER AND STREAM TRANSMISSION LINE SPAN LOCATIONS

WATER BODY	WIDTH (METERS)	EXISTING INFRASTRUCTURE AT SPANS
South Platte River	80	Adjacent to Interstate 80
North Platte River	72	Bridge on N. Prairie Trace Road
South Loup River	2	Bridge on U.S. Highway 83
Dismal River	10	Bridge on U.S. Highway 83
Middle Loup River	21	Adjacent to State Highway 2
North Loup River	61	None

WATER BODY	WIDTH (METERS)	EXISTING INFRASTRUCTURE AT SPANS
Calamus River	23	None
Birdwood Creek	8	None

Data provided by USFWS and NGPC indicate that whooping cranes have previously been observed on most of the water bodies and adjacent habitat described in Table 5-4 except for the South Loup River and the Dismal River (Figure 5-2). The R-Project spans the South Loup River close to the town of Stapleton, which may negatively affect the potential for whooping crane use. The Dismal River is located in a steep canyon with cottonwood and eastern red cedar, which makes this river less optimal for potential stopover habitat.

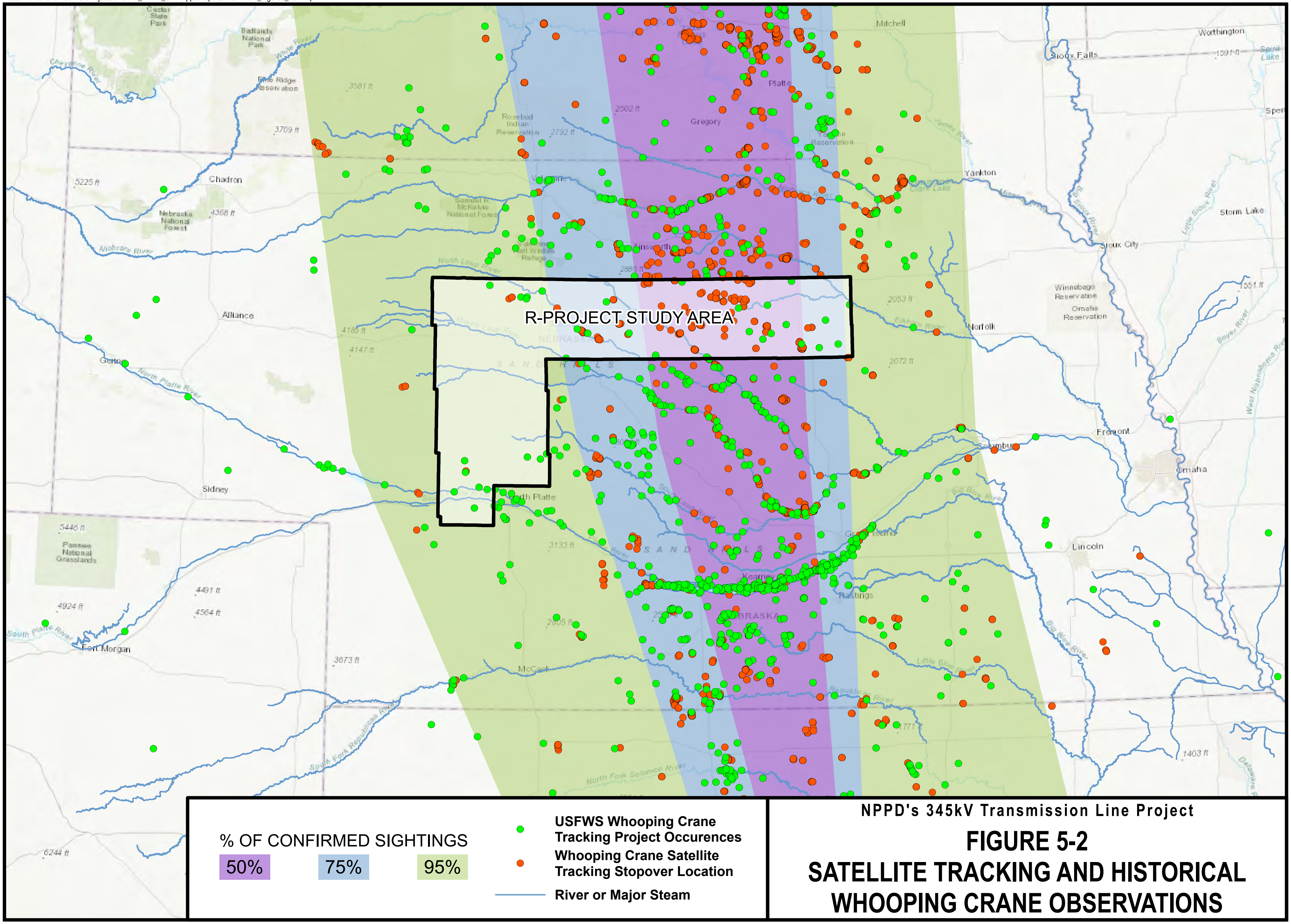
While the R-Project will not span the South Platte River at an existing bridge, it will span the South Platte River immediately north of Interstate 80. Interstate 80 runs parallel to the South Platte River at this location and is located less than 1,000 feet from the river channel. Armbruster and Farmer (1981) found that sandhill cranes avoided paved roads and bridges by 400 meters (1,312 feet), and Armbruster (1990) recommends a similar avoidance be interpreted to apply to whooping cranes. The North Loup River, Calamus River, and Birdwood Creek are spanned at locations where there is no existing infrastructure. These rivers and their adjacent wetland habitat may be suitable for whooping crane use.

The following disclaimer applies to the use of the USFWS Nebraska Ecological Services Field Office whooping crane data, including the historical observations occurrences displayed in Figure 5-2. Figure 5-2 also includes all satellite tracking stopover locations in Nebraska.

> *This document or presentation includes Whooping Crane migration use data from the Central Flyway stretching from Canada to Texas, collected, managed and owned by the U.S. Fish and Wildlife Service. Data were provided to the NPPD as a courtesy for their use. The U.S. Fish and Wildlife Service has not directed, reviewed, or endorsed any aspect of the use of these data. Any and all data analyses, interpretations, and conclusions from these data are solely those of NPPD.*

Whooping cranes are known to avoid human-related disturbances on their nesting and wintering grounds (CWS and USFWS 2007); however, less is known about their avoidance of human-related disturbance during migration. Armbruster (1990) and Armbruster and Farmer (1981) indicate that migrating whooping cranes may avoid areas of repeated human use, such as urban and commercial areas, at distances up to 800 meters (0.5 mile). Pearse et al. (2017) found that distance to nearest disturbance at 504 roost sites had a median value of 572.5 meters.

Date: 11/19/2023 Path: G:\Projects\128143_NPPD_SPP\Apps\Reports\HCP\HCP_Figures_2022.aprx



NPPD's 345kV Transmission Line Project

FIGURE 5-2
SATELLITE TRACKING AND HISTORICAL WHOOPING CRANE OBSERVATIONS

In some areas where the R-Project line was located along existing roads, it is also in the vicinity of potentially suitable whooping crane habitat, particularly in the Platte River Valley and wet meadows in the east-west portion of the R-Project. Evidence suggests that migrating whooping cranes may select stopover habitat away from existing roads. Johns et al. (1997) found migrating whooping cranes avoided paved roads by 635 meters. Armbruster and Farmer (1981) found migrating sandhill cranes, a species similar to whooping cranes in habitat selection, avoided paved roads by 400 meters, gravel roads by 200 meters, and homes by 200 meters. Pearse (2016) saw that global positioning system (GPS)-tracked whooping cranes avoided disturbances, classified as roads, dwellings, machinery, hunting blinds, and other, by an average of 600 meters, but the 10% of these instances were approximately 150 meters. By placing the R-Project along existing roads where practicable, the R-Project utilizes areas that may already be avoided by whooping cranes.

The presence of construction personnel and equipment in and adjacent to potentially suitable habitat along the R-Project over the period of project construction (approximately 21 to 24 months) may cause migrating whooping cranes arriving in the area to avoid potentially suitable whooping crane habitat where the construction activity is occurring. Such potential effects will be limited to the immediate area surrounding construction crews present during whooping crane migration. The 0.5-mile estimate is based on the search radius described in the NGPC and USFWS whooping crane preconstruction survey protocol. Therefore, the potential for migrating whooping cranes to encounter construction crews working near suitable habitat the birds may use upon descent from migration flights is small. Migrating whooping cranes may travel 200 to 400 miles in one day (USFWS 2009b), and wetlands suitable for stopover habitat for migrating whooping cranes are available throughout Nebraska and the Sandhills region (Stahlecker 1997). Pearse and Selbo (2012) completed an energetics model for whooping crane flights and found that whooping cranes that fly an additional 10 kilometers in a wetland-dominated ecosystem would require one extra day of foraging to recoup the energy lost from the additional flight distance. The USFWS-mapped NWI indicates there are over 115,000 acres of wetlands within the Study Area and 50,000 acres of wetlands within 10 kilometers of the R-Project. Given the availability of potentially suitable whooping crane habitat, any additional flights to locate suitable roosting habitat away from construction personnel are expected to be short in distance and duration. At no point would a whooping crane be forced to fly more than 10 kilometers to find suitable roosting and foraging habitat. This would have minimal to no effect on migrating whooping cranes.

Potential Effects from Operations and Maintenance

Collision. Once constructed, a power line—distribution or transmission—presents a potential collision hazard for whooping cranes. Stehn and Wassenich (2008) and USFWS (2009b) each document whooping crane power line collisions (distribution and transmission).

Over the previous decades, whooping crane populations have increased from 18 birds in 1938 (Gil de Weir 2006) to 536 birds in 2023 in the Aransas-Wood Buffalo population (USFWS 2023a). At the same time, the miles of power line throughout the Central Flyway have also increased dramatically. However, while both individual whooping cranes and miles of power lines have increased, there has been no corresponding increase in power line collisions in the migration corridor. The majority of known power line collision mortalities have occurred in the experimental introduced flocks. The Aransas-Wood Buffalo population has had 11 known or assumed whooping cranes collisions with power lines during migration in the United States from 1956 through 2022. Of the eight known or assumed collisions in the Aransas-Wood Buffalo population, five involved distribution lines, two involved a transmission line, and one involved an unknown power line. Three suspected collisions possibly involved an unknown power line type. A summary of all confirmed and suspected whooping crane/power line collisions is provided in Appendix C.

NPPD examined three separate analyses to evaluate the likelihood of a whooping crane take from collision with the R-Project. The first analysis is the one completed by NPPD in 2018 that was included in the prior version of the HCP (hereinafter the "2018 Analysis"). The second analysis is an update to the Reasonably Certain Knowledge (RCK) analysis completed by the USFWS in 2018 (USFWS 2019). While preparing this update, NPPD was unable to replicate all the original inputs to the RCK approach and determined that the different approaches to the treatment of distribution versus transmission lines played a large role in the outcome. Thus, NPPD engaged Western EcoSystems Technologies (WEST) to independently review the available data sets to determine if the RCK model could be modified to evaluate transmission mortality only. A full description of each analysis is provided in Appendix C. Each of these analyses is summarized below.

2018 Analysis

The 2018 analysis used known miles of transmission lines, total known whooping crane mortalities as reported to Stehn and Haralson-Strobel (2014), the estimated migration mortality, and the estimated migration collisions with transmission lines each year 1956 to 2018 to determine the estimated collision risk of any one mile of transmission in the central flyway. This estimated collision risk of any one mile was then applied to the 225 miles of the R-Project, resulting in an estimated collision risk of 0.00044 whooping cranes in any one year and a total of 0.022 whooping cranes over the 50-year life of the permit. The 2018 analysis was not updated for the current HCP because it begins with total known whooping crane mortalities reported by Stehn and Haralson-Strobel (2014), and that document has not been updated with a more recent publication that uses the same or similar methodology for counting and reporting total whooping crane mortalities. The 2018 analysis is fully presented in Appendix C.

Reasonably Certain Knowledge Analysis (2023)

In order to address the scarcity of whooping crane collision data, numerous risk analyses proposed by various parties, and differing assumptions, the USFWS developed the 2018 RCK analysis, which identified data that were reasonably certain and other best available information, to analyze the risk of whooping crane collision for the R-Project. NPPD has updated the 2018 RCK analysis with current (as of May 2023) whooping crane information that has been recorded since the original was developed in 2018. The updated RCK analysis takes into account the following variables relating the Aransas-Wood buffalo whooping crane population to provide an estimated annual and mortality from the R-Project:

- Estimated average population over the 50-year life of the Project: 1,500 whooping cranes.
- Estimated annual migration mortality in the United States from all causes: 0.9483%.
- Estimated proportion of migration mortality that results from power lines: 40%.
- Estimated proportion of the power-line mortality during migration that may occur in Nebraska: 16.67%.
- Estimated proportion of power-line strikes that occur on transmission lines: 25%.

Because the R-Project would add 226 miles of transmission line in Nebraska, all of which are within the whooping crane migratory corridor, the R-Project would increase the length of transmission for collision in Nebraska by 4.7%. When considered over the 50-year life of the transmission line, the Updated RCK analysis predicts that the R-Project may result in 0.3044 whooping crane collisions throughout the expected life of the project. This does not take into account the risk reduction achieved through marking the line with bird flight diverters, which is identified as 50% to 80% in the Region 6 Guidance and APLIC (2012). To fully minimize potential impacts to whooping cranes, NPPD will mark all 226 miles of the R-Project, regardless of proximity to whooping crane suitable habitat. If the line marking achieved a reduction of 50%, the low end of the range noted in the Region 6 Guidance, the risk projection would be reduced to 0.1522 whooping crane collisions over the life of the R-Project.

WEST Analysis

NPPD's inability to fully replicate the RCK analysis led NPPD to engage WEST to review all data inputs and examine steps in the RCK analyses that were identified as not being reasonably certain and identify potential alternative approaches. The result was a risk assessment that is similar to the RCK analyses but is simplified and can be applied to any transmission line within the 95% migratory corridor. The WEST analysis applies the population viability analysis completed by Traylor-Holzer (2018). Additionally, the WEST analysis uses only known mortality data specific to transmission lines, which reduces the uncertainty associated with applying distribution-line strikes to estimate transmission-line strikes. It also eliminates the need to use distribution-line strikes in Nebraska to estimate transmission-line strikes in Nebraska, which was necessary in the RCK analysis due to the lack of known transmission-line strikes in Nebraska. Variables considered in the WEST analysis include:

- Estimated annual migration mortality in the United States from all causes: 0.9483%.
- Known and attributed transmission-line migration mortalities: 2.377 whooping cranes.
- Estimated annual migration mortality rate attributable to transmission-line strikes: 0.000867 whooping cranes.
- Estimated R-Project annual mortality rate: 0.000004182 whooping cranes.

In order to account for increases in the whooping crane population over the 50-year life of the transmission line, the WEST analysis uses a published population viability analysis to estimate the whooping crane population (Traylor-Holzer 2018). When the annual estimated mortality specific to the R-Project is applied to the population model, the WEST analysis predicts the R-Project may result in 0.365 whooping crane collisions throughout the expected life of the project, not accounting for any risk reduction from marking the line with bird flight diverters.

Collision-Risk Conclusion

While numerous approaches to evaluate the likelihood of a whooping crane take from collision with the R-Project have been proposed, each has similar data limitations and is highly influenced by assumptions regarding data uncertainties. None of the three analyses presented here are unique to the R-Project and could, with little or no modification, be applied to all power lines. These analyses must be viewed in light of the plausibility of applying such take estimates to all transmission lines.

Any method used to assess the likelihood that a whooping crane will collide with the R-Project is confined by the limited documented mortality due to transmission lines and will inherently have a high degree of uncertainty. However, despite the different approaches taken in the three analyses above, each concludes that the risk of whooping crane mortality on the R-Project is extremely low.

This is consistent with the fact that the R-Project will increase the miles of transmission line in the whooping crane migration corridor by only 0.048%.When the low likelihood of collision is considered along with implementation of line marking, the R-Project is not reasonably certain to incidentally take a whooping crane, which is the USFWS's standard for recommending that an applicant seek coverage in an ITP (USFWS and NMFS 2016).

New information, data, or research results could alter the understanding, reduce uncertainties, or increase scientific vigor of the analysis of potential impacts to the whooping crane as compared to what was available at the time the HCP was prepared. If USFWS, NGPC, or NPPD becomes aware of credible, empirical data that could materially alter the whooping crane risk analyses prepared for the HCP, NPPD will coordinate with USFWS and NGPC to discuss how best to analyze those data. New information may inform a novel approach to assessing risk or improve the existing approaches. If credible, empirical data do emerge to modify the risk analyses, and based on that analysis, USFWS, NGPC, and NPPD agree that take of the whooping crane is reasonably certain to occur, NPPD will coordinate with USFWS and NGPC to determine whether additional measures could be implemented to avoid take or whether amendment of the ITP to seek incidental take coverage for the whooping crane is warranted.

If NPPD, the USFWS, or NGPC becomes aware of a wounded or deceased whooping crane discovered in the vicinity of the R-Project, the party that learned of the incident will informally notify the other parties by telephone call or email within 24 hours of obtaining credible knowledge of the discovery. Within one week of the initial notification, the notifying party will send a written notification to the other parties that includes, to the extent known, the date of discovery, a description of the location of the individual or carcass, notes on the condition of the individual or carcass that might help indicate how and when it died or was wounded, and notes on the characteristics of the individual or carcass. If possible, such documentation should include photographs and location coordinates.

If the wounding or death is determined to be attributable to the R-Project, then NPPD will consult with the USFWS to determine what actions are necessary to address the impacts of the collision-associated take.

NPPD, USFWS, and NGPC will jointly analyze the information gathered with respect to the wounding or death of the whooping crane to determine if any additional avoidance measures that were not in place at the time the HCP was prepared are warranted or if additional actions are warranted. Based on that analysis, and accounting for any such additional actions or measures that NPPD agrees to implement, NPPD, USFWS, and NGPC will determine if future take of a whooping crane on the R-Project can likely be avoided or if future take is reasonably certain to occur. If NPPD and the USFWS determine that future take of the whooping crane is reasonably certain to occur, NPPD will seek an amendment to the HCP, ITP, and related documents (as applicable). The amendments will address the amount of collision-associated take of the whooping crane that is reasonably certain to occur during the remainder of the ITP term. However, if at the time of the collision-associated take, NPPD has already started the process to obtain a take permit for whooping cranes through either a programmatic permit for NPPD's entire system or as a member of a utility group that obtains take authorization for a larger set of power lines, NPPD may choose to respond by ensuring that the R-Project is included in that broader effort, in lieu of seeking an amendment to the R-Project's existing ITP.

Potential Effects from Distribution Line Relocation. Relocation of distribution power lines in the ROW will reduce the likelihood of whooping crane collision by placing eight of the 28 miles underground. The 20 miles that have been or will be relocated as overhead power lines will not present an increase in the likelihood of whooping crane collision because these lines currently occur on the landscape and will only be relocated a short distance to avoid the R-Project. Burial of the distribution lines is undertaken at the request of the local public utility district that manages those lines. The intent of placing distribution lines underground is not to reduce potential impacts to whooping cranes, but it will have the added beneficial effect of reducing potential collisions.

Potential Effects from Routine Inspection, Maintenance, and Repairs. Routine inspection of the transmission line will be completed by helicopter, fixed-wing aircraft, drones, or ground patrol twice per year, in the spring and fall following completion of construction. Ground patrols are typically conducted using light ATVs or foot patrol. Patrols will note the general condition of the line and any infrastructure, including line marking devices that may require repair or replacement. Spiral bird flight diverters are static marking devices that are not prone to wear or breaking. Inspections will be conducted along the transmission line ROW. Given the infrequent nature of routing inspection, and the methods that only require crews to pass down the line with minimal stopping, the likelihood that these crews would encounter a whooping crane is very low and is not likely to have an effect.

Routine maintenance and repairs will not begin until 30 years after the in-service date and will occur once every 10 years for the remainder of the life of the transmission line. Routine maintenance and repair activities will be scheduled outside the whooping crane migration season to the maximum extent practicable. The whooping crane monitoring protocol will be implemented prior to routine maintenance and repair activities that occur during the whooping crane migration season.

Potential Effects from Emergency Repairs. Emergency repairs may temporarily disturb an estimated 351 acres during the life of the R-Project; however, the timing and location of emergency repair activities cannot be predicted. It is unlikely that potentially suitable whooping crane habitat will be directly impacted by emergency repair activities because the disturbance will largely be a result of required access to structures for equipment completing the repairs. Access for emergency repairs will likely avoid potentially suitable whooping crane habitat because those areas are not conducive for vehicle travel. Additionally, emergency repairs are typically required during the winter when ice storms can damage large stretches of power lines. Emergency repairs would largely be conducted outside the whooping crane migration season.

Potential Effects from Vegetation Management. Vegetation management will only be required in areas where tall vegetation may encroach on the transmission line. Vegetation management is unlikely to disturb migrating whooping cranes because the species typically selects stopover habitat devoid of the type of tall vegetation that could interfere with operation of the transmission line.

5.2.2 Piping Plover

Potential Effects from Construction

Impacts to Nesting Habitat. The North Platte and South Platte rivers are the only rivers crossed by the R-Project that occur in the NGPC's estimated breeding range of the piping plover (NGPC 2014). Natural Heritage Program data do not contain any occurrences of piping plover at Sandhill lakes within the study area (NGPC 2015). A field assessment of piping plover nesting habitat was completed in June 2014 within 0.25 mile of the R-Project's river crossing locations on the North Platte and South Platte rivers (POWER 2014). No suitable nesting habitat was identified. No other types of nesting habitat, including alkali lakes, large reservoir or lake shorelines, sandpit lakes, or industrial dredge areas occur within 0.25 mile of the R-Project. The 0.25-mile buffer is based on survey protocols used by NPPD on previous transmission related projects (POWER 2009) and the standard best management practice employed by various state and federal agencies. Measurements of detailed aerial imagery showed that the North Platte River channel is 205 feet (62 meters) wide at the crossing location, and the South Platte River channel is 262 feet (80 meters) wide at the crossing location. This is much narrower than the 600 feet identified by Ziewitz et al. (1992) and 1,000 feet identified by Jorgensen et al. (2012) as suitable nesting habitat. Removal of riparian areas within the R-Project ROW or presence of construction equipment at the North Platte and South Platte river crossings will not create a temporary impact to nesting piping plovers because nesting is unlikely to occur due to lack of habitat. Project activities will not be located within potential piping plover nesting habitat. Therefore, construction of the R-Project will not result in permanent or temporary disturbance of piping plover nesting habitat.

Habitat Fragmentation. The R-Project will not result in the fragmentation of suitable piping plover nesting habitat. The R-Project will span the North Platte and South Platte rivers where the rivers are narrow and do not provide suitable nesting habitat. The R-Project will not present a barrier to migrating or nesting individuals. The R-Project will cross the North Platte River adjacent to an existing bridge on North Prairie Trace Road. By crossing the North Platte and South Platte rivers in areas without suitable nesting habitat, and adjacent to existing anthropogenic disturbance such as the bridge over the North Platte River, the R-Project will not fragment suitable piping plover nesting habitat.

Displacement. Construction activities will not displace foraging piping plovers with nests further than 0.25 mile from the R-Project. Piping plovers rarely leave the nesting colony to forage. Sherfy et al. (2012) found that 98% of all piping plover foraging activity occurred within the nesting colony. Therefore, construction activities associated with the R-Project will not affect foraging piping plovers.

Little is known about the migration paths of piping plovers. However, they are known to use the shores of large reservoirs, rivers, wetlands, and sandpits as stopover habitat (Elliott-Smith and Haig 2004). Lake McConaughy is a known piping plover nesting and migration stopover site and individual migrants may use large wetland complexes and natural lakes throughout the Sandhills. Migrating piping plovers were also documented at Carson Lake in 1992 (Ducey 2014). However, migrating piping plovers are not commonly observed at Carson Lake, as is the case for Lake McConaughy. Ducey (2014) completed migratory bird point counts at Carson Lake from 1990 through 1995, 2003, and 2004. Piping plover were only observed during the 1992 migration. While Carson Lake may have supported suitable migration habitat for piping plover in 1992, the lake does not currently provide the open shoreline habitat typically associated with piping plover. Construction activities may temporarily disturb migrating piping plovers if individuals are passing the North Platte and South Platte river crossing locations or using other migration stopover habitat, such as large wetland complexes or Sandhills lakes, during construction. This disturbance will be temporary and limited to instances when construction crews are present. No construction activities will take place within the North Platte and South Platte river channels and migrating piping plovers will not be forced to move upstream or downstream. In the unlikely event piping plovers migrating cross-country encounter construction activities, they likely will avoid construction activities and instead use abundant adjacent habitats, including wetlands and Sandhills lakes throughout the Study Area.

Predation. The installation of transmission structures in grassland habitat will provide additional hunting and loafing perches for raptors, which can potentially prey on nesting piping plovers. However, because of the lack of suitable nesting habitat near the R-Project, potential effects to piping plover from increased raptor use are not anticipated.

Potential Effects from Operation and Maintenance

Collision Risk. The transmission line span over the North Platte and South Platte rivers presents a potential collision hazard for piping plovers. A study on transmission line marking identified one piping plover mortality from a power line collision on Lake Sakakawea and Lake Audubon in North Dakota (Sporer et al. 2013). However, collision with transmission lines is not considered a major threat to the species and is not addressed in the USFWS Piping Plover Recovery Plan or 5-Year Review (USFWS 2016; USFWS 2020b). Marking of the transmission line specifically designed to minimize the collision hazard for whooping cranes will also minimize the risk of collision for piping plovers. Crossing the North Platte and South Platte rivers where the channels are narrow and lack piping plover nesting habitat minimizes the risk of collision for piping plovers. Marking the transmission line at these river crossings will further minimize the already low risk of collision for the piping plover.

Displacement. Routine inspection of the transmission line will be completed by helicopter, fixed-wing aircraft, drones, or ground patrol twice per year. Ground patrols typically are conducted using ATVs or foot patrol. Routine inspections will pass directly down the transmission line and will note areas requiring maintenance. Routine inspections will not displace nesting piping plovers due to the lack of suitable nesting habitat at the line crossing locations on the North Platte and South Platte rivers.

Routine maintenance and repair activities could potentially displace migrating or foraging piping plovers if individuals occur at the crossing locations at the same time as inspection or maintenance crews. Routine maintenance and repairs will not begin until 30 years after the in-service date and will occur once every 10 years for the remainder of the life of the transmission line. This potential effect is unlikely given the limited number of times routine maintenance activities are likely to occur and the low probability that those activities would occur at the same time migrating and foraging piping plovers are present.

Riparian areas along the North Platte and South Platte river crossings may require vegetation management during which trees adjacent to the ROW that could interfere with the energized transmission line are removed. Vegetation management crews may displace migrating or foraging piping plovers, if individuals occur at the crossing location during maintenance activities. This potential effect is unlikely given the lack of suitable nesting habitat.

Habitat Disturbance and Displacement During Emergency Repairs. Emergency repairs may temporarily disturb an estimated 351 acres during the life of the R-Project; however, the timing and location of emergency repair activities cannot be predicted. No structures or access routes will be sited in piping plover nesting habitat. Therefore, none of the 351 acres of temporary disturbance for emergency repairs will occur in piping plover nesting habitat.

Emergency repair activities are not likely to displace foraging piping plovers because no nesting habitat occurs at the river crossing locations and individuals typically forage near nesting colonies. Avoidance of crews completing emergency repair activities at the North Platte and South Platte river crossings may temporarily displace piping plovers traveling along these river corridors if emergency repairs are required during migration. This displacement will be temporary and limited to if and when emergency repair crews are working at the North Platte and South Platte river crossings.

5.2.3 Bald Eagle

Potential Effects from Construction

Habitat Loss. Forested riparian areas that provide potential bald eagle nesting, foraging, and roosting habitat are found within the R-Project area. While NPPD attempted to avoid all riparian habitat that may provide bald eagle nesting, roosting, and foraging habitat during design of the R-Project, complete avoidance was not possible, particularly in forested riparian areas that must be crossed. Permanent habitat loss will result from clearing of 18 acres of forested riparian habitat within the ROW to satisfy utility safety requirements. Potential effects of habitat fragmentation of nesting and foraging habitat from the removal of riparian habitat within the ROW will be negligible, given the availability of suitable habitat both upstream and downstream of each river crossing location.

Impacts to Nesting Eagles. Bald eagle nest surveys were conducted in 2014, 2016, 2017, 2018, 2019, and 2020 at each major river crossed by the R-Project. Bald eagle nests were surveyed by NPPD in an area within one mile of the R-Project. One bald eagle nest was identified within 0.5 mile of the R-Project centerline near Sunfish Lake in northern Garfield County. One occupied bald eagle nest was identified on the North Loup River 0.56 mile south of the R-Project selected route and 0.4 mile west of a potential access path. One occupied bald eagle nest was identified on Birdwood Creek approximately 1.4 miles downstream of the R-Project centerline. One public road that may be used for access is located approximately 0.2 mile from this nest. All other nests identified during R-Project bald eagle nest surveys were more than 0.5 mile from the R-Project centerline and associated disturbance areas. A preconstruction bald eagle nest survey will be completed prior to leaf-out the spring (February to March) before construction to identify any nests that may have been established since the 2020 survey. If an occupied bald eagle nest is identified during the preconstruction survey, construction activities would comply with seasonal nest restrictions identified in Section 6.7. This will avoid potential effects to nesting bald eagles should additional nests be established prior to construction.

Impacts to Foraging Eagles. Numerous foraging bald eagles were observed along the North Platte, Middle Loup, North Loup, and Calamus rivers during the nest surveys. Most individuals were observed perching in trees along river edges. Construction activities at river crossings may temporarily cause foraging bald eagles to relocate to another perch; however, the effect will be temporary, and bald eagles likely will continue foraging in adjacent suitable habitat.

Impacts to Winter Roosts. Existing spatial data identified three bald eagle communal winter roosts in the Study Area (NGPC 2015 and 2022). Two of these roosts are located on the west side of Sutherland Reservoir, approximately two miles from the R-Project. Birds using the winter roosts located on Sutherland Reservoir are acclimated to human activity associated with operation of the power plant, recreational fishing, and hunting. Construction activities will not likely affect birds using these winter roosts. The third winter roost is located on the North Platte River approximately three miles upriver of the R-Project. Construction activities will not likely affect birds using this winter roost due to the distance between construction and the roost.

Impacts to Migrating Eagles. Migrating bald eagles are common in Nebraska where major river corridors provide migratory stopover habitat and winter habitat. The presence of construction crews may cause migrating bald eagles to move to other adjacent habitat. This displacement will be temporary and limited within the R-Project ROW.

Potential Effects from Operations and Maintenance

Electrocution Risk. Electrocution of bald eagles is unlikely given the spacing between energized conductors and between energized conductors and grounded portions of the structure (Figure 5-1). For the steel monopoles, the vertical separation between energized conductors is 23 feet. The separation between energized conductors and grounded portions of the structure is 11 feet. The straight-line horizontal spacing on steel monopoles is the same. The horizontal spacing on lattice towers is 30 feet. The separation between energized conductors and grounded portions of the structure on lattice towers is 10 feet 9 inches. These spacing distances are substantially greater than the 60 inches (five feet) recommended by APLIC (2006 and 2018).

Bald eagles occasionally will hunt in upland habitat. The placement of transmission structures in upland habitat will provide hunting and loafing perches that may be used by bald eagles. Because conductor spacing makes electrocution unlikely, the presence of transmission structures may be beneficial to bald eagles utilizing upland habitat by increasing available hunting and loafing perches.

Collision Risk. While unlikely, the R-Project may present a potential collision risk for bald eagles. See Section 6.11 for a discussion of the avoidance and minimization measures NPPD will implement to minimize this risk. Although transmission lines pose a collision risk, bald eagles successfully navigate over large transmission lines daily throughout their range and will use transmission support structures for perching and nesting. The R-Project should not present a barrier to migrating bald eagles.

The R-Project is not expected to result in the take of a bald eagle through electrocution or collision. Correspondence with USFWS states that the expected risk to bald eagles is low, so long as the R-Project follows the guidance described in APLIC (2006), APLIC (2012), and APLIC (2018), and take of a bald eagle is not anticipated (Kritz, Kevin. Biologist, USFWS Region 6 Migratory Bird Management Office, personal communication via email with Jim Jenniges, May 27, 2016).

Displacement from Inspection Activities. Routine inspection of the transmission line will be completed by helicopter, fixed-wing aircraft, drones, or ground patrol twice per year. Ground patrols typically are conducted using ATVs or foot patrol. Routine inspections will pass directly down the transmission line and will note areas requiring maintenance. Routine inspections are not likely to affect nesting, roosting, or foraging bald eagles. Bald eagles typically experience numerous anthropogenic disruptions during foraging activities and will not likely be affected by biannual surveys. Bald eagles nesting, roosting, and foraging during the aerial surveys did not react to the aircraft, indicating that bald eagles will not likely react to routine inspection aircraft.

Impacts from Vegetation Management. Vegetation management within the ROW could cause bald eagles to temporarily vacate an area if individuals occur at the location requiring management. Bald eagles could return to the area upon completion of activities. Vegetation management also could remove potential future bald eagle nest trees, night roosts, foraging perches, or winter roost trees, if trees adjacent to the ROW present a risk to the energized transmission line. However, these potential effects will be minimal considering the infrequent nature of vegetation management and the availability of suitable adjacent habitat for bald eagles.

Impacts to Nesting Eagles. Currently, one known nest occurs within 0.5 mile of the R-Project centerline, and two nests occur within 0.5 mile of proposed access routes. Potential effects to nesting bald eagles will be minimal because routine maintenance and repairs will not begin until 30 years after the in-service date and will occur once every 10 years for the remainder of the life of the transmission line. See Section 6.12.4 below for a discussion of seasonal buffers around nests.

In the unlikely event that a bald eagle nest threatens the energized transmission line and needs to be removed to ensure safe operation of the line or alleviate a threat of harm to eagles, NPPD would pursue an Eagle Take Permit from USFWS for removal of the nest (see Section 2.2).

Habitat Disturbance and Displacement During Emergency Repairs. Emergency repairs may cause temporary surface disturbance of an estimated 351 acres during the life of the R-Project; however, the timing and location of emergency repair activities cannot be predicted. Emergency repairs may require the removal of trees encroaching on the ROW that may provide future nesting, roosting, or foraging habitat. However, hazard-tree removal will be limited in scope, and suitable bald eagle habitat is readily available upstream and downstream of all riparian areas where emergency repairs may need to occur.

Emergency repair activities may cause foraging bald eagles to move to other locations if repairs are necessary adjacent to foraging habitat. Effects from emergency repair activities will be temporary and limited to the specific location requiring repairs. Bald eagles could return to the area upon completion of emergency repair activities.

5.2.4 Golden Eagle

Potential Effects from Construction

Permanent Loss of Potential Nesting Habitat. Nesting golden eagles in Nebraska typically occur farther west than the R-Project. The range map presented in DeLong (2004) shows golden eagle nesting territory in the extreme western portion of the Nebraska panhandle and non-breeding individuals extending farther east into the state. Range maps provided in Sibleys (2003) and Kochert et al. (2002) show a similar range. Occurrence of nesting golden eagles along the R-Project is unlikely given the species nesting distribution within the state. Golden eagle nests in Nebraska typically occur on cliff sides, but may also be in trees. R-Project design has largely avoided tress that may serve as future golden eagle nesting habitat. However, the complete avoidance of such habitat was not possible given engineering and design constraints.

Transmission line ROW clearing will require tree clearing on 23 acres between Gerald Gentleman Station and the Thedford Substation with the potential to support nesting golden eagles. Nesting golden eagles are not anticipated as the R-Project moves east to the Western line from the Thedford Substation. No previously documented golden eagle nests occur within 0.5 mile of the R-Project (NGPC 2015 and 2022), and no golden eagle nests were anecdotally observed during the aerial bald eagle nest surveys. Construction of the R-Project is not likely to affect nesting golden eagles, considering the species' typical range in Nebraska and lack of any identified nests along the R-Project. Potential effects of fragmentation of nesting habitat from the removal of trees within the ROW will be negligible, given the availability of suitable habitat and the unlikely occurrence of nesting golden eagles.

Impacts to Foraging Eagles. Golden eagles are habitat generalists that may forage in several habitat types, including grassland habitat that is prevalent along the R-Project. Hares, rabbits, and prairie dogs make up the bulk of golden eagle diets (Kochert et al. 2002). Golden eagles may also forage at wetlands, rivers, and streams, which may attract prey, such as waterfowl and other shorebirds. Wetlands and riverine foraging habitat have been avoided by construction-related activities to the maximum extent practicable. River and stream crossings will occur in close proximity to existing disturbances where possible (see Section 5.2.1). Grassland habitat within the majority of the R-Project ROW will not be disturbed, either permanently or temporarily, since most of it will be spanned. Areas of golden eagle foraging habitat temporarily disturbed during construction will be restored with native vegetation following completion of construction activities. This temporary habitat disturbance is not anticipated to result in discernable impacts to golden eagle prey species. Given the availability of suitable foraging habitat surrounding the R-Project, temporary disturbance of grassland, wetland, and riverine foraging habitat will not affect potential foraging of the golden eagle in the area.

As noted in Section 1.1, approximately 13 acres of grassland habitat that may have supported foraging golden eagles were cleared for the Thedford Substation when ITP #TE72710C-0 was in effect. It is unlikely the removal of 13 acres of grassland impacted golden eagles in light of ample foraging habitat in the area and the low likelihood of the species' presence in this portion of its range. The extent of permanent access is not known at this time, but it is anticipated to be minimal, conservatively estimated at no more than 26 acres, and permanent structure foundations will affect approximately one acre. This permanent disturbance is also likely to have negligible, if any, impacts on golden eagles.

In light of the fact that (1) the permanent impacts to foraging habitat are minimal, (2) the majority of the native grassland in the ROW will not be altered, and (3) the areas of temporary habitat disturbance will be restored to native grasslands, the R-Project is not anticipated to result in additional fragmentation of golden eagle habitat.

Displacement. Foraging golden eagles may avoid areas occupied by construction crews and equipment during construction. This will be a temporary effect, and golden eagles will be able to forage in adjacent or other grassland habitats further from the R-Project construction activities. Effects to foraging golden eagles will be minimal given the availability of suitable grassland foraging habitat surrounding the R-Project. Individual golden eagles attempting to expand their range by traveling along river corridors may also avoid construction crews and equipment. These golden eagles will not be precluded from continuing travel along the river corridor or using portions of the river corridor adjacent to construction.

Potential Effects from Operations and Maintenance

Electrocution Risk. As stated above for bald eagles, the R-Project will far exceed NPPD and APLIC (2006 and 2018) conductor spacing requirements. Electrocution of golden eagles is unlikely given NPPD and APLIC design standards requirements and conductor spacing that will be applied on the R-Project.

Collision Risk. Golden eagles are strong fliers that are not typically prone to collision with transmission lines (APLIC 2012). However, Bevanger (1994) hypothesizes that some raptor species, including golden eagles, may be at an increased risk of power line collision when flying at high speeds chasing prey. While the R-Project lacks areas of elevated mammal prey densities preferred by golden eagles, wetlands, rivers, and streams may concentrate waterfowl and attract foraging individuals. Marking the transmission line at river crossings and wetlands crossings (see Section 6.2) that attract waterfowl will reduce the risk of collision for golden eagle. Due to the rarity of golden eagles in the project vicinity (DeLong 2004; NGPC 2015) and the project's use of line markers, the potential to take golden eagles is negligible.

Although transmission lines pose a collision risk, golden eagles successfully navigate such lines throughout their range and will use transmission structures for perching and hunting (APLIC 2006). The installation of transmission structures in grassland habitat will provide additional raptor hunting and loafing perches that may potentially benefit golden eagles.

The R-Project is not expected to result in the take of a golden eagle through electrocution or collision. Correspondence with USFWS states that the expected risk to golden eagles is low, so long as the R-Project follows the guidance described in APLIC (2006), APLIC (2012), and APLIC (2018), and take of a golden eagle is not anticipated (Kritz, Kevin. Biologist, USFWS Region 6 Migratory Bird Management Office, personal communication via email with Jim Jenniges, May 27, 2016).

Displacement from Inspection Activities. Routine inspection of the transmission line will be completed by helicopter, fixed-wing aircraft, drones, or ground patrol twice per year. Ground patrols are typically conducted using ATVs or foot patrol. Inspections will be conducted along the ROW and will identify areas requiring maintenance. Golden eagles may avoid inspection personnel and equipment but will be able to reoccupy all areas once the inspection has concluded.

Displacement from Routine Maintenance and Repair Activities. Routine maintenance and repair activities may cause golden eagles to temporarily vacate an area. Golden eagles could return to the site upon completion of activities. No golden eagle nests are known to occur within 0.5 mile of the R-Project. Potential effects to nesting golden eagles will be minimal because the R-Project is located on the far eastern edge of the species nesting range where nesting is uncommon. Routine maintenance and repairs will not begin until 30 years after the in-service date and will occur once every 10 years for the remainder of the life of the transmission line.

Habitat Disturbance and Displacement During Emergency Repairs. Emergency repairs may cause temporary surface disturbance of an estimated 351 acres during the life of the R-Project; however, the timing and location of emergency repair activities cannot be predicted. Currently, no known golden eagle nests occur within 0.5 mile of the R-Project. However, emergency repair activities may cause golden eagles to temporarily vacate an area. Golden eagles could return to the site upon completion of activities.

Because golden eagles forage in a wide variety of habitats, it is likely that the 351 acres of temporary surface disturbance associated with emergency repairs will occur in golden eagle foraging habitat. All activities will be temporary and limited to the specific location requiring repairs.

Impacts from Vegetation Management. Vegetation management within the ROW could cause golden eagles to temporarily vacate an area if individuals occur at the location requiring management. Golden eagles could return to the location upon completion of activities. Vegetation management could also remove potential future golden eagle nest trees and foraging perches; however, these effects will be minimal considering the infrequent nature of vegetation management and the availability of suitable adjacent habitat.

5.2.5 Rufa Red Knot

Potential Effects from Construction

It is unlikely that rufa red knot will be affected by construction of the R-Project because the species rarely occurs in Nebraska. Rufa red knot has only been observed in Nebraska 28 times over the last 60 years (Silcock and Jorgensen 2022). The R-Project does not occur within the breeding range of rufa red knot and will not result in the loss of nesting habitat.

Impacts to Migration Habitat. Spring migration occurs primarily in May; fall migration occurs between August and September. Rufa red knots do not have any traditional stopover sites in Nebraska and typically complete their migrations in a matter of days. While the likelihood of migrating rufa red knots occurring in wetland habitat during construction activities is extremely low, the R-Project may result in the temporary disturbance of wetland habitat that may be used by migrating individuals. Both permanent and temporary disturbance in wetlands will be avoided to the maximum extent practicable by siting activities outside wetlands and using matting and other protective construction methods. Wetlands temporarily disturbed by construction activities will be restored following the completion of construction. Potential effects to rufa red knots from temporary habitat disturbance, loss, and fragmentation will be minimal.

Displacement. Construction activities may temporarily displace migrating rufa red knots by causing them to avoid construction crews and equipment in suitable wetland habitat near construction sites. Displacement will be temporary and limited to work areas and access paths. Rufa red knots will be able to foraging in areas adjacent to construction activities or other habitats further from the R-Project.

Potential Effects from Operations and Maintenance

Collision Risk. Shorebirds such as the rufa red knot are typically less agile fliers with a larger body size in relation to wing size. This makes the rufa red knot more susceptible to collision with power lines (APLIC 2012). The lack of rufa red knot occurrences in Nebraska makes the likelihood of an individual striking the R-Project extremely low. While the potential for rufa red knot collision is highly unlikely, marking the transmission line at river and wetland crossings (see Section 6.2) will further reduce the risk of collision.

Predation. The installation of transmission structures adjacent to wetland habitat will provide additional hunting and loafing perches for raptors, which may prey on rufa red knot. Individual rufa red knots rarely occur in Nebraska, will only be present (if at all) while migrating through the region, and will not occupy habitat surrounding the completed project for long periods of time. Avoidance of wetlands will continue to provide wetland vegetation cover for migrating individuals, thus minimizing the potential effects from raptor predation.

Inspection Activities. Routine inspection of the transmission line will be completed by helicopter, fixed-wing aircraft, drones, or ground patrol twice per year. Ground patrols are typically conducted using ATVs or foot patrol. Inspections are conducted along the ROW. If rufa red knots are present in wetland habitat, individuals will not likely react to survey aircraft, and foot, light vehicle, or ATV surveys will avoid wetland habitat.

Routine Maintenance and Repair Activities. Routine maintenance and repair activities are not likely to impact rufa red knots since structures will be in upland habitat, and routine maintenance and repairs will not begin until 30 years after the in-service date and will occur once every 10 years for the remainder of the life of the transmission line.

Habitat Disturbance and Displacement During Emergency Repairs. Emergency repairs may temporarily disturb an estimated 351 acres during the life of the R-Project; however, the timing and location of emergency repair activities cannot be predicted. It is unlikely that suitable rufa red knot habitat will be directly impacted by emergency repair activities because habitat disturbance will largely be a result of required access to structures for equipment completing the repairs. Access for emergency repairs will likely avoid rufa red knot habitat because those areas are not conducive for vehicle travel. Emergency repair activities may temporarily displace migrating rufa red knots by causing them to avoid crews and equipment in suitable wetland habitat near emergency repair sites. Displacement will be temporary and limited to work areas and access routes.

Vegetation Management. Vegetation management will not be required in wetlands preferred by rufa red knot, so no effects are anticipated.

5.3 Potential Effects on USFWS Birds of Conservation Concern

Effects on BCC will be similar to those described in Section 5.1 and may include temporary displacement as a result of construction activities, temporary disturbance of habitat, a small amount of permanent loss of habitat, habitat fragmentation, and potential collision with the completed transmission line.

Impacts to Nesting BCC. While a number of BCC have been documented or may potentially occur in the R-Project study area, only six of these species have been documented as breeding birds since the beginning of the BBS surveys in 1966 (Pardieck et al. 2015). These six birds are: bald eagle, Swainson's hawk, long-billed curlew, red-headed woodpecker, loggerhead shrike, and Bell's vireo.

The long-billed curlew and loggerhead shrike may nest in grassland habitat. The bald eagle, Swainson's hawk, redheaded woodpecker, and Bell's vireo may nest in forested habitat. No BCC species listed for the Central Mixed-grass Prairie Region nest in wetlands/aquatic, developed, or row-crop agriculture habitat types. Nests of BCC species will be identified prior to construction and avoided per the seasonal restrictions described in Section 6.7 below.

Impacts to Migrating BCC. The remaining BCC species are likely to migrate in the vicinity of the R-Project and may be less susceptible to the direct and indirect effects of habitat clearing and displacement than breeding birds, because migrating birds spend less time in any one location. Migrating individuals may be affected by a short-term temporary loss of habitat during construction activities. Individuals may also be displaced by construction crews working adjacent to suitable habitat for migrating birds. In such instances, migrating birds would likely use adjacent habitat before continuing their migration. Displacement from construction crews will be a short-term temporary effect. Migrating individuals may be at risk of colliding with the completed transmission line. NPPD will mark all 226 miles of the R-Project and at least 124 miles of existing transmission lines to reduce the risk of avian collision. See Section 6.2 for a full description of the application of bird flight diverters on the R-Project and existing transmission lines.

6.0 AVOIDANCE AND MINIMIZATION STRATEGY

6.1 Route Selection

The transmission line routing process was conducted in four phases: delineation of the study area, identification of study corridors, identification of alternative routes, and determining the selected route. The R-Project team initially established the R-Project study area through evaluation of the termination points of the transmission line that need to be connected. These termination points are consistent with SPP’s Notice to Construct, which indicated that the new 345 kV line must begin at the Gerald Gentleman Station located south of Sutherland, go north to connect with a new 345 kV substation to be located in or near Cherry County, and then go east and connect to a second substation to be sited near the existing Western 345 kV transmission line in Holt County.

These starting, ending, and intermediate points, along with the need to identify an area that provides for reasonable alternatives development, largely dictated the size and shape of the study area boundaries. The points of interconnection for the R-Project are dictated by: (1) all elements of the project purpose and need, (2) NPPD and other electrical system constraints, (3) project budget, and (4) project schedule. A major consideration in defining the study area is that shorter and straighter routes are generally better to minimize costs, schedules, impacts to property owners, and overall impacts to the environment. For reliability purposes, the study area in and near Gerald Gentleman Station is constrained by the need to come out of the only remaining bay in the existing substation and get separation from all other lines as quickly as possible without interference with existing transmission lines that would reduce reliability of NPPD’s system.

Next, the project team developed routing criteria based on the data collected for the R-Project study area, input from the public, and agency concerns and priorities. It used these criteria to evaluate the study area for areas of resource sensitivity for purposes of identifying routing corridors. Resource sensitivity is a measure of probable adverse response of each resource to direct and indirect impacts associated with the construction, operation, and maintenance of the proposed 345 kV transmission line. Criteria are specific characteristics or traits that are measured and used as factors or points of comparison between route alternatives. Generally these criteria fall into four broad categories: (1) engineering data and information, (2) human impacts, (3) land use impacts, and (4) environmental impacts. Line routing also involves consideration of public input. In the line-routing process, several of the criteria, as well as public input, represent conflicting interests; route selection, therefore, involves trade-offs between particular advantages and disadvantages. Line routing thus becomes a process of identifying alternatives that represent a balance of the criteria that fall within the four general categories, while also considering community input and meeting the specific electric system needs.

The R-Project team created a composite resource sensitivity map using the data collected for the R-Project study area and the key routing criteria to geographically illustrate opportunities for transmission line routing and constraints where routing should be avoided. High-sensitivity areas indicate limited opportunities because of potential conflicts with existing or planned land uses, sensitive resources, residential areas, communities, or airport height restrictions. Areas of low sensitivity generally indicate routing opportunities because few potential conflicts were identified.

Based on these sensitivity maps and routing criteria, the project team identified and evaluated three north/south and two east/west corridors. The east/west corridors were established in the southern portion of the study area due to the increased prevalence of wetlands and potentially better habitat for American burying beetle, whooping cranes, and other sensitive species in the northern parts of the study area. NPPD mapped the study corridors and presented them to community leaders, agencies, and the general public in a second round of open house meetings in September 2013. The project team used the comments received at these meetings during the route identification process.

The R-Project team identified over 2,000 miles of potential route links, which were systematically evaluated using the routing criteria and public input from the study corridor open house meetings. Based on this analysis, the R-Project team connected route links to create potential routes that presented the least impacts with an acceptable balance of the routing criteria. Approximately 800 miles of potential routes were identified and evaluated. The R-Project team met to review and further evaluate the potential routes and selected five end-to-end alternative routes. Of the potential route links identified and evaluated, the project team determined that two potential route segments provided the best routing opportunities from Gerald Gentleman Station to the Thedford Substation and three route segments provided the best routing opportunities from Thedford Substation to the Western Line.

The R-Project team analyzed and compared these route segments and selected a Preferred Route that it judged to be the most suitable for construction after consideration of many variables, including balancing of routing criteria and public input. Substation sites were selected based on five primary criteria: close proximity to the Preferred Route, generally level topography, close proximity to existing all-weather access, availability of appropriate acreage, and no environmental issues on the site. NPPD presented the Preferred and Alternative Routes, along with several alternate links, to community leaders, agencies, and the general public in a third round of open house meetings in April and May 2014. The project team used the comments it received at these meetings, as well as input received from additional landowner meetings in August 2014, to modify the Preferred Route and identify a Proposed Route.

NPPD held public hearings on the Proposed Route in November 2014, where it received additional public comments. There was also a 30-day public comment period following the public hearings. NPPD evaluated public concerns in determining the selected route, which it announced to the public on January 20, 2015. The public was involved during all four phases of the routing and siting process, and the R-Project team received and evaluated over 2,500 public comments. At each phase of the routing and siting process, NPPD coordinated with and sought input from the NGPC and the USFWS.

NPPD used minor route adjustments to reduce the extent of impacts on birds, including avoiding bisecting feeding and roosting areas, crossing rivers at existing infrastructure, avoidance of state-owned WMAs, State Recreation Areas (SRAs), and privately held conservation easements, which likely attract waterfowl and shorebirds. Table 6-1 identifies the WMAs, SRAs, Audubon Society-designated Important Bird Areas (IBA), and privately held conservation easements identified and avoided during route development. Only one privately held conservation easement, the Hansen Conservation Easement Phase 1 in Lincoln County, could not be avoided during routing due to other environmental constraints.

TABLE 6-1 WMA, SRA, IBA, AND CONSERVATION PROPERTIES IN STUDY AREA AVOIDED BY R-PROJECT

NAME	COUNTY
American Game Marsh WMA	Brown
East Hershey WMA	Lincoln
East Sutherland WMA	Lincoln
Goose Lake WMA	Holt
Hershey WMA	Lincoln
Muskrat Run WMA	Lincoln
North River WMA	Lincoln

NAME	COUNTY
South Twin Lake WMA	Brown
Twin Lakes R.C. WMA	Rock
Calamus Lake WMA	Loup and Garfield
West Hershey WMA	Lincoln
Willow Lake B.C. WMA	Brown
Long Lake SRA	Brown
Sutherland Reservoir SRA	Lincoln
Calamus Lake SRA	Loup and Garfield
Schafer Conservation Easement (held by Ducks Unlimited, Inc. (Wetlands America Trust))	Lincoln
Double Dog Ranch, LLC (Ducks Unlimited, Inc. (Wetlands America Trust))	Lincoln
North Platte River Fee (owned by The Nature Conservancy)	Lincoln
North Platte River Easement (held by The Nature Conservancy)	Lincoln
Herrod Easement (held by Ducks Unlimited, Inc. (Wetlands America Trust))	Lincoln
Sandhills Easement (held by The Nature Conservancy)	McPherson
Horse Creek Fen Easement (held by The Nature Conservancy)	Cherry
Weber/Keller Sandhills Task Force Conservation Easement	Cherry
Greater Gracie Creek IBA	Loup

As stated in the NGPC Migratory Game Birds document (NGPC Unpublished), the primary needs of waterbirds in winter are met with open water and waste grain in agricultural fields. This report identifies the Platte rivers and Sutherland Reservoir as important winter areas. NPPD's selected route minimizes the amount of line bisecting agricultural fields between Gerald Gentleman Station and the North Platte River, spans the North Platte River at the Sutherland Bridge to minimize birds roosting in close proximity to the line, and spans Birdwood Creek north of the existing center pivots to reduce potential risk of collision to birds traveling between roosting sites on Birdwood Creek and foraging sites in these agricultural areas (APLIC 2012). Specifically, the North Platte River crossing location was moved to the west to avoid a known sandhill crane roost,[5] and the Birdwood Creek crossing location was moved further north to avoid placing it between birds roosting on the North Platte River and Birdwood Creek and their foraging areas in agricultural fields to the east of Birdwood Creek.

The USFWS either proposed or supported three alternate routes that it indicated would have a lower impact to migratory birds than NPPD's Route. However, no data were provided along with the alternate routes that would allow NPPD to evaluate that determination. NPPD evaluated these routes to determine if they met the purpose and need of the R-Project. All three routes failed to meet at least one purpose and need, and a detailed response was sent to the USFWS in all cases. The route that went west out of Gerald Gentleman Station and then north and the route that went south out of Gerald Gentleman Station and then east both would have created interferences with multiple existing single- and double-circuit transmission lines that would result in greater risk to the reliability of NPPD's major electrical system in the North Platte area. The third proposed route going diagonal from

[5] NPPD conducted sandhill crane roost surveys on March 7 and 21 and April 4, 2013.

Stapleton to the Holt County substation would not meet one of the major requirements of the SPP Notice to Construct because it did not extend to the Thedford substation.

6.2 Installation of Bird Flight Diverters to Minimize Collision

Conceptually, power lines placed in close proximity to suitable whooping crane habitat are more likely to present a risk of collision than those located farther away from suitable habitat. However, insufficient data are available to reliably evaluate this concept. Because the risk of a whooping crane colliding with the R-Project is not zero, NPPD will minimize that risk by marking the entirety of the R-Project with bird flight diverters.

Using the 95% whooping crane migration corridor from Pearse et al. (2018) and Platts Electric Transmission Lines data (April 2021), 46,851 miles of transmission line (≥69kV) exist in the whooping crane migration corridor in the United States, and 4,808 miles exist in the state of Nebraska. The R-Project will increase the transmission line miles in these areas by 0.48% and 4.7%, respectively. The USFWS memorandum Region 6 Guidance for Minimizing Effects of Power Line Projects within the Whooping Crane Migration Corridor (hereafter referred to as Region 6 Guidance; Appendix D) indicates that, to maintain baseline threat to whooping cranes, all new lines within 1 mile of potentially suitable habitat and an equal amount of existing line should be marked with bird flight diverters.

To maintain the baseline threat to whooping cranes per the Region 6 Guidance, NPPD will mark 124 miles of its existing transmission system in the state of Nebraska (Figure 6-2). The Region 6 Guidance states implementation of the measures described in the guidance “if implemented and maintained, could reduce the potential effects to the whooping crane to an insignificant and/or discountable level” by not increasing the potential risk above the current level. Existing lines that have the potential for marking include the 115 kV transmission line between Thedford Substation and the Ainsworth Substation, lines within the federally designated Whooping Crane Critical Habitat along the Platte River, and lines in Pearse et al. (2015) extended-use core intensity areas. NPPD construction standards call for the placement of spiral bird flight diverters at 50-foot intervals alternating on opposite shield wires. This application is within the recommended spacing per APLIC (2012) and will increase protection against collision. The NPPD construction standard is based upon available information on the effectiveness of marker types, durability of markers, and the engineering constraints of the line.

NPPD will install spiral bird flight diverters on the shield wires of the R-Project in an effort to minimize avian collisions (Figure 6-1). Spiral bird-flight diverters are compatible with the OPGW that NPPD uses in most transmission lines. The spiral bird flight diverters are maintenance free and will remain in place for the life of the line as opposed to other marker types that need to be replaced frequently (Sporer et al. 2013). The Region 6 Guidance recognizes that marking lines is only 50 to 80 percent effective at reducing collisions and offsets this by requiring the marking of currently existing but unmarked power lines. The effectiveness of marking is the subject of many studies, with most relevant studies referenced in APLIC (2012). A few papers have hypothesized that the use of markers with high contrast or that glow in the dark may be more appropriate over water areas with large concentrations of water birds (Sporer et al. 2013; Murphy et al. 2009; Wright et al. 2009). However, both Sporer et al. (2013) and Murphey et al. (2009) acknowledge that direct comparison of the effectiveness of different marker types has not been done and that results from their respective studies did not have the statistical power to provide for direct comparisons. One study in South Africa compared different marker devices; however, the natural variation in bird populations and habitat use made drawing conclusions about the effectiveness of different marker types impossible (Jenkins et al.

2010). These same sorts of exterior environmental influences are noted in Sporer et al. (2013) and especially so in Murphy et al. (2009), where a line marked with flapping glow in the dark markers had numerous collisions while a line one mile upstream marked with the same devices had few collisions and a line 6.5 miles upstream had no marking devices and no documented collisions. NPPD will continue to evaluate available studies, local information, and available marker types to determine if its current marking standard should be modified.

Regardless of the ambiguity in line-marking publications, NPPD has agreed to apply avian flight diverters with reflective and glow-in-the-dark surfaces to reduce avian collision in low-light conditions. Portions of the R-Project that will be marked with the reflective and glow-in-the-dark avian flight diverters include river crossings and areas identified as areas of bird use during low-light conditions. Consultation with USFWS has determined approximately 10-15% of the R-Project proposed line marking will require these alternate avian flight diverters. The remainder of the R-Project proposed line marking will use spiral bird flight diverters. NPPD will continue to evaluate available studies, local information, and available marker types to determine if identified marking should be modified.

During routine inspection of the transmission line, patrols will note the general condition of the line and note any infrastructure, including line marking devices that may require repair or replacement. Spiral bird flight diverters, which are typically used by NPPD, are static marking devices that are not prone to wear or breaking.

Whooping cranes typically roost on rivers or shallow wetlands (Stahlecker 1997). These habitat types are also typically used by waterfowl, cranes, and shorebirds, which are more prone to collision based on their body style. By placing spiral bird flight diverters on all of the R-Project and at least 124 miles of existing transmission line, NPPD will greatly reduce the likelihood of avian collision for all species, as acknowledged in the Region 6 Guidelines. Existing transmission lines identified by NPPD that would be marked are described below.

NPPD used two approaches to identify existing transmission lines for line marking that pose the greatest risk to birds. First, NPPD identified where it owns and operates lines in the central Platte River Valley, which includes critical habitat for whooping cranes, provides spring staging area for 80 percent of the mid-continental sandhill crane population, and provides migration and winter habitat for millions of waterfowl. Through that effort, NPPD identified 64 miles of line in the central Platte River Valley to be marked, including all power lines in whooping crane critical habitat (Figure 6-2).

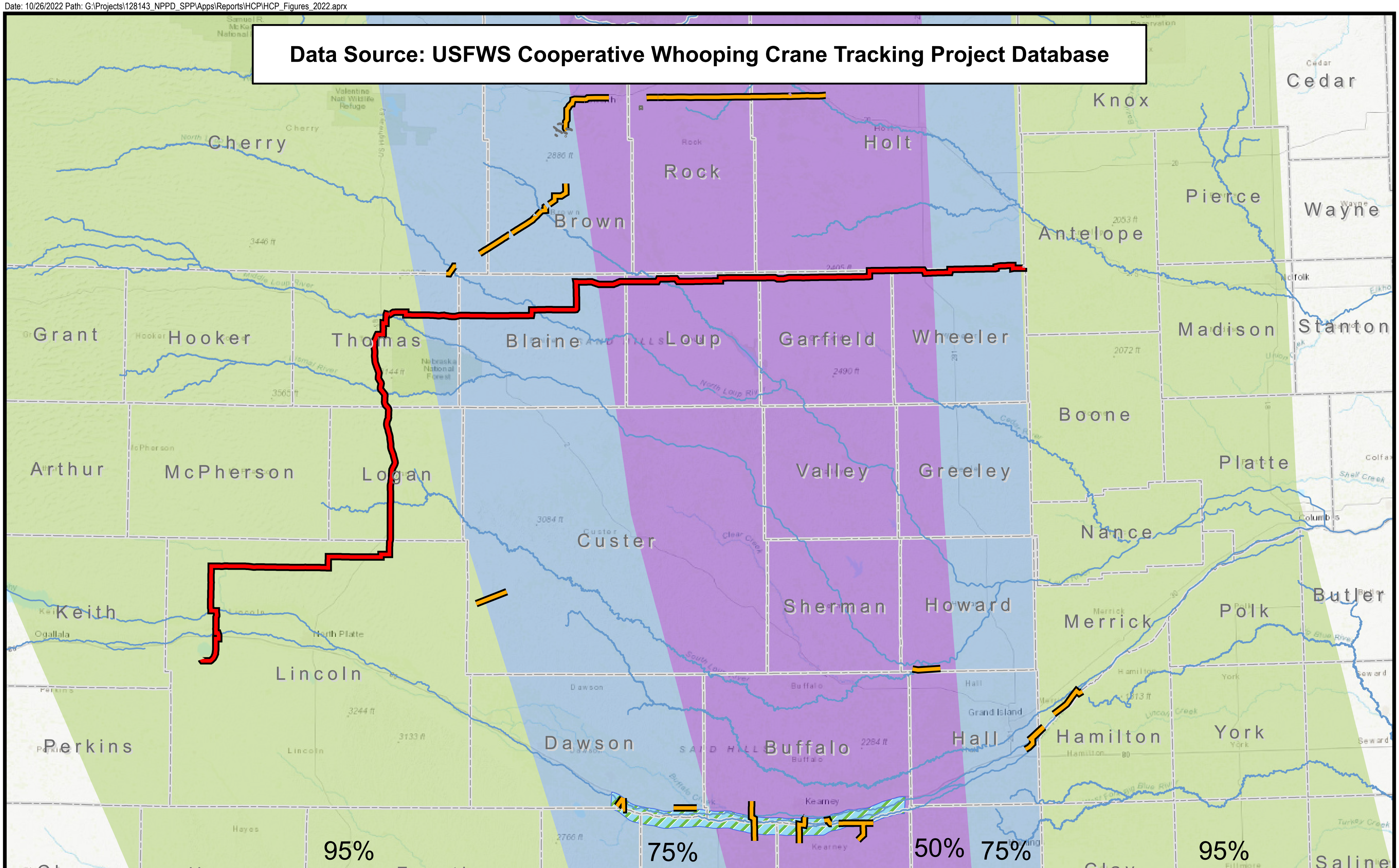
Second, NPPD identified power lines owned and operated by NPPD that are in the same ecoregion and habitats as the R-Project and applied the whooping crane habitat suitability assessment to those power lines. This identified lines that have the same risk to whooping cranes and other water birds as the R-Project. Through this process, NPPD identified 65 miles for line marking on transmission lines 1090, 1081, 1267, 1167, and 1164 (Figure 6-2).

The R-Project will add five new river crossings, all of which will be marked. In addition, NPPD evaluated other lines in its system that cross major rivers in the state. Because river crossings have been identified as having high potential for avian collisions (APLIC 2012), many NPPD lines are already marked at these crossings. However, NPPD will mark Lines 3509, 1068, and 2305A where those power lines cross the South Platte River and Lines 3507, 3505A, 2304B, 1242A, and 1067 where those power lines cross the Platte River (Figure 6-2).

In addition to the line marking discussed above, the Region 6 Guidance also calls for the avoidance of designated critical habitat and known high-use areas by five miles and the burial of power lines within one mile of suitable habitat. The R-Project is approximately 70 miles north of designated critical habitat on the Platte River. No other high-use areas were identified at the time of route selection. Burial of the R-Project was dismissed from consideration because temporary and permanent disturbance associated with Project construction, operation, and maintenance would significantly increase, causing an increase in the take of American burying beetle as described in the R-Project HCP. NPPD was not willing to increase the take of one federally endangered species to potentially decrease the already low likelihood of take of a whooping crane.

FIGURE 6-1 SPIRAL BIRD FLIGHT DIVERTER

Date: 10/26/2022 Path: G:\Projects\128143_NPPD_SPP\Apps\Reports\HCP\HCP_Figures_2022.aprx



% of Confirmed Sightings

50% 75% 95%

Marking of R-Project Line

Marking of Existing Line

Whooping Crane Designated Critical Habitat

River or Major Stream

NPPD's 345kV Transmission Line Project

FIGURE 6-2
WHOOPING CRANE LINE MARKING

6.3 Use of Existing Road and Two-Tracks for Access

To further minimize ground disturbance, the R-Project will use existing roads, two-tracks, and existing stream and wetland crossings wherever feasible for accessing transmission line structure locations during construction. The preliminary access plan includes approximately 200 miles of existing public roads that may be used by construction vehicles and equipment to access structure locations. Existing roads that will be used to provide access include, but are not limited to, U.S. Highway 83, State Highway 7, State Highway 2, North Prairie Trace Road, Gracie Creek Road, and various county roads in southern Holt County.

6.4 Siting Temporary Work Areas in Previously Disturbed Areas

Where feasible, areas of temporary surface disturbance have been located within the same footprint in an effort to reduce temporary disturbance. Preliminary locations for fly yards/assembly areas and construction yards/staging areas are along existing access roads for easy access. Approximately 37 acres of preliminary locations for fly yard/assembly areas and construction yard/staging areas are in areas that have previously been disturbed and thus provide poor quality habitat for migratory birds. A field verification of these areas and others will be completed to confirm and identify areas that contain unsuitable or poor quality habitat for migratory birds during the final design.

6.5 Use of Helical Pier Foundations in the Sandhills

In areas of the Sandhills where existing publicly maintained access roads are not available, screw-in helical pier foundations will be used for lattice structures. Helical pier foundations for lattice structures require fewer pieces of equipment, a smaller temporary structure work area, and less improved access to each structure than traditional foundations on steel monopole structures. Helical pier foundations do not require excavation, and thus the use of these structures minimizes impacts. The piers are screwed into the ground by an excavator with a torque head where a bucket typically is located. Because the piers are hollow, no spoils need to be removed from the site, nor concrete brought in.

In addition to requiring less equipment for installation, helical pier foundations also require a much smaller temporary work area. The work area needed is 100 feet by 100 feet in size, whereas an area 200 feet by 200 feet in size is needed for a monopole structure with a concrete foundation. The temporary disturbance required for structure work areas is reduced by 75% using helical piers.

6.6 Helicopter Construction

As recognized in Section 5.1.1, the use of helicopters during construction could result in the displacement of migratory birds. However, the use of helicopters for Covered Activities will reduce the need for heavy equipment, such as large cranes, at lattice tower locations, reducing the need for access improvements. By limiting the need for heavy equipment, helicopter construction will benefit migratory birds by reducing the acres of temporary habitat disturbance associated with construction. Additionally, helicopter construction can accelerate construction activities under favorable flight conditions. This will reduce the duration of construction activities and allow NPPD to begin restoration efforts to restore suitable migratory bird habitat faster than under standard construction practices.

6.7 Seasonal Restrictions

Tree clearing will be completed outside of the migratory bird nesting season as the schedule allows. If clearing must be completed during the migratory bird nesting season, clearance surveys conducted by a qualified biologist will be completed prior to removal to identify occupied nests for avoidance. Birds are not limited to nesting in trees and may also nest on the ground or in low vegetation. R-Project construction activities scheduled between April 1 and July 15 will include an onsite investigation to determine if any occupied nests are present. If active nests are found, construction activities will be delayed or the area around the nest(s) left undisturbed until all active nests are no longer active. Exceptions to the April 1 through July 15 timeframe are described below.

Limiting potential effects to nesting raptors is of particular importance to NPPD and the USFWS. Because raptors may use the same nests from year to year, seasonal avoidance of these nests will be implemented to reduce impacts to nesting raptors. NPPD will complete a preconstruction raptor survey to identify nests and the species occupying the nest. Because the USFWS Nebraska Ecological Services Field Office has not published a list of seasonal and spatial raptor nest buffers, for the R-Project, NPPD will adhere to the buffers identified by the USFWS Wyoming Ecological Services Field Office (USFWS 2015). Those raptors that are likely to nest in close proximity to the R-Project and their respective seasonal and spatial buffers are provided in Table 6-2. Construction will not occur within the species-specific spatial buffer during the nesting periods described in Table 6-2. Seasonal and spatial buffers described in Table 6-2 will only apply to active nests. Construction would be able to resume if a nesting attempt fails or after the young have fledged and are no longer dependent on the nest. See Section 6.12.4 below for a discussion of seasonal restrictions for the bald eagle.

TABLE 6-2 RAPTOR NEST SEASONAL AND SPATIAL RESTRICTIONS

SPECIES[1]	NESTING PERIOD	SPATIAL BUFFER (MILES)
Swainson's hawk	April 1 – August 31	0.25
Red-tailed hawk	February 1 – August 15	0.25
American kestrel	April 1 – August 31	0.125
Barn owl	February 1 – September 15	0.125
Great horned owl	December 1 – September 15	0.125
Burrowing owl	April 1 – September 15	0.25
Eastern screech owl	March 1 – August 15	0.125

Source: USFWS Wyoming Ecological Services Field Office (USFWS 2022).
[1] Information on raptors likely to nest surrounding R-Project obtained from Sharpe et al. (2001).

6.8 Adherence to APLIC Design Standards to Prevent Electrocution

A common concern regarding transmission lines is the possibility of raptor electrocution. Transmission lines require large spacing between conductors to prevent flashover between phases and to prevent contact during galloping events, both of which cause line outages. Also, sufficient clearance is needed to provide safe working distances for lineman to perform hot line maintenance work, which also reduces the outage events required to maintain the line. The spacing is utility specific, based on each utility's design and maintenance practices. Suggested transmission line conductor spacing and configurations are described in APLIC's 2006 electrocution document *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC

2006). As discussed above, the R-Project will be designed to NPPD and APLIC standards that will eliminate the potential for raptor electrocution. The bald eagle and golden eagle are the largest birds with potential to perch on R-Project structures. APLIC (2012) recommends 60 inches of spacing between energized portions of transmission lines or grounds. For the steel monopoles, the vertical separation between energized conductors and the supporting arm of the conductor below is 13 feet. The separation between energized conductors and grounded portions of the structure is 11 feet. The straight-line horizontal spacing on steel monopoles is 22 feet. The horizontal spacing between energized conductors on lattice towers is 30 feet. The shortest separation between energized conductors and grounded portions of the structure on lattice towers is 10 feet 9 inches (Figure 5-1). These spacing distances are substantially greater than the 60 inches (five feet) recommended by APLIC (2006).

6.9 Worker Environmental Awareness Program

All personnel entering R-Project work areas, including contractors, will receive environmental training. Training will emphasize compliance with all project-wide environmental requirements, emphasizing stipulations in this Plan and the HCP. Roles and responsibilities will be reviewed, and the authority of the compliance monitors will be emphasized. A list of all personnel who successfully completed the environmental training will be maintained and updated as needed.

6.10 Habitat Restoration

The R-Project’s restoration planning team, private landowners, local NRCS offices, and other rangeland experts were consulted regarding the appropriate methods, seed mixes, and rates to restore vegetation in areas disturbed by construction activities. All practical means will be used to restore the land, outside the minimum areas needed for safe operation and maintenance, to its original contour and natural drainage patterns. A Restoration Management Plan has been developed that describes the methods and activities that will be executed to restore temporary disturbances to habitat that supports the American burying beetle and native bird life.

NPPD will conduct restoration monitoring to document implementation and progress of the restoration efforts and evaluate restoration effectiveness. NPPD will implement adaptive management in areas that do not meet success criteria. NPPD will establish an Escrow Account with a banking association to serve as a financial guarantee that there is money available to restore temporary disturbance areas if NPPD fails to take the appropriate steps to do so.

Restoration efforts may include broadcast seeding, mulching, and soil stabilization efforts. Restoration monitoring will employ vegetation density sampling at 30 disturbance areas and 30 adjacent control plots. Control plots will be no further than the next structure from its paired disturbance area. Restoration will be deemed successful when vegetation density at disturbance area is at least 80% of the paired control plot. For a full description of restoration efforts, see the R-Project HCP and Restoration Management Plan.

6.11 Other Best Management Practices

NPPD will implement the following best management practices during construction, operation, and maintenance of the R-Project, which will help avoid and minimize impacts to avian species.

- Implement erosion and sediment control measures throughout Project construction, including stabilization measures for disturbed areas and structural controls to divert runoff and remove sediment before reaching receiving waters.
- Implement noxious weed control as described in the Restoration Management Plan. Control measures include avoidance of noxious weed infected areas, cleaning vehicles and construction personnel clothing after operation in noxious weed areas, and limited herbicide application in restoration areas if noxious weeds begin to establish.
- Minimize the risk of fire ignitions during construction by implementing fire prevention and control measures.
- Avoid the use of permanent lighting of transmission support structures, unless required by FAA regulations. Use downshielded, low-temperature lighting at substations to reduce night glare and light pollution.
- Require the contractor to develop a Spill Prevention and Response Plan that includes a hazardous communications program and measures for handling, storing, and disposing of hazardous materials.
- Use only Nebraska Certified Pesticide Applicators for herbicide application for ROW vegetation management.
- Equip each fuel truck with automatic shutoff valves.
- Equip all fuel trucks and all pertinent sites with spill response kits and train construction personnel in the use of the kits.

6.12 Species-Specific Avoidance and Minimization Measures

6.12.1 Whooping Crane

Avoidance and Minimization of Impacts to Suitable Habitat. The R-Project transmission line spans rivers and streams at locations with existing bridge crossings where possible. Temporary and permanent habitat disturbance areas, such as construction yards/staging areas, fly yards/assembly areas, structure work areas, temporary access, and structure locations, were sited to avoid potentially suitable whooping crane habitat to the maximum extent practicable. The existing road network and two-tracks will be used where available during construction to reduce the need for new access.

No permanent structures or temporary disturbance areas will occur within rivers and streams. All named perennial rivers and streams along the project route will be spanned by the transmission line conductors, and construction equipment will utilize existing crossings for access during construction. Temporary crossings for construction equipment will not be required on named perennial rivers and streams.

The R-Project will utilize existing roads for construction access to reduce the environmental impact from new access. Existing roads that will be used to provide access include, but are not limited to, U.S. Highway 83, State Highway 7, State Highway 2, North Prairie Trace Road, Gracie Creek Road, and county roads in southern Holt County.

Protocol Surveys and Avoidance of Whooping Crane Displacement. Construction activities will occur year-round, including the whooping crane migration season. However, during the whooping crane migration season, all construction-related activities including helicopter use will be preceded by a daily whooping crane presence/absence survey that will meet or exceed the standard agency protocol in place at the time of construction. The USFWS and NGPC's current protocol includes spring and fall whooping crane migration periods of March 6 to April 29 and October 9 to November 15, respectively (Appendix E). For all construction that takes place during these migration periods (or the revised migration periods, if any, of the preconstruction survey protocol in place at the time of construction), surveys will occur in the morning prior to the initiation of construction activities that day. If no whooping cranes are observed within 0.5 mile, work will commence at that location. If a whooping crane is observed within 0.5 mile of any location where construction-related activity is planned to occur, work would not be allowed to begin until the whooping crane vacates the area of its own accord. If, during the day, a whooping crane lands within 0.5 mile, all work will cease and will not resume until the whooping crane(s) has left the area or relocated at least 0.5 mile away from the construction area of its own accord. NPPD completed daily whooping crane presence/absence surveys during migration periods in the Fall 2019, Spring 2020, Fall 2020, Spring 2021, and Fall 2021 for a total of 699 surveys before construction or restoration activities. No whooping cranes were observed during these daily whooping crane presence/absence surveys. All personnel, including contractors, will be required to complete the Worker Environmental Awareness Program regarding ESA-protected species described in Section 6.9.

Line Marking The risk the R-Project presents to whooping cranes is discussed in detail in Section 5.2.1, and the likelihood a whooping crane will collide with the R-Project is extremely low. Conceptually, power lines placed in close proximity to suitable whooping crane habitat are more likely to present a risk of collision than those located farther away from suitable habitat. However, insufficient data are available to reliably evaluate this concept. Because the risk of a whooping crane colliding with the R-Project is not zero, NPPD will minimize that risk by marking the entirety of the R-Project with bird flight diverters.

Using the 95% whooping crane migration corridor from Pearse et al. (2018) and Platts Electric Transmission Lines data (April 2021), 46,851 miles of transmission line (≥69kV) exist in the whooping crane migration corridor in the United States, and 4,808 miles exist in the state of Nebraska. The R-Project will increase the transmission line miles in these areas by 0.48% and 4.7%, respectively. The Region 6 Guidance indicates that, to maintain baseline condition to address threats to whooping cranes, all new lines within one mile of potentially suitable habitat and an equal amount of existing line should be marked with bird flight diverters. Using the habitat assessment described in Section 5.2.1, NPPD estimates that there are 124 miles of the R-Project within 1 mile of suitable whooping crane habitat. To maintain the baseline threat to whooping cranes per the Region 6 Guidance, NPPD will mark 124 miles of its existing transmission system in the state of Nebraska (Figure 6-2). The Region 6 Guidance states implementation of the measures described in the guidance "if implemented and maintained, could reduce the potential effects to the whooping crane to an insignificant and/or discountable level" by not increasing the potential risk above the current level.

Brown et al. (1987) and Shaw et al. (2010) support the one-mile distance identified in the Region 6 Guidance. Brown et al. (1987) found that the threat to cranes posed by collision decreased to zero when the power line was located a mile (1,600 meters) or more from where the bird took flight. Brown et al. (1987) does not indicate a relationship between distance from flight origin and potential for collision, only that at no collisions were observed if the bird took flight more than one mile from the power line. Additionally, Shaw et al. (2010) states that power lines greater than 1,500 meters (0.93 mile) from blue crane (*Anthropoides paradiseus*) habitat present no risk to those birds and should not require line marking.

While birds occurring beyond one mile from a power line do not appear to be susceptible to power line collision (Brown et al. 1987; Shaw et al. 2010), just because a whooping crane selects stopover habitat less than one mile from a power line of any voltage does not automatically mean that bird will suffer a power line collision. Transmission line data are available in a GIS format, making it possible to evaluate the tracked whooping crane occurrences in relation to transmission lines. Data from Phase 1 the satellite tracking study show that 53 of the 58 satellite-tracked birds used stopover habitat less than one mile from a transmission line during migration at least once. Distribution line data are not available in a GIS format for a similar analysis. However, researchers completing Phase 1 of the satellite tracking study completed site visits to stopover locations and noted distribution lines in the area. Of those occurrence points where site visits were made, two-thirds (66%) were within one mile of a transmission or distribution line. Despite these numerous uses of habitat within one mile of a transmission or distribution line, not one whooping crane in Phase 1 of the satellite tracking study collided with a power line (Headwaters Corporation 2018; Pearse et al. 2019).

As stated in Section 6.2, NPPD will mark all of the R-Project with spiral bird flight diverters or avian flight diverters with reflective, glow-in-the-dark surfaces to comply with the Region 6 Guidance. Also as per the Region 6 Guidance, NPPD will also mark at least 124 miles of existing line. See Section 6.2 for a full description of bird flight diverters and their installation on the R-Project.

Avoidance of Migration Season for Routine Maintenance. Routine maintenance and repairs will not begin until 30 years after the in-service date and will occur once every 10 years for the remainder of the life of the transmission line. Routine maintenance and repair activities will be scheduled outside the whooping crane migration season to the maximum extent practicable.

6.12.2 Piping Plover

Habitat Avoidance. The R-Project will span the North Platte and South Platte rivers at locations that do not provide suitable piping plover nesting habitat, and the remaining project activities will not be located within potential piping plover nesting habitat.

Line Marking. Line marking devices will be installed on the overhead shield wire at the North Platte and South Platte river spans according to APLIC Guidance (2012) and NPPD construction standards.

6.12.3 Bald Eagle

Trash Removal. Bald eagles are known scavengers and will prey on fish carcasses, roadkill, and human refuse. Construction personnel will remove all trash to avoid attracting scavenging bald eagles to the construction areas.

Seasonal Nest Restrictions. A bald eagle nest survey will be conducted during the spring prior to construction to ensure no new bald eagle nests have been constructed within 0.5 mile of the R-Project. If a new occupied bald eagle nest is identified during the preconstruction survey, construction will not be allowed within 0.5 mile of the occupied nest during the bald eagle nesting season. The nesting season is February 1 through August 31 as discussed in the NGPC Bald Eagle Survey Protocol (NGPC 2007). NPPD will consult with the USFWS and NGPC regarding the need for a second follow-up preconstruction survey.

For emergency repairs, NPPD will adhere to the 0.5-mile seasonal restriction, when it is feasible. However, the location of the emergency repair may be within 0.5 mile of an active nest. At a minimum, NPPD will comply with the distances identified the National Bald Eagle Management Guidelines for emergency repairs. This should avoid potential effects to nesting bald eagles should additional nests be established.

Transmission Line Design to Minimize Electrocution Risk. The R-Project has been designed to NPPD and APLIC (2006) standards to minimize the risk of bald eagle electrocution. As noted above, for the steel monopoles, the vertical separation between energized conductors is 23 feet. The separation between energized conductors and grounded portions of the structure is 11 feet. The straight-line horizontal spacing on steel monopoles is the same. The horizontal spacing on lattice towers is 30 feet. The separation between energized conductors and grounded portions of the structure on lattice towers is 10 feet 9 inches. Thus, there is negligible risk of electrocution.

Line Marking. Line marking devices will be installed on the overhead shield wire at river spans and near wetland habitats frequented by bald eagles according to APLIC Guidance (2012) and NPPD standards.

Winter Roost Surveys. Winter roost surveys will be conducted according to Nebraska Bald Eagle Survey Protocol if active construction is to take place in areas of suitable roost habitat. If active roosts are located within 0.25 mile of construction, then construction activities will be delayed until eagles leave roosts for the day.

6.12.4 Golden Eagle

Trash Removal. Like bald eagles, golden eagles are known scavengers and will prey on roadkill and human refuse. Construction personnel will be required to remove all trash to avoid attracting scavenging golden eagles in construction areas.

Transmission Line Design to Minimize Electrocution Risk. The R-Project has been designed to NPPD and APLIC (2006) standards to minimize the risk of golden eagle electrocution. As noted above, for the steel monopoles, the vertical separation between energized conductors is 23 feet. The separation between energized conductors and grounded portions of the structure is 11 feet. The straight-line horizontal spacing on steel monopoles is the same. The horizontal spacing on lattice towers is 30 feet. The separation between energized conductors and grounded portions of the structure on lattice towers is 10 feet 9 inches. Thus, there is negligible risk of electrocution.

Line Marking. Line marking devices will be installed on the overhead shield wire across the R-Project according to APLIC Guidance (2012) and NPPD standards.

6.12.5 Rufa Red Knot

Avoidance of Wetland Habitat. Wetland habitat will be avoided to the maximum extent practicable. Wetland habitat will be crossed using specialized equipment, temporary mattering, or other BMPs.

Restoration of Wetland Disturbance. Temporary disturbance of wetlands from construction will be restored upon project completion.

Line Marking. Line marking devices will be installed on the overhead shield wire at river spans and near wetlands according to APLIC Guidance (2012) and NPPD standards.

7.0 OFF-SITE HABITAT CONSERVATION

As part of the R-Project HCP, NPPD has purchased in fee title 594 acres of mitigation lands that include portions of Sections 15 and 22 in T24N, R22W in Blaine County, Nebraska to offset temporary and permanent impacts to the American burying beetle. Given the American burying beetle is a habitat generalist that may occur in grasslands, forests, or wet meadow habitat, the conservation of 594 acres of suitable American burying beetle habitat will also conserve habitat for migratory birds. The mitigation lands include approximately 550 acres of grassland habitat and 44 acres of wetland habitat. A site visit in the spring of 2018 found grasses within the site had been grazed to three to four inches in height. Management for American burying beetle habitat will result in better grassland coverage and will result in better overall habitat conditions to the benefit of migratory birds. Conservation lands will be protected in perpetuity and will be owned and managed by either NPPD or a third party.

8.0 INCIDENT REPORTING AND PERMITS

All dead or injured birds found on or beneath NPPD-owned or operated electric facilities (e.g., power lines, substations) are to be reported at the earliest convenience (during normal working hours) to the Environmental Department at (402) 563-5088 or (402) 563-5493 in accordance with NPPD’s Corporate Avian Protection. This information has been requested by USFWS and the NGPC. Records of these reports shall be maintained by the Environmental Department and forwarded to the appropriate NGPC and USFWS offices.

At this time, NPPD does not hold permits to allow for the collection, possession, transportation, protection, or storage of dead or injured migratory birds. Unless directed otherwise by USFWS personnel in a specific situation, NPPD will not handle dead or injured birds without first obtaining the appropriate permits. A list of migratory bird permits that may be issued by USFWS is available at http://www.fws.gov/permits/applicationforms/ApplicationLM.html#MBTA.

9.0 KEY RESOURCES

Nebraska Public Power District

Nebraska Public Power District
P.O. Box 499
1414 15th Street
Columbus, NE 68602-0499
1-877-275-6773
Ask for Corporate Environmental Manager

U.S. Fish and Wildlife Service

Nebraska Ecological Services Field Office
9325 South Alda Road
Wood River, NE 68883
308-382-6468

John Brooks
Office of Law Enforcement
P.O. Box 185
Derby, KS 67037
316-788-4474
john_brooks@fws.gov

Region 6 Migratory Bird Permit Office
P.O. Box 25486
DFC (60154)
Denver, CO 80225-0486
Phone: 303-236-8171
Fax: 303-236-8017
permitsR6MB@fws.gov
http://www.fws.gov/permits/

Nebraska Game and Parks Commission

2200 N. 33rd St.
P.O. Box 30370
Lincoln, NE 68503-0370
402-471-0641

Bird Rehabilitators

Fontenelle Forest
1111 Bellevue Blvd
Bellevue, NE 68005
866-888-7261;

Nebraska Wildlife Rehab, Inc.
P.O. Box 24122
Omaha, NE 68124
402-234-2473

10.0 LITERATURE CITED

Armbruster, M.J. 1990. Characterization of habitat used by whooping cranes during migration. U.S. Fish and Wildlife Service. Biol. Rep. 90(4). 16pp.

Armbruster, M.J. and Farmer, A.H. 1981. Draft Sandhill Crane Habitat Suitability Index Model. Pages 136-143 in J.D. Lewis, ed. Proceedings to the 1981 Crane Workshop. National Audubon Society. Tavernier, Florida.

Austin, J.E. and A.L. Richert. 2005. Patterns of habitat use by whooping cranes during migration: summary from 1977-1999 site evaluation data. Proceedings of the North American Crane Workshop. 9:79-104.

Avian Power Line Interaction Committee (APLIC). 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

_____. 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C.

_____. 2018. Eagle Risk Framework: A Practical Approach for Power Lines. Edison Electric Institute and APLIC. Washington, DC.

Bennett, A.F. 1991. Roads, roadsides, and wildlife conservation: a review. *In* Nature Conservation 2: The Role of Corridors. ed. by D.A. Saunders and R.J. Hobbes. Surry Beatry and Sons. 1991. Pp: 99-118.

Bevanger, K. 1994. Bird interactions with utility structures: collision and electrocution, causes and mitigating measures. IBIS. 136:412-425.

Bleed, A.S., and C.A. Flowerday. 1998. An atlas of the Sand Hills. Resource Atlas No. 5b. Third edition, May 1998. University of Nebraska-Lincoln, Institute of Agriculture and Natural Resources, Conservation and Survey Division. 260 pp.

Brown, W.M. and R.C. Drewien. 1995. Evaluation of two power line markers to reduce crane and waterfowl collision mortality. Wildlife Society Bulletin. 23:217-227.

Brown, W.M., R.C. Drewien, and E.G. Bizeau. 1987. Mortality of cranes and waterfowl from power line collisions in the San Luis Valley, Colorado. Pages 128–136 in J. C. Lewis, editor. Proceedings of the 1985 Crane Workshop. Platte River Whooping Crane Habitat Maintenance Trust, Grand Island, Nebraska, USA.

Canadian Wildlife Service (CWS) and United States Fish and Wildlife Service (USFWS). 2007. International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and USFWS Albuquerque, New Mexico. 162pp.

Center for Advanced Land Management Information (CALMIT). 2007. Delineation of 2005 Land Use Patterns for the State of Nebraska Department of Natural Resources. University of Nebraska, Lincoln. 80 pp. Available at http://www.dnr.state.ne.us/Publications_Studies /2005_Landuse_FinalReport.pdf. Accessed December 14, 2009.

Central Flyway Council. 2013. Response letter to proposed rule to list rufa Red Knot as a threatened species. Dave Morrison, Chair. November 26, 2013.

Cornell Lab of Ornithology. 2015. The Birds of North America Online. Accessed December 10, 2015. http://bna.birds.cornell.edu/bna/.

DeLong, J.P. 2004. Effects of management practices on grassland birds: Golden Eagle. Northern Prairie Wildlife Research Center, Jamestown, ND. 22pp.

Elliott-Smith, E. and S.M. Haig. 2004. Piping Plover (Charadrius melodus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/002doi:10.2173/bna.2. Accessed July 9, 2013.

Gil De Weir, K. 2006. Whooping Crane (Grus americana) Demography and Environmental Factors in a Population Growth Simulation Model. Dissertation for Doctor of Philosophy. Texas A&M University. May, 2006.

Headwaters Corporation. 2018. Final Whooping Crane Telemetry Study Report: Whooping Crane Telemetry Analysis. Kearney, NE.

Janss, G.F.E. and M. Ferrer. 1998. Rate of bird collision with power lines - effects of conductor marking and static wire marking. Journal of Field Ornithology 69:8-17.

Jenkins, A.R., J.J. Smallie and M. Diamond. 2010. Avian collisions with power line: a global review of causes and mitigation with a South African perspective. Bird Conservation International. Pp. 1-16.

Johns, B.W., Woodsworth, E.J., and Driver, E.A. 1997. Habitat Use by Migrant Whooping Cranes in Saskatchewan. In Proceedings of the North American Crane Workshop 7: 123-131.

Jorgensen, J.G., M. Bomberger Brown, and A.J. Tyre. 2012. Channel width and least tern and piping plover nesting incidence on the lower Platte River, Nebraska. Great Plains Research. 22:59-67.

Kaul, R.B., D. Sutherland, and S. Rolfsmeier. 2006. The Flora of Nebraska. School of Natural Resources, University of Nebraska–Lincoln. 966 pp.

Knight, R.L., F.W. Smith, S.W. Buskirk, W.H. Romme, and W.L. Baker. 2000. Forest Fragmentation in the Southern Rocky Mountains. University Press of Colorado, Boulder, CO, USA.

Kochert, M.N., K. Steenhof, C.L. Mcintyre and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/684doi:10.2173/bna.684.

Lewis, J.C., E. Kuyt, K.E. Schwindt, and T.V. Stehn. 1992. Mortality in fledged cranes of the Aransas-Wood Buffalo population. Pages 145-148 in D. A. Wood, ed. Proc. 1988 N. Am. Crane Workshop. Florida Game and Fresh Water Fish Commission, Tallahassee.

Murphy, R.K., S.M. McPherron, G.D. Wright and K.L. Serbousek. 2009. Effectiveness of avian collision averters in preventing migratory bird mortality from powerline strikes in the central

Platte River, Nebraska. 2008-2009 Final Report. University of Nebraska-Kearney, Kearney, NE 68848 pp. 34.

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA, U.S.A. Data current as of 06 February 2009.

Nebraska Game and Parks Commission (NGPC). 2007. Bald Eagle Survey Protocol. Nebraska Game and Parks Commission. Lincoln, NE. January 19, 2007.

_____. 2014. Endangered and Threatened Species Range Maps. Available URL: http://outdoornebraska.ne.gov/wildlife/programs/nongame/Heritage/ET_Ranges.asp. Accessed September 4, 2014.

_____. 2015. Nebraska Natural Heritage Program data export. Lincoln, Nebraska. Received September 1, 2015.

_____. 2022. Nebraska Natural Heritage Program data request output. Lincoln, Nebraska. Received February 4, 2022.

_____. Unpublished. Migratory Game Birds. http://outdoornebraska.ne.gov/staff/focus/docs1/FOTF3-14%20Migratory%20Game%20Birds%20Program.pdf. Accessed December 11, 2015.

Pardieck, K.L., D.J. Ziolkowski, Jr., M.-A.R. Hudson. 2015. North American Breeding Bird Survey Dataset 1966 - 2014, version 2014.0. U.S. Geological Survey, Patuxent Wildlife Research Center <www.pwrc.usgs.gov/BBS/RawData/>.

Pearse, A.T. 2016. Characterization of stopover sites used by whooping cranes. 2015 annual report presented to the Platte River Recovery Implementation Program. February 26, 2016.

Pearse, A.T., and S.M. Selbo. 2012. Model of whooping crane energetics as foundation for development of a method to assess potential take during migration: U.S. Geological Survey Open-File Report 2012-1156, 13p.

Pearse, A.T., D.A. Brandt, W.C. Harrell, K.L. Metzger, D.M. Baasch, and T.J. Hefley. 2015. Whooping crane stopover site use intensity within the Great Plains: U.S. Geologic Survey Open File Report 2015-1166. 12p.

Pearse, A.T., M.J. Harner, D.M. Baasch, G.D. Wright, A.J. Caven, and K.L. Metzger. 2017. Evaluation of nocturnal roost and diurnal sites used by whooping cranes in the Great Plains, United States: U.S. Geological Survey Open-File Report 2016-1209. 29 p. https://pubs.er.usgs.gov/publication/ofr20161209.

Pearse, A. T., D. A. Brandt, B. K. Hartup, and M. T. Bidwell. 2018. Mortality in Aransas-Wood Buffalo Whooping Cranes: Timing, Location, and Causes. Chapter 6 In: French, J.B. Jr., Converse, S. J., and Austin, J. E., (Eds.). Whooping Cranes: Biology and Conservation. Biodiversity of the World: Conservation from Genes to Landscapes. Academic Press, San Diego, CA.

Pearse, A.T., D.A. Brandt, B.K. Hartup, and M.T. Bidwell. 2019. Mortality in Aransas-Wood Buffalo Whooping Cranes: Timing, Location, and Causes. Chapter 6 In: French, J.B. Jr., Converse, S.

J., and Austin, J. E., (Eds.). Whooping Cranes: Biology and Conservation. Biodiversity of the World: Conservation from Genes to Landscapes. Academic Press, San Diego, CA.

Pearse, A.T., K.L. Metzger, D.A. Brandt, M.T. Bidwell, M.J. Harner, D.M. Baasch, and W. Harrell. 2020. Heterogeneity in migration strategies of Whooping Cranes. The Condor. Ornithological Applications. 122:1-15.

POWER Engineers, Inc. (POWER). 2009. Electric Transmission Reliability Project, 2009 Interior Least Tern and Piping Plover Survey Report. Report for Nebraska Public Power District.

_____. 2014. Nebraska Public Power District R-Project Interior Least Tern and Piping Plover Habitat Assessment. Report for Nebraska Public Power District.

Rural Utilities Service. 2013. The 2011 Statistical Report for Rural Electric Borrowers (March 2013). Informational USDA Rural Utilities Service Bulletin 201-1.

Schneider, R., K. Stoner, G. Steinauer, M. Panella, and M. Humpert (Eds.). 2011. The Nebraska Natural Legacy Project: State Wildlife Action Plan. 2nd ed. The Nebraska Game and Parks Commission, Lincoln. 344 pages. Available URL: http://outdoornebraska.ne.gov/wildlife/programs/legacy/pdfs/NE %20Natural %20Legacy %20Project %20- %202nd %20edition.pdf. Accessed August 18, 2014.

Sharpe. R.S., W.R. Silcock. and J.G. Jorgensen. 2001. Birds of Nebraska: Their distribution and Temporal Occurrence. University of Nebraska of Press.

Shaw, J.M., A.R. Jenkins, J.J. Smallie, and P.G. Ryan. 2010. Modelling power-line collision risk for the Blue Crane *Anthropoides paradiseus* in South Africa. Ibus. 152: 590-599.

Sherfy, M.H., M.J. Anteau, T.L. Shaffer, M.A. Sovada, and J.H. Stucker. 2012. Foraging ecology of least terns and piping plovers nesting on Central Platte River sandpits and sandbars: U.S. Geological Survey Open-File Report 2012–1059, 50p.

Sibley, D.A. 2003. The Sibley Field Guide to Birds of Eastern North America. Alfred A. Knopf, Inc. New York, NY.

Silcock, W.R. and J.G. Jorgensen. 2022. Birds of Nebraska – Online. www.birdsofnebraska.com. Accessed March 30, 2022.

Sporer, M.K., J.F. Dwyer, B.D. Gerber, R.E. Harness, and A.K. Pandey. 2013. Marking power lines to reduce avian collision near the Audubon National Wildlife Refuge, North Dakota. Wildlife Society Bulletin. 37:796-804.

Stahlecker, D.W. 1997. Availability of stopover habitat for migrant whooping cranes in Nebraska. Proceedings of the North American Crane Workshop. 7:132-140.

Stehn, T.V. and Haralson-Strobel, C.L. 2014. An update on mortality of fledged whooping cranes in the Aransas/Wood Buffalo Population. Proceedings of the North American Crane Workshop 12:43-50.

Stehn, T.V. and C. Strobel. 2011. An update on mortality of fledged whooping cranes in the Aransas/Wood Buffalo population. Proceedings of the North American Crane Workshop 12.

Stehn, T.V. and T. Wassenich. 2008. Whooping crane collisions with power lines: an issue paper. Proceedings of the North American Crane Workshop. 10:25-36.

Stucker, J.H. 2012. Sandbars managed for Least Terns within the Missouri River: Evaluating the influence of fish, spatial scale, and environment on habitat use. PhD Dissertation. University of Minnesota. September 2012.

Traylor-Holzer, K. 2018. Whooping crane population viability analysis (PVA) report: AWBP model and alternative scenario results. IUCN SSC Conservation Planning Specialist Group. 15 May 2018.

United States Fish and Wildlife Service (USFWS). 1988. Great Lakes and Northern Great Plains Piping Plover Recovery Plan. U.S. Fish and Wildlife Service, Twin Cities, MN. 160pp.

_____. 2007. National Bald Eagle Management Guidelines. U.S. Fish and Wildlife Service. Washington, D.C.

_____. 2009a. Piping Plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation. Northeast Region, Hadley, MA and Midwest Region, East Lansing, MI.

_____. 2009b. Whooping cranes and wind development – an issue paper. Regions 2 and 6, U.S. Fish and Wildlife Service. April 2009.

_____. 2011. Birds of Management Concern and Focal Species. U.S. Fish and Wildlife Service, Migratory Bird Program. November 2011.

_____. 2015. Species of Concern. Raptors in Wyoming. USFWS Wyoming Ecological Services Field Office. Cheyenne, WY. Accessed December 12, 2015. http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/Raptors.html.

_____. 2016. Draft Revised Recovery Plan for the Northern Great Plains Piping Plover (*Charadrius melodus*). First Revision. USFWS Region 6. March 2016.

_____. 2018. Whooping Crane Survey Results. Winter 2017-2018. https://www.fws.gov/uploadedFiles/WHCR%20Update%20Winter%202017-2018.pdf. Accessed August 24, 2018.

_____. 2019. A Review and Critique of Risk Assessments Considered by the U.S. Fish and Wildlife Service Regarding the Collision Risk for Whooping Cranes with NPPD's R-Project. January 30, 2019.

_____. 2020a. Whooping Crane Survey Results: Winter 2019-2020. https://www.fws.gov/nwrs/threecolumn.aspx?id=6442464082. Accessed December 6, 2021.

_____. 2020b. Piping plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation. USFWS. March 2020.

_____. 2021. Division of Migratory Bird Management. Birds of conservation concern 2021. Arlington, Virginia.

_____. 2022. Wyoming Ecological Services Field Office Raptor Guidelines. March 9, 2022.

_____. 2023. Whooping Crane Survey Results: Winter 2022-2023.

USFWS and National Marine Fisheries Service (NMFS). 2016. Habitat Conservation Planning and Incidental Take Permit Processing Handbook. December 21, 2016.

United States Geological Survey (USGS). 2020. The National Map LANDFIRE: LANDFIRE National Existing Vegetation Type layer. Issue LANDFIRE 2020 (lf_1.2.0). Wildland Fire Science, Earth Resources Observation and Science Center, Sioux Falls, SD. Updated March 31, 2013. Available at http://www.landfire.gov. Accessed January 9, 2023.

Watershed Institute, Inc. 2013. Potentially Suitable Habitat Assessment for the Whooping Crane (*Grus americana*).

Wright. G.D., T.J. Smith, R. K. Murphey, J.T. Runge and R.R. Harms. 2009. Mortality of cranes (*Gruidae*) associated with powerlines over a major roost on the Platte River, Nebraska. Prairie nat. 41(3/4) pp. 116-120.

Ziewitz, J.W., J.G. Sidle, and J.J. Dinan. 1992. Habitat conservation for least terns and piping plovers on the Platte River, Nebraska. Prairie Naturalist. 24:1–20.

Ziolkowski Jr., D.J., Lutmerding, M., Aponte, V.I., and Hudson, M-A.R., 2022, North American Breeding Bird Survey Dataset 1966 - 2021: U.S. Geological Survey data release. Accessed July 12,2022. https://doi.org/10.5066/P97WAZE5.

APPENDIX A NORTH AMERICAN BREEDING BIRD SURVEY ROUTE SPECIES LISTS

Table A-1 provides a list of all historical records of breeding and non-breeding bird species detected at sample locations along the five BBS routes (Pardieck et al. 2015). The BBS began recording birds in 1966.

TABLE A-1 BREEDING AND NON-BREEDING BIRDS RECORDED ON BBS ROUTES

BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.
Total = 112	Total = 90	Total = 107	Total = 73	Total = 96
American Bittern	American Crow	American Bittern	American Coot	American Avocet
American Coot	American Goldfinch	American Coot	American Crow	American Bittern
American Crow	American Kestrel	American Crow	American Goldfinch	American Coot
American Goldfinch	American Robin	American Goldfinch	American Kestrel	American Crow
American Kestrel	Baltimore Oriole	American Kestrel	American Robin	American Goldfinch
American Robin	Barn Swallow	American Robin	American White Pelican	American Kestrel
American White Pelican	Bell's Vireo	American White Pelican	Baltimore Oriole	American Robin
Bald Eagle	Black-billed Cuckoo	American Wigeon	Bank Swallow	Baltimore Oriole
Baltimore Oriole	Black-capped Chickadee	Bald Eagle	Barn Swallow	Barn Swallow
Bank Swallow	Blue Grosbeak	Baltimore Oriole	Bell's Vireo	Bell's Vireo
Barn Swallow	Blue Jay	Barn Swallow	Black-crowned Night-Heron	Belted Kingfisher
Bell's Vireo	Blue-winged Teal	Bell's Vireo	Black-headed Grosbeak	Black Tern
Belted Kingfisher	Bobolink	Black Tern	Blue Grosbeak	Black-billed Cuckoo
Black Tern	Brown Thrasher	Black-billed Cuckoo	Blue Jay	Black-billed Magpie
Black-capped Chickadee	Brown-headed Cowbird	Black-billed Magpie	Blue-winged Teal	Black-capped Chickadee
Blue Grosbeak	Burrowing Owl	Black-capped Chickadee	Bobolink	Black-crowned Night-Heron
Blue Jay	Canada Goose	Blue Grosbeak	Brown Thrasher	Blue Grosbeak
Blue-winged Teal	Chimney Swift	Blue Jay	Brown-headed Cowbird	Blue Jay
Bobolink	Chipping Sparrow	Blue-winged Teal	Burrowing Owl	Blue-winged Teal
Brown Thrasher	Cliff Swallow	Bobolink	Canada Goose	Bobolink
Brown-headed Cowbird	Common Grackle	Brown Thrasher	Chimney Swift	Brown Thrasher
Burrowing Owl	Common Nighthawk	Brown-headed Cowbird	Chipping Sparrow	Brown-headed Cowbird
Cackling Goose	Cooper's Hawk	Burrowing Owl	Cliff Swallow	Burrowing Owl
Canada Goose	Dickcissel	Canada Goose	Common Grackle	Canada Goose
Canvasback	Downy Woodpecker	Cedar Waxwing	Common Nighthawk	Cattle Egret
Cattle Egret	Eastern Bluebird	Chimney Swift	Common Yellowthroat	Chimney Swift
Chimney Swift	Eastern Kingbird	Chipping Sparrow	Dickcissel	Chipping Sparrow

BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.
Chipping Sparrow	Eastern Meadowlark	Cliff Swallow	Double-crested Cormorant	Cliff Swallow
Cliff Swallow	Eastern Phoebe	Common Grackle	Eastern Kingbird	Common Grackle
Common Grackle	Eastern Towhee	Common Nighthawk	Eurasian Collared-Dove	Common Nighthawk
Common Nighthawk	Eurasian Collared-Dove	Common Yellowthroat	European Starling	Common Yellowthroat
Common Yellowthroat	European Starling	Dickcissel	Field Sparrow	Dickcissel
Dickcissel	Ferruginous Hawk	Double-crested Cormorant	Grasshopper Sparrow	Double-crested Cormorant
Double-crested Cormorant	Field Sparrow	Downy Woodpecker	Great Blue Heron	Downy Woodpecker
Downy Woodpecker	Gadwall	Eastern Bluebird	Great Horned Owl	Eared Grebe
Eared Grebe	Grasshopper Sparrow	Eastern Kingbird	Greater Prairie-Chicken	Eastern Bluebird
Eastern Bluebird	Gray Catbird	Eastern Meadowlark	Hairy Woodpecker	Eastern Kingbird
Eastern Kingbird	Great Blue Heron	Eurasian Collared-Dove	Horned Lark	Eastern Meadowlark
Eastern Meadowlark	Great Crested Flycatcher	European Starling	House Finch	European Starling
Eurasian Collared-Dove	Great Horned Owl	Field Sparrow	House Sparrow	Field Sparrow
European Starling	Greater Prairie-Chicken	Franklin's Gull	House Wren	Gadwall
Ferruginous Hawk	Hairy Woodpecker	Gadwall	Killdeer	Grasshopper Sparrow
Field Sparrow	Horned Lark	Grasshopper Sparrow	Lark Bunting	Gray Catbird
Forster's Tern	House Finch	Gray Catbird	Lark Sparrow	Great Blue Heron
Franklin's Gull	House Sparrow	Great Blue Heron	Loggerhead Shrike	Great Horned Owl
Gadwall	House Wren	Great Crested Flycatcher	Long-billed Curlew	Greater Prairie-Chicken
Grasshopper Sparrow	Indigo Bunting	Great Horned Owl	Mallard	Greater Yellowlegs
Gray Catbird	Killdeer	Greater Prairie-Chicken	Mourning Dove	Green-winged Teal
Great Blue Heron	Lark Bunting	Green-winged Teal	Northern Cardinal	Hairy Woodpecker
Great Horned Owl	Lark Sparrow	Hairy Woodpecker	Northern Mockingbird	Horned Lark
Greater Prairie-Chicken	Lesser Yellowlegs	Horned Lark	Northern Rough-winged Swallow	House Sparrow
Green-winged Teal	Loggerhead Shrike	House Finch	Northern Shoveler	House Wren
Hairy Woodpecker	Long-billed Curlew	House Sparrow	Orchard Oriole	Killdeer
Horned Lark	Mallard	House Wren	Red-headed Woodpecker	Lark Bunting
House Sparrow	Mourning Dove	Indigo Bunting	Red-tailed Hawk	Lark Sparrow
House Wren	Northern Bobwhite	Killdeer	Red-winged Blackbird	Least Flycatcher
Indigo Bunting	Northern Cardinal	Lark Bunting	Ring-necked Pheasant	Lesser Yellowlegs

BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.
Killdeer	Northern Harrier	Lark Sparrow	Sharp-tailed Grouse	Loggerhead Shrike
Lark Bunting	Northern Mockingbird	Lesser Scaup	Spotted Towhee	Mallard
Lark Sparrow	Northern Rough-winged Swallow	Loggerhead Shrike	Swainson's Hawk	Marsh Wren
Loggerhead Shrike	Northern Shoveler	Long-billed Curlew	Tree Swallow	Mourning Dove
Long-billed Curlew	Orchard Oriole	Mallard	Trumpeter Swan	Northern Bobwhite
Mallard	Red-bellied Woodpecker	Marsh Wren	Turkey Vulture	Northern Pintail
Marsh Wren	Red-eyed Vireo	Mourning Dove	Upland Sandpiper	Northern Rough-winged Swallow
Mourning Dove	Red-headed Woodpecker	Northern Bobwhite	Western Kingbird	Northern Shoveler
Northern Bobwhite	Red-tailed Hawk	Northern Cardinal	Western Meadowlark	Orchard Oriole
Northern Cardinal	Red-winged Blackbird	Northern Harrier	White-breasted Nuthatch	Pied-billed Grebe
Northern Harrier	Ring-necked Pheasant	Northern Pintail	Wild Turkey	Red-bellied Woodpecker
Northern Pintail	Rock Pigeon	Northern Rough-winged Swallow	Wilson's Snipe	Redhead
Northern Rough-winged Swallow	Savannah Sparrow	Northern Shoveler	Yellow Warbler	Red-headed Woodpecker
Northern Shoveler	Say's Phoebe	Orchard Oriole	Yellow-billed Cuckoo	Red-tailed Hawk
Orchard Oriole	Sedge Wren	Peregrine Falcon	Yellow-headed Blackbird	Red-winged Blackbird
Pied-billed Grebe	Sharp-tailed Grouse	Pied-billed Grebe	Yellow-shafted Flicker Northern Flicker	Ring-necked Pheasant
Prairie Falcon	Solitary Sandpiper	Redhead		Rock Pigeon
Red-bellied Woodpecker	Swainson's Hawk	Red-headed Woodpecker		Ruddy Duck
Redhead	Tree Swallow	Red-tailed Hawk		Sedge Wren
Red-headed Woodpecker	Turkey Vulture	Red-winged Blackbird		Sharp-tailed Grouse
Red-shafted Flicker Northern Flicker	unid. Bullock's Oriole / Baltimore Oriole	Ring-necked Duck		Song Sparrow
Red-tailed Hawk	unid. Red/Yellow Shafted Northern Flicker	Ring-necked Pheasant		Sora
Red-winged Blackbird	Upland Sandpiper	Rock Pigeon		Swainson's Hawk
Ring-billed Gull	Vesper Sparrow	Ruddy Duck		Swamp Sparrow
Ring-necked Pheasant	Warbling Vireo	Say's Phoebe		Tree Swallow
Rock Pigeon	Western Kingbird	Sharp-tailed Grouse		unid. Red/Yellow Shafted Northern Flicker
Ruddy Duck	Western Meadowlark	Sora		Upland Sandpiper
Say's Phoebe	Wild Turkey	Spotted Towhee		Warbling Vireo

BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.
Sharp-tailed Grouse	Wood Duck	Swainson's Hawk		Western Kingbird
Song Sparrow	Yellow Warbler	Tree Swallow		Western Meadowlark
Sora	Yellow-billed Cuckoo	Trumpeter Swan		White-faced Ibis
Spotted Sandpiper	Yellow-headed Blackbird	Turkey Vulture		Wild Turkey
Spotted Towhee	Yellow-shafted Flicker Northern Flicker	unid. Bullock's Oriole / Baltimore Oriole		Wilson's Phalarope
Swainson's Hawk		unid. Red/Yellow Shafted Northern Flicker		Wilson's Snipe
Tree Swallow		Upland Sandpiper		Wood Duck
Trumpeter Swan		Vesper Sparrow		Yellow Warbler
Turkey Vulture		Warbling Vireo		Yellow-billed Cuckoo
unid. Red/Yellow Shafted Northern Flicker		Western Kingbird		Yellow-headed Blackbird
Upland Sandpiper		Western Meadowlark		Yellow-shafted Flicker Northern Flicker
Vesper Sparrow		Wild Turkey		
Warbling Vireo		Willet		
Western Grebe		Willow Flycatcher		
Western Kingbird		Wilson's Phalarope		
Western Meadowlark		Wilson's Snipe		
White-faced Ibis		Wood Duck		
Wild Turkey		Yellow Warbler		
Willet		Yellow-billed Cuckoo		
Willow Flycatcher		Yellow-breasted Chat		
Wilson's Phalarope		Yellow-headed Blackbird		
Wilson's Snipe		Yellow-shafted Flicker Northern Flicker		
Wood Duck				
Yellow Warbler				
Yellow-billed Cuckoo				
Yellow-headed Blackbird				
Yellow-shafted Flicker Northern Flicker				

Table A-2 provides the abundance of each species of breeding bird recorded along the five BBS routes (Sauer 2014). The numbers reported represent averages of the total breeding bird counts along each route for the period 1989 – 1998. Each BBS is 24.5 miles long and consists of 50 counts three minutes in duration. The abundance estimates provided in Table A-2 represent the number of birds an experienced ornithologist may encounter during a BBS route survey.

Habitat associations reflect those described in the NPPD R-Project Migratory Bird Conservation Plan and are derived from Sharpe et al (2001) and Ehrlich et al (1988).

TABLE A-2 ANNUAL ABUNDANCE OF BREEDING BIRDS ON BBS ROUTES

COMMON NAME	SCIENTIFIC NAME	HABITAT ASSOCIATION	ANNUAL ABUNDANCE ON BBS ROUTE					
			BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.	AVERAGE
Alder and Willow Flycatcher	*Empindonax spp.*	Forest	0.22		0.4			0.31
American Bittern	*Botaurus lentiginosus*	Wetland/Aquatic	2		0.46		2.26	1.57
American Coot	*Fulica americana*	Wetland/Aquatic	2.56		2.39	0.93	4.58	2.62
American Crow	*Corvus brachyrhynchus*	Forest	7.22	18.19	5.68	12.79	4	9.58
American Goldfinch	*Spinus tristis*	Generalist	4.67	3.94	2.71	0.29	3.53	3.03
American Kestrel	*Falco sparverius*	Forest	1.22	2.13	0.46	0.21	1.63	1.13
American Robin	*Turdus migratorius*	Generalist	7.56	7.31	5.36	8.71	25.05	10.80
American White Pelican	*Pelecanus erythrorhynchos*	Wetland/Aquatic	21.11		6	3.93		10.35
American Widgeon	*Anas americana*	Wetland/Aquatic/Grassland			0.11			0.11
Bald Eagle	*Haliaetus leucocephalus*	Generalist	0.67					0.67
Baltimore Oriole	*Icterus galbula*	Forest	0.89	4.63	2.5		5.89	3.48
Bank Swallow	*Riparia riparia*	Generalist				9.57		9.57

COMMON NAME	SCIENTIFIC NAME	HABITAT ASSOCIATION	ANNUAL ABUNDANCE ON BBS ROUTE					
			BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.	AVERAGE
Barn Swallow	*Hirundo rustica*	Generalist	13.22	9.75	9.86	3.29	25.42	12.31
Bell's Vireo	*Vireo bellii*	Forest	0.56		0.07		0.05	0.23
Belted Kingfisher	*Megaceryle alcyon*	Wetland/Aquatic	0.22				0.05	0.14
Black Tern	*Chlidonias niger*	Wetland/Aquatic	5.56		0.75		0.68	2.33
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Forest		0.13	0.04		0.26	0.14
Black-billed Magpie	*Pica hudsonia*	Forest			0.04		0.37	0.21
Black-capped Chickadee	*Poecile atricapillus*	Forest		0.25	0.07		0.47	0.26
Black-crowned Night Heron	*Nycticorax nycticorax*	Wetland/Aquatic				0.21		0.21
Black-headed Grosbeak	*Pheucticus melanocephalus*	Forest				0.07		0.07
Blue Grosbeak	*Passerina caerulea*	Forest	0.22	3.25	0.25	0.43	0.11	0.85
Blue Jay	*Cyanocitta cristata*	Forest		2.56	1.25	0.57	2.58	1.74
Blue-winged Teal	*Anas discors*	Wetland/Aquatic/Grassland	5.78	0.06	6.89	3.21	16.79	6.55
Bobolink	*Dolichonyx oryzivorus*	Grassland	40.11	1.31	0.54	0.14	20.63	12.55
Brown Thrasher	*Toxostoma rufum*	Generalist	3.22	3.25	3	2.43	3.05	2.99
Brown-headed Cowbird	*Molthrus ater*	Grassland	42.11	12.25	36.96	15.93	47.79	31.01
Burrowing Owl	*Athene cunicularia*	Grassland		0.06	0.25	0.07	0.37	0.19
Canada Goose	*Branta canadensis*	Wetland/Aquatic/Grassland	8.33		34.21	1.29	0.37	11.05

COMMON NAME	SCIENTIFIC NAME	HABITAT ASSOCIATION	ANNUAL ABUNDANCE ON BBS ROUTE					
			BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.	AVERAGE
Cattle Egret	*Bubulcus ibis*	Wetland/Aquatic	0.22				0.68	0.45
Chimney Swift	*Chaetura pelagica*	Developed	0.22	1	0.07		0.79	0.52
Chipping Sparrow	*Spizella passerina*	Forest		0.81	0.07		0.68	0.52
Cliff Swallow	*Petrochelidon pyrrhonota*	Generalist	0.22	0.44	0.04	3.36	2.42	1.30
Common Grackle	*Quiscalus quiscala*	Generalist	14.11	18.63	13.79	3	53.21	20.55
Common Nighthawk	*Chordeiles minor*	Grassland	3.67	0.06	7.39	2.14	4.58	3.57
Common Yellowthroat	*Geothlypis trichas*	Wetland/Aquatic/Grassland	4.22		1.11		10.63	5.32
Cooper's Hawk	*Accipiter cooperii*	Forest		0.06				0.06
Dickcissel	*Spiza americana*	Grassland	12.67	18	7.54	0.29	13.79	10.46
Double-crested Cormorant	*Phalacrocrax auritus*	Wetland/Aquatic	2		14.54	0.29		5.61
Downy Woodpecker	*Picoides pubescens*	Forest	0.22	0.06	0.07		0.21	0.14
Eared Grebe	*Podiceps nigricollis*	Wetland/Aquatic	0.11				0.32	0.22
Eastern Bluebird	*Sialia sialis*	Forest	0.22	0.56	0.25		0.58	0.40
Eastern Kingbird	*Tyrannus tyrannus*	Forest/Grassland	16.56	11.5	13.04	4.5	16.89	12.50
Eastern Meadowlark	*Sturnella magna*	Grassland	1.67	0.19	0.11		1.95	0.98
Eastern Phoebe	*Sayornis phoebe*	Forest		0.06				0.06
Eastern Towhee	*Pipilo erythrophthalums*	Forest		0.06				0.06
Eurasian Collared Dove	*Streptopelia decaocto*	Generalist	0.89	0.94				0.92

COMMON NAME	SCIENTIFIC NAME	HABITAT ASSOCIATION	ANNUAL ABUNDANCE ON BBS ROUTE					
			BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.	AVERAGE
European Starling	*Sturnus vulgaris*	Forest	3	9.69	2.89	4.07	13.42	6.61
Ferruginous Hawk	*Buteo regalis*	Grassland		0.31				0.31
Field Sparrow	*Spizella pusilla*	Grassland	0.11	0.31	3.18		1.84	1.36
Forster's Tern	*Sterna forsteri*	Wetland/Aquatic	0.11					0.11
Franklin's Gull	*Leucophaeus pipixcan*	Wetland/Aquatic	0.33					0.33
Gadwall	*Anas strepera*	Wetland/Aquatic	0.89	0.25	1.64		1.11	0.97
Grasshopper Sparrow	*Ammodramus savannarum*	Grassland	13.67	107.69	39.68	25.07	17.53	40.73
Gray Catbird	*Dumetella carolinensis*	Forest	0.22	0.19	0.04		0.11	0.14
Great Blue Heron	*Ardea herdias*	Wetland/Aquatic	2.44	0.06	0.79	0.14	0.42	0.77
Great Crested Flycatcher	*Myiarchus crinitus*	Forest			0.04			0.04
Great Horned Owl	*Bubo virginianus*	Forest	0.22	0.38	0.14	0.14	0.21	0.22
Greater Prairie Chicken	*Tympanuchus cupido*	Grassland	3	25.81	6.39	0.14	14.11	9.89
Green-winged Teal	*Anas crecca*	Wetland/Aquatic/Grassland			0.07		0.95	0.51
Hairy Woodpecker	*Picoides villosus*	Forest		0.25	0.04		0.05	0.11
Horned lark	*Eremophilia alpestris*	Grassland	0.78	27.75	10.14	9.79	3.16	10.32
House Finch	*Carpodacus mexicanus*	Forest		1.81	0.07			0.94
House Sparrow	*Passer domesticus*	Generalist		4	0.82	7.93	4.21	4.24

COMMON NAME	SCIENTIFIC NAME	HABITAT ASSOCIATION	ANNUAL ABUNDANCE ON BBS ROUTE					
			BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.	AVERAGE
House Wren	*Troglodytes aedon*	Forest	0.56	1.75	3.21		4.89	2.60
Indigo Bunting	*Passerina cyanea*	Forest		0.13	0.11			0.12
Killdeer	*Charadrius vociferus*	Generalist	8.67	3.5	8.79	1.64	14.68	7.46
Lark Bunting	*Calamospiza melanocorys*	Grassland	0.22	5.81	7.86	11	0.42	5.06
Lark Sparrow	*Chondestes grammacus*	Grassland	9.78	51.81	8.43	17.21	2.16	17.88
Lesser Scaup	*Aythya affinis*	Wetland/Aquatic			0.14			0.14
Loggerhead Shrike	*Lanius ludovicianus*	Grassland	1.89	1.75	2.07	1.93	1	1.73
Long-billed Curlew	*Numenius americanus*	Grassland	2.56	6.69	0.46	0.21		2.48
Mallard	*Anas platyrhynchos*	Wetand/Grassland	12.56	1.06	16.32	6.5	13.84	10.06
Marsh Wren	*Cistothorus palustris*	Wetland/Aquatic	0.22		0.07			0.15
Mourning Dove	*Zenaida macroura*	Generalist	35.67	103.44	60.68	36.93	64.11	60.17
Northern Bobwhite	*Colinus virginianus*	Grassland	0.11	0.31	0.36		1.68	0.62
Northern Cardinal	*Cardinalis cardinalis*	Forest		0.19	0.07			0.13
Northern Harrier	*Circus cyaneus*	Grassland		0.31	0.07			0.19
Northern Mockingbird	*Mimus polyglottos*	Forest		0.25		0.07		0.16
Northern Pintail	*Anas acuta*	Wetland/Aquatic/Grassland	0.22		3.68		5.16	3.02
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Generalist	0.89	0.13	0.43		0.53	0.50
Northern Shoveler	*Anas clypeata*	Wetland/Aquatic/Grassland	0.78	0.13	1.04	0.14	4.58	1.33

COMMON NAME	SCIENTIFIC NAME	HABITAT ASSOCIATION	ANNUAL ABUNDANCE ON BBS ROUTE					
			BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.	AVERAGE
Orchard Oriole	*Icterus spurius*	Forest	11.33	7.5	3.04	1.36	3.11	5.27
Pie-billed Grebe	*Podilymbus podiceps*	Wetland/Aquatic	3.78		0.96		0.79	1.84
Red-bellied Woodpecker	*Melanerpes carolinus*	Forest	0.22	0.06			0.11	0.13
Red-eyed Vireo	*Vireo olivaceus*	Forest		0.13				0.13
Redhead	*Aythya americana*	Wetland/Aquatic	0.33		0.93		1.63	0.96
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Forest	0.78	3.69	1.75	0.71	3.68	2.12
Red-tailed Hawk	*buteo jamaicensis*	Generalist	1.11	1.5	0.46	0.5	0.47	0.81
Red-winged Blackbird	*Agelaius phoeniceus*	Wetland/Aquatic	164.78	14.19	45.14	39.93	255.11	103.83
Ring-necked Pheasant	*Phasianus colchicus*	Grassland	13.67	8.56	8.96	2.5	12	9.14
Rock Pigeon	*Columbia livia*	Generalist	0.78	0.06	0.14		0.58	0.39
Ruddy Duck	*Oxyura jamaicensis*	Wetland/Aquatic	0.89		1.29		0.42	0.87
Savannah Sparrow	*Passerculus sandwichensis*	Grassland		0.25				0.25
Say's Phoebe	*Sayornis saya*	Forest			0.04			0.04
Sedge Wren	*Cistothorus platensis*	Wetland/Aquatic/Grassland		0.13				0.13
Sharp-tailed Grouse	*Tympanuchus phasianellus*	Grassland	0.44	3	0.11	1.36	0.05	0.99
Song Sparrow	*Melospiza melodia*	Forest	0.22					0.22
Sora	*Porzana carolina*	Wetland/Aquatic	0.11		0.07		0.53	0.24
Spotted Sandpiper	*Actitis macularius*	Wetland/Aquatic	0.11					0.11

COMMON NAME	SCIENTIFIC NAME	HABITAT ASSOCIATION	ANNUAL ABUNDANCE ON BBS ROUTE					
			BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.	AVERAGE
Spotted Towhee	*Pipilo maculatus*	Forest			0.04			0.04
Swainson's Hawk	*Buteo swainsoni*	Grassland	1.11	1.25	0.5	1.79	0.32	0.99
Swamp Sparrow	*Melospiza georgiana*	Wetland/Aquatic					0.05	0.05
Tree Swallow	*Tachycineta bicolor*	Forest	3.78	0.06	0.29	0.86	0.26	1.05
Turkey Vulture	*Cathartes aura*	Generalist		0.44	0.14	0.14		0.24
Upland Sandpiper	*Bartramia longicauda*	Grassland	22.22	24.5	28.89	15.64	18.53	21.96
Vesper Sparrow	*Pooecetes gramineus*	Grassland		0.06	0.11			0.09
Warbling Vireo	*Vireo gilvus*	Forest	2.56	0.94	2.75		2.16	2.10
Western and Clark's Grebe	*Aechmophorus spp.*	Wetland/Aquatic	4					4.00
Western Kingbird	*Tyrannus verticalis*	Forest/Grassland	5.33	20.25	4.89	5.57	5.05	8.22
Western Meadowlark	*Sturnella neglecta*	Grassland	221.22	239.88	199.54	260.71	230.79	230.43
White-faced Ibis	*Plegadis chihi*	Wetland/Aquatic	0.22				0.21	0.22
Wild Turkey	*Meleagris gallapavo*	Forest	4.67	0.88	0.61		0.11	1.57
Willet	*Tringa semipalmata*	Wetland/Aquatic	1.78		0.71			1.25
Willow Flycatcher	*Empidonax trailii*	Forest	0.22		0.04			0.13
Wilson's Phalarope	*Phalaropus tricolor*	Wetland/Aquatic	0.89		0.61		6.95	2.82
Wilson's Snipe	*Gallinago delicata*	Wetland/Aquatic	8.33		2.07	0.07	1.21	2.92
Wood Duck	*Aix sponsa*	Wetland/Aquatic/Forest	4.22	0.06	0.07		0.37	1.18

COMMON NAME	SCIENTIFIC NAME	HABITAT ASSOCIATION	ANNUAL ABUNDANCE ON BBS ROUTE					
			BROWNLEE	RINGGOLD	SWAN LAKE	MULLEN	WHEELER CO.	AVERAGE
Yellow Warbler	*Setophaga petechia*	Forest	2.56	0.44	2.32	0.21	1.68	1.44
Yellow-billed Cuckoo	*Coccyzus americanus*	Forest	0.22	0.5	0.29	0.14	0.16	0.26
Yellow-breasted Chat	*Icteria virens*	Forest			0.04			0.04
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Wetland/Aquatic	19.56		4.57	12.64	9.05	11.46
BREEDING BIRDS PER ROUTE			**89**	**80**	**98**	**56**	**85**	**81.6**

APPENDIX B WHOOPING CRANE HABITAT ASSESSMENT

December 7, 2023

NEBRASKA PUBLIC POWER DISTRICT

R-Project Transmission Line

Whooping Crane: Potentially Suitable Habitat Assessment

PROJECT NUMBER:
128143
PROJECT CONTACT:
Ben Bainbridge
EMAIL:
Ben.bainbridge@powereng.com
PHONE:
208-788-0391

POWER ENGINEERS

Whooping Crane: Potentially Suitable Habitat Assessment

PREPARED FOR: *NEBRASKA PUBLIC POWER DISTRICT*

PREPARED BY: *BEN BAINBRIDGE*
208-788-0391
BEN.BAINBRIDGE@POWERENG.COM

TABLE OF CONTENTS

1.0 INTRODUCTION **1**
2.0 SPECIES INFORMATION **3**
3.0 METHODS CONSIDERED **5**
4.0 UTILIZED METHODOLOGY **6**
4.1 WHOOPING CRANE STUDY CORRIDOR 7
4.2 POTENTIALLY SUITABLE HABITAT COMPONENTS 7
4.3 AVAILABLE GIS DATA 9
4.4 INITIAL ANALYSIS 9
4.4.1 Wetland Size 9
4.4.2 Visibility Obstruction 10
4.4.3 Disturbance 10
4.5 SECONDARY ANALYSIS 11
4.5.1 Water Regime 11
4.5.2 Proximity to Food Source 12
4.5.3 Wetland Size 12
4.5.4 Natural Wetlands 12
4.5.5 Wetland Density 13
4.5.6 Total Habitat Quality Score 13
5.0 RESULTS **14**
6.0 LITERATURE CITED **15**

FIGURES:

FIGURE 1 WHOOPING CRANE 95% SIGHTING CORRIDOR 2
FIGURE 2 WHOOPING CRANE STUDY CORRIDOR 8

TABLES:

TABLE 1 POTENTIALLY SUITABLE HABITAT COMPONENTS 7
TABLE 2 AVAILABLE GIS DATA USED IN ANALYSES 9
TABLE 3 TYPES OF DISTURBANCE AND DISTANCE FROM AFFECTED AREA ASSUMED TO INFLUENCE ROOSTING SITES[1] 10
TABLE 4 WATER REGIME HABITAT SCORE[1] 11
TABLE 5 PROXIMITY TO FOOD HABITAT SCORE[1] 12
TABLE 6 WETLAND SIZE HABITAT SCORE[1] 12
TABLE 7 NATURAL WETLAND HABITAT SCORE[1] 13
TABLE 8 WETLAND DENSITY HABITAT SCORE[1] 13
TABLE 9 WETLAND HABITAT QUALITY SCORE 13

ACRONYMS AND ABBREVIATIONS

CWS	Canadian Wildlife Service
DEM	digital elevation model
ESA	Endangered Species Act
FR	Federal Register
GIS	geographic information system
kV	kilovolt
NESCA	Nebraska Nongame and Endangered Species Conservation Act
NHD	National Hydrography Dataset
NPPD	Nebraska Public Power District
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

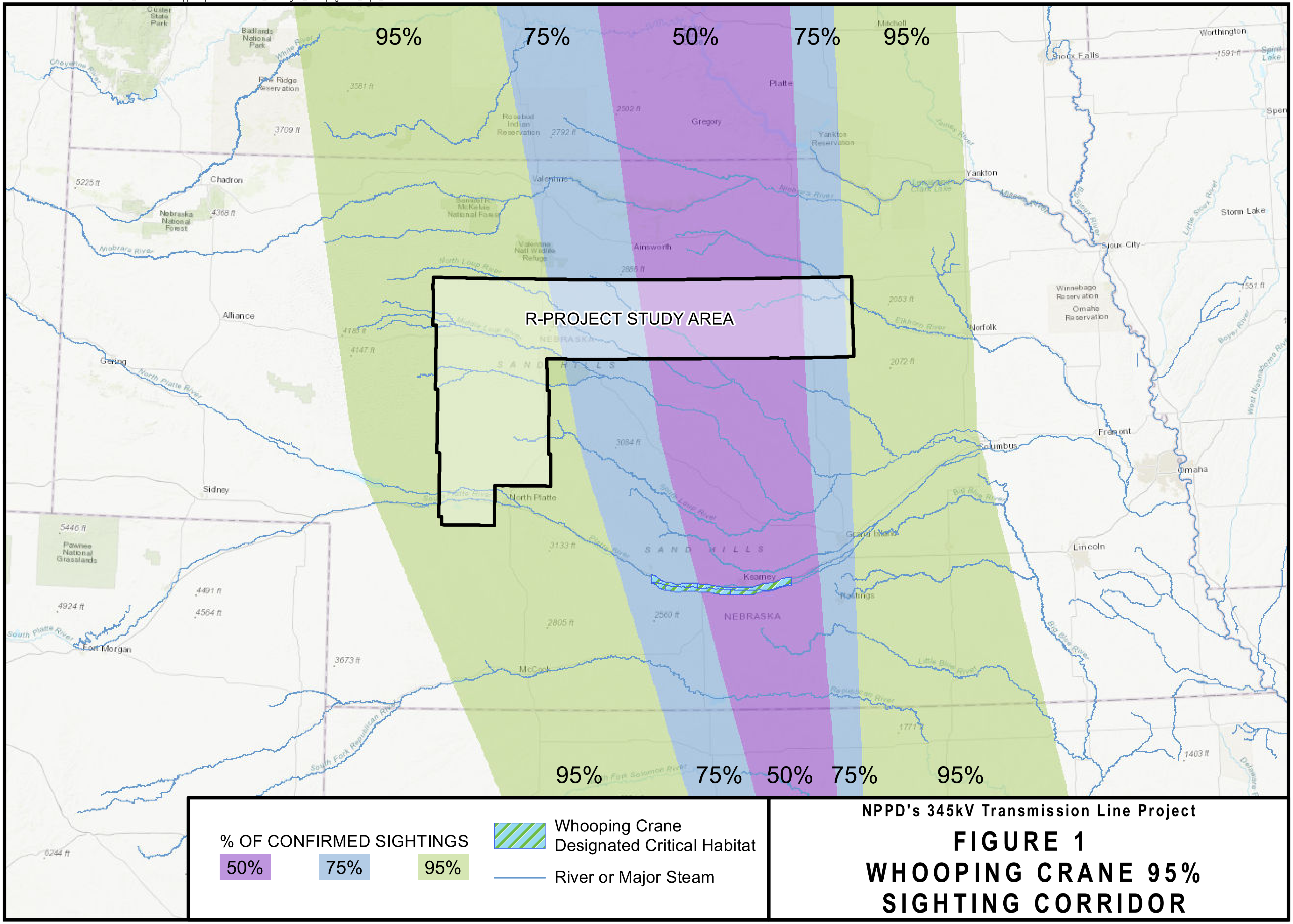
1.0 INTRODUCTION

The Nebraska Public Power District (NPPD) proposes to construct a 345 kilovolt (kV) transmission line from NPPD's Gerald Gentleman Station near Sutherland, Nebraska north to the Thedford substation, and then east to a new substation at Western Area Power Administration's existing Fort Thompson to Grand Island 345 kV transmission line along the western boundary of Antelope County. This line is referred to as the R-Project. The approximately 226-mile-long line will help enhance operation of NPPD's electric transmission system, ensure reliable supplies of power, relieve congestion from existing lines within the transmission system, and provide additional opportunities for development of renewable energy projects. The R-Project project area intersects the Nebraska Sandhills grassland region in the whooping crane (*Grus americana*) migration corridor.

The whooping crane migration corridor in the Central Flyway is based on 100- and 200-mile thresholds around a center line, created by using all previously documented whooping crane locations (Stehn and Wassenich 2008). The 100-mile corridor represents 82% of all sightings, and the 200-mile corridor represents 94% of all sightings. This information was then adapted to create a 95%-sighting corridor and a 75%-sighting corridor in a USFWS memo titled *Region 6 Guidance for Minimizing Effects of Power Line Projects within the Whooping Crane Migration Corridor*. The sighting corridors were updated in 2018 using current opportunistic sightings and locations of 58 satellite-tracked whooping cranes. Figure 1 depicts where the R-Project area falls within the migration corridor in Nebraska.

This document provides a proposed method for identifying potentially suitable whooping crane habitat along the R-Project and subsequently identifies portions of the project to be marked to minimize the potential for whooping crane collisions. The USFWS recommends marking future power lines that occur within one mile of "potentially suitable habitat" in the whooping crane migration corridor. The R-Project crosses the Calamus River, North Loup River, South Loup River, Middle Loup River, North Platte River, South Platte River, and Birdwood Creek. These riverine/riparian areas are known whooping crane stopover habitats. Other potentially suitable habitats include shallow emergent wetlands, sub-irrigated wet meadows, and farmed wetlands that were identified using the methods set forth in this document.

Date: 1/13/2022 Path: W:\128143_NPPD_SPP\DD\GIS\Apps\Reports\HCP\202201_HCP\Fig3-4_WhoopingCrane_95pct_20220113.mxd



NPPD's 345kV Transmission Line Project

FIGURE 1
WHOOPING CRANE 95% SIGHTING CORRIDOR

2.0 SPECIES INFORMATION

Status and Distribution: The whooping crane was given legal protection under the Endangered Species Preservation Act (P.L. 89-699) in 1967 (32 Federal Register [FR] 4001) and the Endangered Species Conservation Act (P.L. 91-135) in 1970 (35 FR 6069), each of which were incorporated into the current Federal Endangered Species Act (ESA) in 1973. The Nebraska Nongame Endangered Species Conservation Act (NESCA) states that a species occurring in the state of Nebraska protected under the ESA will also receive the same listing status under NESCA. Therefore, the whooping crane also is protected as a state of Nebraska endangered species under NESCA. Federally designated critical habitat for the whooping crane occurs in Nebraska along the Platte River approximately 80 miles south of the R-Project area. The critical habitat includes an area of land, water, and airspace in Dawson, Buffalo, Hall, Phelps, Kearney, and Adams Counties along the Platte River bottoms from the junction of U.S. Highway 283 and Interstate 80 to the interchange for Shelton and Dehman near the Buffalo-Hall County line (43 FR 20941) (Figure 1).

Whooping cranes that may occur in the R-Project area are part of the Aransas-Wood Buffalo migratory population. The Aransas-Wood Buffalo population is the only remaining naturally migrating population of whooping cranes. Whooping cranes in this population nest in Wood Buffalo National Park in Northwest Territories, Canada and winter in Aransas National Wildlife Refuge in Texas. Spring migrants leave Aransas National Wildlife Refuge in March and April, arriving on the nesting grounds in April and May (Canadian Wildlife Service [CWS] and USFWS 2007). Fall migrants leave the nesting grounds in Wood Buffalo National Park in September and October, and arrive on the wintering grounds in October and November. States and provinces which fall within the identified migration corridor include Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Montana, Manitoba, Saskatchewan, Alberta, and Northwest Territories (Stehn and Wassenich 2008, Pearse et al. 2020).

The Aransas-Wood Buffalo population is the only remaining completely self-sustaining population of whooping cranes. Surveys to count whooping cranes within the Aransas-Wood Buffalo population occur multiple times each winter while the birds are at Aransas National Wildlife Refuge. Surveys completed in the 2022 - 2023 wintering period estimate the whooping crane population at 536 whooping cranes (443 to 644, 95% confidence interval) (USFWS 2023). It is not possible to know the exact number of cranes outside of the surveyed area. However, it is unlikely that the entire population of whooping cranes was within the surveyed area during the survey; in the 2022 - 2023 survey period, it is estimated that an additional 14 whooping cranes were beyond the primary survey area (USFWS 2023).

Three other populations of whooping cranes have been reintroduced in their historic range. One population migrates between Florida and central Wisconsin. The second population is a group of non-migratory birds in central Florida, and the third is a non-migratory flock at White Lake, Louisiana. Each of these populations is established and supplemented by whooping cranes raised in captivity and released into the populations until such time that the population becomes self-sustaining or it is determined that natural reproduction will not sustain the reintroduced population.

Habitat Characteristics/Use: Whooping cranes do not breed in Nebraska. Rather, they occur in the state only while migrating between Aransas National Wildlife Refuge and Wood Buffalo National Park. Migration is generally very fast, lasting two to four weeks in the spring and one to two weeks in the fall (CWS and USFWS 2007), and migrating individuals may occur in Nebraska during the spring and fall intervals.

Whooping crane sightings in Nebraska have primarily been in palustrine wetland (56 percent) and riverine habitats (40 percent) (Austin and Richert 2005). During migration, whooping cranes roost in shallow depressional wetlands or large, shallow riverine habitat, typically adjacent to agricultural fields. Whooping cranes will use small, isolated wetlands for migratory stopover habitat, but prefer larger wetlands over 2.5 acres and shallow broad river channels (Armbruster 1990; Watershed Institute, Inc. 2013). Additionally, USFWS defines potentially suitable migratory stopover habitat as wetlands with areas of shallow water without visual obstructions (i.e., high or dense vegetation) and submerged sandbars in wide, unobstructed river channels that are isolated from human disturbance. Roosting wetlands are typically located within one mile of grain fields (USFWS 2010). Agricultural fields provide stopover habitat by providing food, and subsequently, energy to whooping cranes during migration. Whooping cranes may spend several days resting in a given area and making short flights between roosting and foraging areas, generally less than 0.62 mile apart (Howe 1987). Migrating whooping cranes rarely use the same specific roosting habitat year after year, preferring to find suitable roosting habitat in their vicinity when conditions are no longer optimal for migrating. The exceptions to this include several large wetland complexes along the migration corridor which have been designated as critical habitat, and the stretch of Platte River bottoms which has been designated as critical habitat.

The diet of migrating whooping cranes is poorly documented. However, individuals are known to consume frogs, fish, crayfish, insects, plant tubers, and agricultural waste grain during migration (CWS and USFWS 2007). Feeding sites of migrating whooping cranes noted from 1977 through 1999 were largely upland crops. Seasonal or permanent wetlands or upland perennial cover was used less frequently (Austin and Richert 2005).

The two most commonly identified sources of whooping crane mortality within the Aransas-Wood Buffalo population are shootings and power line collisions (Stehn and Strobel 2011). However, in over 90 percent of all mortality cases a carcasses is not found and the cause of mortality is unknown and speculative (Stehn and Strobel 201). In water bird studies, collisions typically occur when a transmission line bisects roosting and foraging habitats (Brown et al. 1987; Morkill and Anderson 1991). It is not possible to predict which row crop agriculture fields would be used by whooping cranes for foraging, and therefore not possible to predict where foraging might take place; however, a field's proximity to wetlands provides insight into where whooping cranes may to occur. Kaufield (1981) found that optimal stopover habitat for migrating whooping cranes had adequate roosting and foraging sites within two kilometers of one another and that foraging locations more than ten kilometers from the roost site were not used. Austin and Richert (2005) found that approximately two-thirds of whooping crane foraging locations during migration were within 0.5 mile of the roost site. Howe (1989) observed 27 whooping cranes, seven of which were radio tracked, and found that whooping cranes travelled up to 5.0 miles to upland feeding sites from their roost sites, but that 56 percent travelled less than 0.62 mile.

3.0 METHODS CONSIDERED

Currently published methodologies for identifying potentially suitable habitat for whooping cranes were reviewed and evaluated to determine the most applicable method for the R-Project. The Watershed Institute's "Potentially Suitable Habitat Assessment for the Whooping Crane" ([TWI method], Watershed Institute, Inc. 2013) was selected as the best method for the R-Project because it is applicable to transmission lines, uses available desktop GIS data, is the most comprehensive, and is easily replicable. The TWI method was determined to be the most applicable of the methods evaluated and follows the *Region 6 Guidance for Minimizing Effects of Power Line Projects within the Whooping Crane Migration Corridor*. Two levels of desktop analyses are used within one mile on each side of a proposed power line project. The TWI method is broken into two main steps, the Initial Analysis and the Secondary Analysis. The Initial Analysis eliminates wetlands from consideration as potentially suitable habitat based on wetland size, visibility obstructions and slope, and distance to disturbances. The Secondary Analysis then ranks the wetlands which remained after the Initial Analysis based on wetland water regimes, wetland size, proximity to food sources, natural versus man-made wetlands, and wetland density.

The following methods were considered but not selected for use on the R-Project because each was developed for assessing potential impacts to whooping cranes from proposed wind generation facilities. The additional methods considered did not analyze the landscape and potentially suitable habitat surrounding a proposed project to the same degree of specificity as the TWI method. A brief description of the evaluation completed for each is provided.

Predicting and Mapping Potential Whooping Crane Stopover Habitat to Guide Site Selection for Wind Energy Projects (Belaire et al. 2013). This method originally was developed to identify potential effects to whooping cranes from wind energy development. This method analyzed land use variables including agricultural land, roads, urban areas, and wetlands/water as factors determining potentially suitable habitats with whooping crane distribution (based on sightings), and wind resources/site suitability locations. As the location of potential wind resources was the primary factor for this method, it was determined not to be appropriate for the R-Project. Additionally, several factors related to potentially suitable habitat for whooping cranes (wetland size, visibility obstructions, distances from disturbances, water regime, and wetland density) were not considered in this assessment method.

Whooping Crane Likelihood of Occurrence Report – Cimarron Wind Energy Project – Phase 1 Gray County, Kansas (Tetra Tech EC, Inc. 2010). This method originally was developed to identify potential effects to whooping cranes from wind energy development by using National Wetlands Inventory (NWI) and U.S. Geological Survey (USGS) National Land Cover Database data to identify wetland locations and cropland in comparison to a specific wind energy project area. A likelihood of occurrence formula was created by utilizing the location of the project in comparison to the whooping crane migration corridor, a suitable wetlands ratio (suitable wetlands in the project area to suitable wetlands in a 35-mile area around the project), and a wetland-agricultural matrix score (distance between wetlands and agricultural land cropland). Suitable wetlands in this method were wetlands greater than one acre in size and less than 0.62 mile from cropland foraging locations. This method was designed for a specific wind farm project area, not for a linear project like the R-Project. Several factors related to potentially suitable habitat for whooping cranes (visibility obstructions, distance from disturbances, water regime, and wetland density) were not considered in this assessment method.

Whooping Crane Desktop Stopover Risk Assessment: Grande Prairie Wind Farm Holt County, Nebraska (Stantec 2014). This method originally was developed to identify potential effects to whooping cranes from wind energy development and included a review of available data regarding the potential for whooping crane interactions with a specific wind farm project area. Data analyzed included whooping crane migration ecology and potentially suitable habitat requirements, potential impacts from wind development and wind development guidance, federal and state conservation areas near the project area, characteristics and conservation issues of Nebraska's wetlands, confirmed whooping crane record locations, and wetland resources in the project area and vicinity. Additionally, a site-specific wetland delineation was completed for the project area. Risk associated with the project development was then determined utilizing the previously mentioned factors. Several factors related to potentially suitable habitat for whooping cranes (visibility obstructions, distance from disturbances, water regime, proximity to food sources, and wetland density) were not considered in this assessment method.

Guidelines for Wind Energy and Wildlife Resource Management in Nebraska (Nebraska Wind and Wildlife Working Group 2013). This method originally was developed to identify potential effects to whooping cranes from wind energy development. This method is very brief and describes that a desktop assessment should be completed utilizing information including whooping crane ecology, location of a project site relative to the whooping crane migration corridor, and a low-level geographic information system (GIS) analysis of wetland and habitat resources located within and adjacent to a project site. No further specifications were provided in this method. This was not selected to identify whooping crane potentially suitable habitat for the R-Project because of the low level of analysis and the original application to wind energy development.

Wind Energy and Nebraska's Wildlife: Avian Assessment Guidance for Wind Energy Facilities; Whooping Crane Desktop Stopover Risk Assessment (NGPC and USFWS 2012). This method originally was developed to identify potential effects to whooping cranes from wind energy development. This method considers whooping crane migration ecology, the specific location of a proposed project relative to the whooping crane migration corridor, and a low-level GIS analysis of wetland and habitat resources within and adjacent to a proposed project site. A fatal flaw analysis is completed to indicate if construction of a wind project in a specific location would be detrimental to whooping cranes. Known occurrences of whooping cranes, NWI data, and Natural Resource Conservation Service (NRCS) hydric soil data are reviewed. Several factors related to potentially suitable habitat for whooping cranes (visibility obstructions, distance from disturbances, proximity to food sources, and wetland density) were not utilized in this method.

4.0 UTILIZED METHODOLOGY

As described above, the TWI method was selected for determining potentially suitable habitat for whooping cranes along the R-Project. It is likely that a site visit with USFWS and Nebraska Game and Parks Commission staff will be required to groundtruth areas of potentially suitable habitat in the field once right-of-entry is acquired along the transmission line route.

The following sections outline the utilized methodology to identify potentially suitable habitat in the R-Project Whooping Crane Study Corridor (defined in Section 4.1 below). The Initial Analysis eliminated wetlands that were determined to not meet the requirements of potentially suitable habitat based on wetland size, visibility obstruction, and distance from disturbances. Following the elimination of unsuitable wetlands during the Initial Analysis, the remaining wetlands were analyzed in the Secondary Analysis to rank the habitat quality (suitability) based on water regime, distance to food, wetland size, natural vs. manmade wetland, and wetland density.

4.1 Whooping Crane Study Corridor

As specified in the *Region 6 Guidance for Minimizing Effects of Power Line Projects within the Whooping Crane Migration Corridor*, new power lines within one mile of potentially suitable habitat should be marked to reduce the risk of a line strike by whooping cranes. Therefore, the study corridor for the R-Project included one mile on each side of the proposed transmission line (two-mile width) for its entire length (approximately 226 miles long) (Figure 2). This corridor will subsequently be referred to as the "Whooping Crane Study Corridor."

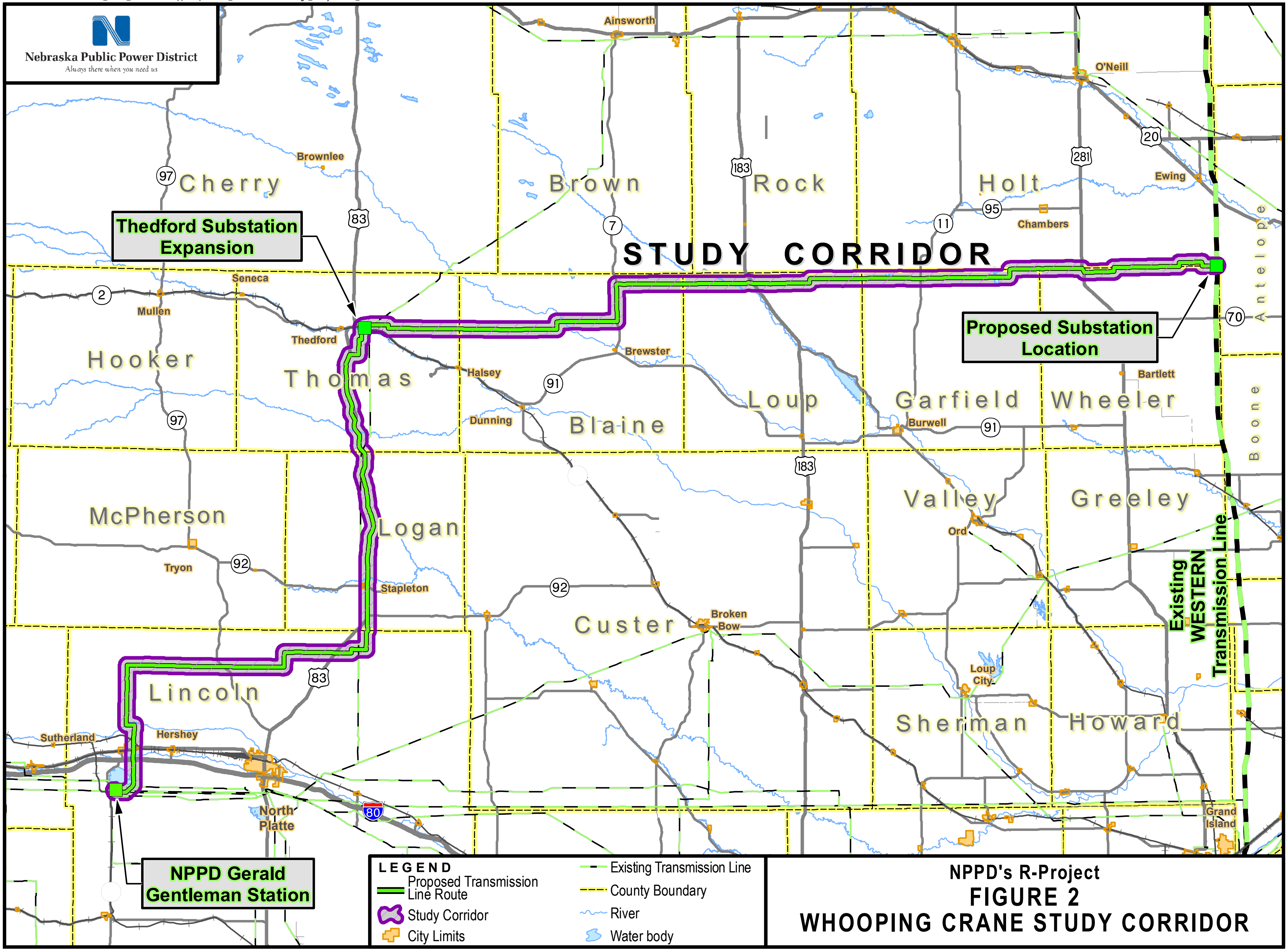
4.2 Potentially Suitable Habitat Components

The components for wetlands to be used by whooping cranes during migration are provided in Table 1. These habitat components are described in general terms here and will be described in greater detail in Sections 4.4 and 4.5.

TABLE 1 POTENTIALLY SUITABLE HABITAT COMPONENTS

HABITAT COMPONENT	DEFINITION
Wetland Size	Greater than 0.25 acre; larger than 7.0 acres preferred.
Open sight lines	No visibility obstructions, including slopes, within 328 feet.
Limited human disturbances	No human disturbances within specified distances from habitat.
Suitable water regime	Maintains water during migratory season. Preferably permanent/perennial, intermittently exposed, or semi-permanently flooded.
Close proximity to food source	Row crop agriculture within 0.93 mile.
Wetland type	Natural wetland preferred over manmade or highly modified wetland.
Wetland complexes	Several wetlands grouped close to one another with no obstruction in between.

Date: 2/2/2015 Path: W:\128143_NPPD_SPP\DD\GIS\Apps\Reports\WC_HabitatAssessment\Fig2_StudyCorridor_8x11.mxd



NPPD's R-Project
FIGURE 2
WHOOPING CRANE STUDY CORRIDOR

4.3 Available GIS Data

GIS software (ArcMap) was used to analyze available GIS data for the Whooping Crane Study Corridor. Table 2 identifies the available GIS data that were used in the Initial and Secondary Analyses.

TABLE 2 AVAILABLE GIS DATA USED IN ANALYSES

GIS RESOURCE DATA	SOURCE	ANALYSIS STEP
Aerial photography (aerial interpretation of surface waters)	Westwood Imagery 2013	Initial Analysis
Wetland polygons (wetland size, type, water regime, density, and manmade vs. natural)	USFWS National Wetland Inventory 2011	Initial and Secondary Analysis
Hydric soils (used with NWI to identify wetlands)	NRCS	Initial Analysis
Open and surface water (lakes, rivers and streams)	National Hydrography Dataset	Initial Analysis
Slope (visibility obstruction)	Digital Elevation Model – auto classification from aerial photograph terrain model	Initial Analysis
Disturbances (roads, dwellings, railroads, commercial developments, bridges, etc.)	Aerial interpretation (residences, commercial developments, and bridges). Transportation data - Nebraska Department of Natural Resources (roads, railroads), aerial photography, ground-based survey.	Initial Analysis
Cropland (food source)	Aerial Interpretation and Landfire data	Secondary Analysis

4.4 Initial Analysis

Analysis of potentially suitable habitat for whooping cranes was limited to the Whooping Crane Study Corridor. A GIS based desktop wetland layer was developed utilizing aerial photographs, USFWS NWI polygons, NRCS hydric soil polygons, open water/surface water data from USGS National Hydrography Dataset (NHD), and rivers/streams digitized from detailed aerial imagery. Only soils identified as "all hydric" were utilized for inclusion in the analysis. Partially hydric soils in the Whooping Crane Study Corridor have varying percentages of hydric soils, with the majority of the polygons less than five percent hydric. Following development of the desktop wetland layer, the Initial Analysis determined if identified wetlands met the requirements for size, visibility obstructions, and disturbance to qualify as potentially suitable habitat that were carried forward to Secondary Analysis.

4.4.1 Wetland Size

Wetlands larger than 2.5 acres are optimal for whooping crane stopover habitat; however, smaller wetlands are used (Watershed Institute, Inc. 2013). Armbruster (1990) concluded that a wetland equal to or less than 0.25 acre is not potentially suitable habitat. Therefore, the initial analysis eliminated all wetlands within the Whooping Crane Study Corridor that are equal to or less than 0.25 acre in size.

4.4.2 Visibility Obstruction

Visibility obstructions can be any feature greater than 4.6 feet in height (height at crane eye level) and can include vegetation, buildings, and topography. Potentially suitable habitats do not have visibility obstructions within 328 feet (Armbruster 1990). Wetlands not eliminated in the above step were evaluated for obstructions within 328 feet using GIS. If wetlands were identified as palustrine scrub-shrub (vegetation is less than 20 feet tall) or forested wetlands (vegetation equal to or greater than 20 feet tall; possible along streams. rivers or lakes), those areas were determined to have vegetation visibility obstructions and were eliminated. Any wetlands with manmade visibility obstructions, such as buildings within 328 feet were also eliminated.

Tall vegetation was not included in the visibility obstruction analysis due to a lack of sufficient data. Existing vegetation data, such as LandFire landcover data, did not provide sufficient detail to identify tall vegetation.

The TWI method includes an analysis of topography surrounding potential roost sites. The TWI method considers topography to be a visibility obstruction when the average slope is greater than 1.5 percent within 328 feet of the roost site (Watershed Institute 2013). During draft development of the current habitat assessment, it was determined that inclusion of slopes greater than 1.5% within 328 feet eliminated a substantial portion of potentially suitable habitat. Given the rolling terrain nature of the Sandhills, it was decided that a slope analysis would not be included in this habitat assessment.

4.4.3 Disturbance

Whooping crane-specific data regarding the species reaction to various human disturbances are limited. However, sandhill crane (*Grus canadensis*) responses to human activities have been documented (Armbruster 1990). Given the similarities between whooping cranes and sandhill cranes, the TWI method uses the sandhill crane as a surrogate species with regard to human disturbances. Table 3 identifies types of disturbance and distance from the disturbance assumed to influence potentially suitable habitat. Wetlands were analyzed for proximity to human disturbances described in Table 3.

TABLE 3 TYPES OF DISTURBANCE AND DISTANCE FROM AFFECTED AREA ASSUMED TO INFLUENCE ROOSTING SITES[1]

TYPE OF DISTURBANCE	WIDTH OF AFFECTED AREA (FEET)
Paved Road	1,312
Gravel Road	656
Private Road	328
Urban Dwelling[2]	2,625
Single Dwelling	656
Railroad	1,312
Commercial Development	2,625
Recreational Area[3]	656
Bridges	1,312

Notes:
1. Watershed Institute, Inc. 2013.
2. An urban dwelling is a residence located in an area characterized by a higher population density/human features in comparison to the areas surrounding it (i.e., a town, city, or community).

3. A recreational area is classified as any park, picnic area, river access site, etc. where concentrated human activity occurs related to recreation.

Roads in the Whooping Crane Study Corridor were identified from county-based road databases. Paved roads included those categorized as paved or bituminous surface. Gravel roads will include those categorized as gravel, one-lane oil, dirt, or minimum maintenance surface. Private roads are those categorized as driveways. Other road categories in the county-based road databases include primitive, trail, and unimproved. These categories were not included in the analysis because they do not represent actual roads in the Whooping Crane Study Corridor and are not frequently traveled.

Disturbance buffers were created in GIS for each type of disturbance according to the distances provided in Table 3. Wetlands located within the disturbance buffers were not considered potentially suitable habitat and were eliminated from the analysis. If any wetlands were partially within the disturbance buffers, the portion of those wetlands within the disturbance buffers was removed from consideration as suitable habitat. The area of the remaining portion of wetlands that did not fall within disturbance buffers was recalculated and analyzed further if greater than 0.25 acre in size (see Section 4.4.1).

4.5 Secondary Analysis

Wetlands meeting Initial Analysis criteria were analyzed further to score potentially suitable habitat in the Secondary Analysis. Wetland habitat criteria considered in the Secondary Analysis are water regime, distance to food, additional wetland size criteria, natural wetland habitat, and wetland density. Each habitat criteria was assigned a value resulting in a habitat score for wetlands. Wetlands with higher scores indicate a higher suitability for whooping crane use.

4.5.1 Water Regime

Palustrine and lacustrine wetlands that maintain permanent/perennial water, are intermittently exposed, or are semi-permanently flooded have been identified as preferred whooping crane stopover habitat (Armbruster 1990). Table 4 scores wetlands based on these water regimes. NWI water regime data for each wetland was reviewed and a rating was assigned according to Table 4.

TABLE 4 WATER REGIME HABITAT SCORE[1]

WATER REGIME[2]	SCORE
Permanent	5
Intermittently Exposed	4
Semi-Permanent	3
Seasonally Flooded	2
Intermittent/Temporarily Flooded	1

Notes:
1. Watershed Institute, Inc. 2013.
2. Cowardin et al. 1979.

The water regime classifications identified above are derived from Cowardin et al. (1979) and are typically included in NWI data. However, potentially suitable habitat analyzed includes data from the NHD waterbodies, rivers and streams, and soils classified as “all hydric”, which do not include the Cowardin et al. classifications. In these instances, polygons consisting of NHD waterbodies and rivers and streams were assigned a water regime of “permanent”, and polygons derived from the “all hydric” soils will be assigned a water regime of “intermittent/temporarily flooded”.

4.5.2 Proximity to Food Source

Whooping cranes prefer roost sites that are located near food sources (cropland). Armbruster (1990) found that a food source within 0.93 mile from roosting sites provide optimal conditions for whooping cranes. Each wetland was evaluated for its proximity to cropland. The distance from each wetland area to cropland was measured and a score was assigned according to Table 5. For the purposes of this analysis, any mechanized irrigation (i.e., pivots) or dry-land farmed row-crops was considered a potential food source.

TABLE 5 PROXIMITY TO FOOD HABITAT SCORE[1]

DISTANCE TO FOOD SOURCE (MILES)	SCORE
Within or Adjacent to Cropland	5
<0.31	4
0.32-0.62	3
0.62-0.93	2
>0.93	1

Note:
1. Watershed Institute, Inc. 2013.

4.5.3 Wetland Size

Whooping cranes have been observed utilizing wetlands of varying sizes. However, Armbruster (1990) identified the preferred wetland size as being greater than 7.8 acres as larger wetlands provide greater distances from disturbances located onshore. Additionally, Armbruster (1990) concluded that the probability of a suitable roost site was higher for wetlands greater than 2.5 acres in size. The area for each wetland was calculated using GIS. A score for wetland size was then assigned to each wetland according to Table 6. Note that wetlands smaller than 0.25 acre were removed from consideration as potentially suitable habitat under the Initial Analysis in Section 4.4.1.

TABLE 6 WETLAND SIZE HABITAT SCORE[1]

WETLAND SIZE (ACRES)	SCORE
>7.0	5
5.0 - 6.9	4
3.0 - 4.9	3
1.0 - 2.9	2
0.25-1.0	1

1. Watershed Institute, Inc. 2013.

4.5.4 Natural Wetlands

Studies indicate that man-made palustrine wetlands, stock ponds, and other man-made water features do not maintain quality whooping crane roosting habitat due to the proximity to human disturbances, water depths being too deep for adequate shallow areas, and steeper slopes adjacent to the features creating visibility obstructions (Stahlecker 1997). Therefore, natural wetlands are thought to be preferred roosting habitats to man-made wetlands. NWI data provide modifiers for wetlands such as “diked/impounded” and “excavated” that indicate a wetland is man-made or substantially altered by man. All polygons derived from NHD, rivers and streams, and the “all hydric” soils data were classified as "natural" for scoring purposes. A score was then assigned to each wetland according to Table 7.

TABLE 7 NATURAL WETLAND HABITAT SCORE[1]

WETLAND TYPE	SCORE
Natural	2
Man-made	0

Note:
1. Watershed Institute, Inc. 2013.

4.5.5 Wetland Density

As previously stated, whooping cranes have been documented to prefer large wetlands and wetland complexes as they provide less visibility obstruction, typically have perennial surface water, and less human disturbance. For the purposes of this methodology, wetland complexes were defined as five or more wetlands located within a one-quarter section without identified visual obstructions between the wetlands (Watershed Institute, Inc. 2013). A wetland density score was then assigned to each wetland according to Table 8.

TABLE 8 WETLAND DENSITY HABITAT SCORE[1]

WETLAND COMPLEX	SCORE
Yes	3
No	0

Note:
1. Watershed Institute, Inc. 2013.

4.5.6 Total Habitat Quality Score

The Watershed Institute (2013) utilized the Quivira National Wildlife Refuge in central Kansas as a reference location for assessing potentially suitable habitat. Quivira National Wildlife Refuge is a traditional migratory stopover wetland and federally designated critical habitat for whooping cranes. The Watershed Institute concluded that total habitat scores of 12 or higher were considered potentially suitable habitat after analyzing approximately 500 wetland features at Quivira National Wildlife Refuge (Watershed Institute, Inc. 2013).

The habitat scores from the Secondary Analysis were totaled for a possible maximum score of 20. Wetlands scoring between 13 and 20 (Table 9) were considered potentially suitable habitat for whooping cranes (Watershed Institute, Inc. 2013). A wetland score of 13 was the mean Secondary Analysis score from all analyzed wetlands.

TABLE 9 WETLAND HABITAT QUALITY SCORE

TOTAL HABITAT SCORE	POTENTIALLY SUITABLE HABITAT?
13 - 20	Yes
0 - 13	No

5.0 RESULTS

A one-mile buffer was placed around the potentially suitable habitat identified to determine which portions of the transmission line require marking based on the Region 6 Guidance. Based on results of this analysis, a total of 113 miles of the R-Project falls within one mile of potentially suitable habitat. However, NPPD's local knowledge of the R-Project landscape along with further conversation with USFWS and NGPC identified additional portion of the R-Project which will be marked. In total, NPPD has identified 124 miles of the R-Project in close proximity to whooping crane potentially suitable habitat. The R-Project will comply with the Region 6 Guidance by marking all portions of the transmission line within one mile of potentially suitable habitat (124 miles). However, the R-Project will go one step further in the avoidance and minimization of whooping crane impacts and mark all 226 miles of the completed transmission line. To comply with the Region 6 Guidance, NPPD will place bird flight diverters on 124 miles of existing power lines in the migration corridor.

6.0 LITERATURE CITED

Armbruster, M.J. and Farmer, A.H. 1981. Draft Sandhill Crane Habitat Suitability Index Model. Pages 136-143 in J.D. Lewis, ed. Proceedings to the 1981 Crane Workshop. National Audubon Society. Tavernier, Florida.

Armbruster, M.J. 1990. Characterization of habitat used by whooping cranes during migration. U.S. Fish and Wildlife Service. Biol. Rep. 90(4). 16pp.

Austin, J.E. and A.L. Richert. 2005. Patterns of habitat use by whooping cranes during migration: summary from 1977-1999 site evaluation data. Proceedings of the North American Crane Workshop. 9:79-104.

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C.

Belaire, J.A., B.J. Kreakie, T. Keitt, and E. Minor. 2013. Predicting and Mapping Potential Whooping Crane Stopover Habitat to Guide Site Selection for Wind Energy Projects. Conservation Biology, Volume 28. No. 2, 541-550.

Brown, W.M., R.C. Drewien, and E.G. Bizeau. 1987. Mortality of cranes and waterfowl from power line collisions in the San Luis Valley, Colorado. Pages 128–136 in J. C. Lewis, editor. Proceedings of the 1985 Crane Workshop. Platte River Whooping Crane Habitat Maintenance Trust, Grand Island, Nebraska, USA.

Canadian Wildlife Service (CWS) and U.S. Fish and Wildlife Service (USFWS). 2007. International recovery plan for the whooping crane. Ottawa: Recovery of Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 162 pp.

Cowardin, L.M., Carter, V.M., Golet, F.C., and LaRoe, E.T. 1979. Classification of Wetlands and Deepwater Habitats in the United States. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-79/31. 103 pages.

Howe, M.A. 1987. Habitat used by migrating whooping cranes in the Aransas – Wood Buffalo corridor. Pages 303 – 311 in J.C. Lewis, ed. Proc. 1985 crane workshop. Platte River Whooping Crane Habitat Maintenance Trust. Grand Island, NE.

_____. 1989. Migration of radio-marked whooping cranes from the Aransas – Wood Buffalo population: patterns of habitat use, behavior, and survival. U.S. Fish and Wildlife Service Technical Report 21. pp 33.

Kauffeld, J.D. 1981. Management of migratory whooping crane habitat on Alamosa and Monte Vista National Wildlife Refuges. Pages 117 – 121 in J. C. Lewis, ed. Proc. 1981 crane workshop. National Audubon Society. Tavernier, FL.

Morkill, A.E. and S.H. Anderson. 1991. Effectiveness of Marking Powerlines to Reduce Sandhill Crane Collisions. Wildlife Society Bulletin, Vol. 19, No. 4 (Winter, 1991), pp. 442-449.

Nebraska Game and Parks Commission (NGPC). 2013. Nebraska Natural Heritage Program data export. Lincoln, Nebraska. Received April 29, 2013.

Nebraska Game and Parks Commission, and U.S. Fish and Wildlife Service (NGPC and USFWS). 2012. Wind energy and Nebraska's wildlife: Avian assessment guidance for wind energy facilities. February 2012.

Nebraska Wind and Wildlife Working Group. 2013. Guidelines for Wind Energy and Wildlife Resource Management in Nebraska. March 2013.

Pearse, A.T., K.L. Metzger, D.A. Brandt, M.T. Bidwell, M.J. Harner, D.M. Baasch, and W. Harrell. 2020. Heterogeneity in migration strategies of Whooping Cranes. The Condor. Ornithological Applications. 122:1-15.

Stahlecker, D.L. 1997. Availability of Stopover Habitat for Migrant Whooping Cranes in Nebraska. In Proceedings of the North American Crane Workshop 10:25-36.

Stantec Consulting Services Inc. (Stantec). 2014. Whooping Crane Desktop Stopover Risk Assessment, Grande Prairie Wind Farm, Holt County, Nebraska. April, 2014.

Stehn, T.V. and C. Strobel. 2011. An update on mortality of fledged whooping cranes in the Aransas/Wood Buffalo population. Proceedings of the North American Crane Workshop. 12:43-50.

Stehn, T.V. and T. Wassenich. 2008. Whooping crane collisions with power lines: an issue paper. Proceedings of the North American Crane Workshop. 10:25-36.

Tetra Tech EC, Inc. 2010. Whooping Crane Likelihood of Occurrence Report: Cimarron Wind Energy Project – Phase 1 Gray County, Kansas.

_____. 2009. Whooping Cranes and Wind Development – An Issue Paper. U.S. Fish and Wildlife Service, Regions 2 and 6. 27 pages.

_____. 2010. Region 6 Guidance for Minimizing Effects from Power Line Projects Within the Whooping Crane Migration Corridor.

U.S. Fish and Wildlife Service. 2023. Whooping Crane Survey Results: Winter 2022-2023.

Watershed Institute, Inc. 2013. Potentially Suitable Habitat Assessment for the Whooping Crane (*Grus americana*).

APPENDIX C R-PROJECT WHOOPING CRANE MORTALITY RISK ASSESSMENT

December 15, 2023

NEBRASKA PUBLIC POWER DISTRICT

R-Project

Whooping Crane Risk Analysis Review

This page intentionally left blank.

Whooping Crane Risk Analysis Review

PREPARED FOR: *NEBRASKA PUBLIC POWER DISTRICT*

This page intentionally left blank.

TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 2018 ANALYSIS 5
3.0 REASONABLY CERTAIN KNOWLEDGE ANALYSIS 7
4.0 WEST ANALYSIS 9
5.0 UNCERTAINTY 10
6.0 LITERATURE CITED 12

TABLES:

TABLE 1 KNOWN WHOOPING CRANE MIGRATION MORTALITY IN THE UNITED STATES 2

ATTACHMENTS:

ATTACHMENT 1 R-PROJECT WHOOPING CRANE RISK EVALUATION MODEL UPDATE FOR EVALUATING POTENTIAL IMPACTS TO WHOOPING CRANES

ACRONYMS AND ABBREVIATIONS

%	percent
APLIC	Avian Power Line Interaction Committee
DOJ	Department of Justice
HCP	Habitat Conservation Plan
kV	Kilovolt
NPPD	Nebraska Public Power District
NWR	National Wildlife Refuge
RCK	Reasonably Certain Knowledge
USFWS	United States Fish and Wildlife Service
WEST	Western EcoSystems Technology, Inc.

1.0 INTRODUCTION

As stated in the R-Project Habitat Conservation Plan (HCP), Nebraska Public Power District (NPPD) examined three separate analyses to evaluate the likelihood of a whooping crane take from collision with the R-Project. A summary of these analyses is included in Section 4.1.2 of the HCP. Expanded descriptions of the methods, variables, and assumptions applied for each analysis are provided below.

Note that the 2018 analysis (Section 2.0) was not updated for this effort and is provided as a summary of previous whooping crane risk analyses. The 2018 analysis was not updated for the current HCP because it begins with total known whooping crane mortalities reported by Stehn and Haralson-Strobel (2014), and that document has not been updated with a more recent publication that uses the same or similar methodology for counting and reporting total whooping crane mortalities.

NPPD has updated the "Reasonably Certain Knowledge" analysis originally prepared by the U.S. Fish and Wildlife Service (USFWS) (Section 3.0) with the most recent information regarding whooping crane mortalities that occurred during migration. NPPD also engaged Western EcoSystems Technology, Inc. (WEST) to develop a different approach to analyzing the whooping crane risk, which also used the most recent information available regarding whooping crane migration mortalities. A summary of all known or assumed whooping crane power-line mortalities that occurred during migration is provided in Table 1.

Previously, it was assumed that two power-line collisions occurred in Nebraska; however, USFWS reviewed these occurrences and determined that a potential collision in 1988 did not meet the definition of a confirmed whooping crane sighting (M. Rabbe, personal communication, email March 20, 2023). That data point was removed from the analysis.

TABLE 1 KNOWN OR ASSUMED WHOOPING CRANE MIGRATION MORTALITY IN THE UNITED STATES

YEAR	DATE	MIGRATION PERIOD	LOCATION	AGE[1]	RECOVERED	REPORTED CAUSE OF DEATH	CLASSIFIED CAUSE OF DEATH	COMMENTS/SOURCE
KNOWN POWER-LINE COLLISIONS								
1956	May	Spring migration	Lampass City, Texas	SA	Yes	Power line	Power line (transmission)	Transmission line,[2] broken wing tip[3]
1965	Nov	Fall migration	Rawlins City, Kansas	SA	Yes	Power line	Power line (distribution)	Distribution (3 wire)[2,3]
1967*	Apr	Spring migration	Russell City, Kansas	A	Unknown	Power line	Power line (distribution)	Distribution (3 wire)[2]
1982	Oct	Fall migration	Oglesby, Texas	A	Yes	Power line	Power line (distribution)	Distribution (4 wire, <8 m)[2, 3]
1984	Oct	Fall migration	Linton, North Dakota	A	Yes	Power line	Power line (unknown type)	Male with multiple fractures in wing, captured but later died Jan 1985, aspergillosis, and partial paralysis from running into captive fence during handling[3]
1989	Oct	Fall migration	Stratton, Nebraska	SA	Yes	Power line	Power line (distribution)	Distribution (12 kv);[2] flew into 2-wire transmission line, found dead[3]
2002	Apr	Spring migration	De Leon, Texas	A	Yes	Power line	Power line (distribution)	Distribution[2] power-line strike[3]
2020	23 Apr	Spring migration	Mountrail County, North Dakota	Juv	Yes	Power line	Power line (transmission)	Radio telemetry, appeared to have struck a transmission line the night of 20 April 2020[4]

YEAR	DATE	MIGRATION PERIOD	LOCATION	AGE[1]	RECOVERED	REPORTED CAUSE OF DEATH	CLASSIFIED CAUSE OF DEATH	COMMENTS/SOURCE
KNOWN POSSIBLE POWER-LINE COLLISION								
1952	Oct	Fall migration	Sharon, Kansas	A	Yes	Unknown	Possible power line	Had dislocated wing, died in route to San Antonio Zoo[3]
KNOWN NON-POWER-LINE MORTALITY								
1955	Fall	Fall migration	Sioux Falls, South Dakota	A	Unknown	Shot	Non-power line	Snow goose hunter[3]
1982	Jun	Spring migration	Minton, South Dakota	Unknown	Yes	Aircraft	Non-power line	Feathers identified on military tanker aircraft[3]
1991	Apr	Spring migration	Bend, Texas	A	Yes	Shot	Non-power line	Shot[3]
2003	Nov	Fall migration	Dallas, Texas	A	Yes	Shot	Non-power line	Shot[3]
2004	Nov	Fall migration	Quivira NWR, Kansas	SA	Yes	Shot	Non-power line	Had a leg amputated, died in captivity 9 Nov[3]
2004	Nov	Fall migration	Quivira NWR, Kansas	SA	Yes	Shot	Non-power line	Second bird had a fractured humerus repaired, died due to complications mid-Nov[3]
2005	Dec	Fall migration	Missouri	Juv	Yes	Bacterium	Non-power line	Bacterium obstructing the larynx[3]
2007	7 Apr	Spring migration	North Dakota	A	Yes	Collision	Non-power line	Collision with a blunt object;[3] sighting database states "died in flight, fell to ground"
2011	8 Nov	Fall migration	Kansas	Juv	Yes	Unknown	Non-power line	No necropsy was attempted, no direct or indirect evidence of power line collision[5]
2012	Apr	Spring migration	Hand County, South Dakota	A	Unknown	Shot	Non-power line	Shot by a hunter near Miller, SD[6]
2013	8 Apr	Spring migration	South Dakota	A	Yes	Predation	Non-power line	Predation[5]
2021	Dec	Fall migration	Kiowa County, Oklahoma	A	Yes	Shot	Non-power line	Discovered by hunters near Tom Sneed Lake; died in transport to veterinary clinic[8]
2021	Dec	Fall migration	Kiowa County, Oklahoma	A	Yes	Shot	Non-power line	Evidence discovered while investigating the location of the original injured crane[8]

YEAR	DATE	MIGRATION PERIOD	LOCATION	AGE[1]	RECOVERED	REPORTED CAUSE OF DEATH	CLASSIFIED CAUSE OF DEATH	COMMENTS/SOURCE
2021	Dec	Fall migration	Kiowa County, Oklahoma	A	Yes	Shot	Non-power line	Evidence discovered while investigating the location of the original injured crane[8]
2021	Dec	Fall migration	Kiowa County, Oklahoma	A	Yes	Shot	Non-power line	Evidence discovered while investigating the location of the original injured crane[8]
2022	Apr	Spring migration	South Dakota	A	Yes	Trap	Non-power line	Bird caught in a muskrat trap.
2022	Nov	Fall migration	South Dakota	A	Yes	Infected Transmitter	Non-power line	GPS transmitter cause infection in leg. Bird died in South Dakota during fall migration.[9]
ASSUMED MORTALITIES								
1957	Oct	Fall migration	Ketchum, Oklahoma	A	No	Trauma	Possible power line	Crippled bird seen, then was lost from sight[3]
1998	Nov	Fall migration	Quivira National Wildlife Refuge (NWR), Kansas	A	No	Broken leg	Possible power line	Last seen with broken leg; mate appeared at Aransas NWR without her[3]
2004	Nov	Fall migration	Quivira NWR, Kansas	SA	No	Shot	Non-power line	Shot at, red spot seen on breast, not captured, stayed in area and was last observed in Dec; assumed mortality[3]
2012	23 Nov	Fall migration	Nebraska	Juv	No	N/A	Non-power line	Mortality suspected, not confirmed; no direct or indirect evidence of power line collision[7]

*Reported as 1968 in Stehn and Haralson-Strobel (2016)
[1] A = Adult, Juv = Juvenile, SA = Subadult.
[2] Stehn and Wassenich (2008)
[3] Stehn and Haralson-Strobel (2014)
[4] Harrell and Bidwell (2020)
[5] U.S. Fish and Wildlife Service Nebraska Ecological Services Field Office Whooping Crane Database
[6] U.S Department of Justice (2013)
[7] Pearse et al. (2019)
[8] Godfrey (2022)
[9] USFWS (2023)

2.0 2018 ANALYSIS

In the 2018 Analysis, NPPD first considered the 10 whooping crane power line mortalities that were known at that time to have occurred within the Aransas-Wood Buffalo population since 1956, proportionally expanded to account for unknown mortalities as described in the next section below. In light of the physical differences between transmission and distribution lines and the differences in their respective prevalence on the landscape, NPPD used only transmission line data to estimate the risk for the R-Project. However, the inclusion of distribution lines in the evaluation would not materially change the outcome because the proportion of collision mortalities to miles of distribution line is roughly the same as collision mortalities to miles of transmission line.

NPPD estimated in 2018 that there were approximately 326,000 miles of power lines (transmission and distribution) within the migration corridor in the United States. Out of these 326,000 miles, approximately 34,000 miles were transmission lines, and 292,000 were distribution lines. For the 2018 Analysis, transmission lines were defined as those power lines with a voltage greater than or equal to 115 kilovolts (kV).

According to Stehn and Haralson-Strobel (2014), the total mortality in the Aransas-Wood Buffalo population between 1950 and 2010 was 546 (taken from the text; note that Table 1, in Stehn and Haralson-Strobel indicates 541 total mortalities). Only 50 of these 546 deaths, or 9.2%, identified cause of mortality, as the majority of birds that disappear from the Aransas-Wood Buffalo population are completely unaccounted for (Stehn and Haralson-Strobel 2014). It has been reported that 80% of mortality occurs off the wintering grounds and likely occurs during migration (Lewis et al. 1992; Stehn and Haralson-Strobel 2014). However, the satellite tracking study indicates that this past assumption is incorrect and that mortality is proportional to the whooping crane's life cycle (Pearse et al. 2018).

The whooping crane is in migration approximately 17% of the year (USFWS 2009). Thus, in the 2018 Analysis, the number of mortalities that occurred during migration was estimated at 93 (17% of 546). The analysis of mortality in Pearse et al. (2018) indicates that approximately 15% of mortality occurs during migration, confirming this assumption.[1] Out of the 50 recovered carcasses known at the time of 2018 Analysis, 28 occurred during migration (Stehn and Haralson-Strobel 2014). Out of those 28, one was reported to be caused by collision with a transmission line (Stehn and Haralson-Strobel 2014). In other words, approximately 3.6% of identified mortalities during migration could be attributed to transmission lines. Applying this ratio to the 93 estimated mortalities during migration, it was estimated approximately four whooping cranes (rounded up from 3.3) collided with transmission lines in the migratory corridor in the United States and Canada between 1956 and 2016.[2] Although only 80% of the known power line collisions occurred in the United States (8 out of the 10), NPPD assumed all four estimated collisions with transmission lines occurred in the United States. This equated to 0.067 crane collisions with transmission lines per year (estimated four collisions over the 60-year period from 1956 to 2016).

---

[1] Note that the use of 17% mortality during migration is conservative, as the use of 15%, as indicated in tracking study would have resulted in 82 estimated mortalities during migration, three whooping cranes colliding with transmission lines in the migratory corridor in the United States and Canada since 1956, 0.05 crane collisions with transmission lines per year, a risk of 0.00000147 crane per mile per year, a risk of 0.00033 cranes per year for the R-Project, and 0.017 cranes per the 50-year project life.

[2] Although the data set in Stehn and Haralson-Strobel (2014) was from 1950 to 2010, the first reported collision with a transmission line occurred in 1956, and no additional whooping crane collision with a power line occurred between 2010 and the 2018 Analysis. NPPD conservatively used a 60-year period to estimate the annual crane-transmission line collision rate, even though it could have used the period from 1950 to 2018, which would have reduced the per-mile risk per year.

NPPD evaluated the number of collisions compared to the number of miles of transmission line. As noted above, there are approximately 34,000 miles of 115 kV and above transmission line within the United States portion of the Aransas-Wood Buffalo population migratory corridor. If it is assumed that all of these transmission lines have an equal probability of collision, the per-mile risk of mortality would be 0.00000197 crane per mile per year (0.067 cranes per year divided by 34,000).

In the 2018 Analysis, NPPD recognized it is unlikely that all of the 34,000 estimated miles of power line pose a similar level of threat to the crane. NPPD is aware of several different efforts to model whooping crane habitat in the flyway relative to the probability of use. However, due to the very limited number of documented mortalities on any overhead lines and the fact they are widespread, both temporally and spatially, and do not appear to be related to areas with frequent use (Stehn and Wassenich 2008), it is difficult to envision how even a model that accurately predicts probability of use could predict probability of collision. Therefore, NPPD did not attempt to create a habitat model that would predict probability of use due to the apparent lack of correlation between whooping crane habitat use and collisions. For this reason, NPPD used the entire 34,000 miles of 115 kV and above transmission line, rather than a subset of transmission lines in areas with whooping crane habitat. To justify the use of all transmission lines in its analysis, NPPD completed a high-level analysis of miles of transmission line within one mile of a National Wetland Inventory wetland. Nearly all miles of transmission line within the whooping crane migratory corridor are within one mile of a National Wetland Inventory wetland. Wetlands were not screened for habitat suitability during this high-level analysis.

For the R-Project as proposed in 2018, 225 miles of new transmission line would be constructed in the Aransas-Wood Buffalo population migratory corridor.[3] Applying methodology from above (using all 34,000 miles of 115 kV and above transmission line) to the 225-mile R-Project would equate to a risk of 0.00044 crane per year (225 x 0.00000197) or 0.022 crane per the 50-year project life (0.00044 x 50). This does not take into account the risk reduction achieved through line marking, which is identified as 50% to 80% in the Region 6 Guidance and Avian Power Line Interaction Committee (APLIC) (2012).

Because NPPD recognizes that not all transmission lines present a collision hazard to whooping cranes, the 2018 Analysis was also run assuming that only 50% and 10% of the transmission lines in the whooping crane migratory corridor present a collision hazard to whooping cranes.[4] Note that in these additional analyses, the estimated crane collisions per year remains constant, but the miles of transmission line that present a risk is reduced. This analysis shows that even if only a small portion of all transmission lines present a collision risk, and all reaches of the R-Project are within that group, the estimated collisions with the R-Project over a 50-year period is still very small. This additional analysis is summarized below:

- 50% analysis (50% of transmission lines present a collision risk)
    - 0.067/17,000 = 0.0000039 collision/mile/year
    - 0.0000039*225*50 = 0.044 estimated collisions with the R-Project in 50-year period

- 10% analysis (10% of transmission lines present a collision risk)
    - 0.067/3400=0.0000197 collision/mile/year

[3] Note that, at the time of the 2018 Analysis, the R-Project was proposed to be 225 miles. The current estimated length of the R-Project is 226 miles. However, the addition of one mile of transmission line would not affect the calculated outcome of the 2018 Analysis.
[4] Considering the amount of suitable habitat in the whooping crane migratory corridor, it is highly unlikely that 90% of existing transmission lines pose no collision risk.

- 0.0000197*225*50 = 0.22 estimated collisions with the R-Project in 50-year period

3.0 REASONABLY CERTAIN KNOWLEDGE ANALYSIS

In order to address the scarcity of whooping crane collision data, numerous risk analyses proposed by various parties, and differing assumptions, the USFWS developed the "Reasonably Certain Knowledge" (RCK) analysis in 2018, which identified data that were reasonably certain and other best available information, to analyze the risk of whooping crane collision for the R-Project. The 2018 RCK analysis concluded that, even if bird flight diverters were only 15% effective, there would be less than a 50% chance of at least one whooping crane striking the R-Project over its 50-year life. The 2018 RCK analysis was included in the document *A Review and Critique of Risk Assessments Considered by the United States Fish and Wildlife Service Regarding the Collision Risk for Whooping Cranes with NPPD's R-Project* (USFWS 2019).

NPPD has updated the 2018 RCK analysis with current (as of December 2023) whooping crane information that has been recorded since the original was developed in 2018. A summary of the Updated RCK analysis is provided below. The Updated RCK analysis takes into account the following variables relating to the Aransas-Wood Buffalo whooping crane population to provide an estimated annual and mortality from the R-Project:

- Estimated average population over the 50-year life of the Project: 1,500 whooping cranes
- Estimated annual migration mortality in the United States from all causes: 0.9483%
- Estimated proportion of migration mortality that results from power lines: 36.67%
- Number of identified power-line mortality: 8 individuals
- Number of known and assumed power-line mortality (includes unidentified trauma): 11 individuals
- Estimated proportion of the power-line mortality during migration that may occur in Nebraska: 9.09%
- Estimated proportion of powerline strikes that occur on transmission lines: 27.27%

<u>Average population</u>: Like the 2018 RCK analysis, the Updated RCK analysis assumes a 4% population growth over the next 50 years based on available data. This population was then averaged to estimate an annual Aransas-Wood Buffalo population of 1,500 cranes throughout the 50-year life of the R-Project.

<u>Estimated annual migration mortality in the United States</u>: Of these 1,500 whooping cranes, the annual post-fledge mortality rate is 10.9%, with 17.4% of those mortalities coming during migration (Kuyt 1992; Pearse et al. 2018). Approximately 50% of the time spent during whooping crane migration is in the United States (Pearse et al. 2020). Using these reasonably certain metrics, 0.9483% of the Aransas-Wood Buffalo population dies each year during migration in the United States (10.9% x 17.4% x 50% = 0.9483%). Based on this annual migration mortality percentage in the United States and estimated annual population over the next 50 years, an average of 14.2245 whooping cranes (1,500 x 0.009483 = 14.2245) will die during migration each year in the United States throughout the 50-year life of the R-Project.

<u>Estimated proportion of migration mortality that results from power lines</u>: There have been 30 known or assumed whooping crane mortalities in the United States during migration from 1952 through the spring of 2023 (Table 1). Of these 30 instances, eight were identified as powerline strikes, and an additional three were not specifically identified as powerline strikes but exhibited injuries that could have been due to collision with a power line. The Updated RCK analysis assumes that all three are line strikes for a total

of 11 assumed power-line mortalities during migration. Accordingly, approximately 36.67% of all known migration mortalities may be attributed to power lines (11 / 30 = 0.3667 or 36.67%). Multiplying the estimated percent of power line mortalities during migration by the estimated annual migration mortality results in average of 5.22 whooping cranes colliding with power lines each year during migration in the United States (14.2245 x 0.3667 = 5.2157).

Estimated proportion of the power-line mortality during migration that may occur in Nebraska: The Updated RCK analysis includes all known and assumed power line mortality (n=11), including those with injuries consistent with power-line collision, when estimating this parameter. The USFWS's original 2018 analysis used only those mortalities confirmed as a power-line mortality (n=8). This difference is one of interpretation, rather than new data, to remain consistent with the 36.67% of all known migration mortalities attributed to power lines as calculated above. Of the 11 known and assumed mortalities attributed to power-line collision in this analysis, one was documented in Nebraska (Stehn and Haralson-Strobel 2014; M. Rabbe, personal communication, email March 20, 2023) (1/11 = 0.0909 or 9.09%). This suggests that an average of approximately 0.4742 whooping crane collides with power lines in Nebraska each year (5.2157 x 0.0909 = 0.4742). Transmission lines (69 kV and higher) make up approximately 11% of all power lines throughout the whooping crane migratory corridor, but transmission lines may pose a higher collision risk than distribution lines.[5] The Updated RCK analysis assumes that one of the three mortalities attributed to power-line strikes (but of an unknown line type) was the result of a transmission line. This results in three transmission line strikes during migration (two documented and one assumed), resulting in 27.27% of collisions occurring on a transmission line (3/11=0.2727 or 27.27%). The Updated RCK analysis uses this transmission-line-collision ratio to estimate that an average of 0.1293 whooping cranes collide with a transmission line each year in Nebraska (0.4742 x 0.2727 = 0.1293).

Results: Because the R-Project would add 226 miles of transmission line in Nebraska, all of which are within the whooping crane migratory corridor, the R-Project would increase the length of transmission for collision in Nebraska by 4.7% (S&P Global 2021).[6] Under the Updated RCK analysis, if an average of 0.1293 whooping cranes may collide with a transmission line each year, then an average of 0.0061 whooping cranes may collide with the R-Project (0.1293 x 0.047 = 0.0061). When considered over the 50-year life of the transmission line, the Updated RCK analysis predicts that the R-Project may result in 0.3044 whooping crane collisions throughout the expected life of the project. This does not take into account the risk reduction achieved through line marking, which is identified as 50% to 80% in the Region 6 Guidance and APLIC (2012).

Line Marking: NPPD has committed to mark and maintain all 226 miles of the R-Project according to APLIC Guidelines (APLIC 2012), which goes beyond the Region 6 Guidance (see HCP Section 4.1.2). NPPD construction standards call for the placement of spiral bird flight diverters at 50-foot intervals alternating on opposite shield wires. This application is within the recommended spacing per APLIC (2012) and will increase protection against collision. The NPPD construction standard is based upon

[5] In the 2018 Analysis, transmission lines included lines that were 115 kV or higher. However, upon further investigation, NPPD determined that transmission lines include lines that are 69 kV or higher. For instance, the NERC Reliability Standards define transmission line to include those carrying "relatively high voltages varying from 69 kV up to 765 kV." *See* Glossary of Terms Used in NERC Reliability Standards, updated June 28, 2021, available at https://www.nerc.com/pa/Stand/Pages/USRelStand.aspx. SPP includes 69 kV lines in the 70,025 miles of transmission lines in its territory. *See* https://www.spp.org/Documents/31587/SPP101%20-%20An%20Introduction%20to%20SPP%20-%20All%20Slides%20PRINT.pdf. And the U.S. Energy Information Administration includes lines of 69 kV to 765 kV in its database of transmission lines. https://www.eia.gov/tools/faqs/faq.php?id=567&t=3. Thus, for the Updated RCK, transmission lines are defined to include lines of 69 kV or greater.

[6] There are currently 4,800 miles of 69 kV and above transmission line in Nebraska portion of the whooping crane migratory corridor (S&P Global 2021).

available information on the effectiveness of marker types, durability of markers, and the engineering constraints of the line.

Effectiveness of line marking devices intended to reduce avian collision varies based on local conditions and habitats but typically ranges from 50% to 80%. The Region 6 Guidance recognizes a 50% to 80% effectiveness in line marking. The effectiveness of marking is the subject of many studies, with most relevant studies referenced in APLIC (2012). Publications cited in APLIC (2012) studied some form of spiral bird flight diverters and recorded 60% to 80% reductions in mortalities and collision (see APLIC (2012) Table 6.8).

4.0 WEST ANALYSIS

In addition to updating the 2018 RCK model, NPPD contracted WEST to examine steps in the RCK analyses that were identified as not being reasonably certain. The result was a risk assessment that is similar to the RCK analyses but is simplified and can be applied to any transmission line within the 95% migratory corridor (not just those in Nebraska). The WEST analysis retains all the reasonably certain variables of the RCK analyses. However, unlike the RCK analyses the WEST analysis uses only known and documented mortalities (n=26), whereas the RCK analyses use known and assumed mortalities (n=30). Additionally, the WEST analysis uses mortality data specific to transmission lines when calculating collision rates. Unknown trauma mortalities that could have been due to a power line collision was proportionally assigned as transmission collision (see attached report). This approach eliminates using distribution line strike data to estimate transmission line strikes. The WEST analysis also eliminates the need to consider a collision-risk differential between distribution and transmission lines, thereby eliminating the uncertainty associated with the estimated miles of distribution line.

<u>Estimated annual migration mortality rate</u>: Under the WEST analysis, the annual mortality percentage during migration in the United States is calculated the same as the Updated RCK analysis (10.9% x 17.4% x 50% = 0.9483%).

<u>Known and attributed transmission-line mortalities</u>: The WEST analysis uses the 26 total known mortalities during migration (Table 1). Two of those mortalities were identified as transmission-line collisions, and five were identified as distribution-line collisions. Mortalities that could possibly be attributed to transmission lines include one strike on an unidentified power line and one where the cause of the mortality was unknown but involved some form of trauma. To account for the unknown trauma and the collision on an unidentified power line, the WEST analysis line proportionally adjusted the input of transmission line mortalities to account for the possibility that a portion of the mortalities with unknown causes were due to collisions with transmission lines. This proportionally adjusted figure was 2.377 whooping crane mortalities attributed to transmission lines.

<u>Estimated annual migration mortality rate attributable to transmission-line strikes</u>: WEST then used the proportionally adjusted whooping crane mortalities attributed to transmission-line strikes to determine an annual migration mortality rate attributable to transmission-line strikes of 0.000867 cranes. It did so by multiplying the annual migration mortality rate (0.009483) by the proportion of known migration mortalities attributed to transmission lines [(2.377/26) x 0.009483 = 0.000867].

<u>Estimated R-Project annual mortality rate</u>: WEST proportionally applied annual migration mortality rate for transmission lines (0.000867) to the 226 miles of R-Project in relation to all 46,851 miles transmission lines in the whooping crane migratory corridor (226/46,851 = 0.0048) to determine an R-Project-specific annual mortality rate of 0.000004574 (0.000867 x 0.0048 = 0.000004182).

Overall R-Project estimate: If the whooping crane population remained steady at the most recent estimate of 536 over the 50-year life of the R-Project, the estimated total mortality based on the project-specific mortality rate would be 0.112 (0.000004182 x 536 x 50). However, the potential for population growth must be taken into account. While the RCK analyses used a 4% annual growth rate to estimate an average annual population, the WEST analysis used a published population viability analysis to estimate the whooping crane population for the next 50 years (Traylor-Holzer 2018). When the annual estimated mortality specific to the R-Project is applied to the population model, the WEST analysis predicts the R-Project may result in 0.365 whooping crane collisions throughout the expected life of the project. This estimate does not take into account any level of risk reduction from marking the R-Project with bird flight diverters.

5.0 UNCERTAINTY

The USFWS recognized the uncertainty associated with attempting to predict collision with a single transmission project, and peer review concurred with that conclusion (USFWS 2019). Limited number of documented collisions, large temporal and spatial scales over which the data are distributed, increasing miles of power line and whooping crane populations over time, and the relative importance of collisions as a source of mortality all create areas of uncertainty. Despite this uncertainty, data are available to evaluate risk, as is demonstrated in the Updated RCK and WEST approaches. While NPPD has updated previous analyses with new information where feasible, it is also important to keep in mind that uncertainty remains and the fact that assumptions about the available data must be made. The following is a discussion regarding the differences in outcome of the Updated RCK and WEST approaches if different assumptions are applied about certain aspects of the published data.

One source of uncertainty is known mortality (i.e., recovered carcasses) versus assumed mortality (i.e., an observed injured bird that was assumed a mortality). Currently, the Updated RCK approach includes all known and assumed mortality is included in the analysis. However, if all assumed mortality is removed and only recovered birds are used, the estimated take in the Updated RCK analysis of 0.54 cranes is reduced to an estimated take of 0.29 cranes over the life of the Project. Conversely, if all assumed mortalities are included in the WEST analysis, the outcome is 0.314 whooping crane mortalities over the life of the Project.

A second source of uncertainty is if the mortality occurred at a transmission line or a distribution line. Misclassification can again have a large effect on the results of both the Updated RCK and WEST approaches to take. Currently, there are two estimated transmission line mortalities during migration. One individual bird was marked with a satellite tracker and hit a marked transmission line in North Dakota after being flushed at night (USFWS 2020). The other is a collision in Texas in 1956 identified as a transmission line in Stehn and Wassenich (2008); however, in Stehn and Haralson-Strobel (2014), the same individual is identified as a power-line collision, not a transmission-line collision. An older reference lists the injury to this bird as being the result hitting a high wire (McNulty 1966), which at the time could have been a distribution line, transmission line, or even a telephone line. While there is likely no way to ascertain exactly what the bird struck in 1956, the impacts of it being misclassified on the outcomes of the existing take calculation approaches can be calculated.

Any approach to estimating take on the R-Project must rely on a data set that, over 66 years, has eight confirmed power-line mortality collisions and three unknown traumas, two of which are assumed mortalities where the whooping crane was never recovered. Of those 11 individuals, only one is known to have hit a transmission line for certain, and one is assumed to have done so based on a publication that is 52 years after the incident. Because available publications (Stehn and Wassenich 2008 and Stehn and

Haralson-Strobel 2014) are not consistent in all aspects on the same data, certain assumptions on use of those data must be made, and changing those assumptions can have large impacts on the outcome.

6.0 LITERATURE CITED

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C.

Baasch, D.M., P. D. Farrell, A.T. Pearse, D.A. Brandt, A.J. Caven, M.J. Harner, G.D. Wright, and K.L. Metzger. 2019. Diurnal Habitat Selection of Migrating Whooping Crane in the Great Plains. Avian Conservation & Ecology 14(1): Article 6. doi: 10.5751/ACE-01317-140106.

Godfrey, E. 2022. 'Angry and heartsick': Oklahoma game wardens still investigating deaths of whooping cranes. The Oklahoman. January 8, 2022.

Harrell, W. and M. Bidwell. 2020. Report on Whooping Crane Recovery Activities. 2019 Breeding Season-2020 Spring Migration. US Fish and Wildlife Service and Canadian Wildlife Service. November 2020. Available online: https://www.fws.gov/uploadedFiles/2019-20%20WHCR%20Recovery%20 Activities%20Report_final.pdf

Kuyt, E. 1992. Aerial radio-tracking of whooping cranes migrating between Wood Buffalo National Park and Aransas National Wildlife Refuge, 1981-1984. Occasional Paper No. 74. Canadian Wildlife Service. 53 pp.

Lewis, J.C., E. Kuyt, K.E. Schwindt, and T.V. Stehn. 1992. Mortality in fledged cranes of the Aransas-Wood Buffalo population. Pages 145-148 in D. A. Wood, ed. Proc. 1988 N. Am. Crane Workshop. Florida Game and Fresh Water Fish Commission, Tallahassee.

McNulty, F. 1966. The Whooping Crane; the Bird that Defies Extinction. E.P.Dutton & Company. Boston, MA.

Pearse, A.T., D.A. Brandt, B.K. Hartup, and M.T. Bidwell. 2018. Mortality in Aransas-Wood Buffalo Whooping Cranes: Timing, Location, and Causes. Chapter 6 In: French, J.B. Jr., Converse, S.J., and Austin, J.E., (Eds.). Whooping Cranes: Biology and Conservation. Biodiversity of the World: Conservation from Genes to Landscapes. Academic Press, San Diego, CA.

Pearse, A.T., D.A. Brandt, B.K. Hartup, and M.T. Bidwell. 2019. Mortality in Aransas-Wood Buffalo Whooping Cranes: Timing, Location, and Causes. In: Whooping Cranes: Biology and Conservation. Pp.125-138.

Pearse, A. T., D. A. Brandt, D. M. Baasch, M. T. Bidwell, J. A. Conkin, M. J. Harner, W. Harrell, and K. L. Metzger. 2020. Location Data for Whooping Cranes of the Aransas-Wood Buffalo Population, 2009-2018. US Geological Survey (USGS) data release. USGS, Reston, Virginia. May 15, 2020. doi: 10.5066/P9Y8KZJ9. Available online: https://www.sciencebase.gov/catalog/item/5ea3071582 cefae35a19349a

S&P Global. 2021. Platts Transmission Line geospatial layer. Accessed April 2021.

Stehn, T.V. and T. Wassenich. 2008. Whooping crane collisions with power lines: an issue paper. Proceedings of the North American Crane Workshop. 10:25-36.

Stehn, T.V. and Haralson-Strobel, C.L. 2014. An update on mortality of fledged whooping cranes in the Aransas/Wood Buffalo Population. Proceedings of the North American Crane Workshop 12:43-50.

Traylor-Holzer, K. 2018. Whooping crane population viability analysis (PVA) report: AWBP model and alternative scenario results. IUCN SSC Conservation Planning Specialist Group. 15 May 2018.

U.S. Department of Justice (DOJ). 2013. Miller man sentenced for killing endangered species. U.S. Attorney's Office. District of South Dakota. February 13, 2013. https://www.justice.gov/usao-sd/pr/miller-man-sentenced-killing-endangered-species. Accessed October 12, 2022.

United States Fish and Wildlife Service (USFWS). 2009. Whooping cranes and wind development – an issue paper. Regions 2 and 6, U.S. Fish and Wildlife Service. April 2009.

_____. 2019. A Review and Critique of Risk Assessments Considered by the U.S. Fish and Wildlife Service Regarding the Collision Risk for Whooping Cranes with NPPD's R-Project. January 30, 2019.

_____. 2023. Veterinary Pathology Examination. Final Report. OLE National Fish and Wildlife Forensic Laboratory. Ashland, OR.

ATTACHMENT 1 R-PROJECT WHOOPING CRANE RISK EVALUATION MODEL UPDATE FOR EVALUATING POTENTIAL IMPACTS TO WHOOPING CRANES

R-Project Whooping Crane Risk Evaluation Model Update for Evaluating Potential Impacts to Whooping Cranes

January 17, 2021 (Revised December 14, 2023)

Western EcoSystems Technology, Inc.

Environmental & Statistical Consultants
415 W. 17th Street. Suite 200
Cheyenne, Wyoming 82001

TABLE OF CONTENTS

1.0 BACKGROUND 1
2.0 INTRODUCTION 1
3.0 UPDATE TO USFWS-RCK APPROACH TO ESTIMATE WHOOPING CRANE TAKE AND DOCUMENTATION OF DECISION PROCESS USED IN MAKING UPDATE 2
3.1 Model Overview 2
3.2 Annual US Migration Mortality 3
3.3 Transmission Mortality 4
3.4 Project-specific Mortality 8
3.5 Future Projection 8
4.0 LITERATURE CITED 12

LIST OF TABLES

Table 1. Model Input Parameters and Values 3
Table 2. Known whooping crane mortality in the US during the migration seasons. 6
Table 3. Model Estimates 8

LIST OF FIGURES

Figure 1. Comparison of whooping crane population projections and estimates from wintering-ground population surveys. 10
Figure 2. Projected collision fatalities of whooping cranes over the 50-year R-Project life span. 11

LIST OF APPENDICES

Appendix A: Percent of Whooping Crane Migration Days in US

1.0 BACKGROUND

Nebraska Public Power District (NPPD) has proposed a 226-mile, 345-kilovolt (kV) electric transmission line in Lincoln, Logan, Thomas, Blaine, Loup, Garfield, Wheeler, and Holt counties, Nebraska, referred to herein as the R-Project or the Project. Because the R-Project crosses the range of threatened American burying beetle, NPPD sought an incidental take permit under the Endangered Species Act from the US Fish and Wildlife Service (USFWS). As part of that permitting process, USFWS and NPPD evaluated the potential for incidental take of the whooping crane (*Grus americana*). USFWS prepared an analysis of the potential for take using a "Reasonably Certain Knowledge" (USFWS-RCK) approach (USFWS 2018), which reviewed reasonable and best available environmental parameters and data. NPPD engaged Western EcoSystems Technology, Inc. (WEST) to review available data and provide an update to the USFWS-RCK approach for the Project.[1]

The whooping crane was federally listed as endangered in the US in 1967 (32 Federal Register 4001, USFWS 1967) and was designated as endangered in Canada in 1978 (Committee on the Status of Endangered Wildlife in Canada 2000). There are currently four wild whooping crane populations, but only one is naturally occurring and self-sustaining (Urbanek and Lewis 2020): the Aransas/Wood Buffalo whooping crane population (AWBP), which migrates between Aransas National Wildlife Refuge on the Texas coast, where it winters, and the Wood Buffalo National Park, along the boundary between Alberta and Northwest Territories, where it nests. Since 1941, the AWBP has increased from 15 birds (Allen 1952) to over 535 (USFWS 2023). Migration for the AWBP occurs from March through May in the spring and September through November in the fall (Pearse et al. 2020). It is only during migration that the Project may pose a risk to the AWBP.

2.0 INTRODUCTION

This effort has two principal objectives, as described below.

Objective 1: Where possible and appropriate, revise the USFWS-RCK approach to estimating potential whooping crane take on the R-Project to incorporate the following updates.

- Based on the latest boundaries of the whooping crane migration corridor that NPPD received from the USFWS, all 226 miles of the R-Project are in the 95% whooping crane migratory corridor.
- Four suspected mortalities (during the fall seasons of 1957, 1988, 1998, and 2004 wherein no carcasses were recovered) were removed from analyses.

[1] Note that NPPD has undertaken a separate effort to update the USFWS-RCK approach with new information. WEST's analysis differs from NPPD's update in that it revises certain aspects of the USFWS-RCK approach rather than just updating the information used therein.

- One new known whooping crane migration power-line-strike mortality occurred in North Dakota in spring 2020 (Table 2).
- For consistency with prior USFWS modeling (USFWS 2019a, 2019b) and industry standards,[2] define transmission power lines as those lines that are 69 kV and above.

Objective 2: Address uncertainties, discrepancies, and documentation of process used in model development.

Many of the existing efforts to evaluate the collision risk associated with the R-Project have noted the lack of data and the uncertainty associated with what data are available (USFWS 2018). Therefore, reasoning behind selection of data inputs and construction of the modeling process is described in terms that allow the reader to understand the construction and application of the model in developing the take prediction values. Relevant decision points and options, and the rationale behind selection of the options used in the model, are provided below, so that conclusions drawn from the model outcomes are fully documented and supported in text. We did not attempt to rectify discrepancies in existing published information; rather, we just documented how those data are used.

3.0 UPDATE TO USFWS-RCK APPROACH TO ESTIMATE WHOOPING CRANE TAKE AND DOCUMENTATION OF DECISION PROCESS USED IN MAKING UPDATE

3.1 Model Overview

The USFWS-RCK model utilized "reasonably certain" information on annual AWBP mortality rates during migration, combined with historic AWBP known-source mortality data, to calculate an expected number of collisions with transmission lines in the US AWBP migratory corridor. Additionally, the USFWS-RCK model produced a Project-specific estimate for the expected number of collisions resulting from the Project, which was assumed to be directly proportional to the increase in length of transmission lines in Nebraska. We describe the USFWS-RCK model, WEST's revisions to the model formulation, and updates to input parameter values in more detail below.

[2] The North American Electric Reliability Corporation (NERC) Reliability Standards define transmission lines to include those carrying "relatively high voltages varying from 69 kV up to 765 kV". *See* Glossary of Terms Used in NERC Reliability Standards, updated June 28, 2021, available at https://www.nerc.com/pa/Stand/Pages/USRelStand.aspx. The U.S. Energy Information Administration includes lines of 69 kV to 765 kV in its database of transmission lines. https://www.eia.gov/tools/faqs/faq.php?id=567&t=3. The Southwest Power Pool includes 69 kV lines in the 70,025 miles of transmission lines in its territory. See https://www.spp.org/Documents/31587/SPP101%20-%20An%20Introduction%20to%20SPP%20-%20All%20Slides%20PRINT.pdf. And the Occupational Health and Safety Administration indicates that transmission system voltages are typically from 69 kV up to 765 kV, while distribution systems typically operate in a voltage range of 4 kV to 46 kV. *See* https://www.osha.gov/etools/electric-power/generation-transmission-distribution/transmission-distribution.

3.2 Annual US Migration Mortality

WEST estimated the proportion of the post-fledging AWBP whooping cranes that die during migration in the US using the formula originally specified in the USFWS-RCK model:

$$m = \alpha \times \beta \times \lambda$$

where m is the proportion of post-fledging AWBP mortality during migration in the United States, α is the total annual AWBP post-fledging mortality, β is proportion of post-fledging mortality that occurs during migration, and λ is the proportion of migration days spent in the US. USFWS (2018) estimated an average total annual AWBP post-fledging mortality rate (α) of 0.109 and that the proportion of post-fledging that occurs during migration (β) is 0.174. WEST uses these values herein.

USFWS (2018) estimated a value of 0.55 for λ (proportion of migration days in the US). However, based on our literature search, the percent of whooping crane migration days spent in the US is between 42% and 50% (Appendix A). We have used 50% (0.50) as a conservative value (i.e., tending towards overestimate; Table 1). Based on these inputs, the resulting estimate for the proportion of post-fledging mortality during migration in the United States (m) is 9.483×10^{-3} (0.9%; 0.109 × 0.174 × 0.500 = 0.009483), meaning less than 1% of post-fledging AWBP whooping cranes are estimated to die during migration per year.

Table 1. Model Input Parameters and Values

Symbol	Value	Description
α	0.109	Average total annual post-fledging Aransas-Wood Buffalo (AWBP) mortality
β	0.174	Proportion of annual mortality occurring during migration
λ	0.500	Proportion of migration days in US
$d_{nonline}$	17[a]	Documented mortality (non-power line)
$d_{distline}$	5	Documented mortality (distribution line)
$d_{transline}$	2	Documented mortality (transmission line)
$d_{unkline}$	1	Documented mortality (unknown line type)
$d_{possline}$	1	Documented mortality (possible power line)
L_{total}	46,851	Miles of transmission lines in US AWBP corridor
L_{proj}	226	Miles of R-project transmission lines in the AWBP corridor

[a] This document or presentation includes Whooping Crane migration use data from the Central Flyway stretching from Canada to Texas, collected, managed, and owned by the US Fish and Wildlife Service (USFWS). Data were provided to NPPD as a courtesy for its use. The USFWS has not directed, reviewed, or endorsed any aspect of the use of these data. Any and all data analyses, interpretations, and conclusions from these data are solely those of NPPD.

While mortality during migration is known to occur within both the US and Canada portions of the migration corridor, the number of miles of transmission line occurring within Canada is not available to include in the model. Therefore, the analysis was restricted to include only mortality within the US.

3.3 Transmission Mortality

The USFWS-RCK model utilized data on documented mortality (Stehn and Haralson-Strobel 2014) to estimate the proportion of migration mortalities resulting from collisions with transmission and distribution power lines, as well as the proportion of collisions that occurred in Nebraska. While this approach attempts to estimate a Nebraska-specific collision rate for transmission lines, we posit that there are not enough sufficiently documented mortality data from the US portion of the AWBP migration corridor (N = 26 publicly reported mortalities; Table 2) to support such an estimate. To minimize the potential for erroneous assumptions based on incomplete data, WEST implements an approach that calculates an average mortality rate for transmission lines in the US.

Brightwell et al. (2023) reviewed the known-source mortality data (see Table 2) utilized in the USFWS-RCK model as well as a number of additional sources to evaluate and accurately attribute whooping crane mortalities to transmission-line strikes.

Evaluating these sources, Brightwell et al. (2023) found that there have been 26 documented mortalities (d_{tot}) during migration in the US (Table 2). Of these mortalities, 17 were not attributed to power lines ($d_{nonline}$), 5 were attributed to distribution lines ($d_{distline}$), 2 were attributed to transmission lines ($d_{transline}$), 1 was attributed to a power line of unknown type ($d_{unkline}$), and 1 was identified as a trauma mortality that could potentially be the result of power-line collisions ($d_{possline}$) (Table 1). The death of the individual that was attributed to a power-line collision with an unknown type ($d_{unkline}$) was injured in North Dakota in 1984 and died in captivity in 1985; this mortality is assumed here to have resulted from an initial power-line strike. Because power lines are specifically identified as a cause of mortality and are easily identified as a potential source of trauma (Table 2), we assume that, for whooping crane fatalities attributed to trauma, there was a reason that trauma was not classified as a result of power-line collision. We do, however, recognize and agree with the USFWS (2019) that cause of death of migrating whooping cranes may in some instances be inaccurately or incompletely reported. Therefore, we adjusted the number of documented transmission-line mortalities to account for the possibility that a portion of the mortalities with unknown causes were due to collisions with transmission lines as follows.

First, we calculated the proportion of known-cause mortality attributed to power lines (p_{line}):

$$p_{line} = \frac{k_{line}}{k_{line} + d_{nonline}}$$

where k_{line} is the sum of known-cause mortality attributed to all power-line types:

$$k_{line} = d_{distline} + d_{transline} + d_{unkline}$$

Using these formulas, k_{line} equals 8 (5 + 2 + 1), so p_{line} equals 0.320 (8/[8+17]).

Additionally, we calculated the proportion of known power-line mortalities that were attributed to transmission lines ($p_{transline}$) as the ratio:

$$p_{transline} = d_{transline}/(d_{transline} + d_{distline})$$

Using this formula, $p_{transline}$ equals 0.286 or (2/7). With these proportions, we calculated an adjusted number of transmission-line mortalities (adj_{trans}), which accounts for mortalities that had unknown line types or were otherwise possible collisions with power lines:

$$adj_{trans} = d_{transline} + (d_{unkline} * p_{transline}) + (d_{possline} * p_{line} * p_{transline})$$

From these calculations, we estimated the adjusted number of transmission-line mortalities (adj_{trans}) as 2.377 (2 + [1 × 0.286] + [1 × 0.320 × 0.286]). Thus, we assume a total of 2.377 out of 26 documented mortalities (d_{tot}) were caused by transmission lines. We then calculated the proportion of post-fledging mortality during migration for transmission lines in the United States (m_{trans}) as:

$$m_{trans} = m * \frac{ceiling(adj_{trans})}{d_{tot}}$$

Our estimate for m_{trans} was then 0.009483 × (2.377/26) or 8.670 × 10^{-4}. This equated to approximately 0.434 mortalities per year due to collisions with transmission lines in the US portion of the AWBP corridor for a hypothetical population of 500 individuals.

Table 2. Known whooping crane mortality in the US during the migration seasons.

Year	Date	Migration Period	Location[a]	Age[b]	Recovered	Reported Cause of Death	Classified Cause of Death	Comments
1952	Oct	Fall	Sharon, KS	A	Yes	Unknown	Possible power line	Had dislocated wing, died en route to San Antonio Zoo[1].
1955	Fall	Fall	Sioux Falls, SD	A	Yes	Shot	Non-power line	Snow goose hunter[1,2].
1956	May	Spring	Lampass City, TX	SA	Yes	Power line	Power line (transmission)	Transmission line,[3] broken wing tip[1].
1965	Nov	Fall	Rawlins City, KS	SA	Yes	Power line	Power line (distribution)	Distribution (3-wire) line [1,3].
1967	Apr	Spring	Russell City, KS	A	Yes	Power line	Power line (distribution)	Distribution (3-wire) line [3].
1982	Jun	Spring	Minton, SD	Unknown	Yes	Aircraft	Non-power line	Feathers identified on military tanker aircraft[1].
1982	Oct	Fall	Oglesby, TX	A	Yes	Power line	Power line (distribution)	Distribution (4-wire, <8 meters) line[1,3].
1984	Oct	Fall	Linton, ND	A	Yes	Power line	Power line (unknown type)	Male with multiple fractures in wing, captured but later died Jan 1985, aspergillosis, and partial paralysis from running into captive fence during handling[1]. Died from power-line collision complications.
1989	Oct	Fall	Stratton, NE	SA	Yes	Power line	Power line (distribution)	Distribution (12-kilovolt);[3] flew into 2-wire distribution line, found dead[1,3].
1991	Apr	Spring	Bend, TX	A	Yes	Shot	Non-power line	Shot[1].
2002	Apr	Spring	De Leon, TX	A	Yes	Power line	Power line (distribution)	Distribution[3] power-line strike[1] found under power line[4].
2003	Nov	Fall	Dallas, TX	A	Yes	Shot	Non-power line	Shot[1].
2004	Nov	Fall	Quivira NWR, KS	SA	Yes	Shot	Non-power line	Had a leg amputated, died in captivity 9 Nov[1].
2004	Nov	Fall	Quivira NWR, KS	SA	Yes	Shot	Non-power line	Second bird had a fractured humerus repaired, died due to complications mid-Nov[1].
2005	Dec	Fall	MO	Juv	Yes	Bacterium	Non-power line	Bacterium obstructing the larynx[1].
2007	7 Apr	Spring	ND	A	Yes	Unknown	Non-power line	Collision with a blunt object[1]; U.S. Fish and Wildlife Service (USFWS) sighting database[4] states, "died mid-air and fell to ground, possible broken neck. Nearest power line was too far away".
2011	8 Nov	Fall	KS	Juv	Yes	Unknown	Non-power line	No necropsy was attempted,[5] no direct or indirect evidence of power-line collision[4].

Table 2. Known whooping crane mortality in the US during the migration seasons, *continued*.

Year	Date	Period	Location[a]	Age[b]	Recovered	Reported Cause of Death	Classified Cause of Death	Comments
2012	Apr	Spring	Hand County, SD	A	Yes	Shot	Non-power line	Shot by an individual near Miller, SD; prosecuted 13 Feb 2013[6].
2013	8 Apr	Spring	SD	A	Yes	Predation	Non-power line	Predation[5].
2020	22 Apr	Spring	Mountrail County, ND	Juv	Yes	Power line	Power line (transmission)	Carcass found beneath a transmission line. Radiotelemetry indicates death occurred at approximately 01:30[4].
2021	5 Nov	Fall	Kiowa Co., OK	A	Yes	Shot	Non-power line	Discovered by hunters near Tom Sneed Lake; died in transport to veterinary clinic[7]. Case pending at time of writing.
2021	5 Nov	Fall	Kiowa Co., OK	A	Yes	Shot	Non-power line	Radioed crane. Case pending at time of writing[7].
2021	5 Nov	Fall	Kiowa Co., OK	A	Yes	Shot	Non-power line	Evidence discovered while investigating the location of the radioed crane also shot in the area. Case pending at time of writing[7].
2021	5 Nov	Fall	Kiowa Co., OK	A	Yes	Shot	Non-power line	Evidence discovered while investigating the location of the radioed crane also shot in the area. Case pending at time of writing[8].
2022	Apr	Spring	SD	A	Yes	Trap	Non-power line	Possible cause of death suggested to be from being caught in a muskrat trap[7].
2022	18 Nov	Fall	SD	A	Yes	Leg injury/exposure	Non-power line	Leg mounted transmitter became iced during severe conditions[9].

[a] Co. = County, NWR = National Wildlife Refuge
[b] A = Adult, Juv = Juvenile, SA = Subadult

[1] Stehn and Haralson-Strobel 2014
[2] McNulty 1966
[3] Stehn and Wassenich 2008
[4] US Fish and Wildlife Service (USFWS) 2022
[5] Pearse et al. 2019
[6] US Department of Justice 2013
[7] Godfrey 2022
[8] Matt Rabbe, USFWS, pers. comm. June 22, 2022
[9] USFWS 2023

3.4 Project-specific Mortality

The overall power-line mortality defined in the USFWS-RCK model (USFWS 2018) included data from whooping cranes that collided with distribution as well as transmission lines. Because the R-Project is a transmission line, we removed distribution lines from consideration as they present a different risk profile. Following the formulation of the USFWS-RCK model, we calculated a Project-specific mortality rate based on the proportional increase in transmission-line miles associated with the Project:

$$m_{proj} = m_{trans} * \frac{L_{proj}}{L_{total}}$$

where m_{proj} is the proportion of post-fledging mortality occurring at the Project, L_{proj} is the number of transmission-line miles associated with the Project (226 miles) in the US AWBP migration corridor, and L_{total} is the total number of transmission-line miles in the US AWBP migration corridor. Based on April 2021 Platts Electric Transmission Lines data filtered to show operational 69 kV and higher (A. Ames pers. comm., Sept. 15, 2021), there are 46,851 miles of transmission lines within the US AWBP 95% migration corridor. Using these values, we estimate the proportion of post-fledging mortality occurring at the Project (m_{proj}) is 4.182×10^{-6} (Table 3; 0.000867 * [226/46,851]), which equates to approximately 0.002 cranes per year for a hypothetical population of 500 cranes. Consistent with the USFWS-RCK model, we assume this proportion (m_{proj}) is representative of unmarked transmission lines.

Table 3. Model Estimates

Symbol	Name	Value	Description
m	US migration mortality proportion	9.483×10^{-3}	Proportion of AWBP post-fledging mortality during migration in the US
m_{trans}	Transmission-line mortality proportion	8.670×10^{-4}	Proportion of AWBP post-fledging mortality during migration in the US at transmission lines
m_{proj}	Project mortality proportion	4.182×10^{-6}	Proportion of Project-specific mortality with unmarked lines
N_t	Population size	-	AWBP size in in year t
F_t	Project Fatalities	-	Fatalities at the Project in year t

3.5 Future Projection

The USFWS-RCK model projected a cumulative take for the Project assuming a 4% growth rate. However, USFWS recognized that factors such as limited wintering-ground capacity could slow growth. The USFWS-RCK model used an average population of 1500 individuals to calculate the cumulative take, which in the end provides the same result as actually growing the population over time. However, it does not take into account that, given a 4% growth rate, the potential for collision in year 50 (population 3938) is about 8 times greater than in year 1 (population 506), indicating the model is sensitive to the end population size.

WEST qualitatively assessed the literature regarding AWBP growth rates and determined the population viability analysis conducted by Traylor-Holzer (2018) likely provides a more accurate prediction of future population growth. Dr. Traylor-Holzer, Senior Program Officer, International Union for Conservation of Nature Species Survival Commission Conservation Planning Specialist Group and author of the *Whooping Crane Population Viability Analysis (PVA) Report* (Traylor-Holzer 2018) provided to WEST a spreadsheet (without underlying data) with a 100-year projection for the annual population size for the AWBP. These population estimates represent counts in the wintering grounds just after fall migration and, therefore, approximate winter counts. These estimates may present a slight overestimation of the total population, as the estimates do not include mortality that may have occurred between fall migration and the winter population counts.

Additionally, these population projections are cyclic due to the model assuming an 11-year solar cycle and associated impacts. Traylor-Holzer (2018) identifies other factors that may contribute to uncertainty in the population estimate, especially those that may lead to a lower population growth (i.e., lower recruitment related to increasing atmospheric carbon dioxide levels and potential of increased mortality with increased anthropogenic threats during migration). Therefore, the input parameter value used herein may be considered conservative (tending toward overestimation rather than underestimation of take).

Lastly, it is uncertain if the model was initiated at the optimal point in this cycle to match the actual phase of the 11-year solar cycle in the wild (K. Traylor-Holzer, pers. comm. April 9, 2020). Given the relatively stable winter count data collected since 2017, it is possible or even likely that the model should be shifted a few years in relation to the phase of the cycle in recruitment and population growth, but we expect the impact of this uncertainty to have little effect on the 50-year predictions. To evaluate performance of the Traylor-Holzer model to date, WEST compared predictions from the model to population estimates produced by the USFWS for years 2017-2021. In all years, the Traylor-Holzer model predictions fell within the 95% CI of the estimated population for the primary winter survey area (Figure 1).

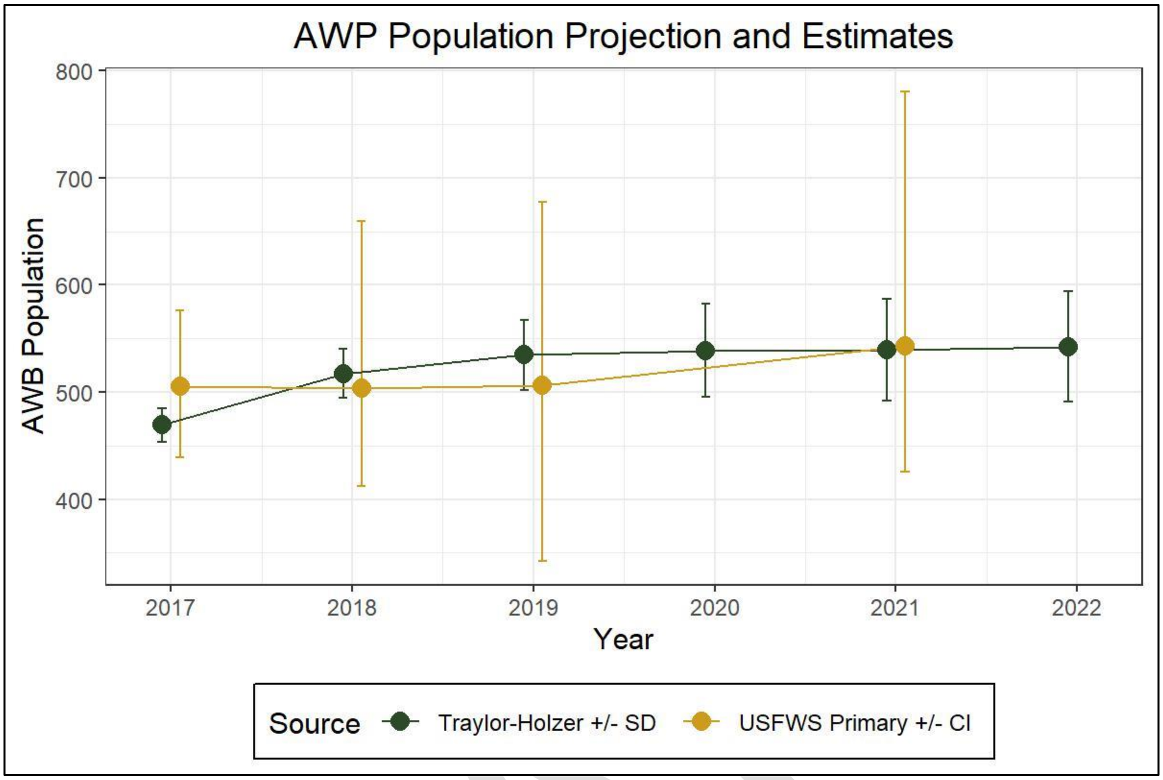


Figure 1. Comparison of whooping crane population projections and estimates from wintering-ground population surveys. Projections (in green) are from Traylor-Holzer (2018), and error bars represent standard deviations around the projected population mean. Population estimates (in yellow) are from the USFWS population estimates for the primary winter survey area with error bars indicating a 95% confidence interval.

WEST applied the Traylor-Holzer (2018) population projections and Project-specific mortality rates defined above to estimate annual take at the Project over a 50-year period from 2026 to 2075:

$$F_t = N_t * m_{proj}$$

where F_t is the estimated number of fatalities at the Project in year (*t*), and N_t is the projected population size in year (*t*). Over the 50-year period, we estimate a total take of 0.365 whooping cranes (Figure 2). As noted above, this estimate does not take into account any risk reduction from the use of bird flight diverters.

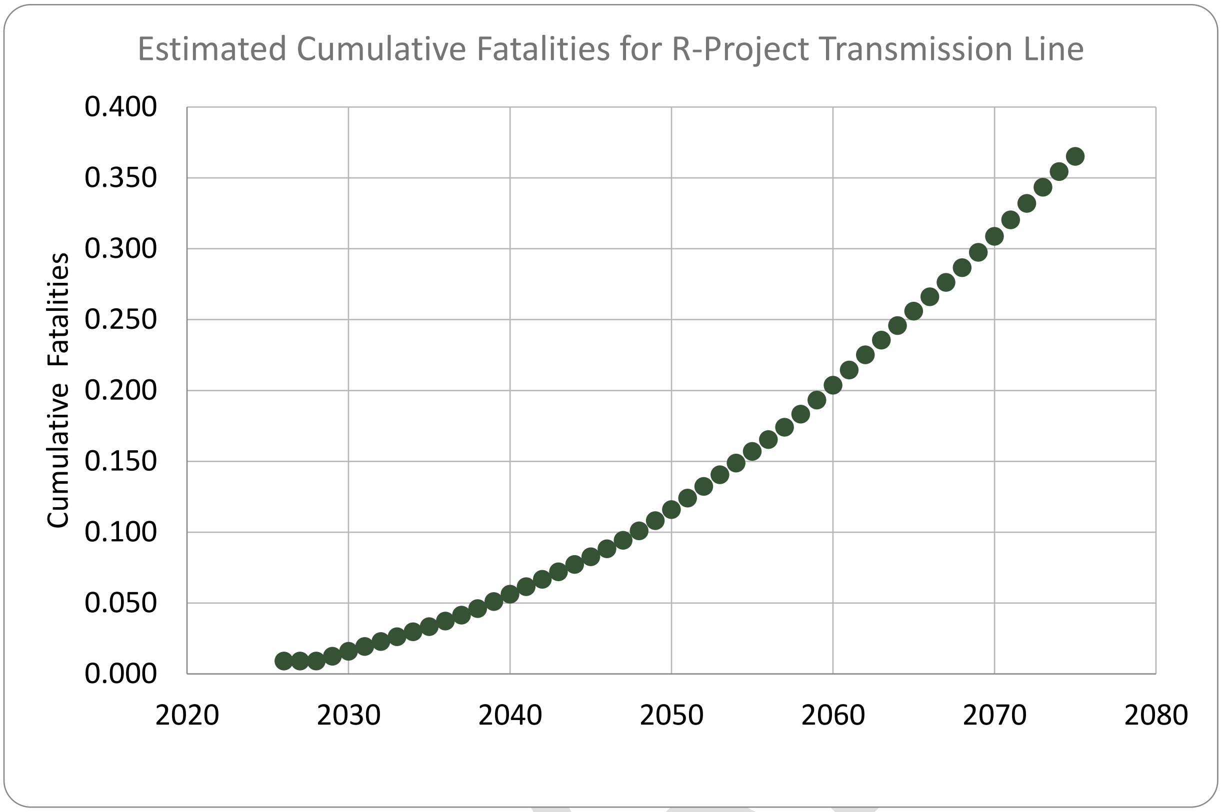


Figure 2. Projected collision fatalities of whooping cranes over the 50-year R-Project life span.

4.0 LITERATURE CITED

Allen, R. P. 1952. The Whooping Crane. National Audubon Society Resource Report 3. 246 pp.

Brightwell, K., M. Rabbe, A. Pearse, B. Bainbridge, K. Tyrell, and C. Derby. 2023. Mortality Update of Fledged Whooping Cranes in the Aransas/Wood Buffalo Population. Proceedings of the North American Crane Workshop. Presentation. October 23–26, 2023. Available online: https://www.nacwg.org/workshop16.html

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2000. COSEWIC Assessment and Update Status Report on the Endangered Whooping Crane (*Grus Americana*) in Canada. COSEWIC, Ottawa. vii + 28 pp.

Godfrey, E. 2022. 'Angry and Heartsick': Oklahoma Game Wardens Still Investigating Deaths of Whooping Cranes. The Oklahoman. January 8, 2022. Available online: https://www.oklahoman.com/story/sports/outdoors/2022/01/08/oklahoma-game-wardens-still-investigating-deaths-whooping-cranes/9121136002

Harrell, W. and M. Bidwell. 2020. Report on Whooping Crane Recovery Activities. 2019 Breeding Season-2020 Spring Migration. US Fish and Wildlife Service and Canadian Wildlife Service. November 2020.

McNulty, F. 1966. The Whooping Crane: The Bird that Defies Extinction. E. P. Dutton & Co. Inc., New York, New York.

Pearse, A. T., D. A. Brandt, B. K. Hartup, and M. T. Bidwell. 2019. Mortality in Aransas-Wood Buffalo Whooping Cranes: Timing, Location, and Causes. Pp. 125-139. *In:* P. J. Nyhus, J. B. French, S. J. Converse, J. E. Austin, and J. H. Delap, eds. Whooping Cranes: Biology and Conservation. Academic Press, San Diego, California.

Pearse, A. T., D. A. Brandt, D. M. Baasch, M. T. Bidwell, J. A. Conkin, M. J. Harner, W. Harrell, and K. L. Metzger. 2020. Location Data for Whooping Cranes of the Aransas-Wood Buffalo Population, 2009-2018. U.S. Geological Survey data release. doi: 10.5066/P9Y8KZJ9. Available online: https://www.sciencebase.gov/catalog/item/5ea3071582cefae35a19349a

Stehn, T. V. and T. Wassenich. 2008. Whooping Crane Collisions with Power Lines: An Issue Paper. Proceedings of the North American Crane Workshop 10: 25-36.

Stehn, T. V. and C. Haralson-Strobel. 2014. An Update on Mortality of Fledged Whooping Cranes in the Aransas/Wood Buffalo Population. Proceedings of the North American Crane Workshop 12: 43-50.

Traylor-Holzer, K. 2018. Whooping Crane Population Viability Analysis (PVA) Report: AWBP Model and Alternative Scenario Results. AWBP PVA Report Update. May 15, 2018.

Urbanek, R. P. and J. C. Lewis. 2020. Whooping Crane (*Grus Americana*), Version 1.0. A. F. Poole, ed. *In:* Birds of the World. Cornell Lab of Ornithology, Ithaca, New York. doi: 10.2173/bow.whocra.01. Information online: http://birdsoftheworld.org/bow/species/whocra/cur/

US Department of Justice. 2013. Miller Man Sentenced for Killing Endangered Species. Press Release. U.S. Attorney's Office. District of South Dakota. February 13, 2013. Updated June 22, 2015. Available online: https://www.justice.gov/usao-sd/pr/miller-man-sentenced-killing-endangered-species

US Fish and Wildlife Service (USFWS). 2018. Unpublished. Memorandum for the Record. *Review of "Take Calculation for Whooping Cranes (Grus americana) for the Nebraska Public Power*

District's R-Project Transmission Line" (September 10, 2018 draft). Prepared by the Nebraska Field Office (NEFO) of the USFWS, and a proposed use of reasonably certain knowledge to assess the risk of power-line strikes for the R-Project. December 7, 2018.

US Fish and Wildlife Service (USFWS). 2019a. Final Environmental Impact Statement on Issuance of an Incidental Take Permit and Implementation of a Habitat Conservation Plan for the R Project Transmission Line. Nebraska Ecological Services Field Office. Wood River, NE. February 19, 2019. Available online: https://www.regulations.gov/document/FWS-R6-ES-2014-0048-0193

US Fish and Wildife Service (USFWS). 2019b. A Review and Critique of Risk Assessments Considered by the U.S. Fish and Wildlife Service Regarding the Collision Risk for Whooping Cranes with NPPD's R-Project. USFWS. January 30, 2019. Available online: https://www.fws.gov/nebraskaes/library/USFWS-Whooping-Crane-Whitepaper-final-w-Attachments.pdf

US Fish and Wildlife Service (USFWS). 2022. Whooping Crane Tracking Project: Public Sightings Database [ongoing]. Nebraska Ecological Services Field Office, Wood River, Nebraska.

US Fish and Wildlife Service (USFWS). 2023. Veterinary Pathology Examination. Final Report. Office of Law Enforcement, National Fish and Wildlife Forensic Laboratory. Ashland, Oregon.

Appendix A: Percent of Whooping Crane Migration Days in US

Pearse et al. (2020) (Appendix A1, A2) provides support for the conclusion that 50% of migration days for the Aransas-Wood Buffalo whooping crane population are in the US.

- Whooping cranes spent about 50.1% of total annual migration (spring + fall) in Zones 5 and 6, which are exclusively in Canada
- Whooping cranes spent 21.0% of total annual migration (spring + fall) in Zone 4, and some of Zone 4 (about 20%) is in Canada

Baasch et al. (2019) demonstrates that the use of 50% is conservative, as the data in that report suggest that only 42% of the migration days are in the US.

- Platte River Recovery Implementation Program unpublished data (reported in Baasch et al. 2019) identified the average number of days telemetry-marked whooping crane individuals spent within the US portion of the migration corridor during spring 2013 – fall 2015
    - Fall migration = 10.5 days
    - Spring migration = 20.5 days
    - Average total migration days spent in US = 31.0 days
- 31 days in US (Baasch et al. 2019)/74 days migration (Pearse et al. 2020) = 41.9% of migration days in US.

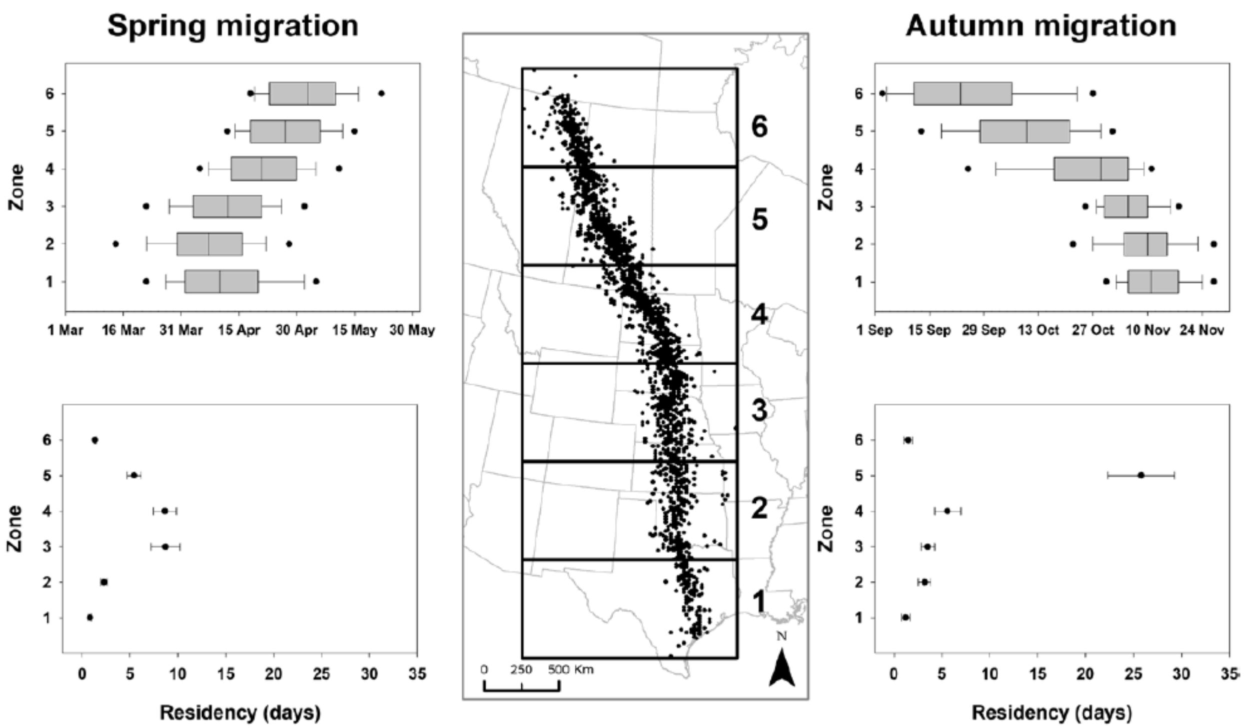
Appendix A1. Data from Pearse et al. 2020.

	Spring Migration (days)	**Fall Migration (days)**	**Total Migration (Spring + Fall) (days)**
Migration time (avg)	29	45	74
Time in Zone 6 (CAN)	*~1.5*	*~1.4*	*~2.9*
Time in Zone 5 (CAN)	5.4	25.8	31.2
Time in Zone 4 (CAN/US)	8.7	5.6	14.3
Time in Zone 3 (US)**	8.7	*~3.5*	*~12.2*
Time in Zone 2 (US)	*~2.4*	*~3.1*	*~5.5*
Time in Zone 1 (US)	0.8	1.2	2.0
Total migration days (sum in zone 1-6)	27.5 (95% of reported migration time avg [29 days])	40.5 (90% of reported migration time avg [45 days])	68.0 (92% of reported migration time avg [74 days]))
Total days exclusively in CAN	~6.9 (25.1%)	27.2 (67.1%)	~50.1%
Total Zone 4 (CAN/US)	8.7 (31.6%)	5.6 (13.7%)	21.0%
Total days exclusively in US	~11.9 (43.3%)	7.8 (19.2%)	~28.9%

avg = average; CAN = Canada; ~ = about.

* Italicized days were estimated from the graphs in Appendix A2 below.

** The Project is located in Zone 3.



Appendix A2. Data from Pearse et al. 2020.

APPENDIX A LITERATURE CITED

Baasch, D. M., P. D. Farrell, A. T. Pearse, D. A. Brandt, A. J. Caven, M. J. Harner, G. D. Wright, and K. L. Metzger. 2019. Diurnal Habitat Selection of Migrating Whooping Crane in the Great Plains. Avian Conservation & Ecology 14(1): Article 6. doi: 10.5751/ACE-01317-140106.

Pearse, A. T., K. L. Metzger, D. A. Brandt, M. T. Bidwell, M. J. Harner, D. M. Baasch, and W. Harrell. 2020. Heterogeneity in Migration Strategies of Whooping Cranes. Condor 122: 1-15. doi: 10.1093/condor/duz056.

APPENDIX D WHOOPING CRANE REGION 6 GUIDANCE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

IN REPLY REFER TO:
FWS/R6
ES

MAILING ADDRESS:
P.O. Box 25486, DFC
Denver, Colorado 80225-0486

STREET LOCATION:
134 Union Boulevard
Lakewood, Colorado 80228-1807

FEB 04 2010

Memorandum

To: Field Office Project Leaders, Ecological Services, Region 6
Montana, North Dakota, South Dakota, Nebraska, Kansas

From: Assistant Regional Director, Ecological Services, Region 6

Subject: Region 6 Guidance for Minimizing Effects from Power Line Projects Within the Whooping Crane Migration Corridor

This document is intended to assist Region 6 Ecological Services (ES) biologists in power line (including generation lines, transmission lines, distribution lines, etc.) project evaluation within the whooping crane migration corridor. The guidance contained herein also may be useful in planning by Federal action agencies, consultants, companies, and organizations concerned with impacts to avian resources, such as the Avian Power Line Interaction Committee (APLIC). We encourage action agencies and project proponents to coordinate with their local ES field office early in project development to implement this guidance.

The guidance includes general considerations that may apply to most, but not every, situation within the whooping crane migratory corridor. Additional conservation measures may be considered and/or discretion may be applied by the appropriate ES field office, as applicable. We believe that in most cases the following measures, if implemented and maintained, could reduce the potential effects to the whooping crane to an insignificant and/or discountable level. Where a Federal nexus is lacking, we believe that following these recommendations would reduce the likelihood of a whooping crane being taken and resulting in a violation of Endangered Species Act (ESA) section 9. If non-Federal actions cannot avoid the potential for incidental take, the local ES field office should encourage project proponents to develop a Habitat Conservation Plan and apply for a permit pursuant to ESA section 10(a)(1)(B).

Finally, although this guidance is specific to impacts of power line projects to the whooping crane within the migration corridor, we acknowledge that these guidelines also may benefit other listed and migratory birds.

If you have any questions, please contact Sarena Selbo, Section 7 Coordinator, at (303) 236-4046.

Region 6 Guidance for Minimizing Effects from Power Line Projects Within the Whooping Crane Migration Corridor

1) Project proponents should avoid construction of overhead power lines within 5.0 miles of designated critical habitat and documented high use areas (these locations can be obtained from the local ES field office).

2) To the greatest extent possible, project proponents should bury all new power lines, especially those within 1.0 mile of potentially suitable habitat[1].

3) If it is not economically or technically feasible to bury lines, then we recommend the following conservation measures be implemented:

   a) Within the 95-percent sighting corridor (see attached map)

      i) Project proponents should mark[2] new lines within 1.0 mile of potentially suitable habitat and an equal amount of existing line within 1.0 mile of potentially suitable habitat (preferably within the 75-percent corridor, but at a minimum within the 95-percent corridor) according to the U.S. Fish and Wildlife Service (USFWS) recommendations described in APLIC 1994 (or newer version as updated).

      ii) Project proponents should mark replacement or upgraded lines within 1.0 mile of potentially suitable habitat according to the USFWS recommendations described in APLIC 1994 (or newer version as updated).

   b) Outside the 95-percent sighting corridor within a State's borders

      Project proponents should mark new lines within 1.0 mile of potentially suitable habitat at the discretion of the local ES field office, based on the biological needs of the whooping crane.

   c) Develop compliance monitoring plans

      Field offices should request written confirmation from the project proponent that power lines have been or will be marked and maintained (i.e., did the lines recommended for marking actually get marked? Are the markers being maintained in working condition?)

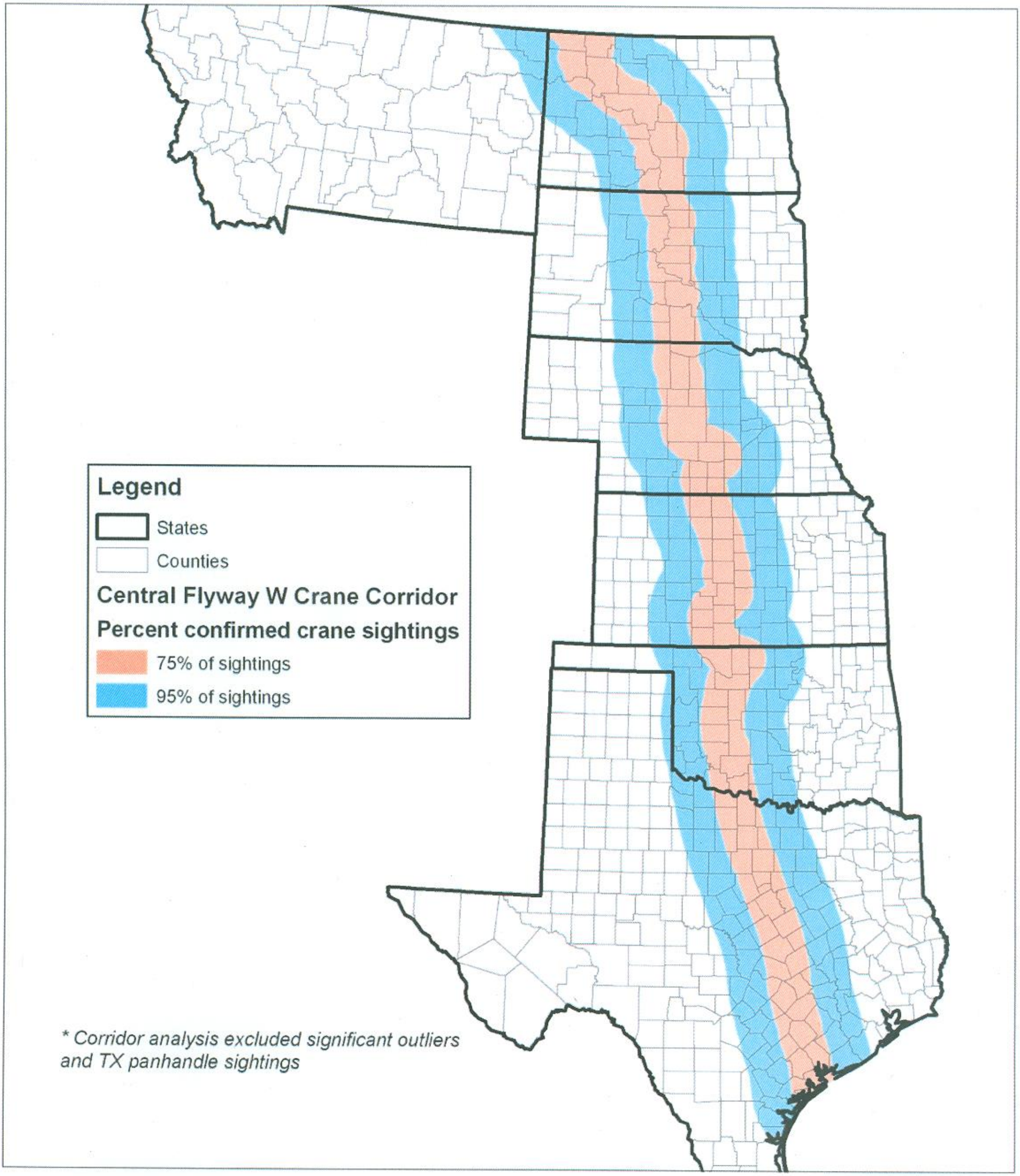
---

[1] Potentially suitable migratory stop over habitat for whooping cranes includes wetlands with areas of shallow water without visual obstructions (i.e., high or dense vegetation) (Austin & Richert 2001; Johns et al. 1997; Lingle et al. 1991; Howe 1987) and submerged sandbars in wide, unobstructed river channels that are isolated from human disturbance (Armbruster 1990). Roosting wetlands are often located within 1 mile of grain fields. As this is a broad definition, ES field office biologists should assist action agencies/applicants/companies in determining what constitutes potentially suitable habitat at the local level.

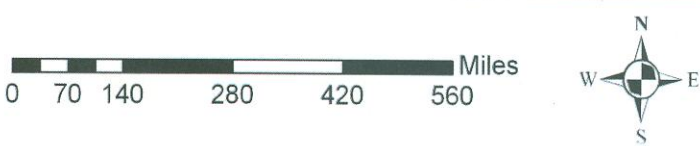
[2] Power lines are cited as the single greatest threat of mortality to fledged whooping cranes. Studies have shown that marking power lines reduces the risk of a line strike by 50 to 80 percent (Yee 2008; Brown & Drewien 1995; Morkill & Anderson 1991). Marking new lines and an equal length of existing line in the migration corridor maintains the baseline condition from this threat.

U.S. Fish & Wildlife Service

United States Central Flyway Whooping Crane Migration Corridor *



Produced for Ecological Services
Grand Island, NE
Current to: 2008
Basemap (Date): U.S. Counties
Meridian:
File:



Literature Cited

Armbruster, M.J. 1990. Characterization of habitat used by whooping cranes during migration. U.S. Fish and Wildlife Service. Biological Report 90(4). 16 pp.

Austin, E.A., and A.L. Richert. 2001. A comprehensive review of observational and site evaluation data of migrant whooping cranes in the United States, 1943-99. U.S. Geological Survey. Northern Prairie Wildlife Research Center, Jamestown, North Dakota, and State Museum, University of Nebraska, Lincoln, Nebraska. 157 pp.

Avian Power Line Interaction Committee. 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute. Washington, D.C. 99 pp.

Brown, W.M., and R.C. Drewien. 1995. Evaluation of two powerline markers to reduce crane and waterfowl collision mortality. Wildlife Society Bulletin 23(2):217-227.

Howe, M.A. 1987. Habitat use by migrating whooping cranes in the Aransas-Wood Buffalo corridor. Pp 303-311, in J.C. Lewis and J.W. Ziewitz, eds. Proc. 1985 Crane Workshop. Platte River Whooping Crane Habitat Maintenance Trust and U.S. Fish and Wildlife Service, Grand Island, Nebraska.

Johns, B.W., E.J. Woodsworth, and E.A. Driver. 1997. Habitat use by migrant whooping cranes in Saskatchewan. Proc. N. Am. Crane Workshop 7:123-131.

Lingle, G.R., G.A. Wingfield, and J.W. Ziewitz. 1991. The migration ecology of whooping cranes in Nebraska, U.S.A. Pp 395-401 in J. Harris, ed. Proc. 1987 International Crane Workshop, International Crane Foundation, Baraboo,Wisconsin.

Morkill, A.E., and S.H. Anderson. 1991. Effectiveness of marking powerlines to reduce sandhill crane collisions. Wildlife Society Bulletin 19:442-449.

Yee, M.L. 2008. Testing the effectiveness of an avian flight diverter for reducing avian collisions with distribution power lines in the Sacramento Valley, California. California Energy Commission; Publication CEC-500-2007-122.

APPENDIX E WHOOPING CRANE SURVEY PROTOCOL

Whooping Crane Fact Sheet

Whooping Cranes in Flight

Foraging Whooping Cranes

Adult with juvenile

The Whooping Crane (*Grus americana*) is a federal and state listed endangered migratory species. The Whooping Crane was federally listed as endangered in 1967. Major river systems used by whooping cranes in Nebraska include the Platte, Loup, Republican, and Niobrara rivers. Additionally, a 3-mile-wide, 56-mile-long reach of the Platte River between Lexington and Denman, Nebraska, has been federally designated as critical habitat for whooping cranes. (Information from U.S. Fish and Wildlife Service)

Whooping Crane (*Grus americana*)
Order: *Gruiformes*
Family: *Gruidae*

Status: State and Federally Endangered. **Description:** L 52"(132 cm) W 87"(221 cm). Sexes similar but males are larger. White body with red and black facial markings. Yellow bill and long dark legs. Immature is white with tawny head and neck, and reddish-brown mottling on rest of body. **Habitat:** In Nebraska is found along the Platte Valley, with its wide slow moving river and associated sandbars and islands. Nearby wet meadows, croplands, and marshlands are important for foraging. **Status/Range:** Occasional spring and fall migrant along Platte Valley. 90% of sightings within 30 miles of Platte River, and 80% occurred between Lexington and Grand Island. **Call:** Shrill "*ker-loo-ker-lee-loo"* trumpet. **Comments:** Endangered. Management and protection programs slowly succeeding.

Similar: Sandhill Crane, Snow Geese, and especially American White Pelicans in flight:
(Information from Nebraska Game and Parks Commission website)

American White Pelican

The Whooping Crane is the tallest bird in North America and one of the rarest birds in the world. Whooping cranes are vulnerable to accidents during migration. Each spring they travel north from their wintering grounds around Aransas National Wildlife Refuge in Texas to their breeding grounds in Wood Buffalo National Park in central Canada (2,400 miles). Each fall this route is reversed. Their journey traverses eastern Montana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma and Texas. In Nebraska, they stop to rest and feed on the Platte, North and Middle Loup and Niobrara rivers. (International Recovery Plan, Whooping Crane *Grus americana*; Third revision, 2007).

Whooping Crane Survey Protocol

Whooping Cranes can be disturbed by sight (human figures, equipment within sight) and sound (loud equipment, banging, etc.) that are abnormal (roadway traffic is normal), therefore surveys are needed to ensure disturbance is minimized.

Dates of Survey:

- Spring Migration – March 6 – April 29
- Fall Migration – October 9 – November 15
- When construction activities are occurring, surveys should be conducted daily during these two time frames.

Time of Survey:

- Survey project each day within one hour of start of workday, with at least one survey done no later than 10 am. Record start and stop time.
- Survey area within 0.5 miles [*Not a sufficient distance if this protocol were to be used during operation of a wind farm*] of project using binoculars or spotting scope.

If Whooping Cranes are not seen during the morning survey, work may begin after completion of the survey.

If Whooping Cranes are spotted within 0.5 miles of the active construction:

- Do not start work. Contact the Commission[1] or the U.S. Fish and Wildlife Service[2] (Service) for further instruction.
- Stop work if seen at times other than the morning survey, and contact the Commission and the Service, as above .
- Work can begin or resume if birds move off and are greater than 0.5 miles from the construction/activity area; record sighting, bird departure time, and work start time on survey form. **[***This bullet may apply to construction of simple, linear, projects, but it's insufficient protection from operating wind farms.*]

[1] Nebraska Game and Parks Commission Point of Contact:
Melissa Marinovich, Assistant Division Administrator, (402) 471-5422
OR
Joel Jorgensen, Nongame Bird Program Manager, (402) 471-5440

[2] U.S. Fish and Wildlife Service, Nebraska Field Office Point of Contact:
Matt Rabbe, Fish & Wildlife Biologist, (308) 379-5562
OR
Mark Porath, Nebraska Ecological Services Project Leader, (308) 216-2077