Exhibit M
Pre-Construction Avian Survey Report
Westwood
March 2, 2020

DICKINSON WRIGHT PLLC

2019-2020 ANNUAL PRE-CONSTRUCTION AVIAN SURVEY REPORT

Grover Hill Wind Energy Project

Paulding County, Ohio

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2019-2020 Annual Pre-Construction Avian Survey Report

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Prepared for:

Prepared by:

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EXHIBITS

ACRONYMS AND ABBREVIATIONS

AGL	Above Ground Level
Amsl	Above Mean Sea Level
ANOVA	Analyses of Variance
BGEPA	Bald and Golden Eagle Protection Act of 1973
BCC	Birds of Conservation Concern
DOW	Division of Wildlife
ECPG	Eagle Conservation Plan Guidance
ESA	Endangered Species Act
ft	feet
GPS	Global Positioning System
MBTA	Migratory Bird Treaty Act
MET	Meteorological Evaluation Tower
m	meters
MW	Megawatt
NLCD	National Land Cover Database
ODNR	Ohio Department of Natural Resources
O&M	Operations and Maintenance
Project	Grover Hill Wind Project
RSH	Rotor Swept Height
SD	Standard Deviation
Starwood	Starwood Energy Group Global, LLC
USFWS	U.S. Fish and Wildlife Service
Westwood	Westwood Professional Services
WTG	Wind Turbine Generator

1.0   INTRODUCTION

Starwood Energy Group Global, LLC (Starwood) proposes to construct and operate the Grover Hill Wind Project (Project) in Paulding County, Ohio **(Exhibit 1).** The proposed Project Area is located in southern Paulding County, Ohio, approximately three miles east of the town of Haviland and six miles to the southeast of the town of Paulding. The town of Grover Hill is located within the east-central portion of the Project Area **(Exhibit 2).**

The Project will be configured as a wind energy conversion facility with a total nameplate capacity of up to 150 megawatts (MW). Starwood continues to assess its turbine options, and is currently evaluating wind turbine generators (WTGs) with rated power outputs between 2.82 to 4.2 MW each, which could result in the installation of up to 53 wind turbines, depending upon the model(s) selected and the final output of the Project. The proposed Project will consist of WTGs, supporting towers, foundations, crane pads, access roads, and 1-2 meteorological evaluation towers (MET). Additional facilities will include transmission line, underground and potentially overhead electric collection and communication systems, an operations and maintenance (O&M) facility, substation, and a laydown area.

Starwood contracted Westwood Professional Services (Westwood) to conduct pre-construction wildlife surveys within the Project Area, including avian point surveys and a ground-based raptor nest survey. Observations of special status species, such as species of concern and state- or federally-listed species, were documented and analyzed in order to assess Project related risk to these species.

1.1   Goals and Objectives of the Avian Baseline Study

The principal goals of the studies were to (1) provide baseline information of avian activity within the Project Area, (2) estimate potential impacts that wind power development may have on birds, and (3) provide information that would help to design a wind farm such that it minimizes the potential for bird collisions with turbines. Specific objectives of the studies were to accomplish the following:

- Identify avian species that occur within the Project Area throughout the year;
- Quantitatively and qualitatively describe the relative abundance and temporal and spatial use of avian species within the Project Area during the winter, spring, summer, and fall periods with an emphasis on special status species (i.e., federally- or state-listed species, U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern (BCC), or Ohio Species of Concern;
- Identify areas of high avian use within the Project Area which may pose greater risk to avian species as a result of wind farm development;
- Identify which raptor species nest, and the spatial distribution of raptor nests, within or near (i.e., 1-mile buffer) the Project Area; and
- Determine mean use of special-status avian species within the Project Area.

This report presents results from all avian studies conducted within the Project Area from March 2019 - February 2020.

2.0   PROJECT AREA

The Project Area consists of approximately 9,687 acres (15 square miles) located in southern Paulding County, Ohio. Land ownership within the Project Area is almost exclusively private. Topography within the Project Area is relatively flat; no rolling hills or draws exist **(Exhibit 3).** Elevation of the Project Area ranges from approximately 709 feet to 735 feet above mean sea level (amsl).

A total of seven principal land cover types are recognized and mapped within the Project Area (NLCD 2011). Approximately 89 percent of the Project Area is comprised of cultivated cropland, consisting primarily of corn (*Zea mays*) and soybeans (*Glycine max*), as well as some areas of alfalfa (*Medicago sativa*). The remaining 11 percent is comprised of developed, forest, herbaceous, woody wetlands, open water, and emergent herbaceous wetlands **(Exhibit 4) (Table 2.0).**

Table 2.0: Land Cover Types in the Project Area		
Land Cover Type	**Area (Acres)**	**Percent of Total**
Cultivated Crops	8,580	88.6
Developed	674	7.0
Forest	315	3.3
Herbaceous	92	0.9
Woody Wetlands	11	0.1
Open Water	8	< 0.1
Emergent Herbaceous Wetlands	7	< 0.1
Total	**9,687**	**100**

Portions of eight named waterways are located within the Project Area including Town Creek, Maddox Creek, Middle Creek, Hoaglin Creek, West Branch Creek, Prairie Creek, Dog Run, and Hog Run **(Exhibit 5).**

3.0   METHODS

To evaluate avian risk at wind energy facilities, standardized protocols for pre-construction avian surveys have been established. The protocols are designed to be responsive to the objectives defined for the Project Area and recommendations in the National Wind Coordinating Committee's *Comprehensive Guide to Studying Wind Energy/Wildlife Interactions* (Strickland et

al. 2011), USFWS *Land-Based Wind Energy Guidelines* (USFWS 2012), Eagle Conservation Plan Guidance (ECPG) (USFWS 2013), and Ohio Department of Natural Resources (ODNR) *On-Shore Bird and Bat Pre- and Post-Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio* (ODNR 2009). Surveys described in this report were conducted in accordance with established ODNR protocols. Data collected during these surveys were used to identify species or species groups that may be at risk from Project construction and operation and may provide additional guidance for micro-siting wind facilities to minimize impacts to birds. The avian studies conducted for the Project consisted of avian point count surveys and a ground based raptor nest survey[1].

3.1   Avian Point Count Surveys

Ten point count locations were generally distributed throughout the potentially buildable portions of the Project Area. The point count locations were placed along existing roadways and stratified by land cover types to attain a minimum survey coverage of 30% of the Project Area **(Exhibit 6).** During the 2019 – 2020 field season, a total of 34 surveys were conducted at each of the 10 locations. Of the 34 survey events, 11 point count surveys were conducted weekly during the spring (March 17 – June 1, 2019), six surveys were conducted bi-monthly during the summer (June 2 – August 31, 2019), nine surveys were conducted weekly during the fall (September 1 – November 2, 2019), and eight surveys were conducted bi-weekly during the winter (November 3, 2019 – February 15, 2020).

Each of the 10 point count stations were visited during a survey event. Surveys were conducted for 20-minute periods within 800-meter (m) radius circular plots and the information gathered during point counts was used to assess avian community composition, species-specific relative abundances, and avian spatial and temporal usage of the Project Area.

Surveys were conducted during daylight hours (i.e., one-half hour before sunrise to one-half hour after sunset). The order in which stations were surveyed was randomly alternated between survey events so that each station was surveyed at different times of day to reduce temporal bias. Birds detected visually or aurally were identified to species (when possible) and recorded on a data form at each of the ten point count stations. In situations where it was not possible to identify individuals to species, birds were identified to the genus level or functional group (e.g., unknown sparrow, unknown woodpecker, etc.).

A unique observation number was assigned to each bird or flock of birds that were observed. Estimated horizontal distance from observer and flight altitude were also

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[1] A meeting was held with USFWS and ODNR staff on March 7, 2019 via conference call to review and discuss the Pre-construction Avian and Bat Survey Work Plan prepared for the Project. Westwood presented information on the Project description and location, habitat types, and survey methods and schedule for proposed avian and bat surveys within the Project Area.

recorded for each bird or flock at the time they were first observed. Estimated flight altitudes above ground level (AGL) were recorded (in meters) and evaluated to determine which species and how many individuals were observed flying within the minimum and maximum rotor swept height (RSH) of the turbine. Ten turbine options are being considered by Starwood and the space occupied by turbine blades (i.e., RSH) could range from 11.5 to 189 m (36 - 620 ft) AGL, which is the approximate distance between the ground and the bottom of the tip of the blade when pointed straight down and the distance between the ground and the maximum height of a turbine blade when pointed straight up.

The behavior (e.g., perched, flying, etc.) of each bird or flock observed and the land cover type where the bird occurred were recorded based on the point of first observation. When possible, sex and stage-class (i.e., juvenile or adult) were also recorded. The date, time of survey start and end, and weather conditions were also recorded for each point count station.

3.1.1   Data Analysis

A Microsoft Excel database was created to store, retrieve, and organize field data. Data from field forms were entered into the database using a pre-defined format. All original field data forms, field notebooks, and electronic data files were retained for reference.

Relative abundances (the number of birds observed per species) and species richness (the number of species excluding unknown species groups) were calculated for each season and for the 2019 - 2020 survey period. Annual species richness per point count station was categorized into three groups (e.g., low, moderate, and high) based on the mean and one standard deviation (1SD); where low included values ($< \bar{x}$ - 1SD), moderate included values ($\bar{x} \pm$ 1SD), and high included values ($> \bar{x} +$ 1SD). Mean species richness was calculated for each season in order to compare seasonal differences in species richness. The number of birds observed during each point count survey were standardized to 20 minutes, the duration of an individual point count. Field data were then calculated as mean observations per 20-minute survey for each point and survey date. Standardizing mean use rates allowed for the comparison of avian use among point count stations and seasons.

Annual mean use rates were calculated for each point count station by dividing the number of observed per species by the total number of point count surveys. Annual mean use estimates per point count station were categorized into three groups (e.g., low, moderate, and high) based on the mean and one standard deviation (1SD) of the estimates; where low included estimates ($< \bar{x}$ - 1SD), moderate included estimates ($\bar{x} \pm$ 1SD), and high included estimates ($> \bar{x} +$ 1SD).

Seasonal mean use rates were determined by dividing the number of individuals observed per species by the total number of surveys (i.e., the number of point count stations multiplied by the number of days surveyed) that occurred during each season. In this study, we defined seasons as spring (March 17 - June 1), summer (June 2 – August 31) fall (September 1 -November 2), and winter (November 3 – February 15). Daily mean use rates were calculated by dividing the number of individuals observed per species by ten (the number of point count stations that were surveyed during the field visit). We also used analysis of variance tests (ANOVAs) to compare estimated mean use rates of the entire avian community (i.e., all species included) to mean use rates of the native avian community (i.e., with non-native and unprotected species removed) by survey event and by point count station.

Frequency of occurrence was calculated as the percent of surveys where a species was observed. Seasonal species composition was estimated by dividing a species' mean use by the total use of all species or all species within a species group and multiplying that value by 100. Frequency of occurrence provides a measure of how often a species may occur within the Project Area and percent composition provides a relative estimate of the avian diversity within the Project Area.

Westwood also estimated encounter rates (i.e., the rate at which a species flew within the RSH) for each species. Turbine type has not been determined by Starwood as of February 2020, so Westwood designated the RSH by using the maximum and minimum rotor height of the turbine options being considered by Starwood. To estimate the encounter rates, the following equation was applied to each species observed in the Project Area:

$$Encounter\ Rate = A*Pf*Pt$$

Where A is the mean intensity of use for a species (mean number of individuals/20 min survey for each species), Pf is the proportion of all behavioral observations for a given species that were classified as flight; and Pt is the proportion of in-flight observations that occurred within the RSH for that species. If a bird or flock was observed flying but flight altitude was not recorded, such observations were excluded from encounter rate analyses. The encounter rate provides an estimated rate that a species may occur within the RSH of the proposed turbines. This information is an important component for estimating collision risk; however, this value alone does not predict collision risks to a species. Species with greater encounter rates are potentially at a greater risk of collision than species with a low encounter rate, but a direct correlation between encounter rates and mortality-risk has not been shown as of yet. Other factors such as turbine location, a species ability to detect turbine blades, flight maneuverability, and habitat selection also contribute to mortality risk.

4.0 RESULTS

4.1 Avian Point Count Surveys

During 2019 - 2020 avian point count surveys a total of 340 20-minute surveys were conducted. A total of 21,838 birds representing 92 species, 12 species groups (e.g., passerines, raptors, etc.), and nine unknown groups (e.g., unknown flycatcher, unknown hawk, unknown sparrow, etc.) were identified during surveys. Of the 21,838 birds observed during avian point counts, 5,166 birds representing 31 species and six species groups were identified during the winter survey period (**Table 4.1a**) and 8,789 birds representing 71 species and 10 species groups were identified during the spring survey period (**Table 4.1b**). During the summer survey period 2,901 birds representing 53 species and eight species groups were identified (**Table 4.1c**) and 4,982 birds representing 50 species and nine species groups were identified during the fall survey period (**Table 4.1d**).

The most commonly observed species during the winter survey effort were the European starling (*Sturnus vulgaris*) (38.3 percent of all birds observed), horned lark (*Eremophila alpestris*) (23.4 percent), mourning dove (*Zenaida macroura*) (20.1 percent), house sparrow (*Passer domesticus*) (4.5 percent), and blue jay (*Cyanocitta cristata*) (2.4 percent). The remaining 26 species comprised 13.7 percent of the total number of birds observed (**Table 4.1a**).

The most commonly observed species during the spring survey effort were the European starling (20.2 percent of all birds observed), red-winged blackbird (*Agelaius phoeniceus*) (18.7 percent), horned lark (9.3 percent), house sparrow (9.2 percent), and American robin (*Turdus migratorius*) (8.3 percent). The remaining 66 species comprised 34.3 percent of the total number of birds observed (**Table 4.1b**).

During the summer survey period, the most commonly observed species were the house sparrow (21.6 percent of all birds observed), European starling (13.8 percent), red-winged blackbird (11.8 percent), barn swallow (*Hirundo rustica*) (6.2 percent), and mourning dove (5.6 percent). The remaining 48 species comprised 41.0 percent of the total number of birds observed during summer (**Table 4.1c**).

During the fall survey period, the most commonly observed species were the house sparrow (22.7 percent of all birds observed), European starling (18.1 percent), red-winged blackbird (11.1 percent), killdeer (*Charadrius vociferus*) (5.5 percent), brown-headed cowbird (*Molothrus ater*) (4.3 percent), and horned lark (4.3 percent). The remaining 44 species comprised 34.0 percent of the total number of birds observed during fall (**Table 4.1d**).

Table 4.1a: Species winter (November 3 – February 15) ranks were based on the number of individuals observed during eight point count surveys (total of 80 point count station visits). Mean use is a measure of the number of individuals observed during each 20-min survey. Species were organized into species groups, and percent composition was estimated for each species within their respective species group and the overall avian community. The frequency of occurrence (i.e., the percent of stations where the species was documented) was calculated from the number of occurrences (i.e., the number of point count stations where a species was observed).

Table 4.1a: Species Groups Winter Ranks							
Species Group	**Winter Rank**	**Number of Birds**	**Number of Occurrences**	**Mean Use (No. Birds/20 Min)**	**Frequency (% of Stations Detected)**	**Species Composition (%)**	
						Group	**Overall**
Passerines							
European starling	1	1,978	96	24.725	68.8	51.8	38.3
Horned lark	2	1,208	105	15.100	66.3	31.6	23.4
House sparrow	4	232	35	2.900	31.3	6.1	4.5
Blue jay	6	122	51	1.525	27.5	3.2	2.4
Red-winged blackbird	7	60	3	0.750	3.8	1.6	1.2
Dark-eyed junco	10	40	6	0.500	5.0	1.0	0.8
Northern cardinal	11	33	10	0.413	8.8	0.9	0.6
American crow	12	22	3	0.275	3.8	0.6	0.4
American goldfinch	13	21	10	0.263	8.8	0.5	0.4
Eastern bluebird	13	21	3	0.263	2.5	0.5	0.4
House finch	14	20	6	0.250	7.5	0.5	0.4
Chipping sparrow	15	18	4	0.225	3.8	0.5	0.3
Brown-headed cowbird	17	12	1	0.150	1.3	0.3	0.2
White-breasted nuthatch	17	12	9	0.150	7.5	0.3	0.2
Unidentified bird (Passerine)	18	11	4	0.138	5.0	0.3	0.2
Unidentified sparrow	21	5	2	0.063	2.5	0.1	0.1
Song sparrow	23	3	2	0.038	2.5	0.1	0.1
American robin	24	2	2	0.025	1.3	0.1	<0.1
Eastern wood-pewee	24	2	2	0.025	2.5	0.1	<0.1
Fox sparrow	25	1	1	0.013	1.3	0.0	<0.1
Total	**--**	**3,823**	**--**	**47.788**	**--**	**100.0**	**73.9**

Table 4.1a: Species Groups Winter Ranks						
Species Group	Winter Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/20 Min)	Frequency (% of Stations Detected)	Species Composition (%)	
						Group	Overall
Waterfowl							
Canada goose	5	158	13	1.975	12.5	100.0	3.1
Total	**--**	**158**	**--**	**1.975**	**--**	**100.0**	**3.1**
Shorebirds							
Killdeer	8	50	10	0.625	7.5	100.0	1.0
Total	**--**	**50**	**--**	**0.625**	**--**	**100.0**	**1.0**
Doves and Pigeons							
Mourning dove	3	1039	77	12.988	48.8	96.2	20.1
Rock pigeon	9	41	7	0.513	5.0	3.8	0.8
Total	**--**	**1,080**	**--**	**13.501**	**--**	**100.0**	**20.9**
Raptors							
Red-tailed hawk	16	14	11	0.175	11.3	36.8	0.3
American kestrel	17	12	12	0.150	12.5	31.6	0.2
Northern harrier[3]	19	6	6	0.075	7.5	15.8	0.1
Bald eagle[1,5]	22	4	3	0.050	3.8	10.5	0.1
Cooper's hawk	25	1	1	0.013	1.3	2.6	<0.1
Unknown hawk	25	1	1	0.013	1.3	2.6	<0.1
Total	**--**	**38**	**--**	**0.476**	**--**	**100.0**	**0.7**
Woodpeckers							
Northern flicker[1]	20	6	6	0.075	6.3	35.3	0.1
Red-bellied woodpecker	22	4	4	0.050	2.5	23.5	0.1
Downy woodpecker	23	3	2	0.038	1.3	17.6	0.1
Red-headed woodpecker[1,2]	24	2	2	0.025	2.5	11.8	<0.1
Unknown woodpecker	24	2	2	0.025	2.5	11.8	<0.1
Total	**--**	**17**	**--**	**0.213**	**--**	**100.0**	**0.3**
Grand Total	**--**	**5,166**		**64.575**	**--**	**--**	**100.0**

[1]USFWS Bird of Conservation Concern, [2]Ohio Species of Concern, [3]Ohio State Endangered Species, [5]Bald and Golden Eagle Protection Act

Table 4.1b: Species spring (March 17 – June 1) ranks were based on the number of individuals observed during 11 point count surveys (total of 110 point count station visits). Mean use is a measure of the number of individuals observed during each 20-min survey. Species were organized into species groups, and percent composition was estimated for each species within their respective species group and the overall avian community. The frequency of occurrence (i.e., the percent of stations where the species was documented) was calculated from the number of occurrences (i.e., the number of point count stations where a species was observed).

Table 4.1b: Species Group Spring Ranks							
Species Group	**Spring Rank**	**Number of Birds**	**Number of Occurrences**	**Mean Use (No. Birds/20 Min)**	**Frequency (% of Surveys Detected)**	**Species Composition (%)**	
						Group	**Overall**
Passerines							
European starling	1	1,778	232	16.164	81.8	23.3	20.2
Red-winged blackbird	2	1,646	408	14.964	94.5	21.5	18.7
Horned lark	3	821	267	7.464	83.6	10.7	9.3
House sparrow	4	805	106	7.318	55.5	10.5	9.2
American robin	5	727	322	6.609	94.5	9.5	8.3
Song sparrow	6	412	162	3.745	75.5	5.4	4.7
Blue jay	8	320	90	2.909	43.6	4.2	3.6
Common grackle	10	253	116	2.300	51.8	3.3	2.9
Barn swallow	12	150	55	1.364	27.2	2.0	1.7
Eastern meadowlark	14	108	54	0.982	32.7	1.4	1.2
Chipping sparrow	15	92	43	0.836	22.7	1.2	1.0
American goldfinch	16	60	14	0.545	7.2	0.8	0.7
Vesper sparrow[2]	17	59	27	0.536	18.2	0.8	0.7
Brown-headed cowbird	18	57	30	0.518	18.2	0.7	0.6
Northern cardinal	19	44	31	0.400	19.1	0.6	0.5
Carolina wren	22	30	21	0.273	12.7	0.4	0.3
House finch	23	26	13	0.236	9.1	0.3	0.3
American crow	24	25	14	0.227	7.2	0.3	0.3
Eastern phoebe	25	23	16	0.209	11.8	0.3	0.3
Bobolink[2]	26	22	10	0.200	6.4	0.3	0.3
Field sparrow[1]	27	20	12	0.182	9.1	0.3	0.2

Table 4.1b: Species Group Spring Ranks						
Species Group	**Spring Rank**	**Number of Birds**	**Number of Occurrences**	**Mean Use (No. Birds/20 Min)**	**Frequency (% of Surveys Detected)**	**Species Composition (%)**	
						Group	**Overall**
Savannah sparrow	28	17	6	0.155	4.5	0.2	0.2
Eastern bluebird	29	16	11	0.145	9.1	0.2	0.2
Tufted titmouse	30	15	10	0.136	8.2	0.2	0.2
Warbling vireo	31	14	7	0.127	4.5	0.2	0.2
Dark-eyed junco	32	13	8	0.118	4.5	0.2	0.1
Bank swallow	33	12	6	0.109	4.5	0.2	0.1
Baltimore oriole	34	11	9	0.100	5.5	0.1	0.1
Tree swallow	35	8	3	0.073	2.7	0.1	0.1
Yellow warbler	36	7	5	0.064	3.6	0.1	0.1
Carolina chickadee	37	6	3	0.055	2.7	0.1	0.1
Black-capped chickadee	38	5	4	0.045	2.7	0.1	0.1
House wren	38	5	4	0.045	3.6	0.1	0.1
Palm warbler	38	5	3	0.045	2.7	0.1	0.1
White-throated sparrow	38	5	3	0.045	1.8	0.1	0.1
White-breasted nuthatch	39	4	4	0.036	3.6	0.1	<0.1
American tree sparrow	40	3	2	0.027	1.8	<0.1	<0.1
Gray catbird	40	3	3	0.027	2.7	<0.1	<0.1
Blackburnian warbler	41	2	1	0.018	0.9	<0.1	<0.1
Blackpoll warbler	41	2	1	0.018	0.9	<0.1	<0.1
Blue-gray gnatcatcher	41	2	2	0.018	1.8	<0.1	<0.1
Brown thrasher	41	2	2	0.018	1.8	<0.1	<0.1
Indigo bunting	41	2	2	0.018	1.8	<0.1	<0.1
Cape may warbler	42	1	1	0.009	0.9	<0.1	<0.1
Common raven	42	1	1	0.009	0.9	<0.1	<0.1
Eastern kingbird	42	1	1	0.009	0.9	<0.1	<0.1
Nashville warbler	42	1	1	0.009	0.9	<0.1	<0.1
Red-eyed vireo	42	1	1	0.009	0.9	<0.1	<0.1
Scarlet tanager	42	1	1	0.009	0.9	<0.1	<0.1

Table 4.1b: Species Group Spring Ranks							
Species Group	**Spring Rank**	**Number of Birds**	**Number of Occurrences**	**Mean Use (No. Birds/20 Min)**	**Frequency (% of Surveys Detected)**	**Species Composition (%)**	
						Group	**Overall**
Total	--	**7,643**	--	**69.477**	--	**100.0**	**86.8**
Waterfowl							
Canada goose	11	247	93	2.245	54.5	86.4	2.8
Mallard	21	34	22	0.309	15.5	11.9	0.4
American coot[2]	41	2	1	0.018	0.9	0.7	<0.1
Pied-billed grebe[1]	41	2	2	0.018	1.8	0.7	<0.1
Wood duck	42	1	1	0.009	0.9	0.3	<0.1
Total	--	**286**	--	**2.599**	--	**100.0**	**3.2**
Upland Gamebirds							
Wild turkey	42	1	1	0.009	0.9	100.0	<0.1
Total	--	**1**	--	**0.009**	--	**100.0**	**<0.1**
Cranes							
Sandhill crane[4]	42	1	1	0.009	0.9	100.0	<0.1
Total		**1**		**0.009**		**100.0**	**<0.1**
Cuckoos							
Yellow-billed cuckoo	42	1	1	0.009	0.9	100.0	<0.1
Total	--	**1**	--	**0.009**	--	**100.0**	**<0.1**
Doves and Pigeons							
Mourning dove	9	255	156	2.318	71.8	98.5	2.9
Rock pigeon	39	4	3	0.036	2.7	1.5	<0.1
Total	--	**259**	--	**2.354**	--	**100.0**	**2.9**
Shorebirds							
Killdeer	7	370	212	3.364	83.6	100.0	4.2
Total	--	**370**	--	**3.364**	--	**100.0**	**4.2**
Wading Birds							
Great blue heron	29	16	15	0.145	12.7	100.0	0.2
Total	--	**16**	--	**0.145**	--	**100.0**	**0.2**
Raptors							

Table 4.1b: Species Group Spring Ranks						
Species Group	**Spring Rank**	**Number of Birds**	**Number of Occurrences**	**Mean Use (No. Birds/20 Min)**	**Frequency (% of Surveys Detected)**	**Species Composition (%)**
						Group	**Overall**
Turkey vulture	13	113	56	1.027	28.2	84.9	1.3
Red-tailed hawk	33	12	12	0.109	9.1	9.0	0.1
Sharp-shinned hawk[2]	37	6	5	0.055	4.5	4.5	0.1
American kestrel	42	1	1	0.009	0.9	0.8	<0.1
Northern harrier[3]	42	1	1	0.009	0.9	0.8	<0.1
Total	**--**	**133**	**--**	**1.209**	**--**	**100.0**	**1.5**
Woodpeckers							
Red-bellied woodpecker	20	41	37	0.373	21.8	51.9	0.5
Northern flicker[1]	26	22	19	0.200	12.7	27.8	0.3
Downy woodpecker	34	11	9	0.100	5.5	13.9	0.1
Red-headed woodpecker[1,2]	39	4	4	0.036	3.6	5.1	<0.1
Pileated woodpecker	42	1	1	0.009	0.9	1.3	<0.1
Total	**--**	**79**	**--**	**0.718**	**--**	**100.0**	**0.9**
Grand Total	**--**	**8,789**	**--**	**79.893**	**--**	**--**	**100.0**

[1]USFWS Bird of Conservation Concern, [2]Ohio Species of Concern, [3]Ohio State Endangered Species, [4]Ohio State Threatened Species

Table 4.1c: Species summer (June 2 – August 31) ranks were based on the number of individuals observed during six bi-monthly point count surveys (total of 60 point count station visits). Mean use is a measure of the number of individuals observed during each 20-min survey. Species were organized into species groups, and percent composition was estimated for each species within their respective species group and the overall avian community. The frequency of occurrence (i.e., the percent of stations where the species was documented) was calculated from the number of occurrences (i.e., the number of point count stations where a species was observed).

Table 4.1c: Species Group Summer Ranks						
Species Group	Summer Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/10 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Passerines							
House Sparrow	1	626	111	10.433	80.0	24.5	21.6
European Starling	2	400	85	6.667	76.7	15.7	13.8
Red-winged Blackbird	3	341	69	5.683	68.3	13.3	11.8
Barn Swallow	4	179	63	2.983	65.0	7.0	6.2
American Robin	6	161	78	2.683	68.3	6.3	5.5
Horned Lark	7	153	62	2.550	53.3	6.0	5.3
Song Sparrow	8	136	61	2.267	80.0	5.3	4.7
Chipping Sparrow	9	81	40	1.350	55.0	3.2	2.8
Brown-headed Cowbird	11	74	33	1.233	38.3	2.9	2.6
American Goldfinch	12	72	46	1.200	53.3	2.8	2.5
Common Grackle	14	47	20	0.783	26.7	1.8	1.6
Blue Jay	15	39	22	0.650	26.7	1.5	1.3
Dickcissel[1]	16	31	15	0.517	20.0	1.2	1.1
House Finch	17	22	9	0.367	13.3	0.9	0.8
Northern Cardinal	18	21	15	0.350	23.3	0.8	0.7
Eastern Meadowlark	19	19	14	0.317	16.7	0.7	0.7
Eastern Wood-Pewee	19	19	13	0.317	18.3	0.7	0.7
Bobolink[3]	20	14	8	0.233	10.0	0.5	0.5
Unidentified Sparrow	20	14	5	0.233	6.7	0.5	0.5
Eastern Bluebird	21	11	7	0.183	11.7	0.4	0.4
Gray Catbird	21	11	11	0.183	13.3	0.4	0.4

Table 4.1c: Species Group Summer Ranks						
Species Group	Summer Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/10 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Vesper Sparrow[3]	22	10	7	0.167	11.7	0.4	0.3
Field Sparrow[1]	23	9	6	0.150	10.0	0.4	0.3
Bank Swallow	25	7	1	0.117	1.7	0.3	0.2
Cedar Waxwing	25	7	3	0.117	3.3	0.3	0.2
Tree Swallow	25	7	2	0.117	1.7	0.3	0.2
White-breasted Nuthatch	25	7	4	0.117	6.7	0.3	0.2
Savannah Sparrow	26	6	4	0.100	6.7	0.2	0.2
Red-eyed Vireo	27	4	3	0.067	5.0	0.2	0.1
Yellow Warbler	27	4	2	0.067	3.3	0.2	0.1
Eastern Kingbird	28	3	3	0.050	5.0	0.1	0.1
Indigo Bunting	28	3	3	0.050	5.0	0.1	0.1
Unidentified Blackbird	28	3	1	0.050	1.7	0.1	0.1
Warbling Vireo	28	3	2	0.005	3.3	0.1	0.1
Baltimore Oriole	29	2	2	0.033	3.3	0.1	0.1
Eastern Phoebe	29	2	1	0.033	1.7	0.1	0.1
Black-and-white Warbler	30	1	1	0.017	1.7	<0.1	<0.1
Carolina Chickadee	30	1	1	0.017	1.7	<0.1	<0.1
Carolina Wren	30	1	1	0.017	1.7	<0.1	<0.1
House Wren	30	1	1	0.017	1.7	<0.1	<0.1
Red-breasted Nuthatch	30	1	1	0.017	1.7	<0.1	<0.1
Unidentified Flycatcher	30	1	1	0.017	1.7	<0.1	<0.1
Unidentified Warbler	30	1	1	0.017	1.7	<0.1	<0.1
Total	--	2,555	--	42.583	--	100.0	87.9
Waterfowl							
Mallard	24	8	7	0.133	10	57.1	0.3
Canada Goose	26	6	2	0.100	3.3	57.1	0.2
Total	--	14	--	0.233	--	42.9	0.5
Swifts and Hummingbirds							

Table 4.1c: Species Group Summer Ranks							
Species Group	**Summer Rank**	**Number of Birds**	**Number of Occurrences**	**Mean Use (No. Birds/10 Min)**	**Frequency (% of Surveys Detected)**	**Species Composition (%)**	
						Group	**Overall**
Chimney Swift	30	1	1	0.017	1.7	100.0	<0.1
Total	**--**	**1**	**--**	**0.017**	**--**	**100.0**	**<0.1**
Doves and Pigeons							
Mourning Dove	5	163	104	2.717	83.3	100.0	5.6
Total	**--**	**163**	**--**	**2.717**	**--**	**100.0**	**5.6**
Shorebirds							
Killdeer	10	78	46	1.300	43.3	100.0	2.7
Total	**--**	**78**	**--**	**1.300**	**--**	**100.0**	**2.7**
Wading Birds							
Great Blue Heron	27	4	4	0.067	6.7	100.0	0.1
Total	**--**	**4**	**--**	**0.067**	**--**	**100.0**	**0.1**
Raptors							
Turkey Vulture	13	52	21	0.867	25.0	83.8	1.8
American Kestrel	27	4	3	0.067	5.0	6.5	0.1
Red-tailed Hawk	27	4	4	0.067	6.7	6.5	0.1
Northern Harrier[2]	29	2	2	0.033	3.3	3.2	0.1
Total	**--**	**62**	**--**	**1.034**	**--**	**100.0**	**2.1**
Woodpeckers							
Northern Flicker[1]	23	9	7	0.150	8.3	37.5	0.3
Red-headed Woodpecker[1,3]	25	7	7	0.117	11.7	37.5	0.2
Red-bellied Woodpecker	27	4	4	0.067	5.0	29.2	0.1
Downy Woodpecker	29	2	2	0.033	3.3	16.7	0.1
Unidentified Woodpecker	29	2	2	0.033	3.3	8.3	0.1
Total	**--**	**24**	**--**	**0.400**	**--**	**8.3**	**0.8**
Grand Total	**--**	**2,901**		**48.350**	**--**	**100.0**	**100.0**

[1]USFWS Bird of Conservation Concern, [2]Ohio Species of Concern, [3]Ohio State Endangered Species

Table 4.1d: Species fall (September 1 – November 2) ranks were based on the number of individuals observed during nine weekly point count surveys (total of 90 point count station visits). Mean use is a measure of the number of individuals observed during each 20-min survey. Species were organized into species groups, and percent composition was estimated for each species within their respective species group and the overall avian community. The frequency of occurrence (i.e., the percent of stations where the species was documented) was calculated from the number of occurrences (i.e., the number of point count stations where a species was observed).

Table 4.1d: Species Group Fall Ranks							
Species Group	**Fall Rank**	**Number of Birds**	**Number of Occurrences**	**Mean Use (No. Birds/20 Min)**	**Frequency (% of Surveys Detected)**	**Species Composition (%)**	
						Group	**Overall**
Passerines							
House sparrow	1	1,131	115	12.567	71.1	27.4	22.7
European starling	2	900	140	10.000	68.9	21.8	18.1
Red-winged blackbird	3	553	34	6.144	26.7	13.4	11.1
Brown-headed cowbird	5	215	13	2.389	8.9	5.2	4.3
Horned lark	6	213	48	2.367	26.7	5.2	4.3
Blue jay	7	196	120	2.178	64.4	4.7	3.9
American robin	8	173	51	1.922	31.1	4.2	3.5
Common grackle	9	164	23	1.822	14.4	4.0	3.3
Chipping sparrow	10	130	37	1.440	32.2	3.1	2.6
American goldfinch	11	115	46	1.278	40.0	2.8	2.3
Bobolink[2]	14	75	17	0.833	14.4	1.8	1.5
Song sparrow	15	66	26	0.733	21.1	1.6	1.3
Barn swallow	16	64	17	0.711	11.1	1.6	1.3
Unidentified sparrow	18	47	27	0.522	26.7	1.1	1.0
American crow	21	14	2	0.156	2.2	0.3	0.3
Unidentified warbler	23	9	4	0.100	4.4	0.2	0.2
Unidentified bird (Passerine)	25	7	6	0.078	4.4	0.2	0.1
Eastern bluebird	26	6	2	0.067	2.2	0.1	0.1
Eastern wood-pewee	27	5	4	0.056	3.3	0.1	0.1
Field sparrow[1]	27	5	1	0.056	1.1	0.1	0.1
Fox sparrow	27	5	1	0.056	1.1	0.1	0.1

Table 4.1d: Species Group Fall Ranks							
Species Group	Fall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/20 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Northern cardinal	27	5	5	0.056	3.3	0.1	0.1
Gray catbird	28	4	4	0.044	3.3	0.1	0.1
Blue-gray gnatcatcher	29	3	3	0.033	3.3	0.1	0.1
Cedar waxwing	29	3	1	0.033	1.1	0.1	0.1
Rose-breasted grosbeak	29	3	3	0.033	3.3	0.1	0.1
Swainson's thrush	29	3	3	0.033	3.3	0.1	0.1
Golden-crowned kinglet[2]	30	2	1	0.022	1.1	<0.1	<0.1
Savannah sparrow	30	2	2	0.022	1.1	<0.1	<0.1
Unidentified flycatcher	30	2	2	0.022	2.2	<0.1	<0.1
Unidentified wren	30	2	2	0.022	2.2	<0.1	<0.1
American redstart	31	1	1	0.011	1.1	<0.1	<0.1
Carolina wren	31	1	1	0.011	1.1	<0.1	<0.1
Hermit thrush	31	1	1	0.011	1.1	<0.1	<0.1
Yellow warbler	31	1	1	0.011	1.1	<0.1	<0.1
Unidentified thrush	31	1	1	0.011	1.1	<0.1	<0.1
Total	--	**4,127**	--	**45.850**	--	**100.0**	**69.0**
Waterfowl							
Canada goose	13	95	12	1.056	11.1	61.3	1.9
Common goldeneye	17	50	1	0.556	1.1	32.3	1.0
Blue-winged teal	22	10	2	0.111	2.2	6.4	0.2
Total	--	**155**	--	**1.723**	--	**100.0**	**3.1**
Cormorants							
Double-crested cormorant	12	100	1	1.111	1.1	100.0	2.0
Total	--	**100**	--	**1.111**	--	**100.0**	**2.0**
Swifts and Hummingbirds							
Chimney swift	26	6	4	0.067	4.4	100.0	0.1
Total	--	**6**	--	**0.067**	--	**100.0**	**0.1**
Doves and Pigeons							

Table 4.1d: Species Group Fall Ranks

Species Group	Fall Rank	Number of Birds	Number of Occurrences	Mean Use (No. Birds/20 Min)	Frequency (% of Surveys Detected)	Species Composition (%)	
						Group	Overall
Mourning dove	6	213	70	2.367	42.2	100.0	4.3
Total	**--**	**213**	**--**	**2.367**	**--**	**100.0**	**4.3**
Shorebirds							
Killdeer	4	276	120	3.07	72.2	100.0	5.5
Total	**--**	**276**	**--**	**3.07**	--	**100.0**	**5.5**
Wading Birds							
Great blue heron	30	2	2	0.022	2.2	100.0	<0.1
Total	**--**	**2**	**--**	**0.022**	--	**100.0**	**<0.1**
Raptors							
Turkey vulture	19	43	21	0.478	17. 8	56.6	0.9
American kestrel	20	23	4	0.256	4.4	30.3	0.5
Bald eagle[1,5]	29	3	2	0.033	2.2	3.9	0.1
Northern harrier[3]	29	3	3	0.033	4.4	3.9	0.1
Cooper's hawk	31	1	1	0.011	1.1	1.3	<0.1
Merlin	31	1	1	0.011	1.1	1.3	<0.1
Red-tailed hawk	31	1	1	0.011	1.1	1.3	<0.1
Unidentified hawk	31	1	1	0.011	1.1	1.3	<0.1
Total	**--**	**76**	**--**	**0.844**	**--**	**99.9**	**6.6**
Woodpeckers							
Northern flicker[1]	21	14	13	0.156	6. 7	51.9	0.3
Unidentified woodpecker	24	8	6	0.089	5. 6	29.6	0.2
Red-bellied woodpecker	30	2	2	0.022	1.1	7.4	<0.1
Downy woodpecker	31	1	1	0.011	1.1	3.7	<0.1
Hairy woodpecker	31	1	1	0.011	1.1	3.7	<0.1
Red-headed woodpecker[1,2]	31	1	1	0.011	1.1	3.7	<0.1
Total	**--**	**27**	**--**	**0.300**	**--**	**100.0**	**0.2**
Grand Total	**--**	**4,982**		**55.354**	**--**	**--**	**100.0**

[1]USFWS Bird of Conservation Concern, [2]Ohio Species of Concern, [3]Ohio State Endangered Species, [5]Bald and Golden Eagle Protection Act

4.1.1   Mean Bird Use

Overall mean bird use within the Project Area during the winter was 64.53 birds/20 min (range 0 to 446 birds/20 min). Mean use was greatest for passerines (47.73 birds/20 min) among all species groups. Of the passerines, the European starling was the most abundant species accounting for 51.8 percent of the species group. Among doves and pigeons, the second greatest species group (13.50 birds/20 min), the most abundant species was the mourning dove (96.2 percent) (**Table 4.1a**). The remaining species groups, waterfowl, raptors, shorebirds, and woodpeckers had mean use estimates of 1.98 birds/20 min, 0.46 birds/20 min, 0.63 birds/20 min, and 0.21 birds/20 min, respectively (**Table 4.1a**).

Overall mean bird use within the Project Area during the spring was 79.89 birds/20 min (range 0 to 624 birds/20 min). Among all species groups, mean use was greatest for passerines (69.48 birds/20 min). The most abundant species was the European starling, accounting for 23.3 percent of passerines. Among shorebirds, the second highest species group (3.36 birds/20 min), killdeer accounted for all observations (**Table 4.1b**). The remaining species groups, waterfowl, upland gamebirds, cranes, cuckoos, doves and pigeons, wading birds, raptors, and woodpeckers had mean use estimates of 2.60 birds/20 min, 0.01 birds/20 min, 0.01 birds/20 min, 0.01 birds/20 min, 2.36 birds/20 min, 0.15 birds/20 min, 1.21 birds/20 min, and 0.72 birds/20 min, respectively (**Table 4.1b**).

Overall mean bird use within the Project Area during the summer was 48.35 birds/20 min (range 0 to 293 birds/20 min). Among all species groups, mean use was greatest for passerines (42.59 birds/20 min). The most abundant species was the house sparrow, accounting for 24.5 percent of the species group. Among doves and pigeons, the second highest species group at 2.72 birds/20 min, the mourning dove accounted for all observations (**Table 4.1c**). The remaining species groups, waterfowl, swifts and hummingbirds, shorebirds, wading birds, raptors, and woodpeckers had mean use values of 0.23 birds/20 min, 0.02 birds/20 min, 1.3 birds/20 min, 0.07 birds/20 min, 1.03 birds/20 min, and 0.4 birds/20 min, respectively (**Table 4.1c**).

Overall mean bird use within the Project Area during the fall survey period was 55.35 birds/20 min (range 2 to 293 birds/20 min). Among all species groups, mean use was greatest for passerines (45.85 birds/20 min). The house sparrow was the most abundant species and accounted for 27.4 percent of passerines. Among shorebirds, the second most common species group (3.07 birds/20 min), the killdeer accounted for all observations (**Table 4.1d**). The remaining species groups, waterfowl, seabirds, swifts and hummingbirds, doves and pigeons, wading birds, raptors, and woodpeckers had mean use estimates of 1.72 birds/20 min, 1.11

birds/20 min, 0.07 birds/20 min, 2.37 birds/20 min, 0.02 birds/20 min, 0.84 birds/20 min, and 0.3 birds/20 min, respectively (**Table 4.1d**).

Overall winter, spring, summer, and fall mean uses for raptors were 0.48 birds/20 min, 1.21 birds/20 min, 1.03 birds/20 min, and 0.84 birds/20 min, respectively. The raptor species with the greatest mean use for all seasons combined were the turkey vulture (*Cathartes aura*) (2.37 birds/20 min) and the American kestrel (*Falco sparverius*) (0.48 birds/20 min) (**Tables 4.1a – 4.1d**).

Mean bird use per survey event ranged from 38.7 to 143.9 birds/20 min with all species included, and from 17.0 to 70.8 birds/20 min when non-native invasive species were removed. Mean bird use (birds/20 min) average was 64.25 ± 21.98 when all species were included, and 41.03 ± 15.91 when non-native invasive species were removed. Mean bird use per survey event was less when non-native invasive species (i.e., house sparrow, European starling, and rock pigeon) were removed (ANOVA $F_{(1, 66)}$ = 24.90, p < 0.01) **(Exhibit 7).**

4.1.2   Species Composition

Species composition is a measure of the percent composition that a species (based on number of individuals) comprises of the total avian community during a season. Passerines comprised the greatest species composition of all species groups during all seasons.

During the winter, passerines accounted for 73.9 percent of the avian community, followed by doves and pigeons (20.9 percent), and waterfowl (3.1 percent). The European starling (38.3 percent of the winter avian community) and horned lark (23.4 percent) had the greatest composition of passerines. The mourning dove had the greatest composition from the doves and pigeons species group, accounting for 20.1 percent of the winter community, while the Canada goose (3.1 percent) was the only waterfowl species recorded during winter surveys (**Table 4.1a**).

During the spring, the European starling accounted for 20.2 percent of the avian community, followed by the red-winged blackbird (18.7 percent), horned lark (9.3 percent), house sparrow (9.2 percent), and American robin (8.3 percent). The killdeer had the greatest composition from other species groups, accounting for 4.2 percent of the avian community, followed by the mourning dove (2.9 percent) and Canada goose (2.8 percent). All other species groups represented small proportions of the spring avian community (**Table 4.1b**).

During the summer, the house sparrow comprised the greatest percentage of the avian community (21.6 percent), followed by the European starling (13.8 percent), red-winged blackbird (11.8 percent), and barn swallow (6.2 percent). The

mourning dove (5.6 percent), killdeer (2.7 percent) and turkey vulture (1.8 percent) accounted for the greatest compositions from the doves and pigeons, shorebird, and raptor species groups. All other species groups represented small proportions of the summer avian community (**Table 4.1c**).

During the fall survey period, the house sparrow accounted for 22.7 percent of the avian community, followed by the European starling (18.1 percent), and red-winged blackbird (11.1 percent). The killdeer, the only shorebird species, had the fourth greatest composition (5.5 percent) for the fall, followed by the mourning dove (4.3 percent), and double-crested cormorant (*Phalacrocorax auritus*) (1.9 percent) (**Table 4.1d**). All other species comprised ≤ 1 percent of the overall fall community (**Table 4.1d**).

4.1.3   Species Frequency of Occurrence

Passerines were the most frequently observed species group during all seasons. Species of the doves and pigeons, shorebird, and raptor species groups were the second, third, and fourth most frequently observed during 2019 - 2020 avian point count surveys. Frequency of occurrence for other species groups was typically below 10 percent of surveys within a season.

During the winter, 10 point count stations were surveyed eight times, totaling 80 surveys during this time period. Within passerines, the European starling was observed most frequently (68.8 percent of all surveys), followed by the horned lark (66.3 percent), house sparrow (31.3 percent), blue jay (27.5 percent), and northern cardinal (*Cardinalis cardinalis*) and American goldfinch (*Spinus tristis*) (8.8 percent of all surveys, each) (**Table 4.1a**). Among doves and pigeons, the mourning dove occurred in 48.8 percent of surveys. Among raptors, the American kestrel occurred in 12.5 percent of surveys and the red-tailed hawk occurred in 11.3 percent of surveys, while the Canada goose (12.5 percent of surveys) was the only species observed in the waterfowl group. Woodpeckers and shorebirds were observed less frequently during winter, with the northern flicker (*Colaptes auratus*) occurring in 6.3 percent of surveys and killdeer occurring in 7.5 percent of surveys (**Table 4.1a**). Frequency of occurrence for other species during winter surveys were low.

During the spring, 10 point count stations were surveyed 11 times, totaling 110 surveys during this time period. Among passerines, the red-winged blackbird and American robin were observed most frequently (94.5 percent of surveys), followed by the horned lark (83.6 percent), European starling (81.8 percent), song sparrow (75.5 percent), and house sparrow (55.5 percent) (**Table 4.1b**). Among doves and pigeons, the mourning dove (71.8 percent of all surveys) was detected most frequently (**Table 4.1b**). Among raptors, the turkey vulture was observed at 28.2 percent of surveys and the red-tailed hawk at 9.1 percent of surveys; while

the Canada goose (54.5 percent of surveys) was the most frequently observed waterfowl species (**Table 4.1b**). Killdeer were the only representative shorebird species during the spring and were detected at 83.6 percent of surveys. Frequency of occurrence for species in all other species groups during spring surveys were low.

During the summer, 10 point count stations were surveyed six times, totaling 60 surveys during this time period. Within passerines, the house sparrow and song sparrow were the most commonly observed species (80.0 percent of surveys), followed by the European starling (76.7 percent), red-winged blackbird and American robin (68.3 percent), barn swallow (65.0 percent), and chipping sparrow (*Spizella passerina*) (55.0 percent). Among doves and pigeons, the mourning dove was detected at 83.3 percent of surveys (**Table 4.1c**). Among shorebirds, the killdeer was detected at 43.3 percent of surveys; while the turkey vulture (25.0 percent of surveys) was the most frequently detected species among the raptor group (**Table 4.1c**). Frequency of occurrence for species in all other species groups during summer surveys were low.

During the fall, 10 point count stations were surveyed nine times, totaling 90 surveys during this time period. Among passerines, the house sparrow was observed most frequently (71.1 percent of surveys), followed by the European starling (68.9 percent), blue jay (64.4 percent), American goldfinch (40.0 percent), and chipping sparrow (32.2 percent). Within raptors, the turkey vulture was detected at 17.8 percent of surveys, while killdeer represented the only shorebird species and was observed in 72.2 percent of surveys (**Table 4.1d**). Among waterfowl, the Canada goose was observed at 11.1 percent of surveys, and within doves and pigeons, the mourning dove was the only observed species and was detected in 42.2 percent of surveys (**Table 4.1d**). Frequency of occurrence for species in all other species groups during fall surveys were low.

4.1.4   Spatial Use

Mean use and species richness were calculated for individual point count stations to qualitatively assess spatial use of the Project Area by birds (**Table 4.1.4**) (**Exhibits 8a and 9**). Mean use was categorized into low (0 – 55.13 birds/20 min), moderate (55.14 – 73.33 birds/20 min), or high (73.34 – 84.68 birds/20 min) categories. One point count station had mean use estimates that were considered high, seven point count stations had moderate mean use estimates, and two point count stations had a low mean use estimate. Overall mean use was greatest at point count station 10 (84.68 birds/20 min) and point count station 7 (72.53 birds/20 min) in the eastern and central portions of the Project Area, and least at point count station 5 (54.06 birds/20 min) and point count station 4 (54.32 birds/20 min) in the eastern and central portion of the Project Area. Mean use does not appear to be influenced by location within the Project Area (**Exhibit 8a**).

Mean bird use per point ranged from 54.06 to 84.68 birds/20 min with all species included, and 13.62 to 54.74 birds/20 min when non-native invasive species (i.e., house sparrow, European starling, and rock pigeon) were removed(**Exhibit 10**). Mean bird use (birds/20 min) average (±1SD) for all species per point was 64.23 ± 9.10, and was 38.78 ± 12.90 when non-native invasive species were removed. Mean bird use per point count station was less when non-native invasive species were removed (ANOVA $F_{(1, 18)}$ = 25.98, p < 0.01) **(Exhibit 8b)**. Mean use of native species does not appear to be influenced by location within the Project Area.

Species richness was greatest at point count station 6 (n = 63), point count station 5 (n = 61), and point count station 10 (n = 48) all of which were located on the eastern edge of the Project Area. Species richness was least at point count station 4 (n = 31) and point count station 8 (n = 31) in the central and western portions of the Project Area, respectively (**Exhibit 9**). Species richness varied across the Project Area, but was greatest in areas with forested or wooded wetland habitats.

Table 4.1.4. Species richness at point count stations within the Project Area ranged from 31 to 63 and mean use ranged from 54.06 to 84.68 birds/20 min based on 2019 – 2020 data. All 10 point count stations were surveyed 34 times in 2019-2020. Mean species richness within the Project Area was 41.9 ± 11.7 ($\bar{x}$ ± 1SD) and average mean use was 64.23 ± 9.1.

Table 4.1.4. Species Richness and Mean Use by Point Count Station		
Point Count Station	**Species Richness**	**Mean Use (Birds/20 min)**
1	32	64.85
2	38	64.47
3	37	63.50
4	31	54.32
5	61	54.06
6	63	61.59
7	38	72.53
8	31	65.00
9	40	57.29
10	48	84.68

4.1.5   Seasonal Abundance and Species Richness

A total of 21,838 birds representing 92 species and 12 species groups were identified during the 2019-2020 avian point count surveys. Some species (e.g., horned lark and house sparrow) were observed throughout the year, while others occurred within the Project Area seasonally (e.g., barn swallow). In 2019 - 2020, the European starling (n = 5,056) was the most abundant species within the Project Area, followed by the house sparrow (n = 2,794), and red-winged blackbird

(n = 2,600) (**Table 4.1.5**). Ten species were ranked within the top five most abundant species in multiple seasons including the European starling, house sparrow, red-winged blackbird, horned lark, mourning dove, American robin, barn swallow, killdeer, and brown-headed cowbird. The European starling was the most abundant species in the winter and spring and the house sparrow was the most abundant species in the summer and fall.

The number of birds observed varied by season with 5,162 in the winter, 8,789 in the spring, 2,901 in the summer, and 4,982 in the fall. Species richness was greatest in the spring ($\bar{x}$ = 31.0), intermediate in the summer ($\bar{x}$ = 24.1) and fall ($\bar{x}$ = 19.9), and least in the winter ($\bar{x}$ = 12.4) (**Exhibit 11**). Fluctuations in species richness appears to coincide with spring and fall migration periods. However, it should be noted that survey effort also varied by season with 8 survey events in the winter, 11 in the spring, 6 in the summer, and 9 in the fall and the variation observed in species richness and seasonal abundance may be attributed to the differences in survey effort.

Table 4.1.5. Abundances and the proportion of the avian community are provided for the top five species observed during the 2019 - 2020 avian point count surveys and each respective season. Species are ranked based on the proportion of the avian community they comprise, in the case of a tie, more than one species is listed.

Table 4.1.5. Percent Composition of Avian Community		
Common name	**Number Observed**	**Percent Composition of Avian Community**
Year (n = 21,838)		
European starling	5,056	23.1
House sparrow	2,794	12.7
Red-winged blackbird	2,600	11.9
Horned lark	2,395	10.9
Mourning dove	1,670	7.6
Winter (n = 5,166)		
European starling	1,978	38.3
Horned lark	1,208	23.4
Mourning dove	1,039	20.1
House sparrow	232	4.5
Canada goose	158	3.1
Spring (n = 8,789)		
European starling	1,778	20.2
Red-winged blackbird	1,646	18.7
Horned lark	821	9.3
House sparrow	805	9.2
American robin	727	8.3
Summer (n = 2,901)		
House sparrow	626	21.6

Table 4.1.5. Percent Composition of Avian Community		
Common name	**Number Observed**	**Percent Composition of Avian Community**
European starling	400	13.8
Red-winged blackbird	341	11.8
Barn swallow	179	6.2
Mourning dove	163	5.6
Fall (n = 4,982)		
House sparrow	1,131	22.7
European starling	900	18.1
Red-winged blackbird	553	11.1
Killdeer	276	5.5
Brown-headed cowbird	215	4.3

4.1.6   Flight Altitude and Encounter Rates

Behavioral data were recorded for all birds observed during avian point counts within the Project Area. Approximately 51 percent (number in-flight = 11,052) of all birds observed were in-flight. Flight altitude was reported in meters for all individuals that were observed in-flight. The percent of individuals per species flying at altitudes within the RSH of turbines provides an estimate of the risk of collision for a given species.

Of all birds that were observed flying during the 2019-2020 avian point count surveys (n = 11,052), 50 percent flew below the RSH (0 – 11.5 m AGL [0 – 36 ft]), 50 percent flew within the RSH (11.5 – 189 m AGL [36 – 620 ft]), and less than one percent flew above the RSH (≥189 m AGL [≥ 620 ft]). A total of 5,489 individuals representing 45 species were observed flying within the RSH (**Table 4.1.6**). The European starling had the greatest encounter rate (4.771 birds within the RSH/20 min), followed by the red-winged blackbird (2.344 birds within the RSH/20 min), horned lark (1.382 birds within the RSH/20 min), and house sparrow (0.982 birds within the RSH/20 min) (**Table 4.1.6**).

Table 4.1.6: Encounter rates of the 45 species observed flying within the rotor swept height (RSH) ranged from 0.003 to 4.771 birds/20 min.

Table 4.1.6. Encounter Rates					
Species	**No. of Birds**	**Mean Use (No. Birds/20 min)**	**Proportion Observed in Flight**	**Proportion Flying within RSH**	**Encounter Rate (No. birds within RSH/20 min)**
European starling	5,056	14.871	1.000	1.000	4.771
Red-winged blackbird	2,600	7.647	0.443	0.704	2.344
Horned lark	2,395	7.044	0.451	0.843	1.382
House sparrow	2,794	8.218	0.125	0.200	0.982

Table 4.1.6. Encounter Rates					
Species	No. of Birds	Mean Use (No. Birds/20 min)	Proportion Observed in Flight	Proportion Flying within RSH	Encounter Rate (No. birds within RSH/20 min)
Mourning dove	1,670	4.912	0.292	0.826	0.959
American robin	1,063	3.126	0.714	1.000	0.753
Brown-headed cowbird	358	1.053	0.579	0.091	0.674
Blue jay	677	1.991	0.921	0.149	0.626
Killdeer	774	2.276	0.707	0.905	0.571
Canada goose	506	1.488	0.667	1.000	0.529
Turkey vulture	208	0.612	0.397	0.792	0.497
Common grackle	464	1.365	0.568	0.127	0.485
American goldfinch	268	0.788	1.000	0.300	0.300
Double-crested cormorant	100	0.294	0.403	0.882	0.294
Barn swallow	393	1.156	0.178	0.386	0.159
Common goldeneye	50	0.147	1.000	0.857	0.147
Rock pigeon	45	0.132	1.000	1.000	0.097
Song sparrow	617	1.815	0.478	0.743	0.068
Chipping sparrow	321	0.944	0.500	1.000	0.065
Mallard	42	0.124	1.000	1.000	0.065
Great blue heron	22	0.065	0.259	0.286	0.059
American crow	61	0.179	0.071	0.556	0.056
Red-tailed hawk	31	0.091	0.696	0.461	0.050
Northern flicker[1]	51	0.150	0.147	1.000	0.047
Bobolink[2]	111	0.326	0.955	0.952	0.024
Chimney swift	7	0.021	1.000	1.000	0.018
Bald eagle[1,5]	7	0.021	0.553	0.355	0.015
Eastern meadowlark	127	0.374	0.371	0.322	0.015
Field sparrow[1]	34	0.100	0.394	0.636	0.015
Eastern bluebird	54	0.159	0.833	0.629	0.012
Blue-winged teal	10	0.029	0.651	0.300	0.009
American coot[2]	2	0.006	0.471	0.667	0.006
Blue grosbeak	3	0.009	0.917	0.182	0.006
Northern harrier[3]	12	0.035	0.400	1.000	0.006
Palm warbler	5	0.015	1.000	0.667	0.006
Rose-breasted grosbeak	3	0.009	0.357	0.400	0.006
Red-headed woodpecker[1,2]	14	0.041	0.978	0.750	0.006
American kestrel	40	0.118	0.677	0.810	0.003
Bank swallow	19	0.056	0.428	0.717	0.003
Cooper's hawk	2	0.006	1.000	1.000	0.003
Hairy woodpecker	1	0.003	1.000	1.000	0.003
Sandhill crane[4]	1	0.003	0.125	0.299	0.003
Scarlet tanager	1	0.003	1.000	0.167	0.003
Sharp-shinned hawk[2]	6	0.018	0.733	0.091	0.003
Tree swallow	15	0.044	0.899	0.904	0.003

[1]USFWS Bird of Conservation Concern, [2]Ohio Species of Concern, [3]Ohio State Endangered Species, [4]Ohio Threatened Species, [5]Bald and Golden Eagle Protection Act

4.1.7   Special-Status Species

Thirteen of the 92 avian species (14.1 percent) identified during avian point count surveys are considered special-status species. Special-status species include those listed as threatened or endangered under the federal Endangered Species Act (ESA) of 1973, as amended; those protected in accordance with the Ohio Revised Code (Chapter 1531.25, Protection of species threatened with statewide extinction), the Bald and Golden Eagle Protect Act (BGEPA), species identified by the USFWS as Birds of Conservation Concern (BCC)[2], and other species identified by ODNR Division of Wildlife (DOW) as Species of Concern. These species, including their status, number of individuals observed, percent composition of seasonal and overall communities, and mean use estimates within the Project Area are provided in **Table 4.1.7a**. A comparison of seasonal and annual special-status species mean-use estimates is provided in **Table 4.1.7b**.

A total of 331 individuals representing 13 special-status species were observed during point count surveys (**Table 4.1.7a**). Six of the special-status species are listed as BCC, including the field sparrow (*Spiza pusilla*), pied-billed grebe (*Podilymbus podiceps*), northern flicker, dickcissel (*Spiza americana*), bald eagle, and red-headed woodpecker (*Melanerpes erythrocephalus*). The red-headed woodpecker is also an Ohio Species of Concern. Five additional species are considered Ohio Species of Concern including the vesper sparrow (*Pooecetes gramineus*), bobolink (*Dolichonyx oryzivorus*), American coot (*Fulica americana*), sharp-shinned hawk (*Accipiter striatus*), and golden-crowned kinglet (*Regulus satrapa*). Two federally- or state-listed species were observed during point count surveys, including the state-endangered northern harrier (*Circus hudsonius*), and state-threatened sandhill crane (*Grus canadensis*).

Of the 331 individuals observed, 33.5 percent were bobolinks, 17.8 percent were vesper sparrows, and 15.4 percent were northern flickers. The remaining ten species comprised 33.3 percent of the recorded special-status birds. Mean use was greatest for the bobolink (0.33 birds/20 min), followed by the vesper sparrow (0.17 birds/20 min), northern flicker (0.15 birds/20 min), and field sparrow (0.10 birds/20 min) (**Table 4.1.7a**).

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[2] The formal BCC list was developed by USFWS as a result of a 1988 amendment to the Fish and Wildlife Conservation Act. This Act mandated that USFWS "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 (ESA) of 1973." The goal of the BCC list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions and to consult on these species in accordance with Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.

Table 4.1.7a. Special-status species observed within the Project Area during avian point counts. Species are listed based on the number of individuals observed during each season or year. Percent composition of avian community is calculated based on the total number of individuals observed for all species during each season or year. Mean use refers to the average number of individuals per species observed per 20-minute survey for each season or year.

Table 4.1.7a. Special Status Species			
Common name	**No. observed**	**Percent composition of avian community**	**Mean use (No. birds/20 min)**
Spring			
Vesper sparrow[2]	59	0.7	0.536
Bobolink[2]	22	0.3	0.200
Northern flicker[1]	22	0.3	0.200
Field sparrow[1]	20	0.2	0.182
Sharp-shinned hawk[2]	6	0.1	0.055
Red-headed woodpecker[1,2]	4	<0.1	0.036
American coot[2]	2	<0.1	0.018
Pied-billed grebe[1]	2	<0.1	0.018
Northern harrier[3]	1	<0.1	0.009
Sandhill crane[4]	1	<0.1	0.009
Total	**139**	**1.6**	**1.263**
Summer			
Dickcissel[1]	31	1.1	0.517
Bobolink[2]	14	0.5	0.233
Vesper sparrow[2]	10	0.3	0.167
Field sparrow[1]	9	0.3	0.150
Northern flicker[1]	9	0.3	0.150
Red-headed woodpecker[1,2]	7	0.2	0.117
Northern harrier[3]	2	0.1	0.033
Total	**82**	**2.8**	**1.367**
Fall			
Bobolink[2]	75	1.5	0.833
Northern flicker[1]	14	0.3	0.156
Field sparrow[1]	5	0.1	0.056
Bald eagle[1,5]	3	0.1	0.033
Northern harrier[3]	3	0.1	0.033
Golden-crowned kinglet[2]	2	<0.1	0.022
Red-headed woodpecker[1,2]	1	<0.1	0.011
Total	**103**	**2.1**	**1.144**
Winter			
Northern harrier[3]	6	0.1	0.075
Northern flicker[1]	6	0.1	0.075
Bald eagle[1,5]	4	0.1	0.050
Red-headed woodpecker[1,2]	2	<0.1	0.025
Total	**18**	**0.3**	**0.225**

Table 4.1.7a. Special Status Species			
Common name	**No. observed**	**Percent composition of avian community**	**Mean use (No. birds/20 min)**
Year			
Bobolink[2]	111	0.5	0.326
Vesper sparrow[2]	59	0.3	0.174
Northern flicker[1]	51	0.2	0.150
Field sparrow[1]	34	0.2	0.100
Dickcissel[1]	31	0.1	0.091
Red-headed woodpecker[1,2]	14	0.1	0.041
Northern harrier[3]	12	0.1	0.035
Bald eagle[1,5]	7	<0.1	0.021
Sharp-shinned hawk[2]	6	<0.1	0.018
American coot[2]	2	<0.1	0.006
Pied-billed grebe[1]	2	<0.1	0.006
Sandhill crane[4]	1	<0.1	0.003
Golden-crowned kinglet[2]	1	<0.1	0.003
Total	**331**	**1.5**	**0.974**

[1]USFWS Bird of Conservation Concern, [2]Ohio Species of Concern, [3]Ohio State Endangered Species, [4]Ohio Threatened Species, [5]Bald and Golden Eagle Protection Act

Table 4.1.7b: Special-status species seasonal and annual mean use of the Project Area varied by species but was greatest for the bobolink. Thirteen species were identified as Birds of Conservation Concern, Ohio state-listed threatened or endangered species, or Ohio Species of Concern.

Table 4.1.7b. Special-Status Species Seasonal and Annual Mean Use					
Common name	**Spring**	**Summer**	**Fall**	**Winter**	**Annual**
Bobolink[2]	0.200	0.233	0.833	--	0.326
Vesper sparrow[2]	0.536	0.167	--	--	0.174
Northern flicker[1]	0.200	0.15	0.156	0.075	0.150
Field sparrow[1]	0.182	0.15	0.056	--	0.100
Dickcissel[1]	--	0.517	--	--	0.091
Red-headed woodpecker[1,2]	0.036	0.117	0.011	0.025	0.041
Northern harrier[3]	0.009	0.033	0.033	0.075	0.035
Bald eagle[1,5]	--	--	0.033	0.050	0.021
Sharp-shinned hawk[2]	0.055	--	--	--	0.018
American coot[2]	0.018	--	--	--	0.006
Pied-billed grebe[1]	0.018	--	--	--	0.006
Sandhill crane[4]	0.009	--	--	--	0.003
Golden-crowned kinglet[2]	--	--	--	--	0.003

[1]USFWS Bird of Conservation Concern, [2]Ohio Species of Concern, [3]Ohio State Endangered Species, [4]Ohio Threatened Species, [5]Bald and Golden Eagle Protection Act

4.1.8   Incidental Observations

Thirteen incidental observations of bald eagles were recorded within the Project Area. One adult eagle was observed March 22, 2019, two adults were observed on October 29, 2019, one adult and one unknown age were observed January 16, 2020, and five adults and three juveniles were observed on February 11, 2020. No other incidental observations of special status-species were recorded during the 2019 - 2020 avian point count surveys. One great blue heron (*Ardea herodias*) rookery was located during the Raptor Nest Survey **(Exhibit 12)** on March 24, 2019 and was determined to be active as individuals were observed inhabiting nests at the location. It is located in the northeastern portion of the Project Area, near Prairie Creek **(Exhibit 12).**

5.0   DISCUSSION

5.1   Avian Use

A total of 21,838 birds representing 92 species during 2019 - 2020 avian point count surveys. The number of birds observed varied by season with 5,162 in the winter, 8,789 in the spring, 2,901 in the summer, and 4,982 in the fall. It should be noted that survey effort also varied by season with 80 point counts in the winter, 110 in the spring, 60 in the summer, and 90 in the fall and the variation observed in seasonal abundance may be attributed to the differences in survey effort.

Comparatively, Stantec Consulting Services, Inc. (2012) observed 97 species at a proposed wind farm in Champaign County in west central Ohio, approximately 60 miles southeast from the Project Area. Passerines were the most common species group observed in the Grover Hill Wind study, accounting for 83.1 percent of all birds observed. The most commonly observed passerines at Grover Hill in 2019 - 2020 include the European starling (n = 5,056, mean use = 14.87 birds/20 min), house sparrow (n = 2,794, mean use = 8.22 birds/20 min), horned lark (n = 2,395, mean use = 7.04 birds/20 min), American robin (n = 1,063, mean use = 3.12 birds/20 min), and red-winged blackbird (n = 2,600, mean use = 7.65 birds/20 min). Similarly, the most common passerines observed by Stantec Consulting Services, Inc. (2012) were the red-winged blackbird, horned lark, American robin, song sparrow, and American crow (*Corvus brachyrhynchos*).

Passerines have been identified as a group at risk from collisions with wind turbines (Arnett et al. 2007, Dewitt and Langston 2006, Erickson et al. 2005, Strickland et al. 2011). Specifically, migrating passerines are the most commonly found group of birds found during post-construction fatality monitoring studies compared to other groups of birds (Arnett et al. 2007). At wind energy facilities outside of California, approximately 60 percent of documented fatalities have been passerines, of which 50 percent are nocturnal migrants, a group that has had the most reported fatalities (Erickson et al. 2001, Johnson

and Stephens 2011, Strickland et al. 2011). Year-round resident species may experience lower fatality rates than migrants because many of these species tend to fly below the physical extent of turbine blades during the breeding season, in contrast to species like nocturnal migrants, which often fly at greater altitudes and are at risk of collision when ascending from, or descending to, stop-over or roosting sites (Young et al. 2007).

The red-winged blackbird, horned lark, chipping sparrow, and song sparrow are ubiquitous species typically associated with agricultural and pastureland habitats that are prevalent throughout the Project Area and surrounding region. All of these species have been documented as fatalities at other wind energy facilities (Allison and Butryn 2019). However, Project-related fatalities of these species, should they occur, are unlikely to have population-level impacts as populations for these species are large and widely distributed across North America.

5.2   Special-Status Bird Species Use

Thirteen of the 92 avian species (14.1 percent) identified during avian point count surveys are considered BCC, Ohio state-listed threatened or endangered species, or Ohio Species of Concern. While BCCs and Species of Concern are of interest to the USFWS and ODNR, they are not afforded legal status or protection under state or federal statutes. However, the bald eagle is protected by BGEPA and many other species are protected under the Migratory Bird Treaty Act (MBTA).

The federally-protected bald eagle, as well as the state-listed northern harrier and sandhill crane were observed during avian point count surveys in 2019 - 2020. The most abundant special-status species observed during avian point count surveys were the bobolink and vesper sparrow. Comparatively, the most abundant special-status species observed by Stantec Consulting Services, Inc. (2012) was the field sparrow and wood thrush (*Hylocichla mustelina*). Collectively, the bobolink and vesper sparrow comprised 51 percent of all of the observed special-status species. While the bobolink had the greatest mean use estimate of special status species, the species was not often observed flying at altitudes that would encounter the RSH of the wind turbine options being considered for Grover Hill. Eighty-three bobolinks were observed in flight (57 percent of total observed), eight of which were observed flying in the RSH (7 percent). The vesper sparrow had the second greatest mean use estimate of special status species, but was not observed flying within the RSH. Bobolinks and vesper sparrows have both been documented as fatalities at other wind energy facilities (Allison and Butryn 2019).

Results from a post-construction monitoring study at a wind farm in Madison and Tipton counties, Indiana (Stantec 2018) reported fatalities of two special-status species, the sharp-shinned hawk (n = 2) and common nighthawk (*Chordeiles minor*) (n = 1). Proportions of the observed American coot, bald eagle, field sparrow, northern flicker, northern harrier, red-headed woodpecker, sandhill crane, and sharp-shinned hawk individuals flew within the RSH. However, all of these species had low encounter rates

(0.006, 0.015, 0.015, 0.047, 0.006, 0.006, 0.003, and 0.003 birds flying within the RSH/20 min, respectively).

5.3   Raptor Use

Despite the observation that most avian fatalities at wind farms are passerines, raptor fatalities (including eagles) have historically received the most attention (Pagel et al. 2013). Raptor fatalities at modern wind facilities has been low relative to older-generation wind farms, although there is substantial regional variation in raptor fatality rates (Erickson et al. 2002, Jain et al. 2007, Johnson et al. 2002, Kerns and Kerlinger 2004). Raptors constitute approximately six percent of reported bird fatalities in the contiguous United States, but generally comprise a smaller percentage of the total birds observed during pre-construction surveys (Strickland et al. 2011). Similar proportions of raptor to non-raptor fatalities have been reported by post-construction monitoring studies in Illinois and Wisconsin (i.e., 0 to 10 percent), with all of the reported fatalities being comprised of red-tailed hawks (BHE Environmental, Inc. 2011, Grodsky and Drake 2011, Gruver et al. 2009, Kerlinger et al. 2007).

High raptor use (greater than 2.0 birds/20 min) has been associated with high raptor mortality at wind farms (Strickland et al. 2011). Conversely, raptor mortality appears to be low when raptor use is low (less than 1.0 birds/20 min) (Strickland et al. 2011), which is the case for all raptor species usage of the Project Area during all seasons (range 0.009 to 0.867 birds/20 min), excluding turkey vultures during the spring season (1.027 birds/20 min). As seasonal mean raptor use within the Project Area was typically low, it suggests that raptor fatality may be low during Project operation.

The turkey vulture, red-tailed hawk, and American kestrel had the greatest mean use estimates and were among the most frequently detected raptor species within the Project Area during avian point count surveys. All three species are commonly associated with agricultural (88.6 percent of the Project Area) and grassland (0.9 percent of the Project Area) habitats which provide opportunities for foraging, an activity associated with susceptibility to turbine-collisions (Thelander et al. 2003). Fatalities resulting from collisions with turbines have been reported for turkey vultures, red-tailed hawks, and American kestrels at other wind energy facilities (Kingsley and Whittman 2005). In Illinois and Wisconsin, post-construction monitoring studies indicate that raptor-turbine collision fatalities have been limited to red-tailed hawks (BHE Environmental, Inc. 2011, Grodsky and Drake 2011, Gruver et al. 2009, Kerlinger et al. 2007).

Although a total of 12 northern harriers were observed during the year of avian point counts, few documented fatalities of northern harriers have been reported, even in areas that have reported high northern harrier use (Erickson et al. 2002). The limited number of northern harrier fatalities could result from the typical flight behavior of the species being below most RSHs. During 2019-2020 avian point count surveys only two northern

harriers (16.7 percent of all northern harrier observations) were observed flying within the RSH.

Risks to non-eagle raptors are expected to be low for the Project Area, as mean raptor use is considered low for most species and during most seasons, excluding turkey vultures during the spring and their mean use was only slightly greater than the threshold of 1.0 birds/20 min (1.027 birds/20 min). Also, Project-related fatalities are unlikely to have population-level impacts to red-tailed hawks or turkey vultures as both species are common nationwide (Sauer et al. 2012).

While data on the collision risks of red-tailed tailed hawks and other raptors at wind energy facilities are well documented, information concerning the collision risk of bald or golden eagles near wind energy facilities are limited. Preliminary data analyses indicate that 52 bald eagle mortalities or injuries were reported from wind-farms between 2013 and 2018 (Kritz et al. 2018). A total of seven bald eagles were observed during fall and winter avian point count surveys, indicating that the species overwinters within the Project Area. Also, an active bald eagle nest is located approximately 3.5 miles south of the Project Area, indicating that bald eagles occur within the Project Area year-round.

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EXHIBITS

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Michigan
Canada
Lake Erie
New York
Project
Pennsylvania
Indiana
Ohio
Maryland
West Virginia
Virginia
Kentucky

Noble County
DeKalb County
Indiana
Ohio
Williams County
Fulton County
Henry County
Defiance County

Timber Road III Wind Farm
Timber Road I Wind Farm
Northwest Ohio Wind Project
Grover Hill Wind

Allen County
Paulding County
Putnam County

Timber Road II Wind Farm

Blue Creek Wind Farm

Van Wert County

Adams County
Wells County
Allen County

Indiana
Ohio

Mercer County
Auglaize County

Jay County

Shelby County

N
0   3   6 Miles

Data Source(s): Westwood (2020); ESRI WMS
World Streets Basemap (Accessed 2018).

Legend

🟥 Project Boundary		⬛ County Boundary	
⬜ Nearby Operational Wind Farm Boundary		⬛ State Boundary	

Grover Hill Wind
Paulding County, Ohio

Project Vicinity Map

EXHIBIT 1

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Broughton

Rd 125
Twp Hwy 125
Twp Hwy 131
Town Hwy 131
Rd 131
Rd 72   Town Hwy 72
Twp Hwy T-54
Co Rd 123
Rd 123
Twp Hwy T-48
Rd 48
Twp Rd 137
Town Hwy 137
Rd 137
Twp Hwy T-28
Twp Rd 24
Twp Hwy 370
John Yóh Rd
Twp Hwy 123
Hoaglin Center Rd
Co Hwy 5
Walford Rd
Slane Rd
Twp Hwy 145
Harvey Rd   Twp Hwy 212
Co Hwy 214   Elm Sugar Rd
Twp Hwy 236
Twp Hwy 175
Doner Rd
Middle Point Wetzel Rd   Co Hwy 165

Twp Rd 82   Town Hwy 82   Rd 82
State Rte 637
Co Rd 82
Twp Hwy 72
Co Rd 60
Twp Hwy T-54
Main St
Wayne St
N Tyler
State Rte 114   Grover Hill
Harrison St
S Main St   1st St
Co Hwy C-24   Rd 24
Twp Hwy T-18   Rd 18
State Rte 637

Rd 151
Co Hwy 151
Rd 78
Twp Hwy T-159
Twp Rd 88
Twp Hwy T-165
Twp Hwy T-56
Rd 48   Twp Hwy T-48
Twp Hwy T-40
Rd 30   Twp Hwy T-30
Twp Hwy T-155
Twp Hwy T-24
Twp Hwy T-20
Rd 155
Co Rd 165
Van Wert Paulding-Co-Line-Rd   Rd 12

Paulding County
Van Wert County

N
Feet
0   3,000

Data Source(s): Westwood (2020); ESRI WMS World Imagery Basemap (Accessed 2018); Census Bureau (2017).

Legend

☐ Project Boundary

☐ County Boundary

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Grover Hill Wind
Paulding County, Ohio

Project Site Map
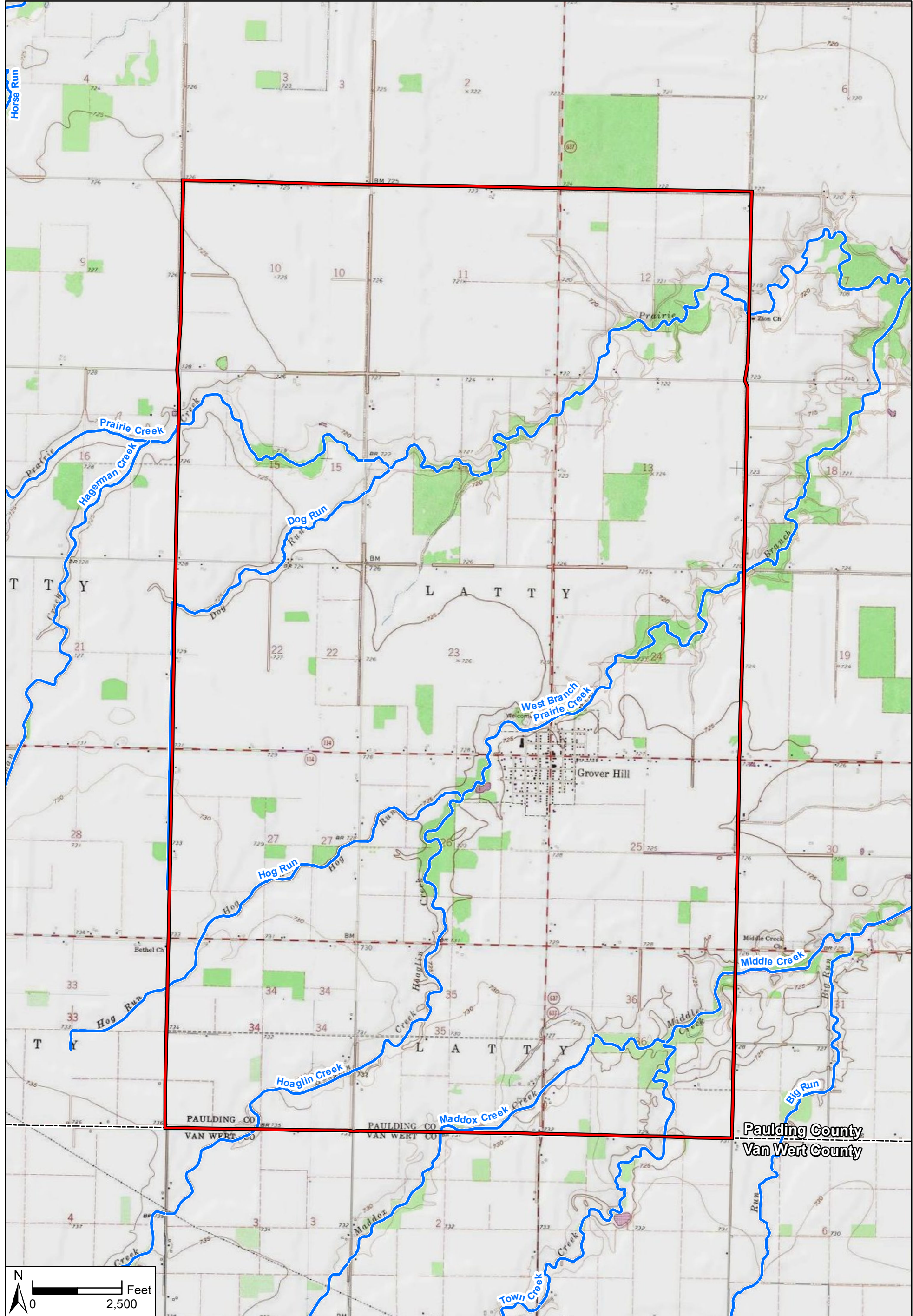
EXHIBIT 2

© 2020 Westwood Professional Services, Inc.

Horse Run

Prairie Creek

Hagerman Creek

Dog Run

LATTY

West Branch Prairie Creek

Grover Hill

Hog Run

Hoaglin Creek

Middle Creek

LATTY

Maddox Creek

Big Run

PAULDING CO
VAN WERT CO

Town Creek

Paulding County
Van Wert County

N

Feet
0   2,500
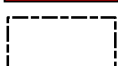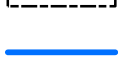
Legend

Project Boundary

County Boundary

Major Drainage Feature

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Grover Hill Wind

Paulding County, Ohio

Topography & Major
Drainage Features

EXHIBIT 3
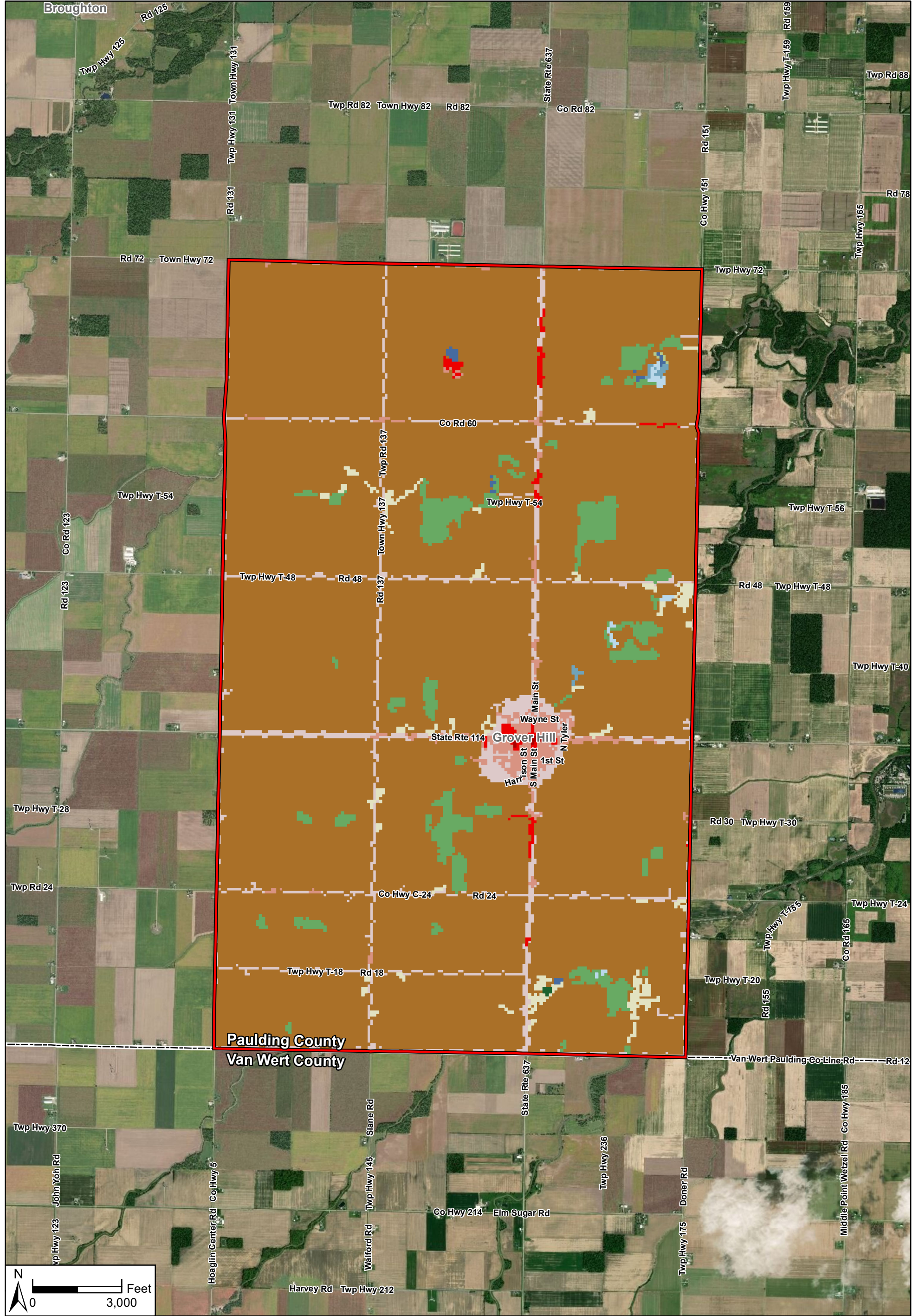
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Broughton

Paulding County
Van Wert County

Grover Hill

Data Source(s): Westwood (2020); ESRI WMS World Imagery Basemap (Accessed 2018); Census Bureau (2017); U.S. Geological Survey (2011).

N

Feet
0   3,000

Legend

☐ Project Boundary	■ Developed, Medium Intensity	Herbaceuous	
☐ County Boundary	■ Developed, High Intensity	Mixed Forest	
■ Cultivated Crops	■ Developed, Open Space	■ Open Water	
Deciduous Forest	Emergent Herbaceuous Wetlands	Woody Wetlands	
Developed, Low Intensity	■ Evergreen Forest		
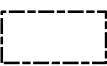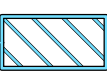
Westwood
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Grover Hill Wind
Paulding County, Ohio

Land Cover Types
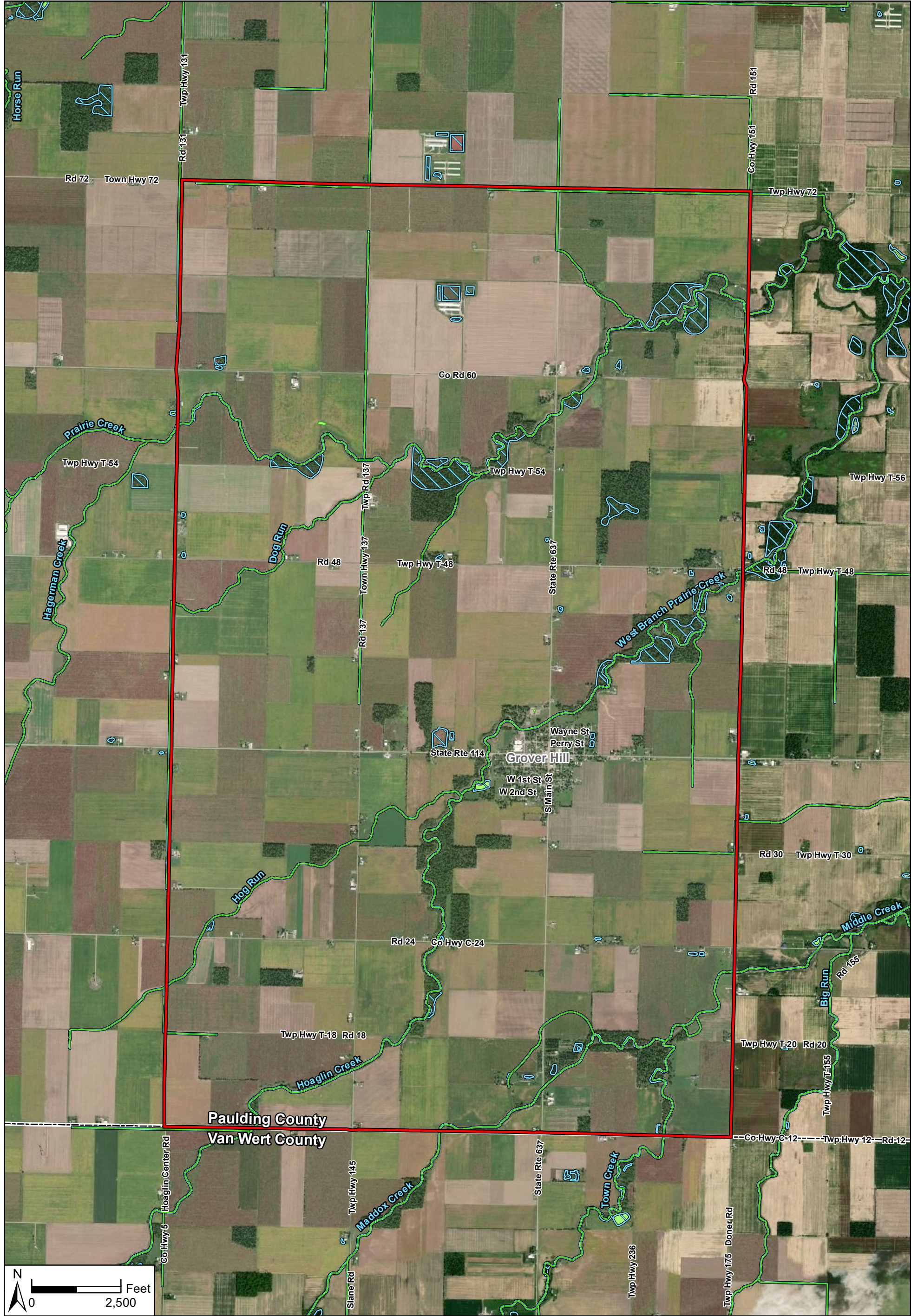
EXHIBIT 4

Horse Run
Rd Hwy 131
Rd 131
Rd 72   Town Hwy 72
Co Hwy 151
Rd 151
Twp Hwy 72
Co Rd 60
Prairie Creek
Twp Hwy T-54
Hagerman Creek
Dog Run
Twp Rd 137
Twp Hwy T-54
Twp Hwy T-56
Rd 48
Town Hwy 137
Twp Hwy T-48
State Rte 637
Rd 48   Twp Hwy T-48
Rd 137
West Branch Prairie Creek
Wayne St
Perry St
State Rte 114
Grover Hill
W 1st St St
W 2nd St
S Main St
Rd 30   Twp Hwy T-30
Hog Run
Middle Creek
Rd 24   Co Hwy C-24
Rd 155
Big Run
Twp Hwy T-18 Rd 18
Twp Hwy T-20 Rd 20
Twp Hwy T-155
Hoaglin Creek
Paulding County
Van Wert County
Co Hwy C-12 — Twp Hwy 12 — Rd 12
Hoaglin Center Rd
Co Hwy 5
Twp Hwy 145
Maddox Creek
State Rte 637
Town Creek
Twp Hwy 236
Slane Rd
Twp Hwy 175 — Doner Rd

N
Feet
0   2,500

Legend

▭ Project Boundary	—— NHD Flowline
▭ County Boundary	▮ NHD Waterbody
▨ NWI Wetland	

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Grover Hill Wind
Paulding County, Ohio

Surface Waters & Wetlands

EXHIBIT 5

Grover Hill Wind

Paulding County, Ohio

Avian Point Count Locations

EXHIBIT 6

Legend

Project Boundary

Raptor Nest Survey Area

County Boundary

800-Meter Buffer

NHD Flowline

Proposed Avian Point Count Location

Bat Acoustic Survey Location

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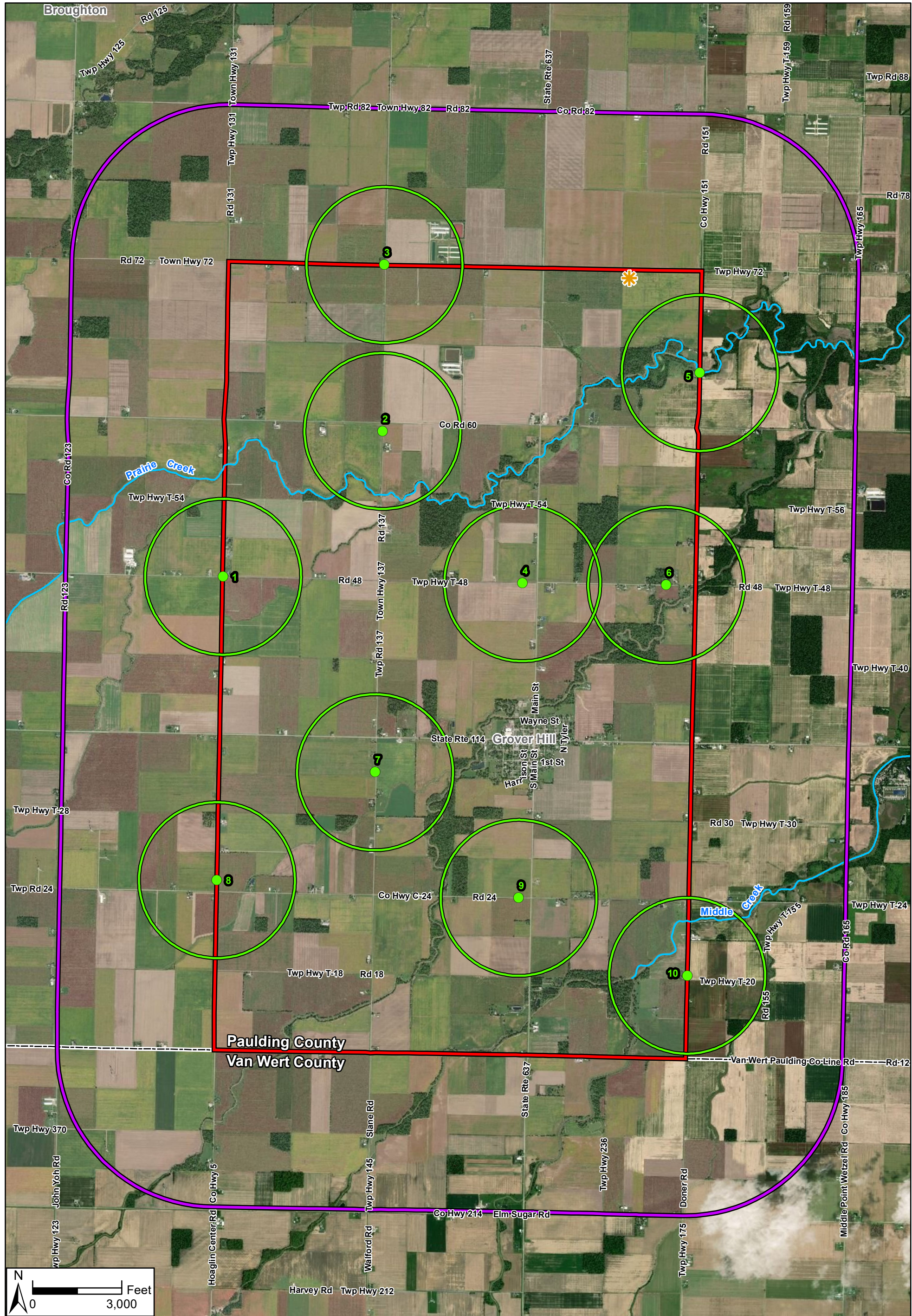
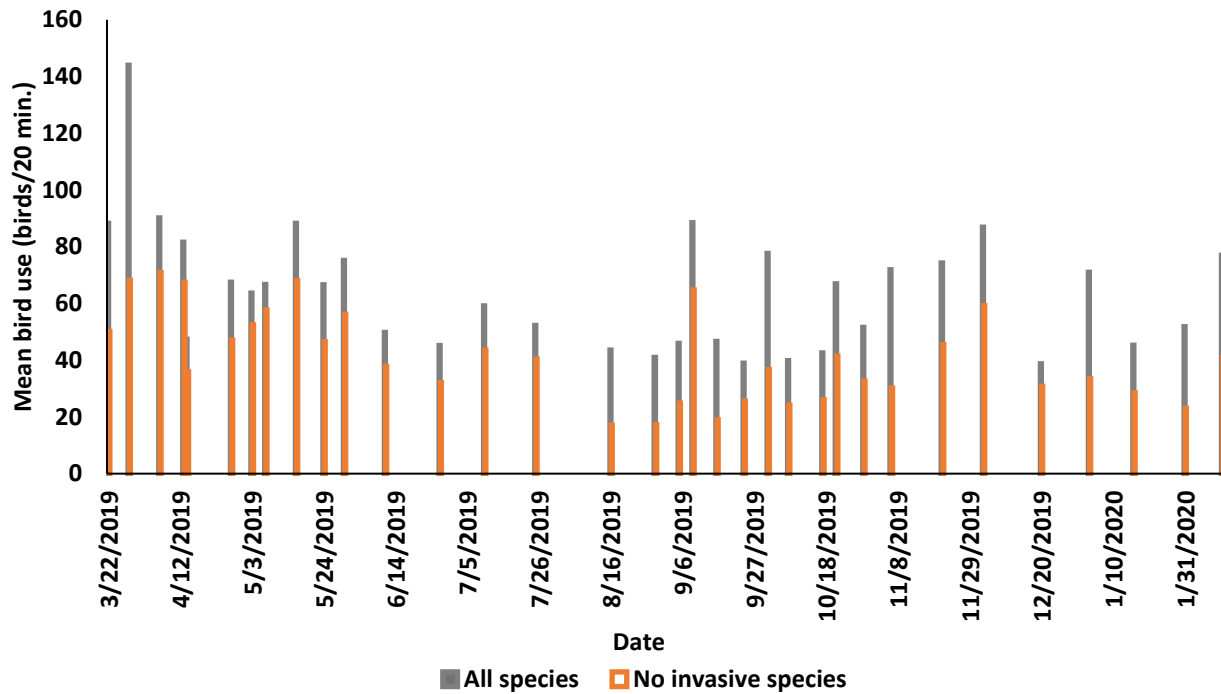Data Source(s): Westwood (2020); ESRI WMS World Imagery Basemap (Accessed 2018); U.S. Census Bureau (2017).

0   3,000 Feet

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Map Document: \\westwoodps.local\GFS\Global Projects\0015695.00\docs\Envir\Wind CPCN Application\Exhibits Q-S\Exhibit N - Avian Report\Exhibits\GH_Avian_Ex6_AvianPointLocations_190808.mxd 2/25/2020 1:12:32 PM ELPratt

Exhibit 7. Mean bird use (birds/20 min.) per survey event was less when non-native invasive species (i.e., house sparrow, European starling, and rock pigeon) were removed (ANOVA $F_{(1, 66)}$ = 24.90, p < 0.01).

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3
63.50

5
54.06

2
64.47

1
64.85

4
54.32

6
61.59

Grover Hill

7
72.53

8
65.00

9
57.29

84.68 10

Paulding County
Van Wert County

N
0   2,000   Feet
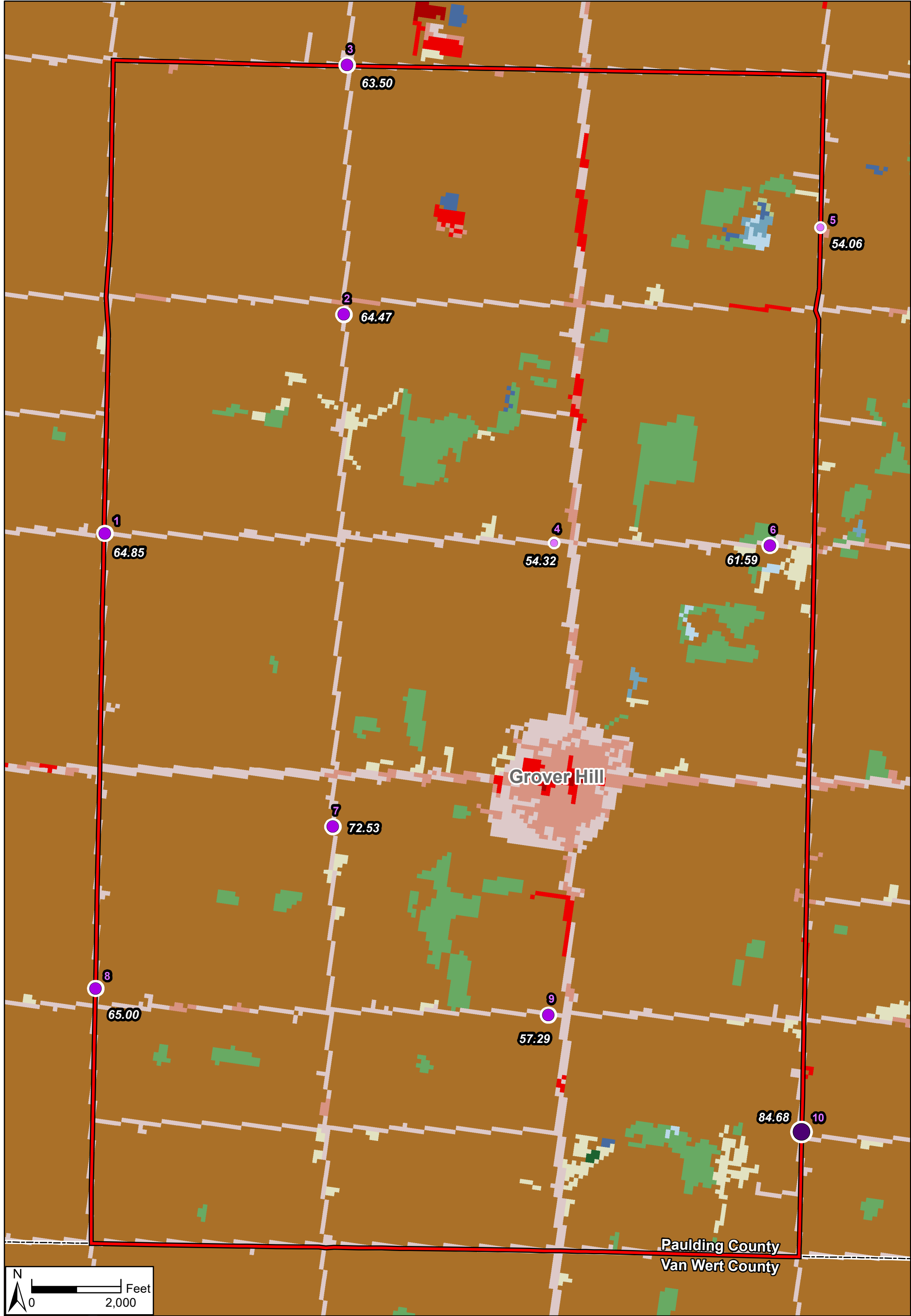
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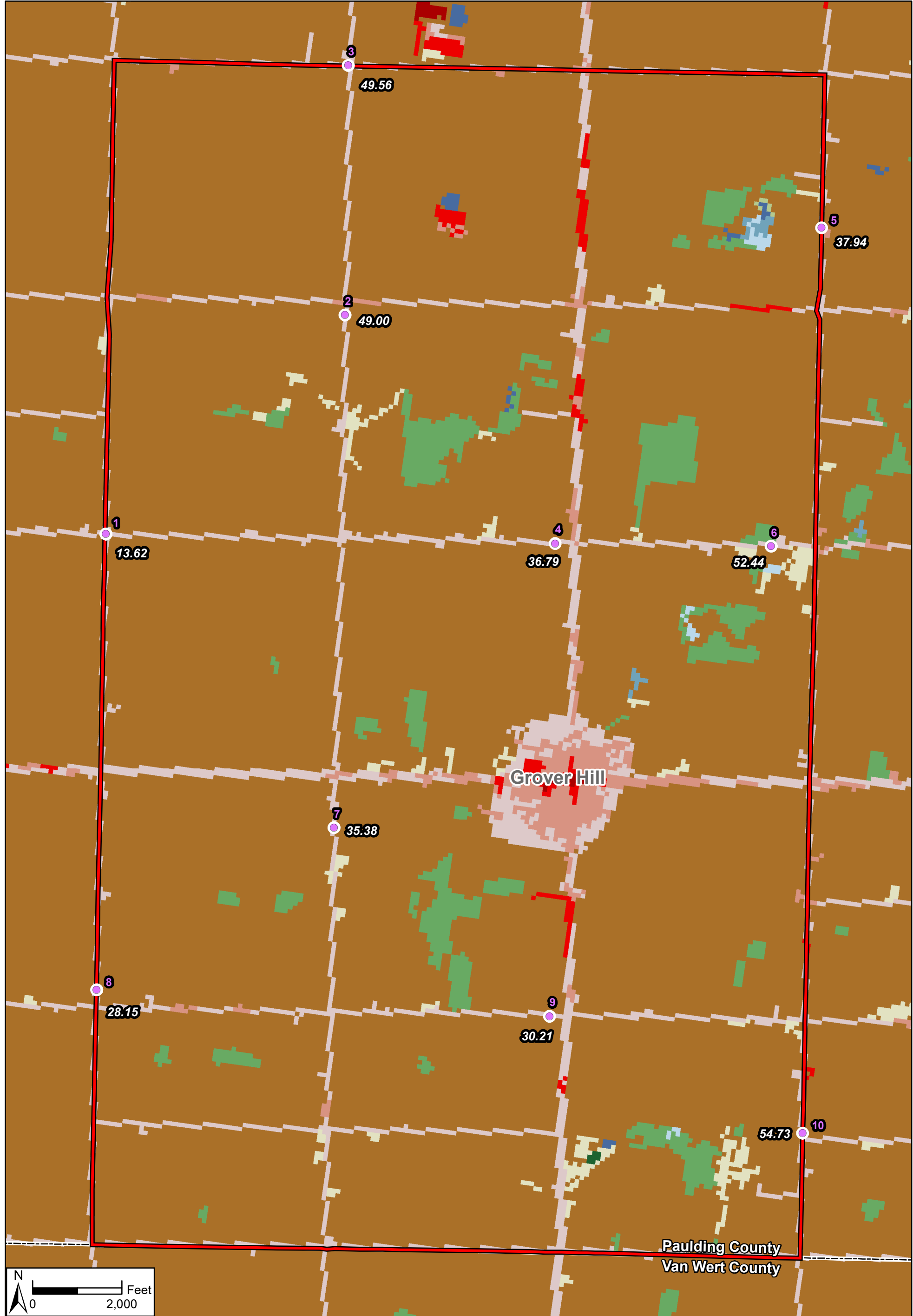Geological Survey NLCD Land Cover (2014).

Legend

▭ Project Boundary

▭ County Boundary

64.85 Mean Use
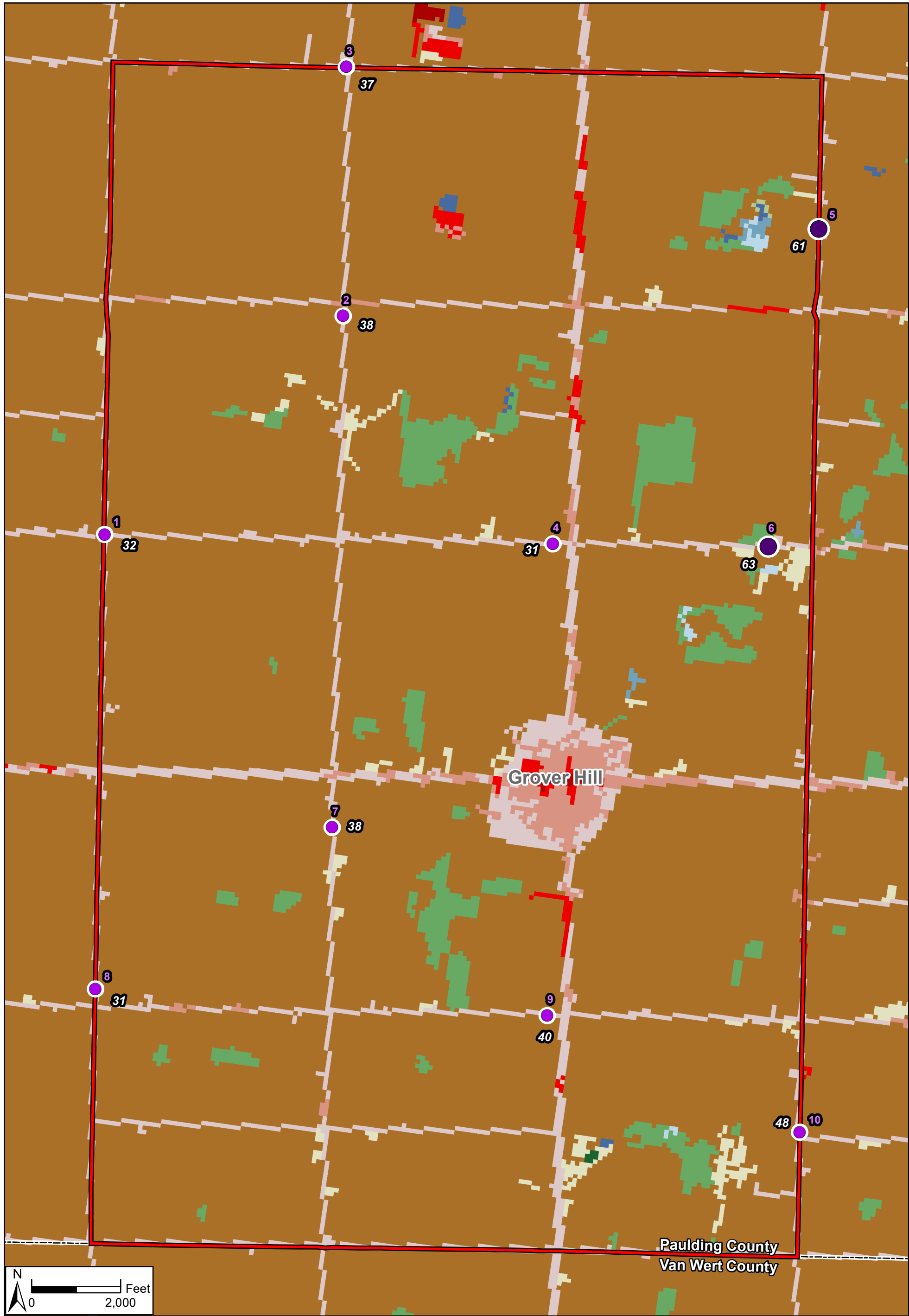
Mean Use (No. Birds/20 min)

● Low (0.00 - 55.13)

● Moderate (55.14 - 73.33)

● High (73.34 - 84.68)

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Paulding County, Ohio

Mean Use by Survey Point

EXHIBIT 8a

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3
49.56

5
37.94

2
49.00

1
13.62

4
36.79

6
52.44

Grover Hill

7 35.38

8
28.15

9
30.21

54.73 10

Paulding County
Van Wert County

N

0   2,000   Feet

Data Source(s): Westwood (2020); U.S.
Geological Survey NLCD Land Cover (2014).

Legend

Mean Use (No. Birds/20 min)

Project Boundary

County Boundary

13.62 Mean Use

Low (0.00 - 55.13)

Moderate (55.14 - 73.33)

High (73.34 - 84.68)

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Mean Use by Survey Point With
Non-Native Species Excluded

EXHIBIT 8b

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3
37

5
61

2
38

1
32

4
31

6
63

Grover Hill

7
38

8
31

9
40

48 10

Paulding County
Van Wert County

N
0   2,000 Feet

Data Source(s): Westwood (2020); U.S.
Geological Survey NLCD Land Cover (2014).

Legend

Species Richness (No. Species/Survey Point)

Project Boundary

County Boundary

32 Species Richness

Low (0 - 30)

Moderate (31-54)

High (55 - 63)

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Grover Hill Wind
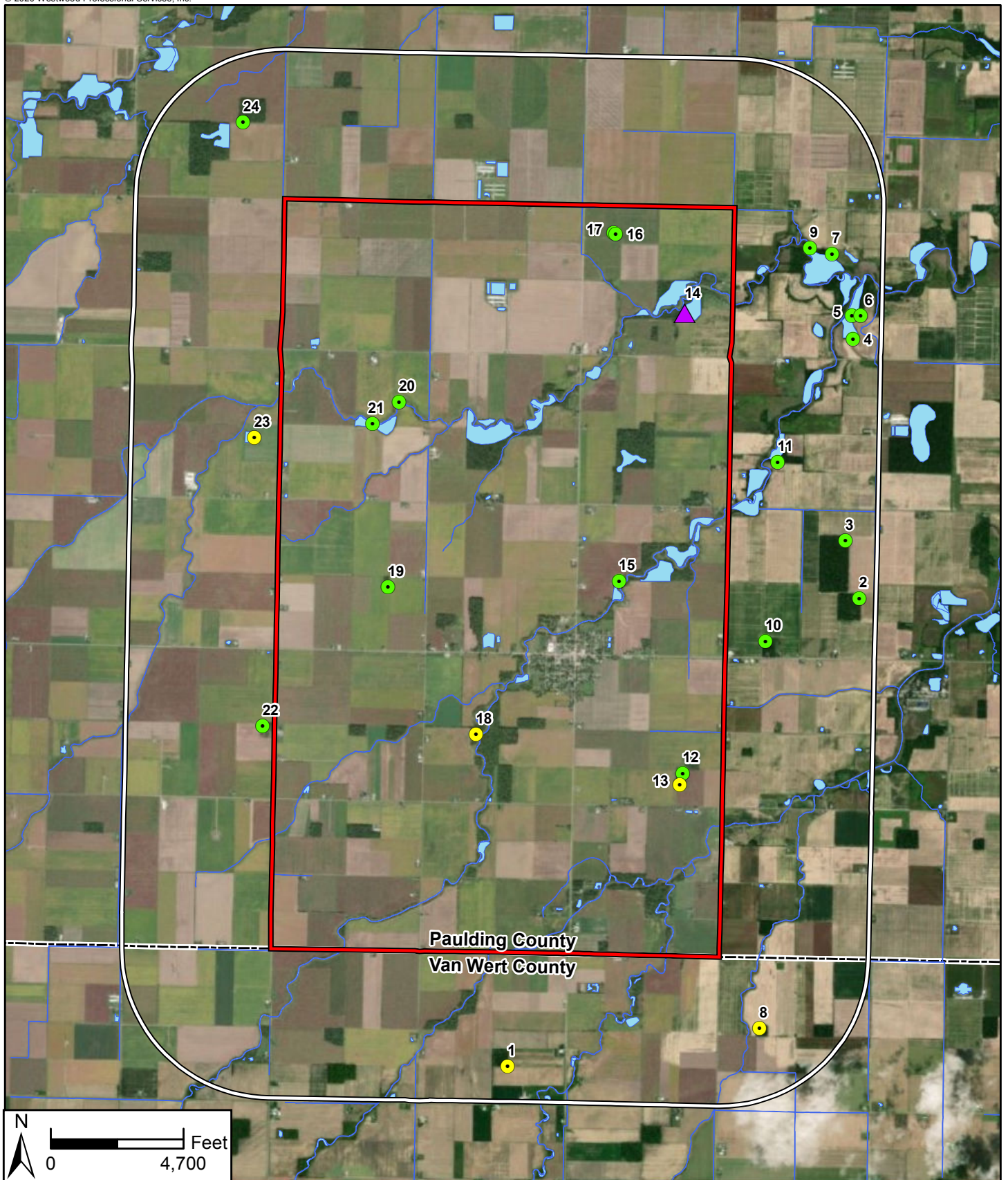Paulding County, Ohio

**Bird Species Richness
by Survey Point**
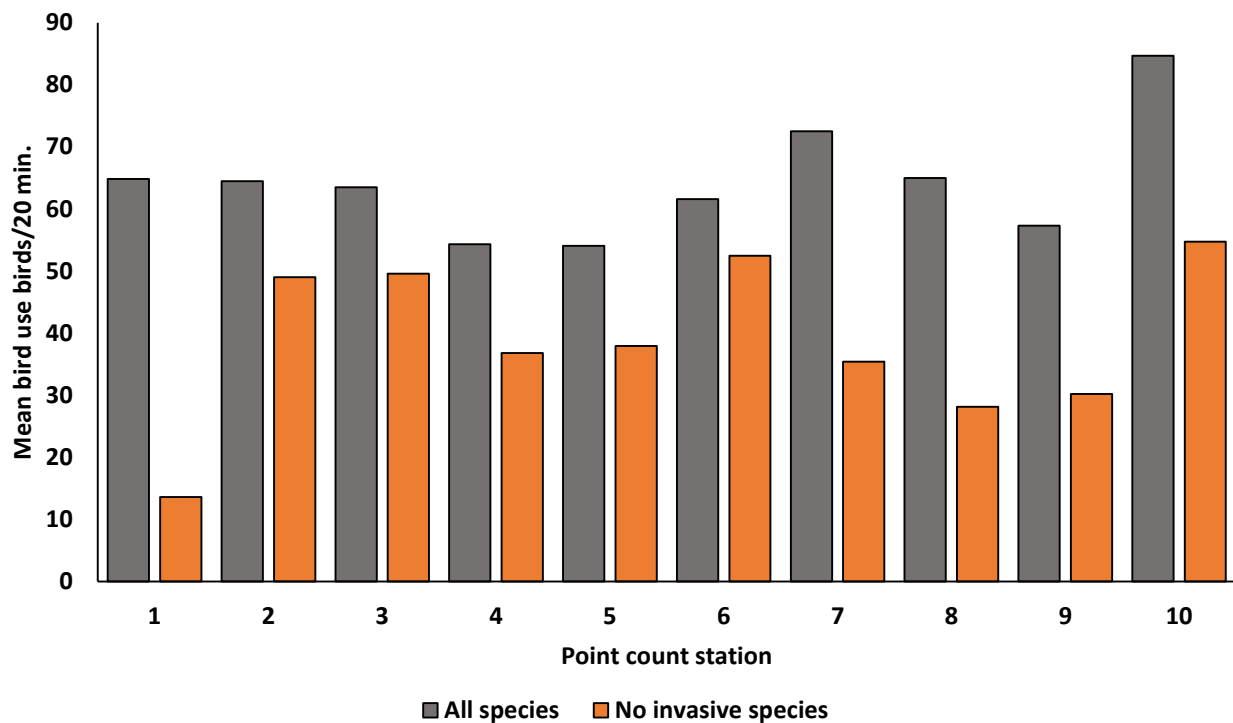
EXHIBIT 9

Exhibit 10. Mean bird use (birds/20 min) per point count station was less for all points when non-native invasive species (i.e., house sparrow, European starling, and rock pigeon) were removed (ANOVA $F_{(1, 18)}$ = 25.98, p < 0.01).
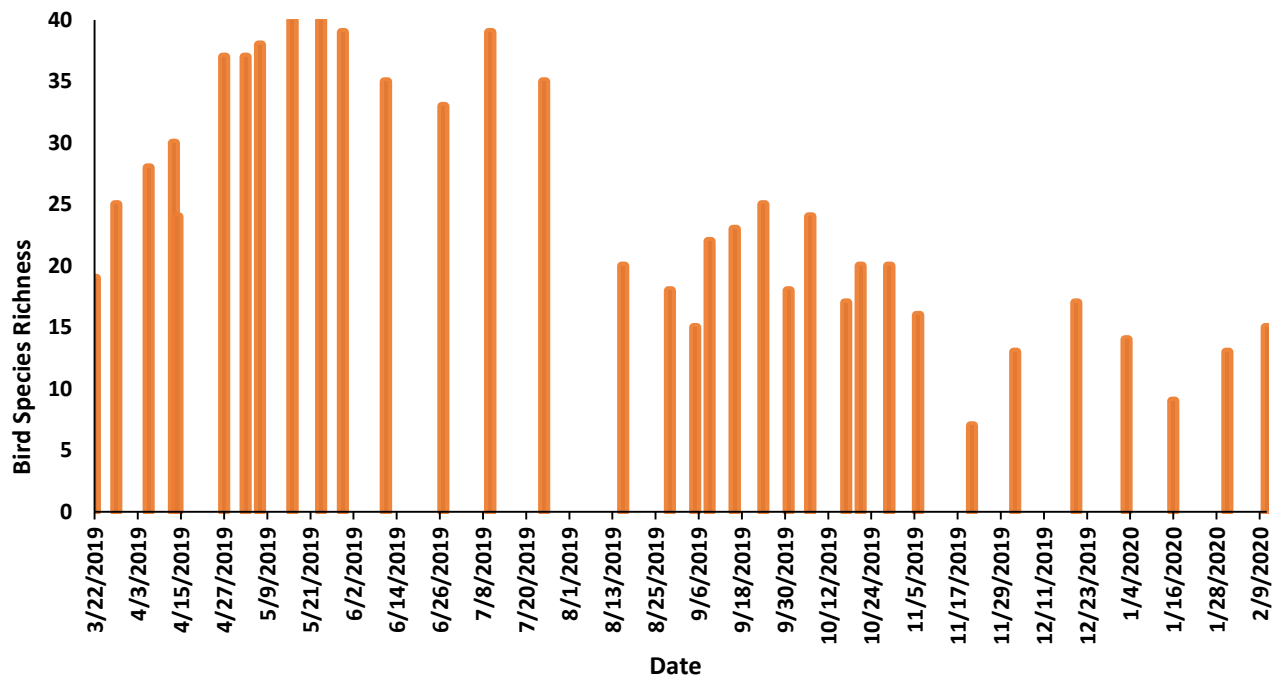
Exhibit 11: Bird species richness ranged from 7 to 40 per survey event during the 2019 – 2020 field season. Species richness was greatest in the spring ($\bar{x}$ = 31.0), intermediate in the summer ($\bar{x}$ = 24.1) and fall ($\bar{x}$ = 19.9), and least in the winter ($\bar{x}$ = 12.4).

Paulding County
Van Wert County

N

Feet

0   4,700

Legend

- Project Boundary
- County Boundary
- 1-Mile Buffer
- NWI Wetland

▲ Great Blue Heron Rookery
● Red-tailed hawk
● Unknown
18 Nest ID

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Grover Hill Wind Project
Paulding County, Ohio

Raptor Nest Survey Buffer & Nest & Rookery Locations

EXHIBIT 12

This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

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in

Case No(s). 20-0417-EL-BGN

Summary: Application - 18 of 40 (Exhibit M – Pre-Construction Avian Survey Report) electronically filed by Christine M.T. Pirik on behalf of Grover Hill Wind, LLC