

Appendix I
Avian Use Assessment Report

**Draft Avian Use Assessment Report on the
Black Oak/Getty Wind Development Sites**

**Stearns County, Minnesota
August 2011**

**Prepared by
HDR Engineering, Inc.**



Summary

The proposed Black Oak and Getty Wind Farms Projects (collectively, the Projects) occupy approximately 20 square miles of cropland, grassland, isolated wetland, and small woodlots. Within the boundaries of the Projects (collectively, the Sites) are numerous lakes, wetlands, and ditches that attract waterfowl and waterbirds. Several Waterfowl Production Areas (WPAs) and Waterfowl Management Areas (WMAs) also occur near or within the project boundaries. Many Project area wetlands are ephemeral in nature and express surface water only early in the spring or after a heavy rain. In order to facilitate row cropping, some ephemeral basins within the Sites have been ditched or tiled to remove surface water quickly.

Avian issues with wind projects have increasingly drawn concern from agencies and interest groups. Under the guidance of the US Fish and Wildlife Service (USFWS), the Minnesota Department of Commerce Energy Facility Permitting (EFP), and the Minnesota Department of Natural Resources (DNR), HDR Engineering, Inc., (HDR) developed biological survey protocols to address concerns about avian/wind turbine collisions, the disruption of avian flights, and wind project site use by bald eagles, marbled godwits, waterfowl, and other avian species of concern. These protocols characterize risks to avian species at wind development sites.

For the Projects, specific issues of concern included the present and historic use by bald eagles, marbled godwits, trumpeter swans, loons, and other selected Species of Greatest Conservation Need (SGCN). HDR was retained to evaluate avian use within a study area comprising the Sites and adjacent lands (Figure 1). The resulting surveys included a spring Avian Use/Flight Path survey, an Avian Wetland Utilization survey, Marbled Godwit nesting surveys, and a Bald Eagle Nest monitoring effort.

HDR biologists conducted Avian Use/Flight Path surveys to document all avian species and their associated flight paths at 11 survey points from April 1 through June 29, 2011. HDR estimated flight height, flight direction, distance from the survey point, and flight behavior of more than 106 different species during these surveys. An additional 10 species were observed during the three other surveys. HDR plotted flight paths on aerial photographs then digitized them using ArcGIS software to analyze flight information. No distinct flight corridors were identified for any particular species within the Project boundaries. However, grouping the data according to broad categories (i.e. waterfowl, waterbirds, raptors, passerines, etc.) may facilitate planning, micro-siting, minimizing impacts to sensitive species, and avoiding impacts to avian concentration areas or other high use areas that occur on the site during certain times of the year.

HDR biologists documented 22,863 individual birds made up of 116 different species during 23 separate monitoring dates. Four species identified by the DNR as endangered, threatened, or special concern (ETSC), and 22 species designated as a SGCN were documented within the

study area during the spring of 2011. An additional three ETSC species were observed outside Sites but within the study area. The seven ETSC species and the SGCN species together are referred to as sensitive species throughout the remainder of the document. Flight heights varied between species and individuals but biologists assessed flight trends by establishing a Mean Flight Height for each species observed. HDR also analyzed observation and flight data for four sensitive species avian groupings that included waterfowl, waterbirds, raptors, and passerines. The percentage of observed flights within the Rotor Swept Zone (RSZ, between 28 and 150 m above ground level (AGL)) was 24.0 percent for raptors, 33.1 percent for waterbirds, 37.6 percent for waterfowl, and 3.3 percent for passerines. However, a bias does exist toward birds that fly closer to the ground as they are more easily detected by observers.

HDR staff also monitored four wetlands near or within the project boundaries for waterfowl and waterbird use on nine separate occasions from April 1 through May 26, 2011. Use by 36 species and 1,472 individuals was documented in the four selected wetland complexes. The most commonly observed species were the American coot (50 percent of all observations) and ring-necked duck (8 percent of all observations). These surveys also documented the presence of breeding marbled godwits adjacent to the Projects' southern boundaries.

Biologists conducted marbled godwit surveys on April 19, May 10, and June 9, 2011, at the Kenna WPA, Trisko WPA, and Behnen WPA. The three WPAs are located immediately adjacent to or within the Sites. The purpose of this survey was to detect the presence or absence of breeding marbled godwits within the Black Oak/Getty Wind Farms. The DNR and USFWS requested the surveys based on historic records for this species on grassland habitats in the Project vicinity. No marbled godwits were detected during these surveys.

An active Bald Eagle nest discovered during the first week of Avian Use/Flight Path surveys was monitored weekly from April 7 through July 12, 2011. Raptors were present in low numbers at the site throughout the survey period. However, six different raptor species were observed using land on or adjacent to the Black Oak/Getty Wind Farms. Of the six raptor species observed, the red-tailed hawk and American kestrel are known to be susceptible to increased mortality rates from wind development due to flight behavior. Horned larks and vesper sparrows were abundant and are considered potentially sensitive to habitat displacement and higher mortality rates from wind development. During the breeding season, the vesper sparrow occurred in cropland habitat. Horned larks were present at all Avian Use/Flight Path observation points throughout the survey period.

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Introduction

Geronimo Wind Energy, LLC, is developing the Black Oak Wind Farm, a 42 megawatt wind energy project located on a site of approximately 7,064 acres in northwestern Stearns County. Getty Wind, LLC, is developing the Getty Wind Farm on a site of approximately 7,630 acres immediately west of the Black Oak Wind Farm (Figure 1). Because of the proximity of the Black Oak and Getty Wind Farms (collectively, the Sites) Geronimo Wind, LLC and Getty Wind, LLC, retained HDR to conduct biological surveys for the Projects. During the spring of 2011, HDR biologists conducted Avian Use/Flight Path surveys, Wetland Utilization surveys, Marbled Godwit surveys, and large bird/raptor nest surveys that later became an Eagle Nest Monitoring effort. This report summarizes the methods employed and results obtained during the spring season surveys, evaluates avian risk and implications of these surveys, and summarizes avian risks from the development of the Black Oak/Getty Wind Farms Project.

The Projects will be built on lands dominated by agricultural uses southwest of the city of Sauk Centre. While the turbine models have not yet been selected, they are expected to fall in the range of 1.5 to 3.0 Megawatts (MW), with tower heights of 80-100 meters (m) and rotor diameters between 82.5 and 112 m. Given these general specifications, the upper and lower limits of the rotor sweep zone (RSZ) would be between 28 and 150 m above ground level (AGL).

Habitats and Land Types

The Sites are located at the transition between the Minnesota River Prairie Ecological Subsection of the Prairie Parkland Province and the Hardwood Hills Ecological Subsection of the Eastern Broadleaf Forest Province (MDNR 2005). Historically, the predominant land cover in these sections and subsections was treeless, fire-dependent grassland and brushland types interrupted by lakes, streams, marshes, and pothole wetlands. Current land uses at the Sites are primarily croplands with numerous drained and undrained wetlands, along with pasture, homesteads, small woodlots, and fencerows to a lesser extent. Just outside the Site, several WPAs and WMAs harbor restored prairie, grassland, and lake habitats.

The Minnesota River Prairie Subsection of the North-Central Glaciated Plains of Stearns County is considered to be the heart of the Minnesota Cornbelt and the prairie pothole region, which hosts the most productive breeding habitat for North American waterfowl and other waterbird species.

The Hardwood Hills Subsection lies within the heart of the Mississippi flyway and harbors a large number of wetlands. Despite drainage of many of the historic wetland habitat, this part of Minnesota is also part of the prairie pothole region. This ecological subsection formed along the historic shores of Glacial Lake Agassiz, and rolling moraines deposited during the last

glaciations characterize the landscape. Level farmland, rivers, lakes, and wetlands of various sizes characterize the project area and glacial outwash land features. Land use within this subsection is predominantly agricultural, including corn and soybean production. Other land uses include pastured land, single-family homes, farmsteads, and WMAs or WPAs.

Regulatory Framework

Endangered Species Act

The federal Endangered Species Act (ESA) protects listed endangered and threatened species and their habitats. The ESA provides a mechanism to grant permission for incidental takings of listed species. At the state level, Minnesota Statutes, Section 84.0895, requires the Minnesota Department of Natural Resources (DNR) to adopt rules designating species meeting statutory definitions of endangered, threatened, and special concern (ETSC). The resulting list of ETSC species is codified as Minnesota Rules, Chapter 6134. The Endangered Species Statute also authorizes the DNR to adopt rules that regulate treatment of species designated as endangered and threatened. These regulations are further codified as Minnesota Rules, Parts 6212.1800 to 6212.2300. ETSC species are defined by the DNR as:

- **Minnesota Endangered Species:** A plant or animal species that is threatened with extinction throughout all or a significant portion of its range in Minnesota.
- **Minnesota Threatened Species:** A plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in Minnesota.
- **Minnesota Special Concern Species:** Species that are not endangered or threatened, but are extremely uncommon in Minnesota, or have unique or highly specific habitat requirements and deserve careful monitoring of their status. Species on the periphery of their range that are not listed as threatened may be included in this category along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) was established in 1940 and assigns legal authority to USFWS to protect bald and golden eagles from takings and disturbance. Rules published on September 11, 2009, and finalized on November 10, 2009 (USFWS 2009), outline the issuance of take permits under the BGEPA. Permitted activities do not distinguish between lethal and non-lethal takes. Regulated activities also include those that disturb individual eagles by causing injury, decreasing eagle productivity, or by substantially interfering with normal breeding, feeding, or sheltering behavior.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) assigns legal authority to the USFWS Office of Law Enforcement to protect migratory birds from takings. The MBTA protects 1,006 species of birds, including waterfowl, shorebirds, songbirds, raptors, wading birds, and seabirds. Unlike the ESA and the BGEPA, MBTA regulates direct takings or nest destruction, and not habitat modifications. The level of direct take by a wind energy production facility that would invoke prosecution under the MBTA has not been established. There is currently no permitting process to protect a project developer from prosecution for incidental takings under the MBTA. The USFWS is actively developing a process similar to the BGEPA's under the MBTA that is specific to migratory birds other than bald and golden eagles (USFWS 2011).

Wind Advisory Committee Guidelines

The USFWS Wind Turbine Guidelines Advisory Committee (WTGAC) completed its recommended guidelines to mitigate impact to wildlife and their habitats related to land-based wind energy facilities on March 4, 2010. The WTGAC outline a tiered approach to evaluating and quantifying the affects of wind development on resident wildlife resources. This document recommends voluntary compliance with the guidelines and development of communication with USFWS personnel as part of due diligence to avoid and minimize effects to species regulated under the ESA, BGEPA, and MBTA. The WTGAC also recommends the adoption of best management practices during the development and construction of wind energy production sites. The WTGAC recommendations identifying species of concern to include those protected under the ESA, BGEPA, MBTA, or any that “(i) is designated by law, regulation or other formal process for protection and/or management by the relevant agency or other authority, or that has been shown to be significantly adversely affected by wind energy development, and ii) is determined to be possibly affected by the project.”

Several WPAs and WMAs also occur adjacent to, or within 1 mile of the Sites. The USFWS established guidelines for considering wind turbine siting on WPA lands that may directly influence development of wind energy at this site. One of the guidelines directs USFWS refuge managers and district managers to avoid obvious “duck passes” between large, semi-permanent wetlands or sloughs and known migratory bird corridors or flight paths, especially in areas such as colonial bird nesting areas.

At the state level, the DNR has developed post-construction monitoring recommendations for wind developments. Additional state guidelines exist for setbacks from WMAs, Conservation Reserve Program, Board of Water and Soil Resources conservation easements, Conservation Reserve Enhancement Programs, Reinvest in Minnesota-Wetland Reserve Programs, Shoreland, and Public Waters.

Study Methods

Combining guidance provided by the DNR in their January 13, 2011, draft survey methodology, and information provided in direct consultations with the DNR, USFWS, and EFP, HDR developed a survey protocol for spring 2011 avian surveys. Survey methodologies for avian use implemented on the Project site included the following analyses: (1) Preconstruction Avian Use/Flight Paths, (2) Bald Eagle Nesting Activity, (3) Wetland Utilization and, (4) Marbled Godwit Surveys. The objectives of these surveys was to sample avian use of the site during the spring migratory period, identify breeding species within the site, develop data on habitat use patterns, and document flight paths used. USFWS, EFP, and DNR staff reviewed and approved the survey methods prior to implementation.

Preconstruction Avian Use/Flight Path Surveys

HDR conducted fixed-radius point counts to provide baseline data regarding the temporal and spatial use of the Sites by birds. Staff conducted point count surveys once per week for 13 weeks beginning April 1, 2011, and continuing through June 29, 2011. Standardized point count techniques were used to reduce methodological variance between observers or points (Ralph et al. 1995). The spring survey incorporated 11 fixed points in the study area (Figure 2) to address habitat use and document flight paths of migratory and breeding species. Points were established at locations that provided unobstructed sight lines to potential avian concentration areas such as wetlands, grasslands, and agricultural land. USFWS and DNR provided comment and suggestions on survey point selection. HDR staff monitored survey points within the study area for 30 minutes each monitoring period. Sometimes all eleven survey points could not be completed in one day and were monitored during consecutive days. In these instances, each day was counted as a separate survey.

Biologists documented information on species observed, flight height, flight direction, and behaviors within 200 meters beginning one-half hour before sunrise to 11 a.m., or for three hours before sunset. In addition, aerial photographs, landmarks, and standardized objects were measured using a laser rangefinder to standardize flight height estimates and to document the distance of flights taken by raptors and other large birds within 1 mile of each point. Avian flight height, flight direction, behavior, species, and time of day were recorded for each species observed during monitoring periods on data sheets and on aerial photographs. Surveys were conducted during all weather conditions and points were established with GPS technology capable of sub-meter accuracy to standardize sampling locations.

HDR used existing information prepared by the DNR and USFWS to compare data and to place observed data in context with trends detected by the Breeding Bird Survey (BBS), Minnesota Breeding Bird Atlas project, and historic records of sensitive species use. The BBS route at New London provided information about species composition in a similar habitat type and provided

an index of population trends in the same region of the state. Species richness was calculated for each observation point and for the site as a whole.

Bald Eagle Nest Activity Surveys

Recent developments involving the BGEPA in relationship to wind energy projects are creating a need for detailed information on bald eagle nests and eagle activity on and near wind energy project sites. Based on comments received from the USFWS and the proximity to known nest locations and potential habitat, HDR conducted an Eagle Nest Activity survey to identify nest locations and use areas in the Project vicinity. Experienced avian biologists conducted eagle and other stick-nest activity surveys within 5 miles of the Sites to identify current bald eagle and other raptor breeding use at current and historic nest sites. The biologists conducted searches for new nests from public roads by scanning forested areas and woodlots for stick nests and eagle activity. They observed raptor nests, and documented all raptor observations, and behavioral information.

Wetland Utilization Surveys

HDR biologists conducted wetland utilization surveys at open water wetlands within 1 mile of the project site to document waterfowl and waterbird use (Figure 2). They documented observations of waterfowl and waterbirds from publicly accessible sites at four wetland locations within or near the Sites, recording the number and species of waterfowl and waterbirds present at each site during a stay of 10-15 minutes. Wetland observations occurred weekly from April 7 through May 20, 2011.

Marbled Godwit Surveys

HDR biologists conducted transect surveys on the adjacent publicly owned Behnen, Trisko, and Kenna WPAs (Figure 2). The Behnen WPA contains historic breeding season records of marbled godwits and the WPAs in aggregate contain most of the suitable grassland habitat within the Project boundaries for this species.

Field investigations focused on the presence of marbled godwits but also documented the presence and behavior of other species at these sites. HDR used two different survey methods: pedestrian transect surveys and observation point surveys. Transects were established at each of the three WPAs and surveys were conducted once each in April, May, and early June. An HDR biologist walked each transect (starting from approximately 30 to 120 meters from adjacent roads and continuing as far into the WPA as practicable) stopping to listen for 3 minutes every 50 m for the presence of marbled godwits. A 30-minute point count occurred from one centrally located point at each WPA. HDR biologists used binoculars and spotting scopes to observe bird activity at each site. Information on all species observed, flight directions, behaviors, flight heights, weather information and time of day were recorded. When marbled godwits were seen,

notes on behavioral information, habitat use, and location were collected using a hand-held GPS capable of sub-meter accuracy.

Data Analysis

Data were analyzed to determine which species utilize airspace within the RSZ, where flight paths occurred, and where birds were concentrated. Relative abundance (the number of birds of a particular species as a percentage of the total observations in a given area) was calculated for each species. Flight frequency within the RSZ was also calculated for each of the four species groups observed during the Avian Use/Flight Path Surveys based upon the number of times a species was observed per 30 minutes of observation. Those species with the highest relative abundance occurring within the RSZ theoretically have a higher chance of experiencing mortality as a result of collisions with turbine blades. However, recent studies suggest that exposure in the RSZ is not always a good predictor of bird mortality because bird behavior also affects mortality (e.g., Erickson et al. 2002, Smallwood et al. 2009). Sensitive species flight data were further evaluated by species to assess risk and utilization of flights within the RSZ.

Waterfowl data were divided into Migratory (April 7 to May 5, 2011) and Breeding (May 5 to June 29, 2011) periods in order to evaluate utilization. Those species that breed on the site are expected to incur higher utilization rates due to their presence throughout the survey period than species that are present for a few days or weeks at a time during spring migration.

Literature Review

HDR conducted a literature review to assess potential impacts to waterfowl, grassland birds, or birds of conservation concern at the Project site. Literature referring to avian impacts due to collisions, habitat fragmentation, and behavioral avoidance was reviewed for relevance to the proposed Project. HDR reviewed several peer-reviewed studies, consultant studies for wind energy developers, and government agency studies, and incorporated the relevant conclusions into the study design, data review, and resulting conclusions.

Results and Discussion

Habitat and Land Use

According to GAP land cover data (Figure 3), the Sites are primarily cropland with scattered patches of grassland. Table 1 estimates the acreages of each land cover type based on GAP data.

Table 1: GAP Land Cover Data within Sites

Cover Type	Study Area (Ac)	Percent of Study Area
Aquatic	22	0.2
Cropland	12,130	82.5
Grassland	2,340	15.9
Forested	9	<0.1
Marsh	121	0.8
Shrubland	76	0.5
Total	14,699	100

Based on HDR's site observations, most of the mapped grassland areas are cropped, plowed, or converted to cropland. The few parcels of grassland that exist within the Sites consist of pasture or wetlands. Substantially less grassland exists within the Study Area than suggested by the GAP land cover.

Observation Effort

HDR conducted 22 Avian Use/Flight Path surveys at 11 stations on the Sites between April 1, 2011, and June 29, 2011. Each station was surveyed for 30 minutes every week for a total preconstruction Avian Use/Flight Path survey time of 4,290 minutes (71.5 hours total observation time or 6.5 hours of observation per station). Three additional 30-minute point counts were conducted three times during the Marbled Godwit Surveys. Additional observation time was logged during Bald Eagle Nest Activity surveys and Wetland Utilization surveys for a total of 180 additional minutes (3 hours) of observation at the Project site.

Detection Data

A total of 22,863 individual birds, representing 106 different species, were documented during the spring visits to the 11 point count stations. An additional 4,880 individual birds were documented that were either too far away to identify to species level, too abundant to identify individually, or were only observed for a moment and critical identification characteristics were missed. An additional 1,897 individual birds were counted during Wetland Utilization (Appendix A) and Marbled Godwit (Appendix B) surveys, adding 10 more species to the overall species richness of the site.

The observation point with the highest species richness (60) was observation point 161027-4, situated on the eastern boundary of the Trisko WPA. Habitat associated with point 161027-4 included a large grassland/wetland complex to the west of the point and a mixture of cropland, wetland, and planted trees to the east, north, and south. Avian use in this area reflected species associated with wetland nesting and foraging as well as grassland species and some woodland species utilizing the patchy woodlands. Observation points 113816-3 and 113816-4 had the next highest richness totals with 54 and 52, respectively. Both of these points likely had higher species richness due to the presence of trees, which harbored many woodland species that were not present at most of the remaining observation points. Both points are also situated north of a wetland complex that harbored marbled godwits and a variety of waterbirds and waterfowl.

Survey points with the lowest richness totals (29, 34, and 35) were located in areas that were predominantly cropland with little habitat diversity and that were relatively isolated from larger waterbodies associated with WMAs and WPAs.

The Project Snapshot (Appendix C) provides a list of species documented at the Sites site along with a summary of species richness by point, species richness by habitat, mean abundance by point, mean abundance by habitat, mean flight-height, mean flight-height by point, mean flight-height by species, overall mean abundance, mean abundance by point, total abundance, and a list of sensitive species and their abundance. Species richness is the number of different species observed at a given point. The mean abundance is the average abundance at a given point and was also calculated for each species' flight heights.

Comparison of Use Data

Comparisons of avian use data between the Black Oak/Getty Project study area and other wind projects were conducted by calculating mean use. Mean-use rates were measured by dividing the number of birds observed within 800 m from each point during 20 minutes of survey (i.e. birds/plot/20 min. survey/800 m). Although surveys were conducted for 30 minutes at each point in the study area, observations were recorded in 10-minute intervals that allow a comparison between projects with shorter survey periods. HDR eliminated the last ten minutes of the 30-minute survey period to compare the Black Oak/Getty Wind Farms with 20-minute surveys at other sites. Eliminating the last 10-minute interval resulted in 14,575 birds being counted as one of 93 species at the Black Oak/Getty Wind Farms study area. HDR calculated use-rates by combining species into the following groups: waterfowl (all ducks, geese, and swans), waterbirds (loons, herons, terns, pelicans, bitterns, and cranes), and raptors (hawks, eagles, falcons, and harriers). Mean-use rates for passerine (all songbirds, perching birds, or landbirds) were not widely available so only general abundance and flight data information was calculated for the Project. Additionally, species listed as ETSC/SGCN were also grouped to analyze flight paths and assess risk.

HDR analyzed flight data for each species and for waterfowl, waterbirds, raptors, and passerines. Flight height was analyzed to assess the relative collision risk for each species considered sensitive (i.e. species designated as ETSC and those considered SGCN) and species groups that were detected during the spring surveys. Relative risk was calculated by estimating the number of individuals of each species group that flew through the likely RSZ (Table 2). Four turbine designs are currently being considered for the Projects. The RSZ for project turbines ranges from approximately 28 meters to 150 meters. Those species whose mean flight-height was below or above the RSZ would incur relatively lower risk than those species whose mean flight-height was within the RSZ.

**Table 2: Relative Risk by Species Groups Observed
 During Avian Use/Flight Path Surveys**

Species Group	Number of Flights Observed	Percentage of Flights Observed in RSZ
Waterfowl	379	37.6
Waterbirds	181	33.1
Raptors	129	24.0
Passerines	1792	3.3

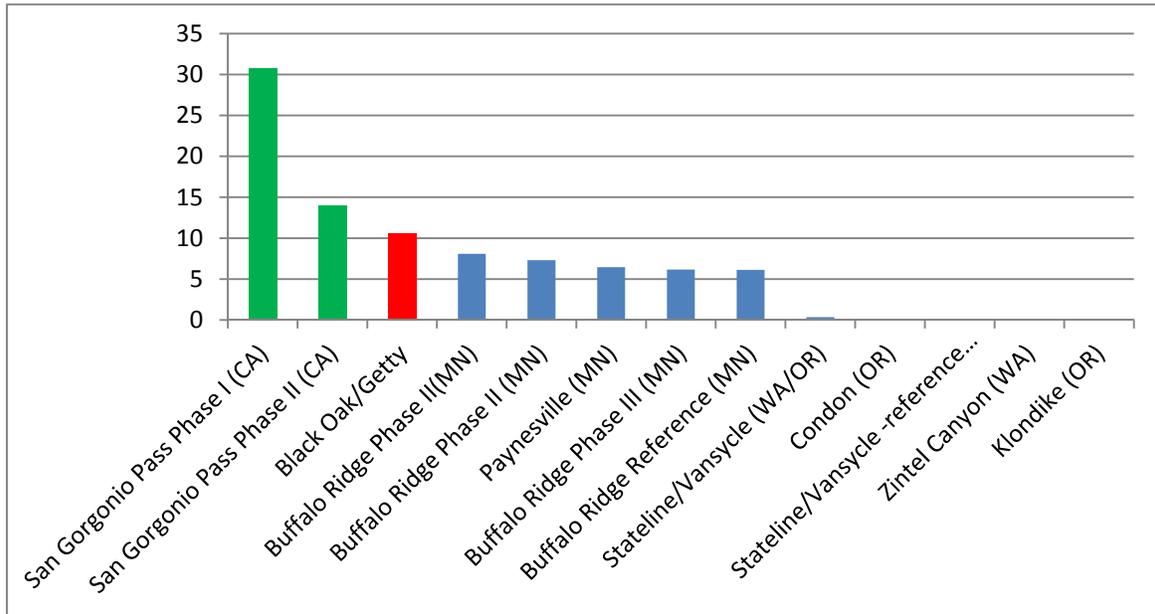
Waterfowl/Waterbird Use Comparison

Waterfowl/waterbird use at the Black Oak/Getty Wind Farms study area was compared to the Paynesville Wind Resource Area (6.46 birds/survey) also located in Stearns County, Minnesota (Hamer Environmental, 2010). The higher waterfowl/waterbird use at the Black Oak/Getty Wind Farms study area (10.59 birds/survey) is likely due to the presence of numerous large waterbodies associated with Padua WMA, Trisko WPA, Kenna WPA, and Raymond Lake, as well as other nearby marsh systems that harbor suitable nest habitat associated with the wetlands. The avian use report for an additional Stearns County wind farm, Lake Country Wind Farm, was also reviewed for comparison (Malcolm Pirnie, 2010). The study revealed similar species composition and migration timing, but mean use numbers were calculated based upon a different sample period. Therefore, dissimilar use results were reported and could not be directly compared. Erickson et al. (2002) analyzed overall avian use and compared it to observed mortality at several wind farm sites throughout the country. This study concluded that for waterfowl, mortality appear to be very low compared to use of the site. It also concluded that those sites with year-round use have exhibited the highest levels of mortality.

Avian use rates at the Black Oak/Getty Wind Farms study area were compared to other agricultural wind resource areas across the country based on data from the Erickson report. However, it was necessary to modify the data analysis to make the use-data comparable (e.g. using only 20 minutes of data instead of the full 30-minute data set). Mean use by waterfowl and

waterbirds was higher at the Black Oak/Getty Wind Farm study area than at any of the other 10 wind resource areas evaluated by Erickson in an agricultural landscape. However, two other wind resource areas located in a natural landscape with significant water resources had higher rates (San Gorgonio Pass Phase I and II, with 30.771 and 13.973 birds/survey, respectively).

Chart 1. Mean Waterfowl/Waterbird Use



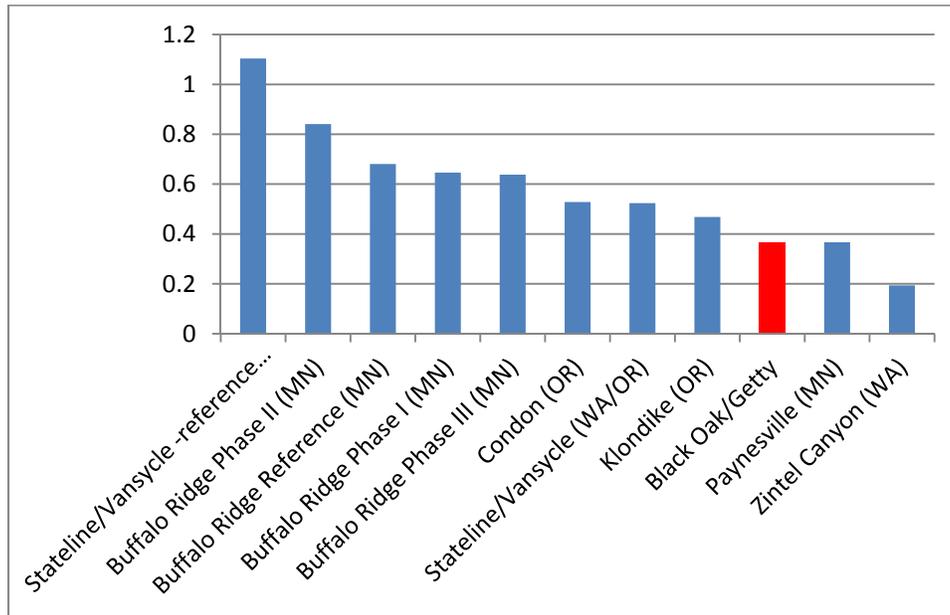
Note:

Mean Use was compared to ten wind resource areas located in agricultural landscapes (Blue) and two located in native landscapes with significant water features (Green). Mean Use was calculated using (Birds/20 Minute Survey/under 800 meters)

Raptor Use Comparison

Raptor use at the Black Oak/Getty Wind Farms study area was 0.36 birds/survey which is similar to the Paynesville Wind Resource Area (0.36 birds/survey) in Stearns County, Minnesota. HDR also used Erickson et al. (2002) who analyzed overall raptor use and compared it to observed raptor mortality at several wind farm sites throughout the country. This study concluded that for raptors, use may not be a good predictor for mortality when considering newer generation wind turbines. Raptor use rates at the Black Oak/Getty Wind Farms study area were compared to other agricultural wind resource areas across the country based on data from the Erickson report. However, some data analysis modifications were necessary to make the use-data comparable (e.g. using only 20 minutes of data instead of the full 30-minute data set). Mean use by raptors at the Black Oak/Getty Wind Farms study area was in the lowest quartile (0.36 birds/survey) of the other 10 wind resource areas evaluated by Erickson in an agricultural landscape (Chart 2).

Chart 2. Raptor Utilization at Black Oak/Getty Wind Farms



Note:

Mean Use was compared to ten wind resource areas located in agricultural landscapes (Blue). Black Oak/Getty use is depicted in red. Mean Use was calculated using (Birds/20 Minute Survey/under 800 meters)

Passerine Comparison

A comparison of the most frequently recorded Passerine species at the New London BBS routes in Stearns County, and those observed at the Black Oak/Getty Wind Farms study area, indicate the species most frequently observed are very similar. As a comparison, Table 3 lists the 10 most commonly observed species along the New London BBS route and at the Black Oak/Getty Wind Farm study area.

Table 3: Ten Most Frequently Observed Passerine Species at the New London BBS Route and Black Oak/Getty Wind Farms Study Area

New London BBS Route	Common Name	Scientific Name	Black Oak/Getty	Common Name	Scientific Name
1	Red-winged blackbird	<i>Agelaius phoeniceus</i>	1	Red-winged blackbird	<i>Agelaius phoeniceus</i>
2	Common grackle	<i>Quiscalus quiscula</i>	2	Common grackle	<i>Quiscalus quiscula</i>
3	Common yellowthroat	<i>Geothypis trichas</i>	3	Lapland longspur	<i>Calcarius lapponicus</i>
4	Mourning dove	<i>Zenaida macroura</i>	4	Brown-headed cowbird	<i>Molothrus ater</i>
5	European starling	<i>Stunus vulgaris</i>	5	Horned lark	<i>Eremophila alpestris</i>

New London BBS Route	Common Name	Scientific Name	Black Oak/Getty	Common Name	Scientific Name
6	Horned lark	<i>Eremophila alpestris</i>	6	American crow	<i>Corvus brachyrhynchos</i>
7	American robin	<i>Turdus migratorius</i>	7	Brewer's blackbird	<i>Dolichonyx aryzivorus</i>
8	Cliff swallow	<i>Petrochelidon pyrrhonota</i>	8	Barn swallow	<i>Hirundo rustica</i>
9	Grasshopper sparrow	<i>Ammodramus savannarum</i>	9	American Robin	<i>Turdus migratorius</i>
10	Ring-necked pheasant	<i>Phasianus colchicus</i>	10	American goldfinch	<i>Spinus tristis</i>

Conservation Priority Species

No species currently listed under the federal ESA was detected during the spring 2011 surveys. However, seven species listed by the State of Minnesota as endangered, threatened, or special concern were detected at the Sites during spring 2011 surveys. Observations of state-listed sensitive species include; marbled godwit (*Limosa fedoa*, SPC), Wilson's phalarope (*Phalaropus tricolor*, T), trumpeter swan (*Cygnus buccinator*, T), horned grebe (*Podiceps auritus*, T), Forster's Tern (*Sterna forsteri*, SPC), American white pelican (*Pelecanus erythrorhynchos*, SPC), and bald eagle (*Haliaeetus leucocephalus*, SPC). Special concern species are not provided the same statutory protection as endangered or threatened species, but are protected from indiscriminant taking by the MBTA and state wildlife laws (i.e. hunting regulations). The bald eagle is also protected from taking and disturbance by the BGEPA.

Additionally, species that are experiencing population declines or are considered to be particularly susceptible to wind development (i.e. species listed as ETSC or SGCN that are cited in research reports such as Erickson et; al.) were also noted during the spring 2011 survey period. Species designated as SGCN or that are experiencing local or regional declines by the BBS were documented on the Sites. While neither an SGCN or BBS declining-species designation confers legally protected status, they are protected from indiscriminate taking by the MBTA and were noted as a concern by the DNR or USFWS during review of survey methods or preconstruction meetings.

State Listed Species

Trumpeter Swan

The trumpeter swan is currently a state-listed threatened species. A forthcoming update of the endangered species list will downgrade this species to special concern due to the success of restoration efforts exceeding population goals. During the breeding season, trumpeter swans

typically select small ponds, lakes, or bays within larger lakes with extensive beds of cattails, bulrush, sedges, and/or horsetail. Coffin and Pfanmuller (1988) state that “Muskrat houses and beaver lodges are frequently used for nesting platforms.” They are known to protect large territories during the nesting period and are intolerant of crowding by other species. They have been known to kill perceived competitors such as pelicans while protecting breeding territories (Mathisen pers. com.). Trumpeter swan nesting territories range from 6 to 150 acres. They use large, shallow wetlands 1-3 ft deep where a diverse mix of emergent vegetation and open water offer ideal habitat. Such locations support a rich variety of submerging (underwater) plants used for food, such as pondweed and water milfoil.

Trumpeter swans were observed during the Wetland Utilization Survey on May 19, 2011. Two feeding adult swans were observed at Wetland Point #3 in a wetland south of County Road 22 adjacent to the southern limit of the Sites. Numerous lakes and wetlands in this area display suitable nesting characteristics. However, no additional trumpeter swan observations were noted during Avian Use/Flight Path surveys and no nests were found within or near the Project on subsequent visits to this same wetland or surrounding waterbodies.

Horned Grebe

Horned grebes are a state-listed threatened species. Historically this species has bred throughout the Prairie Parkland Province of Minnesota. Horned grebes inhabit lakes with a mix of open water and wetland vegetation during the breeding season. Nests are built over water on large water bodies (over 10 hectares (ha.)) where bays and inlets provide protection from wind action (Coffin and Pfanmuller 1988). Nests are constructed in shallow water, usually within emergent vegetation. Coffin and Pfanmuller state that “On larger wetlands and water bodies, they tend to lose out in competition with other grebes and probably also with loons. As a result, they are usually found on small water bodies that often have little emergent vegetation.” The horned grebe is a summer resident that is now primarily restricted to Roseau, Marshall, and Pennington Counties in northwestern Minnesota (Janssen 1987).

The one observation of a horned grebe occurred on April 14 during Wetland Utilization surveys at Wetland Point #1 and was recorded during the migratory period for this species. No additional observations of any kind were documented in subsequent surveys. Although suitable habitat does occur within the Padua WMA and other WPAs near the Sites, an isolated observation of this species during the migratory period seems to indicate that this species is a migrant and not a breeding species at this location.

Wilson’s Phalarope

Wilson’s phalaropes are listed as a threatened species by the State of Minnesota. Recent breeding records for this species occur throughout the Prairie Parkland Province in wet meadows or grasslands associated with shallow wetlands (Coffin and Pfanmuller, 1988). This species is

highly aquatic and forages for dipterans and crustaceans while swimming (O'Brien et al. 2006). DeGraaf and Rappole (1995) state that "The primary breeding habitat of Wilson's phalarope is shallow water bodies in disturbed mixed grass prairies and agricultural areas." The species may breed semi-colonally and nests in a variety of wetland types that range from shallow ponds to lakes. Several authors note that it has also been found nesting in shallow swales along streams, in shallow sloughs fringed with short grasses, and in hay meadows or pastures (Colwell and Jehl 1994, DeGraaf and Rappole 1995).

Several areas within and near the Sites provide some of the preferred habitat characteristics of the species. One flock of 16 Wilson's phalaropes was recorded during Avian Use/Flight Path Surveys on May 20, 2011, and up to eight individuals were recorded during Wetland Utilization surveys. Wilson's phalaropes occurred during three consecutive weeks beginning on May 10, 2011, with the last observation occurring on May 27, 2011 (Figure 4).

On May 10, eight birds were observed within a wetland/pasture complex in the NW ¼ of Section 25 Raymond Township. Three males and five females foraged in several small, shallow-water wetlands with grassy edges at Wetland Point #3 within 400 m of the Sites. The following week one male and one female were observed engaging in low circling flights around the same wetland/pasture complex in the SW ¼ of Section 24 Raymond Township. Additionally, 16 Wilson's phalaropes were recorded at 113816-3, 1 mile north of the same wetland/pasture complex flying to the northwest during point count surveys. The last observation of this species was recorded at Wetland Point #3 on May 27, 2011 in a flooded grassland one-quarter mile west of the same wetland/pasture complex in the SE ¼ Section 23, Raymond Township.

The multiple observations of Wilson's phalaropes within the same wetland/pasture complex indicate the area is important as a migratory use area but all observations of this species are outside of what is considered a "safe date" for breeding. The Minnesota Breeding Bird Atlas (MBBA) establishes the "safe date" for probable evidence of breeding to begin on June 1 and end on August 1 of a given year. No subsequent Avian Use/Flight Path or Wetland Utilization surveys detected the presence of this species. However, this species has been recorded breeding in Stearns County and the presence of abundant suitable habitat on and near the Sites indicates the species may be a breeding species in some years.

Marbled Godwit

Marbled godwits are listed as a special concern species by the State of Minnesota. Recent breeding records for this species occur in two regions of the Prairie Parkland Province within the state. The primary breeding areas within Minnesota occur along the Glacial Lake Agassiz Beach Ridge of the Red River Valley and northwestern portion of the state. Two smaller populations are centered along the Minnesota River and wet prairie areas of central Minnesota (Melcher et al. 2006). Melcher et al. also suggests that the Minnesota population nests preferentially in sparsely

vegetated native grassland habitats that are often grazed or recently idled from grazing. However, other studies indicate that they will use tame grass habitats, including hayfields and idle pastures if the vegetative structure is similar to native grassland habitats (Ryan et al. 1984). Marbled godwits require large contiguous blocks of grassland/wetland complexes that represent a broad range of sizes and types to breed successfully (Ryan et al. 1984). Records of historic use near the Sites by this species are also recorded in the DNR Natural Heritage Inventory System (NHIS) database.

Areas that exhibit these habitat characteristics are located in Sections 23, 24, and 25 of Raymond Township at the southern end of the Sites (Figure 4). Godwits were documented at Wetland Point #3 in this area every week from April 19 through June 24, 2011, during Wetland Utilization surveys. On several occasions, two male-female pairs could be seen on the north and south sides of a wetland/pasture complex in Sections 24 and 25. Up to three males were seen engaging in aerial displays over this same wetland/pasture complex on April 19 and 29, and May 10, 20, and 26. Observations at Wetland Point #3 continued to note marbled godwit behaviors and to assess breeding evidence beyond May 20. Additionally, marbled godwits were noted during Avian Use/Flight Path counts at Points 1, 2, 3, 4, and 6 from the end of April through June. Most observations were associated with grasslands or pastures. However, three observations were associated with flooded cropland where the birds were seen foraging.

Marbled godwits engaged in two distinct flight types during the spring 2011 surveys. The display/courtship flights consisted of birds observed circling suitable nesting habitat while calling or chasing other godwits. In these flights, the birds were noted flying as high as 70 meters AGL and activity occurred for periods of 3 to 20 minutes. Biologists observed these display flights on five different days and display flights occurred multiple times during some observation periods.

The second flight type was a directional flight, which was noted on two occasions. Flight heights during directional flights ranged from 2 to 20 m. In both instances flights originated in areas north or west of the presumed breeding area at the south end of the Sites. The MBBA establishes the "safe date" for evidence of probable breeding marbled godwits to begin on May 10 and end on July 20 of a given year. The presence of territorial godwits of both sexes in suitable habitat throughout the spring indicate that this species likely breeds on or near the Sites. No godwits were observed during any of the marbled godwit surveys conducted at the Behnen, Trisko, or Kenna WPAs. These WPAs contain abundant grassland/wetland complexes of suitable size, but during the 2011 surveys were characterized by monotypic late season grass species and forbs that did not provide the short stature grassland/wetland interface preferred by this species. The observations of godwits at other locations throughout the project area may indicate that, in addition to using the site for foraging, this species utilizes grasslands throughout the project site

when they provide habitat with the proper structure and vegetative composition in any given year.

Forster's Tern

Forster's terns are listed as a special concern species by the State of Minnesota. Historically this colonial species has bred throughout the western third of the state in the Prairie Parkland Province eastward into the Eastern Hardwood Forest Province. Although this species is known to occupy traditional nesting locations throughout the state, water levels appear to dictate whether a given nest site is occupied during a given year. Nesting colonies are located on the floating vegetation at the interior of marshes or lakes (Scharf 1991). In Minnesota, some studies of Forster's Tern have found that reproductive success was below levels needed to maintain this species at its current size (Cuthbert and Louis, 1986). Habitat utilized by this species consists of extensive areas of emergent vegetation where nests are constructed on emergent vegetation or muskrat houses.

Forster's terns were observed during Wetland Utilization surveys at Wetland Point #4 twice during migration on May 10 and 19, 2011, at the wetland located adjacent to U.S. Highway 71 on the northeast boundary of the Project site (Figure 4). This species was not observed during the Avian Use/Flight Path surveys and no active breeding colonies were found on wetlands within or adjacent to Sites.

American White Pelican

The Minnesota DNR currently lists this species as of special concern and several studies have shown this species' abundance is increasing across its range over the past 20 to 25 years (Wires et al. 2005; Evans and Knopf 1993). This species is a colonial nesting species that selects large, shallow bodies of water that are rich in prey fish. Usually the nesting site is a flat, bare island that is isolated from human disturbance (Coffin and Pfanmuller, 1988).

American white pelicans were observed frequently during both the Avian Use/Flight Path and Wetland Utilization Surveys. They were observed feeding at waterbodies associated with the Kenna, Trisko, and Behnen WPAs and at the Padua WMA adjacent to Raymond Lake. Observations were also documented while this species was flying to other lakes and rivers near the Project. Most of the flight observations were of birds travelling between wetlands, rivers, and the larger lakes and waterbodies to the west and northeast of the Sites (Figure 4). Raymond Lake at the south end of the site was also used frequently by this species.

Bald Eagle

The DNR currently lists the bald eagle as of Special Concern but is proposing to upgrade the species to "no status." The bald eagle breeds across much of North America and is known to have a presence in every U. S. state except Hawaii. Bald Eagles that reside in the northern U. S. and Canada migrate to the warmer southern climates of the U.S. during the winter. However,

nesting pairs have been known to reside near nest sites throughout the winter. Bald eagle characteristic breeding habitat includes super-canopy trees such as red and white pine near lakes and rivers that support an abundant supply of fish. While most nest sites are located in areas with minimal human activity, some eagles have adapted to human presence and nest near human dwellings and other features such as railroads, highways, and boat landings. The annual life of bald eagles can be broadly categorized into nesting and non-nesting periods. The nesting period varies by latitude; in the Midwest, it begins with courtship and nest building in late January and early February and ends when the young fledge by late July. The non-nesting period is thus from August through mid-January.

One nesting pair of eagles occurs in the NW $\frac{1}{4}$ of Section 18 of Getty Township (Figure 4). Nest observations of this pair throughout the breeding season indicated the pair successfully raised at least one young from this site. A total of 18 bald eagles were observed throughout the migratory season from April 1 through May 5, 2011. These observations were primarily of the resident adults tending to their nest and young, or engaged in foraging forays. Two juvenile birds and a sub-adult bird were also observed perching or following the northward migration of waterfowl. On one occasion, a single adult from the Getty nest shadowed the flight of a sub-adult eagle while it was within 1.5 miles of the active nest. Juvenile eagles were seen conducting feeding forays that originated near waterfowl concentrations or were seen soaring from the northeast to the west end of the Sites. The presence of an active nest, eagle foraging, and migration through the Sites will require further analysis under provisions of the BGEPA. The Draft Eagle Conservation Plan Guidance (USFWS January 2011) indicate that further assessment of eagle use within 10 miles of wind farm projects may be required to identify and quantify risk associated with wind development at this site.

Colonial Nesting Species

Although the species in this group are not protected by federal or state endangered species regulations, their nesting sites are identified and tracked by the DNR NHIS and takings are regulated by the MBTA.

Black Tern

Black terns are a neotropical migratory species that are semi-colonial breeders. Black terns reach their breeding territories in Minnesota in late-April through the beginning of May (Janssen, 1987). Breeding occurs in shallow freshwater marshes with emergent vegetation found along lake margins and occasionally in rivers (Dunn and Argo 1995). Vegetation used for nest platforms can vary, but cattails or bulrushes are characteristically dominant in black tern colonies (Dunn 1979). Vegetation cover can also vary between dense and sparse but nests are usually protected from direct open water to avoid dangers such as wind and wave action (Currier 2000). Nesting locations of 5 ha. or more are thought to be necessary for establishment of nesting colonies. The black tern is found throughout most of the state during the breeding season and

Minnesota is thought to harbor the largest population in the north central United States (Baker and Hines, 1996). Population declines have been noted by National Biological Service's BBS and this decline has resulted in the species being protected in nearby states such as Ohio, Indiana, Illinois, Iowa, and Wisconsin.

A black tern nesting colony was observed at a wetland adjacent to U.S. Highway 71 by Minnesota Breeding Bird atlas volunteers in 2010 and one was noted northwest of observation point 161027-2 during the 2011 surveys. The 2011 colony was located in a large emergent wetland complex north of County Route 28 in Getty Township (Figure 4). Breeding generally occurs in shallow freshwater marshes with emergent vegetation found along lake margins and occasionally in rivers (Dunn and Argo, 1995). Terns from this colony were observed landing in a dense stand of cattails (*Typha* sp.) and giant reed grass (*Phragmites australis*) with areas of open water surrounding the colony. Upland areas around the wetland are used to produce corn, soybeans, and silage. Terns from this colony were also seen flying between the nesting colony and Padua WMA to the south or to Trisko WPA north of the nesting location. The colony observed at this location is estimated to be between 19 and 30 birds based upon numbers of birds seen flying during any one given observation period.

Red-Necked Grebe

Red-necked grebes were observed nesting at Padua WMA during the spring of 2011. Up to five red-necked grebes were observed conducting courtship displays, pair bonding, and nest platform construction on the southeastern portion of the wetland. Breeding for this species generally occurs in shallow, freshwater marshes or protected bays of larger lakes. Nests at this location were constructed of cattails and bulrushes (*Scirpus* sp.) along the eastern edge of the lake where emergent vegetation juts out into the open water portion of the lake.

This species becomes relatively sedentary once arriving on the breeding grounds. The total number of resident red-necked grebes at the Padua WMA appears to be four. Only one nest platform was detected along the east side of the Raymond Lake (Figure 4).

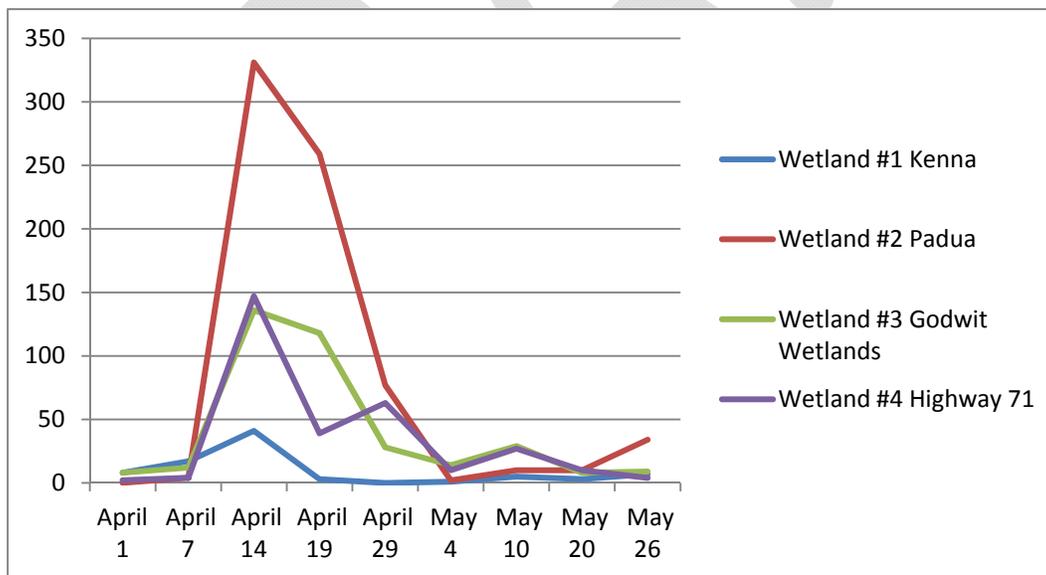
Waterfowl and Waterbirds

The intent of HDR's avian research was to describe the general flight patterns and habitat utilization by migratory waterfowl, water birds, raptors, passerines, and sensitive species across the site. Since wind turbines will be sited on lands currently planted in crops, the analyses focused on identifying flight patterns of target species between concentration areas such as WPAs, WMAs, wetland areas, and other grassland habitats within the study area. Wetland areas are abundant during the spring thaw and waterfowl occur in large numbers where water ponds over a frost layer in the soil on agricultural lands. Waterfowl use of these flooded fields generally subsides once the frost leaves the soil and surface waters recede. WPAs and WMAs such as Padua, Trisko, and Kenna provide more permanent water sources used by waterfowl and water

birds during migration, breeding, and rearing seasons. Waterfowl and other water birds generally concentrate at wetlands or waterbodies for roosting or loafing during the evening hours. Conducting surveys in the early morning or late evening when these species travel to feeding areas is the best way to identify the elevation, duration, and direction of flights so that turbines can be sited to avoid impacts. Scheduling surveys from April to June allowed HDR to assess use patterns during migratory and breeding periods.

A total of 23 species of waterfowl were observed between April and June 2011, during either the Avian Use/Flight Path or Wetland Utilization Surveys. Utilization of the site can be divided into two distinct categories. Many birds utilize the abundant wetlands and lakes in this region as migration stopover points or as staging areas to refuel depleted energy reserves before continuing their migration north. Others utilize the uplands and wetlands in this area for breeding and feeding. For purposes of analysis and risk assessment, the surveys were broken into a migration period running from April 1 to May 5, 2011, and a breeding period from May 5 through June 29, 2011. These categories are based upon observations of the number of waterfowl in the area documented during Waterfowl Utilization Surveys (Chart 3). Of the 23 species observed, 14 were observed flying at one time or another. The remaining species apparently are flying after sunset or before sunrise.

Chart 3. Waterfowl Utilization at Area Wetlands



Raptors

Raptors were found utilizing the study area in relatively low numbers. A total of seven species of raptors/vultures were observed between April and June 2011, during the Avian Use/Flight Path, Eagle Nest Monitoring, or Wetland Utilization Surveys. Utilization of the study area can be divided into two distinct categories. A single sharp-shinned hawk (*Accipiter striatus*) was the

only raptor species observed solely during migration. The remaining observations are presumed to be of breeding individuals because there were repeated observations in the same general areas throughout the spring surveys. Of the seven species observed, six were observed flying at one time or another (Figure 6). The great horned owl (*Bubo virginianus*) was only observed perching near its nest in the Behnen WPA during Marbled Godwit Surveys.

Passerines

Red-winged blackbirds, common grackles, unidentified species of blackbirds, and Lapland longspurs were the most abundant species observed during the Avian Use/Point Count Surveys in the spring of 2011 (Appendix C). These species made up 16,201 of the 22,863 individuals counted, or 71 percent of all observations. Passerines as a group made up 18,807 (82 percent) of all individuals observed. This group also made up 55 percent of the species listed as ETSC or SGCN observed on the Sites. Despite the large numbers of passerine species observed, only 3.3 percent of all flights for this group occurred within the RSZ and the only species within this group with a mean flight-height within the RSZ was a single flock of Smith's longspurs that was first observed at 35 meters AGL. This flock of longspurs was originally detected at this height but quickly dropped to land in a grassy field and then flew away at an elevation below the RSZ at 10 meters. Horned larks were the only passerine species observed regularly utilizing airspace within the RSZ throughout the spring season. Erickson et al. (2001) found that passerines are the most common group of birds killed at new generation wind farms and make up as much as 80 percent of all fatalities reported.

Collision Risk

The most apparent risk to native and sensitive birds from wind energy facilities is collision with turbine blades. Recent studies suggest that bird behavior is a stronger predictor of collision risk than other factors, such as observed flight height or local abundance (de Lucas et al. 2008, Smallwood et al. 2009). However, habitat is important in predicting the location of species. As a result, avoiding habitats supporting concentrations of native birds, especially sensitive species, reduces collision risk for birds that are susceptible due to their behavior.

Members of the family *Icteridae* (blackbirds) were the most abundant group with over 10,000 individuals counted during the spring 2011 Avian Use/Flight Path surveys. *Emberizidae* (sparrows, particularly members of the Genus *Calcarius* (longspurs)) were the second most abundant group of birds with more than 2,700 individuals counted. Observed flight heights for both of these families of birds were generally below the RSZ and daytime flights would likely not be affected by the construction of wind turbines in this area. The third most abundant group was made up of waterfowl species. All species of waterfowl totaled 3,695 individuals or only 16.1 percent of the individuals observed in surveys across the site during the Avian Use/Flight Path Surveys. Although mortality among waterfowl was found to be low when compared to waterfowl/waterbird use (Erickson et. al.,2001), some individual species may be more

susceptible to collision due to the kinds of behaviors they engage in near wind farm sites. Mortality is predicted to be highest in species such as the mallard, which historically experience higher than average mortality at wind farms (Johnson et al,2000). The higher mortality associated with Mallards may be due to behavioral attributes such as “chase flights” that are engaged in during the breeding season by this species.

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Sensitive Bird Species Collision Risk

Turbines would primarily be placed in croplands at the Black Oak/Getty Wind Farms. Collision risk to sensitive species and long-distance migrants is thought to be low in cropland, given the low abundance of these species in point counts. However, the behavior of individual species affects the risk. For instance, Johnson et al. (2000) found that two of 55 avian mortalities at Buffalo Ridge, Minnesota, were vesper sparrows despite observation information indicating that the species did not fly through the RSZ. Of the species considered sensitive to wind farm development at the Project, the horned lark may have the greatest potential for collision fatality due to its higher abundance in croplands, higher documented mortality, and propensity to engage in territorial displays that occur within the RSZ. Other sensitive species of note that occurred within the RSZ included American white pelican (SPC/SGCN), bald eagle (SPC/SGCN), upland sandpiper (SGCN), American bittern (SGCN), black tern (SGCN), marbled godwit (SPC/SGCN), and northern harrier (SGCN). Flights of these sensitive species were associated with waterbodies as flight origination or destination and existing grassland habitats (Figure 4).

Table 4: ETSC/SGCN Species Observed Within the Rotor Sweep Zone (RSZ)

Common Name	Scientific Name	Abundance	% below RSZ (<30 m)	% within RSZ (30-150 m)	% above RSZ (>150 m)
American Bittern	<i>Botaurus lentiginosus</i>	1	0.00	100.00	0.00
Common Loon	<i>Gavia immer</i>	14	57.14	42.86	0.00
American White Pelican	<i>Pelecanus erythrorhynchos</i>	125	6.89	79.32	13.79
Lesser Scaup	<i>Aythya affinis</i>	42	66.66	33.33	0.00
Bald Eagle	<i>Haliaeetus leucocephalus</i>	18	33.33	66.66	0.00
Northern Harrier	<i>Circus cyaneus</i>	60	91.08	8.92	0.00
Marbled Godwit*	<i>Limosa fedoa</i>	11	27.27	72.73	0.00
Upland Sandpiper	<i>Bartramia longicauda</i>	13	57.15	42.85	0.00
Wilson's Phalarope	<i>Phalaropus tricolor</i>	17	50.00	50.00	0.00
Black Tern	<i>Chlidonias niger</i>	48	28.58	71.42	0.00
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	1	100.00	0.00	0.00
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	1	100.00	0.00	0.00
Least Flycatcher	<i>Empidonax minimus</i>	1	100.00	0.00	0.00

Common Name	Scientific Name	Abundance	% below RSZ (<30 m)	% within RSZ (30-150 m)	% above RSZ (>150 m)
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	12	100.00	0.00	0.00
Sedge Wren	<i>Cistothorus platensis</i>	4	100.00	0.00	0.00
Marsh Wren	<i>Cistothorus palustris</i>	1	100.00	0.00	0.00
Brown Thrasher	<i>Toxostoma rufum</i>	5	100.00	0.00	0.00
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	3	100.00	0.00	0.00
Bobolink	<i>Dolichonyx oryzivorus</i>	86	100.00	0.00	0.00
Rusty Blackbird	<i>Euphagus carolinus</i>	56	100.00	0.00	0.00

* Display flights observations noted at breeding location south of the Project on April 19, May 10, 20, and 26. These displays did not occur at established points.

Waterfowl, and Waterbird Collision Risk

Several studies have evaluated whether utilization of flights within the RSZ correlate to higher mortality rates at wind farms (Strickland et al. 2001, Hunt 2002, Smallwood et al. 2008). Some of these studies have shown that although general mortality increases across all species, behaviors or visual acuity differentiate a species susceptibility to collisions at wind farms (Smallwood 2008). The Smallwood study indicated that mortality rates did not correlate with utilization rates for most species but did correlate with species such as mallards, American kestrel, and red-tailed hawk. The results of the Smallwood study and others (Strickland et al. 2001, Smallwood and Thelander 2004) indicate that behavior may play a vital role in determining mortality associated with collisions with wind turbines. Mallards have among the highest utilization rates of the waterfowl observed during the breeding season at the study area. The results of several studies indicate that mallards, in particular, exhibit behaviors that may increase the likelihood of collisions with wind turbines. Chase flights by mallards were observed throughout the migration and breeding season during the spring of 2011. These flights may increase mortality rates because birds involved in the chase flight are concentrating on courtship or evasion of courting males and may not be aware of the presence of moving turbine blades. This inattention may result in higher mortality rates at wind farms.

Three different flight behaviors were noted for the 14 waterfowl species observed during the Avian Use/Flight Path Surveys conducted at the study area (Figure 5). The first category observed was migration flights. These flights occurred at higher elevations and involved from 10 to 30 individuals engaging in linear flights that bypassed wetlands, lakes, or potential foraging sites. These groups of waterfowl were observed for long distances and appeared to pass through

the survey area without taking off, landing, turning or stopping. The second category appeared to be foraging flights and was characterized by individual birds or flocks flying at lower altitudes. Biologists at any one of the survey points generally observed the origin or termination of the flight. Several individuals engaging in chase flights characterized a third category. The origins and termination of these flights were generally observed by the biologist at a given survey point and occurred at varying altitudes. Chase flights were never linear but involved looping, diving, or zigzagging flight paths that may have started with at least two individuals and gained or lost individuals as the flight continued.

In summary, waterfowl used agricultural fields extensively during the spring migration, and foraging flights occurred between WPAs, WMAs, and flooded fields where waterfowl congregated to feed (Figure 5). The mean observed flight-height for waterfowl was 19 meters. Once migration ceased, waterfowl use was characterized by fewer flights between wetlands or lakes, and an absence of flights to agricultural fields to feed. Flight paths during both periods generally originated or terminated at Padua WMA, or Trisko and Kenna WPAs. The largest percentage of flights occurred along a broad corridor that connects Padua to Trisko and then on to the Sauk River northeast of the Sites. Large flocks of tundra swans were noted roosting and feeding in flooded fields in Sections 6 and 7 of Getty Township and in Sections 1, 2, 3, 11, 12, and 14 of Raymond Township within the Sites during early April. April and May surveys documented large numbers of waterfowl migrating, and trading between concentration waterbodies and feeding areas.

Raptor Collision Risk

Northern harriers and red-tailed hawks were the two raptors species that occurred with the highest frequency. These two species were often observed soaring over agricultural lands or grassland while foraging. Flight paths recorded during the spring of 2011 show no definite use patterns that would allow micro-siting to reduce potential impacts. The Black Oak/Getty Wind Farms raptor mean-use rates are among the lowest reported at ten sites reporting this metric across the U.S. (Chart 2). Six bald eagles flights were documented during the spring 2011 surveys and consist of four flights for foraging or territorial defense by the resident eagle pair and two by migratory eagles that were present only during April and May. Due to the low use of the Sites and the low frequency of mortality reported from other U.S. wind farms with similar use rates, impacts to raptors are expected to be minimal. Only 30 percent of the red-tailed hawk flights observed within the Sites occur within the RSZ. Total observations of red-tailed hawks were also in the bottom quartile of wind farms with recorded raptor use. The low relative use and reduced percentage of flights within the RSZ indicate that there will be a lower likelihood of red-tailed hawk mortality at this site than on other sites where this index was studied.

Passerine Collision Risk

Passerines were the most abundant group of species observed during the Avian Use/Point Count Surveys in the spring of 2011. These species make up 16,201 of the 22,863 individuals counted, or 71 percent of all observations. Passerines as a group make up 18,807 (82 percent) of all individuals observed. Despite the large numbers of passerine species observed, only 3.3 percent of all flights for this group occurred within the RSZ and the only species within this group with a mean flight-height within the RSZ was a single flock of Smith's longspurs that was first observed at 35 m AGL. Horned larks were the only passerine species observed regularly utilizing airspace within the RSZ throughout the spring season. The skylarking behavior included flights that sometimes lifted horned larks as high as 50 or 60 m. These skylarking flights often occurred while facing into prevailing winds that allowed horned larks to hang in the air for up to 15 minutes of a given survey period. Passerine observations from spring 2011 provide an index of daytime flights at select locations within the Sites. The relative abundance of passerines and mean flight-height assessed for this group during daytime flights, indicate that passerines have a relatively low risk for collision during daytime flights at the Sites. However, most migratory flights from this group occur at night (Richardson 1990) and these flights are not represented in this analysis.

Habitat Displacement Risk

Bird species sensitive to changes to habitat size, composition, or construction of various kinds of infrastructure are thought to be most at risk of habitat displacement. Recent studies to detect habitat effects caused by wind turbines have focused on grassland birds since these seem more sensitive to habitat displacement than forest or water birds and appear to be experiencing greater declines as a group in North America than forest birds (Leddy et al. 1999; Herkert et al. 2003; CEIWEF 2007; Mabey and Paul 2007).

Sensitive Species (ETSC/SGCN) Habitat Displacement Risk

Sensitive species can be used as an indicator of displacement risk because they are often more susceptible to habitat alteration or fragmentation. Species in this group may include species that are area-sensitive, require unique habitat parameters to breed successfully, or are at risk due to habitat availability. Habitats that contain more sensitive species and individuals may be at greater risk of habitat displacement than those with few of these species.

Bird species at Sites that are considered sensitive to habitat displacement include marbled godwit, upland sandpiper, bobolink, and sedge wren. During the breeding season, bobolinks were found at every Avian Use/Flight Path Survey point and were associated with grasslands of various sizes and hay fields, or were observed flying over cropland with little-to-no vegetation. Grasshopper sparrows, bobolinks, and sedge wrens are all examples of species noted as declining in the BBS region and are also considered SGCN species.

In summary, habitat displacement is most likely to occur for grasslands breeders occurring ≤ 100 m from turbine sites (Johnson et al. 2002) due to the response of grassland birds to tall structures, noise, or human disturbance. The proposed perimeter setbacks per the Stearns County wind ordinance from grassland habitats at the Padua WMA and Trisko, Kenna, Behnen WPAs will be more than adequate to avoid habitat displacement for the majority of grassland habitats on the Sites. The level of displacement assumed on the remaining grassland habitat is thought to pose a low risk to the populations of affected species mainly because turbine placement is expected to be associated with cropland areas and not grassland habitat.

Waterfowl and Waterbird Habitat Displacement Risk

Habitat displacement associated with waterfowl and wind development has not been evaluated in the U.S. However, some European studies have shown disturbance effects to breeding birds is variable, and in some instances, negligible (Peterson and Poulsen 1991). Despite the variety and large numbers of waterfowl utilizing the Sites during the migratory period, relatively low species richness for waterfowl was recorded during the breeding period. The two most abundant species observed during the breeding period were Canada goose and mallard. These species use grasslands and wetlands for nesting but have been known to use croplands adjacent to wetland complexes. The proposed setbacks from wetland/grassland complexes at the Padua WMA and Trisko, Kenna, Behnen WPAs will be more than adequate to avoid habitat displacement for the majority of wetland/grassland habitats on Sites. The level of displacement is assumed on the remaining grassland habitat is thought to pose a low risk to the populations of affected species mainly because turbine placement is expected to be associated with cropland areas and not wetland or grassland habitat.

Raptor Habitat Displacement Risk

Nest displacement may be a factor for raptor species when wind farm development occurs very close to existing nests. Species that nest within one-half mile of wind development sites may be at a higher risk due to disturbance created by wind development, operation, and maintenance. However, Erickson et al. (2002) found that few raptor species targeted in nest surveys were found as fatalities when nests are within 2 miles. Northern harriers and red-tailed hawks are the two most abundant raptors on the Sites. Approximately four different pairs of red-tailed hawks nest throughout the project boundaries and may occur within 2 miles of any project design developed for the site. The northern harriers observed within the project boundaries may represent only one nesting pair and are likely nesting within the Trisko WPA. Nest displacement could be mitigated by the proposed setback requirements relative to the WPA. Despite the relatively proximity of nests to future turbine locations, Erickson et al. (2002) found that although use rates for these two species were relatively high in an agricultural setting, few mortalities were reported at U.S. wind plants.

Passerine Habitat Displacement Risk

The risk of habitat displacement in birds is poorly understood. Some studies have shown that some grassland species appear to nest at lower densities near wind turbines and other tall structures (Johnson et al. 2000). Species such as savannah sparrow, sedge wren, and bobolink exhibited lower than expected use of grassland habitats after wind turbines were in operation. These grassland species may respond negatively to the presence of wind turbines because turbines are vertical structures that may represent potential predator perches and therefore are avoided. Noise also may be an issue because territorial birds, which use song to defend territories, may avoid habitats where wind turbine noise interferes with territorial singing.

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Conclusions

Surveys conducted between April 1, 2011, and June 29, 2011, documented sightings of 22,863 individual birds, representing 106 different species. An additional 1,473 individual birds were counted during Wetland Utilization and Marbled Godwit surveys and added 10 more species to the species richness of the site. Members of the Passerine group were the most abundant group observed during the 2011 surveys. No federally listed species were observed during the surveys. Seven species considered state-endangered, threatened, or of special concern were documented using the site for breeding or migration. One active bald eagle nest site is located in the NW ¼ of Section 18 of Getty Township. This nest site produced at least one juvenile eagle during the spring of 2011. Marbled godwits occupied pastured grasslands at the south end of the Sites and at least one nesting pair was present throughout the survey period. Additionally, nesting black terns and red-necked grebes were located at a wetland north of County Road 28 in Section 7 of Getty Township and Section 24 of Raymond Township, respectively.

Twenty-two SGCN species were observed at the Sites. Breeding was also observed or presumed for upland sandpiper, bobolink, sedge wren, marsh wren, northern harrier, common loon, brown thrasher, black-billed cuckoo, rose-breasted grosbeak, and swamp sparrow. Several SGCN are relatively sedentary once they arrive at their breeding grounds while others conduct frequent foraging flights between nests and feeding areas. Collision risk at this site was analyzed due to the location of the proposed wind farm and its relation to abundant wetlands and lakes in the area. The abundance of lakes and wetlands concentrate waterfowl, waterbirds, and other sensitive species and act as an attractant during migration. Several of these species already are experiencing problems that make them a focus of conservation. For this reason, waterfowl, waterbirds, and sensitive bird species are of the greatest interest in risk assessment at this site.

Analysis of flight path data identified significant movement and concentration areas within the Sites. These areas lie in a broad corridor stretching from the Padua WMA south of the Sites, northward through Trisko WPA then northeast or northwest to the Sauk River. Waterbodies associated with the Raymond Lake/Padua WMA are the source or destination of many of the flights that were observed during the spring 2011 studies.

This area also harbors a perennial nest location for bald eagles, nesting red-necked grebes, a black tern colony, occasional use by sandhill cranes, and frequent common loon use. Since collision risk is related to local abundance at some level, and to flight physiology (i.e. wing loading characteristics), with behavior an important additional factor, ETSC, SGCN, waterfowl, and other sensitive species that utilize flight paths between wetland and lake areas should be considered when designing turbine arrays and associated infrastructure. Areas southwest of the Raymond Lake area also harbored probable breeding marbled godwits and potential Wilson's phalarope habitat, and foraging flights of these species were documented during the 2011 Avian Use/Flight Path surveys.

Numerous seasonal and permanent wetlands that occur throughout this broad corridor contributed to additional bird concentration sites that provided seasonal stopover habitat or breeding habitat in the case of the black terns observed at Point 161027-2. A large number of grasslands also occur within the same broad corridor stretching from the Raymond Lakes/Padua WMA area northward through the Trisko WPA, but also included several pastured areas that provided suitable breeding habitat for additional grassland dependant species such as bobolinks, savannah sparrows, western meadowlarks, and a variety of other songbirds and shorebirds.

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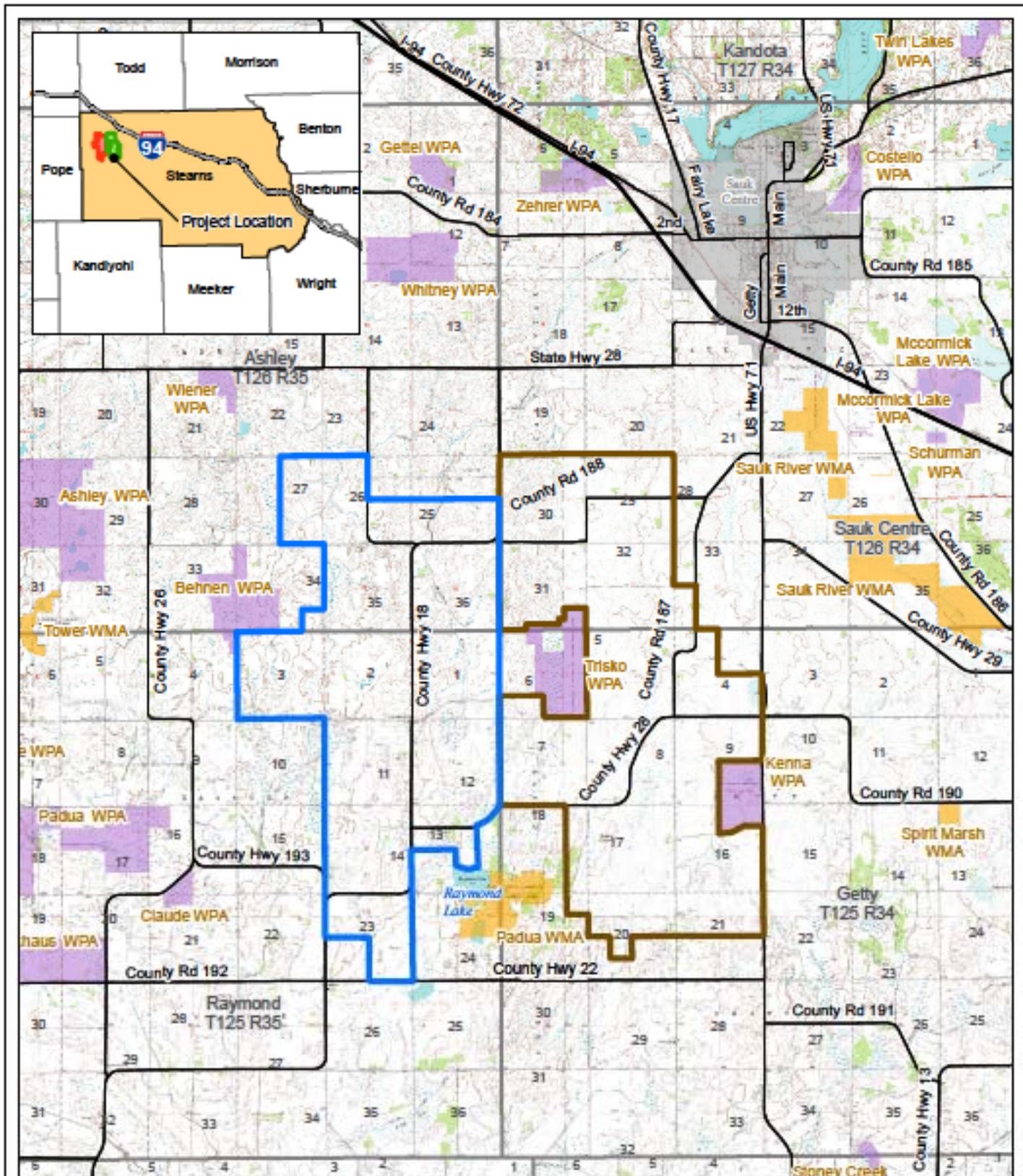


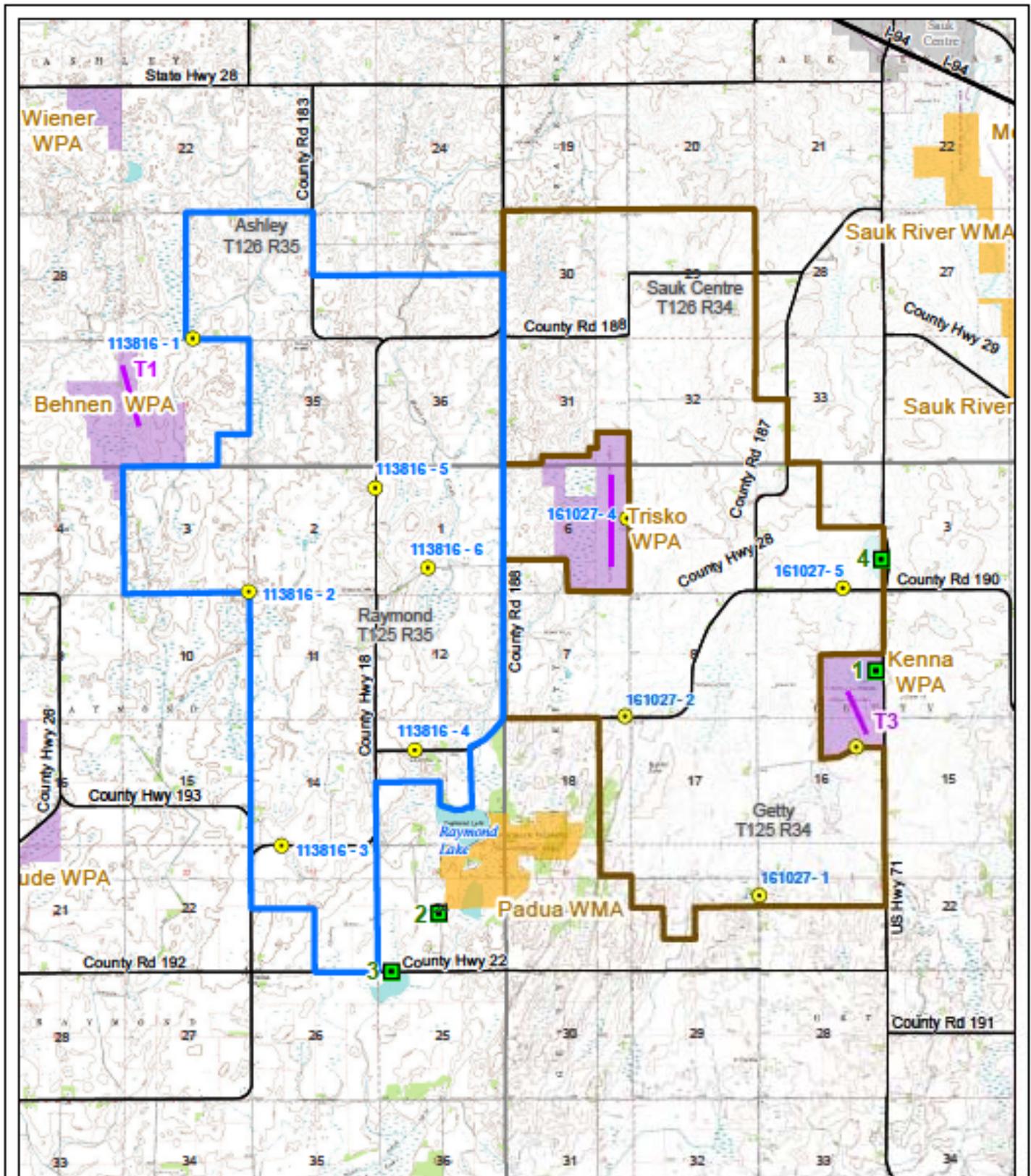
Figure 1
Project Location Map

-  North
-  Black Oak Boundary
-  Getty Boundary
-  PLSS Section Boundary
-  PLSS Township Boundary

-  Wildlife Management Area (WMA)
-  Waterfowl Production Area (WPA)

 Miles
0 1 2

Black Oak/Getty Wind Farm
Geronimo & Getty Wind



**Figure 2
Transect Map**



**Black Oak/Getty Wind Farm
Geronimo & Getty Wind**

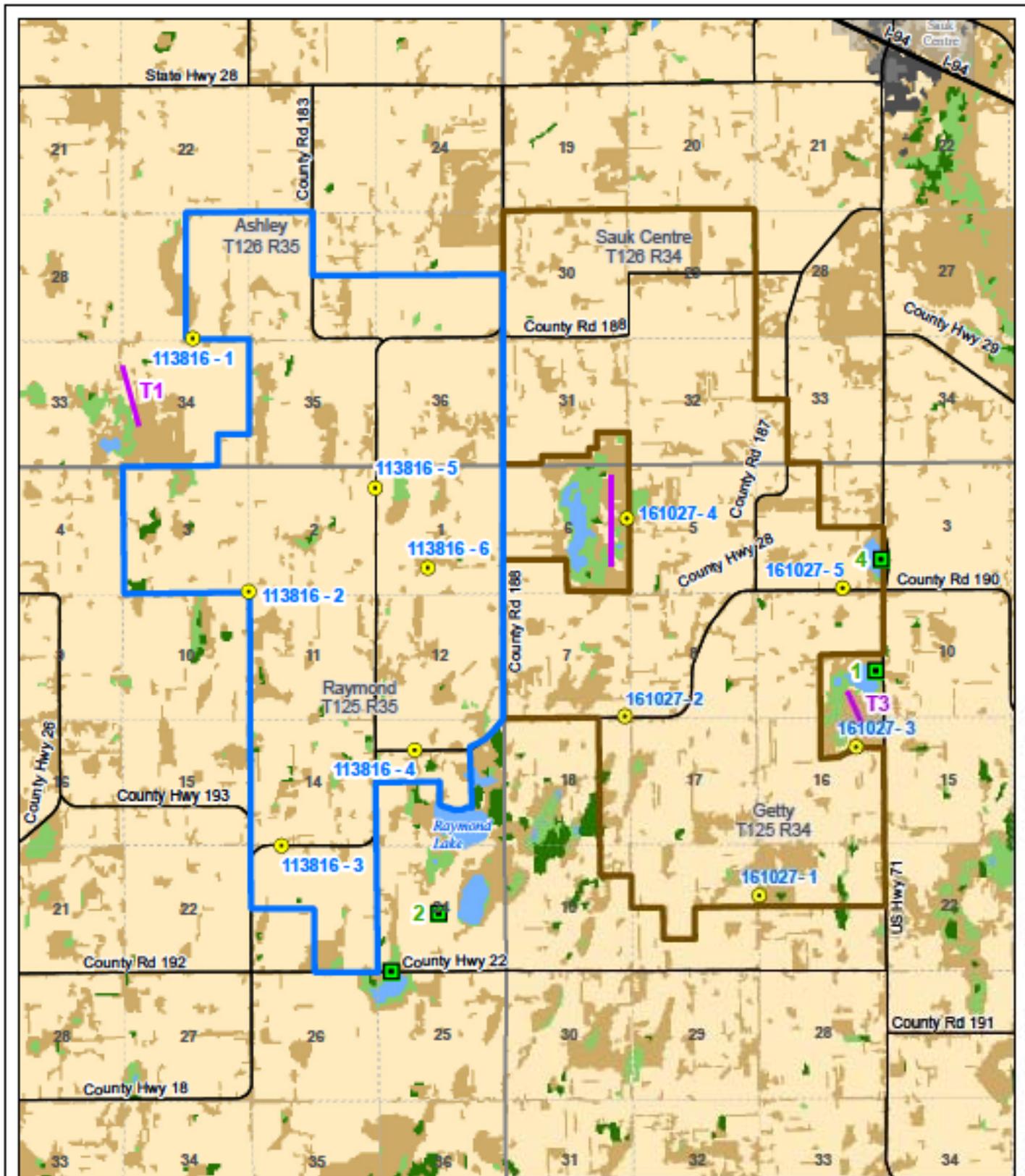
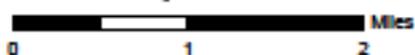
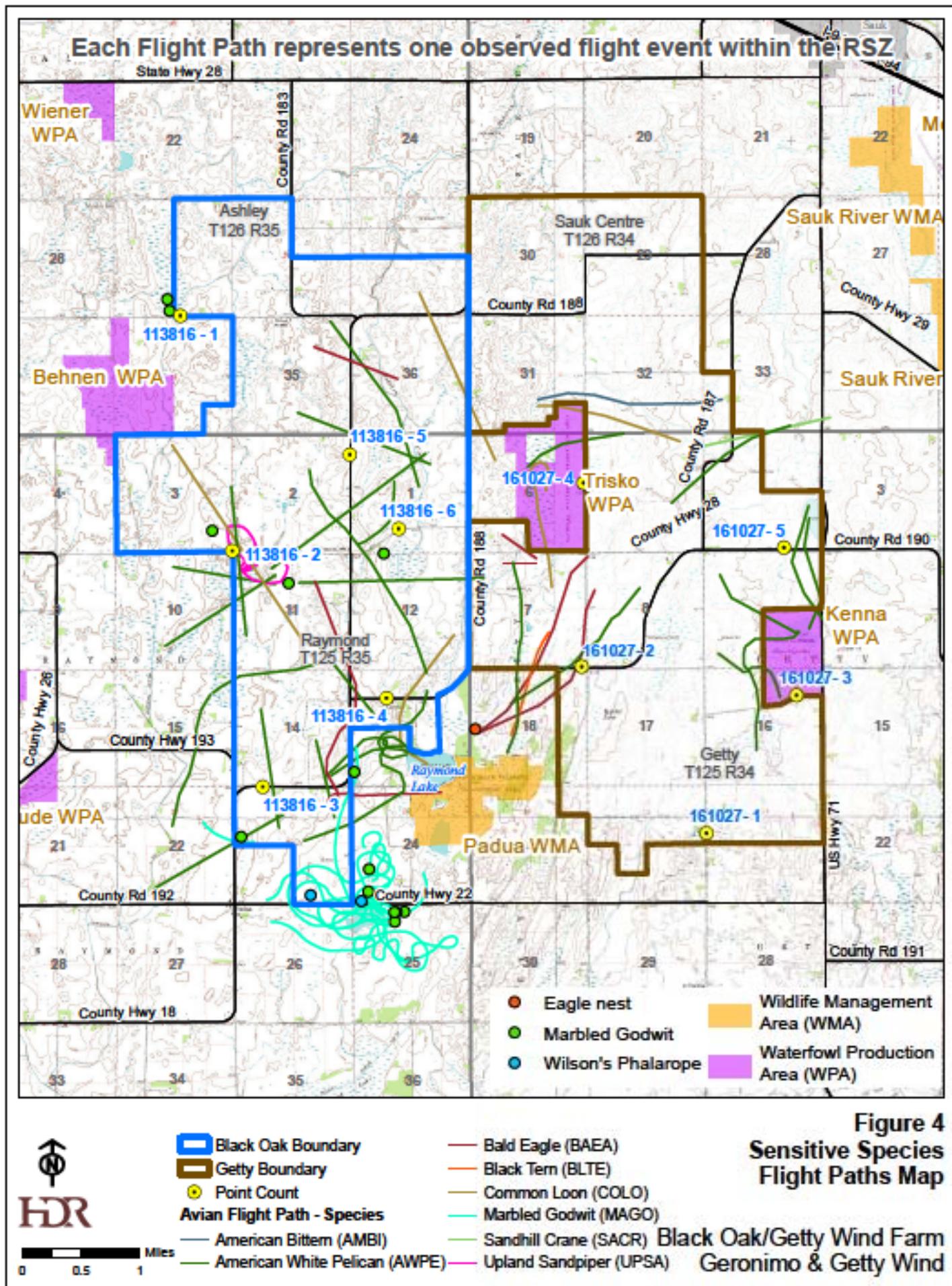


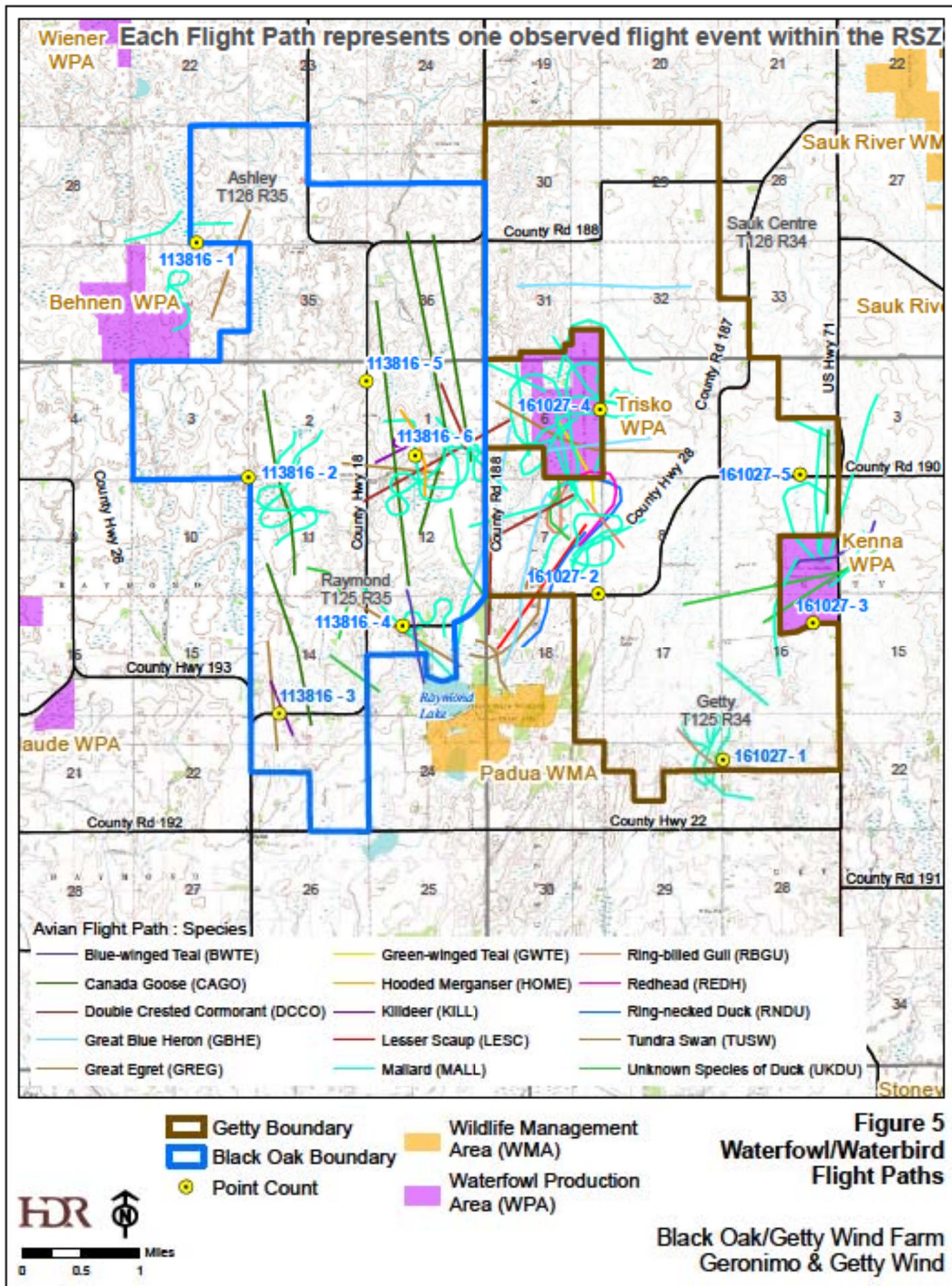
Figure 3
Land Use (GAP) Map

- | | |
|--------------------|-----------|
| Black Oak Boundary | Aquatic |
| Getty Boundary | Cropland |
| Wetland Points | Developed |
| Point Count | Grassland |
| Godwit Transects | Marsh |
| | Forested |

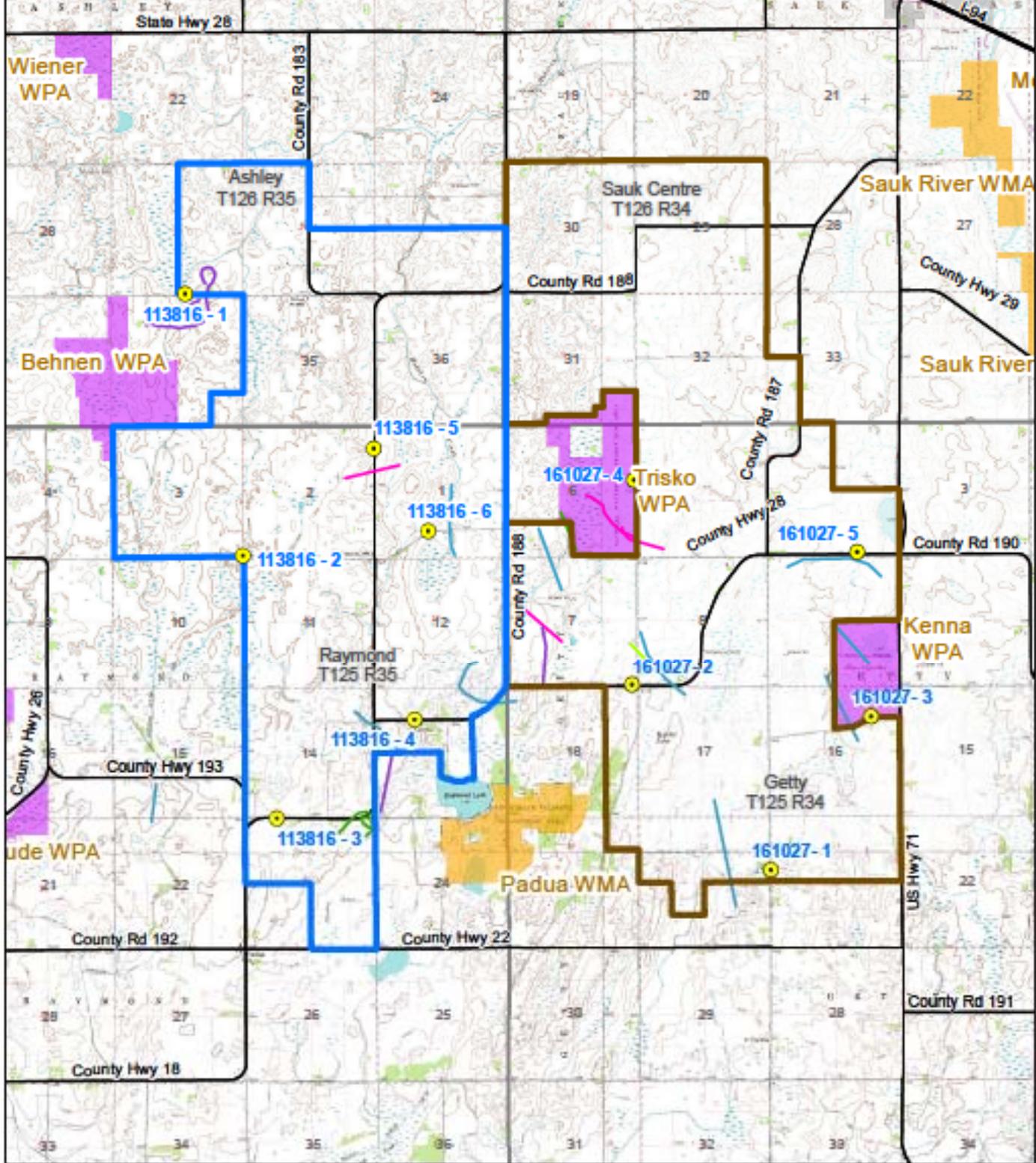
Black Oak/Getty Wind Farm
Geronimo & Getty Wind







Each Flight Path represents one observed flight event within the RSZ



- | | |
|---------------------------------|------------------------------------|
| Black Oak Boundary | Avian Flight Paths: Species |
| Getty Boundary | American Kestrel (AMKE) |
| Point Count | Coopers Hawk (COHA) |
| Wildlife Management Area (WMA) | Northern Harrier (NOHA) |
| Waterfowl Production Area (WPA) | Red-tailed Hawk (RTHA) |
| | Turkey Vulture (TUVU) |

Figure 6
Raptor Flight Paths Map

Black Oak/Getty Wind Farm
Geronimo & Getty Wind



Appendix A. Species Abundance During Wetland Utilization Surveys

Species	Wetland #1 Kenna									Wetland #2 Padua									Wetland #3 (Godwit Wetlands)									Wetland #4 (Highway 71)									Total s													
	T#1 (Apr il 1)	T#2 (Apr il 7)	T#3 (Apr il 14)	T#4 (Apr il 19)	T#5 (Apr il 29)	T#6 (May 4)	T#7 (May 10)	T#8 (May 20)	T#9 (May 26)	T#1 (Apr il 1)	T#2 (Apr il 7)	T#3 (Apr il 14)	T#4 (Apr il 19)	T#5 (Apr il 29)	T#6 (May 4)	T#7 (May 10)	T#8 (May 20)	T#9 (May 26)	T#1 (Apr il 1)	T#2 (Apr il 7)	T#3 (Apr il 14)	T#4 (Apr il 19)	T#5 (Apr il 29)	T#6 (May 4)	T#7 (May 10)	T#8 (May 20)	T#9 (May 26)	T#1 (Apr il 1)	T#2 (Apr il 7)	T#3 (Apr il 14)	T#4 (Apr il 19)	T#5 (Apr il 29)	T#6 (May 4)	T#7 (May 10)	T#8 (May 20)	T#9 (May 26)														
American Coot			33									188	217	36								47	67	21		6												104	3	19								741		
American White Pelican						5		7								7																							5	17	3	2							46	
American Wigeon																							6																											6
Bald Eagle												2											1																											3
Black Tern															4	6	3									1																								14
Blue-winged Teal												11													1															7										19
Bufflehead													4	8								8		3																2		6								31
Canada Goose	8	11	2	2		1		2			4	6	6	6						6	12		11	4		4			2	4	2		2							4	2	2								87
Canvasback												10		2																										15	9	7		6						49
Common Goldeneye													1																																					1
Common Merganser													6																																					6
Common Loon												2				1																																		3
Double-crested Cormorant															1		1	2																																4
Forster's Tern																																																		2
Gadwall				1								14													1																									16
Great Blue Heron								1									1																																	2
Great Egret																	2	5								1		2								5	2	1	2											20
Green-winged Teal												8		16																																				24
Hooded Merganser																							5																	7	4									16
Horned Grebe			1																																															1
Lesser Scaup												30	17									8	5																	3	10									73
Mallard		6	2									4	6									12			4	4																						3	41	
Marbled Godwit																				2			2	1	4	3	4	4																					20	
Northern Pintail																									3																									3
Northern Shoveler																																																	6	13
Pied-billed Grebe				2									5																																					5
Red-breasted																																								2	2									5

Appendix A. Species Abundance During Wetland Utilization Surveys

Species	Wetland #1 Kenna							Wetland #2 Padua							Wetland #3 (Godwit Wetlands)							Wetland #4 (Highway 71)							Total s								
Merganser																																					
Redhead								19		3								3												7							
Red-necked Grebe								4	2	2	1	5																		1							
Ring-necked Duck								28										56	18											5	7	11	125				
Ruddy Duck															16															6							
Sandhill Crane																				2											2						
Sora													1											2							3						
Trumpeter Swan																				2											2						
Wilson's Phalarope																				8	2	2									12						
Wood Duck												4																			5						
Total Observations	8	17	41	3	0	1	5	3	7	0	4	331	259	77	2	10	10	34	8	12	136	118	29	15	29	8	8	2	4	147	39	63	10	27	10	4	1473

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Appendix B. Species Abundance During Marbled Godwit Surveys

Species	Transect #1 Kenna			Transect #2 Trisko			Transect #3 Behnen			Totals
	(April 19)	(May 10)	(June 9)	(April 19)	(May 10)	(June 9)	(April 19)	(May 10)	(June 9)	
American Crow				4				3		7
American Goldfinch			3							3
American Robin		4			3	1		2		10
American Kestrel	1						1			1
American White Pelican					7					7
American Tree Sparrow	4									4
Barn Swallow		3	7		4	7		5	1	27
Black-billed Cuckoo									1	1
Blue-winged Teal				2	3					5
Blue Jay				2	5					7
Bobolink		2	3		6	15			3	29
Brown-headed Cowbird		3						2		5
Brown Thrasher						1				1
Canada Goose	2				4			6		10
Clay-colored Sparrow		4	1		1	3		2	5	16
Common Grackle	16	6	5	16		7	2	8	9	53
Cooper's Hawk		1								1
Common Yellowthroat			4			5			15	24
European Starling						2				2
Great-horned Owl							3	3		6
House Wren									1	1
Horned Lark								2		2
Indigo Bunting									1	1
Killdeer		1			2					3
Lapland Longspur		3								3

Appendix B. Species Abundance During Marbled Godwit Surveys

Species	Transect #1 Kenna		Transect #2 Trisko			Transect #3 Behnen			Totals	
Marsh Wren						3		8	11	
Mallard	7	3		5	6		3	3	20	
Mourning Dove	1	3				2		2	10	
Northern Harrier	2	1				2		1	4	
Northern Flicker							1		1	
Red-tailed Hawk	1							1	1	
Red-winged Blackbird	15	8	8	8	7	13	12	5	89	
Ring-necked Duck					7				7	
Ring-necked Pheasant	2	1			1			1	3	
Ruddy Duck								1	1	
Red-eyed Vireo								1	1	
Savannah Sparrow	1	2						2	4	
Sandhill Crane							2		2	
Sedge Wren		2			3	5		4	14	
Sora								1	1	
Song Sparrow		2	2		3	1	2	2	12	
Swamp Sparrow		2	2		3	5		3	20	
Tree Swallow		2							2	
Vesper Sparrow							2		2	
Western Meadowlark							2		2	
White-throated Sparrow								3	3	
Yellow-headed Blackbird					4	3			7	
Yellow Warbler								4	4	
Total Observations	52	49	32	33	66	74	30	48	94	426

Project Snapshot

113816 Black Oak

SPECIES DATA

Overall Species Richness		Species Richness By Point		Species Richness By Habitat	
111		Point Number	Species Richness	Habitat Type	Species Richness
Species List		113816-001	34	Agriculture - Cropland	111
Species	Abundance	113816-002	39	Grassland-Non-native	31
Red-winged Blackbird	4958	113816-003	54		
Common Grackle	4754	113816-004	52		
Unidentified Blackbird	3750	113816-005	29		
Lapland Longspur	2739	113816-006	45		
Unidentified Duck	1056	161027-001	35		
Canada Goose	1013	161027-002	49		
Mallard	694	161027-003	37		
Tundra Swan	452	161027-004	60		
Brown-headed Cowbird	293	161027-005	40		
Horned Lark	177	Sensitive Species			
American Crow	174	Species	Abundance		
Brewer's Blackbird	157	American Bittern	1		
Barn Swallow	156	Bald Eagle	18		
American Robin	148	Black Tern	48		
American Goldfinch	127	Black-billed Cuckoo	1		
American White Pelican	125	Bobolink	86		
European Starling	122	Brown Thrasher	6		
Yellow-headed Blackbird	112	Common Loon	14		
Mourning Dove	107	Least Flycatcher	1		
Bobolink	86	Lesser Scaup	65		
Blue-winged Teal	77	Marbled Godwit	7		
Ring-billed Gull	76	Marsh Wren	1		
Vesper Sparrow	75	Northern Harrier	60		
Killdeer	73	Northern Rough-winged Swallow	12		
Ring-necked Duck	66	Rose-breasted Grosbeak	3		
Lesser Scaup	65				
Unidentified Longspur	65				
Northern Harrier	60				

Species List		Sensitive Species	
Rusty Blackbird	56	Rusty Blackbird	56
Snow Goose	55	Savannah Sparrow	41
Ring-necked Pheasant	52	Sedge Wren	4
Common Yellowthroat	49	Semipalmated Sandpiper	1
Tree Swallow	48	Swamp Sparrow	19
Black Tern	48	Upland Sandpiper	13
Blue Jay	47	Wilson's Phalarope	17
Red-tailed Hawk	42	Yellow-bellied Sapsucker	1
Redhead	42		
Savannah Sparrow	41		
Green-winged Teal	40		
Song Sparrow	37		
Greater White-fronted Goose	35		
Smith's Longspur	30		
Rock Pigeon	26		
American Tree Sparrow	25		
Gadwall	24		
Canvasback	24		
Swamp Sparrow	19		
House Sparrow	18		
Bald Eagle	18		
Wilson's Phalarope	17		
Common Loon	14		
Upland Sandpiper	13		
Northern Shoveler	13		
Northern Rough-winged Swall	12		
Sandhill Crane	12		
Wood Duck	12		
American Kestrel	12		
Double-crested Cormorant	11		
Great Egret	11		
Chipping Sparrow	10		
Cooper's Hawk	9		
Great Blue Heron	8		
Turkey Vulture	7		
Clay-colored Sparrow	7		
Hooded Merganser	7		
Marbled Godwit	7		

ABUNDANCE DATA

Overall Mean Abundance	Mean Abundance By Point		Mean Abundance By Habitat	
9	Point Number	Mean Abundance	Habitat Type	Mean Abundance
Total Abundance	113816-001	3	Agriculture - Cropland	10
	113816-002	7	Grassland-Non-native	4
22863	113816-003	10		
	113816-004	25		
	113816-005	5		
	113816-006	11		
	161027-001	11		
	161027-002	16		
	161027-003	7		
	161027-004	3		
	161027-005	3		

FLIGHT HEIGHT DATA

Mean Flight Height	Mean Flight Height By Point		Mean Flight Height By Species	
13 meters	Point Number	Mean Flight Height	Species	Mean Flight Height
	113816-001	9 meters	American Bittern	100 meters
	113816-002	16 meters	American Crow	7 meters
	113816-003	18 meters	American Goldfinch	13 meters
	113816-004	16 meters	American Kestrel	14 meters
	113816-005	13 meters	American Pipit	20 meters
	113816-006	18 meters	American Robin	6 meters
	161027-001	9 meters	American Tree Sparrow	2 meters
	161027-002	18 meters	American White Pelican	75 meters
	161027-003	8 meters	American Wigeon	20 meters
	161027-004	12 meters	Baird's Sandpiper	8 meters
	161027-005	14 meters	Bald Eagle	62 meters
			Baltimore Oriole	15 meters
			Bank Swallow	14 meters
			Barn Swallow	5 meters
			Black Tern	41 meters
			Black-and-white Warbler	2 meters
			Black-billed Cuckoo	1 meters
			Black-capped Chickadee	meters
			Blue Jay	14 meters
			Blue-winged Teal	11 meters
			Bobolink	9 meters
			Brewer's Blackbird	9 meters
			Brown Thrasher	2 meters
			Brown-headed Cowbird	6 meters
			Bufflehead	meters
			Canada Goose	13 meters
			Canvasback	10 meters
			Cedar Waxwing	15 meters
			Chimney Swift	11 meters
			Chipping Sparrow	meters
			Clay-colored Sparrow	meters
			Cliff Swallow	18 meters
			Common Grackle	8 meters
			Common Loon	23 meters
			Common Snipe	50 meters
			Common Yellowthroat	meters
			Cooper's Hawk	25 meters

Mean Flight Height by Species

Double-crested Cormorant	31 meters
Downy Woodpecker	20 meters
Eastern Phoebe	6 meters
European Starling	10 meters
Gadwall	18 meters
Great Blue Heron	27 meters
Great Crested Flycatcher	meters
Great Egret	22 meters
Greater White-fronted Goose	meters
Green Heron	10 meters
Green-winged Teal	50 meters
Hooded Merganser	17 meters
Horned Lark	25 meters
House Finch	10 meters
House Sparrow	12 meters
House Wren	meters
Indigo Bunting	10 meters
Killdeer	14 meters
Lapland Longspur	16 meters
Least Flycatcher	meters
Lesser Scaup	22 meters
Mallard	18 meters
Marbled Godwit	10 meters
Marsh Wren	meters
Mourning Dove	8 meters
Northern Cardinal	5 meters
Northern Flicker	7 meters
Northern Harrier	9 meters
Northern Rough-winged Swallow	14 meters
Northern Shoveler	8 meters
Pine Warbler	meters
Red-bellied Woodpecker	10 meters
Redhead	30 meters
Red-tailed Hawk	24 meters
Red-winged Blackbird	8 meters
Ring-billed Gull	24 meters
Ring-necked Duck	18 meters
Ring-necked Pheasant	2 meters
Rock Pigeon	16 meters
Rose-breasted Grosbeak	meters
Ruby-throated Hummingbird	1 meters

Mean Flight Height by Species

Rusty Blackbird	8 meters
Sandhill Crane	17 meters
Savannah Sparrow	8 meters
Sedge Wren	meters
Semipalmated Sandpiper	5 meters
Sharp-shinned Hawk	9 meters
Smith's Longspur	35 meters
Snow Goose	20 meters
Solitary Sandpiper	30 meters
Song Sparrow	3 meters
Sora	meters
Swamp Sparrow	meters
Tree Swallow	9 meters
Tundra Swan	17 meters
Turkey Vulture	43 meters
Unidentified Blackbird	12 meters
Unidentified Diver	40 meters
Unidentified Duck	22 meters
Unidentified Longspur	17 meters
Unidentified Teal	25 meters
Unidentified Warbler	25 meters
Upland Sandpiper	31 meters
Vesper Sparrow	5 meters
Warbling Vireo	meters
Western Meadowlark	0 meters
Wild Turkey	meters
Wilson's Phalarope	20 meters
Wood Duck	15 meters
Yellow Warbler	meters
Yellow-bellied Sapsucker	9 meters
Yellow-headed Blackbird	10 meters
Yellow-rumped Warbler	meters
Yellow-throated Vireo	meters

Appendix J
Potential Species Lists by Class

Mammal Species

Marsupials

- Virginia opossum (A)

Insectivores

- Masked Shrew
- Arctic Shrew
- Northern water shrew
- Pygmy shrew
- Short-tailed shrew
- Star-nosed mole
- Eastern mole

Bats

- Little brown bat
- Keen's little brown bat*
- Silver-haired bat
- Eastern pipistrelle (?)*
- Big brown bat*
- Red bat
- Hoary bat

Carnivores

- Marten (?)*
- Short-tailed weasel
- Least weasel (?)*
- Long-tailed weasel*
- Spotted skunk*
- Striped skunk
- Coyote
- Gray wolf*
- Cougar (?)*

Squirrels

- Woodchuck
- Thirteen-lined ground squirrel
- Franklin's ground squirrel
- Eastern chipmunk

Reference:

Guide to Non-Game Mammals of Central Minnesota- Region 3 West. Minnesota Department of Natural Resources, 1979

- Least chipmunk
- Red squirrel
- Southern flying squirrel*
- Northern flying squirrel*

Other Rodents

- Porcupine
- Plains pocket gopher
- Plains pocket mouse
- Deer mouse
- White-footed mouse
- Southern bog lemming
- Northern bog lemming (?)
- Gapper's red-backed vole
- Meadow vole
- Prairie vole
- Norway rat (E)
- House mouse (E)
- Meadow jumping mouse
- Woodland jumping mouse (?)

Ungulates

- American Elk (X)

Key

* – Priority species

E – Exotic species

? – Hypothetical species

A – Accidental species

E – Extirpated species

Reference:

Guide to Non-Game Mammals of Central Minnesota- Region 3 West. Minnesota Department of Natural Resources, 1979

Reptile and Amphibian Species

Turtles

- Common snapping turtle
- Map turtle
- Western painted turtle
- Blanding's turtle*
- Western spiny softshell
- Smooth softshell

Lizards

- Northern prairie skink

Snakes

- Red-bellied snake
- Texas brown (Dekay's) snake
- Northern water snake
- Western plains garter snake
- Red-sided garter snake
- Eastern garter snake
- Eastern hognose snake
- Western smooth green snake*
- Eastern smooth green snake*
- Bullsnake

Salamanders

- Blue-spotted salamander
- Eastern tiger salamander
- Mudpuppy (?)
- Central (common) newt *(?)
- Red-backed salamander *(?)

Toads

- American toad

Reference:

Guide to Reptiles and Amphibians of Central Minnesota- Region 3 West. Minnesota Department of Natural Resources, 1980

Frogs

- Northern spring peeper
- Common (gray) treefrog
- Boreal chorus frog
- Western chorus frog
- Mink frog
- Northern leopard frog
- Green frog
- Wood frog

Key

* – species of special interest

? – Hypothetical species

Reference:

Guide to Reptiles and Amphibians of Central Minnesota- Region 3 West. Minnesota Department of Natural Resources, 1980

Butterfly and Moth Species (rare and sighted)

Skippers

- Poweshiek Skipper *
- Silver-spotted Skipper
- Northern Cloudywing
- Dakota Skipper (T)
- Tawny-edged Skipper
- Long Dash
- Hobomok Skipper
- Mulberry Wing
- Dion Skipper

Parnassians and Swallowtails

- Eastern Tiger Swallowtail

Whites and Sulphurs

- Clouded Sulphur

Brush-footed Butterflies

- Great Spangled Fritillary
- Regal Fritillary*
- Silver-bordered Fritillary
- Northern Crescent
- Northern Pearly Eye
- Little Wood Satyr
- Common Wood Nymph

Milkweed Butterfly Family

- Monarch

Sphinx Moths, Hawkmoths

- Hummingbird clearwing
- White-lined sphinx

Rare Flightless Insects

- Red-Tailed Prairie Leafhopper*

Key

* – Special Concern species

T – State Threatened species

Reference: Minnesota Department of Natural Resources Rare Species Guide, Stearns County (rare) Butterflies and Moths of North America. Stearns County Minnesota, United States. 2011
http://www.butterfliesandmoths.org/checklists?species_type=All&tid=1617 (sighted)