MANITOBA HYDRO
BIPOLE III TRANSMISSION PROJECT

2017 AVIAN MONITORING REPORT

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1.0 INTRODUCTION

On August 14th, 2013, Manitoba Conservation and Water Stewardship granted an Environment Act Licence to Manitoba Hydro for the construction, operation, and maintenance of the Bipole III Transmission Project (the 'Project'). The Project is a new 500 kilovolt (kV) high voltage direct current (HVdc) transmission line on the west side of Manitoba extending from a new converter station to be located near the site of the proposed Conawapa Generating Station on the Nelson River to a new converter station to be located at the Riel site east of Winnipeg (~1,400 km total length). The Bipole III Project also includes new 230 kV transmission lines linking the northern converter station to the northern collector system at the existing 230 kV switchyards at the Henday Converter Station and Long Spruce Generating Station. Clearing for the Project began in the winter of 2014 and construction was scheduled for completion in the summer 2017. Due to delays in schedule, construction is expected to be completed in winter 2019.

1.1 Purpose and Objectives

As part of the Environment Act Licence for the Project, Manitoba Hydro has committed to a five-year monitoring project designed to study the impacts of Project construction and associated infrastructure on birds. Manitoba Hydro has committed to implementing bird diverters at high-risk of collision habitats (e.g., near waterfowl staging areas, brooding areas, and colonial sites) and to studying the efficacy of these diverters during periods of high bird activity. Areas of potentially high-risk of collision have been identified in the Bipole III Environmental Impact Statement (EIS) as Environmentally Sensitive Sites (ESS's). In addition, Manitoba Hydro has committed to monitoring disturbance/avoidance impacts of the Project on birds along the transmission line route during construction, as right-of-way (ROW) clearing has been shown to affect bird abundance, density, richness and habitat use.

Based on these commitments, the goal of this environmental effects monitoring is to evaluate whether the construction and operation of the Project has an impact on birds, to determine which components are adversely affecting birds, and to estimate the magnitude of the effects.

The goals of the environmental effects monitoring for birds include the following:

- Identify the locations where bird diverters should be installed based on the potential for 'high-risk' bird-wire collisions.
- Conduct bird-wire collision mortality monitoring at areas of potential 'high-risk'.
- Determine the efficacy of bird diverters in preventing bird-wire collisions and implement adaptive management strategies where mortalities are higher than expected.
- Conduct disturbance/avoidance monitoring of Sharp-tailed Grouse Leks and evaluate potential increased predation by raptors.
- Conduct disturbance/avoidance monitoring of colonial nesting birds and species of conservation concern (SCC) birds.

- Conduct nest searching activities in areas where construction will occur during the active breeding bird season.

As the Project has progressed through the 5-year monitoring program, survey results and delays in schedule have resulted in several goals yet to be achieved or removed from the monitoring program. A summary of monitoring conducted since 2014 are provided in **Table 1**. The following avian monitoring report is being submitted to Manitoba Hydro for the Bipole III Bird Monitoring Project. This report represents Year 4 of the avian environmental effects monitoring through to 2018.

Table 1: Summary of Monitoring Activities Between Monitoring Years

Goal	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)
Identify bird diverter locations	✓	✓	-	-
Conduct bird-wire collision mortality monitoring	-	-	1	1
Determine the efficacy of bird diverters in preventing bird-wire collisions	-	-	1	1
Conduct disturbance/avoidance monitoring of Sharp-tailed Grouse Leks	2	✓	1	✓
Conduct disturbance/avoidance monitoring of colonial nesting birds	✓	3	3	3
Conduct disturbance/avoidance monitoring of species of conservation concern (SCC) birds	✓	✓	-	✓
Conduct nest searching activities	-	✓	-	-

[1] Not completed due to construction schedule delays
[2] Project start-up after seasonal survey window
[3] Removed from monitoring due to lack of colonial nesting sites within proximity to transmission corridor

1.2 Study Area

The Final Preferred Route (FPR) is approximately 1,400 kilometres (km) long and transects five distinct ecozones: Hudson Plains (3%), Taiga Shield (3%), Boreal Softwood Shield (37%), Boreal Taiga Plains (35%) and Prairie Potholes (23%). The Study Area for the avian monitoring extends the length of the FPR from the proposed Riel site east of Winnipeg to the proposed Conawapa Generating Station on the Nelson River, as well as the transmission lines linking the northern converter station to the northern collector system at the existing switchyards at the Henday Converter Station and Long Spruce Generating Station. The Study Area extends up to 3 km from the ROW. An illustration of the FPR is provided in **Figure 1 (Appendix A)**.

2.0 STUDY DESIGN AND METHODOLOGY

As identified in the EIS for Bipole III, the construction of the transmission line has the potential to affect birds directly (e.g., collisions with wires, bird nest sites) and indirectly (e.g., disturbance and/or avoidance). To detect direct and indirect effects on birds, baseline environmental monitoring was conducted prior to construction in 2014 (Amec Foster Wheeler, 2015) and within the first year of post-clearing conducted as part of this 2015 monitoring report (Amec Foster Wheeler, 2016). This report represents the third year of post-clearing monitoring. The following section outlines the study design of the avian monitoring program.

For the purpose of implementing the environmental monitoring program, the project has been divided into three distinct periods:

- Pre-construction;
- Pre-tower and conductor construction (vegetation clearing in the proposed ROW); and
- Post-tower and conductor construction (wire stringing and operations).

This monitoring report provides methodologies for collecting post-tower and conductor construction (includes wire stringing in some areas).

2.1 Bird–Wire Collisions

2.1.1 Bird–Wire Collisions Study Design

Bird diverter monitoring is designed to test the hypothesis that bird diverters are sufficient in reducing mortality of birds due to collisions with the transmission line to a level that is negligible in areas determined to have a high-risk of collision. As such, the null and alternate hypotheses state:

- H^0 (null): The mortality of birds at high-risk areas with bird diverters will not be different than the mortality of birds at low-risk areas with bird diverters.
- H^1 (alternate): The mortality of birds at high-risk areas with bird diverters will be greater than the mortality of birds at low-risk areas with bird diverters.

To test this hypothesis, a Control-Impact study design will be implemented. The Before-After Control-Impact study cannot be implemented for this study as mortality of birds is not expected prior to the installation of the transmission lines. For the purpose of this study, control sites will consist of ESS's considered to be 'low-risk' and impact sites will consist of ESS's considered to be 'high-risk'. If transmission lines containing diverters yield negligible avian mortality, then the mortality of birds relative to the number of bird passes at high-risk transmission lines with diverters should be comparable or lower than those at low-risk transmission lines with diverters. Using the ratio of mortality to number of bird passes instead of simply the numbers of avian mortality allows correction for differences in bird activity between high-risk and low-risk sites.

For details on mortality monitoring components (e.g., flight activity surveys, carcass searches, sampling bias correction), refer to the 2014 and 2015 Avian Monitoring Reports (Amec Foster Wheeler, 2015; Amec Foster Wheeler, 2016).

2.1.2 Bird–Wire Collisions Methodology

As the Project has experienced construction schedule delays which resulted in limited wire stringing at the start of the 2017 monitoring program, no mortality monitoring surveys were conducted as part of the 2017 work program. Monitoring of bird-wire collisions will commence following the transmission line wire stringing (post-tower and conductor construction stage), which is expected to be sufficiently completed in the winter of 2017 to allow for the commencement of the mortality monitoring in spring 2018. As such, the first year of bird-wire collision monitoring is anticipated to commence in April 2018.

The 2014 and 2015 pre-construction surveys consisted of verification surveys to determine the relative significance of candidate ESS identified in the EIS based on the density and richness of bird species that have a greater potential for bird-wire collision (e.g., waterfowl, waterbirds, colonial nesting birds). The relative significance of each ESS with and without bird diverters will allow for a priority assessment of mortality monitoring survey efforts in April 2018 (and beyond); however, the ESS's to be monitored cannot be determined until the expected extent of wire stringing is confirmed throughout the winter of 2018.

Environmentally Sensitive Site (ESS) Surveys

Baseline studies for the Project identified the locations of 134 candidate ESS's for birds. Candidate ESS's were generated via desktop analysis of available data including Ducks Unlimited waterfowl pair density estimates, Important Bird Area (IBAs), surveys for colonial waterbird and waterfowl studies, known raptor migration routes, and other data which identified areas with high concentrations of birds. Data was overlaid with other imagery and reviewed for geographical features including river crossings, lakes, wetlands, and other features known to attract or concentrate birds. Bird habitat qualifying as ESS's included bird colonies, raptor nesting habitat, and waterbird nesting or migration stopover habitat. Of these pre-determined sites, certain candidate ESS's could be combined into a single site due to habitat linkages. This resulted in 120 candidate ESS's.

Aerial surveys to assess candidate ESS's were undertaken in 2014 (July 19th to 21st and September 25th to 28th) and 2015 (May 4th to 5th). The July 2014 survey aimed to identify the presence of breeding bird ESS's such as raptor nests, waterbird colonies, and waterfowl nesting sites. Conducting this breeding survey in July corresponded with waterfowl breeding such that waterfowl broods were hatched and actively feeding at the time of survey. Bird nesting was considered to be later in Manitoba in 2014 as a cold winter and widespread flooding likely delayed the onset of leafing-out across the province.

The September (2014) and May (2015) surveys were conducted in order to record fall and spring migration, respectively, for ducks, geese, swans and shorebirds (waterbirds), cranes and raptors. Both fall and spring migration surveys identified the presence of important stopover habitat and waterbird movement routes which intersect with the proposed Project. As flocks of larger birds are particularly susceptible to collisions with transmission wires (APLIC, 2012), it is important to monitor concentrations of migrating birds, particularly large birds such as ducks, geese, swans, shorebirds, cranes and raptors. Fall migration of waterbirds occurs between late August and November and peaks between late September and mid-October (eBird, 2014). More northerly breeding species such as geese and swans are particularly active during this period of the fall.

No aerial surveys of ESS's were conducted as part of the 2017 avian monitoring program. For details on ESS analysis criteria and diverter recommendations, refer to the 2014 and 2015 Avian Monitoring Reports (Amec Foster Wheeler, 2015; Amec Foster Wheeler, 2016).

2.2 Species of Conservation Concern

2.2.1 Species of Conservation Concern Survey Study Design

SCC birds, which include SAR and provincially rare species, have the potential to be adversely affected by the clearing and construction of the Bipole III transmission line. Such impacts may include displacement of birds and/or decreased nesting success due to habitat disturbance or noise disturbance. The SCC bird monitoring will test the hypothesis that the installation of the Bipole III Transmission Line adversely affects the abundance, density and richness of SCC birds in the vicinity of the Project. As such, the null and alternate hypotheses state:

Hypothesis 1:

- H^0 (null): The construction and installation of the Bipole III Transmission Line does not affect the abundance, density and richness of SCC birds.
- H^1 (alternate): The construction and installation of the Bipole III Transmission Line does affect the abundance, density and richness of SCC birds.

To test these hypotheses, a BACI study design was implemented to evaluate Project-related effects on SCC birds. Permanent monitoring plots (point count stations) were established in 2014 throughout the transmission line route and were stationed in areas identified in the Bipole III EIS report as supporting or potentially supporting SCC birds (based on habitat), including those areas not predicted to be impacted by the Project (control sites). Non-SCC birds were also recorded during these surveys to document changes in overall bird species abundance, density and richness. Statistical analysis was conducted using repeated measures analysis of variance (ANOVA) to evaluate the effects of the Project on species abundance (unlimited distance), species density (birds per hectare), and species richness, with an emphasis on dominant SCC birds and guilds. Similar analyses were also conducted on non-SCC birds.

For the purpose of this monitoring report, SCC birds shall include those species listed under the federal *Species at Risk Act, 2002* (SARA) and the *Manitoba Endangered Species Act, 1990* (MESA), as well as priority bird species listed within Bird Conservation Region (BCR) 6 and BCR 11 (Boreal Taiga Plains and Prairie Potholes Ecozones, respectively.

To survey for breeding birds, three (3) types of point count surveys were conducted to target birds active at different times of the day and to target more secretive species. These surveys included:

- Morning songbird surveys;
- Morning and evening marsh bird surveys; and
- Night time crepuscular bird surveys.

For survey details relative to the establishment of permanent monitoring point count stations, refer to the 2014 and 2015 Avian Monitoring Reports (Amec Foster Wheeler, 2015; Amec Foster Wheeler, 2016).

2.2.1.1 Data Analysis

To assess potential impacts of the Project on breeding birds, several metrics were assessed, including species distribution across point counts, species abundance, species density, and species richness. Data is presented by individual dominant species and by guild (edge/shrub/successional, forest, grassland/open country, and wetland/open water) for SCC and non-SCC birds. Specific analyses include:

- Species Distribution Across Point Counts (Percent Occurrence);
- Species Abundance;
- Species Density; and
- Species Richness.

To determine the number of birds of individual species at each point count station, the highest number of an individual species recorded during either the first or second round of surveys was considered the 'maximum number of birds' regardless of the distance of the bird from the centre of the station. For example, if two birds of the same species were recorded during the first survey and three birds of that same species were recorded during the second visit, the maximum number of that species was three.

Species Distribution Across Point Counts

Species distribution across point counts is a measure of the occurrence of individual species of birds at each point count station and is measured based on percent occurrence. Percent occurrence was calculated based on total number of each species recorded divided by the total number of point counts surveyed. This index of species prevalence does not take into account observation distance. Species and guild data are provided separately for control and impact stations, as well as the combined distribution across all stations.

Species Abundance

Abundance is a measure of the maximum number of individuals recorded across all visits to a single point count regardless of distance. The mean species abundance was calculated by dividing the sum of the maximum number of individuals recorded across all visits by the total number of count stations where the species were recorded. Species and guild data are provided separately for control and impact stations, as well as the combined abundance across all stations where birds were recorded.

Species Density

Species density is a measure of the number of an individual species per unit area. Density was calculated at each survey station as the maximum number of birds per species recorded within a 100 m radius of the surveyor divided by the total area of the survey station (3.14 ha), then divided by the total number of count stations where the species were recorded. This metric is only measured for songbird surveys; marsh and crepuscular birds are recorded at an unlimited distance. Species and guild data are provided separately for control and impact stations, as well as the combined density across all stations where birds were recorded.

Species Richness

Species richness is a measure of the total maximum number of species recorded across all visits to a single point count regardless of distance. The mean species richness was calculated by dividing the sum of the maximum number of species recorded across all visits by the total number of count stations where species were recorded. Species and guild data are provided separately for control and impact stations, as well as the combined richness across all stations where birds were recorded.

Statistical Analysis

Statistical analysis was conducted using STATISTICA© software (StatSoft, Inc., 2009). The study design requires an evaluation using a paired design (yearly effect) with one categorical predictor (impact vs. control). As such, the repeated measures analysis of variance (ANOVA) is applicable. Assumptions of normality (normal distribution) were tested using Kolmogorov-Smirnov test and Shapiro-Wilk's test, as well as visually assessing quantile-quantile (Q-Q) plots and histograms. As the data only has two repeated measures (pre-post measure), the assumption of homoscedasticity is not applicable as there is only one correlation coefficient that can be calculated. The results of the assumption testing and subsequent statistical tests applied for each analysis are provided in the results section below. An alpha equal to 0.05 was used to detect significant differences. Where the analyses revealed a significant interaction, post-hoc tests (Tukey's HSD test) was utilized to detect differences between groups.

Power analysis was conducted to determine the probability of correctly rejecting the null hypothesis when it is false. Statistical power below 0.8 (80% probability) will be considered undesirable where the null hypothesis is rejected (significant effects), whereas statistical power above 0.2 (20% probability) will be considered undesirable where the null hypothesis is accepted (non-significant effects).

2.2.2 Species of Conservation Concern Survey Methodology

Pre-stringing surveys to document all SCC birds (and other non-SCC birds) were conducted between June 7th – 12th and June 23th – June 30th, 2017. Surveys were conducted throughout the monitoring areas in 2017 (Sections N4, C1, and C2); however, due to realignment of the transmission corridor in 2016 in Section S1, survey points added in 2015 were no longer valid within the context of the study design and were, therefore, removed from the monitoring program in 2017. The locations of all songbird, marsh bird and crepuscular bird point count stations are presented on **Figure Series 2, 3 and 4 (Appendix A)**.

2.2.2.1 Songbird Surveys

A total of 222 morning songbird point count stations (112 impact and 110 control stations) were established in 2014 in Sections N4, C1 and C2 (see **Figure Series 2, Appendix A**). Due to property access restrictions and movement of the FPR between 2014 and 2015, 21 impact stations were not surveyed in 2015; however, 15 of these impact stations were added back into the monitoring program in 2017 due to the removal of land access restrictions. Accordingly, a total of 106 impact stations and 110 control stations were monitored in 2017 for morning songbird activity.

Surveys were undertaken during the breeding bird season, from late May to the end of June, when birds are known to be the most vocal. Surveys were undertaken at each station twice by qualified biologists skilled in the identification of birds by sight and sound. Few stations were only surveyed once due to poor weather conditions. During the second round of sampling, stations were surveyed in the reverse order from the first round (to the greatest extent possible) to reduce temporal sampling bias. Surveys were initiated prior to sunrise and extended to five hours after sunrise, depending on the weather conditions. Point count surveys were aborted or postponed if weather conditions were not optimal (winds above 20 km/hr or light rain). Surveys were conducted for ten minutes at each station and all birds heard or observed were recorded at intervals of 0-50 m, 50-100 m, >100 m and flyovers. In addition, birds were recorded at intervals of 0-3 minutes, 3-5 minutes and 5-10 minutes. Each bird was recorded once and mapped on the field data sheets to ensure no duplication of individual birds.

The point count stations were established in a range of habitats and vegetation communities (e.g., deciduous, coniferous and mixed forests, trees and shrub swamps, sedge and cattail marshes and meadows) to allow for an adequate representation of species guilds. Stations were geo-referenced in the field using a hand-held GPS unit with 5 m accuracy. Incidental sightings were documented, particularly for SAR and species not detected during standardized point counts.

2.2.2.2 Marsh Bird Surveys

A total of 73 marsh bird point count stations (37 impact and 46 control stations) were established and surveyed in 2014 in Sections C1 and C2 (see **Figure Series 3, Appendix A**). Due to property access restrictions, ten control stations were not surveyed in 2015 and therefore, removed from statistical analysis; however, one of these impact stations was added back into the monitoring program in 2017 due to the removal of land access restrictions.

Surveys were undertaken during the breeding bird season, from late May to the end of June, when birds are known to be the most vocal. Surveys were conducted at each station twice by qualified biologists skilled in the identification of birds by sight and sound. During the second round of sampling, stations were surveyed in the reverse order from the first round (to the greatest extent possible) to reduce temporal sampling bias. Surveys were initiated either prior to sunrise and extending up to three hours after sunrise or were initiated three hours before sunset and continuing after sunset. Point count surveys were aborted or postponed if weather conditions were not optimal (winds above 20 km/hr or light rain). Marsh bird playback were conducted for 15 minutes at each station and consisted of five (5) minutes of passive listening, followed by five (5) minutes of marsh bird broadcasts[1], and ending with five (5) minutes of passive listening. Marsh birds were recorded at intervals of 0-100 m, 100-200 m, >200 m. Each bird was recorded once and mapped on the field data sheets to ensure no duplication of individual birds.

Stations were geo-referenced in the field using a hand-held GPS unit with 5 m accuracy. Incidental sightings were documented, particularly for SAR and species not detected during standardized point counts.

2.2.2.3 Crepuscular Bird Surveys

A total of 48 crepuscular bird point count stations (24 impact and 24 control stations) were established and surveyed in 2014 and surveyed again in both 2015 and 2017 (see **Figure Series 4, Appendix A**). Surveys were undertaken during the breeding bird season, from late May to the end of June, when birds are known to be the most vocal. Surveys were conducted 30-minutes after sunset and extended until after midnight. All surveys were conducted during the optimal moon illumination period for crepuscular bird surveys (>50% illumination is generally considered optimal). All surveys were conducted during optimal weather conditions for detecting crepuscular birds (e.g., little cloud cover, winds below 20 km/hr and no precipitation). Point count surveys were aborted or postponed if weather conditions were not optimal. Crepuscular bird surveys were conducted for six (6) minutes at each station and consisted of recording birds at intervals of 0-200 m, 200-400 m, >400 m. Each Eastern Whip-poor-will was recorded once, mapped on the field data sheets, and triangulated to determine their location and to prevent duplication of individuals.

2.3 Sharp-tailed Grouse Lekking

2.3.1 Sharp-tailed Grouse Lekking Survey Study Design

Sharp-tailed Grouse have a reproductive system known as lekking, where males form large groups and vocalize and display at the same time in attempts to attract females. Leks are generally elevated sites associated with sparse or disturbed vegetation and are typically used for many years. Sharp-tailed Grouse nesting usually occurs in shrub habitat located close to the lek.

[1] Marsh bird playback consisted of five (5) one-minute intervals of Virginia Rail, Least Bittern, Yellow Rail, Sora and Pied-billed Grebe. During each one-minute interval, calls of the select species were broadcast for 30-45 seconds followed by 15-30 seconds of passive listening.

The construction and installation of the Bipole III Transmission Line has the potential to adversely affect the abundance of Sharp-tailed Grouse at lekking sites by way of habitat loss or disturbance during construction. The Project also has the potential to increase rates of predation by raptors or mammals due to increased nesting sites on newly constructed transmission line towers and hydro corridor use, respectively. As such, the Sharp-tailed Grouse lek monitoring will test two hypotheses: 1) that the installation of the Bipole III Transmission Line affects the abundance of male Sharp-tailed Grouse displaying at lekking sites, and 2) that the installation of the Bipole III Transmission Line increases Sharp-tailed Grouse predation. As such, the null and alternate hypotheses state:

Hypothesis 1:

- H^0 (null): The installation of the Bipole III Transmission Line does not affect the abundance of male Sharp-tailed Grouse at lekking sites.
- H^1 (alternate): The installation of the Bipole III Transmission Line does affect the abundance of male Sharp-tailed Grouse at lekking sites.

Hypothesis 2:

- H^0 (null): The installation of the Bipole III Transmission Line does not increase Sharp-tailed Grouse nest predation.
- H^1 (alternate): The installation of the Bipole III Transmission Line does increase Sharp-tailed Grouse nest predation.

To test these hypotheses, a BACI study design was implemented. Initial monitoring for Sharp-tailed Grouse required conducting searches for leks in the vicinity of modelled Sharp-tailed Grouse habitat and grouse observations as presented in the Bipole III Birds Technical Report (Wildlife Resources Consulting Services, 2011). Due to the large area of modelled habitat for this species along the proposed transmission line route, an aerial survey for groups of Sharp-tailed Grouse was undertaken in early spring 2015 to scope for potential lekking locations. Aerial surveys offer an efficient means of covering a large area and locating individuals of a species that is secretive yet flushes easily. Sharp-tailed Grouse stay close to breeding sites all year-round, meaning baseline observations may indicate the nearby presence of a lekking site. Once leks are identified, ground surveys consist of scanning candidate lekking sites with binoculars and a spotting scope and listening for sounds of displaying grouse.

2.3.2 Sharp-tailed Grouse Lekking Survey Methodology

During the aerial surveys in spring 2015, individual Sharp-tailed Grouse were mainly observed is section S1 and C2. These locations were examined more closely during ground surveys in spring 2015, but no Sharp-tailed Grouse lekking sites were confirmed within the project boundaries during ground surveys. Consultations with Manitoba Conservation established they also had no confirmed lekking sites within project boundaries. Follow-up ground surveys to identify Sharp-tailed Grouse lekking sites were conducted between April 18th – 22nd, 2017 to substantiate the previous findings. Sharp-tailed Grouse surveys were conducted based on the Sharp-tailed

Grouse Survey Protocol (WDNR, 2013) and Sensitive Species Inventory Guidelines (Government of Alberta, 2013). Surveys were conducted entirely from public roadways and routes were selected based on modeled Sharp-tailed Grouse habitat, previously identified lekking sites, and locations where previous Amec Foster Wheeler aerial and ground surveys detected grouse. Routes were largely restricted by the need to use readily traversable roads as close as possible to the transmission line route. All surveys were conducted within approximately two km of the transmission line route.

Along the selected routes, surveys were made every 1.6 km near intersections or field boundaries whenever possible to view as many fields as possible. A total of 122 survey points were conducted along the selected routes in sections C2, S1, and S2. At each survey point, observers listened for lekking grouse for three minutes, as well as carefully scanning nearby fields with binoculars. Surveys were conducted beginning one hour before sunrise and finishing three hours after sunrise. On several occasions, sharp-tailed grouse were flushed from the roadside or otherwise observed at some distance from a planned stop. In each case a survey was immediately conducted close to this location. All lekking activities were recorded as well as the number of males and females present, where possible.

2.4 Active Bird Nests

Clearing of vegetation and other construction activities (field exploration, installation of footings, and tower and conductor erection) across most of the Project route will take place during the winter months (December to March) to avoid harming, disturbing or destroying nesting migratory birds and their nests. However, in the event that some construction activity is necessary during the bird breeding season, area searches will be conducted prior to construction activities in order to prevent disruption or harm to nesting birds. Area searches will consist of two or more surveyors slowly walking approximately 10 m from each other. The survey route will sufficiently cover the proposed affected area and associated buffer zones. Birds exhibiting parental behaviours such as carrying nesting material or food, aggressive territorial behavior, or distraction behavior will be noted and depending upon breeding activity levels and density of breeding pairs in the area, "nest areas" or "territories" defined by observing a singing male bird "defending" the territory, will be identified and flagged for exclusion of clearing activities. Clearing activities can commence in these areas when the nesting activity is complete. The estimated date of nest completion will be determined based on known incubation and brood rearing periods for each bird species, as documented in the online Birds of North America (http://bna.birds.cornell.edu/bna/) species accounts.

Area searches will also record any raptor nests (those of hawks, eagles, falcons, osprey and owls), as will aerial surveys for waterfowl and Sharp-tailed Grouse. Raptor species nest in large stick nests, tree cavities or on cliff edges. When possible, the location of nests, the species present, the number of eggs or young present, and whether any other sources of human disturbance is present will be documented. When approaching nests, care will be taken to keep a safe distance from nests to minimize stress to incubating birds in June or to nestlings in July.

Nest searching efforts were not conducted as part of the avian monitoring program in 2017; however, nest searches were conducted as part of the construction monitoring program. Details relative to nest searching activities during construction monitoring are provided under a separate cover.

3.0 RESULTS

A total of 171 bird species have been recorded during the 2014, 2015, and 2017 monitoring program, of which seven (7) species were newly recorded in 2017 (Brown Thrasher, Chimney Swift, Eastern Bluebird, Herring Gull, Lesser Yellowlegs, Pine Siskin, and White-winged Crossbill). Eighty-two (82) of the species recorded are considered SCC birds, of which ten (10) species are listed under SARA, seven (7) species are listed under MESA, and 71 species are BCR 6 and/or BCR 11 priority species[2]). The complete complied list of species is presented in **Table 2**. Only common names are provided within the body of the report; all scientific names are provided within Table 1. The locations of all recorded SARA and MESA species are presented in **Figure Series 5 (Appendix A)**.

3.1 Bird–Wire Collisions

As identified is Section 2.1.2, no bird-wire collision mortality monitoring surveys were conducted as part of the 2017 work program. Monitoring of bird-wire collisions will commence following the transmission line wire stringing (post-tower and conductor construction stage), which is expected to be sufficiently completed in the winter of 2017 to allow for the commencement of the mortality monitoring in spring 2018.

[2] Five (5) species are listed under both SARA and MESA. All SARA and MESA species are also considered BCR priority species, but are excluded from the total count to draw attention to birds with only a BCR designation.

Table 2: Compiled Bird Species List from the 2014, 2015, and 2017 Monitoring Program[1]

Common Name	Latin Name	Songbird Surveys	Marsh / Crep. Bird Surveys	Aerial Surveys	SARA[1]	MESA[2]	BCR 6 Priority Species	BCR 11 Priority Species	Guild
Alder Flycatcher	*Empidonax alnorum*	✓					✓		Edge/Shrub/Successional
American Avocet	*Recurvirostra americana*			✓				✓	Wetland/Open Water
American Bittern	*Botaurus lentiginosus*	✓	✓	✓			✓	✓	Wetland/Open Water
American Coot	*Fulica americana*		✓	✓					Wetland/Open Water
American Crow	*Corvus brachyrhynchos*	✓		✓					Forest
American Goldfinch	*Carduelis tristis*	✓							Edge/Shrub/Successional
American Kestrel	*Falco sparverius*	✓		✓			✓		Edge/Shrub/Successional
American Redstart	*Setophaga ruticilla*	✓							Edge/Shrub/Successional
American Robin	*Turdus migratorius*	✓							Edge/Shrub/Successional
American Three-toed Woodpecker	*Picoides dorsalis*	✓					✓		Forest
American White Pelican	*Pelecanus erythrorhynchos*	✓		✓			✓	✓	Wetland/Open Water
American Wigeon	*Anas americana*	✓		✓				✓	Wetland/Open Water
Bald Eagle	*Haliaeetus leucocephalus*	✓		✓					Forest
Baltimore Oriole	*Icterus galbula*	✓					✓		Edge/Shrub/Successional
Barn Swallow	*Hirundo rustica*	✓					✓		Edge/Shrub/Successional
Bay-breasted Warbler	*Setophaga castanea*	✓					✓		Forest
Belted Kingfisher	*Ceryle alcyon*	✓							Wetland/Open Water
Black Tern	*Chlidonias niger*			✓			✓	✓	Wetland/Open Water
Black-and-white Warbler	*Mniotilta varia*	✓							Forest
Black-backed Woodpecker	*Picoides arcticus*	✓					✓		Forest
Black-billed Cuckoo	*Coccyzus erythropthalmus*	✓					✓	✓	Edge/Shrub/Successional
Black-billed Magpie	*Pica hudsonia*	✓		✓					Edge/Shrub/Successional
Blackburnian Warbler	*Setophaga fusca*	✓					✓		Forest
Black-capped Chickadee	*Poecile atricapillus*	✓							Forest
Blackpoll Warbler	*Setophaga striata*	✓					✓		Forest
Black-throated Green Warbler	*Setophaga virens*	✓					✓		Forest
Blue Jay	*Cyanocitta cristata*	✓							Forest
Blue-headed Vireo	*Vireo solitarius*	✓							Forest

Common Name	Latin Name	Songbird Surveys	Marsh / Crep. Bird Surveys	Aerial Surveys	SARA[1]	MESA[2]	BCR 6 Priority Species	BCR 11 Priority Species	Guild
Blue-winged Teal	*Anas discors*	✓		✓				✓	Wetland/Open Water
Bobolink	*Dolichonyx oryzivorus*	✓					✓	✓	Grassland/Open Country
Bonaparte's Gull	*Chroicocephalus philadelphia*			✓					Wetland/Open Water
Boreal Chickadee	*Poecile hudsonica*	✓					✓		Forest
Brewer's Blackbird	*Euphagus cyanocephalus*	✓	✓						Edge/Shrub/Successional
Broad-winged Hawk	*Buteo platypterus*	✓					✓		Forest
Brown Creeper	*Certhia americana*	✓					✓		Forest
Brown Thrasher	*Toxostoma rufum*	✓						✓	Edge/Shrub/Successional
Brown-headed Cowbird	*Molothrus ater*	✓							Edge/Shrub/Successional
Bufflehead	*Bucephala albeola*	✓		✓				✓	Wetland/Open Water
California Gull	*Larus californicus*		✓				✓		Wetland/Open Water
Canada Goose	*Branta canadensis*	✓		✓				✓	Wetland/Open Water
Canada Warbler	*Cardellina canadensis*	✓			THR	THR	✓		Forest
Cape May Warbler	*Setophaga tigrina*	✓					✓		Forest
Canvasback	*Aythya valisineria*			✓				✓	Wetland/Open Water
Cedar Waxwing	*Bombycilla cedrorum*	✓							Edge/Shrub/Successional
Chestnut-sided Warbler	*Setophaga pensylvanica*	✓							Edge/Shrub/Successional
Chimney Swift	*Chaetura pelagica*	✓			THR	THR	✓	✓	Edge/Shrub/Successional
Chipping Sparrow	*Spizella passerina*	✓							Edge/Shrub/Successional
Clay-colored Sparrow	*Spizella pallida*	✓					✓	✓	Edge/Shrub/Successional
Common Goldeneye	*Bucephala clangula*	✓		✓					Wetland/Open Water
Common Grackle	*Quiscalus quiscula*	✓							Edge/Shrub/Successional
Common Loon	*Gavia immer*	✓		✓			✓	✓	Wetland/Open Water
Common Merganser	*Mergus merganser*			✓					Wetland/Open Water
Common Nighthawk	*Chordeiles minor*		✓		THR	THR	✓	✓	Grassland/Open Country
Common Raven	*Corvus corax*	✓		✓					Forest
Common Tern	*Sterna hirundo*			✓			✓	✓	Wetland/Open Water
Common Yellowthroat	*Geothlypis trichas*	✓					✓	✓	Edge/Shrub/Successional
Connecticut Warbler	*Oporornis agilis*	✓					✓		Forest
Dark-eyed Junco	*Junco hyemalis*	✓							Forest

Common Name	Latin Name	Songbird Surveys	Marsh / Crep. Bird Surveys	Aerial Surveys	SARA[1]	MESA[2]	BCR 6 Priority Species	BCR 11 Priority Species	Guild
Double-crested Cormorant	*Phalacrocorax auritus*			✓					Wetland/Open Water
Downy Woodpecker	*Picoides pubescens*	✓							Forest
Eared Grebe	*Podiceps nigricollis*			✓			✓	✓	Wetland/Open Water
Eastern Bluebird	*Sialia sialis*	✓							Grassland/Open Country
Eastern Kingbird	*Tyrannus tyrannus*	✓							Edge/Shrub/Successional
Eastern Towhee	*Pipilo erythrophthalmus*	✓							Edge/Shrub/Successional
Eastern Whip-poor-will	*Antrostomus vociferus*		✓		THR	THR	✓	✓	Forest
Eastern Wood-Pewee	*Contopus virens*	✓							Forest
Evening Grosbeak	*Coccothraustes vespertinus*	✓							Forest
Franklin's Gull	*Leucophaeus pipixcan*	✓		✓				✓	Wetland/Open Water
Gadwall	*Anas strepera*			✓					Wetland/Open Water
Golden-crowned Kinglet	*Regulus satrapa*	✓							Forest
Golden-winged Warbler	*Vermivora chrysoptera*	✓			THR	THR	✓	✓	Edge/Shrub/Successional
Grasshopper Sparrow	*Ammodramus savannarum*	✓						✓	Grassland/Open Country
Gray Catbird	*Dumetella carolinensis*	✓							Edge/Shrub/Successional
Gray Jay	*Perisoreus canadensis*	✓							Forest
Great Blue Heron	*Ardea herodias*	✓		✓				✓	Wetland/Open Water
Great Crested Flycatcher	*Myiarchus crinitus*	✓							Forest
Great Gray Owl	*Strix nebulosa*	✓		✓					Forest
Great Horned Owl	*Bubo virginianus*		✓	✓					Forest
Greater White-fronted Goose	*Anser albifrons*			✓					Wetland/Open Water
Greater Yellowlegs	*Tringa melanoleuca*	✓		✓			✓		Wetland/Open Water
Green-winged Teal	*Anas cracca*	✓		✓				✓	Wetland/Open Water
Hairy Woodpecker	*Picoides villosus*	✓							Forest
Hermit Thrush	*Catharus guttatus*	✓							Forest
Herring Gull	*Larus argentatus*	✓					✓		Wetland/Open Water
Hooded Merganser	*Lophodytes cucullatus*			✓					Wetland/Open Water
House Wren	*Troglodytes aedon*	✓							Edge/Shrub/Successional
Indigo Bunting	*Passerina cyanea*	✓							Edge/Shrub/Successional
Killdeer	*Charadrius vociferus*	✓		✓			✓	✓	Grassland/Open Country

Common Name	Latin Name	Songbird Surveys	Marsh / Crep. Bird Surveys	Aerial Surveys	SARA[1]	MESA[2]	BCR 6 Priority Species	BCR 11 Priority Species	Guild
Least Bittern	*Ixobrychus exilis*		✓		THR	END		✓	Wetland/Open Water
Least Flycatcher	*Empidonax minimus*	✓					✓	✓	Edge/Shrub/Successional
Le Conte's Sparrow	*Ammodrammus leconteii*	✓					✓	✓	Grassland/Open Country
Lesser Scaup	*Aythya affinis*			✓				✓	Wetland/Open Water
Lesser Yellowlegs	*Tringa flavipes*	✓					✓		Wetland/Open Water
Lincoln's Sparrow	*Melospiza lincolnii*	✓							Edge/Shrub/Successional
Long-eared Owl	*Asio otus*		✓					✓	Forest
Magnolia Warbler	*Setophaga magnolia*	✓							Forest
Mallard	*Anas platyrhynchos*	✓		✓				✓	Wetland/Open Water
Marbled Godwit	*Limosa fedoa*			✓			✓		Grassland/Open Country
Marsh Wren	*Cistothorus palustris*	✓							Wetland/Open Water
Mourning Dove	*Zenaida macroura*	✓							Edge/Shrub/Successional
Mourning Warbler	*Geothlypis philadelphia*	✓					✓		Forest
Nashville Warbler	*Oreothlypis ruficapilla*	✓							Forest
Nelson's Sparrow	*Ammodramus nelsoni*	✓					✓	✓	Grassland/Open Country
Northern Flicker	*Colaptes auratus*	✓					✓	✓	Forest
Northern Goshawk	*Accipiter gentilis*	✓					✓		Forest
Northern Harrier	*Circus cyaneus*	✓		✓			✓	✓	Grassland/Open Country
Northern Pintail	*Anas acuta*			✓				✓	Wetland/Open Water
Northern Shoveler	*Anas clypeata*			✓				✓	Wetland/Open Water
Northern Waterthrush	*Parkesia noveboracensis*	✓							Forest
Olive-sided Flycatcher	*Contopus borealis*	✓			THR	THR	✓	✓	Edge/Shrub/Successional
Orange-crowned Warbler	*Oreothlypis celata*	✓							Edge/Shrub/Successional
Osprey	*Pandion haliaetus*			✓					Wetland/Open Water
Ovenbird	*Seiurus aurocapilla*	✓							Forest
Palm Warbler	*Setophaga palmarum*	✓							Edge/Shrub/Successional
Philadelphia Vireo	*Vireo philadelphicus*	✓							Forest
Pied-billed Grebe	*Podilymbus podiceps*	✓	✓	✓			✓	✓	Wetland/Open Water
Pileated Woodpecker	*Dryocopus pileatus*	✓					✓		Forest
Pine Grosbeak	*Pinicola enucleator*	✓							Forest

Common Name	Latin Name	Songbird Surveys	Marsh / Crep. Bird Surveys	Aerial Surveys	SARA[1]	MESA[2]	BCR 6 Priority Species	BCR 11 Priority Species	Guild
Pine Siskin	*Carduelis pinus*	✓							Forest
Purple Finch	*Haemorhous purpureus*	✓							Forest
Red-breasted Nuthatch	*Sitta canadensis*	✓							Forest
Red-eyed Vireo	*Vireo olivaceus*	✓							Forest
Redhead	*Aythya americana*			✓				✓	Wetland/Open Water
Red-headed Woodpecker	*Melanerpes erythrocephalus*	✓			THR	THR	✓	✓	Forest
Red-necked Grebe	*Podiceps grisegena*			✓			✓	✓	Wetland/Open Water
Red-tailed Hawk	*Buteo jamaicensis*	✓		✓					Forest
Red-winged Blackbird	*Agelaius phoeniceus*	✓							Wetland/Open Water
Ring-billed Gull	*Larus delawarensis*	✓		✓					Wetland/Open Water
Ring-necked Duck	*Aythya collaris*			✓				✓	Wetland/Open Water
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	✓							Forest
Rough-legged Hawk	*Buteo lagopus*			✓					Grassland/Agricultural
Ruby-crowned Kinglet	*Regulus calendula*	✓							Forest
Ruby-throated Hummingbird	*Archilochus colubris*	✓							Forest
Ruddy Duck	*Oxyura jamaicensis*			✓				✓	Wetland/Open Water
Ruffed Grouse	*Bonasa umbellus*	✓							Forest
Rusty Blackbird	*Euphagus carolinus*	✓			SC		✓	✓	Wetland/Open Water
Sandhill Crane	*Grus canadensis*	✓		✓					Grassland/Open Country
Savannah Sparrow	*Passerculus sandwichensis*	✓							Grassland/Open Country
Sedge Wren	*Cistothorus platensis*	✓					✓	✓	Wetland/Open Water
Sharp-shinned Hawk	*Accipiter striatus*			✓					Forest
Sharp-tailed Grouse	*Tympanuchus phasianellus*			✓			✓	✓	Grassland/Open Country
Short-eared Owl	*Asio flammeus*	✓			SC	THR	✓	✓	
Solitary Sandpiper	*Tringa solitaria*	✓		✓			✓		Wetland/Open Water
Song Sparrow	*Melospiza melodia*	✓							Edge/Shrub/Successional
Sora	*Porzana carolina*	✓	✓	✓			✓	✓	Wetland/Open Water
Spotted Sandpiper	*Actitis macularia*	✓		✓				✓	Wetland/Open Water
Swainson's Thrush	*Catharus ustulatus*	✓							Forest
Swamp Sparrow	*Melospiza georgiana*	✓							Wetland/Open Water

Common Name	Latin Name	Songbird Surveys	Marsh / Crep. Bird Surveys	Aerial Surveys	SARA[1]	MESA[2]	BCR 6 Priority Species	BCR 11 Priority Species	Guild
Tennessee Warbler	*Oreothlypis peregrina*	✓							Edge/Shrub/Successional
Tree Swallow	*Tachycineta bicolor*	✓							Edge/Shrub/Successional
Trumpeter Swan	*Cygnus buccinator*			✓		END		✓	Wetland/Open Water
Tundra Swan	*Cygnus colombianus*			✓					Wetland/Open Water
Turkey Vulture	*Cathartes aura*	✓		✓					Forest
Veery	*Catharus fuscescens*	✓							Forest
Virginia Rail	*Rallus limicola*	✓	✓	✓			✓	✓	Wetland/Open Water
Warbling Vireo	*Vireo gilvus*	✓							Edge/Shrub/Successional
Western Meadowlark	*Sturnella neglecta*	✓						✓	Grassland/Open Country
White-breasted Nuthatch	*Sitta carolinensis*	✓							Forest
White-throated Sparrow	*Zonotrichia albicollis*	✓					✓		Edge/Shrub/Successional
White-winged Crossbill	*Loxia leucoptera*	✓					✓		Forest
Willet	*Tringa semipalmata*			✓					Wetland/Open Water
Wilson's Snipe	*Gallinago delicata*	✓					✓	✓	Edge/Shrub/Successional
Wilson's Warbler	*Cardellina pusilla*	✓							Forest
Winter Wren	*Troglodytes troglodytes*	✓							Forest
Wood Duck	*Aix sponsa*			✓					Forest
Yellow Rail	*Coturnicops noveboracensis*		✓		SC			✓	Wetland/Open Water
Yellow Warbler	*Setophaga petechia*	✓							Edge/Shrub/Successional
Yellow-bellied Flycatcher	*Empidonax flaviventris*	✓							Forest
Yellow-bellied Sapsucker	*Sphyrapicus varius*	✓					✓		Forest
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*			✓					Wetland/Open Water
Yellow-rumped Warbler	*Setophaga coronata*	✓							Forest

[1] SARA = *Species at Risk Act, 2003*
[2] MESA = Manitoba *Endangered Species Act, 1990*

3.2 Species of Conservation Concern Bird Monitoring

The purpose of this monitoring component is to evaluate potential disturbance/avoidance impacts on SCC birds following transmission corridor clearing, although the means by which the evaluation of impacts are conducted (point count surveys) allows for the examination of potential impacts on birds beyond solely SCC birds. Accordingly, this section also evaluates potential impacts on non-SCC birds following transmission corridor clearings. The approach allows for a more comprehensive evaluation of bird species typically detected through the application of point count surveys.

3.2.1 Songbird Surveys

3.2.1.1 Species Distribution Across Point Counts

A total of 142 bird species were recorded during the morning songbird surveys between 2014 and 2017 (although several species recorded are not considered songbirds such as American Bittern and Bald Eagle), of which 132 bird species have been recorded at impact sites and 114 bird species have been recorded at control sites. The number of species recorded has increased with each year of monitoring, with 111 bird species (3945 total birds) recorded during the baseline monitoring in 2014, 112 bird species (3883 total birds) recorded during the first year after vegetation clearing monitoring in 2015, and 115 bird species (4386 total birds) recorded during this year's monitoring. A complete list of all bird species recorded and their percent occurrence is provided in **Appendix B**.

The six most widely occurring SCC birds recorded across impact and control stations between 2014 and 2017 included Alder Flycatcher, Clay-colored Sparrow, Common Yellowthroat, Least Flycatcher, Mourning Warbler, and White-throated Sparrow. The six most widely occurring non-SCC birds recorded across impact and control stations between 2014 and 2017 included American Redstart, Chestnut-sided Warbler, Ovenbird, Red-eyed Vireo, Tennessee Warbler, and Veery. A summary of these dominant bird species occurrence is provided in **Table 3**. Statistical comparisons based on the most commonly occurring species and based on guild are provided in subsection 3.2.1.2.

Three SARA and/or MESA listed species (Canada Warbler, Golden-winged Warbler, and Olive-sided Flycatcher) were recorded at several point count stations in all years in monitoring; however, due to the low numbers of these three species recorded at both impact and control stations, meaningful statistical comparisons could not be completed (**Table 4**). Nonetheless, the occurrence of these three species is discussed herein. Canada Warbler presence was sparse in 2017, with only six males observed in the monitoring area (one at impact sites, five at control sites). These numbers are comparable to the occurrence recorded during the baseline monitoring in 2014 and remained consistent with occurrence at control sites in 2015, but decreased from the occurrence at impact sites in the first year after clearing in 2015. Canada Warbler occurrence does not appear to follow a trend, as no Canada Warblers were recorded at the same point count station in all monitoring years. Instead, the occurrence of Canada Warblers appears dynamic, with intermittent occurrence at both impact and control sites. Accordingly, there is no evidence to infer that the project has affected the occurrence of Canada Warblers within the monitoring period.

Golden-winged Warblers presence was uncommon in 2017, with 17 males observed in the monitoring area (11 at impact sites, 6 at control sites). The numbers were roughly comparable with the occurrence recorded during the baseline monitoring in 2014, but marginally increased at impact sites and decreased at control sites (**Table 4**). The occurrence of Golden-winged Warblers was markedly less at impact sites in 2015; however, this was due to the limitation on surveying areas where Golden-winged Warblers had been recorded in 2014. Golden-winged Warblers also occurred at the same point count stations across each monitoring year (at both impact and control sites) suggesting less dynamic population than Canada Warblers. The findings also indicate the project has not affected the occurrence of Golden-winged Warblers within the monitoring period.

Olive-sided Flycatchers presence was very scarce in 2017, with only six males observed in the monitoring area (three at impact sites, three at control sites); however, these numbers were slightly greater than the occurrence recorded during the baseline monitoring in 2014 and during the first year after clearing in 2015 (**Table 4**). Olive-sided Flycatcher occurrence does not appear to follow a trend, as no Olive-sided Flycatchers were recorded at the same point count station in all monitoring years. Instead, the occurrence of Olive-sided Flycatchers appears dynamic, with intermittent occurrence at both impact and control sites. Accordingly, there is no evidence to suggest the project has affected the occurrence of Olive-sided Flycatchers within the monitoring period.

Two other SARA and/or MESA listed species were newly recorded within the monitoring area during the 2017 songbird surveys, including Red-headed Woodpecker and Chimney Swift. These observations include a single recorded Red-headed Woodpecker at control station C-BB10 and a single recorded Chimney Swift at impact station I-BB3.

Table 3: Summary of Dominant Bird Species Occurrence within the Monitoring Area

Species[1]	Year	Impact			Control		
		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Species of Conservation Concern Birds							
Alder Flycatcher β	2014	32	22	20.8	21	18	16.4
	2015	41	29	31.9	36	29	26.4
	2017	66	42	39.6	35	25	22.7
Clay-colored Sparrow βϕ	2014	89	47	44.3	76	42	38.2
	2015	79	43	47.3	52	36	32.7
	2017	72	55	51.9	52	35	31.8
Common Yellowthroat βϕ	2014	82	51	48.1	82	55	50.0
	2015	64	44	48.4	68	42	38.2
	2017	129	71	67.0	61	40	36.4
Least Flycatcher βϕ	2014	121	60	56.6	67	38	34.5
	2015	86	45	49.5	38	24	21.8
	2017	105	57	53.8	28	19	17.3
Mourning Warbler β	2014	20	17	16.0	20	17	15.5
	2015	27	18	19.8	27	20	18.2
	2017	32	28	26.4	23	16	14.5
White-throated Sparrow β	2014	117	64	60.4	210	96	87.3
	2015	111	58	63.7	197	88	80.0
	2017	145	72	67.9	153	82	74.5
Non-Species of Conservation Concern Birds							
American Redstart	2014	72	45	42.5	98	50	45.5
	2015	35	19	20.9	79	48	43.6
	2017	50	32	30.2	93	51	46.4
Chestnut-sided Warbler	2014	63	46	43.4	54	34	30.9
	2015	44	31	34.1	79	55	50.0
	2017	63	42	39.6	50	35	31.8
Ovenbird	2014	84	47	44.3	123	67	60.9
	2015	70	42	46.2	110	70	63.6
	2017	86	57	53.8	112	68	61.8
Red-eyed Vireo	2014	161	89	84.0	142	84	76.4
	2015	138	71	78.0	159	86	78.2
	2017	207	86	81.1	178	90	81.8
Tennessee Warbler	2014	46	35	33.0	68	47	42.7
	2015	35	24	26.4	71	51	46.4
	2017	11	9	8.5	17	15	13.6
Veery	2014	53	37	34.9	58	38	34.5
	2015	47	32	35.2	60	44	40.0
	2017	43	31	29.2	52	38	34.5

[1] β - BCR 6 priority species; ϕ - BCR 11 priority species
[2] Measure of the number of each species recorded at each point count station.
[3] Measure of the percent occurrence of each species recorded at each point count station.

Table 4: Occurrence of SARA and/or MESA Listed Species in 2014, 2015, and 2017

Point Count Station	Canada Warbler			Golden-winged Warbler			Olive-sided Flycatcher		
	2014	2015	2017	2014	2015	2017	2014	2015	2017
Impact Stations									
I-BB3	0	0	0	0	-	1	0	0	0
I-BB4	0	0	0	1	-	0	0	0	0
I-BB5	0	0	0	0	-	1	0	0	0
I-BB6	0	0	0	0	-	1	0	0	0
I-BB8	0	0	0	0	-	2	0	0	0
I-BB9	0	0	0	1	-	0	0	0	0
I-BB10	0	0	0	1	0	1	0	0	0
I-BB14	0	0	0	1	-	2	0	0	0
I-BB21	0	0	0	0	0	2	0	0	0
I-BB22	0	0	0	0	0	1	0	0	0
I-BB26	0	1	0	0	0	0	0	0	0
I-BB27	0	1	0	0	0	0	0	0	0
I-BB28	0	1	1	0	0	0	0	0	0
I-BB29	0	0	0	0	0	0	0	1	0
I-BB33	0	0	0	0	0	0	0	0	1
I-BB41	0	0	0	0	0	0	0	0	1
I-BB42	0	0	0	0	0	0	0	0	1
I-BB43	0	0	0	1	0	0	0	0	0
I-BB44	0	0	0	0	0	0	0	1	0
I-BB45	1	1	0	0	0	0	0	0	0
I-BB47	0	1	0	0	0	0	0	0	0
I-BB51	0	0	0	0	1	0	0	0	0
I-BB105	0	0	0	0	1	0	0	0	0
I-BB118	0	0	0	1	0	0	0	0	0
I-BB120	0	0	0	1	0	0	0	0	0
Control Stations									
C-BB2	0	0	0	0	1	1	0	0	0
C-BB9	0	0	0	3	1	0	0	0	0
C-BB10	0	0	0	1	0	0	0	0	0
C-BB11	0	0	0	0	0	2	0	0	0
C-BB12	0	0	0	1	0	0	0	0	0
C-BB14	0	0	0	0	1	0	0	0	0
C-BB15	0	0	0	1	1	2	0	0	0
C-BB17	1	0	0	1	0	0	0	0	0
C-BB19	0	0	0	2	1	1	0	0	0
C-BB25	1	0	0	0	0	0	0	0	0
C-BB27	0	1	0	0	0	0	0	0	0
C-BB29	0	2	2	0	0	0	0	0	0
C-BB30	0	1	0	0	0	0	0	0	0
C-BB32	0	1	0	0	0	0	0	0	0
C-BB33	0	0	0	0	0	0	0	0	2
C-BB38	0	0	0	0	0	0	1	0	0
C-BB39	0	0	0	0	0	0	0	0	1
C-BB44	0	0	2	0	0	0	0	0	0
C-BB46	1	0	1	0	0	0	0	0	0
C-BB93	0	0	0	0	0	0	0	1	0
C-BB96	0	0	0	0	0	0	0	1	0
C-BB100	0	0	0	0	1	0	0	0	0

3.2.1.2 Species Abundance

Species of Conservation Concern

Statistical comparisons on the six most widely occurring SCC birds recorded across impact and control stations in 2014, 2015, and 2017 (Alder Flycatcher, Clay-colored Sparrow, Common Yellowthroat, Least Flycatcher, Mourning Warbler, and White-throated Sparrow) were conducted to detect significant differences in abundance between year (2014 vs. 2015 vs. 2017) and treatment (impact vs. control). The assumption of homogeneity of variance was not violated for any of these species. Some minor deviations from normality were detected for each species depending on the normality test applied; however, a graphical assessment of histograms and Q-Q plots indicated deviations were minor. As paired analyses are highly robust to the presence of small deviations from normality, the application of parametric repeated measures ANOVA was validated for the six most abundant SCC birds.

The abundance of Black-billed Cuckoos was assessed in 2015, but due to the dramatic decline in species presence in 2017 (only five total individuals observed), statistical comparisons could not be performed. A discussion on the decline of this species is provided in Section 4.0.

Alder Flycatcher

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Alder Flycatchers ($F_{2,176} = 1.63$, $p = 0.198$) indicating that the project has not affected the abundance of Alder Flycatchers adjacent to cleared areas (**Table 5** and **Table 6**). The main effects analysis revealed no significant differences in abundance between impact and control sites ($F_{1,88} = 1.13$, $p = 0.290$); however, the abundance increased significantly between monitoring years ($F_{2,176} = 8.20$, $p < 0.001$), with post-hoc tests revealing an increase in abundance between the baseline abundance in 2014 and 2017 ($p < 0.001$). The abundance of Alder Flycatchers also increased in the first year after clearing (2015) relative to baseline abundance in 2014 ($p = 0.047$), which demonstrates a wide-ranging increase in the abundance of Alder Flycatchers within the monitoring areas.

Clay-colored Sparrow

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Clay-colored Sparrows ($F_{2,212} = 2.53$, $p = 0.082$) suggesting that the project has not affected the abundance of Clay-colored Sparrows adjacent to cleared areas (**Table 5** and **Table 6**). The main effects analysis revealed that the abundance decreased significantly between monitoring years ($F_{2,212} = 4.70$, $p = 0.010$), with post-hoc tests revealing decreases between 2014 and 2017 ($p = 0.008$); however, no significant differences in abundance between impact and control sites were observed ($F_{1,106} = 0.66$, $p = 0.417$) potentially indicating a wide-ranging decrease in the abundance of Clay-colored Sparrows within the monitoring areas. The decreasing trend in abundance in control sites relative to impact sites demonstrates there may also be other factors (e.g., population dynamics, food availability) contributing to their decreased abundance in the control areas.

Common Yellowthroat

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of Common Yellowthroats ($F_{2,278} = 14.70$, $p < 0.001$). Post-hoc analysis revealed the abundance of Common Yellowthroats significantly increased at impact sites in 2017 compared to baseline conditions in 2014 ($p < 0.001$) and initial clearing conditions in 2015 ($p < 0.001$), but remained statistically unchanged at control sites (**Table 5** and **Table 6**). The results indicate the vegetation clearing may have increased access to shrub and edge habitats adjacent to the transmission corridor for Common Yellowthroats.

Least Flycatcher

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of Least Flycatchers ($F_{2,202} = 4.15$, $p = 0.017$). Post-hoc analysis revealed the abundance of Least Flycatchers significantly decreased at control sites in 2017 compared to baseline conditions in 2014 ($p = 0.002$) and initial clearing conditions in 2015 ($p < 0.001$), but remained statistically unchanged at impact sites (**Table 5** and **Table 6**). The results may indicate a wide-ranging decrease in the abundance of Least Flycatchers within the control sites, whereas the increased access to shrub and edge habitats adjacent to the transmission corridor may be providing additional nesting and breeding habitats for Least Flycatchers.

Mourning Warbler

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Mourning Warblers ($F_{2,144} = 0.48$, $p = 0.622$) suggesting that the project has not affect the abundance of Mourning Warblers adjacent to cleared areas (**Table 5** and **Table 6**). The main effects analysis revealed that the abundance of Mourning Warblers was not significantly different between monitoring years ($F_{2,144} = 2.07$, $p = 0.130$) and did not significantly differ between impact and control stations ($F_{1,72} = 0.01$, $p = 0.942$).

White-throated Sparrows

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of White-throated Sparrows ($F_{2,358} = 7.59$, $p < 0.001$). Post-hoc analysis revealed the abundance of White-throated Sparrows significantly decreased at control sites in 2017 compared to baseline conditions in 2014 ($p = 0.001$), but remained statistically unchanged at impact sites (**Table 5** and **Table 6**). The results may indicate a wide-ranging decrease in the abundance of White-throated Sparrows within the monitoring areas, whereas the increased access to shrub and edge habitats adjacent to the transmission corridor may be providing additional nesting and breeding habitats for White-throated Sparrows.

Non-Species of Conservation Concern

Statistical comparisons on the six most widely occurring non-SCC birds recorded across impact and control stations in 2014, 2015, and 2017 (American Redstart, Chestnut-sided Warbler, Ovenbird, Red-eyed Vireo, Tennessee Warbler, and Veery) were conducted to detect significant differences in abundance between year (2014 vs. 2015 vs. 2017) and treatment (impact vs. control). The assumption of homogeneity of variance was not violated for any of these species. Some minor deviations from normality were detected for each species depending on the normality test applied; however, a graphical assessment of histograms and Q-Q plots suggested deviations were minor. As paired analyses are highly robust to the presence of small deviations from normality, the application of parametric repeated measures ANOVA was validated for the six most abundant non-SCC birds.

American Redstart

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of American Redstarts ($F_{2,240} = 1.97$, $p = 0.142$) suggesting that the project has not affected the abundance of American Redstarts adjacent to cleared areas (**Table 5** and **Table 6**). The main effects analysis revealed that the abundance of American Redstarts was significantly greater at control sites compared to impact sites ($F_{1,120} = 5.54$, $p = 0.020$) and significantly changed between monitoring years ($F_{2,240} = 5.40$, $p = 0.005$). Post-hoc analysis revealed the abundance of American Redstarts significantly decreased between baseline conditions in 2014 and initial clearing conditions in 2015 ($p = 0.008$), but was unchanged between 2015 and 2017 ($p = 0.727$) potentially suggesting American Redstart abundance is stable within the monitoring areas.

Chestnut-sided Warbler

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of Chestnut-sided Warblers ($F_{2,268} = 4.01$, $p = 0.019$). Post-hoc analysis revealed the abundance of Chestnut-sided Warblers significantly increased between 2014 and 2015 at control sites ($p = 0.022$), but returned to levels similar to those observed during the baseline monitoring (**Table 5** and **Table 6**). The abundance of Chestnut-sided Warblers at impact sites was unchanged between monitoring years. The results indicate the vegetation clearing did not affect the abundance of Chestnut-sided Warblers adjacent to cleared areas; however, there may be other factors (e.g., population dynamics, food availability) contributing to annual changes in the abundance of Chestnut-sided Warblers in the control areas.

Ovenbird

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Ovenbirds ($F_{2,282} = 1.02$, $p = 0.363$) suggesting that the project has not affected the abundance of Ovenbirds adjacent to cleared areas (**Table 5** and **Table 6**). The main effects analysis revealed that the abundance of Ovenbirds was not significantly different between monitoring years ($F_{2,282} = 0.05$, $p = 0.955$) and did not significantly differ between impact and control stations ($F_{1,141} = 2.54$, $p = 0.113$).

Red-eyed Vireo

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Red-eyed Vireos ($F_{2,374} = 0.59$, $p = 0.553$) indicating that the project has not affected the abundance of Red-eyed Vireos adjacent to cleared areas (**Table 5** and **Table 6**). The main effects analysis revealed that the abundance of Red-eyed Vireos significantly changed between monitoring years ($F_{2,374} = 9.40$, $p < 0.001$), with post-hoc tests revealing a significant increase between 2014 and 2015 ($p < 0.001$), as well as between 2015 and 2017 ($p < 0.001$). The abundance of Red-eyed Vireo did not significantly differ between impact and control stations, but showed a trend towards greater abundances at impact sites ($F_{1,187} = 3.15$, $p = 0.077$). The results demonstrate the abundance of Red-eyed Vireo may be increasing within the monitoring area.

Tennessee Warbler

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Tennessee Warblers ($F_{2,202} = 0.81$, $p = 0.447$) suggesting that the project has not affected the abundance of Tennessee Warblers adjacent to cleared areas (**Table 5** and **Table 6**). The main effects analysis revealed that the abundance of Tennessee Warblers significantly changed between monitoring years ($F_{2,202} = 35.70$, $p < 0.001$), with post-hoc tests revealing a significant decrease between 2015 and 2017 ($p < 0.001$). The abundance of Tennessee Warblers did not significantly differ between impact and control stations, but showed a trend towards greater abundances at control sites ($F_{1,101} = 3.10$, $p = 0.081$). The results indicate the abundance of Tennessee Warblers may be increasing within the monitoring area.

Veery

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Veery ($F_{2,216} = 0.02$, $p = 0.983$) suggesting that the project has not affected the abundance of Veery adjacent to cleared areas (**Table 5** and **Table 6**). The main effects analysis revealed that the abundance of Veery was not significantly different between monitoring years ($F_{2,216} = 1.01$, $p = 0.365$) and did not significantly differ between impact and control sites ($F_{1,108} = 0.28$, $p = 0.599$).

Table 5: Summary of Bird Species with the Highest Abundance

Species[1]	Year	2014 Mean Abundance ±SE (n)	2015 Mean Abundance ±SE (n)	2017 Mean Abundance ±SE (n)
Species of Conservation Concern Birds				
Alder Flycatcher $^{\beta}$	Impact	0.58 ± 0.12 (53)	0.82 ± 0.12 (50)	1.25 ± 0.13 (53)
	Control	0.53 ± 0.12 (40)	0.90 ± 0.12 (40)	0.87 ± 0.15 (40)
Clay-colored Sparrow $^{\beta\phi}$	Impact	1.37 ± 0.16 (65)	1.39 ± 0.15 (57)	1.11 ± 0.09 (65)
	Control	1.49 ± 0.14 (51)	1.02 ± 0.12 (51)	1.02 ± 0.12 (51)
Common Yellowthroat $^{\beta\phi}$	Impact	0.99 ± 0.10 (83)	0.86 ± 0.10 (74)	1.55 ± 0.12 (83)
	Control	1.22 ± 0.11 (67)	1.01 ± 0.13 (67)	0.91 ± 0.12 (67)
Least Flycatcher $^{\beta\phi}$	Impact	1.70 ± 0.13 (71)	1.39 ± 0.15 (62)	1.47 ± 0.13 (71)
	Control	1.60 ± 0.14 (42)	0.90 ± 0.17 (42)	0.67 ± 0.13 (42)
Mourning Warbler $^{\beta}$	Impact	0.45 ± 0.09 (44)	0.71 ± 0.16 (38)	0.73 ± 0.10 (44)
	Control	0.56 ± 0.11 (36)	0.75 ± 0.13 (36)	0.64 ± 0.14 (36)
White-throated Sparrow $^{\beta}$	Impact	1.31 ±0.12 (89)	1.46 ± 0.13 (76)	1.63 ± 0.13 (89)
	Control	2.00 ± 0.13 (105)	1.88 ± 0.14 (105)	1.46 ± 0.12 (105)
Non-Species of Conservation Concern Birds				
American Redstart	Impact	1.22 ± 0.14 (59)	0.73 ± 0.15 (48)	0.85 ± 0.14 (59)
	Control	1.32 ± 0.15 (74)	1.07 ± 0.13 (74)	1.26 ± 0.13 (74)
Chestnut-sided Warbler	Impact	0.85 ± 0.10 (74)	0.71 ± 0.11 (62)	0.85 ± 0.11 (74)
	Control	0.73 ± 0.11 (74)	1.07 ± 0.10 (74)	0.68 ± 0.10 (74)
Ovenbird	Impact	1.20 ± 0.13 (70)	1.21 ± 0.13 (58)	1.23 ± 0.10 (70)
	Control	1.45 ± 0.12 (85)	1.29 ± 0.10 (85)	1.32 ± 0.11 (85)
Red-eyed Vireo	Impact	1.61 ± 0.09 (100)	1.62 ± 0.11 (85)	2.07 ± 0.14 (100)
	Control	1.37 ± 0.09 (104)	1.53 ± 0.10 (104)	1.71 ± 0.11 (104)
Tennessee Warbler	Impact	0.96 ± 0.11 (48)	0.85 ± 0.15 (41)	0.23 ± 0.08 (48)
	Control	1.10 ± 0.10 (62)	1.15 ± 0.10 (62)	0.27 ± 0.07 (62)
Veery	Impact	0.96 ± 0.11 (55)	0.94 ± 0.14 (50)	0.78 ± 0.12 (55)
	Control	0.97 ± 0.13 (60)	1.00 ± 0.12 (60)	0.87 ± 0.10 (60)

[1] β - BCR 6 priority species; ϕ - BCR 11 priority species; δ - SARA and/or MESA listed species

Table 6: Repeated Measures ANOVA of Bird Species with the Highest Abundance

Species[1]	Effect	DF	F	*P**	Power
Species of Conservation Concern Birds					
Alder Flycatcher $^{\beta}$	Treatment	1,88	1.13	0.290	0.18
	Year	**2,176**	**8.20**	**<0.001**	**0.96**
	Treatment * Year	2,176	1.63	0.198	0.34
Clay-colored Sparrow $^{\beta\phi}$	Treatment	1,106	0.66	0.417	0.13
	Year	**2,212**	**4.70**	**0.010**	**0.78**
	Treatment * Year	2,212	2.53	0.082	0.58
Common Yellowthroat $^{\beta\phi}$	Treatment	1,139	0.27	0.607	0.08
	Year	**2,278**	**4.87**	**0.008**	**0.80**
	Treatment * Year	**2,278**	**14.70**	**<0.001**	**>0.99**
Least Flycatcher $^{\beta\phi}$	Treatment	1,102	9.28	0.003	0.86
	Year	**2,204**	**14.55**	**<0.001**	**>0.99**
	Treatment * Year	**2,204**	**4.15**	**0.017**	**0.73**
Mourning Warbler $^{\beta}$	Treatment	1,72	0.01	0.942	0.05
	Year	2,144	2.07	0.130	0.42
	Treatment * Year	2,144	0.48	0.622	0.13
White-throated Sparrow $^{\beta}$	**Treatment**	**1,179**	**5.66**	**0.018**	**0.66**
	Year	2,358	1.34	0.263	0.29
	Treatment * Year	**2,358**	**7.59**	**<0.001**	**0.94**
Non-Species of Conservation Concern Birds					
American Redstart	**Treatment**	**1,120**	**5.54**	**0.020**	**0.65**
	Year	**2,240**	**5.39**	**0.005**	**0.84**
	Treatment * Year	2,240	1.97	0.142	0.40
Chestnut-sided Warbler	Treatment	1,134	0.02	0.889	0.05
	Year	2,268	0.64	0.526	0.16
	Treatment * Year	**2,268**	**4.01**	**0.019**	**0.71**
Ovenbird	Treatment	1,141	2.54	0.113	0.35
	Year	2,282	0.05	0.955	0.06
	Treatment * Year	2,282	1.02	0.363	0.23
Red-eyed Vireo	Treatment	1,187	3.16	0.077	0.42
	Year	**2,374**	**9.40**	**<0.001**	**0.98**
	Treatment * Year	2,374	0.59	0.553	0.15
Tennessee Warbler	Treatment	1,101	3.10	0.081	0.42
	Year	**2,202**	**35.70**	**<0.001**	**1.00**
	Treatment * Year	2,202	0.81	0.447	0.19
Veery	Treatment	1,108	0.28	0.599	0.08
	Year	2,216	1.01	0.365	0.23
	Treatment * Year	2,216	0.02	0.983	0.05

[1] β - BCR 6 priority species; ϕ - BCR 11 priority species; δ - SARA and/or MESA listed species
* Bolded values represent statistically significant at $p < 0.05$.

3.2.1.3 Species Abundance by Guild

Statistical comparisons on the four primary guilds were conducted to detect significant differences in abundance between year (2014 vs. 2015 vs 2017) and treatment (impact vs. control). The assumption of homogeneity of variance was not violated for any of the guilds for SCC and non-SCC birds. Some minor deviations from normality were detected for each species depending on the normality test applied; however, a graphical assessment of histograms and Q-Q plots suggested deviations were minor. As paired analyses are highly robust to the presence of small deviations from normality, the application of parametric repeated measures ANOVA was validated for analysis.

Species of Conservation Concern

Edge/Shrub/Successional Birds

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of SCC edge/shrub/successional birds ($F_{2,398} = 20.88$, $p < 0.001$). Post-hoc analysis revealed the abundance of these birds significantly increased at impact sites in 2017 compared to baseline abundance in 2014 ($p < 0.001$) and initial clearing in 2015 ($p = 0.043$). Conversely, their abundance significantly decreased at control sites in 2017 compared to baseline abundance in 2014 ($p < 0.001$) and initial clearing in 2015 ($p = 0.027$) (**Table 7** and **Table 8**). The results indicate the vegetation clearing may have increased access to shrub and edge habitats adjacent to the transmission corridor for edge/shrub/successional species. Conversely, there may be other factors (e.g., population dynamics, food availability) contributing to decline in abundance observed at control sites.

Forest Birds

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of SCC forest birds ($F_{2,352} = 0.74$, $p = 0.480$) indicating that vegetation clearing did not affect the abundance of these birds adjacent to cleared areas (**Table 7** and **Table 8**). The main effects analysis revealed that the abundance of forest birds was not significantly different between monitoring years ($F_{2,352} = 0.47$, $p = 0.626$) and did not significantly differ between impact and control stations ($F_{1,176} = 0.07$, $p = 0.790$).

Grassland/Open Country Birds

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of SCC grassland/open country birds ($F_{2,106} = 0.08$, $p = 0.926$) suggesting that vegetation clearing did not affect the abundance of these birds adjacent to cleared areas (**Table 7** and **Table 8**). The main effects analysis revealed that the abundance of grassland/open country birds was not significantly different between 2014, 2015, and 2017 ($F_{2,106} = 1.33$, $p = 0.269$) and did not significantly differ between impact and control stations ($F_{1,53} = 1.13$, $p = 0.292$).

Wetland/Open Water Birds

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of SCC wetland/open water birds ($F_{2,100} = 1.26$, $p = 0.289$) suggesting that vegetation clearing did not affect the abundance of these birds adjacent to cleared areas (**Table 7** and **Table 8**). The main effects analysis revealed that the abundance of wetland/open water birds was not significantly different between 2014, 2015, and 2017 ($F_{2,100} = 0.49$, $p = 0.613$), but was significantly greater at impact sites compared to control sites ($F_{1,50} = 5.77$, $p = 0.020$).

Total Combined Birds

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of SCC birds within all guilds ($F_{2,398} = 16.13$, $p < 0.001$). Post-hoc analysis revealed the abundance of SCC birds significantly increased at impact sites in 2017 compared to baseline abundance in 2014 ($p < 0.001$) and initial clearing in 2015 ($p = 0.045$). Conversely, the abundance of SCC birds significantly decreased at control sites in 2017 compared to baseline abundance in 2014 ($p < 0.001$), but was not significantly different from initial clearing in 2015 ($p = 0.112$) (**Table 7** and **Table 8**). The results indicate the vegetation clearing may have increased access to shrub and edge habitats adjacent to the transmission corridor for SCC birds in contrast to the declining abundance of SCC birds observed at control sites. This trend follows very closely with the significant increase in abundance observed in the edge/shrub/successional guild adjacent to the transmission corridor.

Non-Species of Conservation Concern

Edge/Shrub/Successional Birds

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of non-SCC edge/shrub/successional birds ($F_{2,394} = 9.22$, $p < 0.001$). Post-hoc analysis revealed the abundance of these birds significantly increased at impact sites in 2017 compared to baseline abundance in 2014 ($p < 0.001$), but was not significantly different from initial clearing in 2015 ($p = 0.110$). The abundance of edge/shrub/successional birds was not significantly different at control sites in 2017 compared to baseline abundance in 2014 ($p = 0.707$) and initial clearing in 2015 ($p = 0.128$) (**Table 7** and **Table 8**). Similar to the findings observed for SCC edge/shrub/successional birds, the results indicate the vegetation clearing may have increased access to shrub and edge habitats adjacent to the transmission corridor for non-SCC edge/shrub/successional species as well.

Forest Birds

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of non-SCC forest birds ($F_{2,398} = 3.03$, $p = 0.049$). Post-hoc analysis revealed the abundance of these birds significantly increased at impact sites in 2017 compared to baseline abundance in 2014 ($p = 0.038$), but was not significantly different from initial clearing in 2015 ($p = 0.991$). The abundance of non-SCC forest birds was not significantly different at control sites in 2017 compared to baseline abundance in 2014 ($p = 0.999$) and initial clearing in 2015 ($p = 0.925$) (**Table 7** and **Table 8**). As an increase in non-SCC forest birds adjacent to a transmission corridor is unexpected due to the increase in 'edge' habitat, there may be other factors (e.g., population dynamics, food availability) contributing to increase abundance of non-SCC forest birds at impact sites.

Grassland/Open Country Birds

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of non-SCC grassland/open country birds ($F_{2,144} = 2.14$, $p = 0.121$) indicating that the project has not affected the abundance of these birds adjacent to cleared areas (**Table 7** and **Table 8**). The main effects analysis revealed that the abundance of non-SCC grassland/open country birds significantly changed between monitoring years ($F_{2,144} = 20.22$, $p < 0.001$), with post-hoc analysis revealing the abundance of grassland/open country birds increased in 2017 compared to baseline abundance in 2014 ($p < 0.001$) and initial clearing in 2015 ($p < 0.001$). The abundance of grassland/open country birds was also significantly greater at impact compared to control sites ($F_{1,72} = 8.93$, $p = 0.003$). The increase in abundance of non-SCC grassland/open country birds is directly attributable to the increase in Sandhill Crane observations since 2014, with only four (4) birds observed in 2014, 53 birds observed in 2015, and 73 birds observed in 2017. The majority of cranes observed in 2015 and 2017 were also observed at impact sites (36 birds and 51 birds, respectively) due to increased access to cleared areas within the transmission corridor.

Wetland/Open Water Birds

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of non-SCC wetland/open water birds ($F_{2,166} = 4.43$, $p = 0.013$). Post-hoc analysis revealed the abundance of these birds significantly increased at impact sites in 2017 compared to baseline abundance in 2014 ($p = 0.024$), whereas abundance of wetland/open water birds was not significantly different at control sites in 2017 compared to baseline abundance in 2014 or initial clearing in 2015 (**Table 7** and **Table 8**). A significant difference in wetland/open water birds was also observed between control and impact sites in 2017 (p = 0.026), with nearly four times the number of wetland/open water birds at impact sites compared to control sites. The results suggest wetland/open water bird habitats are increasing at impact sites due to the increase in beaver ponds and/or open flooded areas within the transmission corridor.

Total Combined Birds

The analysis revealed a significant interaction effect between treatment and year relative to the abundance of non-SCC birds within all guilds ($F_{2,398} = 13.00$, $p < 0.001$). Post-hoc analysis revealed the abundance of non-SCC birds significantly increased at impact sites in 2017 compared to baseline abundance in 2014 ($p < 0.001$) and initial clearing in 2015 ($p = 0.020$). Conversely, the abundance of non-SCC birds at control sites was not significantly different in 2017 compared to baseline abundance in 2014 or initial clearing in 2015 (**Table 7** and **Table 8**). The results indicate the vegetation clearing may have increased access to shrub and edge habitats adjacent to the transmission corridor for non-SCC birds. This trend follows very closely with the significant increase in abundance observed in SCC and non-SCC edge/shrub/successional birds adjacent to the transmission corridor.

Table 7: Summary of Bird Species Abundance by Guild

Species[1]	Year	2014 Mean Abundance ±SE (n)	2015 Mean Abundance ±SE (n)	2017 Mean Abundance ±SE (n)
Species of Conservation Concern Birds				
Edge/Shrub/Successional Birds	Impact	5.08 ± 0.28 (106)	5.41 ± 0.29 (91)	6.16 ± 0.32 (106)
	Control	4.71 ± 0.29 (110)	4.24 ± 0.31 (110)	3.44 ± 0.28 (110)
Forest Birds	Impact	1.16 ± 0.13 (92)	1.24 ± 0.15 (79)	1.42 ± 0.13 (92)
	Control	1.25 ± 0.12 (99)	1.36 ± 0.14 (99)	1.22 ± 0.13 (99)
Grassland/Open Country Birds	Impact	1.12 ± 0.22 (51)	1.20 ± 0.17 (44)	1.49 ± 0.21 (51)
	Control	0.82 ± 0.38 (11)	0.73 ± 0.30 (11)	1.18 ± 0.40 (11)
Wetland/Open Water Birds	Impact	0.97 ± 0.22 (36)	1.06 ± 0.34 (31)	0.92 ± 0.18 (36)
	Control	0.14 ± 0.08 (21)	0.52 ± 0.19 (21)	0.71 ± 0.16 (21)
Total Birds	Impact	6.96 ± 0.34 (106)	7.43 ± 0.36 (91)	8.43 ± 0.43 (106)
	Control	5.95 ± 0.31 (110)	5.63 ± 0.36 (110)	4.79 ± 0.34 (110)
Non-Species of Conservation Concern Birds				
Edge/Shrub/Successional Birds	Impact	4.63 ± 0.28 (106)	5.38 ± 0.29 (91)	5.92 ± 0.36 (106)
	Control	3.81 ± 0.26 (108)	4.14 ± 0.24 (108)	3.35 ± 0.24 (108)
Forest Birds	Impact	6.00 ± 0.31 (106)	6.24 ± 0.31 (91)	7.43 ± 0.34 (106)
	Control	7.86 ± 0.29 (110)	7.30 ± 0.25 (110)	7.66 ± 0.36 (110)
Grassland/Open Country Birds	Impact	0.25 ± 0.09 (51)	1.20 ± 0.17 (45)	1.35 ± 0.19 (51)
	Control	0.14 ± 0.07 (29)	0.59 ± 0.14 (29)	0.76 ± 0.14 (29)
Wetland/Open Water Birds	Impact	1.60 ± 0.26 (58)	2.02 ± 0.33 (52)	2.50 ± 0.56 (58)
	Control	1.12 ± 0.20 (33)	1.12 ± 0.24 (33)	0.67 ± 0.16 (33)
Total Birds	Impact	11.62 ± 0.37 (106)	13.32 ± 0.47 (91)	15.32 ± 0.68 (106)
	Control	11.97 ± 0.38 (110)	11.86 ± 0.38 (110)	11.39 ± 0.51 (110)

Table 8: Repeated Measures ANOVA of Bird Species Abundance by Guild

Guild	Effect	DF	F	*P**	Power
Species of Conservation Concern Birds					
Edge/Shrub/Successional Birds	**Treatment**	**1,199**	**15.04**	**<0.001**	**0.97**
	Year	**2,398**	**0.04**	**0.959**	**0.06**
	Treatment * Year	**2,398**	**20.88**	**<0.001**	**>0.99**
Forest Birds	Treatment	1,176	0.07	0.790	0.06
	Year	2,352	0.47	0.626	0.13
	Treatment * Year	2,352	0.74	0.480	0.17
Grassland/Open Country Birds	Treatment	1,53	1.13	0.292	0.18
	Year	2,106	1.33	0.269	0.28
	Treatment * Year	2,106	0.08	0.926	0.06
Wetland/Open Water Birds	**Treatment**	**1,50**	**5.77**	**0.020**	**0.65**
	Year	2,100	0.49	0.614	0.13
	Treatment * Year	2,100	1.26	0.289	0.27
Total Birds	**Treatment**	**1,199**	**23.93**	**<0.001**	**>0.99**
	Year	2,398	0.34	0.709	0.10
	Treatment * Year	**2,398**	**16.13**	**<0.001**	**>0.99**
Non-Species of Conservation Concern Birds					
Edge/Shrub/Successional Birds	**Treatment**	**1,197**	**25.55**	**<0.001**	**>0.99**
	Year	**2,394**	**3.93**	**0.020**	**0.71**
	Treatment * Year	**2,394**	**9.22**	**<0.001**	**0.98**
Forest Birds	**Treatment**	**1,199**	**13.30**	**<0.001**	**0.95**
	Year	**2,398**	**3.20**	**0.042**	**0.61**
	Treatment * Year	**2,398**	**3.03**	**0.049**	**0.59**
Grassland/Open Country Birds	**Treatment**	**1,72**	**8.93**	**0.003**	**0.84**
	Year	**2,144**	**20.22**	**<0.001**	**>0.99**
	Treatment * Year	2,144	2.14	0.121	0.43
Wetland/Open Water Birds	**Treatment**	**1,83**	**5.13**	**0.026**	**0.61**
	Year	2,166	0.53	0.591	0.14
	Treatment * Year	**2,166**	**4.43**	**0.013**	**0.76**
Total Birds	**Treatment**	**1,199**	**12.70**	**<0.001**	**0.94**
	Year	**1,398**	**7.07**	**0.001**	**0.93**
	Treatment * Year	**1,398**	**13.00**	**<0.001**	**>0.99**

* Bolded values represent statistically significant at $p < 0.05$.

3.2.1.4 Species Density

Species of Conservation Concern

The density of SCC birds closely resembled the abundance of SCC birds suggesting that most of the birds detected were within 100 m of the surveyor. The six SCC birds recorded with the highest density across impact and control stations included Alder Flycatcher, Clay-colored Sparrow, Common Yellowthroat, Least Flycatcher, Mourning Warbler, and White-throated Sparrow. Similar to abundance analysis, Black-billed Cuckoos were excluded from the density analysis in this annual report due to very low sample sizes.

Statistical comparisons on the six most widely occurring SCC birds recorded across impact and control stations were conducted to detect significant differences in density between year (2014 vs. 2015 vs. 2017) and treatment (impact vs. control). The assumption of homogeneity of variance was not violated for any of these species. Some minor deviations from normality were detected for each species depending on the normality test applied; however, a graphical assessment of histograms and Q-Q plots suggested deviations were minor. As paired analyses are highly robust to the presence of small deviations from normality, the application of parametric repeated measures ANOVA was validated for the six SCC birds with the highest density.

Alder Flycatcher

The analysis revealed no significant interaction effect between treatment and year relative to the density of Alder Flycatchers ($F_{2,152} = 1.05$, $p = 0.354$) indicating that the project has not affected the density of Alder Flycatchers adjacent to cleared areas (**Table 9** and **Table 10**). The main effects analysis revealed that the density of Alder Flycatchers significantly changed between monitoring years ($F_{2,152} = 4.70$, $p = 0.010$), with post-hoc tests revealing a significant increase between 2014 and 2015 ($p = 0.012$) and no significant change between 2015 and 2017 ($p = 0.858$). The density of Alder Flycatchers did not significantly differ between impact and control stations ($F_{1,76} = 0.77$, $p = 0.384$).

Clay-colored Sparrow

The analysis revealed no significant interaction effect between treatment and year relative to the density of Clay-colored Sparrows ($F_{2,200} = 2.10$, $p = 0.126$) suggesting that the project has not affected the density of Clay-colored Sparrows adjacent to cleared areas (**Table 9** and **Table 10**). The main effects analysis revealed that the density of Clay-colored Sparrows decreased significantly between monitoring years ($F_{2,20} = 9.27$, $p < 0.001$), with post-hoc tests revealing decreased densities in 2017 relative to both 2014 ($p < 0.001$) and 2015 ($p = 0.024$); however, no significant differences in density between impact and control sites were observed ($F_{1,100} = 0.83$, $p = 0.365$). The decline in density potentially suggests a wide-ranging decrease in Clay-colored Sparrows within the monitoring areas.

Common Yellowthroat

The analysis revealed a significant interaction effect between treatment and year relative to the density of Common Yellowthroats ($F_{2,264} = 11.42$, $p < 0.001$). Post-hoc analysis revealed the density of Common Yellowthroats significantly increased at impact sites in 2017 compared to baseline conditions in 2014 ($p < 0.004$) and initial clearing conditions in 2015 ($p < 0.001$), but remained statistically unchanged at control sites (**Table 9** and **Table 10**). The results suggest the vegetation clearing may have increased access to shrub and edge habitats adjacent to the transmission corridor for Common Yellowthroats.

Least Flycatcher

The analysis revealed a significant interaction effect between treatment and year relative to the density of Least Flycatchers ($F_{2,202} = 4.58$, $p = 0.011$). Post-hoc analysis revealed the density of Least Flycatchers significantly decreased at control sites in 2017 compared to baseline conditions in 2014 ($p = 0.005$) and initial clearing conditions in 2015 ($p < 0.001$), but remained statistically unchanged at impact sites (**Table 9** and **Table 10**). The results may indicate a wide-ranging decrease in the density of Least Flycatchers within the control sites, whereas the increased access to shrub and edge habitats adjacent to the transmission corridor may be providing additional nesting and breeding habitats for Least Flycatchers.

Mourning Warbler

The analysis revealed no significant interaction effect between treatment and year relative to the density of Mourning Warblers ($F_{2,142} = 0.06$, $p = 0.937$) indicating that the project has not affected the density of Mourning Warblers adjacent to cleared areas (**Table 9** and **Table 10**). The main effects analysis revealed that the density of Mourning Warblers was not significantly different between monitoring years ($F_{2,142} = 1.47$, $p = 0.234$) and did not significantly differ between impact and control stations ($F_{1,71} = 0.22$, $p = 0.224$).

White-throated Sparrows

The analysis revealed a significant interaction effect between treatment and year relative to the density of White-throated Sparrows ($F_{2,358} = 7.59$, $p < 0.001$). Post-hoc analysis revealed the density of White-throated Sparrows significantly decreased at control sites in 2017 compared to baseline conditions in 2014 ($p = 0.001$), but remained statistically unchanged at impact sites (**Table 9** and **Table 10**). The results may indicate a wide-ranging decrease in the density of White-throated Sparrows within the monitoring areas, whereas the increased access to shrub and edge habitats adjacent to the transmission corridor may be providing additional nesting and breeding habitats for White-throated Sparrows.

Non-Species of Conservation Concern

Statistical comparisons on the six most widely occurring non-SCC birds recorded across impact and control stations (American Redstart, Chestnut-sided Warbler, Ovenbird, Red-eyed Vireo, Tennessee Warbler, and Veery) were conducted to detect significant differences in density between year (2014 vs. 2015 vs. 2017) and treatment (impact vs. control). The assumption of homogeneity of variance was not violated for any of these species. Some minor deviations from normality were detected for each species depending on the normality test applied; however, a graphical assessment of histograms and Q-Q plots suggested deviations were minor. As paired analyses are highly robust to the presence of small deviations from normality, the application of parametric repeated measures ANOVA was validated for the six most abundant non-SCC birds.

American Redstart

The analysis revealed no significant interaction effect between treatment and year relative to the density of American Redstarts ($F_{2,238} = 2.01$, $p = 0.137$) suggesting that the project has not affected the density of American Redstarts adjacent to cleared areas (**Table 9** and **Table 10**). The main effects analysis revealed that the density of American Redstarts was significantly greater at control sites compared to impact sites ($F_{1,119} = 5.72$, $p = 0.018$) and significantly decreased between monitoring years ($F_{2,240} = 6.17$, $p = 0.002$). Post-hoc analysis revealed the density of American Redstarts in 2017 significantly decreased between baseline conditions in 2014 (p = 0.023) and initial clearing conditions in 2015 ($p = 0.007$) and was unchanged between 2015 and 2017 ($p = 0.921$) potentially indicating American Redstart density is stable within the monitoring areas.

Chestnut-sided Warbler

The analysis revealed a significant interaction effect between treatment and year relative to the density of Chestnut-sided Warblers ($F_{2,262} = 3.59$, $p = 0.029$). Post-hoc analysis revealed the density of Chestnut-sided Warblers significantly increased between 2014 and 2015 at control sites ($p = 0.043$), but returned to levels similar to those observed during the baseline monitoring (**Table 9** and **Table 10**). The density of Chestnut-sided Warblers at impact sites was unchanged between monitoring years. The results indicate the vegetation clearing did not affect the density of Chestnut-sided Warblers adjacent to cleared areas; however, there may be other factors (e.g., population dynamics, food availability) contributing to annual changes in the density of Chestnut-sided Warblers in the control areas.

Ovenbird

The analysis revealed no significant interaction effect between treatment and year relative to the density of Ovenbirds ($F_{2,254} = 2.78$, $p = 0.064$) suggesting that the project has not affected the density of Ovenbirds adjacent to cleared areas (**Table 9** and **Table 10**). The main effects analysis revealed that the density of Ovenbirds decreased significantly between monitoring years ($F_{2,254} = 10.02$, $p < 0.001$), with post-hoc tests revealing decreased densities in 2017 relative to both 2014 ($p < 0.001$) and 2015 ($p = 0.024$); however, no significant differences in density between impact and control sites were observed ($F_{1,100} = 0.83$, $p = 0.365$). The discrepancy observed between density and abundance of Ovenbirds (declines in abundance were not observed in 2017 – see Section 3.2.1.2) is likely due to a movement of Ovenbirds further from the point count centre (outside 100 m) or observer bias relative to the subjective estimate of distance to the calling bird.

Red-eyed Vireo

The analysis revealed no significant interaction effect between treatment and year relative to the density of Red-eyed Vireos ($F_{2,352} = 2.52$, $p = 0.082$) indicating that the project has not affected the density of Red-eyed Vireos adjacent to cleared areas (**Table 9** and **Table 10**). The main effects analysis revealed that the density of Red-eyed Vireos was not significantly different between monitoring years ($F_{2,352} = 0.69$, $p = 0.503$) and did not significantly differ between impact and control sites ($F_{1,176} = 0.63$, $p = 0.430$).

Tennessee Warbler

The analysis revealed no significant interaction effect between treatment and year relative to the density of Tennessee Warblers ($F_{2,192} = 0.44$, $p = 0.647$) suggesting that the project has not affected the density of Tennessee Warblers adjacent to cleared areas (**Table 9** and **Table 10**). The main effects analysis revealed that the density of Tennessee Warblers significantly changed between monitoring years ($F_{2,192} = 41.98$, $p < 0.001$), with post-hoc tests revealing a significant decrease between 2015 and 2017 ($p < 0.001$). The density of Tennessee Warblers significantly differed between impact and control stations, with greater densities at control sites relative to impact sites ($F_{1,96} = 4.19$, $p = 0.043$).

Veery

The analysis revealed no significant interaction effect between treatment and year relative to the density of Veeries ($F_{2,184} = 0.05$, $p = 0.950$) indicating that the project has not affected the density of Veeries adjacent to cleared areas (**Table 9** and **Table 10**). The main effects analysis revealed that the density of Veeries decreased significantly between monitoring years ($F_{2,184} = 6.75$, $p = 0.001$), with post-hoc tests revealing decreased densities in 2017 relative to both 2014 ($p = 0.002$) and 2015 ($p = 0.007$); however, no significant differences in density between impact and control sites were observed ($F_{1,92} = 0.04$, $p = 0.841$). The discrepancy observed between density and abundance of Veeries (declines in abundance were not observed in 2017 – see Section 3.2.1.2) is likely due to a movement of Veery further from the point count centre (outside 100 m) or observer bias relative to the subjective estimate of distance to the calling bird.

Table 9: Summary of Bird Species with the Highest Density

Species[1]	Year	2014 Mean Abundance ±SE (n)	2015 Mean Abundance ±SE (n)	2017 Mean Abundance ±SE (n)
Species of Conservation Concern Birds				
Alder Flycatcher $^{\beta}$	Impact	0.66 ± 0.13 (44)	0.90 ± 0.13 (42)	0.98 ± 0.13 (44)
	Control	0.53 ± 0.11 (36)	1.00 ± 0.11 (36)	0.75 ± 0.13 (36)
Clay-colored Sparrow $^{\beta\phi}$	Impact	1.34 ± 0.16 (61)	1.38 ± 0.15 (53)	0.98 ± 0.10 (61)
	Control	1.47 ± 0.14 (49)	1.04 ± 0.12 (49)	0.82 ± 0.12 (49)
Common Yellowthroat $^{\beta\phi}$	Impact	0.98 ± 0.10 (80)	0.79 ± 0.10 (73)	1.35 ± 0.12 (80)
	Control	1.25 ± 0.10 (61)	1.00 ± 0.13 (61)	0.85 ± 0.13 (61)
Least Flycatcher $^{\beta\phi}$	Impact	1.65 ± 0.13 (71)	1.31 ± 0.15 (62)	1.38 ± 0.14 (71)
	Control	1.58 ± 0.15 (41)	0.93 ± 0.18 (41)	0.59 ± 0.12 (41)
Mourning Warbler $^{\beta}$	Impact	0.46 ± 0.10 (41)	0.68 ± 0.14 (37)	0.59 ± 0.10 (41)
	Control	0.53 ± 0.10 (36)	0.69 ± 0.12 (36)	0.64 ± 0.13 (36)
White-throated Sparrow $^{\beta}$	Impact	1.17 ± 0.10 (76)	1.39 ± 0.13 (64)	1.18 ± 0.13 (76)
	Control	1.57 ± 0.12 (99)	1.52 ± 0.13 (99)	0.77 ± 0.10 (99)
Non-Species of Conservation Concern Birds				
American Redstart	Impact	1.24 ± 0.14 (58)	0.73 ± 0.15 (48)	0.81 ± 0.14 (58)
	Control	1.33 ± 0.15 (73)	1.07 ± 0.13 (73)	1.22 ± 0.13 (73)
Chestnut-sided Warbler	Impact	0.87 ± 0.10 (71)	0.73 ± 0.11 (60)	0.82 ± 0.12 (71)
	Control	0.73 ± 0.11 (74)	1.07 ± 0.10 (74)	0.68 ± 0.10 (74)
Ovenbird	Impact	1.10 ± 0.14 (62)	1.14 ± 0.13 (50)	0.87 ± 0.10 (62)
	Control	1.30 ± 0.12 (79)	1.24 ± 0.10 (79)	0.67 ± 0.08 (85)
Red-eyed Vireo	Impact	1.47 ± 0.09 (98)	1.45 ± 0.10 (83)	1.69 ± 0.13 (98)
	Control	1.39 ± 0.09 (95)	1.56 ± 0.09 (95)	1.36 ± 0.11 (95)
Tennessee Warbler	Impact	0.91 ± 0.10 (45)	0.87 ± 0.16 (38)	0.16 ± 0.05 (45)
	Control	1.10 ± 0.10 (60)	1.15 ± 0.10 (60)	0.25 ± 0.07 (60)
Veery	Impact	0.96 ± 0.11 (46)	0.83 ± 0.14 (41)	0.57 ± 0.10 (46)
	Control	0.87 ± 0.12 (53)	0.85 ± 0.12 (53)	0.49 ± 0.08 (53)

[1] $^{\beta}$ - BCR 6 priority species; $^{\phi}$ - BCR 11 priority species; $^{\delta}$ - SARA and/or MESA listed species

Table 10: Repeated Measures ANOVA of Bird Species with the Highest Density

Species[1]	Effect	DF	F	*P**	Power
Species of Conservation Concern Birds					
Alder Flycatcher β	Treatment	1,76	0.77	0.384	0.14
	Year	**2,152**	**4.70**	**0.010**	**0.78**
	Treatment * Year	2,152	1.05	0.354	0.23
Clay-colored Sparrow βϕ	Treatment	1,100	0.83	0.365	0.14
	Year	**2,200**	**9.27**	**<0.001**	**0.98**
	Treatment * Year	2,200	2.10	0.126	0.43
Common Yellowthroat βϕ	Treatment	1,132	0.08	0.783	0.06
	Year	2,264	2.47	0.087	0.49
	Treatment * Year	**2,264**	**11.42**	**<0.001**	**0.99**
Least Flycatcher βϕ	**Treatment**	**1,101**	**6.95**	**0.010**	**0.74**
	Year	**2,202**	**15.66**	**<0.001**	**1.00**
	Treatment * Year	**2,202**	**4.58**	**0.011**	**0.77**
Mourning Warbler β	Treatment	1,71	0.22	0.637	0.08
	Year	2,142	1.47	0.234	0.31
	Treatment * Year	2,142	0.06	0.937	0.06
White-throated Sparrow β	Treatment	1,161	0.38	0.540	0.09
	Year	**2,322**	**13.36**	**<0.001**	**0.99**
	Treatment * Year	**2,322**	**5.06**	**0.007**	**0.82**
Non-Species of Conservation Concern Birds					
American Redstart	**Treatment**	**1,119**	**5.72**	**0.046**	**0.66**
	Year	**2,238**	**6.17**	**0.002**	**0.89**
	Treatment * Year	2,238	2.01	0.137	0.41
Chestnut-sided Warbler	Treatment	1,131	0.01	0.945	0.05
	Year	2,262	0.99	0.373	0.22
	Treatment * Year	**2,262**	**3.59**	**0.029**	**0.66**
Ovenbird	Treatment	1,127	0.39	0.535	0.31
	Year	**2,254**	**10.02**	**<0.001**	**0.07**
	Treatment * Year	2,254	2.78	0.064	0.16
Red-eyed Vireo	Treatment	1,176	0.63	0.430	0.12
	Year	2,352	0.69	0.503	0.17
	Treatment * Year	2,352	2.52	0.082	0.50
Tennessee Warbler	Treatment	1,96	4.19	0.043	0.53
	Year	**2,192**	**41.98**	**<0.001**	**1.00**
	Treatment * Year	2,192	0.44	0.647	0.12
Veery	Treatment	1,92	0.04	0.841	0.05
	Year	**2,184**	**6.75**	**0.001**	**0.91**
	Treatment * Year	2,184	0.05	0.950	0.06

[1] β - BCR 6 priority species; ϕ - BCR 11 priority species; δ - SARA and/or MESA listed species
* Bolded values represent statistically significant at $p < 0.05$.

3.2.1.5 Species Density by Guild

Statistical comparisons on the four primary guilds were conducted to detect significant differences in density between year (2014 vs. 2015 vs 2017) and treatment (impact vs. control). The assumption of homogeneity of variance was not violated for any of the guilds for SCC and non-SCC birds. Some minor deviations from normality were detected for each species depending on the normality test applied; however, a graphical assessment of histograms and Q-Q plots suggested deviations were minor. As paired analyses are highly robust to the presence of small deviations from normality, the application of parametric repeated measures ANOVA was validated for analysis.

Species of Conservation Concern

Edge/Shrub/Successional Birds

The analysis revealed a significant interaction effect between treatment and year relative to the density of SCC edge/shrub/successional birds ($F_{2,398} = 11.77$, $p < 0.001$). Post-hoc analysis revealed the density of these birds significantly decreased at control sites in 2017 compared to baseline density in 2014 ($p < 0.001$) and initial clearing in 2015 ($p < 0.001$), but did not significant differ between years at impact sites (**Table 11** and **Table 12**). The results indicate the vegetation clearing did not affect the density of SCC edge/shrub/successional birds adjacent to cleared areas; however, there may be other factors (e.g., population dynamics, food availability) contributing to annual declines in the density of edge/shrub/successional birds in the control areas.

Forest Birds

The analysis revealed no significant interaction effect between treatment and year relative to the density of SCC forest birds ($F_{2,328} = 0.19$, $p = 0.825$) suggesting that vegetation clearing did not affect the density of SCC forest birds adjacent to cleared areas (**Table 11** and **Table 12**). The main effects analysis revealed that the density of forest birds was not significantly different between monitoring years ($F_{2,328} = 1.23$, $p = 0.292$) and did not significantly differ between impact and control stations ($F_{1,164} = 0.19$, $p = 0.661$).

Grassland/Open Country Birds

The analysis revealed no significant interaction effect between treatment and year relative to the density of SCC grassland/open country birds ($F_{2,92} = 0.26$, $p = 0.770$) indicating that vegetation clearing did not affect the density of SCC grassland/open country birds adjacent to cleared areas (**Table 11** and **Table 12**). The main effects analysis revealed that the density of SCC grassland/open country birds was not significantly different between monitoring years ($F_{2,92} = 1.90$, $p = 0.155$) and did not significantly differ between impact and control stations ($F_{1,46} = 0.27$, $p = 0.606$).

Wetland/Open Water Birds

The analysis revealed no significant interaction effect between treatment and year relative to the density of SCC wetland/open water birds ($F_{2,62}$ = 1.16, p = 0.321) suggesting that vegetation clearing did not affect the density of wetland/open water birds adjacent to cleared areas (**Table 11** and **Table 12**). The main effects analysis revealed that the density of wetland/open water birds was not significantly different between monitoring years ($F_{2,62}$ = 1.30, p = 0.281) and did not significantly differ between impact and control stations ($F_{1,31}$ = 1.38, p = 0.249).

Total Combined Birds

The analysis revealed a significant interaction effect between treatment and year relative to the density of SCC birds within all guilds ($F_{2,398}$ = 8.49, p < 0.001). Post-hoc analysis revealed the density of SCC birds significantly decreased at control sites in 2017 compared to baseline abundance in 2014 (p < 0.001) and initial clearing in 2015 (p < 0.001), but did not significantly differ between years at impact sites (**Table 11** and **Table 12**). The results indicate the vegetation clearing did not affect the density of SCC birds adjacent to cleared areas; however, there may be other factors (e.g., population dynamics, food availability) contributing to annual declines in the density of SCC birds in the control areas. This trend follows very closely with the significant decrease in density observed in SCC edge/shrub/successional birds adjacent to the transmission corridor.

Non-Species of Conservation Concern

Edge/Shrub/Successional Birds

The analysis revealed a significant interaction effect between treatment and year relative to the density of non-SCC edge/shrub/successional birds ($F_{2,394}$ = 8.34, p < 0.001). Post-hoc analysis revealed the density of these birds significantly increased at impact sites in 2017 compared to baseline density in 2014 (p = 0.029) and initial clearing densities in 2015 (p = 0.048). The density of non-SCC edge/shrub/successional birds was not significantly different at control sites in 2017 compared to initial clearing in 2015 (p = 0.099), but significantly decreased from baseline densities in 2014 (p = 0.001) (**Table 11** and **Table 12**). A significant difference in edge/shrub/successional birds was also observed between control and impact sites in 2017 (p < 0.001), with an average density of approximately two more non-SCC edge/shrub/successional birds per hectare at impact sites compared to control sites. Similar to the findings observed for SCC edge/shrub/successional birds, the results suggest the vegetation clearing may have increased access to shrub and edge habitats adjacent to the transmission corridor for non-SCC edge/shrub/successional species as well; however, there may be other factors (e.g., population dynamics, food availability) contributing to annual declines in the density of non-SCC birds in the control areas.

Forest Birds

The analysis revealed a significant interaction effect between treatment and year relative to the density of non-SCC forest birds ($F_{2,398} = 4.29$, $p = 0.014$). Post-hoc analysis revealed the density of non-SCC forest birds significantly decreased at control sites in 2017 compared to baseline density in 2014 ($p < 0.001$) and initial clearing in 2015 ($p = 0.001$); however, the density of forest birds was not significantly different at impact sites in 2017 compared to baseline density in 2014 or initial clearing density in 2015 (**Table 11** and **Table 12**). As a decrease in non-SCC forest birds at control sites is unexpected, there may be other factors (e.g., population dynamics, food availability) contributing to decreased density of forest birds at control sites. Alternatively, observer bias relative to the subjective estimate of distance to the calling bird may have led to the findings observed for non-SCC forest bird density. Observer bias is plausible due to the differences observed between abundance and density analyses, where abundance analysis of non-SCC forest birds conversely revealed increased abundance over the monitoring years at impact sites while the abundance was unchanged over the monitoring years at control sites.

Grassland/Open Country Birds

The analysis revealed no significant interaction effect between treatment and year relative to the density of non-SCC grassland/open country birds ($F_{2,32} = 0.14$, $p = 0.866$) suggesting that vegetation clearing did not affect the density of these birds adjacent to cleared areas (**Table 11** and **Table 12**). The main effects analysis revealed that the density of grassland/open country birds was not significantly different between monitoring years ($F_{2,32} = 1.44$, $p = 0.253$) and did not significantly differ between impact and control stations ($F_{1,16} = 1.02$, $p = 0.329$).

Wetland/Open Water Birds

The analysis revealed a significant interaction effect between treatment and year relative to the density of non-SCC wetland/open water birds ($F_{2,142} = 3.24$, $p = 0.042$). Post-hoc analysis revealed the density of wetland/open water birds did not significantly change at impact or control sites across the monitoring years; however, the density of wetland/open water birds was significantly greater at impact site compared to control sites in 2017 ($p = 0.030$) with impact sites having nearly four times the density of wetland/open water birds than control sites (**Table 11** and **Table 12**). The results demonstrate wetland/open water bird habitats are increasing at impact sites due to the increase in beaver ponds and/or open flooded areas within the transmission corridor. These findings were paralleled in the abundance analysis of non-SCC wetland/open water birds (see Section 3.2.1.3).

Total Combined Birds

The analysis revealed a significant interaction effect between treatment and year relative to the density of non-SCC birds within all guilds ($F_{2,398} = 12.16$, $p < 0.001$). Post-hoc analysis revealed the density of non-SCC birds significantly decreased at control sites in 2017 compared to baseline density in 2014 ($p < 0.001$) and initial clearing in 2015 ($p < 0.001$); however, the density of forest birds was not significantly different at impact sites in 2017 compared to baseline density in 2014 or initial clearing density in 2015 (**Table 11** and **Table 12**). As a decrease in non-SCC birds at control sites is unexpected, there may be other factors (e.g., population dynamics, food availability) contributing to decreased density of all non-SCC birds at control sites. Similar to the results observed for non-SCC forest birds, observer bias relative to the subjective estimate of distance to the calling bird may have led to the findings observed for non-SCC bird density.

Table 11: Summary of Bird Species Density by Guild

Species[1]	Year	2014 Mean Density ±SE (n)	2015 Mean Density ±SE (n)	2017 Mean Density ±SE (n)
Species of Conservation Concern Birds				
Edge/Shrub/Successional Birds	Impact	4.41 ± 0.27 (106)	4.51 ± 0.25 (91)	4.33 ± 0.29 (106)
	Control	3.98 ± 0.26 (108)	3.50 ± 0.28 (108)	2.21 ± 0.24 (108)
Forest Birds	Impact	1.08 ± 0.12 (84)	1.17 ± 0.15 (72)	1.08 ± 0.1 (84)
	Control	1.16 ± 0.11 (94)	1.27 ± 0.13 (94)	1.03 ± 0.12 (94)
Grassland/Open Country Birds	Impact	1.13 ± 0.22 (46)	1.03 ± 0.18 (40)	1.39 ± 0.20 (46)
	Control	0.75 ± 0.49 (8)	0.75 ± 0.41 (8)	1.50 ± 0.42 (8)
Wetland/Open Water Birds	Impact	0.92 ± 0.28 (5)	0.96 ± 0.36 (23)	0.56 ± 0.18 (25)
	Control	0.10 ± 0.10 (10)	0.90 ± 0.35 (10)	0.40 ± 0.16 (10)
Total Birds	Impact	5.98 ± 0.32 (106)	6.12 ± 0.31 (91)	5.92 ± 0.34 (106)
	Control	4.96 ± 0.27 (110)	4.65 ± 0.32 (110)	3.20 ± 0.28 (110)
Non-Species of Conservation Concern Birds				
Edge/Shrub/Successional Birds	Impact	4.20 ± 0.26 (106)	4.95 ± 0.27 (91)	4.93 ± 0.32 (106)
	Control	3.67 ± 0.26 (108)	4.04 ± 0.23 (108)	2.92 ± 0.23 (108)
Forest Birds	Impact	4.84 ± 0.27 (106)	4.62 ± 0.30 (91)	4.63 ± 0.26 (106)
	Control	6.77 ± 0.27 (110)	6.41 ± 0.25 (110)	5.06 ± 0.31 (110)
Grassland/Open Country Birds	Impact	0.72 ± 0.21 (18)	1.27 ± 0.23 (15)	0.89 ± 0.27 (18)
	Control	0.33 ± 0.33 (3)	0.67 ± 0.57 (3)	0.33 ± 0.33 (3)
Wetland/Open Water Birds	Impact	1.49 ± 0.25 (51)	1.98 ± 0.36 (45)	2.20 ± 0.54 (51)
	Control	1.07 ± 0.23 (28)	1.14 ± 0.22 (28)	0.57 ± 0.16 (28)
Total Birds	Impact	9.88 ± 0.34 (106)	10.76 ± 0.43 (91)	10.77 ± 0.53 (106)
	Control	10.65 ± 0.35 (110)	10.68 ± 0.35 (110)	8.08 ± 0.43 (110)

Table 12: Repeated Measures ANOVA of Bird Species Density by Guild

Guild	Effect	DF	F	*P**	Power
Species of Conservation Concern Birds					
Edge/Shrub/Successional Birds	**Treatment**	**1,197**	**14.01**	**<0.001**	**0.96**
	Year	**2,394**	**11.84**	**<0.001**	**0.99**
	Treatment * Year	**2,394**	**12.03**	**<0.001**	**0.99**
Forest Birds	Treatment	1,164	0.19	0.661	0.07
	Year	2,328	1.24	0.292	0.27
	Treatment * Year	2,328	0.19	0.825	0.08
Grassland/Open Country Birds	Treatment	1,46	0.27	0.606	0.08
	Year	2,92	1.90	0.155	0.39
	Treatment * Year	2,92	0.26	0.770	0.09
Wetland/Open Water Birds	Treatment	1,31	1.38	0.249	0.21
	Year	2,62	1.29	0.281	0.27
	Treatment * Year	2,62	1.16	0.321	0.25
Total Birds	**Treatment**	**1,199**	**23.50**	**<0.001**	**>0.99**
	Year	**2,398**	**8.79**	**<0.001**	**0.97**
	Treatment * Year	**2,398**	**8.49**	**<0.001**	**0.97**
Non-Species of Conservation Concern Birds					
Edge/Shrub/Successional Birds	**Treatment**	**1,197**	**15.51**	**<0.001**	**0.97**
	Year	**2,394**	**5.10**	**0.007**	**0.82**
	Treatment * Year	**2,394**	**8.34**	**<0.001**	**0.96**
Forest Birds	**Treatment**	**1,199**	**27.74**	**<0.001**	**>0.99**
	Year	**2,398**	**8.48**	**<0.001**	**0.97**
	Treatment * Year	**2,398**	**4.29**	**0.014**	**0.75**
Grassland/Open Country Birds	Treatment	1,16	1.02	0.329	0.16
	Year	2,32	1.44	0.253	0.28
	Treatment * Year	2,32	0.14	0.866	0.07
Wetland/Open Water Birds	**Treatment**	**1,71**	**4.23**	**0.043**	**0.53**
	Year	2,142	0.43	0.654	0.12
	Treatment * Year	**2,142**	**3.24**	**0.042**	**0.61**
Total Birds	Treatment	1,199	2.19	0.141	0.31
	Year	**2,398**	**6.02**	**0.003**	**0.88**
	Treatment * Year	**2,398**	**12.16**	**<0.001**	**>0.99**

* Bolded values represent statistically significant at $p < 0.05$.

3.2.1.6 Species Richness

Statistical comparisons on the four primary guilds were conducted to detect significant differences in species richness between year (2014 vs. 2015 vs. 2017) and treatment (impact vs. control). The assumption of homogeneity of variance was not violated for any of the guilds for SCC and non-SCC birds. Some minor deviations from normality were detected for each species depending on the normality test applied; however, a graphical assessment of histograms and Q-Q plots suggested deviations were minor. As paired analyses are highly robust to the presence of small deviations from normality, the application of parametric repeated measures ANOVA was validated for analysis.

Species of Conservation Concern

Edge/Shrub/Successional Species

The analysis revealed a significant interaction effect between treatment and year relative to the richness of SCC edge/shrub/successional species ($F_{2,398} = 21.08$, $p < 0.001$). Post-hoc analysis revealed the density of edge/shrub/successional species significantly increased at impact sites in 2017 compared to baseline density in 2014 ($p < 0.001$), but was not significantly different than initial clearing richness in 2015 ($p = 0.184$). The richness of SCC edge/shrub/successional species was not significantly different at control sites in 2017 compared to initial clearing in 2015, but significantly decreased from baseline richness in 2014 ($p = 0.001$) (**Table 13** and **Table 14**). The results indicate the vegetation clearing increased the richness of SCC edge/shrub/successional species is likely due to an increase in edge related habitats.

Forest Species

The analysis revealed no significant interaction effect between treatment and year relative to the richness of SCC forest species ($F_{2,352} = 0.84$, $p = 0.430$) indicating that vegetation clearing did not affect the richness of forest species adjacent to cleared areas (**Table 13** and **Table 14**). The main effects analysis revealed that the richness of SCC forest species was not significantly different between monitoring years ($F_{2,352} = 0.71$, $p = 0.492$) and did not significantly differ between impact and control stations ($F_{1,176} = 0.01$, $p = 0.910$).

Grassland/Open Country Species

The analysis revealed no significant interaction effect between treatment and year relative to the richness of SCC grassland/open country species ($F_{2,106} = 0.22$, $p = 0.801$) suggesting that vegetation clearing did not affect the richness of these species adjacent to cleared areas (**Table 13** and **Table 14**). The main effects analysis revealed that the richness of SCC grassland/open country species was not significantly different between monitoring years ($F_{2,106} = 0.59$, $p = 0.554$) and did not significantly differ between impact and control stations ($F_{1,53} = 3.11$, $p = 0.084$), but showed a trend towards a greater richness of SCC grassland/open country species at impact sites relative to control sites.

Wetland/Open Water Species

The analysis revealed no significant interaction effect between treatment and year relative to the richness of SCC wetland/open water species ($F_{2,100}$ = 0.82, p = 0.444) indicating that vegetation clearing did not affect the richness of these species adjacent to cleared areas (**Table 13** and **Table 14**). The main effects analysis revealed that the richness of SCC wetland/open water species was not significantly different between monitoring years ($F_{2,100}$ = 1.72, p = 0.185); however, was significantly greater at impact sites relative to control sites ($F_{1,50}$ = 5.93, p = 0.012) which may demonstrate that habitats for SCC wetland/open water species is more abundant near the transmission line corridor, which may be due to the increase in beaver ponds and/or open flooded areas within the transmission corridor.

Total Combined Species

The analysis revealed a significant interaction effect between treatment and year relative to the richness of SCC species within all guilds ($F_{2,398}$ = 35.58, p < 0.001). Post-hoc analysis revealed the richness of combined SCC species significantly increased at impact sites in 2017 compared to baseline abundance in 2014 (p < 0.001), but was not significantly different compared with bird richness in 2015 (p = 0.185). The richness of combined SCC species was not significantly different across years at control sites (**Table 13** and **Table 14**). The results suggest the vegetation clearing may have increased access to shrub and edge habitats adjacent to the transmission corridor for SCC species. This trend follows very closely with the significant increase in bird richness observed in SCC edge/shrub/successional species adjacent to the transmission corridor.

Non-Species of Conservation Concern

Edge/Shrub/Successional Species

The analysis revealed a significant interaction effect between treatment and year relative to the richness of non-SCC edge/shrub/successional species ($F_{2,394}$ = 27.60, p < 0.001). Post-hoc analysis revealed the density of non-SCC edge/shrub/successional species significantly increased at impact sites in 2017 compared to baseline density in 2014 (p = 0.002), but was not significantly different than initial clearing richness in 2015 (p = 0.371). The richness of non-SCC edge/shrub/successional species was not significantly different at control sites in 2017 compared to baseline richness in 2014 (p = 0.888), but significantly decreased from initial clearing in 2015 (p = 0.017) (**Table 13** and **Table 14**). The richness of non-SCC edge/shrub/successional species in 2017 was also significant (and considerably) greater at impacts sites (p < 0.001). The results suggest the vegetation clearing increased the richness of non-SCC edge/shrub/successional species is likely due to an increase in edge related habitats, but there may be other factors (e.g., population dynamics, food availability) contributing to the decline in species richness observed in the control areas.

Forest Species

The analysis revealed no significant interaction effect between treatment and year relative to the richness of non-SCC forest species ($F_{2,398} = 1.82$, $p = 0.163$) suggesting that vegetation clearing did not affect the richness of these species adjacent to cleared areas (**Table 13** and **Table 14**). The main effects analysis revealed that the richness of forest species was not significantly different between monitoring years ($F_{2,398} = 2.45$ $p = 0.088$), but showed a trend towards increased richness of forest species in 2017. The richness of the forest species was significantly greater at control stations ($F_{1,199} = 15.53$, $p < 0.001$) indicating forest habitats are more prevalent within the control areas.

Grassland/Open Country Species

The analysis revealed no significant interaction effect between treatment and year relative to the richness of non-SCC grassland/open country species ($F_{2,144} = 1.47$, $p = 0.232$) indicating that vegetation clearing did not affect the richness of grassland/open country species adjacent to cleared areas (**Table 13** and **Table 14**). The main effects analysis revealed that the richness grassland/open country species was significantly different between monitoring years ($F_{2,144} = 20.74$, $p <0.001$), with species richness significantly increasing four-fold in 2015 and nearly five-fold in 2017 from baseline conditions in 2014 ($p < 0.001$). The richness of the grassland/open country species was also significantly greater at impact sites ($F_{1,72} = 6.75$, $p = 0.011$) which implies grassland/open country habitats are more prevalent in the vicinity of the transmission corridor.

Wetland/Open Water Species

The analysis revealed no significant interaction effect between treatment and year relative to the richness of non-SCC wetland/open water species ($F_{2,168} = 0.98$, $p = 0.3792$) indicating that vegetation clearing did not affect the richness of wetland/open water species adjacent to cleared areas (**Table 13** and **Table 14**). The main effects analysis revealed that the richness of wetland/open water species was significantly greater at impact stations ($F_{1,84} = 4.53$, $p = 0.036$) suggesting wetland/open water habitats are more prevalent in the vicinity of the transmission corridor. The richness of wetland/open water species was not significantly different between monitoring years ($F_{2,168} = 2.62$, $p = 0.076$), but showed a trend towards decreased species richness in 2017.

Total Combined Species

The analysis revealed a significant interaction effect between treatment and year relative to the richness of non-SCC species within all guilds ($F_{2,398} = 7.18$, $p < 0.001$). Post-hoc analysis revealed the species richness of non-SCC species significantly increased at impact sites in 2017 compared to baseline richness in 2014 ($p < 0.001$), whereas the richness of combined non-SCC species was not significantly different at control sites in 2017 compared to baseline richness in 2014 ($p = 0.982$) or initial clearing in 2015 ($p = 0.927$) (**Table 13** and **Table 14**). The richness of combined non-SCC species was also significantly greater at impact sites in 2017 ($p < 0.001$). The results indicate the vegetation clearing increased the richness of combined non-SCC species likely due to an increase in edge related habitats.

Table 13: Summary of Bird Species Richness by Guild

Species[1]	Year	2014 Mean Richness ±SE (n)	2015 Mean Richness ±SE (n)	2017 Mean Richness ±SE (n)
Species of Conservation Concern Species				
Edge/Shrub/Successional Species	Impact	3.10 ± 0.15 (106)	3.42 ± 0.17 (91)	3.76 ± 0.16 (106)
	Control	2.75 ± 0.15 (110)	2.60 ± 0.16 (110)	2.22 ± 0.15 (110)
Forest Species	Impact	1.00 ± 0.10 (92)	1.03 ± 0.11 (79)	1.22 ± 0.11 (92)
	Control	1.02 ± 0.08 (99)	1.12 ± 0.10 (99)	1.03 ± 0.10 (99)
Grassland/Open Country Species	Impact	0.76 ± 0.13 (51)	0.93 ± 0.11 (44)	1.00 ± 0.13 (51)
	Control	0.55 ± 0.21 (11)	0.55 ± 0.21 (11)	0.64 ± 0.15 (11)
Wetland/Open Water Species	Impact	0.67 ± 0.12 (36)	0.74 ± 0.19 (31)	0.83 ± 0.16 (36)
	Control	0.14 ± 0.08 (21)	0.48 ± 0.16 (21)	0.62 ± 0.13 (21)
Total Species	Impact	4.57 ± 0.20 (106)	5.01 ± 0.22 (91)	5.58 ± 0.23 (106)
	Control	3.75 ± 0.17 (110)	3.75 ± 0.20 (110)	3.33 ± 0.19 (110)
Non-Species of Conservation Concern Species				
Edge/Shrub/Successional Species	Impact	3.33 ± 0.18 (106)	3.68 ± 0.17 (91)	4.08 ± 0.21 (106)
	Control	2.64 ± 0.17 (108)	3.06 ± 0.16 (108)	2.43 ± 0.15 (108)
Forest Species	Impact	4.30 ± 0.21 (106)	4.45 ± 0.22 (91)	5.05 ± 0.22 (106)
	Control	5.54 ± 0.19 (110)	5.19 ± 0.17 (110)	5.47 ± 0.23 (110)
Grassland/Open Country Species	Impact	0.18 ± 0.05 (51)	0.73 ± 0.09 (45)	0.86 ± 0.10 (51)
	Control	0.14 ± 0.07 (29)	0.41 ± 0.09 (29)	0.59 ± 0.09 (29)
Wetland/Open Water Species	Impact	0.98 ± 0.11 (59)	1.09 ± 0.14 (53)	0.90 ± 0.13 (59)
	Control	0.82 ± 0.11 (33)	0.70 ± 0.12 (33)	0.48 ± 0.11 (33)
Total Species	Impact	8.26 ± 0.26 (106)	9.13 ± 0.29 (91)	10.01 ± 0.35 (106)
	Control	8.41 ± 0.26 (110)	8.51 ± 0.25 (110)	8.15 ± 0.31 (110)

[1] $^{\beta}$ - BCR 6 priority species; $^{\phi}$ - BCR 11 priority species; $^{\delta}$ - SARA and/or MESA listed species

Table 14: Repeated Measures ANOVA of Bird Species Richness by Guild

Guild	Effect	Degrees of Freedom	F	*P**	Power
Species of Conservation Concern Species					
Edge/Shrub/Successional Species	**Treatment**	**1,199**	**22.29**	**<0.001**	**0.99**
	Year	2,398	0.80	0.450	0.19
	Treatment * Year	**2,398**	**21.08**	**<0.001**	**0.99**
Forest Species	Treatment	1,176	0.01	0.910	0.05
	Year	2,352	0.71	0.492	0.17
	Treatment * Year	2,352	0.84	0.430	0.19
Grassland/Open Country Species	Treatment	1,53	3.11	0.084	0.41
	Year	2,106	0.59	0.554	0.15
	Treatment * Year	2,106	0.22	0.801	0.08
Wetland/Open Water Species	**Treatment**	**1,50**	**5.93**	**0.018**	**0.67**
	Year	2,100	1.72	0.185	0.35
	Treatment * Year	2,100	0.82	0.444	0.19
Total Species	**Treatment**	**1,199**	**35.58**	**<0.001**	**0.99**
	Year	2,398	2.95	0.054	0.57
	Treatment * Year	**2,398**	**13.97**	**<0.001**	**0.48**
Non-Species of Conservation Concern Species					
Edge/Shrub/Successional Species	**Treatment**	**1,197**	**27.60**	**<0.001**	**0.99**
	Year	**2,394**	**4.33**	**0.014**	**0.75**
	Treatment * Year	**2,394**	**8.58**	**<0.001**	**0.97**
Forest Species	**Treatment**	**1,199**	**15.53**	**<0.001**	**0.98**
	Year	2,398	2.45	0.088	0.49
	Treatment * Year	2,398	1.82	0.163	0.38
Grassland/Open Country Species	**Treatment**	**1,72**	**6.75**	**0.011**	**0.73**
	Year	**2,144**	**20.74**	**<0.001**	**0.99**
	Treatment * Year	2,144	1.48	0.232	0.31
Wetland/Open Water Species	Treatment	**1,84**	**4.53**	**0.036**	**0.56**
	Year	2,168	2.62	0.076	0.52
	Treatment * Year	2,168	0.98	0.379	0.22
Total Species	**Treatment**	**1,199**	**7.62**	**0.006**	**0.78**
	Year	**2,398**	**4.07**	**0.018**	**0.72**
	Treatment * Year	**2,398**	**7.18**	**<0.001**	**0.93**

* Bolded values represent statistically significant at p < 0.05.

3.2.1.7 Power Analysis

An examination of power indicates the paired analyses are generally robust; however, inherent variability in species abundance, density and richness between years and treatments resulted in low power (<0.80) for a number of analyses. Power analysis for the interaction effects (the main component of the study design) revealed the probability of correctly rejecting the null hypothesis when it is false was generally acceptable (>0.80), although the power was below 80% for a number of analyses for individual species and guilds. Where the null hypothesis was accepted, power levels were generally acceptable (<0.20) for the majority of evaluated species and guilds; however, power levels generally considered unacceptable for correctly accepting the null hypothesis were observed in the analyses. Nonetheless, statistical power increased considerably over previous monitoring years, indicating the study design was robust relative to our confidence in accepting or rejecting the null hypothesis. The results of the power analyses for songbirds are presented in **Table 6**, **Table 8**, **Table 10**, **Table 12**, and **Table 14.** The inclusion of survey stations added in 2015 should increase the power of the analyses in subsequent years of monitoring.

3.2.2 Marsh Bird Surveys

A total of five target marsh bird species were recorded during the 2017 marsh bird surveys (which is the same number of species recorded in 2015), in comparison to the six species recorded in 2014 (**Table 15**). Sora occurred with the highest frequency at both impact and control stations throughout the monitoring years (**Table 15**). Virginia Rails were the second most common species recorded at impact and control stations throughout the monitoring years, followed by American Bitterns. Yellow Rail, a federally Special Concern species under SARA Schedule 1, was not commonly recorded at impact or control stations throughout the monitoring years. Pied-billed Grebe was rarely recorded throughout the monitoring years, whereas only one American Coot was recorded throughout the monitoring years. Least Bittern, a federally Threatened and provincially Endangered species under SARA Schedule 1 and MESA, respectively, was not recorded in 2014, 2015, or 2017 at any marsh bird survey locations. Overall, the number of marsh birds recorded at both control and impact decreased between 2014 and 2015, but slightly increased between 2015 and 2017 (**Table 15**); however, the number of birds recorded in 2017 was still less than the number of birds recorded during the baseline monitoring in 2014.

Table 15: Summary of Marsh Bird Recorded in 2014, 2015, and 2017

Species[1]	Year	Impact (n=37)			Control (n=36)		
		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
American Bittern βϕ	2014	10	8	21.6	24	20	55.6
	2015	5	5	13.5	11	7	19.4
	2017	4	4	10.8	28	19	41.3
American Coot	2014	0	0	0	1	1	2.8
	2015	0	0	0	0	0	0
	2017	0	0	0	0	0	0
Pied-billed Grebe βϕ	2014	0	0	0	3	3	8.3
	2015	2	2	5.4	2	2	5.6
	2017	2	2	5.4	3	3	6.5
Sora βϕ	2014	124	35	94.6	102	31	86.1
	2015	70	28	75.7	64	25	69.4
	2017	63	30	81.1	65	29	63.0
Virginia Rail βϕ	2014	24	14	37.8	26	18	50.0
	2015	9	6	16.2	19	14	38.9
	2017	18	12	21.6	23	14	30.4
Yellow Rail ϕδ	2014	9	6	16.2	6	4	11.1
	2015	14	9	24.3	8	5	13.9
	2017	11	8	21.6	7	7	15.2

[1] β - BCR 6 priority species; ϕ - BCR 11 priority species
[2] Sum of the maximum number of each species recorded at all stations (37 impact stations, 36 control stations).
[3] Measure of the percent occurrence of each species recorded at each point count station (n / # of station observed).

3.2.2.1 Marsh Bird Abundance by Species

Sample sizes of marsh birds allowed for statistical comparison between four target marsh bird species (American Bittern, Sora, Virginia Rail, and Yellow Rail). Statistical comparisons were conducted to detect significant differences in species abundance between year (2014 vs. 2015 vs. 2017) and treatment (impact vs. control). The assumption of homogeneity of variance was not violated for any of the marsh birds. Some minor deviations from normality were detected for each species depending on the normality test applied; however, a graphical assessment of histograms and Q-Q plots suggested deviations were minor. As paired analyses are highly robust to the presence of small deviations from normality, the application of parametric repeated measures ANOVA was validated for analysis.

American Bittern

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of American Bitterns ($F_{2,82} = 2.19$, $p = 0.118$) indicating that the project has not affected the abundance of American Bitterns in the vicinity of the transmission corridor (**Table 16** and **Table 17**); however, there is a strong trend identifying decreased abundance at impact sites since baseline conditions. Between 2014 and 2015, a marked decline is American Bitterns across both impact and control sites was observed, but is 2017 there was an increase in abundance back to baseline levels at the control sites; a similar increase to baseline levels was not observed at impact sites. The main effects analysis revealed that the abundance of American Bitterns was not significantly different between control sites and impact sites ($F_{1,41} = 3.61$, $p = 0.065$), but showed a strong trend towards greater abundance at control sites compared to impact sites. The overall abundance of American Bitterns was significantly different between monitoring years ($F_{2,82} = 3.15$, $p = 0.048$), with significant declines observed between baseline levels in 2014 and the first year after clearing levels in 2015 ($p = 0.021$) and a strong trend towards increased abundance in 2017 ($p = 0.065$).

Sora

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Sora ($F_{2,138} = 0.60$, $p = 0.549$) suggesting that the project has not affected the abundance of Soras in the vicinity of the transmission corridor (**Table 16** and **Table 17**). The main effects analysis revealed that the abundance of Sora was not significantly different between impact and control stations ($F_{1,69} = 0.48$, $p = 0.489$); however, the abundance of Sora was significantly different between monitoring years ($F_{2,138} = 16.44$, $p < 0.001$), with significantly fewer Soras observed is both 2017 and 2015 ($p < 0.001$) compared to baseline abundance observed in 2014. The results suggest Sora populations remained below baseline levels within the monitoring areas, which is unrelated to the project activities.

Virginia Rail

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Virginia Rail ($F_{2,94} = 0.61$, $p = 0.544$) indicating that the project has not affected the abundance of Virginia Rails in the vicinity of the transmission corridor (**Table 16** and **Table 17**). The main effects analysis revealed that the abundance of Virginia Rails was not significantly different between impact and control stations ($F_{1,47} = 0.17$, $p = 0.679$) and was not significantly different between monitoring years ($F_{2,94} = 3.02$, $p = 0.054$), but showed a strong trend towards decreased abundance in the first year after clearing in 2015 compared to baseline levels in 2014 (p = 0.055). Virginia Rail abundance also increased in 2017 to near baseline levels at both impact and control sites ($p = 0.605$).

Yellow Rail

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Yellow Rail ($F_{2,46} = 0.03$, $p = 0.970$) suggesting that the project has not affected the abundance of Yellow Rails in the vicinity of the transmission corridor (**Table 16** and **Table 17**). The main effects analysis revealed that the abundance of Yellow Rails was not significantly different between impact and control stations ($F_{1,23} = 0.07$, $p = 0.796$) and was not significantly different between monitoring years ($F_{2,46} = 0.46$, $p = 0.635$).

All Marsh Birds

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of combined marsh birds ($F_{2,138}$ = 0.65, p = 0.522) indicating that vegetation clearing has not affected the combined abundance of marsh birds in the vicinity of the transmission corridor (**Table 16** and **Table 17**). The combined abundance of marsh birds was not significantly different between impact sites and control sites ($F_{1,69}$ = 0.54, p = 0.465); however, the combined abundance of marsh birds was significantly different between monitoring years ($F_{2,138}$ = 14.76, p <0.001). Post-hoc tests revealed the combined abundance was significantly lower in 2017 (p < 0.001) and 2015 (p < 0.001) relative to baseline levels in 2014, which demonstrated an overall wide-ranging decrease in the abundance of marsh birds within the monitoring areas.

3.2.2.2 Power Analysis

An examination of power indicates the paired analyses are generally robust. Power analysis for the interaction effects (the main component of the study design) revealed the probability of correctly accepting the null hypothesis when it is true was generally acceptable (<0.20), except for the American Bittern analysis. Where the null hypothesis was rejected (main effects analyses of year), power levels were excellent (>0.99) for Sora and combined marsh birds, but was well below satisfactory for American Bittern (0.59), meaning this significant result should be interpreted with caution. The low power for American Bittern was likely due to the high variation is species abundance and occurrence at point count stations within the monitoring areas. The results of the power analyses for marsh birds are presented in **Table 17.**

Table 16: Summary of Marsh Birds Abundance

Species[1]	Year	No. of Stations (N)	2014 Mean Abundance ±SE	2015 Mean Abundance ±SE	2017 Mean Abundance ±SE
American Bittern βϕ	Impact	15	0.67 ± 0.19	0.33 ± 0.13	0.27 ± 0.12
	Control	28	0.86 ± 0.13	0.39 ± 0.14	0.96 ± 0.21
Sora βϕ	Impact	36	3.44 ± 0.27	1.94 ± 0.24	1.75 ± 0.19
	Control	35	2.91 ± 0.47	1.83 ± 0.29	1.80 ± 0.27
Virginia Rail βϕ	Impact	22	1.09 ± 0.22	0.41 ± 0.17	0.82 ± 0.21
	Control	27	0.96 ± 0.17	0.70 ± 0.18	0.85 ± 0.20
Yellow Rail ϕδ	Impact	15	0.60 ± 0.24	0.93 ± 0.25	0.73 ± 0.27
	Control	10	0.60 ± 0.27	0.80 ± 0.39	0.70 ± 0.15
Total Marsh Birds	Impact	36	4.63 ± 0.39	2.83 ± 0.32	2.67 ± 0.30
	Control	35	4.63 ± 0.59	3.03 ± 0.42	3.43 ± 0.43

[1] β - BCR 6 priority species; ϕ - BCR 11 priority species; δ - SARA and/or MESA listed species

Table 17: Repeated Measures ANOVA of Marsh Birds Abundance

Guild	Effect	DF	F	*P*	Power
American Bittern	Treatment	1,41	3.61	0.065	0.45
	Year	**2,82**	**3.15**	**0.048**	**0.59**
	Treatment * Year	2,82	2.19	0.118	0.44
Sora	Treatment	1,69	0.48	0.489	0.11
	Year	**2,138**	**16.44**	**<0.001**	**>0.99**
	Treatment * Year	2,138	0.60	0.549	0.15
Virginia Rail	Treatment	1,47	0.17	0.679	0.06
	Year	2,94	3.02	0.054	0.57
	Treatment * Year	2,94	0.61	0.544	0.15
Yellow Rail	Treatment	1,23	0.07	0.796	0.06
	Year	2,46	0.46	0.635	0.12
	Treatment * Year	2,46	0.03	0.970	0.05
Total Marsh Birds	Treatment	1,69	0.54	0.465	0.11
	Year	**2,138**	**14.76**	**<0.001**	**>0.99**
	Treatment * Year	2,138	0.65	0.522	0.16

* Bolded values represent statistically significant at p < 0.05.

3.2.3 Crepuscular Bird Surveys

The crepuscular bird surveys were designed to target Eastern Whip-poor-wills and Common Nighthawks. Eastern Whip-poor-wills were recorded at 70.8% of the impact sites in 2017 compared to the 50% recorded in both 2014 and 2015, with abundance increasing two-fold from baseline abundance in 2014, whereas Eastern Whip-poor-will occurrence was marginally greater at control sites in 2017 compared to 2014 and 2015. Common Nighthawks were recorded for the first time within the monitoring area in 2017. Three Common Nighthawks were recorded at two impact stations (I-CB15 and I-CB22) and one control station (C-CB18). Due to low sample sizes for Common Nighthawk, statistical analysis could only be conducted on Eastern Whip-poor-will abundance.

The analysis revealed no significant interaction effect between treatment and year relative to the abundance of Eastern Whip-poor-wills ($F_{2,64} = 1.68$, $p = 0.194$) indicating that vegetation clearing has not affected the abundance of Eastern Whip-poor-will adjacent to cleared areas (**Tables 18**). The main effects analysis revealed that the abundance of Eastern Whip-poor-wills was not significantly different between impact and control stations ($F_{1,32} = 0.30$, $p = 0.591$), but was significantly different between monitoring years ($F_{2,64} = 6.24$, $p = 0.003$). Post-hoc analysis revealed that the abundance of Eastern Whip-poor-wills increased at impact and control stations combined between 2014 and 2017 ($p = 0.002$).

Power analysis for the interaction effects (the main component of the study design) revealed the probability of correctly accepting the null hypothesis was undesirable (0.34), meaning there is a

34% probability the null hypothesis is incorrect (or 34% probability there is an effect). The low power for the Eastern Whip-poor-will analysis was likely due to the high variation is species abundance at point count stations within the monitoring areas. Eastern Whip-poor-wills cover large areas for foraging and depending on the survey window, may or may not have been detected, which may factor into the observed variation between years and treatments (impact vs. control). Power analysis for the main effects of year revealed the probability of correctly rejecting the null hypothesis was desirable (0.88) demonstrating there is strong evidence for a year effect relative to Eastern Whip-poor-will abundance.

Table 18: Summary of Crepuscular Birds Abundance

Metric	Impact (n=17)			Control (n=17)		
	2014	2015	2017	2014	2015	2017
Max. Birds[1]	13	18	27	14	18	19
No. Of Stations Observed	12	12	17	12	12	13
Percent Occurrence[2]	50.0	50.0	70.8	50.0	50.0	54.2
Mean Abundance ± SE	0.76 ± 0.25	1.06 ± 0.20	1.59 ± 0.17	0.82 ± 0.24	1.06 ± 0.23	1.12 ± 0.21

[1] Sum of the maximum number of each species recorded at all stations (37 impact stations, 46 control stations).
[2] Measure of the percent occurrence of each species recorded at each point count station (n / # of station observed).

3.3 Sharp-tailed Grouse Lekking Sites

During the focused spring 2017 grouse surveys, at least 63 Sharp-tailed Grouse were detected at ten (10) locations (**Table 19**). Six of the locations were confirmed lekking sites, one location was a probable lekking site (no displaying observed), and three locations were incidental sightings with no observed lekking. Three of these sighting locations are in the same area as the 2015 sightings. Of the six confirmed lekking sites, only two were within proximity to the transmission corridor (<1 km). The other four confirmed lekking sites were over 1.6 km from the transmission corridor. Sharp-tailed Grouse sightings are provided on **Figure Series 6.**

A number of raptors were also observed in the vicinity of the lekking locations, including an instance of a Northern Harrier harassing a lekking site. Raptors observed throughout the monitoring route area that are known to prey on Sharp-tailed Grouse included:

- 15 Northern Harrier;
- 1 Great Horned Owl;
- 26 Red-tailed Hawks.

The sample size of Sharp-tailed Grouse lekking sites is too small to allow for any statistical comparisons. These Sharp-tailed Grouse sighting locations shall be surveyed again in 2018 to document any expansion or change in observed lekking sites and raptor presence; however, the likelihood of increased sample sizes to allow for successful implementation of the intended study design, as described in section 2.3.1, are substantially low.

Table 19: Summary of Sharp-tailed Grouse Lekking Surveys

Date	Type of Observation	No. of Sharp-tailed Grouse Present	Approximate Distance from Bipole III Route	Section	UTM	
					Easting	Northing
April 18, 2017	Lek observed	11	2.1 km	S1	0531827	5523186
April 19, 2017	Incidental sighting	1	0.7 km	S1	0521663	5567009
April 19-20, 2017	Grouse observed on April 19, Lek heard on April 20	15	<100 m	S1	0520643	5584903
April 20, 2017	Lek heard	Unknown	2.3 km	C2	0515706	5595715
April 20, 2017	Birds at probable lek, but no displays observed	7	0.5 km	C2	0518619	5595250
April 20, 2017	Incidental sighting	2	2.0 km	C2	0514556	5598632
April 20, 2017	Birds at probable lek, but no displays observed	15	1.6 km	C2	0515387	5604461
April 21, 2017	Lek heard	Unknown	0.7 km	S1	0537921	5507891
April 21, 2017	Lek observed	8	2.1 km	S1	0536976	5502933
April 21, 2017	Incidental sighting	1	0.7 km	S1	0540547	5498298

* Highlighted sightings were in the same area as the 2015 sighting.

4.0 DISCUSSION

4.1 Songbirds

Species of conservation concern, particularly BCR 6 and 11 priority species, were recorded throughout the targeted survey areas; however, species listed under the SARA and/or the MESA (Canada Warbler, Golden-winged Warbler, and Olive-sided Flycatcher) were far less common and have remained consistently low between baseline condition is 2014 and post-vegetation clearing conditions in 2015 and 2017. The relatively consistent occurrence of these species indicates the project has not adversely impacted the abundance of these three species.

Based on the analysis of the most commonly occurring species, abundance and density followed similar trends for many SCC and non-SCC species, although several species had varying results relative to abundance and density (**Table 20**). Amongst impact and control sites, three of the species examined (Clay-colored Sparrow, American Redstart, and Tennessee Warbler) experienced decreases in both abundance and density between the monitoring years, one species (Alder Flycatcher) experienced an increase in both abundance and density between the monitoring years, and one species (Mourning Warbler) was unchanged in both abundance and density between the monitoring years. Overall, none of the dominant SCC or non-SCC birds experienced declines in abundance or density at impact sites only which indicates the project has not had an adverse impact on the most commonly occurring species. In fact, the vegetation removal may have increased access to shrub and edge habitats adjacent to the transmission corridor, which is evident in Common Yellowthroats abundance and density and potentially Least Flycatcher and White-throated Sparrow, which showed a decrease in both abundance and density at control sites, but remained consistent at impact sites (**Table 20**). Chestnut-sided Warbler appears to the only commonly occurring species to experience no change in abundance and density at impact sites yet increase at control site, potentially suggesting populations of Chestnut-sided Warblers have increased in the monitoring areas, but those population increased have been limited adjacent to the transmission corridor. There may be other factors (food availability, population dynamics) causing the increases at control sites and/or this species may increase its utilization of the cleared habitats adjacent to the transmission corridor as shrubs and trees mature to more preferred heights and densities. Ovenbird and Veery, both forest interior species showed no change in abundance between monitoring years, but showed a decrease in density between monitoring years suggesting these two species may have adapted to the vegetation clearing by moving further into the forest interior, although it's unclear as to the reason for decreased density at control sites (**Table 20**). As discussed in Section 3.2.1.2 and 3.2.1.4, this discrepancy between no change in abundance and a decrease in density could be caused by other factors (food availability, population dynamics), due to the movement of these species further from the point count centre (outside 100 m) or observer bias relative to the subjective estimate of distance to the calling bird.

Of particular note was the dramatic decline in Black-billed Cuckoos. The high abundance of Black-billed Cuckoo in previous years, particularly in 2015, was likely due to a forest tent caterpillar outbreak within the monitoring areas, as the diet of Black-billed Cuckoos is predominantly caterpillars. Forest tent caterpillar outbreaks tend to recur at reasonably regular intervals, with outbreaks usually lasting two to four years. Forest tent caterpillars were virtually absent from the monitoring area in 2017. However, the decline of such scale is unexpected as Black-billed Cuckoos are known to shift their diet on non-outbreak years, which indicates there may be other factors unrelated to the Bipole III Project that may be contributing to the decline of this species within the monitoring areas.

Based on the analysis of guilds, species abundance and density followed similar trends for SCC (**Table 20**). Overall, the clearing of vegetation did not appear to have a negative effect on species abundance and density adjacent to the transmission corridor. On the contrary, the abundance of edge/shrub/successional SCC birds significantly increased at impacts sites adjacent to the transmission corridor clearing whereas their abundance decreased at control sites, which further supports the suggestion that the project had increased access to shrub and edge habitats adjacent to the transmission corridor. Total combined SCC birds showed the same increase in abundance and density at impacts sites, which is due to the observed increase in edge/shrub/successional birds since neither forest birds, grassland/open country birds, or wetland/open water birds showed a yearly change in abundance and density (**Table 20**).

Regarding non-SCC guilds, the abundance and density of edge/shrub/successional birds also increased at impact sites compared to control sites, which were unchanged in abundance but decreased in density (**Table 20**). The abundance of forest birds also unexpectedly increased at impact sites compared to control sites indicating there may be other factors (e.g., population dynamics, food availability) contributing to observations. A similar difference was observed for non-SCC forest bird density, where impact sites were unchanged between monitoring years, but control sites decreased (**Table 20**). The differences observed between abundance and density analyses of forest birds may be due to observer bias relative to the subjective estimate of distance to the calling bird. The abundance and density of non-SCC wetland/open water birds increased at impact sites, but were unchanged at control sites, indicating the wetland/open water bird habitats are increasing at impact sites due to the increase in beaver ponds and/or open flooded areas within the transmission corridor (**Table 20**).

Species richness of SCC and non-SCC birds showed similar trends, with edge/shrub/ successional bird richness increasing at impact sites between monitoring years, but decreasing at control sites. The richness of forest birds, grassland/open country birds, and wetland/open water birds was unchanged between the monitoring years except for the increased richness of non-SCC grassland/open country birds. Overall, the richness of total combined SCC and non-SCC increased adjacent to the transmission corridor between monitoring years, whereas the richness was unchanged at control sites (**Table 20**).

An overarching trend in the analysis suggests that the transmission corridor has not adversely affected songbird populations; on the contrary, the transmission corridor appears to have provided increased habitat opportunities for songbirds within the corridor and in the areas immediately surrounding (approx. 150–200 m) the corridor. However and importantly, it’s unclear whether productivity (e.g., clutch size, fledgling rate), rates of depredation, and/or brood parasitism by Brown-headed Cowbirds have been adversely affected by the project (although a review of Brown-headed Cowbird presence has shown no changes between monitoring years or treatment). All of these rates can be influenced by factors caused by edge effects (eg. habitat quality, food availability, habitat openness) for various species.

Table 20: Summary of Yearly and Project-Related Effects on Songbirds

Species/Guild	Abundance[1]		Density		Richness	
	Impact	Control	Impact	Control	Impact	Control
Species Effects – Species of Conservation Concern						
Alder Flycatcher	+	+	+	+	NA	NA
Clay-colored Sparrow	-	-	-	-	NA	NA
Common Yellowthroat	+	Nil	+	-	NA	NA
Least Flycatcher	Nil	-	Nil	-	NA	NA
Mourning Warbler	Nil	Nil	Nil	Nil	NA	NA
White-throated Sparrow	Nil	-	Nil	-	NA	NA
Species Effects – Non-Species of Conservation Concern						
American Redstart	-	-	-	-	NA	NA
Chestnut-sided Warbler	Nil	+	Nil	+	NA	NA
Ovenbird	Nil	Nil	-	-	NA	NA
Red-eyed Vireo	+	+	Nil	Nil	NA	NA
Tennessee Warbler	-	-	-	-	NA	NA
Veery	Nil	Nil	-	-	NA	NA
Guide Effects – Species of Conservation Concern						
Edge/Shrub/Successional Birds	+	-	Nil	-	+	-
Forest Birds	Nil	Nil	Nil	Nil	Nil	Nil
Grassland/Open Country Birds	Nil	Nil	Nil	Nil	Nil	Nil
Wetland/Open Water Birds	Nil	Nil	Nil	Nil	Nil	Nil
Total Combined Birds	+	-	Nil	-	+	Nil
Guide Effects – Non-Species of Conservation Concern						
Edge/Shrub/Successional Birds	+	Nil	+	-	+	-
Forest Birds	+	Nil	Nil	-	Nil	Nil
Grassland/Open Country Birds	+	+	Nil	Nil	+	+
Wetland/Open Water Birds	+	Nil	+	Nil	Nil	Nil
Total Combined Birds	+	Nil	Nil	-	+	Nil

[1] The positive and negative symbols represent significant yearly increases or decreases in abundance, density, or richness. Where symbols are different between impact and control within the abundance, density, and richness columns, it denotes a significant interaction effect.

4.2 Marsh Birds

The outcome of the marsh bird monitoring indicates the project has not adversely affected the abundance of target species within the monitoring areas. However, there appears to be a general decline in abundance at both impact and control sites between monitoring years (**Table 21**). The overall marsh bird abundance decreased between monitoring years for American Bittern and Sora, which produced an observed decrease in total combined target marsh birds, although American Bittern did show a trend towards returning to baseline abundance levels at control sites, but not impact sites. Water levels in wetland habitats were noticeably high in 2014 due to high amounts of snow melt and spring flooding; however, water levels were noticeably lower in both 2015 and 2017. Habitat adjacent to the survey stations may have become less favourable for Sora and American Bittern. Marsh birds are very sensitive to water levels and may adjust breeding areas to accommodate for differing water levels. Nonetheless, the clearing of vegetation appeared to have no effect on the abundance of marsh birds adjacent to the transmission corridor, whereas yearly changes in marsh bird abundance are potentially caused by fluctuating water levels. Similar to songbirds, it's unclear whether productivity or rates of depredation have been adversely affected by the project.

Table 21: Summary of Yearly and Project-Related Effects on Marsh Birds

Species/Guild	Abundance[1]	
	Impact	Control
American Bittern	-	-
Sora	-	-
Virginia Rail	Nil	Nil
Yellow Rail	Nil	Nil
Total Combined Birds	-	-

[1] The negative symbol represents significant yearly decreases in abundance. No significant interaction effect were observed.

4.3 Crepuscular Birds

Eastern Whip-poor-will abundance has increased between 2014 and 2017, but the increase was consistently observed between both impact and control stations. Based on triangulation of the Eastern Whip-poor-wills, birds recorded in 2017 were in similar locations as those recorded in 2014 and 2015; however, many birds were observed at locations where they had not previously been detected. The results demonstrate that the clearing of vegetation appeared to have no effect on the abundance of Eastern Whip-poor-wills adjacent to the transmission corridor and that populations in the monitoring areas are being sustained and may be experiencing population growth.

4.4 Sharp-tailed Grouse

Sharp-tailed Grouse within the monitoring areas are uncommon. During the 2017 monitoring, only six lekking sites were documented, of which two were within proximity to the transmission corridor (<1 km) and the other four were over 1.6 km from the transmission corridor. Sharp-tailed Grouse occurrences were too few to support any statistical analysis; however, evidence of lekking has been documented near the transmission corridor in section C2 and S1 suggesting Sharp-tailed Grouse have some level of tolerance to the transmission corridor clearing. The clearing areas may also provide new areas for lekking opportunities. The limited sample size of lekking sites will likely prevent the implementation of the proposed study design; however, qualitative and semi-quantitative surveys can still be undertaken to document lekking site activity, and the presence of predatory raptors.

Predatory raptors can be influenced by the construction and installation of transmission line corridors which can provide increased perching and nesting locations and increased line of sight for hunting. Predatory raptors observed during previous surveys have been utilizing all normal habitats within the area; perched or hunting in forested areas, perched on poles, wires and trees in open areas and hunting over fields. Several species known to utilize transmission lines (e.g., Bald Eagle, Red-tailed Hawk, American Kestrel) have been observed within the project boundaries, however, of these only the Red-tailed Hawk is known to prey on Sharp-tailed Grouse. The only raptor directly observed at a Sharp-tailed Grouse lek was a Northern Harrier, a species which does not hunt from perches.

5.0 CLOSURE

This document is intended for the exclusive use of Manitoba Hydro and resource agency representatives, as required, to support Manitoba Hydro’s commitment to undertake a five-year avian monitoring program under the Environment Act Licence for the Bipole III Project. The findings and interpretations are based on the expertise of Amec Foster Wheeler specialists.

If you should have any questions regarding this submittal or require further information, please contact the undersigned at 905-568-2929.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure
a division of Amec Foster Wheeler Americas Limited.

Prepared by:

Jeff Balsdon, M.Sc.
Senior Wildlife Biologist

Reviewed by:

Matt Evans

Matt Evans, Ph.D.
Senior Wildlife Biologist

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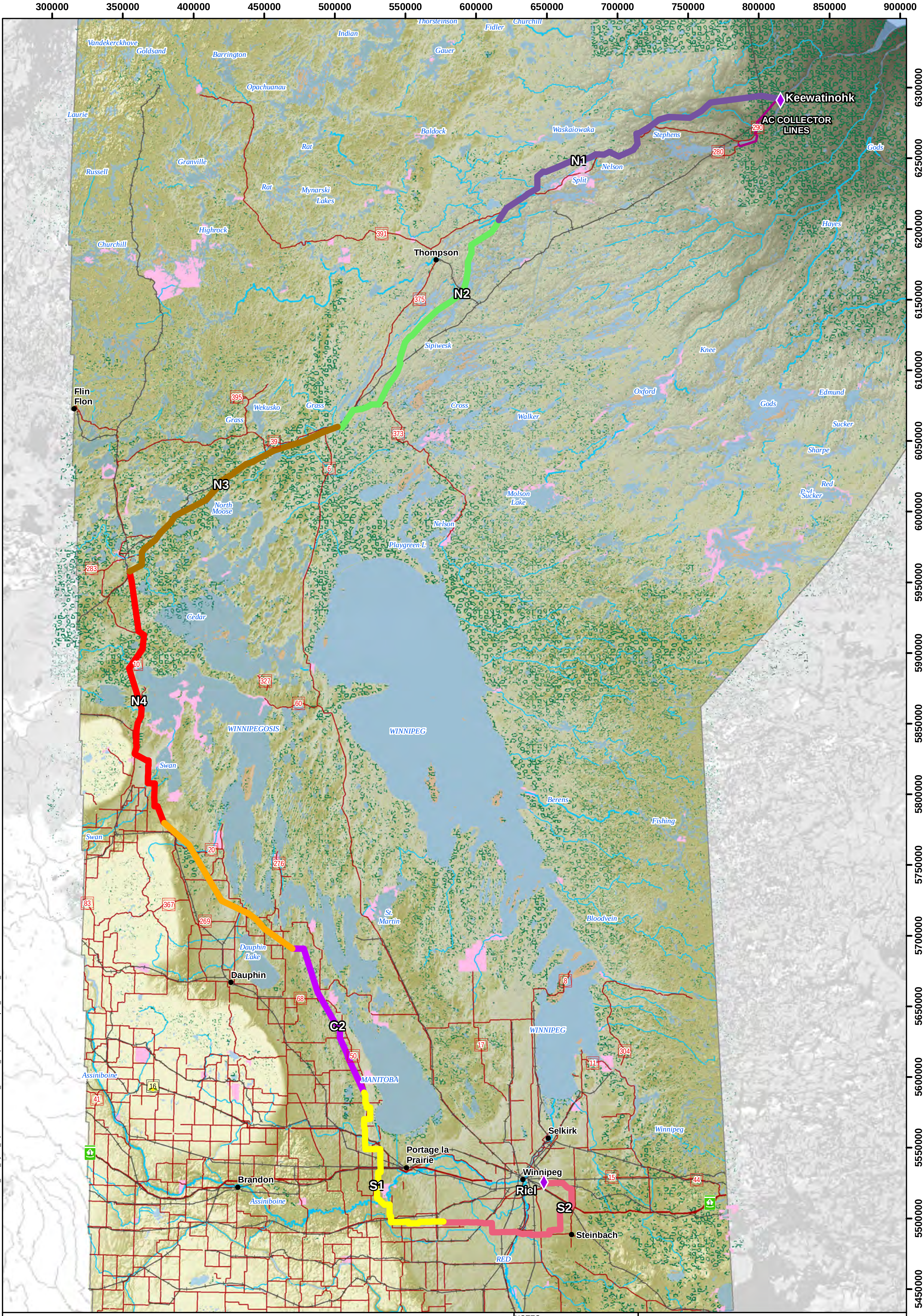
APPENDIX A

FIGURES



LEGEND

Final Preferred Route (FPR)

- Section C1
- Section C2
- Section N1
- Section N2
- Section N3
- Section N4
- Section S1
- Section S2
- Converter Station
- City
- AC Collector Lines
- Major River
- Medium River
- Rail
- Provincial Highway
- First Nations Communities
- Island
- Waterbody
- Wetland

0 50 100 150 200 250 Kilometres

NOTES:
-Topographic data extracted from Manitoba Land Iniative and NRCan.
- DEM extracted from Geobase

Datum: NAD83
Projection: UTM Zone 14N

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Project Location

PROJECT N°: WX17393	**FIGURE: 1**
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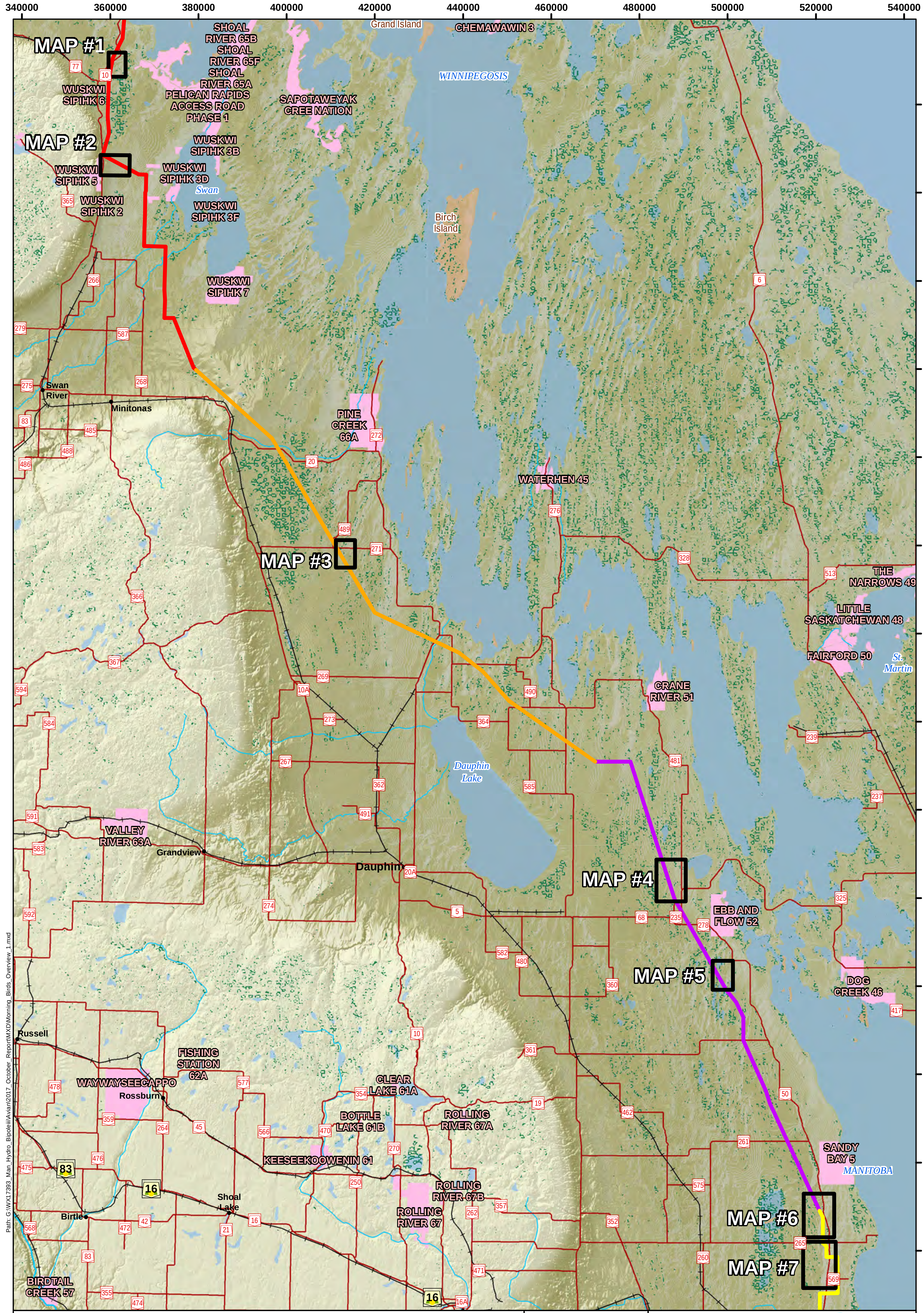

LEGEND

- Songbird Bird Index Map
- Final Preferred Route (FPR)
  - Section C1
  - Section C2
  - Section N4
  - Section S1
- City / Town
- Major River
- Medium River
- Rail
- Provincial Highway
- First Nations Communities
- Island
- Waterbody
- Wetland

0 10 20 30 40 50 Kilometres

NOTES:
- Topographic data extracted from Manitoba Land Iniative and NRCan.
- DEM extracted from Geobase

Datum: NAD83
Projection: UTM Zone 14N

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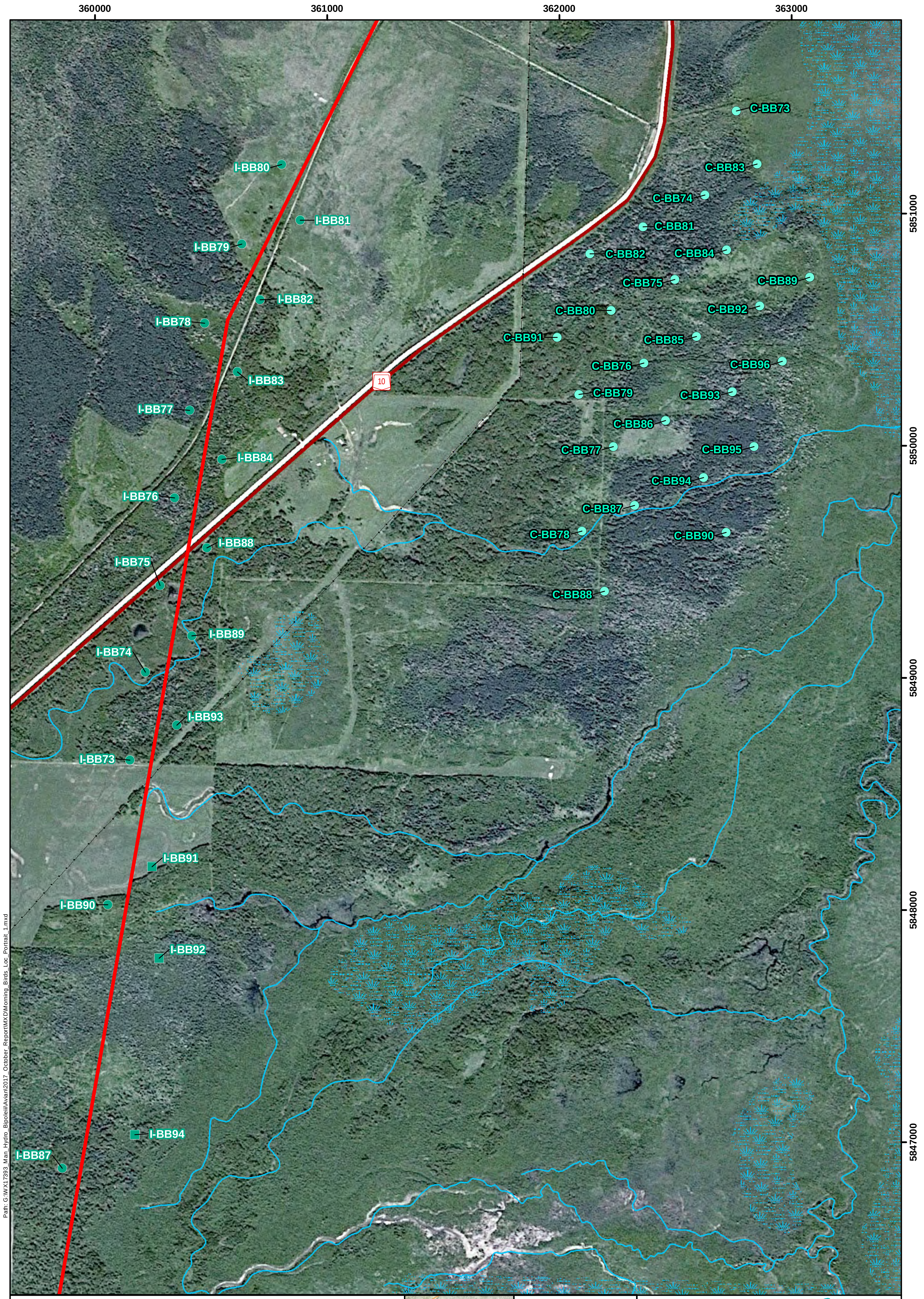
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Songbird Map Overview

PROJECT N^{o}: WX17393	FIGURE: 2
SCALE: 1:800,000	DATE: May 2018



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LEGEND

Final Preferred Route (FPR)

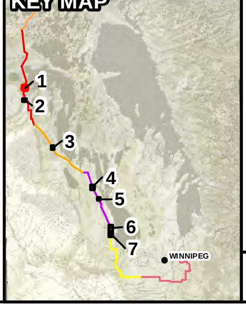
Section N4

Songbird Survey Locations

- Control Stations (Surveyed in 2015)
- Impact Stations (Surveyed in 2015)
- Impact Stations (Not surveyed in 2015)

- Utility corridor
- Provincial Highway
- Watercourse
- Waterbody
- Island
- Wetland

KEY MAP



NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 0.5 1 1.5 2 Kilometres

N E S W

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Songbird Survey Stations

PROJECT N^{o}: WX17393	**FIGURE: 2-1**
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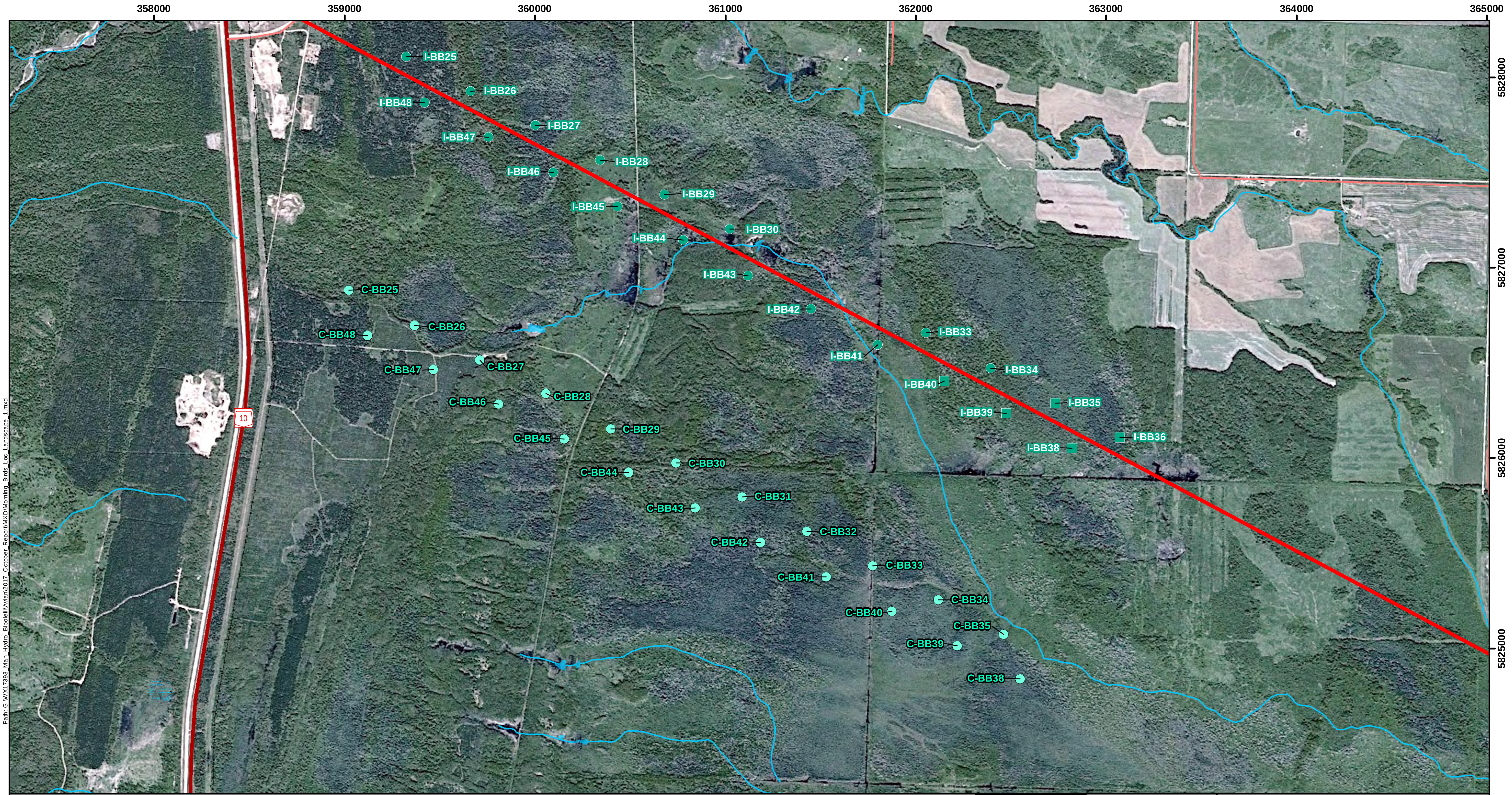

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LEGEND

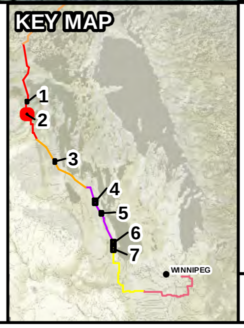
Final Preferred Route (FPR)
- Section N4

Songbird Survey Locations
- Control Stations (Surveyed in 2015)
- Impact Stations (Surveyed in 2015)
- Impact Stations (Not surveyed in 2015)

- Utility corridor
- Provincial Highway
- Provincial Road
- Watercourse
- Waterbody
- Island
- Wetland

0 1 2 3 4 Kilometres

KEY MAP



NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted under Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Songbird Survey Stations

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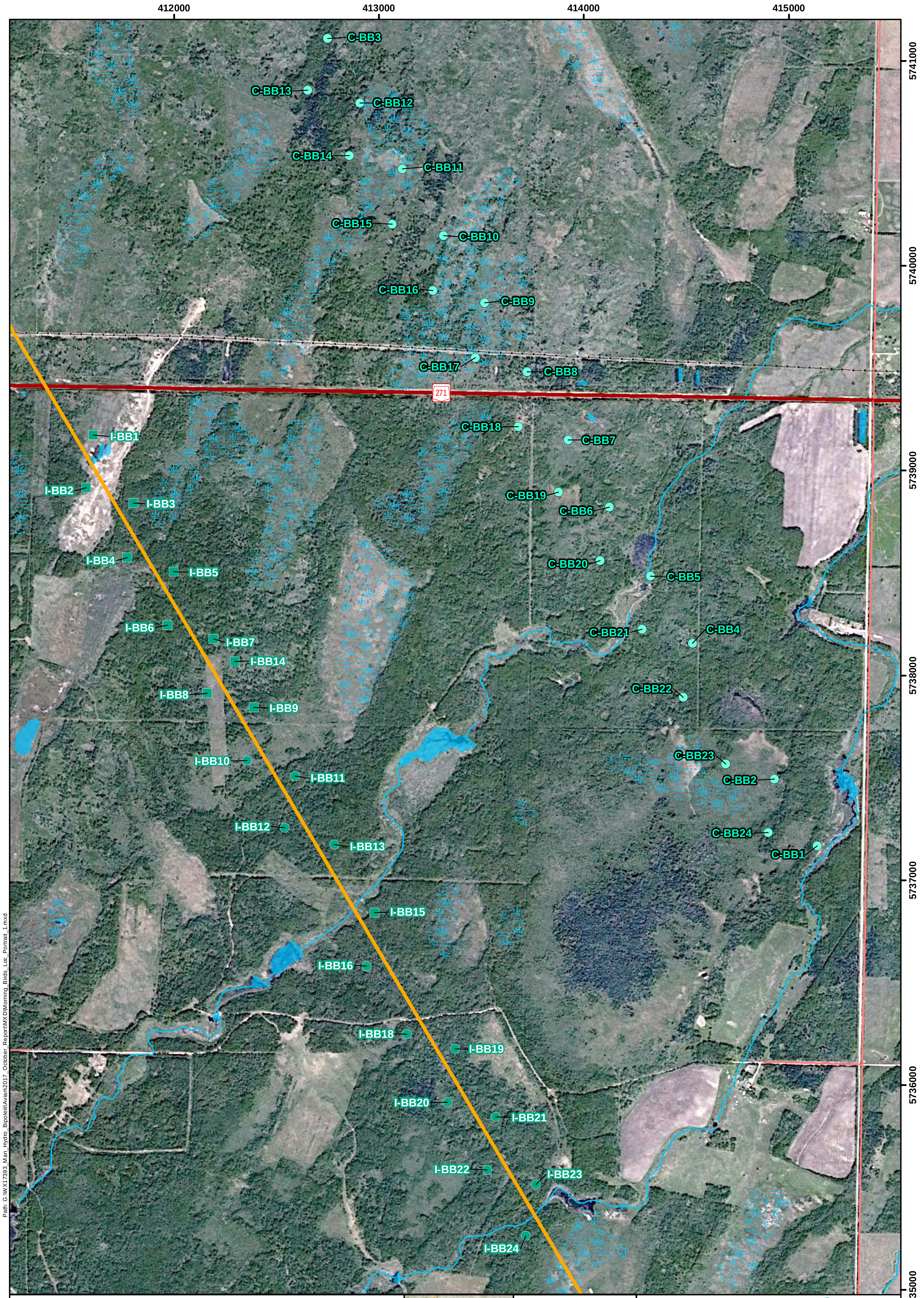

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LEGEND

Final Preferred Route (FPR)

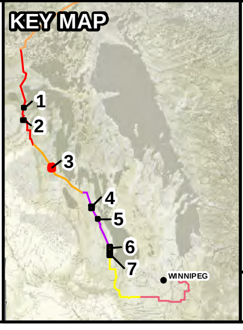
- **Section C1**

Songbird Survey Locations

- **Control Stations (Surveyed in 2015)**
- **Impact Stations (Surveyed in 2015)**
- **Impact Stations (Not surveyed in 2015)**

- **Utility corridor**
- **Provincial Highway**
- **Provincial Road**
- **Watercourse**
- **Waterbody**
- **Island**
- **Wetland**

KEY MAP



NOTES:
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- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N W E S

0 0.5 1 1.5 2 Kilometres

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Songbird Survey Stations

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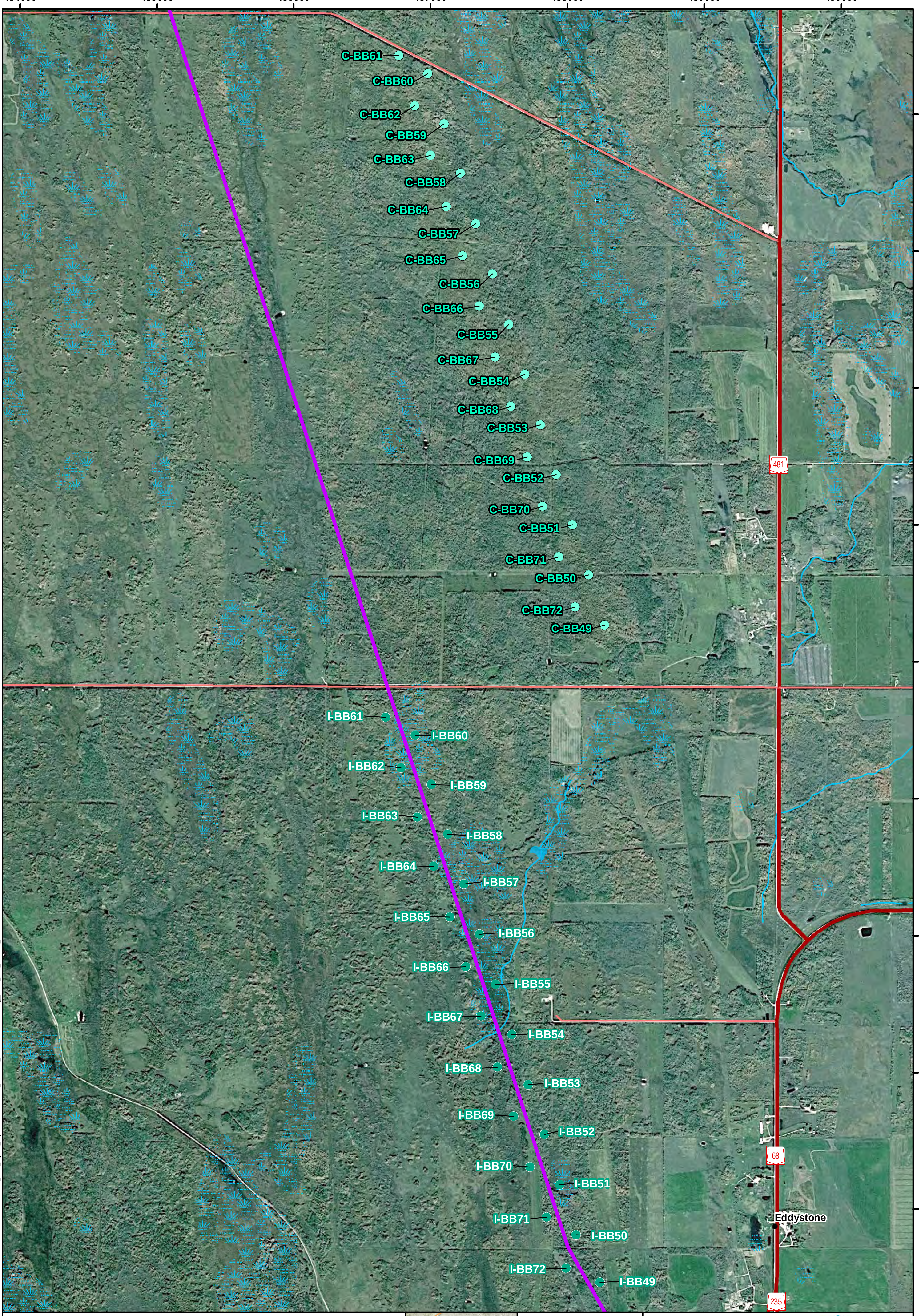


LEGEND

Final Preferred Route (FPR)

Section C2

Songbird Survey Locations

Control Stations (Surveyed in 2015)

Impact Stations (Surveyed in 2015)

Utility corridor

Provincial Highway

Provincial Road

Watercourse

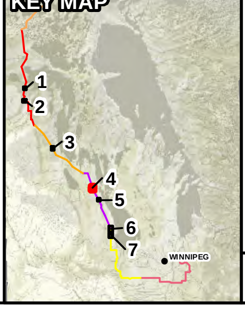
Waterbody

Island

Wetland

0 0.5 1 1.5 2 Kilometres

KEY MAP



NOTES:
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- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N E S W

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Songbird Survey Stations

PROJECT N^{o}: WX17393	**FIGURE: 2-4**
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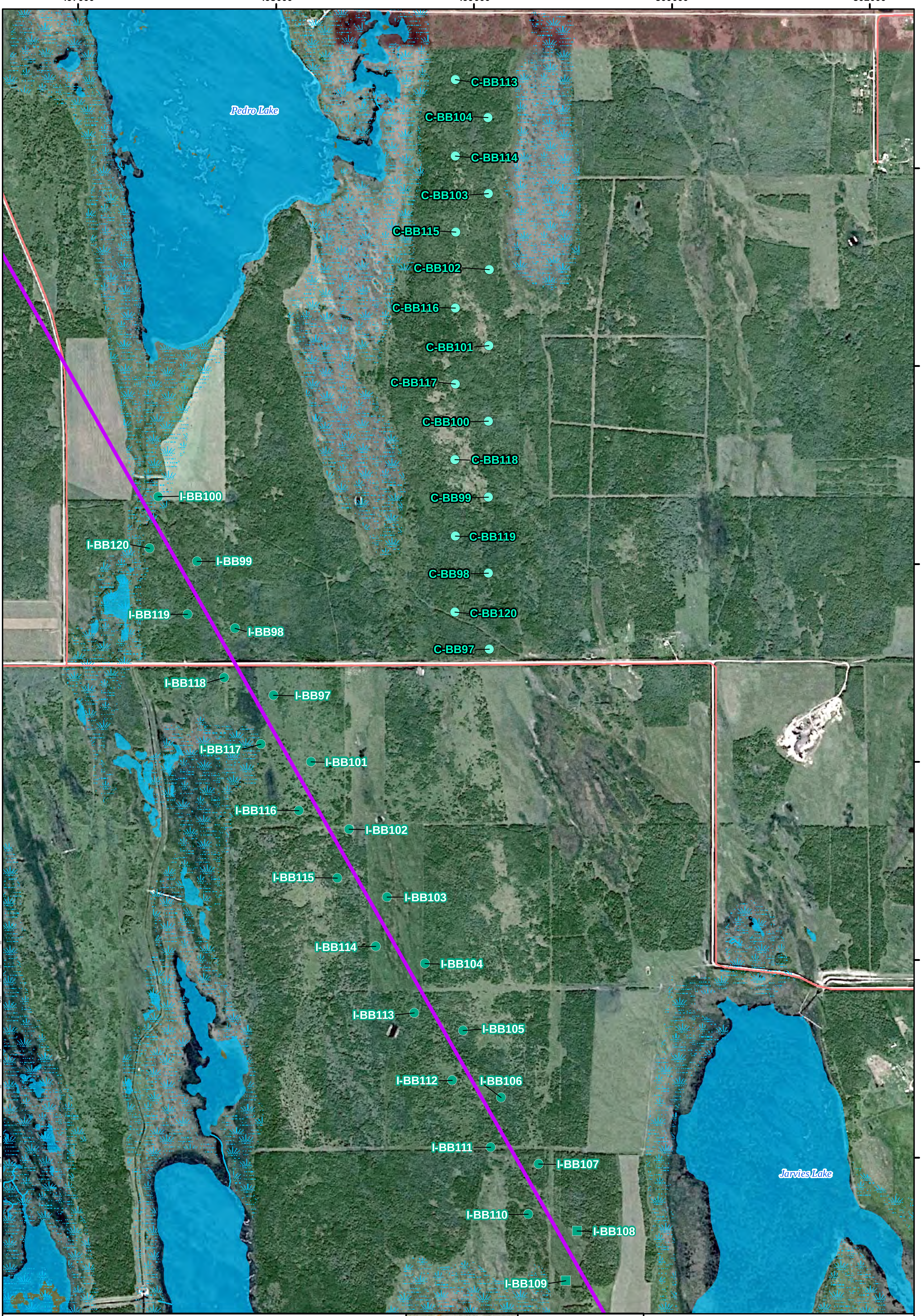

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LEGEND

Final Preferred Route (FPR)

Section C2

Songbird Survey Locations

- Control Stations (Surveyed in 2015)
- Impact Stations (Surveyed in 2015)
- Impact Stations (Not surveyed in 2015)

- Utility corridor
- Provincial Road
- Watercourse
- Waterbody
- Island
- Wetland

KEY MAP

1 2 3 4 5 6 7 WINNIPEG

NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 0.5 1 1.5 2 Kilometres

amec foster wheeler

MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Songbird Survey Stations

PROJECT N^{0}: WX17393	**FIGURE: 2-5**
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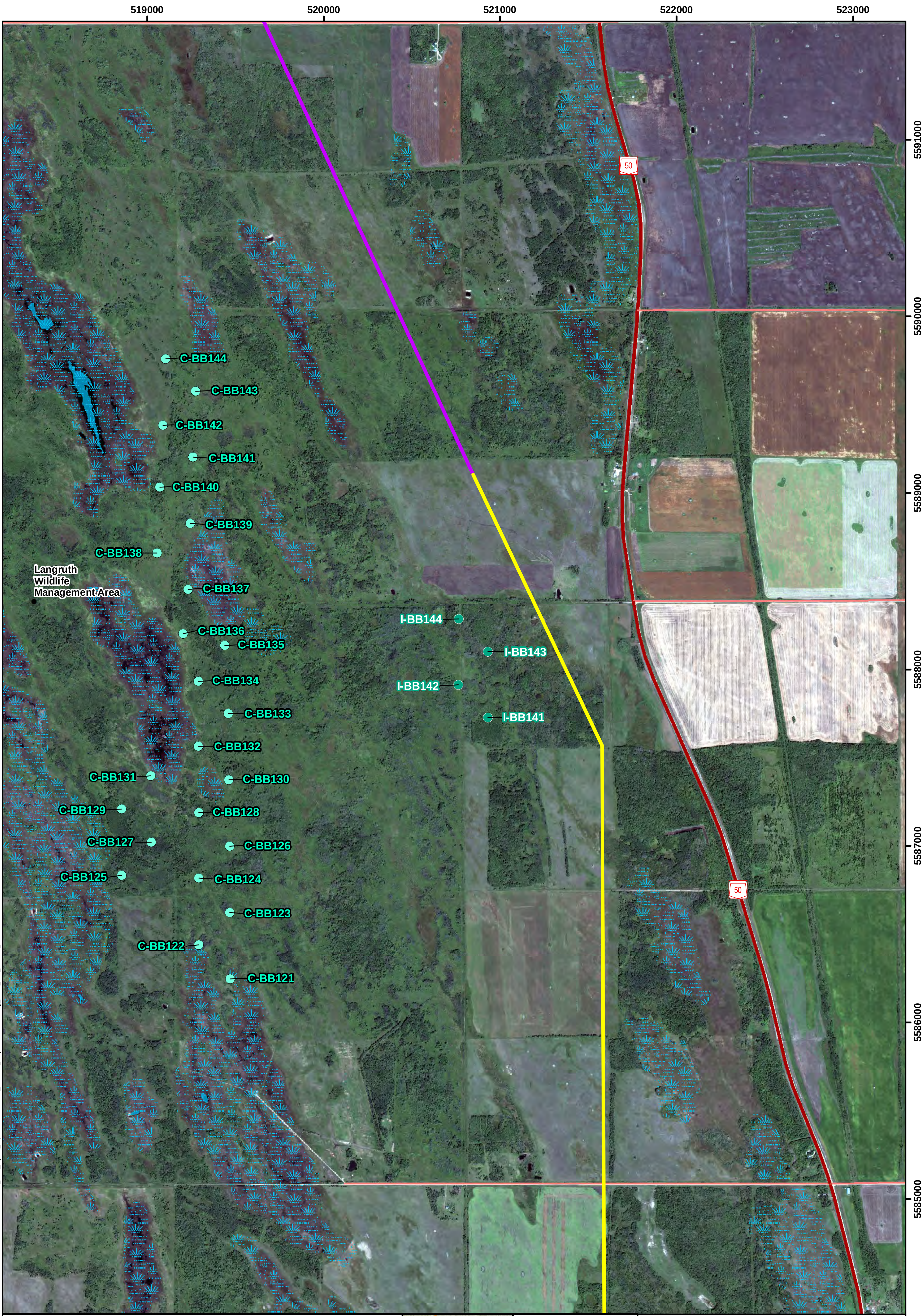

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LEGEND

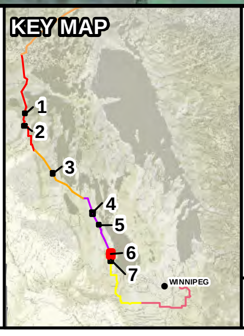
Final Preferred Route (FPR)

- Section C2
- Section S1

Songbird Survey Locations

- Control Stations (Surveyed in 2015)
- Impact Stations (Surveyed in 2015)

- Utility corridor
- Provincial Highway
- Provincial Road
- Watercourse
- Waterbody
- Island
- Wetland



NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

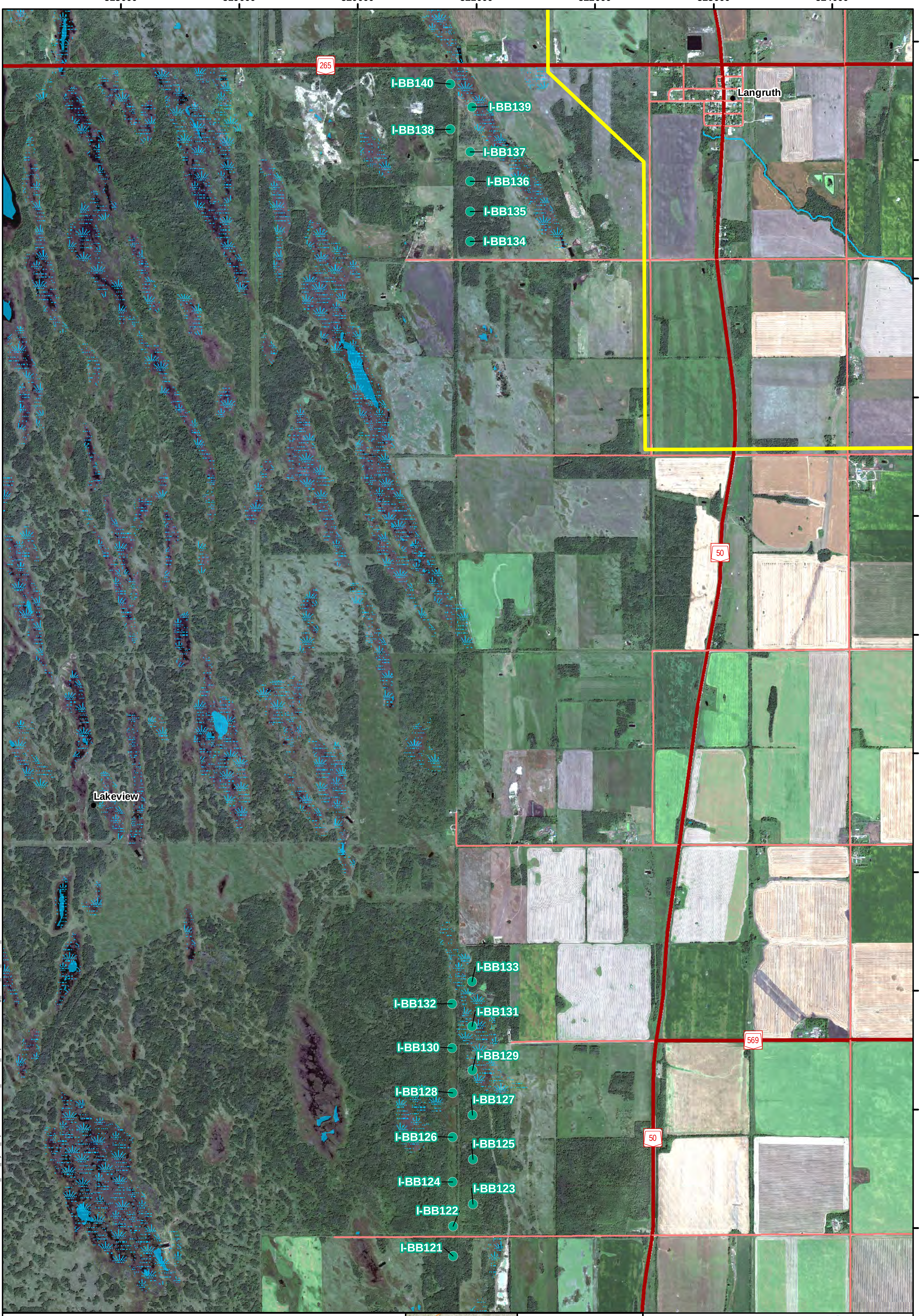
0 0.5 1 1.5 2 Kilometres

amec foster wheeler

MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Songbird Survey Stations

PROJECT N[0]: WX17393	FIGURE: 2-6
SCALE: 1:20,000	DATE: May 2018



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\Morning_Birds_Loc_Portrait_1.mxd

LEGEND

Final Preferred Route (FPR)

- Section S1

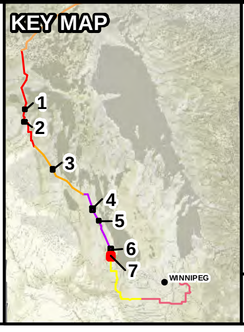
Songbird Survey Locations

- Impact Stations (Surveyed in 2015)

- Utility corridor
- Provincial Highway
- Provincial Road
- Watercourse
- Waterbody
- Island
- Wetland

0 0.5 1 1.5 2 Kilometres

KEY MAP



NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

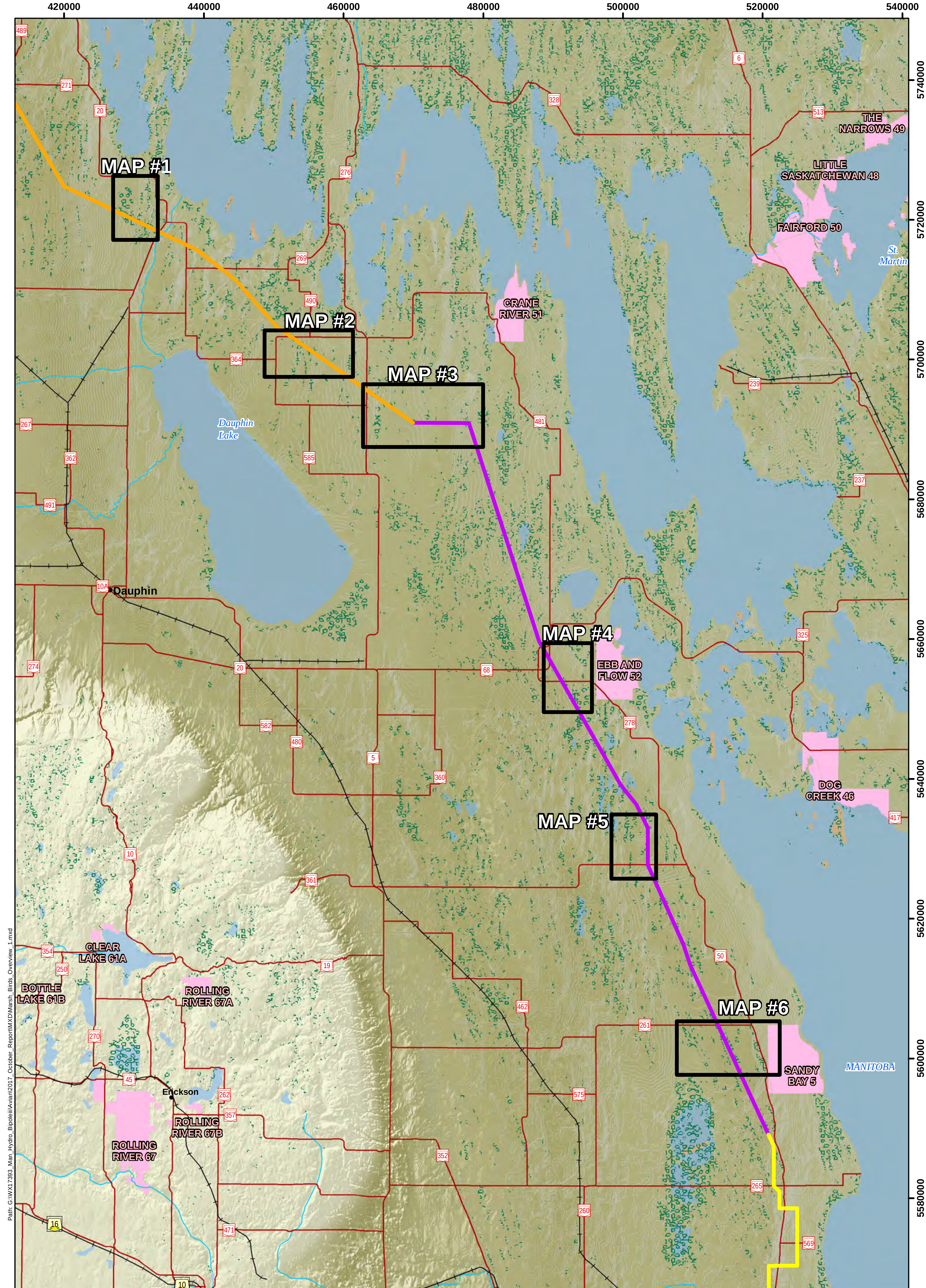
Datum: NAD83
Projection: UTM Zone 14N

amec foster wheeler

MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Songbird Survey Stations

PROJECT N°: WX17393	FIGURE: 2-7
SCALE: 1:30,000	DATE: May 2018



LEGEND

- Marsh Bird Index Map
- Final Preferred Route (FPR)
  - Section C1
  - Section C2
  - Section S1
- City / Town
- Medium River
- Rail
- Provincial Highway
- First Nations Communities
- Island
- Waterbody
- Wetland

0 10 20 30 40 50 Kilometres

NOTES:
- Topographic data extracted from Manitoba Land Iniative and NRCan.
- DEM extracted from Geobase

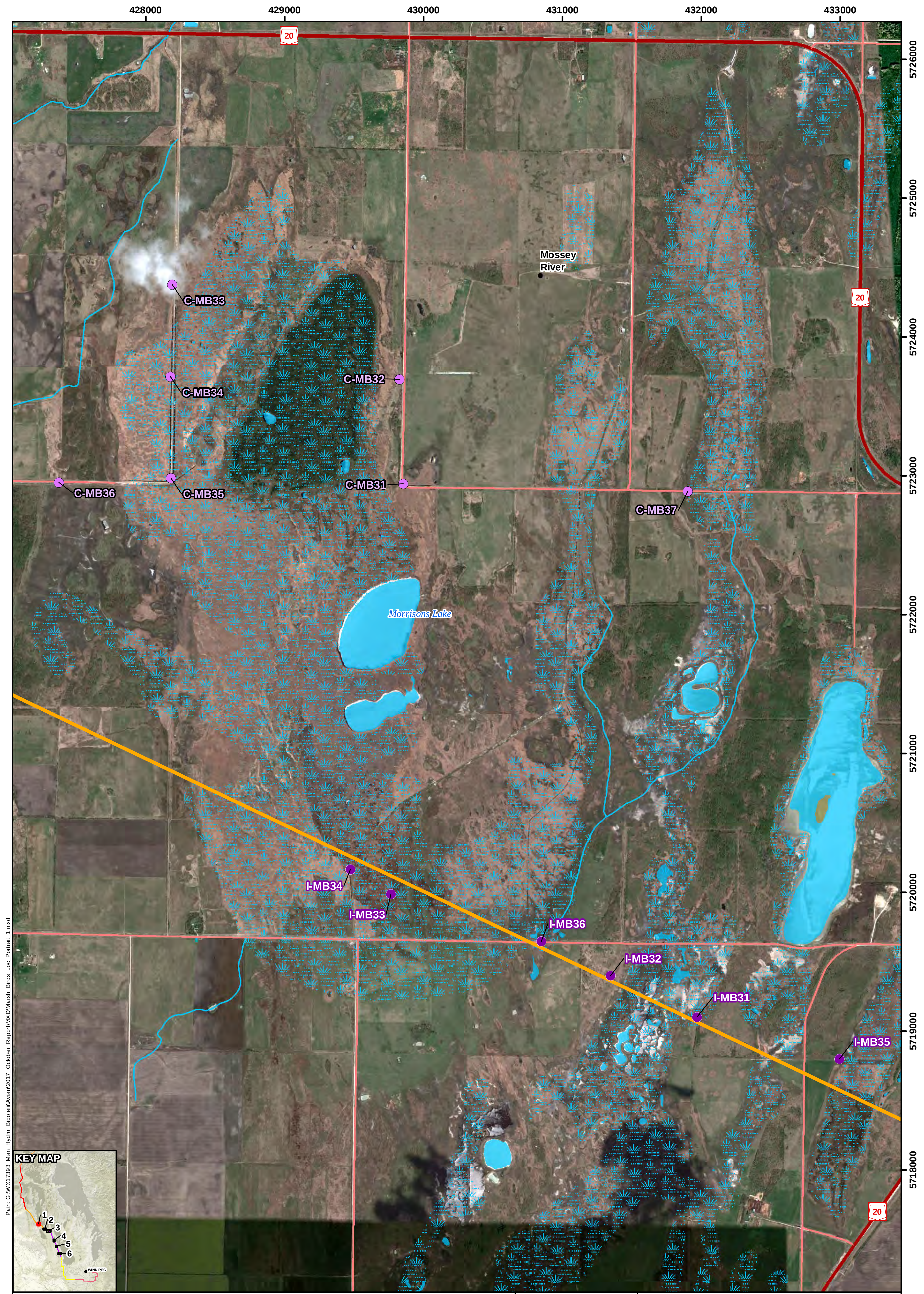
Datum: NAD83
Projection: UTM Zone 14N

amec foster wheeler

MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Marsh Birds Map Overview

PROJECT N^{o}: WX17393	**FIGURE: 3**
SCALE: 1:500,000	DATE: May 2018



LEGEND

Final Preferred Route (FPR)

Section C1

Marsh Bird Survey Stations

Control Stations (Surveyed in 2015)

Impact Stations (Surveyed in 2015)

Provincial Highway

Provincial Road

Watercourse

Wetland

Waterbody

Island

NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 1 2 3 4 Km

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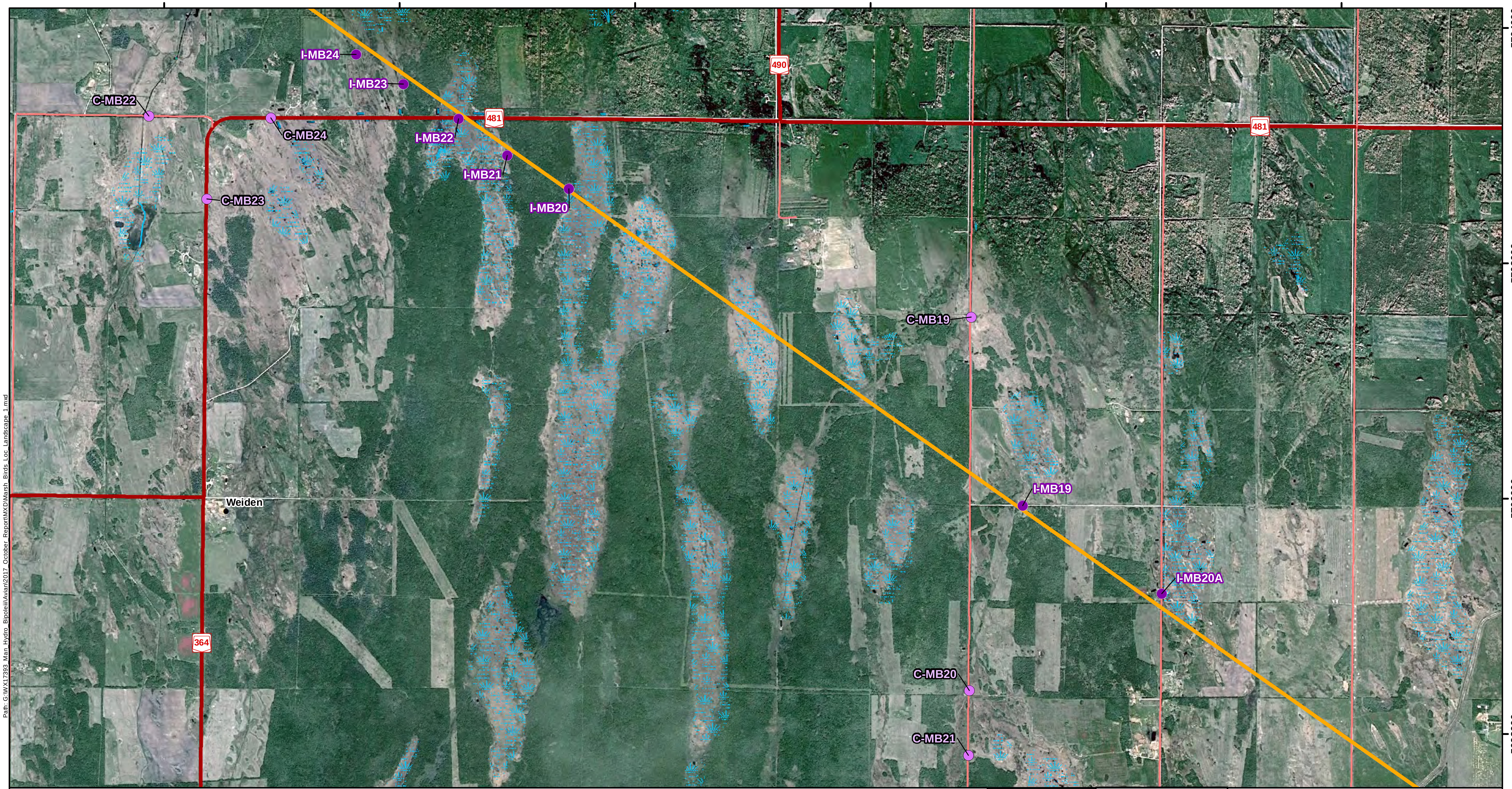
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Marsh Bird Survey Stations

PROJECT N°: WX17393	**FIGURE: 3-1**
SCALE: 1:25,000	DATE: May 2018



Path: G:\WX17393_Man_Hydro_Bipoleiii\Avian\2017_October_Report\MXD\Marsh_Birds_Loc_Landscape_1.mxd

LEGEND

Final Preferred Route (FPR)

Section C1

Marsh Bird Survey Stations

Control Stations (Surveyed in 2015)

Impact Stations (Surveyed in 2015)

Provincial Highway

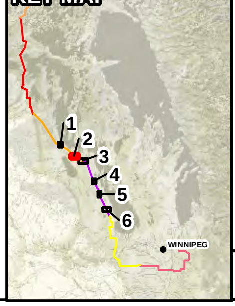
Provincial Road

Watercourse

Wetland

Waterbody

KEY MAP



NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N
W
E
S

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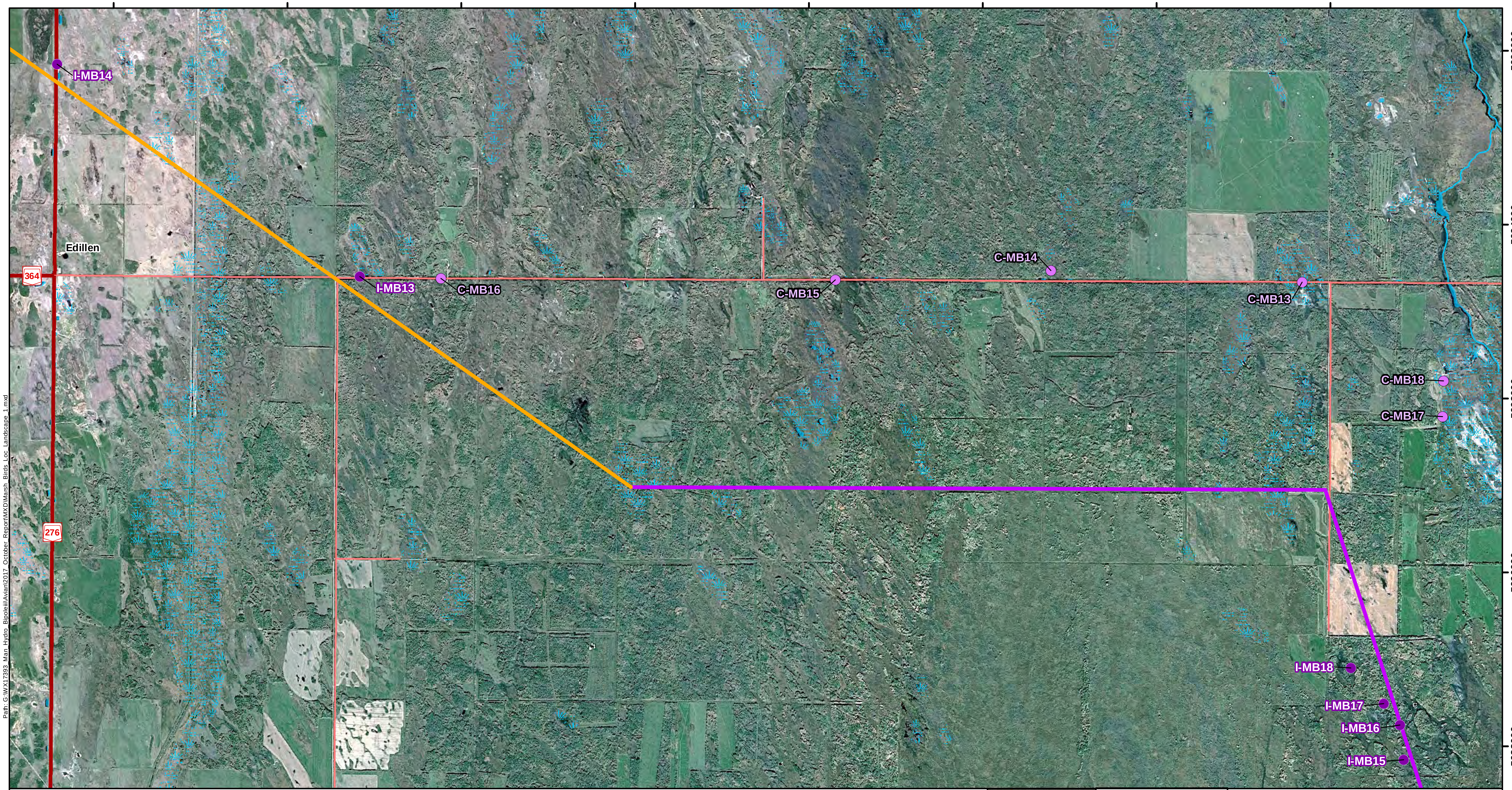
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Marsh Bird Survey Stations

PROJECT Nº: WX17393	**FIGURE: 3-2**
SCALE: 1:31,000	DATE: May 2018



Path: G:\WX17393_Man_Hydro_Bipoleiii\Avian\2017_October_Report\MXD\Marsh_Birds_Loc_Landscape_1.mxd

LEGEND

Final Preferred Route (FPR)

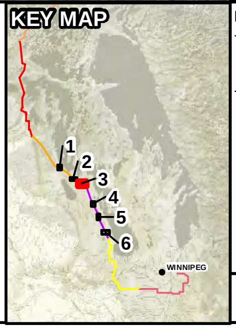
- **Section C1**
- **Section C2**

Marsh Bird Survey Stations

- **Control Stations (Surveyed in 2015)**
- **Impact Stations (Surveyed in 2015)**

- **Provincial Highway**
- **Provincial Road**
- **Watercourse**
- **Wetland**
- **Waterbody**

0 1 2 3 4 5 Kilometres



NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N S W E

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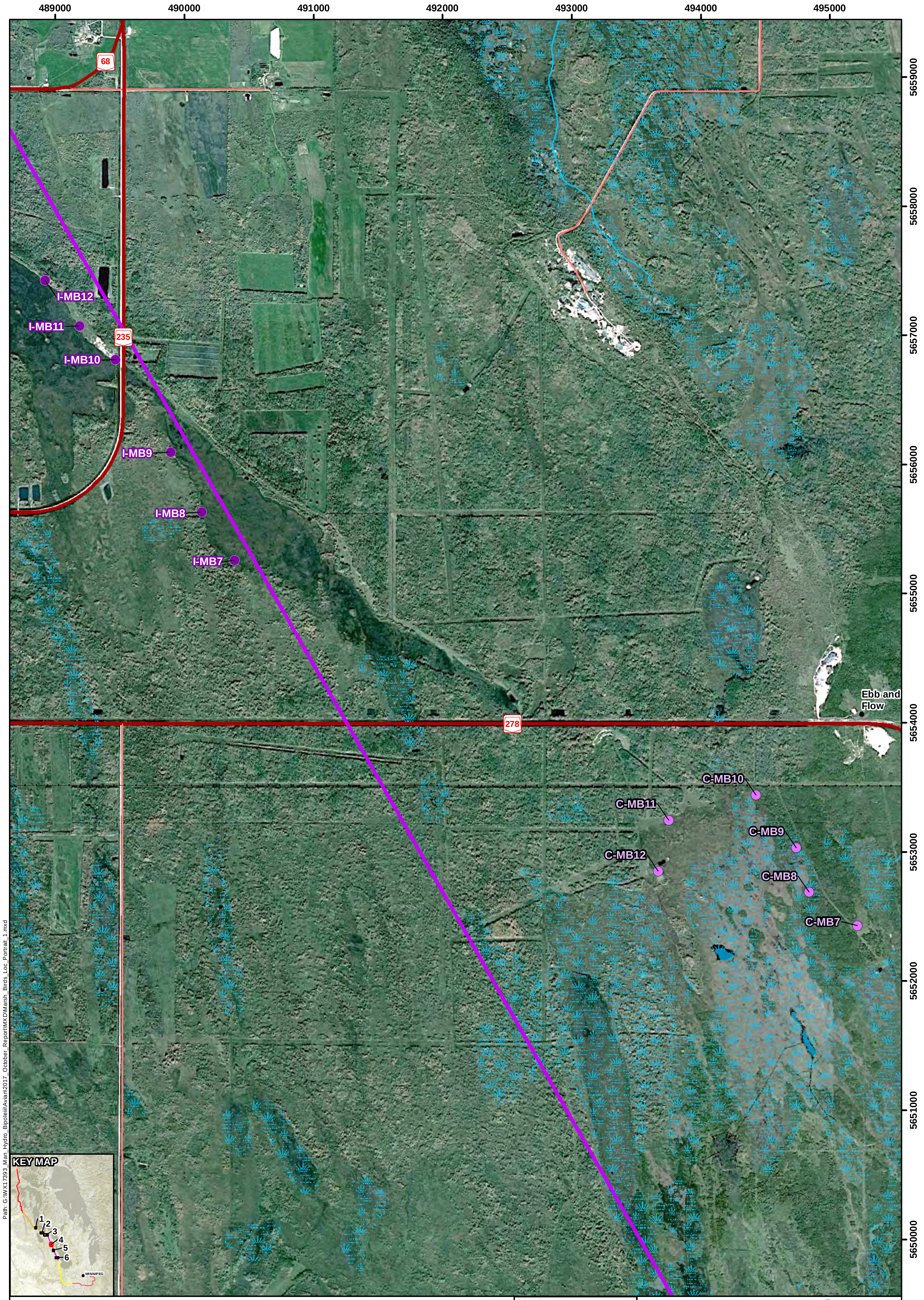
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Marsh Bird Survey Stations

PROJECT N^{0}: WX17393	**FIGURE: 3-3**
SCALE: 1:42,000	DATE: May 2018



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\Marsh_Birds_Loc_Portrait_1.mxd

LEGEND

Final Preferred Route (FPR)
- Section C2

Marsh Bird Survey Stations
- Control Stations (Surveyed in 2015)
- Impact Stations (Surveyed in 2015)

- Utility corridor
- Provincial Highway
- Provincial Road
- Watercourse
- Wetland
- Waterbody

NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 1 2 3 4 Km

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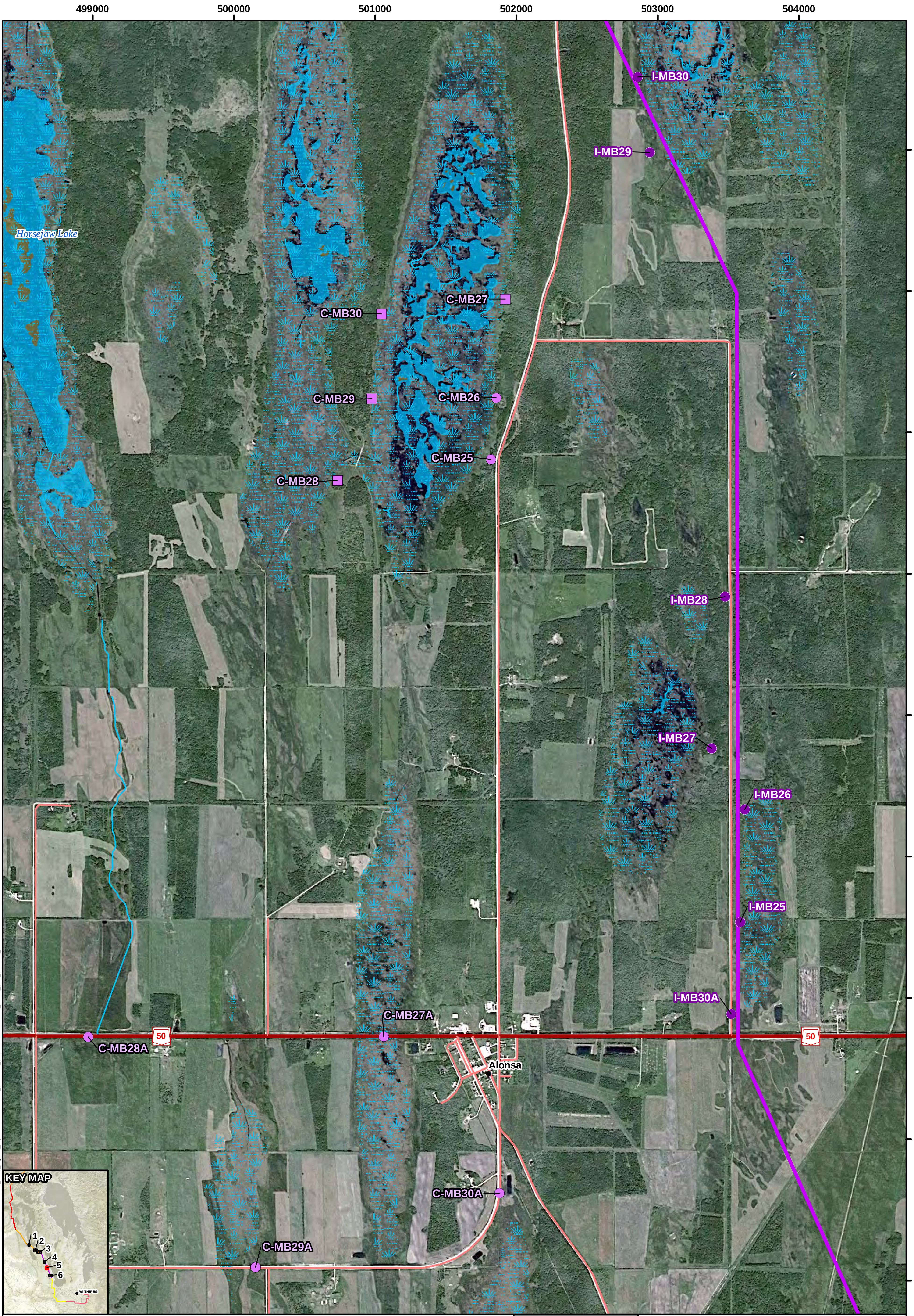
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Marsh Bird Survey Stations

PROJECT N°: WX17393	**FIGURE: 3-4**
SCALE: 1:27,000	DATE: May 2018



LEGEND

Final Preferred Route (FPR)

- Section C2

Marsh Bird Survey Stations

- Control Stations (Surveyed in 2015)
- Control Stations (Not surveyed in 2015)
- Impact Stations (Surveyed in 2015)

- Provincial Highway
- Provincial Road
- Watercourse
- Wetland
- Waterbody
- Island

NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

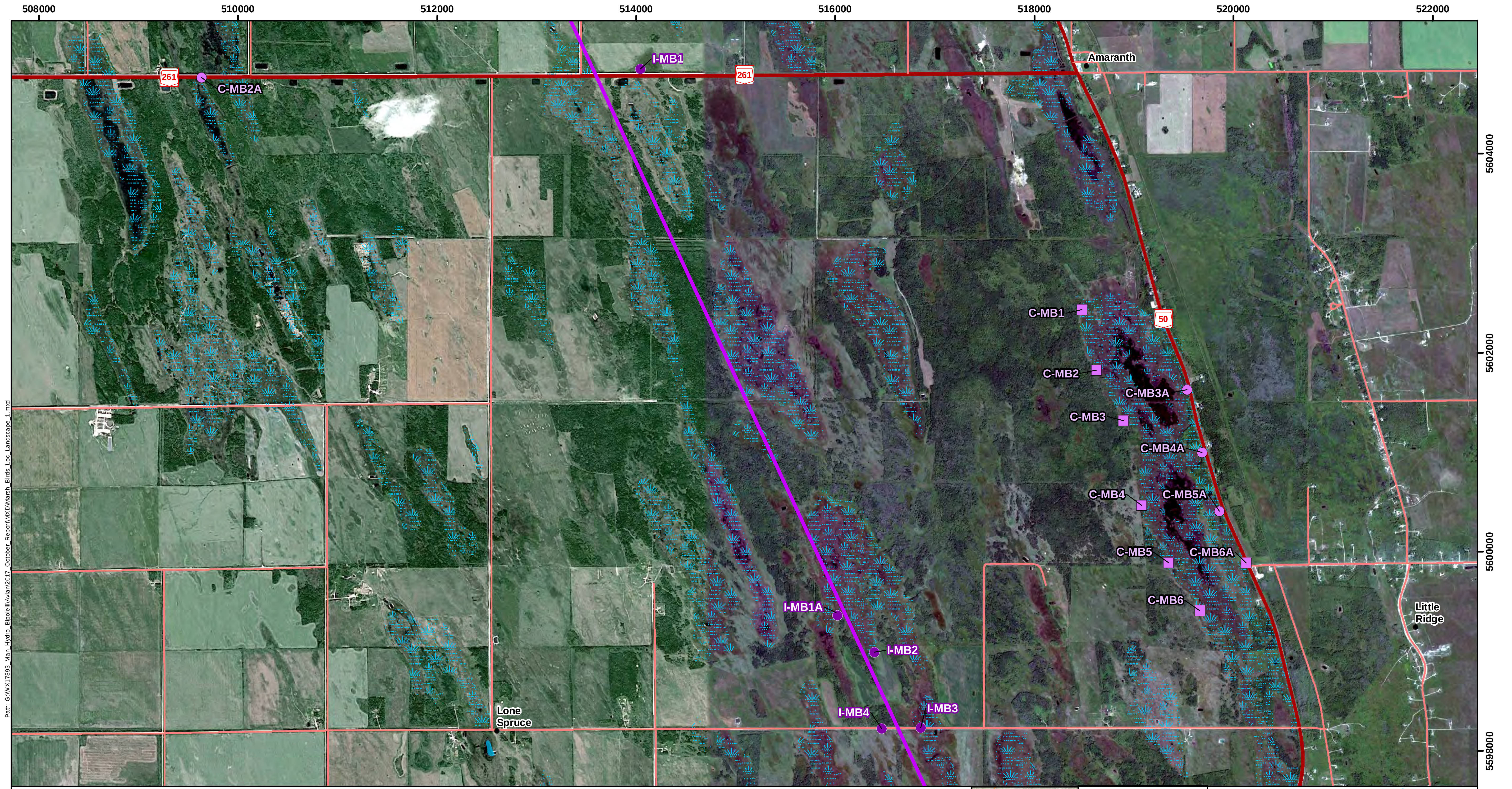
0 1 2 3 4 Km

amec foster wheeler

MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Marsh Bird Survey Stations

PROJECT N^{o}: WX17393	**FIGURE: 3-5**
SCALE: 1:25,000	DATE: May 2018



LEGEND

Final Preferred Route (FPR)

Section C2

Marsh Bird Survey Stations

Control Stations (Surveyed in 2015)

Control Stations (Not surveyed in 2015)

Impact Stations (Surveyed in 2015)

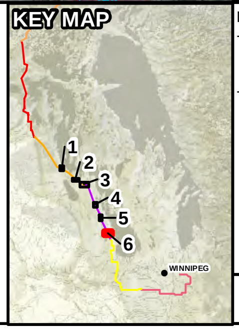
Provincial Highway

Provincial Road

Wetland

Waterbody

0 1 2 3 4 5 Kilometres



NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

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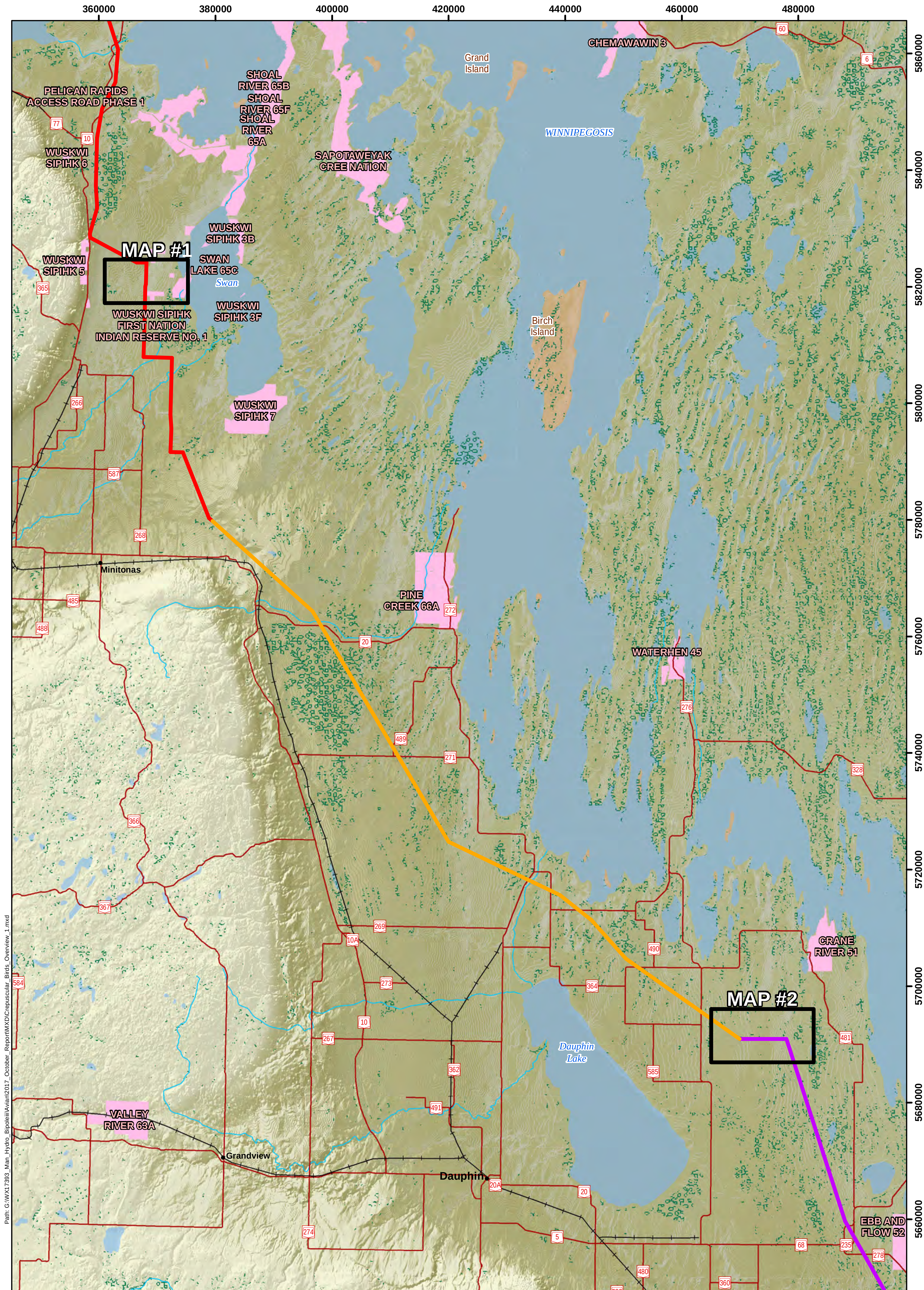
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Marsh Bird Survey Stations

PROJECT N°: WX17393	FIGURE: 3-6
SCALE: 1:36,000	DATE: May 2018



LEGEND

- Crepuscular Bird Index Map

Final Preferred Route (FPR)

- Section C1
- Section C2
- Section N4
- City / Town
- Medium River
- Rail
- Provincial Highway
- First Nations Communities
- Island
- Waterbody
- Wetland

0 10 20 30 40 50 Kilometres

NOTES:
-Topographic data extracted from Manitoba Land Iniative and NRCan.
- DEM extracted from Geobase

Datum: NAD83
Projection: UTM Zone 14N

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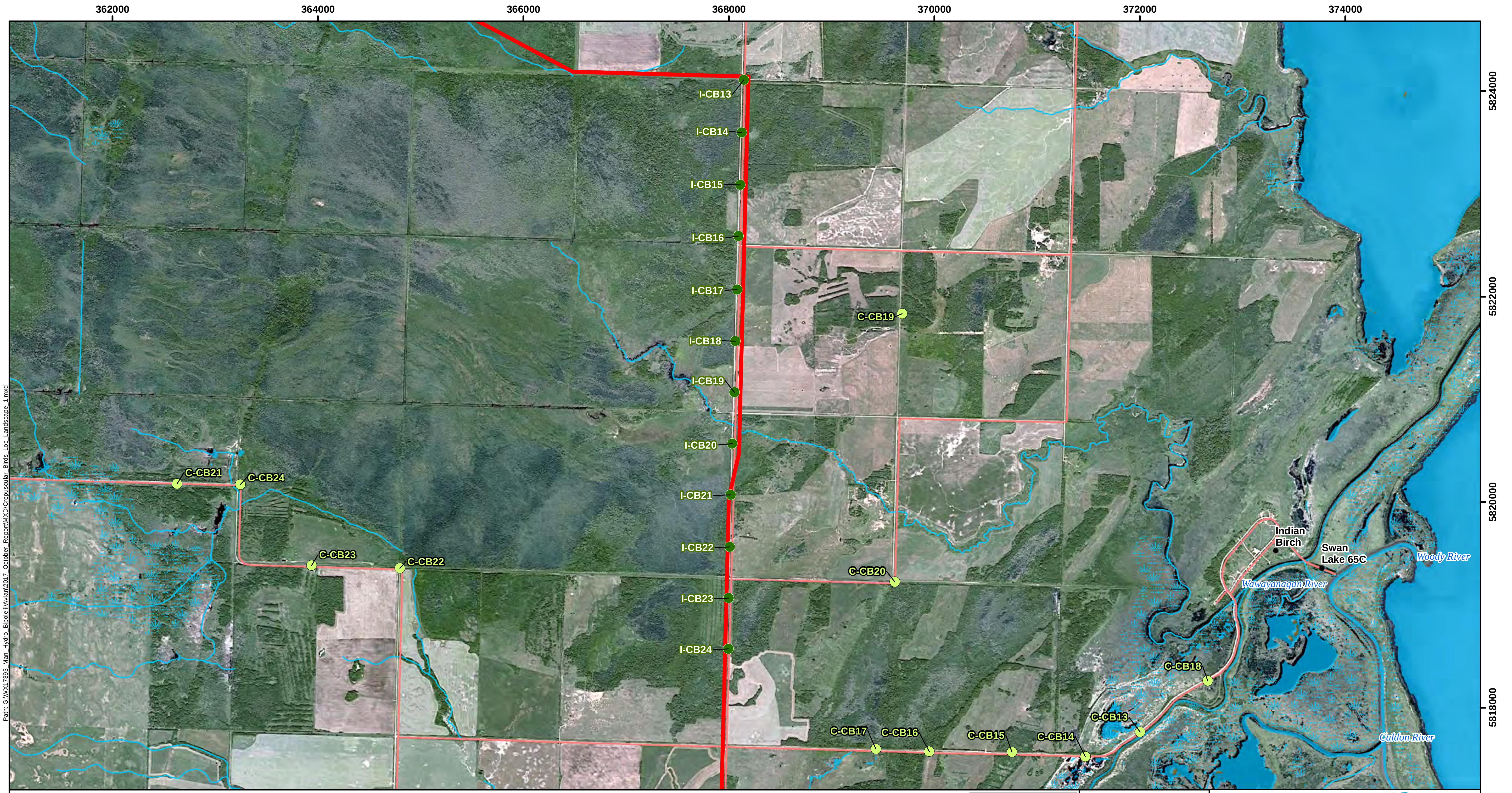
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Crepuscular Birds Map Overview

PROJECT N^{o}: WX17393	**FIGURE: 4**
SCALE: 1:600,000	DATE: May 2018



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\Crepuscular_Birds_Loc_Landscape_1.mxd

LEGEND

Final Preferred Route (FPR)

Section N4

Crepuscular Bird Survey Locations

Control Stations

Impact Stations

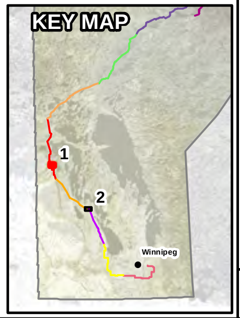
Provincial Road

Watercourse

Wetland

Waterbody

Island



NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 2 4 6 8 10 Kilometres

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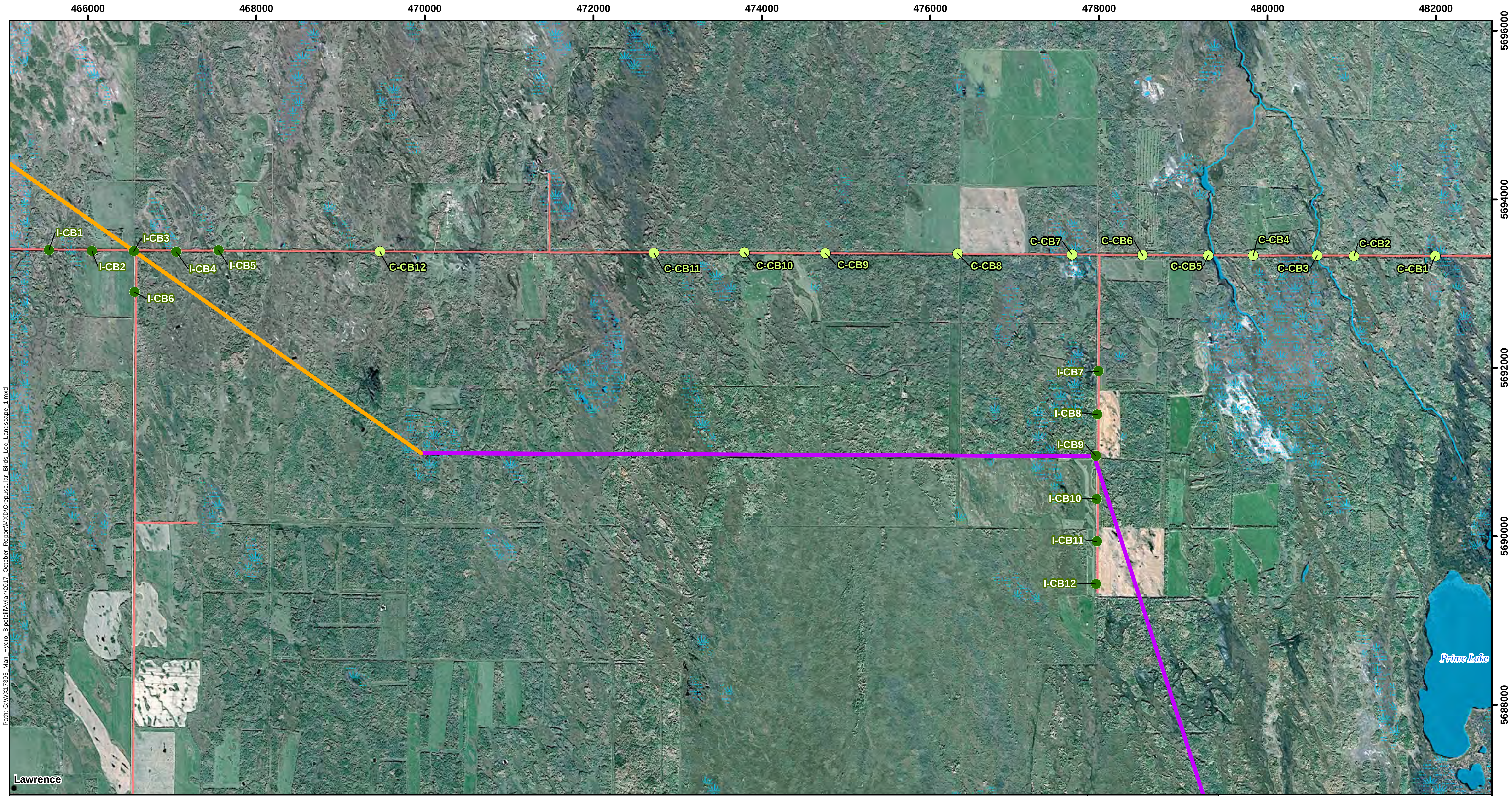
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Crepuscular Bird Survey Stations

PROJECT N°: WX17393	**FIGURE: 4-1**
SCALE: 1:35,000	DATE: May 2018



Path: G:\WX17393_Man_Hydro_BipoleIII\Avian\2017_October_Report\MXD\Crepuscular_Birds_Loc_Landscape_1.mxd

LEGEND

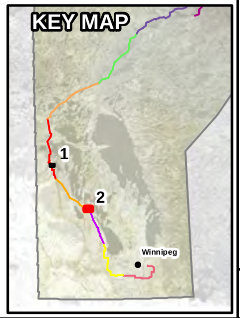
Final Preferred Route (FPR)

- **Section C1**
- **Section C2**

Crepuscular Bird Survey Locations

- **Control Stations**
- **Impact Stations**

- **Provincial Road**
- **Watercourse**
- **Wetland**
- **Waterbody**



NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 2 4 6 8 10 Kilometres

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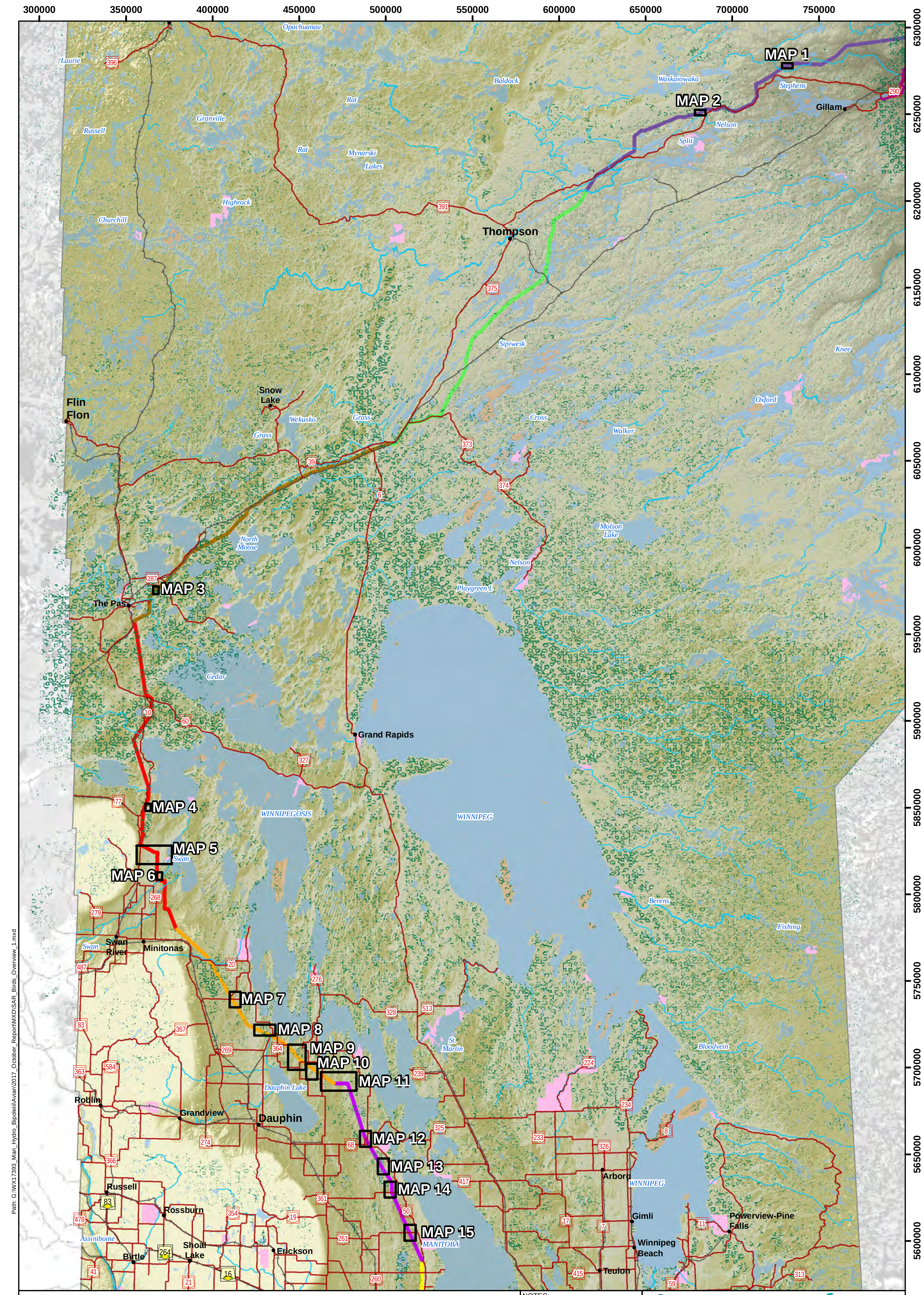
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Crepuscular Bird Survey Stations

PROJECT N°: WX17393	**FIGURE: 4-2**
SCALE: 1:43,000	DATE: May 2018



LEGEND

- Species at Risk Index
- Final Preferred Route (FPR)
  - Section C1
  - Section C2
  - Section N1
  - Section N2
  - Section N3
  - Section N4
  - Section S1
- City / Town
- Major River
- Medium River
- Rail
- Provincial Highway
- Indian Reserve
- Island
- Waterbody
- Wetland

0 40 80 120 160 200 Kilometres

NOTES:
-Topographic data extracted from Manitoba Land Iniative and NRCan.
- DEM extracted from Geobase

Datum: NAD83
Projection: UTM Zone 14N

Manitoba Hydro

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Map Overview

PROJECT N^{o}: WX17393	**FIGURE: 5**
SCALE: 1:2,000,000	DATE: December 2017

Path: G:\WX17393 Man Hydro Bipoleiii\Avian\2017 October Report\MXD\SAR results 2017 Landscape 2.mxd

LEGEND

2014 Species at Risk Observations

- TRUS - Trumpeter Swan

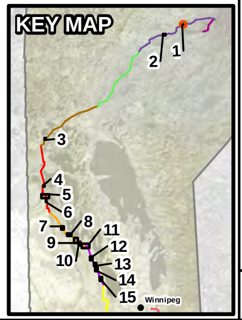
2015 Species at Risk Observations

2017 Species at Risk Observations

Final Preferred Route (FPR)

- Section N1

KEY MAP



NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N W E S

0 1 2 3 4 Kilometres

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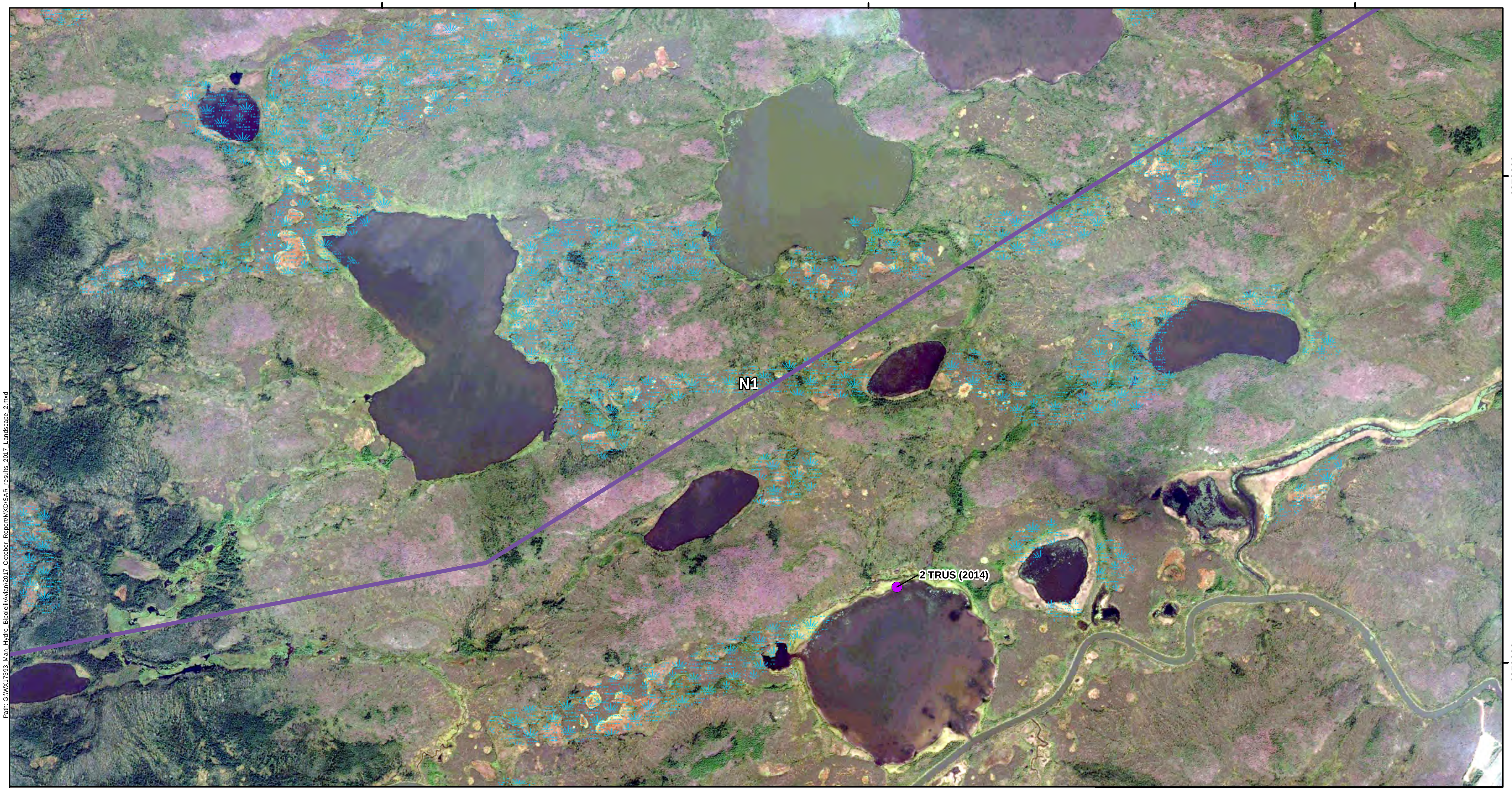
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N°: WX17393	**FIGURE: 5-1**
SCALE: 1:15,000	DATE: December 2017

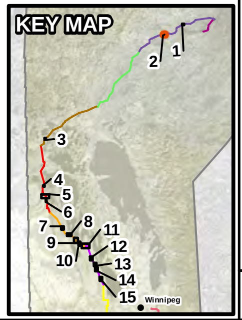
Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\SAR_results_2017_Landscape_2.mxd



LEGEND

2014 Species at Risk Observations	2015 Species at Risk Observations	2017 Species at Risk Observations	Final Preferred Route (FPR)
TRUS - Trumpeter Swan			Section N1

KEY MAP



NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N
W E
S

0 1 2 3 4 Kilometres

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

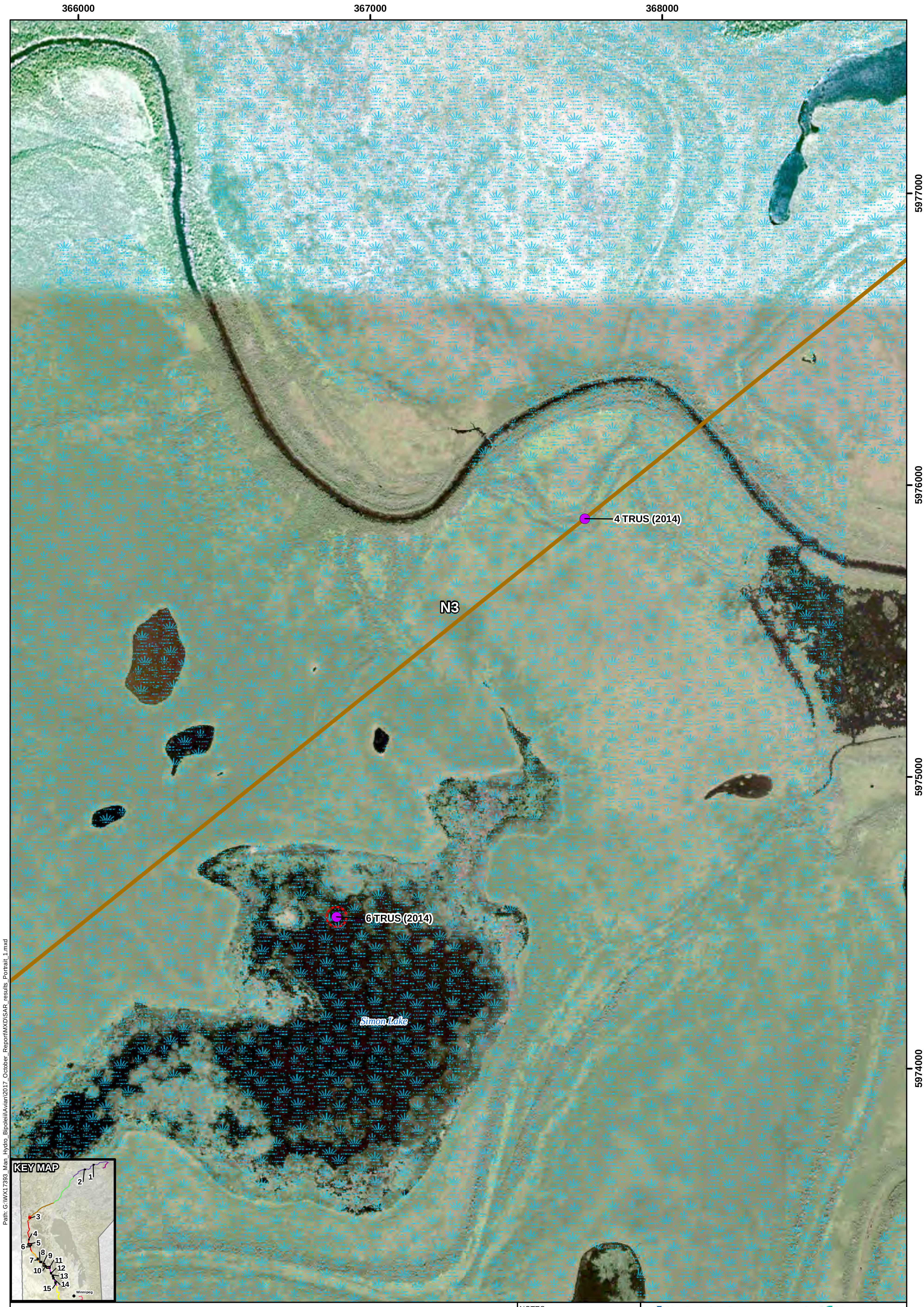
Species at Risk Observations

PROJECT N°: WX17393

FIGURE: 5-2

SCALE: 1:15,000

DATE: December 2017



LEGEND

2014 Species at Risk Observations

- TRUS - Trumpeter Swan
- Bird Nest

2015 Species at Risk Observations

2017 Species at Risk Observations

Final Preferred Route (FPR)

- Section N3
- Wetland

NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 0.5 1 1.5 Kilometres

Manitoba Hydro

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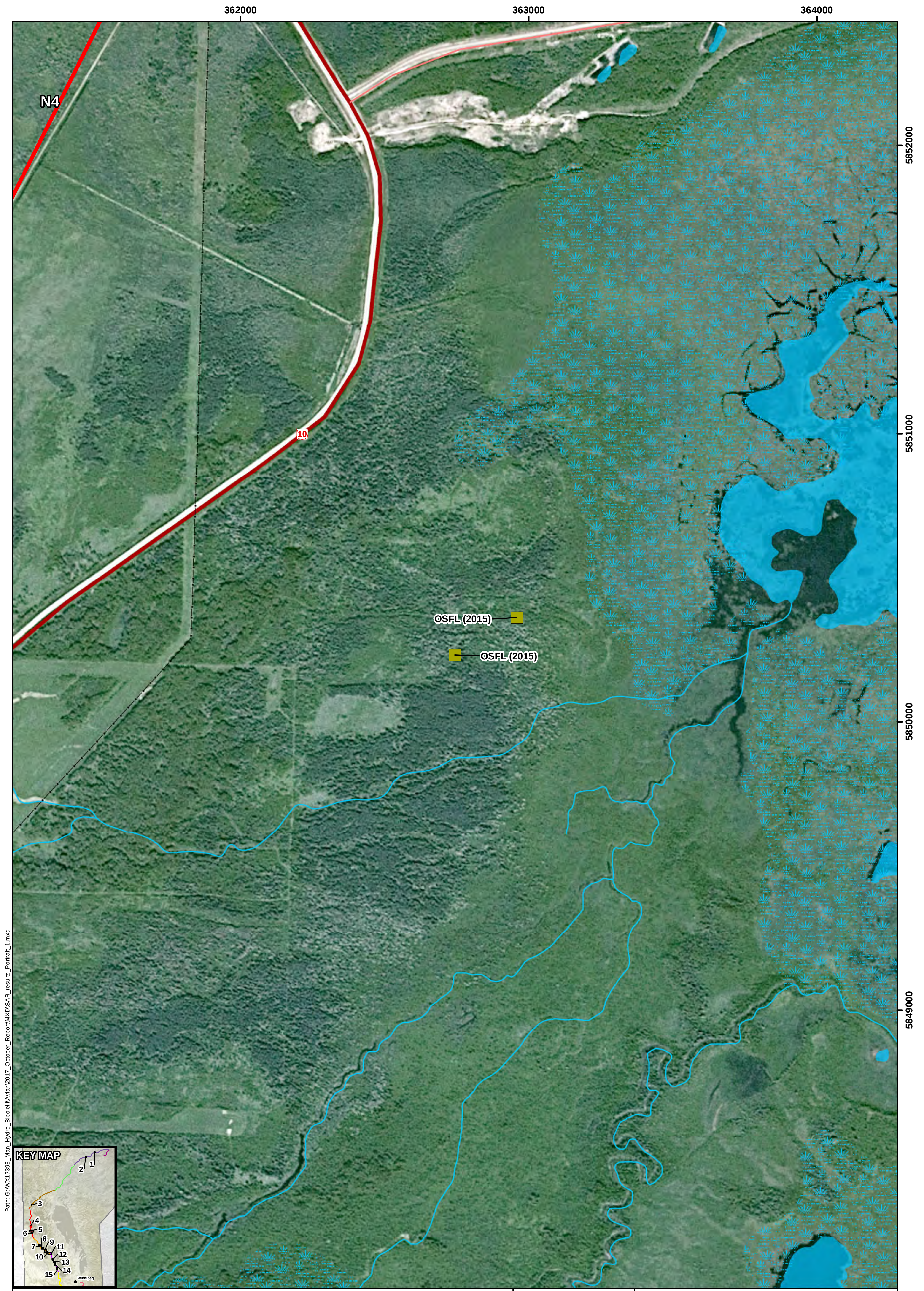
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N°: WX17393	**FIGURE: 5-3**
SCALE: 1:12,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\SAR_results_Portrait_1.mxd

LEGEND

2014 Species at Risk Observations

2017 Species at Risk Observations

2015 Species at Risk Observations

OSFL - Olive-sided Flycatcher

Final Preferred Route (FPR)

- **Section N4**
- **Provincial Highway**
- **Provincial Road**
- **Watercourse**
- **Waterbody**
- **Wetland**

NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 0.5 1 1.5 Kilometres

N W E S

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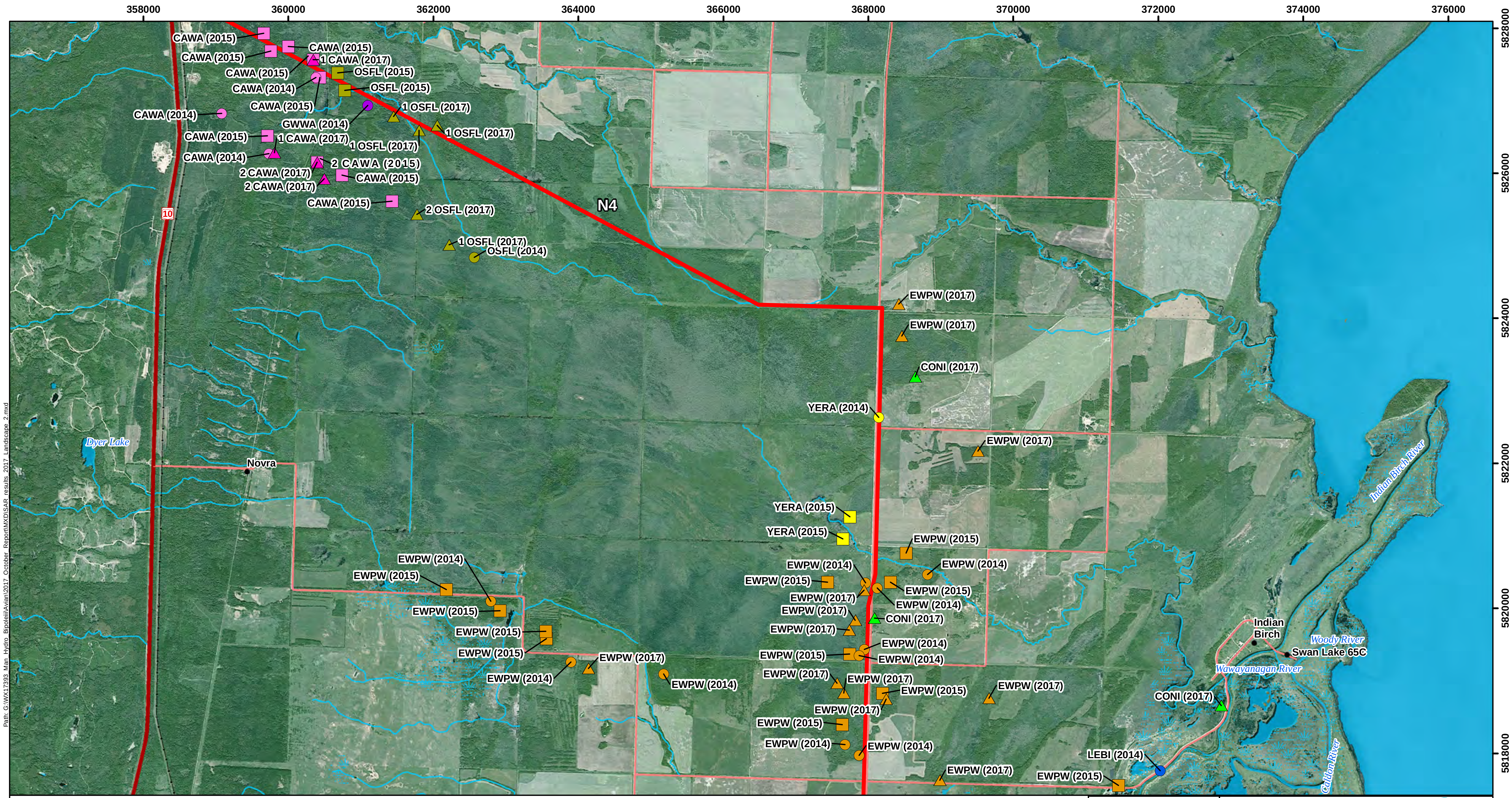
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N^{o}: WX17393	**FIGURE: 5-4**
SCALE: 1:12,000	DATE: December 2017



LEGEND

2014 Species at Risk Observations

- CAWA - Canada Warbler
- EWPW - Eastern Whip-poor-will
- GWWA - Golden-winged Warbler
- LEBI - Least Bittern
- OSFL - Olive-sided Flycatcher
- YERA - Yellow Rail

2015 Species at Risk Observations

- CAWA - Canada Warbler
- EWPW - Eastern Whip-poor-will
- OSFL - Olive-sided Flycatcher
- YERA - Yellow Rail

2017 Species at Risk Observations

- CAWA - Canada Warbler
- CONI - Common Nighthawk
- EWPW - Eastern Whip-poor-will
- OSFL - Olive-sided Flycatcher

Final Preferred Route (FPR)

- Section N4

0 1 2 3 4 Kilometres

KEY MAP

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Winnipeg

NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N E S W

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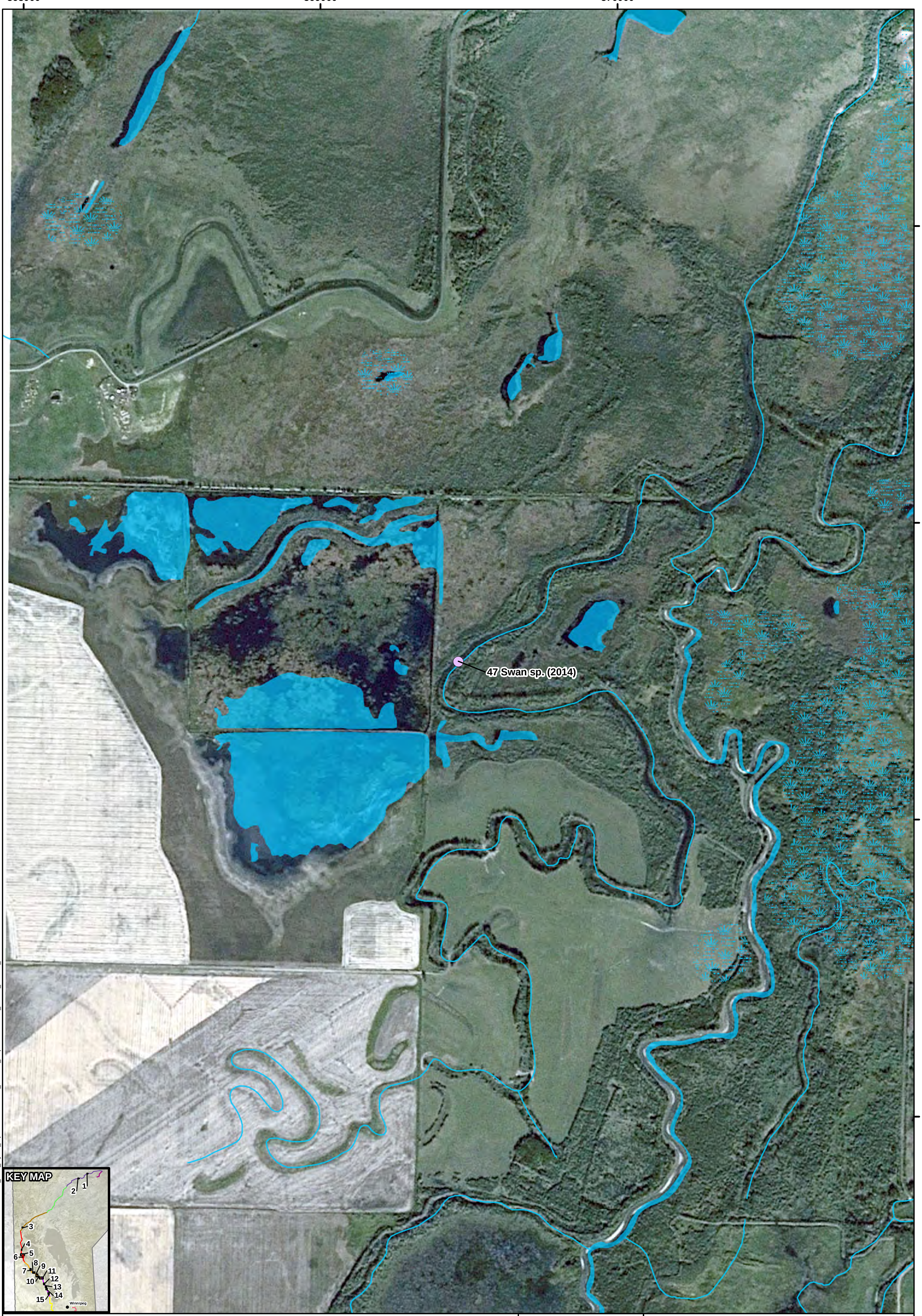
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N^{o}: WX17393	**FIGURE: 5-5**
SCALE: 1:50,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_BipoleIII\Avian\2017_October_Report\MXD\SAR_results_Portrait_1.mxd

LEGEND

2014 Species at Risk Observations

Swan sp. (Likely Tundra Swan)

2015 Species at Risk Observations

2017 Species at Risk Observations

Watercourse

Waterbody

Wetland

0 0.5 1 1.5 Kilometres

NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

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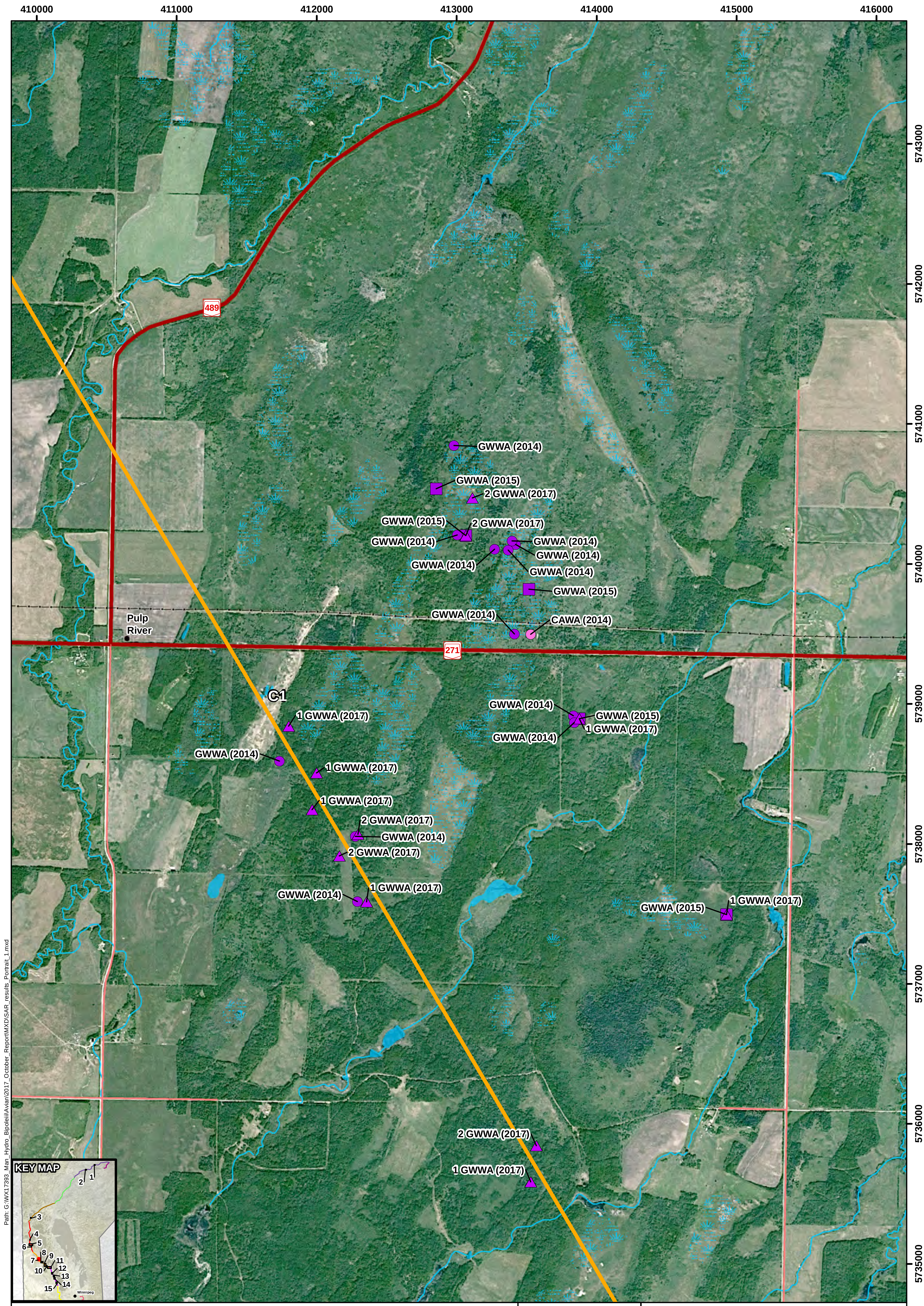
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N^{o}: WX17393	**FIGURE: 5-6**
SCALE: 1:12,000	DATE: December 2017



LEGEND

2014 Species at Risk Observations
- CAWA - Canada Warbler
- GWWA - Golden-winged Warbler

2015 Species at Risk Observations
- GWWA - Golden-winged Warbler

2017 Species at Risk Observations
- GWWA - Golden-winged Warbler

Final Preferred Route (FPR)
- Section C1
- Provincial Highway
- Provincial Road
- Watercourse
- Waterbody
- Wetland

NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 0.5 1 1.5 Kilometres

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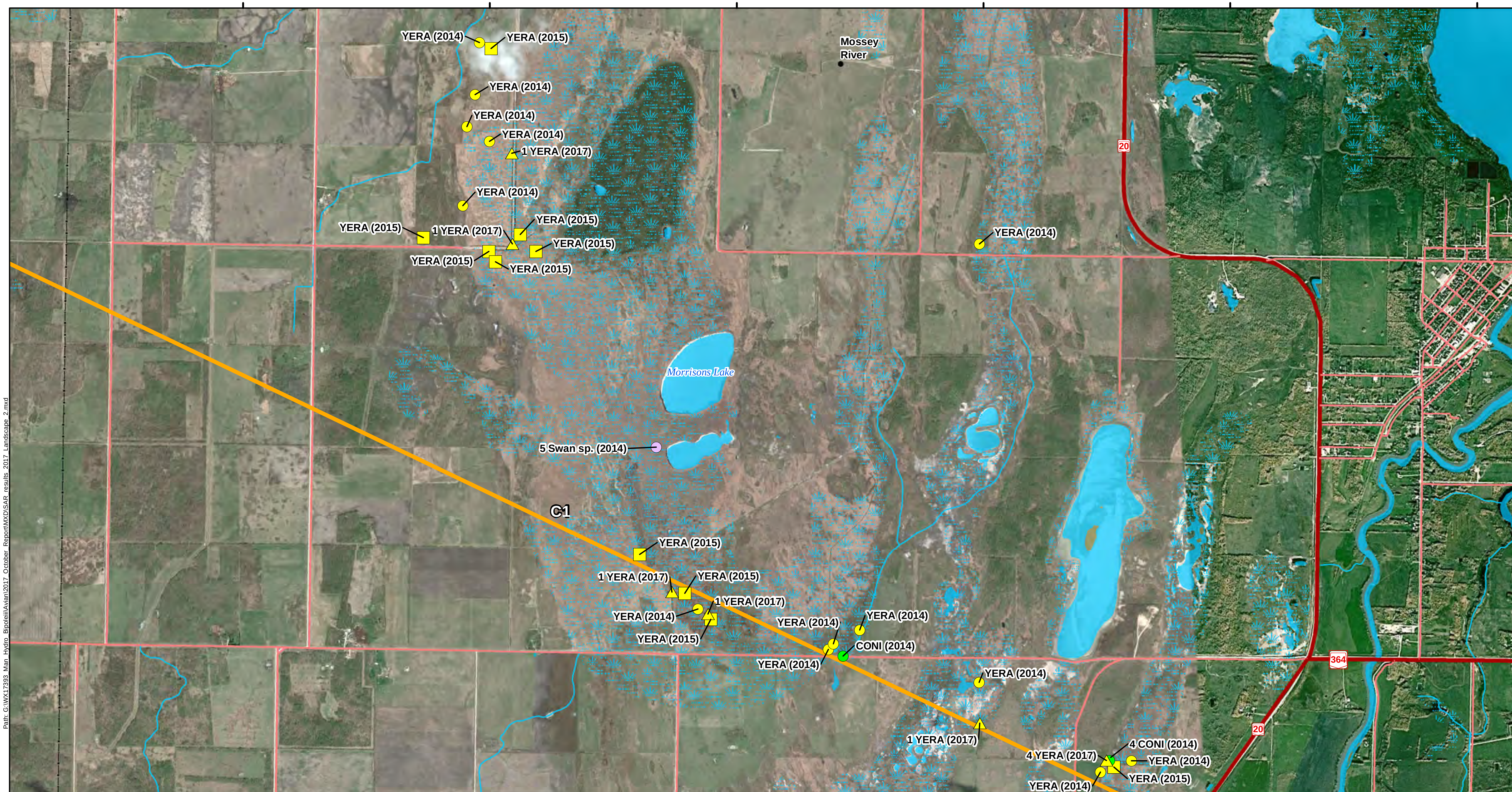
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N°: WX17393	FIGURE: 5-7
SCALE: 1:25,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\SAR_results_2017_Landscape_2.mxd

LEGEND

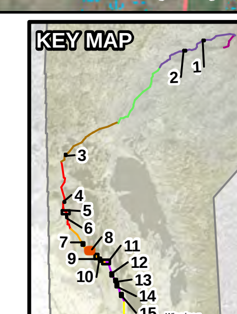
2014 Species at Risk Observations
- CONI - Common Nighthawk
- YERA - Yellow Rail
- Swan sp. (Likely Tundra Swan)

2015 Species at Risk Observations
- YERA - Yellow Rail

2017 Species at Risk Observations
- YERA - Yellow Rail

Final Preferred Route (FPR)
- Section C1

0 1 2 3 4
Kilometres



NOTES:
- Topographic data extracted from Manitoba Land Inaitive.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

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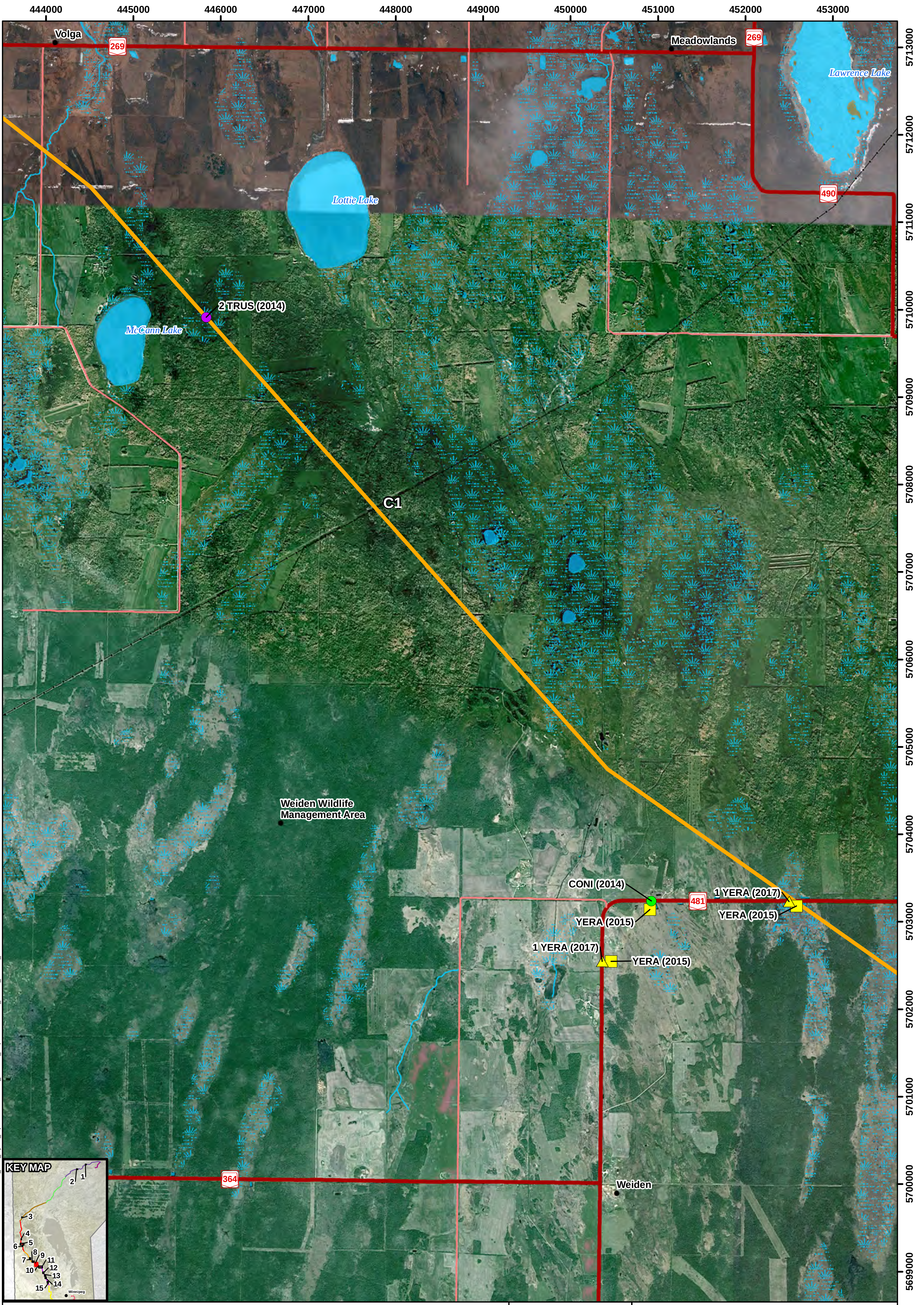
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N°: WX17393	**FIGURE: 5-8**
SCALE: 1:30,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\SAR_results_Portrait_1.mxd

LEGEND

2014 Species at Risk Observations

- CONI - Common Nighthawk
- TRUS - Trumpeter Swan

2015 Species at Risk Observations

- YERA - Yellow Rail

2017 Species at Risk Observations

- YERA - Yellow Rail

Final Preferred Route (FPR)

- Section C1
- Provincial Highway
- Provincial Road
- Watercourse
- Waterbody
- Island
- Wetland

0 0.5 1 1.5 Kilometres

NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

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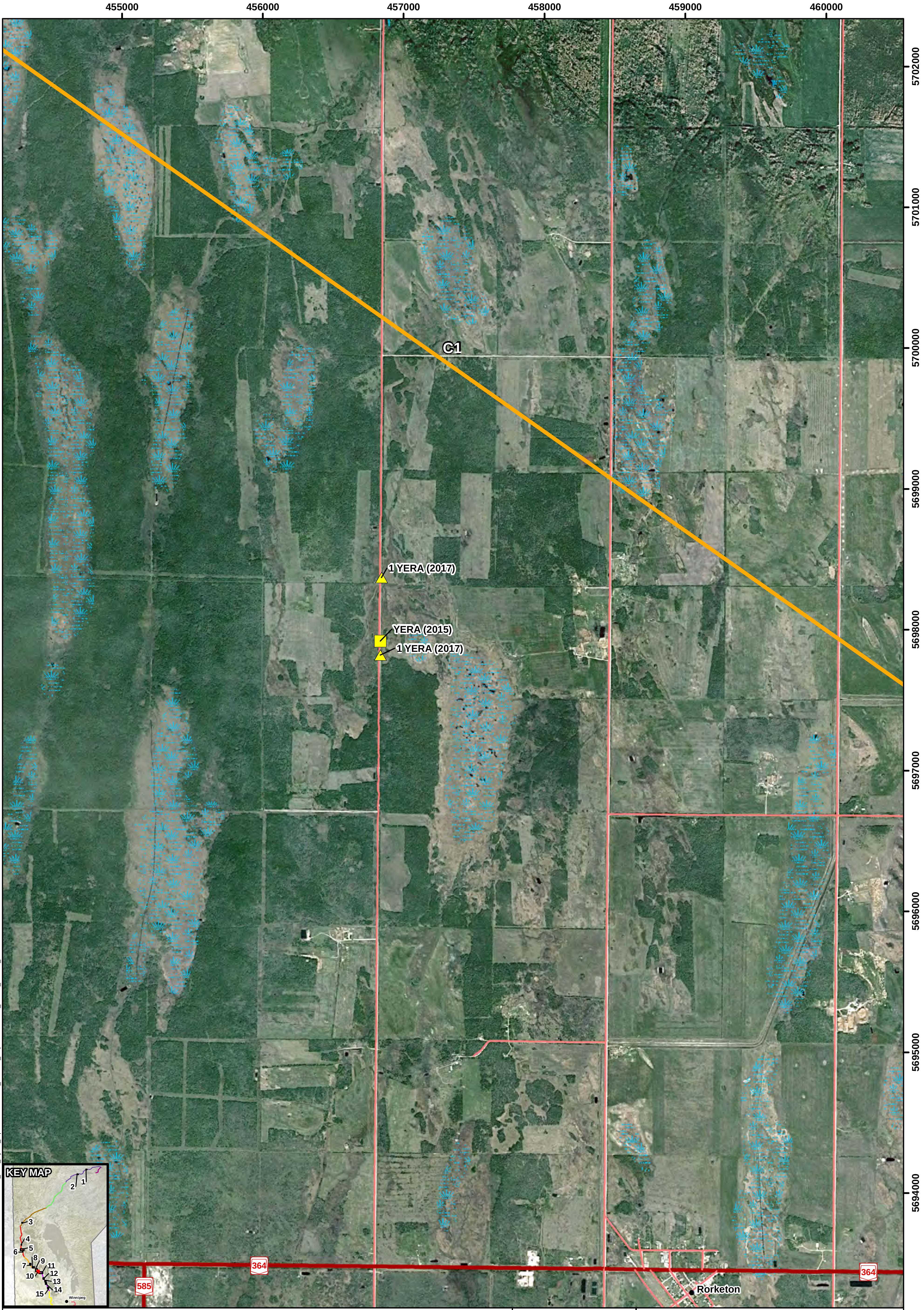
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N°: WX17393 | FIGURE: 5-9

SCALE: 1:40,000 | DATE: December 2017



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\SAR_results_Portrait_1.mxd

LEGEND

2014 Species at Risk Observations

2015 Species at Risk Observations

YERA - Yellow Rail

2017 Species at Risk Observations

YERA - Yellow Rail

Final Preferred Route (FPR)

Section C1

Provincial Highway

Provincial Road

Waterbody

Wetland

NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 0.5 1 1.5 Kilometres

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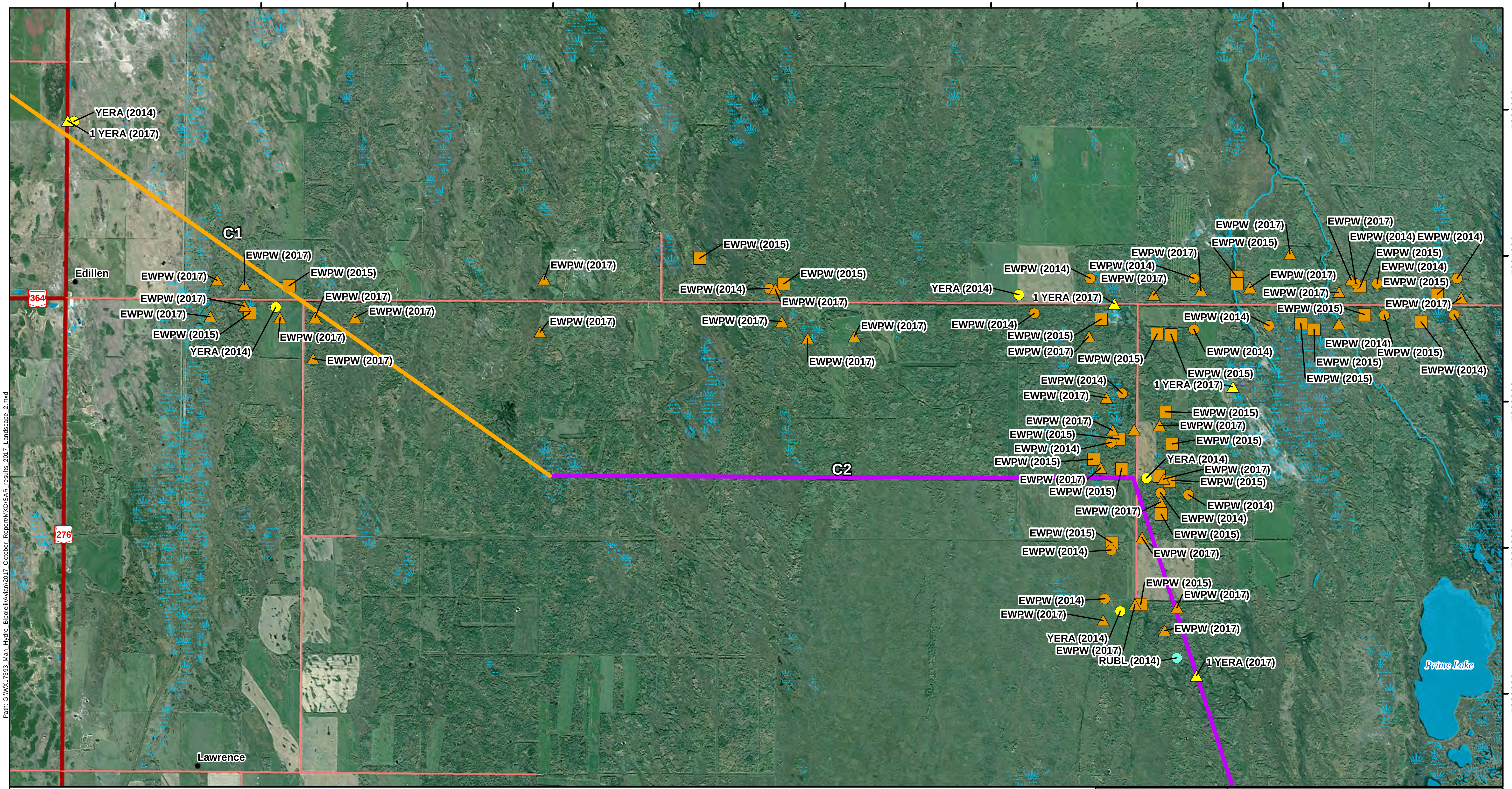
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N°: WX17393	FIGURE: 5-10
SCALE: 1:25,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_BipoleIII\Avian\2017_October_Report\MXD\SAR_results_2017_Landscape_2.mxd

LEGEND

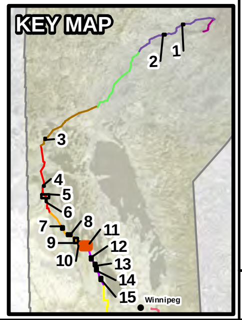
2014 Species at Risk Observations
- EWPW - Eastern Whip-poor-will
- RUBL - Rusty Blackbird
- YERA - Yellow Rail

2015 Species at Risk Observations
- EWPW - Eastern Whip-poor-will

2017 Species at Risk Observations
- EWPW - Eastern Whip-poor-will
- YERA - Yellow Rail

Final Preferred Route (FPR)
- Section C1
- Section C2

0 1 2 3 4 Kilometres



NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

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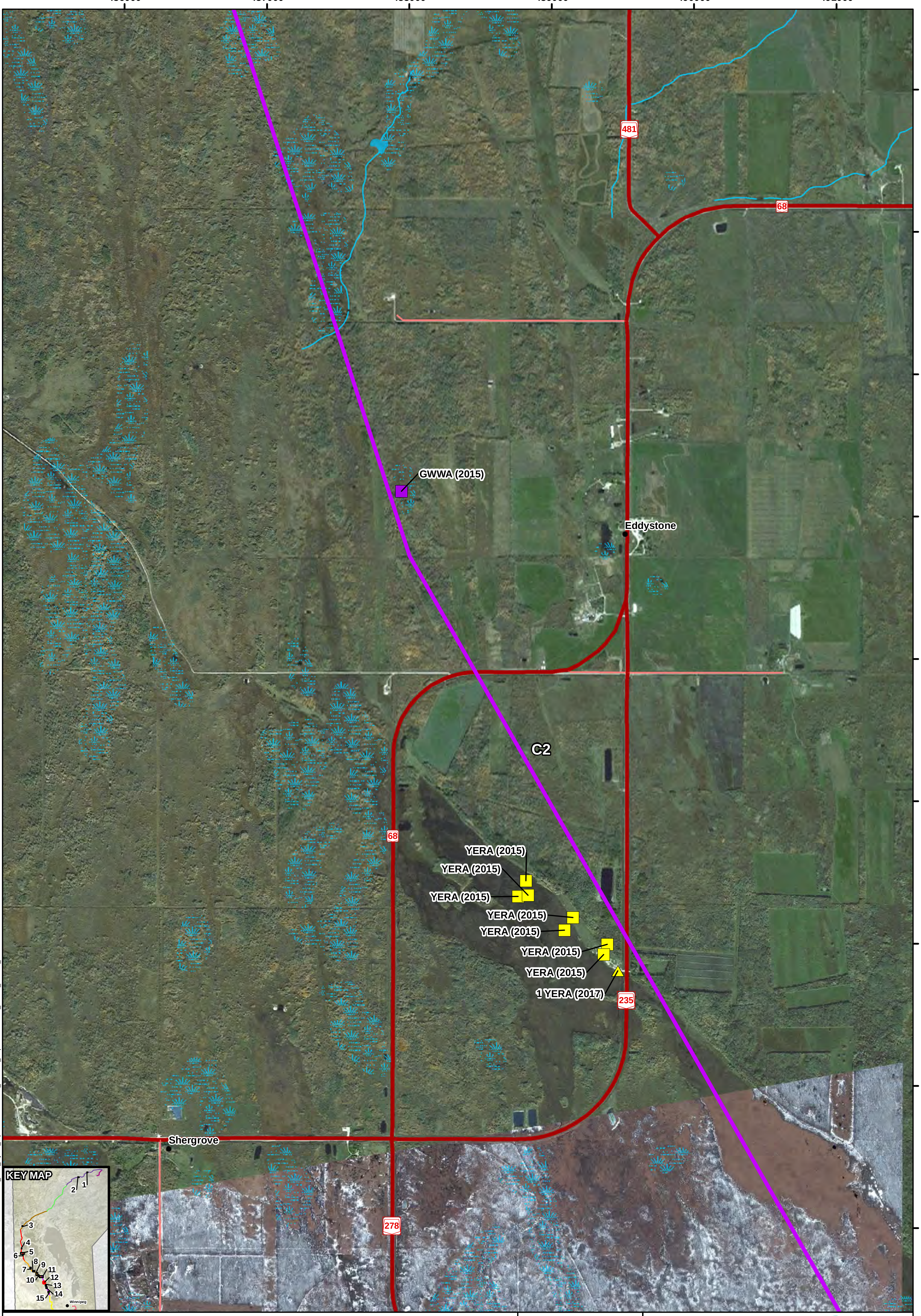
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N°: WX17393	FIGURE: 5-11
SCALE: 1:50,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\SAR_results_Portrait_1.mxd

LEGEND

2014 Species at Risk Observations

2017 Species at Risk Observations
- YERA - Yellow Rail

2015 Species at Risk Observations
- GWWA - Golden-winged Warbler
- YERA - Yellow Rail

Final Preferred Route (FPR)
- Section C2
- Provincial Highway
- Provincial Road
- Watercourse
- Waterbody
- Wetland

0 0.5 1 1.5 Kilometres

NOTES:
- Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N W E S

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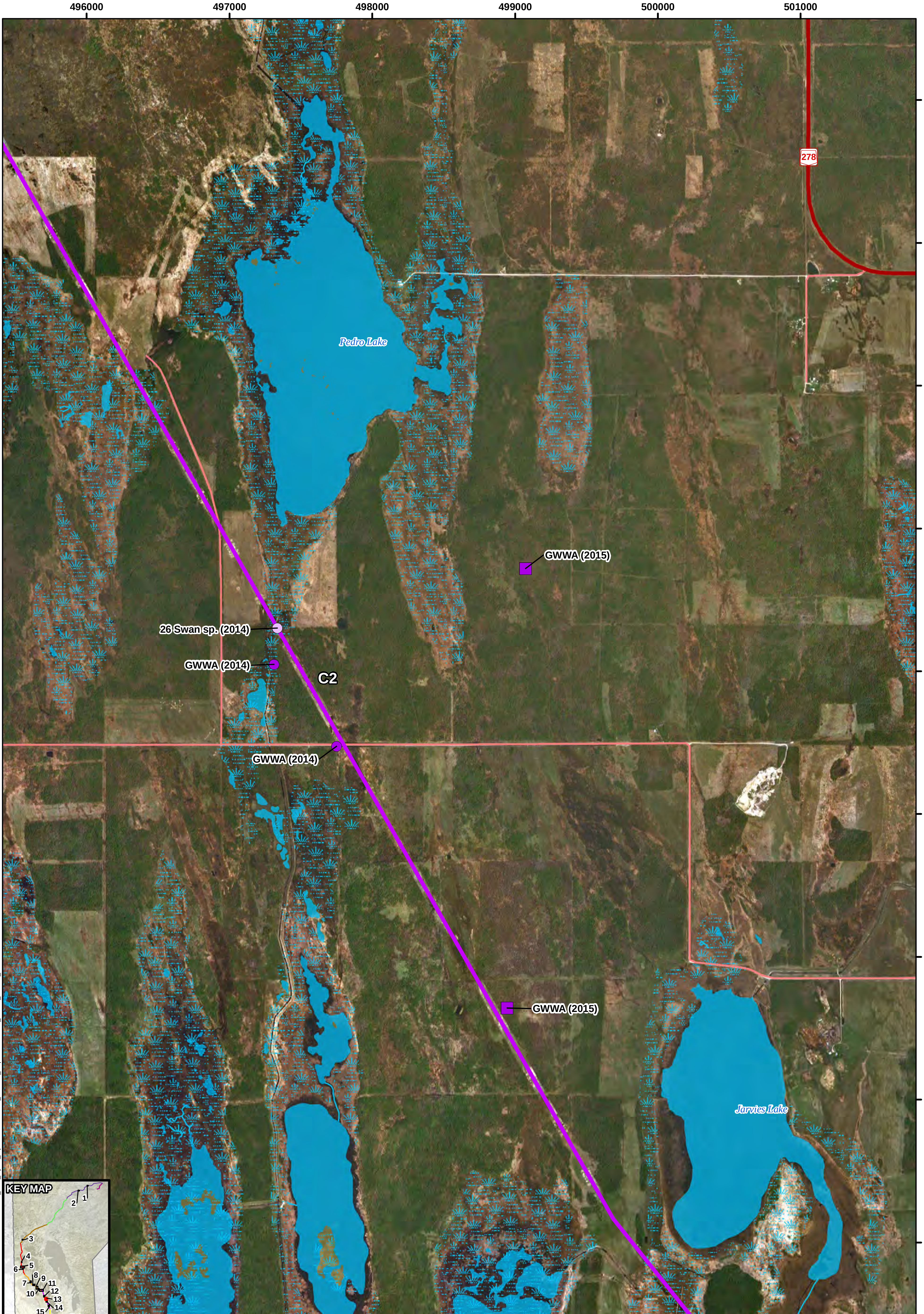
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N^{o}: WX17393	FIGURE: 5-12
SCALE: 1:25,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\SAR_results_Portrait_1.mxd

LEGEND

2014 Species at Risk Observations

- GWWA - Golden-winged Warbler
- Swan sp. (Likely Tundra Swan)

2015 Species at Risk Observations

- GWWA - Golden-winged Warbler

2017 Species at Risk Observations

Final Preferred Route (FPR)

- Section C2
- Provincial Highway
- Provincial Road
- Watercourse
- Waterbody
- Island
- Wetland

NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

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0 0.5 1 1.5 Kilometres

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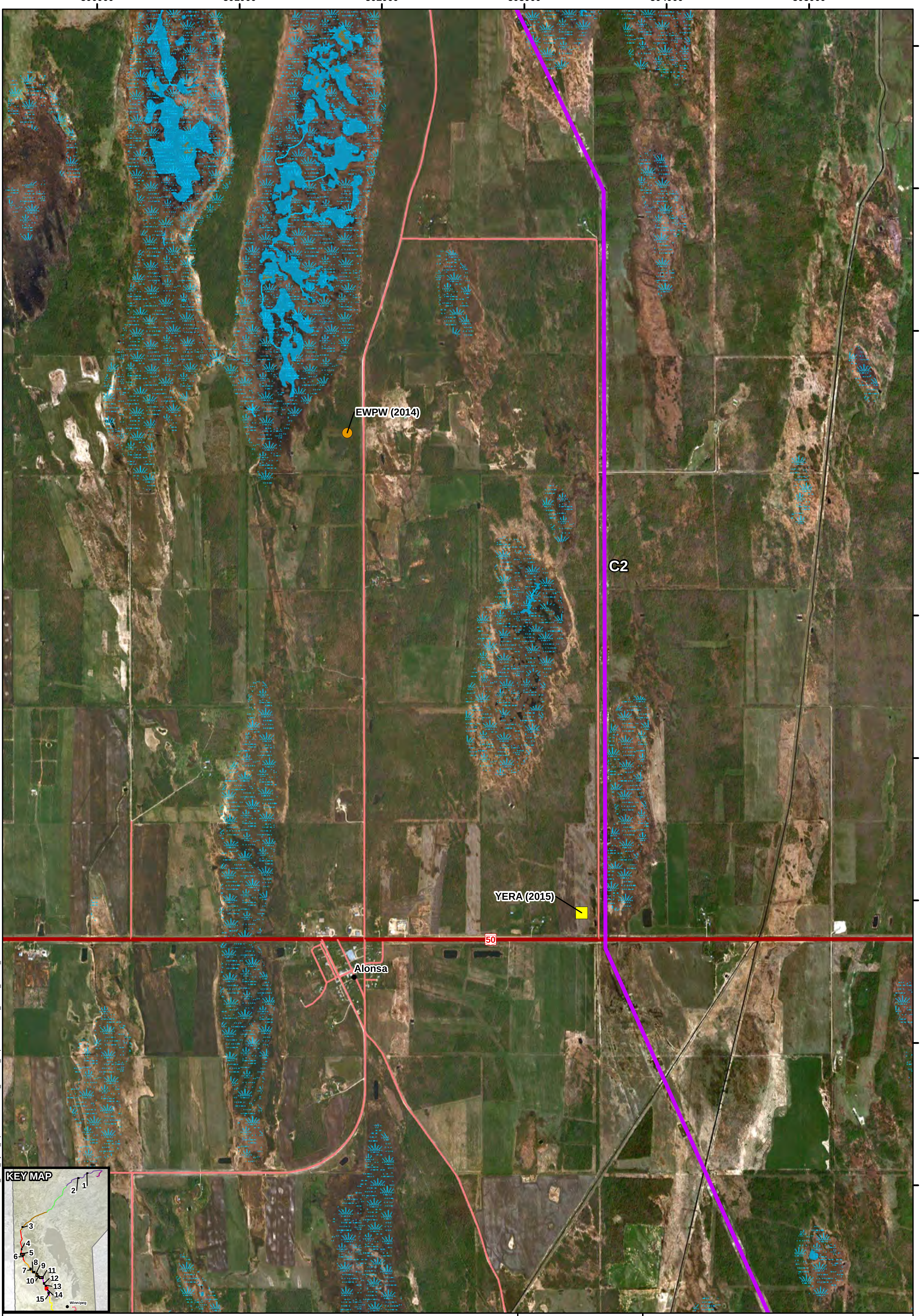
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N°: WX17393	**FIGURE: 5-13**
SCALE: 1:25,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_BipoleIII\Avian\2017_October_Report\MXD\SAR_results_Portrait_1.mxd

LEGEND

2014 Species at Risk Observations

- **EWPW - Eastern Whip-poor-will**

2017 Species at Risk Observations

2015 Species at Risk Observations

- **YERA - Yellow Rail**

Final Preferred Route (FPR)

- **Section C2**
- **Provincial Highway**
- **Provincial Road**
- **Watercourse**
- **Waterbody**
- **Island**
- **Wetland**

NOTES:
-Topographic data extracted from Manitoba Land Inative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

N W E S

0 0.5 1 1.5 Kilometres

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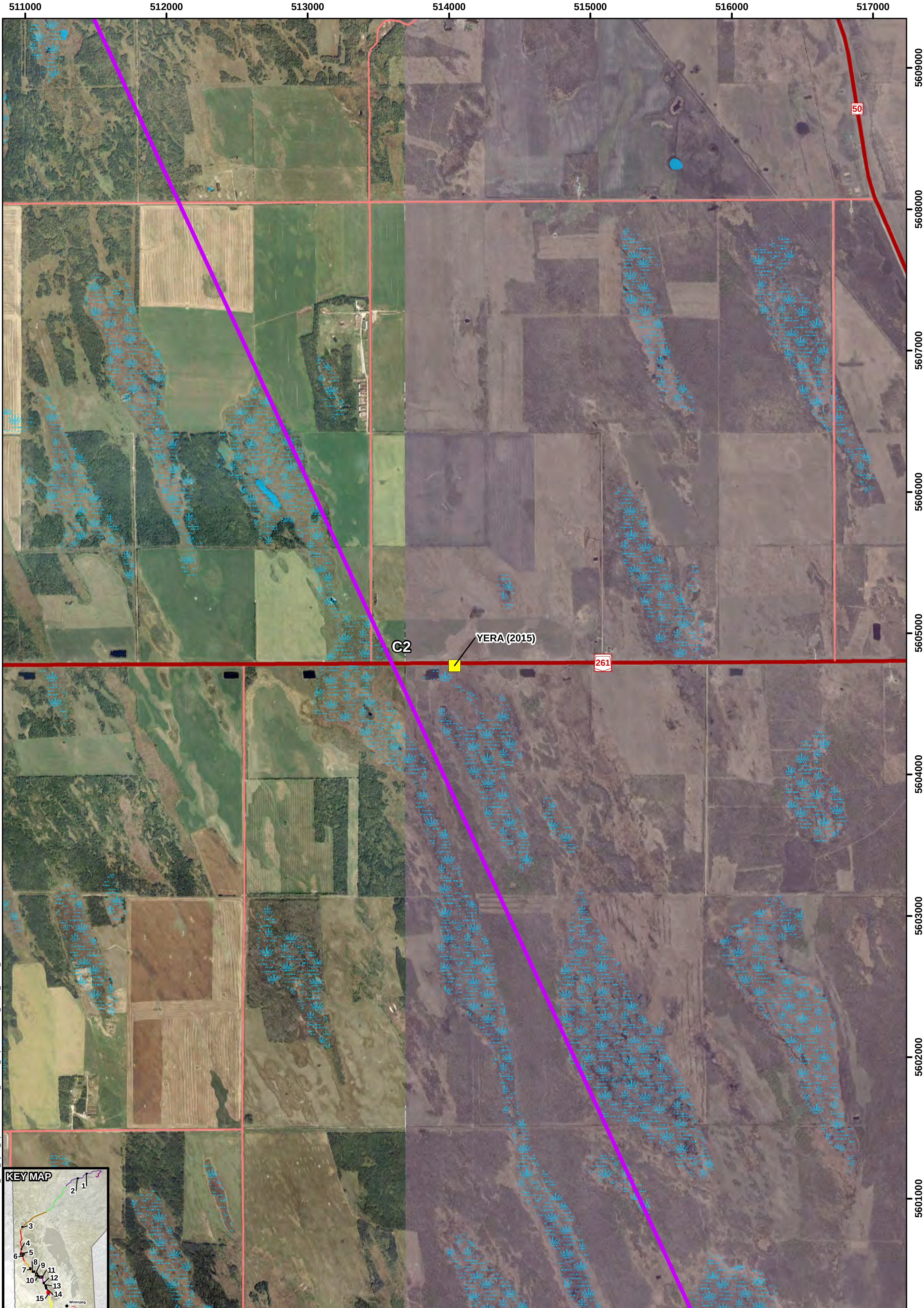
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N^{o}: WX17393	**FIGURE: 5-14**
SCALE: 1:25,000	DATE: December 2017



Path: G:\WX17393_Man_Hydro_Bipole\Avian\2017_October_Report\MXD\SAR_results_Portrait_1.mxd

LEGEND

2014 Species at Risk Observations

2017 Species at Risk Observations

2015 Species at Risk Observations

YERA - Yellow Rail

Final Preferred Route (FPR)

Section C2

Provincial Highway

Provincial Road

Waterbody

Wetland

NOTES:
-Topographic data extracted from Manitoba Land Iniative.
- Imagery extracted from Google Earth Pro.

Datum: NAD83
Projection: UTM Zone 14N

0 0.5 1 1.5 Kilometres

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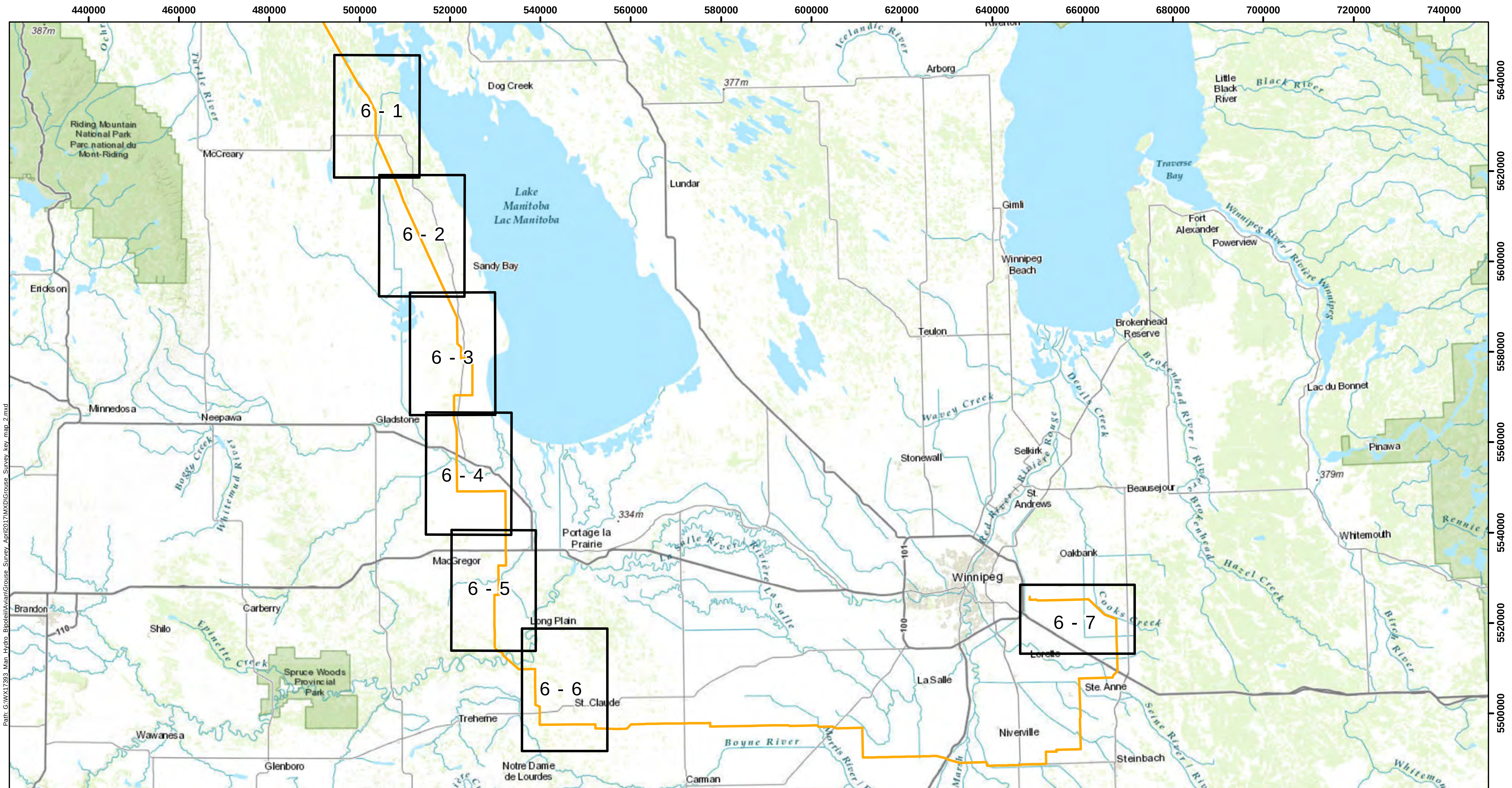
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Species at Risk Observations

PROJECT N^{o}: WX17393	**FIGURE: 5-15**
SCALE: 1:25,000	DATE: December 2017



LEGEND

Key Map

NOTES:
-Topographic map extracted from ESRI online.

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Sharp-tailed grouse Survey Key Map

Datum: NAD83
Projection: UTM Zone 14N

PROJECT N°: WX17393

FIGURE: 6

SCALE: 1:800,000

DATE: May 2018

0 40 80 120 160 200 Kilometres

Path: G:\WX17393_Man_Hydro_Bipole\AvianGrouse_Survey_April2017\MXD\Grouse_Survey_key_map_2.mxd

Path: G:\WX17393_Man_Hydro_Bipoleiii\Avian\Grouse_Survey_April2017\MXD\Grouse_Results_2017_Portrait_3.mxd

LEGEND

- Survey Locations (2017)
- Sharp-tailed Grouse sightings (2015)
- Sharp-tailed Grouse sightings (2017):
- ◇ Confirmed Leks
- △ Other Grouse Sightings
- Planned Route (not surveyed)
- Transmission Line
- Permanent Watercourse
- Wetland
- Waterbody

NOTES:
- Aerial Imagery extracted from ESRI online and Google Earth.
-Topographic data extracted from Manitoba Land Iniative.

Datum: NAD83
Projection: UTM Zone 14N

0 2 4 6 8 10 Kilometres

N W E S

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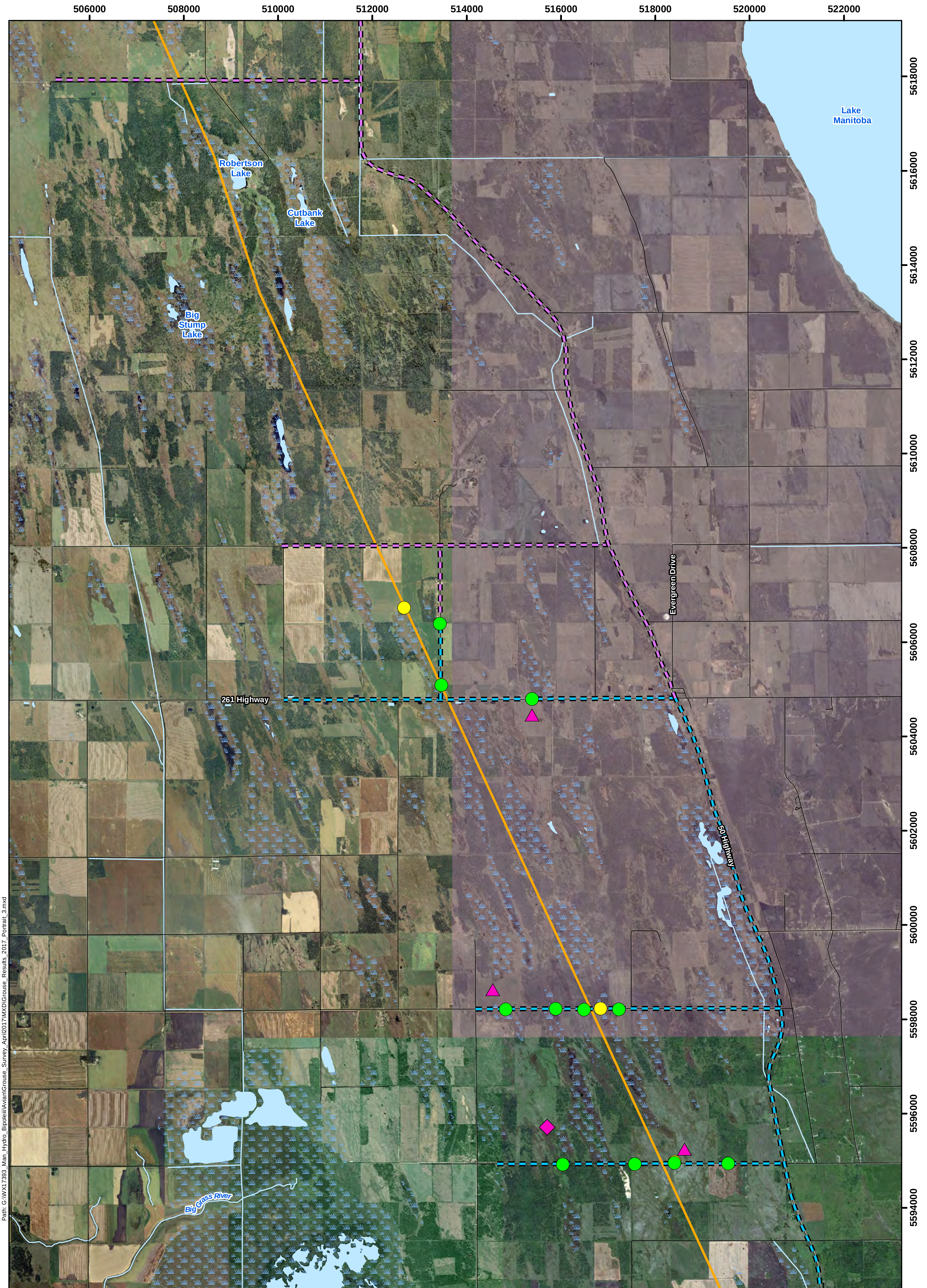
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Sharp-tailed Grouse Survey

PROJECT N^{o}: WX17393	**FIGURE: 6-1**
SCALE: 1:74,000	DATE: May 2018



Path: G:\WX17393_Man_Hydro_Bipole\Avian\Grouse_Survey_April2017\MXD\Grouse_Results_2017_Portrait_3.mxd

LEGEND

- Survey Locations (2017)
- Sharp-tailed Grouse sightings (2015)
- Sharp-tailed Grouse sightings (2017):
  - Confirmed Leks
  - Other Grouse Sightings
- Planned Route (surveyed)
- Planned Route (not surveyed)
- Transmission Line
- Permanent Watercourse
- Wetland
- Waterbody

NOTES:
- Aerial Imagery extracted from ESRI online and Google Earth.
-Topographic data extracted from Manitoba Land Iniative.

Datum: NAD83
Projection: UTM Zone 14N

0 2 4 6 8 10 Kilometres

N E S W

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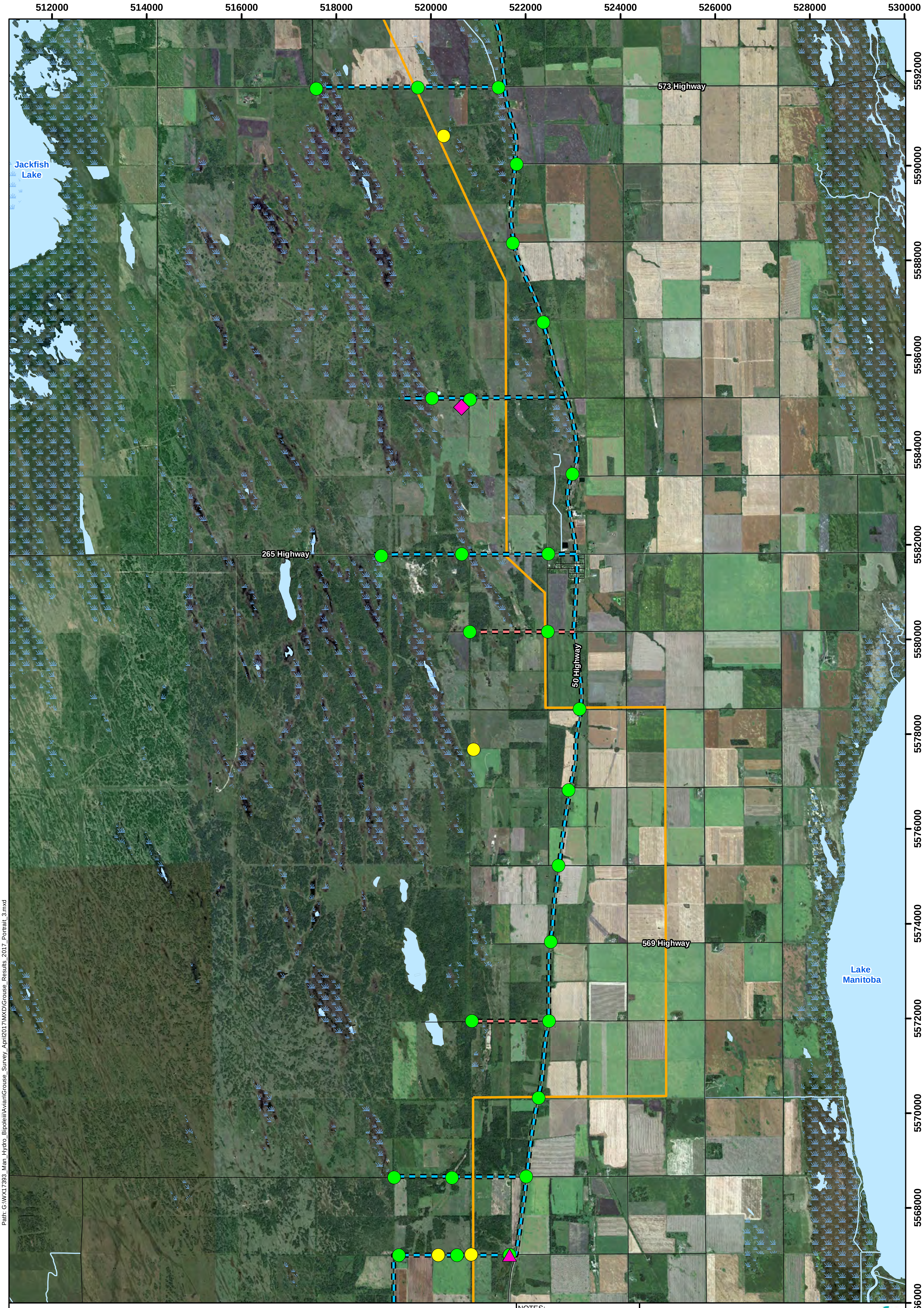
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Sharp-tailed Grouse Survey

PROJECT N^{o}: WX17393	**FIGURE: 6-2**
SCALE: 1:74,000	DATE: May 2018



Path: G:\WX17393_Man_Hydro_Bipole\Avian\Grouse_Survey_April2017\MXD\Grouse_Results_2017_Portrait_3.mxd

LEGEND

- Survey Locations (2017)
- Sharp-tailed Grouse sightings (2015)
- Sharp-tailed Grouse sightings (2017):
  - Confirmed Leks
  - Other Grouse Sightings
- Planned Route (surveyed)
- Additional Route Surveyed
- Transmission Line
- Permanent Watercourse
- Wetland
- Waterbody

0 2 4 6 8 10 Kilometres

NOTES:
- Aerial Imagery extracted from ESRI online and Google Earth.
- Topographic data extracted from Manitoba Land Iniative.

Datum: NAD83
Projection: UTM Zone 14N

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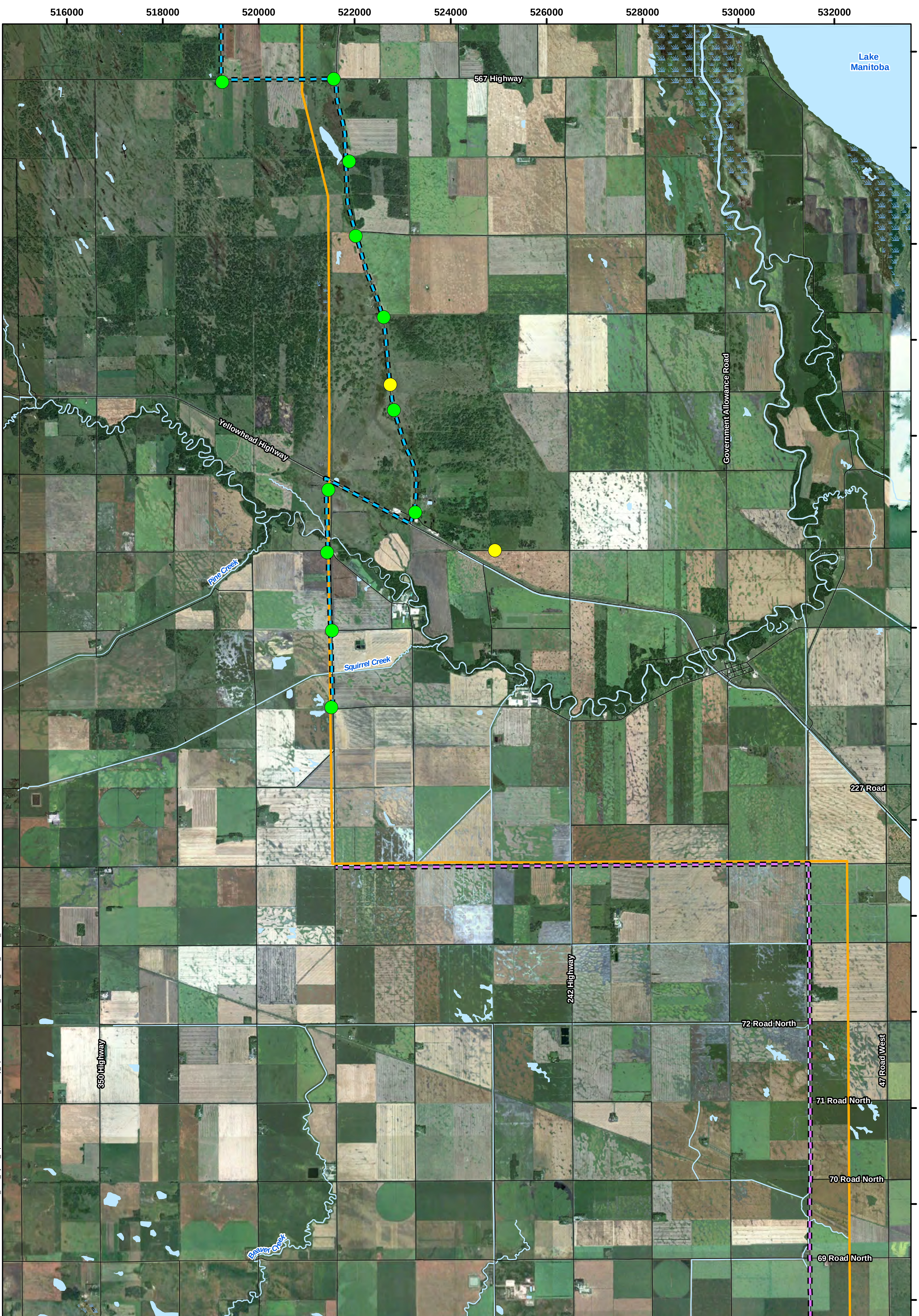
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Sharp-tailed Grouse Survey

PROJECT N°: WX17393	FIGURE: 6-3
SCALE: 1:74,000	DATE: May 2018



LEGEND

- Survey Locations (2017)
- Sharp-tailed Grouse sightings (2015)
- Sharp-tailed Grouse sightings (2017):
- Confirmed Leks
- Other Grouse Sightings
- Planned Route (surveyed)
- Planned Route (not surveyed)
- Transmission Line
- Permanent Watercourse
- Wetland
- Waterbody

0 2 4 6 8 10 Kilometres

NOTES:
- Aerial Imagery extracted from ESRI online and Google Earth.
- Topographic data extracted from Manitoba Land Iniative.

Datum: NAD83
Projection: UTM Zone 14N

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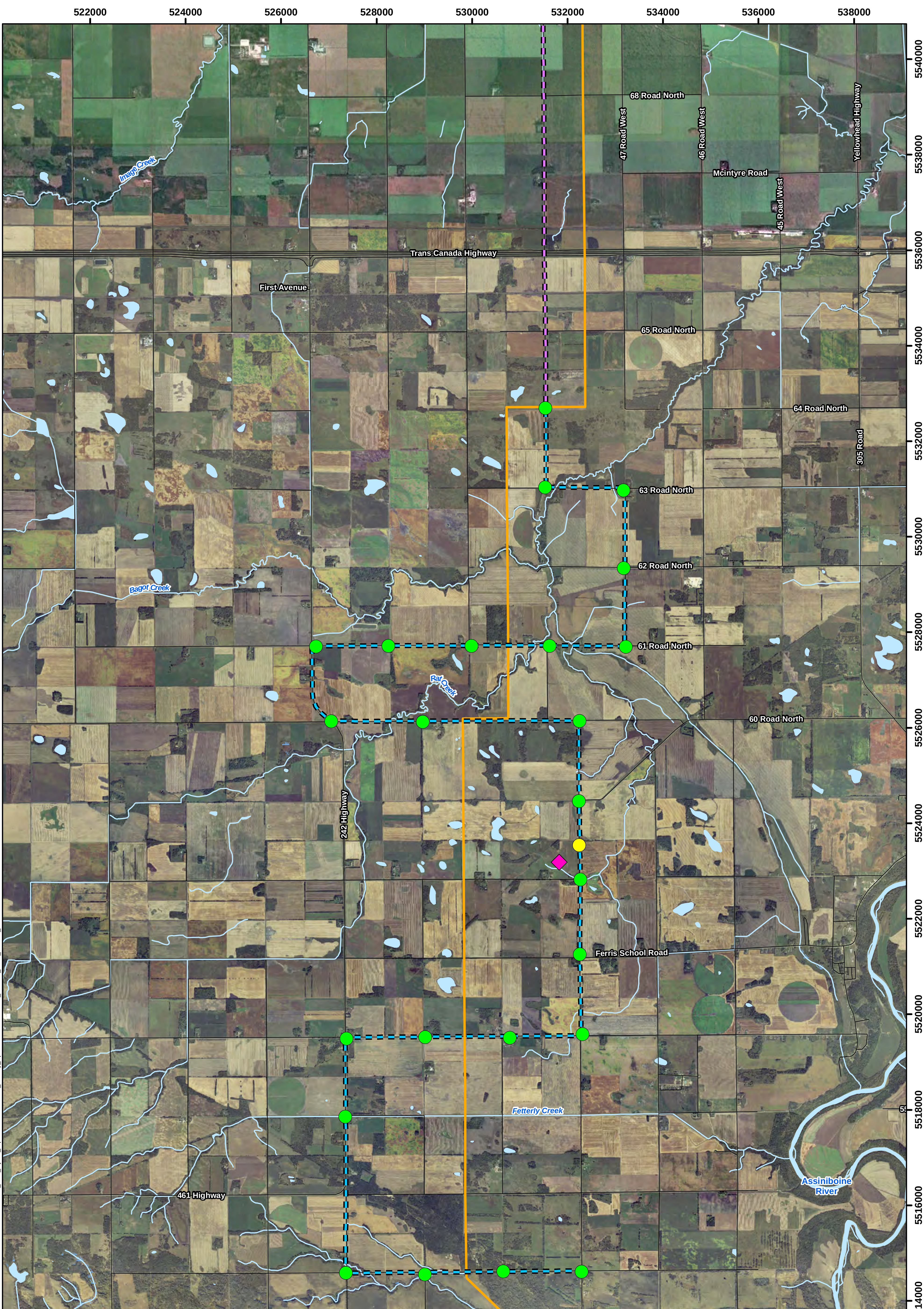
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Sharp-tailed Grouse Survey

PROJECT N°: WX17393	**FIGURE: 6-4**
SCALE: 1:74,000	DATE: May 2018



LEGEND

- Survey Locations (2017)
- Sharp-tailed Grouse sightings (2015)
- Sharp-tailed Grouse sightings (2017):
- Confirmed Leks
- Other Grouse Sightings
- Planned Route (surveyed)
- Planned Route (not surveyed)
- Transmission Line
- Permanent Watercourse
- Wetland
- Waterbody

NOTES:
- Aerial Imagery extracted from ESRI online and Google Earth.
- Topographic data extracted from Manitoba Land Iniative.

Datum: NAD83
Projection: UTM Zone 14N

0 2 4 6 8 10 Kilometres

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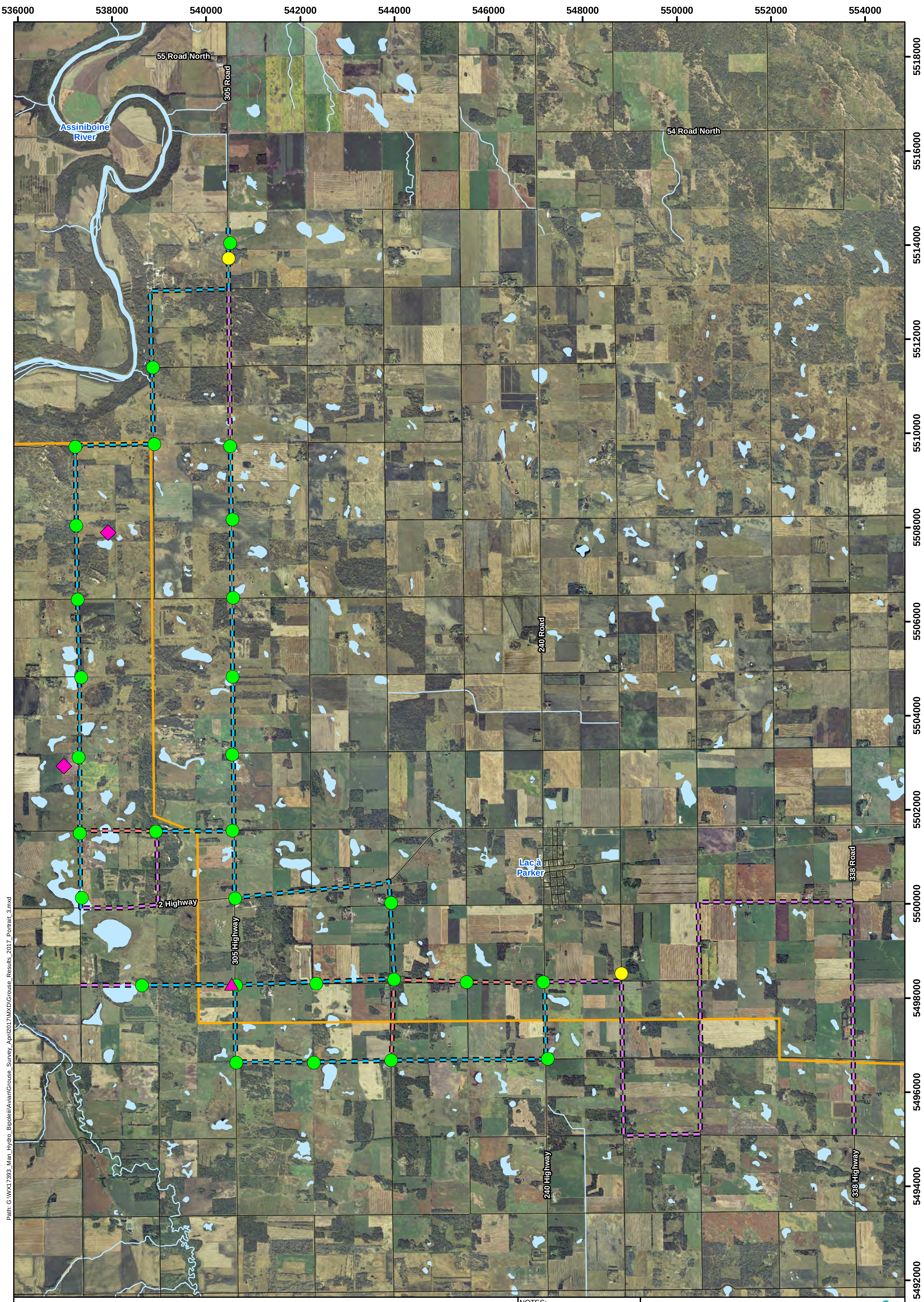
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Sharp-tailed Grouse Survey

PROJECT N°: WX17393	**FIGURE: 6-5**
SCALE: 1:74,000	DATE: May 2018

Path: G:\WX17393_Man_Hydro_Bipole\Avian\Grouse_Survey_April2017\MXD\Grouse_Results_2017_Portrait_3.mxd



LEGEND

- Survey Locations (2017)
- Sharp-tailed Grouse sightings (2015)
- Sharp-tailed Grouse sightings (2017):
  - Confirmed Leks
  - Other Grouse Sightings
- Planned Route (surveyed)
- Planned Route (not surveyed)
- Additional Route Surveyed
- Transmission Line
- Permanent Watercourse
- Wetland
- Waterbody

0 2 4 6 8 10 Kilometres

NOTES:
- Aerial Imagery extracted from ESRI online and Google Earth.
- Topographic data extracted from Manitoba Land Iniative.

Datum: NAD83
Projection: UTM Zone 14N

N E S W

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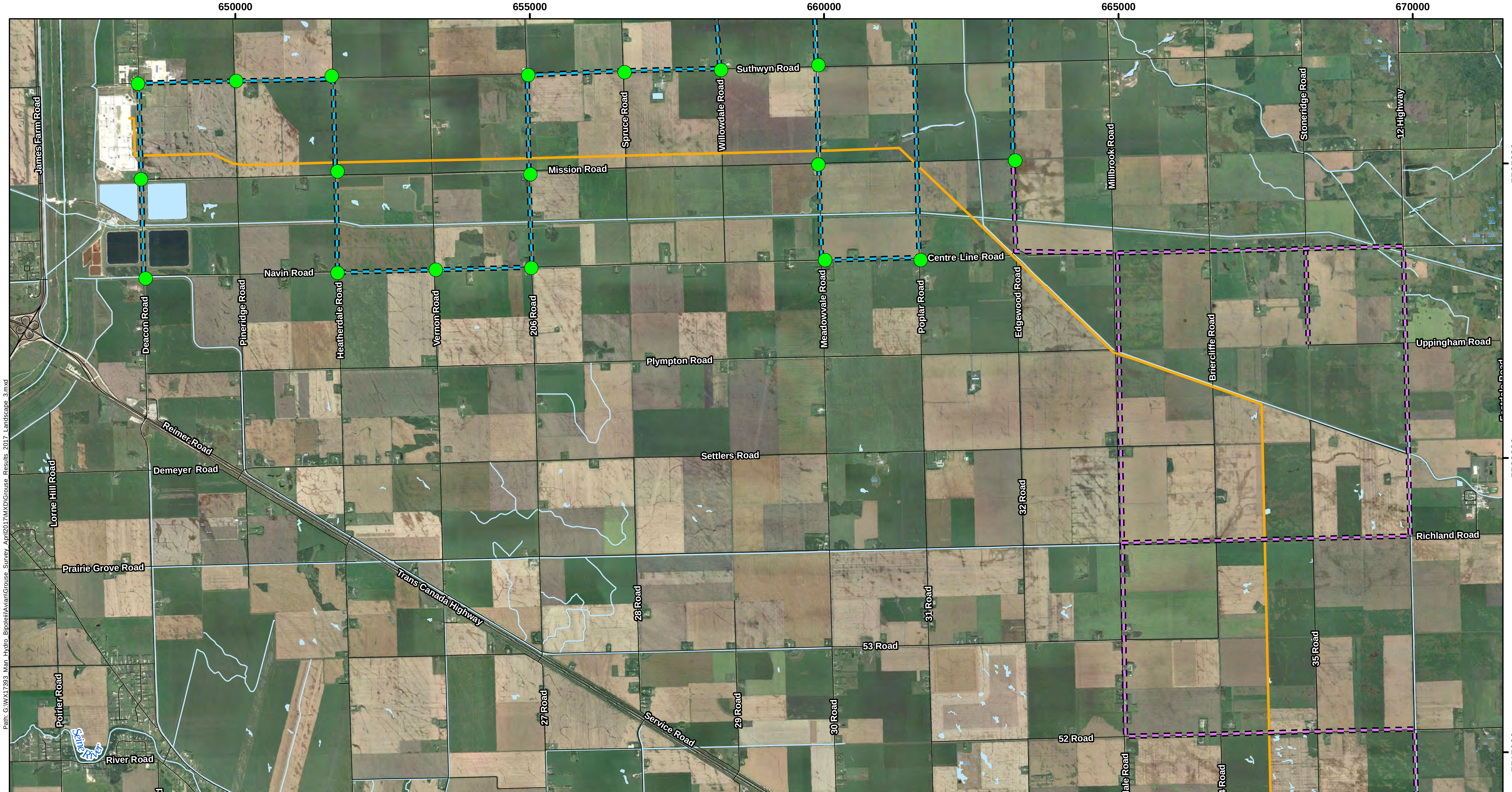
MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Sharp-tailed Grouse Survey

PROJECT N°: WX17393	FIGURE: 6-6
SCALE: 1:74,000	DATE: May 2018

Path: G:\WX17393_Man_Hydro_Bipole\Avian\Grouse_Survey_April2017\MXD\Grouse_Results_2017_Portrait_3.mxd



LEGEND

- Survey Locations (2017)
- Sharp-tailed Grouse sightings (2015)
- Sharp-tailed Grouse sightings (2017):
- Confirmed Leks
- Other Grouse Sightings
- Planned Route (surveyed)
- Planned Route (not surveyed)
- Transmission Line
- Permanent Watercourse
- Wetland
- Waterbody

0 2 4 6 8 10 Kilometres

NOTES:
- Aerial Imagery extracted from ESRI online and Google Earth.
-Topographic data extracted from Manitoba Land Iniative.

Datum: NAD83
Projection: UTM Zone 14N

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MANITOBA HYDRO BIPOLE III TRANSMISSION PROJECT

Sharp-tailed Grouse Survey

PROJECT N°: WX17393	**FIGURE: 6-7**
SCALE: 1:62,000	DATE: May 2018

Path: G:\WX17393 Man Hydro Bipole\Avian\Grouse Survey April2017\MXD\Grouse Results 2017 Landscape 3.mxd

APPENDIX B

OCCURRENCE OF ALL BIRDS RECORDED DURING MORNING SONGBIRD SURVEYS

Appendix B: Occurrence of All Birds Recorded During Morning Songbird Surveys

Species[1]	Year	Impact			Control		
		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Alder Flycatcher [β]	2014	32	22	20.8	21	18	16.4
	2015	41	29	31.9	36	29	26.4
	2017	66	42	39.6	35	25	22.7
American Bittern [βɸ]	2014	5	5	4.7	1	1	0.9
	2015	1	1	1.1	1	1	0.9
	2017	1	1	0.9	2	2	1.8
American Coot	2014	0	0	0.0	0	0	0.0
	2015	1	1	1.1	0	0	0.0
	2017	0	0	0.0	0	0	0.0
American Crow	2014	26	21	19.8	10	9	8.2
	2015	54	37	40.7	18	16	14.5
	2017	76	43	40.6	21	14	12.7
American Goldfinch	2014	21	17	16.0	22	19	17.3
	2015	32	22	24.2	22	19	17.3
	2017	31	27	25.5	18	16	14.5
American Kestrel [β]	2014	2	2	1.9	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	1	1	0.9
American Redstart	2014	72	45	42.5	98	50	45.5
	2015	35	19	20.9	79	48	43.6
	2017	50	32	30.2	93	51	46.4
American Three-toed Woodpecker [β]	2014	0	0	0.0	1	1	0.9
	2015	0	0	0.0	0	0	0.0
	2017	1	1	0.9	2	2	1.8
American White Pelican [βɸ]	2014	0	0	0.0	0	0	0.0
	2015	1	1	1.1	0	0	0.0
	2017	7	1	0.9	1	1	0.9
American Wigeon [ɸ]	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	1	1	0.9	0	0	0.0
Bald Eagle	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	1	1	0.9	0	0	0.0
Baltimore Oriole [β]	2014	17	11	10.4	4	4	3.6
	2015	8	8	8.8	5	5	4.5
	2017	28	21	19.8	8	8	7.3
Barn Swallow [β]	2014	1	1	0.9	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Bay-breasted Warbler [β]	2014	2	2	1.9	1	1	0.9
	2015	1	1	1.1	2	2	1.8
	2017	7	6	5.7	8	8	7.3
Belted Kingfisher	2014	1	1	0.9	0	0	0.0
	2015	2	2	2.2	0	0	0.0
	2017	0	0	0.0	0	0	0.0

Appendix B: Occurrence of All Birds Recorded During Morning Songbird Surveys

Species[1]	Year	Impact			Control		
		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Black-and-white Warbler	2014	42	38	35.8	50	41	37.3
	2015	12	11	12.1	27	25	22.7
	2017	30	28	26.4	45	37	33.6
Black-backed Warbler [β]	2014	1	1	0.9	0	0	0.0
	2015	0	0	0.0	1	1	0.9
	2017	1	1	0.9	0	0	0.0
Black-billed Cuckoo [βϕ]	2014	16	15	14.2	7	7	6.4
	2015	34	33	36.3	46	38	34.5
	2017	4	4	3.8	1	1	0.9
Black-billed Magpie	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	11	5	4.7	0	0	0.0
Blackburnian Warbler [β]	2014	13	12	11.3	19	14	12.7
	2015	8	8	8.8	14	13	11.8
	2017	11	11	10.4	27	22	20.0
Black-capped Chickadee	2014	16	10	9.4	15	12	10.9
	2015	13	12	13.2	22	9	8.2
	2017	24	18	17.0	28	21	19.1
Blackpoll Warbler [β]	2014	0	0	0.0	1	1	0.9
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Black-throated Green Warbler [β]	2014	3	2	1.9	0	0	0.0
	2015	4	2	2.2	5	5	4.5
	2017	3	3	2.8	9	7	6.4
Blue Jay	2014	11	11	10.4	28	24	21.8
	2015	23	19	20.9	40	35	31.8
	2017	22	19	17.9	32	26	23.6
Blue-headed Vireo	2014	5	5	4.7	9	8	7.3
	2015	6	5	5.5	24	19	17.3
	2017	10	8	7.5	17	15	13.6
Blue-winged Teal [ϕ]	2014	0	0	0.0	0	0	0.0
	2015	4	2	2.2	0	0	0.0
	2017	1	1	0.9	0	0	0.0
Bobolink [βϕ]	2014	10	5	4.7	0	0	0.0
	2015	3	3	3.3	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Boreal Chickadee	2014	0	0	0.0	6	4	3.6
	2015	1	1	1.1	6	5	4.5
	2017	0	0	0.0	1	1	0.9
Boreal Owl	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	1	1	0.9
	2017	0	0	0.0	0	0	0.0
Brewer's Blackbird	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	2	2	1.9	0	0	0.0

Appendix B: Occurrence of All Birds Recorded During Morning Songbird Surveys

Species[1]	Year	Impact			Control		
		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Broad-winged Hawk [β]	2014	4	4	3.8	2	2	1.8
	2015	3	2	2.2	1	1	0.9
	2017	1	1	0.9	2	2	1.8
Brown Creeper [β]	2014	8	6	5.7	5	5	4.5
	2015	0	0	0.0	2	2	1.8
	2017	2	2	1.9	4	3	2.7
Brown Thrasher [ϕ]	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	1	1	0.9
Brown-headed Cowbird	2014	33	22	20.8	30	20	18.2
	2015	33	20	22.0	38	29	26.4
	2017	26	25	23.6	27	22	20.0
Bufflehead [ϕ]	2014	6	1	0.9	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Canada Goose [ϕ]	2014	0	0	0.0	0	0	0.0
	2015	44	6	6.6	12	3	2.7
	2017	6	2	1.9	22	4	3.6
Canada Warbler [β]	2014	1	1	0.9	3	3	2.7
	2015	5	5	5.5	5	4	3.6
	2017	1	1	0.9	5	3	2.7
Cape May Warbler [β]	2014	0	0	0.0	0	0	0.0
	2015	1	1	1.1	4	4	3.6
	2017	12	12	11.3	3	3	2.7
Cedar Waxwing	2014	35	26	24.5	32	27	24.5
	2015	21	12	13.2	34	26	23.6
	2017	12	9	8.5	16	12	10.9
Chestnut-sided Warbler	2014	63	46	43.4	54	34	30.9
	2015	44	31	34.1	79	55	50.0
	2017	63	42	39.6	50	35	31.8
Chimney Swift [βϕ]	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	1	1	0.9
Chipping Sparrow	2014	9	7	6.6	7	7	6.4
	2015	18	14	15.4	20	17	15.5
	2017	11	9	8.5	13	10	9.1
Clay-colored Sparrow [βϕ]	2014	89	47	44.3	76	42	38.2
	2015	79	43	47.3	52	36	32.7
	2017	72	55	51.9	52	35	31.8
Common Goldeneye	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	9	1	0.9	0	0	0.0
Common Grackle	2014	6	2	1.9	1	1	0.9
	2015	1	1	1.1	4	2	1.8
	2017	9	5	4.7	0	0	0.0

Appendix B: Occurrence of All Birds Recorded During Morning Songbird Surveys

Species[1]	Year	Impact			Control		
		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Common Loon βϕ	2014	1	1	0.9	1	1	0.9
	2015	3	3	3.3	1	1	0.9
	2017	5	5	4.7	4	4	3.6
Common Raven	2014	15	13	12.3	8	7	6.4
	2015	23	21	23.1	10	7	6.4
	2017	29	24	22.6	18	13	11.8
Common Yellowthroat βϕ	2014	82	51	48.1	82	55	50.0
	2015	64	44	48.4	68	42	38.2
	2017	129	71	67.0	61	40	36.4
Connecticut Warbler β	2014	23	19	17.9	23	20	18.2
	2015	6	6	6.6	28	21	19.1
	2017	13	10	9.4	17	16	14.5
Dark-eyed Junco	2014	7	6	5.7	30	26	23.6
	2015	3	2	2.2	5	4	3.6
	2017	5	5	4.7	5	5	4.5
Downy Woodpecker	2014	7	7	6.6	9	7	6.4
	2015	1	1	1.1	0	0	0.0
	2017	5	5	4.7	2	2	1.8
Eastern Bluebird	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	4	4	3.8	0	0	0.0
Eastern Kingbird	2014	4	4	3.8	3	2	1.8
	2015	5	4	4.4	0	0	0.0
	2017	9	7	6.6	3	2	1.8
Eastern Towhee	2014	3	3	2.8	12	9	8.2
	2015	7	6	6.6	11	10	9.1
	2017	7	7	6.6	5	4	3.6
Eastern Wood-pewee	2014	7	6	5.7	6	6	5.5
	2015	0	0	0.0	0	0	0.0
	2017	3	2	1.9	4	4	3.6
European Starling	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	1	1	0.9
	2017	0	0	0.0	0	0	0.0
Evening Grosbeak	2014	1	1	0.9	6	1	0.9
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Franklin's Gull ϕ	2014	0	0	0.0	2	2	1.8
	2015	1	1	1.1	0	0	0.0
	2017	17	7	6.6	1	1	0.9
Golden-crowned Kinglet	2014	2	2	1.9	13	9	8.2
	2015	2	2	2.2	11	10	9.1
	2017	0	0	0.0	3	3	2.7
Golden-winged Warbler βϕ	2014	7	7	6.6	9	6	5.5
	2015	2	2	2.2	6	6	5.5
	2017	11	8	7.5	6	4	3.6

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		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Grasshopper Sparrow ɸ	2014	4	2	1.9	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Gray Catbird	2014	11	11	10.4	8	6	5.5
	2015	22	19	20.9	9	8	7.3
	2017	25	18	17.0	12	8	7.3
Gray Jay	2014	2	2	1.9	10	6	5.5
	2015	4	4	4.4	10	8	7.3
	2017	5	5	4.7	15	11	10.0
Great Blue Heron ɸ	2014	1	1	0.9	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Great Crested Flycatcher	2014	17	15	14.2	15	14	12.7
	2015	16	15	16.5	11	11	10.0
	2017	20	15	14.2	23	22	20.0
Great Gray Owl	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	1	1	0.9
	2017	0	0	0.0	1	1	0.9
Greater Yellowlegs β	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	1	1	0.9	0	0	0.0
Green-winged Teal ɸ	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	2	1	0.9
	2017	2	2	1.9	0	0	0.0
Gull sp.	2014	0	0	0.0	0	0	0.0
	2015	3	3	3.3	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Hairy Woodpecker	2014	7	6	5.7	5	5	4.5
	2015	7	6	6.6	5	5	4.5
	2017	6	6	5.7	4	4	3.6
Hermit Thrush	2014	28	25	23.6	39	30	27.3
	2015	22	18	19.8	29	24	21.8
	2017	28	23	21.7	41	31	28.2
Herring Gull β	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	2	2	1.9	6	4	3.6
Hooded Merganser	2014	0	0	0.0	0	0	0.0
	2015	3	1	1.1	0	0	0.0
	2017	0	0	0.0	0	0	0.0
House Wren	2014	12	10	9.4	6	5	4.5
	2015	12	9	9.9	8	7	6.4
	2017	20	15	14.2	4	3	2.7
Indigo Bunting	2014	0	0	0.0	0	0	0.0
	2015	1	1	1.1	1	1	0.9
	2017	0	0	0.0	0	0	0.0

Appendix B: Occurrence of All Birds Recorded During Morning Songbird Surveys

Species[1]	Year	Impact			Control		
		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Killdeer βϕ	2014	4	2	1.9	2	1	0.9
	2015	20	15	16.5	0	0	0.0
	2017	13	10	9.4	0	0	0.0
Least Flycatcher βϕ	2014	121	60	56.6	67	38	34.5
	2015	86	45	49.5	38	24	21.8
	2017	105	57	53.8	28	19	17.3
LeConte's Sparrow βϕ	2014	18	13	12.3	2	1	0.9
	2015	6	5	5.5	0	0	0.0
	2017	17	14	13.2	2	2	1.8
Lesser Yellowlegs β	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	2	1	0.9	0	0	0.0
Lincoln's Sparrow	2014	1	1	0.9	3	3	2.7
	2015	6	6	6.6	3	3	2.7
	2017	8	7	6.6	3	2	1.8
Magnolia Warbler	2014	11	7	6.6	43	31	28.2
	2015	2	2	2.2	13	11	10.0
	2017	18	15	14.2	28	26	23.6
Mallard ϕ	2014	5	3	2.8	2	2	1.8
	2015	3	3	3.3	0	0	0.0
	2017	23	4	3.8	1	1	0.9
Marsh Wren	2014	2	1	0.9	6	4	3.6
	2015	4	3	3.3	0	0	0.0
	2017	5	3	2.8	0	0	0.0
Mourning Dove	2014	1	1	0.9	1	1	0.9
	2015	4	4	4.4	2	2	1.8
	2017	21	18	17.0	5	4	3.6
Mourning Warbler β	2014	20	17	16.0	20	17	15.5
	2015	27	18	19.8	27	20	18.2
	2017	32	28	26.4	23	16	14.5
Nashville Warbler	2014	47	30	28.3	93	60	54.5
	2015	20	18	19.8	65	44	40.0
	2017	33	25	23.6	65	43	39.1
Nelson's Sparrow βϕ	2014	2	2	1.9	0	0	0.0
	2015	1	1	1.1	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Northern Flicker βϕ	2014	8	8	7.5	9	7	6.4
	2015	7	7	7.7	8	8	7.3
	2017	7	7	6.6	3	3	2.7
Northern Goshawk β	2014	1	1	0.9	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	1	1	0.9	0	0	0.0
Northern Harrier βϕ	2014	1	1	0.9	0	0	0.0
	2015	0	0	0.0	2	2	1.8
	2017	1	1	0.9	0	0	0.0

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		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Northern Waterthrush	2014	7	6	5.7	0	0	0.0
	2015	7	7	7.7	2	2	1.8
	2017	7	6	5.7	2	2	1.8
Olive-sided Flycatcher βϕ	2014	0	0	0.0	1	1	0.9
	2015	2	2	2.2	2	2	1.8
	2017	3	3	2.8	3	2	1.8
Orange-crowned Warbler	2014	0	0	0.0	3	3	2.7
	2015	2	2	2.2	1	1	0.9
	2017	0	0	0.0	0	0	0.0
Ovenbird	2014	84	47	44.3	123	67	60.9
	2015	70	42	46.2	110	70	63.6
	2017	86	57	53.8	112	68	61.8
Palm Warbler	2014	0	0	0.0	3	3	2.7
	2015	0	0	0.0	0	0	0.0
	2017	1	1	0.9	0	0	0.0
Philadelphia Vireo	2014	4	4	3.8	1	1	0.9
	2015	0	0	0.0	0	0	0.0
	2017	1	1	0.9	5	4	3.6
Pied-billed Grebe βϕ	2014	0	0	0.0	0	0	0.0
	2015	2	2	2.2	2	2	1.8
	2017	2	2	1.9	0	0	0.0
Pileated Woodpecker β	2014	3	3	2.8	2	2	1.8
	2015	5	4	4.4	5	5	4.5
	2017	6	5	4.7	1	1	0.9
Pine Grosbeak	2014	1	1	0.9	1	1	0.9
	2015	1	1	1.1	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Pine Siskin	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	2	2	1.8
Purple Finch	2014	1	1	0.9	1	1	0.9
	2015	0	0	0.0	1	1	0.9
	2017	0	0	0.0	0	0	0.0
Red-breasted Nuthatch	2014	9	8	7.5	4	4	3.6
	2015	12	11	12.1	19	14	12.7
	2017	3	2	1.9	8	8	7.3
Red-eyed Vireo	2014	161	89	84.0	142	84	76.4
	2015	138	71	78.0	159	86	78.2
	2017	207	86	81.1	178	90	81.8
Red-headed Woodpecker βϕ	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	1	1	0.9
Red-tailed Hawk	2014	1	1	0.9	0	0	0.0
	2015	3	3	3.3	0	0	0.0
	2017	7	6	5.7	0	0	0.0

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		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Red-winged Blackbird	2014	45	24	22.6	4	4	3.6
	2015	57	25	27.5	12	8	7.3
	2017	104	29	27.4	7	5	4.5
Ring-billed Gull	2014	3	3	2.8	1	1	0.9
	2015	2	1	1.1	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Rose-breasted Grosbeak	2014	35	31	29.2	26	22	20.0
	2015	36	31	34.1	36	33	30.0
	2017	28	24	22.6	14	10	9.1
Ruby-crowned Kinglet	2014	4	3	2.8	23	20	18.2
	2015	11	10	11.0	41	29	26.4
	2017	10	10	9.4	22	17	15.5
Ruby-throated Hummingbird	2014	0	0	0.0	1	1	0.9
	2015	2	2	2.2	0	0	0.0
	2017	3	3	2.8	0	0	0.0
Ruffed Grouse	2014	0	0	0.0	15	8	7.3
	2015	2	2	2.2	5	2	1.8
	2017	20	20	18.9	14	14	12.7
Rusty Blackbird [βϕ]	2014	0	0	0.0	0	0	0.0
	2015	2	2	2.2	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Sandhill Crane	2014	0	0	0.0	4	4	3.6
	2015	36	23	25.3	17	12	10.9
	2017	51	30	28.3	22	17	15.5
Savannah Sparrow	2014	13	9	8.5	0	0	0.0
	2015	18	10	11.0	0	0	0.0
	2017	12	8	7.5	0	0	0.0
Sedge Wren [βϕ]	2014	16	12	11.3	5	4	3.6
	2015	22	16	17.6	6	4	3.6
	2017	36	20	18.9	11	5	4.5
Short-eared Owl [βϕ]	2014	0	0	0.0	0	0	0.0
	2015	1	1	1.1	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Solitary Sandpiper [β]	2014	1	1	0.9	0	0	0.0
	2015	0	0	0.0	1	1	0.9
	2017	0	0	0.0	0	0	0.0
Song Sparrow	2014	40	29	27.4	6	5	4.5
	2015	71	47	51.6	15	10	9.1
	2017	139	76	71.7	22	20	18.2
Sora [βϕ]	2014	19	13	12.3	1	1	0.9
	2015	21	13	14.3	4	4	3.6
	2017	16	14	13.2	2	2	1.8
Spotted Sandpiper [ϕ]	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	1	1	0.9

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		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Swainson's Thrush	2014	1	1	0.9	10	7	6.4
	2015	9	7	7.7	19	13	11.8
	2017	16	12	11.3	26	21	19.1
Swamp Sparrow	2014	37	26	24.5	24	16	14.5
	2015	30	19	20.9	25	15	13.6
	2017	33	16	15.1	14	10	9.1
Tennessee Warbler	2014	46	35	33.0	68	47	42.7
	2015	35	24	26.4	71	51	46.4
	2017	11	9	8.5	17	15	13.6
Tree Swallow	2014	2	2	1.9	0	0	0.0
	2015	2	1	1.1	0	0	0.0
	2017	1	1	0.9	2	1	0.9
Turkey Vulture	2014	1	1	0.9	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Veery	2014	53	37	34.9	58	38	34.5
	2015	47	32	35.2	60	44	40.0
	2017	43	31	29.2	52	38	34.5
Virginia Rail βϕ	2014	2	2	1.9	0	0	0.0
	2015	2	2	2.2	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Warbling Vireo	2014	18	14	13.2	6	4	3.6
	2015	23	15	16.5	2	2	1.8
	2017	33	20	18.9	4	4	3.6
Western Meadowlark ϕ	2014	2	2	1.9	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	9	6	5.7	0	0	0.0
White-breasted Nuthatch	2014	1	1	0.9	1	1	0.9
	2015	0	0	0.0	1	1	0.9
	2017	5	3	2.8	1	1	0.9
White-throated Sparrow β	2014	117	64	60.4	210	96	87.3
	2015	111	58	63.7	197	88	80.0
	2017	145	72	67.9	153	82	74.5
White-winged Crossbill β	2014	0	0	0.0	0	0	0.0
	2015	0	0	0.0	0	0	0.0
	2017	0	0	0.0	1	1	0.9
Wilson's Snipe βϕ	2014	57	51	48.1	41	36	32.7
	2015	63	45	49.5	16	16	14.5
	2017	90	66	62.3	30	27	24.5
Wilson's Warbler	2014	0	0	0.0	2	2	1.8
	2015	0	0	0.0	0	0	0.0
	2017	4	3	2.8	3	3	2.7
Winter Wren	2014	11	10	9.4	30	26	23.6
	2015	10	10	11.0	18	16	14.5
	2017	13	11	10.4	18	14	12.7

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		Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]	Max. Birds Observed[2]	No. of Stations Observed	Percent of Stations Observed[3]
Wood Duck	2014	0	0	0.0	0	0	0.0
	2015	9	2	2.2	0	0	0.0
	2017	0	0	0.0	0	0	0.0
Woodpecker sp.	2014	0	0	0.0	1	1	0.9
	2015	2	2	2.2	4	4	3.6
	2017	0	0	0.0	0	0	0.0
Yellow Warbler	2014	72	42	39.6	18	13	11.8
	2015	65	37	40.7	17	13	11.8
	2017	65	40	37.7	34	24	21.8
Yellow-bellied Flycatcher	2014	6	5	4.7	5	5	4.5
	2015	1	1	1.1	6	6	5.5
	2017	7	7	6.6	15	12	10.9
Yellow-bellied Sapsucker [β]	2014	20	16	15.1	26	23	20.9
	2015	30	26	28.6	28	21	19.1
	2017	34	24	22.6	14	13	11.8
Yellow-rumped Warbler	2014	5	5	4.7	39	26	23.6
	2015	2	1	1.1	34	23	20.9
	2017	12	11	10.4	23	20	18.2

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