MANITOBA-MINNESOTA TRANSMISSION PROJECT

BIRD-WIRE COLLISION MONITORING 2024

Prepared for

Manitoba Hydro

By

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SUMMARY

As part of the Environmental Monitoring Plan for the Manitoba-Minnesota Transmission Project (MMTP), bird-wire collision surveys were conducted in 2024 to further monitor the effectiveness of avian collision mitigation installed. The 2024 survey also served to determine the effectiveness of retrofitting transmission lines with more diverters at sites with higher-than-expected rates of collision mortality.

In 2023, five of the monitored sites were retrofitted with additional bird diverters (high treatment sites, diverters at 2.5 m intervals) after previous MMTP bird-wire collision monitoring studies (2020-2022) found they had higher-than-expected rates of mortality. Six of the monitored sites were ESS or previous control sites that had been fitted with bird diverters (standard treatment sites, diverters at 5 m intervals). ESS were sites identified as being higher risk for bird-wire collisions during pre-construction monitoring. Two of the sites, previously defined as low-risk sites, did not have bird diverters and were located nearby (control sites). Each survey site was visited twice during the survey period.

Bird-wire collision mortality monitoring was conducted in spring 2024 using standardized survey methods. A bird movement survey was conducted at most sites prior to the collision survey to help evaluate of the effectiveness of the bird diverters. Evidence of 41 bird collisions were found at the survey sites in spring 2024. Of the total collisions found, 20 were observed at sites with additional bird diverters, 15 were observed at sites with bird diverters, and six were observed at control sites. The most common species observed among mortalities was Canada goose (*Brant canadensis*). Bird movements were similar to those monitored from 2020 to 2022.

The estimated weekly bird mortality per kilometre was similar among sites with bird diverters, additional diverters, and control sites during the spring 2024. This suggests that the mortality of birds at high-risk areas with additional bird diverters are not different than the mortality of birds at low-risk areas without bird diverters. Over all sites estimated weekly bird mortality was lower in spring 2024, so it is unclear if the additional bird diverters are responsible for the decreases observed. Estimated weekly bird mortality per km ranged from 0 to 35.1 mortalities/km at sites with additional bird diverters, 0 to 64.2 mortalities/km at sites with bird diverters, and 12.1 to 35.4 at control sites. These mortality rates are similar to those found elsewhere in Manitoba and North America.

This survey found anecdotal evidence to suggest that increasing the density of bird diverters from one diverter per 5 m to one diverter per 2.5 m reduced bird mortality in spring. The three sites that had more diverters added to existing diverters had lower bird mortalities compared to previous survey years. This held true even though the bird passage over the line was similar among all survey years. One control site that had diverters added to it, and one site where diverter density increased, had collision mortality reduced to zero in 2024. A larger sample size and a longer-term monitoring program would be required to test whether increasing the density of diverters does reduce the bird mortality rate significantly.

Table of Contents

List of Tables

List of Figures

List of Maps

List of Appendices

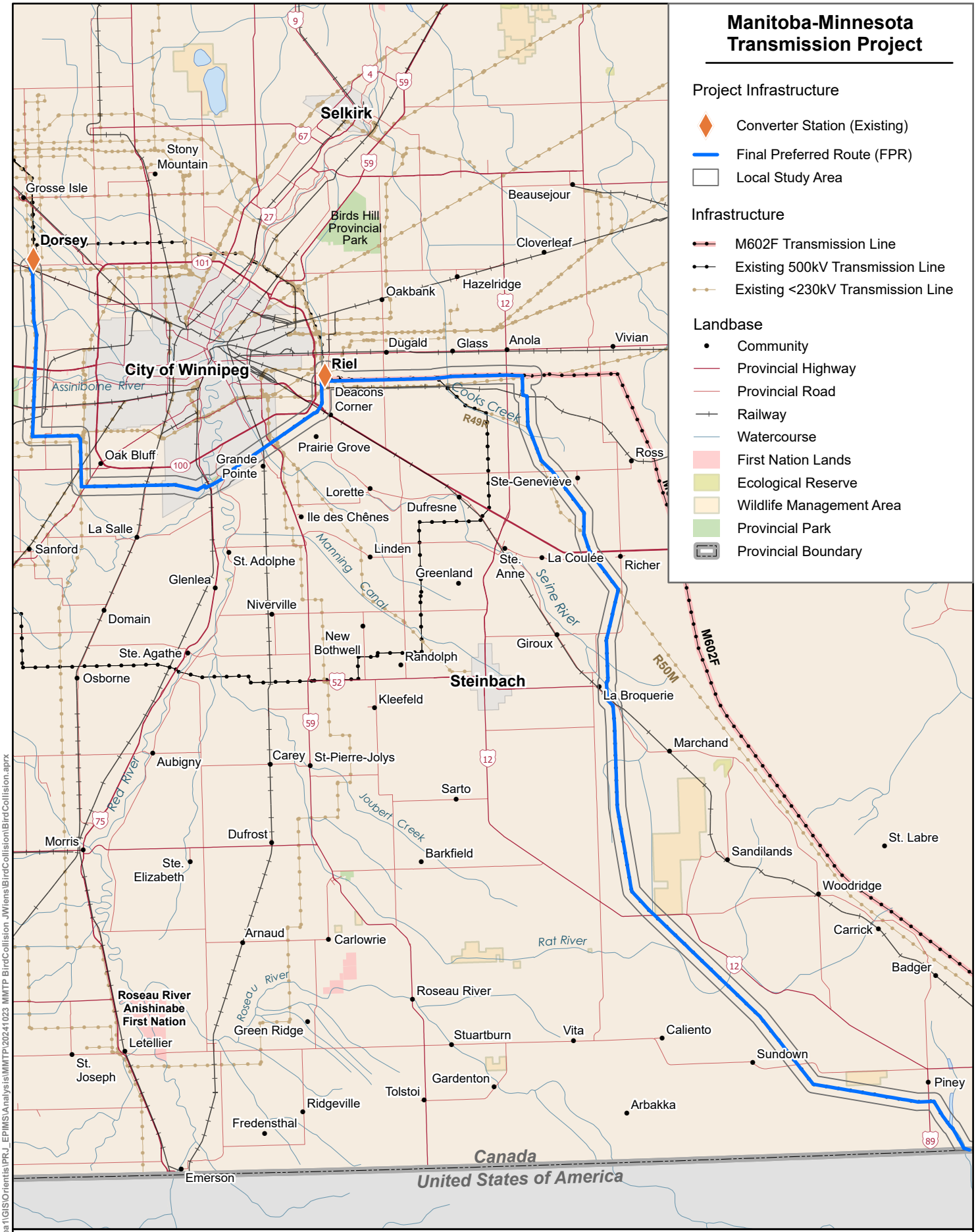
1.0 INTRODUCTION

The Manitoba-Minnesota Transmission Project (MMTP) is a 500 kilovolt, alternating current transmission line that originates at the Dorsey Converter Station on the northwest side of Winnipeg, and ends at the United States border near Piney, Manitoba (Map 1). During the environmental assessment process, a potential increase of bird mortalities was identified due to bird-wire collisions. Section 4.5.3 in the MMTP Environmental Monitoring Plan outlined the monitoring approach for bird-wire collisions (Manitoba Hydro 2019).

Transmission lines pose a collision risk to birds and can cause fatalities or injuries that can be a significant source of mortality for some species (APLIC 2012; Loss et al. 2014). Birds that are most vulnerable to wire collisions often include long-distance migrants, nocturnal migrants, and species with high wing-loading (small wings relative to body size) (Bevanger 1994; Rioux et al. 2013). Other factors that also can affect bird collision risk, include the local habitat, environmental conditions, and the design of the transmission line (Bevanger 1994; Bevanger and Broseth 2001). Generally, birds can avoid colliding with transmission lines if they are able to see the obstacle early enough (APLIC 2012). Commercially available products can be installed on transmission lines to increase their visibility to birds and have been proven to reduce bird collisions (Barrientos et al. 2012; Brown and Drewien 1995; Morkill and Anderson 1991).

Migration studies, bird movement studies, and bird collision monitoring were performed during pre-construction monitoring in 2014 to identify Environmentally Sensitive Sites (ESS's) where there was potential for a high number of bird-wire collisions (Stantec 2015). To mitigate risk of bird-wire collisions posed by the MMTP, ESS's were fitted with bird diverters during construction. Bird diverters were installed on the ground conductor wires, including an alternating sequence of Swan-Flight™ Bird Diverters and Bird Flight Diverters, and in some areas additional aircraft cone line markers, that also served to make the transmission line visible to aircraft (Photo 1; Photo 2).

Bird-wire collision surveys along the MMTP from 2020 to 2022 found average estimated seasonal bird mortality/km to range from 30.6 to 478.6 mortalities/km at sites with bird diverters and 48.3 to 209.1 mortalities/km at control sites (WRCS 2022). Due to the higher estimated bird-wire collision mortality compared to pre-construction monitoring and other collision mortality studies in the province, some spans along the MMTP were retrofitted to see if bird-wire collision risk could be mitigated further (Wiens 2023). Additional devices were added in 2023 to some ESS sites that increased the number of existing diverters from one diverter per 5 m to one diverter per 2.5 m. Diverters were also added to some control sites which previously had none. This report examines the additional monitoring for avian mortality caused by transmission line infrastructure in 2024 and to determine the effectiveness of adding more diverters to the MMTP and M602F transmission lines. Since the M602F transmission line may have contributed to the high number of collisions observed in previous years at the Wild-106 site on the MMTP, the survey site Wild-M01 on the M602F transmission line was added.


Manitoba-Minnesota Transmission Project
Project Infrastructure
Converter Station (Existing)
Final Preferred Route (FPR)
Local Study Area
Infrastructure
M602F Transmission Line
Existing 500kV Transmission Line
Existing <230kV Transmission Line
Landbase
Community
Provincial Highway
Provincial Road
Railway
Watercourse
First Nation Lands
Ecological Reserve
Wildlife Management Area
Provincial Park
Provincial Boundary
Selkirk
Stony Mountain
Grosse Isle
Dorsey
Birds Hill Provincial Park
Beausejour
Cloverleaf
Oakbank
Hazelridge
Dugald
Glass
Anola
Vivian
City of Winnipeg
Riel
Assiniboine River
Deacons Corner
Cooks Creek
R49R
Prairie Grove
Oak Bluff
Grande Pointe
Ross
Ste-Genevieve
Lorette
Dufresne
Ile des Chênes
La Salle
Sanford
Linden
St. Adolphe
Manning Canal
Ste. Anne
La Coulée
Richer
Glenlea
Greenland
Seine River
Niverville
Domain
New Bothwell
Giroux
Ste. Agathe
Randolph
M602F
R50M
Osborne
Steinbach
La Broquerie
Kleefeld
Marchand
Aubigny
Carey
St-Pierre-Jolys
Red River
Sarto
Joubert Creek
Dufrost
Morris
Barkfield
Sandilands
St. Labre
Ste. Elizabeth
Woodridge
Carrick
Arnaud
Carlowrie
Rat River
Badger
Roseau River Anishinabe First Nation
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Green Ridge
Stuartburn
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Caliento
Letellier
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Ridgeville
Arbakka
Fredensthal
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Data Source: MBHydro, ProvMB, NRCan
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MMTP Project Area
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Map 1-1
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Photo 1. Swan-Flight Bird Diverter (top) and Bird Flight Diverter (bottom) (Linestar Utility Supply 2021; Preformed Line Products 2021)

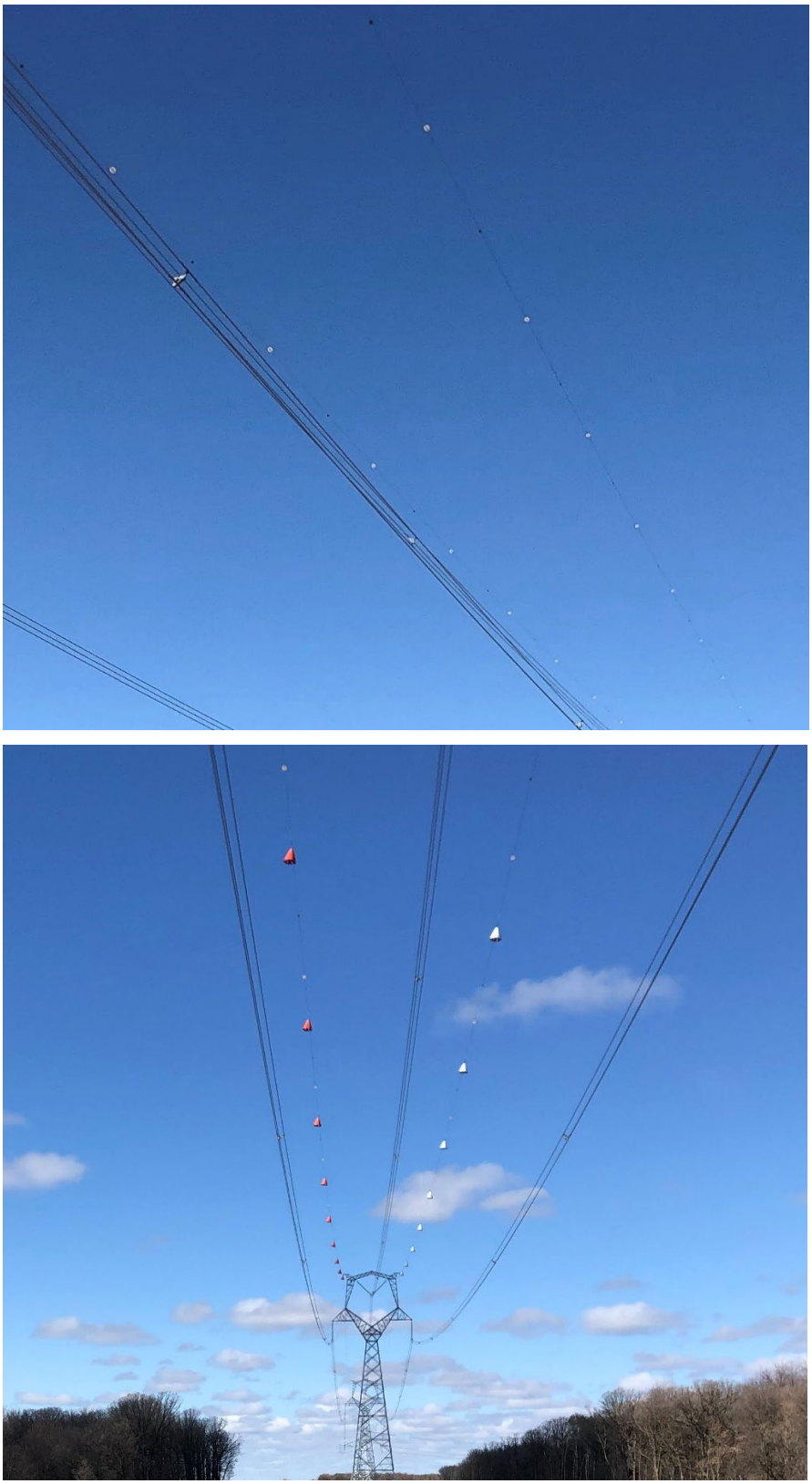


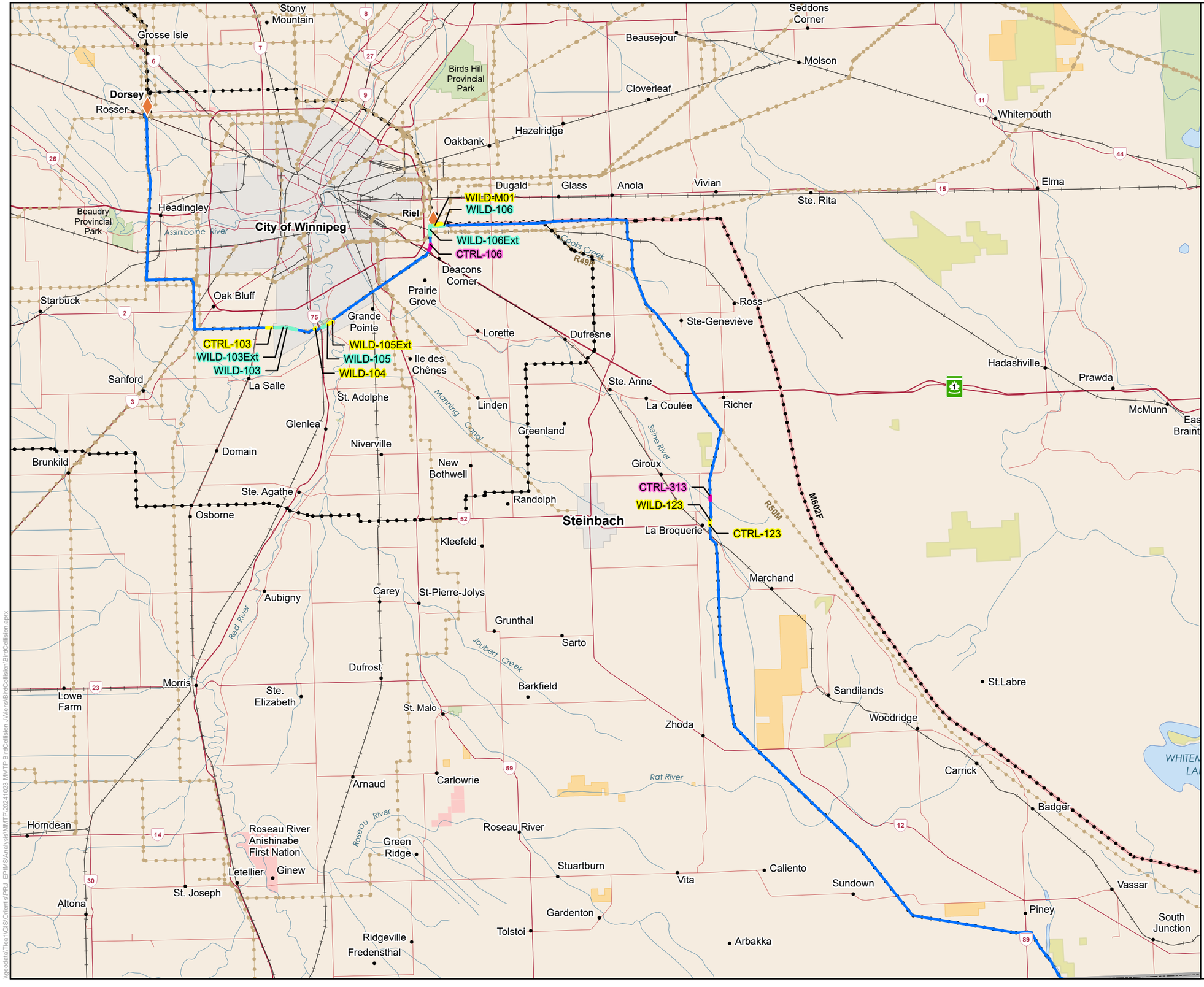
Photo 2. Alternating Swan-Flight Bird Diverters and Bird Flight Bird Diverters (top), and additional aircraft cone markers (bottom) on the Manitoba-Minnesota Transmission Project

2.0 METHODS

2.1 BIRD-WIRE COLLISION MONITORING

Twelve sites were selected for bird-wire collision mortality monitoring along the Manitoba-Minnesota Transmission Project, focusing on sites where diverters were added (Map 2). Originally, eight of the sites were identified as ESS's that were fitted with bird diverters at 5 m intervals. Of these eight sites, five received additional diverters, increasing them to a density of one diverter per 2.5 m. Four of the sites were originally control sites, which were not fitted with bird diverters, but were expected to have above average bird activity due to waterbody crossings or were nearby ESS's that were also selected for monitoring. Two of these control sites were fitted with diverters (5 m intervals) following bird-wire collision monitoring from 2020-2022. One site (Wild-M01) was located on the M602F transmission line, which runs parallel to MMTP (Wild-106) near the Deacon Reservoir. Sites ranged in length from 136 to 1,477 m in length (Table 1). Sites with one diverter per 2.5 m were defined as high treatment sites. Sites with one diverter at 5 m intervals were defined as standard treatment sites. Sites with no diverters were defined as control sites.

Methods for bird-wire collision monitoring followed methods similar to previous studies in Manitoba (Wood 2019; WRCS 2018a, 2018b, 2018c), MMTP studies (Stantec 2015; WRCS 2021, 2022) and elsewhere (APLIC 2012). Surveys for bird-wire collisions were conducted at each site by four observers. Each site was visited twice, with 6-7 days between visits. Visits occurred between 14 May 2024 and 23 May 2024. Observers walked parallel lines spaced 5-10 m apart, for the entire length of the site, below the cleared right-of-way (ROW) (CWSEC 2007; Photo 3). The spacing of observers varied slightly depending on depending on the relative density of vegetation and terrain. Observers visually inspected the search area for signs of bird collisions (i.e., carcasses and clusters of feathers). Collisions were recorded when the remains found consisted of more than five feathers in a square metre (Barrientos et al. 2012). The location of the collision was recorded using a handheld global positioning system (GPS) and collision evidence was identified to species where possible and photographed.



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Converter Station
- Final Preferred Route (FPR)

Bird Collision Survey Location

- Bird Diverter - Absent
- Bird Diverter - Present
- Bird Diverter - Additional

Infrastructure

- Existing 500kV Transmission Line
- M602F Transmission Line
- Existing ≤230kV Transmission Line

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- City
- First Nation Lands
- Ecological Reserve
- Wildlife Management Area
- Provincial Park

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: October 25, 2024

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Bird Collision Surveys 2024
Overview

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Table 1. Survey Dates and Site Characteristics for Bird-wire Collision Monitoring

Site ID	UTM Start	UTM End	Bird Diverters	Change from 2022	Environmentally Sensitive Site	Site Length (m)	Spring 2024	
							Visit 1 Date	Visit 2 Date
Wild-103	14N 631009 5511990	14N 629896 5512242	Present (2.5 m interval)	More diverters added	Brady Landfill	1141	May 14	May 21
Wild-103ext	14N 628472 5512218	14N 629408 5512252	Present (2.5 m interval)	Transect added	Brady Landfill	961	May 15	May 22
Wild-104	14N 633256 5512083	14N 633375 5512151	Present (5 m interval)	None	La Salle River	136	May 14	May 21
Wild-105	14N 634221 5512238	14N 634926 5512641	Present (2.5 m interval)	More diverters added	Red River	647	May 14	May 21
Wild-105ext	14N 635509 5512977	14N 634926 5512643	Present (5 m interval)	Transect added	Red River	672	May 14	May 21
Wild-106	14N 647685 5524748	14N 649187 5524786	Present (2.5 m interval)	More diverters added	Deacon Reservoir	1477	May 14	May 21
Wild-106ext	14N 647460 5524743	14N 647488 5523632	Present (2.5 m interval)	Transect added	Deacon Reservoir	1069	May 14	May 21
Wild-123	14N 681840 5488435	14N 681914 5488533	Present (5 m interval)	None	Seine River	275	May 15	May 22
Wild-M01	14N 648080 5524851	14N 648883 5524988	Present (5 m interval)	Transect added	Deacon Reservoir	919	May 15	May 22
Ctrl-103	14N 627981 5512213	14N 627408 5512198	Present (5 m interval)	Diverters added	Brady Landfill	573	May 14	May 21
Ctrl-106	14N 647519 5522464	14N 647351 5521749	Absent	None	Deacon Reservoir	761	May 16	May 23
Ctrl-123	14N 681842 5488432	14N 681863 5487958	Present (5 m interval)	Diverters added	Seine River	575	May 15	May 22
Ctrl-313	14 U 681909 5491502	14N 681923 5491017	Absent	None	Unnamed Creek	485	May 15	May 22

Photo 3. Personnel Conducting a Bird-mortality Collision Survey along the MMTP right-of-way, May 2024

Sources of bias, including searcher efficiency bias and scavenger bias, can influence the estimations of bird collisions. Searcher efficiency bias is important to include in mortality estimates as dead or injured birds may be overlooked during a survey, particularly when vegetation is present. Additionally, scavenger bias is important to include as both mammalian and avian scavengers may remove carcasses before they are located. By placing (planting) dead birds on the survey sites, these sources of biases can be considered, and a more accurate estimate of bird mortality can be produced.

Searcher efficiency bias was estimated by planting quail (*Coturnix* sp.) carcasses, sourced from a commercial supplier, within search areas in locations unknown to the searchers prior to searches commencing (California Energy Commission 2003; APLIC 2012). In 2020, one quail was planted at 14 sites, in 2021 two quail were planted at 15 sites during each survey period (spring, summer, fall), and in 2022, two quail were planted at 11 sites during each survey period for the searcher efficiency trials. The proportion of the planted birds found is then used in the estimation of total collision mortality. Searcher efficiency was calculated for sites with bird diverters and control sites for each survey period. The overall searcher efficiency for each survey period, including both sites with bird diverters and control

sites, was used in final calculations as it provided a larger sample size and better estimation of searcher efficiency.

Searcher efficiency was calculated as:

$$\text{Seacher Efficiency} = \frac{\text{Number of planted birds found}}{\text{Number of birds planted}}$$

The planted birds used in the searcher efficiency trials were also used to estimate the scavenger removal bias. Search periods were separated by six to seven days to allow time for potential scavengers, such as red fox (*Vulpes vulpes*), coyote (*Canis latrans*), racoon (*Procyon lotor*), common raven (*Corvus corax*), American crow (*Corvus brachyrhynchos*), gull species (family Laridae), and burying beetle species (genus *Nicrophorus*), to locate planted bird carcasses. Carcasses were considered scavenged if they were missing, or partially consumed. The proportion of planted birds remaining after the specified period was used to determine the scavenger bias. The scavenger bias for sites with bird diverters and control sites for each survey period was used in final calculations to account for differences in scavenger presence between the site types.

Scavenger bias was calculated as:

$$\text{Scavenger Bias} = \frac{\text{Number of planted birds remaining}}{\text{Number of birds planted}}$$

Habitat bias effects were also calculated to account for unsearchable portions of the formal search areas (i.e., marshes, ponds, thick standing crops). Unsearchable areas were delineated in the field with a handheld GPS and its size was subtracted from the formal search area.

Habitat bias was calculated as:

$$\text{Habitat Bias} = \frac{\text{Actual area searched}}{\text{Formal search area}}$$

Estimated collision mortality (collisions/site/week) was calculated using searcher efficiency, scavenger, and habitat bias at all surveyed sites. The following assumptions were made during calculations:

- Due to logistical restraints, weather conditions, etc., site revisits were conducted from six to seven days after the initial visit. Despite these differences in duration, it was assumed that collision mortalities and scavenging results are representative of a seven-day period.
- The observed level of mortality was consistent throughout the six-week spring and six-week fall migration periods.
- Bird mortality is negligible outside these six-week migration periods.

- The sites surveyed have representative levels of mortality in comparison to other areas of the transmission line.

Estimated weekly mortality was calculated as:

$$\text{Estimated Weekly Mortality} = \frac{\text{Number of bird carcasses found}}{\text{Searcher Efficiency} * \text{Scavenger Bias} * \text{Habitat Bias}}$$

The estimated weekly mortality was then standardized per kilometre of transmission line searched to obtain the estimated weekly mortality/km. To estimate seasonal collision mortality (spring or fall), weekly collision mortality estimates were multiplied by a factor of six weeks (42 days). Annual collision mortality can be calculated by adding the spring and fall collision mortality estimates together.

Due to the low number of sites as treatments and the low number of controls, statistical tests were not performed.

2.2 BIRD MOVEMENT SURVEYS

To provide a comparison of bird activity between the sites with bird diverters to the control sites, a bird movement survey was conducted in 2021, 2022, and 2024. As sites fitted with bird diverters were chosen because they had high numbers of bird movements observed prior to construction (Stantec 2015; Manitoba Hydro 2015), a comparison of bird movements with control sites is useful in helping to determine if bird diverters are working successfully. Bird movement surveys were conducted at all sites, except for site Wild-123, prior to searching for bird carcasses. All personnel were involved monitoring bird activity across and around the ROW for 15 minutes at each bird-wire collision site. The number, species (where possible), approximate flight height in relation to tower height, and general cardinal direction of birds crossing the ROW was recorded. A Mann-Whitney u-test ($\alpha = 0.05$) was used to test for a difference of bird movements observed in 2024 to those observed in 2022 and 2021.

Photo 4. Personnel Conducting a Bird Movement Survey Along the MMTP Right-of-way, May 2022

3.0 RESULTS

3.1 BIRD-WIRE COLLISION SURVEYS

Evidence of 41 bird collisions were found at the survey sites in 2024. Of the total collisions found, 20 were observed at high treatment sites where bird diverter intervals were reduced to one per 2.5 m, 15 were found at standard treatment sites with diverters at one per 5 m, and six were observed at control sites (no diverters) (Table 2). The greatest number of collisions (9) were found at both the Wild-105ext, which crosses the Red River spillway, and the Wild-106 site, at the Deacon Reservoir (Table 2). Sites, Wild-103ext, Wild-M01, and CTRL-106 also had relatively high numbers of collisions compared to other sites (Table 2).

Collision mortality estimates were greatest at site Wild-105ext (Table 2). Compared to previous spring surveys, collision mortalities were lower in 2024 (Table 2). Collision mortality estimates tended to be similar among control, standard treatment, and high treatment sites (Figure 1). One standard treatment site (i.e., one diverter per 5 m) and one high treatment site (i.e., one diverter per 2.5 m) had collision mortality estimates reduced to zero in 2024 compared to 2020-22 (Table 2). It should be noted however, that two standard treatment sites with high collision mortality in 2020-2022 were also reduced to a zero-collision mortality estimate in 2024 without any additional diverters being added. All sites previously surveyed in 2020-2022 that had diverters or increased density of diverters in 2024 saw a reduction in estimated collision mortality as well as in total number of collisions (Table 2, Table 3).

Waterfowl (family Anatidae) and Sparrows (family Passerellidae) were the most common groups of birds found during the surveys, and each consisted of 13 of the total mortalities observed in 2024 (Appendix 1). The most common species observed during the surveys were Canada goose (*Branta canadensis*), which consisted of eight of the total mortalities observed (Appendix 1). American crows were also a common mortality, accounting for four of the total mortalities observed (Appendix 1).

Searcher efficiency was relatively high compared to previous surveys at 0.68 (Appendix 2). Proportion of quail remaining was relatively high compared to previous spring surveys (Appendix 2). On 15 May 2024 an additional check for quail scavenging was made and nine of the 22 quail remained. When the sites were revisited a week later (21-23 May 2024) from when the quail were originally deployed six of the 22 quail remained. A final check was conducted on 24 May 2024; no quail remained.

Table 2. Bird Collision Evidence Observed Along the MMTP from 2020-2022 and 2024

Site	Bird Diverters (2020-2022)	Bird Diverters (2024)	Average Weekly Mortality/km (2020-2022)	Average Spring Weekly Mortality/km (2021-2022)	Average Spring Weekly Mortality/km (2024)	Relative Change in Spring Weekly Mortality/km
Wild-103	5 m interval	2.5 m interval	27.4	46.8	9.5	Decrease
Wild-103ext	-	2.5 m interval	-	-	35.1	-
Wild-104	5 m interval	5 m interval	45.6	182.5*	0	Large decrease
Wild-105	5 m interval	2.5 m interval	52.8	192.2*	0	Large decrease
Wild-105ext	-	5 m interval	-	-	64.2	-
Wild-106	5 m interval	2.5 m interval	69.4	187.5	34	Large decrease
Wild-106ext	-	2.5 m interval	-	-	15.9	-
Wild-123	5 m interval	5 m interval	32.6	56.5	0	Decrease
Wild-M01	-	5 m interval	-	-	30.7	-
Ctrl-103	Absent	5 m interval	40.5	68.3	18.8	Decrease
Ctrl-106	Absent	Absent	18.9	24.7	35.4	Increase
Ctrl-123	Absent	5 m interval	43.5	93.8	0	Decrease
Ctrl-313	Absent	Absent	36.1	91.84	17.1	Decrease

*Surveyed only in Spring, 2021

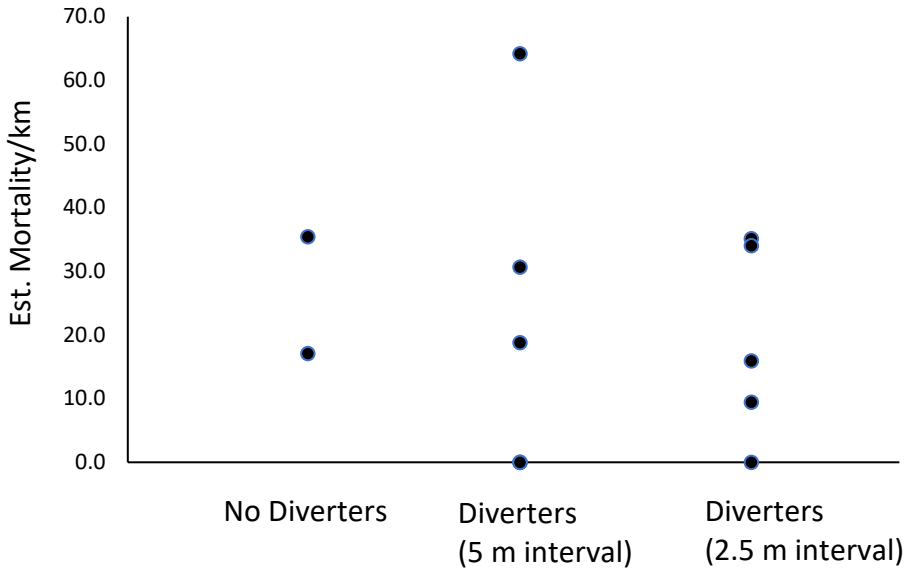

Figure 1. Estimated (Est.) Bird Collision Mortality at Sites in Spring 2024

Table 3. Bird Collision Evidence Observed Along the MMTP and M602F in Spring from 2021-2022 and in 2024

Site	Bird Diverters	Collisions 2024	Collisions 2022	Collisions 2021
Wild-103	2.5 m interval	2	2	4
Wild-103ext		6	-	-
Wild-105		0	5	-
Wild-106		9	10	22
Wild-106ext		3	-	-
Wild-104	5 m interval	0	1	-
Wild-105ext		8	-	-
Wild-123		0	0	1
Wild-M01		5	-	-
Ctrl-103		2	4	3
Ctrl-123		0	5	2
Ctrl-106	Absent	5	1	2
Ctrl-313		1	1	3
Total		41	29	37

- = not sampled

3.2 BIRD MOVEMENT SURVEYS

Bird movements appeared to be slightly higher at sites with bird diverters in spring 2024, but bird movements at sites without diverters were well within the range observed at sites with diverters (Table 4). Overall, bird movements in 2024 did not differ significantly ($p = 0.98$) from bird movements observed in spring 2021 and 2022 combined.

Table 4. Bird Movement Numbers and Site Type During Spring 2024

Site	Bird Diverters 2024	Spring 2024	Spring 2022	Spring 2021
Wild-103	2.5 m interval	22	28	22
Wild-103ext		4	-	-
Wild-105		8	-	1
Wild-106		23	4	16
Wild-106ext		23	-	-
Wild-104	5 m interval	40	-	21
Wild-105ext		16	-	-
Wild-123		-	-	-
Wild-M01		7	-	-
Ctrl-103		5	46	1
Ctrl-123		55	66	80
Ctrl-106	Absent	6	4	4
Ctrl-313		21	44	18

4.0 DISCUSSION

Estimated weekly mortality was much lower in 2024 compared to previous survey years. This is true when comparing the 2024 estimated mortality to the previous years' average weekly mortality, which includes summer and fall surveys which have a lower average weekly mortality when compared to spring. The decrease is even more pronounced when comparing the 2024 spring estimated weekly mortality to the average spring estimated weekly mortality observed during 2022-2021.

The weekly mortality estimates observed in 2024 are comparable to mortality rates reported in other published studies. Faanes (1987) estimated bird collision mortality rate of 69 birds/km and Rioux et al. (2013) found average mortality rates of 42.3 ± 17.1 birds/km/year. However, comparisons of mortality rates between studies may be misleading as sources of bias (searcher efficiency, scavenger bias, habitat bias) can vary substantially between study locations (Morrison 2002; APLIC 2006).

The estimated collision mortality rates observed during this study are also comparable to those observed during the pre-construction studies conducted along the proxy transmission lines in 2014, and those observed at other transmission lines in the province (Table 5). Some of the difference in annual mortality observed in this study compared to the studies listed in Table 5 may be due to differences in bird abundance and diversity due to latitude of the study sites.

Table 5. Estimated Seasonal Collision Mortality (mortalities/km/6 weeks) from Other Studies Conducted in Manitoba (WRCS 2017; WRCS 2018a; WRCS 2018b; WRCS 2018c; WRCS 2021)

Study and Year(s)	Estimated Collision Mortality (mortalities/km/6 weeks)					
	Spring Migration Diverters Present	Spring Migration Diverters Absent	Breeding Bird Diverters Present	Breeding Bird Diverters Absent	Fall Migration Diverters Present	Fall Migration Diverters Absent
Keeyask Transmission Project 2016	NA	NA	10.8	0	10.32	0
Keeyask Transmission Project 2017	469.09*	1130.88*	0	54.91	14.54	27.49
Lake Winnipeg East 2018	NA	NA	NA	NA	5.98	NA
Wuskwatim Outlet Transmission Line 2014, 2016-2018	NA	NA	NA	27.34	NA	27.34
Bipole III Transmission Line 2018-2020	35.10	29.64	NA	NA	19.68	19.38

* The estimated collision mortality was inflated due to efficient scavengers.

That all high treatment sites had lower estimated spring mortality in 2024 than previous survey years provides anecdotal evidence that, in this case, doubling the number of diverters may have helped reduce the bird mortality rate. That estimated spring mortality among high treatment, standard treatment, and control sites had similar ranges of estimated spring mortality suggests that diverters are successfully mitigating collision risk across sites. The number of birds crossing the line in 2024 did not differ significantly from previous survey years, suggesting that the decrease in spring mortality estimates is not due fewer bird movements compared to previous survey years.

Support for the explanation that increasing bird diverter density to one per 2.5 m reduced spring mortality should be interpreted cautiously, as estimated weekly spring mortality was lower at most sites in 2024, including at sites that had not received any additional diverters. Of sites monitored in 2024 and in previous survey years, only a control site (Ctrl-106) had a higher estimated spring mortality in 2024. The survey's small sample size and single season of bird-wire collision monitoring since the installation of additional diverters are further reasons to interpret these results with caution. The spring bird mortality rate observed in 2024 may be unusually low, and the mortality rates observed in the springs of 2021 and 2022 could be more typical.

A lower proportion of quail were scavenged during 2024's scavenging trials compared to previous spring surveys, which reduced the estimated collision mortality despite similar numbers of collisions found at sites in spring 2024 compared to previous spring surveys. In 2024 scavengers took 75% of quail at sites with bird diverters in spring, as compared to previous years where scavengers took 90-94% of all the planted bird carcasses (Appendix 2). Additional checks on the deployed quail revealed that within four days of the first quail being deployed over half the quail had been scavenged. The proportion of quail scavenged during the trial might be influenced by site conditions such as vegetation cover, weather, and human activity. Scavenger behaviour should also influence the proportion of quail scavenged and would be expected to vary year to year with fluctuations in factors such as disease, food availability, and predator presence for scavenging species.

Two of the new sites (Wild-103ext and Wild-105ext) were among the sites with higher numbers of collisions observed at sites in 2024, despite Wild-103ext having extra diverters installed. Generally, the previously monitored counter parts of new sites had relatively high collision mortality estimates for spring, except for Wild-103, which had a medium collision mortality estimate. At the Wild-106 site, a similar number of collisions to spring of 2022 were observed. This supports the hypothesis that the extremely high number of collisions observed at Wild-106 in 2021 may have been in part due to extensive flooding in southern Manitoba restricting the habitat available to birds and concentrating them in higher numbers in unflooded habitat near the MMTP that year (WRCS 2022). As with earlier interpretations in this report, caution should be taken when interpreting these results as the low sample size of the survey and the single year of monitoring since the installation of additional bird diverters makes the results susceptible to environmental variables that change year to year as well as random chance.

Another factor previously suggested to have influenced the collision mortality at site Wild-106 is the presence of several other transmission lines adjacent to the MMTP that lack bird diverters (WRCS 2022). There are three other transmission lines parallel to the MMTP, along the Deacon Reservoir, two of which do not have bird diverters. These transmission lines could potentially contribute to bird mortalities in the area and along the MMTP ROW if crippled birds end up at site Wild-106. To mitigate this, diverters were added to the M602F transmission line in 2024. Wild-M01, a site on the M602F transmission line with bird diverters added to it, had a similar mortality estimate to Wild-106 in 2024. That the M602F site had a moderate number of collisions supports that the two transmission lines might be contributing collisions to each other through crippling events.

The Wild-105ext, Wild-106, and Wild-103ext sites also had relatively high numbers of bird collisions in comparison to other sites in spring 2024. With Wild-105ext having the highest bird mortality estimate, almost over double the collision mortality estimates of Wild-106 and Wild-103ext. It is possible that the waterbodies at sites Wild-105ext and Wild-106, the Red River and Deacon Reservoir, respectively, may provide some of the earliest open water habitat in spring due to the presence of flowing or circulating water. Open water habitat is attractive to species groups such as waterfowl and gulls, which have been detected during collision surveys. Wild105ext did not have flowing or circulating water, but did have a wetland on the western portion of the site. The wetland may have similarly been attractive to waterfowl and other species.

The groups of birds and species observed as collision mortalities in this study were consistent with other studies. In previous studies, waterfowl, grebes, shorebirds, and cranes were common collision fatalities (Bevanger 1998; Rioux et al. 2013; Bernardino et al. 2018), generally due to their relatively large body size and small wings. In this study, species of waterfowl were some of the most common collision fatalities observed. Sparrows were also a common group of birds observed as mortalities in this study and may be attributed to their relative abundance, particularly during the spring migration period.

The results in this report described an additional season of bird-wire collision monitoring for MMTP operation at sites retrofitted with more bird diverters. No further monitoring is scheduled currently.

5.0 CONCLUSIONS

Collision mortality rates along all monitored MMTP sites in 2024 were lower than previous survey years, suggesting that collision mortality rates along the MMTP may not be as high as previously estimated and perhaps more similar to other studies in Manitoba and in North America. Anecdotal evidence suggests that increasing the density of bird-wire diverters, and in this case, changing it from one diverter per 5 m to one diverter per 2.5 m, may have reduced the bird mortality rate over the number of previously prescribed bird-wire diverters in spring 2024. Alternative mitigation measures may not be required as in 2024 sites of concern and other sites had similar collision mortality rates, but the low number of surveys makes this difficult to conclude. No further monitoring is currently planned.

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APPENDIX 1: BIRD COLLISION SURVEY RESULTS 2024

Table 1. Bird Collision Survey Results 2024

Site	Bird Diverters	Date	Species	UTM	Total Collisions
Wild-103	Present	14-May-24	Canada Goose	14 U 630620 5512065	2
		14-May-24	Western Meadowlark	14 U 630316 5512167	
Wild-103ext		15-May-24	Juvenile Gull	14 U 629406 5512246	6
		15-May-24	Savannah Sparrow	14 U 628995 5512231	
		15-May-24	Canada Goose	14 U 628899 5512221	
		15-May-24	Unknown Species	14 U 628794 5512232	
		15-May-24	Juvenile Gull	14 U 628762 5512253	
		22-May-24	Canada Goose	14 U 629068 5512235	
Wild-105ext		15-May-24	Savannah Sparrow	14 U 634717 5512498	8
		15-May-24	Gull Spp.	14 U 635381 5512898	
		15-May-24	American Crow	14 U 635477 5512942	
		15-May-24	White Throated Sparrow	14 U 635381 5512920	
		15-May-24	American White Pelican	14 U 635309 5512886	
		15-May-24	Mallard	14 U 635199 5512812	
		15-May-24	Virginia Rail	14 U 634972 5512690	
		21-May-24	American Crow	14 U 635478 5512951	
Wild-106		14-May-24	Unknown Species	14 U 648262 5524756	9
		14-May-24	American Crow	14 U 648074 5524744	
		14-May-24	Duck Spp.	14 U 647594 5524761	
		14-May-24	American Crow	14 U 647711 5524758	
		14-May-24	Canada Goose	14 U 647753 5524759	
		14-May-24	Duck Spp.	14 U 647960 5524763	
		14-May-24	Savannah Sparrow	14 U 648824 5524779	
		21-May-24	Unknown Species	14 U 647878 5524756	
		22-May-24	Corvid Spp.	14 U 648756 5524775	
Wild-106ext		14-May-24	Canada Goose	14 U 647474 5524308	3
		14-May-24	Canada Goose	14 U 647482 5523663	
		21-May-24	Unknown Species	14 U 647485 5524200	
Wild-M01		15-May-24	Unknown Species	14 U 648482 5524861	5
		15-May-24	White-throated Sparrow	14 U 648455 5524921	
		15-May-24	Canada Goose	14 U 648161 5524864	
		15-May-24	Canada Goose	14 U 648191 5524851	
		22-May-24	Gull Spp.	14 U 648103 5524877	
Ctrl-103		21-May-24	Unknown Species	14 U 627987 5512215	2
		21-May-24	Unknown Species	14 U 627691 5512219	
		16-May-24	Mallard	14 U 647535 5522095	
		16-May-24	Mallard	14 U 647512 5522016	

Ctrl-106	Absent	23-May-24	Song Sparrow	14 U 647478 5522008	5
		23-May-24	Great Horned Owl	14 U 647527 5522061	
		23-May-24	Common Raven	14 U 647527 5522061	
Ctrl-313		15-May-24	Unknown Species	14 U 681899 5491245	1

APPENDIX 2: BIRD COLLISION SURVEY RESULTS AND ESTIMATED MORTALITIES 2020-2022 AND 2024

Table 1. Bird Collision Survey Results and Estimated Mortalities along the Manitoba-Minnesota Transmission Project in Fall 2020

Site Type	Total Length (km)	Searched Length (km)	No. Collisions	No. Birds Planted	No. Birds Not Scavenged	No. Planted Birds Found	Searcher Efficiency	Scavenger Bias	Habitat Bias	Est. Weekly Mortality*	Est. Weekly Mortality/km	Est. Seasonal Mortality/km**
Bird Diverters Absent (Control)	4.69	4.69	6	6	4	2	0.33	0.67	1	85.7	18.3	109.6
Bird Diverters Present	8.58	8.58	10	8	3	0	0	0.38	1	142.9	16.6	99.9
Total	13.28	13.28	16	14	7	2	0.14	0.5	1	228.6	17.2	103.3

* Calculations used the total scavenger bias due to larger sample size

**Multiplied by a factor of six weeks

Table 2. Bird Collision Survey Results and Estimated Mortalities along the Manitoba-Minnesota Transmission Project in Spring 2021

Site Type	Total Length (km)	Searched Length (km)	No. Collisions	No. Birds Planted	No. Birds Not Scavenged	No. Planted Birds Found	Searcher Efficiency	Scavenger Bias	Habitat Bias	Est. Weekly Mortality	Est. Weekly Mortality/km	Est. Seasonal Mortality/km*
Bird Diverters Absent (Control)	3.80	3.68	12	12	2	9	0.75	0.17	0.97	108.6	28.6	153.5
Bird Diverters Present	7.63	7.24	22	18	1	11	0.61	0.06	0.95	576.1	75.5	453.0
Total	11.43	10.92	34	30	3	20	0.67	0.1	0.96	528.6	46.3	277.5

*Multiplied by a factor of six weeks

Table 3. Bird Collision Survey Results and Estimated Mortalities along the Manitoba-Minnesota Transmission Project in Summer 2021

Site Type	Total Length (km)	Searched Length (km)	No. Collisions	No. Birds Planted	No. Birds Not Scavenged	No. Planted Birds Found	Searcher Efficiency	Scavenger Bias	Habitat Bias	Est. Weekly Mortality	Est. Weekly Mortality/km	Est. Seasonal Mortality/km*
Bird Diverters Absent (Control)	3.80	3.68	4	12	2	6	0.5	0.17	0.97	51.6	13.6	81.6
Bird Diverters Present	7.63	7.49	5	18	3	8	0.44	0.17	0.98	63.9	8.4	50.4
Total	11.43	11.17	9	30	5	14	0.47	0.17	0.98	114.9	10.1	60.6

*Multiplied by a factor of six weeks

Table 4. Bird Collision Survey Results and Estimated Mortalities along the Manitoba-Minnesota Transmission Project in Fall 2021

Site Type	Total Length (km)	Searched Length (km)	No. Collisions	No. Birds Planted	No. Birds Not Scavenged	No. Planted Birds Found	Searcher Efficiency	Scavenger Bias	Habitat Bias	Est. Weekly Mortality	Est. Weekly Mortality/km	Est. Seasonal Mortality/km*
Bird Diverters Absent (Control)	3.80	3.68	4	12	6	5	0.42	0.5	0.97	15.6	4.1	24.6
Bird Diverters Present	7.63	7.49	5	18	4	11	0.61	0.22	0.98	43.8	5.7	34.2
Total	11.43	11.17	9	30	10	16	0.53	0.33	0.98	52.5	4.6	27.6

*Multiplied by a factor of six weeks

Table 5. Bird Collision Survey Results and Estimated Mortalities along the Manitoba-Minnesota Transmission Project in Spring 2022

Site Type	Total Length (km)	Searched Length (km)	No. Collisions	No. Birds Planted	No. Birds Not Scavenged	No. Planted Birds Found	Searcher Efficiency	Scavenger Bias	Habitat Bias	Est. Weekly Mortality	Est. Weekly Mortality/ km	Est. Seasonal Mortality/km*
Bird Diverters Absent (Control)	3.8	3.59	11	12	2	5	0.42	0.17	0.94	167.67	44.12	264.74
Bird Diverters Present	5.07	4.59	27	10	1	7	0.70	0.10	0.91	426.05	84.03	504.20
Total	8.87	8.18	38	22	3	12	0.55	0.14	0.92	553.98	62.46	374.74

*Multiplied by a factor of six weeks

Table 6. Bird Collision Survey Results and Estimated Mortalities along the Manitoba-Minnesota Transmission Project in Summer 2022

Site Type	Total Length (km)	Searched Length (km)	No. Collisions	No. Birds Planted	No. Birds Not Scavenged	No. Planted Birds Found	Searcher Efficiency	Scavenger Bias	Habitat Bias	Est. Weekly Mortality	Est. Weekly Mortality/km	Est. Seasonal Mortality/km*
Bird Diverters Absent (Control)	3.8	3.59	1	12	2	8	0.67	0.17	0.94	9.53	2.51	15.04
Bird Diverters Present	5.07	4.59	1	10	3	4	0.40	0.30	0.91	9.20	1.82	10.89
Total	8.87	8.18	2	22	5	12	0.55	0.23	0.92	17.49	1.97	11.83

*Multiplied by a factor of six weeks

Table 7. Bird Collision Survey Results and Estimated Mortalities along the Manitoba-Minnesota Transmission Project in Spring 2024

Site Type	Total Length (km)	Searched Length (km)	No. Collisions	No. Birds Planted	No. Birds Not Scavenged	No. Planted Birds Found	Searcher Efficiency	Scavenger Bias	Habitat Bias	Est. Weekly Mortality	Est. Weekly Mortality/km	Est. Seasonal Mortality/km*
Bird Diverters Absent (Control)	1.25	1.08	6	4	0	3	0.75	0.00	0.86	154.32	123.46	740.74
Bird Diverters Present	3.15	2.85	15	8	2	5	0.63	0.25	0.90	106.11	33.68	202.11
Additional Bird Diverters Present	5.33	5.15	20	10	4	7	0.70	0.40	0.97	73.93	13.87	83.22
Total	9.73	9.08	41	22	6	15	0.68	0.27	0.93	236.27	24.28	145.70

*Multiplied by a factor of six weeks

**Calculation not possible when scavenger bias is 0. Scavenger bias was set to 0.06, which is the lowest bias observed previously

APPENDIX 3: BIRD MOVEMENT OBSERVATIONS 2021, 2022, AND 2024

Table 1. Number of Bird Movements Observed at Sites During Spring Survey Period in 2024

Site	Bird Diverters	Species	Spring 2024	Total
Wild-103	Present	American Crow	2	22
		Blackbird Spp.	2	
		Canada Goose	5	
		Duck Spp.	3	
		Mallard	10	
Wild-103ext	Present	Canada Goose	4	4
Wild-104	Present	American Goldfinch	2	40
		Baltimore Oriole	1	
		Brewer's Blackbird	1	
		Passerine Spp.	15	
		Ring-billed Gull	2	
		Song Sparrow	18	
		Western Meadowlark	1	
Wild-105	Present	American Crow	1	8
		Blackbird Spp.	1	
		Common Raven	1	
		Duck Spp.	1	
		Passerine Spp.	4	
Wild-105ext	Present	American Crow	1	16
		Blackbird Spp.	9	
		Brewer's Blackbird	2	
		Canada Goose	2	
		Red-winged Blackbird	1	
		Red-tailed Hawk	1	
Wild-106	Present	American Crow	1	23
		Blackbird Spp.	5	
		Brewer's Blackbird	2	
		Eastern Kingbird	1	
		Passerine Spp.	7	
		Red-winged Blackbird	2	
		Turkey Vulture	2	
		Western Kingbird	1	
		Western Meadowlark	1	
		Yellow Warbler	1	
Wild-106ext	Present	American White Pelican	10	23
		Blackbird Spp.	8	

		Passerine Spp.	5	
Wild-M01	Present	Blackbird Spp.	1	7
		Gull Spp.	1	
		Passerine Spp.	3	
		Red-winged Blackbird	2	
Ctrl-103	Present	American Crow	3	5
		Passerine Spp.	1	
		Western Meadowlark	1	
Ctrl-106		American Crow	1	6
		Common Raven	1	
		Passerine Spp.	1	
		Red-tailed Hawk	2	
		Western Meadowlark	1	
Ctrl-123	Absent	American Crow	5	55
		Blackbird Sp..	1	
		Brewer's Blackbird	5	
		Passerine Spp.	35	
		Red-winged Blackbird	9	
Ctrl-313	Absent	American Crow	13	21
		Blackbird Spp.	5	
		Common Raven	1	
		Passerine Spp.	2	
			Grand Total	230

Table 2. Number of Bird Movements Observed at Sites During Each Survey Period in 2021

Site	Bird Diverters	Species	Spring 2021	Summer 2021	Fall 2021	Total	Grand Total
Wild-100	Present	American Crow	2	4	20	26	212
		American Robin	4	1	2	7	
		Bald Eagle	0	0	2	2	
		Blackbird Spp.	6	0	0	6	
		Black-capped Chickadee	0	0	2	2	
		Brewer's Blackbird	5	0	0	5	
		Canada Goose	2	0	18	20	
		Cedar Waxwing	0	29	0	29	
		Clay-coloured Sparrow	0	1	0	1	
		Duck Spp.	7	1	1	9	
		Eastern Kingbird	0	2	0	2	
		Franklin's Gull	10	0	0	10	
		Gull Spp.	3	0	32	35	
		Mallard	4	1	0	5	

Site	Bird Diverters	Species	Spring 2021	Summer 2021	Fall 2021	Total	Grand Total
		Merlin	1	2	1	4	
		Northern Flicker	0	2	1	3	
		Red-tailed Hawk	0	1	0	1	
		Red-winged Blackbird	13	13	0	26	
		Ring-billed Gull	3	0	0	3	
		Ruby-throated Hummingbird	0	0	1	1	
		Sandhill Crane	1	0	0	1	
		Savannah Sparrow	0	2	0	2	
		Song Sparrow	1	0	0	1	
		Sparrow Spp.	0	0	7	7	
		Unknown Sp..	0	0	1	1	
		White-breasted Nuthatch	1	0	2	3	
Wild-103	Present	American Robin	4	0	0	4	1349
		Brewer's Blackbird	5	0	0	5	
		Canada Goose	6	277	2	285	
		Duck Spp.	2	0	30	32	
		Gull Spp.	0	0	1012	1012	
		Peregrine Falcon*	3	0	0	3	
		Red-winged Blackbird	1	5	0	6	
		Ring-billed Gull	0	0	1	1	
		Swainson's Hawk	1	0	0	1	
Wild-104	Present	American Crow	0	1	0	1	72
		American Goldfinch	0	4	0	4	
		American Robin	0	0	1	1	
		American White Pelican	0	3	2	5	
		Blackbird Spp.	4	0	6	10	
		Black-capped Chickadee	0	0	1	1	
		Blue Jay	0	1	11	12	
		Brown-headed Cowbird	0	1	0	1	
		Canada Goose	3	0	0	3	
		Downy Woodpecker	0	0	1	1	
		Duck Spp.	4	0	0	4	
		Franklin's Gull	2	0	0	2	
		Gull Spp.	1	0	0	1	
		Mallard	0	2	0	2	
		Red-tailed Hawk	1	2	1	4	
		Red-winged Blackbird	0	12	0	12	
		Western Kingbird	0	1	0	1	
		White-breasted Nuthatch	5	1	0	6	
		Yellow Warbler	1	0	0	1	
Wild-105	Present	American Goldfinch	0	0	2	2	37

Site	Bird Diverters	Species	Spring 2021	Summer 2021	Fall 2021	Total	Grand Total
		American White Pelican	0	0	6	6	
		Black-billed Magpie	1	0	0	1	
		Blackbird Spp.	0	3	0	3	
		Blue Jay	0	1	0	1	
		Cooper's Hawk	0	1	0	1	
		Franklin's Gull	0	0	2	2	
		Gull Spp.	0	0	3	3	
		Mallard	0	2	0	2	
		Mourning Dove	0	2	0	2	
		Red-tailed Hawk	0	3	1	4	
		Red-winged Blackbird	0	2	0	2	
		Ring-billed Gull	0	0	2	2	
		Western Kingbird	0	1	0	1	
		Western Meadowlark	0	3	0	3	
		Woodpecker Spp.	0	1	0	1	
		Yellow Warbler	0	1	0	1	
Wild-106	Present	American White Pelican	0	0	1	1	87
		Baltimore Oriole	0	1	0	1	
		Blackbird Spp.	5	0	0	5	
		Common Grackle	1	0	0	1	
		Franklin's Gull	7	0	0	7	
		Killdeer	1	2	0	3	
		Mourning Dove	0	3	19	22	
		Orchard Oriole	0	1	0	1	
		Red-winged Blackbird	0	14	24	38	
		Song Sparrow	2	0	0	2	
		Swainson's Hawk	0	0	2	2	
		Tree Swallow	0	1	0	1	
		Western Kingbird	0	3	0	3	
Wild-118	Present	American Crow	1	0	0	1	114
		American Robin	12	0	0	12	
		Blue Jay	1	0	0	1	
		Brewer's Blackbird	8	0	0	8	
		Common Raven	0	10	0	10	
		Franklin's Gull	0	0	70	70	
		Great-crested Flycatcher	0	2	0	2	
		Red-winged Blackbird	7	0	0	7	
		Sandhill Crane	0	0	2	2	
		Yellow Warbler	1	0	0	1	
Wild-123	Present	Downy Woodpecker	1	0	0	1	2
		Pileated Woodpecker	1	0	0	1	

Site	Bird Diverters	Species	Spring 2021	Summer 2021	Fall 2021	Total	Grand Total
Wild-126	Present	American Goldfinch	0	4	0	4	14
		American Robin	0	1	0	1	
		Baltimore Oriole	0	1	0	1	
		Blackbird Spp.	3	0	0	3	
		Blue Jay	0	0	1	1	
		Northern Flicker	2	0	0	2	
		Red-tailed Hawk	0	1	0	1	
		Ruby-throated Hummingbird	0	1	0	1	
Wild-131	Present	Blackbird Spp.	5	3	0	8	37
		Brewer's Blackbird	1	1	0	2	
		Canada Goose	2	0	0	2	
		Cedar Waxwing	0	3	0	3	
		Common Grackle	1	0	0	1	
		Common Yellowthroat	0	2	0	2	
		Duck Spp.	1	0	0	1	
		Killdeer	2	0	0	2	
		Merlin	0	0	1	1	
		Mourning Dove	2	0	0	2	
		Red-winged Blackbird	10	2	0	12	
		Trumpeter Swan*	1	0	0	1	
Wild-132	Present	American Crow	0	2	10	12	16
		Mourning Dove	0	2	0	2	
		None	0	0	0	0	
		Ruby-throated Hummingbird	0	1	0	1	
		Sandhill Crane	1	0	0	1	
Ctrl-103	Absent	American Crow	0	0	1	1	19
		Canada Goose	0	0	3	3	
		Duck Spp.	0	1	0	1	
		Hawk Spp.	0	1	0	1	
		Lincoln Sparrow	1	0	0	1	
		Northern Harrier	0	1	0	1	
		Red-winged Blackbird	0	4	0	4	
		Sparrow Spp.	0	0	7	7	
Ctrl-106	Absent	Barn Swallow*	0	0	3	3	29
		Blackbird Spp.	0	3	0	3	
		Canada Goose	0	0	10	10	
		Duck Spp.	1	0	0	1	
		Hawk Spp.	1	0	0	1	
		Northern Harrier	0	0	1	1	
		Red-tailed Hawk	0	2	3	5	

Site	Bird Diverters	Species	Spring 2021	Summer 2021	Fall 2021	Total	Grand Total
		Red-winged Blackbird	0	3	0	3	
		Sharp-tailed Grouse	2	0	0	2	
Ctrl-123	Absent	American Crow	0	1	0	1	106
		American Robin	1	2	0	3	
		Bald Eagle	0	0	4	4	
		Blue Jay	2	0	0	2	
		Brown-headed Cowbird	0	1	0	1	
		Canada Goose	2	0	0	2	
		Common Grackle	0	2	0	2	
		Common Raven	1	0	0	1	
		Eastern Kingbird	0	2	0	2	
		Killdeer	0	1	0	1	
		Mallard	2	0	0	2	
		Mourning Dove	0	2	0	2	
		Red-tailed Hawk	0	0	1	1	
		Red-winged Blackbird	64	9	0	73	
		Rock Pigeon	3	0	0	3	
		Turkey Vulture	1	0	1	2	
		Western Kingbird	1	0	0	1	
		Western Meadowlark	2	0	0	2	
		Yellow-headed Blackbird	1	0	0	1	
Ctrl-132	Absent	American Crow	2	1	0	3	20
		Blackbird Spp.	0	1	0	1	
		Canada Goose	1	0	0	1	
		Chipping Sparrow	1	0	0	1	
		Killdeer	2	0	0	2	
		Mallard	0	9	0	9	
		Northern Flicker	0	0	1	1	
		Warbler Spp.	0	2	0	2	
Ctrl-243	Absent	American Crow	1	0	4	5	30
		American Robin	1	0	2	3	
		Bald Eagle	0	0	2	2	
		Black-billed Magpie	2	3	0	5	
		Blackbird Spp.	2	0	0	2	
		Blue Jay	3	0	0	3	
		Brewer's Blackbird	5	0	0	5	
		Canada Goose	0	0	1	1	
		Common Grackle	1	0	0	1	
		Merlin	0	0	1	1	
		Red-winged Blackbird	0	2	0	2	
Ctrl-313	Absent	American Crow	0	1	0	1	31

Site	Bird Diverters	Species	Spring 2021	Summer 2021	Fall 2021	Total	Grand Total
		American Robin	0	1	0	1	
		Black-billed Magpie	0	1	0	1	
		Brewer's Blackbird	2	0	0	2	
		Common Grackle	0	3	0	3	
		Common Raven	1	4	2	7	
		Mallard	10	0	0	10	
		Red-winged Blackbird	3	0	0	3	
		Turkey Vulture	2	0	1	3	
Total			310	513	1352	2175	2175

*Listed under Schedule 1 of the federal Species at Risk Act or Under Manitoba's Species at Risk Act

Table 3. Number of Bird Movements Observed at Sites During Each Survey Period in 2022

Site	Species	Spring 2022	Summer 2022	Total	Grand Total
Wild-100	American Crow	9	6	15	469
	American Goldfinch	0	3	3	
	American Robin	1	4	5	
	Bald Eagle	2	0	2	
	Baltimore Oriole	1	0	1	
	Barn Swallow	2	30	32	
	Blackbird Spp.	38	79	117	
	Black-capped Chickadee	4	0	4	
	Blue Jay	1	10	11	
	Common Starling	0	28	28	
	Duck Spp.	0	12	12	
	Eastern Kingbird	0	4	4	
	Mallard	5	0	5	
	Passerine Spp.	34	148	182	
	Red-winged Blackbird	0	8	8	
	Rock Pigeon	2	0	2	
	Savannah Sparrow	3	0	3	
	Sparrow Spp.	19	0	19	
	Swallow Spp.	2	0	2	
	White-breasted Nuthatch	5	0	5	
	Yellow Warbler	0	9	9	
Wild-103	American Crow	0	3	3	124
	American White Pelican	0	33	33	
	Barn Swallow*	0	4	4	
	Blackbird Spp.	15	7	22	
	Canada Goose	0	36	36	
	Duck Spp.	10	0	10	
	Lesser Yellowlegs	1	0	1	
	Mallard	2	10	12	
	Sparrow Spp.	0	3	3	
Wild-106	American Crow	0	4	4	367
	Blackbird Spp.	26	119	145	
	Brewer's Blackbird	0	16	16	
	Canada Goose	2	0	2	
	Common Grackle	0	4	4	
	Common Starling	0	8	8	
	Mourning Dove	0	23	23	
	Passerine Spp.	24	68	92	
	Red-tailed Hawk	1	0	1	
	Red-winged Blackbird	9	17	26	

Site	Species	Spring 2022	Summer 2022	Total	Grand Total
	Swallow Spp.	0	38	38	
	Tree Swallow	0	8	8	
Wild-118	American Crow	2	0	2	135
	American Robin	3	11	14	
	Baltimore Oriole	0	4	4	
	Blackbird Spp.	19	32	51	
	Brewer's Blackbird	0	4	4	
	Common Raven	0	3	3	
	Downy Woodpecker	1	0	1	
	Duck Spp.	0	3	3	
	Passerine Spp.	26	27	53	
Wild-132	American Robin	2	3	5	38
	Blackbird Spp.	7	0	7	
	Duck Spp.	0	3	3	
	Golden-winged Warbler*	0	3	3	
	Mallard	0	9	9	
	Passerine Spp.	5	3	8	
	Swallow Spp.	0	3	3	
Ctrl-103	Blackbird Spp.	36	35	71	126
	Brewer's Blackbird	0	39	39	
	Canada Goose	8	0	8	
	Mallard	1	0	1	
	Northern Harrier	0	3	3	
	Passerine Spp.	0	3	3	
	Trumpeter Swan*	1	0	1	
Ctrl-106	Barn Swallow	0	14	14	34
	Blackbird Spp.	0	4	4	
	Red-tailed Hawk	3	0	3	
	Red-winged Blackbird	1	0	1	
	Swallow Spp.	0	9	9	
	Western Meadowlark	0	3	3	
Ctrl-106	American Crow	5	6	11	220
	American Robin	0	3	3	
	Barn Swallow	0	3	3	
	Blackbird Spp.	27	63	90	
	Brewer's Blackbird	2	0	2	
	Buteo Spp.	0	4	4	
	Canada Goose	0	8	8	
	Cliff Swallow	12	0	12	
	Duck Spp.	0	3	3	
	Eastern Kingbird	0	3	3	
	Passerine Spp.	9	34	43	

Site	Species	Spring 2022	Summer 2022	Total	Grand Total
	Red-winged Blackbird	8	4	12	
	Rock Pigeon	2	0	2	
	Swallow Spp.	0	8	8	
	Tree Swallow	0	8	8	
	Waterfowl Spp.	1	0	1	
	Western Meadowlark	0	3	3	
	Yellow Warbler	0	4	4	
Ctrl-132	American Crow	0	7	7	41
	American Robin	0	4	4	
	Blue Jay	0	8	8	
	Crane Spp.	0	8	8	
	Passerine Spp.	8	6	14	
Ctrl-243	American Crow	9	4	13	47
	Black-billed Magpie	2	0	2	
	Blackbird Spp.	2	0	2	
	Black-capped Chickadee	2	0	2	
	Canada Goose	4	0	4	
	Duck Spp.	4	0	4	
	Passerine Spp.	3	4	7	
	Swallow Spp.	0	4	4	
	Turkey Vulture	0	6	6	
	Western Meadowlark	0	3	3	
Ctrl-313	American Crow	7	4	11	93
	Barn Swallow*	2	0	2	
	Black-billed Magpie	0	4	4	
	Blackbird Spp.	15	3	18	
	Blue Jay	0	4	4	
	Eastern Kingbird	2	0	2	
	Great Blue Heron	1	0	1	
	Mallard	2	0	2	
	Passerine Spp.	15	23	38	
	Red-tailed Hawk	0	4	4	
	Red-winged Blackbird	0	7	7	
Total		477	1,217	1,694	1,694

*Listed under Schedule 1 of the federal Species at Risk Act or Under Manitoba's Species at Risk Act

APPENDIX 4: BIRD COLLISION MAP SERIES

Manitoba-Minnesota Transmission Project

Manitoba Hydro

Project Infrastructure
- Converter Station
- Final Preferred Route (FPR)

Bird Collision Survey Location
- Bird Diverter - Absent
- Bird Diverter - Present
- Bird Diverter - Additional

Map Tile Index - 1:30,000
- Map Series Tile

Infrastructure
- Existing 500kV Transmission Line
- M602F Transmission Line
- Existing ≤230kV Transmission Line

Landbase
- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- City
- First Nation Lands
- Ecological Reserve
- Wildlife Management Area
- Provincial Park

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: October 25, 2024

N

0 3 6 9 12 Kilometres
0 1.5 3 6 9 12 Miles

1:450,000

Index of Map Series
Bird Collision Surveys 2024

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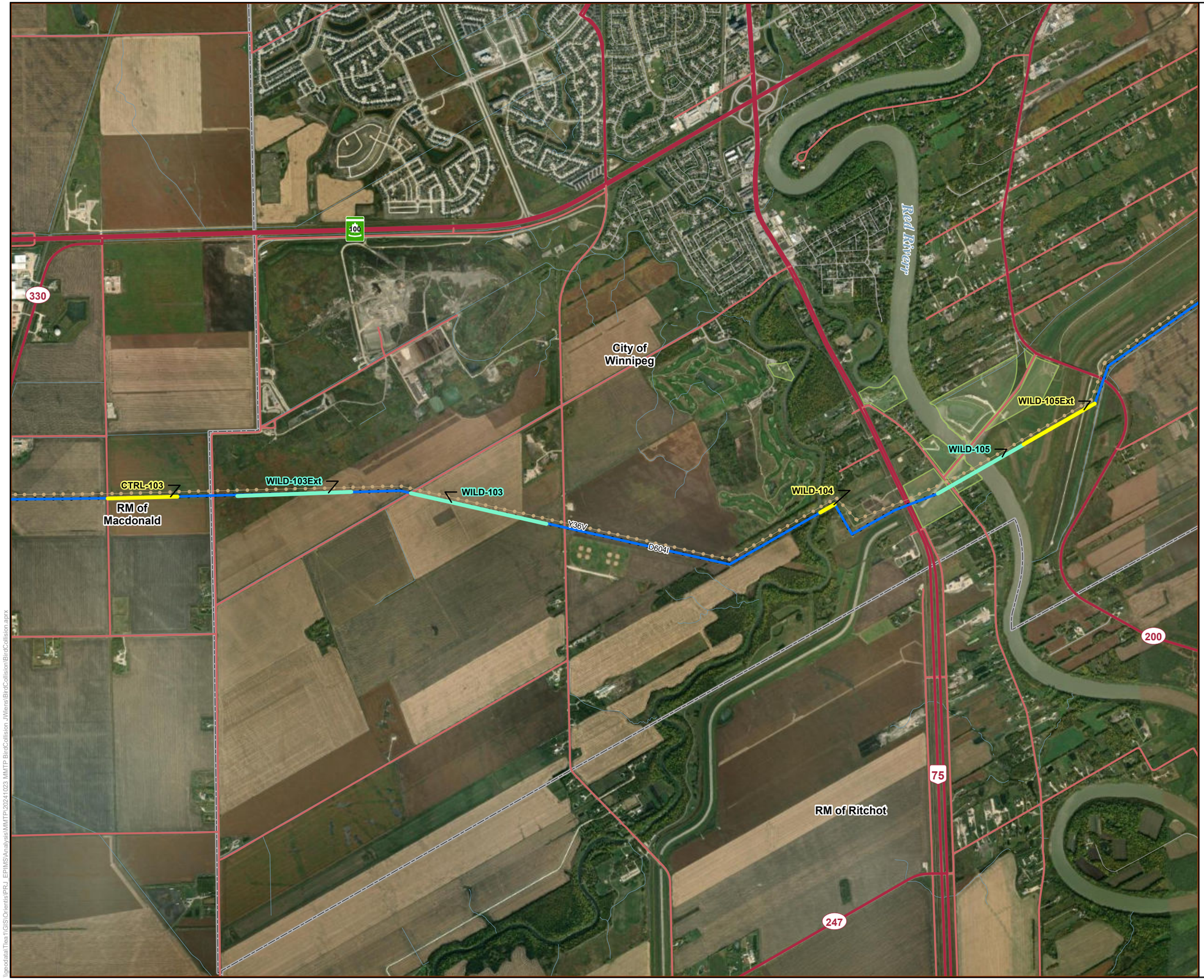

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Converter Station (Existing)
- MMTP Final Preferred Route

Infrastructure

- Existing 500kV Transmission Line
- M602F Transmission Line
- Existing ≤230kV Transmission Line

Bird Collision Survey Location

- Bird Diverter - Absent
- Bird Diverter - Present
- Bird Diverter - Additional

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Provincial Park
- Rural Municipality

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: October 25, 2024

N

0 0.25 0.5 0.75 1 Kilometres
0 0.125 0.25 0.5 Miles

1:30,000

Bird Survey Locations 2024

Map 1

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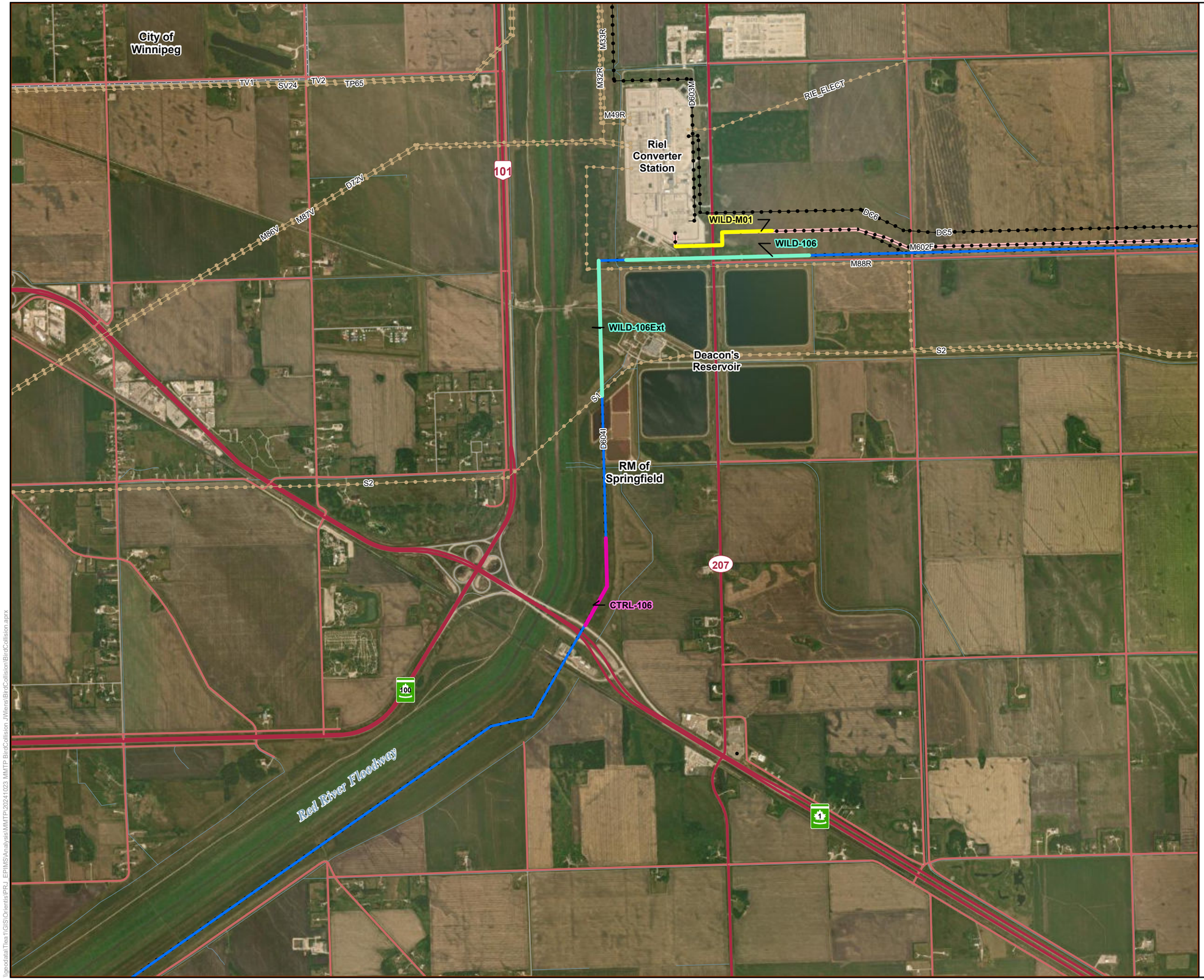

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure
- Converter Station (Existing)
- MMTP Final Preferred Route

Infrastructure
- Existing 500kV Transmission Line
- M602F Transmission Line
- Existing ≤230kV Transmission Line

Bird Collision Survey Location
- Bird Diverter - Absent
- Bird Diverter - Present
- Bird Diverter - Additional

Landbase
- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Provincial Park
- Rural Municipality

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: October 25, 2024

N

0 0.25 0.5 0.75 1 Kilometres
0 0.125 0.25 0.5 Miles

1:30,000

Bird Survey Locations 2024

Map 2

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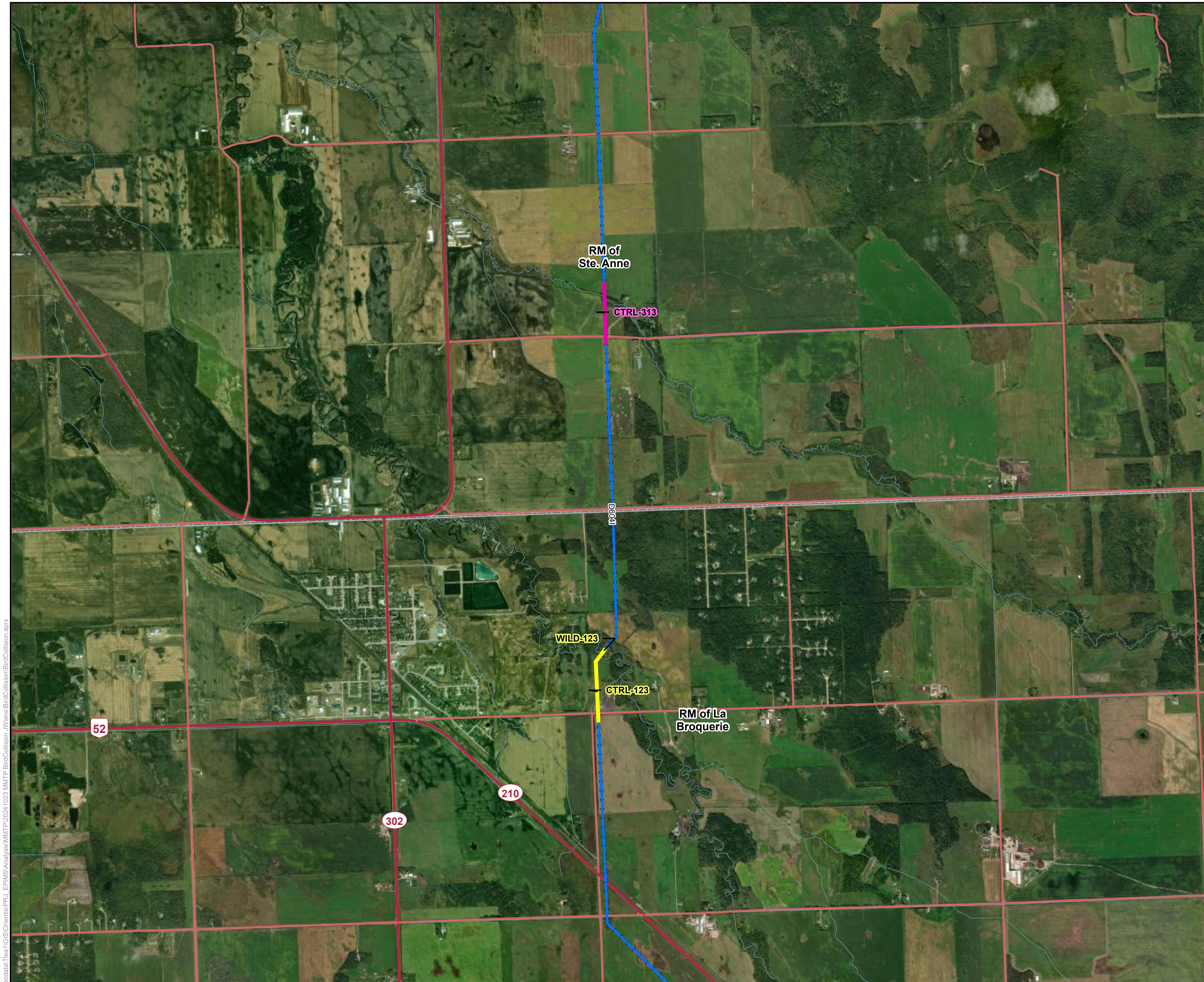

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure
- Converter Station (Existing)
- MMTP Final Preferred Route

Infrastructure
- Existing 500kV Transmission Line
- M602F Transmission Line
- Existing ≤230kV Transmission Line

Bird Collision Survey Location
- Bird Diverter - Absent
- Bird Diverter - Present
- Bird Diverter - Additional

Landbase
- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Provincial Park
- Rural Municipality

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: October 25, 2024

N

0 0.25 0.5 0.75 1 Kilometres
0 0.125 0.25 0.5 Miles

1:30,000

Bird Survey Locations 2024

Map 3

APPENDIX 5: PHOTOS

Photo 1. White-throated Sparrow Carcass Observed at Site Wild-105ext, May 2024

Photo 2. Mallard Carcass Observed at Site Wild-105ext, May 2024

Photo 3. Virginia Rail Carcass Observed at Site Wild-105ext, May 2022

Photo 4. Savannah Sparrow Carcass Observed at Site Wild-106, May 2022

Photo 5. Great Horned Owl Carcass Observed at Site Ctrl-106, May 2024