# MANITOBA-MINNESOTA TRANSMISSION PROJECT:

# MAMMALS MONITORING PROGRAM TECHNICAL REPORT (2021/22)

JANUARY 19, 2023

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|---|---|
| AC | Alternating Current |
| BACI | Before-After-Control-Impact |
| EIS | Environmental Impact Statement |
| FPR | Final Preferred Route |
| GHA | Game Hunting Area |
| GPS | Global Positioning Service |
| IR | Infrared |
| LAA | Local Assessment Area |
| MMTP | Manitoba-Minnesota Transmission Project |
| MSD | Manitoba Sustainable Development |
| RAA | Regional Assessment Area |
| RAI | Relative Abundance Index |
| RM | Rural Municipality |
| ROW | Right-of-way |
| SD | Secure Digital |
| VC | Valued Component |
| WMA | Wildlife Management Area |

# EXECUTIVE SUMMARY

Aerial surveys for ungulates and predators were replicated in 2020 and 2022 as part of the wildlife monitoring requirements outlined in the Manitoba-Minnesota Transmission Line Project (MMTP) Environmental Monitoring Plan (2019). Surveys were conducted in previously identified survey units including two affected units and five control units. The 2020 survey represents data for the construction period and the 2022 survey for the after construction (operation) period. In total, 584 individual white-tailed deer tracks, or animals, were observed in 2020 in the potentially affected and control survey units with a density of 1.3 deer/km$^2$, and 296 individual white-tailed deer in 2022 with a density of 0.7 deer/km$^2$. The distribution and relative abundance of deer densities in the 2020 construction phase and 2022 operation phases matched patterns during pre-construction (2017-2018) and support hypotheses that null effects have been observed during the construction and operation periods relative to ungulate density, distribution, and mortality. The gradient in deer abundance observed is consistent across years, with fewer deer in the southwest, and greater densities to the north and east, corresponding to habitat cover and land-use. Although absolute densities in 2020 during construction and 2022 after construction were lower than pre-construction (2017-2018), these differences were not statistically significant. Potentially affected survey units had no significant differences. Additionally, no moose or elk were observed in any of the survey units. Total predator species (individual animals) observed in 2020 and 2022 included three bears (2020 only), three wolves, and 12 coyotes all observed mainly in control units; few predator tracks were found within the affected areas and the null hypothesis of no predation effects has been accepted.

Camera trap monitoring was also replicated in 2019 and 2020, with a total of 16 camera trap arrays used in the study including 10 cameras positioned in potentially affected areas along the FPR and 6 cameras in reference or control areas. A combined total of 10,758 camera-days in the 2019 and 2020 seasons observed 1,505 white-tailed deer events (2,112 individuals), 284 black bear events (333 individuals), 44 gray wolf events (56 individuals) and 39 coyote events (42 individuals). Statistical analysis of control and affected site observations revealed no significant variation between treatments for white-tailed deer and black bear; observations of gray wolf and coyote were also similar between affected and control treatments, though total observations were too low for statistical analysis.

Both survey methods continue to support the predictions as outlined in the MMTP Environmental Impact Statement (EIS). Recommendations for further monitoring include ongoing replication of aerial surveys and trail camera studies and analysis to augment ungulate and predator distribution, abundance, and potential mortality risks to ungulates during the operation phase.

# 1.0 INTRODUCTION

Manitoba Hydro (MH) constructed the Manitoba-Minnesota Transmission Project (MMTP), which consists of a 500 kilovolt AC transmission line in southeastern Manitoba. Construction of the MMTP began during the summer of 2019 and was completed in June of 2020. The Project originates at the Dorsey Converter Station northwest of Winnipeg and continues south around Winnipeg, within the Existing Transmission Corridor, the Southern Loop Transmission Corridor, and the Riel-Vivian Transmission Corridor, to just east of Provincial Trunk Highway 12. The route continues southward across the rural municipalities (RM) of Springfield, Tache, Ste. Anne, La Broquerie, Stuartburn, and exits at the Canada-United States border near the community of Piney.

This report provides the results of mammal monitoring including white-tailed deer and predators from aerial surveys conducted during winter in 2016, 2017, 2018 (pre-construction), 2020 (during construction), and 2022 (after construction). Surveys were conducted to evaluate null and alternate hypotheses for ungulates (elk, moose, and white-tailed deer) relative to mortality, distribution, and abundance. Surveys also provided data on the distribution and abundance of predators (coyote and grey wolf) to test null and alternative hypotheses on their observed impact on ungulates as outlined in the MMTP Environmental Monitoring Plan (2019). Existing camera traps installed for pre-construction monitoring were also carried over into post-construction monitoring, with a total of 16 camera trap arrays used in the study with 10 cameras positioned in potentially affected areas along the FPR and 6 cameras in reference or control areas.

The purpose of this report is to summarize the results of the pre-construction aerial survey data (2016-2018) and trail camera data (2018-2020), and to compare/contrast results from construction/operation data (2020-2022 aerial surveys) and assess/accept null or alternate hypotheses related to Project effects. Narratives of results relative to the potential effects described in the EIS and Environmental Monitoring Plan are provided.

# 2.0 MAMMALS OVERVIEW AND PROJECT RELATED POTENTIAL EFFECTS

*White-tailed deer*

White-tailed deer are the predominant ungulate in the Project area, a Valued Component (VC) species, and an important species to the Project. Within Game Hunting Area (GHA) 35, white-tailed deer are a highly valued species for hunting and outfitting use. Previous monitoring reports have provided thorough species overviews as shared below (Stantec 2018).

> *Transmission line corridors create habitat edges for white-tailed deer that provide an ecotone with high quality forage resources and accessible hiding cover in adjacent forest (Reimers et al. 2000). Disturbed vegetation is favoured by white-tailed deer because of the high diversity of plants in those areas (Stewart et al. 2011). Riparian areas, edge habitats, and linear features function as important habitats for travel and forage. Therefore, white-tailed deer are not particularly susceptible to the effects of habitat fragmentation but may be susceptible to increased mortality associated with moving through higher risk areas created by habitat loss and degradation of matrix quality (Stewart et al. 2011).*
>
> *The EIS identified a potential Project effect of increased mortality risk from hunters and predators by enhanced access to white-tailed deer habitat in eastern portions of the Project, however the effect is expected to be minimal with no measurable effect on abundance anticipated. In that portion of the Project, white-tailed deer concentrations were noted in areas near Ste. Genevieve, Richer, Sundown, Piney, and in the Watson P. Davidson and Spurwoods WMAs. The deer population in the area is considered to be stable. Habitat loss and sensory disturbance effects from ROW clearing are considered minimal and short-term, ultimately resulting in a positive effect of enhanced deciduous browse forage and increased edge habitat during the operation phase.*

*Elk*

Studies regarding elk have been initiated by Manitoba Conservation and Climate. In addition, a Memorial University Master’s program is reviewing components of elk populations with the same range as studied for the right-of-way (ROW). Both initiatives may provide future data and perspectives to supplement this monitoring effort.

Previous monitoring reports have provided thorough species overviews as shared below (Stantec 2018).

> *As described in the EIS, the Vita elk population in Manitoba (fall/winter range) is shared with Minnesota (summer range) and is the only elk population with potential to interact with the Project. Long-term census data in Manitoba for this elk population are limited, with a stable population estimate of 100-150. Annual surveys (2004-2008) conducted in Minnesota estimated the population at 112-215 elk (MDNR 2009). The Vita elk range in Manitoba may overlap an eastern portion of the Project Regional Assessment Area (RAA; a 15 km buffer around the Project footprint) in areas near Vita and Caliento, however, EIS field studies did not detect elk occurrence within the ROW or Local Assessment Area (LAA; a 1 km buffer around the Project footprint), or RAA. The closest observations during baseline surveys were 20 km from the final preferred route. The ROW avoids the core areas known to support elk near Vita and Arbakka, with no anticipated significant adverse Project effects on the population. Since the filing of the EIS, MH has joined with the RM of Stuartburn, MSD, and the Nature Conservancy Canada to form the Vita Cross-Border Elk Monitoring Partnership. This new partnership is aimed to understand movements and home range size of elk by utilizing GPS collar technology in southeast Manitoba but is not part of this monitoring report.*

*Moose*

As described in the MMTP EIS, moose populations in southern Manitoba have experienced significant declines over the years. Previous monitoring reports have provided thorough species overviews as shared below (Stantec 2018).

> *Moose were a common ungulate species in southeastern Manitoba prior to the 1990s but populations in the region have since collapsed (Leavesley 2015, pers. comm., Rebizant 2015, pers. comm.). Despite the presence of suitable moose habitat (e.g., shrubby wetlands, alder swamps, sub-climax deciduous forest; Banfield 1974), moose are rare in southeastern Manitoba due to a combination of factors such as habitat fragmentation, predation by wolves, parasites, fire suppression, and unregulated harvest (Leavesley 2015, pers. comm., Rebizant 2015, pers. comm). The areas south of the Watson P. Davidson Wildlife Management Area heading southeast to the Spur Woods WMA and south of Piney, in the RAA was identified as containing moose habitat, especially near Piney (Black River First Nation, Long Plain First Nation and Swan Lake First Nation 2015).*

*Black Bear*

Previous monitoring reports have provided thorough species overviews as shared below (Stantec 2018).

> *Black bears favor high landscape connectivity and are sensitive to significant habitat changes and disturbances that affect access to, and availability of, food resources (Rogers and Allen 1987, Gunson 1993, Kindell and Van Manen 2007). They are widely distributed as a consequence of food resource availability both spatially and seasonally (Gunson 1993, Costello and Sage 1994, Pelton et al. 1999, Pelton 2000), but local abundance may be variable depending on annual severity of weather and food availability. Bears may avoid linear development with active human activity, particularly during denning (Forman et al. 1997, Linnell et al. 2000).*
>
> *The EIS indicates the black bear population within the RAA is stable (possibly increasing), with common occurrence and widespread distribution throughout areas supporting forest habitat; particularly at the forest-agricultural habitat interface, primarily east and south of the Watson P. Davidson WMA. Field studies identified bear activity within the vicinity of the proposed D604I ROW, along existing transmission line M602F, and other forested parts of the RAA, occupying forested areas near the communities of Richer, Marchand, Sundown, and Piney.*
>
> *Black bears are an important species to subsistence users (First Nations and Metis) and to the livelihood of local commercial outfitters. The Project footprint will contribute to habitat fragmentation of natural habitat patches that may affect bear habitat availability, occurrence, and distribution. Measurable changes in abundance are not anticipated because of Project activities or disturbance because of routing and scheduling of construction activities.*

*Predators*

> *The ROW and Project access development may enhance predator mobility into areas that were previously secure habitat for prey species, decrease predator search times for prey, and/or make prey escape more difficult. Predators such as wolves and coyotes may benefit from enhanced access, leading to increased predation of ungulates.*

# 3.0 MAMMALS MONITORING PLAN OVERVIEW

The MMTP Environmental Monitoring Plan (2019) identifies specific monitoring activities to evaluate several null and alternate hypotheses related to Project effects. To test these hypotheses, a Before-After-Control-Impact (BACI) has been implemented using data gathered during the mammal baseline (pre-construction), during construction and operation monitoring surveys described in this report and the Environmental Monitoring Plan (2019). Distribution of white-tailed deer, elk, wolves and coyotes through aerial surveys and camera trap studies have been conducted relative to the Project ROW to assess distribution and population trends as a factor of density in Project effected and control blocks to assess any potential of increased mortality. The monitoring program has been designed to test these hypotheses and are summarized as follows (MMTP Environmental Monitoring Plan, 2019).

- *Hypothesis 1:*
- $H_0$ (null): The construction of the transmission line does not affect the distribution of white-tailed deer.
- $H_1$ (alternate): The construction of the transmission line does affect the distribution of white-tailed deer.
- *Hypothesis 2:*
- $H_0$ (null): The operation of the transmission line does not affect the distribution of white-tailed deer.
- $H_1$ (alternate): The operation of the transmission line does affect the distribution of white-tailed deer.
- *Hypothesis 3:*
- $H_0$ (null): The operation of the transmission line does not change the mortality risk for white-tailed deer.
- $H_1$ (alternate): The operation of the transmission line does affect the mortality risk for white-tailed deer.

Initial monitoring focused on pre-construction baseline data collection to facilitate the validation of EIS predictions and verification of mitigation measures to determine if the Project has altered distribution and occurrence of ungulates and predators. Monitoring during construction and operation is to assess whether distribution and occurrence has changed relative to the baseline conditions. Monitoring is focused on white-tailed deer as this is the dominant ungulate in the Project area, as well as predators, which include wolves, coyotes, and black bears. Moose densities are known to be very low. Therefore, specific monitoring of moose populations was not conducted. However, all moose observations have been documented from both pre-construction and construction monitoring activities, including aerial transect and camera trap surveys.

Pre-construction baseline data provided information on the distribution and abundance of white-tailed deer, allowing for comparison with data collected during construction in January 2020 and operation (2022) and beyond. These data were used to determine changes resulting from the development, to validate and accept the hypotheses and predictions in the EIS, and apply adaptive management if necessary, during the operational phase.

# 4.0 METHODS

## 4.1 Aerial Mammal Survey

Aerial transect surveys have been consistent and applied across the study areas across 7 survey blocks (A-G) and are illustrated on Map 1. These consist of potentially affected and control blocks to allow for comparison of densities throughout the Project area. Previous surveys were conducted March 7-9, 2016, February 8-9, 2017, and February 8-10, 2018 (pre-construction), March 4-6, 2020 (during construction), and March 8-10, 2022 (after construction). No surveys were conducted in 2021 (during construction) due to poor weather conditions. Methods for all surveys followed those described in Stantec (2018) and include:

- Aerial survey of 400-m-wide, east-west transects spaced 1 km apart that comprise 40% (421 $km^2$) of the 1055 $km^2$ overall survey area (Map 2).
- Surveys were conducted using a Bell 206 Jet Ranger helicopter and four observers: the front-left and rear-right observers acted as primary observers on their respective sides while the data recorder in the rear-left and pilot in the front-right acted as secondary observers.
- Surveys were flown at approximately 120 m above ground level at speeds between 90-110 km/h during good environmental conditions:
    - temperature -20 to -30°C;
    - wind 10-20 km/h;
    - cloud ceiling >150 m;
    - no precipitation;
    - no fog or hoar frost;
    - adequate daylight (from one half hour after sunrise to one half hour before sunset);
    - with a snow base of ≥25 cm (MCWS 2015, unpublished).
- Using a handheld GPS (Garmin® GPSMAP® 62SC) the surveys focused on counting individuals as opposed to counting both tracks and individuals, as was done in 2014-2015, as counting tracks has the potential to decrease detection rates of observers. Track observations were collected for species such as gray wolf and coyote where possible. Maps 4 and 5 show the aerial survey observations for 2020 and 2022.

### 4.1.1 Analytical Methods

To accommodate a future Before-After-Control-Impact (BACI) analysis, density statistics were generated for all survey units illustrated in Map 1. These units included the Final Preferred Route (FPR) with a 1 km buffer to represent potentially affected after construction units (survey units A and B), following Linnell *et al.* (2000) and Benitez-Lopez *et al.* (2010). Five units are considered control units (units C-G). All survey units were georeferenced and survey data were summarized and mapped using ArcGIS® ArcMap 10.8. During construction (2020) and after construction data (2022) were compared to pre-construction baseline data and summarized by survey unit and year. White-tailed deer density is calculated as the number of individuals observed per unit area surveyed.

Summary statistics were calculated in CRAN R (R Core Team 2020). Statistics include means for 2017-2018 (excluding 2016 as in previous reports) for pre-construction, and pooled means for 2020-2022 for construction and after construction phases. To test pre-construction densities compared to construction (2020) and after construction densities (2022), a Welch Two Sample t-test was performed (Welch 1947). This statistic is more robust than the student's t-test in ecological applications (Ruxton 2006). This test calculates a t-test (and associated t-value) for grouped independent observations (i.e., during- and after construction densities in each survey unit) to second set of grouped independent observations (i.e., pre-construction densities in the survey units), and is suitable for small sample sizes where uneven variances may be present. Observed densities during the 2020 construction, and 2022 after construction phase, are only considered significantly different from the pre-construction baseline, when the P-value calculated on a t-value is less than 0.05. The p-value is the probability that the observed density differences between group means is zero (groups do not statistically differ), so the lower the P-value, the more likely the differences are significant (there is a difference between densities pre and following the start of construction). Selecting a P-value cut-off of 0.05 reduces the risk of erroneously concluding that an observed difference is significant (Type I Error). However, when multiple tests are performed, this error increases and a threshold of 0.05 is no longer applicable or P-values need to be adjusted. We adjusted the P-values using the 'P. Adjust' function in R setting the method to Holm (Holm 1979).

## 4.2 Camera Trap Survey

Large mammals, particularly white-tailed deer, elk, and black bear are the primary targets of the camera trap study, but incidental observations of other species (i.e., moose) and human activity were also recorded. In this study, infrared (IR) camera trap arrays are used to monitor mammal activity along the FPR (i.e., potentially affected sites) and adjacent control areas (>500 m from the FPR).

Survey efforts focused on large, contiguous patches of intact forested habitats between Provincial Highway 12 and the Canada-U.S. border that are most likely to be affected by habitat fragmentation. The LAA in this extent includes softwood forest (36% total area), hardwood forest (18%), and mixedwood forest (4%). Site selection aimed to sample each forested habitat equally in both potentially affected sites and control sites; however, the lack of mixedwood forest within the LAA limited its inclusion.

Existing camera traps installed for pre-construction monitoring were carried over into post-construction monitoring, with a total of 16 camera trap arrays used in the study with 10 cameras positioned in potentially affected areas along the FPR and 6 cameras in reference or control areas (Map 3). These include one long term monitoring camera site (MMTP_LTM_012) originally installed in 2015, and 15 monitoring camera sites originally installed in May 2017. No new camera trap sites were established for post construction monitoring.

Camera traps were checked and redeployed/reset in June 2018 and again in April 2019, with the final data retrieval to date occurring in October/November 2020 or January 2021. For post-construction monitoring assessment in this report, data between November 2018 and October 2020 were analyzed and reported on, divided into winter (November – April) and summer (May – October) cohorts.

IR cameras were attached to trees at approximately 1 m from ground level and all vegetation that might falsely trigger or obscure the camera view was removed within at least 5 m, where possible. Reconyx™ cameras were used in continuous photo capture mode (i.e., a 2-photo burst with no time delay) and using compact flash type I/II or SD (Secure Digital) memory cards.

### 4.2.1 Analytical Methods

Results of camera trap surveys were provided by MH, generated following established photo analysis. All photographs were classified using MH's Camera Trap Data Classification Guide (Manitoba Hydro 2014) to identify the number, age, sex, and species involved in each camera event. A camera event is considered to be any number of individuals of a particular species captured on camera within a one-hour period. An annual relative abundance index (RAI; number of photo events / camera-days) is calculated for key species (i.e., white-tailed deer, black bear, gray wolf, and coyote), year, and season (summer [May-October] and winter [November-April]) at each of the 23 IR camera trap sites (10 affected sites, and 6 control sites). Analyses were not constrained to a minimum number of operational days per site/season combination. Box plots of annual RAIs are be used to visualize differences between IR camera trap treatments (i.e., potentially affected sites vs. control sites). A two-sample T-test was used to test for differences between RAI treatment means of each species (after a F-test was used to determine equality of sample variances).

# 5.0 RESULTS

The following sections describe the results of pre-, during, and after construction aerial mammal surveys (2016-2022) and camera trap surveys (2018-2020) conducted. Figure 1 shows an example of a black bear den observed during aerial survey. In some instances, pre-construction data have been grouped into treatment categories (e.g., potentially affected) to facilitate comparisons with data gathered during the construction and after construction (operation) phases. All null and alternate hypotheses were evaluated and tested resulting in the current acceptance of the null hypotheses of no detectible Project effects on the distribution of ungulates and predators and no indication of decreased ungulate densities as a result of increased mortality. The following sections provide the results of the analyses conducted throughout the pre-, during, and after construction periods.

**Figure 1: Example of black bear den observation during aerial survey**

## 5.1 Aerial Mammal Survey

*Ungulates*

The density trends are considered to be representative of white-tailed deer populations in the survey area during the years surveyed and there are no detectible or significant changes in densities which support the null hypotheses relating to changes in distribution, abundance or mortality.

As a result of poor snow conditions, data from 2016 are not considered robust, and subsequently not used in the calculation of any statistics in this report, including mean density comparisons. Overall, the total density of deer observed were lower in the reporting area in

2020 (1.3 deer/km$^2$) and 2022 (0.7 deer/km$^2$) (Table 1) compared with 2017 (2.3 deer/km$^2$) and 2018 (2.0 deer/km$^2$). Deer densities observed in 2020 were highest in north-eastern and eastern control survey units (C, D, and E) with densities ranging from 1.46-2.55 deer/km$^2$, while western survey units (A, B, F, and G) ranged from 0.26-0.91 deer/km$^2$ (Table 2). Density of deer in the 2020 survey units along the Final Preferred Route (FPR) were lower than the control blocks to the north-east, with unit B having a higher deer density than unit A, but these densities were higher than the south-west control survey units F and G. Deer densities observed in 2022 were highest in the north-eastern survey unit (C) with a density of 1.59 deer/km$^2$, while the two eastern survey units (D and E), and remaining western survey units (A, B, F, and G) ranged from 0.00-0.63 deer/km$^2$ (Table 2). Density of deer in the 2022 survey units along the Final Preferred Route (FPR) were lower than the control blocks to the north-east (units C-E) and one to the west (unit G), with unit B having a higher deer density than unit A, but the density of deer in B were higher than one south-west control survey (unit F). The pattern in deer densities observed in 2020 and 2022 for both the control, and potentially-affected survey units matches the pre-construction surveys in terms of relative abundance, but in general, there were consistently higher deer densities in all survey units in 2017 and 2018 compared with 2020 and 2022 (Figure 2; Table 1 and Table 2). That said, the lower densities of deer observed in 2020 (during construction) and 2022 (after construction) are not statistically significant from the 2017-2018 (pre-construction) survey units. These units are not affected by construction or operation, and the variation is likely a result of annual variation in natural deer populations and their distribution.

There were no elk observations in 2016-2018, 2020, or 2022 and moose observations have been limited to three tracks in 2018, in the southeast corner of the survey area. These results support the assumption of the null hypotheses that the Project has had no effect on elk or moose distribution or abundance.

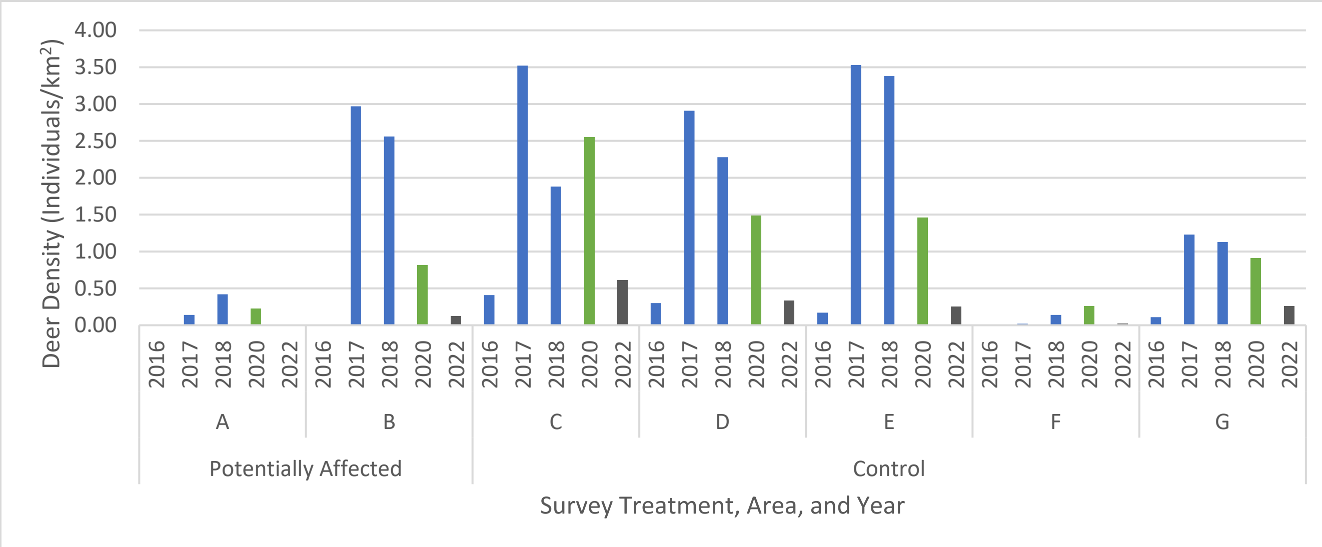


**Figure 2: Summary of white-tailed deer densities by survey treatment, survey unit, & year, pre-construction (blue), during construction (green) and after construction (black)**

**Table 1: Summary statistics of white-tailed deer individuals observed in 2016-2022**

| Year | No. of Observations | No. of Individuals | Min. Group Size | Max. Group Size | Density (deer/km$^2$) |
|---|---|---|---|---|---|
| 2016 | 45 | 83 | 1 | 5 | 0.2 |
| 2017 | 311 | 978 | 1 | 16 | 2.3 |
| 2018 | 299 | 840 | 1 | 12 | 2.0 |
| 2020 | 216 | 548 | 1 | 18 | 1.3 |
| 2022 | 126 | 296 | 1 | 11 | 0.7 |

**Table 2: Summary of white-tailed deer densities by survey treatment, unit, and year. Statistics include pre-development means (2017-2018, excluding 2016 as in previous reports) and post-development means for 2020-2022, also provided are Welch Two Sample t-tests with associated multiple comparison Holm adjusted P-values**

| Survey Treatment | Survey Unit | Year | Survey Unit Density (deer/km$^2$) | Mean Survey Unit Density (deer/km$^2$) 2017-2018 (2020-2022) | t-value | Adjusted P-value |
|---|---|---|---|---|---|---|
| Potentially Affected | A | 2016 | 0.00 | 0.28 (0.12) | 0.889 | 1.000 |
| | | 2017 | 0.14 | | | |
| | | 2018 | 0.42 | | | |
| | | 2020 | 0.23 | | | |
| | | 2022 | 0.00 | | | |
| | B | 2016 | 0.00 | 2.77 (0.59) | 7.049 | 0.142 |
| | | 2017 | 2.97 | | | |
| | | 2018 | 2.56 | | | |
| | | 2020 | 0.82 | | | |
| | | 2022 | 0.36 | | | |
| Control | C | 2016 | 0.41 | 2.70 (2.07) | 0.652 | 1.000 |
| | | 2017 | 3.52 | | | |
| | | 2018 | 1.88 | | | |
| | | 2020 | 2.55 | | | |
| | | 2022 | 1.59 | | | |
| | D | 2016 | 0.30 | 2.59 (1.15) | 3.128 | 0.536 |
| | | 2017 | 2.91 | | | |
| | | 2018 | 2.28 | | | |
| | | 2020 | 1.49 | | | |
| | | 2022 | 0.82 | | | |
| | E | 2016 | 0.17 | 3.45 (1.04) | 5.745 | 0.536 |
| | | 2017 | 3.53 | | | |
| | | 2018 | 3.38 | | | |
| | | 2020 | 1.46 | | | |
| | | 2022 | 0.63 | | | |
| | F | 2016 | 0.00 | 0.08 (0.16) | -0.711 | 1.000 |
| | | 2017 | 0.02 | | | |
| | | 2018 | 0.14 | | | |
| | | 2020 | 0.26 | | | |
| | | 2022 | 0.06 | | | |
| | G | 2016 | 0.11 | 1.18 (0.73) | 2.550 | 0.827 |
| | | 2017 | 1.23 | | | |
| | | 2018 | 1.13 | | | |
| | | 2020 | 0.91 | | | |
| | | 2022 | 0.57 | | | |

*Predators*

Observations of wolf and coyote have not illustrated any detectable changes in densities or occurrence from the pre-, during, and after construction period (Table 3).

**Table 3: Summary statistics of gray wolf and coyote observations in 2016-2022**

| Species | Year | Observation Type | No. of Observations | No. of Individuals | Min. Group Size | Max. Group Size |
|---|---|---|---|---|---|---|
| Gray Wolf | 2016 | Individual | 0 | 0 | 0 | 0 |
| | | Track | 10 | 12 | 1 | 3 |
| | 2017 | Individual | 4 | 13 | 1 | 8 |
| | | Track | 8 | 31 | 1 | 8 |
| | 2018 | Individual | 2 | 2 | 1 | 1 |
| | | Track | 4 | 6 | 1 | 3 |
| | 2020 | Individual | 0 | 0 | 0 | 0 |
| | | Track | 6 | 6 | 1 | 1 |
| | 2022 | Individual | 1 | 3 | 3 | 3 |
| | | Track | 6 | 6 | 1 | 1 |
| Coyote | 2016 | Individual | 1 | 2 | 2 | 2 |
| | | Track | 18 | 19 | 1 | 2 |
| | 2017 | Individual | 5 | 6 | 1 | 2 |
| | | Track | 6 | 6 | 1 | 1 |
| | 2018 | Individual | 4 | 4 | 1 | 1 |
| | | Track | 0 | 0 | 0 | 0 |
| | 2020 | Individual | 0 | 0 | 0 | 0 |
| | | Track | 0 | 0 | 0 | 0 |
| | 2022 | Individual | 5 | 12 | 1 | 4 |
| | | Track | 11 | 11 | 1 | 1 |

## 5.2 Camera Trap Survey

A total of 10,758 camera-days from 16 cameras were assessed between November 2018 and October 2020 to assess RAI between potentially affected sites and control sites (Appendix 2, Table 1). There were no moose or elk observations, and data discussed hereafter pertain to white-tailed deer, black bear, gray wolf, and coyote. There were a total of 1,872 wildlife events recorded over the 2019 and 2020 study periods (Table 4), including 1,505 white-tailed deer events (2,112 individuals), 284 black bear events (333 individuals), 44 gray wolf events (56 individuals) and 39 coyote events (42 individuals). Statistical analyses and boxplots were conducted on the dataset divided into winter (November – April) and summer (May – October) study periods. Table 4 provides a summary of camera trap survey events and individual species recorded during the post-construction monitoring period. Detailed trail camera data and results of statistical analyses are provided in Appendix 2.

**Table 4: Summary of camera trap survey events and individuals in affected and control areas recorded in 2019-2020 post-construction monitoring**

| | | **White-tailed Deer** | | **Black Bear** | | **Gray Wolf** | | **Coyote** | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Affected** | **Control** | **Affected** | **Control** | **Affected** | **Control** | **Affected** | **Control** |
| 2019 | Observation Days | 3534 | 2190 | 3534 | 2190 | 3534 | 2190 | 3534 | 2190 |
| | Events | 323 | 647 | 71 | 49 | 15 | 10 | 13 | 13 |
| | # of Individuals | 448 | 943 | 78 | 57 | 18 | 12 | 14 | 15 |
| 2020 | Observation Days | 2883 | 2151 | 2883 | 2151 | 2883 | 2151 | 2883 | 2151 |
| | Events | 121 | 414 | 9 | 155 | 10 | 9 | 6 | 7 |
| | # of Individuals | 154 | 567 | 13 | 185 | 14 | 12 | 6 | 7 |
| **Total** | **Observation Days** | **6417** | **4341** | **6417** | **4341** | **6417** | **4341** | **6417** | **4341** |
| | **Events** | **444** | **1061** | **80** | **204** | **25** | **19** | **19** | **20** |
| | **# of Individuals** | **602** | **1510** | **91** | **242** | **32** | **24** | **20** | **22** |

*White-tailed Deer*

White-tailed deer was observed at 12 of 16 sites during summer and 13 of 16 sites in winter 2019/2020 (Map 5 and 6, Photo 1). There was no significant difference between RAI means during summer with 0.12 ± 0.11 and 0.31 ± 0.41 for potentially affected and control sites, respectively ($p = 0.37$; Figure 2a). Similarly, there was no significant difference between RAI means during winter with 0.11 ± 0.11 and 0.20 ± 0.19 for potentially affected and control sites, respectively ($p = 0.33$; Figure 2b).


**Figure 3: A white-tailed deer captured on a trail camera**

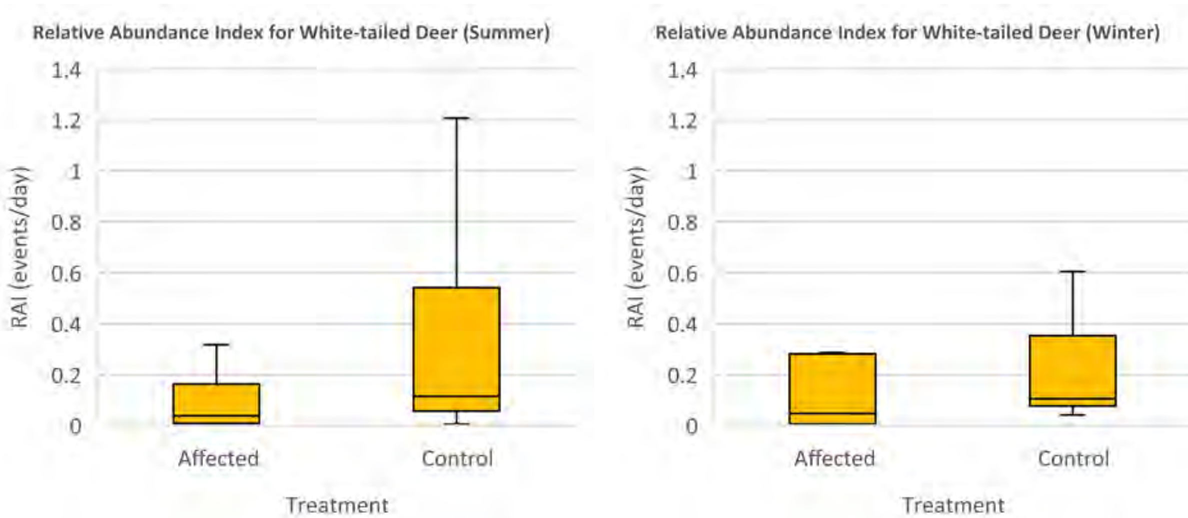


**Figure 4a and 5b: Box plot of white-tailed deer relative abundance index (RAI) for potentially affected and control sites, for summer (Figure 5a on left, May-October 2019 and 2020 combined) and winter (Figured 5b on right, November 2018-April 2019 and November 2019-April 2020 combined)**

*Black Bear*

Black bear was observed at 11 of 16 sites during summer (no data for winter months as black bears typically hibernate during this period; Map 7, Photo 2). There was no significant difference between RAI means with 0.07 ± 0.08 and 0.09 ± 0.15 for potentially affected and control sites, respectively ($p = 0.83$; Figure 3).


**Figure 5: A black bear captured on a trail camera**

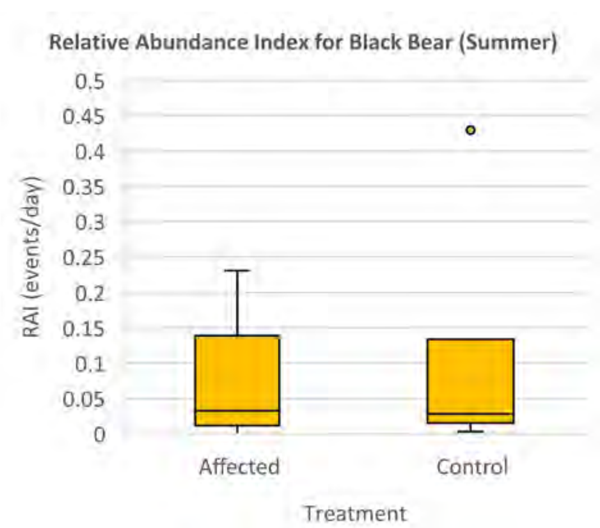


**Figure 6: Box plot of black bear relative abundance index (RAI) for potentially affected and control sites between November 2019 and October 2020, summer and winter combined**

*Gray Wolf and Coyote*

Gray wolf was observed at 9 of 16 sites during both summer and winter (Map 8, Photo 3) and coyote was observed at 8 sites in each period (Map 9, Photo 4). The limited number of gray wolf and coyote observations precludes formal analyses.


**Figure 7: A gray wolf captured on a trail camera**


**Figure 8: A coyote captured on a trail camera**

# 6.0 DISCUSSION

The densities and distribution of white-tailed deer and predators across all survey blocks during the construction, and after construction (operation) phases is consistent with pre-construction data described in the EIS. This confirms Hypothesis 1, that distribution of white-tailed deer has not changed, and density estimates confirm no detectible increase in mortality during construction and operation. White-tailed deer densities remain highest in dense forested areas found in the eastern survey blocks, as observed during pre-construction surveys. During the survey periods (March), deer are expected to utilize dense forest due to lower snow cover compared to more open areas where snow depth can reduce mobility and foraging opportunities (Nelson and Mech 1986). Although not statistically significant, there were slight trends in reduced densities across most survey blocks following the pre-construction phase. There is a pattern in abundance across the survey area, with more deer in the northeast than southwest corresponding to habitat and land-use differences across the study area. This suggests overall, population trends in the region are not related to Project construction during winter of 2020 or operation during winter of 2022. One control block (E) showed a slight decline during the 2020 construction period; however, this block is not affected by the Project and no blocks were significantly different between pre-construction and construction/post-construction based on the addition of the 2022 survey results. Natural annual variability of white-tailed deer populations and their distribution is well known to be influenced by late season snow cover, spring weather (fawn survival), and hunting policy (Fuller 1990). Camera trap surveys similarly identified no significant variation between affected and control treatments during the 2019 and 2020 monitoring seasons. A post-construction aerial survey initiated in 2021 was canceled due to poor weather conditions, but the aerial survey conducted in 2022 does support null Hypothesis 2 and 3 that there will be no effect on deer densities or mortality as a result of operation. Future surveys during the operation period would be helpful to further confirm and accept these hypotheses.

Low numbers of gray wolves and coyotes have been observed during both pre-, during, and after construction (0-3 wolves observed per year since 2018). Additionally, camera traps identified gray wolf events at nine sites during the 2019 and 2020 seasons combined, with 25 events and 30 observations documented in 2019, and 19 events and 26 observations in 2020, and no notable difference in RAI between control and affected treatments in either year. Similarly, coyote events were identified at eight sites during the 2019 and 2020 seasons combined, with 26 events and 29 observations documented in 2019, and 13 events and 13 observations documented in 2020, with similar trends between affected and control treatments. As with deer and elk, Hypothesis 2 and 3 supports no detectible effects of the Project construction and operation on increased predators and the associated predation on ungulates. Earlier observations of a wolf pack in 2017 have not been observed during the surveys since.

Observations and presence of coyotes should be interpreted with caution, as the survey is a onetime event for that year, and they become more mobile in February and March, which coincides with breeding season (Roy and Dorrance 1985). Coyotes are also generally recognized to be nocturnal, and their habitat selection may be associated with transition forest-agricultural lands, particularly during the breeding season. It is also more difficult to detect coyotes during winter in dense forest, and their distribution is pack-dependent, rather than individuals being evenly distributed over the landscape, making them difficult to observe.

# 7.0 FUTURE MONITORING

Replication of aerial surveys during the winter months (2023 and beyond) in the future to assess operation effects and hypotheses testing as outlined in the MMTP Environmental Monitoring Plan (2019) would be informative.

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# APPENDIX 1: MAPS

# APPENDIX 2: TABLES

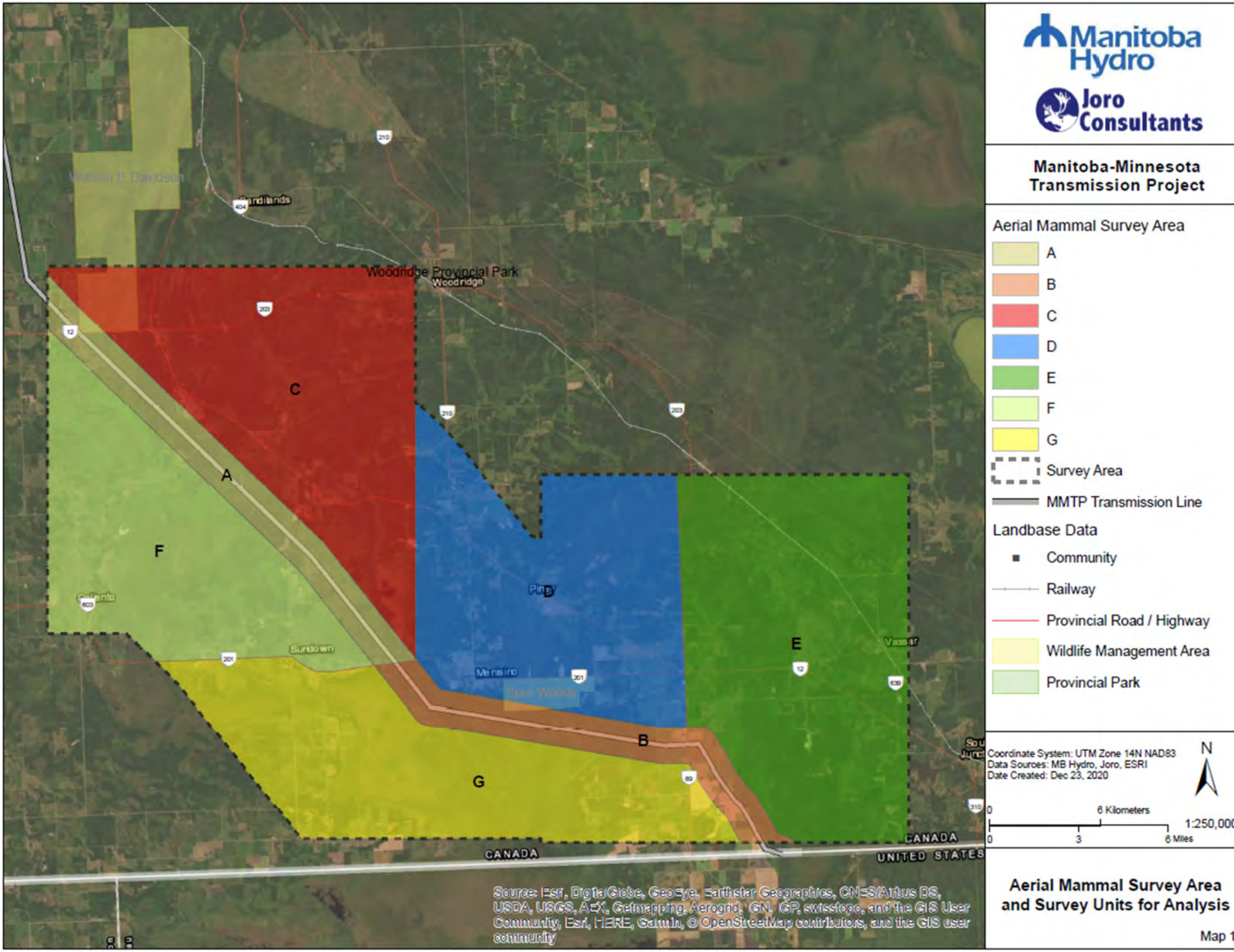
**Appendix 2, Table 1: Summary of the MMTP 2019-2020 mammal camera trap study results**

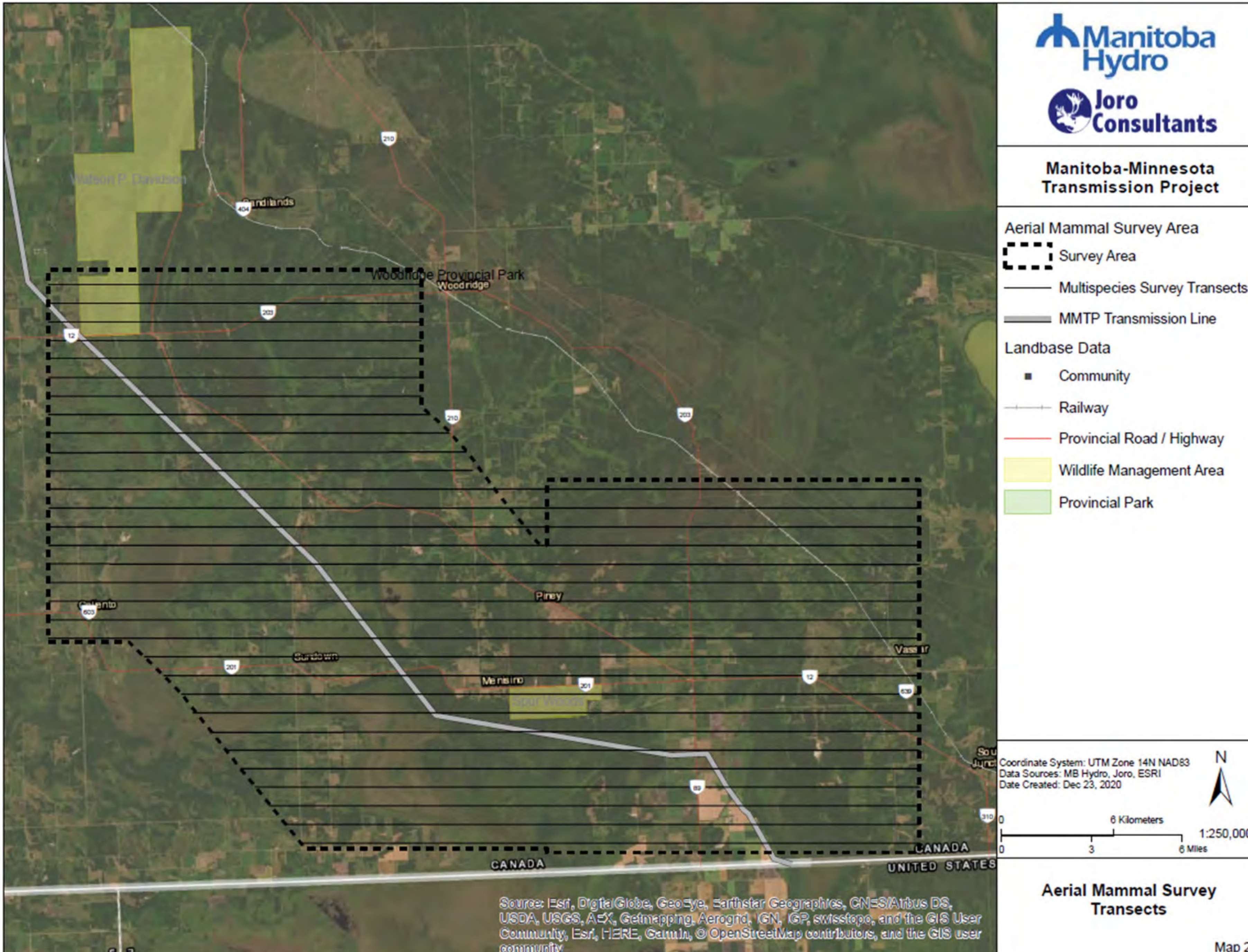
| Camera ID | Treatment | Season | Year | No. of Operation Days | White-tailed Deer | | | Black Bear | | | Gray Wolf | | | Coyote | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI |
| MMTP_LTM_12 | Affected | winter | 2018-19 | 181 | 9 | 5 | 0.03 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_LTM_12 | Affected | summer | 2019 | 184 | 4 | 4 | 0.02 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_LTM_12 | Affected | winter | 2019-20 | 182 | 3 | 3 | 0.02 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_LTM_12 | Affected | summer | 2020 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_002 | Affected | winter | 2018-19 | 181 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_002 | Affected | summer | 2019 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_002 | Affected | winter | 2019-20 | 182 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_002 | Affected | summer | 2020 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_005 | Affected | winter | 2018-19 | 181 | 17 | 12 | 0.07 | 2 | 2 | 0.01 | 9 | 8 | 0.04 | 2 | 2 | 0.01 |
| MMTP_MONITORING_005 | Affected | summer | 2019 | 184 | 5 | 2 | 0.01 | 10 | 8 | 0.04 | 1 | 1 | 0.01 | 0 | 0 | 0.00 |
| MMTP_MONITORING_005 | Affected | winter | 2019-20 | 182 | 5 | 5 | 0.03 | 1 | 1 | 0.01 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_005 | Affected | summer | 2020 | 184 | 2 | 2 | 0.01 | 4 | 4 | 0.02 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_006 | Control | winter | 2018-19 | 181 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_006 | Control | summer | 2019 | 184 | 2 | 1 | 0.01 | 3 | 3 | 0.02 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_006 | Control | winter | 2019-20 | 182 | 16 | 15 | 0.08 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |

| Camera ID | Treatment | Season | Year | No. of Operation Days | White-tailed Deer | | | Black Bear | | | Gray Wolf | | | Coyote | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI |
| MMTP_MONITORING_006 | Control | summer | 2020 | 184 | 1 | 1 | 0.01 | 5 | 5 | 0.03 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_007 | Affected | winter | 2018-19 | 181 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_007 | Affected | summer | 2019 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_007 | Affected | winter | 2019-20 | 182 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_007 | Affected | summer | 2020 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_008 | Control | winter | 2018-19 | 181 | 50 | 30 | 0.17 | 0 | 0 | 0.00 | 3 | 3 | 0.02 | 10 | 8 | 0.04 |
| MMTP_MONITORING_008 | Control | summer | 2019 | 184 | 71 | 40 | 0.22 | 8 | 7 | 0.04 | 1 | 1 | 0.01 | 0 | 0 | 0.00 |
| MMTP_MONITORING_008 | Control | winter | 2019-20 | 182 | 2 | 2 | 0.01 | 0 | 0 | 0.00 | 1 | 1 | 0.01 | 1 | 1 | 0.01 |
| MMTP_MONITORING_008 | Control | summer | 2020 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_011 | Affected | winter | 2018-19 | 181 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_011 | Affected | summer | 2019 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_011 | Affected | winter | 2019-20 | 182 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_011 | Affected | summer | 2020 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_012 | Control | winter | 2018-19 | 181 | 42 | 36 | 0.20 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_012 | Control | summer | 2019 | 184 | 34 | 29 | 0.16 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_012 | Control | winter | 2019-20 | 182 | 78 | 62 | 0.34 | 0 | 0 | 0.00 | 5 | 3 | 0.02 | 0 | 0 | 0.00 |
| MMTP_MONITORING_012 | Control | summer | 2020 | 184 | 18 | 15 | 0.08 | 1 | 1 | 0.01 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_015 | Affected | winter | 2018-19 | 181 | 110 | 67 | 0.37 | 0 | 0 | 0.00 | 3 | 2 | 0.01 | 5 | 4 | 0.02 |

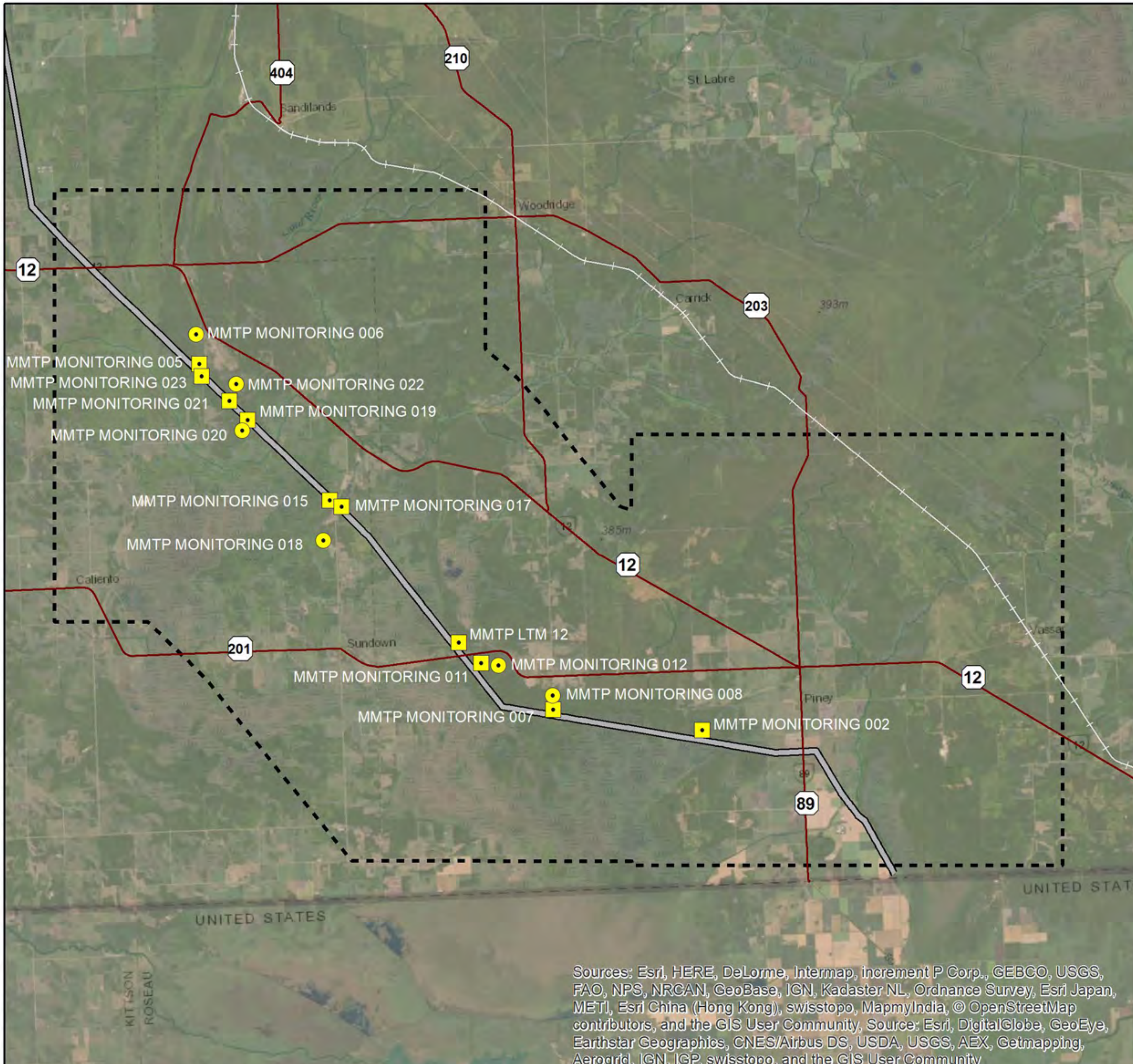
| Camera ID | Treatment | Season | Year | No. of Operation Days | White-tailed Deer | | | Black Bear | | | Gray Wolf | | | Coyote | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI |
| MMTP_MONITORING_015 | Affected | summer | 2019 | 184 | 79 | 66 | 0.36 | 7 | 6 | 0.03 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_015 | Affected | winter | 2019-20 | 182 | 55 | 37 | 0.20 | 4 | 1 | 0.01 | 10 | 7 | 0.04 | 4 | 4 | 0.02 |
| MMTP_MONITORING_015 | Affected | summer | 2020 | 169 | 57 | 46 | 0.27 | 2 | 2 | 0.01 | 0 | 0 | 0.00 | 2 | 2 | 0.01 |
| MMTP_MONITORING_017 | Affected | winter | 2018-19 | 181 | 14 | 14 | 0.08 | 1 | 1 | 0.01 | 0 | 0 | 0.00 | 5 | 5 | 0.03 |
| MMTP_MONITORING_017 | Affected | summer | 2019 | 184 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_017 | Affected | winter | 2019-20 | 182 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_017 | Affected | summer | 2020 | 154 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_018 | Control | winter | 2018-19 | 181 | 235 | 141 | 0.78 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_018 | Control | summer | 2019 | 184 | 345 | 228 | 1.24 | 9 | 5 | 0.03 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_018 | Control | winter | 2019-20 | 182 | 137 | 78 | 0.43 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 3 | 3 | 0.02 |
| MMTP_MONITORING_018 | Control | summer | 2020 | 139 | 218 | 162 | 1.17 | 6 | 6 | 0.04 | 2 | 1 | 0.01 | 1 | 1 | 0.01 |
| MMTP_MONITORING_019 | Affected | winter | 2018-19 | 181 | 1 | 1 | 0.01 | 6 | 6 | 0.03 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_019 | Affected | summer | 2019 | 126 | 9 | 8 | 0.06 | 32 | 29 | 0.23 | 1 | 1 | 0.01 | 0 | 0 | 0.00 |
| MMTP_MONITORING_020 | Control | winter | 2018-19 | 181 | 19 | 18 | 0.10 | 2 | 2 | 0.01 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_020 | Control | summer | 2019 | 184 | 95 | 82 | 0.45 | 28 | 25 | 0.14 | 8 | 6 | 0.03 | 4 | 4 | 0.02 |
| MMTP_MONITORING_020 | Control | winter | 2019-20 | 182 | 30 | 22 | 0.12 | 8 | 4 | 0.02 | 4 | 4 | 0.02 | 0 | 0 | 0.00 |
| MMTP_MONITORING_020 | Control | summer | 2020 | 184 | 44 | 36 | 0.20 | 158 | 133 | 0.72 | 0 | 0 | 0.00 | 2 | 2 | 0.01 |
| MMTP_MONITORING_021 | Affected | winter | 2018-19 | 181 | 75 | 51 | 0.28 | 4 | 4 | 0.02 | 3 | 2 | 0.01 | 2 | 2 | 0.01 |

| Camera ID | Treatment | Season | Year | No. of Operation Days | White-tailed Deer | | | Black Bear | | | Gray Wolf | | | Coyote | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI | No. of Individuals | No. of Events | RAI |
| MMTP_MONITORING_021 | Affected | summer | 2019 | 126 | 24 | 14 | 0.11 | 7 | 6 | 0.05 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_022 | Control | winter | 2018-19 | 181 | 26 | 21 | 0.12 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_022 | Control | summer | 2019 | 184 | 24 | 21 | 0.11 | 7 | 7 | 0.04 | 0 | 0 | 0.00 | 1 | 1 | 0.01 |
| MMTP_MONITORING_022 | Control | winter | 2019-20 | 182 | 17 | 15 | 0.08 | 0 | 0 | 0.00 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_022 | Control | summer | 2020 | 184 | 6 | 6 | 0.03 | 7 | 6 | 0.03 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_023 | Affected | winter | 2018-19 | 181 | 29 | 19 | 0.10 | 0 | 0 | 0.00 | 1 | 1 | 0.01 | 0 | 0 | 0.00 |
| MMTP_MONITORING_023 | Affected | summer | 2019 | 184 | 72 | 60 | 0.33 | 9 | 9 | 0.05 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |
| MMTP_MONITORING_023 | Affected | winter | 2019-20 | 182 | 4 | 3 | 0.02 | 0 | 0 | 0.00 | 4 | 3 | 0.02 | 0 | 0 | 0.00 |
| MMTP_MONITORING_023 | Affected | summer | 2020 | 184 | 28 | 25 | 0.14 | 2 | 1 | 0.01 | 0 | 0 | 0.00 | 0 | 0 | 0.00 |


Manitoba Hydro
Joro Consultants
Manitoba-Minnesota Transmission Project
Aerial Mammal Survey Area
A
B
C
D
E
F
G
Survey Area
MMTP Transmission Line
Landbase Data
Community
Railway
Provincial Road / Highway
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Sources: MB Hydro, Joro, ESRI
Date Created: Dec 23, 2020
N
0
6 Kilometers
1:250,000
0
3
6 Miles
Aerial Mammal Survey Area and Survey Units for Analysis
Map 1
Watson P. Davidson
Sandilands
Woodridge Provincial Park
Woodridge
Piney
Menisino
Sundown
Vassar
Spur Woods
CANADA
UNITED STATES
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community



Manitoba Hydro
Joro Consultants
Manitoba-Minnesota Transmission Project
Aerial Mammal Survey Area
Survey Area
Multispecies Survey Transects
MMTP Transmission Line
Landbase Data
Community
Railway
Provincial Road / Highway
Wildlife Management Area
Provincial Park
Coordinate System: UTM Zone 14N NAD83
Data Sources: MB Hydro, Joro, ESRI
Date Created: Dec 23, 2020
N
0
6 Kilometers
0
3
6 Miles
1:250,000
Aerial Mammal Survey Transects
Map 2
Sandilands
Woodridge Provincial Park
Woodridge
Piney
Sundown
Menisino
Vassar
CANADA
UNITED STATES
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community




Manitoba Hydro

Joro Consultants

**Manitoba - Minnesota Transmission Project**

Camera Trap Survey Observations 2019-2020

Mammal Camera Trap Locations 2019-2020

- Affected
- Control

Mammal Survey Area

- Survey Area (2016-2020)
- MMTP Final Preferred Route (FPR)

Landbase Data

- Provincial Road / Highway
- Railway

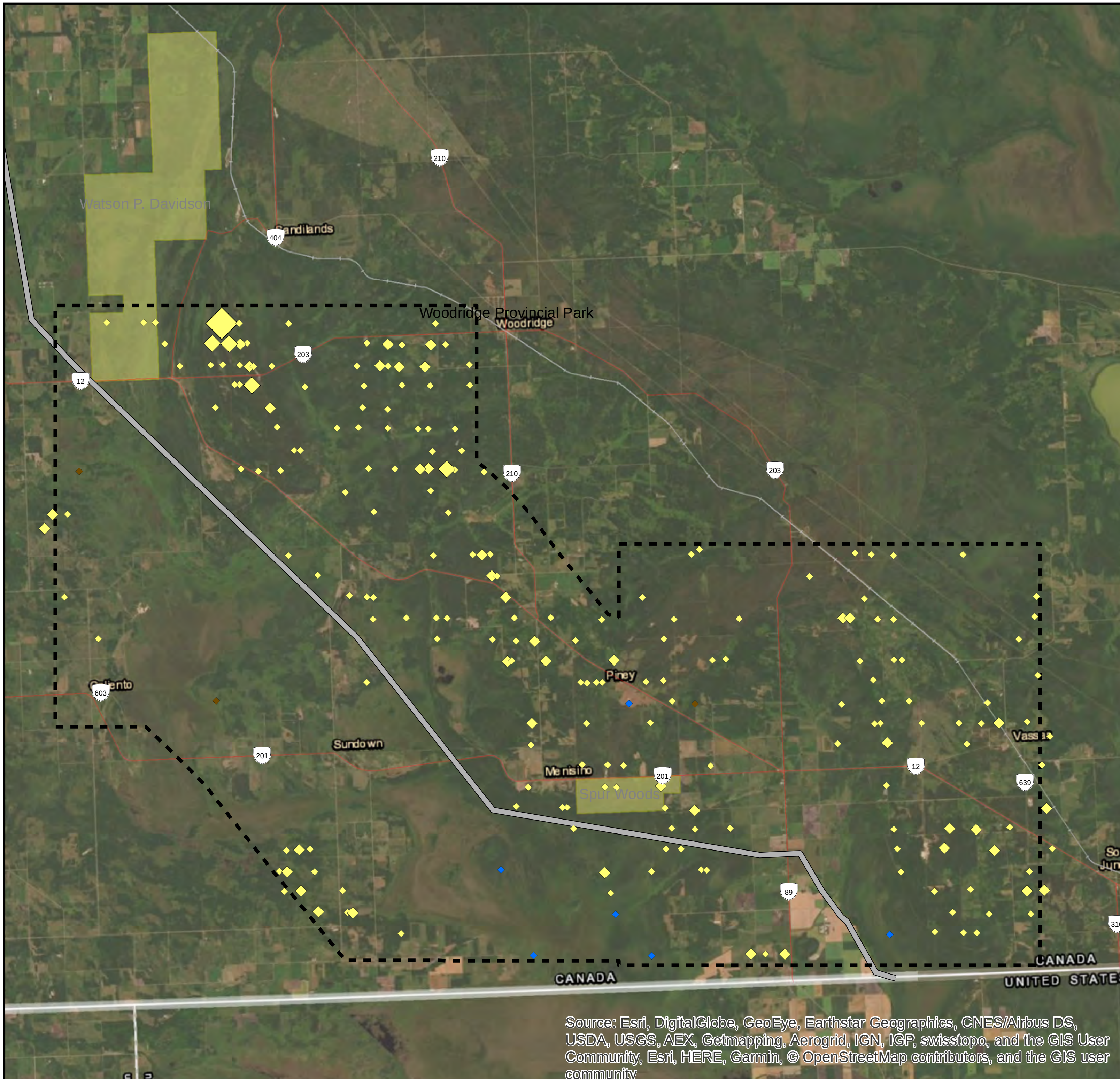
Coordinate System: NAD 1983 UTM Zone 14N
Data Source: MB Hydro, Joro, ESRI, NRCAN
Date Created: Nov 9, 2021

N

0 — 6 Kilometers
0 — 3 — 6 Miles
1:250,000

**Camera Trap Survey Locations 2019-2020**

Map 3




Manitoba Hydro

Joro Consultants

**Manitoba-Minnesota Transmission Project**

Aerial Mammal Survey Observations 2020

| Bear | Deer | Wolf |
|---|---|---|
| 1-3 | 1-3 | 1-3 |
| | 4-6 | |
| | 7-9 | |
| | 10-12 | |
| | 12-15 | |
| | 16-18 | |

Aerial Mammal Survey Area

- Survey Area (2016-2020)
- MMTP Transmission Line

Landbase Data

- Community
- Railway
- Provincial Road / Highway
- Wildlife Management Area
- Provincial Park

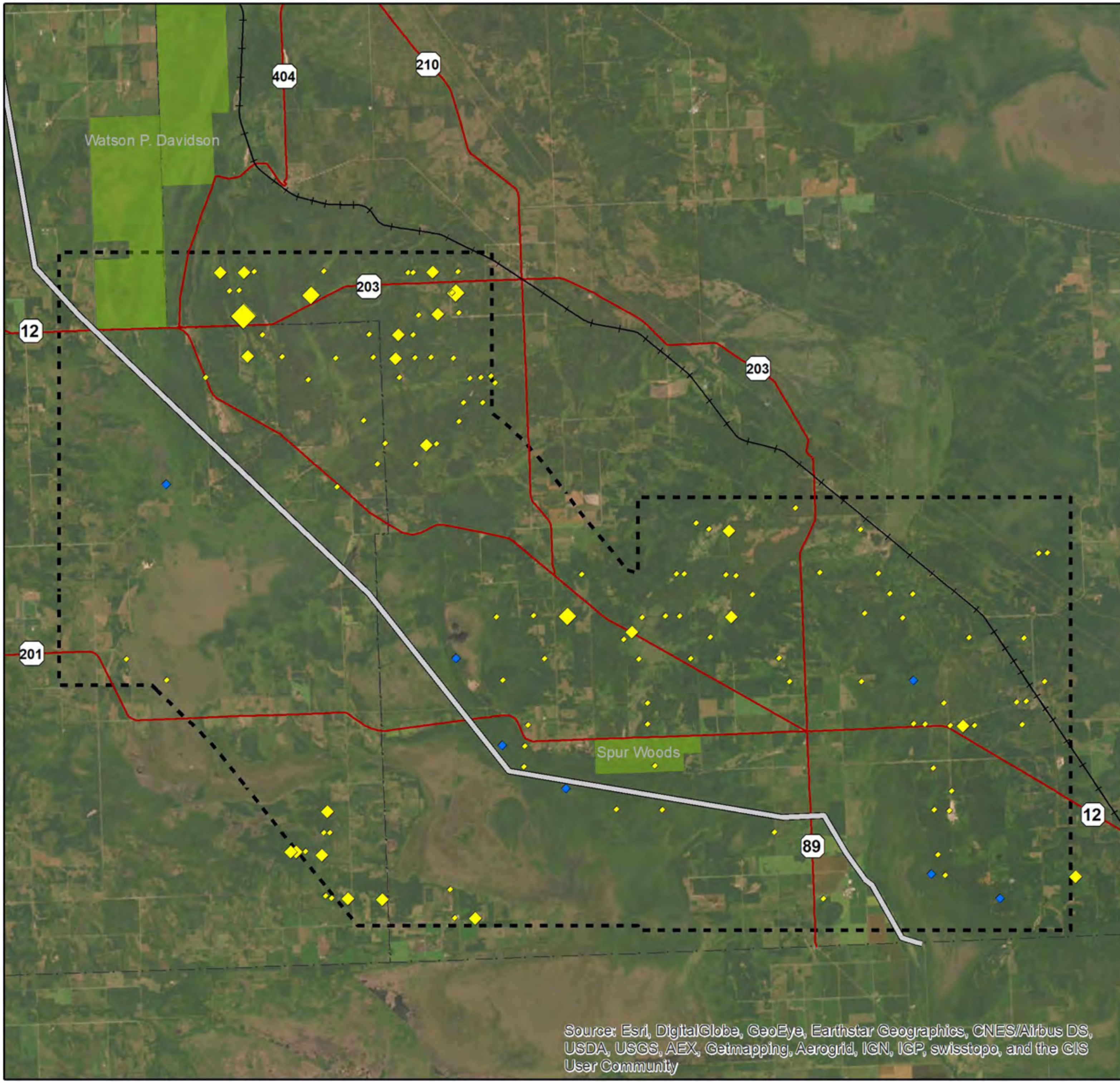
Coordinate System: UTM Zone 14N NAD83
Data Sources: MB Hydro, Joro, ESRI
Date Created: Dec 23, 2020

N

0 6 Kilometers
0 3 6 Miles
1:250,000

**Aerial Mammal Survey Observations 2020**

Map 4




Manitoba Hydro

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**Manitoba - Minnesota Transmission Project**

Aerial Mammal Survey Observations 2022

**Deer**
- 1-3
- 4-6
- 7-9
- 10-11

**Wolf**
- 1-3

Mammal Survey Area
- MMTP Transmission Line
- Mammal Aerial Survey Area

Landbase Data
- MMTP Transmission Line
- Provincial Road / Highway
- Railway
- Wildlife Managment

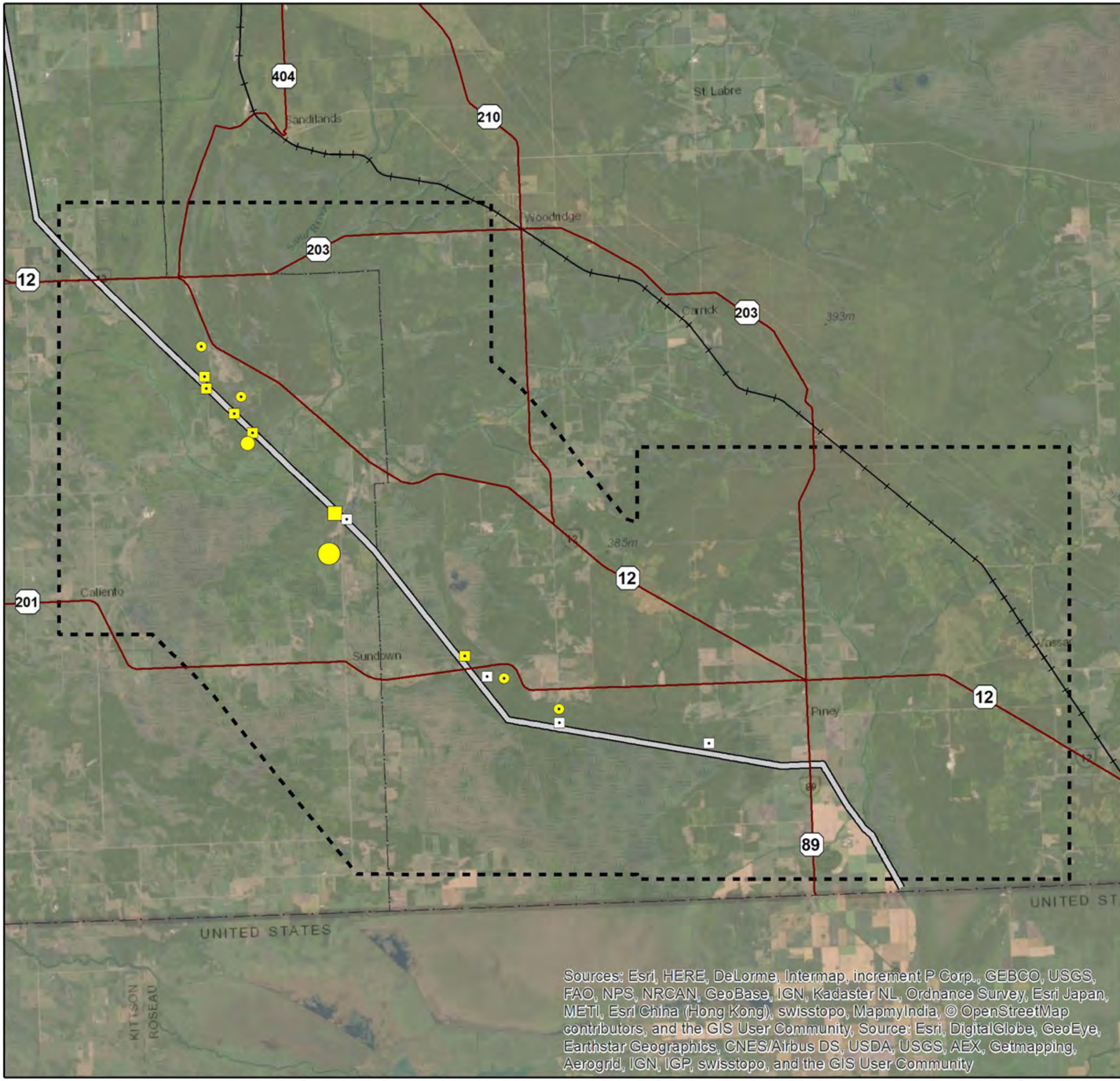
Coordinate System: NAD 1983 UTM Zone 14N
Data Source: MB Hydro, Joro, ESRI, NRCAN
Date Created: Nov 9, 2021

N

0 6 Kilometers
0 3 6 Miles
1:250,000

**Aerial Mammal Survey Observations 2022**

Map 5




Manitoba Hydro

Joro Consultants

**Manitoba - Minnesota Transmission Project**

**White-tailed Deer RAI Values (Summer)**

| Control | | Affected |
|---|---|---|
| | 0.00 | |
| | >0 - 0.25 | |
| | 0.26 - 0.50 | |
| | 0.51 - 0.75 | |
| | >0.75 | |

Mammal Survey Area

MMTP Transmission Line

Mammal Aerial Survey Area

Landbase Data

Provincial Road / Highway

Railway

Coordinate System: NAD 1983 UTM Zone 14N
Data Source: MB Hydro, Joro, ESRI, NRCAN
Date Created: Nov 9, 2021

N

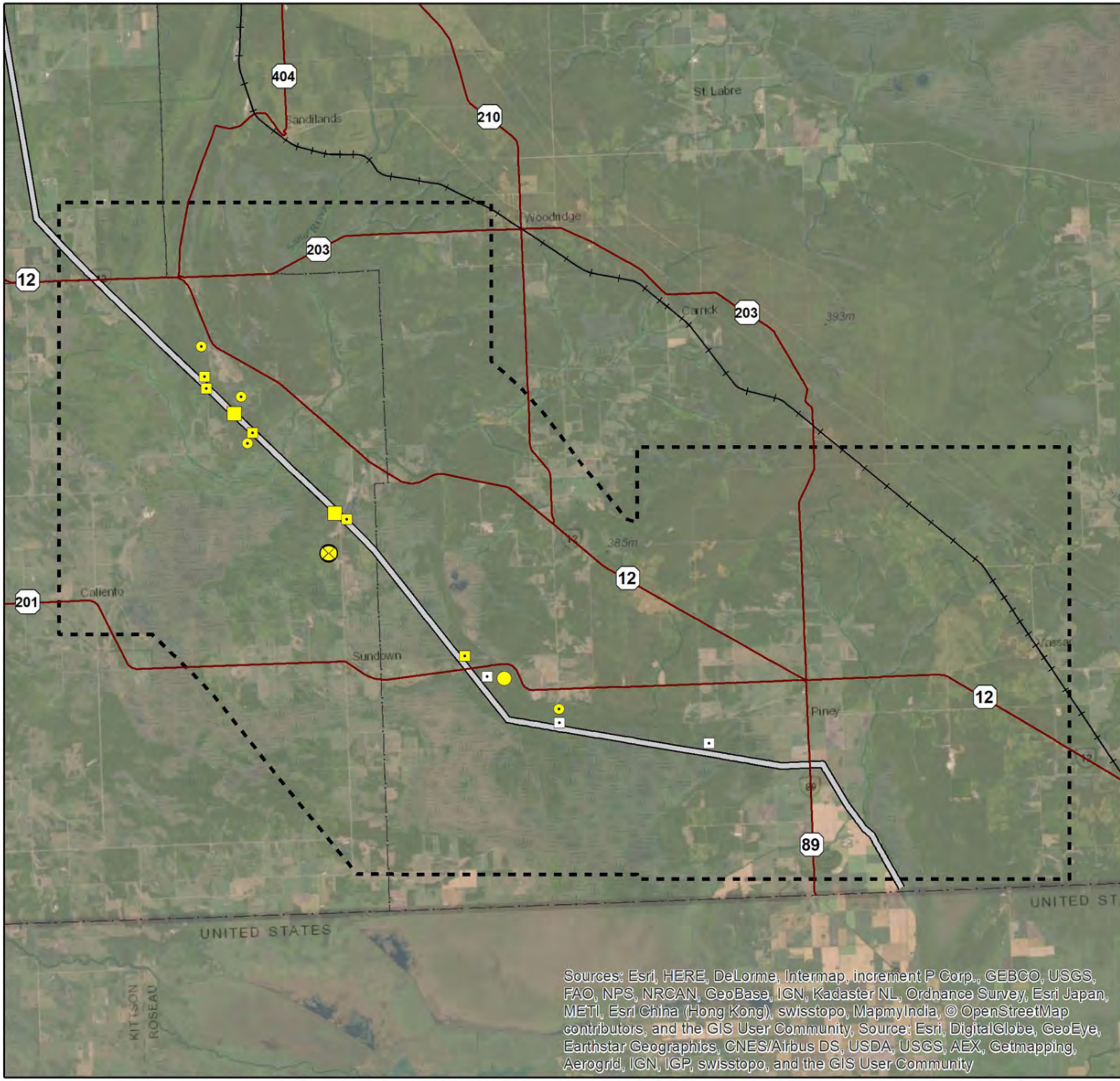
0 6 Kilometers

0 3 6 Miles

1:250,000

**Camera Trap Results 2019-2020**
**White-tailed Deer - Summer**

Map 6




Manitoba Hydro

Joro Consultants

**Manitoba - Minnesota Transmission Project**

**White-tailed Deer RAI Values (Winter)**

| Control | | Affected |
|---|---|---|
| | 0.00 | |
| | >0 - 0.25 | |
| | 0.26 - 0.50 | |
| | 0.51 - 0.75 | |
| | >0.75 | |

Mammal Survey Area

MMTP Transmission Line

Mammal Aerial Survey Area

Landbase Data

Provincial Road / Highway

Railway

Coordinate System: NAD 1983 UTM Zone 14N
Data Source: MB Hydro, Joro, ESRI, NRCAN
Date Created: Nov 9, 2021

N

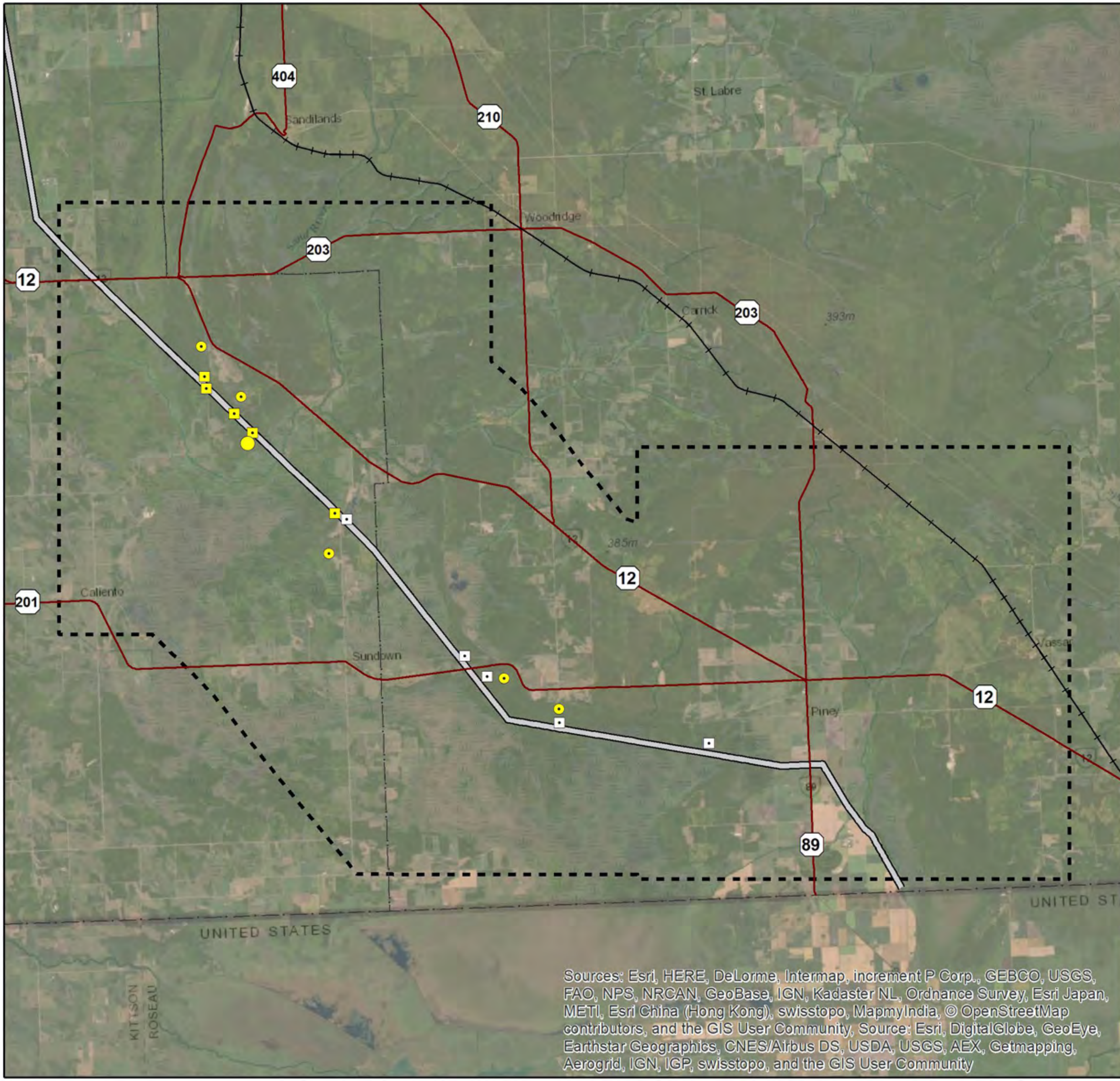
0 6 Kilometers

0 3 6 Miles

1:250,000

**Camera Trap Results 2019-2020**
**White-tailed Deer - Winter**

Map 7




Manitoba Hydro

Joro Consultants

**Manitoba - Minnesota Transmission Project**

**Black Bear RAI Values (Summer)**

| **Control** | | **Affected** |
|---|---|---|
| | 0.00 | |
| | >0 - 0.25 | |
| | 0.26 - 0.50 | |
| | 0.51 - 0.75 | |
| | >0.75 | |

Mammal Survey Area

MMTP Transmission Line

Mammal Aerial Survey Area

Landbase Data

Provincial Road / Highway

Railway

Coordinate System: NAD 1983 UTM Zone 14N
Data Source: MB Hydro, Joro, ESRI, NRCAN
Date Created: Nov 9, 2021

N

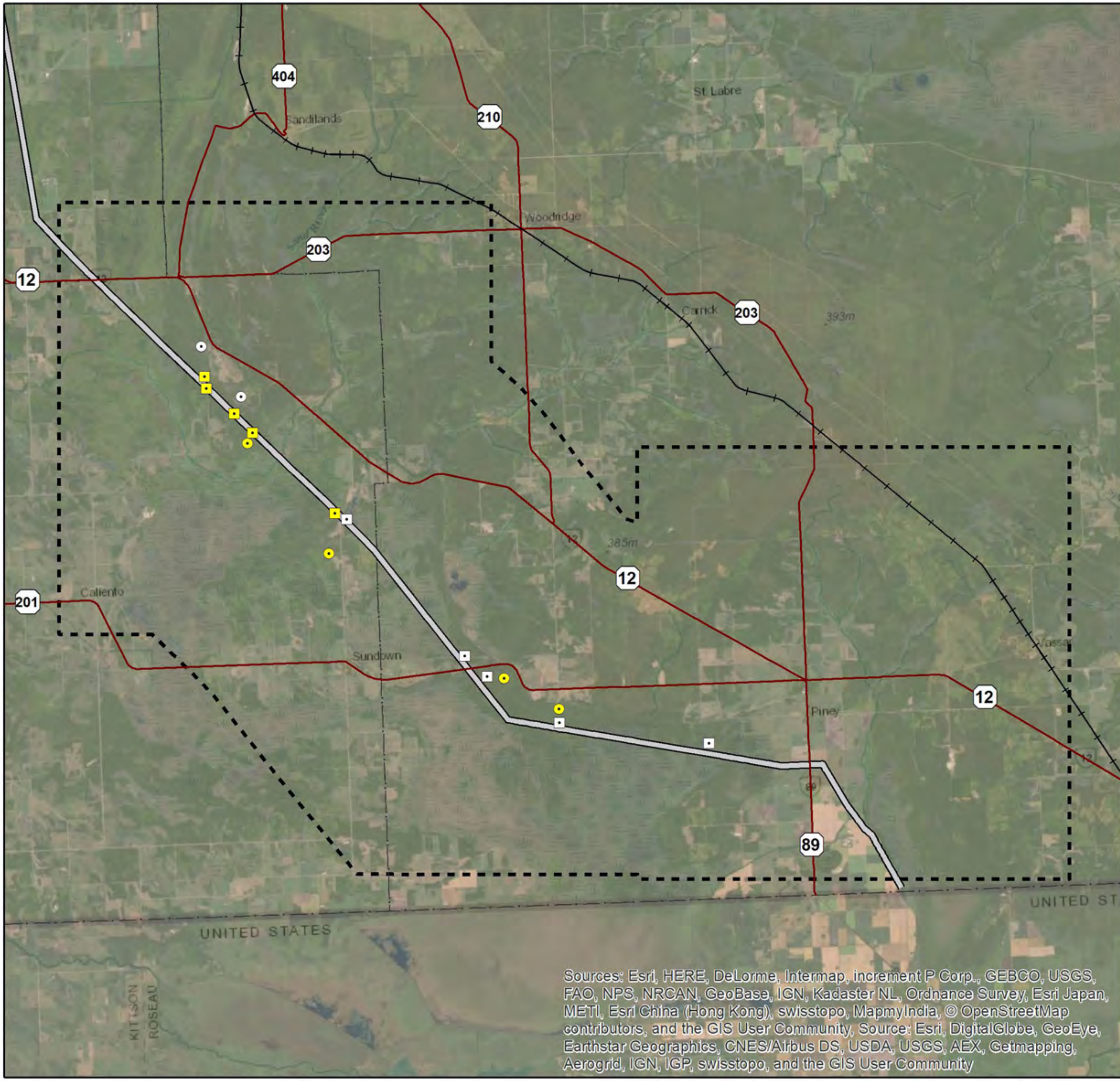
0 — 6 Kilometers

0 — 3 — 6 Miles

1:250,000

**Camera Trap Results 2019-2020**
**Black Bear**

Map 8




Manitoba Hydro

Joro Consultants

**Manitoba - Minnesota Transmission Project**

**Gray Wolf RAI Values**

| Control | | Affected |
|---|---|---|
| | 0.00 | |
| | >0 - 0.25 | |
| | 0.26 - 0.50 | |
| | 0.51 - 0.75 | |
| | >0.75 | |

Mammal Survey Area

MMTP Transmission Line

Mammal Aerial Survey Area

Landbase Data

Provincial Road / Highway

Railway

Coordinate System: NAD 1983 UTM Zone 14N
Data Source: MB Hydro, Joro, ESRI, NRCAN
Date Created: Nov 9, 2021

N

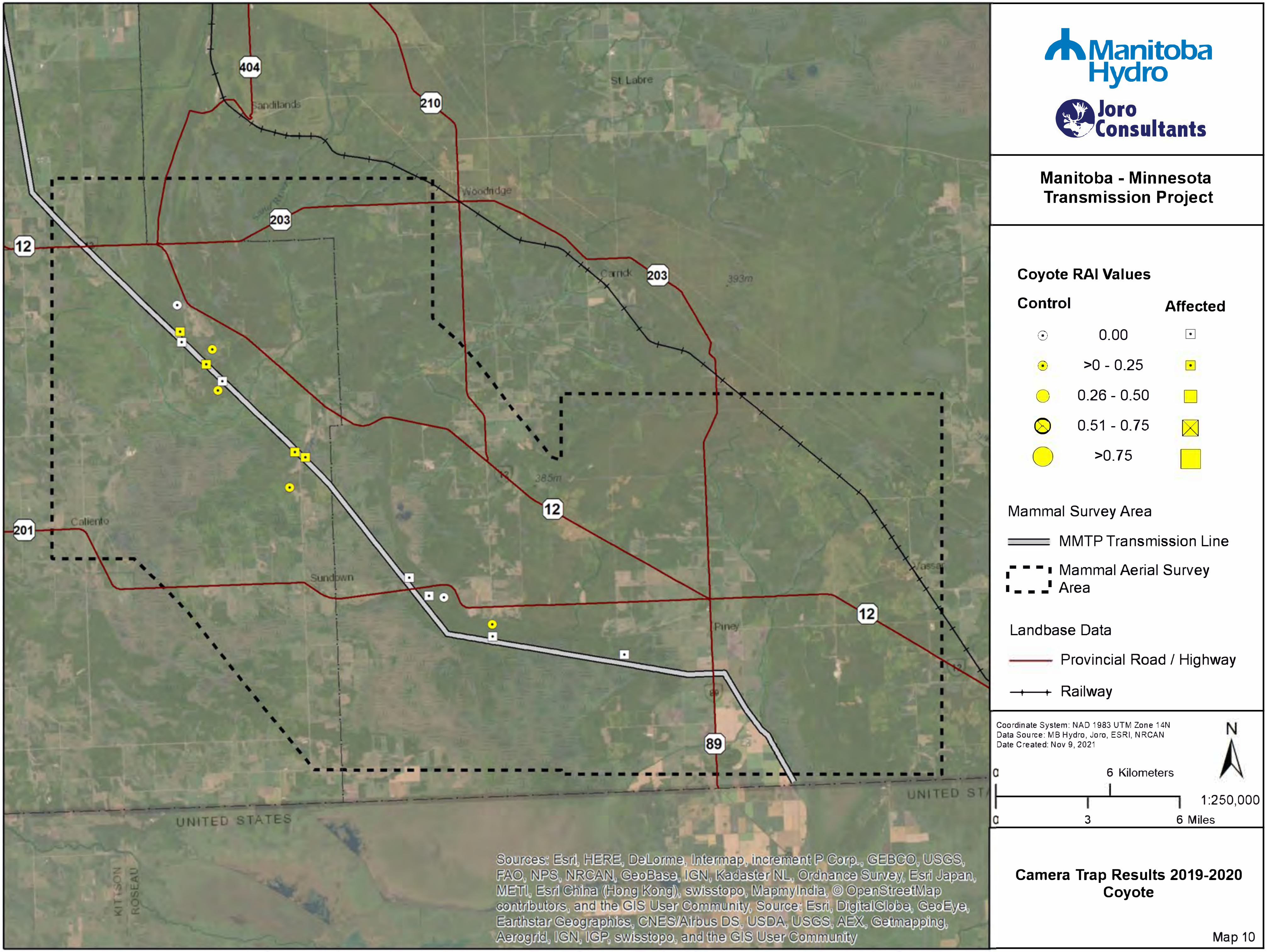
0 6 Kilometers

0 3 6 Miles

1:250,000

**Camera Trap Results 2019-2020**
**Gray Wolf**

Map 9




**Camera Trap Results 2019-2020**
**Coyote**

Map 10

Available in accessible formats upon request