BIRTLE TRANSMISSION PROJECT

Bird Species of Conservation Concern Monitoring 2021

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ENVIRONMENTAL MONITORING PLAN

Bird Species of Conservation Concern Monitoring 2021

Prepared for

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Winnipeg, Manitoba

By

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*with redactions to protect sensitive sites

EXECUTIVE SUMMARY

The Birtle Transmission Project (the Project) is a 230 kV AC transmission line that spans 46.2 km from the Birtle South Station, through the Spy Hill-Ellice Community Pasture, to the Saskatchewan border. Project construction began in July 2020 and was completed by March 2021.

The chestnut-collared longspur (*Calcarius ornatus*) is listed as Threatened under the federal *Species at Risk Act* and Endangered under *The Endangered Species and Ecosystems Act* of Manitoba. The Sprague's pipit (*Anthus spragueii*) is listed as Threatened under each. The species' population declines are due in part to the loss of grassland habitat. The Spy Hill-Ellice Community Pasture, which may be subject to disturbance due Project construction and operation, provides grazing for livestock and important habitat for grassland birds. As described in the Birtle Transmission Project Environmental Monitoring Plan, the objectives of grassland bird species of conservation concern (SOCC) monitoring are to identify the location of chestnut-collared longspur and Sprague's pipit within or near the Project footprint to compare their abundance before and after Project construction; to monitor perching avian predators and brood parasites near the transmission line and compare abundance to nearby reference sites; and to determine the effectiveness of mitigation measures and, if appropriate, propose revisions to existing plans or develop new mitigation options should unexpected impacts to grassland bird SOCCs occur as a result of Project construction or operation activities.

Pre-construction surveys for grassland bird SOCCs conducted in 2017 and 2019 were continued in 2021, the first year after Project construction. Ten-minute point counts for birds were conducted at 291 sites within four broad habitat classes in the Spy Hill-Ellice Community Pasture. Surveys focused mainly on chestnut-collared longspur and Sprague's pipit; however, aural and visual observations of all bird species, including other SOCCs, were recorded. Statistical analyses were conducted to compare the abundance of chestnut-collared longspurs and Sprague's pipits at grassland habitat sites before and after Project construction, to test the hypothesis that the construction and operation of the transmission line affects the abundance of each species.

To monitor the abundance of perching avian predators, surveys were conducted at four sites where perch deterrents were installed on transmission towers and at two sites with no deterrents. At each site, two tower spans (three towers) were monitored for one hour by an observer who noted the species and behaviour of raptors (falcons, hawks, eagles) and of black-billed magpie (*Pica hudsonia*), common raven (*Corvus corax*), and American crow *(Corvus brachyrhynchos*), which are common nest predators. Each site was surveyed eight times. Statistical analyses were conducted to compare the abundance of raptors and nest predators at sites with and without perch deterrents in 2021, to test the hypothesis that the construction and operation of the transmission line affects the abundance of perching avian predators.

Monitoring for brown-headed cowbird (*Molothrus ater*), a brood parasite, was conducted in conjunction with grassland bird SOCCs. Statistical analyses were conducted to compare its abundance in four broad habitat classes before and after Project construction, to test the

hypothesis that the construction and operation of the transmission line affects brown-headed cowbird abundance.

First-year operation monitoring indicated that:

- Chestnut-collared longspur and Sprague's pipit were relatively widely distributed in the Spy Hill-Ellice Community Pasture and were the most frequently detected SOCCs. No adverse Project effects on chestnut-collared longspur were detected during the first year of operation monitoring, but a decline in the abundance of Sprague's pipits was observed throughout the study area.

- Perching avian predators were observed at sites with and without perch deterrents. There was no difference in the abundance of raptors or nest predators at each; no Project effects on the abundance of perching avian predators were observed during the first post-construction monitoring year.

- There was no difference in brown-headed cowbird abundance before and after Project construction in each of four habitat types; however, total abundance was significantly greater in 2019 than in 2017 or 2021. Because the post-construction abundance of brown-headed cowbirds was within the range of pre-construction survey years, no Project effects were observed during the first year of operation monitoring.

Surveys for grassland bird SOCCs, perching avian predators, and brown-headed cowbird will conclude in 2022, the second year of operation monitoring. Further analyses of chestnut-collared longspur and Sprague's pipit abundance that incorporate variables such as grass height and proximity of grassland habitat sites to forest and to the right-of-way will be conducted where possible. An additional year of monitoring avian predators will aid in determining the effectiveness of perch deterrents as a mitigation measure.

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1.0 INTRODUCTION

The Birtle Transmission Project (the Project) is a 230 kV AC transmission line that spans 46.2 km from the Birtle South Station, through the Spy Hill-Ellice Community Pasture, to the Saskatchewan border. Project construction began in July 2020 and was completed by March 2021. The transmission line right-of-way (ROW), described as the Project footprint, is approximately 184 hectares (ha) in area and is where most direct effects are expected to occur. In 2017, a baseline breeding bird study was conducted in the region where the Project was to be constructed, which was incorporated into the description of the existing environment. The study, which focused on species of conservation concern (SOCCs) listed under the federal *Species at Risk Act* (SARA) and *The Endangered Species and Ecosystems Act* (ESEA) of Manitoba, was repeated in 2019 to describe the pre-construction bird community and again in 2021, the first year of Project operation.

There are two intact native mixed-grass prairies in the Project region, the Spy Hill-Ellice and Ellice-Archie community pastures, which encompass a combined 23,000 hectares (Manitoba Hydro 2018). These flat, open pastures provide grazing for livestock and important habitat for grassland birds, particularly SOCCs such as chestnut-collared longspur (*Calcarius ornatus*) and Sprague's pipit (*Anthus spragueii*), whose populations are in decline due in part to habitat loss (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2019, 2010). The chestnut-collared longspur is listed as Threatened under the SARA and Endangered under the ESEA and the Sprague's pipit is listed as Threatened under both. These species are relatively common in the Spy Hill-Ellice Community Pasture, which may be subject to disturbance due Project construction and operation. For this reason, Project monitoring efforts for SOCCs were focused on the Spy Hill-Ellice Community pasture.

As described in the Birtle Transmission Project Environmental Monitoring Plan (Manitoba Hydro 2020), the objectives of grassland bird SOCC monitoring are to identify the location of chestnut-collared longspur and Sprague's pipit within or near the Project footprint to compare their abundance before and after Project construction; to monitor perching avian predators and brood parasites near the transmission line and compare abundance to nearby reference sites; and to determine the effectiveness of mitigation measures and, if appropriate, propose revisions to existing plans or develop new mitigation options should unexpected impacts to grassland bird SOCCs occur as a result of Project construction or operation activities. Potential Project effects on chestnut-collared longspur and Sprague's pipit include displacement of birds and/or decreased nesting success due to habitat disturbance during construction and long-term habitat loss during operation. Grassland bird SOCC monitoring will test the hypothesis that development of the transmission line will adversely affect the two focal species.

2.0 METHODS

2.1 Grassland Bird Species of Conservation Concern

As described in section 6.2.1 of the Environmental Monitoring Plan, the purpose of grassland bird SOCC monitoring was to test the following hypothesis:

Hypothesis 1:

- H_0 (null): The construction and operation of the transmission line does not affect the abundance of chestnut-collared longspur and Sprague's pipit.

- H_1 (alternative): The construction and operation of the transmission line does affect the abundance of chestnut-collared longspur and Sprague's pipit.

To test Hypothesis 1, ten-minute point counts for birds were conducted at 291 sites in the Spy Hill-Ellice Community Pasture in 2021 (Map 1), repeating the pre-construction surveys conducted in 2017 and 2019. Point-count sites were spaced a minimum of 250 m apart within four broad habitat classes: grassland (Photo 1), shrubland (Photo 2), forest (Photo 3), and edge (Photo 4; Table 1). Sites in grassland habitat were at various distances from the ROW (Table 2). An observer listened for birds for 10 minutes at each site from June 20 to 24, 2021. Surveys focused mainly on chestnut-collared longspur and Sprague's pipit; however, aural and visual observations of all bird species, including other SOCCs, were recorded.

Table 1: Number of ten-minute point count sites surveyed in four habitat types before (2017, 2019) and after (2021) Project construction

Habitat Type	Description	2017	2019	2021
Grassland	Grassland-dominated, few shrubs	140	152	146
Shrubland	Shrub/small tree-dominated	42	52	51
Forest	Dense trees with overhead canopy	54	55	51
Edge	Transition between grassland and forest	50	51	43
Total		286	310	291

Table 2: Number of ten-minute point count sites surveyed at various distances from the right-of-way in grassland habitat before (2017, 2019) and after (2021) Project construction

Distance from ROW (m)	2017	2019	2021
0–1000	28	33	30
1001–2000	21	24	22
>2000	91	95	94

Statistical analyses were conducted with SYSTAT 13. Abundance data for chestnut-collared longspur and Sprague's pipit in grassland habitat were tested for normality with a Shapiro-Wilk test. Non-normal data were square route transformed (McDonald 2014) and tested again. For non-normal data, the number of chestnut-collared longspurs and Sprague's pipits observed at grassland habitat sites was compared among survey years with a nonparametric Kruskal-Wallis test (McDonald 2014). The square root-transformed data were compared with a one-way analysis of variance or ANOVA (McDonald 2014). Because one-way ANOVA is not sensitive to deviations from normality (McDonald 2014), results of both tests were reported for comparison. Where the results of Kruskal-Wallis tests were significant, Dwass-Steel-Chritchlow-Flinger tests for all pairwise comparisons were performed to analyze differences between individual survey years. Significance was determined at the $\alpha = 0.05$ level.

Photo 1: Grassland habitat in the Spy Hill-Ellice Community Pasture

Photo 2: Shrubland habitat in the Spy Hill-Ellice Community Pasture

Photo 3: Forest habitat in the Spy Hill-Ellice Community Pasture

Photo 4: Edge habitat in the Spy Hill-Ellice Community Pasture

2.2 Perching Avian Predators

As described in section 6.2.1 of the Environmental Monitoring Plan, the purpose of perching avian predator monitoring was to test the following hypothesis:

Hypothesis 2:

- H_0 (null): The construction and operation of the transmission line does not affect the abundance of perching avian predators.

- H_1 (alternative): The construction and operation of the transmission line does affect the abundance of perching avian predators.

To test Hypothesis 2, avian predator perch surveys were conducted from April 20 to 23 and on June 20, 22, 23, and 24, 2021, the first year after Project construction. Six sites were surveyed, four where perch deterrents were installed on transmission towers (Photo 5) and two with no deterrents (Map 2). At each site, two tower spans (three towers) were monitored for one hour by a single observer who noted the species and behaviour of raptors (falcons, hawks, eagles) and of black-billed magpie (*Pica hudsonia*), common raven (*Corvus corax*), and American crow *(Corvus brachyrhynchos*), which are common nest predators. The total number of observations of each species was recorded each day, as it was not always possible to determine whether an individual was returning to the location or if more than one individual was observed. Each site was surveyed daily over the two four-day periods.

Statistical analyses were conducted with SYSTAT 13. Abundance data for raptors and nest predators were tested for normality with a Shapiro-Wilk test. Non-normal data were square route transformed (McDonald 2014) and tested again. For non-normal data, the number of raptors and nest predators observed at sites with and without perch deterrents was compared with a nonparametric Mann-Whitney test (McDonald 2014). The square root-transformed data were compared with a one-way ANOVA (McDonald 2014). Because one-way ANOVA is not sensitive to deviations from normality (McDonald 2014), results of both tests were reported for comparison. Significance was determined at the $\alpha = 0.05$ level.

Photo 5: Perch deterrents on a transmission tower

2.3 Brood Parasites

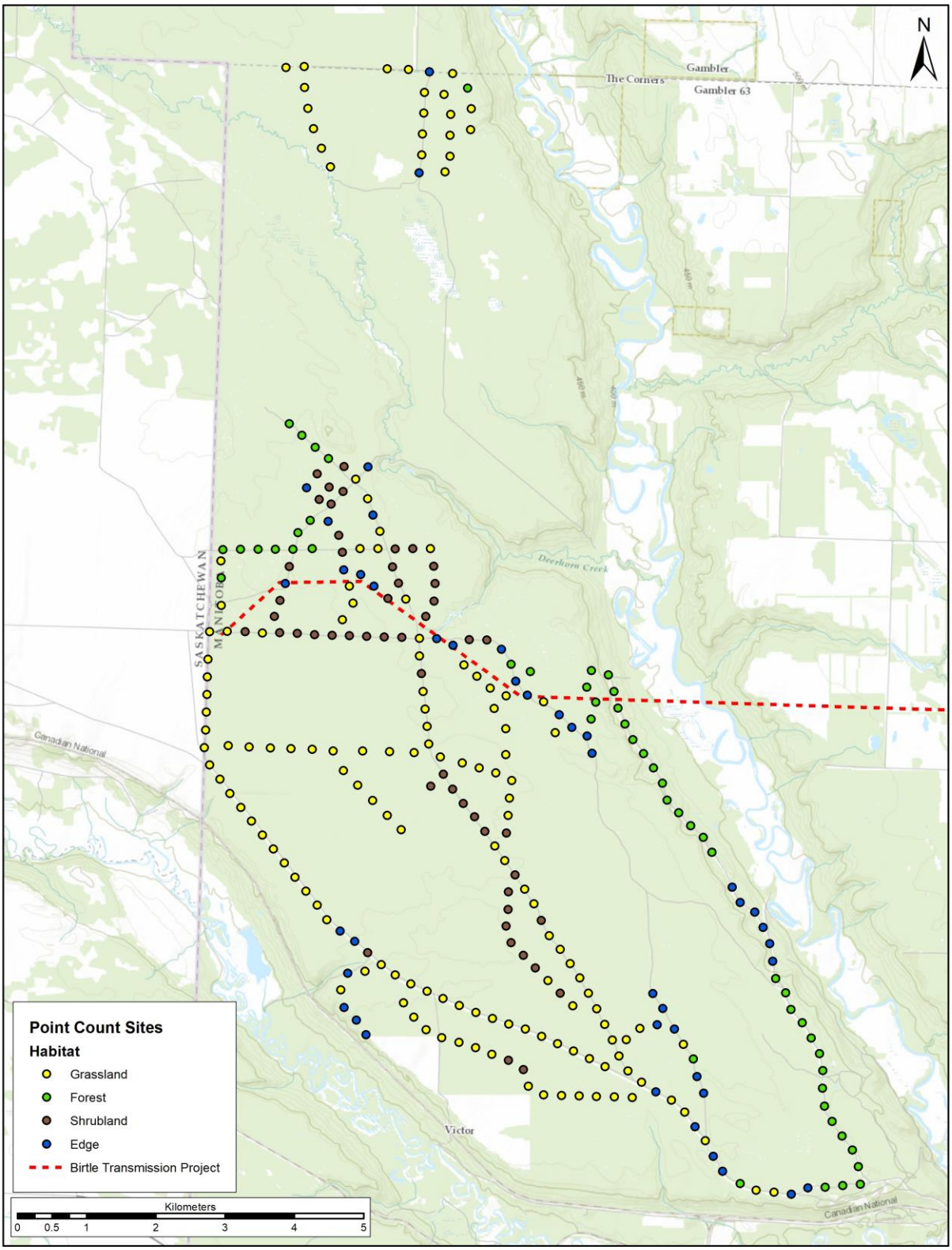
As described in section 6.2.1 of the Environmental Monitoring Plan, the purpose of brood parasite (brown-headed cowbird, *Molothrus ater*) monitoring was to test the following hypothesis:

Hypothesis 3:

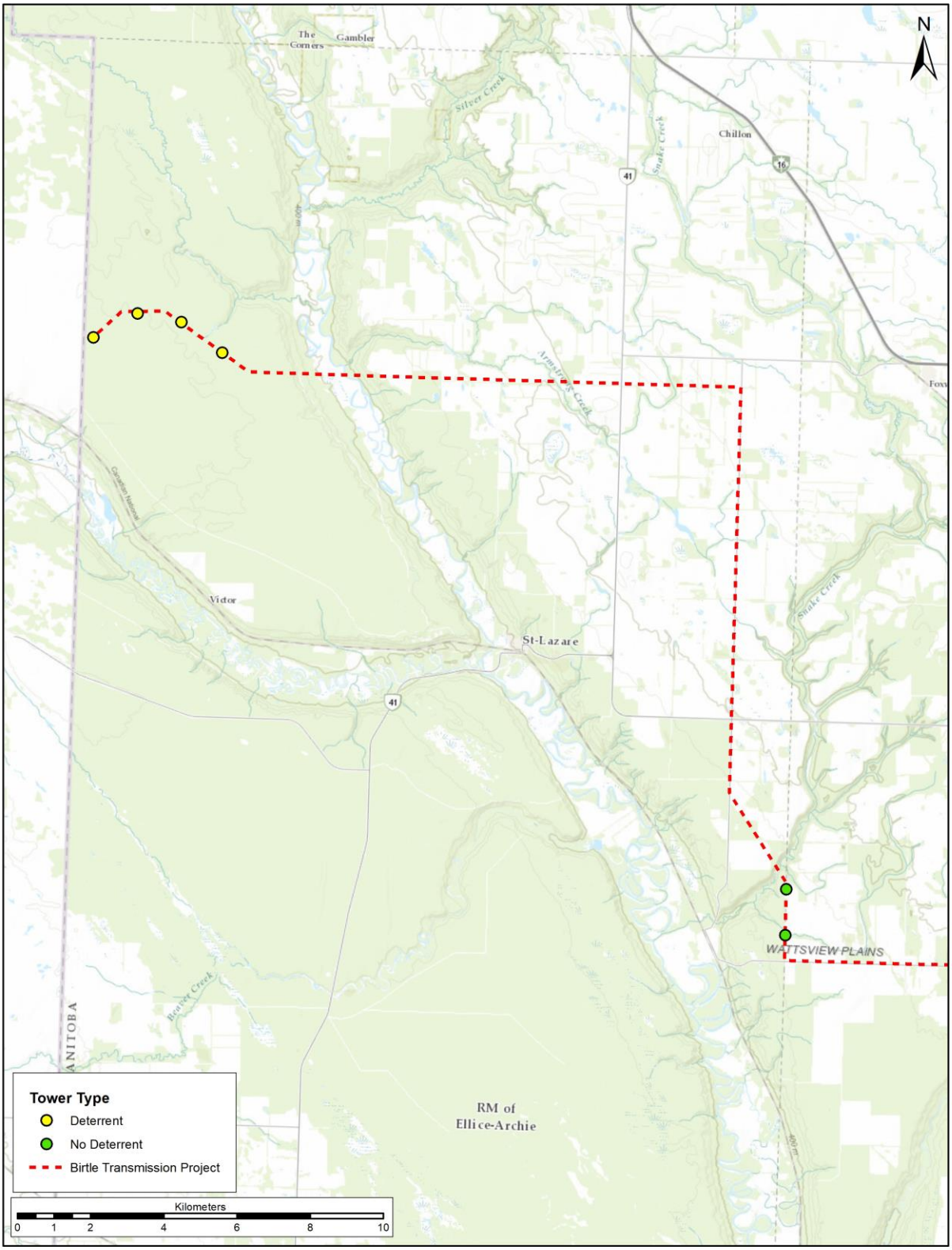
- H_0 (null): The construction and operation of the transmission line does not affect the abundance of brown-headed cowbirds.

- H_1 (alternative): The construction and operation of the transmission line does affect the abundance of brown-headed cowbirds.

To test Hypothesis 3, observations of brown-headed cowbirds were recorded during grassland bird SOCC surveys (see Section 2.1). Statistical analyses were conducted with SYSTAT 13. Abundance data were tested for normality with a Shapiro-Wilk test. Non-normal data were square route transformed (McDonald 2014) and tested again. For non-normal data, the number of brown-headed cowbirds observed in four habitat types was compared among survey years with a nonparametric Kruskal-Wallis test (McDonald 2014). The square root-transformed data were compared with a one-way ANOVA (McDonald 2014). Because one-way ANOVA is not sensitive to deviations from normality (McDonald 2014), results of both tests were reported for comparison. Where the results of Kruskal-Wallis tests were significant, Dwass-Steel-Chritchlow-Flinger tests for all pairwise comparisons were performed to analyze differences between individual survey years. Significance was determined at the $\alpha = 0.05$ level.



Map 1: Ten-minute point count sites surveyed for birds, 2021



Map 2: Transmission towers surveyed for perching avian predators, 2021

3.0 RESULTS

3.1 Grassland Bird Species of Conservation Concern

One hundred bird species were detected at 291 sites during ten-minute point counts in 2021. Western meadowlark (*Sturnella neglecta*) and clay-colored sparrow (*Spizella padllida*) were the most widespread species, found at 76% and 53% of sites, respectively (Appendix A, Table A-1). Eighty-six species were observed at sites in grassland habitat, 51 in shrubland habitat, 72 in forest habitat, and 69 in edge habitat (Appendix A, Table A-2). Nine SOCCs, including chestnut-collared longspur and Sprague's pipit, were detected (Table 3). No Canada warblers (*Cardellina canadensis*), which were observed at a single site in 2019, were found. Chestnut-collared longspurs and Sprague's pipits were observed at 12% and 16% of ten-minute point count sites, respectively (Table 4). Most observations of chestnut-collared longspurs and Sprague's pipits (91% and 78%, respectively) were at sites in grassland habitat. The species were each found at one site in edge habitat, and neither was detected in forest habitat (Map 3, Map 4). Four Sprague's pipits were observed incidentally in 2021.

Table 3: Species of conservation concern observed during ten-minute point counts, 2021

Species	SARA Status	ESEA Status
Baird's sparrow	Special Concern	Endangered
Bank swallow	Threatened	Not listed
Barn swallow	Threatened	Not listed
Bobolink	Threatened	Not listed
Chestnut-collared longspur	Threatened	Endangered
Common nighthawk	Threatened	Threatened
Eastern wood-pewee	Special Concern	Not listed
Olive-sided flycatcher	Threatened	Threatened
Sprague's pipit	Threatened	Threatened

Table 4: Percentage and (number) of ten-minute point count sites in four habitat types at which species of conservation concern were observed, 2021

Species	Grassland	Shrubland	Forest	Edge	Total
Chestnut-collared longspur	21 (31)	4 (2)	0	2 (1)	12 (34)
Sprague's pipit	25 (36)	18 (9)	0	2 (1)	16 (46)
Baird's sparrow	4 (6)	2 (1)	0	0	2 (7)
Bank swallow	1 (1)	0	0	2 (1)	1 (2)
Barn swallow	4 (6)	0	2 (1)	9 (4)	4 (11)
Bobolink	1 (2)	0	0	2 (1)	1 (3)
Common nighthawk	2 (3)	4 (2)	4 (2)	0	2 (7)
Eastern wood-pewee	0	0	2 (1)	5 (2)	1 (3)
Olive-sided flycatcher	0	0	2 (1)	0	<1 (1)

In 2021, chestnut-collard longspur was the most abundant of the SOCCs, with 84 individuals detected (Table 5) and comprising 41% of 206 total SOCC observations. Sprague's pipit was the next most abundant with 77 individuals representing 37% of SOCC observations. A single olive-sided flycatcher (*Contopus cooperi*) was detected in forest habitat next to the Assiniboine River.

Table 5: Number of species of conservation concern observed in four habitat types during ten-minute point counts, 2021

Species	Grassland	Shrubland	Forest	Edge	Total
Chestnut-collared longspur	77	5	0	2	84
Sprague's pipit	61	14	0	2	77
Barn swallow	10	0	3	7	20
Baird's sparrow	8	1	0	0	9
Common nighthawk	3	2	2	0	7
Bobolink	2	0	0	1	3
Eastern wood-pewee	0	0	1	2	3
Bank swallow	1	0	0	1	2
Olive-sided flycatcher	0	0	1	0	1

Chestnut-collared Longspur

All observations of chestnut-collared longspur in 2017, 2019, and 2021 are listed in Appendix A, Table A-3. When only grassland habitat sites were considered, more chestnut-collared longspurs were observed in 2021, during Project operation, than in 2017 or 2019, before construction (Table 6). The mean number of observations per site was also greatest in 2021. Overall, there was little difference in the distribution of chestnut-collared longspurs over the study period, with birds detected at 21% of sites in 2017 and 2021 and at 24% of sites in 2019.

Table 6: Chestnut-collared longspurs observed at grassland habitat sites before (2017, 2019) and after (2021) Project construction

Year	Number Observed	Number of Sites at which Observed	Percentage of Sites at which Observed	Mean Number of Observations per Site	SD
2017	58	30	21	0.41	0.97
2019	68	37	24	0.45	0.91
2021	77	31	21	0.53	1.12

Chestnut-collared longspurs were observed at similar percentages of grassland habitat sites at all distance from the ROW categories before (2017, 2019) and after (2021) Project construction (Table 7). At sites within 1,000 m of the ROW, the mean number of individuals observed in 2021 was within the range of pre-construction observations. At sites between 1,001 and 2,000 m and more than 2,000 m from the ROW, the mean number of individuals observed was greatest in 2021.

Table 7: Chestnut-collared longspurs observed at various distances from the right-of-way in grassland habitat before (2017, 2019) and after (2021) Project construction

Distance from ROW (m)	Metric	2017	2019	2021
0–1000	Number of sites at which observed	4	8	5
	Percentage of sites	14	24	17
	Number observed	5	17	8
	Mean	0.18	0.52	0.27
	SD	0.48	1.03	0.78
1001–2000	Number of sites at which observed	11	14	12
	Percentage of sites	52	58	55
	Number observed	27	23	37
	Mean	1.29	0.96	1.68
	SD	1.76	1.08	1.89
>2000	Number of sites at which observed	15	15	14
	Percentage of sites	16	16	15
	Number observed	26	28	32
	Mean	0.29	0.29	0.34
	SD	0.70	0.76	0.89

Abundance data and square root-transformed abundance data were non-normal for all survey years (p = 0.000). There was no significant difference in the abundance of chestnut-collared longspurs among survey years (Kruskal-Wallis H = 0.350, p = 0.840; ANOVA F = 0.170, p = 0.844). There was no change in the abundance of chestnut-collared longspurs during the first year after Project construction.

Sprague's Pipit

All observations of Sprague's pipits in 2017, 2019, and 2021 are listed in Appendix A, Table A-4. When only grassland habitat sites were considered, fewer Sprague's pipits were observed in 2021, during Project operation, than in 2017 and 2019, before construction (Table 8). The mean number of observations per site decreased and Sprague's pipits were less widely distributed post-construction, having been observed at a smaller percentage of sites than in previous survey years.

Table 8: Sprague's pipits observed at grassland habitat sites before (2017, 2019) and after (2021) Project construction

Year	Number Observed	Number of Sites at which Observed	Percentage of Sites at which Observed	Mean Number of Observations per Site	SD
2017	107	69	49	0.76	1.18
2019	107	67	44	0.70	0.96
2021	61	36	25	0.42	0.94

Sprague's pipits were observed at similar percentages of grassland habitat sites within 2,000 m of the ROW in 2017 and 2019, before Project construction (Table 9). Observations were made at smaller percentages of sites at all distance from the ROW categories in 2021, after Project construction. The mean number of individuals observed was also lower in 2021 than in pre-construction survey years at all distance from the ROW categories. The mean number of individuals observed was greatest at sites between 1,001 and 2,000 m from the ROW in all survey years.

Table 9: Sprague's pipits observed at various distances from the right-of-way in grassland habitat before (2017, 2019) and after (2021) Project construction

Distance from ROW (m)	Metric	2017	2019	2021
0–1000	Number of sites at which observed	6	7	4
	Percentage of sites	21	21	13
	Number observed	7	8	5
	Mean	0.25	0.24	0.17
	SD	0.52	0.50	0.46
1001–2000	Number of sites at which observed	13	16	7
	Percentage of sites	62	67	32
	Number observed	24	32	11
	Mean	1.14	1.33	0.50
	SD	1.11	1.24	0.86
>2000	Number of sites at which observed	50	44	25
	Percentage of sites	55	46	27
	Number observed	76	67	45
	Mean	0.84	0.71	0.48
	SD	0.98	0.89	0.97

Abundance data and square root-transformed abundance data were non-normal for all survey years (p = 0.000). There was a significant difference in the abundance of Sprague's pipits among years (Kruskal-Wallis H = 18.020, p = 0.000; ANOVA F = 8.772, p = 0.000). Post hoc analysis indicated that there was a significant difference in abundance between 2017 and 2021 (test statistic = -3.702, p = 0.024) and between 2019 and 2021 (test statistic = -6.842, p = 0.000). A decline in the abundance of Sprague's pipits was observed during the first year of Project operation.

3.2 Perching Avian Predators

Four raptor species were observed at sites with transmission tower perch deterrents and five species were observed at sites with no deterrents (Appendix A, Table A-5). Three nest predator species were observed at each site type. At site 1, where perch deterrents were installed, a total of four observations were made of a raptor perched on a transmission tower over two days. All were of rough-legged hawk (*Buteo lagopus*), including an individual that approached the area with perch deterrents, altered its course, and perched on a nearby tower over the border in

Saskatchewan. A common raven was observed perching on a transmission tower with perch deterrents at site 4, on a crossbar below the deterrents. At site 5, with no deterrents, three observations of perching raptors were made, one each of rough-legged hawk, red-tailed hawk (*Buteo jamaicensis*) and American kestrel (*Falco sparverius*). A common raven nest was noted at site 3.

Abundance data and square root-transformed abundance data were non-normal for raptors and nest predators ($p = 0.000$). The mean number of raptors observed at sites with transmission tower perch deterrents was lower than at sites with no perch deterrents (Table 10). There was no significant difference in raptor abundance (Mann-Whitney $U = 186.000$, $p = 0.066$; ANOVA $F = 3.287$, $p = 0.076$). The mean number of nest predators was greatest at sites with perch deterrents. There was no significant difference in nest predator abundance ($U = 260.500$, $p = 0.916$; $F = 0.029$, $p = 0.865$). There was no difference in the abundance of perching avian predators at towers with and without perch deterrents during the first year of Project operation.

Table 10: Raptors and nest predators observed at sites with and without perch deterrents, 2021

Perch Deterrents	Site	Number of Raptors	Number of Nest Predators
Yes	1	9	23
	2	2	2
	3	2	16
	4	1	19
	Total	14	60
	Mean	0.44	1.88
	SD	1.01	2.67
No	5	13	22
	6	3	4
	Total	16	26
	Mean	1.00	1.63
	SD	1.41	2.31

3.3 Brood Parasites

The abundance and distribution of brown-headed cowbirds was greatest in forest habitat during all study years (Table 11). Abundance and distribution (percentage of sites at which observed) were lowest in shrubland habitat in 2017 and 2019, and in grassland habitat in 2021. Overall abundance and distribution were greatest in 2019. The mean number of brown-headed cowbirds was lowest in 2017 and the percentage of sites at which they were observed was lowest in 2021.

Table 11: Abundance and distribution of brown-headed cowbirds in four habitat types during ten-minute point counts, 2021

Habitat	Metric	2017	2019	2021
Grassland	Number of sites at which observed	10	21	11
	Percentage of sites	7	14	8
	Number observed	10	27	16
	Mean	0.07	0.18	0.11
	SD	0.26	0.49	0.46
Shrubland	Number of sites at which observed	1	4	4
	Percentage of sites	2	8	8
	Number observed	1	5	10
	Mean	0.02	0.10	0.20
	SD	0.15	0.36	0.72
Forest	Number of sites at which observed	33	33	22
	Percentage of sites	61	60	43
	Number observed	41	64	38
	Mean	0.76	1.16	0.75
	SD	0.70	1.41	1.81
Edge	Number of sites at which observed	20	18	10
	Percentage of sites	40	35	23
	Number observed	20	28	17
	Mean	0.40	0.55	0.40
	SD	0.50	0.88	0.96
Total	Number of sites at which observed	64	76	47
	Percentage of sites	22	25	16
	Number observed	72	124	81
	Mean	0.25	0.40	0.28
	SD	0.50	0.87	0.79

Abundance data and square root-transformed abundance data were non-normal for all survey years and habitat types ($p = 0.000$). There was no significant difference in brown-headed cowbird abundance in grassland (Kruskal-Wallis $H = 4.940$, $p = 0.085$; ANOVA $F = 2.578$, $p = 0.077$), shrubland ($H = 1.552$, $p = 0.460$; $F = 1.079$, $p = 0.343$), forest ($H = 3.783$, $p = 0.151$; $F = 1.964$, $p = 0.144$), or edge ($H = 2.275$, $p = 0.321$; $F = 0.804$, $p = 0.450$) habitat among survey years. The difference in total abundance among survey years was significant ($H = 6.373$, $p = 0.041$; $F = 3.045$, $p = 0.048$). Post hoc analysis indicated that there was a significant difference in abundance between 2017 and 2019 (test statistic = 7.995, $p = 0.000$) and between 2019 and 2021 (test statistic = -8.925, $p = 0.000$). Because the post-construction abundance of brown-headed cowbirds was within the range of pre-construction survey years, no change in the species' abundance was observed during the first post-construction monitoring year.

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Map 3: Distribution of chestnut-collared longspurs at ten-minute point count sites in grassland habitat, 2021

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Map 4: Distribution of Sprague's pipits at ten-minute point count sites in grassland habitat, 2021

4.0 DISCUSSION

Chestnut-collared longspur and Sprague's pipit were relatively widely distributed in the Spy Hill-Ellice Community Pasture and were the most frequently detected SOCCs. Few were observed in habitat other than grassland. The abundance and distribution of chestnut-collared longspurs in grassland habitat was unchanged during the first year after Project construction. No adverse Project effects on chestnut-collared longspur were detected during the first year of operation monitoring.

The abundance and distribution of Sprague's pipits declined in grassland habitat during the first year after Project construction. It is unclear if the lower abundance of Sprague's pipits was a result of construction and operation of the transmission line. The decline was observed at all distance from the ROW categories and not limited to sites near the ROW. As there was no increase in the abundance of perching avian predators or brown-headed cowbirds during the first year of operation, there were likely no associated Project-related effects on Sprague's pipit mortality or productivity.

Chestnut-collared longspur and Sprague's pipit abundance and distribution are influenced by grass height and density. Chestnut-collared longspurs prefer short grass (COSEWIC 2019) while Sprague's pipits prefer grass of intermediate height (COSEWIC 2010). The Spy Hill-Ellice Community Pasture is subject to rotational grazing for cattle (Z. Fredbjornson, Pers. Comm.), which may result in differences in habitat quality for grassland birds. Accounting for differences in grass height or in other vegetation variables could help to explain the differences in Sprague's pipit abundance and distribution among survey years, as the species prefers taller grass than chestnut-collared longspurs. In 2021, grass height varied at the 146 point-count sites in grassland habitat, with 50 sites in moderate grass, 61 sites in short to moderate grass, and 18 sites in moderate to tall grass, suggesting that suitable habitat was available for Sprague's pipits. As Sprague's pipit density increases with grassland patch size (Davis 2004; COSEWIC 2010), the decline in the species' abundance and distribution could be due to changes in the size or configuration of habitat patches in the pasture or may be related to the habitat in the surrounding area (COSEWIC 2010).

Of the 12 SOCCs detected before Project construction, all but Canada warbler, eastern whip-poor-will (*Antrostomus vociferus*), and short-eared owl (*Asio flammeus*) were observed in 2021. A single Baird's sparrow, listed as Endangered in Manitoba, was found at one site in 2017. The species was considerably more widely distributed in 2019, when 17 individuals were detected at 14 sites and a 1,600% increase in its numbers was observed. Nine Baird's sparrows were observed at seven sites in 2021.

Transmission towers can provide hunting perches for avian predators (e.g., Lammers and Collopy 2007; Dwyer and Doloughan 2014), increasing the mortality of prey species. Perching avian predators were observed at sites with and without perch deterrents in 2021 and there was no difference in the abundance of raptors or nest predators at each, but the deterrents appeared to be effective in at least one instance where a rough-legged hawk's landing attempt was thwarted. A few avian predators were observed on transmission towers with deterrents, indicating that some

individuals were not dissuaded from perching on other parts of the transmission towers at these sites.

Brown-headed cowbirds are brood parasites that lay their eggs in other species' nests, reducing the host's productivity (Sealy 2018). If the eggs are not rejected the host provides parental care, often at the expense of the host's own offspring (Lowther 1993). Brown-headed cowbirds are relatively common in Manitoba and are associated with pastures and feedlots (Sealy 2018). They have not been associated with species declines in Manitoba but may affect species at risk such as Sprague's pipit (Sealy 2018). Brown-headed cowbirds were observed at point count sites in all habitat types over the three-year study period. They were most abundant in forest habitat all years and were relatively sparse in grassland and shrubland. There was no difference in brown-headed cowbird abundance before and after Project construction in each of four habitat types; however, abundance was significantly greater in 2019 than in 2017 or 2021. Because the post-construction abundance of brown-headed cowbirds was within the range of pre-construction survey years, no substantial change in the species' abundance was observed during the first post-construction monitoring year.

Surveys for grassland bird SOCCs, perching avian predators, and brown-headed cowbird will conclude in 2022, the second year of operation monitoring. Further analyses of chestnut-collared longspur and Sprague's pipit abundance that incorporate variables such as grass height and proximity of grassland habitat sites to forest and to the ROW will be conducted where possible. An additional year of monitoring avian predators will aid in determining the effectiveness of perch deterrents as a mitigation measure. No additional mitigation mesures are recommended at this time.

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PERSONAL COMMUNICATIONS

Z. Fredbjornson. Pasture manager. Association of Manitoba Community Pastures (AMCP). Communications with R. Berger, President, WRCS on February 16, 2022.

APPENDIX A
Tables

Table A-1; Bird species detected during ten-minute point counts, 2021

Common Name	Scientific Name	Number of Sites	Percentage of Sites
Alder flycatcher	*Empidonax alnorum*	14	5
American coot	*Fulica americana*	1	<1
American crow	*Corvus brachyrhynchos*	110	38
American goldfinch	*Spinus tristis*	54	19
American kestrel	*Falco sparverius*	5	2
American redstart	*Setophaga ruticilla*	10	3
American robin	*Turdus migratorius*	69	24
Baird's sparrow	*Ammodramus bairdii*	7	2
Bald eagle	*Haliaeetus leucocephalus*	1	<1
Baltimore oriole	*Icterus galbula*	37	13
Bank swallow	*Riparia riparia*	2	1
Barn swallow	*Hirundo rustica*	11	4
Black tern	*Childonias niger*	10	3
Black-and-white warbler	*Mniotilta varia*	3	1
Black-billed cuckoo	*Coccyzus erythropthalmus*	9	3
Black-billed magpie	*Pica hudsonia*	42	14
Black-capped chickadee	*Poecile atricapillus*	4	1
Blue jay	*Cyanocitta cristata*	11	4
Bobolink	*Dolichonyx oryzivorus*	3	1
Brewer's blackbird	*Euphagus cyanocephalus*	41	14
Brown thrasher	*Toxostoma rufum*	9	3
Brown-headed cowbird	*Molothrus ater*	47	16
Canada goose	*Branta canadensis*	21	7
Cedar waxwing	*Bombycilla cedrorum*	17	6
Chestnut-collared longspur	*Calcarius ornatus*	34	12
Chestnut-sided warbler	*Setophaga pensylvanica*	11	4
Chipping sparrow	*Spizella passerina*	6	2
Clay-colored sparrow	*Spizella pallida*	155	53
Common grackle	*Quiscalus quiscula*	12	4
Common loon	*Gavia immer*	2	1
Common nighthawk	*Chordeiles minor*	7	2
Common raven	*Corvus corax*	40	14
Common yellowthroat	*Geothlypis trichas*	15	5
Downy woodpecker	*Picoides pubescens*	2	1
Eastern bluebird	*Sialia sialis*	18	6
Eastern kingbird	*Tyrannus tyrannus*	16	5
Eastern phoebe	*Sayornis phoebe*	1	<1
Eastern towhee	*Pipilo erythrophthalmus*	22	8
Eastern wood-pewee	*Contopus virens*	3	1
European starling	*Sturnus vulgaris*	9	3
Grasshopper sparrow	*Ammodramus savannarum*	58	20

Common Name	Scientific Name	Number of Sites	Percentage of Sites
Gray catbird	*Dumetella carolinensis*	70	24
Great crested flycatcher	*Myiarchus crinitus*	66	23
Greater snow goose	*Chen caerulescens*	1	<1
Hairy woodpecker	*Picoides villosus*	3	1
Hermit thrush	*Catharus guttatus*	2	1
Horned lark	*Eremophila alpestris*	46	16
House sparrow	*Passer domesticus*	2	1
House wren	*Troglodytes aedon*	93	32
Killdeer	*Charadrius vociferus*	6	2
Lark sparrow	*Chondestes grammacus*	32	11
Least flycatcher	*Empidonax minimus*	128	44
LeConte's Sparrow	*Ammodramus leconteii*	11	4
Mallard	*Anas platyrhynchos*	12	4
Marbled godwit	*Limosa fedoa*	44	15
Merlin	*Falco columbarius*	9	3
Mountain bluebird	*Sialia currucoides*	3	1
Mourning dove	*Zenaida macroura*	124	43
Myrtle warbler	*Setophaga coronata*	1	<1
Northern flicker	*Colaptes auratus*	13	4
Northern harrier	*Circus hudsonius*	12	4
Northern pintail	*Anas acuta*	2	1
Northern waterthrush	*Parkesia noveboracensis*	5	2
Olive-sided flycatcher	*Contopus cooperi*	1	<1
Orange-crowned warbler	*Leiothylpis celata*	8	3
Ovenbird	*Seiurus aurocapilla*	7	2
Philadelphia vireo	*Vireo philadelphicus*	1	<1
Pileated woodpecker	*Dryocopus pileatus*	5	2
Purple martin	*Progne subis*	1	<1
Red-eyed vireo	*Vireo olivaceus*	92	32
Red-tailed hawk	*Buteo jamaicensis*	12	4
Red-winged blackbird	*Agelaius phoeniceus*	36	12
Ring-billed gull	*Larus delawarensis*	4	1
Rock pigeon	*Columbia livia*	3	1
Rose-breasted grosbeak	*Pheucticus ludovicianus*	37	13
Ruby-throated hummingbird	*Archilochus colubris*	4	1
Ruffed grouse	*Bonasa umbellus*	7	2
Savannah sparrow	*Passerculus sandwichensis*	144	49
Say's phoebe	*Sayornis saya*	1	<1
Sharp-tailed grouse	*Tympanuchus phasianellus*	25	9
Song sparrow	*Melospiza melodia*	8	3
Spotted towhee	*Pipilo maculatus*	7	2
Sprague's pipit	*Anthus spragueii*	46	16

Common Name	Scientific Name	Number of Sites	Percentage of Sites
Swamp sparrow	*Melospiza georgiana*	1	<1
Tree swallow	*Tachycineta bicolor*	9	3
Turkey vulture	*Cathartes aura*	3	1
Upland sandpiper	*Bartramia longicauda*	133	46
Veery	*Catharus fuscescens*	28	10
Vesper sparrow	*Pooecetes gramineus*	146	50
Warbling vireo	*Vireo gilvus*	58	20
Western kingbird	*Tyrannus verticalis*	6	2
Western meadowlark	*Sturnella neglecta*	222	76
White-throated sparrow	*Zonotrichia albicollis*	1	<1
Willet	*Tringa semipalmata*	1	<1
Wilson's snipe	*Gallinago delicata*	11	4
Yellow warbler	*Setophaga petechia*	85	29
Yellow-bellied flycatcher	*Empidonax flaviventris*	1	<1
Yellow-bellied sapsucker	*Sphyrapicus varius*	20	7
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	2	1
Yellow-throated vireo	*Vireo flavifrons*	9	3

Table A-2: Bird species detected in four habitat types during ten-minute point counts, 2021

Habitat	Site	Location	Number of Species	Number of Individuals
Grassland	110	14 U 327532 5607231	11	14
	111	14 U 327518 5606932	11	54
	112	14 U 327501 5606629	13	32
	113	14 U 327489 5606326	14	34
	121	14 U 327298 5607558	24	43
	122	14 U 326994 5607570	16	22
	187	14 U 327814 5607200	15	33
	188	14 U 327909 5606911	14	50
	189	14 U 327900 5606611	16	40
	190	14 U 327899 5606311	14	48
	191	14 U 327828 5606084	20	34
	192	14 U 328194 5606690	14	18
	193	14 U 328204 5606993	12	23
	195	14 U 327936 5607503	20	24
	196	14 U 325795 5607604	17	27
	197	14 U 325801 5607302	18	22
	198	14 U 325847 5606998	15	25
	199	14 U 325930 5606706	19	26
	200	14 U 326043 5606425	21	30
	201	14 U 326175 5606153	18	31
	202	14 U 325531 5607587	16	41
	48	14 U 324698 5597804	4	13
	49	14 U 324997 5597784	8	15
	50	14 U 325305 5597770	4	10
	51	14 U 325603 5597762	9	17
	52	14 U 325909 5597752	6	13
	53	14 U 326213 5597731	9	168
	54	14 U 327379 5597705	3	11
	55	14 U 327026 5597717	4	9
	56	14 U 326636 5597731	7	15
	57	14 U 326359 5597444	9	20
	58	14 U 326566 5597233	6	13
	59	14 U 326780 5597016	7	17
	60	14 U 326993 5596799	4	11
	61	14 U 327194 5596592	4	8
	G0	14 U 324429 5599448	6	15
	G1	14 U 324683 5599454	7	15
	G12	14 U 327457 5599356	13	20
	G123	14 U 329249 5598439	13	19
	G125	14 U 329417 5597994	7	11
	G128	14 U 328706 5598052	13	15

Habitat	Site	Location	Number of Species	Number of Individuals
Grassland	G130	14 U 326499 5599862	4	7
	G131	14 U 326444 5600106	8	36
	G134	14 U 326598 5600649	9	17
	G135	14 U 326857 5600650	7	23
	G145	14 U 326537 5601648	14	19
	G163	14 U 326887 5600898	12	35
	G165	14 U 326712 5601367	13	16
	G168	14 U 327614 5600647	12	13
	G175	14 U 327260 5599919	13	15
	G182	14 U 329314 5594418	6	14
	G184	14 U 329670 5594052	6	13
	G185	14 U 330138 5593176	7	17
	G186	14 U 329912 5593288	8	20
	G187	14 U 329683 5593399	6	14
	G188	14 U 329452 5593506	6	12
	G189	14 U 329220 5593613	5	14
	G190	14 U 328986 5593715	4	7
	G191	14 U 328748 5593791	7	9
	G192	14 U 328510 5593870	7	11
	G193	14 U 328272 5593956	8	12
	G194	14 U 328033 5594058	9	17
	G195	14 U 327800 5594160	6	10
	G196	14 U 327566 5594262	4	6
	G197	14 U 327331 5594368	4	8
	G198	14 U 327110 5594496	7	10
	G199	14 U 326908 5594649	9	13
	G203	14 U 326122 5595295	8	11
	G204	14 U 325979 5595503	7	21
	G205	14 U 325819 5595705	9	15
	G206	14 U 325662 5595909	6	12
	G207	14 U 325506 5596113	8	15
	G208	14 U 325348 5596314	9	16
	G209	14 U 325189 5596517	6	9
	G21	14 U 328710 5598524	15	16
	G210	14 U 325033 5596716	5	15
	G211	14 U 324878 5596913	8	14
	G212	14 U 324721 5597114	4	7
	G213	14 U 324579 5597321	5	9
	G214	14 U 324428 5597529	9	14
	G215	14 U 324350 5597777	8	14
	G216	14 U 324370 5598031	4	7
	G217	14 U 324380 5598290	6	12
	G218	14 U 324388 5598545	2	8
	G219	14 U 324394 5598800	3	8

Habitat	Site	Location	Number of Species	Number of Individuals
Grassland	G22	14 U 328535 5598343	16	22
	G220	14 U 324402 5599051	8	14
	G221	14 U 326347 5599623	11	18
	G222	14 U 328702 5597675	7	13
	G223	14 U 330528 5592729	6	6
	G224	14 U 330269 5592738	5	10
	G225	14 U 330014 5592744	8	15
	G226	14 U 329763 5592753	5	8
	G227	14 U 329508 5592758	4	11
	G228	14 U 329251 5592767	6	10
	G229	14 U 329029 5592890	6	13
	G23	14 U 327456 5599099	9	14
	G232	14 U 328504 5593352	4	9
	G233	14 U 328270 5593450	5	10
	G234	14 U 328028 5593525	4	11
	G235	14 U 327781 5593593	5	12
	G236	14 U 327553 5593707	6	10
	G237	14 U 327375 5593888	9	16
	G238	14 U 327228 5594097	11	14
	G239	14 U 326672 5594550	10	13
	G241	14 U 326320 5594282	15	21
	G245	14 U 330442 5593563	6	12
	G246	14 U 330642 5593724	14	17
	G249	14 U 331270 5593497	15	19
	G25	14 U 327511 5598585	5	10
	G26	14 U 327539 5598333	5	8
	G27	14 U 327566 5598082	6	8
	G28	14 U 327593 5597828	7	15
	G29	14 U 327758 5597641	5	8
	G3	14 U 325189 5599429	10	16
	G356	14 U 328481 5598637	13	15
	G357	14 U 328289 5598805	9	10
	G358	14 U 328100 5598970	9	9
	G36	14 U 328545 5596358	5	8
	G363	14 U 324595 5599830	10	16
	G364	14 U 324592 5600470	7	21
	G37	14 U 328688 5596147	11	15
	G39	14 U 328738 5596799	5	12
	G40	14 U 328759 5597046	4	8
	G41	14 U 328789 5597302	8	9
	G42	14 U 328562 5597412	5	9
	G43	14 U 328322 5597483	7	9
	G44	14 U 328075 5597555	5	7
	G46	14 U 328975 5595733	8	17

Habitat	Site	Location	Number of Species	Number of Individuals
Grassland	G47	14 U 329110 5595522	8	16
	G49	14 U 329330 5595063	6	12
	G50	14 U 329489 5594868	6	11
	G51	14 U 329632 5594661	6	11
	G52	14 U 329771 5594454	7	12
	G53	14 U 329897 5594233	5	9
	G54	14 U 330015 5594008	6	14
	G55	14 U 330131 5593783	5	17
	G56	14 U 330242 5593558	5	18
	G57	14 U 330337 5593329	6	12
	G58	14 U 330466 5593111	9	16
	G59	14 U 330664 5592950	7	8
	G61	14 U 331096 5592691	4	8
	G62	14 U 331289 5592518	8	12
	G64	14 U 331587 5592105	8	13
	G68	14 U 332320 5591394	10	18
	G69	14 U 332575 5591361	5	8
	Total		86	2480
Shrubland	S10	14 U 326952 5599374	10	14
	S11	14 U 327204 5599366	12	18
	S133	14 U 326344 5600593	7	11
	S136	14 U 326294 5600840	15	16
	S138	14 U 326185 5601288	7	7
	S139	14 U 326152 5601536	8	12
	S140	14 U 325982 5601725	11	15
	S142	14 U 326010 5601355	12	14
	S144	14 U 326357 5601473	5	10
	S147	14 U 326370 5601834	8	9
	S15	14 U 328177 5599336	8	11
	S159	14 U 325579 5600388	10	37
	S16	14 U 328431 5599329	13	13
	S161	14 U 325446 5599902	4	6
	S162	14 U 325361 5599668	8	12
	S166	14 U 327108 5600643	9	12
	S167	14 U 327362 5600646	12	13
	S169	14 U 327664 5600396	10	16
	S170	14 U 327684 5600143	13	15
	S171	14 U 327671 5599891	14	17
	S172	14 U 327548 5599672	18	23
	S173	14 U 327068 5600384	8	10
	S174	14 U 327157 5600149	10	10
	S176	14 U 328741 5595698	6	13
	S177	14 U 328737 5595442	8	17
	S178	14 U 328707 5595201	6	11

Habitat	Site	Location	Number of Species	Number of Individuals
Shrubland	S179	14 U 328781 5594961	8	19
	S180	14 U 328960 5594779	8	15
	S181	14 U 329132 5594598	7	15
	S183	14 U 329492 5594236	5	14
	S2	14 U 324940 5599448	12	18
	S200	14 U 326712 5594819	10	12
	S230	14 U 328958 5593131	5	10
	S231	14 U 328744 5593264	6	8
	S24	14 U 327485 5598846	5	10
	S30	14 U 327802 5597392	4	6
	S31	14 U 327623 5597219	8	12
	S32	14 U 327937 5597176	4	6
	S33	14 U 328091 5596973	5	7
	S34	14 U 328255 5596780	8	10
	S35	14 U 328401 5596567	6	8
	S359	14 U 327001 5599931	14	47
	S38	14 U 328712 5596546	5	10
	S4	14 U 325441 5599434	9	16
	S45	14 U 328836 5595940	8	14
	S48	14 U 329218 5595286	8	28
	S5	14 U 325692 5599427	7	14
	S6	14 U 325945 5599407	8	15
	S7	14 U 326196 5599395	7	15
	S8	14 U 326445 5599391	8	17
	S9	14 U 326696 5599381	10	19
	Total		51	727
Forest	194	14 U 328153 5607293	18	22
	F100	14 U 330838 5597482	19	27
	F101	14 U 330691 5597690	13	20
	F102	14 U 330541 5597894	17	24
	F103	14 U 330427 5598116	14	23
	F104	14 U 330324 5598345	17	19
	F105	14 U 330266 5598586	15	20
	F106	14 U 330183 5598824	14	21
	F107	14 U 329942 5598890	9	15
	F108	14 U 329872 5598650	8	16
	F109	14 U 330005 5598431	11	13
	F110	14 U 329936 5598191	11	16
	F148	14 U 326146 5601947	11	14
	F149	14 U 325952 5602111	12	23
	F150	14 U 325763 5602281	13	20
	F151	14 U 325578 5602452	16	23
	F152	14 U 325881 5601057	7	15
	F153	14 U 325703 5600878	11	14

Habitat	Site	Location	Number of Species	Number of Individuals
Forest	F154	14 U 325630 5600638	11	16
	F155	14 U 325379 5600637	9	13
	F156	14 U 325128 5600638	13	20
	F157	14 U 324872 5600637	9	15
	F158	14 U 324620 5600633	10	13
	F18	14 U 328780 5598979	9	11
	F20	14 U 329061 5598873	16	24
	F250	14 U 331410 5593283	6	7
	F362	14 U 325911 5600648	12	19
	F365	14 U 324594 5600227	11	18
	F67	14 U 332087 5591487	7	13
	F72	14 U 333317 5591436	4	4
	F73	14 U 333569 5591460	7	12
	F74	14 U 333824 5591480	5	9
	F75	14 U 333793 5591730	10	11
	F76	14 U 333709 5591971	11	14
	F77	14 U 333558 5592173	9	13
	F78	14 U 333416 5592383	12	18
	F79	14 U 333306 5592607	12	15
	F80	14 U 333278 5592863	13	16
	F81	14 U 333280 5593116	14	19
	F82	14 U 333232 5593364	16	21
	F83	14 U 333113 5593587	12	15
	F84	14 U 332983 5593809	8	13
	F85	14 U 332820 5594001	11	13
	F86	14 U 332744 5594238	15	23
	F87	14 U 332599 5594447	14	24
	F94	14 U 331682 5596267	22	51
	F95	14 U 331558 5596483	16	21
	F96	14 U 331373 5596652	16	22
	F97	14 U 331201 5596835	19	29
	F98	14 U 331032 5597021	13	16
	F99	14 U 330964 5597262	13	22
	Total		72	915
Edge	109	14 U 327601 5607527	19	31
	114	14 U 327451 5606069	17	34
	E111	14 U 329877 5597943	15	18
	E112	14 U 329952 5597697	16	20
	E113	14 U 329658 5598069	7	9
	E122	14 U 329017 5598534	14	19
	E124	14 U 329478 5598249	9	14
	E13	14 U 327709 5599347	13	17
	E132	14 U 326363 5600342	11	13
	E137	14 U 326138 5601041	9	12

Habitat	Site	Location	Number of Species	Number of Individuals
Edge	E14	14 U 327944 5599252	7	11
	E141	14 U 325827 5601525	9	12
	E146	14 U 326713 5601828	15	23
	E160	14 U 325519 5600146	7	11
	E164	14 U 326788 5601130	11	15
	E17	14 U 328644 5599195	11	13
	E19	14 U 328846 5598737	10	16
	E201	14 U 326521 5594981	13	21
	E202	14 U 326313 5595132	8	11
	E240	14 U 326420 5594520	14	14
	E242	14 U 326368 5594029	10	17
	E243	14 U 326547 5593848	7	9
	E244	14 U 326686 5593634	13	28
	E247	14 U 330891 5593777	14	22
	E248	14 U 331139 5593716	6	8
	E251	14 U 331465 5593030	10	12
	E252	14 U 331563 5592791	12	18
	E253	14 U 330972 5594014	11	13
	E254	14 U 330828 5594230	12	22
	E360	14 U 326800 5600107	16	78
	E361	14 U 326607 5600276	16	20
	E60	14 U 330872 5592811	7	12
	E63	14 U 331435 5592306	6	9
	E65	14 U 331702 5591880	9	13
	E66	14 U 331835 5591664	8	12
	E70	14 U 332824 5591333	6	7
	E71	14 U 333066 5591425	8	9
	E88	14 U 332556 5594695	15	21
	E89	14 U 332516 5594948	13	17
	E90	14 U 332417 5595184	17	23
	E91	14 U 332299 5595404	13	21
	E92	14 U 332090 5595543	16	24
	E93	14 U 331972 5595764	27	37
	Total		69	786

Table A-3: Number of chestnut-collared longspurs detected in four habitat types during ten-minute point counts, 2017, 2019, and 2021

Habitat	Site	Location	2017	2019	2021
Grassland	48	Redacted	0	1	4
	49		1	3	3
	50		0	4	2
	51		0	1	2
	52		0	0	1
	53		1	3	2
	54		1	2	6
	55		1	1	5
	56		4	1	3
	57		2	0	4
	58		1	1	3
	59		2	3	4
	60		0	1	2
	G0		0	1	0
	G128		1	1	0
	G134		0	3	0
	G135		0	2	0
	G145		0	2	0
	G163		0	1	1
	G165		1	1	0
	G168		1	0	0
	G186		0	2	2
	G187		0	1	0
	G191		0	0	2
	G195		2	0	0
	G196		1	0	0
	G197		0	1	0
	G198		0	1	0
	G199		0	2	0
	G203		0	1	0
	G206		2	2	0
	G207		2	0	0
	G208		2	0	1
	G209		3	0	0
	G210		1	0	2
	G211		2	0	2
	G212		1	3	0
	G213		1	2	2
	G214		0	2	0
	G215		0	1	2
	G216		1	0	1

Habitat	Site	Location	2017	2019	2021
Grassland	G217		2	2	3
	G218		2	3	4
	G219		0	3	1
	G22		1	0	0
	G220		0	3	1
	G23		0	0	1
	G232		0	2	0
	G27		6	0	0
	G28		4	0	4
	G29		4	1	2
	G44		2	1	0
	G46		0	3	0
	G55		3	0	0
	G58		0	0	2
	G68		0	0	3
	Total		58	68	77
Shrubland	S11		1	0	0
	S167		1	0	0
	S177		0	0	2
	S179		0	3	0
	S30		0	1	0
	S31		0	2	3
	S32		0	1	0
	Total		2	7	5
Edge	E13		2	0	0
	E14		2	0	0
	E164		0	1	0
	E19		1	0	0
	E70		0	0	2
	Total		5	1	2

Table A-4: Number of Sprague's pipits detected in four habitat types during ten-minute point counts, 2017, 2019, and 2021

Habitat	Site	Location	2017	2019	2021
Grassland	48	REDACTED	2	4	3
	49		3	3	2
	50		2	2	0
	51		1	4	1
	52		2	3	2
	53		1	1	1
	54		3	1	0
	56		0	1	0
	57		1	0	0
	60		2	2	0
	61		0	2	0
	62		0	1	0
	110		1	0	0
	111		2	1	0
	112		3	1	0
	113		3	0	0
	187		0	1	0
	188		3	1	0
	189		4	1	0
	190		3	1	1
	191		1	0	0
	192		2	0	0
	193		1	0	0
	196		1	0	0
	G12		1	0	0
	G129		1	1	0
	G130		0	1	0
	G165		0	1	0
	G168		0	0	1
	G175		0	1	0
	G184		0	2	0
	G185		0	1	0
	G186		0	3	0
	G187		0	2	0
	G188		1	1	0
	G189		1	2	0
	G190		0	2	1
	G191		1	3	1
	G192		1	3	0
	G193		1	2	1
	G194		1	1	1

Habitat	Site	Location	2017	2019	2021
Grassland	G195		1	0	2
	G196		1	0	1
	G197		2	1	0
	G199		2	0	0
	G203		1	0	1
	G204		1	1	2
	G205		1	1	1
	G206		1	1	2
	G207		0	1	3
	G208		1	1	1
	G209		0	1	0
	G210		1	2	5
	G211		2	1	2
	G212		1	1	1
	G213		2	1	1
	G214		2	2	1
	G215		2	2	0
	G216		3	2	0
	G217		1	0	1
	G218		1	1	0
	G219		1	1	0
	G221		0	0	2
	G223		1	0	0
	G224		2	2	0
	G225		0	1	4
	G226		3	2	3
	G227		4	2	3
	G228		2	1	2
	G229		1	2	0
	G23		1	2	1
	G232		0	1	0
	G234		1	0	0
	G245		1	0	0
	G25		2	0	0
	G26		0	1	0
	G27		1	1	0
	G28		0	2	0
	G29		0	1	0
	G357		0	0	1
	G36		1	2	0
	G37		0	2	1
	G39		2	2	2
	G40		1	2	0
	G42		1	0	0

Habitat	Site	Location	2017	2019	2021
Grassland	G43		0	0	1
	G44		0	2	0
	G46		0	0	2
	G50		1	0	0
	G51		1	0	0
	G53		1	2	0
	G54		1	0	0
	G55		1	0	0
	G56		1	0	0
	G58		1	1	0
	Total		107	107	61
Shrubland	S10		3	2	1
	S11		0	1	0
	S138		2	1	0
	S139		1	0	0
	S142		1	0	0
	S144		3	0	0
	S159		0	1	0
	S161		0	2	0
	S162		0	1	0
	S169		0	0	1
	S171		0	0	1
	S172		0	1	0
	S178		1	0	0
	S179		1	0	0
	S182		0	1	0
	S183		0	1	0
	S200		0	2	1
	S231		0	2	0
	S24		1	1	0
	S30		0	1	2
	S31		0	0	2
	S32		1	1	0
	S33		0	1	1
	S34		1	2	0
	S35		1	2	0
	S359		0	1	0
	S38		2	2	2
	S4		2	0	0
	S45		0	0	3
	S5		1	0	0
	S6		1	1	0
	S7		1	1	0
	S8		3	1	0

Habitat	Site	Location	2017	2019	2021
Shrubland	S9		3	1	0
	Total		29	30	14
Edge	114		1	0	0
	E13		1	0	0
	E137		1	0	0
	E160		0	1	0
	E164		0	1	0
	E201		0	1	2
	E360		0	1	0
	Total		3	4	2

Table A-5: Raptors and nest predators detected during perching avian predator surveys, 2021

Perch Deterrents	Site	Centre Tower Location	Date	Type	Common Name	Scientific Name	Number Observations	Number Perched
Yes	1	14 U 324678 5599456	20-Apr	Raptor	American kestrel	*Falco sparverius*	2	0
					Rough-legged hawk	*Buteo lagopus*	2	1
				Nest predator	American crow	*Corvus brachyrhynchos*	1	0
					Common raven	*Corvus corax*	1	0
			21-Apr	Raptor	Northern harrier	*Circus cyaneus*	1	0
					Rough-legged hawk	*Buteo lagopus*	3	3
			22-Apr	Raptor	Northern harrier	*Circus cyaneus*	1	0
				Nest predator	American crow	*Corvus brachyrhynchos*	2	0
					Common raven	*Corvus corax*	7	0
			23-Apr	Nest predator	American crow	*Corvus brachyrhynchos*	2	0
					Black-billed magpie	*Pica hudsonia*	2	0
					Common raven	*Corvus corax*	4	0
			20-Jun	Nest predator	American crow	*Corvus brachyrhynchos*	1	0
			22-Jun	Nest predator	American crow	*Corvus brachyrhynchos*	1	0
			23-Jun	Nest predator	Common raven	*Corvus corax*	2	0
	2	14 U 325878 5600107	20-Apr	Nest predator	American crow	*Corvus brachyrhynchos*	1	0
			21-Apr	Raptor	Northern harrier	*Circus cyaneus*	1	0
			22-Apr	Raptor	Rough-legged hawk	*Buteo lagopus*	1	0
			23-Jun	Nest predator	Common raven	*Corvus corax*	1	0
	3	14 U 327076 5599870	20-Apr	Nest predator	Common raven	*Corvus corax*	2	1
			21-Apr	Nest predator	Common raven	*Corvus corax*	4	3
			22-Apr	Nest predator	Common raven	*Corvus corax*	7	4
			23-Apr	Raptor	American kestrel	*Falco sparverius*	1	0
				Nest predator	Common raven	*Corvus corax*	3	3
			20-Jun	Raptor	Red-tailed hawk	*Buteo jamaicensis*	1	0

Perch Deterrents	Site	Centre Tower Location	Date	Type	Common Name	Scientific Name	Number Observations	Number Perched
Yes	4	14 U 328190 5599037	20-Apr	Nest predator	Common raven	*Corvus corax*	5	0
			21-Apr	Nest predator	American crow	*Corvus brachyrhynchos*	2	0
					Common raven	*Corvus corax*	2	0
			22-Apr	Raptor	Northern harrier	*Circus cyaneus*	1	0
				Nest predator	American crow	*Corvus brachyrhynchos*	6	0
					Common raven	*Corvus corax*	1	1
			23-Apr	Nest predator	American crow	*Corvus brachyrhynchos*	1	0
					Common raven	*Corvus corax*	2	0
No	5	14 U 343606 5584402	20-Apr	Nest predator	Common raven	*Corvus corax*	1	0
			21-Apr	Raptor	Northern harrier	*Circus cyaneus*	1	0
				Nest predator	American crow	*Corvus brachyrhynchos*	2	0
					Common raven	*Corvus corax*	3	1
			22-Apr	Raptor	Northern harrier	*Circus cyaneus*	1	0
					Red-tailed hawk	*Buteo jamaicensis*	2	0
					Rough-legged hawk	*Buteo lagopus*	2	1
				Nest predator	Common raven	*Corvus corax*	3	0
			23-Apr	Raptor	American kestrel	*Falco sparverius*	2	0
					Red-tailed hawk	*Buteo jamaicensis*	1	0
				Nest predator	American crow	*Corvus brachyrhynchos*	3	0
					Common raven	*Corvus corax*	5	0
			20-Jun	Raptor	Red-tailed Hawk	*Buteo jamaicensis*	2	1
				Nest predator	Common raven	*Corvus corax*	3	0
			22-Jun	Raptor	Northern harrier	*Circus cyaneus*	1	0
			23-Jun	Nest predator	Black-billed magpie	*Pica hudsonia*	1	1
					Common raven	*Corvus corax*	1	0
			24-Jun	Raptor	American kestrel	*Falco sparverius*	1	1

Perch Deterrents	Site	Centre Tower Location	Date	Type	Common Name	Scientific Name	Number Observations	Number Perched
No	6	14 U 343581 5583145	20-Apr	Nest predator	American crow	*Corvus brachyrhynchos*	2	0
					Common raven	*Corvus corax*	1	0
			20-Jun	Raptor	Red-tailed Hawk	*Buteo jamaicensis*	2	0
				Nest predator	Common raven	*Corvus corax*	1	0
			24-Jun	Raptor	Swainson's hawk	*Buteo swainsoni*	1	0

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