

Mackenzie Valley Highway Project – 2022 Avian Surveys

FINAL

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Government of the Northwest Territories

Prepared by:

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K'alo-Stantec

Limitations and Sign-off

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Abbreviations

%	percent
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
°C	degrees Celsius
ARU	autonomous recording unit
BAMP	Boreal Avian Modelling Project
CEC	Commission for Environmental Cooperation
DAR	Developer's Assessment Report
ECCC	Environment and Climate Change Canada
GNWT	Government of the Northwest Territories
ha	hectare
INF	Department of Infrastructure
K'alo-Stantec	K'alo-Stantec Limited
km	kilometre
km/h	kilometres per hour
LSA	local study area
m	metre
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVH	Mackenzie Valley Highway
MVWR	Mackenzie Valley Winter Road
NRCan	Natural Resources Canada
RSA	regional study area
SAR	species at risk
the “Project”	Mackenzie Valley Highway Project

1 Introduction

1.1 Background

The Government of the Northwest Territories Department of Infrastructure (GNWT-INF) is advancing work on the proposed Mackenzie Valley Highway (MVH) Project (the “Project”; Appendix A, Figure A.1). The Project involves constructing a new all-season gravel road from Wrigley to approximately 28 km south of Norman Wells, mostly along the alignment of the existing Mackenzie Valley Winter Road (MVWR). The Project will involve clearing of right-of-way, developing temporary and permanent quarry/borrow sources, constructing quarry/borrow access roads, and constructing new highway. The Project is undergoing environmental assessment by the Mackenzie Valley Environmental Impact Review Board (MVEIRB). K’alo-Stantec Limited (K’alo-Stantec) is currently supporting GNWT-INF to prepare the Developer’s Assessment Report (DAR) for the Project in accordance with the Terms of Reference as issued by the MVEIRB (MVEIRB 2015).

As an outcome of review of existing information on birds and bird habitat, including species at risk (K’alo-Stantec 2022a), K’alo-Stantec, in discussion with representatives of the GNWT-INF team, GNWT Environment and Natural Resources, and Environment and Climate Change Canada (ECCC), identified the need to obtain additional information to assess the effects of the Project on avian species, particularly species at risk (SAR). As a result, the 2022 Avian Surveys incorporated Project-specific field surveys and additional analyses using publicly available data to address data gaps.

1.2 Purpose

The purpose of the 2022 Avian Surveys is to collect additional field-based information to establish the existing conditions for avian species, including primarily SAR, and support the assessment of effects of the Project on the environment in the DAR.

1.2.1 Objectives

The objectives of the 2022 Avian Surveys were to:

- Establish existing conditions for avian SAR most likely to interact with the Project (e.g., bank swallow [*Riparia riparia*], barn swallow [*Hirundo rustica*]) using in-field surveys.
- Establish existing conditions for avian SAR using autonomous recording units (ARUs) that may not have been adequately captured in the 2017 data (e.g., yellow rail [*Coturnicops noveboracensis*]).
- Supplement existing breeding bird community data using ARUs (i.e., surveys in underrepresented habitats or at quarries and access roads, where practicable).
- Evaluate breeding bird densities relative to the Project to support the assessment of Project effects by using publicly available Boreal Avian Modelling Project (BAMP) data that includes survey data collected by ECCC in 2017 from along the MVWR (BAMP 2020).

2 Methods

The 2022 Avian Surveys were undertaken in the Dehcho and Sahtu regions under the authority of GNWT wildlife research permits WL501066 and WL50105, respectively. This section describes the methods used to complete the surveys within the local study area (LSA) for birds and bird habitat, which is a 1 km buffer around the highway component of the Project, as the centerline of an alignment routing corridor, except around borrow sources and quarries where the LSA increases to a 2 km buffer (K'alo-Stantec 2022a). The size of the LSA is based on measurable effects on migratory birds (e.g., Benitez-Lopez et al. 2010; Shannon et al. 2016). Where appropriate, results are compared the regional study area (RSA) which is a 15 km buffer around the Project (Appendix A, Figure A.1). Incidental observations of birds were also collected in the field.

2.1 Swallow Nesting Survey

A swallow nesting survey was completed from May 26 to 30, 2022, and involved visual inspection by a biologist of nesting habitats that support breeding swallows. For bank swallow, a helicopter was used to survey stream crossings for vertical banks within 300 m of the Project, and existing quarry sites, that may support breeding colonies. For barn swallow, bridges and culverts (diameter ≥ 1 m) along the existing MVWR were inspected for current or historical signs of nesting activity. Data collected at each survey sites included site attributes (e.g., coordinates, photographs) and where appropriate, species observation data (e.g., coordinates, species, number of nests, photographs), including evidence of nesting activity of other bird species. Surveys were undertaken during periods of suitable weather (i.e., clear visibility, wind ≤ 20 km/h, temperature $>0^{\circ}\text{C}$, and precipitation not exceeding a light, intermittent drizzle). Results were summarized by location and mapped relative to the Project.

2.2 Autonomous Recording Unit Surveys

The ARU surveys were developed to supplement existing data collected by ECCC using 53 ARUs in 2017 (ECCC 2020; see K'alo-Stantec 2022a) by deploying 23 additional ARUs in potential yellow rail habitat ($n= 3$ sites), in under-represented land cover classes and relative to ecoregion as recommended in ECCC guidelines (Hache et al. 2018). Habitat for yellow rail was identified by using species-specific mapping developed for the DAR (i.e., wetland herbaceous habitat patches ≥ 10 ha) and professional judgment (K'alo-Stantec 2022b). Survey sites were distributed relative to level III ecoregion and land cover class composition (as recommended by ECCC guidelines [Hache et al. 2018]) but the area of some land cover classes in the LSA are too small to support the minimum recommended sample size of 10. The ECCC guidelines recommend using 250 m resolution land cover classification data whereas the Project-specific land cover data used is of 30 m resolution. The distribution of survey sites is compared using the two different classification systems.

The 23 ARUs were deployed in late May 2022 within the LSA and left to record 10-minutes of audio at the beginning of each hour until their retrieval in mid-July.

2.2.1 Species at Risk Survey

Processing the audio recordings for SAR followed ECCC guidance (Hache et al. 2018) whereby all recordings were examined using automated computer software for SAR of interest, including for common nighthawk (*Chordeiles minor*), yellow rail, olive-sided flycatcher (*Contopus cooperi*), Canada warbler (*Cardellina canadensis*), and rusty blackbird (*Euphagus carolinus*). Audio files were analyzed using Kaleidoscope Pro 5.4.8 (Wildlife Acoustics 2021) cluster analysis, which identifies and groups similar acoustic patterns (i.e., bird vocalizations) using custom classifiers. Advanced classifiers were developed using reference vocalizations for each species and an acceptance threshold of 2.0 maximum distance from cluster centre was used to include all detected vocalizations in the analysis. All other settings were set to the manufacturer's defaults. The vocalization with the lowest distance to each classifier's cluster centre was manually classified by a qualified biologist using Kaleidoscope Pro's Viewer software to confirm species detection / non-detection. A total of 23 clusters were analyzed per ARU, totalling 621 manually identified files.

2.2.2 Community Survey

Processing the audio recordings to characterize the breeding bird community followed ECCC guidance (Hache et al. 2018) whereby a biologist completed traditional “point-count surveys” on a subset of the audio recordings. The subset of data was selected to provide representative coverage throughout the breeding season and to avoid periods of inclement weather that might reduce recording quality. Most recordings in the subset were from June 6, 14, and 23, 2022, which rarely varied by one day depending on weather conditions. Within each sampling day, six three-minute audio recordings were sampled from 01:00, 03:00, 04:00, 05:00, 08:00, and 22:00, which represents a manual analytical effort of 18 minutes of audio per day and 54 total minutes per ARU (a total of 20.7 hours for the entire survey). Using this approach, positive species detections were recorded at each date/time sampling period (i.e., 18 sampling periods per ARU).

Previous analyses (K'alo-Stantec 2022a) examined the mean number of detection for each species per land cover class and/or ecoregion (as per ECCC guidelines [Hache et al. 2018]); however, the uneven sampling of audio recordings between survey years described above precludes comparison using the same metric (i.e., 54 minutes of audio examined in 2022 is anticipated to have three times more detections than the 18 minutes examined in 2017). As a result, species presence at each ARU survey site is summed relative to land cover class and ecoregion.

2.3 Breeding Bird Densities

Publicly available data of species-specific breeding bird densities were used to evaluate differences in predicted breeding densities near the Project (i.e., within the LSA) compared to distant from the Project (i.e., within the RSA). The BAMP has developed generalized national models to predict boreal breeding bird densities across Canada relative to a variety of environmental covariates and has produced species-specific breeding densities (males / hectare [ha]) using raster files at a 1 km resolution (BAMP 2020). The models were developed using 296,061 breeding bird point counts across Canada up to 2018, including from local and regional data sources such as the North American Breeding Bird Survey and the 2017 ECCC data described above (BAMP 2020).

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The BAMP raster files for 151 species were then processed using a zonal statistics spatial analysis tool (ESRI 2022) to estimate the mean breeding density of each species within the LSA (i.e., affected area; see Section 2) and RSA (i.e., reference area). Results were tabulated for 59 species with predicted breeding densities of ≥ 0.005 males/ha.

3 Results

3.1 Swallow Nesting Survey

There were no active bank swallow or barn swallow nests detected during the survey; however, two bridge crossings supported inactive (i.e., historical) barn swallow nests including Whitesand Creek Bridge and Blackwater River Bridge (Appendix A, Figure A.2; Appendix B, Table B.1). Barn swallow was not observed at Whitesand Creek Bridge; however, 1 individual was observed at Blackwater River Bridge. In addition, three barn swallow individuals were observed at Vermillion Creek S Bridge where there was no evidence of previous nesting activity (Appendix A, Figure A.2; Appendix B, Table B.1). The survey was undertaken during the early part of the breeding season (eBird 2022), which may have limited the likelihood that swallows would be actively nesting, but because evidence of swallow nesting activity may persist for several years the survey is assumed to provide reliable information on the distribution and relative abundance of breeding swallows that have potential to interact with the Project. The survey also yielded incidental observations of belted kingfisher (*Megaceryle alcyon*), black-billed magpie (*Pica hudsonia*), and common raven (*Corvus corax*; Appendix B, Table B.2).

3.2 Autonomous Recording Unit Surveys

3.2.1 Species at Risk Survey

The 23 ARUs recorded a total of 4,097 hours of audio, with each ARU recording an average of 178.1 hours of audio (range: 83.7 to 195.7 hours). The software-assisted analysis and subsequent manual validation yielded detections of common nighthawk at 10 of 23 survey sites and olive-sided flycatcher at 6 of 23 survey sites (Appendix A, Figure A.3 and Figure A.4; Appendix B, Table B.3). Common nighthawk were detected in all level III ecoregions in the LSA and in four different land cover classes: mixedwood forest (n = 4), shrubland (n = 3), broadleaf forest (n = 2), herbaceous (n = 1). Olive-sided flycatcher were detected in two of the three level III ecoregions in the LSA (Taiga Cordillera and Taiga Plains) and in four different land cover classes: mixedwood forest (n = 2), wetland (n = 2), shrubland forest (n = 1), shrubland (n = 1). There were no detections of yellow rail, Canada warbler, or rusty blackbird in 2017 or 2022.

The ARU data from 2017 yielded detections of common nighthawk at 29 of 53 (58%) survey sites and olive-sided flycatcher at 8 of 53 (15%) survey sites (ECCC 2020; see K'alo-Stantec 2022a). The combined data yielded detections of common nighthawk at 39 of 76 (51%) survey sites and olive-sided flycatcher at 14 of 76 (18%) survey sites.

3.2.2 Community Survey

A review of the ECCC breeding bird survey data collected in 2017 using ARUs (ECCC 2020) and the 2022 ARU survey data suggest that these data are suitable for meeting the objective of identifying the presence, habitat associations, and relative abundance of breeding migratory birds within the LSA because survey locations were distributed evenly relative to ecoregion and land cover class. The distribution of ARUs by land cover class, using both 30 m and 250 m resolution data, is summarized in Table 3.1).

Table 3.1 Distribution of ARUs from 2017 and 2022 by Land Cover Class¹

Land Cover Class^{2,3}	No. of ARUs in 2017		No. of ARUs in 2022		No. of Total ARUs	
	30 m	250 m	30 m	250 m	30 m	250 m
Broadleaf Forest	3	4	4	7	7	11
Coniferous Forest	25	19	0	4	25	23
Mixedwood Forest	3	12	9	5	12	17
Shrubland	6	14	6	4	12	18
Herbaceous & Unvegetated	2	3	2	2	4	5
Wetland	13	1	2	1	15	2
Water	1	0	0	0	1	0
Total	53		23		76	

NOTES:

¹ dominant land cover class within 100 m of the ARU

² 30 m resolution from Earth Observation of Sustainable Development of Forests Northwest Territories (NRCan and GNWT 2017; K'alo-Stantec 2022c)

³ 250 m resolution land cover data (CEC 2010)

Survey locations were also evenly distributed along the LSA between Wrigley and Norman Wells (Appendix A, Figure A.3 and Figure A.4) and proportionally distributed between the three level III ecoregions intersected by the Project (Table 3.2).

Table 3.2 Distribution of ARUs from 2017 and 2022 by Ecoregions Intercepted by the Project

Ecoregion (Level III)	Area (ha)	Percent of LSA	No. of ARUs in 2017	No. of ARUs in 2022	No. of Total ARUs	Percent of Total ARUs (n = 76)
Boreal Cordillera High Boreal	24,925.0	33.1%	15	7	22	28.9%
Taiga Cordillera Low Subarctic	25,393.9	33.7%	19	6	25	32.9%
Taiga Plains Low Subarctic	25,040.6	33.2%	19	10	29	38.2%
Total	75,359.6	100.0%	53	23	76	100.0%



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Except for mixedwood forest, the ARU survey locations were distributed in relative proportion to the availability of major land cover classes in the LSA (Table 3.3). The land cover composition within a 100 m radius of the survey location was calculated and the dominant land cover class was used to assign a single land cover class for each survey location. However, exposed lands were excluded because most survey locations were near the existing cleared MVWR right-of-way and the dominant habitat for most locations was exposed lands and not indicative of the adjacent breeding habitat for birds.

A total of 84 bird species were detected during the ARU surveys in 2017 and 2022 (72 species in 2017 and 61 species in 2022; Appendix B, Table B.4), with the most common species being Swainson's thrush (*Catharus ustulatus*; at 76 of 76 locations), hermit thrush (*Catharus guttatus*; at 70 of 76 locations), white-throated sparrow (*Zonotrichia albicollis*; at 61 of 76 locations), American robin (*Turdus migratorius*; at 59 of 76 locations), and dark-eyed junco (*Junco hyemalis*; at 57 of 76 locations).

Table 3.3 Distribution of ARUs in 2017 and 2022 Compared to Land Cover Class Composition of the LSA

Land Cover Class ¹	Area (ha)	Percent of LSA	No. of Total ARUs	Percent of ARUs
Broadleaf Forest	4,779.3	6.6%	7	9.2%
Coniferous Forest	25,628.9	35.5%	25	32.9%
Mixedwood Forest	4,059.7	5.6%	12	15.8%
Shrubland	10,882.8	15.1%	12	15.8%
Herbaceous & Unvegetated	261.5	0.4%	4	5.3%
Wetland	17,550.6	24.3%	15	19.7%
Water	8,979.8	12.4%	1	1.3%
Total	72,142.6	100.0%	76	100.0%

NOTE:

¹ 30 m resolution from Earth Observation of Sustainable Development of Forests Northwest Territories (NRCan and GNWT 2017; K'alo-Stantec 2022c)

The most common and total number of species by major land cover classes, excluding water (i.e., a single survey location), in 2017 and 2022 combined were (Appendix B, Table B.5):

- **Broadleaf forest:** most common species were Swainson's thrush, white-throated sparrow, hermit thrush, dark-eyed junco, and yellow-rumped warbler (*Setophaga coronata*). A total of 46 species were recorded at 7 sites (24 species at 3 sites in 2017).
- **Coniferous forest:** most common species were Swainson's thrush, hermit thrush, chipping sparrow (*Spizella passerina*), Tennessee warbler (*Leiothlypis peregrina*) and dark-eyed junco. A total of 48 species were recorded at 25 sites in 2017 (no sites added in 2022).
- **Mixedwood forest:** most common species were Swainson's thrush, hermit thrush, yellow-rumped warbler, white-throated sparrow, and Tennessee warbler. A total of 60 species were recorded at 12 sites (28 species at 3 sites in 2017).

- **Shrubland:** most common species were Swainson's thrush, hermit thrush, white-throated sparrow, American robin, and orange-crowned warbler (*Leiothlypis celata*). A total of 56 species were recorded at 12 sites (39 species at 6 sites in 2017).
- **Herbaceous and Unvegetated:** most common species were Swainson's thrush, hermit thrush, white-throated sparrow, alder flycatcher (*Empidonax alnorum*), and dark-eyed junco. A total of 36 species were recorded at 4 sites (23 species at 2 sites in 2017).
- **Wetland:** most common species were Swainson's thrush, hermit thrush, American robin, white-throated sparrow, and dark-eyed junco. A total of 58 species were recorded at 15 sites (51 species at 14 sites in 2014).

Relative to ecoregion, the most common and total number of species were (Appendix B, Table B.6):

- **Boreal Cordillera:** most common species were Swainson's thrush, white-throated sparrow, chipping sparrow, hermit thrush, and Tennessee warbler. A total of 54 species were recorded at 22 sites (36 species at 15 sites in 2017).
- **Taiga Cordillera:** most common species were Swainson's thrush, hermit thrush, Tennessee warbler, Lincoln's sparrow (*Melospiza lincolni*), and white-throated sparrow. A total of 66 species were recorded at 25 sites (55 species at 19 sites in 2017).
- **Taiga Plains:** most common species were Swainson's thrush, hermit thrush, dark-eyed junco, American robin, and orange-crowned warbler. A total of 70 species were recorded at 29 sites (58 species at 19 sites in 2017).

3.3 Breeding Bird Densities

Most predicted breeding bird densities did not differ between the LSA and RSA; however, there are some species that are expected to breed in greater densities within the LSA, and some expected to breed in lower densities within the LSA (Appendix B, Table B.7). Comparing predicted breeding densities in the LSA to those in the RSA:

- 22 species showed no difference
- 24 species showed a slight reduction (≤ 0.005 males/ha)
- 5 species showed a slight increase (≤ 0.005 males/ha)
- 4 species showed a greater reduction (> 0.005 males/ha): dark-eyed junco (-0.017 males/ha), yellow-rumped warbler (-0.016 males/ha), white-crowned sparrow (-0.015 males/ha), and American robin (-0.010 males/ha)
- 4 species showed a greater increase (> 0.005 males/ha): Tennessee warbler (0.045 males/ha), chipping sparrow (0.012 males/ha), white-throated sparrow (0.009 males/ha), and alder flycatcher (0.007 males/ha)

4 Key Results and Findings

The 2022 Bird Surveys and subsequent data analysis improve confidence in the characterization of the breeding bird community within the LSA and key results and findings include:

- No bank swallow breeding colonies were detected at any of the proposed quarries and borrow sources or stream crossings surveyed within the LSA.
- Most bridge and culvert crossings along the MVWR did not show signs of barn swallow nesting activity, but there are two bridge locations that indicated previous nesting activity and one bridge location that could support the species during the breeding season.
- Common nighthawk are abundant and widespread within the LSA and were detected at 51% of ARU surveys sites in 2017 and 2022.
- Olive-sided flycatcher are relatively common within the LSA and were detected at 18% of ARU survey sites in 2017 and 2022.
- There were no detections of yellow rail, Canada warbler, or rusty blackbird in 2017 or 2022.
- The spatial distribution of survey locations relative to ecoregion and land cover classes are suitable for satisfying the objective of identifying the presence, habitat associations, and relative abundance of breeding migratory birds within the LSA to support requirements and objectives of the DAR.
- ARU surveys in 2022 yielded detections of 12 species not detected in 2017, primarily due to increased sample size in underrepresented land cover classes.
- Notable increases in the number of species were observed in previously underrepresented land cover classes (i.e., broadleaf forest, mixedwood forest, shrubland, herbaceous and unvegetated).
- The predicted breeding densities within the LSA for most bird species did not differ, or differed by a relatively small amount, in comparison to predicted densities within the RSA. However, there are four species expected to breed in notably higher densities (>0.005 males/ha) within the LSA and four species expected to breed in notably lower densities (<0.005 males/ha) within the LSA.
- Incidental bird observations included black-billed magpie and common raven.

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5.2 Personal Communications

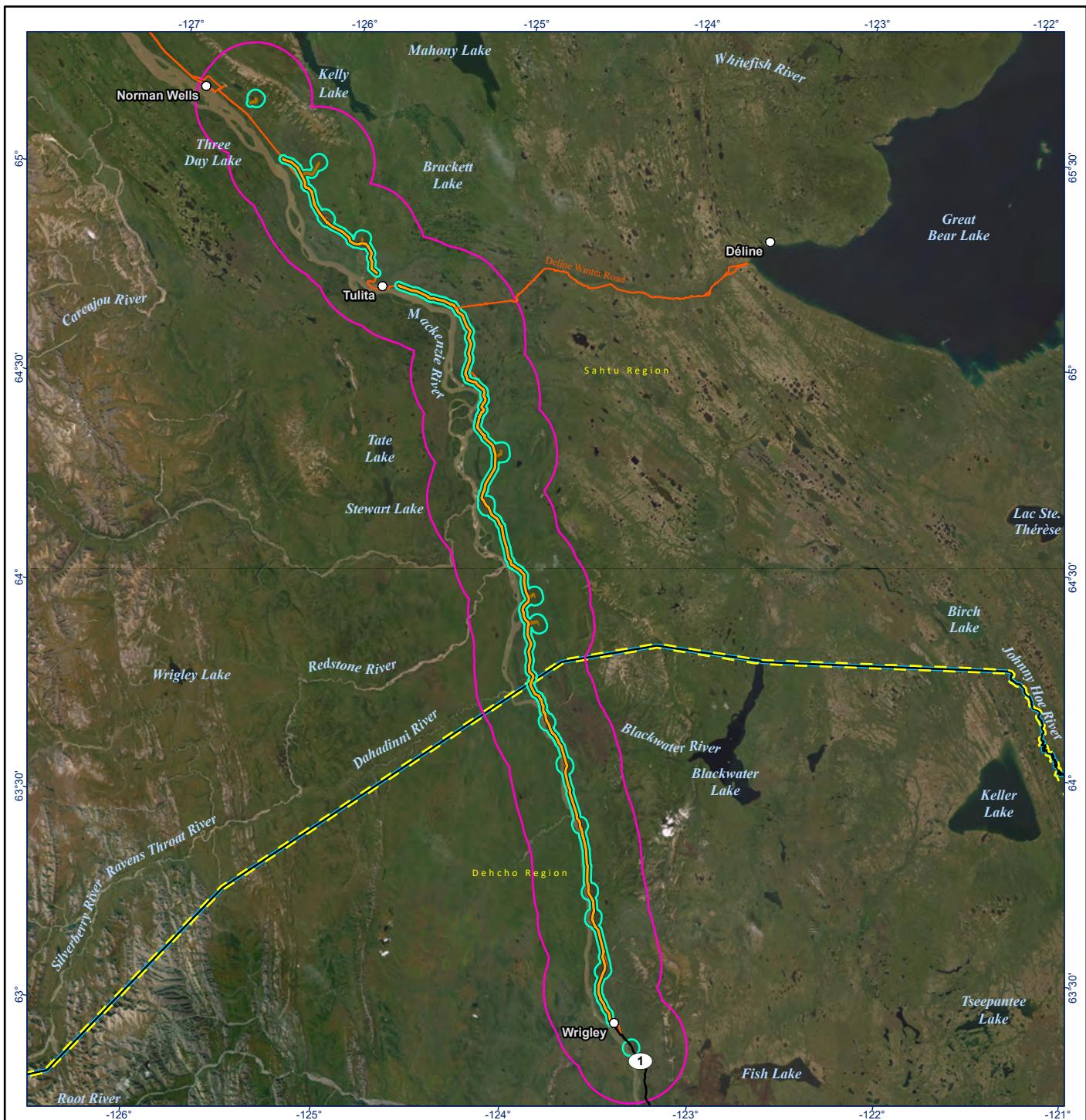
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Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix A Figures

May 2023

Appendix A Figures



Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
 Proposed Granular Borrow / Rock Quarry Site and Access
 Local Study Area
 Regional Study Area

Community
 All-Season Road
 Winter Road
 Region Boundary
 Settlement Area Boundary

0 10 20 Kilometres
 (At original document size of 8.5x11)
 1:1,600,000



Kalo-Stantec



Project Location

Prepared by AT on 3/8/2023

Wrigley to Norman Wells, NWT

TR by AJ on 3/8/2023

Client/Project

144903025-0055 REV8

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No.

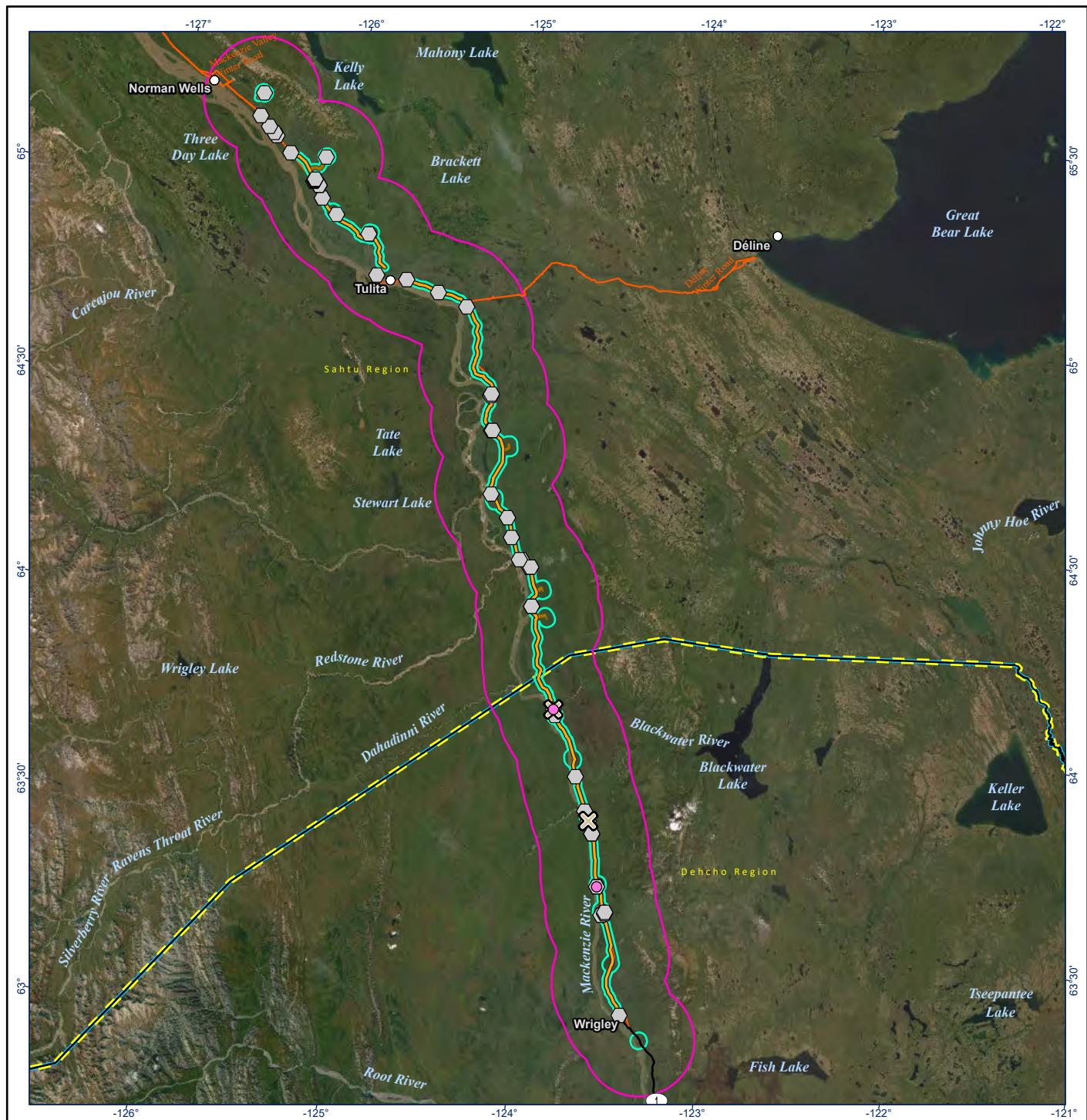
A.1

Title

Bird Survey Study Areas

Notes

- Coordinate System: NAD 1983 Northwest Territories Lambert
- Data Sources: Centre of Geomatics of Government of NWT, Government of Canada, Stantec
- Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
- World Imagery: Earthstar Geographics
- World Hillshade: Esri, USGS



Nesting Activity and Species 2022

- Inactive - Barn Swallow
- ✖ Barn Swallow Individuals
- Survey Location

Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022

Proposed Granular Borrow / Rock Quarry Site and Access

Local Study Area

Regional Study Area

Community

All-Season Road

Winter Road

Region Boundary

Settlement Area Boundary

0 10 20 Kilometres
(At original document size of 8.5x11)



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Project Location

Prepared by DS on 2023-04-05

Wrigley to Norman Wells, NWT

TR by DR on 2023-04-05

Client/Project

144903025-0164 REVA

Government of Northwest Territories
Mackenzie Valley Highway Project

Figure No.

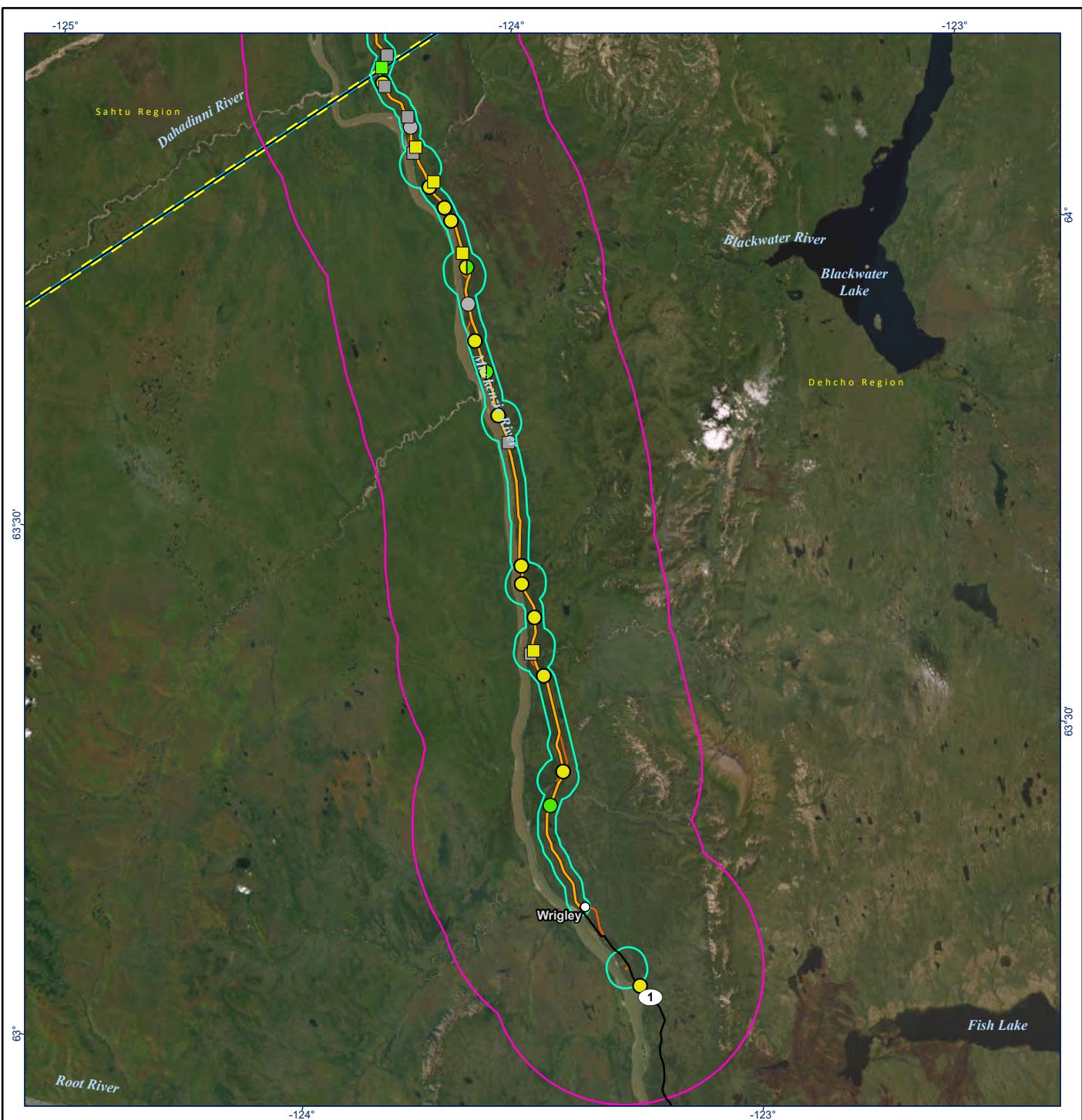
A.2

Title

Swallow Survey Results

Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
2. Data Sources: Centre of Geomatics of Government of NWT, Government of Canada, Stantec
3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
World Imagery: Earthstar Graphics
World Hillshade: Esri, USGS
4. ECCC, 2020. Breeding bird survey data along the Mackenzie Valley winter road. Data request November 23, 2020. Environment and Climate Change Canada, Yellowknife, NT.



ARU Survey Station 2022 ■ **ARU Survey Station 2017** ●

SAR Detection (2022)

- Common nighthawk
- Olive-sided flycatcher

SAR Detection (2017)³

- Common nighthawk
- Harris's sparrow
- Olive-sided flycatcher

Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022 —

Proposed Granular Borrow / Rock Quarry Site and Access ■

Local Study Area ■

Regional Study Area ■

Community ○

All-Season Road —

Winter Road —

Region Boundary □

Settlement Area Boundary ■

Notes

- Coordinate System: NAD 1983 Northwest Territories Lambert
- Data Sources: Centre of Geomatics of Government of NWT, Government of Canada, Stantec
- ECCC. 2020. Breeding bird survey data along the Mackenzie Valley winter road. Data request November 23, 2020. Environment and Climate Change Canada, Yellowknife, NT.
- Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
World Imagery: Earthstar Geographics
World Hillshade: Esri, USGS

0 5 10 Kilometres
(At original document size of 8.5x11)
1:650,000



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Project Location Prepared by DS on 2023-04-05
Wrigley to Norman Wells, NWT TR by DR on 2023-04-05

Client/Project 144903025-0170 REVA

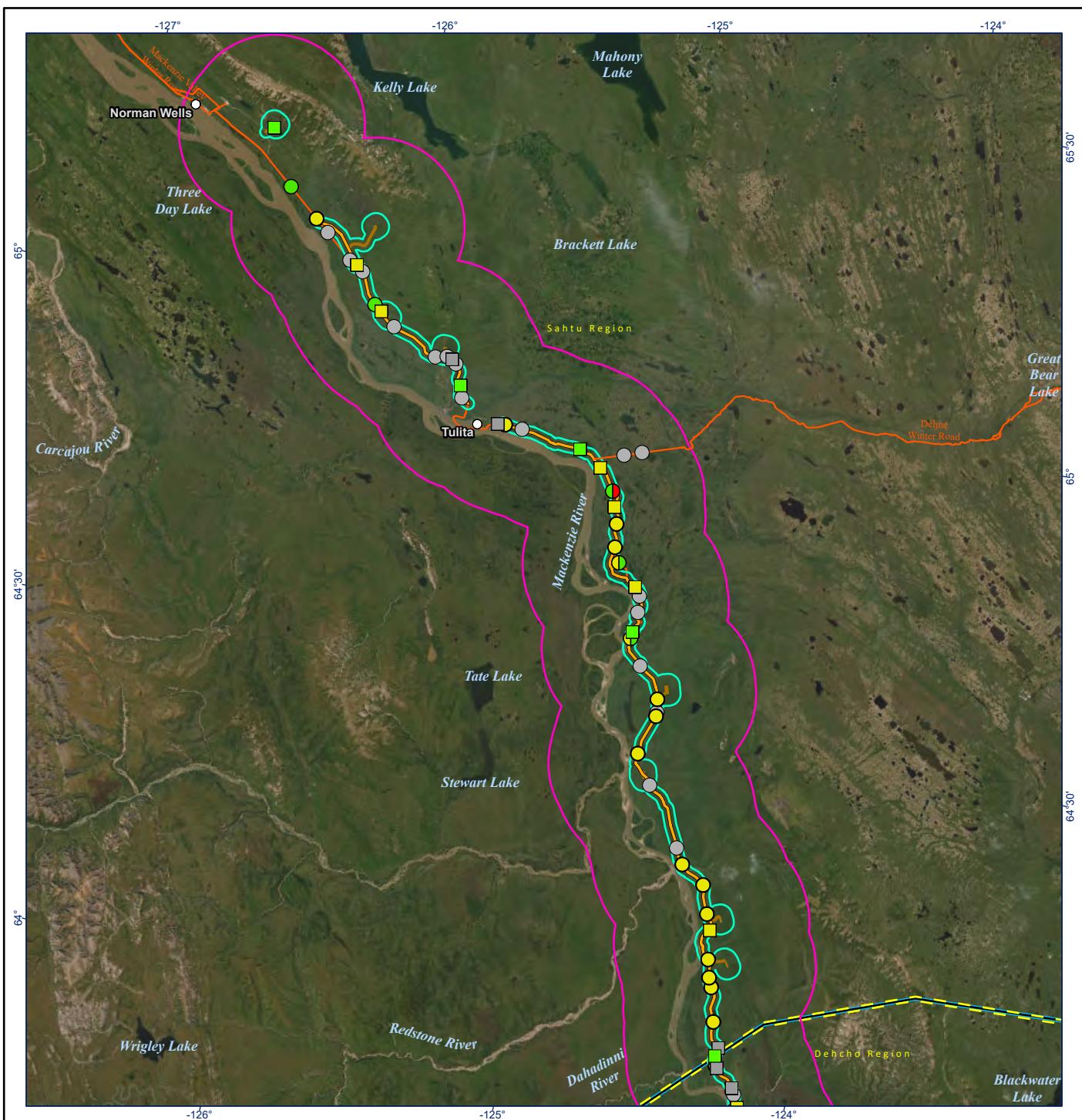
Government of Northwest Territories
Mackenzie Valley Highway Project

Figure No.

A.3

Title

Autonomous Recording Unit
Survey Results for Species at Risk
in the Dehcho Region



ARU Survey Station

- ARU Survey Station 2022
- ARU Survey Station 2017

SAR Detection (2022)

- Common nighthawk (2022)
- Olive-sided flycatcher (2022)

SAR Detection (2017)³

- Common nighthawk
- Harris's sparrow
- Olive-sided flycatcher

Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022

Proposed Granular Borrow / Rock Quarry Site and Access

Local Study Area

Regional Study Area

Community

All-Season Road

Winter Road

Region Boundary

Settlement Area Boundary

0 10 20 Kilometres
(At original document size of 8.5x11)
1:1,000,000



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Project Location Prepared by DS on 2023-04-05
Wrigley to Norman Wells, NWT TR by DR on 2023-04-05

Client/Project 144903025-0165 REVA

Government of Northwest Territories
Mackenzie Valley Highway Project

Figure No.

A.4

Title

Autonomous Recording Unit
Survey Results for Species at Risk
in the Sahtu Region

Notes

- Coordinate System: NAD 1983 Northwest Territories Lambert
- Data Sources: Centre of Geomatics of Government of NWT, Government of Canada, Stantec
- ECCC. 2020. Breeding bird survey data along the Mackenzie Valley winter road. Data request November 23, 2020. Environment and Climate Change Canada, Yellowknife, NT.
- Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCAN
World Imagery: Earthstar Geographics
World Hillshade: Esri, USGS

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

Appendix B Tables

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

Table B.1 Swallow Nesting Survey Results 2022

Date	Location	Coordinates			Nesting Activity	Common Name	Scientific Name	No. Nests	No. Individuals
		Zone	Easting	Northing					
5/29	Whitesand Creek Bridge	10	463462	7045473	Inactive	Barn swallow	<i>Hirundo rustica</i>	7	0
5/29	Vermillion Creek S Bridge	10	458038	7062867	No nests were observed	Barn swallow	<i>Hirundo rustica</i>	0	3
5/30	Blackwater River Bridge	10	443232	7091406	Inactive	Barn swallow	<i>Hirundo rustica</i>	10	1
5/27	Jungle Ridge Creek Bridge	9	638254	7218536	No nests were observed				
5/27	Beaver dam	9	636486	7221670	No nests were observed				
5/27	Notta Creek Bridge	9	636445	7221681	No nests were observed				
5/27	Vermillion Creek N Bridge	9	634731	7222319	No nests were observed				
5/27	Vertical bank	9	634886	7222566	No nests were observed				
5/27	Vertical bank	9	634923	7222777	No nests were observed				
5/27	Vertical bank	9	634994	7223004	No nests were observed				
5/28	Prohibition Creek Bridge	9	626574	7228215	No nests were observed				
5/28	Vertical bank	9	636307	7229672	No nests were observed				
5/28	Christina Creek Bridge	9	621621	7231757	No nests were observed				
5/28	Hellava Creek Bridge	9	620780	7232385	No nests were observed				
5/28	Francis Creek Bridge	9	619001	7233657	No nests were observed				
5/28	Canyon Creek Bridge	9	615903	7235889	No nests were observed				
5/26	Quarry near mvh_30	9	615188	7242143	No nests were observed				
5/29	Hodgson Creek Bridge	10	475735	7011732	No nests were observed				
5/29	Vertical bank	10	466884	7038547	No nests were observed				
5/29	Vertical bank	10	466899	7038950	No nests were observed				
5/29	Big Strawberry Creek Culvert	10	459639	7059494	No nests were observed				
5/29	Small Strawberry Creek Culvert	10	459599	7059588	No nests were observed				
5/29	Bob's Canyon Creek Culvert	10	456586	7065368	No nests were observed				



Mackenzie Valley Highway Project – 2022 Avian Surveys

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Date	Location	Coordinates			Nesting Activity	Common Name	Scientific Name	No. Nests	No. Individuals
		Zone	Easting	Northing					
5/30	Damn Creek Bridge	10	452438	7074266	No nests were observed				
5/30	Borrow	10	443916	7089845	No nests were observed				
5/26	Steep Creek Bridge	10	432369	7118275	No nests were observed				
5/26	Vertical bank	10	429955	7128734	No nests were observed				
5/26	Devil's Canyon Bridge	10	430264	7128862	No nests were observed				
5/26	Vertical bank	10	426820	7130334	No nests were observed				
5/26	Vertical bank	10	423602	7135959	No nests were observed				
5/26	Seagram's Creek Bridge	10	421594	7141121	No nests were observed				
5/26	Little Smith Creek Bridge	10	415994	7146732	No nests were observed				
5/26	Vertical bank	10	413062	7163956	No nests were observed				
5/26	Big Smith Creek Bridge	10	413334	7164040	No nests were observed				
5/26	Vertical bank	10	411191	7173413	No nests were observed				
5/26	Vertical bank	10	411309	7173846	No nests were observed				
5/27	Gotcha Creek Bridge	10	400414	7196261	No nests were observed				
5/27	Twelve Mile Creek Bridge	10	392059	7198785	No nests were observed				
5/27	No Name Creek Bridge	10	374499	7200546	No nests were observed				
5/27	Vertical bank	10	370370	7211313	No nests were observed				
5/27	Vertical bank	10	360704	7215034	No nests were observed				



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Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

Table B.2 Summary of Incidental Wildlife Observations

Species		Observation		Coordinates		
Common Name	Scientific Name	Type	Count	Zone	Easting	Northing
Black-billed magpie	<i>Pica hudsonia</i>	Individual(s)	1	10	476493	7010871
Belted kingfisher	<i>Megaceryle alcyon</i>	Active Nest	1	10	465995	7037999
Common raven	<i>Corvus corax</i>	Active Nest	1	10	465995	7037999
Common raven	<i>Corvus corax</i>	Active Nest	1	10	463462	7045473
Common raven	<i>Corvus corax</i>	Active Nest	1	10	458038	7062867
Common raven	<i>Corvus corax</i>	Active Nest	1	10	382841	7200758
Common raven	<i>Corvus corax</i>	Inactive Nest	1	10	427371	7130469

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables
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Table B.3 2022 Species at Risk Detections using Automated Computer Software

Location ID	Region	Land Cover Class ¹	Coordinates			Species Detections ²	
			Zone	Easting	Northing	Common Nighthawk	Olive-sided Flycatcher
mvh_01*	Sahtu	Wetland	10	437714	7100010	-	✓
mvh_02	Sahtu	Mixedwood	10	438049	7101479	-	-
mvh_05	Sahtu	Broadleaf	10	433071	7121121	✓	-
mvh_10	Sahtu	Mixedwood	10	410987	7169290	-	✓
mvh_11	Sahtu	Mixedwood	10	410121	7176997	✓	-
mvh_15	Sahtu	Shrub	10	404206	7189906	✓	-
mvh_16	Sahtu	Shrub	10	400630	7196125	✓	✓
mvh_17	Sahtu	Mixedwood	10	396618	7198661	-	✓
mvh_20	Sahtu	Shrub	10	381937	7200463	-	-
mvh_22	Sahtu	Herbaceous	10	374464	7205854	-	✓
mvh_23	Sahtu	Broadleaf	10	372282	7210005	-	-
mvh_25	Sahtu	Broadleaf	10	358835	7216011	✓	-
mvh_27	Sahtu	Mixedwood	9	635137	7222600	✓	-
mvh_30*	Sahtu	Wetland	9	615083	7241552	-	✓
mvh_31	Dehcho	Shrub	10	438392	7097992	-	-
mvh_32	Dehcho	Broadleaf	10	441528	7095096	-	-
mvh_33	Dehcho	Mixedwood	10	443005	7091925	✓	-
mvh_34	Dehcho	Shrub	10	442815	7091213	-	-
mvh_35	Dehcho	Shrub	10	445661	7088461	✓	-
mvh_36	Dehcho	Mixedwood	10	450215	7081177	✓	-
mvh_38	Dehcho	Mixedwood	10	458972	7061249	-	-



Mackenzie Valley Highway Project – 2022 Avian Surveys

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Location ID	Region	Land Cover Class ¹	Coordinates			Species Detections ²	
			Zone	Easting	Northing	Common Nighthawk	Olive-sided Flycatcher
mvh_39	Dehcho	Herbaceous	10	465807	7038834	✓	-
mvh_40	Dehcho	Mixedwood	10	465532	7038408	-	-

NOTES:

* Indicates a location with potential yellow rail habitat.

¹ 30 m resolution from Earth Observation of Sustainable Development of Forests Northwest Territories (NRCan and GNWT 2017; K'alo-Stantec 2022c)

² a '✓' indicates a confirmed species detection and a '-' indicates non-detection



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Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables
May 2023

Table B.4 Bird Species with the Potential to Occupy the LSA¹

Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³
Waterbirds	Waterfowl	Greater white-fronted goose	<i>Anser albifrons</i>	-	-
		Brant	<i>Branta bernicla</i>	-	-
		Cackling goose	<i>Branta hutchinsii</i>	-	-
		Canada goose	<i>Branta canadensis</i>	✓	✓
		Trumpeter swan	<i>Cygnus buccinator</i>	-	-
		Tundra swan	<i>Cygnus columbianus</i>	-	-
		American black duck	<i>Anas rubripes</i>	-	-
		Mallard	<i>Anas platyrhynchos</i>	-	✓
		Northern pintail	<i>Anas acuta</i>	-	-
		Green-winged teal	<i>Anas crecca</i>	-	-
		Canvasback	<i>Aythya valisineria</i>	-	-
		Redhead	<i>Aythya americana</i>	-	-
		Ring-necked duck	<i>Aythya collaris</i>	-	-
		Greater scaup	<i>Aythya marila</i>	-	-
		Lesser scaup	<i>Aythya affinis</i>	-	-
		King eider	<i>Somateria spectabilis</i>	-	-
		Harlequin duck	<i>Histrionicus histrionicus</i>	-	-
		Surf scoter	<i>Melanitta perspicillata</i>	-	-
		Black scoter	<i>Melanitta americana</i>	-	-
		Long-tailed duck	<i>Clangula hyemalis</i>	-	-
		Bufflehead	<i>Bucephala albeola</i>	-	-
		Common goldeneye	<i>Bucephala clangula</i>	-	-
		Barrow's goldeneye	<i>Bucephala islandica</i>	-	-
		Hooded merganser	<i>Lophodytes cucullatus</i>	-	-

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables
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Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³
Waterbirds (cont'd)	Waterfowl (cont'd)	Common merganser	<i>Mergus merganser</i>	-	-
		Red-breasted merganser	<i>Mergus serrator</i>	-	-
		Ruddy duck	<i>Oxyura jamaicensis</i>	-	-
		Snow goose	<i>Anser caerulescens</i>	-	-
		Ross's goose	<i>Anser rossii</i>	-	-
		Blue-winged teal	<i>Spatula discors</i>	-	-
		Northern shoveler	<i>Spatula clypeata</i>	-	-
		Gadwall	<i>Mareca strepera</i>	-	-
		Eurasian wigeon	<i>Mareca penelope</i>	-	-
		American wigeon	<i>Mareca americana</i>	-	-
Waterbirds	Waterbirds	White-winged scoter	<i>Melanitta deglandi</i>	-	-
		Red-throated loon	<i>Gavia stellata</i>	-	✓
		Pacific loon	<i>Gavia pacifica</i>	✓	-
		Common loon	<i>Gavia immer</i>	✓	✓
		Yellow-billed loon	<i>Gavia adamsii</i>	-	-
		American white pelican	<i>Pelecanus erythrorhynchos</i>	-	-
		Yellow rail*	<i>Coturnicops noveboracensis</i>	-	-
		Pied-billed grebe*	<i>Podilymbus podiceps</i>	✓	-
		Horned grebe	<i>Podiceps auritus</i>	-	-
Shorebirds	Shorebirds	Red-necked grebe	<i>Podiceps grisegena</i>	✓	-
		American bittern	<i>Botaurus lentiginosus</i>	✓	✓
		Sora	<i>Porzana carolina</i>	✓	✓
		American coot	<i>Fulica americana</i>	-	✓
		Sandhill crane	<i>Antigone canadensis</i>	✓	✓
		Black-bellied plover	<i>Pluvialis squatarola</i>	-	-



Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³
Waterbirds (cont'd)	Shorebirds (cont'd)	American golden-plover	<i>Pluvialis dominica</i>	-	-
		Semipalmated plover	<i>Charadrius semipalmatus</i>	-	-
		Killdeer	<i>Charadrius vociferus</i>	-	-
		Spotted sandpiper	<i>Actitis macularius</i>	-	-
		Solitary sandpiper	<i>Tringa solitaria</i>	✓	-
		Greater yellowlegs	<i>Tringa melanoleuca</i>	✓	-
		Lesser yellowlegs	<i>Tringa flavipes</i>	✓	✓
		Upland sandpiper	<i>Bartramia longicauda</i>	-	-
		Whimbrel	<i>Numenius phaeopus</i>	-	-
		Hudsonian godwit	<i>Limosa haemastica</i>	-	-
		Marbled godwit	<i>Limosa fedoa</i>	-	-
		Ruddy turnstone	<i>Arenaria interpres</i>	-	-
		Sanderling	<i>Calidris alba</i>	-	-
		Semipalmated sandpiper	<i>Calidris pusilla</i>	-	-
		Western sandpiper	<i>Calidris mauri</i>	-	-
		Least sandpiper	<i>Calidris minutilla</i>	-	-
		Baird's sandpiper	<i>Calidris bairdii</i>	-	-
		Pectoral sandpiper	<i>Calidris melanotos</i>	-	-
		Dunlin	<i>Calidris alpina</i>	-	-
		Stilt sandpiper	<i>Calidris himantopus</i>	-	-
		Short-billed dowitcher	<i>Limnodromus griseus</i>	-	-
		Long-billed dowitcher	<i>Limnodromus scolopaceus</i>	-	-
		Wilson's snipe	<i>Gallinago delicata</i>	✓	✓
		Wilson's phalarope	<i>Phalaropus tricolor</i>	-	-
		Red-necked phalarope	<i>Phalaropus lobatus</i>	-	-
		Mew gull	<i>Larus canus</i>	-	-

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables
May 2023

Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³
Waterbirds (cont'd)	Shorebirds (cont'd)	Ring-billed gull	<i>Larus delawarensis</i>	✓	✓
		Herring gull	<i>Larus argentatus</i>	-	-
		Glaucous gull	<i>Larus hyperboreus</i>	-	-
		Black tern	<i>Chlidonias niger</i>	-	-
		Common tern	<i>Sterna hirundo</i>	-	-
		Arctic tern	<i>Sterna paradisaea</i>	-	-
		Parasitic jaeger	<i>Stercorarius parasiticus</i>	-	-
		Long-tailed jaeger	<i>Stercorarius longicaudus</i>	-	-
		Bonaparte's gull	<i>Chroicocephalus philadelphia</i>	-	-
		Buff-breasted sandpiper	<i>Calidris subruficollis</i>	-	-
Birds of Prey	Raptors	Bald eagle	<i>Haliaeetus leucocephalus</i>	-	-
		Northern harrier	<i>Circus hudsonius</i>	-	-
		Sharp-shinned hawk	<i>Accipiter striatus</i>	-	✓
		Northern goshawk	<i>Accipiter gentilis</i>	-	-
		Swainson's hawk	<i>Buteo swainsoni</i>	-	-
		Red-tailed hawk	<i>Buteo jamaicensis</i>	-	✓
		Rough-legged hawk	<i>Buteo lagopus</i>	-	-
		Golden eagle	<i>Aquila chrysaetos</i>	-	-
		American kestrel	<i>Falco sparverius</i>	-	-
		Merlin	<i>Falco columbarius</i>	-	✓
		Gyrfalcon	<i>Falco rusticolus</i>	-	-
		Peregrine falcon	<i>Falco peregrinus</i>	-	-
		Osprey	<i>Pandion haliaetus</i>	-	-
	Owls	Great horned owl	<i>Bubo virginianus</i>	✓	-
		Snowy owl	<i>Bubo scandiacus</i>	-	-
		Northern hawk owl	<i>Surnia ulula</i>	-	-



Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³	
Birds of Prey (cont'd)	Owls (cont'd)	Great grey owl	<i>Strix nebulosa</i>	-	-	
		Short-eared owl	<i>Asio flammeus</i>	-	-	
		Boreal owl	<i>Aegolius funereus</i>	-	✓	
Upland game birds		Ruffed grouse	<i>Bonasa umbellus</i>	✓	✓	
		Spruce grouse	<i>Canachites canadensis</i>	-	-	
		Willow ptarmigan	<i>Lagopus lagopus</i>	-	-	
		Rock ptarmigan	<i>Lagopus muta</i>	-	-	
		Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	-	-	
Landbirds	Near-passerines	Common nighthawk	<i>Chordeiles minor</i>	✓	✓	
		Belted kingfisher	<i>Megaceryle alcyon</i>	-	-	
		Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	✓	✓	
		Downy woodpecker	<i>Dryobates pubescens</i>	-	-	
		American three-toed woodpecker	<i>Picoides dorsalis</i>	-	-	
		Black-backed woodpecker	<i>Picoides arcticus</i>	✓	-	
		Northern flicker	<i>Colaptes auratus</i>	✓	✓	
		Pileated woodpecker	<i>Dryocopus pileatus</i>	✓	✓	
		Hairy woodpecker	<i>Dryobates villosus</i>	-	✓	
	Passerines	Mourning dove	<i>Zenaida macroura</i>	-	-	
		Olive-sided flycatcher	<i>Contopus cooperi</i>	✓	✓	
		Western wood-peewee	<i>Contopus sordidulus</i>	✓	-	
		Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	✓	✓	
		Alder flycatcher	<i>Empidonax alnorum</i>	✓	✓	
		Least flycatcher	<i>Empidonax minimus</i>	✓	✓	
		Hammond's flycatcher	<i>Empidonax hammondi</i>	-	-	
		Eastern phoebe	<i>Sayornis phoebe</i>	-	-	
		Say's phoebe	<i>Sayornis saya</i>	-	-	



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Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables
May 2023

Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³
Landbirds (cont'd)	Passerines (cont'd)	Eastern kingbird	<i>Tyrannus tyrannus</i>	-	-
		Blue-headed vireo	<i>Vireo solitarius</i>	✓	✓
		Warbling vireo	<i>Vireo gilvus</i>	✓	-
		Philadelphia vireo	<i>Vireo philadelphicus</i>	-	-
		Red-eyed vireo	<i>Vireo olivaceus</i>	✓	-
		Black-billed magpie	<i>Pica hudsonia</i>	-	-
		American crow	<i>Corvus brachyrhynchos</i>	-	✓
		Common raven	<i>Corvus corax</i>	✓	✓
		Horned lark	<i>Eremophila alpestris</i>	-	-
		Tree swallow	<i>Tachycineta bicolor</i>	✓	-
		Violet-green swallow	<i>Tachycineta thalassina</i>	-	-
		Bank swallow	<i>Riparia riparia</i>	-	-
		Cliff swallow	<i>Petrochelidon pyrrhonota</i>	-	-
		Barn swallow	<i>Hirundo rustica</i>	-	-
		Black-capped chickadee	<i>Poecile atricapillus</i>	✓	✓
		Boreal chickadee	<i>Poecile hudsonicus</i>	✓	-
		Red-breasted nuthatch	<i>Sitta canadensis</i>	-	-
		American dipper	<i>Cinclus mexicanus</i>	-	-
		Golden-crowned kinglet	<i>Regulus satrapa</i>	-	-
		Northern wheatear	<i>Oenanthe oenanthe</i>	-	-
		Mountain bluebird	<i>Sialia currucoides</i>	-	-
		Townsend's solitaire	<i>Myadestes townsendi</i>	✓	-
		Gray-cheeked thrush	<i>Catharus minimus</i>	✓	-
		Swainson's thrush	<i>Catharus ustulatus</i>	✓	✓
		Hermit thrush	<i>Catharus guttatus</i>	✓	✓
		American robin	<i>Turdus migratorius</i>	✓	✓

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Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³
Landbirds (cont'd)	Passerines (cont'd)	Varied thrush	<i>Ixoreus naevius</i>	✓	✓
		European starling	<i>Sturnus vulgaris</i>	-	-
		American pipit	<i>Anthus rubescens</i>	-	-
		Bohemian waxwing	<i>Bombycilla garrulus</i>	✓	✓
		Cedar waxwing	<i>Bombycilla cedrorum</i>	-	-
		Yellow warbler	<i>Setophaga petechia</i>	✓	✓
		Magnolia warbler	<i>Setophaga magnolia</i>	✓	✓
		Cape May warbler	<i>Setophaga tigrina</i>	✓	-
		Yellow-rumped warbler	<i>Setophaga coronata</i>	✓	✓
		Palm warbler	<i>Setophaga palmarum</i>	✓	✓
		Bay-breasted warbler	<i>Setophaga castanea</i>	✓	-
		Blackpoll warbler	<i>Setophaga striata</i>	✓	✓
		Black-and-white warbler	<i>Mniotilla varia</i>	✓	✓
		American redstart	<i>Setophaga ruticilla</i>	✓	✓
		Ovenbird	<i>Seiurus aurocapilla</i>	✓	✓
		Northern waterthrush	<i>Parkesia noveboracensis</i>	✓	✓
		Mourning warbler	<i>Geothlypis philadelphia</i>	-	-
		Common yellowthroat	<i>Geothlypis trichas</i>	✓	-
		Wilson's warbler	<i>Cardellina pusilla</i>	✓	✓
		Tennessee warbler	<i>Leiothlypis peregrina</i>	✓	✓
		Orange-crowned warbler	<i>Leiothlypis celata</i>	✓	✓
		Ruby-crowned kinglet	<i>Corthylio calendula</i>	✓	✓
		American tree sparrow	<i>Spizelloides arborea</i>	✓	-
		Chipping sparrow	<i>Spizella passerina</i>	✓	✓
		Vesper sparrow	<i>Pooecetes gramineus</i>	-	-
		Savannah sparrow	<i>Passerculus sandwichensis</i>	✓	✓



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Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³
Landbirds (cont'd)	Passerines (cont'd)	Fox sparrow	<i>Passerella iliaca</i>	✓	✓
		Song sparrow	<i>Melospiza melodia</i>	-	-
		Lincoln's sparrow	<i>Melospiza lincolni</i>	✓	✓
		Swamp sparrow	<i>Melospiza georgiana</i>	✓	✓
		White-throated sparrow	<i>Zonotrichia albicollis</i>	✓	✓
		Harris's sparrow	<i>Zonotrichia querula</i>	✓	-
		White-crowned sparrow	<i>Zonotrichia leucophrys</i>	✓	✓
		Golden-crowned sparrow	<i>Zonotrichia atricapilla</i>	-	-
		House sparrow	<i>Passer domesticus</i>	-	-
		Clay-colored sparrow	<i>Spizella pallida</i>	✓	-
		Le Conte's sparrow	<i>Ammospiza leconteii</i>	✓	-
		Dark-eyed junco	<i>Junco hyemalis</i>	✓	✓
		Lapland longspur	<i>Calcarius lapponicus</i>	-	-
		Smith's longspur	<i>Calcarius pictus</i>	-	-
		Snow bunting	<i>Plectrophenax nivalis</i>	-	-
		Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	-	-
		Lazuli bunting	<i>Passerina amoena</i>	-	-
		Red-winged blackbird	<i>Agelaius phoeniceus</i>	-	✓
		Rusty blackbird	<i>Euphagus carolinus</i>	-	-
		Brewer's blackbird	<i>Euphagus cyanocephalus</i>	-	-
		Common grackle	<i>Quiscalus quiscula</i>	-	-
		Brown-headed cowbird	<i>Molothrus ater</i>	-	-
		Pine grosbeak	<i>Pinicola enucleator</i>	-	✓
		Red crossbill	<i>Loxia curvirostra</i>	-	-
		White-winged crossbill	<i>Loxia leucoptera</i>	✓	✓
		Common redpoll	<i>Acanthis flammea</i>	✓	✓



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Group	Order	Common Name	Scientific Name	ECCC Detection ²	2022 ARU Detection ³	
Landbirds (cont'd)	Passerines (cont'd)	Hoary redpoll	<i>Acanthis hornemannii</i>	-	-	
		Pine siskin	<i>Spinus pinus</i>	✓	-	
		Evening grosbeak	<i>Coccothraustes vespertinus</i>	-	-	
		Western tanager	<i>Piranga ludoviciana</i>	✓	-	
		Canada jay	<i>Perisoreus canadensis</i>	✓	✓	
		Winter wren	<i>Troglodytes hiemalis</i>	-	-	
		Purple finch	<i>Haemorhous purpureus</i>	-	✓	
		Northern shrike	<i>Lanius borealis</i>	-	-	
Total number of species		214		72	61	
Grand total		214		84		

NOTES:

- 1 Species within Level IV ecoregions 3.3.2.2 North Mackenzie Plain, 3.3.2.3 Norman Range, 3.2.2.11 Central Mackenzie Plain, and 6.1.5.1 Central Mackenzie Valley (GNWT 2020).
- 2 '✓' indicates a historical record from the ECCC 2017 ARU data (ECCC 2020; see K'alo-Stantec 2022a) and a '-' indicates non-detection.
- 3 '✓' indicates a positive species detection during the 2022 Avian Surveys and a '-' indicates non-detection.
- * Species included as indicated by ECCC (Dufour 2020, pers. comm.; ECCC 2020).

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Table B.5 Summary of the Number of Survey Locations with Breeding Bird Species Detections from the ECCC ARU Surveys in 2017 and the 2022 Avian Surveys Relative to Major Land Cover Class¹

Group	Order	Species		Major Land Cover Class ¹							Total
		Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Waterbirds	Waterfowl	Canada goose	<i>Branta canadensis</i>	2	1	3	3	0	3	0	12
		Mallard	<i>Anas platyrhynchos</i>	0	0	1	0	0	0	0	1
	Waterbirds	Red-throated loon	<i>Gavia stellata</i>	0	0	1	0	0	0	0	1
		Pacific loon	<i>Gavia pacifica</i>	0	0	0	1	0	0	0	1
		Common loon	<i>Gavia immer</i>	2	1	3	6	0	1	0	13
		Pied-billed grebe	<i>Podilymbus podiceps</i>	0	0	0	1	0	0	0	1
		Red-necked grebe	<i>Podiceps grisegena</i>	0	0	0	1	0	0	0	1
	Shorebirds	American bittern	<i>Botaurus lentiginosus</i>	0	2	1	1	0	1	0	5
		Sora	<i>Porzana carolina</i>	2	0	1	0	1	2	0	6
		American coot	<i>Fulica americana</i>	0	0	0	0	0	1	0	1
		Sandhill crane	<i>Antigone canadensis</i>	2	0	4	6	2	3	0	17
		Solitary sandpiper	<i>Tringa solitaria</i>	1	1	0	0	1	0	0	3
		Greater yellowlegs	<i>Tringa melanoleuca</i>	0	0	0	0	0	1	0	1
		Lesser yellowlegs	<i>Tringa flavipes</i>	0	2	1	3	0	3	0	9

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Group	Order	Species		Major Land Cover Class ¹							Total
		Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Waterbirds (cont'd)	Shorebirds (cont'd)	Wilson's snipe	<i>Gallinago delicata</i>	5	7	9	8	0	5	0	34
		Ring-billed gull	<i>Larus delawarensis</i>	0	0	0	3	0	1	0	4
Birds of Prey	Raptors	Sharp-shinned hawk	<i>Accipiter striatus</i>	0	0	1	0	0	0	0	1
		Red-tailed hawk	<i>Buteo jamaicensis</i>	0	0	1	0	0	0	0	1
		Merlin	<i>Falco columbarius</i>	0	0	1	2	0	0	0	3
	Owls	Great horned owl	<i>Bubo virginianus</i>	0	0	0	0	0	1	0	1
		Boreal owl	<i>Aegolius funereus</i>	1	0	0	0	0	0	0	1
Upland Game Birds		Ruffed grouse	<i>Bonasa umbellus</i>	0	1	0	5	1	2	1	10
Landbirds	Near-passerines	Common nighthawk	<i>Chordeiles minor</i>	0	0	1	2	0	1	0	4
		Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	1	3	5	1	0	2	1	13
		Black-backed woodpecker	<i>Picoides arcticus</i>	0	0	1	0	0	0	0	1
		Northern Flicker	<i>Colaptes auratus</i>	1	3	2	2	0	2	1	11
		Pileated woodpecker	<i>Dryocopus pileatus</i>	0	1	1	2	0	0	0	4
		Hairy woodpecker	<i>Dryobates villosus</i>	0	0	1	0	0	0	0	1

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Group	Order	Species		Major Land Cover Class ¹							Total
		Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Landbirds (cont'd)	Passerines	Olive-sided flycatcher	<i>Contopus cooperi</i>	1	1	2	1	0	0	0	5
		Western wood-peewee	<i>Contopus sordidulus</i>	0	0	0	0	0	2	0	2
		Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	2	2	4	6	1	3	0	18
		Alder flycatcher	<i>Empidonax alnorum</i>	2	13	5	9	4	8	0	41
		Least flycatcher	<i>Empidonax minimus</i>	2	1	3	1	2	2	0	11
		Blue-headed vireo	<i>Vireo solitarius</i>	0	0	1	1	0	0	0	2
		Warbling vireo	<i>Vireo gilvus</i>	0	3	0	1	1	3	0	8
		Red-eyed vireo	<i>Vireo olivaceus</i>	0	0	0	0	0	1	0	1
		American crow	<i>Corvus brachyrhynchos</i>	0	0	2	1	0	1	0	4
		Common raven	<i>Corvus corax</i>	0	0	6	3	1	2	0	12
		Tree swallow	<i>Tachycineta bicolor</i>	0	0	0	0	0	1	0	1
		Black-capped chickadee	<i>Poecile atricapillus</i>	1	0	3	2	1	1	0	8
		Boreal chickadee	<i>Poecile hudsonicus</i>	0	3	1	0	0	0	0	4
		Townsend's solitaire	<i>Myadestes townsendi</i>	0	1	0	0	0	0	0	1
		Gray-cheeked thrush	<i>Catharus minimus</i>	0	0	1	0	0	2	0	3

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Group	Order	Species		Major Land Cover Class ¹							Total
		Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Landbirds (cont'd)	Passerines (cont'd)	Swainson's thrush	<i>Catharus ustulatus</i>	7	25	12	12	4	15	1	76
		Hermit thrush	<i>Catharus guttatus</i>	6	23	12	12	4	13	0	70
		American robin	<i>Turdus migratorius</i>	5	17	9	11	3	13	1	59
		Varied thrush	<i>Ixoreus naevius</i>	1	6	3	0	1	3	0	14
		Bohemian waxwing	<i>Bombycilla garrulus</i>	1	0	2	1	0	0	0	4
		Yellow warbler	<i>Setophaga petechia</i>	2	1	4	6	3	1	0	17
		Magnolia warbler	<i>Setophaga magnolia</i>	2	4	6	4	0	3	0	19
		Cape May warbler	<i>Setophaga tigrina</i>	1	1	0	0	0	0	0	2
		Yellow-rumped warbler	<i>Setophaga coronata</i>	6	16	12	8	2	7	1	52
		Palm warbler	<i>Setophaga palmarum</i>	2	11	1	6	1	3	0	24
		Bay-breasted warbler	<i>Setophaga castanea</i>	0	1	0	0	0	0	0	1
		Blackpoll warbler	<i>Setophaga striata</i>	3	4	4	1	2	2	0	16
		Black-and-white warbler	<i>Mniotilla varia</i>	1	0	2	2	0	1	0	6
		Tennessee warbler	<i>Leiothlypis peregrina</i>	5	21	10	4	3	10	1	54



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Group	Order	Species		Major Land Cover Class ¹							Total
		Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Landbirds (cont'd)	Passerines (cont'd)	Orange-crowned warbler	<i>Leiothlypis celata</i>	6	9	8	11	3	8	0	45
		Ruby-crowned kinglet	<i>Corthylio calendula</i>	5	17	10	4	1	6	1	44
		American redstart	<i>Setophaga ruticilla</i>	1	1	0	1	0	2	0	5
		Ovenbird	<i>Seiurus aurocapilla</i>	1	0	4	1	1	5	0	12
		Northern waterthrush	<i>Parkesia noveboracensis</i>	1	1	4	6	1	2	0	15
		Common yellowthroat	<i>Geothlypis trichas</i>	0	3	1	0	0	1	0	5
		Wilson's warbler	<i>Cardellina pusilla</i>	2	1	0	1	1	1	0	6
		American tree sparrow	<i>Spizelloides arborea</i>	0	1	0	0	1	0	0	2
		Chipping sparrow	<i>Spizella passerina</i>	2	23	9	5	3	9	1	52
		Savannah sparrow	<i>Passerculus sandwichensis</i>	0	0	0	0	0	3	0	3
		Fox sparrow	<i>Passerella iliaca</i>	6	5	5	8	2	6	0	32
		Lincoln's sparrow	<i>Melospiza lincolni</i>	5	20	7	10	3	10	0	55
		Swamp sparrow	<i>Melospiza georgiana</i>	1	3	7	3	1	4	0	19
		White-throated sparrow	<i>Zonotrichia albicollis</i>	7	15	11	12	4	11	1	61



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Group	Order	Species		Major Land Cover Class ¹							Total
		Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Landbirds (cont'd)	Passerines (cont'd)	Harris's sparrow	<i>Zonotrichia querula</i>	0	0	0	1	0	0	0	1
		White-crowned sparrow	<i>Zonotrichia leucophrys</i>	3	2	2	7	4	4	0	22
		Clay-colored sparrow	<i>Spizella pallida</i>	0	2	1	0	0	0	0	3
		LeConte's sparrow	<i>Ammospiza leconteii</i>	0	0	0	0	0	1	0	1
		Dark-eyed junco	<i>Junco hyemalis</i>	6	20	8	8	4	10	1	57
		Purple finch	<i>Haemorhous purpureus</i>	1	0	3	1	0	0	0	5
		Red-winged blackbird	<i>Agelaius phoeniceus</i>	4	0	7	4	2	2	0	19
		Pine grosbeak	<i>Pinicola enucleator</i>	2	0	1	1	0	0	0	4
		White-winged crossbill	<i>Loxia leucoptera</i>	3	11	6	5	1	5	0	31
		Common redpoll	<i>Acanthis flammea</i>	3	0	7	4	2	3	0	19
		Pine siskin	<i>Spinus pinus</i>	0	2	1	0	1	0	0	4
		Western tanager	<i>Piranga ludoviciana</i>	0	5	0	0	0	5	1	11
		Canada jay	<i>Perisoreus canadensis</i>	1	7	3	2	0	4	0	17
		TOTAL		127	324	248	234	73	228	12	1,246

Note:

¹ 30 m resolution from Earth Observation of Sustainable Development of Forests Northwest Territories (NRCan and GNWT 2017; K'alo-Stantec 2022c)

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Table B.6 Summary of the Number of Survey Locations with Breeding Bird Species Detections from the ECCC ARU Surveys in 2017 and the 2022 Avian Surveys Relative to Level III Ecoregion

Group	Order	Species		Level III Ecoregion			Total
		Common Name	Scientific Name	Boreal Cordillera	Taiga Cordillera	Taiga Plains	
Waterbirds	Waterfowl	Canada goose	<i>Branta canadensis</i>	0	3	9	12
		Mallard	<i>Anas platyrhynchos</i>	0	1	0	1
	Waterbirds	Red-throated loon	<i>Gavia stellata</i>	0	1	0	1
		Pacific loon	<i>Gavia pacifica</i>	0	0	1	1
		Common loon	<i>Gavia immer</i>	1	5	7	13
		Pied-billed grebe	<i>Podilymbus podiceps</i>	0	0	1	1
		American bittern	<i>Botaurus lentiginosus</i>	0	5	0	5
	Shorebirds	Sora	<i>Porzana carolina</i>	1	3	2	6
		American coot	<i>Fulica americana</i>	0	1	0	1
		Sandhill crane	<i>Antigone canadensis</i>	2	5	10	17
		Solitary sandpiper	<i>Tringa solitaria</i>	0	0	3	3
		Greater yellowlegs	<i>Tringa melanoleuca</i>	0	0	1	1
		Lesser yellowlegs	<i>Tringa flavipes</i>	0	1	8	9
		Wilson's snipe	<i>Gallinago delicata</i>	6	14	14	34
		Ring-billed gull	<i>Larus delawarensis</i>	1	0	3	4
		Red-necked grebe	<i>Podiceps grisegena</i>	0	0	1	1
Birds of Prey	Raptors	Sharp-shinned hawk	<i>Accipiter striatus</i>	1	0	0	1
		Red-tailed hawk	<i>Buteo jamaicensis</i>	0	0	1	1
		Merlin	<i>Falco columbarius</i>	2	0	1	3
	Owls	Great horned owl	<i>Bubo virginianus</i>	0	1	0	1
		Boreal owl	<i>Aegolius funereus</i>	0	1	0	1
Upland Game Birds		Ruffed grouse	<i>Bonasa umbellus</i>	5	4	1	10

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Group	Order	Species		Level III Ecoregion			Total
		Common Name	Scientific Name	Boreal Cordillera	Taiga Cordillera	Taiga Plains	
Landbirds	Near-passerines	Common nighthawk	<i>Chordeiles minor</i>	2	1	1	4
		Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	7	4	2	13
		Black-backed woodpecker	<i>Picoides arcticus</i>	0	1	0	1
		Northern flicker	<i>Colaptes auratus</i>	2	3	6	11
		Pileated woodpecker	<i>Dryocopus pileatus</i>	4	0	0	4
		Hairy woodpecker	<i>Dryobates villosus</i>	0	0	1	1
	Passerines	Olive-sided flycatcher	<i>Contopus cooperi</i>	0	1	4	5
		Western wood-peewee	<i>Contopus sordidulus</i>	1	0	1	2
		Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	6	6	6	18
		Alder flycatcher	<i>Empidonax alnorum</i>	12	13	16	41
		Least flycatcher	<i>Empidonax minimus</i>	4	2	5	11
		Blue-headed vireo	<i>Vireo solitarius</i>	1	1	0	2
		Warbling vireo	<i>Vireo gilvus</i>	2	4	2	8
		Red-eyed vireo	<i>Vireo olivaceus</i>	0	1	0	1
		American crow	<i>Corvus brachyrhynchos</i>	0	3	1	4
		Common raven	<i>Corvus corax</i>	4	2	6	12
		Tree swallow	<i>Tachycineta bicolor</i>	0	0	1	1
		Black-capped chickadee	<i>Poecile atricapillus</i>	1	2	5	8
		Boreal chickadee	<i>Poecile hudsonicus</i>	2	1	1	4
		Townsend's solitaire	<i>Myadestes townsendi</i>	0	1	0	1
		Gray-cheeked thrush	<i>Catharus minimus</i>	0	2	1	3
		Swainson's thrush	<i>Catharus ustulatus</i>	22	25	29	76
		Hermit thrush	<i>Catharus guttatus</i>	19	24	27	70
		American robin	<i>Turdus migratorius</i>	18	17	24	59
		Varied thrush	<i>Ixoreus naevius</i>	12	0	2	14

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Group	Order	Species		Level III Ecoregion			Total
		Common Name	Scientific Name	Boreal Cordillera	Taiga Cordillera	Taiga Plains	
Landbirds (cont'd)	Passerines (cont'd)	Bohemian waxwing	<i>Bombycilla garrulus</i>	1	2	1	4
		Yellow warbler	<i>Setophaga petechia</i>	5	5	7	17
		Magnolia warbler	<i>Setophaga magnolia</i>	5	12	2	19
		Cape May warbler	<i>Setophaga tigrina</i>	1	0	1	2
		Yellow-rumped warbler	<i>Setophaga coronata</i>	16	16	20	52
		Palm warbler	<i>Setophaga palmarum</i>	4	9	11	24
		Bay-breasted warbler	<i>Setophaga castanea</i>	0	1	0	1
		Blackpoll warbler	<i>Setophaga striata</i>	4	2	10	16
		Black-and-white warbler	<i>Mniotilla varia</i>	0	4	2	6
		Tennessee warbler	<i>Leiothlypis peregrina</i>	19	22	13	54
		Orange-crowned warbler	<i>Leiothlypis celata</i>	7	14	24	45
		Ruby-crowned kinglet	<i>Corthylio calendula</i>	18	13	13	44
		American redstart	<i>Setophaga ruticilla</i>	0	1	4	5
		Ovenbird	<i>Seiurus aurocapilla</i>	5	6	1	12
		Northern waterthrush	<i>Parkesia noveboracensis</i>	4	6	5	15
		Common yellowthroat	<i>Geothlypis trichas</i>	1	3	1	5
		Wilson's warbler	<i>Cardellina pusilla</i>	0	2	4	6
		American tree sparrow	<i>Spizelloides arborea</i>	0	1	1	2
		Chipping sparrow	<i>Spizella passerina</i>	20	15	17	52
		Savannah sparrow	<i>Passerculus sandwichensis</i>	0	0	3	3
		Fox sparrow	<i>Passerella iliaca</i>	3	13	16	32
		Lincoln's sparrow	<i>Melospiza lincolni</i>	14	19	22	55
		Swamp sparrow	<i>Melospiza georgiana</i>	3	6	10	19
		White-throated sparrow	<i>Zonotrichia albicollis</i>	21	18	22	61
		Harris's sparrow	<i>Zonotrichia querula</i>	0	0	1	1

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Group	Order	Species		Level III Ecoregion			Total	
		Common Name	Scientific Name	Boreal Cordillera	Taiga Cordillera	Taiga Plains		
Landbirds (cont'd)	Passerines (cont'd)	White-crowned sparrow	<i>Zonotrichia leucophrys</i>	1	5	16	22	
		Clay-colored sparrow	<i>Spizella pallida</i>	1	2	0	3	
		Leconte's sparrow	<i>Ammospiza leconteii</i>	0	0	1	1	
		Dark-eyed junco	<i>Junco hyemalis</i>	18	14	25	57	
		Purple finch	<i>Haemorhous purpureus</i>	2	1	2	5	
		Red-winged blackbird	<i>Agelaius phoeniceus</i>	6	5	8	19	
		Pine grosbeak	<i>Pinicola enucleator</i>	2	1	1	4	
		White-winged crossbill	<i>Loxia leucoptera</i>	15	8	8	31	
		Common redpoll	<i>Acanthis flammea</i>	7	3	9	19	
		Pine siskin	<i>Spinus pinus</i>	1	2	1	4	
		Western tanager	<i>Piranga ludoviciana</i>	9	1	1	11	
		Canada jay	<i>Perisoreus canadensis</i>	5	6	6	17	
				TOTAL	356	397	493	
							1,246	



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Appendix B Tables
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Table B.7 Difference in Mean Breeding Bird Densities between the Local and Regional Study Areas¹

Group	Order	Species		Mean Breeding Density (males/ha)		
		Common Name	Scientific Name	LSA	RSA	Difference
Waterbirds	Shorebirds	Wilson's snipe	<i>Gallinago delicata</i>	0.021	0.021	0.000
		Solitary sandpiper	<i>Tringa solitaria</i>	0.012	0.012	0.000
		Lesser yellowlegs	<i>Tringa flavipes</i>	0.011	0.012	0.000
Landbirds	Near-passerines	Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	0.024	0.025	-0.001
		Hairy woodpecker	<i>Dryobates villosus</i>	0.006	0.006	0.000
		Northern flicker	<i>Colaptes auratus</i>	0.013	0.013	0.000
	Passerines	Olive-sided flycatcher	<i>Contopus cooperi</i>	0.008	0.008	0.000
		Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	0.019	0.019	0.000
		Alder flycatcher	<i>Empidonax alnorum</i>	0.151	0.144	0.007
		Least flycatcher	<i>Empidonax minimus</i>	0.052	0.051	0.001
		Blue-headed vireo	<i>Vireo solitarius</i>	0.011	0.012	0.000
		Warbling vireo	<i>Vireo gilvus</i>	0.025	0.026	-0.001
		Red-eyed vireo	<i>Vireo olivaceus</i>	0.045	0.044	0.001
		Canada jay	<i>Perisoreus canadensis</i>	0.139	0.145	-0.005
		Common raven	<i>Corvus corax</i>	0.007	0.007	0
		Black-capped chickadee	<i>Poecile atricapillus</i>	0.005	0.005	0
		Boreal chickadee	<i>Poecile hudsonicus</i>	0.057	0.059	-0.002
		Cliff swallow	<i>Petrochelidon pyrrhonota</i>	0.04	0.041	-0.001
		Ruby-crowned kinglet	<i>Corthylio calendula</i>	0.094	0.096	-0.002
		Red-breasted nuthatch	<i>Sitta canadensis</i>	0.013	0.013	0.000
		Varied thrush	<i>Ixoreus naevius</i>	0.005	0.006	0.000
		Gray-cheeked thrush	<i>Catharus minimus</i>	0.012	0.014	-0.002
		Swainson's thrush	<i>Catharus ustulatus</i>	0.399	0.395	0.004

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Appendix B Tables
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Group	Order	Species		Mean Breeding Density (males/ha)		
		Common Name	Scientific Name	LSA	RSA	Difference
Landbirds (cont'd)	Passerines (cont'd)	Hermit thrush	<i>Catharus guttatus</i>	0.106	0.108	-0.002
		American robin	<i>Turdus migratorius</i>	0.15	0.16	-0.01
		Bohemian waxwing	<i>Bombycilla garrulus</i>	0.034	0.036	-0.002
		Pine grosbeak	<i>Pinicola enucleator</i>	0.006	0.007	0.000
		Red crossbill	<i>Loxia curvirostra</i>	0.005	0.005	0.000
		White-winged crossbill	<i>Loxia leucoptera</i>	0.111	0.117	-0.005
		Pine siskin	<i>Spinus pinus</i>	0.058	0.062	-0.003
		Chipping sparrow	<i>Spizella passerina</i>	0.312	0.3	0.012
		Clay-colored sparrow	<i>Spizella pallida</i>	0.008	0.008	0.000
		American tree sparrow	<i>Spizelloides arborea</i>	0.014	0.015	-0.001
		Fox sparrow	<i>Passerella iliaca</i>	0.041	0.045	-0.004
		Dark-eyed junco	<i>Junco hyemalis</i>	0.271	0.288	-0.017
		White-crowned sparrow	<i>Zonotrichia leucophrys</i>	0.075	0.09	-0.015
		White-throated sparrow	<i>Zonotrichia albicollis</i>	0.18	0.171	0.009
		LeConte's sparrow	<i>Ammospiza leconteii</i>	0.005	0.005	0.000
		Savannah sparrow	<i>Passerculus sandwichensis</i>	0.01	0.011	-0.001
		Lincoln's sparrow	<i>Melospiza lincolnii</i>	0.17	0.173	-0.003
		Swamp sparrow	<i>Melospiza georgiana</i>	0.026	0.026	0.000
		Ovenbird	<i>Seiurus aurocapilla</i>	0.048	0.046	0.001
		Northern waterthrush	<i>Parkesia noveboracensis</i>	0.033	0.034	-0.001
		Black-and-white warbler	<i>Mniotilla varia</i>	0.022	0.023	-0.001
		Tennessee warbler	<i>Leiothlypis peregrina</i>	0.399	0.355	0.045
		Orange-crowned Warbler	<i>Leiothlypis celata</i>	0.143	0.142	0.001
		Common yellowthroat	<i>Geothlypis trichas</i>	0.016	0.016	-0.001
		American redstart	<i>Setophaga ruticilla</i>	0.039	0.04	0.000

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Appendix B Tables

May 2023

Group	Order	Species		Mean Breeding Density (males/ha)		
		Common Name	Scientific Name	LSA	RSA	Difference
Landbirds (cont'd)	Passerines (cont'd)	Cape May warbler	<i>Setophaga tigrina</i>	0.031	0.032	-0.001
		Magnolia warbler	<i>Setophaga magnolia</i>	0.084	0.085	-0.001
		Bay-breasted warbler	<i>Setophaga castanea</i>	0.037	0.037	0.000
		Yellow warbler	<i>Setophaga petechia</i>	0.033	0.034	-0.001
		Blackpoll warbler	<i>Setophaga striata</i>	0.091	0.095	-0.004
		Palm warbler	<i>Setophaga palmarum</i>	0.079	0.08	-0.002
		Yellow-rumped warbler	<i>Setophaga coronata</i>	0.38	0.395	-0.016
		Canada warbler	<i>Cardellina canadensis</i>	0.005	0.005	0.000
		Wilson's warbler	<i>Cardellina pusilla</i>	0.031	0.033	-0.002
		Western tanager	<i>Piranga ludoviciana</i>	0.039	0.039	0.000
		Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	0.006	0.006	0.000

NOTE:

¹ Data from the Boreal Avian Modelling Project (BAMP 2020)



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