

APPENDIX 20A

Birds and Bird Habitat Technical Data Report

Mackenzie Valley Highway Project Technical Data Report—Birds and Bird Habitat

Prepared for:

Government of the Northwest Territories

Prepared by:

K'alo-Stantec Limited

March 2023


Project No.: 144903025



K'alo-Stantec

Limitations and Sign-off


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Principal, Environmental Services

Executive Summary

The Government of the Northwest Territories (GNWT), Department of Infrastructure (INF) is proposing the Mackenzie Valley Highway Project (the Project) that will extend the Mackenzie Highway (Northwest Territories Highway #1) from Wrigley to Norman Wells to replace the Mackenzie Valley Winter Road (MVWR) along this portion. The Project includes construction of approximately 281 kilometres (km) of new all-season highway, and the construction and operation of temporary and permanent quarry and borrow sources. The project highway alignment will pass through the Dehcho Region and a portion of the Tulita District of the Sahtu Region within the Northwest Territories (NT).

The Regional Study Area (RSA), which is a 15 km buffer of the Project has the potential to provide habitat for 213 bird species, including 85 waterbird species, 5 upland gamebird species, 19 bird of prey species, and 104 landbird species. The RSA is also within the breeding range of 10 bird species at risk (SAR) and 2 bird species of conservation concern (SOCC). There are historical records for 11 of the 12 species within the RSA and Local Study Area (LSA), which is a 1 km buffer of the Project. The LSA is not expected to provide a key source of habitat for bird SAR and SOCC when compared to other areas in the RSA or NT as a whole, because these species are generally widely distributed and/or at the northern edge of their range. Data availability is limited for some SAR and targeted surveys for SAR most likely to interact with the Project are planned to be undertaken to fill this remaining data gap.

The biophysical characteristics of the LSA are influenced by the Mackenzie River valley that defines the landscape and is dominated by coniferous forest habitats interspersed with wetlands and watercourses. Land cover in the Dehcho Region portion of the LSA is dominated by coniferous forest (43.6%), wetlands (19.8%), and open water (19.3%), while the LSA that overlaps the Sahtu Region is dominated by coniferous forest (28.7%), wetlands (25.2%), and shrubland (20.6%). Since 1960, 18.5% of the LSA within the Dehcho Region while 75.2% of the LSA within the Sahtu Region has been subject to forest fire.

Along with the existing MVWR and communities along it (e.g., Hamlet of Tulita), the LSA contains disturbances from oil and gas exploration and production infrastructure, borrow sources and quarries, a fibre line, and bridges associated with the MVWR. Notably, the Norman Wells Pipeline, commissioned in 1985, conveys crude oil from Norman Wells south to Alberta and is located in the LSA. The RSA is relatively undisturbed, but oil and gas exploration and production infrastructure does exist on the west side of the Mackenzie River near Norman Wells.

Many bird species are culturally important to local communities (e.g., birds of prey) and for subsistence hunting (e.g., waterbirds, upland gamebirds).

The LSA is partially within the Middle Mackenzie River Important Bird Area (IBA) that provides a significant source of staging and migration habitat for migratory birds, especially waterfowl and other waterbirds. The Brackett Lake IBA provides a similarly significant source of habitat, and is located in the RSA, outside the LSA. Other sensitive wildlife features for birds are nest locations, primarily for raptors, that are located throughout the LSA and RSA. Notable concentrations of raptor nests exist in the Bear Rock Conservation Zone, west of Tulita, which is also a culturally sacred site.

Table of Contents

1	INTRODUCTION.....	1
2	STUDY AREAS	3
2.1	Project Development Area	3
2.2	Local Study Area.....	3
2.3	Regional Study Area	3
3	REVIEW OF EXISTING DATA	5
3.1	Traditional Knowledge and Traditional Land and Resource Use	5
3.1.1	Methods.....	5
3.1.2	Results.....	6
3.2	Literature Review	12
3.2.1	Methods.....	12
3.2.2	Results.....	14
4	KEY RESULTS AND FINDINGS.....	45
4.1	Additional Studies	46
5	CLOSURE.....	47
6	REFERENCES.....	48
6.1	Literature Cited.....	48
6.2	Personal Communications	55

List of Tables

Table 3.1	Bird Species at Risk and Species of Conservation Concern (*) with Potential to Occur in the Regional Study Area.....	14
Table 3.2	Land Cover Classes in the LSA and RSA for the Dehcho Region and Sahtu Region.....	17
Table 3.3	Mean 5-year Breeding Waterfowl Population Estimates from the Waterfowl Breeding Population and Habitat Survey from 2011 to 2015 ¹ in Strata 15 ²	24
Table 3.4	Critical Breeding Periods for Raptors in the Low Subarctic Ecoregion ¹	28
Table 3.5	Distribution of ECCC Breeding Bird Survey Locations by Ecoregion.....	29
Table 3.6	Distribution of ECCC Breeding Bird Survey Locations by Land Cover Class.....	29

List of Figures

Figure 1.1	MVH Project Overview	2
Figure 2.1	Birds and Bird Habitat Study Area	4
Figure 3.1	Project Overview within the Dehcho Region.....	7
Figure 3.2	Project Overview within the Sahtu Settlement Area	9
Figure 3.3	Ecoregions	16
Figure 3.4	Land Cover in the Dehcho Region.....	19
Figure 3.5	Land Cover in the Sahtu Settlement Area	20
Figure 3.6	Important Bird & Wildlife Areas in the RSA.....	22
Figure 3.7	WMIS and GNWT 2021 Raptor Nest Observations.....	27
Figure 3.8	ECCC Breeding Bird Survey and Species at Risk Observations	30
Figure 3.9	WMIS SAR Observations.....	34
Figure 3.10	eBird SAR Observations	35
Figure 3.11	Olive-sided Flycatcher Breeding Density	40

List of Appendices

APPENDIX A TABLES

Abbreviations

ATV	all-terrain vehicle
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CZ.....	Conservation Zone
DLUP	Dehcho Land Use Plan
ECCC	Environment and Climate Change Canada
EOSD NWT	Earth Observation of Sustainable Development of Forests Northwest Territories
GNWT	Government of the Northwest Territories
ha	hectare
IBA.....	Important Bird Area
INF.....	Department of Infrastructure
IWA.....	Important Wildlife Area
KM.....	kilometre marker
km.....	kilometre
LSA.....	local study area
m	metre
MVH	Mackenzie Valley Highway
MVWR	Mackenzie Valley Winter Road
NT.....	Northwest Territories
PDA	project development area
RSA	regional study area
SAR	species at risk
SARA.....	Species at Risk Act
SMZ.....	Special Management Zone
SLUP	Sahtu Land Use Plan
SOCC	species of conservation concern
TDR	Technical Data Report
TK.....	traditional knowledge
TLRU	traditional land and resource use

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

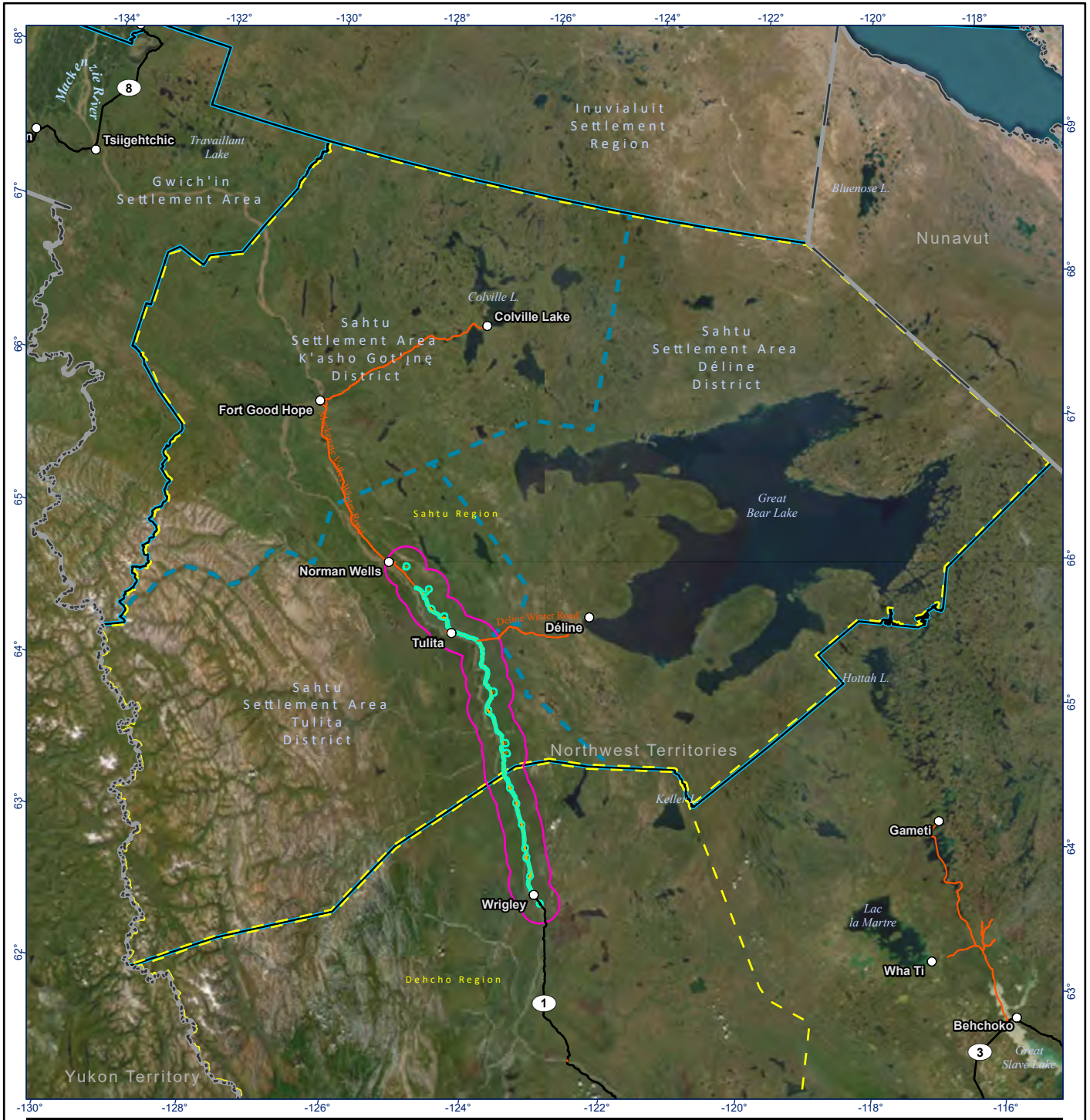
Abbreviations
March 2023

the Project Mackenzie Valley Highway Project
WMIS Wildlife Management Information System

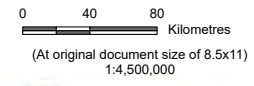
1 Introduction

The Government of the Northwest Territories (GNWT), Department of Infrastructure (INF) is proposing the Mackenzie Valley Highway Project (the Project) that will extend the Mackenzie Highway (Northwest Territories Highway #1) from Wrigley to Norman Wells to replace the Mackenzie Valley Winter Road (MVWR) along this portion. The Project includes construction of approximately 281 kilometres (km) of new all-season highway, and the construction and operation of temporary and permanent quarry and borrow sources. The project highway alignment will pass through the Dehcho Region and a portion of the Tulita District of the Sahtu Region within the Northwest Territories (NT; Figure 1.1).

The Project is subject to an environmental assessment and the requirements of Part 5 of the *Mackenzie Valley Resource Management Act*. This Technical Data Report (TDR) presents the existing conditions for the Birds and Bird Habitat valued component to support development of the Developer's Assessment Report, as required by the Terms of Reference (MVEIRB, 2015). As part of the environmental assessment process, the Developer's Assessment Report will present the GNWT's assessment of effects of the Project on the environment.



- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
- Granular Borrow / Rock Quarry Site and Access
- Local Study Area
- Regional Study Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- Settlement Area Boundary
- Region Boundary
- Territorial Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by AT on 3/8/2023
 TR by AJ on 3/8/2023

Client/Project: 144903025-0031 REV8

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No. **1.1**
 Title **MVH Project Overview**

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

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2 Study Areas

The Project is in the Mackenzie Valley region of the NT between the current terminus of the existing all-weather highway in Wrigley (Highway #1, kilometre marker [KM] 690) and Prohibition Creek (located approximately 28 km southeast of Norman Wells). The Project alignment parallels the Mackenzie River to its east and passes through the community of Tulita (KM 938 of the MVWR). The Mackenzie Valley region has the potential to provide breeding habitat for hundreds of bird species and important staging habitat for more northern migratory species.

The local study area (LSA) and regional study area (RSA) used in this TDR are areas where data was collected to characterize the existing environmental conditions for birds and bird habitat in support of the Project-specific effects assessment and the cumulative effects assessment (Figure 2.1).

2.1 Project Development Area

The Project Development Area (PDA) is the area of direct Project disturbance within which works and activities will occur (footprint). This includes a new two-lane gravel highway, 60 metre (m) wide highway right-of-way (ROW), laydown and staging areas, maintenance yards, construction camps and quarry/borrow sites with access roads on a 30 m ROW.

2.2 Local Study Area

The LSA is a 1 km buffer around the highway alignment component of the Project (i.e., centreline), except around quarries where the LSA increases to a 2 km buffer around the PDA. The size of the buffer is based on measurable effects on migratory birds (e.g., songbirds and waterbirds; Benitez-Lopez et al., 2010; Shannon et al., 2016) while also considering recommended setback distances from bird habitat features (Appendix A, Table A.1; GNWT, 2015a). The size of the LSA is also consistent with guidance provided by Environment and Climate Change Canada (ECCC; Dufour, 2020, pers. comm.).

2.3 Regional Study Area

The RSA is a 15 km buffer around the proposed road alignment that is used to capture a wide range of wildlife species and wildlife habitats that could potentially be affected cumulatively by the Project and other past, present, and reasonably foreseeable projects. This is consistent with other highway projects in the NT (e.g., Inuvik to Tuktoyaktuk Highway [Kiggiak - EBA Consulting Ltd., 2011]) and follows recommendations from ECCC (Dufour, 2020, pers. comm.).



- Proposed Mackenzie Valley Highway Project
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (Permitted)
- Proposed Great Bear River Bridge
- Local Assessment Area
- Regional Assessment Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- Region Boundary
- Settlement Area Boundary

0 10 20 Kilometres
 (At original document size of 8.5x11)
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Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0030 REV B
 Prepared by AT on 3/8/2023
 TR by AJ on 3/8/2023

Government of Northwest Territories
 Mackenzie Valley Highway Project
 Figure No. 2.1
 Title: **Wildlife and Wildlife Habitat Study Areas**

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 Geographics
 World Hillshade: Esri, USGS. Imagery date: 2021

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3 Review of Existing Data

The TDR was developed to address the Project Terms of Reference (MVEIRB, 2015) using a literature review of currently available information.

A review of existing traditional knowledge (TK) and traditional land and resource use (TLRU; Section 3.1) and review of relevant literature for birds (Section 3.2) was completed. Results are used to characterize the existing conditions for birds and bird habitat within the LSA and RSA.

An overview characterizing the bird community is provided by general species groups (waterbirds, upland game birds, raptors, and landbirds) and there is an emphasis on species at risk (SAR) and species of conservation concern (SOCC; defined in Section 3.2.2.1).

3.1 Traditional Knowledge and Traditional Land and Resource Use

Available TK and TLRU contributed to the description of existing conditions for birds and bird habitat, particularly as it relates to harvested species, species of cultural importance, and the presence of sensitive habitat features in the RSA.

3.1.1 Methods

Existing TK and TLRU information were obtained through several sources, including land use planning documents and regional research projects for the two administrative regions traversed by the Project: the Dehcho Region and the Sahtu Region. An overview of the key TK and TLRU resources used to assist in characterizing the existing condition for birds and bird habitat are presented below.

- ***Respect for the Land: the Dehcho Land Use Plan – Draft (DLUP)***: Guidance document that incorporates the cultural, social, and economic factors relating to the management and conservation of natural resources as it relates to development projects within the Dehcho Region (DLUPC, 2006).
- ***A Spatial Analysis and Literature Review of Wildlife and Wildlife Habitat in the Dehcho Territory***: A spatial representation of the current knowledge of wildlife and wildlife habitat within the Dehcho Region (EBA Engineering Consultants, 2003).
- ***Project Description Report for the Dehcho Region***: A preliminary screening document summarizing baseline environmental information, including for migratory birds and SAR/SOCC, as it relates to the Project in the Dehcho Region (Dessau, 2012).
- ***Tulita Renewable Resources Council Traditional Land and Resource Use Study for Tulita District Mackenzie Highway Project 2022***: Report prepared for MVH Project to describe Traditional Land and Resource use within the Tulita District (TRRC, 2022).
- ***Sahtu Land Use Plan (SLUP)***: A document guiding how natural resources will be conserved and developed in the Sahtu Region (SLUPB, 2013).

- ***The Sahtu Atlas – Maps and Stories from the Sahtu Settlement Area in Canada’s Northwest Territories:*** A document containing historical TK and TU information from the Sahtu Region (Auld and Kershaw, 2005).
- ***Final Report of the Sahtu Harvest Study:*** A survey of Sahtu Dene and Métis hunters that reported wildlife harvest activities in the Sahtu Region between 1998 and 2005 (SRRB, 2021).
- ***Sahtu Dene and Métis Comprehensive Land Claim Agreement:*** A document outlining the species and areas subject to preferential or exclusive rights for Indigenous Peoples of the Sahtu Region (INAC, 1993).
- ***Project Description Report for the Sahtu Region:*** A preliminary screening document summarizing baseline environmental information, including for migratory birds and SAR/SOCC, as it relates to the proposed Project in the Sahtu Region (5658 NWT Ltd. and GNWT, 2011).
- **Other TK and TLRU Resources:** Documents that provided information on the historical or existing condition for birds and bird habitat:
 - *Rakekée Gok’é Godi: Places We Take Care Of* (SHPSJWG, 2000).
 - *Draft Report on Renewable Resource Assessment of the Pehdzeh Ndeh Area of Interest* (IMG-Golder Corporation, 2006).
 - *Traditional Knowledge Study Report Tulita, NT, Great Bear River Bridge* (EBA Engineering Consultants, 2006).
 - *Traditional Knowledge Study for the Great Bear River Bridge Project* (TRRC, 2019).

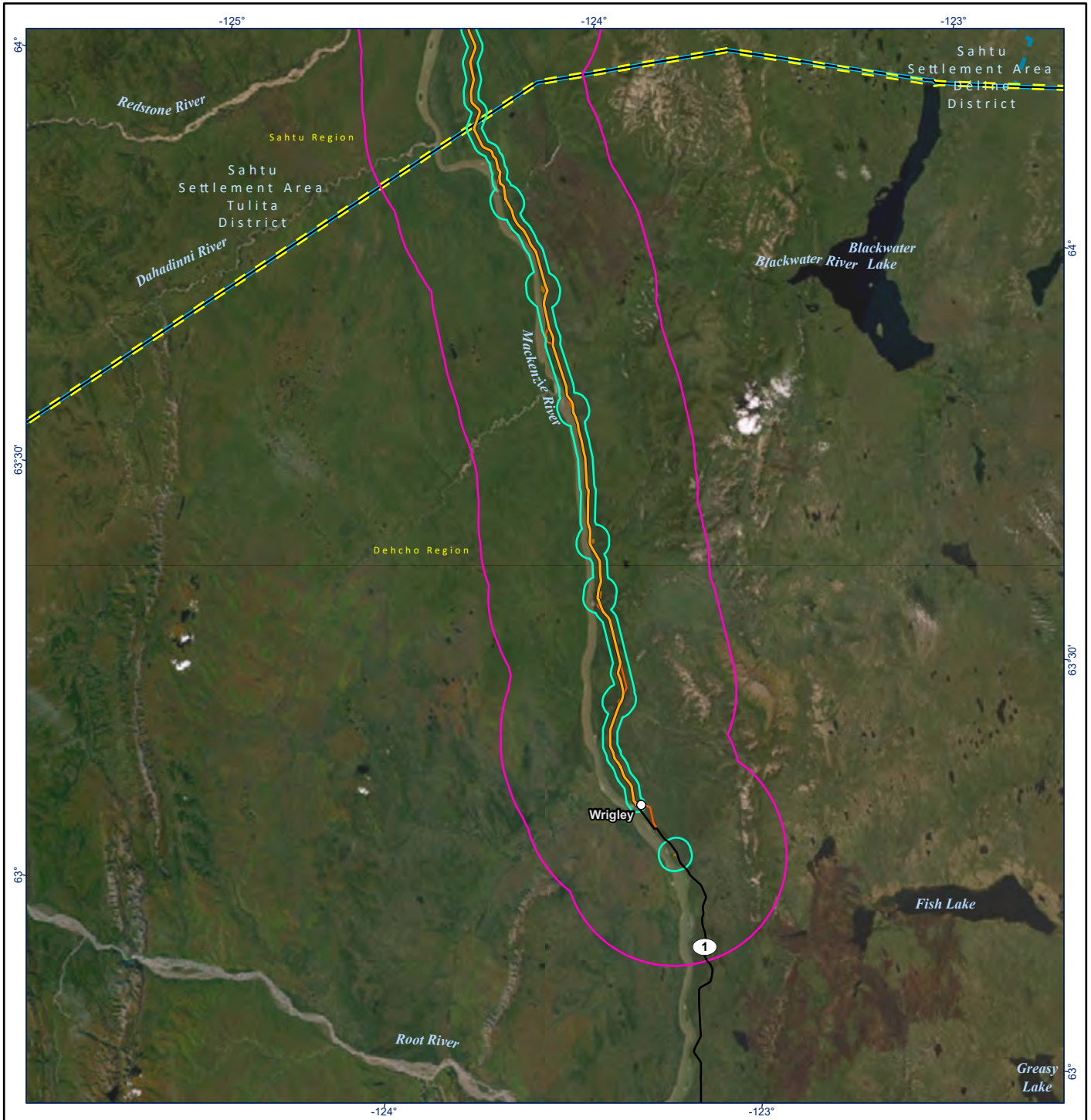
3.1.2 Results

The results are presented by their respective region and are consistent with information summarized in the Cultural and Traditional Land Use TDR (K’alo-Stantec, 2022a).

3.1.2.1 Dehcho Region

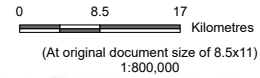
The Project traverses approximately 102 km of the Dehcho Region and includes 26,819.7 hectares (ha) of land within the LSA and 359,038.0 ha within the RSA (Figure 3.1).

The DLUP focuses on protecting Dene culture and traditional land use (e.g., hunting, trapping) as the highest priority. Dehcho First Nation members seek to maintain existing TLRU opportunities within the territory (DLUPC, 2006). The DLUP identified areas that have significant ecological and cultural values (DLUPC, 2006) and provides habitat for a wide variety of wildlife species, including migratory birds (Desseau, 2012). The Project also traverses the proposed Mackenzie Valley Special Infrastructure Corridor, which has been approved for infrastructure development (primarily the previously proposed Mackenzie Valley Pipeline).



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- Region Boundary
- Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0032 REV B

Prepared by AT on 3/8/2023
 TR by AJ on 3/8/2023

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No.
3.1

Project Overview within the Dehcho Region

Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
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 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS

The DLUP also provides guidance for critical lifecycle periods for several sensitive bird species. The activity restrictions presented in Appendix A, Table A.1 are consistent with or more conservative than those proposed in the DLUP.

There is no land claim agreement in the Dehcho Region and, thus, there are no species or areas subject to preferential or exclusive rights for Indigenous Peoples of the region.

Wetlands and watercourses have been identified as being an important resource for waterfowl in the region and ducks, geese, and swans are harvested by local resource users (Desseau, 2012). Wildlife is a key renewable resource and subsistence harvesting is an important food resource among residents (IMG-Golder Corporation, 2011; also see the Cultural and Traditional Land Use TDR [K'alo-Stantec, 2022a]). The Blackwater River system between Blackwater Lake and the Mackenzie River is an important hunting area for ducks, geese, and swans (Desseau, 2012).

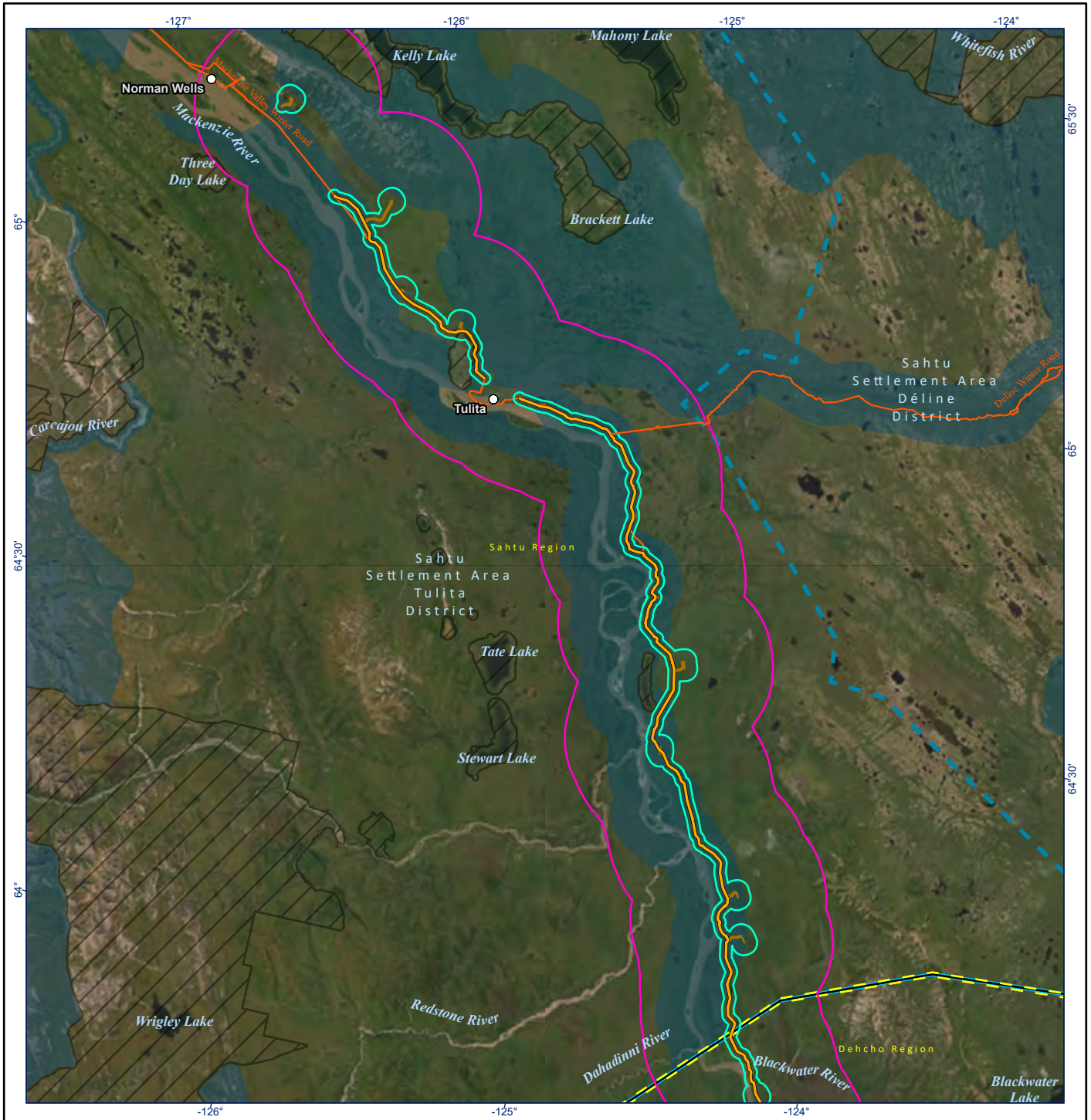
3.1.2.2 *Sahtu Settlement Area*

The Project traverses 179 km of the Sahtu Region and includes 48,539.9 ha of land within the LSA and 616,807.0 ha within the RSA (Figure 3.2).

The SLUP focuses on maintaining and/or enhancing ecological and cultural integrity while increasing the decision-making capacity and economic self-sufficiency of the community through sustainable development of natural resources (SLUBP, 2013). A key component of the SLUP is the protection and conservation of species of interest (i.e., species of cultural, conservation, or subsistence importance) and their habitats, and includes recommended activity restriction guidelines for sensitive species. The activity restrictions presented in Appendix A, Table A.1 are consistent with or more conservative than those presented in the SLUP.

The Project primarily traverses through the Deh Cho (Mackenzie River) SMZ No. 63 of the SLUP (2.2% of Sahtu Region) that is an area designated to protect the water quality, riparian habitat, cultural/heritage sites, and areas that are important for wildlife and wildlife harvesting (SHPSJWG, 2000; SLUBP, 2013). The SMZ allows for the continued use of the areas as a riverine and territorial transportation corridor (e.g., barge traffic, MVWR). Bulk water removal is the only prohibited land use.

The Bear Rock CZ (No. 32), approximately 4 km northwest of Tulita, is a culturally sacred site located within the LSA (SLUBP, 2013). The CZ is a large karst formation subject to traditional storytelling and provides habitat for a wide variety of wildlife species (see Section 3.2.2.1), including nesting raptors (SHPSJWG, 2000; EBA Engineering Consultants, 2003; SLUBP, 2013).



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0 10 20 Kilometres
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Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0033 REV B
 Prepared by AT on 3/8/2023
 TR by AJ on 3/8/2023

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No.
3.2

Project Overview within the Sahtu Settlement Area

Notes
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 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 Geographics
 World Hillshade: Esri, USGS

The Mackenzie Valley is along an important migratory route in the Central Flyway, a path used by a large number of birds migrating between northern breeding grounds and southern overwintering grounds. The RSA contains the northernmost waterfowl banding station at Willow Lake that is jointly operated by the United States Fish and Wildlife Service, the Tulita Renewable Resources Council and the GNWT Department of Environment and Natural Resources (Auld and Kershaw, 2005; SRRB, 2020). The station is within the Brackett Lake Important Bird Area (IBA; IBA Canada, 2020a) and has been in operation since 1995 (25 years), with the primary objective of capturing and banding mallard (*Anas platyrhynchos*) and northern pintail (*Anas acuta*; SRRB, 2020).

Bird species occurring within the RSA that are important to members of the Sahtu Region for subsistence and cultural reasons include Canada goose (*Branta canadensis*), tundra swan (*Cygnus columbianus*), snow goose (*Anser caerulescens*), loon (*Gavia* species), sandhill crane (*Grus canadensis*), peregrine falcon (*Falco peregrinus anatum/tundrius*), short-eared owl (*Asio flammeus*), ptarmigan (*Lagopus* species), common raven (*Corvus corax*), and Canada (gray) jay (*Perisoreus canadensis*; Auld and Kershaw, 2005).

The Sahtu Dene and Métis Comprehensive Land Claim Agreement provides Indigenous Peoples the right to harvest bird species, excluding migratory non-gamebirds and migratory insectivorous birds as defined in the *Migratory Birds Convention Act*, within the settlement area at all seasons of the year (subject to limitations within the Agreement; INAC, 1993). There are no Special Harvest Areas within the LSA, but there are three Special Harvest Areas within the RSA; all are islands in the Mackenzie River (IAAC, 1993).

Important areas for birds and bird hunting are typically associated with wetlands and watercourses, including the Mackenzie River and Great Bear River (SHPSJWG, 2000). Four Mile Island south of Tulita has been identified as an area used for hunting during the migration season (EBA Engineering Consultants, 2006) and, according to interviews with Sahtu harvesters, upland gamebirds can be found around Tulita (EBA Engineering Consultants, 2006; TRRC, 2019). The area around Brackett Lake and wetlands nearby support large populations of animals and the oral tradition records many stories that tell of the importance of this lake (SHPSJWG, 2000).

Harvest composition of birds in the Sahtu Region is dominated by Canada goose (34%), followed by mallard (18%), grouse and ptarmigan species (17%), and other duck (17%) and goose (13%) species (SRRB, 2021).

Through the Project-specific engagement program, participants indicated:

- Concern that construction and operation of the Project will disturb (physical and sensory disturbance) wildlife year-round, including during blasting.
- Concern how the Project will affect result in greater boat traffic (and disturbance) on the Mackenzie River.
- Concern that the Project will facilitate the introduction of invasive species.
- There typically no wildlife collisions on the MVWR and most motorists will give wildlife the right of way, but this should be included in Project monitoring.

- Concern that the Project will increase hunting pressure by non-resident hunters and wildlife need to be protected.
- Communities are interested in collaborating with GNWT to address uncertainties around monitoring relating to harvest monitoring and stewardship based on Dene laws, for example.
- Climate change affects food security and many people will fish if wildlife moves away and this should be monitored.

Recent TLRU information (TRRC, 2022) indicates that:

- Many types of wildlife are harvested within the LSA.
- Ptarmigans are harvested within the LSA.
- There is a travel and migration route for waterfowl overhead of the Bear River Bridge.
- There are fewer waterfowl migrating in the LSA due to changes in weather that effect the ability to undertake TLRU.
- Waterfowl are harvested year-round in the LSA, particularly in spring.
- Changes observed in waterfowl health have affected waterfowl harvesting within the LSA.
- There are different species of birds in the LSA that affect undertaking TLRU.
- Geese and ducks are typically harvested in the spring (April, May, June).
- Plants and wildlife are still needed to undertake TLRU (e.g., food and hides for personal use).
- Hunting occurs along the shores of Bear River year-round and camping and fishing during the summer.
- Signage should be used to promote highway access and to protect wildlife in the area and help mitigate potential Project effects.
- Upland gamebirds are harvested in the summer, especially along the pipeline by Four Mile Creek during the winter.
- Country food is an important part of community residents' diet and is shared among the community, family members, and friends in all seasons (particularly during spring and winter). The community relies on it and is in constant need of wildlife/country foods for sustenance.
- The MVWR and pipeline ROW has affected valued resources.
- Harvesting and hunting within the LSA are accessed mostly during the wintertime.
- Previous road construction and operation has made it easier to access valued resources.

3.2 Literature Review

A literature review was used to establish the existing condition for birds and bird habitat and identify the presence of sensitive features and SAR and SOCC in the RSA.

3.2.1 Methods

Background information was obtained through several sources, including maps and photographs, territorial and federal databases and guidance documents, and not-for-profit publications and data sources. An overview of some of the key resources used during background review to assist in characterizing the existing condition for birds and bird habitat is presented below.

- **Maps and photographs:** Topographic mapping and orthographic aerial imagery were used to help identify watercourses, lakes and/or wetlands, and to provide an overall indication of site topography (Digital Globe, 2019).
- **Species at risk public registry:** An online database containing the status of species assessed and listed under the federal *Species at Risk Act* (SARA) and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and associated documentation including assessment and status reports, recovery strategies and critical habitat designations, and management strategies (Government of Canada, 2021a).
- **GNWT Spatial Data Warehouse Geospatial Portal database:** Online databases used, in part, for screening resource development projects in NT. The databases include information such as SAR ranges and important wildlife areas (e.g., raptor nesting areas; GNWT, 2020a).
- **GNWT Species at Risk in the Northwest Territories:** A biennial publication outlining the status and distribution of territorially and federally assessed and listed SAR in NT (GNWT, 2020b).
- **GNWT Species 2016-2020 – General Status Ranks of Wild Species in Northwest Territories:** An overview of the status of the flora and fauna of NT (Working Group on the General Status of NWT Species, 2016).
- **GNWT Wildlife Management Information System (WMIS):** A territorial geo-referenced wildlife database for historical wildlife records (GNWT, 2020c).
- **Important Wildlife Areas in the Western Northwest Territories:** A report outlining the location of known important wildlife areas to help guide development and resource management (Wilson and Haas, 2012).
- **North American Breeding Bird Survey databases:** Data from annual surveys of breeding birds in North America used to monitor trends in species abundance and distribution (Pardieck et al., 2019; Smith et al., 2019) were used to identify potential SAR in the study areas and assess local population trends.
- **IBA Canada:** A national database describing the location and characteristics of important bird areas in Canada (IBA Canada, 2020b).

- **eBird:** A database of locational data for bird species within the RSA (including from past projects [e.g., Mackenzie Valley Pipeline Project]; eBird, 2021).
- **ECCC breeding bird survey data:** A dataset of breeding bird observations from 118 locations along the existing MVWR (i.e., within the LSA) and within the RSA using two survey methods (ECCC, 2020a):
 - Autonomous recording unit surveys completed at 53 locations (50 in the LSA) in 2017, primarily along the existing winter road, using multiple 3-minute listening periods over several days between June 1-30. Automated audio recognizers were used to identify common nighthawk and olive-sided flycatcher at all sites and yellow rail at six sites where preferred habitat was present. The data was also summarized to identify the presence, habitat associations, and relative abundance of breeding migratory birds within the LSA.
 - In-field surveys completed by human observers at 65 locations (34 in the LSA) in 2004 and 2006 using a single 10-minute point count survey method. Clustered sampling with point count locations 100-150 m apart. Data was examined for SAR/SOCC detections and used to characterize the breeding bird community.
- **GNWT aerial raptor survey data:** The Department of Environment and Natural Resources completed an aerial raptor survey within 1.5 km of the winter road in the Sahtu region in 2021 to identify raptor stick nests and sensitive breeding habitats that may interact with the Project (GNWT, 2021).

3.2.1.1 Species at Risk and Species of Conservation Concern

SAR are species listed as special concern, threatened, or endangered under the *Species at Risk (NWT) Act* (GNWT, 2020b) or under Schedule 1 of the federal SARA (Government of Canada, 2021a), and SOCC are species assessed as special concern, threatened, or endangered by the NWT Species at Risk Committee (SARC; GNWT, 2020b) or COSEWIC (Government of Canada, 2021a).

3.2.1.2 Habitat Identification

Land cover within the LSA and RSA was quantified using Earth Observation of Sustainable Development of Forests Northwest Territories (EOSD NWT) geospatial data (NRCan and GNWT, 2017). This dataset is part of the Multi-source Vegetation Inventory Project (Natural Resources Canada, 2020) and uses an unsupervised classification and cluster analysis to classify land cover.

The EOSD NWT dataset includes cover type and density classes and forest structure height and volume information based on Landsat imagery collected from 2007 to 2013. Mapping was done at a scale of 1:250,000 and was refined through field evaluation by the GNWT (NRCan and GNWT, 2017). Detailed land cover classification methods for this Project are discussed in the Vegetation and Wetlands TDR (K'alo-Stantec, 2022b).

3.2.2 Results

Results indicate that 213 bird species have the potential to occur in the RSA (Appendix A, Table A.2; GNWT, 2020c), including 12 SAR/SOCC. The results for birds and bird habitat are presented in greater detail by taxonomic grouping, with an emphasis placed on harvested species and species of regulatory and/or conservation importance:

- **Waterbirds** – 85 species of waterfowl (e.g., ducks, geese [family *Anatidae*]), waterbirds (e.g., grebes [family *Podicipedidae*], loons [family *Gaviidae*]), and shorebirds (e.g., sandpipers [family *Scolopacidae*], terns [family *Sterninae*])
- **Upland gamebirds** – five species of grouse and ptarmigan (family *Phasianidae*)
- **Birds of prey** – 19 species of raptors (e.g., eagles, hawks [family *Accipitridae*]) and owls (family *Strigidae*)
- **Landbirds** – 104 species of passerines (e.g., warbler [family *Parulidae*], sparrows [family *Passerellidae*]) and near-passerines (e.g., woodpeckers [family *Picidae*])
- **SAR and SOCC** – federally and territorially assessed and listed species (see Section 3.2.1.1 and Table 3.1)

Table 3.1 Bird Species at Risk and Species of Conservation Concern (*) with Potential to Occur in the Regional Study Area

Species		Status in NT ¹		Status in Canada ²	
Common Name	Scientific Name	SARC Assessment	SAR (NWT) Act	COSEWIC	SARA
Peregrine falcon	<i>Falco peregrinus anatum/tundrius</i>	Not Assessed	No Status	Not at Risk	Special Concern ^o
Yellow rail	<i>Coturnicops noveboracensis</i>	Not Applicable	Not Applicable	Special Concern	Special Concern
Lesser yellowlegs*	<i>Tringa flavipes</i>	Not Applicable	Not Applicable	Threatened	Not Listed ^o
Red-necked phalarope	<i>Phalaropus lobatus</i>	Not Applicable	Not Applicable	Special Concern	Special Concern
Short-eared owl	<i>Asio flammeus</i>	Not Assessed	No Status	Threatened	Special Concern ^o
Common nighthawk	<i>Chordeiles minor</i>	Not Applicable	Not Applicable	Special Concern	Threatened ^o
Olive-sided flycatcher	<i>Contopus cooperi</i>	Not Applicable	Not Applicable	Special Concern	Threatened ^o
Bank swallow	<i>Riparia riparia</i>	Not Applicable	Not Applicable	Threatened	Threatened
Barn swallow	<i>Hirundo rustica</i>	Not Applicable	Not Applicable	Special Concern	Threatened ^o
Harris's sparrow*	<i>Zonotrichia querula</i>	Not Applicable	Not Applicable	Special Concern	Not Listed ^o

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Section 3: Review of Existing Data
March 2023

Species		Status in NT ¹		Status in Canada ²	
Common Name	Scientific Name	SARC Assessment	SAR (NWT) Act	COSEWIC	SARA
Rusty blackbird	<i>Euphagus carolinus</i>	Not Assessed	No Status	Special Concern	Special Concern
Horned grebe	<i>Podiceps auritus</i>	Not Applicable	Not Applicable	Special Concern	Special Concern

Notes:

- ¹ Species at risk in NT assessed by SARC and listed under the territorial *Species at Risk (NWT) Act* (GNWT, 2020b). Not applicable: *Species at Risk (NWT) Act* does not apply to this species (GNWT, 2020a)
- ² Species at risk in Canada assessed by COSEWIC and listed under Schedule 1 the federal *Species at Risk Act* (Government of Canada, 2021a)
- * Species of conservation concern
- ◊ Under consideration for Schedule 1 status change

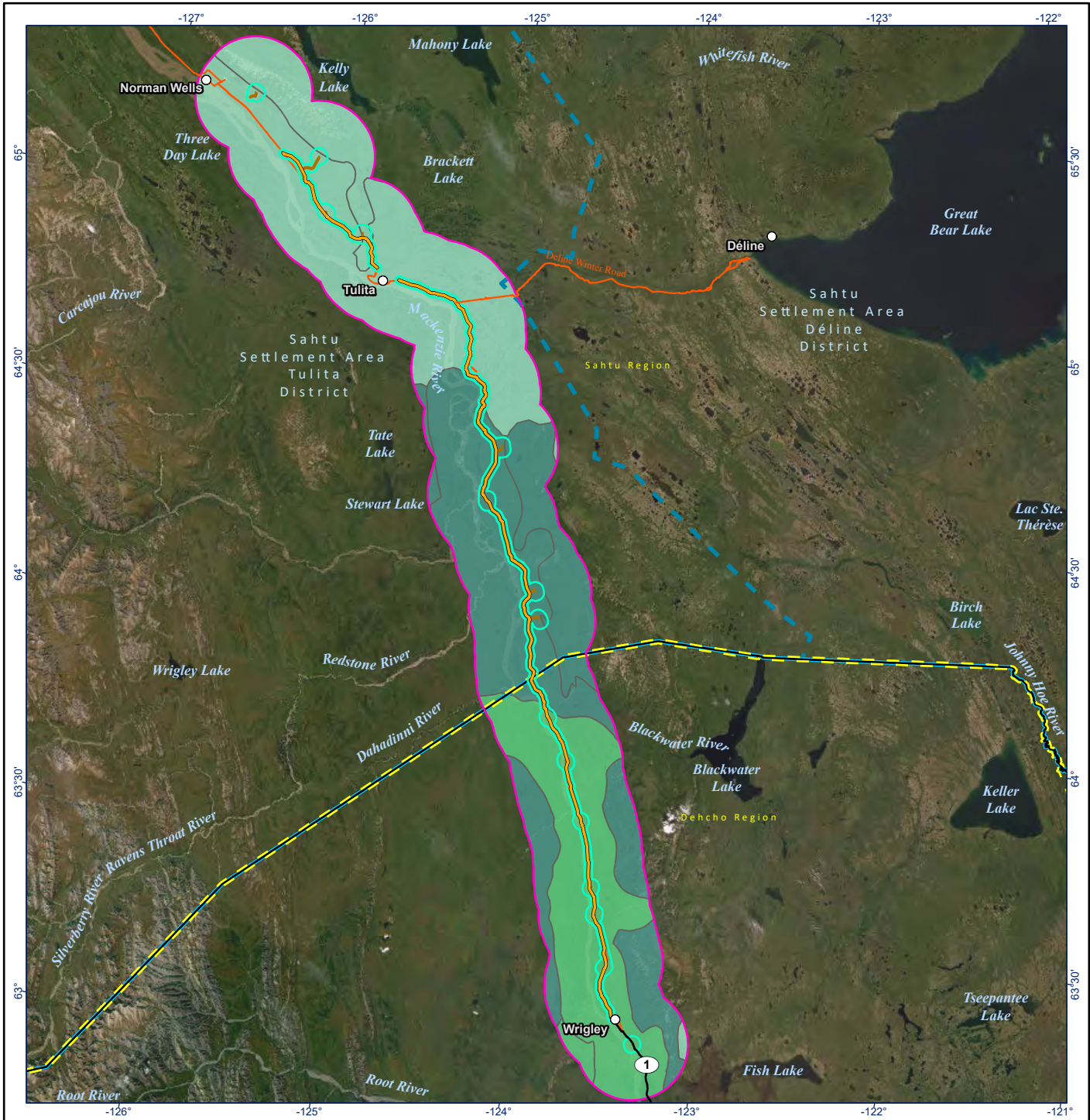
3.2.2.1 Overview

Bird Habitat

The Project is within the Mackenzie River valley (Mackenzie Valley), a landscape dominated by the Mackenzie River, known as the Deh Cho (meaning Big River) by local Dene First Nations, which is the longest river in Canada (1,738 km) spanning from Great Slave Lake to the Beaufort Sea. The Mackenzie River is a defining feature on the western Canadian landscape and the river basin, at 1.8 million km² which is approximately 20% of Canada’s landmass, is the second largest in North America, second only to the Mississippi River basin (MRBB, 2020).

The LSA is located primarily within the Mackenzie River valley plain and characterized by relatively subdued topographical relief that gives rise to the Mackenzie Mountains to the west and the Franklin Mountains to the east. Within the Mackenzie Valley, the LSA traverses the Boreal and Taiga Cordillera Ecoregions (Central Mackenzie Valley and Central Mackenzie Plains subregions [Level IV]; ECG, 2010) in the south and the Taiga Plains Ecoregion (North Mackenzie Plains Low Subarctic and Norman Range Low Subarctic subregions [Level IV]; ECG, 2007) in the north (Figure 3.3). The Norman Range Low Subarctic subregion, traversed by the Project in a small area, is the only area of notable topographical relief along the LSA and contains the Bear Rock massif, a rock formation rising 400 metres (m) above the Mackenzie River and extending east to join the Franklin Mountains.

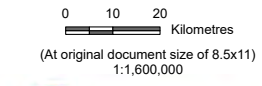
Land cover in the Dehcho Region portion of the LSA (26,819.7 ha) is dominated by coniferous forest (43.6%), wetlands (19.8%), and open water (19.3%; e.g., the Mackenzie River; Table 3.2; Figure 3.4), while the LSA that overlaps the Sahtu Region (48,539.9 ha) is dominated by coniferous forest (28.7%), wetlands (25.2%), and shrubland (20.6%; Table 3.2; Figure 3.5). Forest fires within the Dehcho Region have been relatively uncommon and comparably smaller than in the Sahtu Region. From 1960 to 2019 fires within the LSA have burned a total of 4,956.7 ha (18.5%) of land cover in the Dehcho Region and 36,521.7 ha (75.2%) of land cover in the Sahtu Region. However, forest fire prevalence within the RSA has been similar in the Dehcho Region (50.8%) and Region (52.8%).



Level III Ecoregion

- Boreal Cordillera, High Boreal
- Taiga Cordillera, Low Subarctic
- Taiga Plains, Low Subarctic
- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
- Granular Borrow / Rock Quarry Site and Access

- Local Study Area
- Regional Study Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- Region Boundary
- Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by AT on 2023-03-07
 TR by AJ on 2023-03-07

Client/Project: 144903025-0034 REV C

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 Mackenzie Valley Highway Project

Figure No.
3.3

Title
Ecoregions

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

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Table 3.2 Land Cover Classes in the LSA and RSA for the Dehcho Region and Sahtu Region

Land Cover Category	Land Cover Class ¹	Dehcho Region		Sahtu Region	
		LSA	RSA	LSA	RSA
		ha (%)	ha (%)	ha (%)	ha (%)
Upland	Broadleaf Dense	1,037.4 (3.9%)	43,781.3 (12.2%)	2,253.1 (5.2%)	34,259.4 (5.3%)
	Broadleaf Open	114.8 (0.4%)	4,154.7 (1.2%)	1,103.9 (2.3%)	14,627.9 (2.2%)
	Broadleaf Sparse	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)
	Coniferous Dense	3,374.9 (12.6%)	25,120.5 (7.0%)	917.8 (1.9%)	18,580.5 (2.9%)
	Coniferous Open	4,600.6 (17.2%)	40,034.2 (11.2%)	6,678.1 (13.8%)	113,316.2 (17.4%)
	Coniferous Sparse	3,725.0 (13.9%)	51,491.5 (14.3%)	6,332.6 (13.0%)	71,845.9 (11.0%)
	Mixedwood Dense	1,035.1 (3.9%)	6,786.9 (1.9%)	387.3 (0.8%)	7,494.4 (1.1%)
	Mixedwood Open	117.1 (0.4%)	2,728.5 (0.8%)	2,514.0 (5.2%)	23,834.7 (3.7%)
	Mixedwood Sparse	0.0 (0.0%)	0.0 (0.0%)	6.3 (<0.1%)	11.7 (<0.1%)
	Shrub Low	567.4 (2.1%)	39,005.2 (10.9%)	7,903.4 (16.3%)	72,607.6 (11.1%)
	Shrub Tall	320.6 (1.2%)	1,616.4 (0.5%)	2,091.3 (4.3%)	16,525.8 (2.5%)
	Herbaceous	50.6 (0.2%)	1,300.1 (0.3%)	210.9 (0.4%)	4,093.2 (0.6%)
	Bryoids	7.0 (<0.1%)	20.4 (<0.1%)	6.2 (<0.1%)	137.0 (<0.1%)
	Rock/Rubble	45.1 (0.2%)	4,916.4 (1.4%)	107.3 (0.2%)	10,285.3 (1.6%)
	Exposed Land	1,338.0 (5.0%)	4,862.2 (1.4%)	1,713.2 (3.5%)	9,897.9 (1.5%)
Total	16,333.6 (60.9%)	225,848.3 (62.9%)	32,495.5 (66.9%)	397,517.4 (61.0%)	

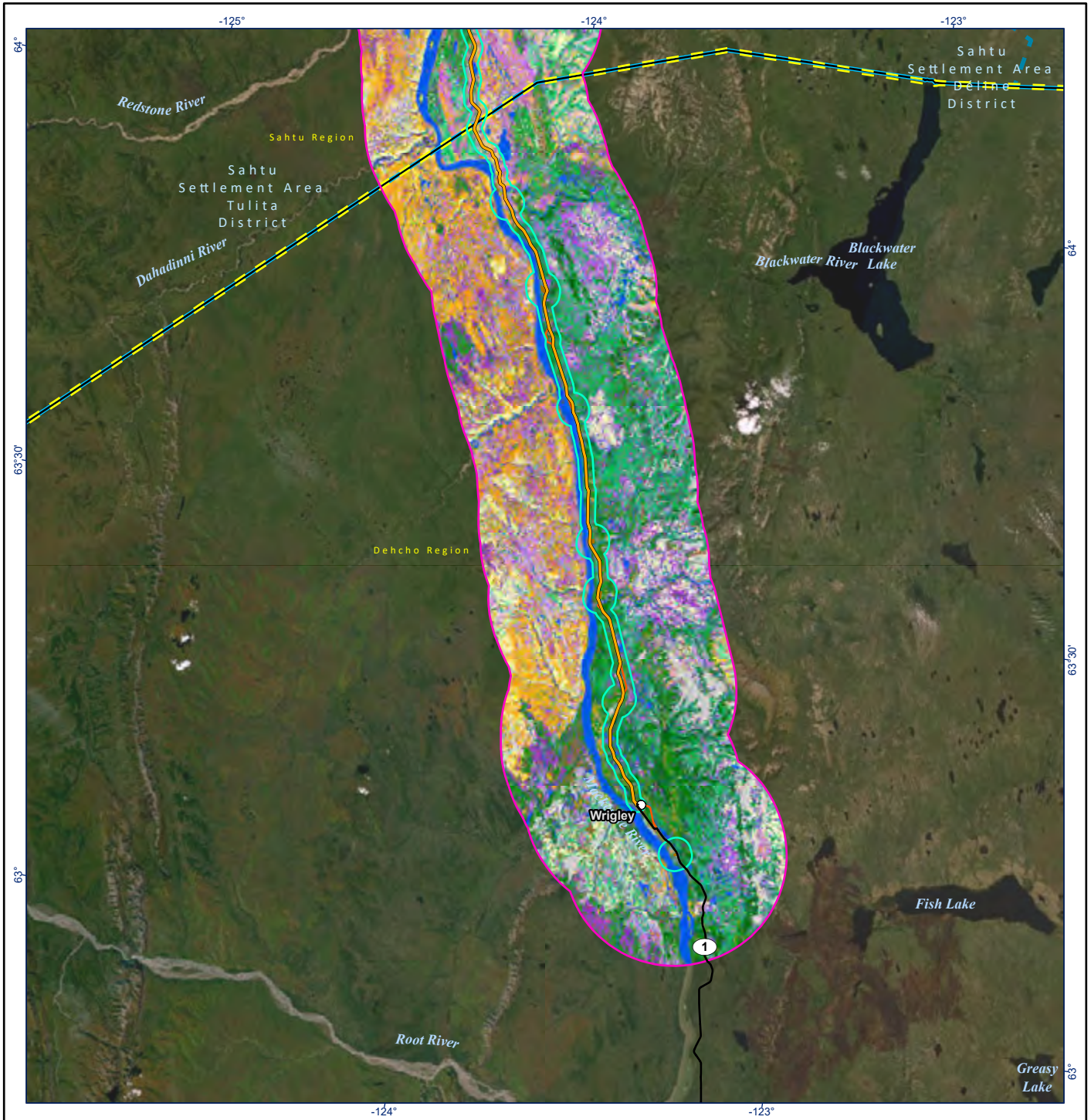
**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Section 3: Review of Existing Data
March 2023

Land Cover Category	Land Cover Class ¹	Dehcho Region		Sahtu Region	
		LSA	RSA	LSA	RSA
		ha (%)	ha (%)	ha (%)	ha (%)
Wetland	Wetland Herbaceous	856.8 (3.2%)	12,668.3 (3.5%)	2,976.9 (6.1%)	44,854.8 (6.9%)
	Wetland Shrub	2,222.9 (8.3%)	44,730.3 (12.5%)	4,503.7 (9.3%)	55,337.6 (8.5%)
	Wetland Treed	2,218.9 (8.3%)	46,859.8 (13.1%)	4,771.6 (9.8%)	64,769.1 (9.9%)
	Total	5,298.5 (19.8%)	104,258.6 (29.0%)	12,252.1 (25.2%)	164,961.5 (25.3%)
Water		5,187.5 (19.3%)	28,835.2 (8.0%)	3,792.3 (7.8%)	89,302.6 (13.7%)
No Data		0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	163.9 (<0.1%)
GRAND TOTAL		26,819.7 (100%)	359,038.0 (100%)	48,539.9 (100%)	616,807.0 (100%)

Note:

¹ From EOSD NWT (NRCan and GNWT, 2017; K'alo-Stantec, 2022b)



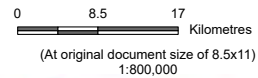
Notes

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 Geographics
World Hillshade: Esri, USGS

Land Cover

- Water
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub - Tall
- Shrub - Low
- Wetland - Treed
- Wetland - Shrub
- Wetland - Herb
- Herb
- Coniferous - Dense
- Coniferous - Open
- Coniferous - Sparse
- Broadleaf - Dense
- Broadleaf - Open

- Mixedwood - Dense
- Mixedwood - Open
- Mixedwood - Sparse
- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
- Granular Borrow / Rock Quarry Site and Access
- Local Study Area
- Regional Study Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- Region Boundary
- Settlement Area Boundary

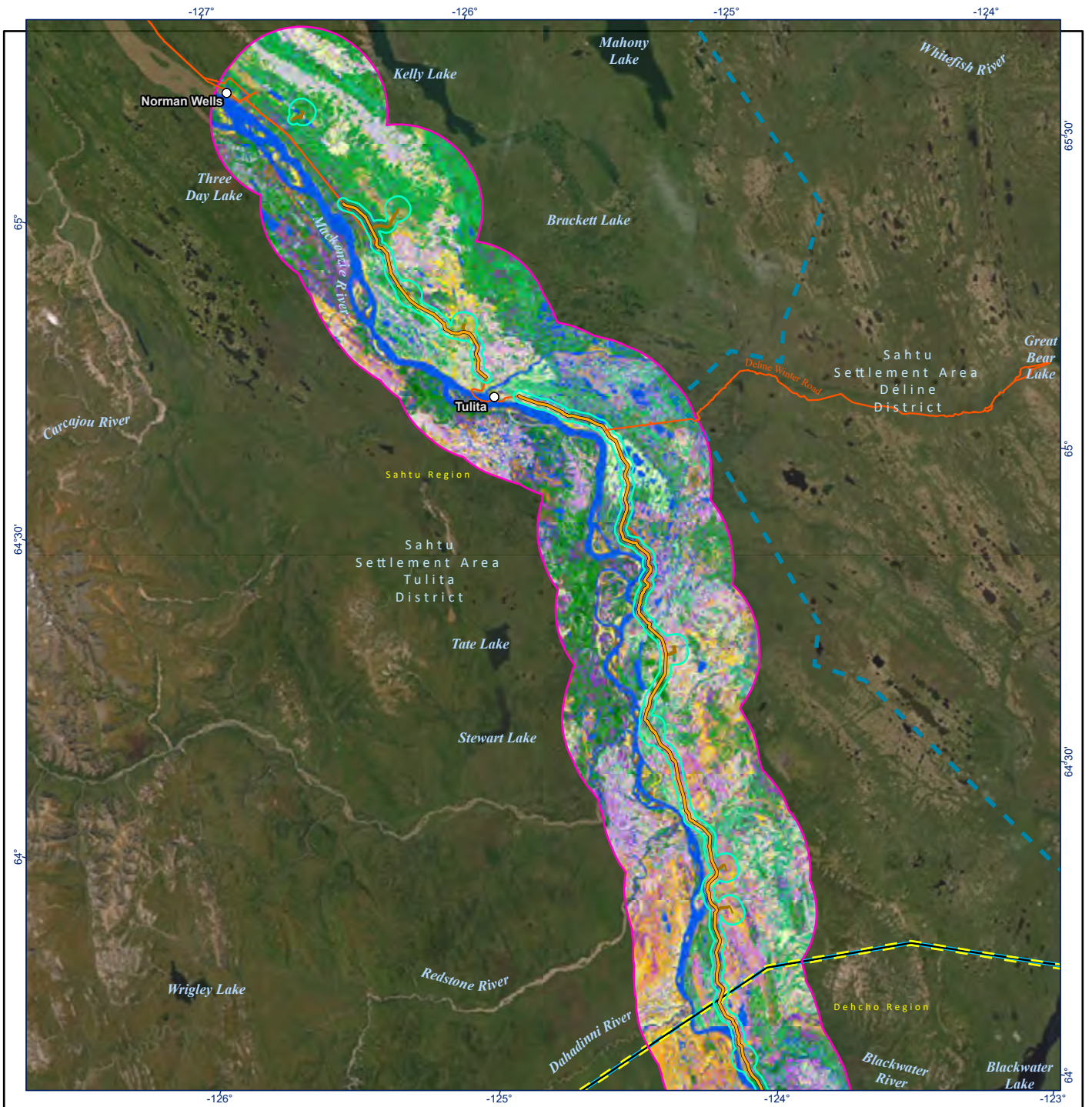


Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0035 REV/B

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 Mackenzie Valley Highway Project

Figure No.
3.4

Land Cover in the Dehcho Region



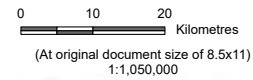
Notes

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World Imagery: Earthstar Geographics
World Hillshade: Esri, USGS

Land Cover

- Water
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub - Tall
- Shrub - Low
- Wetland - Treed
- Wetland - Shrub
- Wetland - Herb
- Herb
- Coniferous - Dense
- Coniferous - Open
- Coniferous - Sparse
- Broadleaf - Dense
- Broadleaf - Open

- Mixedwood - Dense
- Mixedwood - Open
- Mixedwood - Sparse
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- Settlement Area Boundary



Project Location Wrigley to Norman Wells, NWT
Client/Project 144903025-0036 REV B
 Prepared by AT on 3/8/2023
 TR by AJ on 3/8/2023

Government of Northwest Territories
Mackenzie Valley Highway Project
Figure No. 3.5
Title
Land Cover in the Sahtu Settlement Area

The Mackenzie Valley is situated within the Central Flyway which has long been known to provide a corridor and staging habitat for birds migrating to and from all areas of North America (Cooke, 1915). The RSA overlaps two IBAs that primarily provide important habitat for breeding and migrating waterbirds (IBA Canada, 2020b; Figure 3.6) and are discussed in greater detail in Section 3.2.2.2.

The LSA traverses the Bear Rock CZ (3,143.6 ha; RSA: 13,185.3 ha), a rock formation rising 400 m above the Mackenzie River and extending east to join the Franklin Mountains (Figure 3.6). It is an important nesting area for raptors and is a culturally sacred site (Section 3.1.2.2).

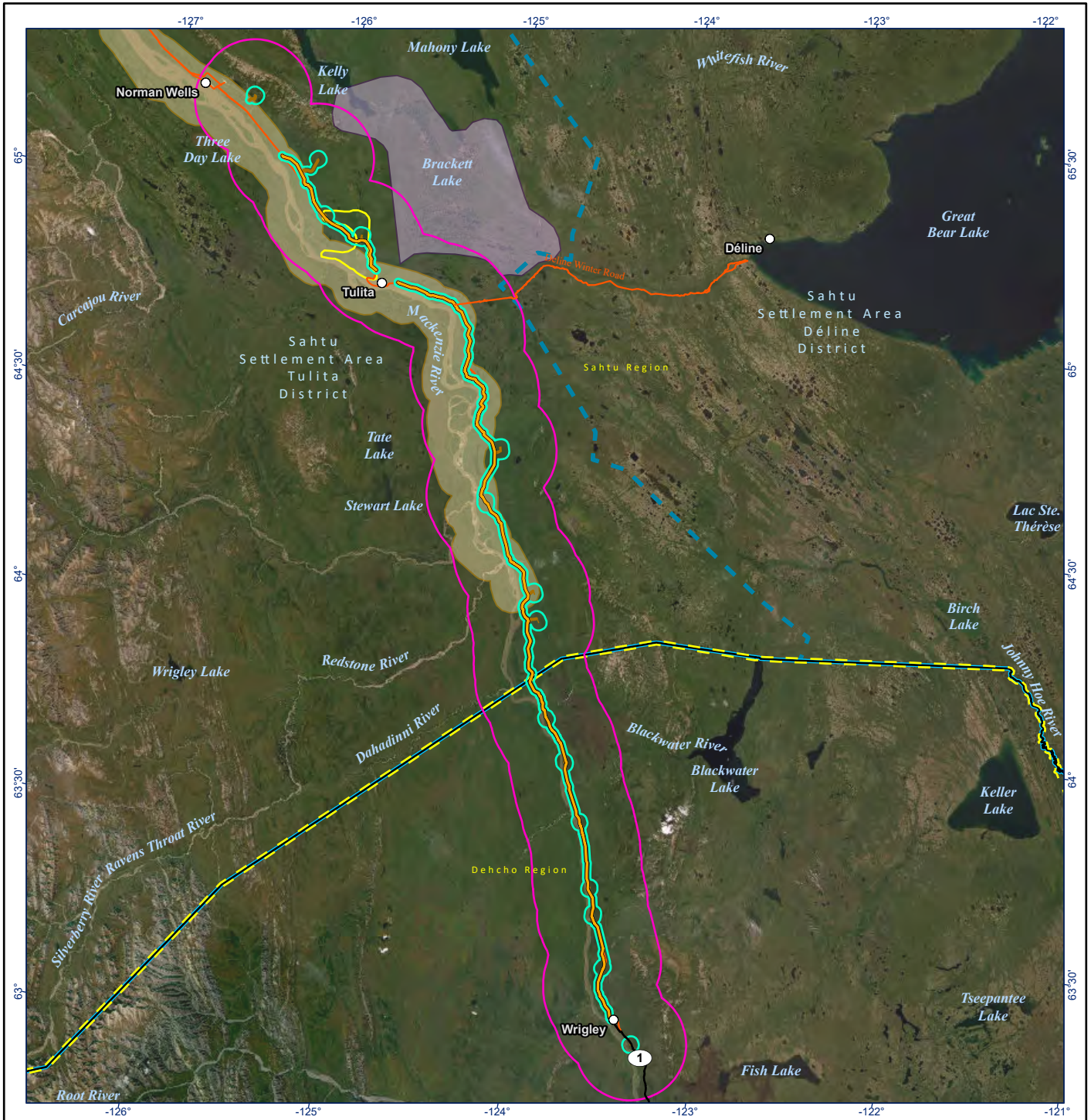
Habitat Disturbance

Except for the existing MVWR and communities along it (e.g., Hamlet of Tulita), the LSA contains disturbances from oil and gas exploration and production infrastructure. Notably, the Norman Wells Pipeline, which conveys crude oil from Norman Wells south to Alberta and is located in the LSA of the Dehcho Region and Sahtu Region. The RSA is relatively undisturbed, but oil and gas exploration and production infrastructure exists on the west side of the Mackenzie River near Norman Wells. Other existing disturbances include borrow sources and quarries, a fibre line, and bridges associated with the MVWR. The Project is in migratory bird nesting zone B8 with a regional nesting period from early-May to late-August (ECCC, 2018a).

The primary nesting period (when >95% of nesting occurs) is May 15 to August 7 for wetland habitat species, May 16 to August 10 for open habitat species, and May 15 to August 8 for forested habitat species (ECCC, 2018a). Raptors typically breed outside the primary nesting periods described above, and, while the critical breeding period for raptors varies by species (see Section 3.2.2.4), their breeding period extends between the first week in April to the second week of September (Shank and Poole, 2016).

Invasive Bird Species

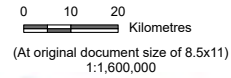
Rock pigeon (*Columba livia*), European starling (*Sturnus vulgaris*), and house sparrow (*Passer domesticus*) are alien / non-native species (i.e., introduced from outside North America) that occur within the LSA (GNWT, 2015b, Working Group on the General Status of NWT Species, 2016; eBird, 2021), but breeding habitats for these species are associated with anthropogenic habitats such as residential areas (Cabe, 2020; Lowther and Cink, 2020; Lowther and Johnson, 2020). However, their presence in these areas may affect native bird species in these altered habitats. Particularly, European starlings aggressively compete for nesting cavities (Cabe, 2020).



Important Wildlife Area

- Bear Rock
- Important Bird Area
- Brackett Lake
- Mackenzie Middle River Islands
- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
- Granular Borrow / Rock Quarry Site and Access

- Local Study Area
- Regional Study Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- Region Boundary
- Settlement Area Boundary



Project Location Wrigley to Norman Wells, NWT
Client/Project 144903025-0037 REV C

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 TR by AJ on 2023-03-07

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No.
3.6

Important Bird & Wildlife Areas in the RSA

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 Geographics
 World Hillshade: Esri, USGS
4. Bird Studies Canada. 2015. Important Bird Areas of Canada Database. Port Rowan, Ontario: Bird Studies Canada. <http://www.ibacanada.org>

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Bird Health

There are several pathogens expected to regularly occur in the RSA that can affect birds, including SAR and SOCC, including lice, ringworm, aspergillosis, tuberculosis, and avian pox (GNWT, 2017). However, most pathogens typically affect individuals without affecting populations and infected individuals may still be safe to consume depending on the pathogen (GNWT, 2017).

Except for waterfowl and upland gamebirds (see Sections 3.2.2.2 and 3.2.2.3, respectively), there is little information on the health of migratory birds in NT as it relates to environmental contamination. Health risks associated with contamination are most likely to be highest in aquatic habitats where deleterious substances have entered the environment and would affect bird species, including SAR and SOCC, that inhabit or forage in aquatic habitats. Like waterfowl and upland gamebirds, contamination risks to other bird species are generally low because they are generally lower on the food chain and consume primarily plants and invertebrates (GNWT, 2016a, 2016b). However, birds of prey may be at higher risk given that they are higher on the food chain and consume other vertebrates (e.g., fish, small mammals).

Bird Mortality

Existing bird mortality as it relates to harvested waterfowl and upland gamebird species is provided in Sections 3.2.2.2 and 3.2.2.3, respectively. For other bird species, including SAR and SOCC, mortality is primarily related to natural predator-prey interactions with other bird species or with mammal species. While vehicle-related bird mortality data is unavailable for the MVWR, it is unlikely to be a notable contributor to mortality because the road has reduced speed limits compared to an all-season road. Additionally, many migratory bird species will have migrated out of the LSA before the MVWR opens in early winter and have yet to return once the road closes in the spring.

3.2.2.2 Waterbirds

The RSA provides breeding and staging habitat for 85 species of wetland and water dependent birds (hereafter waterbirds), including waterfowl (35 species), waterbirds (8 species), and shorebirds (42 species; Appendix A, Table A.2; GNWT, 2020c). Three waterbird SAR (yellow rail [*Coturnicops noveboracensis*], red-necked phalarope [*Phalaropus lobatus*], and horned grebe [*Podiceps auratus*]; Table 3.1) and one SPCC (lesser yellowlegs [*Tringa flavipes*]) have the potential to inhabit the LSA and are discussed in greater detail in Section 3.2.2.6. The primary nesting period for waterbirds is May 15 to August 7 (Zone B8; ECCC, 2018a).

An annual Waterfowl Breeding Population and Habitat Survey has been conducted jointly by the US Fish & Wildlife Service and Canadian Wildlife Service since 1955 to estimate the population size and trends of breeding inland waterfowl species. The data is primarily used as a harvest management tool. Data from strata 15 (USFWS, 2010) in 2011-2015 indicates that the most abundant waterfowl species breeding in the RSA are greater scaup (*Aythya marila*) and lesser scaup (*Aythya affinis*), green-winged teal (*Anas carolinensis*), mallard, American wigeon (*Mareca americana*), and Canada goose (Table 3.3; USFWS, 2019). However, data suggests that waterfowl breeding densities are low for most species within the LSA compared to other areas within strata 15 or adjacent survey strata in the NT (Fournier and Hines, 2005).

In general, waterfowl populations in Canada have increased 150% between 1970 to 2016 (ECCC, 2019a).

The LSA overlaps the Middle Mackenzie River Islands IBA (28,617.9 ha; RSA: 263,567.1 ha) which is a 250 km section of the Mackenzie River between north of Wrigley to north of Norman Wells that includes the water, shoreline, and islands along the river (IBA Canada, 2020b, 2020c; Figure 3.6). The IBA is an important migratory staging site for many duck and goose species, including greater white-fronted goose (*Anser albifrons*), Canada goose, tundra swan, and snow goose (Latour et al., 2008; IBA Canada, 2020c). The IBA also provides breeding and migration habitat for other waterbird species and SAR (e.g., horned grebe, rusty blackbird [*Euphagus carolinus*]; see Section 3.2.2.6; IBA Canada, 2020c). The Brackett Lake IBA is within the RSA (14,789.8 ha), and is a low-lying area dominated by black spruce (*Picea mariana*) and peat bogs interspersed with open wetland habitats, lakes, and sedge meadows (IBA Canada, 2020b, 2020c). This IBA provides a significant source of breeding habitat for several duck species, particularly scaup, and is an important migratory staging site for waterfowl species such as greater white-fronted geese and tundra swan, and shorebird species such as lesser yellowlegs (*Tringa flavipes*), pectoral sandpiper (*Calidris melanotos*), and long-billed dowitcher (*Limnodromus scolopaceus*; Latour et al., 2008, IBA Canada, 2020a). Both IBAs and the broader Mackenzie Valley are along migratory corridors for migrating tundra swans (Ely et al., 2020) and greater white-fronted geese (Meixell, 2018), further suggesting the RSA provides a notable source of staging habitat for waterfowl. See Section 3.2.2.6 for detailed information on waterbird SAR.

Table 3.3 Mean 5-year Breeding Waterfowl Population Estimates from the Waterfowl Breeding Population and Habitat Survey from 2011 to 2015¹ in Strata 15²

Common Name	Scientific Name	Mean Breeding Population
Greater and lesser scaup	<i>Aythya marila and affinis</i>	277,230
Green-winged teal	<i>Anas carolinensis</i>	158,775
Mallard	<i>Anas platyrhynchos</i>	124,979
American wigeon	<i>Mareca americana</i>	77,062
Canada goose	<i>Branta canadensis</i>	63,837
Ring-necked duck	<i>Aythya collaris</i>	34,685
Northern pintail	<i>Anas acuta</i>	33,282
Bufflehead	<i>Bucephala albeola</i>	27,575
Common and Barrow's goldeneye	<i>Bucephala clangula and islandica</i>	25,805
Northern shoveler	<i>Spatula clypeata</i>	7,440
Blue-winged teal	<i>Anas discors</i>	1,915
Canvasback	<i>Aythya valisineria</i>	1,443
Ruddy duck	<i>Oxyura jamaicensis</i>	555

Notes:

¹ Survey population data (USFWS, 2019).

² Survey strata (USFWS, 2010).

Waterfowl are an important subsistence resource for local Indigenous communities (DLUPC, 2006, SLUPB, 2013). Regulated waterfowl (ducks, geese, coots, and snipe) hunting in the NT may occur between September 1 to December 10 under the authorization of a federal Migratory Game Bird Hunting Permit and Canadian Wildlife Habitat Conservation Stamp (ECCC, 2020b). Individuals may also hunt overabundant snow and Ross's geese (*Chen rossii*) between May 1 to May 28.

Waterfowl have been shown to have limited environmental contamination but because some species consume other animals (e.g., fish), some species may experience biomagnification of contaminants, but it is not considered a health risk to consume them, except for regular consumption of organs (GNWT, 2016a).

There are several recommended activity restrictions for waterfowl and other waterbird species nests described in Appendix A, Table A.1 (GNWT, 2015a, 2016a) and there is also a setback of 1,500 m from waterfowl staging areas for general development activities in the spring and fall when concentrations of birds are present. This is consistent with or more conservative than those presented in the regional land use plans (DLUPC, 2006; SLUPB, 2013).

3.2.2.3 Upland Gamebirds

There are five species of upland gamebird that have the potential to occur within the RSA: ruffed grouse (*Bonasa umbellus*), spruce grouse (*Canachites canadensis*), willow ptarmigan (*Lagopus lagopus*), rock ptarmigan (*Lagopus muta*), and sharp-tailed grouse (*Tympanuchus phasianellus*; Appendix A, Table A.2; GNWT, 2020c). There are no upland gamebird SAR or SOCC that have the potential to occur in the LSA (Table 3.1). Upland gamebirds breed in early spring, prior to the primary nesting periods for migratory birds (ECCC, 2018a) and use a wide variety of upland and wetland (e.g., winter forage) habitats throughout the year. There are no documented sharp-tailed grouse leks (traditional mating grounds) within the RSA.

Upland gamebird populations in the NT are naturally cyclical (e.g., Krebs et al., 2001), increasing and decreasing at approximate 10-year intervals in response to broader environmental conditions, including predator populations and climactic conditions (GNWT, 2015c). The most recent population peak was predicted to have occurred in 2016/17 (GNWT, 2015c).

Upland gamebirds are an important subsistence resource for local Indigenous communities (DLUPC, 2006; SLUPB, 2013, SRRB, 2021). Regulated upland gamebird (ptarmigan and grouse) hunting in the NT may occur between September 1 to April 30 under the authorization of a territorial small game hunting permit (GNWT, 2020d). The average annual harvest of upland gamebirds in the NT by resident hunters (i.e., excludes subsistence hunting) between 1998/98 and 2008/09 was approximately 2,000 spruce grouse, 1,700 ptarmigan, 600 ruffed grouse, and 300 sharp-tailed grouse (Carrière, 2012). Harvest data indicates that sharp-tailed grouse, spruce grouse, unidentified grouse species, and ptarmigan species each make up 4% to 5% of the total bird harvest composition within the Sahtu Region (SRRB, 2021).

Upland game birds have been shown to have limited environmental contamination because they are lower on the food chain, consuming primarily plants and invertebrates; it is not considered a health risk to consume them (GNWT, 2016b).

3.2.2.4 Birds of Prey

The RSA provides habitat for 19 bird of prey species, including raptors (13 species) and owls (6 species; Appendix A, Table A.2; GNWT, 2020c). Two bird of prey SAR have the potential to inhabit the LSA (peregrine falcon and short-eared owl; Table 3.1) and are discussed in greater detail in Section 3.2.2.6. In general, bird of prey populations in Canada have increased 110% between 1970 to 2016 (ECCC, 2019a).

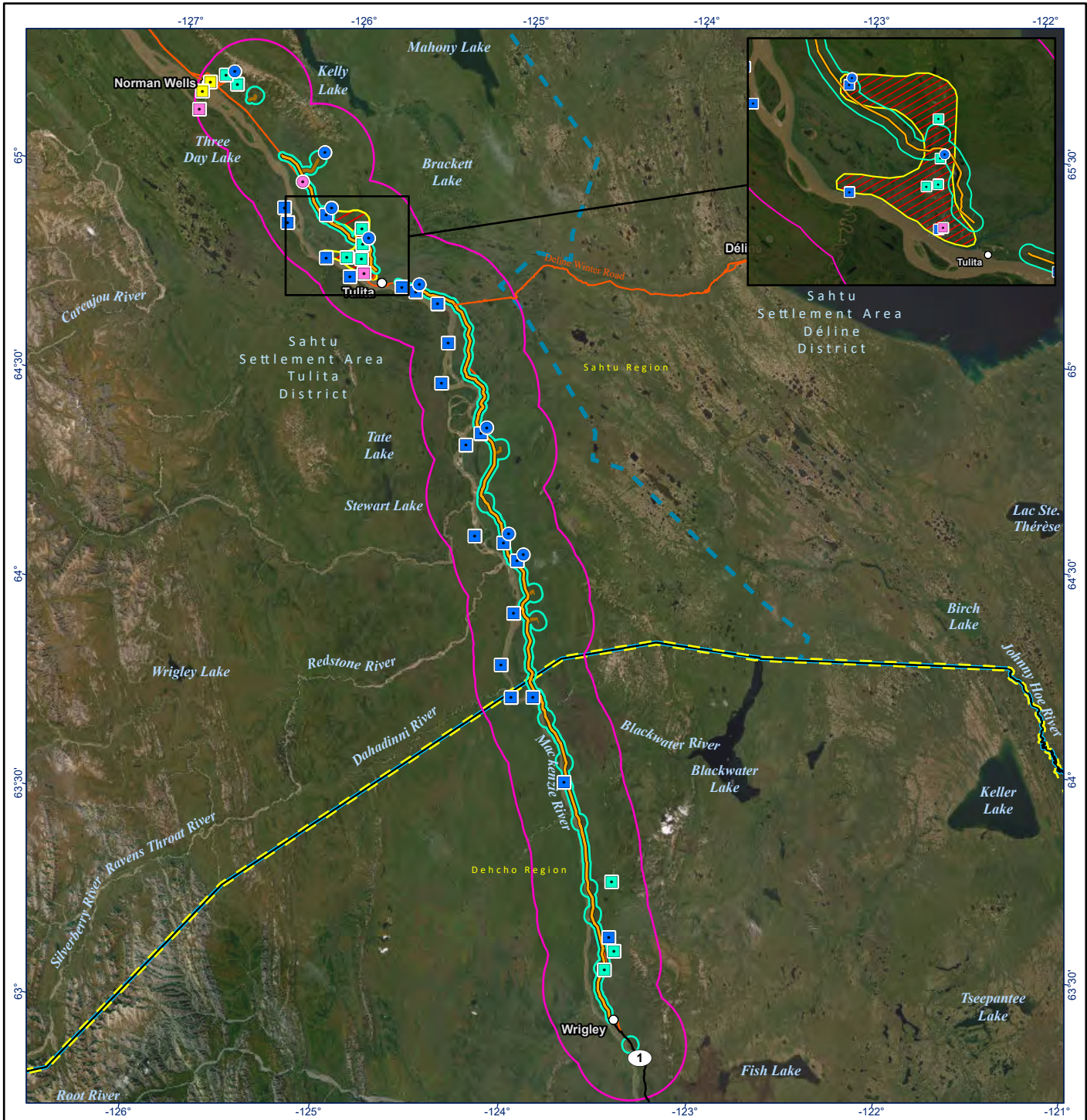
Historical WMIS records indicate that raptor nests within the LSA include two golden eagle (*Aquila chrysaetos*) nests and six peregrine falcon nests (Figure 3.7; GNWT, 2020c). Records within the RSA include 2 bald eagle (*Haliaeetus leucocephalus*) nests, 9 golden eagle nests, 1 American kestrel (*Falco sparverius*) nest, and 21 peregrine falcon nests (Figure 3.7; GNWT, 2020c).

The 2021 aerial raptor survey completed by the GNWT yielded detections of one active bald eagle nest in the LSA, seven active peregrine falcon nests within the LSA (two of which are within or immediately adjacent to proposed quarry locations), and one additional active peregrine falcon nest in the RSA (Figure 3.7). Specialized habitat for raptor species such as peregrine falcon and golden eagle, include steep cliff for nesting, which occur at low densities throughout the LSA and RSA.

Birds of prey breed in early spring, prior to the primary nesting periods for migratory birds (ECCC, 2018a). Published critical nesting periods for raptor species are provided in Table 3.4. In addition to a general year-round setback of 500 m from raptor nests, there are several species-specific recommended activity restrictions for general development activities in the vicinity of active nests (Appendix A, Table A.1; GNWT, 2015a, 2016a):

- Bald eagle – 500 m between April 15 to August 31
- Golden eagle – 800 m between April 15 to August 31
- Osprey (*Pandion haliaetus*) – 1,000 m between May 1 to August 31
- peregrine falcon – 1,500 m between May 1 to August 31

This is consistent with or more conservative than those presented in the regional land use plans (DLUPC, 2006; SLUPB, 2013).



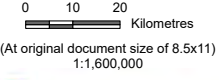
WMIS Observations

- American Kestrel
- Bald Eagle
- Golden Eagle
- Peregrine Falcon

GNWT Observations

- Peregrine Falcon
- Bald Eagle
- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022

- Granular Borrow / Rock Quarry Site and Access
- ▨ Bear Rock Important Wildlife Area
- ▭ Local Study Area
- ▭ Regional Study Area
- Community
- All-Season Road
- Winter Road
- ▭ District Boundary
- ▭ Region Boundary
- ▭ Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by AT on 2023-03-07
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Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No. 3.7

WMIS and GNWT 2021 Raptor Nest Observations

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 Geographics
 World Hillshade: Esri, USGS

Table 3.4 Critical Breeding Periods for Raptors in the Low Subarctic Ecoregion¹

Common Name	Scientific Name	Critical Nesting Period
Bald eagle	<i>Haliaeetus leucocephalus</i>	3 rd wk April – 2 nd wk September
Northern harrier	<i>Circus cyaneus</i>	3 rd wk May – 3 rd wk August
Sharp-shinned hawk	<i>Accipiter striatus</i>	4 th wk May – 2 nd wk August
Northern goshawk	<i>Accipiter gentilis</i>	4 th wk April – 1 st wk August
Swainson's hawk	<i>Buteo swainsoni</i>	3 rd wk May – 4 th wk August
Red-tailed hawk	<i>Buteo jamaicensis</i>	4 th wk April – 1 st wk August
Rough-legged hawk	<i>Buteo lagopus</i>	2 nd wk May – 2 nd wk August
Golden eagle	<i>Aquila chrysaetos</i>	2 nd wk April – 3 rd wk August
American kestrel	<i>Falco sparverius</i>	3 rd wk May – 2 nd wk August
Merlin	<i>Falco columbarius</i>	1 st wk May – 4 th wk July
Gyrfalcon	<i>Falco rusticolus</i>	1 st wk April – 3 rd wk July
Peregrine falcon	<i>Falco peregrinus</i>	3 rd wk May – 3 rd wk August
Osprey	<i>Pandion haliaetus</i>	3 rd wk May – 2 nd wk September

Note:

¹ from Shank and Poole (2016)

3.2.2.5 Landbirds

The RSA provides habitat for 85 species of landbirds, including near-passerines (e.g., woodpeckers; 8 species) and passerines (95 species; Appendix A, Table A.2; GNWT, 2020c). Five landbird SAR (common nighthawk [*Chordeiles minor*], olive-sided flycatcher [*Contopus cooperi*], bank swallow [*Riparia riparia*], barn swallow [*Hirundo rustica*], and rusty blackbird) and one SOCC (Harris's sparrow [*Zonotrichia querula*]) have the potential to inhabit the LSA (Table 3.1) and are discussed in greater detail in Section 3.2.2.6. In general, forest-dwelling passerine populations in Canada have increased 7% between 1970 to 2016 (ECCC, 2019a). See Section 3.2.2.6 for detailed information on landbird SAR. The primary nesting period for landbirds is May 15 to August 8 in forested habitats and May 16 to August 10 in open habitats (Zone B8; ECCC, 2018a).

The North American Breeding Bird Survey is a volunteer-based large-scale program used to monitor the population status and trends of bird populations since 1966 (Government of Canada, 2018; USFWS, 2018). The survey is primarily suited to the collection of songbird data but does provide information on a wide range of other species (e.g., waterfowl). Two survey routes are located within the LSA and within the Taiga Plains ecoregion near Norman Wells (route 43012 – Norman Wells) and near Tulita (route 43014 – Bear River; USFWS, 2020) that contain historical data from 1995-2005 and 2004-2005, respectively (Appendix A, Table A.3, Pardieck et al., 2019). The most abundant species recorded on the Norman Wells route included Swainson's thrush (*Catharus ustulatus*), chipping sparrow (*Spizella passerina*), yellow-rumped warbler (*Setophaga coronata*), American robin (*Turdus migratorius*), and white-crowned sparrow (*Zonotrichia leucophrys*). The most abundant species recorded on the Bear River route included white-crowned sparrow (*Zonotrichia leucophrys*), alder flycatcher (*Empidonax alnorum*), hermit thrush

(*Catharus guttatus*), Lincoln’s sparrow (*Melospiza lincolni*), and white-throated sparrow (*Zonotrichia albicollis*; Pardieck et al., 2019).

The general recommended activity restrictions for songbird nests includes a setback of 100 m from general development activities and 30 m for pedestrian or all-terrain vehicle (ATV) activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1).

ECCC Breeding Bird Survey Data

A review of the ECCC breeding bird survey data collected in 2017 using ARUs (ECCC, 2020a) indicates that 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. Survey locations were evenly distributed along the existing MVWR between Wrigley and Norman Wells (Figure 3.8) and proportionally distributed between the three level III ecoregions traversed by the Project (Table 3.5).

Table 3.5 Distribution of ECCC Breeding Bird Survey Locations by Ecoregion

Ecoregion (Level III)	Area (ha)	Percent of LSA	No. of ARUs	Percent of ARUs
Boreal Cordillera High Boreal	24,925.0	33.1%	15	28.3%
Taiga Cordillera Low Subarctic	25,393.9	33.7%	19	35.8%
Taiga Plains Low Subarctic	25,040.6	33.2%	19	35.8%
Total	75,359.6	100.0%	53	100.0%

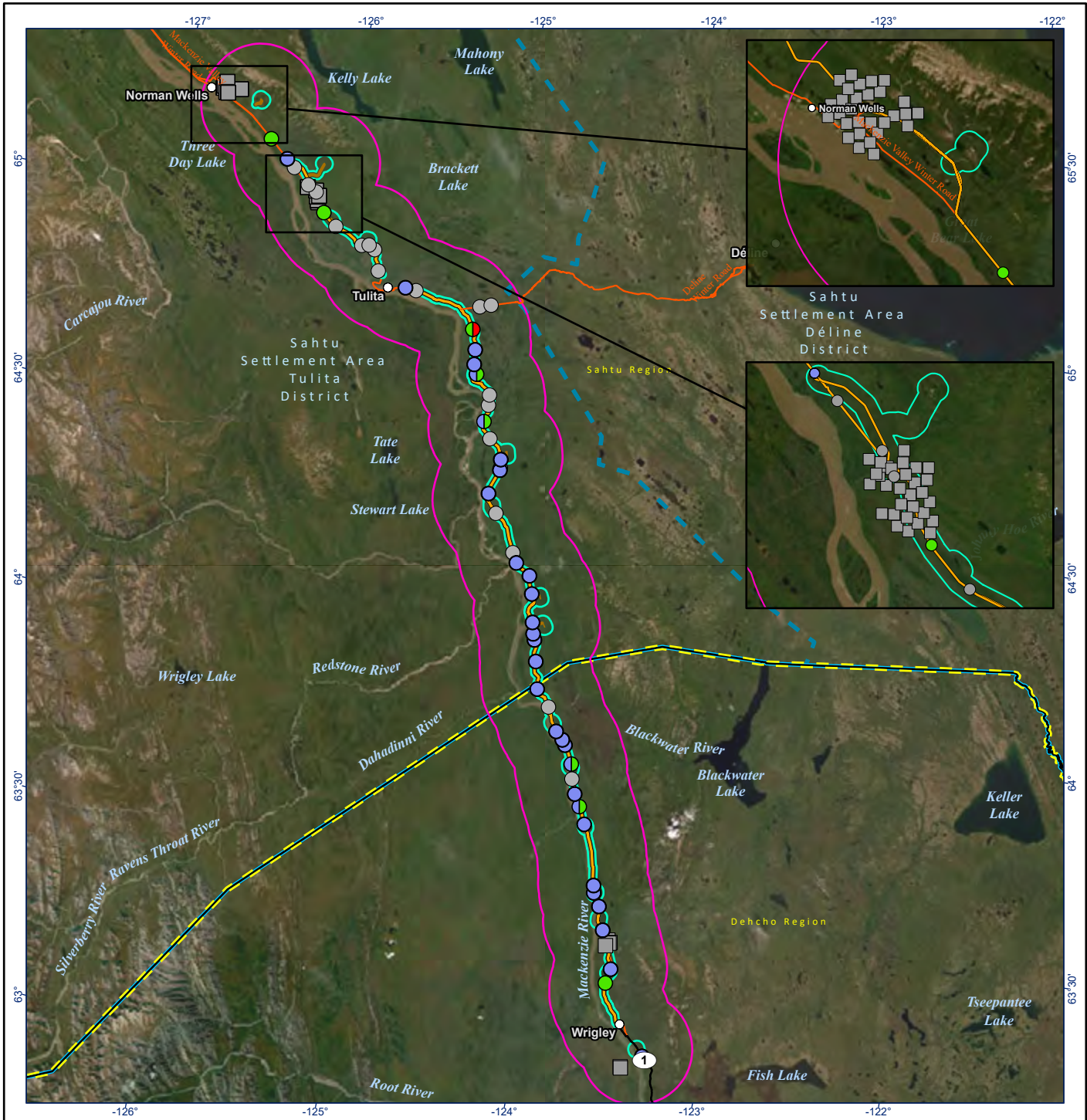
The ARU survey locations were also evenly distributed proportionally relative to the major land cover classes within the LSA (Table 3.6). The land cover composition within a 100 m radius of the survey location was calculated and the dominant land cover class was used to assign a single land cover class for each survey location. However, exposed lands were excluded because most survey locations were along the existing winter road and the dominant habitat for most locations was exposed lands and not indicative of the adjacent breeding habitat for birds.

Table 3.6 Distribution of ECCC Breeding Bird Survey Locations by Land Cover Class

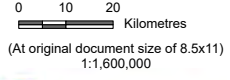
Land Cover Class¹	Area (ha)	Percent of LSA	No. of ARUs	Percent of ARUs
Broadleaf Forest	4,779.3	6.6%	3	5.7%
Coniferous Forest	25,628.9	35.5%	25	47.2%
Mixedwood Forest	4,059.7	5.6%	3	5.7%
Shrubland	10,882.8	15.1%	6	11.3%
Herbaceous & Unvegetated	261.5	0.4%	2	3.8%
Wetland	17,550.6	24.3%	14	24.5%
Water	8,979.8	12.4%	1	1.9%

Note:

¹ See Table 3.2 for refined land cover classification in the LSA.



- Autonomous Recording Unit Survey 2017
- Point Count Surveys 2004-2006
- SAR Observation**
- Common nighthawk
- Harris's sparrow
- Olive-sided flycatcher
- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
- Granular Borrow / Rock Quarry Site and Access
- Local Study Area
- Regional Study Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- Region Boundary
- Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0047 REV B
 Prepared by AT on 3/8/2023
 TR by AJ on 3/8/2023

Government of Northwest Territories
 Mackenzie Valley Highway Project
 Figure No. **3.8**
 Title **ECCC Breeding Bird Survey and Species at Risk Observations**

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 Geographics
 World Hillshade: Esri, USGS
 4. ECCC. 2020. Breeding bird survey data along the Mackenzie Valley winter road. Data request November 23, 2020. Environment

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

At each survey location, ARUs collected daily 3-minute audio recordings and recordings from five to six recordings between June 1-30 were analyzed for species detections; in one case one recording was available for a single ARU while in one other case four recordings were available for a single ARU (ECCC, 2020a). A total of 293 3-minute surveys and 879 minutes of audio were analyzed for species detections.

The detection/non-detection of a species at each ARU survey locations was used to quantify the presence and relative abundance of breeding birds in the LSA and establish habitat associates, which is summarized in Appendix A, Table A.4. Additionally, the mean and standard deviation of the number of detections for each species per Ecoregion is also provided (Appendix A, Table A.5). Only three ARUs were located outside of the LSA, which precludes a comparison of the breeding bird community between the LSA and RSA.

A total of 72 bird species were detected during the ARU survey, with the most common species being Swainson's thrush (at 53 of 53 locations), hermit thrush (at 47 of 53 locations), chipping sparrow (at 42 of 53 locations), Tennessee warbler (*Leiothlypis peregrina*; at 41 of 53 locations), and white-throated sparrow (at 39 of 53 locations).

The most common and total number of species by major land cover classes, excluding water (i.e., a single survey location), were (Appendix A, Table A.4):

- **Broadleaf forest:** Orange-crowned warbler (*Leiothlypis celata*), white-throated sparrow, Tennessee Warbler, Swainson's thrush, and blackpoll warbler (*Setophaga striata*). A total of 24 species.
- **Coniferous forest:** Swainson's thrush, chipping sparrow, hermit thrush, Tennessee warbler, and dark-eyed junco (*Junco hyemalis*). A total of 48 species.
- **Mixedwood forest:** Swainson's thrush, chipping sparrow, hermit thrush, Tennessee warbler, and yellow-rumped warbler. A total of 28 species.
- **Shrubland:** Swainson's thrush, hermit thrush, white-throated sparrow, American robin, and orange-crowned warbler. A total of 39 species.
- **Herbaceous and Unvegetated:** Swainson's thrush, hermit thrush, white-throated sparrow, orange-crowned sparrow, and alder flycatcher. A total of 23 species.
- **Wetland:** Swainson's thrush, hermit thrush, American robin, white-throated sparrow, and Lincoln's sparrow. A total of 51 species.

Relative to Ecoregion, the most common and total number of species were (Appendix A, Table A.5):

- **Boreal Cordillera:** Tennessee warbler, Swainson's thrush, white-throated sparrow, chipping sparrow, and hermit thrush. A total of 36 species.
- **Taiga Cordillera:** Swainson's thrush, hermit thrush, white-throated sparrow, Tennessee warbler, and chipping sparrow. A total of 55 species.
- **Taiga Plains:** Swainson's thrush, hermit thrush, white-throated sparrow, orange-crowned sparrow, Lincoln's sparrow. A total of 58 species.

The ECCC in-field point-count survey data from 2004 and 2006 included point-count surveys (n = 65) in dominant land cover classes that included 29 in coniferous forest, 10 in shrubland, 10 in wetland, 8 in broadleaf forest, 4 in mixedwood forest, and 4 in water. A total of 49 bird species were detected during the point-count survey, with the most common species being Lincoln's sparrow (n = 40), white-crowned sparrow (n = 39), Swainson's thrush (n = 33), dark-eyed junco (n = 30), and chipping sparrow (n = 27) (Appendix A, Table A.6). The survey did not yield any detections of SAR and just one detection of one SOCC: lesser yellowlegs. The most common and total number of species by major land cover classes, excluding the herbaceous and unvegetated (i.e., no survey locations) were (Appendix A, Table A.6):

- **Broadleaf forest:** yellow-rumped warbler, orange-crowned warbler, warbling vireo (*Vireo gilvus*), Swainson's thrush, and Lincoln's sparrow. A total of 13 species.
- **Coniferous forest:** Lincoln's sparrow, white-crowned sparrow, common redpoll (*Acanthis flammea*), dark-eyed junco, and chipping sparrow. A total of 29 species.
- **Mixedwood forest:** Swainson's thrush, orange-crowned warbler, chipping sparrow, Tennessee warbler, boreal chickadee (*Poecile hudsonicus*). A total of 9 species.
- **Shrubland:** white-crowned sparrow, chipping sparrow, Lincoln's sparrow, savannah sparrow (*Passerculus sandwichensis*), and common redpoll. A total of 18 species.
- **Wetland:** dark-eyed junco, Swainson's thrush, Lincoln's sparrow, palm warbler (*Setophaga palmarum*), and blackpoll warbler. A total of 18 species.
- **Water:** Lincoln's sparrow, white-crowned sparrow, northern flicker (*Colaptes auratus*), American robin, and northern waterthrush (*Parkesia noveboracensis*). A total of 28 species.

In general, results of the ECCC breeding bird survey support the results of the North American Breeding Bird Survey (described above) with respect to the presence and relative abundance of species, while also providing insight into habitat associations for breeding species. While the data provides a detailed characterization of the breeding bird community within the LSA, there is limited information on the presence and distribution of most SAR and SOCC.

3.2.2.6 Species at Risk and Species of Conservation Concern

The RSA is within the breeding range of 10 bird SAR (peregrine falcon, yellow rail, red-necked phalarope, short-eared owl, common nighthawk, olive-sided flycatcher, bank swallow, barn swallow, rusty blackbird, and horned grebe) and 2 bird SOCC (lesser yellowlegs, Harris's sparrow; Government of Canada, 2021a; GNWT, 2020a; Table 3.1). There is no SARA-defined critical habitat for any bird SAR within the RSA. The existing conditions for these species are described in greater detail below.

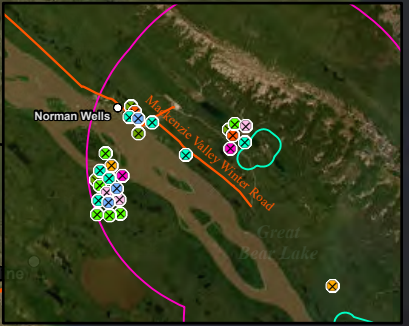
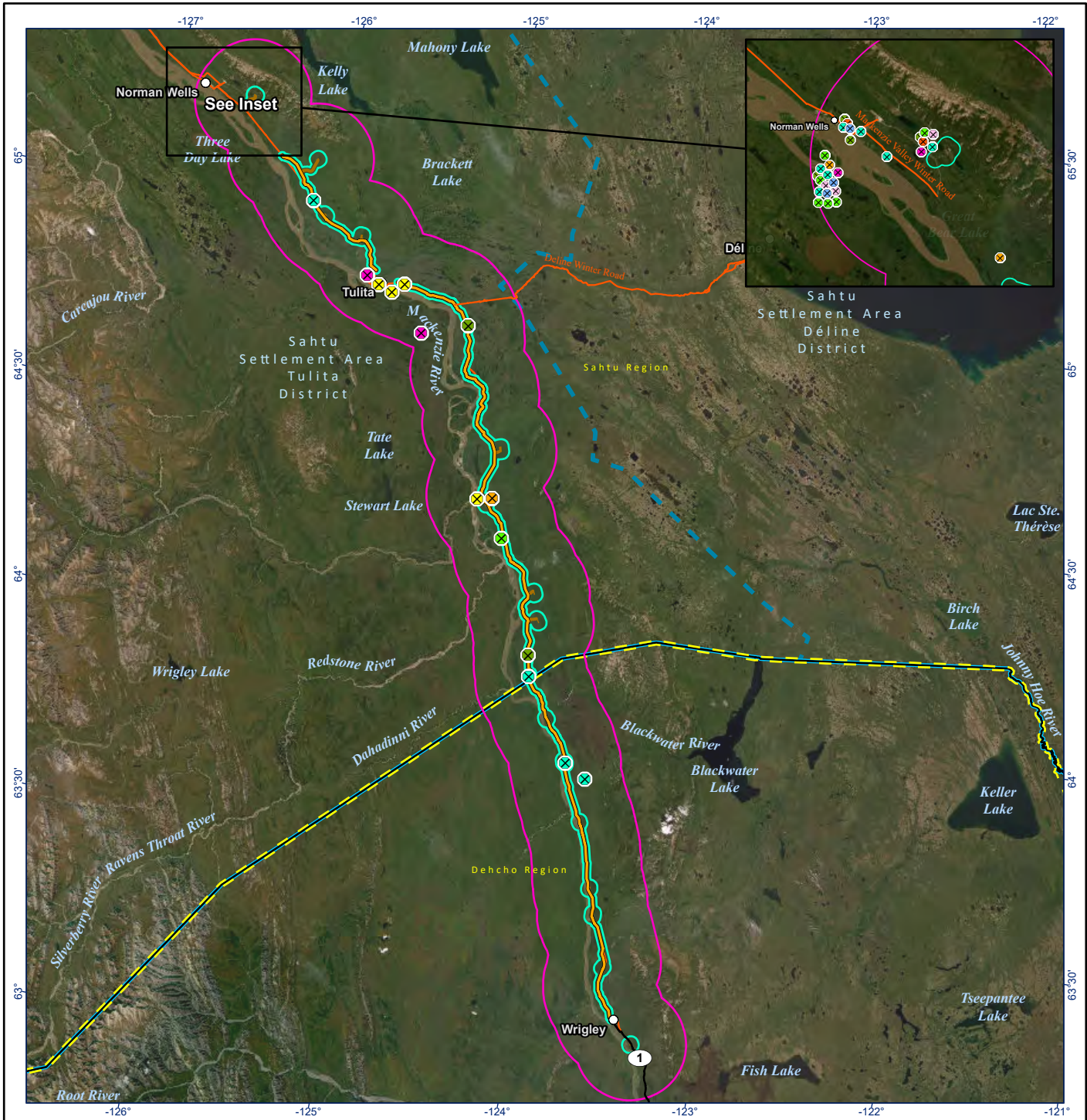
Peregrine Falcon

Peregrine falcon is a raptor species that is federally listed as special concern by SARA (Table 3.1; Government of Canada, 2021a). While not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as sensitive (Working Group on the General Status of NWT Species, 2016). While the species experienced significant population declines throughout Canada in the mid-20th century due largely to now-banned organochlorine pesticide use (e.g., DDT; COSEWIC, 2007a), the species'

population has rebounded and in 2017 was assessed as not at risk by COSEWIC (Government of Canada, 2021a). The species' population increase coincides with a general increase in raptor populations in Canada of 110% between 1970 to 2016 (ECCC, 2019a). Similarly, the population in the Mackenzie Valley has increased dramatically since the late 1960s with the number of successful nesting sites along the river increasing from a low of five in 1972 to a high of 58 in 2011 (Hodson, 2018). Additionally, expanded surveys beyond the Mackenzie Valley have also shown dramatic increases in peregrine falcon occupancy and productivity (Carrière and Matthews, 2013). Threats to peregrine falcon in NT include habitat loss or degradation through anthropogenic disturbance, particularly along the Mackenzie River, disturbance of nest sites, and severe climate-related events that reduce chick survival (GNWT, 2020a). In 2017, a federal management plan was developed for peregrine falcon focusing on stabilizing and increasing the species' declining population trend while increasing the area of occupancy, particularly in southern Canada (ECCC, 2017).

The species' breeding range includes primarily open tundra and coastal habitats throughout the northern NT, but also includes more southern montane habitats and the Mackenzie Valley (COSEWIC, 2007a; GNWT, 2020a). Breeding habitat for peregrine falcon exists throughout the RSA where sheltered cliff ledges or crevices occur near water and/or other areas that congregate prey species, typically other bird species (COSEWIC, 2007a; Carrière and Matthews, 2013; GNWT, 2020a). Historical WMIS records indicate six peregrine falcon nests within the LSA and 21 within the RSA (Figure 3.7; GNWT, 2020c). There are no other WMIS records of peregrine falcon individuals within the LSA, but there are four records within the RSA (Figure 3.9; GNWT, 2020c). There is one historical eBird (2021) record of peregrine falcon within the LSA northwest of Tulita from 2009 and 13 other records of the species occurring within the RSA (Figure 3.10).

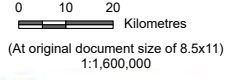
The maximal breeding period (i.e., the widest range of potential breeding dates) in nesting zone B8 for peregrine falcon is March 8 to August 30 (Birds Canada, 2020), while the critical nesting period for the species is from the third week in May to the third week in August (Shank and Poole, 2016). The recommended activity restrictions for peregrine falcon nests include a setback of 1,500 m from general development activities between May 1 to August 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1).



SAR Observation

- ✕ Bank Swallow
- ✕ Horned Grebe
- ✕ Lesser Yellowlegs
- ✕ Olive-Sided Flycatcher
- ✕ Peregrine Falcon
- ✕ Rusty Blackbird

- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
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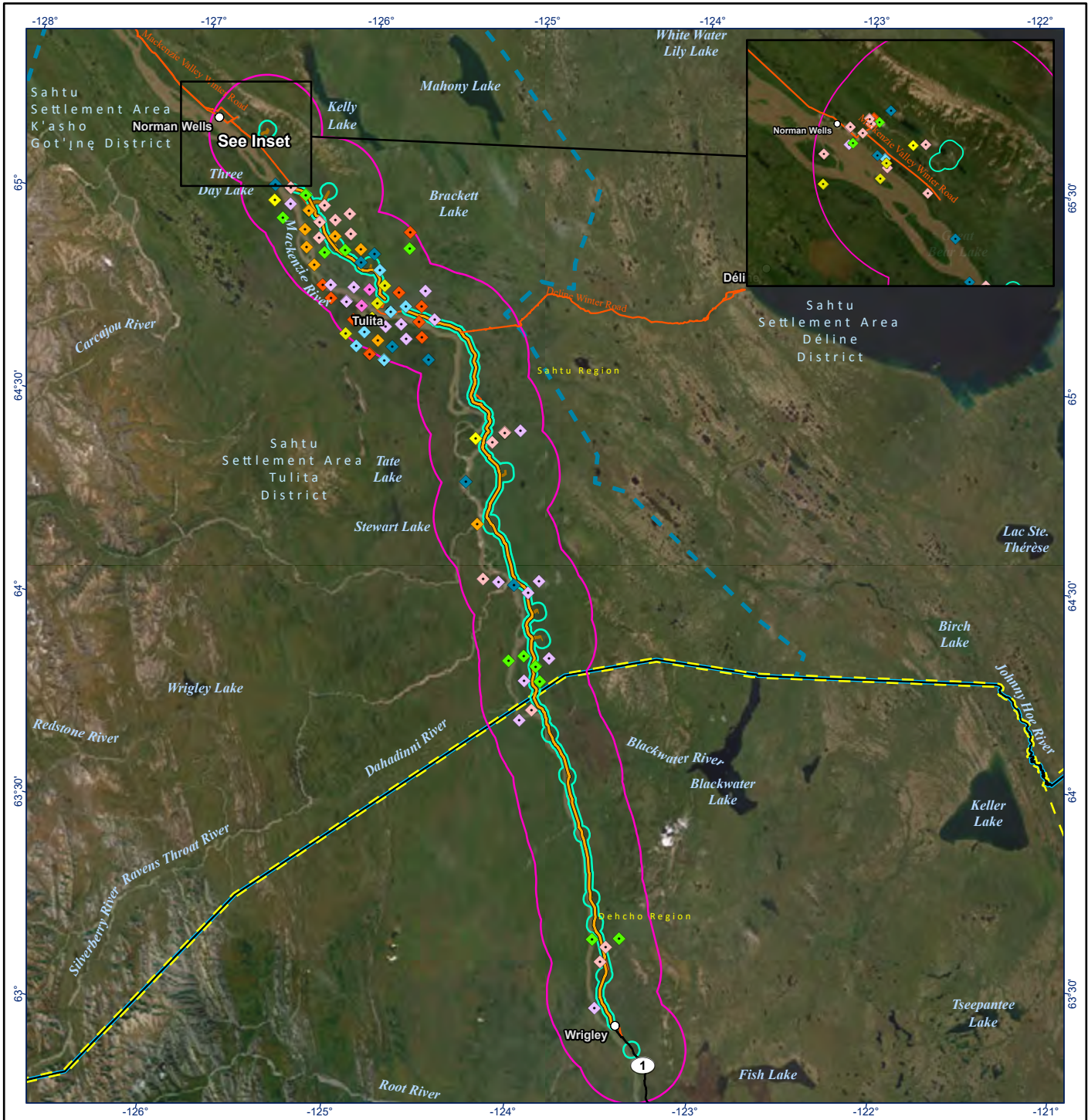
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Figure No. 3.9

WMIS SAR Observations

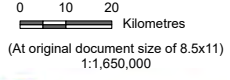
Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: Centre of Geomatics of Government of NWT, Government of Canada, Stantec
 3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCAN
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS



SAR Observation

- ◆ Bank Swallow
- ◆ Barn Swallow
- ◆ Common Nighthawk
- ◆ Harris's Sparrow
- ◆ Horned Grebe
- ◆ Olive-sided Flycatcher
- ◆ Peregrine Falcon
- ◆ Red-necked Phalarope
- ◆ Rusty Blackbird
- ◆ Short-eared Owl

- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
- Granular Borrow / Rock Quarry Site and Access
- Local Study Area
- Regional Study Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- Region Boundary
- Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by AT on 3/8/2023
 TR by AJ on 3/8/2023

Client/Project: 144903025-0040 REV B

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No. 3.10

Title: eBird SAR Observations

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 Geographics
 World Hillshade: Esri, USGS

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Yellow Rail

Yellow rail is a waterbird species that is federally listed as special concern by SARA (Table 3.1; Government of Canada, 2021a) and while not territorially listed under the *Species at Risk (NWT) Act*, is territorially ranked as sensitive (Working Group on the General Status of NWT Species, 2016). Due to the nocturnal and secretive behavior of yellow rails, a population trend is difficult to ascertain but is likely in decline due to habitat loss, primarily in the prairies (COSEWIC, 2001). Threats to yellow rail in NT include habitat loss or degradation through anthropogenic disturbance and climate change (COSEWIC, 2001; GNWT, 2020a).

The species has been traditionally thought to breeding only in the southwestern NT (COSEWIC, 2001; GNWT, 2020a); however, recent evidence indicates that the species has been detected breeding southeast of the RSA near Bulmer Lake and north of the RSA near Fort Good Hope (Dufour, 2020, pers. comm.). Considering recent evidence, habitat for yellow rail may exist for yellow rail throughout the RSA where wet meadow or shallow, sedge-dominated wetlands exist (COSEWIC, 2001; Dufour, 2020, pers. comm.; GNWT, 2020a). There are no historical records of yellow rail within the LSA or RSA (eBird, 2021; ECCC, 2020a; GNWT, 2020c).

The primary nesting period for yellow rail is May 15 to August 7 (ECCC, 2018a). The recommended activity restrictions for yellow rails nests include a setback of 350 m from general development activities between May 15 to August 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1).

Lesser Yellowlegs

Lesser yellowlegs is a shorebird species that has been assessed by COSEWIC as threatened (Table 3.1; Government of Canada, 2021a), but it is not territorially listed under the *Species at Risk (NWT) Act* and is territorially ranked as sensitive (Working Group on the General Status of NWT Species, 2016). While the species has experienced population declines throughout much of Canada, this is primarily attributable to activities outside of Canada such as the loss of staging and wintering habitat and sport and subsistence hunting outside of Canada (Government of Canada, 2021b). Threats to lesser yellowlegs in NT likely include habitat loss or degradation through anthropogenic disturbance and climate change (Government of Canada, 2021b) and contamination of aquatic habitats.

The species' breeding range includes boreal and tundra transition habitats throughout the NT where freshwater shoreline habitats provide foraging opportunities and will nest in anthropogenically disturbed sites, such as cut lines or other clearings (Tibbitts and Moskoff, 2020). Breeding habitat for lesser yellowlegs exists throughout the RSA and ECCC data indicates 6 records of the species within the LSA and 15 within the RSA from 2017 and 1 in the RSA from 2006 (Figure 3.8; ECCC, 2020a). There are 2 historical WMIS records of lesser yellowlegs within the LSA and 10 records within the RSA (Figure 3.9; GNWT, 2020c). There are 6 historical eBird (2020) records of lesser yellowlegs within the LSA and 21 other records of the species occurring within the RSA (Figure 3.10).

The maximal breeding period in nesting zone B8 for lesser yellowlegs is May 21 to July 17 (Birds Canada, 2020). The general recommended activity restrictions for shorebird nests, because there are no species-specific recommendations for lesser yellowlegs, include a setback of 100 m from general

development activities and 50 m from pedestrian or ATV activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1). However, increased setback distances may be considered due to the conservation status of the species (ECCC, 2019b).

Red-necked Phalarope

Red-necked phalarope is a shorebird species that is federally listed as special concern by SARA (Table 3.1; Government of Canada, 2021a) and, while not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as sensitive (Working Group on the General Status of NWT Species, 2016). While the species has experienced population declines throughout much of Canada, this is primarily attributable to significant declines in key staging areas on the Atlantic coast and the vast expanses of remote habitat in the NT where there are limited data collection and population and trend estimation (COSEWIC, 2014). Threats to red-necked phalarope in NT include habitat loss or degradation through anthropogenic disturbance and climate change (GNWT, 2020a) and contamination of aquatic habitats (COSEWIC, 2014).

The species' breeding range includes low- and sub-arctic tundra and tundra-forest transition habitats near freshwater waterbodies throughout most of the NT (COSEWIC, 2014; GNWT, 2020a). Breeding habitat for red-necked phalarope exists throughout the RSA where open, tree- and shrub-less habitats exist adjacent to freshwater ponds, lakes, and streams (COSEWIC, 2014). There are no historical WMIS records of red-necked phalarope within the LSA, but there are three records within the RSA (Figure 3.9; GNWT, 2020c). There is one historical eBird (2020) record of a red-necked phalarope within the LSA near Tulita in 2007 and eight other records of the species occurring within the RSA (Figure 3.10).

The maximal breeding period in nesting zone B8 for red-necked phalarope is May 21 to July 17 (Birds Canada, 2020). The general recommended activity restrictions for shorebird nests, because there are no species-specific recommendations for red-necked phalarope, include a setback of 100 m from general development activities and 50 m from pedestrian or ATV activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1). However, increased setback distances may be considered due to the conservation status of the species (ECCC, 2019b).

Short-eared Owl

Short-eared owl is a raptor species that is federally listed as special concern by SARA (Table 3.1; Government of Canada, 2021a) and, while not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as sensitive (Working Group on the General Status of NWT Species, 2016). While the species has experienced significant population declines throughout Canada, much of this is attributable to habitat loss and degradation on the wintering grounds and more southern breeding grounds (COSEWIC, 2008). Threats to short-eared owl in NT include habitat loss or degradation through anthropogenic disturbance and alteration of tundra habitats due to climate change (GNWT, 2020a). In 2016, a federal management plan was developed for short-eared owl focusing on stabilizing and increasing the species' declining population trend while increasing the area of occupancy, particularly in southern Canada (ECCC, 2018b).

Although the species' breeding range includes open habitats throughout the continental NT, most breeding is believed to occur in coastal and tundra habitats and there is little available data to provide population estimates or trends (COSEWIC, 2008). However, in general, raptor populations in Canada have increased 110% between 1970 to 2016 (ECCC, 2019a). There are no historical WMIS records of short-eared owl within the LSA, but there are three records within the RSA (Figure 3.9; GNWT, 2020c). There are two historical eBird (2020) records of short-eared owl within the LSA near Tulita in 2015 and six other records of the species occurring within the RSA (Figure 3.10).

The maximal breeding period in nesting zone B8 for short-eared owl is March 15 to July 26 (Birds Canada, 2020). The recommended activity restrictions for short-eared owl nests include a setback of 1,500 m from general development activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1).

Common Nighthawk

Common nighthawk is an aerial insectivore species that is federally listed as threatened by SARA (Table 3.1; Government of Canada, 2021a) and, while not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as at risk (Working Group on the General Status of NWT Species, 2016). The species has experienced population declines throughout Canada (COSEWIC, 2007b) and is experiencing long-term (-4.1% per year; 1987-2017) and short-term (-4.0% per year; 2007-2017) declines in the NT portion of the Boreal Taiga Plains Boreal Conservation Region (hereafter BCR6; Smith et al., 2019). The LSA is on the northern edge of the species range and, while relatively widespread in the southern portion of the NT (GNWT, 2020a), there is little available data to provide precise population estimates or trends (Working Group on the General Status of NWT Species, 2016; Smith et al., 2019). However, in general, aerial insectivore bird populations in Canada have increased 59% between 1970 to 2016 (ECCC, 2019a). Threats to common nighthawk in NT include habitat loss or degradation through anthropogenic disturbance, a long-term decline in insect populations, severe weather events, and collisions with vehicle or aircrafts (GNWT, 2020a). In 2016, a federal recovery strategy was developed that provides guidance aimed at halting and reversing population decline of common nighthawk, but existing data has been inadequate for determining critical habitat for common nighthawk (Environment Canada, 2016a).

Common nighthawks breed in a variety of boreal forest habitats, including forest clearings, burns, clearcuts, rocky outcrops, peat bogs, lakeshores, and disturbed areas (COSEWIC, 2007b). Breeding habitat for common nighthawk exists throughout the RSA and ECCC data indicates 29 records of the species within the LSA and one record in the RSA from 2017 (Figure 3.8; ECCC, 2020a). There are no historical eBird (2020) records of common nighthawk within the LSA, but there are three eBird record of the species occurring within the RSA (Figure 3.10).

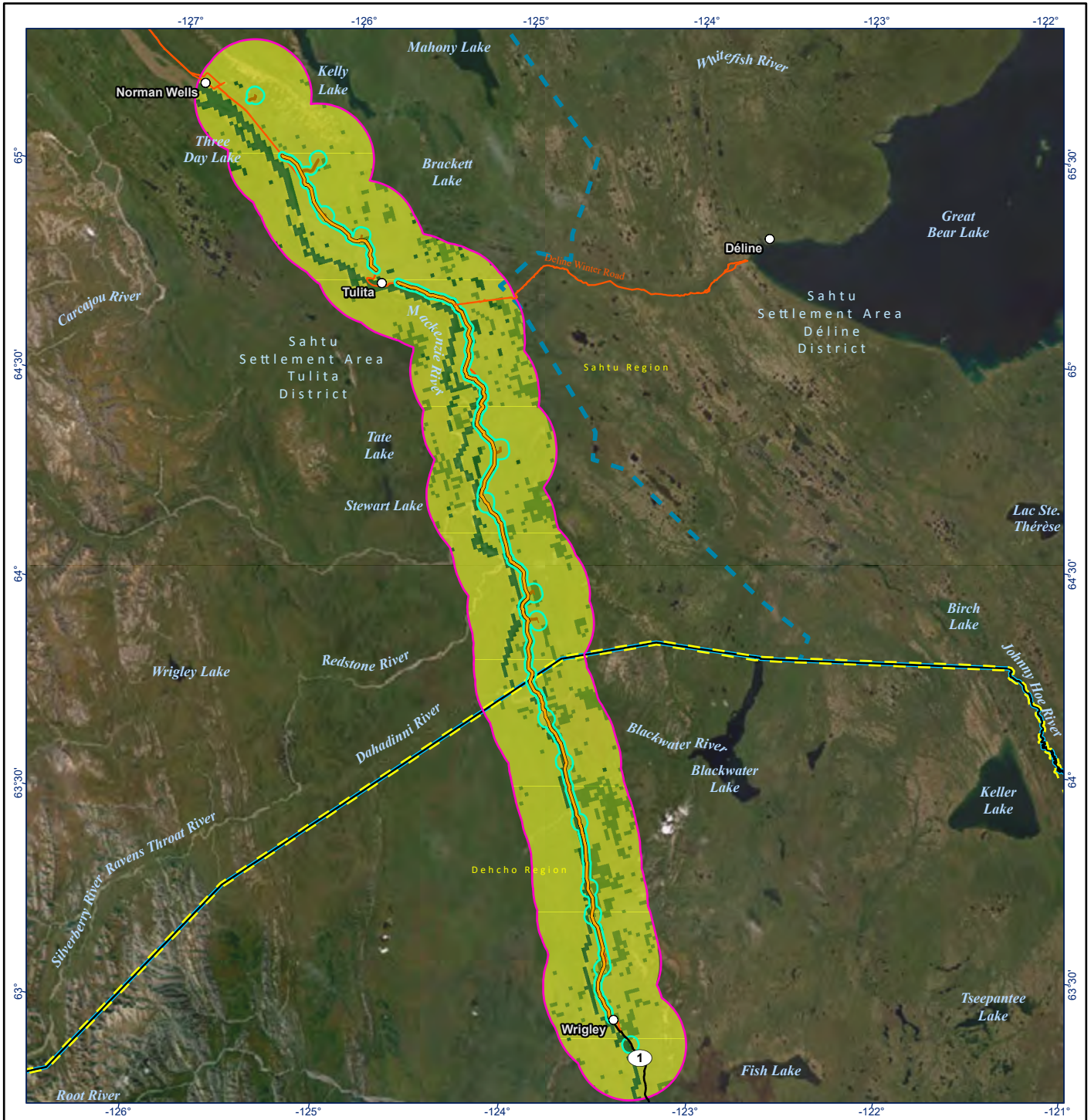
The maximal breeding period in nesting zone B8 for common nighthawk is May 19 to August 2 (Birds Canada, 2020). The recommended activity restrictions for common nighthawk nests include a setback of 200 m from general development activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1).

Olive-sided Flycatcher

Olive-sided flycatcher is an aerial insectivore species that is federally listed as threatened by SARA (Table 3.1; Government of Canada, 2021a) and, while not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as at risk (Working Group on the General Status of NWT Species, 2016). The species has experienced long-term population declines throughout Canada that have slowed in the last decade (COSEWIC, 2018) and is experiencing long-term (-5.8% per year; 1987-2017) and short-term (-10.3% per year; 2007-2017) declines in the NT portion of BCR6 (Smith et al., 2019). The LSA is on the northeastern edge of the species range and while relatively widespread in the southwestern portion of the NT (GNWT, 2020a), there is little available data to provide precise population estimates or trends (Working Group on the General Status of NWT Species, 2016, Smith et al., 2019). However, in general aerial insectivore bird populations in Canada have increased 59% between 1970 to 2016 (ECCC, 2019a). Threats to olive-sided flycatcher in NT include habitat loss or degradation through anthropogenic disturbance and a long-term decline in insect populations (GNWT, 2020a). In 2016, a federal recovery strategy was developed that provides guidance aimed at halting and reversing population decline of olive-sided flycatcher, but existing data has been inadequate for determining critical habitat for olive-sided flycatcher (Environment Canada, 2016b).

Olive-sided flycatcher breeds in a variety of boreal forest habitats, but is typically associated with edge habitats, such as natural (e.g., along riparian areas) and artificial (e.g., tree harvest) clearings and early successional forest (e.g., burns) where tall snags remain (COSEWIC, 2018). Breeding habitat for olive-sided flycatcher exists throughout the RSA and ECCC data indicates eight records of the species within the LSA from 2017 (Figure 3.8; ECCC, 2020a). There is one historical WMIS record of olive-sided flycatcher within the LSA between Wrigley and Tulita from 2003 and an additional three records within the RSA (Figure 3.9; GNWT, 2020c). There are three historical eBird (2020) records of olive-sided flycatcher within the LSA northwest of Tulita from 2004, and seven other records of the species occurring within the RSA (Figure 3.10). Breeding densities of olive-side flycatcher within the RSA are expected to be relatively low (≤ 0.015 males/ha) in comparison to other regions in Canada (BAMP, 2020; Figure 3.11).

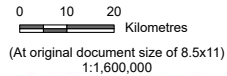
The maximal breeding period in nesting zone B8 for olive-sided flycatcher is May 25 to August 14 (Birds Canada, 2020). The recommended activity restrictions for olive-sided flycatcher nests include a setback of 300 m from general development activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1).



Olive-sided Flycatcher Mean Density

- 0-0.00342
- 0.00342-0.00798
- 0.00798-0.015104
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Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0041 REV/B

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No. 3.11

Olive-sided Flycatcher Breeding Density

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 Geographics
 World Hillshade: Esri, USGS
4. BAM Modeling Results: <https://borealbirds.github.io/species/>; © 2020 Boreal Avian Modelling Project under a CC BY-SA 4.0 license

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Bank Swallow

Bank swallow is an aerial insectivore species that is federally listed as threatened by SARA (Table 3.1; Government of Canada, 2021a) and, while not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as at risk (Working Group on the General Status of NWT Species, 2016). The species has experienced population declines throughout Canada and is experiencing long-term (-2.7% per year; 1987-2017) and short-term (-2.5% per year; 2007-2017) declines in the NT portion of BCR6 (Smith et al., 2019). While the species is relatively widespread throughout the western portion of the NT (GNWT, 2020a), there is little available data to provide precise population estimates or trends (Working Group on the General Status of NWT Species, 2016, Smith et al., 2019). However, in general, aerial insectivore bird populations in Canada have increased 59% between 1970 to 2016 (ECCC, 2019a). Threats to bank swallow in NT include natural (e.g., riverbank collapse) and anthropogenic (e.g., aggregate mounds) nesting colony losses, long-term decline in insect populations, and mortality related to severe weather events (GNWT, 2020a).

Bank swallows nest in soft vertical banks (e.g., riverbanks, quarries) adjacent to open boreal forest habitats that are associated with open water and riparian habitats used for foraging on aerial insects (COSEWIC, 2013). Bank swallow can also nest in human-made habitats including aggregate pits, along roadsides as well as piles of sand or gravel that have slopes that are greater than 70 degrees (ECCC, 2020c; ECCC, 2022)

Breeding habitat for bank swallow exists throughout the RSA where suitable banks exist (e.g., Mackenzie River). There are no historical WMIS records of bank swallow within the LSA, but there are four records within the RSA (Figure 3.9; GNWT, 2020c). There are four historical eBird (2020) records of bank swallow within the LSA between Wrigley and Tulita from 1974 and 2017 and there are 15 other records of the species occurring within the RSA (Figure 3.10). Breeding densities of bank swallow within the RSA are expected to be relatively low (≤ 0.003 males/ha) in comparison to other regions in Canada (BAMP, 2020).

The maximal breeding period in nesting zone B8 for bank swallow is May 15 to August 3 (Birds Canada, 2020). The general recommended activity restrictions are the same as for passerine nests because there are no species-specific recommendations for bank swallows. This includes a setback of 100 m from general development activities and 30 m from pedestrian or ATV activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1). However, increased setback distances may be considered due to the conservation status of the species (ECCC, 2019b).

Barn Swallow

Barn swallow is an aerial insectivore species that is federally listed as threatened by SARA (Table 3.1; Government of Canada, 2021a) and, while not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as at risk (Working Group on the General Status of NWT Species, 2016). The species has experienced population declines throughout Canada and is experiencing long-term (-1.5% per year; 1987-2017) and short-term (-1.2% per year; 2007-2017) declines in the NT portion of BCR6 (Smith et al., 2019). While the species is widespread throughout the western portion of the NT, the species is reliant on anthropogenic structures for nesting (GNWT, 2020a) and there is little available data to provide precise population estimates or trends (Working Group on the General Status of NWT Species, 2016, Smith et

al., 2019). However, in general, aerial insectivore bird populations in Canada have increased 59% between 1970 to 2016 (ECCC, 2019a). Threats to barn swallow in NT include loss or destruction of anthropogenic structures, long-term decline in insect populations, and mortality related to severe weather events (GNWT, 2020a).

Barn swallows nest on anthropogenic structure (e.g., buildings, bridges) adjacent to open boreal forest habitats that are often associated with meadows or riparian habitats used for foraging on aerial insects (COSEWIC, 2011). Breeding habitat for barn swallow exists throughout the RSA where anthropogenic structures exist but there are no historical WMIS (GNWT, 2020c) of the species occurring within the LSA or RSA (GNWT, 2020c). There are three historical eBird (2021) records of barn swallow within the LSA from the Hamlet of Tulita from 2012 to 2017 and 10 other eBird records of the species occurring within the RSA (Figure 3.10). Breeding densities of barn swallow within the RSA are expected to be relatively low (≤ 0.018 males/ha) in comparison to other regions in Canada (BAMP, 2020).

The maximal breeding period in nesting zone B8 for barn swallow is May 12 to August 22 (Birds Canada, 2020). The general recommended activity restrictions are the same as for passerine nests because there are no species-specific recommendations for barn swallows. These include a setback of 100 m from general development activities and 30 m from pedestrian or ATV activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1). However, increased setback distances may be considered due to the conservation status of the species (ECCC, 2019b).

Harris's Sparrow

Harris's sparrow is a large passerine species that has been assessed by COSEWIC as special concern (Table 3.1; Government of Canada, 2021a), but it is not territorially listed under the *Species at Risk (NWT) Act* and is territorially ranked as undetermined (Working Group on the General Status of NWT, Species, 2016). While the species is relatively widespread throughout the central and eastern portions of the NT (GNWT, 2020a), it is one of the least studied passerine species in North America and its remote northern breeding range is not well captured by existing continental survey programs (COSEWIC, 2017a). As a result, there is no available data to provide population estimates or trends (Working Group on the General Status of NWT Species, 2016; Smith et al., 2019). Threats to Harris's sparrow in NT include the loss and degradation of breeding habitat through anthropogenic disturbance and climate-related habitat alteration (GNWT, 2020a).

Harris's sparrow is a ground-nesting species that inhabits semi-forested tundra, preferably in landscapes with coniferous trees interspersed with short (< 1 m) deciduous shrub understories (COSEWIC, 2017a). Breeding habitat for Harris's sparrow may exist within the RSA where semi-forested tundra habitats exist but the LSA is outside of the species' typical breeding range. ECCC data indicates one record of the species within the LSA southeast of Tulita from 2017 (Figure 3.8; ECCC, 2020a). There are no historical WMIS records of Harris's sparrow within the LSA, but there are two records within the RSA (Figure 3.9; GNWT, 2020c). There are three historical eBird (2021) records of Harris's sparrow within the LSA from the Hamlet of Tulita and six other records of the species occurring within the RSA (Figure 3.10).

The primary nesting period for Harris's sparrow is May 5 to August 21 (ECCC, 2018a). The general recommended activity restrictions as the same as for passerine nests because there are no species-specific recommendations for Harris's sparrow. These include a setback of 100 m from general development activities and 30 m from pedestrian or ATV activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1). However, increased setback distances may be considered due to the conservation status of the species (ECCC, 2019b).

Rusty Blackbird

Rusty blackbird is a songbird species that is federally listed as special concern by SARA (Table 3.1; Government of Canada, 2021a) and, while not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as sensitive (Working Group on the General Status of NWT Species, 2016). The species has experienced long-term population declines throughout Canada (COSEWIC, 2017b) and is experiencing long-term (-1.6% per year; 1987-2017) and short-term (-1.6% per year; 2007-2017) declines in the NT portion of BCR6 (Smith et al., 2019). While the species is widespread throughout most of the continental NT (GNWT, 2020a), there is little available data to provide precise population estimates or trends (Working Group on the General Status of NWT Species, 2016; Smith et al., 2019). Threats to rusty blackbird in NT include habitat loss and alteration of riparian and wetland habitats, including through altered drainage patterns, and through climate-related mercury contamination and wetland degradation (COSEWIC, 2017b; GNWT, 2020a). In 2015, a federal management plan was developed for rusty blackbird focusing on stabilizing and increasing the species' declining population trend while increasing the area of occupancy (Environment Canada, 2015).

Rusty blackbird breeds in a variety of boreal forest habitats typically associated with wetlands, including streams, bogs, and marshes but is typically associated with edge habitats, such as natural (e.g., along riparian areas) and artificial (e.g., tree harvest) clearings and early successional forest (e.g., burns) where tall snags remain (COSEWIC, 2017b). There are three historical WMIS records of rusty blackbird within the LSA from 2004: two north of Wrigley and one south of Norman Wells (Figure 3.9; GNWT, 2020c). There are an additional 11 WMIS records of bank swallow within the RSA (Figure 3.9; GNWT, 2020c). There are four historical eBird (2021) records of rusty blackbird within the LSA: one between Wrigley and Tulita from 1972 and three north of Tulita from 2004 (Figure 3.10). There are also 26 other records of the species occurring within the RSA. Breeding densities of rusty blackbird within the RSA are expected to be relatively low (≤ 0.01 males/ha) in comparison to other regions in Canada (BAMP, 2020).

The maximal breeding period in nesting zone B8 for rusty blackbird is April 30 to July 8 (Birds Canada, 2020). The recommended activity restriction for rusty blackbird nests is a setback of 300 m from general development activities between May 1 to July 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1).

Horned Grebe

Horned grebe is a waterbird species that is federally listed as special concern by SARA (Table 3.1; Government of Canada, 2021a) and, while not territorially listed under the *Species at Risk (NWT) Act*, it is territorially ranked as sensitive (Working Group on the General Status of NWT Species, 2016). The species has experienced long-term population declines throughout Canada (COSEWIC, 2009) and is experiencing long-term (-1.3% per year; 1987-2017) and short-term (-1.9% per year; 2007-2017) declines

in the NT portion of BCR6 (Smith et al., 2019). While the species is widespread throughout most of the central and western NT (GNWT, 2020a), there is little available data to provide precise population estimates or trends (Working Group on the General Status of NWT Species, 2016, Smith et al., 2019). In general, wetland bird populations in Canada have increased 30% between 1970 to 2016 (ECCC, 2019a). Threats to horned grebe in NT include increased predation by mammals, birds, and fish, and climate-related changes to wetland habitats and water quality (GNWT, 2020a).

Horned grebes typically breed in small and open boreal forest wetlands, with emergent vegetation for nesting, but they occasionally breed in shallow, marshy bays of larger lakes (Fournier and Hines, 1999; COSEWIC, 2009). Additionally, borrow pits left following highway construction projects in the northern boreal have been shown to provide suitable breeding habitat for horned grebes (Kuczynski et al., 2012). There is one historical WMIS record of horned grebe within the LSA between Wrigley and Tulita from 2004 and an additional seven records within the RSA (Figure 3.9; GNWT, 2020c). There are three historical eBird (2021) records of horned grebe within the LSA: one between Wrigley and Tulita from 1972 and two north of Tulita from 2002 to 2004 (Figure 3.10). There are also 17 other eBird (2021) records of the species occurring within the RSA.

The maximal breeding period in nesting zone B8 for horned grebe is May 4 to July 29 (Birds Canada, 2020). The recommended activity restriction for horned grebe nests is a setback of 100 m (applied from the edge of the waterbody) for general development activities between May 15 to August 31 (GNWT, 2015a, 2016a; Appendix A, Table A.1).

4 Key Results and Findings

The Project consists of construction of a 281 km all-season highway that largely follows the route of the existing MVWR and includes the construction and operation of temporary and permanent borrow sources and quarries. The biophysical characteristics of the LSA are influenced by the Mackenzie River valley that defines the landscape and is dominated by coniferous forest habitats interspersed with wetlands and watercourses. The RSA has the potential to provide habitat for 201 species of bird, including 84 waterbird species, 5 upland gamebird species, 19 bird of prey species, and 93 landbird species (Appendix A, Table A.2; GNWT, 2020c). The RSA also has the potential to provide habitat for 12 SAR/SOCC.

Bird habitat in the Dehcho Region portion of the LSA is dominated by coniferous forest (43.6%), wetlands (19.8%), and open water (19.3%), while landcover in the LSA in the Sahtu Region is dominated by coniferous forest (28.7%), wetlands (25.2%), and shrubland (20.6%). Since 1960, 18.5% of the LSA within the Dehcho Region and 75.2% of the LSA within the Sahtu Region has been subject to forest fire.

Other than communities, the Norman Wells Pipeline, and other developments such as borrow sources and quarries, a fibre line, and bridges associated with the MVWR, the LSA and RSA are relatively undisturbed. Oil and gas exploration and production infrastructure in the RSA occurs on the west side of and within the Mackenzie River near Norman Wells (Auld and Kershaw, 2005).

Key results and findings include:

- Many bird species are culturally important to local communities (e.g., birds of prey) and for subsistence hunting (e.g., waterbirds, upland gamebirds; e.g., Auld and Kershaw, 2005; DLUPC, 2006; SLUBP, 2013; SRRB, 2021, TRRC, 2022).
- The Bear Rock CZ is a large karst formation west of Tulita that is a sacred site and subject to traditional storytelling that also provides habitat for a wide variety of wildlife species, including nesting raptors (SLUBP, 2013).
- The RSA is within the breeding range of 10 bird SAR and 2 bird SOCC.
- Historical records exist within the LSA and RSA for 11 of 12 SAR/SOCC (all but yellow rail) with the potential to occur in the RSA (Government of Canada, 2021a; GNWT, 2020a, 2020b, 2020c; eBird, 2021; ECCC, 2020a).
- The LSA is not expected to provide a notable source of habitat for bird SAR and SOCC when compared to other areas in the RSA and NT as these species are generally widely distributed and/or at the northern edge of their range. However, data availability is limited for some SAR.
- The LSA is partially within the Middle Mackenzie River IBA that provides a notable source of staging and migration habitat for migratory birds, especially waterfowl and other waterbird species (IBA Canada, 2020b).
- Brackett Lake IBA also provides a notable source of breeding and migration habitat for waterbird species. It is located in the RSA and outside of the LSA (IBA Canada, 2020c).

- Other sensitive wildlife features for birds such as nests, primarily for raptors, are located throughout the LSA and RSA (GNWT, 2020c).
- Notable concentrations of raptor nests exist in the Bear Rock CZ, within the RSA, which is also a culturally sacred site (SLUBP, 2013; GNWT, 2020c).

4.1 Additional Studies

Targeted SAR surveys are planned to be undertaken to fill the data gap associated with the limited data availability for SAR. The information will help establish the existing condition for those species within the LSA and support the assessment of effects of the Project on the environment in the Developer's Assessment Report. Surveys will focus on SAR most likely to interact with the Project.

5 Closure

This TDR was prepared for the sole benefit of GNWT to describe existing conditions related to birds and bird habitat within the bird LSA and RSA. If you have any questions, please do not hesitate to contact the undersigned.

Respectfully submitted,

K'alo-Stantec Limited

6 References

6.1 Literature Cited

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Appendix A Tables

List of Tables

Table A.1	Recommended Activity Restriction Guidelines for Sensitive Bird Species ¹	A.1
Table A.2	Bird Species with the Potential to Occupy the Ecoregions in the LSA ¹	A.3
Table A.3	Summary of Historical North American Breeding Bird Survey Data in the RSA (Sahtu Region) ¹	A.12
Table A.4	Summary of the Number of Survey Locations with Breeding Bird Species Detections from the ECCC ARU Surveys in 2017	A.16
Table A.5	Summary of the Number of ARU Species Detections by Ecoregion from the ECCC ARU Surveys in 2017	A.20
Table A.6	Summary of the Number of Individuals Detected during the ECCC Point-count Surveys in 2004 and 2006	A.24

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Table A.1 Recommended Activity Restriction Guidelines for Sensitive Bird Species¹

Wildlife Species	Feature or Habitat	Specific Conditions	Sensitive Period²	Recommended Setback Distance (m)
Species At Risk				
Peregrine falcon	Nest	General development activities	May 1 – Aug 31	1,500
Yellow rail	Edge of waterbody with a nest	General development activities	May 1 – Aug 31	300
Lesser yellowlegs	Nest	General development activities	May 1 – Aug 31	300
Red-necked phalarope	Nest	General development activities	May 1 – Aug 31	300
Short-eared owl	Nest	General development activities	May 1 – Aug 31	1,500
Common nighthawk	Nest	General development activities	May 1 – Aug 31	200
Olive-sided flycatcher	Nest	General development activities	May 1 – Aug 31	200
Bank swallow	Nesting colony	General development activities	May 1 – Aug 31	200
Barn swallow	Nest	General development activities	May 1 – Aug 31	200
Harris's sparrow	Nest	General development activities	May 1 – Aug 31	200
Rusty blackbird	Nest	General development activities	May 1 – Aug 31	300
Horned grebe	Edge of waterbody with a nest	General development activities	May 1 – Aug 31	300
Other Species				
Waterfowl (general)	Staging area	General development activities when large concentrations of birds are present	Spring/Fall	3,000
Swans/Loons/Cranes	Nest	General development activities	May 1 – Aug 31	800
		Pedestrians/ATVs	May 1 – Aug 31	500
Ducks	Nest	General development activities	May 1 – Aug 31	150
		Pedestrians/ATVs	May 1 – Aug 31	50
Geese	Nest	General development activities	May 1 – Aug 31	500
		Pedestrians/ATVs	May 1 – Aug 31	300

**Mackenzie Valley Highway Project
 Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
 March 2023

Wildlife Species	Feature or Habitat	Specific Conditions	Sensitive Period²	Recommended Setback Distance (m)
Shorebirds	Nest	General development activities	May 1 – Aug 31	100
		Pedestrians/ATVs	May 1 – Aug 31	50
Terns/Gulls	Nest	General development activities	May 1 – Aug 31	300
		Pedestrians/ATVs	May 1 – Aug 31	200
Raptors (general)	Nest	General development activities	Mar 1 – Aug 31	1,500
	Nest	General development activities	Sep 1 – Feb 28	500
Songbirds (general)	Nest	General development activities	May 1 – Aug 31	100
		Pedestrians/ATVS	May 1 – Aug 31	30
All other birds	Nest	Varies with region and species; contact GNWT or ECCC office	Breeding / nesting seasons	100

Notes:

¹ Modified from DLUPC, 2006; SLUPB, 2013; and GNWT, 2015a.

² Sensitive periods are a general guide and specific timing may vary. Year-round avoidance may not always be feasible, and exceptions will be discussed with GNWT Environment and Natural Resources to develop appropriate mitigation.

Mackenzie Valley Highway Project
 Technical Data Report—Birds and Bird Habitat

Appendix A Tables
 March 2023

Table A.2 Bird Species with the Potential to Occupy the Ecoregions in the LSA¹

Group	Order	Common Name	Scientific Name	ECCC Detection ²
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
 Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
 March 2023

Group	Order	Common Name	Scientific Name	ECCC Detection²
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>	✓
		White-winged scoter	<i>Melanitta deglandi</i>	
	Waterbirds	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>	
		Red-necked grebe	<i>Podiceps grisegena</i>	✓
	Shorebirds	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>	
		American golden-plover	<i>Pluvialis dominica</i>	

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Group	Order	Common Name	Scientific Name	ECCC Detection²
Waterbirds (cont'd)	Shorebirds (cont'd)	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>	✓		
Ring-billed gull	<i>Larus delawarensis</i>	✓		

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Group	Order	Common Name	Scientific Name	ECCC Detection²
Waterbirds (cont'd)	Shorebirds (cont'd)	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>		
Great grey owl		<i>Strix nebulosa</i>		

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Group	Order	Common Name	Scientific Name	ECCC Detection ²
Birds of Prey (cont'd)	Owls (cont'd)	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-pewee	<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>	
		Eastern kingbird	<i>Tyrannus tyrannus</i>	✓

**Mackenzie Valley Highway Project
 Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
 March 2023

Group	Order	Common Name	Scientific Name	ECCC Detection²
Landbirds (cont'd)	Passerines (cont'd)	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>	✓		
Varied thrush	<i>Ixoreus naevius</i>	✓		

**Mackenzie Valley Highway Project
 Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
 March 2023

Group	Order	Common Name	Scientific Name	ECCC Detection²
Landbirds (cont'd)	Passerines (cont'd)	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>Mniotilta 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>Poocetes gramineus</i>			
Savannah sparrow	<i>Passerculus sandwichensis</i>	✓		
Fox sparrow	<i>Passerella iliaca</i>	✓		

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Group	Order	Common Name	Scientific Name	ECCC Detection²
Landbirds (cont'd)	Passerines (cont'd)	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>	✓		
Hoary redpoll	<i>Acanthis hornemanni</i>			

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Group	Order	Common Name	Scientific Name	ECCC Detection ²
Landbirds (cont'd)	Passerines (cont'd)	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>	

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, 2020c).

² '✓' indicates a historical record from the Environment and Climate Change Canada breeding bird survey data 2004, 2006, and 2017 (ECCC, 2020a).

* As indicated by ECCC (Dufour, 2020, pers. comm.; ECCC, 2020a).

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Table A.3 Summary of Historical North American Breeding Bird Survey Data in the RSA (Sahtu Region)¹

Common Name	Scientific Name	Survey Route and Breeding Abundance ²			
		Norman Wells		Bear River	
		Mean	Range	Mean	range
Canada goose	<i>Branta canadensis</i>	2.5	0-12	-	-
Northern pintail	<i>Anas acuta</i>	0.2	0-1	-	-
Green-winged teal	<i>Anas crecca</i>	1.5	0-6	-	-
Ring-necked duck	<i>Aythya collaris</i>	0.1	0-1	-	-
Greater scaup	<i>Aythya marila</i>	0.9	0-6	-	-
Lesser scaup	<i>Aythya affinis</i>	5.9	0-20	-	-
Blue-winged teal	<i>Spatula discors</i>	0.3	0-1	-	-
Northern shoveler	<i>Spatula clypeata</i>	2.1	0-11	-	-
American wigeon	<i>Mareca americana</i>	3.5	0-10	-	-
White-winged scoter	<i>Melanitta deglandi</i>	0.7	0-8	-	-
Pacific loon	<i>Gavia pacifica</i>	0.8	0-2	0.5	0-1
Horned grebe	<i>Podiceps auritus</i>	0.6	0-3	-	-
Sora	<i>Porzana carolina</i>	2.1	0-5	-	-
American coot	<i>Fulica americana</i>	0.2	0-1	-	-
Sandhill crane	<i>Antigone canadensis</i>	1.5	0-5	2.0	0-4
Semipalmated plover	<i>Charadrius semipalmatus</i>	0.1	0-1	-	-
Killdeer	<i>Charadrius vociferus</i>	0.4	0-2	-	-
Spotted sandpiper	<i>Actitis macularius</i>	0.1	0-1	-	-
Solitary sandpiper	<i>Tringa solitaria</i>	0.5	0-2	-	-
Lesser yellowlegs	<i>Tringa flavipes</i>	6.2	0-18	-	-
Wilson's snipe	<i>Gallinago delicata</i>	3.6	0-10	1.0	1-1
Mew gull	<i>Larus canus</i>	6.6	0-15	-	-
Herring gull	<i>Larus argentatus</i>	3.8	1-9	-	-

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Common Name	Scientific Name	Survey Route and Breeding Abundance ²			
		Norman Wells		Bear River	
		Mean	Range	Mean	range
Bonaparte's gull	<i>Chroicocephalus philadelphia</i>	0.1	0-1	-	-
Short-eared owl	<i>Asio flammeus</i>	0.2	0-2	-	-
Spruce grouse	<i>Canachites canadensis</i>	1.1	0-12	-	-
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	-	-	1.0	1-1
Northern harrier	<i>Circus hudsonius</i>	0.4	0-1	-	-
Red-tailed hawk	<i>Buteo jamaicensis</i>	0.1	0-1	1.0	1-1
American kestrel	<i>Falco sparverius</i>	0.2	0-1	0.5	0-1
Belted kingfisher	<i>Megaceryle alcyon</i>	0.1	0-1	-	-
Downy woodpecker	<i>Dryobates pubescens</i>	0.1	0-1	-	-
Northern flicker	<i>Colaptes auratus</i>	2.7	1-5	5.5	2-9
Olive-sided flycatcher	<i>Contopus cooperi</i>	0.6	0-3	1.5	1-2
Western wood-pewee	<i>Contopus sordidulus</i>	-	-	0.5	0-1
Alder flycatcher	<i>Empidonax alnorum</i>	22.1	9-41	55.5	35-76
Least flycatcher	<i>Empidonax minimus</i>	0.4	0-2	3.5	1-6
Eastern kingbird	<i>Tyrannus tyrannus</i>	0.5	0-2	-	-
Warbling vireo	<i>Vireo gilvus</i>	0.7	0-3	-	-
Red-eyed vireo	<i>Vireo olivaceus</i>	0.5	0-2	2.5	2-3
Common raven	<i>Corvus corax</i>	0.6	0-2	2.0	1-3
Tree swallow	<i>Tachycineta bicolor</i>	2.1	0-13	-	-
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	0.4	0-4	-	-
Boreal chickadee	<i>Poecile hudsonicus</i>	0.6	0-2	-	-
Gray-cheeked thrush	<i>Catharus minimus</i>	0.5	0-2	1.0	1-1
Swainson's thrush	<i>Catharus ustulatus</i>	78.9	55-143	10.0	2-18
Hermit thrush	<i>Catharus guttatus</i>	16.8	4-32	45.0	11-79

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Common Name	Scientific Name	Survey Route and Breeding Abundance ²			
		Norman Wells		Bear River	
		Mean	Range	Mean	range
American robin	<i>Turdus migratorius</i>	30.7	18-45	12.5	7-18
Varied thrush	<i>Ixoreus naevius</i>	1.4	0-5	-	-
Bohemian waxwing	<i>Bombycilla garrulus</i>	0.5	0-3	0.5	0-1
Yellow warbler	<i>Setophaga petechia</i>	4.5	0-10	9.5	4-15
Magnolia warbler	<i>Setophaga magnolia</i>	0.7	0-3	0.5	0-1
Yellow-rumped warbler	<i>Setophaga coronata</i>	34.6	6-63	0.5	0-1
Palm warbler	<i>Setophaga palmarum</i>	9.5	0-27	1.5	0-3
Blackpoll warbler	<i>Setophaga striata</i>	8.2	4-13	0.5	0-1
Northern waterthrush	<i>Parkesia noveboracensis</i>	0.7	0-3	-	-
Common yellowthroat	<i>Geothlypis trichas</i>	1.5	0-4	-	-
Wilson's warbler	<i>Cardellina pusilla</i>	0.2	0-1	0.5	0-1
Ruby-crowned kinglet	<i>Corthylio calendula</i>	14.8	4-29	-	-
Chipping sparrow	<i>Spizella passerina</i>	35.9	15-45	5.0	4-6
Savannah sparrow	<i>Passerculus sandwichensis</i>	4.2	1-8	13.5	9-18
Fox sparrow	<i>Passerella iliaca</i>	11.8	1-21	18.0	16-20
Song sparrow	<i>Melospiza melodia</i>	0.1	0-1	-	-
Lincoln's sparrow	<i>Melospiza lincolnii</i>	26.4	13-42	25.0	22-28
Swamp sparrow	<i>Melospiza georgiana</i>	4.4	0-10	-	-
White-throated sparrow	<i>Zonotrichia albicollis</i>	12.3	3-25	22.5	19-26
Harris's sparrow	<i>Zonotrichia querula</i>	0.1	0-1	-	-
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	27.9	8-56	102.0	89-115
Dark-eyed junco	<i>Junco hyemalis</i>	19.4	6-37	4.0	1-7
Red-winged blackbird	<i>Agelaius phoeniceus</i>	0.5	0-2	-	-
Brown-headed cowbird	<i>Molothrus ater</i>	0.1	0-1	-	-

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Common Name	Scientific Name	Survey Route and Breeding Abundance ²			
		Norman Wells		Bear River	
		Mean	Range	Mean	range
Pine grosbeak	<i>Pinicola enucleator</i>	2.5	0-7	-	-
White-winged crossbill	<i>Loxia leucoptera</i>	7.2	0-34	0.5	0-1
Common redpoll	<i>Acanthis flammea</i>	3.8	0-9	13.5	12-15
Pine siskin	<i>Spinus pinus</i>	0.1	0-1	-	-
Western tanager	<i>Piranga ludoviciana</i>	0.3	0-2	-	-
Canada jay	<i>Perisoreus canadensis</i>	11.1	3-18	3.5	3-4
Clay-colored sparrow	<i>Spizella pallida</i>	0.2	0-1	0.5	0-1
LeConte's sparrow	<i>Ammodramus leconteii</i>	0.2	0-2	-	-
Tennessee warbler	<i>Leiothlypis peregrina</i>	5.2	0-20	1.0	1-1
Orange-crowned warbler	<i>Leiothlypis celata</i>	19.6	1-29	18.0	10-26

Notes:

¹ Data summarized from (Pardieck et al., 2019)

² Historical data (number of individuals detected) from 1995-2005 on the Norman Wells route from 2004-2005 on the Bear River route.

Table A.4 Summary of the Number of Survey Locations with Breeding Bird Species Detections from the ECCC ARU Surveys in 2017

Species		Major Land Cover Class							Total
Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Canada goose	<i>Branta canadensis</i>	0	1	0	1	0	2	0	4
Pacific loon	<i>Gavia pacifica</i>	0	0	0	1	0	0	0	1
Common loon	<i>Gavia immer</i>	0	1	0	1	0	0	0	2
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
American bittern	<i>Botaurus lentiginosus</i>	0	2	0	0	0	0	0	2
Sora	<i>Porzana carolina</i>	1	0	0	0	0	2	0	3
Sandhill crane	<i>Antigone canadensis</i>	0	0	0	4	1	2	0	7
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	0	2	0	2	0	6
Wilson's snipe	<i>Gallinago delicata</i>	1	7	1	4	0	3	0	16
Ring-billed gull	<i>Larus delawarensis</i>	0	0	0	1	0	0	0	1
Great horned owl	<i>Bubo virginianus</i>	0	0	0	0	0	1	0	1
Ruffed grouse	<i>Bonasa umbellus</i>	0	1	0	2	0	2	1	5
Common nighthawk	<i>Chordeiles minor</i>	0	0	0	0	0	1	0	1
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	0	3	0	1	0	2	1	6
Black-backed woodpecker	<i>Picoides arcticus</i>	0	0	1	0	0	0	0	1

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Species		Major Land Cover Class							Total
Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Northern flicker	<i>Colaptes auratus</i>	0	3	0	0	0	1	1	4
Pileated woodpecker	<i>Dryocopus pileatus</i>	0	1	0	0	0	0	0	1
Olive-sided flycatcher	<i>Contopus cooperi</i>	0	1	0	0	0	0	0	1
Western wood-pewee	<i>Contopus sordidulus</i>	0	0	0	0	0	2	0	2
Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	0	2	0	2	0	2	0	6
Alder flycatcher	<i>Empidonax alnorum</i>	1	13	1	4	2	8	0	29
Least flycatcher	<i>Empidonax minimus</i>	1	1	1	0	0	2	0	5
Blue-headed vireo	<i>Vireo solitarius</i>	0	0	1	0	0	0	0	1
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
Common raven	<i>Corvus corax</i>	0	0	1	1	0	2	0	4
Tree swallow	<i>Tachycineta bicolor</i>	0	0	0	0	0	1	0	1
Black-capped chickadee	<i>Poecile atricapillus</i>	0	0	0	0	1	0	0	1
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
Swainson's thrush	<i>Catharus ustulatus</i>	3	25	3	6	2	13	1	52
Hermit thrush	<i>Catharus guttatus</i>	2	23	3	6	2	11	0	47
American robin	<i>Turdus migratorius</i>	1	17	1	5	1	11	1	36
Varied thrush	<i>Ixoreus naevius</i>	1	6	0	0	0	3	0	10

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Species		Major Land Cover Class							Total
Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Bohemian waxwing	<i>Bombycilla garrulus</i>	0	0	0	1	0	0	0	1
Yellow warbler	<i>Setophaga petechia</i>	0	1	1	1	1	1	0	5
Magnolia warbler	<i>Setophaga magnolia</i>	0	4	0	2	0	3	0	9
Cape may warbler	<i>Setophaga tigrina</i>	1	1	0	0	0	0	0	2
Yellow-rumped warbler	<i>Setophaga coronata</i>	2	16	3	3	0	6	1	30
Palm warbler	<i>Setophaga palmarum</i>	1	11	1	4	1	3	0	21
Bay-breasted warbler	<i>Setophaga castanea</i>	0	1	0	0	0	0	0	1
Blackpoll warbler	<i>Setophaga striata</i>	2	4	0	0	1	2	0	9
Black-and-white warbler	<i>Mniotilta varia</i>	0	0	0	0	0	1	0	1
American redstart	<i>Setophaga ruticilla</i>	0	1	0	0	0	2	0	3
Ovenbird	<i>Seiurus aurocapilla</i>	0	0	0	0	0	4	0	4
Northern waterthrush	<i>Parkesia noveboracensis</i>	0	1	1	2	1	2	0	7
Common yellowthroat	<i>Geothlypis trichas</i>	0	3	1	0	0	1	0	5
Wilson's warbler	<i>Cardellina pusilla</i>	1	1	0	1	1	1	0	5
Tennessee warbler	<i>Leiothlypis peregrina</i>	3	21	3	3	1	9	1	40
Orange-crowned warbler	<i>Leiothlypis celata</i>	3	9	1	5	2	6	0	26
Ruby-crowned kinglet	<i>Corthylio calendula</i>	2	17	2	2	0	5	1	28
American tree sparrow	<i>Spizelloides arborea</i>	0	1	0	0	1	0	0	2
Chipping sparrow	<i>Spizella passerina</i>	2	23	3	3	2	8	1	41
Savannah sparrow	<i>Passerculus sandwichensis</i>	0	0	0	0	0	2	0	2

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Species		Major Land Cover Class							Total
Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Fox sparrow	<i>Passerella iliaca</i>	2	5	0	2	1	5	0	15
Lincoln's sparrow	<i>Melospiza lincolni</i>	2	20	2	4	1	9	0	38
Swamp sparrow	<i>Melospiza georgiana</i>	0	3	1	1	0	3	0	8
White-throated sparrow	<i>Zonotrichia albicollis</i>	3	15	2	6	2	10	1	38
Harris's sparrow	<i>Zonotrichia querula</i>	0	0	0	1	0	0	0	1
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	1	2	1	4	2	3	0	13
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>	2	20	1	3	2	8	1	36
White-winged crossbill	<i>Loxia leucoptera</i>	1	11	0	1	0	4	0	17
Common redpoll	<i>Acanthis flammea</i>	0	0	0	0	0	2	0	2
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	10
Canada jay	<i>Perisoreus canadensis</i>	0	7	1	2	0	4	0	14
Total	72 species	40	324	41	95	31	190	12	721

Table A.5 Summary of the Number of ARU Species Detections by Ecoregion from the ECCC ARU Surveys in 2017

Common Name	Scientific Name	Number of Detections (Mean and Standard Deviation)					
		Boreal Cordillera		Taiga Cordillera		Taiga Plains	
		Mean	SD	Mean	SD	Mean	SD
Canada goose	<i>Branta canadensis</i>	0.00	0.00	0.11	0.46	0.16	0.37
Pacific loon	<i>Gavia pacifica</i>	0.00	0.00	0.00	0.00	0.05	0.23
Common loon	<i>Gavia immer</i>	0.00	0.00	0.05	0.23	0.05	0.23
Pied-billed grebe	<i>Podilymbus podiceps</i>	0.00	0.00	0.00	0.00	0.05	0.23
Red-necked grebe	<i>Podiceps grisegena</i>	0.00	0.00	0.00	0.00	0.11	0.46
American bittern	<i>Botaurus lentiginosus</i>	0.00	0.00	0.16	0.50	0.00	0.00
Sora	<i>Porzana carolina</i>	0.20	0.77	0.05	0.23	0.16	0.69
Sandhill crane	<i>Antigone canadensis</i>	0.00	0.00	0.11	0.32	0.47	0.90
Solitary sandpiper	<i>Tringa solitaria</i>	0.00	0.00	0.00	0.00	0.21	0.54
Greater yellowlegs	<i>Tringa melanoleuca</i>	0.00	0.00	0.00	0.00	0.05	0.23
Lesser yellowlegs	<i>Tringa flavipes</i>	0.00	0.00	0.05	0.23	0.32	0.58
Wilson's snipe	<i>Gallinago delicata</i>	0.20	0.56	0.63	0.90	1.00	2.03
Ring-billed gull	<i>Larus delawarensis</i>	0.00	0.00	0.00	0.00	0.05	0.23
Great horned owl	<i>Bubo virginianus</i>	0.00	0.00	0.05	0.23	0.00	0.00
Ruffed grouse	<i>Bonasa umbellus</i>	0.13	0.35	0.21	0.54	0.05	0.23
Common nighthawk	<i>Chordeiles minor</i>	0.00	0.00	0.05	0.23	0.00	0.00
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	0.53	0.92	0.11	0.32	0.00	0.00
Black-backed woodpecker	<i>Picoides arcticus</i>	0.00	0.00	0.05	0.23	0.00	0.00
Northern flicker	<i>Colaptes auratus</i>	0.07	0.26	0.05	0.23	0.16	0.37
Pileated woodpecker	<i>Dryocopus pileatus</i>	0.07	0.26	0.00	0.00	0.00	0.00
Olive-sided flycatcher	<i>Contopus cooperi</i>	0.00	0.00	0.00	0.00	0.16	0.69

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Common Name	Scientific Name	Number of Detections (Mean and Standard Deviation)					
		Boreal Cordillera		Taiga Cordillera		Taiga Plains	
		Mean	SD	Mean	SD	Mean	SD
Western wood-pewee	<i>Contopus sordidulus</i>	0.07	0.26	0.00	0.00	0.05	0.23
Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	0.07	0.26	0.42	0.90	0.05	0.23
Alder flycatcher	<i>Empidonax alnorum</i>	1.00	1.60	2.21	2.53	2.26	2.70
Least flycatcher	<i>Empidonax minimus</i>	0.07	0.26	0.21	0.71	0.11	0.32
Blue-headed vireo	<i>Vireo solitarius</i>	0.00	0.00	0.05	0.23	0.00	0.00
Warbling vireo	<i>Vireo gilvus</i>	0.20	0.56	0.21	0.42	0.11	0.32
Red-eyed vireo	<i>Vireo olivaceus</i>	0.00	0.00	0.05	0.23	0.00	0.00
Common raven	<i>Corvus corax</i>	0.00	0.00	0.11	0.46	0.21	0.54
Tree swallow	<i>Tachycineta bicolor</i>	0.00	0.00	0.00	0.00	0.05	0.23
Black-capped chickadee	<i>Poecile atricapillus</i>	0.00	0.00	0.00	0.00	0.05	0.23
Boreal chickadee	<i>Poecile hudsonicus</i>	0.13	0.35	0.05	0.23	0.11	0.46
Townsend's solitaire	<i>Myadestes townsendi</i>	0.00	0.00	0.11	0.46	0.00	0.00
Gray-cheeked thrush	<i>Catharus minimus</i>	0.00	0.00	0.11	0.32	0.05	0.23
Swainson's thrush	<i>Catharus ustulatus</i>	7.40	4.10	10.11	4.25	7.68	4.04
Hermit thrush	<i>Catharus guttatus</i>	2.33	1.88	5.68	3.79	5.26	3.28
American robin	<i>Turdus migratorius</i>	1.60	1.55	1.68	1.95	1.74	1.37
Varied thrush	<i>Ixoreus naevius</i>	0.93	1.10	0.00	0.00	0.05	0.23
Bohemian waxwing	<i>Bombcilla garrulus</i>	0.00	0.00	0.05	0.23	0.00	0.00
Yellow warbler	<i>Setophaga petechia</i>	0.00	0.00	0.37	1.16	0.21	0.71
Magnolia warbler	<i>Setophaga magnolia</i>	0.07	0.26	0.89	1.41	0.00	0.00
Cape may warbler	<i>Setophaga tigrina</i>	0.07	0.26	0.00	0.00	0.05	0.23
Yellow-rumped warbler	<i>Setophaga coronata</i>	1.67	2.35	1.21	1.87	1.53	2.22
Palm warbler	<i>Setophaga palmarum</i>	0.33	0.62	1.26	2.40	0.58	0.96

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Common Name	Scientific Name	Number of Detections (Mean and Standard Deviation)					
		Boreal Cordillera		Taiga Cordillera		Taiga Plains	
		Mean	SD	Mean	SD	Mean	SD
Bay-breasted warbler	<i>Setophaga castanea</i>	0.00	0.00	0.05	0.23	0.00	0.00
Blackpoll warbler	<i>Setophaga striata</i>	0.00	0.00	0.16	0.50	1.05	1.78
Black-and-white warbler	<i>Mniotilta varia</i>	0.00	0.00	0.05	0.23	0.00	0.00
American redstart	<i>Setophaga ruticilla</i>	0.00	0.00	0.26	1.15	0.11	0.32
Ovenbird	<i>Seiurus aurocapilla</i>	0.07	0.26	0.11	0.32	0.05	0.23
Northern waterthrush	<i>Parkesia noveboracensis</i>	0.00	0.00	0.89	2.58	0.42	1.39
Common yellowthroat	<i>Geothlypis trichas</i>	0.07	0.26	0.32	0.95	0.05	0.23
Wilson's warbler	<i>Cardellina pusilla</i>	0.00	0.00	0.05	0.23	0.21	0.42
Tennessee warbler	<i>Leiothlypis peregrina</i>	10.07	6.04	4.84	3.27	2.42	3.58
Orange-crowned warbler	<i>Leiothlypis celata</i>	0.20	0.56	2.32	3.00	4.16	3.67
Ruby-crowned kinglet	<i>Corthylio calendula</i>	1.93	1.62	1.11	1.33	1.11	1.82
American tree sparrow	<i>Spizelloides arborea</i>	0.00	0.00	0.05	0.23	0.05	0.23
Chipping sparrow	<i>Spizella passerina</i>	2.87	1.60	2.63	2.97	2.79	3.10
Savannah sparrow	<i>Passerculus sandwichensis</i>	0.00	0.00	0.00	0.00	0.37	1.12
Fox sparrow	<i>Passerella iliaca</i>	0.00	0.00	1.16	1.71	1.05	1.87
Lincoln's sparrow	<i>Melospiza lincolnii</i>	2.00	2.30	2.63	2.22	3.47	3.55
Swamp sparrow	<i>Melospiza georgiana</i>	0.07	0.26	0.63	1.64	0.37	0.76
White-throated sparrow	<i>Zonotrichia albicollis</i>	4.40	3.54	5.05	5.24	4.47	4.85
Harris's sparrow	<i>Zonotrichia querula</i>	0.00	0.00	0.00	0.00	0.05	0.23
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	0.00	0.00	0.37	0.83	1.58	2.46
Clay-colored sparrow	<i>Spizella pallida</i>	0.07	0.26	0.21	0.63	0.00	0.00
LeConte's sparrow	<i>Ammodramus leconteii</i>	0.00	0.00	0.00	0.00	0.05	0.23
Dark-eyed junco	<i>Junco hyemalis</i>	1.93	1.39	1.16	1.89	2.00	2.03

**Mackenzie Valley Highway Project
 Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
 March 2023

Common Name	Scientific Name	Number of Detections (Mean and Standard Deviation)					
		Boreal Cordillera		Taiga Cordillera		Taiga Plains	
		Mean	SD	Mean	SD	Mean	SD
White-winged crossbill	<i>Loxia leucoptera</i>	0.73	0.88	0.21	0.54	0.37	0.60
Common redpoll	<i>Acanthis flammea</i>	0.07	0.26	0.00	0.00	0.05	0.23
Pine siskin	<i>Spinus pinus</i>	0.07	0.26	0.11	0.32	0.05	0.23
Western tanager	<i>Piranga ludoviciana</i>	1.20	1.21	0.05	0.23	0.05	0.23
Canada jay	<i>Perisoreus canadensis</i>	0.40	0.63	0.26	0.45	0.26	0.56

Mackenzie Valley Highway Project
 Technical Data Report—Birds and Bird Habitat

Appendix A Tables
 March 2023

Table A.6 Summary of the Number of Individuals Detected during the ECCC Point-count Surveys in 2004 and 2006

Species		Major Land Cover Class							Total
Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Mallard	<i>Anas platyrhynchos</i>	0	0	0	0	0	0	2	2
Ring-necked duck	<i>Aythya collaris</i>	0	0	0	0	0	1	0	1
Lesser scaup	<i>Aythya affinis</i>	0	1	0	0	0	1	1	3
Surf scoter	<i>Melanitta perspicillata</i>	0	0	0	0	0	0	2	2
Bufflehead	<i>Bucephala albeola</i>	0	0	0	0	0	1	1	2
Common goldeneye	<i>Bucephala clangula</i>	0	1	0	0	0	0	0	1
American wigeon	<i>Mareca americana</i>	0	0	0	0	0	0	1	1
Pacific loon	<i>Gavia pacifica</i>	0	1	0	0	0	0	2	3
Common loon	<i>Gavia immer</i>	0	1	0	0	0	0	0	1
Bald eagle	<i>Haliaeetus leucocephalus</i>	0	0	0	0	0	0	1	1
Solitary sandpiper	<i>Tringa solitaria</i>	0	0	0	0	0	0	3	3
Lesser yellowlegs	<i>Tringa flavipes</i>	0	0	0	0	0	0	1	1
Wilson's snipe	<i>Gallinago delicata</i>	0	2	0	2	0	0	3	7
Common gull	<i>Larus canus</i>	0	0	0	0	0	0	1	1
Northern flicker	<i>Colaptes auratus</i>	0	0	0	0	0	1	4	5
Alder flycatcher	<i>Empidonax alnorum</i>	0	3	0	4	0	0	0	7
Least flycatcher	<i>Empidonax minimus</i>	0	0	0	1	0	0	0	1
Eastern kingbird	<i>Tyrannus tyrannus</i>	0	0	0	0	0	0	1	1

**Mackenzie Valley Highway Project
Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
March 2023

Species		Major Land Cover Class							Total
Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Warbling vireo	<i>Vireo gilvus</i>	6	0	0	0	0	0	0	6
Common raven	<i>Corvus corax</i>	0	4	0	1	0	0	0	5
Tree swallow	<i>Tachycineta bicolor</i>	0	2	0	0	0	1	1	4
Boreal chickadee	<i>Poecile hudsonicus</i>	0	1	2	0	0	0	0	3
Swainson's thrush	<i>Catharus ustulatus</i>	5	13	8	0	0	7	0	33
Hermit thrush	<i>Catharus guttatus</i>	0	6	0	1	0	1	1	9
American robin	<i>Turdus migratorius</i>	0	4	0	3	0	0	4	11
Yellow-rumped warbler	<i>Setophaga coronata</i>	7	13	0	0	0	3	3	26
Palm warbler	<i>Setophaga palmarum</i>	0	6	0	0	0	5	0	11
Blackpoll warbler	<i>Setophaga striata</i>	0	7	1	2	0	4	0	14
Black-and-white warbler	<i>Mniotilta varia</i>	1	0	0	0	0	0	0	1
Northern waterthrush	<i>Parkesia noveboracensis</i>	0	0	0	1	0	0	4	5
Mourning warbler	<i>Geothlypis philadelphia</i>	1	0	0	0	0	0	0	1
Tennessee warbler	<i>Leiothlypis peregrina</i>	2	2	2	0	0	1	1	8
Orange-crowned warbler	<i>Leiothlypis celata</i>	6	4	4	4	0	0	0	18
Ruby-crowned kinglet	<i>Corthylio calendula</i>	1	9	0	0	0	1	2	13
Chipping sparrow	<i>Spizella passerina</i>	0	15	2	6	0	2	2	27
Savannah sparrow	<i>Passerculus sandwichensis</i>	0	11	0	6	0	0	0	17
Fox sparrow	<i>Passerella iliaca</i>	0	1	0	1	0	0	0	2
Lincoln's sparrow	<i>Melospiza lincolnii</i>	2	21	0	6	0	6	5	40

**Mackenzie Valley Highway Project
 Technical Data Report—Birds and Bird Habitat**

Appendix A Tables
 March 2023

Species		Major Land Cover Class							Total
Common Name	Scientific Name	Broadleaf Forest	Coniferous Forest	Mixedwood Forest	Shrubland	Herbaceous & Unvegetated	Wetland	Water	
Swamp sparrow	<i>Melospiza georgiana</i>	0	0	0	2	0	0	1	3
White-throated sparrow	<i>Zonotrichia albicollis</i>	0	0	0	2	0	1	1	4
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	1	20	0	11	0	3	4	39
Dark-eyed junco	<i>Junco hyemalis</i>	0	15	1	0	0	12	2	30
Clay-colored sparrow	<i>Spizella pallida</i>	1	2	0	5	0	0	0	8
Red-winged blackbird	<i>Agelaius phoeniceus</i>	0	0	0	0	0	0	4	4
Pine grosbeak	<i>Pinicola enucleator</i>	1	1	0	0	0	0	0	2
White-winged crossbill	<i>Loxia leucoptera</i>	0	1	0	0	0	0	1	2
Common redpoll	<i>Acanthis flammea</i>	1	16	0	5	0	2	0	24
Western tanager	<i>Piranga ludoviciana</i>	0	0	2	0	0	0	0	2
Canada jay	<i>Perisoreus canadensis</i>	0	4	1	0	0	0	0	5
Total	49 species	35	187	23	63	0	53	59	420

APPENDIX 20B

Recommended Activity Restriction Guidelines for Sensitive Bird Species

Appendix 20B RECOMMENDED ACTIVITY RESTRICTION GUIDELINES FOR SENSITIVE BIRD SPECIES

Table 20B.1 Recommended Activity Restriction Guidelines for Sensitive Bird Species¹

Bird Species	Feature or Habitat	Specific Conditions	Sensitive Period / Timing Restriction ²	Recommended Setback Distance (m)
Species At Risk				
Yellow rail	Edge of waterbody with a nest	General development activities	May 1 – Aug 31	300
Lesser yellowlegs	Nest	General development activities	May 1 – Aug 31	300
Red-necked phalarope	Nest	General development activities	May 1 – Aug 31	300
Short-eared owl	Nest	General development activities	May 1 – Aug 31	1,500
Common nighthawk	Nest	General development activities	May 1 – Aug 31	200
Olive-sided flycatcher	Nest	General development activities	May 1 – Aug 31	200
Bank swallow	Nesting colony	General development activities	May 1 – Aug 31	200
Barn swallow	Nest	General development activities	May 1 – Aug 31	200
Harris's sparrow	Nest	General development activities	May 1 – Aug 31	200
Rusty blackbird	Nest	General development activities	May 1 – Aug 31	300
Horned grebe	Edge of waterbody with a nest	General development activities	May 1 – Aug 31	300
Other Species				
Waterfowl (general)	Staging area	General development activities when large concentrations of birds are present	Spring/Fall	3,000
Swans/Loons/Cranes	Nest	General development activities	May 1 – Aug 31	800
		Pedestrians/ATVs	May 1 – Aug 31	500

Mackenzie Valley Highway Project - Developer's Assessment Report

Volume 3: Subjects of Note

Appendix 20B Recommended Activity Restriction Guidelines for Sensitive Bird Species

October 2023

Bird Species	Feature or Habitat	Specific Conditions	Sensitive Period / Timing Restriction²	Recommended Setback Distance (m)
Ducks	Nest	General development activities	May 1 – Aug 31	150
		Pedestrians/ATVs	May 1 – Aug 31	50
Geese	Nest	General development activities	May 1 – Aug 31	500
		Pedestrians/ATVs	May 1 – Aug 31	300
Shorebirds	Nest	General development activities	May 1 – Aug 31	100
		Pedestrians/ATVs	May 1 – Aug 31	50
Terns/Gulls	Nest	General development activities	May 1 – Aug 31	300
		Pedestrians/ATVs	May 1 – Aug 31	200
Raptors (general)	Nest	General development activities	Mar 1 – Aug 31	1,500
	Nest	General development activities	Sep 1 – Feb 28	500
Songbirds (general)	Nest	General development activities	May 1 – Aug 31	100
		Pedestrians/ATVS	May 1 – Aug 31	30
All other birds	Nest	Varies with region and species; contact the GNWT or ECCC office	Breeding / nesting seasons	100

Notes:

- ¹ Modified from SLUPB (2023) and GNWT (2015); most conservative sensitive period and/or recommended setback distance used.
- ² Sensitive periods are a general guide and specific timing may vary. Year-round avoidance may not always be feasible, and exceptions will be discussed with the GNWT-ECC to develop appropriate mitigation.

APPENDIX 20C

2022 Avian Survey Report

Mackenzie Valley Highway Project – 2022 Avian Surveys

FINAL

Prepared for:

Government of the Northwest Territories

Prepared by:

K'alo-Stantec Limited

May 2023


144903265



K'alo-Stantec


Limitations and Sign-off

This document entitled Mackenzie Valley Highway Project – 2022 Avian Surveys was prepared by K’alo-Stantec Limited (“K’alo-Stantec”) for the account of Government of the Northwest Territories (the “Client”) to support the regulatory review process for its Developers Assessment Report (DAR) (the “Application”) for the Mackenzie Valley Highway Project (the “Project”). In connection therewith, this document may be reviewed and used by the Department of Infrastructure (INF) for the Government of the Northwest Territories participating in the review process in the normal course of its duties. Except as set forth in the previous sentence, any reliance on this document by any other party or use of it for any other purpose is strictly prohibited. The material in it reflects K’alo-Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between K’alo-Stantec and the Client. The information and conclusions in the document are based on the conditions existing at the time the document was published and does not take into account any subsequent changes. In preparing the document, K’alo-Stantec did not verify information supplied to it by the Client or others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that K’alo-Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

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Table of Contents

1	INTRODUCTION.....	1
1.1	Background.....	1
1.2	Purpose.....	1
1.2.1	Objectives.....	1
2	METHODS	2
2.1	Swallow Nesting Survey.....	2
2.2	Autonomous Recording Unit Surveys.....	2
2.2.1	Species at Risk Survey.....	3
2.2.2	Community Survey	3
2.3	Breeding Bird Densities.....	3
3	RESULTS	5
3.1	Swallow Nesting Survey.....	5
3.2	Autonomous Recording Unit Surveys.....	5
3.2.1	Species at Risk Survey.....	5
3.2.2	Community Survey	6
3.3	Breeding Bird Densities.....	8
4	KEY RESULTS AND FINDINGS.....	9
5	REFERENCES.....	10
5.1	Literature Cited.....	10
5.2	Personal Communications	11

List of Tables

Table 3.1	Distribution of ARUs from 2017 and 2022 by Land Cover Class ¹	6
Table 3.2	Distribution of ARUs from 2017 and 2022 by Ecoregions Intersected by the Project	6
Table 3.3	Distribution of ARUs in 2017 and 2022 Compared to Land Cover Class Composition of the LSA	7

List of Appendices

Appendix A	Figures	A.1
Figure A.1	Bird Survey Study Areas	A.1
Figure A.2	Swallow Survey Results.....	A.2
Figure A.3	Autonomous Recording Unit Survey Results for Species at Risk in the Dehcho Region.....	A.3
Figure A.4	Autonomous Recording Unit Survey Results for Species at Risk in the Sahtu Region.....	A.4
Appendix B	Tables.....	B.1
Table B.1	Swallow Nesting Survey Results 2022	B.1
Table B.2	Summary of Incidental Wildlife Observations	B.3
Table B.3	2022 Species at Risk Detections using Automated Computer Software.....	B.4
Table B.4	Bird Species with the Potential to Occupy the LSA ¹	B.6
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 Class	B.15
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	B.21
Table B.7	Difference in Mean Breeding Bird Densities between the Local and Regional Study Areas ¹	B.25

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).

Mackenzie Valley Highway Project – 2022 Avian Surveys

Section 2: Methods

May 2023

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 Intersected 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%

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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Appendix A Figures



- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
- All-Season Road
- Winter Road
- Proposed Granular Borrow / Rock Quarry Site and Access
- Local Study Area
- Regional Study Area
- Region Boundary
- Settlement Area Boundary
- Community

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



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0055 REV/B

Prepared by AT on 3/8/2023
 TR by AJ on 3/8/2023

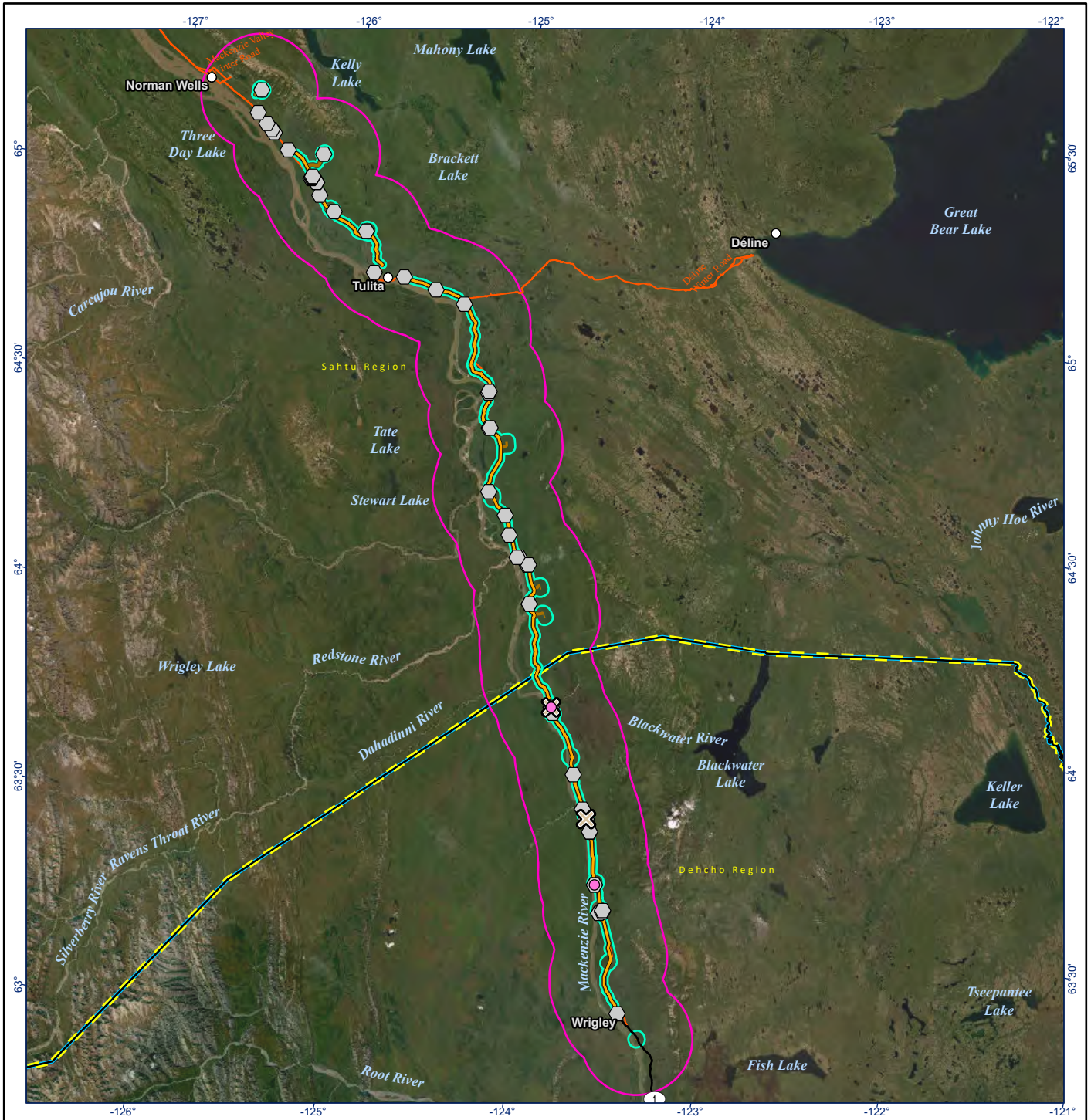
Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No.
A.1

Bird Survey Study Areas

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 Geographics
 World Hillshade: Esri, USGS

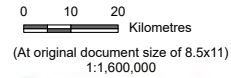
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Nesting Activity and Species 2022

- Inactive - Barn Swallow
- ✕ Barn Swallow Individuals
- Survey Location

- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
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- All-Season Road
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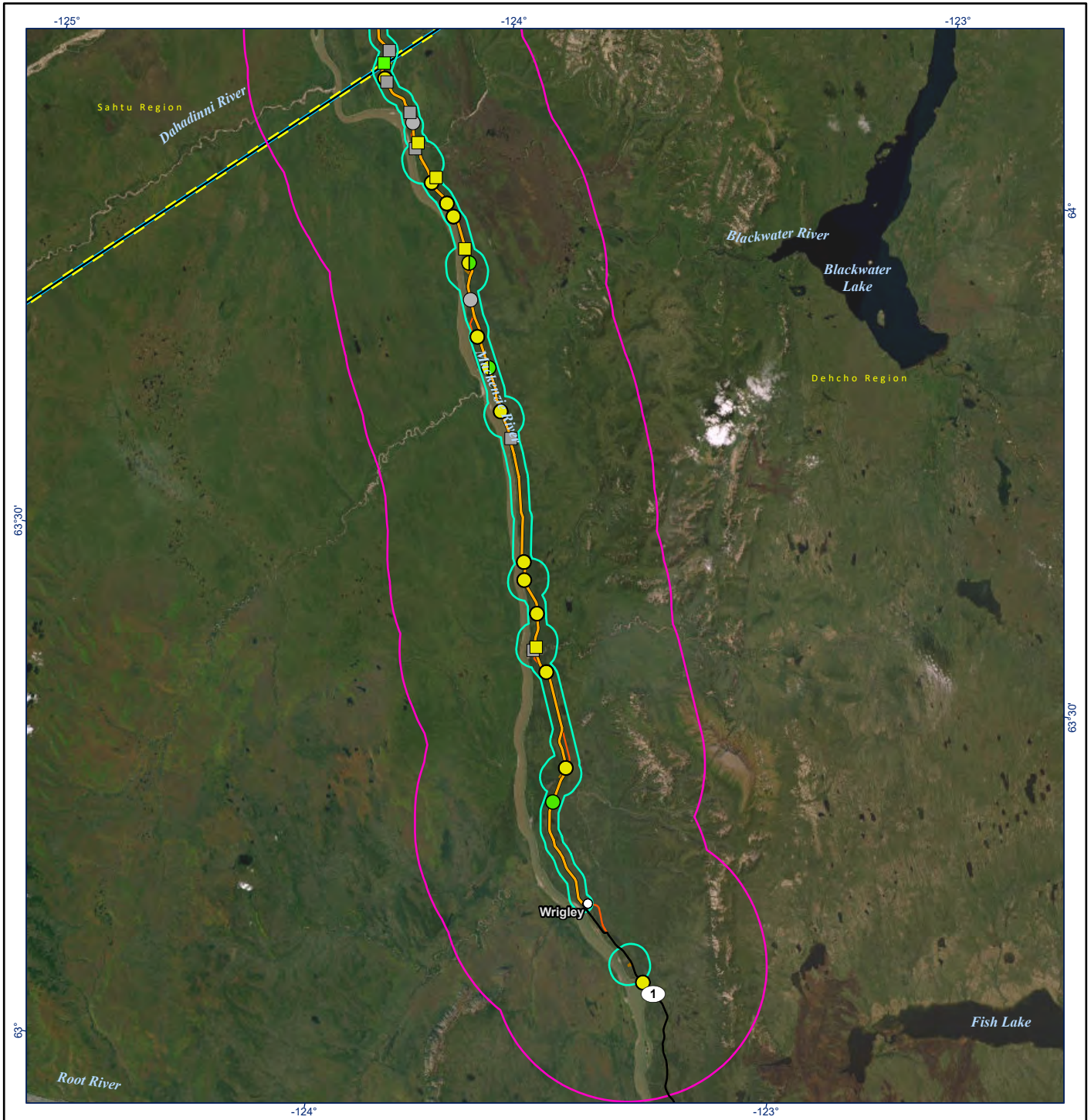
Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0164 REVA

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No. **A.2**
 Title **Swallow Survey Results**

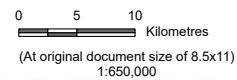
Notes

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 Geographics
 World Hillshade: Esri, USGS
4. ECCO. 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)***
- 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
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- Regional Study Area
- Community
- All-Season Road
- Winter Road
- Region Boundary
- Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0170 REVA

Government of Northwest Territories
 Mackenzie Valley Highway Project

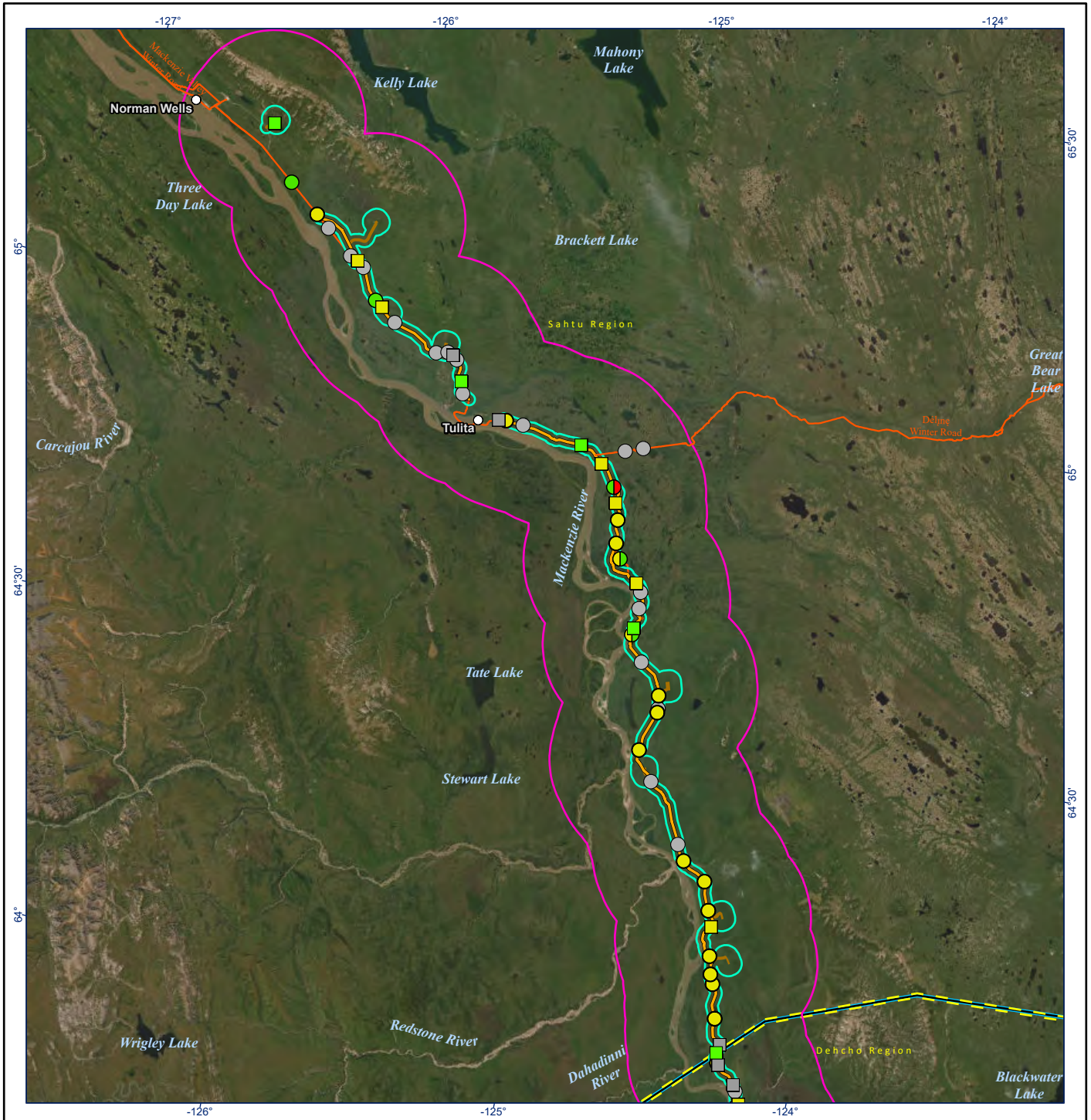
Figure No. **A.3**

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

Notes

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

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- 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

Project Location Wrigley to Norman Wells, NWT
Client/Project 144903025-0165 REVA

Government of Northwest Territories
 Mackenzie Valley Highway Project

Figure No. A.4
Autonomous Recording Unit Survey Results for Species at Risk in the Sahtu Region

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

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

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

Appendix B Tables
 May 2023

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				

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

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

Appendix B Tables

May 2023

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

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

May 2023

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>	-	-
		White-winged scoter	<i>Melanitta deglandi</i>	-	-
	Waterbirds	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>	-	-
		Red-necked grebe	<i>Podiceps grisegena</i>	✓	-
	Shorebirds	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-pewee	<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>	-	-

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>	✓	✓		

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)	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>Mniotilta 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>Poocetes gramineus</i>	-	-		
Savannah sparrow	<i>Passerculus sandwichensis</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
Landbirds (cont'd)	Passerines (cont'd)	Fox sparrow	<i>Passerella iliaca</i>	✓	✓
		Song sparrow	<i>Melospiza melodia</i>	-	-
		Lincoln's sparrow	<i>Melospiza lincolnii</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>	✓	✓		

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)	Hoary redpoll	<i>Acanthis hornemanni</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).

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 Class

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	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	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

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

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>Picooides 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

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables
May 2023

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-pewee	<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		

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

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>Mniotilta varia</i>	1	0	2	2	0	1	0	6
Tennessee warbler	<i>Leiothlypis peregrina</i>	5	21	10	4	3	10	1	54		

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

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 lincolnii</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		

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

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>Ammodramus 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)

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
	Shorebirds	American bittern	<i>Botaurus lentiginosus</i>	0	5	0	5
		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

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

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-pewee	<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

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

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>Mniotilta 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 lincolnii</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		

Mackenzie Valley Highway Project – 2022 Avian Surveys

Appendix B Tables

May 2023

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>Ammodramus 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

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		

Mackenzie Valley Highway Project – 2022 Avian Surveys

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)	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>Ammodramus 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>Mniotilta 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		

Mackenzie Valley Highway Project – 2022 Avian Surveys

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	0.00
		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)

APPENDIX 22A

Heritage Resources Technical Data Report

Mackenzie Valley Highway Project Technical Data Report—Heritage Resources

Prepared for:

Government of the Northwest Territories

Prepared by:

K'alo-Stantec Limited

December 2022

Project No.: 144903025



K'alo-Stantec

Limitations and Sign-off

This document entitled Mackenzie Valley Highway Project Technical Data Report—Heritage Resources was prepared by K’alo-Stantec Limited (“K’alo-Stantec”) for the account of Government of the Northwest Territories (the “Client”) to support the regulatory review process for its Developers Assessment Report (DAR) (the “Application”) for the Mackenzie Valley Highway Project (the Project”). In connection therewith, this document may be reviewed and used by the Department of Infrastructure (INF) for the Government of the Northwest Territories participating in the review process in the normal course of its duties. Except as set forth in the previous sentence, any reliance on this document by any other party or use of it for any other purpose is strictly prohibited. The material in it reflects K’alo-Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between K’alo-Stantec and the Client. The information and conclusions in the document are based on the conditions existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, K’alo-Stantec did not verify information supplied to it by the Client or others, unless expressly stated otherwise in the document. Any use that another party makes of this document is the responsibility and risk of such party. Such party agrees that K’alo-Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

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Principal, Environmental Services

Executive Summary

The Government of the Northwest Territories (GNWT), Department of Infrastructure (INF) is proposing the Mackenzie Valley Highway Project (the Project) that will extend the Mackenzie Valley Highway (Northwest Territories Highway #1) from Wrigley to Norman Wells, replacing the Mackenzie Valley Winter Road (MVWR) along this portion. The Project includes construction of approximately 281 kilometres (km) of new all-season highway, and the construction and operation of temporary and permanent quarry and borrow sources. The Project highway alignment will pass through the Dehcho Region and a portion of the Tulita District of the Sahtu Region within the Northwest Territories (NT).

This technical data report summarizes information on known archaeological sites and provides an evaluation of archaeological site potential within the Mackenzie Valley Winter Road corridor. The study area is defined by the preliminary project highway alignment with a 100 metres (m), 1 km, and 5 km buffer, intended to encompass the area of anticipated disturbance for the Project.

A total of 133 sites within the Regional Study Area (defined by the 5 km buffer) and 33 areas of high potential have been identified, based on known site data and the results of the 2020 desktop Archaeological Overview Assessment, completed relative to the roadway corridor.

The present study was designed solely to identify and assess evidence of past human activity protected under the *Archaeological Sites Act* (GNWT, 2014a). It is not the intent of this report to evaluate traditional Indigenous use, nor is the intent to address potential impacts on non-protected cultural heritage resources within the study area.

Table of Contents

1	INTRODUCTION	1
2	STUDY AREA	4
2.1	MVH Project Area	4
2.2	Local Study Area.....	4
2.3	Regional Study Area	4
2.4	Intersected Ecoregions	4
2.4.1	Taiga Plains Low Subarctic	5
2.4.2	Taiga Cordillera Low Subarctic	5
2.4.3	Boreal Cordillera High Boreal.....	6
2.5	Land Use Plans.....	6
3	REVIEW OF EXISTING DATA	7
3.1	Traditional Knowledge and Traditional Land and Resource Use	7
3.1.1	Methods	7
3.1.2	Results of Site Information Review relative to TLRU	7
3.2	Literature Review	8
3.2.1	Methods.....	8
3.2.2	Results - Sites on Record.....	9
3.2.3	Results - Areas of High Heritage Resource Potential	16
3.2.4	Regulatory Engagement.....	16
4	KEY RESULTS AND FINDINGS	17
5	CLOSURE	18
6	REFERENCES	19

List of Tables

Table 1	Archaeological Sites on Record within Study Areas (potential TLRU in green)	11
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List of Figures

Figure 1.1	Project Location Showing Alignment, Study Areas, and Recorded Sites.....	2
------------	--	---

Abbreviations

AIA.....	Archaeological Impact Assessment
AOA.....	Archaeological Overview Assessment
CR#4	Conformity Requirement Number Four
CZ.....	Conservation Zone
DAR.....	Developer’s Assessment Report
DEM	Digital Elevation Model
DLUP	Draft Dehcho Land Use Plan
GIS	geographic information system
GNWT	Government of the Northwest Territories
GPS.....	global positioning system
INF.....	Department of Infrastructure
km.....	kilometre
KM.....	kilometre marker
LiDAR.....	Light Detection and Ranging
LSA.....	Local Study Area
m	metre
MVH	Mackenzie Valley Highway
MVRMA.....	<i>Mackenzie Valley Resource Management Act</i>
MVWR	Mackenzie Valley Winter Road
NT.....	Northwest Territories
NTS	National Topographic Series
PDA	Project Development Area
PDR.....	Project Description Report
Project Area	Mackenzie Valley Highway Project Area
PWNHC.....	Prince of Wales Northern Heritage Centre
RSA	Regional Study Area
SLUP	Sahtu Land Use Plan
SMZ.....	Special Management Zone

**Mackenzie Valley Highway Project
Technical Data Report—Heritage Resources**

Abbreviations
December 2022

SON..... Subject of Note
SSA Sahtu Settlement Area
TDR Technical Data Report
the Project Mackenzie Valley Highway Project
TLRUtraditional land and resource use
ToR..... Terms of Reference
VC Valued Component

Glossary

Local Study Area (LSA)	The area within which some measurable Project-related effects may occur. This is a 2 km wide corridor centred on the Project highway alignment (1 km on both sides of the alignment).
MVH Project Area (Project Area)	The area to be utilized by the Project and includes the project highway alignment of the MVH between Wrigley and Norman Wells and a 100 m buffer on both sides of the alignment. It also includes the temporary and permanent borrow sources and associated access roads.
MVH Archaeological Study Area	A study area consisting of the project highway alignment of the MVH between Wrigley and Norman Wells and a 5 km buffer on either side.
Project Development Area (PDA)	The area of direct Project disturbance within which works and activities will occur (footprint). The Project consists of a 321 km all-season highway located between Wrigley and Norman Wells, NWT. The highway right-of-way will be 60 m in width. The footprint includes laydown and staging areas, construction camp locations, quarry/borrow sites with access roads on a 30 m ROW.
Regional Study Area (RSA)	The area for which resource information is included to provide a context for evaluation of Project effects. This is a 10 km wide corridor centred on the project highway alignment (5 km on both sides of the alignment).

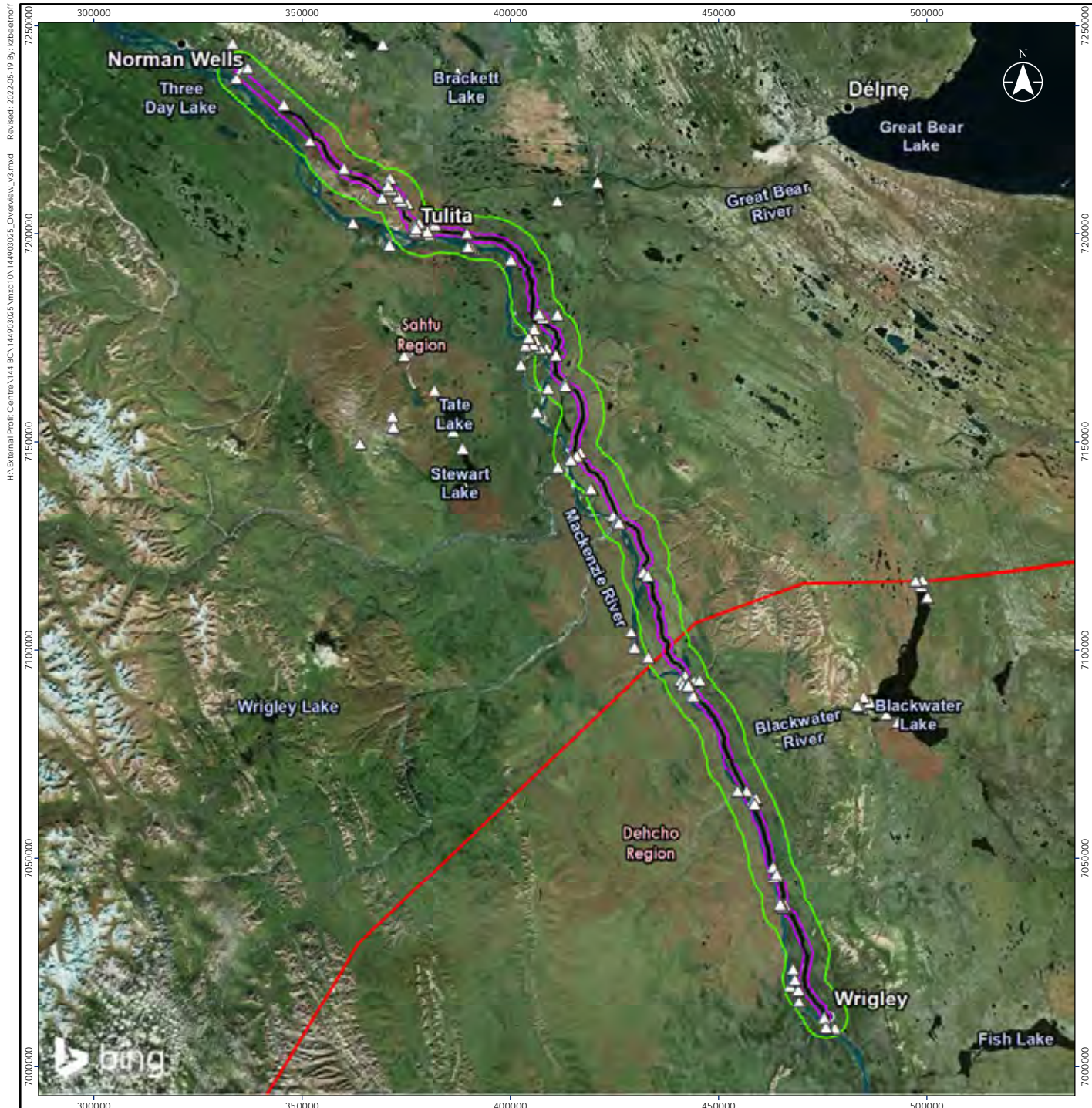
1 Introduction

The Government of the Northwest Territories (GNWT), Department of Infrastructure (INF) is proposing the Mackenzie Valley Highway Project (the Project) that will extend the Mackenzie Highway (Northwest Territories Highway #1) from Wrigley to Norman Wells, replacing the Mackenzie Valley Winter Road (MVWR) in this portion. The Project includes construction of approximately 281 kilometres (km) of new all-season highway, and the construction and operation of temporary and permanent quarry and borrow sources. The Project will pass through the Dehcho Region and a portion of the Tulita District of the Sahtu Region within the Northwest Territories (NT; Figure 1.1).

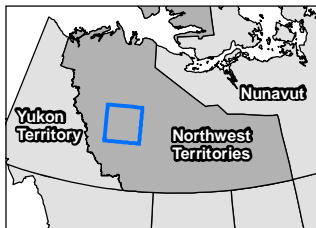
The Project is subject to an environmental assessment and the requirements of Part 5 of the *Mackenzie Valley Resource Management Act* (MVRMA). This Technical Data Report (TDR) presents the existing conditions for Heritage Resources to support development of the Developer's Assessment Report (DAR) as required by the Terms of Reference (ToR; MVEIRB, 2015). As part of the environmental assessment process, the DAR will present the GNWT's assessment of effects of the Project on the environment.

Heritage Resources are a Valued Component (VC) and considered to be a Subject of Note (SON) within the Project ToR. Archaeological sites are fragile and non-renewable resources that are susceptible to alteration or removal by development activities. These resources are protected from disturbance by GNWT legislation, regulation, and policy. The Northwest Territories Archaeological Sites Regulations (GNWT, 2014a), pursuant to the *Archaeological Sites Act* (GNWT, 2014b), apply to all lands and waters in NT under territorial control. The legislation is intended to protect archaeological sites from unpermitted disturbances, alterations, or surveys. Heritage Resources are also protected under the *Mackenzie Valley Resource Management Act* (Government of Canada, 1998) and the associated Mackenzie Valley Land Use Regulations, which prohibit unpermitted land use operations within 30 metres (m) of a known or suspected historical or archaeological site or burial site and require suspension of all operations if an archaeological site or burial is encountered. The Mackenzie Valley Land Use Regulations apply to all lands in the NT outside the Inuvialuit Settlement Region.

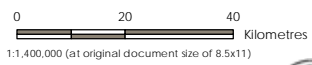
As noted above, the Project passes through portions of the Dehcho Region and the Sahtu Region. The Land Use Plans for both land claim areas reference Heritage Resources. The Dehcho Land Use Plan (DLUP) (DLUPC, 2006) includes Conformity Requirement #4, indicating the need to “assess the impact ... on known heritage, historical, archaeological, cultural and traditional land use and occupancy sites including burial grounds, sacred sites, cabins, and traplines, as identified by the affected Dehcho First Nation(s) and Prince of Wales Northern Heritage Centre” [PWNHC].



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- △ Archaeological Site
- Municipality
- Mackenzie Valley Highway Project
- █ Mackenzie Valley Highway Project LSA
- █ Mackenzie Valley Highway Project RSA
- █ Settlement Region Boundary



Project Location: Central Northwest Territories
 Prepared by BSorensen on 2021-02-05
 Revised by BSorensen on 2021-02-22

Client/Project:
 Client: Government of the Northwest Territories
 Project: Mackenzie Valley Highway Project

Figure No.
1.1

Title
 Project Location Showing Alignment,
 Study Areas, and Recorded Sites

Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Source: © 2022 Microsoft Corporation Earthstar Geographics; SO: LIDAR from Government of Northwest Territories; ArcticDEM
 3. Archaeological Site Data provided by the Prince of Wales Northern Heritage Centre; (c) Government of the Northwest Territories, Education, Culture, and Employment

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

The Sahtu Land Use Plan (SLUP) (SLUPB, 2013) applies to Sahtu Settlement Area (SSA) lands. Conformity Requirement Number Four (CR#4) of the Sahtu Land Use Plan includes provisions related to archaeological resources, indicating that “land use activities must not be located within 500 m of known or suspected burial sites, or within 150 m of known or suspected archaeological sites, unless measures are developed in cooperation with the PWNHC, affected communities, or in the case of burial sites, with affected families where possible” and “where there is a high risk of impact to known or suspected archaeological sites, as determined by the PWNHC, an archaeological impact assessment must be conducted prior to commencement of the land use activity” (SLUPB, 2013).

This report focuses largely on the known archaeological site data as provided by PWNHC (PWNHC, 2020) through an Archaeological Sites Data Base Access Request, for the Regional Study Area, and the existing permit reports (with associated geographic information system [GIS] data, site forms, and field notes where available). An evaluation of archaeological site potential has been completed (Krahulic, 2020) based largely on landscape attributes drawn from National Topographic Series (NTS) maps, satellite imagery, and the Arctic Digital Elevation Model (DEM) dataset for elevation data. Areas of existing anthropogenic disturbance were used in the evaluation of archaeological site potential, given the importance of site integrity as a key attribute in assessing the likelihood of impacts to sites of high heritage value. Palaeontological locations are identified when recorded within the territorial Archaeological Sites Data Base. Traditional Land and Resource Use (TLRU) information is integrated where available; many of the archaeological sites on record reflect relatively recent local community use. The Land Use Planning management zones are also referenced, where applicable.

2 Study Area

The Project is in the Mackenzie Valley region of the NT between the current terminus of the existing all-weather highway at Hodgson Creek (located approximately 1 km north of Wrigley) and Prohibition Creek (located approximately 28 km southeast of Norman Wells). The project highway alignment parallels the Mackenzie River to its east and passes through the community of Tulita (kilometre marker [KM] 938 of the MVWR). The Project is located within the Taiga Plains Low Subarctic, the Taiga Cordillera Low Subarctic, and the Boreal Cordillera Level III ecoregions.

The Project was reviewed relative to the Mackenzie Valley Highway (MVH) Project Area, the Local Study Area (LSA) and the Regional Study Area (RSA), to evaluate potential Project effects on known Heritage Resources. The project highway alignment and recorded archaeological sites in the study area are illustrated in Figure 1.1.

2.1 MVH Project Area

The MVH Project Area (Project Area) is the area to be utilized by the Project and includes the project highway alignment of the MVH between Wrigley and Norman Wells and a 100 m buffer on either side. It also includes the temporary and permanent borrow sources and associated access roads.

2.2 Local Study Area

The LSA is defined as a 2 km wide corridor, centred on the project highway alignment, with a 1 km buffer on either side, within which some measurable Project-related effects may occur. Following completion of design, the evaluation of Project effects on Heritage Resources can be completed within the Project Development Area (PDA) only. Because the 100 m buffer of the Project Area is nested within the LSA, resource counts for the LSA within this document exclude those within the Project Area.

2.3 Regional Study Area

The RSA is defined as a 10 km wide corridor, centred on the project highway alignment, with a 5 km buffer on either side, to allow for greater contextual information, given that relatively few archaeological sites are on record within the general area. As the Project Area and LSA are nested within the RSA, resource counts for the RSA within this document exclude those within the Project Area and LSA.

2.4 Intersected Ecoregions

Archaeological sites are often found associated with a specific set of landforms (including eskers, valley edges, knolls, rivers, lakeshores, coastlines and channels) which would direct travel, bias routes of communication, and enhance or restrict resource procurement and occupation. Due to this close relationship of human settlement and the environment, a brief overview of the regional and local environments is presented, drawn from the Ecosystem Classification Group descriptions and the Vegetation and Wetlands TDR.

2.4.1 Taiga Plains Low Subarctic

The Taiga Plains Low Subarctic is a Level III ecoregion in the central third of the Taiga Plains (Level II), bordered by the Mackenzie River, Great Bear Lake, and Great Slave Lake. The ecoregion is characterized by undulating plains, upland communities of white and black spruce, and permafrost influenced wetlands (Ecosystem Classification Group, 2007).

The northern section of the Project is located within the North Mackenzie Plain, a Level IV classification within the Taiga Plains Low Subarctic ecoregion. The North Mackenzie Plain parallels the Mackenzie River and consists of level to undulating terrain. Forest vegetation consists of white and black spruce, Alaska paper birch and dwarf birch communities. Occurrences of trembling aspen and jack pine occur on well drained sites south of Tulita. Bogs and fens occupy approximately 15% of the ecoregion (Ecosystem Classification Group, 2007).

A small section of the Project north of Tulita intersects the Norman Range ecoregion, a Level IV classification within the Taiga Plains Low Subarctic ecoregion. The Norman Range ecoregion is located northeast of the North Mackenzie Plain ecoregion and is characterized by more rugged terrain. Southwest portions of this ecoregion are composed of mixedwood deciduous and coniferous forest. Upland deciduous areas typically contain trembling aspen, Alaska paper birch, and coniferous forests (typically containing white and black spruce). Bogs and fens comprise approximately 4% of the ecoregion (Ecosystem Classification Group, 2007).

2.4.2 Taiga Cordillera Low Subarctic

The Taiga Cordillera Low Subarctic ecoregion (Level III) is varied, consisting of mountain ranges, foothills, tundra and spruce woodlands located in the central third of the Taiga Cordillera (Level II). In comparison to the Taiga Plains, the Taiga Cordillera Low Subarctic ecoregion has very few waterbodies and peatland establishment (Ecosystem Classification Group, 2010).

Central sections of the Project intersect the Central Mackenzie Plain ecoregion, a Level IV classification within the Taiga Cordillera Low Subarctic ecoregion. The Central Mackenzie Plain is located between the Dahadinni and Blackwater rivers to the south and the boundary of the Taiga Plains ecoregion to the north. Topography includes level to gently sloping terrain that supports a diverse array of forest types. Almost half the ecoregion has been exposed to fires, leading to widespread shrubby and deciduous community development. Black spruce – shrub – moss woodlands are common and similar in structure to the North Mackenzie Plain ecoregion. Jack pine and trembling aspen occur but are limited to southern sections. Wetlands occupy approximately 10% to 20% of the ecoregion and consist of mainly peatlands (Ecosystem Classification Group, 2010).

2.4.3 Boreal Cordillera High Boreal

The Boreal Cordillera High Boreal ecoregion (Level III) is in the southeast portion of the Taiga Cordillera (Level II), south of the Taiga Cordillera Low Subarctic ecoregion. In comparison to the Taiga Cordillera Low Subarctic, the Boreal Cordillera High Boreal has a milder climate, greater precipitation, and taller, more dense stands of spruce woodlands. Mixedwood forest of trembling aspen, white spruce, paper birch, and balsam poplar are common (Ecosystem Classification Group, 2010).

South portions of the Project intersect the Central Mackenzie Valley ecoregion, a Level IV classification within the Taiga Cordillera High Boreal ecoregion. The Central Mackenzie Valley ecoregion is bordered by the Dahadinni and Blackwater rivers to the north and by higher elevation slopes to the south, east, and west. Topography includes undulating terrain, rolling slopes, and level plains. Northern sections consist of closed black spruce woodlands and peat plateaus. Southern sections near Wrigley are composed of mixedwood stands of trembling aspen and white spruce. Wetlands occupy less than 10% of the entire ecoregion and consist mainly of peat plateaus, sedge fens, northern ribbed fens, and horizontal fens (Ecosystem Classification Group, 2010).

2.5 Land Use Plans

As noted above, the Project passes through lands addressed through the Dehcho Region and a portion of the Tulita District of the Sahtu Region.

Relative to the Dehcho Land Use Plan (DLUPC, 2006), the Project intersects the Pehdzeh Ki Ndeh Conservation Zone, as well as the Community of Wrigley. The Conservation Zones are areas of significant ecological and cultural value and, therefore, limitations are in place for activities other than tourism. The Mackenzie Valley Special Infrastructure Corridor “provides a passage through four Conservation Zones” (DLUPC, 2006: vii).

Relative to the SLUP (SLUPB, 2013), the Project intersects three Special Management Zones (SMZ), the Community of Tulit’a, and one Conservation Zone (CZ). The three SMZ are the Deh Cho/Mackenzie River, the Norman Range, and K’ââlô Tué/Willow Lake Wetlands. The CZ is Petiniᶯah/Bear Rock. The latter is “one of the most important sacred sites in Denendeh” (SLUPB, 2013:124), with archaeological sites included as one of the Values to be Protected and traditional trails as one of the Values to Take into Account. Petiniᶯah/Bear Rock is a large karst formation at the confluence of the Sahtu Deh/Great Bear River and Deh Cho/Mackenzie River, across from the community of Tulit’a (SLUPB, 2013).

3 Review of Existing Data

3.1 Traditional Knowledge and Traditional Land and Resource Use

As defined in the ToR, traditional land uses include “traditional lifestyles, values and culture” and “cultural and spiritual sites and activities”. Heritage Resources identified within the territorial archaeological sites database often include contemporary and historic land use locations, such as camp sites, cabins, caches, trails, wood harvesting areas, and traps. Spiritual sites such as graves/burials are also recorded within the sites database.

3.1.1 Methods

Traditional Land and Resource Use (TLRU) information is integrated where available; many of the archaeological sites on record reflect relatively recent (“contemporary”) and historic local community use. The Land Use Planning management zones have been noted in the section above. The SLUP Conservation Zones in particular are defined as “significant traditional, cultural, heritage and ecological areas” (SLUPB, 2013) within the SLUP, with Conservation Zones in the DLUP defined as “areas having significant ecological and cultural values” (DLUPC, 2006). The archaeological site information provided through PWNHC (PWNHC, 2020) is reviewed relative to community use. Sites that definitively or possibly reflect traditional land and resource use have been highlighted in Table 1, below; sites noted as being Euro-Canadian are excluded from this selection regardless of the site type/activity noted, assuming that they are not associated with Indigenous land use. Sites without a clear affiliation but which include TLRU site types such as cabins, caches, trails, and campsites are included in the selection. Precontact archaeological sites are not included as TLRU sites but rather as Heritage Resources; however, it is evident that the two categories are not mutually exclusive.

3.1.2 Results of Site Information Review relative to TLRU

There are 133 recorded archaeological sites within the RSA. Sixty-three of these recorded archaeological sites may be correlated with TLRU, as highlighted in Table 1, see Section 3.2.2, with one located within the Project Area, 33 within the LSA, and 29 within the RSA.

3.2 Literature Review

3.2.1 Methods

The review of existing data summarizes the known archaeological site data as provided by PWNHC through an Archaeological Sites Data Base Access Request, for the RSA and the existing permit reports (with associated GIS data, site forms, and field notes where available). Palaeontological locations are identified when recorded within the territorial Archaeological Sites Data Base.

The Mackenzie Valley corridor has been subject to archaeological desktop studies (Archaeological Overview Assessments [AOAs]) as well as field assessments (Archaeological Impact Assessments [AIAs]) since the early 1970s. Each of these studies has addressed slightly different footprints related primarily to the proposed roadway expansions, the Mackenzie Gas Project and, more recently, the Mackenzie Valley Fibre Link. In 2020, the GNWT INF contracted Stantec and K'alo-Stantec to complete two AOAs. The first is an AOA of the MVWR upgrades from Prohibition Creek to Mount Gaudet; the study area consisted of the current MVWR alignment, the 1974 Public Works Canada alignment, and the proposed alignments within the 2011 Project Description Report (PDR) for Construction of the Mackenzie Valley Highway Tulita District, Sahtu Settlement Area (EBA, 2011) and the 2012 PDR for the Mackenzie Valley Highway Extension Pehdzeh Ki Ndeh – Dehcho Region (GNWT DOT, 2012), with a 500 m buffer on either side of each alignment (Krahulic 2020). The second is an AOA of 39 proposed granular and bedrock sources, along the project highway alignment (Peach, 2021). These two AOAs involved review of previous AOAs (where available), AIAs, and associated spatial data, field notes, maps, and site forms. These AOAs form the basis of the current assessment because they are recent and comprehensive assessments of the MVWR alignment and corridor.

The evaluations of archaeological site potential are based largely on landscape attributes drawn from NTS maps, satellite imagery, and Arctic DEM elevation data, has been previously completed (Krahulic, 2020). Areas of existing anthropogenic disturbance are used in the evaluation of archaeological site potential, given the importance of site integrity as a key attribute in assessing the likelihood of impacts to sites of high heritage value.

The AOA for the MVH (Krahulic, 2020) and for the proposed granular and bedrock sources (Peach, 2021) are based on the following data sources:

- territorial archaeological site data, provided under licence from the PWNHC (PWNHC, 2020)
- Sahtu Land Use Plan (SLUPB, 2013)
- Draft Dehcho Land Use Plan (DLUPC, 2006): this document is a draft that is useful for understanding current and historic land use; however, it is currently non-binding in regard to regulatory process
- Sahtu Heritage Places and Sites report (Sahtu Heritage Places and Sites Joint Working Group, 2000)

- observations and results of the AIAs for:
 - the Mackenzie Highway System, permit 1973-334 (Millar et al., 1985) (no survey polygons are available for this AIA)
 - the Mackenzie Valley Winter Road Upgrade Programme, permit 1999-892 (Ronaghan, 2000) (no survey polygons are available for this AIA)
 - the Mackenzie Gas Project, permits 2002-916, 2003-933, 2004-956 and 2006-978 (Clarke et al., 2003; Clarke et al., 2004; Clarke and Webster, 2005; Webster et al., 2007)
 - the Mackenzie Valley Fibre Link Project, permits 2014-017 and 2015-002 (Leyden et al., 2016)
 - Granular Supply Source Areas along the Mackenzie (No.1), Liard (No.7) and Proposed Mackenzie Valley Highway, permit 2016-004 (Heffner and Young, 2020)
 - 2004 Mackenzie Valley Air Photo collection provided by the PWNHC
 - surficial geology information from the Geological Survey of Canada (Hanley et al., 1973; Rutter and Boydell, 1980; Rutter et al., 1980)
 - Northwest Territories ecosystem classifications (Ecosystem Classification Group, 2007)
 - Fur Trade Posts of the Northwest Territories, 1870-1970 (Usher, 1971)
 - Bing™ imagery
 - Light Detection and Ranging (LiDAR) imagery provided by the GNWT
 - Arctic DEM Imagery

Areas of high archaeological site potential are evaluated based on terrain features and proximity to watercourses and waterbodies, slope, aspect, and drainage. Areas are selected if they are considered to be possible transportation corridors/routes, visible landmarks/lookouts, resource locations for harvesting fish/game/plant/lithic materials, and/or camp/settlement locations. Areas of prior anthropogenic disturbance are considered to be of low archaeological site potential. Areas previously assessed are also removed from the high potential areas. Previously recorded sites are also included in the evaluation of site potential.

3.2.2 Results - Sites on Record

Table 1 lists the 133 archaeological sites on record with PWNHC within 5 km (the RSA), 1 km (the LSA), and/or 100 m (Project Area) of the project highway alignment and prospective borrows or quarries. Sites that might be TLRU (e.g., historic, contemporary) are highlighted in green. Given that sites in this area have been recorded since at least the 1970s and, in some cases, the 1950s, the site type terminology has not been consistently applied. Hand-held global positioning system (GPS) units have been consistently used for perhaps the last 20 years of field assessment; site locations recorded prior to this time must be viewed as approximate until ground-truthed. The distances provided are from a Project component (highway centreline, quarry, borrow, or quarry/borrow access road) to the site point on record. Because sites can range in size from an isolated find of a single artifact to a large campsite, village, trading post or trail, the distance between a Project component and a site is a very approximate indication

of the likelihood of spatial overlap between a heritage site and the Project and, therefore, the overlap could indicate potential Project effects on known Heritage Resources. Conclusions regarding the likelihood of impact to a known site by Project activities must be considered with caution, given the above noted sources of locational inaccuracy.

However, 13 of the 133 sites are within the Project Area and have a greater likelihood of direct impact from Project construction. An additional 50 sites are within the LSA and 70 sites are within the RSA. Until a final footprint has been defined, the likelihood of impact to the majority of these recorded sites is unknown.

Of the 133 sites that are within the RSA, 34 are recorded as being “contemporary”, and include campsites, cabins, shelters, hearths, tent frames/tent emplacements, trap sites, trails, and associated smaller features (i.e., tripod, doghouse, outhouse, smoking frame). Thirty-five of the sites are considered to be “historic”, “Indigenous historic”, or both. These sites include campsites, cabins, tent frames, hearths, trails, midden/debris scatters, wood harvesting areas, sawmills, caches, villages, trading posts/forts, a barge landing, burials, as well as associated smaller features (e.g., chimney). Fifty-nine sites are considered to be solely of precontact age/association. These include isolated artifact finds, artifact scatters, campsites, hunting lookout/short term campsites, and chipping stations/lithic scatters. Hearths are noted additional features, with one ‘wood scatter’ also recorded. Three additional sites are evidently multicomponent, described as a precontact/Indigenous cabin and grave location, a precontact/contemporary burial, and a precontact/historic trading post. Included as of precontact affiliation is a palaeontological fossil site, the Canyon Creek Fossils. Thirteen sites are recorded with an “undetermined” affiliation, including isolated artifact finds, campsites, caches, and graves.

Five of the sites listed above consist of or include a “grave” or “burial”: KIRm-12, KIRm-16, LbRn-4, LbRn-8, and LfRp-1. Three are within the LSA, and two are within the RSA.

Areas of particular site density are at the confluences of the Mackenzie River/Deh Cho and Ochre River, White Sand Creek, Dam Creek, Blackwater River, Step Creek, Saline River, Little Smith Creek, Big Smith Creek, and Great Bear River.

These results will require review once the Project has been fully designed and a PDA has been established, to determine which of the previously recorded site locations may intersect with the Project.

**Mackenzie Valley Highway Project
Technical Data Report—Heritage Resources**

Section 3: Review of Existing Data
December 2022

Table 1 Archaeological Sites on Record within Study Areas (potential TLRU in green)

Archaeological Site (Borden) Number	Site Affiliation; Site Type	Features	Project Study Area (Project Area, LSA, RSA)	Approx. Distance (m) between Project Component and Recorded Site Centre Point
KhRk-1	Precontact; Isolated Find/Campsite	---	RSA	3,434
KhRk-10	Indigenous Historic/Historic; Village/Trading Post	Cabin, cache, artifact scatter	RSA	3,119
KhRk-2	Precontact; Isolated Find	---	RSA	3,559
KhRk-3	Precontact; Isolated Find	---	RSA	1,737
KhRk-4	Indigenous Historic/Historic	Cabin, tent frame	RSA	2,120
KhRk-5	Contemporary; Campsite	---	LSA	518
KhRk-6	Undetermined; Isolated Find	---	RSA	2,549
KhRk-9	Undetermined; Campsite	---	RSA	2,880
KiRI-1	Precontact; Isolated Find	---	LSA	428
KiRI-2	Undetermined	Cache	LSA	411
KiRI-3	Precontact; Chipping station	---	LSA	229
KiRI-4	Indigenous Historic/Historic	Cabin	LSA	231
KiRI-5	Precontact; Chipping station, Campsite	---	LSA	609
KiRI-6	Precontact; Chipping station	---	LSA	428
KiRI-7	Precontact	Lithic scatter	LSA	188
KiRI-8	Historic	Cabin	LSA	549
KiRI-9	Contemporary	Trap	LSA	777
KjRI-1	Precontact	Lithic scatter	LSA	713
KjRI-2	Undetermined; Isolated Find	---	LSA	713
KjRI-3	Precontact	Lithic scatter	LSA	713
KjRI-4	Precontact	Lithic scatter	LSA	713
KjRI-5	Undetermined; Isolated Find	---	LSA	510
KjRI-6	Precontact; Isolated Find	---	LSA	342
KjRI-8	Contemporary; Campsite	Cabin, doghouse, cache	LSA	165
KjRI-9	Contemporary	Trail	LSA	824
KkRI-1	Undetermined; Isolated Find	---	LSA	323
KkRI-2	Contemporary	Trap	LSA	630
KkRI-3	Contemporary; Campsite	---	RSA	1,400
KkRI-4	Contemporary; Campsite	---	RSA	1,413
KkRI-5	Undetermined; Isolated Find	---	LSA	587

**Mackenzie Valley Highway Project
Technical Data Report—Heritage Resources**

Section 3: Review of Existing Data
December 2022

Archaeological Site (Borden) Number	Site Affiliation; Site Type	Features	Project Study Area (Project Area, LSA, RSA)	Approx. Distance (m) between Project Component and Recorded Site Centre Point
KkRI-6	Precontact	Lithic scatter	RSA	1,701
KIRm-1	Historic	Cabin	RSA	1,171
KIRm-10	Historic	Cabin	LSA	312
KIRm-11	Historic; Trading Post	---	LSA	542
KIRm-12	Undetermined	Grave/burial	LSA	134
KIRm-13	Precontact	Lithic scatter	LSA	491
KIRm-15	Indigenous historic; campsite	---	RSA	1,056
KIRm-16	Indigenous historic; burial/campsite	Cabin, grave	RSA	1,339
KIRm-17	Historic; Trading Post (?)	Cabin, cache	RSA	1,430
KIRm-18	Precontact; Isolated Find	---	LSA	660
KIRm-19	Contemporary; Cache	Pits	LSA	430
KIRm-2	Contemporary	Cabin	LSA	491
KIRm-3	Contemporary	Hearth	RSA	1,107
KIRm-4	Contemporary; Campsite	Cabin, cache	LSA	109
KIRm-5	Undetermined	Cache	LSA	304
KIRm-6	Contemporary	Cache (pit)	RSA	1,107
KIRm-7	Contemporary	Shelter	LSA	304
KIRm-8	Undetermined; Campsite		RSA	2,495
KIRm-9	Historic; Trading Post	Cabin	LSA	432
LaRn-2	Indigenous Historic; Campsite	Tent frame	RSA	4,585
LbRn-1	Historic, Indigenous Historic; Campsite	Cabin, cache, hearth, tent frame	LSA	302
LbRn-10	Indigenous Historic; Campsite	Tent floor	LSA	382
LbRn-12	Historic, Indigenous Historic; Campsite	Tent frame	LSA	929
LbRn-2	Indigenous Historic; Campsite	Cabin	LSA	198
LbRn-3	Precontact	Lithic scatter	LSA	263
LbRn-4	Undetermined; Burial	Grave	LSA	796
LbRn-5	Historic	Cabin	LSA	547
LbRn-6	Precontact; Isolated Find	---	LSA	387
LbRn-7	Precontact	Hearth	Project Area	40
LbRn-8	Precontact, Indigenous; Burial/campsite	Cabin, grave	LSA	746
LbRn-9	Precontact; Isolated Find	---	LSA	614

**Mackenzie Valley Highway Project
Technical Data Report—Heritage Resources**

Section 3: Review of Existing Data
December 2022

Archaeological Site (Borden) Number	Site Affiliation; Site Type	Features	Project Study Area (Project Area, LSA, RSA)	Approx. Distance (m) between Project Component and Recorded Site Centre Point
LcRn-1	Contemporary; Campsite	Tent frame, hearth	RSA	2,967
LcRo-1	Precontact	Lithic scatter	RSA	1,084
LcRo-2	Contemporary; Campsite	Hearth	RSA	3,177
LcRo-3	Indigenous Historic; Campsite	Tent frame, cabin, cache	RSA	1,049
LcRo-5	Indigenous Historic; Campsite		RSA	1,397
LcRo-6	Precontact	Lithic scatter	RSA	1,336
LcRo-7	Precontact	Lithic scatter	LSA	121
LcRo-8	Precontact; Campsite	Hearth	RSA	1,714
LdRo-1	Historic; Fort	Depression, chimney	RSA	2,266
LdRo-11	Historic; Indigenous historic	Cabin	RSA	3,704
LdRo-14	Contemporary	Cabin	RSA	3,660
LdRo-15	Contemporary; Campsite	---	LSA	462
LdRo-2	Precontact	Lithic scatter, hearth	Project Area	12
LdRo-3	Precontact; Isolated Find	---	Project Area	12
LdRo-4	Precontact; Campsite	Lithic and bone scatter	Project Area	42
LdRo-5	Precontact; Isolated Find	---	Project Area	62
LdRo-7	Precontact; Isolated Find	---	LSA	143
LdRo-8	Precontact	Lithic scatter	Project Area	46
LdRo-9	Precontact; Isolated Find	---	LSA	366
LeRo-1	Historic	Cabin	RSA	4,124
LeRo-3	Contemporary; Sawmill	Cabin	RSA	3,741
LeRo-4	Indigenous Historic	Cabin	RSA	1,625
LeRo-5	Contemporary; Spring Campsite	Tent emplacement	RSA	1,712
LeRo-6	Contemporary; Winter trapping campsite	Cabin, outhouse, smoking frame	RSA	3,604
LeRo-7	Contemporary; Campsite	---	RSA	1,568
LeRo-8	Historic; Camp (Fishing Lake?)	Trails, clearings, refuse area, cans/cache	RSA	1,730
LeRp-2	Contemporary	Cabin	RSA	3,975

**Mackenzie Valley Highway Project
Technical Data Report—Heritage Resources**

Section 3: Review of Existing Data
December 2022

Archaeological Site (Borden) Number	Site Affiliation; Site Type	Features	Project Study Area (Project Area, LSA, RSA)	Approx. Distance (m) between Project Component and Recorded Site Centre Point
LfRp-1	Precontact; Contemporary; Burial	Grave	RSA	2,820
LfRp-2	Contemporary; Campsite	Tent emplacement	RSA	2,136
LfRp-3	Contemporary; Campsite	Tent frame, cache	RSA	2,525
LfRp-4	Contemporary; Campsite	Tent frame	RSA	2,966
LfRp-5	Historic	Cut wood	RSA	2,526
LfRp-6	Contemporary; Campsite	Tent frame	RSA	2,638
LfRp-7	Indigenous Historic; Campsite	Debris scatter, blazed tree	LSA	323
LfRq-1	Precontact	Lithic scatter	RSA	3,324
LfRq-10	Indigenous Historic	Trail; cut stump	RSA	2,130
LfRq-11	Contemporary; Campsite	Hearth; tent emplacement	RSA	1,880
LfRq-12	Contemporary; Campsite	Hearth	RSA	2,576
LfRq-13	Contemporary; Campsite	Hearth	RSA	1,511
LfRq-14	Contemporary; Campsite	---	RSA	2,563
LfRq-15	Contemporary; Campsite	---	RSA	2,246
LfRq-16	Precontact; Campsite	---	RSA	1,789
LfRq-17	Precontact; Campsite	---	RSA	1,727
LfRq-18	Precontact; Campsite	---	RSA	1,754
LfRq-19	Precontact; Isolated Find	---	RSA	1,667
LfRq-20	Indigenous Historic	Trail	RSA	1,519
LfRq-23	Historic; Camp/Barge Landing	Camp clearing, trail, barge tie-down	RSA	2,736
LfRq-24	Historic; Barge Landing	Wooden structure/barge landing	RSA	2,115
LfRq-25	Precontact; Historic; Campsite, Trading Post, Industrial	Sawmill, cultural depression	RSA	3,412
LfRq-3	Undetermined; Campsite	---	RSA	2,790
LfRq-4	Precontact; Indigenous	Artifact scatter	RSA	3,776
LfRq-6	Precontact; Campsite	Lithic scatter	RSA	1,625
LfRq-7	Precontact	Wood scatter	RSA	3,465
LfRq-8	Precontact; Historic; Trading Post	Hearth	RSA	3,465

**Mackenzie Valley Highway Project
Technical Data Report—Heritage Resources**

Section 3: Review of Existing Data
December 2022

Archaeological Site (Borden) Number	Site Affiliation; Site Type	Features	Project Study Area (Project Area, LSA, RSA)	Approx. Distance (m) between Project Component and Recorded Site Centre Point
LfRq-9	Precontact	Lithic scatter	RSA	1,947
LfRr-1	Indigenous Historic; Campsite (Fall Fishing)	Cache, cut wood/stump	Project Area	5
LfRr-2	Undetermined; Campsite	---	LSA	221
LfRr-5	Indigenous Historic	Trail, cut wood/stump	LSA	223
LfRr-6	Precontact	Lithic scatter	Project Area	60
LfRr-7	Precontact; Isolated Find	Lithic core	Project Area	70
LfRr-8	Precontact; Hunting Lookout	---	RSA	1,587
LgRr-1	Historic; Campsite	Debris scatter	Project Area	0 (within quarry)
LgRr-2	Precontact; Hunting Lookout/Campsite	---	Project Area	0 (within quarry)
LgRr-3	Precontact; Hunting Lookout/Campsite	---	Project Area	0 (within quarry)
LgRr-4	Precontact; Hunting Lookout/Campsite	---	RSA	2,793
LgRr-5	Precontact; Hunting Lookout/Campsite	---	Project Area	0 (within quarry)
LgRs-1	Precontact; Isolated Find	---	RSA	1,150
LgRs-2	Contemporary	Tripod	RSA	1,604
LhRt-2	Contemporary	Cabin	LSA (quarry)	625
LhRt-3	Precontact (Palaeontological)	Natural - "Canyon Creek Fossils"	RSA (quarry access)	3,804
LhRt-4	Precontact; Campsite	---	RSA (quarry access)	4,185
LhRt-5	Precontact; Campsite	---	RSA (quarry access)	4,150

3.2.3 Results - Areas of High Heritage Resource Potential

The archaeological sites on record are typically identified during field studies—AIAs relative to proposed development projects. The AIAs are limited to specific footprints and are not, therefore, a comprehensive dataset of archaeological resources within the current Project study areas. As noted in the ToR, the description of Heritage Resources includes consideration of “heritage resource potential.”

The Mackenzie River/Deh Cho is a primary focus of human settlement and land use, as well as being a transportation corridor. Despite this focus, much of the study area is a level and featureless landscape. Two recent AOAs have evaluated the Project areas relative to heritage resources. One AOA was completed for the MVH corridor (Krahulic, 2020) and resulted in the definition of 33 target areas, recommended for pre-impact, field-based AIA prior to initiation of development activities. These target areas comprise approximately 14.5% of the AOA study area. The areas of high archaeological site potential are associated with:

- level, well-drained terraces of defined watercourses, particularly tributaries of the Mackenzie River/Deh Cho
- well-drained, level areas in proximity to waterbodies, particularly areas of inlet/outlet stream entry
- landmark features, such as Kwetjnj?ah/Bear Rock
- confluences of tributary streams, particularly confluences with the Mackenzie River/Deh Cho
- well-defined ridges/linear landforms/lookouts
- previously recorded archaeological and/or Traditional Land Use sites

The 2020 AOA (Krahulic, 2020) was reviewed and approved by the territorial Assessment Archaeologist, Culture and Heritage Division, Department of Education, Culture and Employment.

A second AOA (Peach, 2021) was completed for an inclusive group of borrow and quarry prospects, including preliminary access routes, where needed. Nine areas of high potential within the Project area were identified in the AOA. This AOA was also reviewed and approved by the territorial Assessment Archaeologist, Culture and Heritage Division, Department of Education, Culture and Employment.

An AIA was completed in 2021 for proposed borrows and quarries, with associated access. Additional assessment is outstanding.

These results will require review once a final footprint and PDA have been defined, to establish where the Project overlaps with areas of high archaeological site potential, as identified in the two AOAs.

3.2.4 Regulatory Engagement

Regulatory engagement was initiated early in the Project’s conceptual development. Recent engagement with the Culture and Heritage Division, Department of Education, Culture, and Employment includes the review of the two desktop AOAs noted above as well as liaison relative to the 2021 AIA of select borrow and quarry sources. Given the approval of the two AOAs by the territorial Assessment Archaeologist, these results will form the basis for additional field assessments (AIAs) to occur once the Project design has been developed and the PDA defined.

4 Key Results and Findings

Of the 133 archaeological sites have been previously recorded within 5 km of Project components (highway alignment centreline, quarry, borrow, and/or associated access road). Of these, 13 sites are within the Project Area (within 100 m of the project highway alignment or within borrow/quarry), 50 sites are within the LSA (between 100 m and 1,000 m of a Project component), and 70 sites are within the RSA (between 1,000 m and 5,000 m of a Project component).

Of these 133 sites, 63 may reflect traditional land and resource use, based on the available site descriptions. Five of these sites consist of, or include, graves/burials.

A total of 33 areas of high archaeological site potential were identified within the 2020 AOA footprint (Krahulic, 2020). Nine areas of high archaeological site potential were identified within the 2021 AOA footprint for borrows, quarries, and associated access within the Project Area. Additionally, previously unknown sites may be present in these areas of high archaeological site potential following AIA field assessment. These results will require review following better definition of the final Project Development Area.

5 Closure

This TDR was prepared for the sole benefit of GNWT to describe existing conditions related to Heritage Resources within the Project Area, LSA and RSA. If you have any questions, please do not hesitate to contact the undersigned.

Respectfully submitted,

K'alo-Stantec Limited

6 References

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**Mackenzie Valley Highway Project
Technical Data Report—Heritage Resources**

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December 2022

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**Mackenzie Valley Highway Project
Technical Data Report—Heritage Resources**

Section 6: References
December 2022

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