



Via Email

APR 28 2020

Mr. Joseph Mackenzie
Chair
Wek'èezhìi Land and Water Board
1-4905 48 STREET
YELLOWKNIFE NT X1A 3S3

Dear Mr. Mackenzie:

Submission of the Water Licence Annual Report 2019 for the Tłıchų All-Season Road

The Government of the Northwest Territories' Department of Infrastructure is pleased to submit the attached Water Licence Annual Report 2019 (W2016L8-0001) for the Tłıchų All Season Road. The Water Licence Annual Report 2019 was prepared in compliance with Part B, Condition 14 and Schedule 1, Part B, Condition 1 of the Water Licence. This report includes information from the issuance of the Water Licence on May 30, 2019 to December 31, 2019.

In accordance with Part B, Condition 23 and Schedule 1, Part B, Condition 1, Item P of the Water Licence W2016L08-0001, a summary of the Traditional Knowledge used as a source of information is included in the Annual Report.

Should you have any questions or concerns please contact me at (867) 767-9086 ext. 31117 or by email at Ziaur_Rahman@gov.nt.ca at your earliest convenience.

Sincerely,

Ziaur Rahman
Manager, Surface Design and
Construction
Department of Infrastructure

Attachment

- c. Ms. Laura Duncan, Tłıchų Executive Officer
Tłıchų Government



Document Name: Annual Water Licence Report	0	43
Reporting Period: May 30, 2019 to December 31 st , 2019	Rev.	Total Pages

Dave Green - Environmental Manager

Signature : _____

Date : 2020-03-20

Table 1-1. Document Revision History

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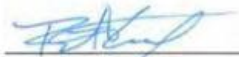
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GLOSSARY AND ACRONYMS

ASR – All Season Road

CDC - Career Development Coordinator

CCL – Community Coordinator Lead

CWG – Community Working Group

DFO – Department of Fisheries and Ocean Canada

EMPs – Environmental Management Plans

GNWT – Government of Northwest Territories

GNWT – ENR – Government of Northwest Territories – Department of Environmental Natural Resources

GNWT – INF Government of Northwest Territories – Department of Infrastructure

NSMA – North Slave Metis Alliance

RoW – Right-of-way

SAR – Species at Risk

SCP – Spill Contingency Plan

TASR – Tłıchq All Season Road

TG – Tłıchq Government

WLWB – Wek'èezhì Land and Water Board

WMP – Water Monitoring Plan

WMMP – Wildlife Management and Monitoring Plan

WRRB – Wek'èezhì Renewable Resource Board

YKDFN – Yellowknives Dene First Nation

1. Introduction

Peter Kiewit Sons (ULC) was retained by the Government of the Northwest Territories (GNWT) to construct the Tł̥chq All Season Road (TASR), which is a 97km long, two-lane gravel road connecting KM 196 along Highway 3 near Behchok̓ to the community government boundary of Whati in the Northwest Territories (see Figure 1-1).

On May 30, 2019 the Wek'èezhìi Land Water Board (WLWB) issued the Type B Water Licence No. W2016L8-000 1 to the Government of the Northwest Territories - Department of Infrastructure (GNWT-INF) for the TASR.

As outlined in Part B General Conditions of the Water Licence item 14:

“The Licensee shall submit an Annual Report to the Board no later than March 31st of the year following the calendar year reported. The report shall contain the information listed in Schedule 1, Condition 1 and shall include, but not limited to, the following:

- (i) Measuring and Reporting on Water and Waste
- (ii) Management Plan Activities
- (iii) Spills and Unauthorized Discharges
- (iv) Other Reporting Requirements
- (v) Wildlife Management and Monitoring

This report summarizes the environmental requirements under the Water License and the Wildlife Management and Monitoring Plan elements that were conducted during the construction of the TASR Project from May 30, 2019 to December 31st, 2019.



REV.	DATE	DESCRIPTION / REVISION	AUTH. BY
0	2018.06.25	DRAFT	SJT





TLICHO ALL SEASON ROAD (TASR)

KEY PLAN

DATE	SCALE (HALF SIZE)	DRAWING No.	SHEET
2018.06.25	N/A	H355788-20-260-SEG0-0101	1 OF 1

2. Measuring and Reporting on Water and Waste

2.1. Calibration - Water Meter Devices

During the reporting period, the first approved water source utilized for water withdrawal was from Lake # 8 (Peanut Lake). The water usage volumes at the beginning of the Project were tracked based on counting the number of water truck loads that were taken daily, until a flow meter arrived onsite and could be installed. The load count was then multiplied by the water trucks capacity of 34,036 litres. Based on this volume, no more than eight (8) water truck loads were taken per day to ensure the Water Licence daily water usage limit of 299m³ (299,000L) was not exceeded.

To ensure the accuracy of water volumes withdrawn on a daily basis, a flow meter was installed at Lake #8 (Peanut Lake) on September 30, 2019. Due to higher than reasonable flow volume measurements recorded during the initial days of use, the flow meter was inspected and recalibrated on October 3, 2019. Questions about the accuracy of the measurements taken with the flow meter, even after recalibration, the flow meter was removed, and water tracking via a flow meter was ceased. For the remainder of the reporting period, water usage was tracked using water truck load counts to measure the volume of water used for the project.

No other meters were utilized during the reporting period to track water quantities or measure water quality.

2.2. Water Usage

As outlined in the Water License W2016L8-0001, the WLWB set various requirements for GNWT-INF to comply with in order to withdraw water and minimize the impact to the environment. The following Conditions were adhered to when withdrawing water for use during project construction:

- The Licensee may only withdraw up to 299 m³/day of Water for the Project.
- The Licensee shall only obtain water from the approved Water Sources
- In any single year, the Licensee shall not withdraw greater than 10% of the available water volume of any Water Source.
- In any single ice-covered season, the Licensee shall not withdraw greater than 10% of the available water volume of any Water Source, as calculated using the appropriate maximum expected ice thickness.
- The Licensee shall not withdraw greater than 10% of instantaneous flow.
- Prior to locating a water intake in a fish-bearing watercourse, the Licensee shall obtain written authorization for the location from an Inspector.

The monthly and annual quantities of water withdrawn from approved water sources is provided in Table 2-1. The consumptive use of water was primarily for the purposes of road construction (dust suppression and compaction), freezing the approaches at ice crossing locations and the maintenance of winter service roads. The non-consumptive water use was primarily used for the establishment and maintenance of ice crossings over at the Duport, James and La Martre Rivers.

As the water being pumped and applied to the existing ice cover is considered non-consumptive, as per the GNWT-ENR Water Officer, detailed tracking of water volumes was not required. During the winter period when water was applied to land to ice the ice crossing approaches, water volumes extracted for this purpose were tracked and reported (see Appendix A).

Table 2-1. Monthly and Annual Water Quantities extract from approved water sources

Quantities Extracted from Approved Water Sources in Meters Cubed for Consumptive purposes					
Source	September	October	November	December	Annual Total Volume (M ³)
Duport River	0	0	59.2	0	59.2
James River	0	0	0	12.1	12.1
Peanut Lake	1327.4	759.5	0	0	2086.9
Unnamed Creek	0	0	27.8	12.1	39.9

2.3. Waste Quantities

The Waste Management Plan (Revision 1.2) developed for the TASR project was drafted to guide site personnel on the waste management goals, objectives and procedures to follow during construction and ultimately operation of the road. Adherence to the plan ensures the protection of the environment as well as aesthetic and land use values, ultimately meeting the regulatory requirements for the project. The plan requires the segregation of various waste streams and provides direction on how each of the streams should be managed and ultimately disposed of. As part of the Water License reporting requirements these waste streams are to be segregated and reported. The following sections detail the segregated waste streams (by type) generated during the reporting period. A copy of the monthly quantities tracking spreadsheet for all waste streams is provided in Appendix B.

2.3.1. Solid Waste

Figure 2-1 show the overall solid waste generated for the year of 2019 during the construction of the TASR reached a maximum of approximately twenty metric tonnes for the month of November in 2019. During the month of November, the main camp was being commissioned as well as the TASR project was preparing for the winter shut down for the year which may have contributed in the elevated quantity waste disposal. The graph illustrates the waste generated from all waste streams which are not associated with hazardous waste or sewage. This includes waste such as domestic waste, wood, metal, recyclables and construction waste. Quantities for each individual waste stream that is classified as solid waste are discussed in more detail below:

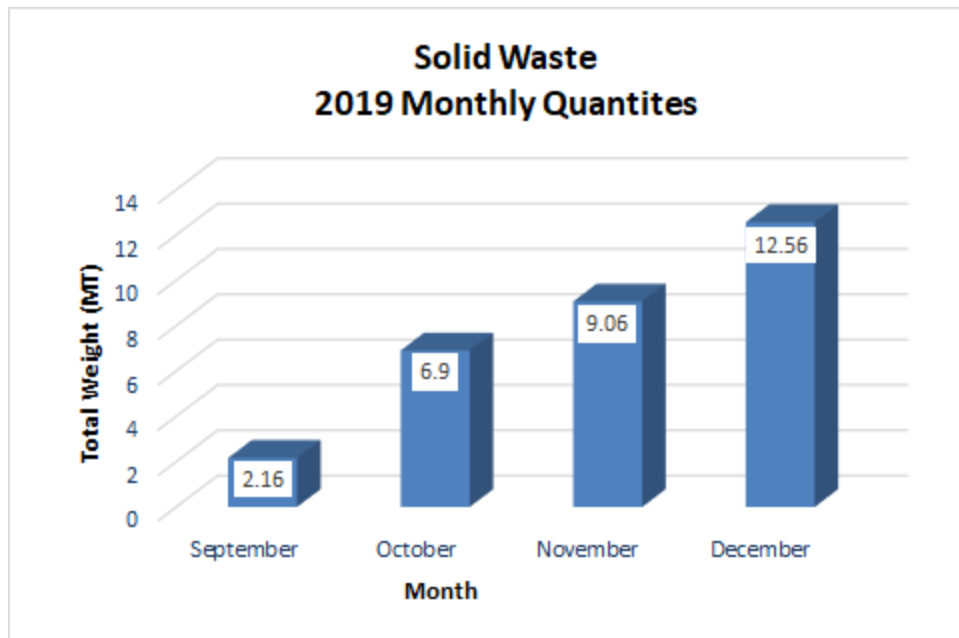


Figure 2-1. 2019 Monthly Solid Waste

2.3.1.1 Domestic Waste

Figure 2-2 illustrates the overall domestic waste generated during the construction of the TASR during the 2019 reporting period. Approximately seven and a half (7.5) metric tonnes of domestic waste was generated in the month of November 2019. Coincidentally, November also marked the highest level of camp occupancy in advance of the anticipated winter shut down for the year.

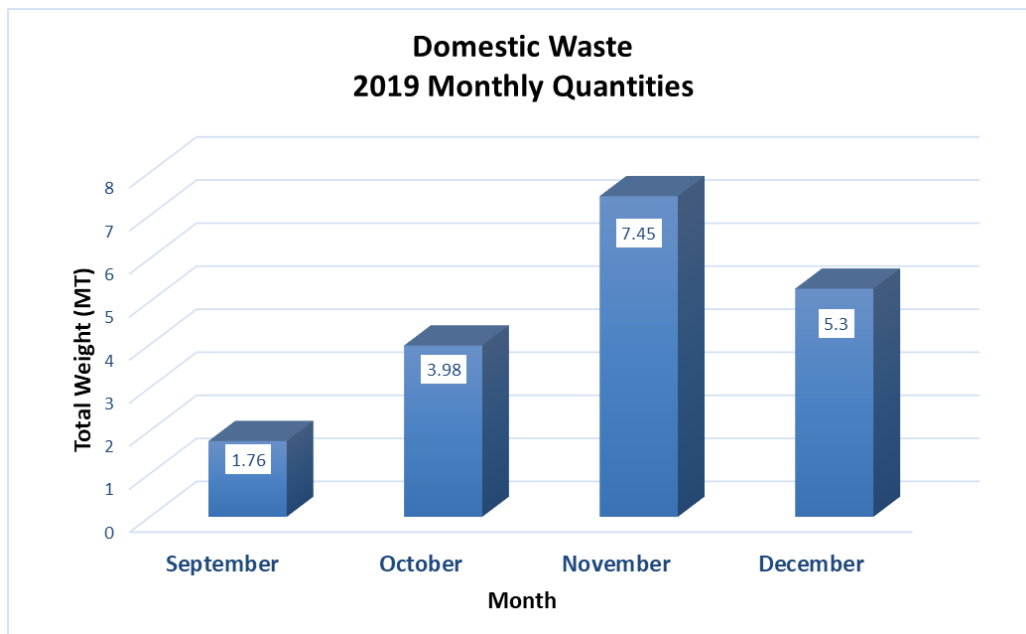


Figure 2-2. 2019 Domestic Water Quantities

2.3.1.2 Construction Waste

Figure 2-3 illustrates the overall construction waste generated during the construction of the TASR during the 2019 reporting period. The maximum amount of construction waste of approximately four (4) metric tonnes was reached in December 2019. During the month of December, the TASR project was preparing for the winter shut down which required the cleaning up of numerous work fronts as well as the maintenance area which likely contributed to the elevated quantity waste disposal.

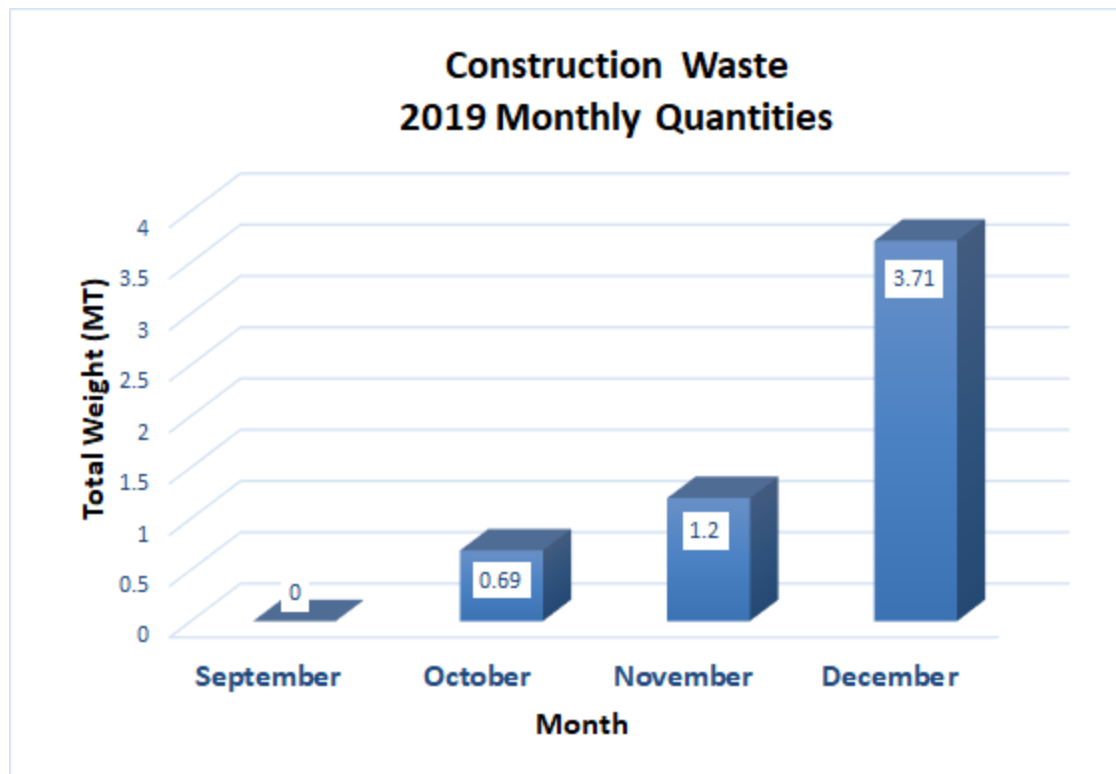


Figure 2-3. 2019 Construction Waste Quantities

2.3.1.3 Wood Waste

Figure 2-4 illustrates the overall wood waste generated during the construction of the TASR during the 2019 reporting period. A maximum of approximately eight and a half (8.5) metric tonnes of wood waste was produced in the month of November 2019. During the month of November, the project was in the midst of transferring to the new main camp located at station 19+800, and the activities associated with the influx of equipment and, supplies likely contributed to the influx of wood waste generated. Additionally, the clean-up of accumulated wood waste from the Drill Camp at 0+000 would also have elevated the volume generated. In the month of December, the wood waste returned to a normal level again of about two metric tonnes produced per month.



Figure 2-4. 2019 Wood Waste Quantities

2.3.1.4 Metal

For the reporting period of 2019 an adequate amount of metal waste was not generated to send a waste bin off site for disposal. Therefore, no metal waste was reported for the year of 2019.

2.3.1.5 Recycling

Figure 2-5 illustrates the overall cardboard waste generated during the construction of the TASR during the 2019 reporting period. A maximum of approximately four (4) metric tonnes of cardboard waste was produced in the month of November 2019. During the month of November, the TASR project was preparing to transfer to the new main camp located at station 19+800 as well as having the highest density of camp residents, as a result it is believed the activities associated with greater amounts of food packaging coupled with the shipment of equipment and supplies would have contributed to the influx of cardboard waste generated. In the following month of December, the cardboard waste generated dropped significantly.



Figure 2-5. 2019 Cardboard Waste (Recycled) Quantities

2.3.2. Hazardous Waste

As seen in Table 2-2 and Figure 2-6 below, most of the hazardous waste generated during the reporting period of 2019 primarily consisted of drums of waste oil followed by contaminated rags and absorbents, filters, used oil and lastly contaminated soil. Quantities described in Table 2-3 have been converted into Kilograms and displayed in Figure 2-6. All hazardous waste which was generated for reporting period of 2019 was collected in the month of November 2019 by KBL Environmental Ltd, a registered hazardous waste carrier. The waste was transported and disposed at their approved facility for treatment/disposal.

Table 2-2. Description of hazardous waste and quantities for 2019

Description	Quantity
Waste Oil	3,000kg
Contaminated Oil/ Fuel Filters	684kg
Contaminated Rags and Absorbents	1,020kg
Contaminated soil with Hydrocarbons	2,400Kg
Contaminated Empty Drums	340kg



Figure 2-6. 2019 Hazardous Waste Quantities

2.3.3. Sewage

Figure 2-7 shows the sewage waste generated during the 2019 reporting period. The maximum amount of sewage generated during the reporting period occurred in the month of December amounting to approximately 354.5 cubic meters of sewage waste generated. The increase of sewage waste produced for the month of December is believed to have been the result of the commissioning of the main camp. In addition to having two camps, there was a significant labour force present. This also would have also coincided with the full pump down of the wastewater storage tank so it could get transported to the camp at 19+800. Wastewater was collected by Kavanaugh Brothers and hauled to the sewage treatment facility in Yellowknife.

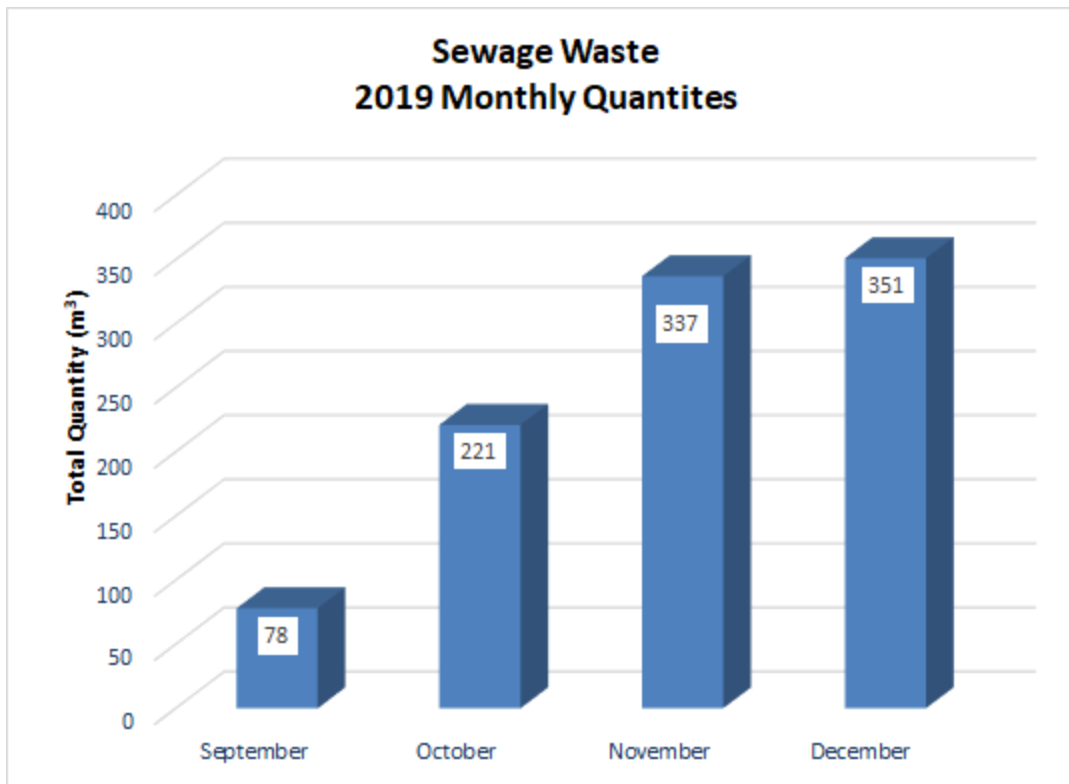


Figure 2-7. 2019 Sewage Waste (Main camp) Quantities

2.4. Waste Management Methods

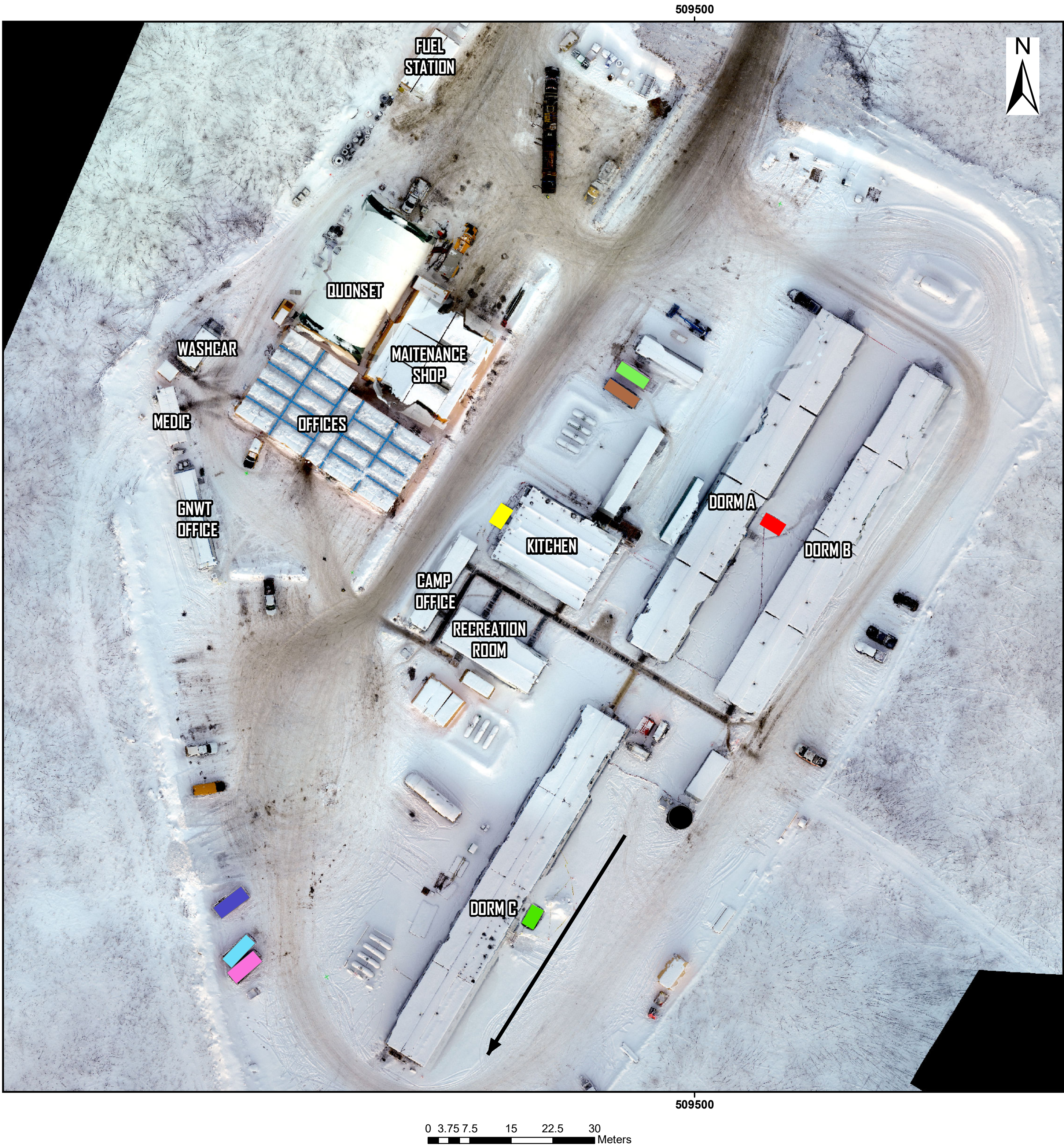
As noted in Section 2.3, various waste streams are generated on the TASR project. It is essential that the waste is handled, stored and managed in a safe and environmentally responsible manner. The waste management program implemented on the TASR site is utilized to minimize waste production by applying the principles of reducing the use of materials, reusing materials whenever possible, recycling materials and recovering value from used materials. The management methods for each of the different waste streams that are generated on site are discussed in more detail below:

2.4.1. Solid Waste

The solid waste streams that are generated on site consist of:

- domestic waste,
- wood,
- metal,
- recyclables and
- construction waste

All the solid waste streams are stored in a designated location at Kilometer 19+800 (Main Camp Laydown) as outlined in Section 26 (1) Condition 57 of the Land Use Permit. Each waste stream is segregated and stored in 30 yd roll-off bins that are clearly labeled. Figure 2-8 provides the locations for the solid waste bins. The waste types are removed from site by Kavanaugh Brothers and offloaded at the City of Yellowknife Landfill, the recycle depot and Precision North Recycling (steel).



Tlicho All Season Road Project

Main Camp
Waste Bin and Sewage Tank Locations

Legend

Waste Bin Locations

- Cardboard
- Construction Waste
- Domestic Waste
- Scrap Metal
- Wood

Sewage Lift Stations

- Dorm A & B Lift Station
- Dorm C Lift Station
- Kitchen Lift Station
- Main Heated Storage Tank

Data Source: Satellite Image 2016 (NAD83)

Created By: Kiewit Environmental Dept.	Date Created: March 25, 2020	Revision No: 0
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Figure 2-8

This map is for general illustration only and should not be considered a legal document. All geographic information has limitations due to the scale, resolution, date and source data. Kiewit is not responsible for any interpretation or conclusions based on the data shown. This map is not to be used in whole without the permission of Kiewit.

2.4.2. Hazardous Waste

Hazardous waste generated at the site from various waste streams fall under various categories including:

- Contaminated Soils
- Waste Oils
- Used oil Filters
- Contaminated soil from spill cleanup
- Oily absorbent rags
- Contaminated plastic containers
- Antifreeze
- Solvents
- Batteries

These various hazardous waste streams are actively segregated and stored within the maintenance laydown area, shop and Quonset building (see Figure 2-10). All hazardous waste containers are covered from the elements and each container is clearly marked noting content and date of generation. The containers are kept clear of debris and snow to facilitate routine inspections checking for leaks. Secondary containment for storage containers is either integrated or supplemented externally.

The waste is removed from the laydown as requested by site and transported by KBL Environmental Ltd and Kavanaugh Brothers Ltd who are registered hazardous waste carriers. The waste is transported and disposed at approved facility for treatment/disposal.

2.4.3. Sewage

The storage of sewage at the TASR project is held primarily at the main camp or in porta-potties stationed throughout the sites where active work is taking place. Sewage waste is removed by Kavanaugh Brothers twice a week or on an as-needed basis. Sewage is hauled to the City of Yellowknife sewage treatment facility for treatment and disposal.

The Drill Camp at Station 0+000 had a sump constructed as per the Geo-technical Land Use Permit. This sump was monitored daily for proper ground filtration of wastewater. Additionally, the drill camp had a winterized sewage storage tank which was emptied on a regular basis by Kavanaugh Brothers. This camp facility is no longer in operation.

There are three (3) auxiliary holding tanks (lift stations) at the main camp. One is positioned to service the kitchen, one is in place for Dorm A and B, and the last facilitates sewage transfers from Dorm C. Heat-traced lines connect these lift stations to the 15,000-liter heated storage tank on the south side of camp. Kavanaugh Brothers attends the camp twice a week, or on an as-needed basis with a vacuum truck and hauls the sewage to the Yellowknife Sewage Treatment Facility.

On the TASR self-contained and heated portable toilets are stationed in active work fronts for construction personal. These portable toilets are emptied routinely using the same vacuum truck as noted above.

2.4.4. Solid Waste Accept by Local Communities

Currently the solid waste streams generated on the TASR project are not sent to the local communities of Whatì and Behchokò for disposal. Kiewit continued to use its vendors to collect and dispose of the waste generated from the project to the City of Yellowknife.

2.4.5. Water Quality Monitoring

No water quality monitoring was conducted during the 2019 reporting period, as at the time the Water Monitoring Plan (WMP) was not approved and due to the type of work that was occurring no in-water work was being completed. Subsequently, the onset of winter precluded the need as well as opportunity to implement the plan. The Water Monitoring Plan was approved by the Board in March 2, 2020 and is expected to be implemented and reported in 2020 as required under the Water License annual report requirements.

2.4.6. Acid Rock Drainage and Metal Leaching (ARD/ML)

Kiewit has not conducted any water quality monitoring of ARD/ML during the 2019 reporting period due to not having an approved water monitoring plan.

3. Management Plan and Activities

3.1. Engagement

3.1.1. Summary of Engagement Activities

Throughout the reporting period, INF and NSI have conducted engagement on a variety of subjects with affected parties in accordance with the approved Engagement Plan. Engagement efforts have been centered around informing affected parties of construction activities, the review and approval of management plans, collaboration on various plans as required by the Report of Environmental Assessment Measures, and the review of proposed changes to the existing permits. Engagement methods have included written notification, telephone calls, face-to-face meetings, and workshops. Full details of the engagement undertaken can be found in Engagement Record found on the Wek'èezhìi Land and Water Boards website¹.

Face-to-face meetings and workshops that have taken place include:

- A third workshop was held on May 9 and 10, 2019, to follow up with Tłıchǫ Elders, Harvesters, and Trappers on the input received in previous workshops and to provide further information about the proposed offsetting options. On May 10, 2019 the TG, YKDFN, NSMA, WRRB, and GNWT-ENR met to further discuss the development of the Caribou Habitat Offset Plan.
- The first TASR Corridor Working Group Meeting was held on June 24, 2019. Parties that attended included the YKDFN, NSMA, CWG, and the TG.
- NSMA and INF met on June 27, 2019 to discuss the NSMA's comments on the WMMP.
- On August 24, 2019 a ground-breaking ceremony and a community barbeque was held in Whatì
- The second Tłıchǫ All Season Road Corridor Working Group Meeting was held on December 11, 2019. Parties that attended included the WLWB, NSMA, WRRB, YKDFN, TG, and CGW
- North Star Infrastructure (NSI) reached out to members from Tlıcho Government, Whatì and Behchokò on July 22, 2019 and had a meeting on July 3, 2019 to review the draft Community Grievance policy and discuss the public engagement sessions.
- On July 5, 2019 NSI had a teleconference call with members from Whatì and Behchokò, teleconference confirmed the dates for the public engagement session (August 6 and August 7, 2019). The Draft Camp and Community procedures was circulated.
- NSI held a teleconference on July 19, 2020 to review the comments and finalize the camp and community Grievance procedures and confirmed the agenda for the Public engagement sessions.
- On August 7, 2019 NSI attended the Whatì community engagement regarding the camp and community grievance policy. CCL went to Whatì to review the policy.
- On August 8, 2019 NSI attended the Behchokò community engagement regarding the camp and community grievance policy. CCL went to Whatì to review the policy.

¹ <http://registry.mvlwb.ca/Documents/W2016L8-0001/W2016L8-0001%20-%20TASR%20-%20Engagement%20Plan%20-%20Version%201.2%20-%20Oct%202019.pdf>

- Behchokò Project Manager interview applicants on August 21, 2019
- On August 21, 2019 attend the Project Managers meeting with TG directors and CDC to discuss training



Photo 1. TASR ground-breaking ceremony at Whatì



Photo 2. TASR ground-breaking ceremony at Whatì

3.2. Work Completed

Construction activities on the TASR commenced on September 3, 2019 between Stations 0+000 up to Station 83+375 and includes, vegetation clearing, stripping, pioneering, blasting operations, roadway embankment, drainage works and crushing, which are still ongoing.

3.3. Modification and / or Major Maintenance Works

During the reporting period, there were no modifications or major maintenance works completed.

3.4. Closure and Reclamation

Areas of the Old Airport Road that fall outside of the RoW that are no longer needed to gain access north were closed down and grubbing was pushed at their entrances to stop unnecessary travel outside the RoW.

Pit 3 at Station 7+000 had all the required material excavated from the borrow source and the pit was remediated as per the Northern Land Use Guidelines from the GNWT. Scarification and blocking the access road occurred when the pit was no longer in use.

3.5. Erosion and Sediment Control Activities

An Erosion and Sediment Control Plan (ESCP) was developed and approved for the TASR project with the intent of providing a guidance document with regards to mitigating erosion during construction. It incorporates and recommends the use of the 2013 GNWT Erosion and Sediment Control Manual as well as other guiding documents and best management practices (BMPs) to prevent the release of sediment into streams during construction activities and to ensure compliance with the Federal Fisheries Act (Section 36(3) which prohibits the deposition of deleterious substances into waterbodies frequented by fish. It provides reference to other approvals, relevant standards, control plans and procedures for training, communications, investigations, corrective actions and audits required under the Project Agreement. It also satisfied the requirement of Conditions under Part C of the Water License.

The ESCP was developed with an assumed schedule and approach to construction with some flexibility to adjust based on actual construction progress. To that end, critical areas were identified including 17 key water crossings that would be subject to the highest degree of risk of sedimentation. It is important to note that the ESCP did not foresee the accelerated construction progress touching Segment 1 through 3 in the first 7 months.

Erosion and sediment control risks were routinely evaluated as construction activities advanced northward from 0+000. Generally, the flat topography found through the majority of the active construction areas diminished the risk of extensive erosion. Consequently, drainage features identified as key water crossings ESCP became the focus areas of ongoing monitoring. Road construction progress northward did not allow the full construction of ditches and therefore, prescribed ESC measures for each of the key areas were modified as required to meet the intended goals of the ESCP. Where possible, such as in Segment 1 between Stations 0+600 and 2+700, rip rap was placed in the established ditches, along with rock aprons and rock check dams as detailed on the construction plans. The silt fence installations detailed in the ESCP for this area were modified to incorporate the use of coir logs positioned part way down the steep (>2m in length) slope sections to reduce runoff velocities and minimize erosion. Weekly monitoring of these erosion and sediment control (ESC) measures allows for the possibility to adjust, improve or bolster existing measures if stability or functionality concerns are noted.

The ESCP provided detailed plans and sequencing for the construction of large water crossings on the project such as Unnamed Creek, James River, Duport River and La Martre River. As each of these crossings were reached after the onset of winter, ESC measures were tailored for each location based on winter conditions and reflective of changes to the design, approach and sequencing of work. Ice and snow berms, enhanced with coir logs were utilized as well as BMPs such as track packing of snow covered, vegetated areas within the Ordinary High-Water Mark. All these measures and modifications were routinely inspected by Environmental staff as well as GNWT-DOL inspectors to ensure effectiveness and install additional measures as required.

3.6. Caribou Management and Habitat Protection

The following section reports on the GNWT's activities undertaken with respect to Measures 6-1, 6-2, 6-3, 7-1 and 7-2 of the Report of Environmental Assessment (REA).

Measures 6-1, Part 1: Develop and implement range plans: In August 2019, GNWT-ENR released [A Framework for Boreal Caribou Range Planning](https://www.enr.gov.nt.ca/sites/enr/files/resources/boreal_caribou_range_planning_framework_2019_-_cadre_de_planification_de_la_repartition_du_caribou_boreal_2019.pdf) (the Framework) that will guide the development of five regional range plans for boreal caribou. The Framework is intended to guide what factors regional range plans will consider, how disturbance will be managed, what kinds of actions are recommended for different levels of disturbance, and how those actions will be implemented. This includes setting regional limits for total habitat disturbance, and human disturbance thresholds to determine the intensity of management actions required. Range planning for the Southern NWT and the Wek'èezhìi regions will start in fall 2019. The Framework is available on ENR's website at [https://www.enr.gov.nt.ca/sites/enr/files/resources/boreal_caribou_range_planning_framework_2019 - cadre de planification de laire de repartition du caribou boreal 2019.pdf](https://www.enr.gov.nt.ca/sites/enr/files/resources/boreal_caribou_range_planning_framework_2019_-_cadre_de_planification_de_la_repartition_du_caribou_boreal_2019.pdf).

In September 2019, ENR initiated the formation of Wek'èezhìi and Southern NWT range planning working groups, as well as a broader Boreal Caribou Range Planning Advisory Group.

In November 2019, ENR held the first meeting of the Wek'èezhìi range planning working group in Yellowknife. The working group consists of 3 Indigenous Governments and Organizations (IGOs), the Wek'èezhìi Renewable Resources Board (WRRB), 4 GNWT departments, and Environment and Climate Change Canada. The purpose of the first meeting was to discuss the development of a Terms of Reference for the group, available information and data that could be shared to support range planning, options for collection and integration of traditional knowledge into the range plans, and next steps.

In December 2019, ENR held the first meeting of the Southern NWT range planning working group in Hay River. The Southern NWT working group consists of 22 IGOs, 4 GNWT departments, Parks Canada and one non-profit organization. The purpose of the first Southern NWT meeting was similar to that of the first Wek'èezhìi meeting.

Measure 6-1, Part 2: Information and adaptive management requirements:

- ENR initiated a boreal caribou monitoring program in the North Slave region focused on the TASR corridor in March 2017, with the deployment of 20 GPS collars on adult female caribou. Five more collars were deployed in the study area in March 2018, and ENR completed the first classification survey to determine cow: calf ratios in March 2018. Seven more collars were deployed in March 2019, and classification surveys were also completed. As of Dec. 31, 2019 there were 30 collared caribou within the TASR study area. As per Appendix D of the WMMP, ENR provided INF and NSI with weekly maps of boreal caribou collar locations which were used to trigger additional mitigation

measures when boreal caribou were within 4 km of active areas of construction along the RoW.

- *See Measure 6-2 regarding activities related to determination of sustainable harvest levels*
- ENR measures and updates fire disturbance on an annual basis. Fire History spatial data is publicly available on the GNWT Center for Geomatics website.
- Disturbance limits and human disturbance management thresholds have been defined for each boreal caribou range planning region within the [Framework for Boreal Caribou Range Planning](#).
- In December 2019, ENR submitted a Wildlife Research Permit application for review by the Wek'èezhì Renewable Resources Board, Tłıchǫ Government, Yellowknives Dene First Nation, North Slave Metis Alliance and Deh Gah Gotie First Nation to conduct a boreal caribou abundance and composition survey, and a wolf abundance survey, within the TASR study area during February/March 2020.

Measure 6-2: Determine sustainable harvest levels for boreal caribou (tǫdzı) and implement measures to ensure harvest is sustainable if required

ENR hired a contractor to conduct population modeling to evaluate sustainable harvest levels using available demographic data from boreal caribou monitoring programs in the Dehcho, South Slave and North Slave regions. This work was ongoing as of Dec. 31, 2019. ENR will engage on the results of the contractor's report once it is finalized.

In July 2019, ENR introduced new harvest regulations to split woodland caribou into separate "boreal caribou" and "northern mountain caribou" tags based on where each ecotype of woodland caribou lives to improve ENR's ability to track resident harvest levels of each ecotype. For boreal caribou, resident hunters and General Hunting Licence holders can now only hunt one bull per year and the hunting season has been shortened. A summary of the harvest regulation changes for boreal caribou can be found at <https://www.enr.gov.nt.ca/en/services/wildlife-act-phase-2-regulations>

Measure 6-3: Habitat offset and restoration plan

A Draft Caribou Habitat Offset Plan was completed and submitted to the Wek'èezhì Renewable Resources Board (WRRB) on July 31, 2019 in accordance with Measure 6-3. Employing the services of a consultant [Associated Environmental (AE)], the developer collaborated with the Tłıchǫ Government (TG) and WRRB, and consulted with Environment and Climate Change Canada (ECCC), Yellowknives Dene First Nation (YKDFN), and North Slave Métis Alliance (NSMA) to develop a Draft Caribou Habitat Offset Plan.

The consultant organized three separate workshops as follows:

Workshop One- February 22, 2019 in Yellowknife

The purpose of workshop one was to encourage a common understanding of the concepts of offsetting and agree upon how the draft Habitat Offset Plan should be developed. The collaborators decided upon a tentative schedule, the parties who needed to be engaged, the methods of engagement, the number of engagement sessions that would be required, and the number of drafts that would be provided.

Workshop Two- April 23 & 24, 2019 in Behchokǫ

During workshop two, offsetting was introduced to the Elders and Harvesters. The collaborators listened to the Elders and Harvesters traditional use of the land and the traditional knowledge they had of todzi use of the land. AE consulted with the Elders and Harvesters on methods of offset and areas for potential offset.

Workshop Three- May 9 & 10, 2019 in Behchokǫ and Yellowknife

Workshop three was a follow-up with Elders and Harvesters to ensure that the information obtained from the previous workshop was correct, and provided Elders and Harvesters with an opportunity to provide further feedback. The second day of the workshop was held with staff to focus on the methods and areas for offsetting and what the draft Habitat Offset Plan will look like.

Contributions, suggestions and pieces of advice from the three workshops were taken into account before developing the Draft Caribou Habitat Offset Plan.

Currently, the developer and AE are in the preparatory phase of developing a Final Caribou Habitat Offset Plan, required to be submitted to the WRRB at least 90 days prior to public use of the road.

Measure 7-1: Incorporate Traditional Knowledge into monitoring of barren-ground caribou (ᑕᑦᑲᑲᑦ)

The GNWT-ENR provided funding to the Tłıchǫ Government for the Community Harvesters Assistance Program, and supported community harvests and the Boots on the Ground monitoring program during the 2019-20 fiscal year. The first winter season monitoring will be completed in 2020 and results provided thereafter.

Measure 7-2: Barren-ground caribou mitigation and policy changes

Measure 7-2, Part a: complete the Bathurst Caribou Range Plan: The [Bathurst Caribou Range Plan](https://www.enr.gov.nt.ca/sites/enr/files/resources/bathurst_caribou_range_plan_2019_-_plan_pour_la_repartition_des_caribous_de_bathurst_2019.pdf) (BCRP) was released on August 21, 2019. The BCRP was developed by a multi-stakeholder working group and will help decision-makers manage activities on the land in a way that supports the recovery of the Bathurst herd, while providing clarity on land use and access for developers, regulators and residents of the Northwest Territories (NWT). It includes guidance for managing the overall amount of disturbance on the land, as well as seven management tools to reduce and manage impacts to caribou and caribou habitat. Actions are currently underway to support implementation of the recommendations contained in the BCRP. The BCRP is available on ENR's website at https://www.enr.gov.nt.ca/sites/enr/files/resources/bathurst_caribou_range_plan_2019_-_plan_pour_la_repartition_des_caribous_de_bathurst_2019.pdf

Measure 7-2, Part b: consider protecting barren-ground caribou historic winter habitat from fires: The BCRP contains a recommendation to: "On an annual basis, identify large, strategically-located patches of forest in the central Bathurst winter range for the GNWT fire management "Values at Risk" database. Response to fires in these areas would be based on an analysis of the current fire load, fire environment, resource availability and similar considerations of the management options at the time of the fire event."

ENR has been exploring ways to identify areas at risk for boreal and barren-ground caribou based on habitat selection models, areas identified as important habitat by communities, availability and location of fire management resources, and logistical constraints. ENR staff met in summer and fall 2019 to discuss different options and this work is ongoing. The Tłıchq Government held a workshop to identify areas of critical winter habitat for boreal and barren-ground caribou, and shared the spatial data from the workshop with ENR in late summer 2019. ENR successfully initially attacked and suppressed fires in some of the areas identified by the Tłıchq Government in summer 2019, and also took Chiefs and elders on tours during the fire season to show where fire suppression efforts had been applied to protect winter habitat. The areas identified by the Tłıchq Government will be used again in decision making in the upcoming summer 2020 fire season.

3.7. Environmental Management Plan Revisions

No additional updates were completed on the Environmental Management Plans (EMPs) during the reporting period.

4. Spills and Unauthorized Discharges

4.1. Spills / Unauthorized Discharges

As outlined in Part 1 of the Water Licence, a Project specific Spill Contingency Plan (SCP) including prevention planning and response of hazardous material spill and unauthorized discharge of waste was developed for the TASR project. The SCP was developed in accordance with the Guidelines for Spill Contingency Planning prepared by Indian and Northern Affairs Canada (INAC 2007) and the Spill Contingency Planning and Reporting Regulations issued under the Environmental Protection Act (EPA).

The purpose of the SCP is to provide a guide to all site personnel in the event of an accidental release of fuel or other materials during the construction of the TASR. All Project personal and contractors are required to read and be familiar with the SCP, which is required to meet the minimum standards set out in the Project specific SCP.

All reporting, remediation and documentation of hazardous material releases and unauthorized discharges of waste is carried out as per the requirements outlined in the Project specific SCP.

4.1.1. Spills

Most of the hazardous material releases recorded during the reporting period (June to December 2019) were the result of contractor activities that were being conducted onsite. The releases were a result of improper maintenance procedures, human-error or mechanical failure. A total of nineteen (19) hazardous material releases occurred during the reporting period, of the releases that occurred, eighteen (18) all were noted to be less 10L in volume, with one 40L release. All releases were cleaned up and the contaminated materials were disposed offsite at a licenced facility.

4.1.2. Unauthorized Discharges

During the reporting period (May 2019 – December 2019) there were a total of three (3) unauthorized discharged of wastewater that were reportable to the 24-Hour NWT – Nunavut Emergency Spill Reporting Line. Table 4-1 provides a description, volumes for each unauthorized discharge and a summary of the follow-up actions taken.

Table 4-1. Unauthorized Discharges of Waste

Date	Discharge ID	Discharge Type	Volume	Description	Corrective Action
30-Aug-19	EIR-SP-002	Wastewater	2.0L	G.N.S Transport Truck was offloading a Wastewater Tank to the Tlıchǫ All season Road Temporary Geo-Technical Investigations Camp, located at 0km, just off Hwy 3 at 196km. During the offloading process, old wastewater from inside the tank started to leak out of the valves on the tank on to the gravel pad. Upon observing the discharge, the operation was immediately stopped, the leak was contained, and absorbent pads were placed on the ground from the on-site spill kit to absorb the spilled wastewater.	The contaminated gravel was excavated using shovels and placed into contaminated soil bin, where it was disposed off-site at a licensed facility. Valves were installed on the tank and secondary containment was placed underneath the valves
24-Nov-19	EIR-SP-014	Wastewater	10L	The wastewater holding tank located at the main camp underneath the washroom behind the main office overflowed releasing approximately 10 liters of wastewater onto the frozen ground and snow	Due to its proximity to the adjacent building, equipment could not be used and therefore contaminated snow / soil was excavated by hand and placed into the contaminated soil bin where it was disposal off-site at a licensed facility. A tank fill level alarm was installed by a plumber (November 25, 2019) that will notify camp staff when the tank is approaching capacity.
14-Dec-19	EIR-SP-019	Wastewater	15,000L	During an environmental inspection of the camp area, the odor of sewage led to the discovery of sewage overflowing the lift station. The extent of the sewage leak to ground was noted between Dorms A&B in the vicinity of the lift station (~2.0m on either side) and flowed south under Dorm B (~ 10m wide). Upon investigation it was determined that the lift station pump malfunctioned resulting in the overflow of the lift station and subsequent freezing of the 2" line that carries wastewater from the lift station to the tank. Also noted was the failure of the high-level alarm system.	A Vacuum truck was dispatched to the site to pump down the lift station halting any additional overflow and restoring capacity for overnight use. The vacuum truck returned on December 15, 2019 at approximately 9:00pm to draw down the lift station tank until the repairs could be made. The contaminated material was placed in a bin where it will be disposed off-site at a licensed facility. Lime was also placed on the spill location to help neutralize the affected areas. Sewage lines were re-installed without check valves between the lift station and the sewage tank to allow for better drainage. A back up pump for the lift station was acquired. All sewage lines from lift stations were re-installed to allow for proper drainage and additional tanks (kitchen) were brought to site to minimize any risks of freezing. Twice daily monitoring of all lift stations, connection points and storage tanks was implemented.

4.2. Spill Training

During the reporting period the Environmental Department provided spill prevention and response management training to Project site personnel. Training was provided in the form of toolbox talks that were presented at the daily, morning and nightshift Pre-Task Instruction (PTI). Below is a list of training that was provided:

- November 30, 2019 - Spill Kits and Inspection procedures.
- December 3, 2019 - Internal Spill Notification Procedures and Spill Kits Inspection procedures.
- December 3, 2019 - Internal Spill Notification Procedures and Spill Kits Inspection procedures.

- December 7, 2019 - Internal Spill Notification Procedures and Spill Kits Inspection procedures.

Additionally, the Environmental Department presented training related to Spill Prevention and Response at the Craft Voice in Safety (CVIS) Rodeo held over the course of 3 days (December 4th to 6th, 2019).

5. Other Reporting Requirements

5.1. Results on Studies Required by the Board

5.1.1. Den Surveys

As outlined in the WMMP (Revision 3.4) Bear Den aerial survey would be completed in the fall. On October 23-25, 2019 a biologist from GNWT-ENR and 2 observers from Behchokò completed the aerial survey (Wildlife Research Permit #WL500763). This survey complimented the ground efforts by the TASR Environmental Departments that occurred during the pre-clearing surveys.

The survey consisted of flying transects within an 800m buffer of centerline of the RoW, borrow sources, and access roads using a helicopter with navigator/data recorder, and 2 observers. The transects were flown at an approximate elevation of 100-200 feet at 60 Km/h and all observations of suspected den sites, wildlife, and habitat features were recorded with GPS waypoints and photos.

The results of the study concluded that no active bear dens were detected during the aerial survey in 2019. However, two (2) potential den sites were observed, with one being within the RoW between Station 65+000 and 70+000. The second potential bear den site was located between station 0+000 and 1+000 roughly 800 m away from the road alignment.

As one of the potential den sites was located on the centreline of the right-of-way, an additional survey by foot was completed to determine if the den was an active den. It was determined by NSI staff that the potential den was not an active den, but rather a very small depression within the ground. The site was documented, and the information was provided to GNWT-ENR. The aerial survey also noted six (6) locations that had caves or sink holes that could potentially provide bat hibernacula habitat, but none were within the RoW. Further details on the 2019 Aerial Bear Den Survey is found in Appendix D.

5.1.2. Wildlife Management and Monitoring Plan (WMMP)

5.2.1.1 Summary of Construction Activities

Construction on the Tłıchǫ All Season Road right-of-way commenced on September 3, 2019 upon receiving approval from the WLWB and GNWT. During the reporting period (May 30, 2019 to December 31st, 2019) construction activities on the TASR were conducted between Stations 0+000 up to Station 83+375 and included:

- Vegetation clearing
- Stripping of Right-of-way
- Installation of Drill Camp
- Installation of Main Camp
- Establishing borrow sources
- Embanking
- Blasting operations
- Pioneering
- Installation of culverts

Vegetation Clearing

Machine clearing of the Right of Way (RoW), Main camp, borrow sources, and road access was completed on the TASR in Segment One (1) and Two (2) between September 3rd, 2019 to December 31st, 2019. Prior to clearing operations commencing Pre-Clearing Wildlife and Bird surveys were conducted to sweep the area for any large mammals, bird nests, and animal dens. Surveys were completed as per Appendix F of the WMMP (Rev 3.4) and are discussed in more detail in Section 7.4 of this report.

From the reporting periods of September to December Kiewit cleared vegetation from Station 0+000 to 54+000 and developed Pits 2B, 3, 13C and 33A in the following timeline.

- September 3 – October 5, 2019, cleared from station 0+000 – 25+000 and developed pit 2B and 3
- October 5 – November 2, 2019, cleared from station 25+000 – 31+300 and developed pit 13C
- November 3 – 30, 2019, cleared from station 31+300 – 42+500 and developed pit 33A
- December 1 – 20 2019, cleared from station 42+500 – 54+000

Stripping

Upon the completion of the clearing / mulching activities, the stripping of the right-of-way (RoW) commenced. The material was pushed into windrows by bulldozers along the RoW tree clearing limits. In order to ensure that wildlife movement was maintained, gaps were left in the windrows approximately every 200m to allow wildlife to travel along or across the RoW.

Installation of Drill Camp

On August 18th, 2019 preparation work commenced on an existing pad at Km 0+000 for the placement of a twenty-six (26) person temporary drill camp which fell under the Geotechnical Land Use Permit (W2016S0009). The work that was conducted included grading the pad, installation of camp infrastructure, building a wastewater sump, and positioning sewage holding

tanks. Once the main Land Use Permit was approved, construction of Main Camp at Station 19+800 commenced.

Installation of Main Camp

Establishment of the main camp began on September 3, 2019 and was completed in November 13, 2019. During the establishment of the camp at 19+800 Kiewit followed the protocol for Working Outside a Developed Area and completed the following work activities.

Pre-Clearing Large Mammal and Bird Nesting Survey completed on September 3rd; followed by completing an in-field walkthrough of the area with the Superintendents, Foreman and Operators prior to clearing. The team was also made aware of the use of coloured flagging which delineated the clearing limits and restricted areas. The team was briefed on required protocols in the event that wildlife was observed within or in the vicinity (500 m) of the clearing area.

- From September 15- 29, after completing the clearing and stripping of the main camp area. A rock pad was placed followed by the arrival and set up of camp dorm and office and maintenance shop structures were delivered.
- From September 29- October 19, the installation of the camp, offices and maintenance shop continued during the reporting period. This consisted of moving the modules into place and installing utilities. No additional modules were delivered during the reporting period.
- From November 3 – 9, Site personnel began to transition from the Drill Camp at and office complex at 0+000 to the Main Camp at 19+000 during the reporting period. Utilities continue to be installed and the last wing of the camp was being prepared for additional staff.
- From November 10-16, the camp construction and installation of camp utilities was completed.

Establishment of Borrow Sources

During the reporting period, five (5) borrow sources and their access roads were established on the TASR including:

- Pit 2B at Station 4+500 was established for crushing operations.
- Pit 3 at Station 7+000 for the excavation of sand (remediated).
- Pit 13C at Station 19+500 for the excavation of sand.
- Pit 21B at Station 24+800 for the extraction of aggregate
- Pit 33A at Station 37+000 for the extraction of aggregate as well as is an equipment laydown.

All borrow sources that were opened during construction phase of the project will be remediated according to the governing pits/quarry permits. This generally involves addressing slope issues and ensuring proper drainage prior to the completion of the project. The notable exception is Pit 3 which has already been remediated and inspected/accepted by the GNWT-DOL Inspectors.

Embankment

Embanking operations which included cut and fill within the RoW limits commenced in September 2019 in Segment 1 and progressed to Segment 2 until the Christmas shutdown on December 20th, 2019. As required by the design, geo-textile fabric and geo-grid were placed in

areas of permafrost that were pre-determined in order to protect ground integrity and prevent slumping. Aggregate from borrow source within the RoW cuts were hauled by rock trucks and placed to form the profile of the road (see Photo 3).



Photo 3. Haul trucks moving embanking materials for the placement.

Blasting Operations

Blasting operations took place in Segment 1 and 2 for ditch cuts, quarrying, and the removal of bed rock from the RoW. The environmental protocols in place before a blast can occur include wildlife sweeps within a 500m radius from blast center (or as determined by the Blast Supervisor). The pre-blast surveys conducted follow protocols that are detailed in the WMMP.

The date and location of the blasts that occurred during the reporting period are provided in Table 5-1.

Table 5-1. Blast Dates and Location on the TASR in 2019.

Date	Blast #	Location
29-Sep-19	Blast #1	Pit 2B
3-Oct-19	Blast #2	Pit 2B
4-Oct-19	Ditch 2	Station 5+000
06-Oct-19	Ditch #3	Station 5+048 to 5+176
08-Oct-19	Ditch #4	Station 5+265 to 5+346
09-Oct-19	Ditch # 5 & 6 (both sides)	Station 6+397 to 6+526
10-Oct-19	Ditch # 7 & 8(both sides)	Station 6+729 to 6+882
11-Oct-19	Ditch #9 & 10	Station 8+016 to 8+470
12-Oct-19	Ditch #11	Station 8+649 to 9+013
19-Oct-19	Ditch # 12	Station 8+500
21-Oct-19	Ditch # 13	Station 10+730 – 11:020
22-Oct-19	Ditch #14	Station 10+830 – 10+920

Date	Blast #	Location
23-Oct-19	Ditch # 15	Station 10+025 – 10+365
23-Oct-19	Ditch # 16	Station 10+ 440 – 10+560
25-Oct-19	Ditch # 17	Station 11+000 – 11+350
25-Oct-19	Ditch # 18	Station 13+722 – 13+965
26-Oct-19	Ditch # 19	Station 11+230 – 11+370
26-Oct-19	Ditch # 20	Station 13+825 – 14+095
27-Oct-19	Ditch #21	Station 10+830 to 10+925
27-Oct-19	Ditch #22	Station 13+772 to 14+095
28-Oct-19	Ditch #23	Station 14+146
29-Oct-19	Ditch #24	Station 13+825 to 14+095
31-Oct-19	Ditch #25	Station 17+400
1-Nov-19	Ditch #26	Station 15+202 to 15+295
2-Nov-19	Ditch #27	Station 14+725
3-Nov-19	Ditch #28	Station 14+820
4-Nov-19	Ditch #29	Station 15+715 to 15+876
5-Nov-19	Ditch #30	Station 15+910 to 16+097
6-Nov-19	Ditch #31	Station 16+000 to 17+000 (ends)
7-Nov-19	Ditch #32	Station 17+750 to 19+000
16-Nov-19	Alignment Cut #1	Station 34+200
20-Nov-19	Alignment Cut #2	Station 34+200
23-Nov-19	Alignment Cut #3	Station 34+350
26-Nov-19	Alignment Cut #4	Station 34+500
30-Nov-19	Alignment Cut #5	Station 35+070
5-Dec-19	Alignment Cut #6	Station 32+000
6-Dec-19	Alignment Cut #7	Station 30+500 to 31+400

Pioneering

Pioneering of the RoW from September 3rd, 2019 to December 31st, 2019 was typically done with a dozer or an excavator. These were utilized depending on the limitations of the equipment to safely perform the work to clear a path for road construction. During the reporting period pioneering provided access for light duty pickups up to Station 83+375 (La Martre River Crossing) using the Old Airport Road and pioneered sections within the RoW. Prior to these operations Pre-Clearing Wildlife and Bird surveys were conducted to sweep the area for any large mammals, bird nests, and animal dens.

Installation of Culverts

The TASR project requires seventeen (17) water crossings including ephemeral drainages to large permanent water courses as well as areas that were determined to need balance culverts installed to facilitate for proper drainage of the surrounding area and ditches. Some of these culverts are installed in accordance with best-management practices set out in the Fish and Fish Habitat Protection Plan (FFHPP) and incorporate measures recommended in the Erosion and Sediment Control Plans. Photo 4 provides an example of specified geotextile and rip rap protection armouring. On occasion, temporary culverts were installed to manage water during the upcoming freshet season. Table 6-2 below lists all culverts that were installed or are pending from the 2019 reporting period.

Table 5-2. 2019 Culvert Locations and Install Dates.

Segment	Station	Diameter	Length	Installation Date
1	2+000.1	1500	32.91	30-Sep-19
1	2+000.2	1500	32.8	30-Sep-19
1	2+400	1500	25.11	1-Oct-19
1	3+400	900	31.65	3-Oct-19
1	4+400	800	31.02	7-Oct-19
1	3+200	1200	34.43	13-Oct-19
1	3+700	1000	27.3	16-Oct-19
1	4+700	1200	32.29	17-Oct-19
1	5+600	800	20.35	18-Oct-19
1	4+060	1500	28.08	6-Nov-19
1	13+200.1	1400	24.84	7-Nov-19
1	13+200.2	1400	24.84	7-Nov-19
1	14+600.1	1400	19.37	7-Nov-19
1	14+600.2	1400	19.37	7-Nov-19
1	12+900	1000	24.4	8-Nov-19
1	19+900.1	1200	32.78	8-Nov-19
1	19+900.2	1200	32.78	8-Nov-19
1	6+100	800	32.88	8-Nov-19
1	12+200	1200	28.41	10-Nov-19
1	7+350	1200	20.8	10-Nov-19
1	7+580	900	26.64	11-Nov-19
1	7+850	1500	21.23	14-Nov-19
1	9+300.1	1400	18.77	19-Nov-19
1	9+300.2	1400	18.77	19-Nov-19
1	11+570	1500	24.82	Pending
1	15+400.1	1200	20.73	Pending
1	15+400.2	1200	20.73	Pending
1	18+300	800	30.66	Pending
1	6+340	800	14.5	Pending

1	9+650.1	1200	25.47	Pending
1	9+650.2	1200	25.4	Pending
1	16+550	2430	34.3	Temp
1	19+500.1	2430	34.24	Temp
1	19+500.2	2430	34.24	Temp



Photo 4. Culvert Installation at Station 7+850 on November 8th, 2019.

5.2. Summary of Wildlife Monitoring Data

Environmental monitoring was integrated with the construction operations to maintain compliance with the Water License and Land Use Permit, as well as other regulatory requirements detailed in the Wildlife Management and Monitoring Plan. The surveys conducted during the construction phase documented areas of concern for sensitive wildlife crossing or zones where human-vehicle interference may be increased. This allows for an adaptive management approach to be used and allow for mitigation measures to be implemented during the construction and operational phases of the TASR. Listed below are summaries of all the data collected in 2019.

5.2.1. Wildlife Road Surveys

Wildlife road surveys are conducted by the environmental monitors that travel the TASR. These road surveys collect invaluable information to determine areas that may be more susceptible to human-wildlife interactions and to inform construction activities where reduced speed areas or potential areas for any wildlife interactions. When species were observed near the RoW call outs over the radio to all staff were implemented to create zones of reduced speed and to educated people on crossing locations.

During this reporting period a total of seventy-two (72) wildlife road surveys were completed by the Environmental Department. Total observations of fauna are shown in Figure 5-3.

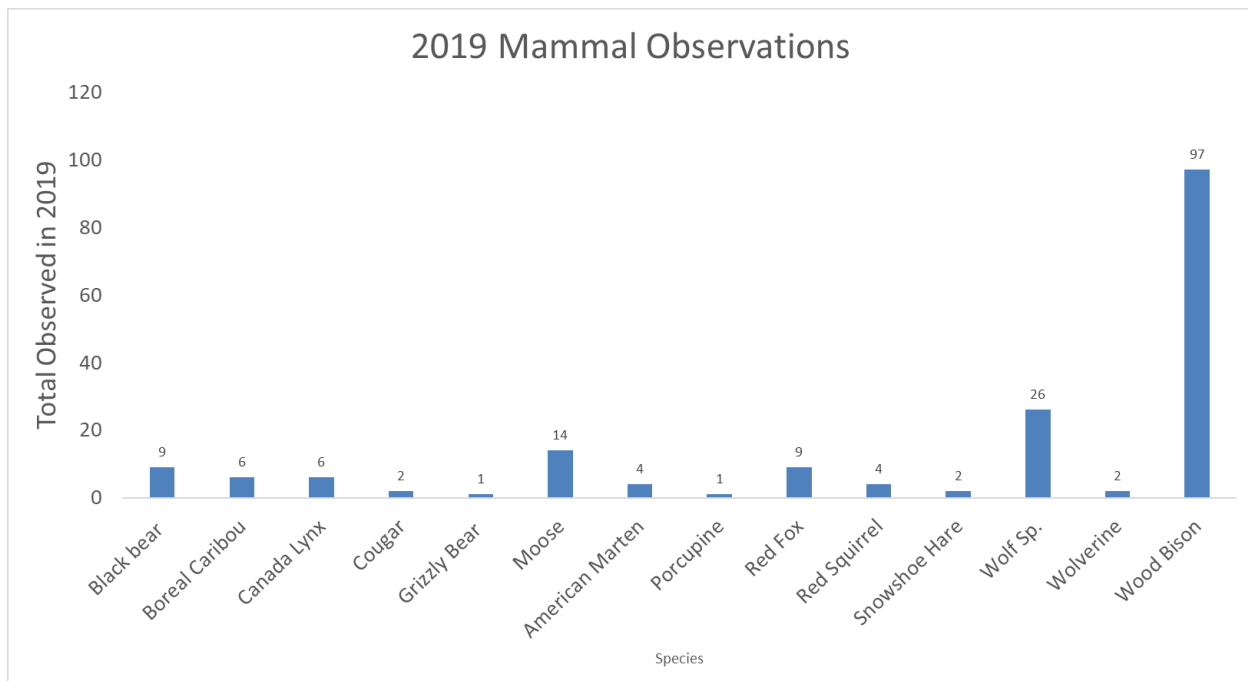


Figure 5-1. 2019 Mammals Observations by Species

5.2.2. Wildlife Sightings

Wildlife sighting logs provide a simple means for all Project staff to contribute to tracking wildlife activity at the Project. The value of the data is limited in that it is not systematically collected and contains repeated observations. Nonetheless it can provide an indication of the potential for wildlife incidents or problem wildlife as well as potential areas of concern.

Wildlife sighting logs are completed weekly and document the observations made by field crews. These observations are then uploaded into an Excel tracking sheet (see Appendix C). Total observations from all other field surveys (Road Surveys, Pre-Clear Surveys, etc.) are also included in that tracking sheet.

During the 2019 reporting period a total of twenty-six (26) different species of birds and mammals were observed within the TASR footprint. Wood bison (*Bison bison athabasca*) had the highest amount of observations with ninety-seven (97) total observations in 2019, wolves sp., was second with twenty-six (26) observations.

Dark-eyed Junco (*Junco hyemalis*), snow buntings (*Plectrophenax nivalis*), and the common raven (*Corvus corax*) were the three most observed bird species in 2019 with a total count of 50, 40, 25 respectively.

Figure 5-5 depicts the total observed bird species within the TASR footprint during the 2019 reporting period.

Species At Risk

Two (2) species at risk (SAR) were observed on the TASR in 2019; they are wood bison and boreal caribou (*Rangifer tarandus*). Wolverine (*Gulo gulo*), a species of Special Concern (SC) were observed crossing the TASR RoW on two occasions. These species were either observed during Wildlife Road Surveys or opportunistically when staff or craft noted them while travelling the RoW.

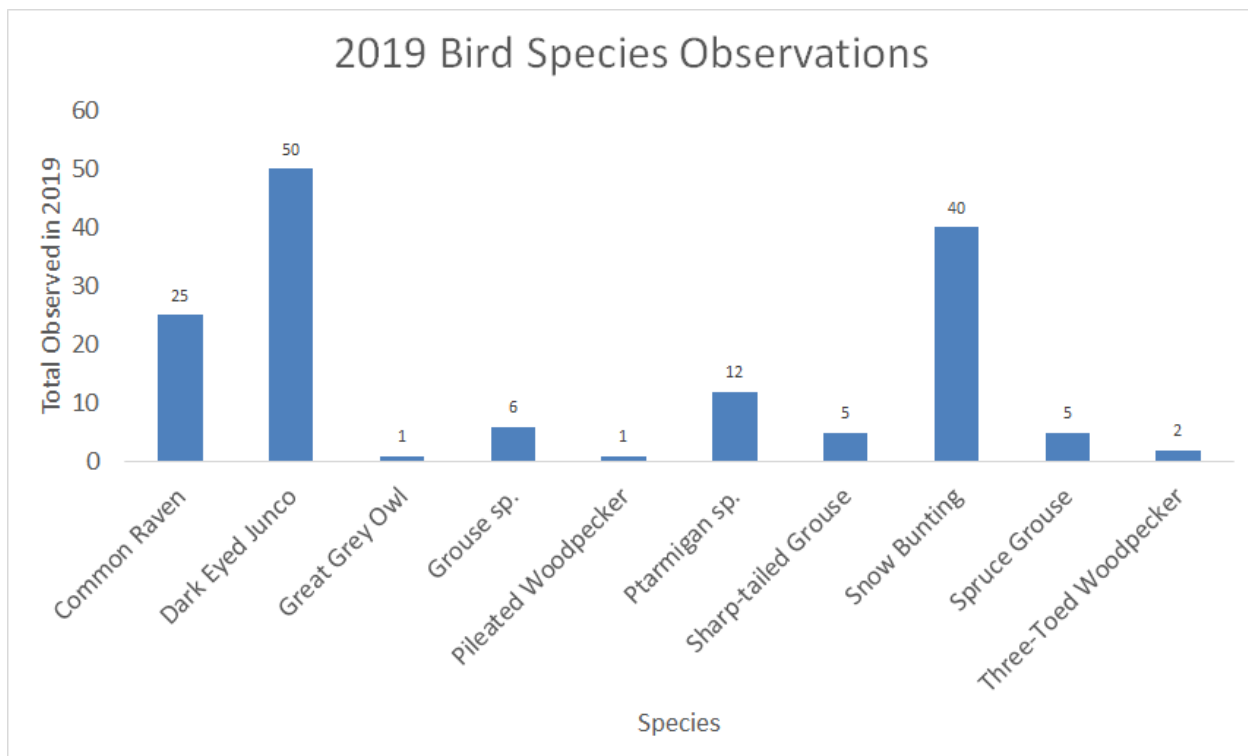


Figure 5-2. 2019 Bird Species Observations

5.2.3. Wildlife Surveillance Survey

Wildlife surveillance monitoring is intended to provide systematic and current information of wildlife activity at the Project construction camps and will provide direct feedback regarding the effectiveness of wildlife mitigation. Examples of wildlife activities that were documented through the Wildlife Surveillance monitoring include presence of wildlife within camp areas, any instances where food or domestic waste may be improperly stored and use of buildings by wildlife for shelter or nesting. Environment Monitors undertake systematic tours of the Project construction camps to record all wildlife observations or recent wildlife sign (e.g., tracks and scat). Environmental Monitors then recorded the area that was surveyed and noted all observations.

During the reporting period weekly wildlife surveillance sweeps were conducted around Camp 0+000 and Camp 19+800. These surveys generally patrol the perimeters of camp and make

observations on active wildlife within certain areas. All observations were reported in the wildlife tracking spread sheet. In total, seventeen (17) sweeps were conducted.

5.2.4. Pre-Clearing Large Mammal and Blast Surveys

Blasting was required both within the TASR RoW and in borrow pits. Blasting was preceded by a scan for large mammals to reduce the risk of injury and the impacts of sensory disturbance. The blast surveys are intended to apply the same standards to large mammals that are used for human safety with regards to proximity to the blast radius. It is noted that it may not be possible to detect all large mammals within the blast radius in dense forest or undulating terrain, but this is partly mitigated by the drilling activity and horn signals that precede the blast, which is likely deter wildlife from the area.

The Pre-Clearing Large Mammal Survey consisted of a ground-based survey no more than 48 hours prior to clearing activities.

During the reporting period, pre-clearing and blast surveys were conducted before all operations of vegetation clearing and blasting on the RoW to sweep for bird nests and large mammals including dens sites.

In total seventy (70) pre-clearing and thirty-seven (37) pre-blast surveys were conducted on the TASR in 2019.

During these surveys large mammals were rarely observed around the blasting or clearing activities. With heavy equipment working in the vicinity, the noise levels were elevated which in turn acted as a deterrent. Another factor that affected the success of these surveys was dense forest composition that made viewing or spotting of fauna difficult even with binoculars or infrared scopes. When encountered, recent sign of animals (tracks and scat) were also documented (see Photo 5.5) which assisted in focusing sweep efforts.



Photo 5. Canada Lynx Tracks found during Pre-clearing survey (2019)

5.3. Human -Wildlife Interactions

5.3.1. Wildlife Incidents / Mortalities

During the reporting period one (1) wildlife mortality occurred on the TASR. The incident occurred on December 10, 2019 when a dead ptarmigan was observed on the RoW. The cause of the mortality was not determined but was thought to be caused by a collision with either a light duty pickup or a haul truck. The incident was reported internally and to the GNWT-ENR as outlined in the Wildlife Incident Reporting Procedure in Appendix F of the WMMP. The incident was reviewed and discussed with onsite personnel during the daily Pre-Task Instruction (PTI) meeting through an environmental toolbox talk.

During the Christmas shutdown of all TASR operations, a skeleton crew stayed behind to maintain the camp. A large wolf was observed loitering near the kitchen building at Main Camp 19+800. The onsite staff notified the Environmental Manager who subsequently notified GNWT-ENR. A Renewable Resource Officer was dispatched to investigate the wolf but upon arrival to site the wolf had left the vicinity. The wolf was not observed again in proximity to camp. The officers returned on January 9th, 2020 to follow up on the reports of the wolf in camp. No further action was required.

5.4. Disturbance of Wildlife Habitat

No unanticipated disturbances to wildlife habitat occurred during the 2019 reporting period. All work complied with the WMMP and Land use Permit reference number (geotechnical and operational). The only concern that was raised (by GNWT-DOL) was the windrows and grubbing piles along the RoW that may have impacted the travel routes of wood bison and other ungulate species. We have also thought that the ditches or embankment heights have made bison movement difficult. Wildlife gaps were established every 200m on the TASR to ease the crossing for animals, however the success of these gaps is not known as animals crossed in various locations.

5.5. WMMP Updates

The WMMP version 3.3 was approved by the WLWB on August 23, 2019. As requested by the Board Version 3.4 of the WMMP was to be submitted to be in accordance with the reason for decision. WMMP Version 3.4 was re-submitted to the WLWB on August 30, 2019.

5.6. Traditional Knowledge

5.6.1. Tłıchq Harvesters and methods to monitor the state of barren-ground caribou winter habitat

GNWT-ENR provided funding to the Tłıchq Government for the Community Harvesters Assistance Program, and supported community harvests and the Boots on the Ground monitoring program during the 2019-20 fiscal year. Traditional Knowledge will be incorporated into this program and results will be provided following the 2020 winter season monitoring.

5.6.2. Provided by Tłıchq Government

GNWT-INF is currently working with members from TG to help develop the monitoring program and will be including the information in the next annual report.

5.6.3. Recreational, Traditional, or non-Traditional Activities

Observations of recreational, traditional, and non-traditional use of the area surrounding the TASR in the 2019 reporting period were limited due to the RoW following the Old Airport Road and access for non-construction users was restricted to site personal. In the event that people from the communities wanted to access the site, they had to be escorted onsite. The only noted observation was the use of an existing cabin that is in Segment One (1). This land user frequented the cabin throughout the Fall and Winter of 2019.

5.7. Scientific or Traditional Study Reports

5.7.1. Bird Surveys (2019)

In 2019 a baseline study was conducted by Golder and Associates Ltd for the Tłıchq All Season Road which investigated migratory and SAR bird species within a 200m distance of the Right of Way. This study was completed in response to the Report on the Environmental Assessment and Reason for Decisions from the Mackenzie Valley Environmental Impact Review Board, as per Measure 10-1 Part 1 which states that the developer will conduct a pre-construction field survey to assess the disturbance of potential habitat which includes the clearing of vegetation for the right of way, borrow sources, camps, and access routes.

After meetings with Environment and Climate Change Canada (ECCC) and Government of Northwest Territories Department of Environment and Natural Resources (GNWT-ENR), Golder completed an Autonomous Recording Unit (ARU) data collection study around the TASR (Appendix E).

In total, sixty (60) ARU's were deployed in five (5) broad habitat classifications dense conifer, sparse conifer, deciduous, open, and wetland habitats. In order to determine if bird abundance varied within and outside the RoW seventeen (17) ARU's were deployed within sixty (60) meters of the Old Airport Road center line, and forty-three (43) ARU's were deployed between sixty-one (61) to two hundred (200) meters from centerline.

The result showed that a total of sixty-nine (69) species were recorded within the RoW during the study and four (4) of them were SAR. The sensitive species were Common Nighthawk, Evening Grosbeak, Olive-sided Flycatcher, and the Rusty Blackbird. The report states that aligning the new RoW as much as possible with the existing Old Airport Road would limit the disturbance to habitat of SAR and migratory species.

5.8. Thermal Imaging Device Pilot Study

The thermal imaging pilot study was developed to determine if alternative measures could be used to detect large mammals during wildlife surveys on the TASR. The procedure behind the study was to observe any large mammal (moose, bison, and caribou) on the RoW and use three methods of detection; naked eye, binoculars, and thermal imaging. This was an opportunistic study that required Environmental monitors to come across these species while traveling the road or during sweeps (pre-blast, pre-clearing). These types of encounters with large animals were rare, and in most cases the observed species would move away from the RoW before the monitors could establish an observation point. This resulted in lack of opportunities to collect data during 2019. The use of thermal imaging devices was inconclusive as opportunistic viewing did not occur. Additionally, when completing pre-blast and pre-clearing walks the forest composition was often dense tree cover with areas lacking active fauna, thus the ability to collect valuable data and conduct a conclusive pilot study has not been completed.

5.9. Traffic Monitoring Results

Currently no traffic monitoring is being conducted as the TASR is not in the Operation Phase.

5.10. Migratory Birds and Bird Species at Risk – Management and Protection

In 2019 no bird SAR were observed within the TASR footprint. To mitigate the risk of any potential sources of conflict with nesting birds, the clearing activities were completed during the late fall and winter months which falls outside of the breeding bird season.

5.11. EA Monitoring Results

Measure 10-1, Part 2: Use of results from pre-construction bird surveys required under Measure 10-1, Part 1 to inform mitigations

Golder and Associates Ltd provided a technical memo detailing how the results of the bird surveys could inform mitigations for the Tłıchq All-Season Road. As part of the technical memo, a thorough review of the mitigation measures proposed in the current Wildlife Management and Monitoring Plan (WMMP) was completed. The report concluded that adequate mitigation measures for birds, under GNWT-ENR's authority, have been included in the current WMMP.

One new mitigation measure has been recommended as a result of the information gathered from the bird survey, which is to create a suitable alternative habitat for bank swallows if they are found to be nesting in any Project stockpiles. This recommendation is currently under consideration. Results from the survey also reinforce the importance of the road alignment following the existing Old Airport Road. Findings from the surveys are also discussed in more detailed in Section 5.7.1.

Measure 10-2, Part 2: Wildlife Management and Monitoring Plan update during permitting

No changes have been made to the WMMP based on the migratory bird survey results.

During the permitting, the developer worked collaboratively with Environment and Climate Change Canada, GNWT-ENR, Wek'èezhì Renewable Resources Board, Tłıchq Government and Indigenous groups and harvesters to develop an updated WMMP.

Traditional knowledge (TK) was provided by The Tłıchq Government and the Yellowknives Dene First Nations. The TK was incorporated into the WMMP with respect to caribou, and will also be incorporated into a Caribou Habitat Offset Plan.

GNWT-ENR approved version 3.3 of the WMMP on August 30, 2019, following review and approval of the WMMP by the Wek'èezhì Renewable Resources Board under Section 12.5.1 of the Tłıchq Agreement which included a period of public review.

In fall 2019, GNWT-ENR hired a contractor to conduct a review of the study designs of wildlife effects monitoring programs outlined in the WMMP (as committed to in Section 5.3 of the WMMP). This review considered the results of moose/bison aerial surveys conducted within the TASR study area in winter 2018. This review was ongoing as of Dec. 31, 2019. The contractor's report will be shared prior to the annual review of the WMMP to help inform any proposed updates or changes to the wildlife effects monitoring programs.

5.12. Education and Training of Project Workers

During the reporting period the Environmental Department provided various types of environmental training to Project site personnel. Training was provided in the form of toolbox talks that were presented at the daily, morning and nightshift Pre-Task Instruction (PTI). Below is a list of training that was provided:

- November 18, 2019 - Installation BMP for installation of straw waddles.
- November 30, 2019 - Spill Kits and Inspection procedures.
- December 3, 2019 - Internal Spill Notification Procedures and Spill Kits Inspection procedures.
- December 3, 2019 - Internal Spill Notification Procedures and Spill Kits Inspection procedures.
- December 7, 2019 - Internal Spill Notification Procedures and Spill Kits Inspection procedures.
- December 7, 2019 - Housekeeping and maintain clear work areas
- December 7, 2019 - Housekeeping and maintain clear work areas
- December 8, 2019 - Housekeeping and maintain clear work areas
- December 14, 2019 - Wildlife Awareness

Additionally, the Environmental Department presented training related to Spill Prevention and Response at the Craft Voice in safety (CVIS) Rodeo held over the course of 3 days (December 4th to 6th, 2020).

Appendix A Water Withdrawal Volumes

Tlıcho All Season Road (Water Volume Tracking)



Record No. KWT-TASR-ENV-TBL-001

SOURCE: Peanut Lake

WATER TRACKING:	Max # of hrs Taken per Day = 24	UTM Location	11V 0523833 6928659	Permit No.
	Max (L) Taken per Day = 299,000			W2016L8-0001
Date	Location	Number of Truck Loads	Volume Taken (L)	Comments
01-Sep-19	-----	0	0	
02-Sep-19	-----	0	0	
03-Sep-19	-----	0	0	
04-Sep-19	-----	0	0	
05-Sep-19	-----	0	0	
06-Sep-19	-----	0	0	
07-Sep-19	-----	0	0	
08-Sep-19	-----	0	0	
09-Sep-19	-----	0	0	
10-Sep-19	-----	0	0	
11-Sep-19	-----	0	0	
12-Sep-19	Lake 8 (Peanut Lake)	2	68072	
13-Sep-19	Lake 8 (Peanut Lake)	0	0	
14-Sep-19	Lake 8 (Peanut Lake)	0	0	
15-Sep-19	Lake 8 (Peanut Lake)	0	0	
16-Sep-19	Lake 8 (Peanut Lake)	0	0	
17-Sep-19	Lake 8 (Peanut Lake)	3	102108	
18-Sep-19	Lake 8 (Peanut Lake)	7	238252	
19-Sep-19	Lake 8 (Peanut Lake)	5	170180	
20-Sep-19	Lake 8 (Peanut Lake)	3	102108	
21-Sep-19	Lake 8 (Peanut Lake)	2	68072	
22-Sep-19	Lake 8 (Peanut Lake)	0	0	
23-Sep-19	Lake 8 (Peanut Lake)	2	68072	
24-Sep-19	Lake 8 (Peanut Lake)	1	34036	
25-Sep-19		0	0	
26-Sep-19	Lake 8 (Peanut Lake)	3	102108	
27-Sep-19		0	0	
28-Sep-19	Lake 8 (Peanut Lake)	4	136144	
29-Sep-19	Lake 8 (Peanut Lake)	4	136144	
30-Sep-19	Lake 8 (Peanut Lake)	3	102108	
Total		39	1,327,404	

Tl̓ich̓o All Season Road (Water Volume Tracking)



Record No. KWT-TASR-ENV-TBL-001

SOURCE: Peanut Lake

WATER TRACKING:	Max # of hrs Taken per Day = 24	Permit No.	
	Max (L) Taken per Day = 299,000	W2016L8-0001	
Date	Flow Meter Reading (L)	Volume Taken (L)	Comments
30-Sep-19	369917.0	0	Flow meter was installed
01-Oct-19	458,427	88,510	
02-Oct-19	788,321	329,894	
03-Oct-19	862,155	73,834	Flow meter calibrated
04-Oct-19	943,230	81,075	
05-Oct-19	107,237	128,207	Flow meter reset its self
06-Oct-19	121,994	14,757	
07-Oct-19	129,183	7,189	
08-Oct-19	129,183	0	No water taken
09-Oct-19	129,183	0	No water taken
10-Oct-19	129,183	0	No water taken
11-Oct-19	129,184	1	No water taken
12-Oct-19	129,185	1	No water taken
13-Oct-19	129,186	1	No water taken
14-Oct-19	129,187	1	No water taken
15-Oct-19	129,188	1	No water taken
16-Oct-19	129,189	1	No water taken
17-Oct-19	129,190	1	No water taken
18-Oct-19	165,226	36,036	No water taken
19-Oct-19	165,226	0	No water taken
20-Oct-19	165,226	0	No water taken
21-Oct-19	165,226	0	No water taken
22-Oct-19	165,226	0	No water taken
23-Oct-19	165,226	0	No water taken
24-Oct-19	165,226	0	No water taken
25-Oct-19	165,226	0	No water taken
26-Oct-19	165,226	0	No water taken
27-Oct-19	165,226	0	No water taken
28-Oct-19	165,226	0	No water taken
29-Oct-19	165,226	0	No water taken
30-Oct-19	165,226	0	No water taken
31-Oct-19	165,226	0	No water taken
Total		759,509	





Tl̓chəq All Season Road (Water Volume Tracking)



Record No. KWT-TASR-ENV-TBL-Duport

SOURCE: James River

WATER TRACKING:	Max # of minutes applied to land per day = 20			UTM Location	11V 6982675 0504470	Permit No.	
	Max (L) Taken per Day = 25m3					W2016L8-0001	
Date	Time On	Time Off	Water Application Location (Land/River)	3" Trash Pump (1 minute = 1.21m3)	Volume Taken (m3)	Comments	
13-Dec-19	10:00 AM	10:05	James River	5	6.05		
13-Dec-19	14:00	14:05	James River	5	6.05		
Total					12.1		



WATER TRACKING:	Max # of minutes applied to land per day = 20			UTM Location	11V 0509487 6959995		Permit No.
	Max volume Taken per Day = 25m ³						W2016L8-0001
Date	Pump Time On	Pump Time Off	Water Application Location (Land/River)	3" Trash Pump (1 minute = 1.21m ³)	Volume Taken (m ³)	Total Volume Taken per day (m ³)	Comments
29-Nov-19	12:31pm	12:41pm	River / Water	10 x 1.21m ³	12.1m ³	N/A	Does not court to water taking total
29-Nov-19	12:45 PM	12:58 PM	Land	13 X 1.2m ³	15.73m ³	15.73m ³	
30-Nov-19	1:02am	1:15am	Water	13 X 1.2m ³	15.73m ³	N/A	Does not court to water taking total
30-Nov-19	12:30pm	12:39 PM	Water	9 X 1.21m ³	10.89m ³	N/A	Does not court to water taking total
30-Nov-19	4:08pm	4:18pm	Land	10 X 1.21m ³	12.1m ³	12.1m ³	
01-Dec-19	1:30am	1:38am	Water	8 X 1.21m3	8.96m3	N/A	Does not court to water taking total
01-Dec-19	2:03pm	2:13pm	Land	10 x 1.21m3	12.1m3	12.1	
01-Dec-19	2:15pm	2:25pm	Water	10 x 1.21m3	12.1m3	N/A	Does not court to water taking total
Total						27.8	

Appendix B Waste Monthly Quantities



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DOMESTIC WASTE MANIFEST TRACKING



Tłchq All Season Road Project

Date Shipped	Landfill Weight Ticket #	Weight (MT)	Volume (Yd)	Comments
5-Sep-19	1435984	0.59	30yd	
20-Sep-19	1439133	1.17	30yd	
4-Oct-19	1441042	1.53	30yd	
17-Oct-19	1443576	1.66	30yd	
23-Oct-19	1444464	0.59	30yd	
26-Oct-19	1445350	0.20	30yd	
7-Nov-19	1446416	1.83	30yd	
7-Nov-19	1446791	2.36	30yd	
14-Nov-19	1447218	1.42	30yd	
25-Nov-19	1448198	1.84	30yd	
3-Dec-19	1449059	1.60	30yd	
12-Dec-19	1449920	1.60	30yd	
26-Dec-19	1451792	2.10	30yd	
Total		18.49		



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CONSTRUCTION WASTE MANIFEST TRACKING



Tłłchq All Season Road Project

Date Shipped	Landfill Weight Ticket #	Weight (MT)	Volume (Yd)	Comments
10-Oct-19	1441064	0.69	30yd	
15-Nov-19	1447206	1.2	30yd	
9-Dec-19	144967	2.04	30yd	
21-Dec-19	1450650	1.67	30yd	
Total		5.6		



Kiewit

RECYCLING MANIFEST TRACKING



Tłchq All Season Road Project

Date Shipped	Recycling Ticket #	Weight (MT)	Type
6-Sep-19	1436700	0.34	Cardboard
20-Sep-19	1439291	0.03	Cardboard
9-Oct-19	1442612	0.29	Cardboard
24-Oct-19	1444542	0.25	Cardboard
6-Nov-19	1446359	1.54	Cardboard
14-Nov-19	1447132	0.25	Cardboard
22-Nov-19	1447908	1.23	Cardboard
28-Nov-19	1448505	1.02	Cardboard
3-Dec-19	1449113	1.07	Cardboard
16-Dec-19	1450240	0.81	Cardboard
TOTAL		6.83	



Kiewit

WOOD WASTE MANIFEST TRACKING



Tłchq All Season Road Project

Date Shipped	Landfill Weight Ticket #	Weight (MT)	Volume (Yd)	Comments
8-Oct-19	1442286	1.69	30 yd	
2-Nov-19	1445784	3.5	30 yd	
12-Nov-19	1446907	4.76	30 yd	
4-Dec-19	1449185	1.67	30 yd	
Total		11.62		



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ON-SITE SEPTIC WASTE TRACKING



Tłchq All Season Road Project

Date	Waste Source	Quantity (L)	Quantity (m ³)
10-Sep-19	Porta Pottie	113	0.113
20-Sep-19	Porta Pottie	113	0.113
30-Sep-19	Porta Pottie	565	0.565
31-Oct-19	Porta Pottie	794	0.794
10-Nov-19	Porta Pottie	794	0.794
20-Nov-19	Porta Pottie	794	0.794
30-Nov-19	Porta Pottie	794	0.794
10-Dec-19	Porta Pottie	794	0.794
12-Dec-19	Porta Pottie	681	0.681
16-Dec-19	Porta Pottie	681	0.681
20-Dec-19	Porta Pottie	681	0.681
31-Dec-19	Porta Pottie	681	0.681
Total		7485	7.485

Tłychq All Season Road Project

[illegible]



DAILY SEPTIC TANK WASTE TRACKING



Tłychq All Season Road Project

Date	Waste Source	Quantity (M³)
3-Oct-19	Sewage	13
5-Oct-19	Sewage	13
7-Oct-19	Sewage	13
8-Oct-19	Sewage	13
9-Oct-19	Sewage	13
10-Oct-19	Sewage	13
12-Oct-19	Sewage	13
14-Oct-19	Sewage	13
19-Oct-19	Sewage	13
21-Oct-19	Sewage	13
23-Oct-19	Sewage	13
24-Oct-19	Sewage	13
25-Oct-19	Sewage	13
25-Oct-19	Sewage	13
26-Oct-19	Sewage	13
26-Oct-19	Sewage	13
28-Oct-19	Sewage	13
Total		221

Tłychq All Season Road Project

Date	Waste Source	Quantity (M³)
1-Nov-19	Sewage	13
2-Nov-19	Sewage	13
3-Nov-19	Sewage	13
3-Nov-19	Sewage	13
4-Nov-19	Sewage	13
5-Nov-19	Sewage	13
6-Nov-19	Sewage	13
7-Nov-19	Sewage	13
8-Nov-19	Sewage	13
9-Nov-19	Sewage	13
10-Nov-19	Sewage	13
11-Nov-19	Sewage	13
12-Nov-19	Sewage	13
13-Nov-19	Sewage	13
14-Nov-19	Sewage	13
15-Nov-19	Sewage	13
16-Nov-19	Sewage	13
17-Nov-19	Sewage	13
19-Nov-19	Sewage	13
20-Nov-19	Sewage	13
21-Nov-19	Sewage	13
22-Nov-19	Sewage	13
23-Nov-19	Sewage	13
24-Nov-19	Sewage	13
24-Nov-19	Sewage	13
26-Nov-19	Sewage	13
27-Nov-19	Sewage	13
28-Nov-19	Sewage	13
30-Nov-19	Sewage	13
Total		377



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DAILY SEPTIC TANK WASTE TRACKING



Tłchq All Season Road Project

Date	Waste Source	Quantity (M ³)
1-Dec-19	Sewage	13
2-Dec-19	Sewage	13
3-Dec-19	Sewage	13
4-Dec-19	Sewage	13
5-Dec-19	Sewage	13
6-Dec-19	Sewage	13
7-Dec-19	Sewage	13
8-Dec-19	Sewage	13
10-Dec-19	Sewage	13
11-Dec-19	Sewage	13
11-Dec-19	Sewage	13
13-Dec-19	Sewage	13
14-Dec-19	Sewage	13
15-Dec-19	Sewage	13
17-Dec-19	Sewage	13
17-Dec-19	Sewage	13
18-Dec-19	Sewage	13
19-Dec-19	Sewage	13
19-Dec-19	Sewage	13
20-Dec-19	Sewage	13
21-Dec-19	Sewage	13
22-Dec-19	Sewage	13
23-Dec-19	Sewage	13
25-Dec-19	Sewage	13
27-Dec-19	Sewage	13
28-Dec-19	Sewage	13
30-Dec-19	Sewage	13
Total		351



Kiewit

HAZARDOUS MATERIALS WASTE TRACKING



Tłchq All Season Road Project

Vendor	Month Shipped	Type	Drum Quantity	Volume Shipped (kg)
Total				13,405



Kiewit

CONSTRUCTION WASTE MANIFEST TRACKING



Tłłchq All Season Road Project

Date Shipped	Landfill Weight Ticket #	Weight (MT)	Volume (Yd)	Comments
10-Oct-19	1441064	0.69	30yd	
15-Nov-19	1447206	1.2	30yd	
9-Dec-19	144967	2.04	30yd	
21-Dec-19	1450650	1.67	30yd	
Total		5.6		

Tłıchq All Season Road Project

Vendor	Month Shipped	Type	Drum Quantity	Volume Shipped (kg)
KBL	November	Waste Oil	3	3,000
KBL	November	Contaminated Oil/ Fuel Filters	4	362.3
KBL	November	Contaminated Rags and Absorbents	6	600
KBL	November	Contaminated soil with Hydrocarbons	1	2400
KBL	November	Contaminated Empty Drums	17	340
Total				6,702



Kiewit

ON-SITE SEPTIC WASTE TRACKING



Tłchq All Season Road Project

Date	Waste Source	Quantity (L)	Quantity (m ³)
10-Sep-19	Porta Pottie	113	0.113
20-Sep-19	Porta Pottie	113	0.113
30-Sep-19	Porta Pottie	565	0.565
31-Oct-19	Porta Pottie	794	0.794
10-Nov-19	Porta Pottie	794	0.794
20-Nov-19	Porta Pottie	794	0.794
30-Nov-19	Porta Pottie	794	0.794
10-Dec-19	Porta Pottie	794	0.794
12-Dec-19	Porta Pottie	681	0.681
16-Dec-19	Porta Pottie	681	0.681
20-Dec-19	Porta Pottie	681	0.681
31-Dec-19	Porta Pottie	681	0.681
Total		7485	7.485



Kiewit

RECYCLING MANIFEST TRACKING



Tłjchq All Season Road Project

Date Shipped	Recycling Ticket #	Weight (MT)	Type
6-Sep-19	1436700	0.34	Cardboard
20-Sep-19	1439291	0.03	Cardboard
9-Oct-19	1442612	0.29	Cardboard
24-Oct-19	1444542	0.25	Cardboard
6-Nov-19	1446359	1.54	Cardboard
14-Nov-19	1447132	0.25	Cardboard
22-Nov-19	1447908	1.23	Cardboard
28-Nov-19	1448505	1.02	Cardboard
3-Dec-19	1449113	1.07	Cardboard
16-Dec-19	1450240	0.81	Cardboard
TOTAL		6.83	



DAILY SEPTIC TANK WASTE TRACKING



Tłychq All Season Road Project

Date	Waste Source	Quantity (M³)
10-Sep-19	Sewage	13
16-Sep-19	Sewage	13
18-Sep-19	Sewage	13
21-Sep-19	Sewage	13
24-Sep-19	Sewage	13
30-Sep-19	Sewage	13
Total		78



DAILY SEPTIC TANK WASTE TRACKING



Tłychq All Season Road Project

[illegible]



DAILY SEPTIC TANK WASTE TRACKING



Tłychq All Season Road Project

Date	Waste Source	Quantity (M³)
1-Nov-19	Sewage	13
2-Nov-19	Sewage	13
3-Nov-19	Sewage	13
3-Nov-19	Sewage	13
4-Nov-19	Sewage	13
5-Nov-19	Sewage	13
6-Nov-19	Sewage	13
7-Nov-19	Sewage	13
8-Nov-19	Sewage	13
9-Nov-19	Sewage	13
10-Nov-19	Sewage	13
11-Nov-19	Sewage	13
12-Nov-19	Sewage	13
13-Nov-19	Sewage	13
14-Nov-19	Sewage	13
15-Nov-19	Sewage	13
16-Nov-19	Sewage	13
17-Nov-19	Sewage	13
19-Nov-19	Sewage	13
20-Nov-19	Sewage	13
21-Nov-19	Sewage	13
22-Nov-19	Sewage	13
23-Nov-19	Sewage	13
24-Nov-19	Sewage	13
24-Nov-19	Sewage	13
26-Nov-19	Sewage	13
27-Nov-19	Sewage	13
28-Nov-19	Sewage	13
30-Nov-19	Sewage	13
Total		377



Kiewit

DAILY SEPTIC TANK WASTE TRACKING



Tłchq All Season Road Project

Date	Waste Source	Quantity (M ³)
1-Dec-19	Sewage	13
2-Dec-19	Sewage	13
3-Dec-19	Sewage	13
4-Dec-19	Sewage	13
5-Dec-19	Sewage	13
6-Dec-19	Sewage	13
7-Dec-19	Sewage	13
8-Dec-19	Sewage	13
10-Dec-19	Sewage	13
11-Dec-19	Sewage	13
11-Dec-19	Sewage	13
13-Dec-19	Sewage	13
14-Dec-19	Sewage	13
15-Dec-19	Sewage	13
17-Dec-19	Sewage	13
17-Dec-19	Sewage	13
18-Dec-19	Sewage	13
19-Dec-19	Sewage	13
19-Dec-19	Sewage	13
20-Dec-19	Sewage	13
21-Dec-19	Sewage	13
22-Dec-19	Sewage	13
23-Dec-19	Sewage	13
25-Dec-19	Sewage	13
27-Dec-19	Sewage	13
28-Dec-19	Sewage	13
30-Dec-19	Sewage	13
Total		351



Kiewit

WOOD WASTE MANIFEST TRACKING



Tłchq All Season Road Project

Date Shipped	Landfill Weight Ticket #	Weight (MT)	Volume (Yd)	Comments
8-Oct-19	1442286	1.69	30 yd	
2-Nov-19	1445784	3.5	30 yd	
12-Nov-19	1446907	4.76	30 yd	
4-Dec-19	1449185	1.67	30 yd	
Total		11.62		

Appendix C Wildlife Sightings Log

 TASR Wildlife Sightings Log 												
Date of Sighting	Time	Species	Number	Age	Injured	Location/GPS Coordinates			Photos	Sighting By	Company	Notes
						Zone	Easting	Northing				
04-Sep-19	12:00 PM	Cougar	1	Not Known	N	11V	512933.00	6932193.00	N/A	Chad G	Kiewit	Observed running into the bush
05-Sep-19	1:00 PM	Black Bear	1	Not Known	N	11V	509788.00	6935812.00	N/A	Max V & Chad G	Kiewit	Walked into the bush
05-Sep-19	1:00 PM	Black Bear	1	Not Known	N	11V	509788.00	6935812.00	N/A	Chad G	Kiewit	Bear exit the road and walked into the bush
05-Sep-19	3:30 PM	Black Bear	1	Not Known	N	11V	518275.00	6928608.00	N/A	Kirk C		
06-Sep-19	5:34 PM	Red Squirrel	1	Adult	N	11V	514904.00	6930782.00	N/A	Caroline W	Kiewit	
06-Sep-19	12:30 PM	Sharp-tailed Grouse	1	Mature Adult	N	11V	515453.00	6930618.00	N/A	Caroline W	Kiewit	Cross the existing road and went into the bush
07-Sep-19	8:17 AM	Wood Bison	2	Calves	N	11V	512486.00	6932516.00	N/A	Caroline W	Kiewit	Observed walking and resting on the edge of the existing road. Two young bulls observed fighting
			3	Adult Female	N					Caroline W	Kiewit	
			5	Bulls	N					Caroline W	Kiewit	
07-Sep-19	8:50 AM	Wood Bison	1	Adult	N	11V	52210.00	6928544.00	N/A	N/A	Kiewit	
07-Sep-19	9:30 AM	Wood Bison	1	Not Known	N	11V	514770.00	6930858.00	N/A	Caroline W	Kiewit	Wood Bison Tracks observed in the sand on the site of the road
07-Sep-19	9:38 AM	Dark Eyed Junco	30	Not Known	N	11V	516474.00	6930098.00	N/A	Caroline W	Kiewit	Flock of Juncos observed foraging on edge of existing road
07-Sep-19	6:30 PM	Wolf sp.	1	Adult Female	N	11V	522546.00	6928066.00	N/A	Zahid Soikot	Kiewit	Track observed on top of berm of the camp sump
07-Sep-19	11:00am	Black Bear	1	Adult Sow	N	11V	519133.00	6928205.00	N/A	Jeff Sorenson	Kiewit	Observed crossing the existing road
			2	Cubs	N	11V						
08-Sep-19	10:23 AM	Black Bear	1	Adult	N	11V	510908.00	6933667.00	N/A	Ralph and Kirk C	Brave	
13-Sep-19	6:30am	Wolf sp.	1	Adult	N	11V	526497.00	6928132.00	N/A	Gerald Tremblay	Kiewit	Observed at the camp
16-Sep-19	2:00 PM	Moose	1	Adult	N	11V	510499.00	6933966.00	N/A	Gary	Kiewit	
18-Sep-19	7:30 AM	Wood Bison	1	Adult	N	11V	511310.00	6933377.00	N/A	Whitney B & Pat	Kiewit	
19-Sep-19	7:45 AM	Wood Bison	1	Adult	N	11V	510501.00	6933958.00	NA	Tommy B	Kiewit	
21-Sep-19	11:00 AM	Wood Bison	1	Adult	N	11V	519622.00	6928266.00	NA	Whitney B	Kiewit	
21-Sep-19	7:15 AM	Lynx	1	Not Known	N	11V	525056.00	6928158.00	NA	Dan Harding	Kiewit	
23-Sep-19	8:30 AM	Wood Bison	10	Not Known	N	11V	515355.00	6930652.00	NA	Wes P	Brave Adventures	
24-Sep-19	11:55 AM	Common Raven	1	Mature Adult	N	11V	509923.00	6935441.00	N/A	Caroline W	Kiewit	Observed flying over ROW
26-Sep-19	4:40 PM	Moose	2	Not Known	N	11V	519827.00	6928283.00	N/A	Michael Beaulieu	Kiewit	Observed in the bush
27-Sep-19	9:46 AM	Moose	1	Not Known	N	11V	519729.00	6928274.00	N/A	Chris Roach	Kiewit	
28-Sep-19	7:00 PM	Great Grey Owl	1	Adult	N	11V	518490.00	6928255.00	N/A	Wes P	Brave	Observed flying across the ROW with mouse in beak.
29-Sep-29	9:005am	Common Raven	1	Adult	N	11V			N/A	Caroline W	Kiewit	Flying overhead of ROW
30-Sep-19	12:17pm	Moose	1	Young Bull	N	11V	520136.00	6928336.00	N/A	Caroline W	Kiewit	Observed in the bush
30-Sep-19	12:30 PM	Canada Jay	1	Mature Adult	N	11V	519128.00	6928199.00	N/A	Caroline W	Kiewit	Observed flying across the ROW
01-Oct-29	10:03 AM	Common Raven	1	Adult	N	11V	524508.00	6928325.00	N/A	Caroline W	Kiewit	Perched in Tree
01-Oct-19	11:30am	Red Squirrel	1	Adult	N	11V	508304.00	6940122.00	N/A	Caroline W	Kiewit	Observed in tree on the edge of ROW
01-Oct-19	11:12am	Common Raven	2	Adult	N	11V	508933.00	6938303.00	N/A	Caroline W	Kiewit	Perched at the very top of a Jack pine
01-Oct-29	11:15am	Canada Jay	1	Adult	N	11V	508872.00	6938474.00	N/A	Caroline W	Kiewit	Observed flying across existing road heading west

 TASR Wildlife Sightings Log 												
Date of Sighting	Time	Species	Number	Age	Injured	Location/GPS Coordinates			Photos	Sighting By	Company	Notes
						Zone	Easting	Northing				
02-Oct-19	10:30am	Common Raven	1	Adult	N	11V	509899.00	6935516.00	N/A	Caroline W	Kiewit	Observed flying east to west across the ROW
02-Oct-19	6:00 PM	Wood Bison	15	Mix of bulls, females and calves	N	11V	520068.00	6928326.00	N/A	Caroline W	Kiewit	Observed on the edge of the ROW in the bush, resting
02-Oct-19	10:33am	American Three-toed Woodpecker	1	Mature Adult	N	11V	510269.00	6934431.00	N/A	Caroline W	Kiewit	Foraging in trees on the edge of ROW
02-Oct-19	10:57am	Sharp-tailed Grouse	1	Mature Adult	N	11V	521574.00	6928510.00	N/A	Caroline W	Kiewit	
03-Oct-19	11:40 AM	Porcupine	1	Adult	N	11V	513563.00	6931726.00	N/A	Wes P	Brave Adventures	Observed walking towards the work area.
06-Oct-19	9:50am	Moose	1	Not Known	N	11V	517891.00	6928932.00	N/A	Not Known	Kiewit	Walked across the ROW
07-Oct-19	10:00am	Wood Bison	1	Adult	N	11V	515956.00	6930442.00	N/A	Darryl	McCaw	Walking south along ROW
08-Oct-19	11:10am	Black Bear	1	Adult	N	11V	521010.00	6920436.00	N/A	Radio Call	Kiewit	Walking along ROW
09-Oct-19	7:30am	Wolf sp.	1	Adult	N	11V	507940.00	6941561.00	N/A	Gerry	Brave Adventures	Crossing the ROW
10-Oct-19	1:50 PM	Canada Jay	1	Adult	N	11V	516944.00	6929710.00	N/A	Dave Green	Kiewit	Flying across NE ditch
10-Oct-19	1:55 PM	Common Raven	1	Adult	N	11V	518352.00	6928550.00	N/A	Dave Green	Kiewit	Flying over ROW
10-Oct-19	2:10 PM	Common Raven	1	Adult	N	11V	519641.00	6928301.00	N/A	Dave Green	Kiewit	Perched in top of tree
14-Oct-19	10:45 AM	Common Raven	1	Adult	N	11V	508620.00	6939167.00	N/A	Dave Green	Kiewit	Flying overhead of ROW
14-Oct-19	11:53 AM	Common Raven	1	Adult	N	11V	510072.00	6935069.00	N/A	Dave Green	Kiewit	Perched on east side of ROW
15-Oct-19	5:30am	Cougar (Possible)	1	Adult	N	11V	516798.00	6929827.00	N/A	Not Known	Kiewit	Observed on the edge of the ROW in the bush
15-Oct-19	9:30 AM	Common Raven	1	Adult	N	11V	523370.00	6928274.00	N/A	Dave Green	Kiewit	Perched on west side of ROW
15-Oct-19	9:42 AM	Common Raven	1	Adult	N	11V	523864.00	6920201.00	N/A	Dave Green	Kiewit	Flying down center line of ROW
15-Oct-19	2:00 PM	Black bear	1	Adult	N	11V	510117.00	6934851.00	N/A	Danny H	Kiewit	Crossing the ROW
15-Oct-19	2:00 PM	Wolf sp.	1	Adult	N	11V	509171.00	6935280.00	N/A	Danny H	Kiewit	walking down main camp road
15-Oct-19	3:40 PM	Wood Bison	8-10	Adult	N	11V	510117.00	6934851.00	N/A	Danny H	Kiewit	Crossing the ROW
16-Oct-19	10:58 AM	Common Raven	1	Adult	N	11V	509922.00	6935406.00	N/A	Dave Green	Kiewit	
16-Oct-19	11:10 AM	Sharp-tailed Grouse	3	Adult	N	11V	510840.00	6933690.00	N/A	Dave Green	Kiewit	Crossing ROW
16-Oct-19	6:00 PM	Wolf sp	2	Adult	N	11V	520015.00	6928314.00	N/A	Radio Call (not known)	Kiewit	observed closed to fiber optic cable
18-Oct-19	10:18am	Red Squirrel	1	Not Known	N	11V	508774.00	6938752.00	N/A	Dave Green	Kiewit	Foraging on west side of ROW
18-Oct-19	10:45am	Wood Bison	12	Not Known	N	11V	5233570.00	6928314.00	N/A	Jason Beacchamp	Kiewit	Walking in the bush line
18-Oct-19	10:46am	Common Raven	1	Adult	N	11V	518161.00	69320029.00	N/A	Dave Green	Kiewit	perched behind school bus
18-Oct-19	10:59am	Common Raven	3	Adult	N	11V	519293.00	6928229.00	N/A	Dave Green	Kiewit	perched
18-Oct-19	11:10am	Common Raven	1	Adult	N	11V	521790.00	6928536.00	N/A	Dave Green	Kiewit	Flying over work activity
19-Oct-19	1:45 PM	Wood Bison	2	Adult	N	11V	523283.00	6928290.00	N/A	Christian P	Kiewit	Crossed ROW near Pit 2B
21-Oct-19	10:09am	Woodland Caribou	2	Adult & Calf	No	11V	508182.00	6940496.00	N/A	Dave Green	Kiewit	Walking along ROW
21-Oct-19	10:23am	Wood Bison	2	Adult	No	11V	509225.00	6937454.00	N/A	Dave Green	Kiewit	traveling along ROW

 TASR Wildlife Sightings Log 												
Date of Sighting	Time	Species	Number	Age	Injured	Location/GPS Coordinates			Photos	Sighting By	Company	Notes
						Zone	Easting	Northing				
21-Oct-19	10:25am	Wolf sp.	1	Adult	No	11V	509246.00	693794.00	N/A	Dave Green	Kiewit	traveling down ROW
23-Oct-19	10:05am	Three-Toed Woodpecker	1	Adult	No	11V	508605.00	6944892.00	N/A	Dave Green	Kiewit	Foraging
23-Oct-19	10:41am	Common Raven	1		No	11V	508703.00	6938964.00	N/A	Dave Green	Kiewit	Flying over ROW
23-Oct-19	14:10pm	Moose	1	Adult	No	11V	517133.00	6929568.00	N/A	Danny H	Kiewit	Walking along ROW near station 11+500
01-Nov-19	13:00pm	Wolf sp	1	Adult	No	11V	520616.00	6928379.00	N/A	Zahid Soikot	Kiewit	seen near Station 6+000
01-Nov-19	15:20pm	Wolf sp	1	Adult	No	11V	518657.00	6920300.00	N/A	Bill Puttick	Kiewit	seen near Station 8+000
01-Nov-19	15:30pm	Wolf sp	1	Adult	No	11V	524577.00	6928270.00	N/A	Bill Puttick	Kiewit	seen near Station 2+000
01-Nov-19	14:30pm	Grizzly Bear	1	Adult	No	11V	518657.00	6920300.00	N/A	Doug	Cascom	seen near Station 8+000
06-Nov-19	9:40am	Wolf Sp	1	Adult	No	11V	508492.00	6945560.00	N/A	Dave G	Kiewit	Observed moving quickly along the R.O.W
08-Nov-19	2:00 PM	Wolf Sp	1	Adult	No	11V	519104.00	6928206.00	N/A	Danny Harding	Kiewit	Observed on the edge of the R.O.W
09-Nov-19	12:00 PM	Wolf Sp	1	Adult	No	11V	520124.00	6920311.00	N/A	Not Known	Not Known	Observed on the edge of the R.O.W
09-Nov-19	7:30 PM	Red Fox	2	Adult	No	11V	508583.00	6944877.00	N/A	Ryan B	Kiewit	Observed running across the R.O.W
11-Nov-19	10:34 AM	Moose	2	Adult	No	11V	508166.00	6942470.00	N/A	John Tanner	Kiewit	Observed running across the R.O.W
12-Nov-19	10:30 AM	Snowshoe Hare	1	Adult	No	11V	507767.00	6954600.00	N/A	John Tanner	Kiewit	Observed running across the R.O.W
12-Nov-19	2:00 PM	Wolf Sp.	1	Adult	No	11V	507967.00	6948774.00	N/A	Sean Cansel	Kiewit	Observed running across the R.O.W
15-Nov-19	1:00 PM	Wolf Sp.	4	Adult	No	11V	508027.00	6948353.00	N/A	Brandon C	Kiewit	
17-Nov-19	10:13 AM	Common raven	1	Adult	No	11V	514545.00	6931011.00	N/A	Rob D	Kiewit	Flying across R.O.W
18-Nov-19	8:47 AM	Grouse sp.	6	Adult	No	11V	519557.00	6928264.00	N/A	Rob D	Kiewit	Landing strikes in snow on west ditch
18-Nov-19	8:55 AM	Pileated Woodpecker	1	Adult	No	11V	517074.00	6929600.00	N/A	Rob D	Kiewit	R.O.W edge on tree
18-Nov-19	9:30 AM	Red Fox	1	Adult	No	11V	509898.41	69355497.00	N/A	Rob D	Kiewit	Near Camp 19
18-Nov-19	1:00 PM	Wolf Sp.	4	Adult	No	11V	507517.00	6951910.00	N/A	Unknown	Kiewit	R.O.W
19-Nov-19	10:30 AM	Snow Bunting	40	Adult	No	11V	507386.00	6953272.00	N/A	Rob D	Kiewit	R.O.W
20-Nov-19	Unknown	Pine Martin	2	Adult	No	11V	509493.00	6960000.00	N/A	Gregory	Kiewit	Duport River
22-Nov-19	8:00 AM	Snowshoe Hare	1	Adult	No	11V	514741.00	6933259.00	N/A	Rob D	Kiewit	Tracks along R.O.W
22-Nov-19	9:10 AM	Red Fox	1	Adult	No	11V	516362.00	6930196.00	N/A	Rob D	Kiewit	Tracks along R.O.W
22-Nov-19	9:10 AM	Red Fox	1	Adult	No	11V	516362.00	6930196.00	N/A	Rob D	Kiewit	Tracks along R.O.W
23-Nov-19	10:31 AM	Canada Jay	1	Adult	No	11V	508380.00	6946123.00	N/A	Caroline W	Kiewit	Flying along R.O.W
23-Nov-19	3:02 PM	Red Squirrel	1	Adult	No	11V	507995.00	5955095.00	N/A	Caroline W	Kiewit	Running across R.O.W
23-Nov-19	3:02 PM	Canada Lynx	1	Adult	No	11V	507995.00	5955095.00	N/A	Rob D	Kiewit	Tracks along R.O.W
23-Nov-19	3:27 PM	Common Raven	1	Adult	No	11V	508511.00	6943733.00	N/A	Caroline W	Kiewit	Flying across R.O.W
24-Nov-19	10:00 AM	Pine Martin	1	Adult	No	11V	508136.00	6955318.00	N/A	Caroline W	Kiewit	Duport River
24-Nov-19	10:01 AM	Dark Eyed Junco	20	Adult	No	11V	509656.00	6936133.00	N/A	Caroline W	Kiewit	R.O.W
24-Nov-19	10:30 AM	Red Fox	1	Adult	No	11V	508252.00	6946883.00	N/A	Kirk C	Kiewit	Running across R.O.W
24-Nov-19	10:31 AM	Common Raven	2	Adult	No	11V	507656.00	6950828.00	N/A	Caroline W	Kiewit	R.O.W
24-Nov-19	10:38 AM	Canada Jay	2	Adult	No	11V	508494.00	6945547.00	N/A	Caroline W	Kiewit	R.O.W
24-Nov-19	10:40 AM	Common Raven	1	Adult	No	11V	508694.00	6944730.00	N/A	Caroline W	Kiewit	R.O.W

 TASR Wildlife Sightings Log 												
Date of Sighting	Time	Species	Number	Age	Injured	Location/GPS Coordinates			Photos	Sighting By	Company	Notes
						Zone	Easting	Northing				
24-Nov-19	10:30 AM	Red Fox	1	Adult	No	11V	509788.00	6935810.00	N/A	Kirk C	Kiewit	Observed on R.O.W
26-Nov-19	12:55 PM	Moose	1	Adult	No	11V	515586.00	6930751.00	N/A	Rob D	Kiewit	R.O.W tracks
27-Nov-19	11:30 AM	Canada Lynx	2	Adult	No	11V	507389.00	6958282.00	N/A	MaxV	Kiewit	Running across R.O.W
28-Nov-19	10:34 AM	Wood Bison	3	Adult	No	11V	508620.00	6944503.00	N/A	Rob D	Kiewit	crossing R.O.W
28-Nov-19	1:38 PM	Boreal Caribou	2	Adult	No	11V	517119.00	6929565.00	N/A	Tommy	Kiewit	crossing R.O.W
29-Nov-19	1:28 PM	Boreal Caribou	2	Adult	No	11V	510245.00	6934491.00	N/A	Rob D	Kiewit	Tracks on R.O.W
29-Nov-19	10:30 AM	Wood Bison	2	Adult	No	11V	508314.00	6940110.00	N/A	Rob D	Kiewit	Tracks
30-Nov-19	1:20 AM	Pine Martin	1	Adult	No	11V	508454.00	6956552.00	N/A	Rob D	Kiewit	Running across R.O.W, climbed tree
01-Dec-19	9:50 AM	Common Raven	1	Adult	No	11V	509418.00	6935271.00	N/A	Caroline W	Kiewit	Flying across R.O.W. heading north
03-Dec-19	7:00 PM	Moose	3	Adult/calf	No	11V	515424.00	6930609.00	N/A	Darryl	McCaw's	crossing R.O.W
03-Dec-19	8:30 AM	Ptarmigan sp.	4	Adult	No	11V	509464.00	6936762.00	N/A	Caroline W	Kiewit	flying along ROW (northward)
04-Dec-19	9:00 AM	Fisher	1	Adult	No	11V	511298.00	6933383.00	N/A	Darryl	McCaw's	along edge of ROW
05-Dec-19	4:00 PM	Wood Bison	4	Adult	No	11V	507885.00	6949344.00	N/A	Darryl	McCaw's	along edge of ROW
05-Dec-19	1:30 PM	Moose	1	Adult (bull)	No	11V	507878.00	6949341.00	N/A	Darryl	McCaw's	walking west edge of ROW heading north
06-Dec-19	3:00 PM	Red Fox	2	Adult	No	11V	508180.00	6947367.00	N/A	Rick	Kiewit	fighting along the ROW and onto the TASR
06-Dec-19	8:41 AM	Ptarmigan sp.	8	Not Known	No	11V	508398.00	6939872.00	N/A	Dave G.	Kiewit	sitting on TASR
06-Dec-19	12:05 PM	Wood Bison	2	Not Known	No	11V	520358.00	6928363.00	N/A	Dave G	Kiewit	tracks observed crossing through ROW
08-Dec-19	10:20 AM	Wolverine	1	Adult	No	11V	508212.00	6955490.00	N/A	Brendon C	Kiewit	Duport River
09-Dec-19	2:00 AM	Wolf	1	Adult	No	11V	507566.00	6951545.00	N/A	Ralph	Kiewit	Pit 33a
09-Dec-19	2:30 PM	Wood Bison	4	Adult	No	11V	508179.00	6947369.00	N/A	Radio Report	Kiewit	R.O.W
09-Dec-19	10:30 AM	Wolverine	1	Adult	No	11V	506947.00	6964024.00	N/A	Dave G	Kiewit	R.O.W
09-Dec-19	2:00 PM	Wolf	1	Adult	No	11V	508853.00	6959014.00	N/A	Multiple Persons	Kiewit	R.O.W
10-Dec-19	1:30 PM	Wood Bison	6	Unknown	No	11V	508262.00	6956087.00	N/A	Ryan B	Kiewit	R.O.W
14-Dec-19	10:00 AM	Wolf	2	Adult	No	11V	504466.00	6982680.00	N/A	Camsel Brothers	Kiewit	James river crossing
14-Dec-19	2:15 PM	Wood Bison	5	Adult	No	11V	514475.00	6931068.00	N/A	Rob D	Kiewit	Tracks on R.O.W
14-Dec-19	2:19 PM	Wood Bison	2	Adult	No	11V	514912.00	6930781.00	N/A	Rob D	Kiewit	Tracks on R.O.W
14-Dec-19	2:21 PM	Lynx	1	Adult	No	11V	515357.00	6930651.00	N/A	Rob D	Kiewit	Tracks on R.O.W
14-Dec-19	2:21 PM	Wood Bison	2	Adult	No	11V	515713.00	6930538.00	N/A	Rob D	Kiewit	Tracks on R.O.W
14-Dec-19	2:30 PM	Wood Bison	1	Adult	No	11V	519236.00	69282232.00	N/A	Rob D	Kiewit	Tracks on R.O.W
14-Dec-19	2:34 PM	Wood Bison	9	Adult	No	11V	520653.00	6928396.00	N/A	Rob D	Kiewit	Tracks on R.O.W
18-Dec-19	12:10 PM	Spruce Grouse	5	Adult	No	11V	508284.00	69673345.00	N/A	Rob D	Kiewit	Birds on R.O.W

Appendix D 2019 Aerial Bear Den Survey



Tłıchǫ All-Season Road Project Aerial Bear Den Survey Results

Wildlife Research Permit #WL500763

James Hodson
11/26/2019

Department of Environment and Natural Resources, Wildlife Division

Government of the Northwest Territories

Tłıchq All-Season Road Project Aerial Bear Den Survey Results – Wildlife Research Permit #WL500763

Purpose

As per the Wildlife Management and Monitoring Plan for the Tłıchq All-Season Road Project (TASR), the purpose of this survey was to document potential or active bear dens within 800 m of the Tłıchq All-Season Road alignment, borrow sources and borrow source access roads, and, in the event that an active den was detected, trigger mitigation and monitoring measures outlined in Appendix F (pages F-20 – F-21) of the WWMP. The aerial surveys were also used to document any conspicuous wildlife features such as mineral licks, raptor nests, or potential habitat for bat hibernacula (e.g. caves) within the survey area that may require mitigation to protect them from disturbance from construction activities.

This aerial survey complements the ground-based pre-clearing and pre-blast surveys that are being conducted on an ongoing basis by North Star Infrastructure (NSI) as clearing and construction of the Tłıchq All-Season Road proceeds.

Methods

The study area for the aerial bear den survey was defined by an 800 m buffer around the proposed 60 m wide Tłıchq All-Season Road right of way, as well as any proposed borrow sources and borrow source access roads.

Aerial surveys were conducted by helicopter along survey transects spaced 250 m apart within the 800 m buffer around the project footprint, with the central transect following the alignment of the Tłıchq All-Season Road (Figure 1).

Surveys were conducted using an A-Star helicopter hired from Great Slave Helicopters Ltd. piloted by T.Firth. The survey crew consisted of an ENR wildlife technician (S.Goodman) who served as observer, navigator and data recorder, and two observers from the community of Behchokò (H.Mantla and L.Ekendia). The helicopter was flown at an altitude of roughly 100-200 feet and speed of 60 km/hr. Suspected den sites, wildlife observations and other wildlife habitat features of note were recorded with GPS waypoints and photos were taken where possible.

The survey took place over a 3-day period from October 23-25, 2019. For aerial bear den surveys to be effective it is important that they be conducted after a recent snowfall in order to

more easily detect bear tracks and signs of den excavation. At the time of the survey there was roughly ~90% snow cover within the study area, and the most recent snowfall was on October 21 (Kiewit-NSI Weekly Environmental Report for October 20-26, 2019). Conditions were overcast with fog patches and ~2.5 miles visibility on the first day, followed by overcast conditions in the mornings of the 2nd and 3rd day with skies clearing in the afternoons. Temperatures varied from -2°C on the first day, 2°C on the second day, and -7°C on the third day.

At the time of the surveys, clearing of the right of way was advancing between kilometers 28.5 to 31.3, two camps were active at kilometer 0 and 19, and quarrying operations were occurring at Pit #2B and #13C (Kiewit-NSI Weekly Environmental Report for October 20-26, 2019).

Results

Wildlife sightings, tracks and notable wildlife habitat features recorded during the survey are summarized in Table 1.

No active bear dens were detected during the aerial survey, but two potential den sites were recorded (waypoint 7; Figure 2,6,7 & waypoint 15; Figures 5,8,9). The potential den site at waypoint #7 was located roughly 800 m away from the road alignment, whereas the potential den site at waypoint #15 is located within the 60 m right of way for the road alignment between km 65-70. The crew landed at waypoint 7 to investigate the potential den site on foot (Figure 9).

There were no old or fresh bear tracks seen around the two potential den sites; however, old bear tracks were detected in 3 locations within the study area (waypoints 1, 2, and 5; Figures 2,4), and one set of fresh bear tracks was observed just south of km 65 (waypoint 16; Figures 5, 10).

There were 3 moose sightings, two of which were in the survey area (waypoints 6 and 20; Figures 2, 5, 11) and one moose that was spotted off-transect during a transit flight (waypoint 18; Figure 2). Bison were sighted on two occasions within the survey area (waypoints 11 and 19; Figures 2, 3, 12), and once off transect (waypoint 17; Figure 3). The only other direct wildlife sighting recorded was a porcupine (waypoint 9; Figure 3).

The survey crew recorded 6 locations (waypoints 3, 4, 8, 10, 12, and 13; Figures 2-4;) that had caves or sink holes that could potentially provide bat hibernacula habitat, but none of them were within the road right of way or potential footprint of any borrow sources. Example photos of these features are provided in Figures 13 and 14.

No raptor nests were recorded during the survey.

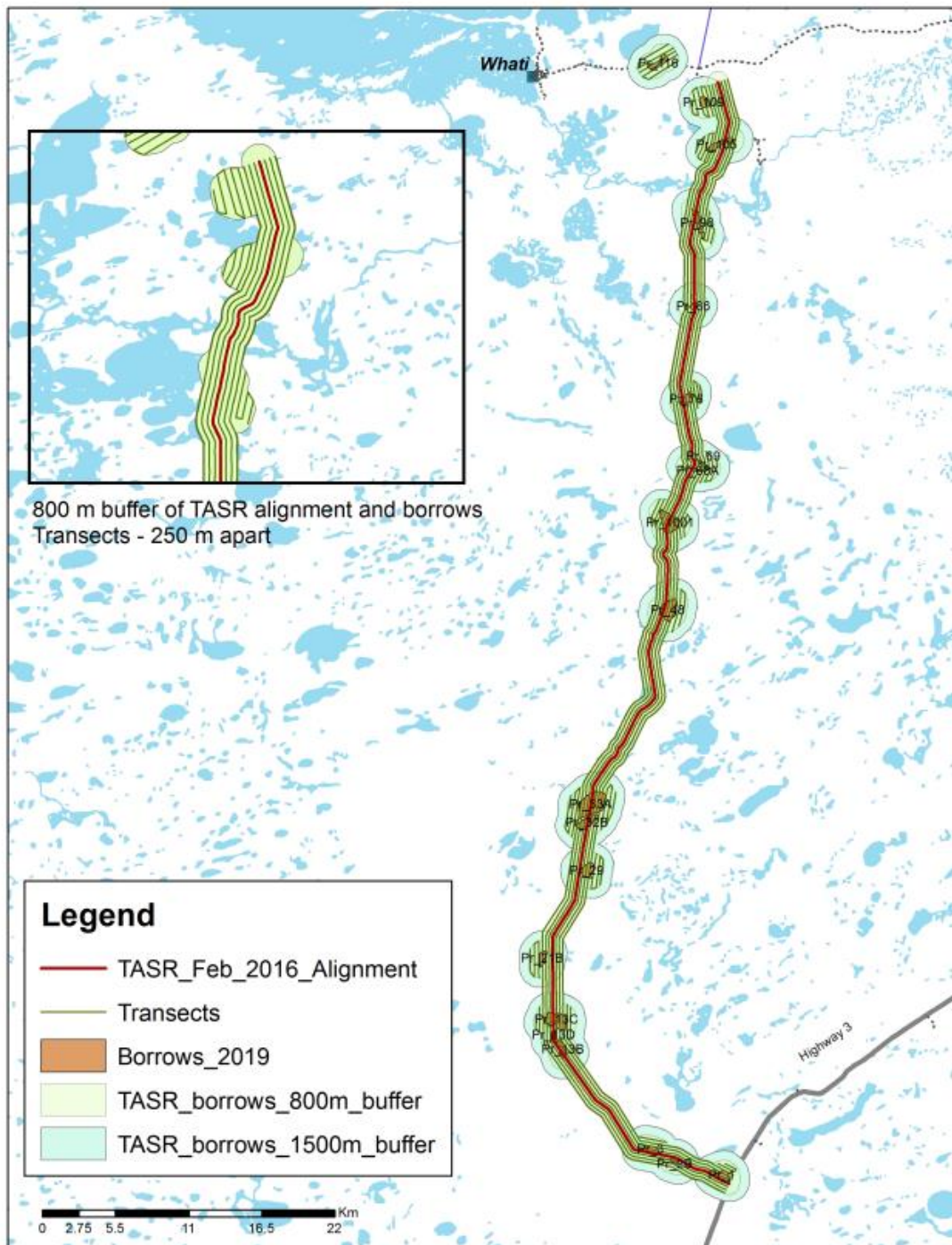


Figure 1. Aerial bear den study area defined by an 800 m buffer around the Tłıchq All-Season Road right of way, borrow sources and borrow source access roads.

Table 1. Wildlife sightings, tracks and notable wildlife habitat features recorded during the aerial bear den survey conducted along the Tłıchq All-Season Road alignment between October 23-25, 2019.

Waypoint	Date	Observation	Group Size	Comments	latitude	longitude
1	10/23/2019	bear track		old track, snow in track	62.53611398	-116.762878
2	10/23/2019	bear track		old track, snow in track	62.55135102	-116.780624
3	10/23/2019	cave		Bat habitat?	62.62277196	-116.820513
4	10/23/2019	sink hole			62.87048402	-116.840865
5	10/23/2019	bear tracks		old track, snow in track	62.75131599	-116.820341
6	10/23/2019	moose	2		62.50846703	-116.687158
7	10/24/2019	potential den		Potential bear den	*	*
8	10/24/2019	sink hole			62.57996902	-116.857571
9	10/24/2019	porcupine	1		62.68804201	-116.863665
10	10/24/2019	cave		karst landscape, lots of caves and sinkholes	62.86244201	-116.873043
11	10/24/2019	bison	6	6 bison (2 cows, 1 bull, 2 yearling, 1 unknown)	62.67264303	-116.854482
12	10/24/2019	cave		sink hole cave, no tracks	62.51901699	-116.760039
13	10/24/2019	sink hole		multiple sink holes	62.49811697	-116.687192
15	10/25/2019	potential den		potential den right beside right of way, no tracks near den/hole. This den should be investigated further.	*	*
16	10/25/2019	bear track		fresh bear track along road/trail cutline, headed N	62.92807499	-116.861076
17	10/25/2019	bison	5	Incidental sighting of 5 bison	62.69168403	-116.735539
18	10/25/2019	moose	3	incidental: 3 moose (cow with 2 yearling, one yearling had small antlers)	62.59630401	-116.642866

19	10/25/2019	bison	9	> 9 bison, headed NE	62.58415796	-116.827455
20	10/25/2019	moose	1	1 moose, cow	63.09134298	-116.953856

* Coordinates of potential den sites have been omitted to protect these locations from non-project related disturbance in the event the dens are active. The coordinates of the potential den sites have been shared with NSI.

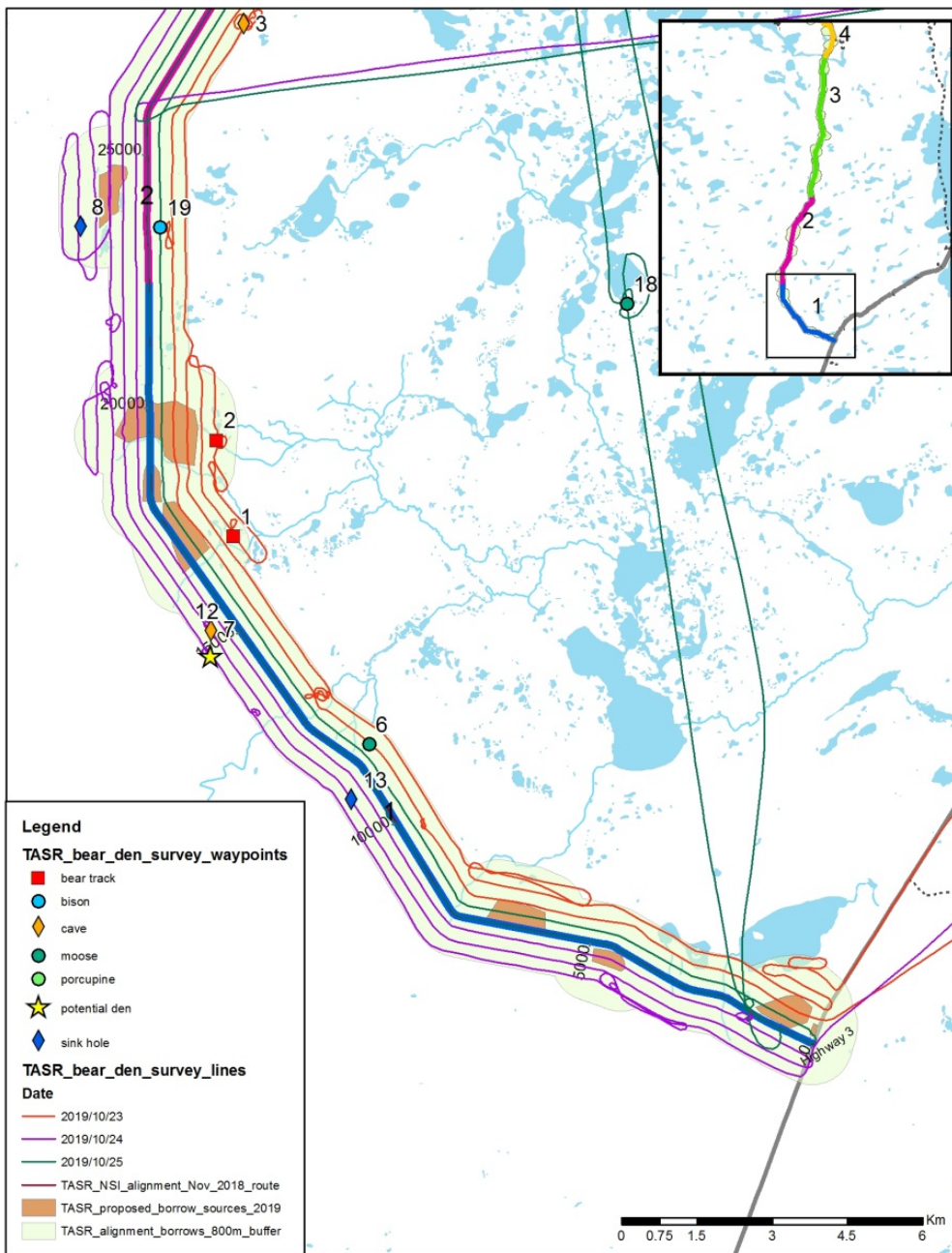


Figure 2. Aerial bear den survey wildlife and wildlife habitat sightings along the first 25 km of the TASR alignment.

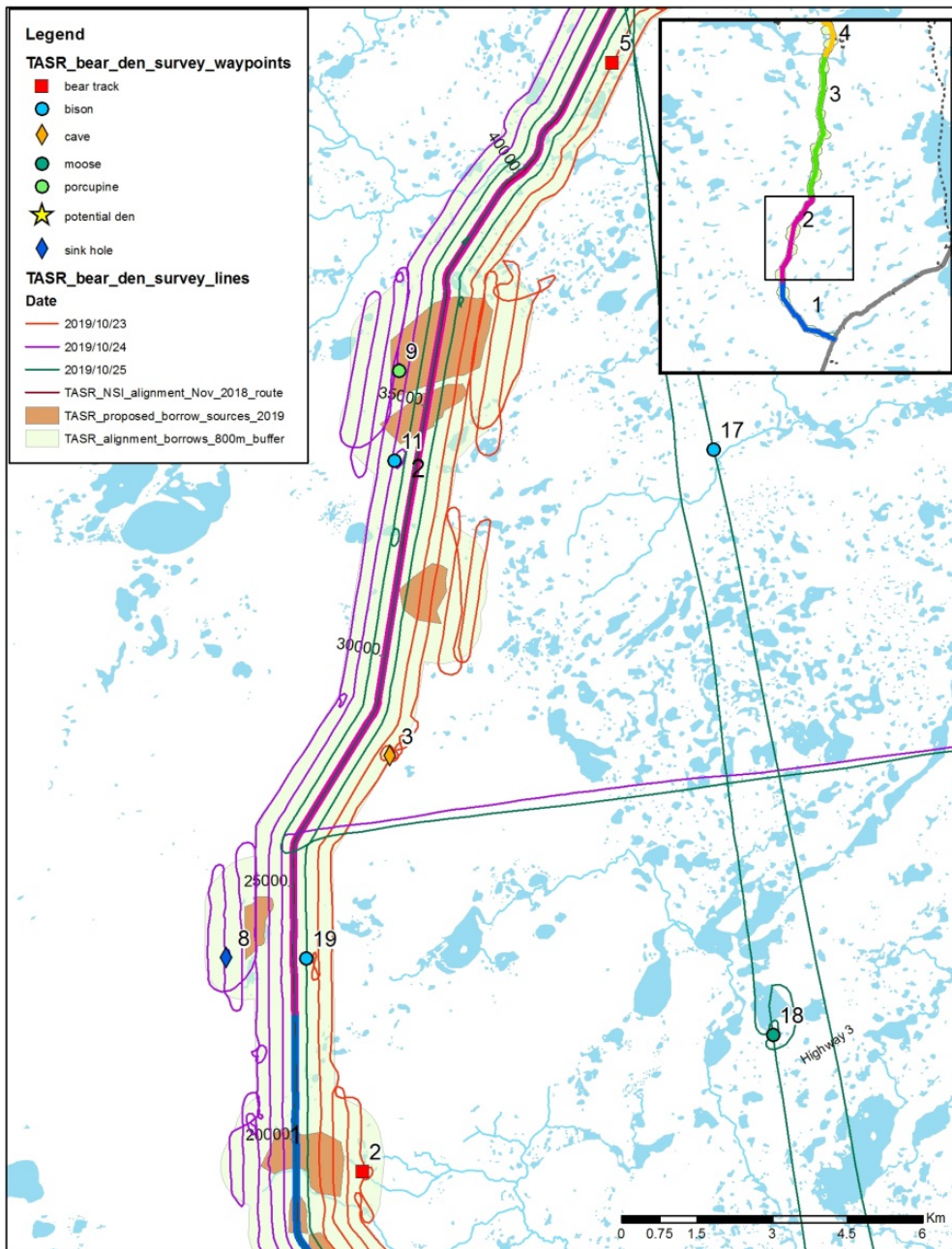


Figure 3. Aerial bear den survey wildlife and wildlife habitat sightings from kilometer 25 to kilometer 40 along the TŁCHQ ALL-SEASON ROAD alignment.

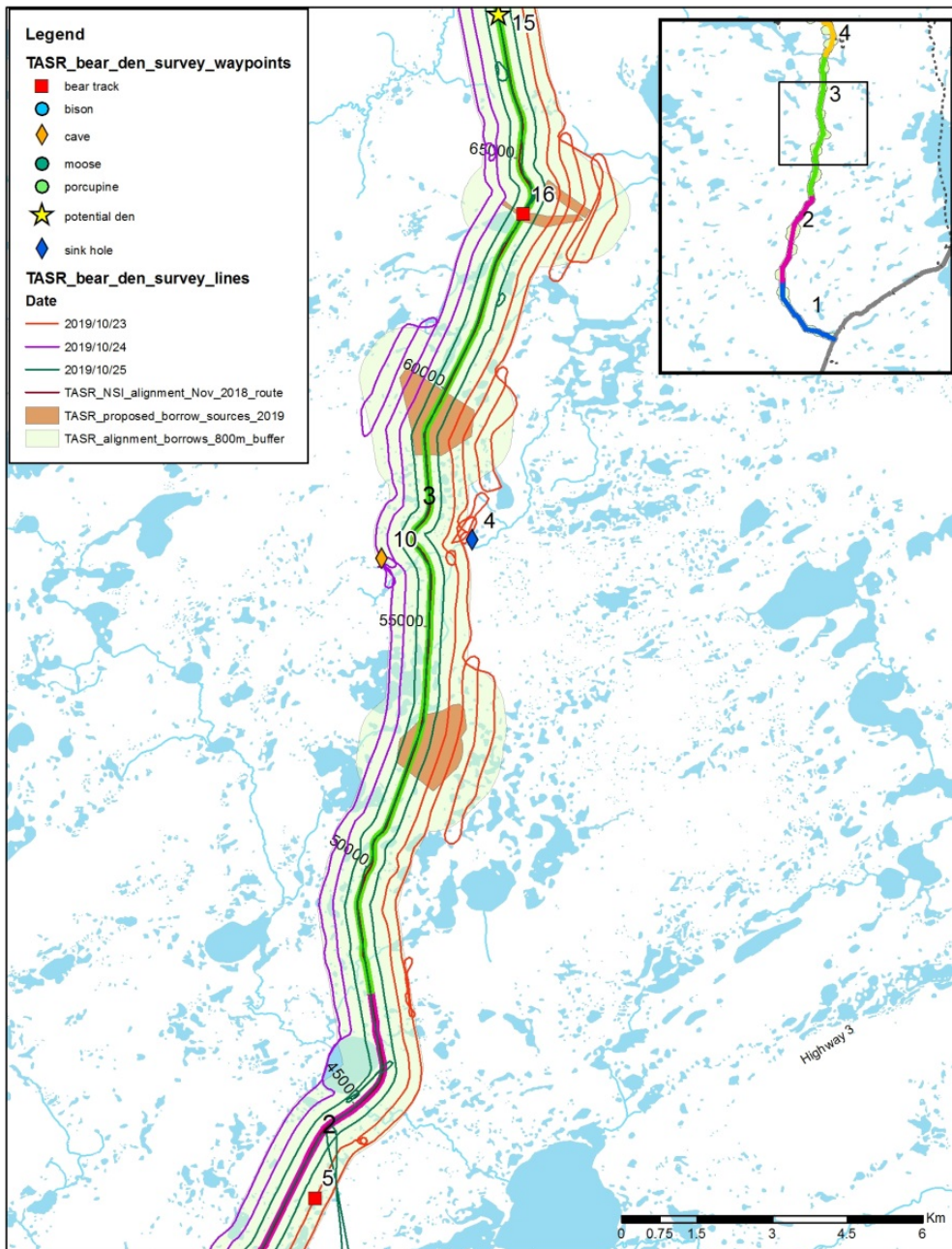


Figure 4. Aerial bear den survey wildlife and wildlife habitat sightings from kilometer 40 to kilometer 65 along the TŁCHQ ALL-SEASON ROAD alignment.

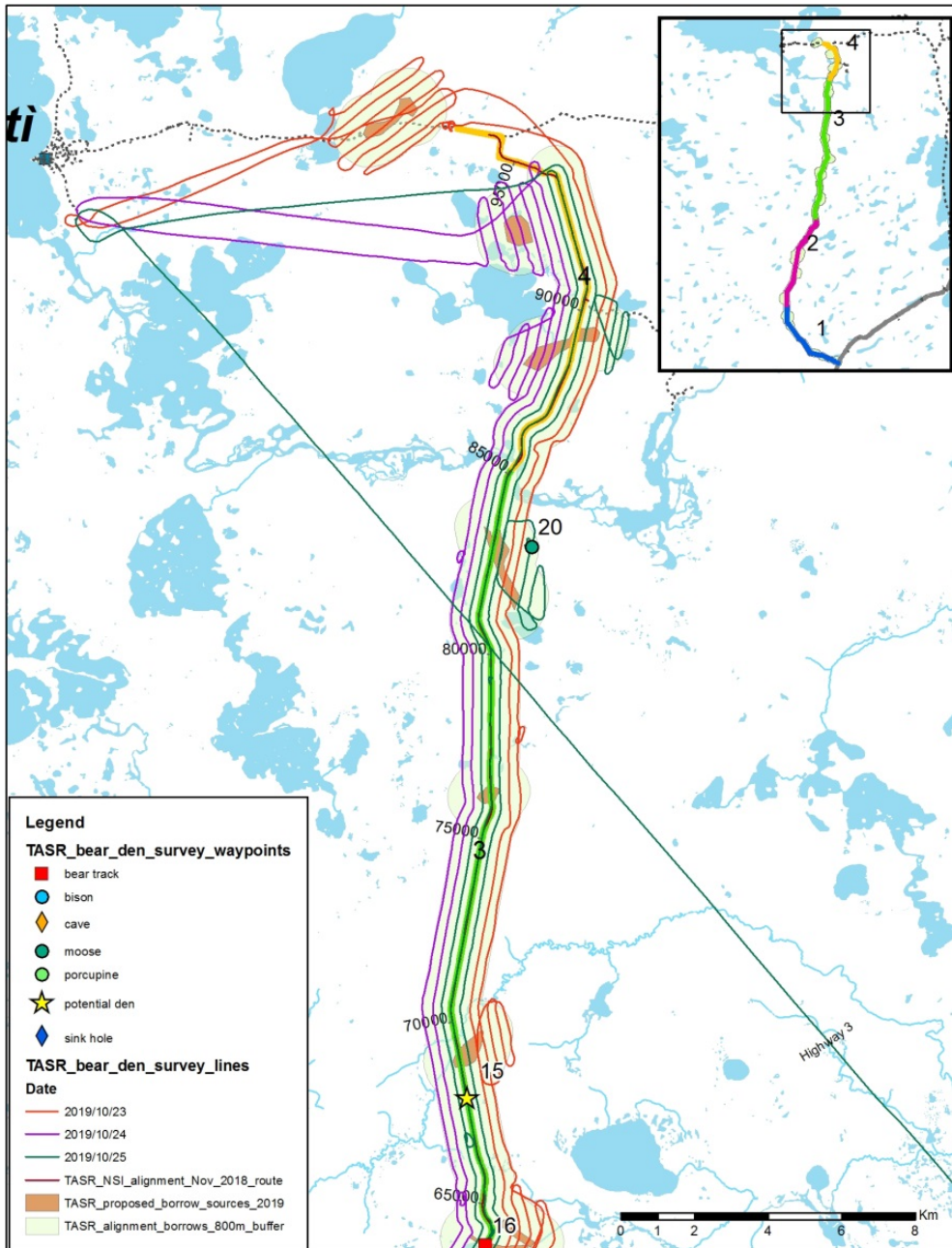


Figure 5. Aerial bear den survey wildlife and wildlife habitat sightings from kilometer 65 to kilometer 97 along the TŁJCHQ ALL-SEASON ROAD alignment.



Figure 6. Potential den site at waypoint 15.



Figure 7. Potential den site at waypoint 15.



Figure 8. Potential den site at waypoint 7



Figure 9. Potential den site at waypoint 7



Figure 10. Fresh bear tracks recorded at waypoint 16



Figure 11. Two moose sighted at waypoint 6



Figure 12. Six bison recorded at waypoint 11.



Figure 13. Sinkhole at waypoint 4.



Figure 14. Cave at waypoint 12.

Conclusions and Recommendations

Although there was sufficient snow cover in the study area to conduct the survey, warm temperatures around the time of the survey degraded some of the wildlife tracks and may have made it more difficult to detect and discern fresh bear tracks. The survey crew nonetheless observed old and fresh bear tracks and two potential den sites which may have been utilized in previous years. Given that a grizzly bear sighting was reported by NSI on November 01, 2019

(Kiewit-NSI Weekly Environmental Report for October 27-November 02, 2019), it is possible that bears had not yet started denning at the time of the aerial surveys.

ENR recommends the following:

- 1) NSI continue to carry out with pre-clearing and pre-blast surveys to look for dens and signs of wildlife presence as per Appendix F of the approved Tłıchǵ All-Season Road Wildlife Management and Monitoring Plan.
- 2) NSI investigate the potential den site that was identified within the right of way between kilometers 65-70 prior to any clearing activities at that location. As outlined in Appendix F of the Wildlife Management and Monitoring Plan, thermal imaging devices were to be trialed by NSI as a tool to detect wildlife. The thermal imaging device should be used to help determine if the den is occupied.
- 3) If it is determined or suspected that the den is occupied, NSI should contact ENR to discuss mitigation options.
- 4) A trail camera should be installed near the potential den site to be able to record if a bear emerges from that den during winter construction activities or in the spring.
- 5) If clearing along the entire length of the right of way and proposed borrow sources is not completed this winter, the aerial bear den survey should be carried out again in fall 2020 for any areas that remain uncleared, and within 800 m of any areas where blasting will occur during the winter 2020-21 season.

Acknowledgments

ENR would like to thank the two monitors from Behchokǵ that participated in the survey, and would also like to thank NSI for allowing ENR to store fuel for the survey within one of their staging areas.



Appendix E 2019 ARU Data Collection Bird Survey



SEP 30 2019

DR. JOE DRAGON
DEPUTY MINISTER
ENVIRONMENT AND NATURAL RESOURCES

Submission of the Bird Survey Report for the Tẖcẖo All Season Road

The Government of the Northwest Territories Department of Infrastructure (GNWT-INF) respectfully submits to the Government of the Northwest Territories Department of Environment and Natural Resources the attached Bird Survey Report. The Bird Survey Report is being provided in accordance with Measure 10-1 of the Environmental Assessment. Please see the attached report for further details.

Should you have any questions or concerns please contact me at (867) 767-9049 ext. 31186 or by email at Cameron_Wilson@gov.nt.ca at your earliest convenience.

Sincerely,

Cameron Wilson
Regional Superintendent
Infrastructure

Attachment

c. Ms. Laurie McGregor
Environmental Assessment Analyst
Environment and Natural Resources

Ms. Loretta Ransom
Manager, Environmental Impact Assessment and Monitoring
Environment and Natural Resources

TECHNICAL MEMORANDUM

DATE September 10, 2019

Project No. 1790290-5000-5007

TO Stu Nivens, Manager – Environmental Affairs Design & Technical Services, Department of Infrastructure, Government of the Northwest Territories

CC Damian Panayi, Paula Bentham

FROM Lynnette Dagenais, Connor Charchuk

EMAIL lynnette_dagenais@golder.com

TŁİCHQ ALL-SEASON ROAD 2019 MIGRATORY BIRD BASELINE STUDY

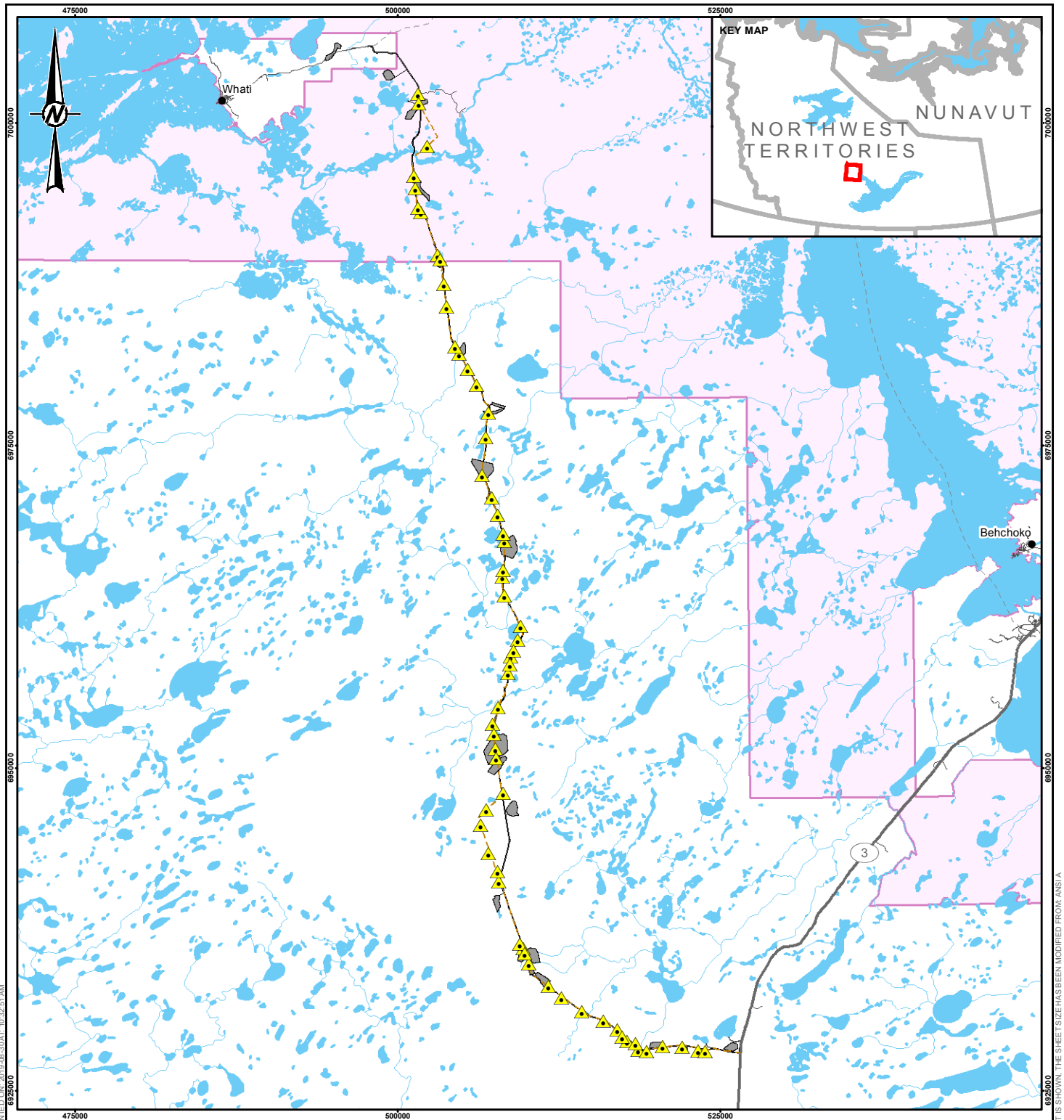
1.0 INTRODUCTION

The Government of the Northwest Territories, Department of Infrastructure (INF) has applied to construct and develop the Tłıchq All-Season Road (the Project), which will be an all-season road from Kilometre 196 of Highway 3 to the Community Government of Whatı boundary. The Project generally follows the Old Airport Road, a historic winter road route connecting Whatı to Highway 3 (Figures 1 to 3) that is still in frequent use for hunting and firewood collection, and by recreational off-road vehicles. The Project triggered an environmental assessment by the Mackenzie Valley Environmental Impact Review Board (MVEIRB; EA1617-01). In the Report of Environmental Assessment and Reasons for Decision, the MVEIRB prescribed Measure 10-1 to mitigate effects on bird species at risk (SAR) and migratory birds (MVEIRB 2018). Part 1 of Measure 10-1 states:

“The developer will conduct pre-construction field surveys of bird species at risk and migratory birds prior to disturbing potential habitat, including any clearing of the right-of-way, quarry sites, camps, access routes, or other project infrastructure. The developer will consult with Environment and Climate Change Canada (ECCC), and GNWT-ENR about methods and timing for a field survey(s). The developer will conduct the survey using methods derived from peer-reviewed scientific literature and best practices.”

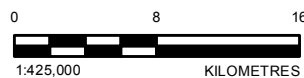
Consultations between INF and ECCC and Government of the Northwest Territories, Department of Environment and Natural Resources (ENR) took place on April 18, May 11, and May 28, 2018 (Golder 2018a). Following the last meeting, INF agreed to implement a study for migratory and SAR birds within 200 metres (m) of the Project centreline (i.e., 400 m corridor; bird baseline regional study area [RSA]) in 2019. The baseline monitoring study design that reflects all engagement recommendations from ECCC and ENR is Version 3.2 of the Tłıchq All-Season Road 2019 Migratory Bird Baseline Study Plan (Golder 2018b) and is described in the sections below.

This report summarizes the results of 2019 baseline monitoring for the Project following the Tłıchq All-Season Road 2019 Migratory Bird Baseline Study Plan (Golder 2018b). The objective of the 2019 bird baseline studies is to comply with Part 1 of Measure 10-1 (MVEIRB 2018).



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- - - WINTER ROAD
- WATERCOURSE
- Tłı̄chǫ LAND
- WATERBODY
- ▲ 2019 ARU LOCATION
- OLD AIRPORT ROAD
- PROJECT FOOTPRINT



REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
Tłı̄chǫ ALL-SEASON ROAD

TITLE
LOCATION OF AUTONOMOUS RECORDING UNITS ALONG THE PROJECT ALIGNMENT, 2019

CONSULTANT	YYYY-MM-DD	2019-08-30
	DESIGNED	DC
	PREPARED	LMS
	REVIEWED	LD
	APPROVED	LD

PROJECT NO.
1790290

REV.
0

FIGURE
1





Figure 2: Existing Conditions on the Old Airport Road



Figure 3: Existing Conditions on the Old Airport Road

2.0 METHODS

The intent of the baseline surveys was to meet the following objectives:

- identify the presence, habitat associations, and relative abundance of migratory birds, with focus on bird SAR; and
- determine if migratory bird abundances are different within and outside of the Project right-of-way (ROW; 60 m from the Old Airport Road centreline [120 m corridor]).

The Project follows the Old Airport Road for most of the alignment. Although there is some deviation of the Project alignment from the Old Airport Road (Figure 1), the ROW and RSA were defined based on the Old Airport Road because of access limitations during ARU deployment, and because the Project route was still under development.

For this report, species at risk are species that are federally listed as endangered, threatened, or of special concern (SARA 2019; COSEWIC 2019).

Autonomous recording units (ARUs) were used for the 2019 baseline surveys and followed the draft guidelines for the use of ARUs in impact assessment studies (ECCC 2018), which were provided to Golder by the ECCC in March 2019. The 2019 baseline surveys were completed under Wildlife Research Permit WL500689 and covered the entire ROW (Figure 1).

2.1 Sampling Design

Land cover types described by Systeme Pour l'Observation de la Terre (SPOT) 4/5 data were used in the Environmental Assessment (EA) for the Project as the basis for describing available bird habitat at baseline. The ECCC recommended that SPOT 4/5 land cover types be combined into broad-scale habitats (Golder 2018a; Table 1, Figure 4). SPOT 4/5 data does not explicitly delineate wildfire burns but combines burns with anthropogenic disturbance into the “recently disturbed” land cover type.

A total of 60 ARUs were deployed within the RSA in 2019 (Table 1; Golder 2018b). The ARUs were deployed in five broad-scale habitat types (Table 1, Figure 4). As per ENR and ECCC recommendations, the broad-scale habitat types excluded NWT wildfire data (Golder 2018a). Prior to site selection, available sites in the RSA were restricted to those separated by a minimum of 500 m in a Geographic Information System (GIS) platform as per ECCC (2018). These were then intersected with habitat polygons. Each location was assigned a habitat type based on the dominant habitat type within 50 m. This scale was chosen to maximize the number of potential sites given the low abundance of several habitat types in the RSA. A 50 m scale is also consistent with breeding bird survey standards for point-counts (Ralph et al. 1995; Matsuoka et al. 2014).

Locations for ARUs in each of the broad-scale habitat types, except wetlands, were selected through generalized random tessellation stratified (GRTS) sampling via the ‘spsurvey’ package in R (Kincade and Olsen 2016; RCDT 2015) to maximize spatial variation in each habitat type. The GRTS sampling also selected three additional alternate sites, where possible, to provide spatially balanced sampling coverage in case some of the main survey locations could not be accessed due to safety or logistical concerns.

For wetlands, there was insufficient habitat area available to deploy 10 ARUs with 500 m spacing. As such, the number of sites selected was set to the number available and additional sites were allocated to other more abundant habitats to achieve deployment of 60 ARUs.

Table A-1 (Appendix A) outlines vegetation data at each ARU location, as identified in the field.

Table 1: SPOT 4/5 Reclassification into Broad-scale Habitat Types, Area and Percent Cover in the Regional Study Area, and Number of Autonomous Recording Units Deployed in Broad-scale Habitat Types Inside and Outside of the Project Right-of-way.

Broad-scale Habitat Type	SPOT 4/5 Grid Codes	SPOT 4/5 Land Cover Class	Area within the RSA (ha)	Proportion of the RSA (%)	Number of ARU Units Deployed within the Project ROW ^(c)	Number of ARU Units Deployed within the RSA ^(d)
Dense conifer	1, 2	Evergreen conifer forest (high density) Evergreen conifer forest (medium density)	1,006	26.9	2	13
Sparse conifer	3, 13	Evergreen conifer (low density/non-forest) Sparse conifer lichen	1,513	40.4	10	12
Deciduous	4, 5, 6	Mixed forest Deciduous forest Young forest	570	15.2	3	6
Open	9, 10, 11, 12	Erect shrub Herbaceous Bryoid Barren	375	10.0	2	6
Wetlands	14, 16	Herbaceous wetlands Water	100	2.7	0	5
Recently disturbed ^(e)	7	Anthropogenic Wildfire burns Cut blocks	6	0.2	0	1 ^(e)
Total	N/A	N/A	3,570^(a)	95.4^(b)	17	43

Note: Spatial and temporal wildfire data was removed to preserve the original SPOT land cover data for site selection. The disturbance land cover type in SPOT 4/5 data includes burns and anthropogenic disturbance.

^(a) Area does not equal RSA size (3,741 ha) because not all land cover types available were assigned to broader habitat types

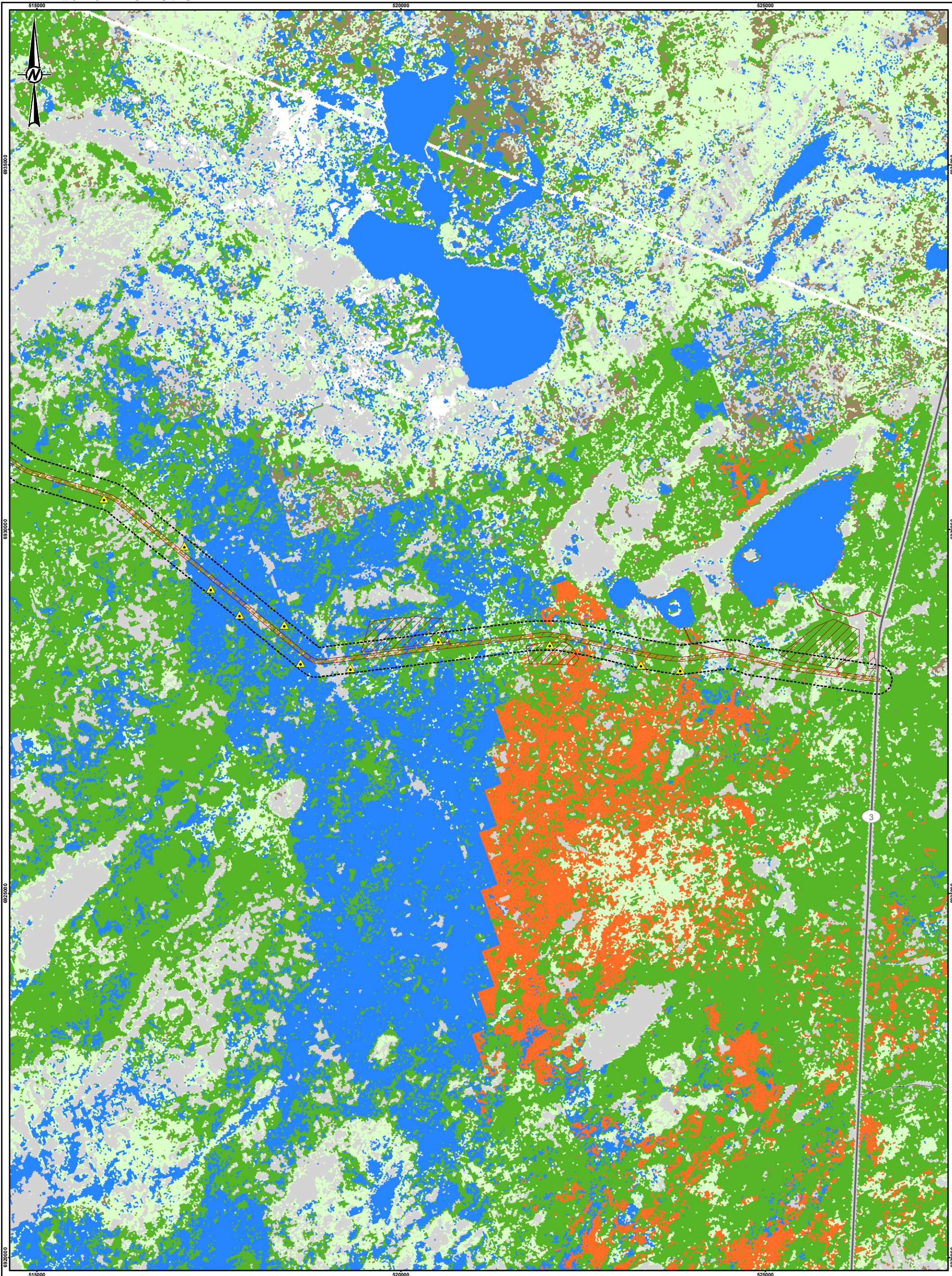
^(b) Percent total does not equal 100% because not all land cover types available were assigned to broader habitat types.

^(c) ROW = 0 to 60 m from the Old Airport Road centreline (120 m wide corridor)

^(d) RSA = 61 to 200 m from the Old Airport Road centreline (400 m wide corridor)

^(e) Due to small sample size, the one ARU deployed in recently disturbed habitat was grouped with open habitat for analysis.

ARU = autonomous recording unit; ha = hectare; m = metres; N/A = not applicable; SPOT = Systeme Pour l'Observation de la Terre dataset; ROW = right-of-way; RSA = regional study area.



LEGEND

- ALL-SEASON ROAD

LOCAL ROAD

OLD AIRPORT ROAD
- 2019 ARU LOCATION

PROJECT FOOTPRINT

STUDY AREA
- LAND COVER

DENSE CONIFER

SPARSE CONIFER

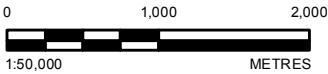
DECIDUOUS

OPEN

WETLANDS

RECENTLY DISTURBED

DRAFT



REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. MEDIUM RESOLUTION LAND COVER MAPPING OF CANADA FROM SPOT 4/5 DATA; GEOMATICS CANADA, OPEN FILE 4, 37 P., DOI:10.4095/295751.
- PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

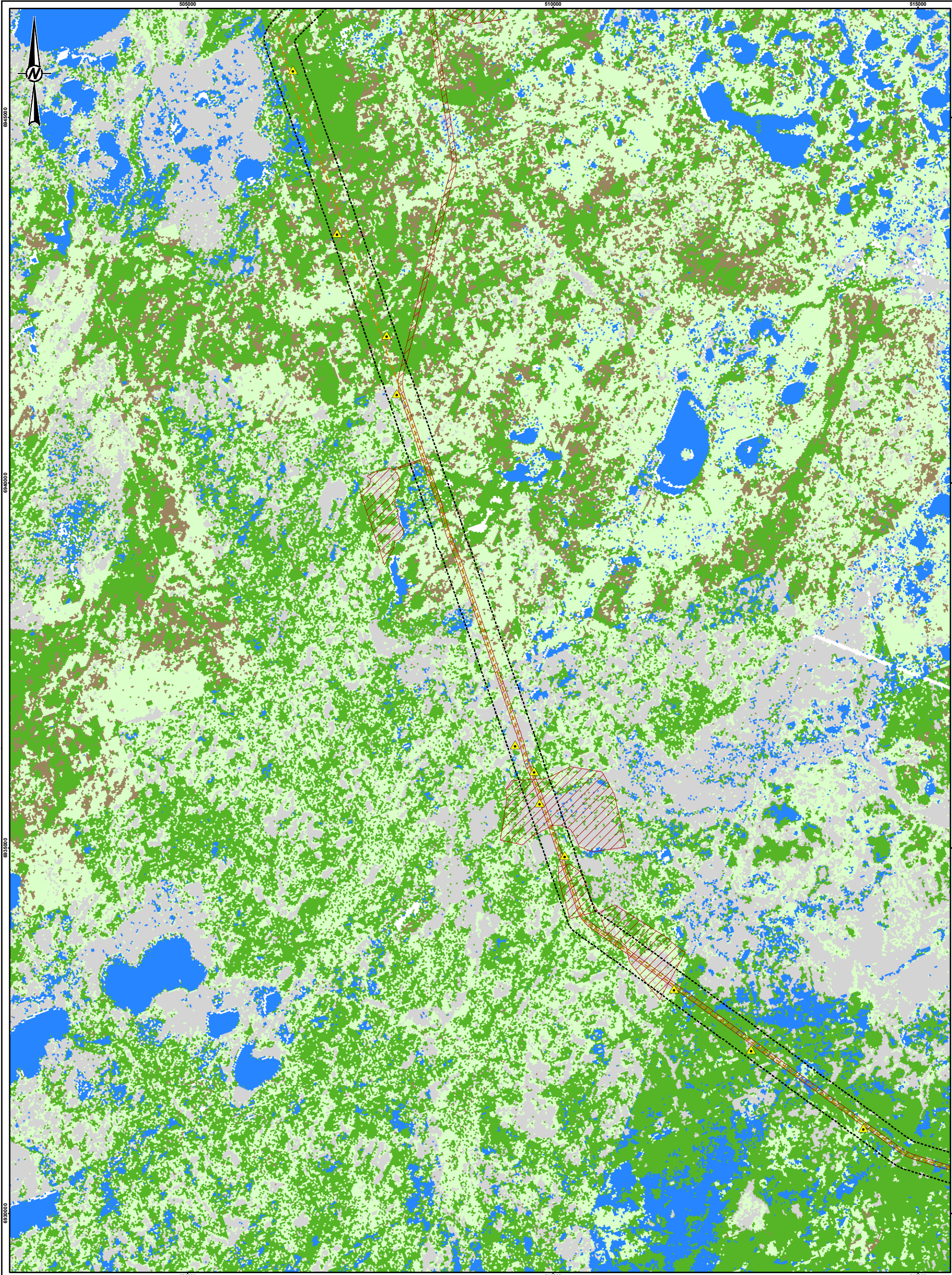
PROJECT
Tłı̨chǫ ALL-SEASON ROAD

TITLE
BROAD-SCALE HABITAT TYPES AND ARU LOCATIONS WITHIN THE BIRD BASELINE REGIONAL STUDY AREA

CONSULTANT	YYYY-MM-DD	2019-09-05
	DESIGNED	LD
	PREPARED	LMS
	REVIEWED	-
	APPROVED	-



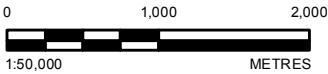
PROJECT NO.	PHASE	REV.	FIGURE
1790290	2000	A	4A



LEGEND

- OLD AIRPORT ROAD
- 2019 ARU LOCATION
- PROJECT FOOTPRINT
- STUDY AREA
- LAND COVER
- DENSE CONIFER
- SPARSE CONIFER
- DECIDUOUS
- OPEN
- WETLANDS

DRAFT



REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. MEDIUM RESOLUTION LAND COVER MAPPING OF CANADA FROM SPOT 4/5 DATA; GEOMATICS CANADA, OPEN FILE 4, 37 P., DOI:10.4095/295751.
- PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

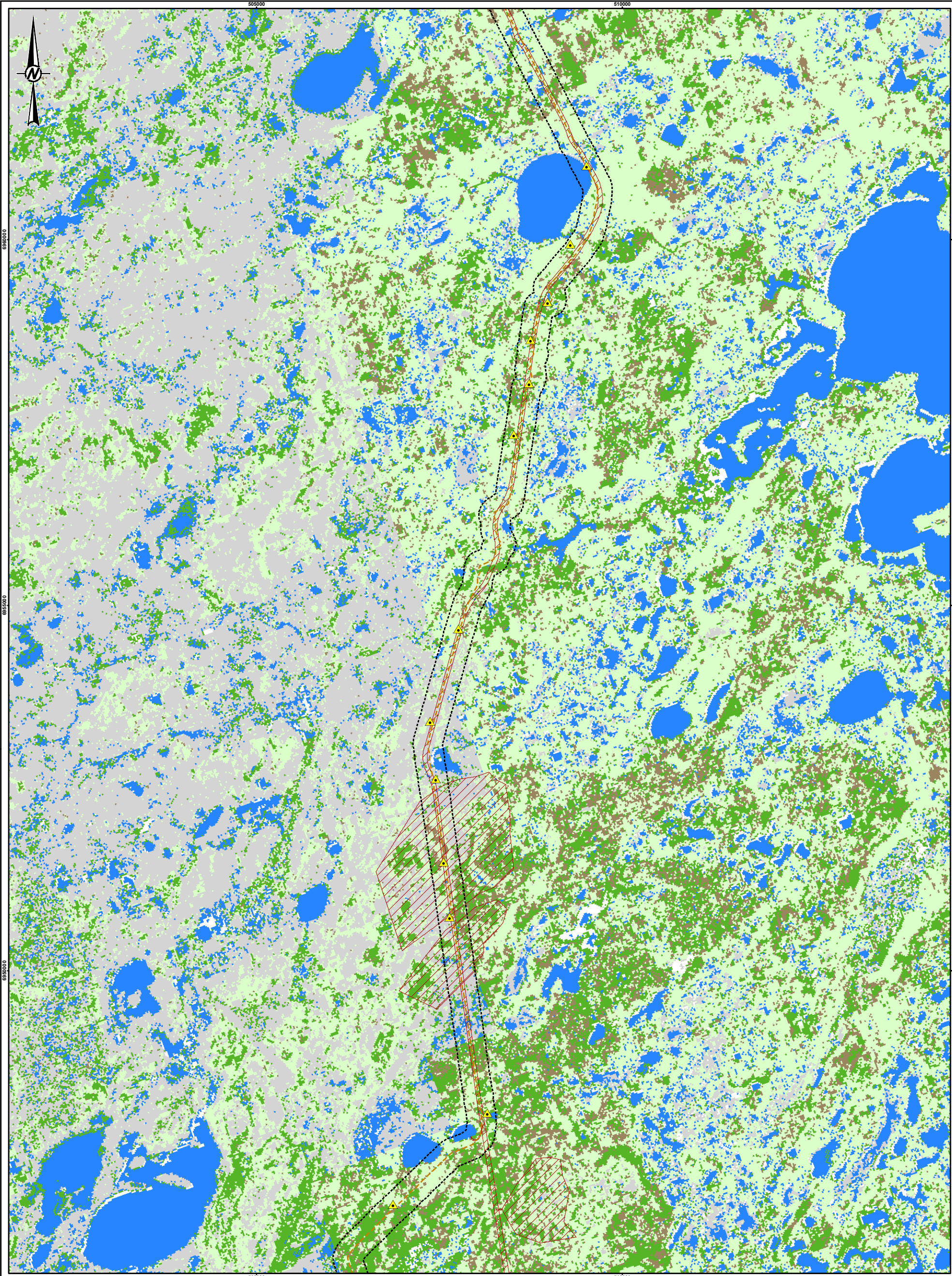
PROJECT
TŁİCHQ ALL-SEASON ROAD

TITLE
BROAD-SCALE HABITAT TYPES AND ARU LOCATIONS WITHIN THE BIRD BASELINE REGIONAL STUDY AREA

CONSULTANT	YYYY-MM-DD	2019-09-05
	DESIGNED	LD
	PREPARED	LMS
	REVIEWED	-
	APPROVED	-



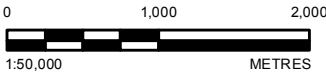
PROJECT NO.	PHASE	REV.	FIGURE
1790290	2000	A	4B



LEGEND

- OLD AIRPORT ROAD
- 2019 ARU LOCATION
- PROJECT FOOTPRINT
- STUDY AREA
- LAND COVER
- DENSE CONIFER
- SPARSE CONIFER
- DECIDUOUS
- OPEN
- WETLANDS

DRAFT



REFERENCE(S)

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2. MEDIUM RESOLUTION LAND COVER MAPPING OF CANADA FROM SPOT 4/S DATA; GEOMATICS CANADA, OPEN FILE 4, 37 P., DOI:10.4095/295751. PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

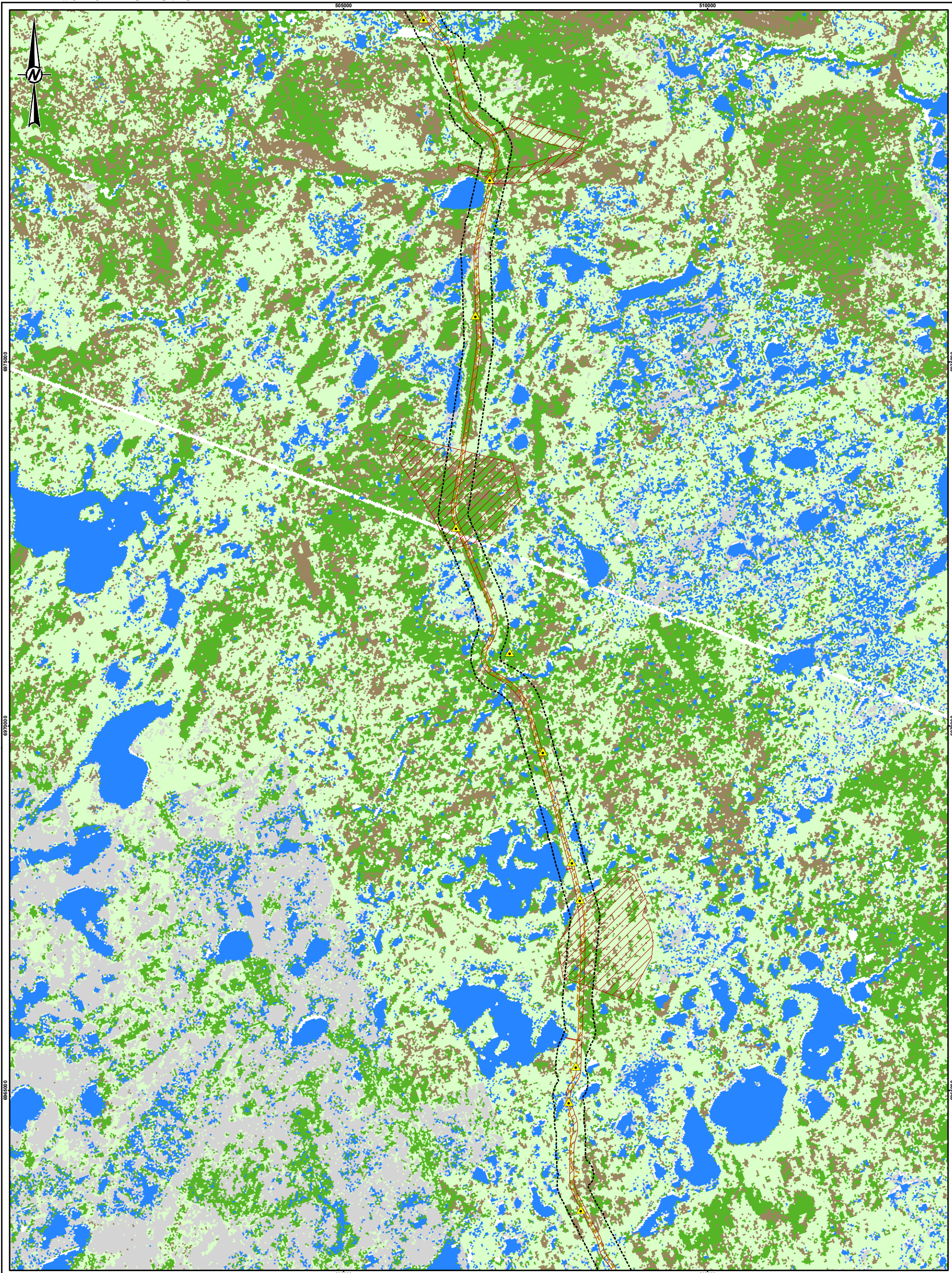
PROJECT
TŁİCHQ ALL-SEASON ROAD

TITLE
BROAD-SCALE HABITAT TYPES AND ARU LOCATIONS WITHIN THE BIRD BASELINE REGIONAL STUDY AREA

CONSULTANT	YYYY-MM-DD	2019-09-05
	DESIGNED	LD
	PREPARED	LMS
	REVIEWED	-
	APPROVED	-



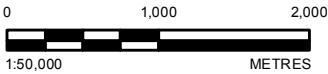
PROJECT NO. 1790290	PHASE 2000	REV. A	FIGURE 4C
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LEGEND

- OLD AIRPORT ROAD
- 2019 ARU LOCATION
- PROJECT FOOTPRINT
- STUDY AREA
- LAND COVER
- DENSE CONIFER
- SPARSE CONIFER
- DECIDUOUS
- OPEN
- WETLANDS

DRAFT



REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. MEDIUM RESOLUTION LAND COVER MAPPING OF CANADA FROM SPOT 4/S DATA; GEOMATICS CANADA, OPEN FILE 4, 37 P., DOI:10.4095/295751. PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁİCHQ ALL-SEASON ROAD

TITLE
BROAD-SCALE HABITAT TYPES AND ARU LOCATIONS WITHIN THE BIRD BASELINE REGIONAL STUDY AREA

CONSULTANT	YYYY-MM-DD	2019-09-05
	DESIGNED	LD
	PREPARED	LMS
	REVIEWED	-
	APPROVED	-



GOLDER

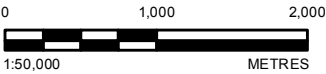
PROJECT NO.	PHASE	REV.	FIGURE
1790290	2000	A	4D



LEGEND

- OLD AIRPORT ROAD
- 2019 ARU LOCATION
- PROJECT FOOTPRINT
- STUDY AREA
- LAND COVER
- DENSE CONIFER
- SPARSE CONIFER
- DECIDUOUS
- OPEN
- WETLANDS
- RECENTLY DISTURBED

DRAFT



REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
 2. MEDIUM RESOLUTION LAND COVER MAPPING OF CANADA FROM SPOT 4/5 DATA; GEOMATICS CANADA, OPEN FILE 4, 37 P., DOI:10.4095/295751.
- PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁİCHQ ALL-SEASON ROAD

TITLE
BROAD-SCALE HABITAT TYPES AND ARU LOCATIONS WITHIN
THE BIRD BASELINE REGIONAL STUDY AREA

CONSULTANT



GOLDER

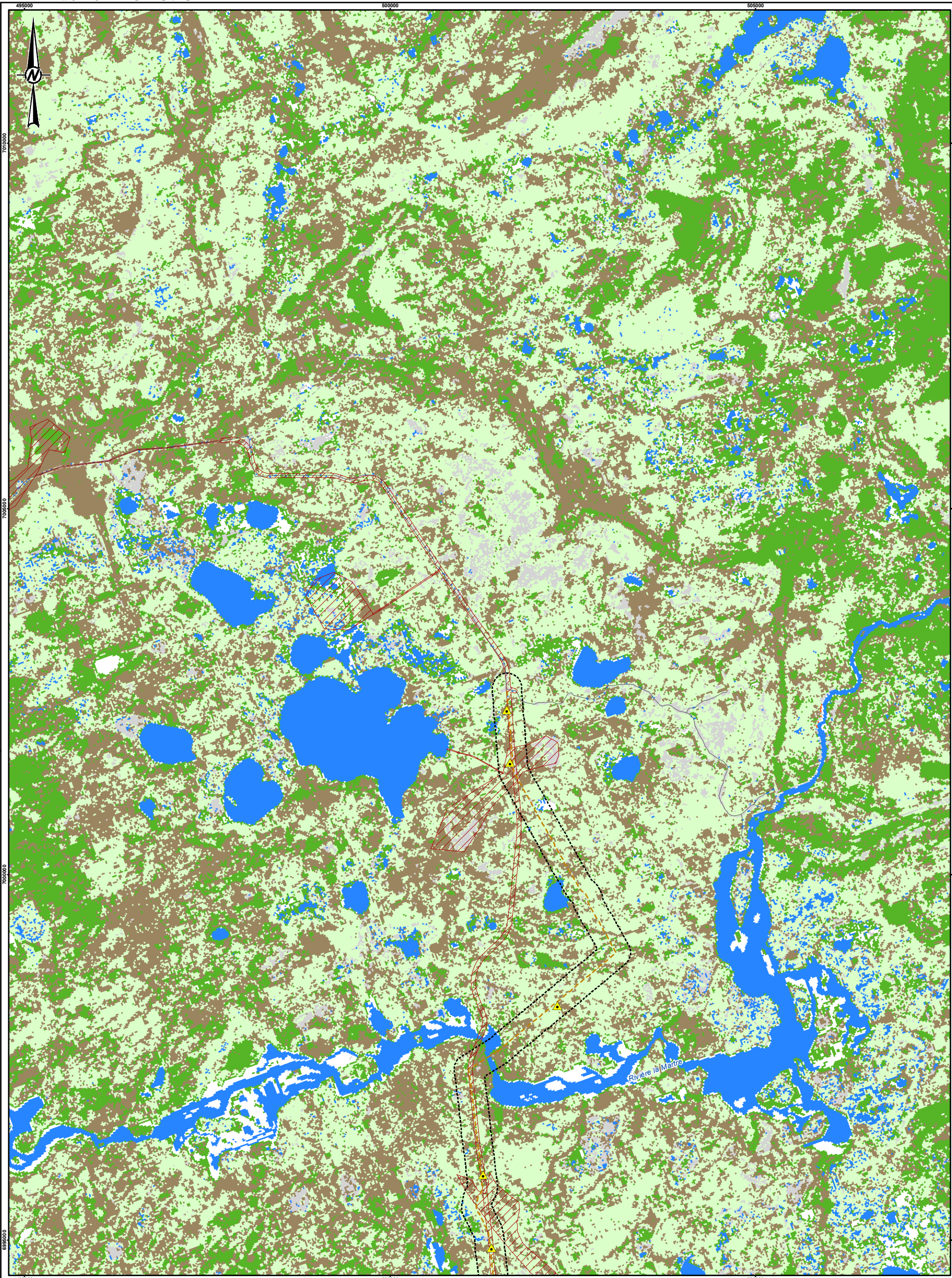
YYYY-MM-DD	2019-09-05
DESIGNED	LD
PREPARED	LMS
REVIEWED	-
APPROVED	-

PROJECT NO.
1790290

PHASE
2000

REV.
A

FIGURE
4E



LEGEND

- LOCAL ROAD
- - -

WINTER ROAD
- - -

OLD AIRPORT ROAD
- ▲

2019 ARU LOCATION
- ▨

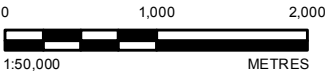
PROJECT FOOTPRINT
- ▤

STUDY AREA
- LAND COVER
- DENSE CONIFER
- SPARSE CONIFER
- DECIDUOUS
- OPEN
- WETLANDS
- RECENTLY DISTURBED

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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PROJECTION: UTM ZONE 11 DATUM: NAD83

DRAFT



CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁİCHQ ALL-SEASON ROAD

TITLE
BROAD-SCALE HABITAT TYPES AND ARU LOCATIONS WITHIN THE BIRD BASELINE REGIONAL STUDY AREA

CONSULTANT	YYYY-MM-DD	2019-09-05
	DESIGNED	LD
	PREPARED	LMS
	REVIEWED	-
	APPROVED	-



PROJECT NO. 1790290	PHASE 2000	REV. A	FIGURE 4F
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To determine if bird abundances are different within and outside of the Project ROW, 17 ARUs were placed within 0 to 60 m from the Old Airport Road centreline (i.e., within the Project ROW [120 m corridor]) and 43 ARUs were placed between 61 to 200 m from the Old Airport Road centreline (i.e., within the RSA [400 m corridor]). The ARUs were deployed on March 27 to 30, 2019 and were retrieved on July 3 to 6 and July 11 and 12, 2019.

There are unequal numbers of ARUs within and outside of the ROW as the bird baseline study design was prepared and approved (Golder 2018b) prior to receiving ECCC's recommendations on ARU data analysis (ECCC 2018). Also, comparing bird density and presence within and outside of the ROW was not discussed during engagement meetings with ECCC and ENR (Golder 2018a,b).

2.2 Recording Schedule

The ARUs (Wildlife Acoustics Song Meter SM4) were programmed to record 10 minutes at the beginning of each hour starting one hour before sunset until five hours after sunrise (i.e., "recalibrating" at one hour before sunrise to five hours after sunrise). An additional 10 minutes was recorded at 12:00 and 15:00. This schedule occurred daily from June 1 to 30, 2019. The ARUs were programmed to record at a sampling rate of 24,000 Hertz (Hz) in a 'w4v' format. The 'w4v' format is a file format developed by Wildlife Acoustics Inc and is a "WAV file compression developed specifically for minimizing loss of useful information in bioacoustics audio recordings while maximizing compression to save on valuable card space" (Wildlife Acoustics 2018).

2.3 ARU Data Interpretation

A total of 15, three-minute recordings were analysed from 59 of the 60 ARUs, as per below. At one location (a deciduous stratum plot outside of the ROW), only six recordings were transcribed due to failure of the recording unit during the survey period.

- Recordings were randomly selected from the total number of recordings within three "breeding periods" (i.e., June 1-9 [period 1], June 10-19 [period 2], June 20-29 [period 3]; total of three days). The resulting dates selected were June 6, June 18, and June 21.
- Three-minute "morning point counts" were completed at the beginning of the hour one hour before sunrise, at sunrise, and two hours after sunrise.
- For the first two breeding periods, three-minute "night surveys" were conducted one hour before sunset, at sunset, and two hours after sunset.
- Alternate recordings were randomly selected within the breeding period if original recordings exceeded weather guidelines (i.e., heavy wind or rain).

The resulting 891 recordings were assigned to two experienced avian biologists for interpretation and transcription. High quality circumaural headphones (i.e., Sennheiser HD380 Pro or equivalent) were used to transcribe ARU recordings. Audacity software (Version 2.2.2) was used to display a stereo spectrogram and listen to ARU recordings to identify all bird species and individuals present. Audacity settings were modified based on recommendations by the Bioacoustic Unit (2017) with the goal to set the frequency, time, and spectral resolution settings to have the most detailed image of a birdsong without comprising the efficiency of interpreting and annotating a recording. Automated species recognition algorithms were not used for data interpretation.

All detected bird vocalizations were identified to species and the time of first detection was recorded. Once an individual was detected, it was "removed" from further detection in a recording. If multiple individuals of the same

species were detected during a recording (based on directionality inferred from stereo channels, timing of song, and other cues), a letter was assigned to each individual (alphabetically in order of detection), to differentiate between individuals. Vocalization types were grouped into two categories: song (i.e., the primary territorial vocalization of male passerines, or equivalent territorial sound display in non-passerines [e.g., woodpecker drumming]) and call (any call unrelated to territorial display). A qualitative confidence level was assigned for each individual heard based on confidence in species identification (i.e., low, medium, and high). Vocalizations that could not be identified to species were recorded using unknown codes (e.g., UNPA for unknown passerine). Metadata recorded for each recording included ambient noise (e.g., industrial noise, traffic) and weather conditions (e.g., light to heavy wind and rain).

2.4 ARU Data Interpretation Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) of interpreted ARU data was performed by two experienced avian biologists. The first minute (33% of each recording) of 429 randomly selected recordings (48% of total recordings) was reviewed by a biologist who did not complete the original data transcription (total 16% QA/QC of all recordings). The transcription QA/QC was completed to confirm the number of species detections and to review low and medium confidence ratings. All low and medium confidence detections were reviewed by a second observer. Only detections that were identified with high confidence were used in further analysis.

2.5 Data Analysis

As only one ARU was deployed in recently disturbed habitat, data from this ARU was combined with data from ARUs deployed in open habitats (Table 1).

2.5.1 Species Density and Species Richness

Species detections tabulated following interpretation (Section 2.3) were analysed to estimate the mean abundance ($\pm$ 95% confidence interval [CI]) of bird species (ECCC 2018). Also reported are the mean number ($\pm$ 95% CI) of individuals of each species observed by broad-scale habitat type, as well as mean number of individuals recorded within and outside of the Project ROW. Mean ($\pm$ 95% CI) species richness (i.e., the number of different species) was estimated for each broad-scale habitat type within and outside of the ROW.

2.5.2 Species Density Models

Two modelling approaches were used to determine the factors that affect bird density in the RSA. The type of modelling approach chosen was based on sample size for individual bird species (i.e., number of recordings in which a species was detected). The preferred modelling approach was the QPAD approach (Solymos 2016), followed by occupancy models (Mackenzie et al. 2002). Each of these approaches is described in more detail below. The candidate models that were compared using either modelling approach are presented in Table 2. Null models were only considered for species that had small sample size to determine if data were sufficient for covariate estimation.

Depending on sample size, either Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), or AIC adjusted for small sample size (AICc) were used to assess the best fit among the models developed. Either BIC or AICc was used for species with small sample size. All predictor variables contained in the top model were considered statistically significant.

Analyses were performed using R version 3.5.1 (The R Foundation for Statistical Computing 2018).

Table 2: Candidate Models that were Analysed using the QPAD Method or Occupancy Models

Model Parameters	Model Description
Null	Intercept only
Location	Location (within or outside ROW) as fixed effect
Habitat	Broad-scale habitat type as fixed effect
Habitat + Location	Habitat and location as fixed effects
Habitat * Location	Interaction between habitat and location
Latitude	Latitude as fixed effect
Habitat * Latitude * Location	Interaction between habitat, latitude and location
Habitat + Latitude	Habitat and latitude as fixed effects
Latitude * Location	Interaction between latitude and location
Habitat * Latitude	Interaction between habitat and latitude

ROW = right-of-way

2.5.2.1 QPAD Approach

The QPAD approach (Sólymos et al. 2013) is a harmonized approach developed for point count surveys where temporal and environmental effects on detectability cannot be controlled for directly. A species' singing rate (sra) and effective detection radius (edr) are modelled as a function of potential covariates to generate statistical offsets for each point count survey. Existing model coefficients for sra and edr are available for many species (Solymos et al. 2013). For example, time since sunrise and Julian date are important predictors for sra and forest density is commonly used as a predictor for edr (i.e., edr decreases with increasing forest density). These existing model coefficients were used to generate statistical offsets for each point count. These offsets are then used in a modelling framework to estimate predicted density (birds per hectare [ha]) in response to treatment variables while controlling for variation in detectability between point counts caused by factors such as time of day, day of year, or habitat.

Time since sunrise and Julian date were used as model coefficients. However, forest density data was not collected during this ARU program; therefore, edr was assumed to be constant across all ARUs. The best model for fitting sra and edr was determined by the availability of covariates in our dataset, and previously compared models in the Solymos et al. (2013) dataset. Models used for estimating sra are contained in Appendix B.

All data from both "morning point count" and "night" survey periods were used in the QPAD analysis. The analysis was run in R version 3.5.1 (R Core Team 2018) using the 'detect' package (Solymos et al. 2018). A Poisson distribution was used in a generalized linear model to run each candidate model. AIC or BIC model selection was used to select the best model. Predicted density values from the best model were then visually compared between inside the ROW and outside the ROW.

2.5.2.2 Occupancy Models

Occupancy models estimate the probability of occurrence of a species at a site while accounting for imperfect detection of the species during surveys (MacKenzie et al. 2002). The occupancy approach allows modelling variation in occupancy and detection, simultaneously, while also accounting for site-specific covariates. Occupancy modelling requires a detection history of detected and non-detected observations from repeated surveys at the same location. To improve sample size for species that were rarely detected on ARUs, survey date was used as the level of visit to aggregate data between recordings (e.g., if a bird was detected in any of the recordings on June 6, it was considered detected in visit 1). Because nocturnal surveys were only completed for visits 1 and 2, only dawn recordings were analysed to maintain equal sample size across each of the three visits.

Occupancy models were run in R version 3.5.1 (R Core Team 2018) using the ‘unmarked’ package (Fiske and Chandler 2011) and the ‘occu’ function. The ‘occu’ function runs the original occupancy models developed by MacKenzie et al. (2002) to estimate probability of occupancy (psi) and probability of detection (p) simultaneously, with potential covariate effects on both. Because data were aggregated across recordings where covariates influencing p varied, it was assumed that detectability is constant across plots. In other words, detectability was controlled through the *a priori* study design rather than through estimating offsets and was assumed constant across ARUs. However, detectability was still imperfect and had to be accounted for when estimating psi. AICc model selection was used to determine the best model, which was then used to calculate predicted probability of occupancy for each plot. Predicted probability of occupancy values from the best model were then visually compared between inside the ROW and outside the ROW.

3.0 RESULTS

3.1.1 Species Density and Species Richness

A total of 69 species, including 4 SAR, were recorded on ARUs in 2019 (Table 3). Average species richness was highest in open habitat and lowest in dense conifer habitat within the Project ROW (Table 3). Outside of the Project ROW, average richness was highest in open habitat and lowest in deciduous habitat (Table 3). Table C-1 (Appendix C) lists the species and average number of individuals per ARU detected within the Project ROW and outside of the ROW. Table C-2 lists the average number of individuals detected per ARU for each species by habitat type.

3.1.1.1 Species at Risk

There were four SAR recorded on ARUs within the ROW: common nighthawk (*Chordeiles minor*), evening grosbeak (*Coccothraustes vespertinus*), olive-sided flycatcher (*Contopus cooperi*), and rusty blackbird (*Euphagus carolinus*) (Table 3). Common nighthawk and olive-sided flycatcher were also observed outside of the ROW (Table 3).

3.1.2 QPAD Approach

Sample size was sufficient to run complex density models using the QPAD method (Solymos et al. 2013; Section 2.5.2.1) for 11 species: alder flycatcher (*Empidonax alnorum*), American robin (*Turdus migratorius*), chipping sparrow (*Spizella passerina*), hermit thrush (*Catharus guttatus*), Lincoln’s sparrow (*Melospiza lincolnii*), palm warbler (*Setophaga palmarum*), Swainson’s thrush (*Catharus ustulatus*), Wilson’s snipe (*Gallinago gallinago*), white-throated sparrow (*Zonotrichia albicollis*), and yellow-rumped warbler (*Setophaga coronata*); statistical offsets were available for these species. Model selection was based on AIC (Table 5), with the exception of models for alder flycatcher and palm warbler, which used BIC due to small sample size (Table 6).

An interaction between habitat type and latitude was the top-ranked model for explaining American robin and hermit thrush densities, while an interaction between habitat and location (inside versus outside of the ROW) was the top-ranked model for chipping sparrow, Lincoln’s sparrow, and yellow-rumped warbler (Table 5). Dark-eyed junco and Swainson’s thrush densities were best explained by interactions among habitat, latitude, and location (Table 5). Interaction between latitude and location was the top-ranked model for alder flycatcher and white-throated sparrow density (Table 5, Table 6). Wilson’s snipe density was best explained by habitat alone (Table 5) and palm warbler density was best explained only by latitude (Table 6).

Dark-eyed junco, alder flycatcher, chipping sparrow, hermit thrush, Lincoln’s sparrow, and white-throated sparrow densities were significantly higher outside of the ROW than inside the ROW (Figure 2, Table 6). Lincoln’s sparrow densities were significantly higher outside of the ROW in dense conifer and significantly higher in open habitats within the ROW (Table 6). Chipping sparrow and dark-eyed junco densities were significantly higher in the ROW

for open and sparse conifer habitats (Table 6). Swainson's thrush densities were significantly higher outside the ROW in open habitats (Table 6).

As latitude increased, dark-eyed juncos were at significantly higher densities inside the ROW (Table 6). The opposite relationship was observed for alder flycatcher, Swainson's thrush, hermit thrush, and white-throated sparrow; the densities of these species were significantly higher outside the ROW at higher latitudes (Table 6).

Effects plots were developed to visualize final model effects for all species (Appendix D; Figures D-1 to D-10). Box plots were used to visualize categorical effects (i.e., habitat) while regression plots were used to visualize continuous variables (i.e., latitude) as a function of predicted density (birds per hectare).

Table 3: Species, Federal and Provincial Status, Total Number of Individuals Detected in the Regional Study Area, and Indication if the Species Detected within the Project Right-of-way on Autonomous Recording Units in 2019

Common Name	Scientific Name	Number of Individuals	Detected in the Project ROW ^(a) in 2019 (Y/N)	COSEWIC Ranking ^(b)	SARA Ranking ^(c)	NWT Ranking ^(d)
alder flycatcher	<i>Empidonax alnorum</i>	35	Y	No Status	No Status	Secure
American bittern	<i>Botaurus lentiginosus</i>	15	Y	No Status	No Status	Sensitive
American robin	<i>Turdus migratorius</i>	78	Y	No Status	No Status	Secure
American three-toed woodpecker	<i>Picoides dorsalis</i>	4	N	No Status	No Status	Secure
black-backed woodpecker	<i>Picoides arcticus</i>	10	N	No Status	No Status	Secure
blackpoll warbler	<i>Setophaga striata</i>	1	N	No Status	No Status	Secure
blue-headed vireo	<i>Vireo solitarius</i>	6	Y	No Status	No Status	Secure
bohemian waxwing	<i>Bombycilla garrulus</i>	5	N	No Status	No Status	Secure
boreal chickadee	<i>Poecile hudsonicus</i>	3	Y	No Status	No Status	Secure
boreal owl	<i>Aegolius funereus</i>	1	N	Not at Risk	No Status	Secure
Canada goose	<i>Branta canadensis</i>	23	Y	No Status	No Status	Secure
Canada jay	<i>Perisoreus canadensis</i>	36	Y	No Status	No Status	Secure
chipping sparrow	<i>Spizella passerina</i>	78	Y	No Status	No Status	Secure
clay-colored sparrow	<i>Spizella pallida</i>	4	N	No Status	No Status	Secure
common loon	<i>Gavia immer</i>	14	Y	Not at Risk	No Status	Secure
common nighthawk	<i>Chordeiles minor</i>	97	Y	Special Concern	Threatened	At Risk
common raven	<i>Corvus corax</i>	9	N	No Status	No Status	Secure
common redpoll	<i>Acanthis flammea</i>	1	N	No Status	No Status	Secure
dark-eyed junco	<i>Junco hyemalis</i>	122	Y	No Status	No Status	Secure
evening grosbeak	<i>Coccothraustes vespertinus</i>	1	Y	Special Concern	No Status	Secure

Table 3: Species, Federal and Provincial Status, Total Number of Individuals Detected in the Regional Study Area, and Indication if the Species Detected within the Project Right-of-way on Autonomous Recording Units in 2019

Common Name	Scientific Name	Number of Individuals	Detected in the Project ROW ^(a) in 2019 (Y/N)	COSEWIC Ranking ^(b)	SARA Ranking ^(c)	NWT Ranking ^(d)
fox sparrow	<i>Passerella iliaca</i>	5	Y	No Status	No Status	Secure
gadwall	<i>Mareca strepera</i>	1	N	No Status	No Status	Undetermined
gray-cheeked thrush	<i>Catharus minimus</i>	1	N	No Status	No Status	Secure
great horned owl	<i>Bubo virginianus</i>	1	Y	No Status	No Status	Secure
hairy woodpecker	<i>Dryobates villosus</i>	3	N	No Status	No Status	Secure
hermit thrush	<i>Catharus guttatus</i>	128	Y	No Status	No Status	Secure
least flycatcher	<i>Empidonax minimus</i>	3	N	No Status	No Status	Secure
LeConte's sparrow	<i>Ammospiza leconteii</i>	3	Y	No Status	No Status	Secure
lesser scaup	<i>Aythya affinis</i>	1	N	No Status	No Status	Sensitive
lesser yellowlegs	<i>Tringa flavipes</i>	38	Y	No Status	No Status	Sensitive
Lincoln's sparrow	<i>Melospiza lincolnii</i>	68	Y	No Status	No Status	Secure
mountain bluebird	<i>Sialia currucoides</i>	2	N	No Status	No Status	Undetermined
Nashville warbler	<i>Leiothlypis ruficapilla</i>	1	Y	No Status	No Status	Undocumented
northern flicker	<i>Colaptes auratus</i>	5	Y	No Status	No Status	Secure
northern goshawk	<i>Accipiter gentilis</i>	1	N	Not at Risk	No Status	Secure
northern shoveler	<i>Spatula clypeata</i>	1	N	No Status	No Status	Secure
northern waterthrush	<i>Parkesia noveboracensis</i>	2	N	No Status	No Status	Secure
olive-sided flycatcher	<i>Contopus cooperi</i>	22	Y	Special Concern	Threatened	At Risk
orange-crowned warbler	<i>Leiothlypis celata</i>	25	Y	No Status	No Status	Secure
pacific loon	<i>Gavia pacifica</i>	15	Y	No Status	No Status	Secure

Table 3: Species, Federal and Provincial Status, Total Number of Individuals Detected in the Regional Study Area, and Indication if the Species Detected within the Project Right-of-way on Autonomous Recording Units in 2019

Common Name	Scientific Name	Number of Individuals	Detected in the Project ROW ^(a) in 2019 (Y/N)	COSEWIC Ranking ^(b)	SARA Ranking ^(c)	NWT Ranking ^(d)
palm warbler	<i>Setophaga palmarum</i>	40	Y	No Status	No Status	Secure
pied-billed grebe	<i>Podilymbus podiceps</i>	5	N	No Status	No Status	Undetermined
pileated woodpecker	<i>Dryocopus pileatus</i>	1	N	No Status	No Status	Secure
pine grosbeak	<i>Pinicola enucleator</i>	1	N	No Status	No Status	Secure
red crossbill	<i>Loxia curvirostra</i>	4	Y	No Status	No Status	Secure
red-breasted nuthatch	<i>Sitta canadensis</i>	1	Y	No Status	No Status	Secure
ruby-crowned kinglet	<i>Regulus calendula</i>	29	Y	No Status	No Status	Secure
rusty blackbird	<i>Euphagus carolinus</i>	1	Y	Special Concern	Special Concern	Sensitive
sandhill crane	<i>Antigone canadensis</i>	34	Y	No Status	No Status	Secure
Savannah sparrow	<i>Passerculus sandwichensis</i>	1	N	No Status	No Status	Secure
sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	3	N	No Status	No Status	Secure
short-billed dowitcher	<i>Limnodromus griseus</i>	2	Y	No Status	No Status	Undetermined
solitary sandpiper	<i>Tringa solitaria</i>	10	Y	No Status	No Status	Secure
sora	<i>Porzana carolina</i>	62	Y	No Status	No Status	Secure
spotted sandpiper	<i>Actitis macularius</i>	1	N	No Status	No Status	Secure
spruce grouse	<i>Falci pennis canadensis</i>	1	N	No Status	No Status	Secure
Swainson's thrush	<i>Catharus ustulatus</i>	116	Y	No Status	No Status	Secure
swamp sparrow	<i>Melospiza georgiana</i>	3	N	No Status	No Status	Secure
Tennessee warbler	<i>Leiostyris peregrina</i>	24	Y	No Status	No Status	Secure
tree swallow	<i>Tachycineta bicolor</i>	4	N	No Status	No Status	Secure

Table 3: Species, Federal and Provincial Status, Total Number of Individuals Detected in the Regional Study Area, and Indication if the Species Detected within the Project Right-of-way on Autonomous Recording Units in 2019

Common Name	Scientific Name	Number of Individuals	Detected in the Project ROW ^(a) in 2019 (Y/N)	COSEWIC Ranking ^(b)	SARA Ranking ^(c)	NWT Ranking ^(d)
warbling vireo	<i>Vireo gilvus</i>	1	N	No Status	No Status	Secure
western wood-pewee	<i>Contopus sordidulus</i>	9	N	No Status	No Status	Secure
white-crowned sparrow	<i>Zonotrichia leucophrys</i>	21	N	No Status	No Status	Secure
white-throated sparrow	<i>Zonotrichia albicollis</i>	116	Y	No Status	No Status	Secure
white-winged crossbill	<i>Loxia leucoptera</i>	12	Y	No Status	No Status	Secure
Wilson's snipe	<i>Gallinago delicata</i>	59	Y	No Status	No Status	Secure
Wilson's warbler	<i>Cardellina pusilla</i>	4	Y	No Status	No Status	Secure
yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	5	Y	No Status	No Status	Secure
yellow-rumped warbler	<i>Setophaga coronata</i>	53	Y	No Status	No Status	Secure

COSEWIC = Committee on the Status of Endangered Wildlife in Canada; m = metres; N = no; NWT = Northwest Territories; ROW = right-of-way; SARA = *Species at Risk Act*; Y = yes

Note: **Bolded** species are species at risk

^(a) ROW = 0 to 60 m from the Old Airport Road centreline (120 m wide corridor).

^(b) COSEWIC (2019)

^(c) SARA (2019)

^(d) *Species at Risk (NWT) Act* (2019)

Table 4: Average Number of Species Detected in each Habitat Type within and outside of the Project Right-of-way.

Stratum	Number of Locations Within ROW ^(a)	Mean Richness ($\pm$ 95% CI) Within ROW ^(a)	Number of Locations Outside ROW ^(b)	Mean Richness ($\pm$ 95% CI) Outside ROW ^(b)
Deciduous	3	11.0 $\pm$ 11.4	6	12.8 $\pm$ 2.3
Dense conifer	2	10.0 $\pm$ 12.7	13	16.8 $\pm$ 1.9
Open	1	19.0 ^(c)	5	19.2 $\pm$ 3.4
Recently disturbed ^(d)	0	NA	1	15.0 ^(c)
Sparse conifer	11	15.8 $\pm$ 1.8	13	15.5 $\pm$ 2.2
Wetlands	0	NA	5	19.0 $\pm$ 3.6

CI = confidence interval; ROW = right-of-way; m = metres; NA = not applicable

(a) Within 0 to 60 m from the Old Airport Road centreline (120 m corridor)

(b) Within 61 to 200 m from the Old Airport Road centreline (400 m corridor)

(c) Only mean presented as sample size was insufficient to calculate 95% confidence interval.

(d) Recent disturbance did not include additional forest fire data per recommendations by ECCC and ENR (Golder 2018a).

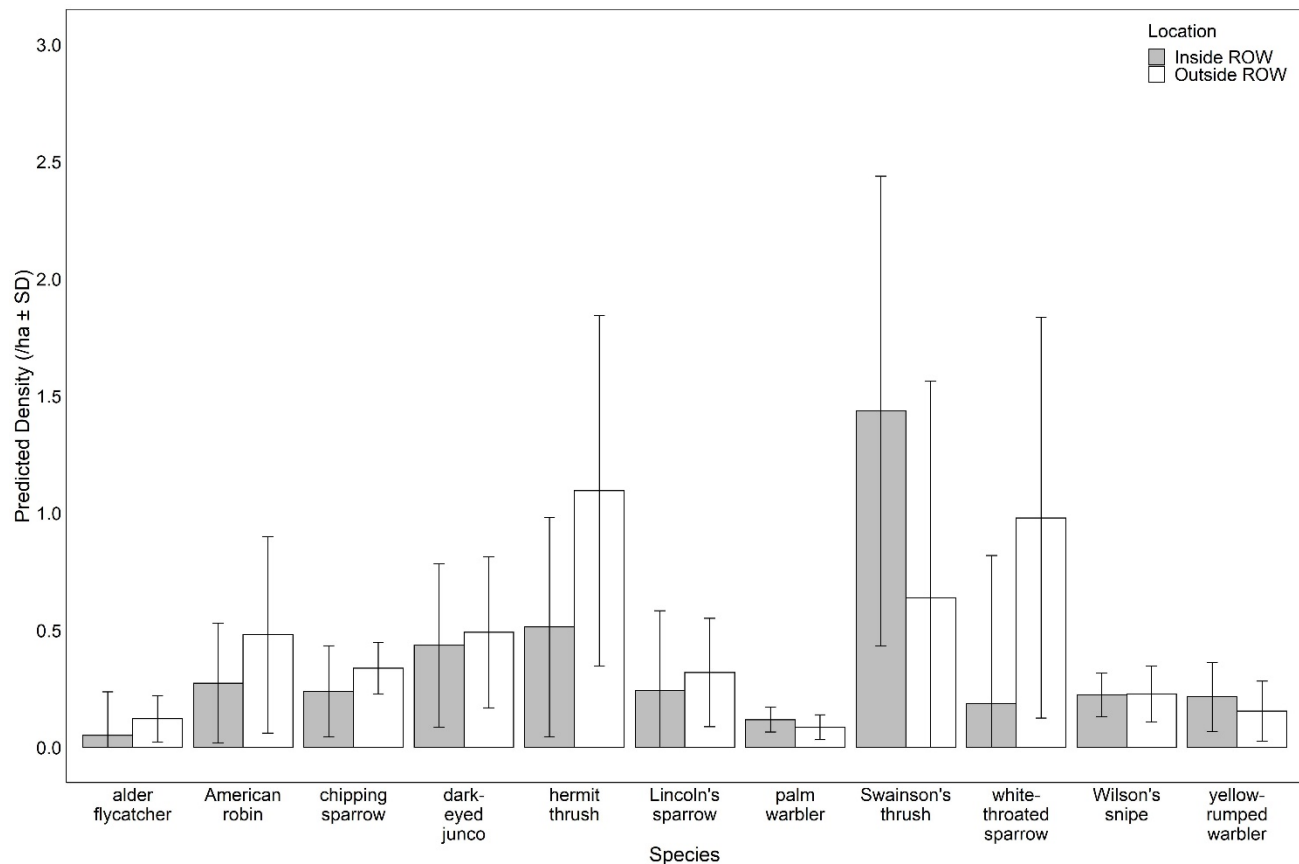
**Figure 2: Predicted Densities ($\pm$ Standard Deviation) of Bird Species in and out of the Project right-of-way for Species with Adequate Data to Complete QPAD Models.**

Table 5: Candidate Models and Akaike's Information Criteria Scores for QPAD Models.

Species	Model Parameters	AIC ^(a)	Δ AIC ^(b)
American robin	Habitat * Latitude	1,383.65	0.00
	Habitat * Latitude * Location	1,383.98	0.34
	Latitude * Location	1,403.88	20.23
	Habitat + Latitude	1,404.05	20.40
	Latitude	1,406.51	22.87
	Habitat * Location	1,436.86	53.22
	Habitat + Latitude	1,437.45	53.81
	Habitat	1,444.90	61.26
	Location	1,487.03	103.38
chipping sparrow	Habitat * Location	1,248.29	0.00
	Habitat * Latitude	1,252.54	4.25
	Latitude	1,252.84	4.55
	Habitat + Latitude	1,253.13	4.84
	Latitude * Location	1,255.41	7.12
	Habitat	1,268.68	20.39
	Habitat + Location	1,270.08	21.79
	Location	1,296.71	48.42
	Habitat * Latitude * Location	1,238.99	NA ^(c)
dark-eyed junco	Habitat * Latitude * Location	1,480.14	0.00
	Habitat * Latitude	1,482.05	1.91
	Habitat + Latitude	1,485.98	5.84
	Habitat * Location	1,488.09	7.95
	Latitude * Location	1,489.24	9.10
	Latitude	1,489.50	9.36
	Location	1,492.80	12.66
	Habitat + Location	1,496.22	16.08
	Habitat	1,497.07	16.93

Table 5: Candidate Models and Akaike's Information Criteria Scores for QPAD Models.

Species	Model Parameters	AIC ^(a)	Δ AIC ^(b)
hermit thrush	Latitude * Location	3,849.20	0.00
	Habitat * Latitude	3,852.48	3.28
	Habitat + Latitude	3,863.53	14.33
	Latitude	3,874.47	25.27
	Habitat * Location	3,939.30	90.10
	Location	3,943.94	94.74
	Habitat + Location	3,944.19	94.99
	Habitat	3,998.93	149.73
	Habitat * Latitude * Location	3,762.99	NA ^(c)
Lincoln's sparrow	Habitat * Location	1,200.97	0.00
	Habitat * Latitude	1,205.69	4.72
	Habitat + Location	1,237.54	36.57
	Habitat	1,237.80	36.83
	Habitat + Latitude	1,237.85	36.88
	Location	1,254.77	53.80
	Latitude * Location	1,257.81	56.84
	Latitude	1,258.40	57.43
	Habitat * Latitude * Location	1,155.16	NA ^(c)
Swainson's thrush	Habitat * Latitude * Location	4,293.24	0.00
	Habitat * Latitude	4,328.57	35.33
	Habitat + Latitude	4,406.10	112.86
	Latitude * Location	4,419.76	126.52
	Latitude	4,478.14	184.90
	Habitat * Location	4,570.01	276.77
	Habitat + Location	4,587.76	294.52
	Habitat	4,613.79	320.55
	Location	4,805.21	511.97

Table 5: Candidate Models and Akaike's Information Criteria Scores for QPAD Models.

Species	Model Parameters	AIC ^(a)	Δ AIC ^(b)
Wilson's snipe	Habitat	1,036.55	0.00
	Habitat + Latitude	1,037.19	0.65
	Habitat + Location	1,037.83	1.28
	Habitat * Location	1,038.01	1.47
	Habitat * Latitude	1,039.40	2.86
	Latitude * Location	1,054.15	17.60
	Latitude	1,063.39	26.85
	Location	1,069.11	32.57
	Habitat * Latitude * Location	1,033.92	NA ^(c)
White-throated sparrow	Latitude * Location	1,487.78	0.00
	Habitat * Latitude	1,573.89	86.11
	Latitude	1,594.30	106.52
	Habitat + Latitude	1,598.70	110.92
	Habitat * Location	1,725.31	237.53
	Habitat + Location	1,767.67	279.89
	Habitat	1,863.95	376.17
	Location	1,878.48	390.70
	Habitat * Latitude * Location	1,455.91	NA ^(c)
Yellow-rumped warbler	Habitat * Latitude	783.86	0.00
	Habitat + Latitude	790.73	6.87
	Habitat * Location	791.63	7.77
	Latitude * Location	793.89	10.02
	Location	795.12	11.26
	Habitat + Location	795.87	12.00
	Latitude	797.75	13.89
	Habitat	807.05	23.19
	Habitat * Latitude * Location	777.29	NA ^(c)

(a) Akaike's Information Criterion.

(b) Change in AIC between the given model and the first model listed per response variable.

(c) Not applicable because the model did not converge

Table 6: Candidate Models and Bayesian Information Criteria Scores for QPAD Models.

Species	Model Parameters	BIC ^(a)	Δ BIC ^(b)
alder flycatcher	Latitude * Location	549.58	0.00
	Habitat * Latitude	561.37	11.80
	Latitude	566.35	16.78
	Habitat + Latitude	567.89	18.32
	Habitat	589.84	40.26
	Habitat * Latitude * Location	590.22	40.65
	Habitat + Location	593.49	43.92
	Habitat * Location	598.67	49.10
	Location	607.78	58.20
	Null	611.33	61.75
palm warbler	Latitude	541.60	0.00
	Null	550.13	8.53
	Latitude * Location	552.24	10.63
	Location	556.82	15.21
	Habitat	557.74	16.13
	Habitat + Latitude	558.78	17.18
	Habitat + Location	561.43	19.82
	Habitat * Latitude	572.96	31.36
	Habitat * Location	578.02	36.42
	Habitat * Latitude * Location	602.63	61.03

^(a) Bayesian Information Criterion.^(b) Change in BIC between the given model and the first model listed per response variable.

Table 7: Coefficients for Top-Ranked Models for Species with Adequate Data to Complete QPAD Models

Species	Model Coefficients																			
	Intercept	Dense Conifer ^(a)	Open ^(a)	Sparse Conifer ^(a)	Wetlands ^(a)	Location ^(b)	Latitude	Dense Conifer * Location ^(a,b)	Open * Location ^(a,b)	Sparse Conifer * Location ^(a,b)	Wetlands * Location ^(a,b)	Latitude * Location ^(b)	Dense Conifer * Latitude ^(a)	Open * Latitude ^(a)	Sparse Conifer * Latitude ^(a)	Wetlands * Latitude ^(a)	Dense Conifer * Latitude * Location ^(a,b)	Open * Latitude * Location ^(a,b)	Sparse Conifer * Latitude * Location ^(a,b)	Wetlands * Latitude * Location ^(a,b)
alder flycatcher	-3.63					1.20	-4.46					3.83								
American robin	-1.48	0.43	0.95**	0.46	2.05		-0.89						0.43	0.6764*	0.1303	1.82				
chipping sparrow	-3.73	0.41	3.66	2.53*	1.10	2.02		0.49	-2.80**	-2.15*	NA									
dark-eyed junco	-4.56*	2.43	3.34	4.35*	-0.18*	4.57*	3.11*	-3.00	-3.74*	-4.38*	NA	-3.43*	-3.11	0.01	-2.88	0.36	2.95	NA	3.01*	NA
hermit thrush	0.31**					0.26*	-0.84					0.52								
Lincoln's sparrow	-1.37	-1.67	1.96	0.15	-0.59	0.20		2.41*	-1.72**	0.26	NA									
palm warbler	-1.72						0.42													
Swainson's thrush	-0.44	0.06	-0.27	1.03	0.35	-0.64	0.83	0.30	3.31**	0.28	NA	0.50	0.06	4.02	-0.43	0.54	0.05	NA	-0.42	NA
Wilson's snipe	3.41	0.7368*	1.63	0.9461**	0.35															
white-throated sparrow	-2.25					1.55	-3.91					3.14								
yellow-rumped warbler	-2.12	0.88	1.17	1.17	1.19		0.74						0.39	-0.48	-0.56	0.95				

Note: p-values: "**bolded text**" = p<0.001, "***" = p<0.01, "**" = p<0.05

^(a) Habitat is a categorical variable that includes five categories. The coefficient is comparing dense conifer, open, sparse conifer, and wetland habitats to the reference condition deciduous forest

^(b) Location is a categorical variable that includes two categories. The coefficient is comparing "outside the ROW" (i.e., within 61 to 200 m from the Old Airport Road centreline) to the reference condition "within the ROW" (i.e., within 0 to 60 m from the Old Airport Road centreline)

3.1.3 Occupancy Models

Sample size was sufficient to run occupancy models (Section 2.5.2.2) for eight species: Canada jay (*Perisoreus canadensis*), common nighthawk, orange-crowned warbler (*Leiothlypis celata*), olive-sided flycatcher, ruby-crowned kinglet (*Regulus calendula*), sora (*Porzana carolina*), Tennessee warbler (*Leiothlypis peregrina*), and white-crowned sparrow (*Zonotrichia leucophrys*).

Common nighthawk and olive-sided flycatcher occupancy was best explained by the model containing only latitude; the probability of occupancy for both species declined as latitude increased (Table 8, Table 9). The probability of Canada jay and Tennessee warbler occupancy was also best explained by the model containing latitude but probability of occupancy increased for these species with increasing latitude (Table 8, Table 9). The ruby-crowned kinglet model revealed a quadratic relationship with latitude, indicating a peak occupancy at an intermediate latitude (Table 8, Table 9). White-crowned sparrow occupancy was best explained by location (in or out of the ROW); the probability of occupancy was higher outside the ROW (Figure 3, Table 8, Table 9). The probability of orange-crowned warbler occupancy was best explained by an interaction between latitude and location (Table 8). Orange-crowned warbler occupancy was higher within the ROW and also at lower latitudes; however, there is a positive relationship between probability of occupancy and the interaction between latitude and location (Table 9). Variables considered in the occupancy models did not explain sora density; the null model was the highest ranked model for this species (Table 8).

Effects plots were made to visualize covariate effects in the final occupancy models (Figures B11-B14). Regression plots were used to visualize the effect of latitude on predicted probability of occupancy.

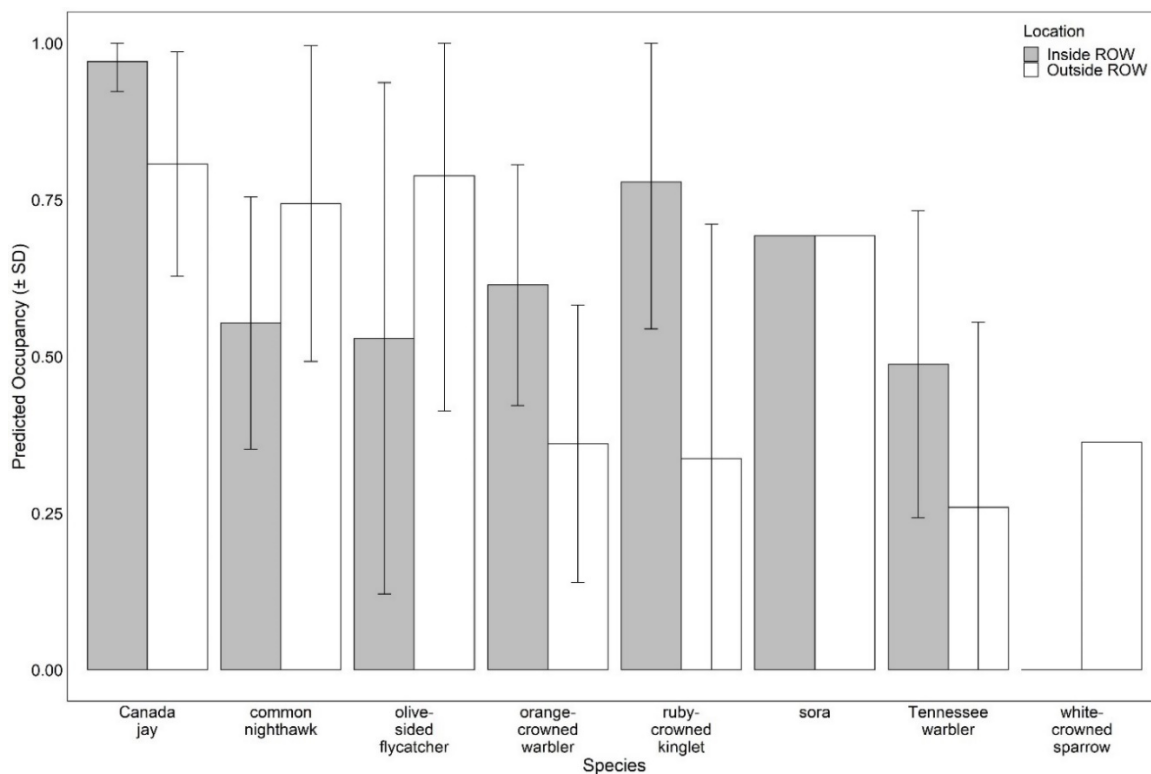


Figure 3: Predicted Occupancy (± Standard Deviation) of Bird Species in and out of the Project right-of-way for Species with Adequate Data to Complete Occupancy Models.

Table 8: Candidate Models and Akaike's Information Criteria Scores for Occupancy Models

Species	Model Parameters	AIC ^(a)	ΔAIC ^(b)	AIC Weight ^(c)
Canada Jay	Psi(Latitude),p(.)	207.28	0.00	0.19
	Psi(Latitude * Location),p(.)	208.46	1.18	0.11
	Psi(.),p(.)	208.59	1.31	0.10
	Psi(Habitat),p(.)	209.05	1.77	0.08
	Psi(Latitude + Latitude2),p(.)	209.35	2.07	0.07
	Psi(Location),p(.)	210.59	3.31	0.04
	Psi(Habitat + Location),p(.)	210.73	3.45	0.03
	Psi(Habitat * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat + Latitude),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
common nighthawk	Psi(Latitude),p(.)	219.25	0.00	0.54
	Psi(Latitude * Location),p(.)	219.81	0.56	0.41
	Psi(Habitat * Latitude),p(.)	225.44	6.19	0.03
	Psi(Habitat + Latitude),p(.)	225.82	6.57	0.02
	Psi(.),p(.)	233.41	14.16	<0.01
	Psi(Location),p(.)	233.92	14.67	<0.01
	Psi(Habitat),p(.)	235.35	16.10	<0.01
	Psi(Habitat + Location),p(.)	236.98	17.73	<0.01
	Psi(Habitat * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)

Table 8: Candidate Models and Akaike's Information Criteria Scores for Occupancy Models

Species	Model Parameters	AIC ^(a)	ΔAIC ^(b)	AIC Weight ^(c)
olive-sided flycatcher	Psi(Latitude),p(.)	144.20	0.00	0.42
	Psi(Habitat),p(.)	151.81	7.61	0.01
	Psi(Habitat + Location),p(.)	153.79	9.59	<0.01
	Psi(.),p(.)	154.24	10.04	0.00
	Psi(Location),p(.)	156.24	12.04	<0.01
	Psi(Habitat * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat + Latitude),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
orange-crowned warbler	Psi(Latitude * Location),p(.)	162.04	0.00	0.69
	Psi(Latitude),p(.)	164.71	2.67	0.18
	Psi(Location),p(.)	167.13	5.09	0.05
	Psi(.),p(.)	167.77	5.73	0.04
	Psi(Habitat + Latitude),p(.)	169.82	7.78	0.01
	Psi(Habitat),p(.)	170.10	8.06	0.01
	Psi(Habitat + Location),p(.)	171.23	9.19	0.01
	Psi(Habitat * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude),p(.)	NA ^(d)	NA ^(d)	NA ^(d)

Table 8: Candidate Models and Akaike's Information Criteria Scores for Occupancy Models

Species	Model Parameters	AIC ^(a)	ΔAIC ^(b)	AIC Weight ^(c)
ruby-crowned kinglet	Psi(Latitude + Latitude2),p(.)	148.55	0.00	0.76
	Psi(Latitude),p(.)	151.53	2.98	0.17
	Psi(Latitude * Location),p(.)	153.83	5.28	0.05
	Psi(Habitat + Latitude),p(.)	156.34	7.79	0.02
	Psi(Habitat + Location),p(.)	174.43	25.88	<0.01
	Psi(Habitat),p(.)	176.04	27.49	<0.01
	Psi(Location),p(.)	176.49	27.94	<0.01
	Psi(.),p(.)	182.69	34.14	<0.01
	Psi(Habitat * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
sora	Psi(.),p(.)	227.74	0.00	0.40
	Psi(Location),p(.)	228.99	1.25	0.21
	Psi(Latitude * Location),p(.)	229.30	1.56	0.18
	Psi(Latitude),p(.)	229.41	1.67	0.17
	Psi(Habitat),p(.)	233.89	6.15	0.02
	Psi(Habitat + Location),p(.)	235.71	7.97	0.01
	Psi(Habitat + Latitude),p(.)	235.81	8.07	0.01
	Psi(Habitat * Latitude),p(.)	237.55	9.81	<0.01
	Psi(Habitat * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)

Table 8: Candidate Models and Akaike's Information Criteria Scores for Occupancy Models

Species	Model Parameters	AIC ^(a)	ΔAIC ^(b)	AIC Weight ^(c)
Tennessee warbler	Psi(Latitude),p(.)	118.91	0.00	0.39
	Psi(Habitat + Latitude),p(.)	118.98	0.07	0.37
	Psi(Latitude + Latitude2),p(.)	120.60	1.69	0.17
	Psi(Latitude * Location),p(.)	122.33	3.42	0.07
	Psi(Location),p(.)	132.83	13.92	<0.01
	Psi(.),p(.)	135.59	16.68	<0.01
	Psi(Habitat + Location),p(.)	138.60	19.69	<0.01
	Psi(Habitat),p(.)	140.50	21.59	<0.01
	Psi(Habitat * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
white-crowned sparrow	Psi(Location),p(.)	109.03	0.00	0.53
	Psi(Latitude * Location),p(.)	111.15	2.12	0.18
	Psi(Habitat + Location),p(.)	111.16	2.13	0.18
	Psi(Latitude),p(.)	113.56	4.53	0.06
	Psi(Habitat),p(.)	115.88	6.85	0.02
	Psi(.),p(.)	117.05	8.02	0.01
	Psi(Habitat * Latitude),p(.)	117.47	8.44	0.01
	Psi(Habitat + Latitude),p(.)	117.48	8.45	0.01
	Psi(Habitat * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)
	Psi(Habitat * Latitude * Location),p(.)	NA ^(d)	NA ^(d)	NA ^(d)

Note: Psi indicates variables tested in relation to occupancy, p indicates variables tested in relation to detection probability. Psi(.) indicates the null model for occupancy and p(.) indicates the null model for detection probability.

^(a) Akaike's Information Criterion.

^(b) Change in AIC between the given model and the first model listed per response variable.

^(c) The probability that the given model is best suited to the data relative to all candidate models

^(d) Not applicable because the model did not converge

Table 9: Coefficients and Probability of Detection Estimates for Top-Ranked Occupancy Models

Species	Detection Estimate ^(a)	Intercept	Location ^(b)	Latitude	Latitude ^{2(c)}	Latitude * Location
Canada jay	0.30	3.10		2.32		
common nighthawk	0.55	1.10**		-1.39		
orange-crowned warbler	0.45	1.40	-1.81	-1.39		2.41*
olive-sided flycatcher	0.21	3.45		-4.94*		
ruby-crowned kinglet	0.53	1.28		4.08**	-2.88**	
sora	0.52	0.81*				
Tennessee warbler	0.45	-1.16*		1.78**		
white-crowned sparrow	0.45	-9.65	9.09			

Note: P-values: "***" = $p < 0.01$, "**" = $p < 0.05$

(a) Detection estimate is the probability that a species will be detected if the species is present at a location.

(b) Location is a categorical variable that includes two categories. The coefficient is comparing "outside the ROW" (i.e., within 61 to 200 m from the Old Airport Road centreline) to the reference condition "within the ROW" (i.e., within 0 to 60 m from the Old Airport Road centreline)

(c) Latitude as a quadratic term

4.0 DISCUSSION

Overall, sample size was a limiting factor for using the QPAD approach, which is the modelling approach suggested by ECCC (2018). The Project is located at the northern range limit for many bird species and so species are expected to occur at relatively low densities in this region. This effect was shown by the occupancy models for common nighthawk and olive-sided flycatcher, which had lower probability of occupancy at higher latitudes. These results are consistent with range maps available for both common nighthawk (Brigham et al. 2011) and olive-sided flycatcher (Altman and Sallabanks 2012).

The 11 species that had sufficient sample sizes for the QPAD approach are common species and most of these species are habitat generalists. Of the 11 species for which density models could be estimated, seven contained the ROW variable in the final model. Density estimates inside the ROW were only higher for Swainson's thrush, and it is interactive with latitude and habitat. These results suggest that overall, even common species are avoiding the ROW, although that effect may be buffered or intensified by latitude or habitat. Avoidance of existing disturbance (i.e., the Old Airport Road; Figures 2 and 3) may explain why birds tend to have higher densities outside of the ROW than inside the ROW.

One constraint with the use of ARUs to conduct point counts is an inability to estimate sampling area for each species at each ARU, thus inhibiting direct estimation of density. The QPAD approach allows for studies to model the edr for each species as a function of forest density to account for differences in detection distance caused by vegetation. Investing additional effort to collect forest density data within 50 m of each ARU could allow the assumption of equal detection area at each sampling location to be relaxed. By using this assumption, differences in bird density may be masked by differences in detectability across survey locations.

The occupancy models revealed latitude to be a strong driver of probability of occupancy for six out of eight species tested. In most cases, increasing latitude was associated with a decreasing probability of occupancy. However, for the Tennessee warbler and Canada jay, the probability of occupancy increased with latitude. This result might be driven by detectability rather than occupancy, as northern populations likely have later nesting periods and may remain vocally active later in the season than southern populations (Ralph et al. 1993). High densities of Tennessee warbler at the higher latitudes in this study could also be indicative of a northern range expansion for this species.

Of the SAR detected in 2019, rusty blackbird, olive-sided flycatcher, and common nighthawk were assessed as valued components in the EA for the Project. As it was listed following the preparation of the EA, the evening grosbeak was not explicitly assessed in the EA. While evening grosbeak was detected inside the ROW, ARUs may not be appropriate for identifying habitat use. Evening grosbeaks do not sing, and most vocalizations are delivered in flight (Gillihan and Byers 2001); therefore, detection at an ARU station does not constitute habitat use as it does with other passerines. Furthermore, evening grosbeak uses similar habitats to olive-sided flycatcher.

Of the bird species that were assessed as valued components in the EA, bank swallow (*Riparia riparia*), barn swallow (*Hirundo rustica*), horned grebe (*Podiceps auritus*), yellow rail (*Coturnicops noveboracensis*), red-necked phalarope (*Phalaropus lobatus*), peregrine falcon (*Falco peregrinus*), and short-eared owl (*Asio flammeus*) were not recorded on the ARUs in 2019. Although these species were not detected on ARUs in 2019, these species were assumed to be present in and around the Project ROW and were assessed as such in the EA for the Project. Using ARUs is not an adequate survey method for red-necked phalarope, peregrine falcon, and short-eared owl and so not detecting these species on the ARUs is not surprising. Horned grebe and yellow rail have potential to be detected using ARUs and other wetland species (e.g., American bittern) were detected on ARUs in 2019 (Table 3).

Aligning the Project along the existing Old Airport Road, as much as possible, is expected to limit residual effects to bird SAR and migratory birds. Mitigation presented in the EA for the Project is anticipated to be sufficient to limit effects on bird SAR and migratory birds; no additional mitigation is suggested based on the results of the 2019 baseline study.

5.0 CLOSURE

We trust the information contained in this technical memorandum is sufficient for your present needs. If you require any further information, please do not hesitate to contact us.

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APPENDIX A

ARU Deployment Location and Vegetation Data

Table A-1: TASR ARU Deployment Location and Vegetation Data

ARU ID	UTM Coordinates (NAD 83)		Deployment Date	Retrieval Date	Landcover Classification	Observed Habitat	Canopy Coverage %	Dominant Tree Species		Burn Present?
	Easting	Northing						Tree	Shrub	
TR-02-01	501598	7002253	30/03/2019	12/07/2019	Deciduous	Sparse conifer/Deciduous	20%	Tamarack/Spruce	Alder	No
TR-02-02	501640	7001529	30/03/2019	12/07/2019	Sparse conifer	Dense conifer	30%	Pine	Soap berry	Yes/New growth
TR-02-04	502286	6998211	30/03/2019	12/07/2019	Deciduous	Sparse conifer	50%	Pine	Willow	Yes
TR-02-05	501269	6995899	30/03/2019	06/07/2019	Deciduous	Deciduous/Sparse conifer	10%	Tamarack/Spruce	Alder	No
TR-02-06	501384	6994903	30/03/2019	06/07/2019	Sparse conifer	Deciduous/Sparse conifer	95%	Tamarack/Spruce	Alder	No
TR-02-08	501556	6993387	30/03/2019	06/07/2019	Deciduous	Deciduous/Sparse conifer	5%	Tamarack/Spruce	Alder	No
TR-02-09	501802	6993097	30/03/2019	06/07/2019	Deciduous	Deciduous/Sparse conifer	20%	Tamarack/Spruce	Alder	No
TR-02-11	503075	6989714	29/03/2019	06/07/2019	Deciduous	Deciduous/Sparse conifer	60%	Pine/Aspen	Soap berry/willow	No
TR-02-12	503321	6989412	29/03/2019	06/07/2019	Deciduous	Dense conifer	60%	Pine	Alder	No
TR-02-13	503588	6987514	29/03/2019	06/07/2019	Sparse conifer	Sparse conifer	30%	Pine	Alder	No
TR-02-14	503780	6985755	29/03/2019	06/07/2019	Sparse conifer	Deciduous	95%	Aspen/Spruce	Willow	No
TR-02-16	504444	6982675	29/03/2019	05/07/2019	Dense conifer	Sparse Conifer	100%	Tamarack/Spruce	Alder	No
TR-02-17	504767	6982121	29/03/2019	05/07/2019	Deciduous	Dense/Sparse conifer	5%	Pine	n/a	Yes/New growth
TR-02-18	505420	6980952	29/03/2019	05/07/2019	Sparse conifer	Sparse conifer	40%	Pine/Spruce	Alder	No
TR-02-19	506098	6979712	29/03/2019	05/07/2019	Deciduous	Dense conifer	70%	Pine/Spruce	Alder	No
TR-02-20	507010	6977516	29/03/2019	05/07/2019	Deciduous	Sparse conifer	70%	Pine	Alder	No
TR-02-21	506811	6975642	29/03/2019	05/07/2019	Sparse conifer	Dense conifer	60%	Pine/Spruce	Alder	n/a
TR-02-24	506548	6972728	29/03/2019	05/07/2019	Dense conifer	Dense conifer	50%	Spruce/Pine	Willow	No
TR-02-25	507282	6971020	29/03/2019	05/07/2019	Dense conifer	Dense conifer	50%	Spruce/Pine	n/a	No
TR-02-26	507741	6969656	29/03/2019	05/07/2019	Sparse conifer	Sparse conifer	70%	Pine/Spruce	Alder	No
TR-02-27	508141	6968146	29/03/2019	05/07/2019	Wetlands	Sparse conifer	5%	Tamarack/Spruce	Alder	n/a
TR-02-28	508245	6967622	29/03/2019	05/07/2019	Sparse conifer	Sparse conifer	30%	Spruce/Pine	Alder	No
TR-02-29	508187	6965337	29/03/2019	05/07/2019	Sparse conifer	Sparse conifer	5%	Spruce/Pine	Alder	No
TR-02-30	508262	6963368	29/03/2019	05/07/2019	Sparse conifer	Sparse conifer	5%	Pine/Spruce	n/a	No
TR-02-31	509511	6961012	29/03/2019	05/07/2019	Wetlands	Wetland	5%	Spruce	n/a	No
TR-02-32	509292	6959943	29/03/2019	05/07/2019	Sparse conifer	Sparse conifer	5%	Spruce/Tamarack	n/a	No
TR-02-33	508981	6959154	28/03/2019	05/07/2019	Wetlands	Sparse conifer/Wetland	n/a	Spruce/Pine	n/a	No
TR-02-34	508748	6958636	28/03/2019	05/07/2019	Dense conifer	Dense Conifer	30%	Spruce	Spruce	No
TR-02-35	508725	6958038	28/03/2019	05/07/2019	Sparse conifer	Sparse conifer/Wetland	10%	Spruce/Tamarack	Spruce	No
TR-02-36	508514	6957342	28/03/2019	05/07/2019	Dense conifer	Dense conifer	20%	Spruce	Birch	No
TR-02-37	507759	6954680	28/03/2019	05/07/2019	Sparse conifer	Dense conifer	40%	Spruce	Willow	No
TR-02-38	507372	6953416	28/03/2019	05/07/2019	Open	Sparse conifer	5%	Pine/Aspen	Spruce	New growth
TR-02-39	507448	6952632	28/03/2019	04/07/2019	Open	Open	5%	Spruce/Tamarack	Alder	No
TR-02-40	507556	6951494	28/03/2019	04/07/2019	Sparse conifer	Dense conifer	5%	Pine	Soap Berry	New growth
TR-02-41	507643	6950738	28/03/2019	04/07/2019	Open	Open	n/a	Pine	Aspen	Yes
TR-02-43	508157	6948060	28/03/2019	04/07/2019	Dense conifer	Wetland	<5%	Spruce/Tamarack	Alder	No
TR-02-44	506866	6946810	28/03/2019	04/07/2019	Sparse conifer	Sparse conifer	30%	Pine/Spruce	Aspen	No
TR-02-45	506442	6945653	28/03/2019	04/07/2019	Dense conifer	Dense conifer	40%	Pine/Aspen	Aspen	Yes
TR-02-46	507043	6943418	28/03/2019	04/07/2019	Dense conifer	Open	10%	Pine	Soap Berry	Yes
TR-02-47	507727	6942026	28/03/2019	04/07/2019	Dense conifer	Wetland/Open	30%	Pine	Aspen	Yes
TR-02-48	507861	6941223	28/03/2019	04/07/2019	Open	Sparse Conifer	10%	Pine	Aspen	Yes
TR-02-49	501598	7002253	28/03/2019	04/07/2019	Sparse conifer	Dense Conifer	20%	Pine	n/a	Yes
TR-02-51	501640	7001529	28/03/2019	04/07/2019	Open	Open	0%	Pine	Alder/Aspen	Yes
TR-02-52	502286	6998211	28/03/2019	04/07/2019	Dense conifer	Dense Conifer	10%	Pine/Aspen	Aspen	Yes
TR-02-53	501269	6995899	28/03/2019	04/07/2019	Open	Open	10%	Pine	n/a	Yes
TR-02-54	501384	6994903	28/03/2019	04/07/2019	Sparse conifer	Wetland	10%	Pine	Aspen	Yes
TR-02-56	501556	6993387	28/03/2019	04/07/2019	Dense conifer	Wetland	5%	Aspen/Pine	Willow/Aspen	Yes
TR-02-57	501802	6993097	28/03/2019	04/07/2019	Dense conifer	Dense conifer	<5%	Pine	Willow/Aspen	Yes
TR-02-58	503075	6989714	28/03/2019	04/07/2019	Sparse conifer	Dense conifer	50%	Pine/Aspen	Aspen	Yes
TR-02-60	503321	6989412	28/03/2019	03/07/2019	Dense conifer	Dense conifer	10%	Pine	n/a	Yes
TR-02-61	503588	6987514	28/03/2019	03/07/2019	Open	Open	5%	Pine	n/a	Yes
TR-02-62	503780	6985755	27/03/2019	04/07/2019	Wetlands	Wetland	10%	Pepper/Spruce	Aspen	No
TR-02-63	504444	6982675	27/03/2019	03/07/2019	Wetlands	Dense conifer	60%	Spruce/Pine	n/a	No
TR-02-64	504767	6982121	27/03/2019	03/07/2019	Wetlands	Dense conifer	50%	Pine/Birch	Aspen	Yes
TR-02-65	505420	6980952	27/03/2019	03/07/2019	Wetlands	Sparse Conifer	15%	Pine	Aspen	Yes
TR-02-66	506098	6979712	27/03/2019	03/07/2019	Open	Open	10%	Pine	Pine	Yes
TR-02-67	507010	6977516	27/03/2019	03/07/2019	Dense conifer	Open	30%	Pine	Aspen	Yes
TR-02-68	506811	6975642	27/03/2019	03/07/2019	Dense conifer	Open	30%	Pine	Alder	Yes
TR-02-69	506548	6972728	27/03/2019	03/07/2019	Open	Sparse Conifer	30%	Pine	Aspen	Yes
TR-02-70	507282	6971020	27/03/2019	03/07/2019	Open	Sparse Conifer	20%	Pine	Aspen	Yes

APPENDIX B

Modals Used for Estimating Singing Rate in QPAD Models

Table B-1: Models Used for Estimating Singing Rate in QPAD Models

Species	Singing rate (sra) model
chipping sparrow	JDAY + TSSR + TSSR2
dark-eyed junco	JDAY + JDAY2 + TSSR + TSSR2
hermit thrush	TSSR + TSSR2
Lincoln's sparrow	JDAY + TSSR + TSSR2
Swainson's thrush	TSSR + TSSR2
Wilson's snipe	JDAY + JDAY2 + TSSR
white-throated sparrow	JDAY + JDAY2 + TSSR + TSSR2
yellow-rumped warbler	JDAY + TSSR + TSSR2
alder flycatcher	JDAY + JDAY2 + TSSR + TSSR2
palm warbler	JDAY + TSSR + TSSR2

JDAY = Julian date; JDAY2 = Julian date²; TSSR = Time since sunrise; TSSR2 = Time since sunrise²

APPENDIX C

2019 ARU Results

Table C-1. Mean Number of Individuals Detected and 95% Confidence Intervals Within and Outside of Project Right-of-way.

Common Name	Scientific Name	Mean Number of Individuals ($\pm$ 95% CI) Within ROW ^(a)	Mean Number of Individuals ($\pm$ 95% CI) Outside ROW ^(b)
alder flycatcher	<i>Empidonax alnorum</i>	0.24 $\pm$ 0.39	0.72 $\pm$ 0.30
American bittern	<i>Botaurus lentiginosus</i>	0.35 $\pm$ 0.25	0.21 $\pm$ 0.13
American robin	<i>Turdus migratorius</i>	0.82 $\pm$ 0.33	1.49 $\pm$ 0.21
American three-toed woodpecker	<i>Picoides dorsalis</i>	-	0.09 $\pm$ 0.11
black-backed woodpecker	<i>Picoides arcticus</i>	-	0.23 $\pm$ 0.15
blue-headed vireo	<i>Vireo solitarius</i>	0.18 $\pm$ 0.20	0.07 $\pm$ 0.08
blackpoll warbler	<i>Setophaga striata</i>	-	0.02 $\pm$ 0.05
boreal chickadee	<i>Poecile hudsonicus</i>	0.12 $\pm$ 0.17	0.02 $\pm$ 0.05
boreal owl	<i>Aegolius funereus</i>	-	0.02 $\pm$ 0.05
bohemian waxwing	<i>Bombycilla garrulus</i>	-	0.12 $\pm$ 0.12
Canada jay	<i>Perisoreus canadensis</i>	0.65 $\pm$ 0.31	0.58 $\pm$ 0.15
Canada goose	<i>Branta canadensis</i>	0.35 $\pm$ 0.25	0.40 $\pm$ 0.15
clay-coloured sparrow	<i>Spizella pallida</i>	-	0.09 $\pm$ 0.09
chipping sparrow	<i>Spizella passerina</i>	1.18 $\pm$ 0.55	1.35 $\pm$ 0.25
common loon	<i>Gavia immer</i>	0.18 $\pm$ 0.20	0.26 $\pm$ 0.15
common nighthawk	<i>Chordeiles minor</i>	1.00 $\pm$ 0.48	1.86 $\pm$ 0.47
common raven	<i>Corvus corax</i>	-	0.21 $\pm$ 0.13
common redpoll	<i>Acanthis flammea</i>	-	0.02 $\pm$ 0.05
dark-eyed junco	<i>Junco hyemalis</i>	2.06 $\pm$ 0.56	2.02 $\pm$ 0.21
evening grosbeak	<i>Coccothraustes vespertinus</i>	0.06 $\pm$ 0.12	-
fox sparrow	<i>Passerella iliaca</i>	0.18 $\pm$ 0.20	0.05 $\pm$ 0.07
gadwall	<i>Mareca strepera</i>	-	0.02 $\pm$ 0.05
gray-cheeked thrush	<i>Catharus minimus</i>	-	0.02 $\pm$ 0.05
great horned owl	<i>Bubo virginianus</i>	0.06 $\pm$ 0.12	-

Table C-1. Mean Number of Individuals Detected and 95% Confidence Intervals Within and Outside of Project Right-of-way.

Common Name	Scientific Name	Mean Number of Individuals ($\pm$ 95% CI) Within ROW ^(a)	Mean Number of Individuals ($\pm$ 95% CI) Outside ROW ^(b)
hairy woodpecker	<i>Dryobates villosus</i>	-	0.07 $\pm$ 0.08
hermit thrush	<i>Catharus guttatus</i>	1.53 $\pm$ 0.52	2.37 $\pm$ 0.32
Le Conte's sparrow	<i>Ammospiza leconteii</i>	0.06 $\pm$ 0.12	0.05 $\pm$ 0.09
least flycatcher	<i>Empidonax minimus</i>	-	0.07 $\pm$ 0.14
lesser scaup	<i>Aythya affinis</i>	-	0.02 $\pm$ 0.05
lesser yellowlegs	<i>Tringa flavipes</i>	0.41 $\pm$ 0.37	0.72 $\pm$ 0.18
Lincoln's sparrow	<i>Melospiza lincolnii</i>	1.00 $\pm$ 0.63	1.19 $\pm$ 0.42
mountain bluebird	<i>Sialia currucoides</i>	-	0.05 $\pm$ 0.09
Nashville warbler	<i>Leiothlypis ruficapilla</i>	0.06 $\pm$ 0.12	-
northern flicker	<i>Colaptes auratus</i>	0.12 $\pm$ 0.17	0.07 $\pm$ 0.08
northern goshawk	<i>Accipiter gentilis</i>	-	0.02 $\pm$ 0.05
northern waterthrush	<i>Parkesia noveboracensis</i>	-	0.05 $\pm$ 0.07
northern shoveler	<i>Spatula clypeata</i>	-	0.02 $\pm$ 0.05
orange-crowned warbler	<i>Leiothlypis celata</i>	0.53 $\pm$ 0.26	0.37 $\pm$ 0.20
olive-sided flycatcher	<i>Contopus cooperi</i>	0.35 $\pm$ 0.25	0.37 $\pm$ 0.16
pacific loon	<i>Gavia pacifica</i>	0.35 $\pm$ 0.25	0.21 $\pm$ 0.14
palm warbler	<i>Setophaga palmarum</i>	0.65 $\pm$ 0.44	0.67 $\pm$ 0.23
pied-billed grebe	<i>Podilymbus podiceps</i>	-	0.12 $\pm$ 0.10
pine grosbeak	<i>Pinicola enucleator</i>	-	0.02 $\pm$ 0.05
pileated woodpecker	<i>Dryocopus pileatus</i>	-	0.02 $\pm$ 0.05
red-breasted nuthatch	<i>Sitta canadensis</i>	0.06 $\pm$ 0.12	-
ruby-crowned kinglet	<i>Regulus calendula</i>	0.94 $\pm$ 0.38	0.30 $\pm$ 0.14
red crossbill	<i>Loxia curvirostra</i>	0.12 $\pm$ 0.25	0.05 $\pm$ 0.09

Table C-1. Mean Number of Individuals Detected and 95% Confidence Intervals Within and Outside of Project Right-of-way.

Common Name	Scientific Name	Mean Number of Individuals ($\pm$ 95% CI) Within ROW ^(a)	Mean Number of Individuals ($\pm$ 95% CI) Outside ROW ^(b)
rusty blackbird	<i>Euphagus carolinus</i>	0.06 $\pm$ 0.12	-
sandhill crane	<i>Antigone canadensis</i>	0.35 $\pm$ 0.25	0.65 $\pm$ 0.18
Savannah sparrow	<i>Passerculus sandwichensis</i>	-	0.02 $\pm$ 0.05
short-billed dowitcher	<i>Limnodromus griseus</i>	0.06 $\pm$ 0.12	0.02 $\pm$ 0.05
sora	<i>Porzana carolina</i>	0.65 $\pm$ 0.36	1.19 $\pm$ 0.33
solitary sandpiper	<i>Tringa solitaria</i>	0.24 $\pm$ 0.22	0.14 $\pm$ 0.11
spruce grouse	<i>Falcipecten canadensis</i>	-	0.02 $\pm$ 0.05
spotted sandpiper	<i>Actitis macularia</i>	-	0.02 $\pm$ 0.05
sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	-	0.07 $\pm$ 0.08
swamp sparrow	<i>Melospiza georgiana</i>	-	0.07 $\pm$ 0.10
Swainson's thrush	<i>Catharus ustulatus</i>	3.06 $\pm$ 0.62	1.49 $\pm$ 0.49
Tennessee warbler	<i>Leiothlypis peregrina</i>	0.65 $\pm$ 0.40	0.30 $\pm$ 0.21
tree swallow	<i>Tachycineta bicolor</i>	-	0.09 $\pm$ 0.11
warbling vireo	<i>Vireo gilvus</i>	-	0.02 $\pm$ 0.05
white-crowned sparrow	<i>Zonotrichia leucophrys</i>	-	0.49 $\pm$ 0.26
western wood-pewee	<i>Contopus sordidulus</i>	-	0.21 $\pm$ 0.17
Wilson's snipe	<i>Gallinago delicata</i>	0.94 $\pm$ 0.38	1.00 $\pm$ 0.16
Wilson's warbler	<i>Cardellina pusilla</i>	0.06 $\pm$ 0.12	0.07 $\pm$ 0.08
white-throated sparrow	<i>Zonotrichia albicollis</i>	0.47 $\pm$ 0.66	2.51 $\pm$ 0.54
white-winged crossbill	<i>Loxia leucoptera</i>	0.18 $\pm$ 0.20	0.21 $\pm$ 0.16
yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	0.06 $\pm$ 0.12	0.09 $\pm$ 0.09
yellow-rumped warbler	<i>Setophaga coronata</i>	1.06 $\pm$ 0.29	0.81 $\pm$ 0.22

^(a) ROW = 0 to 60 m from the Old Airport Road centreline (120 m wide corridor)^(b) RSA = 61 to 200 m from the Old Airport Road centreline (400 m wide corridor)

Note: averages could not be calculated where abundance was too low.

Note: **bolded** species are species at risk

Table C-2. Mean number of individuals detected per ARU and 95% confidence intervals for each habitat stratum.

Common Name	Scientific Name	Mean Number of Individuals (± 95% CI) Deciduous	Mean Number of Individuals (± 95% CI) Dense Conifer	Mean Number of Individuals (± 95% CI) Open	Mean Number of Individuals (± 95% CI) Recently Disturbed	Mean Number of Individuals (± 95% CI) Sparse Conifer	Mean Number of Individuals (± 95% CI) Wetlands
alder flycatcher	<i>Empidonax alnorum</i>	0.11 ± 0.26	1.13 ± 0.69	0.67 ± 0.86	0	0.42 ± 0.35	0.60 ± 0.68
American bittern	<i>Botaurus lentiginosus</i>	0.11 ± 0.26	0.40 ± 0.28	0.33 ± 0.54	0	0.25 ± 0.19	0
American robin	<i>Turdus migratorius</i>	0.89 ± 0.60	1.53 ± 0.35	1.67 ± 0.54	-	1.08 ± 0.30	1.80 ± 0.56
three-toed woodpecker	<i>Picoides dorsalis</i>	0.22 ± 0.51	0	0.17 ± 0.43	0	0	0.20 ± 0.56
black-backed woodpecker	<i>Picoides arcticus</i>	0	0.13 ± 0.19	0.33 ± 0.54	-	0.04 ± 0.09	0.80 ± 1.04
blue-headed vireo	<i>Vireo solitarius</i>	0.22 ± 0.34	0	0.17 ± 0.43	0	0.13 ± 0.14	0
blackpoll warbler	<i>Setophaga striata</i>	0	0	0	0	0.04 ± 0.09	0
boreal chickadee	<i>Poecile hudsonicus</i>	0	0	0	0	0.13 ± 0.14	0
boreal owl	<i>Aegolius funereus</i>	0	0	0	0	0	0.20 ± 0.56
bohemian waxwing	<i>Bombycilla garrulus</i>	0	0	0.50 ± 0.88	-	0.04 ± 0.09	0
Canada jay	<i>Perisoreus canadensis</i>	0.33 ± 0.38	0.40 ± 0.28	0.50 ± 0.57	0	0.79 ± 0.21	-
Canada goose	<i>Branta canadensis</i>	0.33 ± 0.38	0.47 ± 0.29	0.50 ± 0.57	0	0.33 ± 0.20	0.40 ± 0.68
clay-coloured sparrow	<i>Spizella pallida</i>	0	0.20 ± 0.23	0.17 ± 0.43	0	0	0
chipping sparrow	<i>Spizella passerina</i>	0.78 ± 0.51	1.33 ± 0.34	1.67 ± 1.08	-	1.25 ± 0.42	1.80 ± 1.36
common loon	<i>Gavia immer</i>	0.11 ± 0.26	0.13 ± 0.19	0.17 ± 0.43	-	0.33 ± 0.24	0.20 ± 0.56
common nighthawk	<i>Chordeiles minor</i>	0.89 ± 0.90	1.87 ± 0.62	2.67 ± 2.36	-	1.04 ± 0.40	3.00 ± 1.24
common raven	<i>Corvus corax</i>	0.11 ± 0.26	0.13 ± 0.19	0	-	0.04 ± 0.09	0.80 ± 0.56
common redpoll	<i>Acanthis flammea</i>	0	0	0.17 ± 0.43	0	0	0
dark-eyed junco	<i>Junco hyemalis</i>	1.78 ± 0.75	1.87 ± 0.46	2.00 ± 0.94	-	2.25 ± 0.34	-
evening grosbeak	<i>Coccothraustes vespertinus</i>	0	0	0	0	0.04 ± 0.09	0
fox sparrow	<i>Passerella iliaca</i>	0	0	0.17 ± 0.43	0	0.17 ± 0.16	0
gadwall	<i>Mareca strepera</i>	0	0.07 ± 0.14	0	0	0	0
gray-cheeked thrush	<i>Catharus minimus</i>	0	0.07 ± 0.14	0	0	0	0
great horned owl	<i>Bubo virginianus</i>	0	0	0	0	0.04 ± 0.09	0
hairy woodpecker	<i>Dryobates villosus</i>	0	0	0.17 ± 0.43	-	0.04 ± 0.09	0
hermit thrush	<i>Catharus guttatus</i>	1.67 ± 0.86	2.27 ± 0.61	2.33 ± 0.86	-	2.13 ± 0.49	2.20 ± 1.36
LeConte's sparrow	<i>Ammodramus leconteii</i>	0.11 ± 0.26	0	0	0	0.08 ± 0.17	0
least flycatcher	<i>Empidonax minimus</i>	0	0	0.50 ± 1.29	0	0	0
lesser scaup	<i>Aythya affinis</i>	0	0.07 ± 0.14	0	0	0	0
lesser yellowlegs	<i>Tringa flavipes</i>	0.56 ± 0.56	0.67 ± 0.34	1.17 ± 0.43	0	0.50 ± 0.28	0.80 ± 0.56
Lincoln's sparrow	<i>Melospiza lincolnii</i>	0.89 ± 1.05	1.47 ± 0.69	1.33 ± 1.84	0	1.13 ± 0.57	0.60 ± 0.68
mountain bluebird	<i>Sialia currucoides</i>	0	0	0.33 ± 0.86	0	0	0
Nashville warbler	<i>Leiothlypis ruficapilla</i>	0	0	0	0	0.04 ± 0.09	0
northern flicker	<i>Colaptes auratus</i>	0	0.13 ± 0.19	0	0	0.13 ± 0.14	0
northern goshawk	<i>Accipiter gentilis</i>	0.11 ± 0.26	0	0	0	0	0

Table C-2. Mean number of individuals detected per ARU and 95% confidence intervals for each habitat stratum.

Common Name	Scientific Name	Mean Number of Individuals (± 95% CI) Deciduous	Mean Number of Individuals (± 95% CI) Dense Conifer	Mean Number of Individuals (± 95% CI) Open	Mean Number of Individuals (± 95% CI) Recently Disturbed	Mean Number of Individuals (± 95% CI) Sparse Conifer	Mean Number of Individuals (± 95% CI) Wetlands
northern waterthrush	<i>Parkesia noveboracensis</i>	0.11 ± 0.26	0	0	0	0.04 ± 0.09	0
northern shoveler	<i>Spatula clypeata</i>	0	0	0.17 ± 0.43	0	0	0
orange-crowned warbler	<i>Leiothlypis celata</i>	0.44 ± 0.41	0.47 ± 0.51	0.50 ± 0.57	0	0.46 ± 0.21	0
olive-sided flycatcher	<i>Contopus cooperi</i>	0	0.33 ± 0.27	0.33 ± 0.54	0	0.42 ± 0.21	1.00 ± 0.88
pacific loon	<i>Gavia pacifica</i>	0	0.20 ± 0.23	0.33 ± 0.54	0	0.38 ± 0.24	0.20 ± 0.56
palm warbler	<i>Setophaga palmarum</i>	0.44 ± 0.56	0.60 ± 0.41	0.67 ± 0.54	0	0.92 ± 0.37	0.20 ± 0.56
pied-billed grebe	<i>Podilymbus podiceps</i>	0	0.13 ± 0.19	0.17 ± 0.43	-	0	0.20 ± 0.56
pine grosbeak	<i>Pinicola enucleator</i>	0	0	0	0	0.04 ± 0.09	0
pileated woodpecker	<i>Dryocopus pileatus</i>	0	0.07 ± 0.14	0	0	0	0
red-breasted nuthatch	<i>Sitta canadensis</i>	0.11 ± 0.26	0	0	0	0	0
ruby-crowned kinglet	<i>Regulus calendula</i>	0.33 ± 0.38	0.33 ± 0.27	0.17 ± 0.43	0	0.83 ± 0.30	0
red crossbill	<i>Loxia curvirostra</i>	0	0	0	0	0.08 ± 0.17	0.40 ± 1.11
rusty blackbird	<i>Euphagus carolinus</i>	0	0	0	0	0.04 ± 0.09	0
sandhill crane	<i>Antigone canadensis</i>	0.44 ± 0.56	0.60 ± 0.28	0.67 ± 0.54	0	0.50 ± 0.22	1.00 ± 0.88
Savannah sparrow	<i>Passerculus sandwichensis</i>	0	0	0.17 ± 0.43	0	0	0
short-billed dowitcher	<i>Limnodromus griseus</i>	0	0	0	0	0.08 ± 0.12	0
sora	<i>Porzana carolina</i>	1.11 ± 0.98	0.93 ± 0.39	1.83 ± 1.39	-	0.96 ± 0.42	0.40 ± 0.68
solitary sandpiper	<i>Tringa solitaria</i>	0	0.20 ± 0.23	0	0	0.25 ± 0.19	0.20 ± 0.56
spruce grouse	<i>Falcipennis canadensis</i>	0	0.07 ± 0.14	0	0	0	0
spotted sandpiper	<i>Actitis macularius</i>	0	0.07 ± 0.14	0	0	0	0
sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	0	0.07 ± 0.14	0.33 ± 0.54	0	0	0
swamp sparrow	<i>Melospiza georgiana</i>	0	0.07 ± 0.14	0	0	0.08 ± 0.17	0
Swainson's thrush	<i>Catharus ustulatus</i>	2.67 ± 1.33	1.13 ± 0.69	1.00 ± 1.33	0	2.71 ± 0.68	0.80 ± 1.04
Tennessee warbler	<i>Leiothlypis peregrina</i>	0.78 ± 0.75	0.27 ± 0.39	0.50 ± 0.88	0	0.33 ± 0.24	0.40 ± 1.11
tree swallow	<i>Tachycineta bicolor</i>	0	0	0.50 ± 0.88	0	0	0.20 ± 0.56
warbling vireo	<i>Vireo gilvus</i>	0	0	0	0	0	0.20 ± 0.56
white-crowned sparrow	<i>Zonotrichia leucophrys</i>	0	0.40 ± 0.35	0.83 ± 1.68	0	0.17 ± 0.20	1.20 ± 1.04
western wood-pewee	<i>Contopus sordidulus</i>	0	0.13 ± 0.19	0.33 ± 0.86	0	0.04 ± 0.09	0.80 ± 1.36
Wilson's snipe	<i>Gallinago delicata</i>	0.56 ± 0.41	1.00 ± 0.30	1.33 ± 0.54	-	1.04 ± 0.29	-
Wilson's warbler	<i>Cardellina pusilla</i>	0	0.07 ± 0.14	0.17 ± 0.43	0	0.08 ± 0.12	0
white-throated sparrow	<i>Zonotrichia albicollis</i>	1.00 ± 0.94	2.40 ± 1.06	3.50 ± 1.96	-	1.17 ± 0.71	3.80 ± 1.04
white-winged crossbill	<i>Loxia leucoptera</i>	0.33 ± 0.54	0.13 ± 0.19	0.33 ± 0.86	0	0.13 ± 0.14	0.40 ± 0.68
yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	0.11 ± 0.26	0	0.17 ± 0.43	0	0.08 ± 0.12	0.20 ± 0.56
yellow-rumped warbler	<i>Setophaga coronata</i>	1.11 ± 0.46	0.67 ± 0.34	0.83 ± 0.43	-	0.96 ± 0.34	0.80 ± 0.56

"-" = means could not be calculated because of small sample size.

APPENDIX D

Effects Plots for Final Model Effects

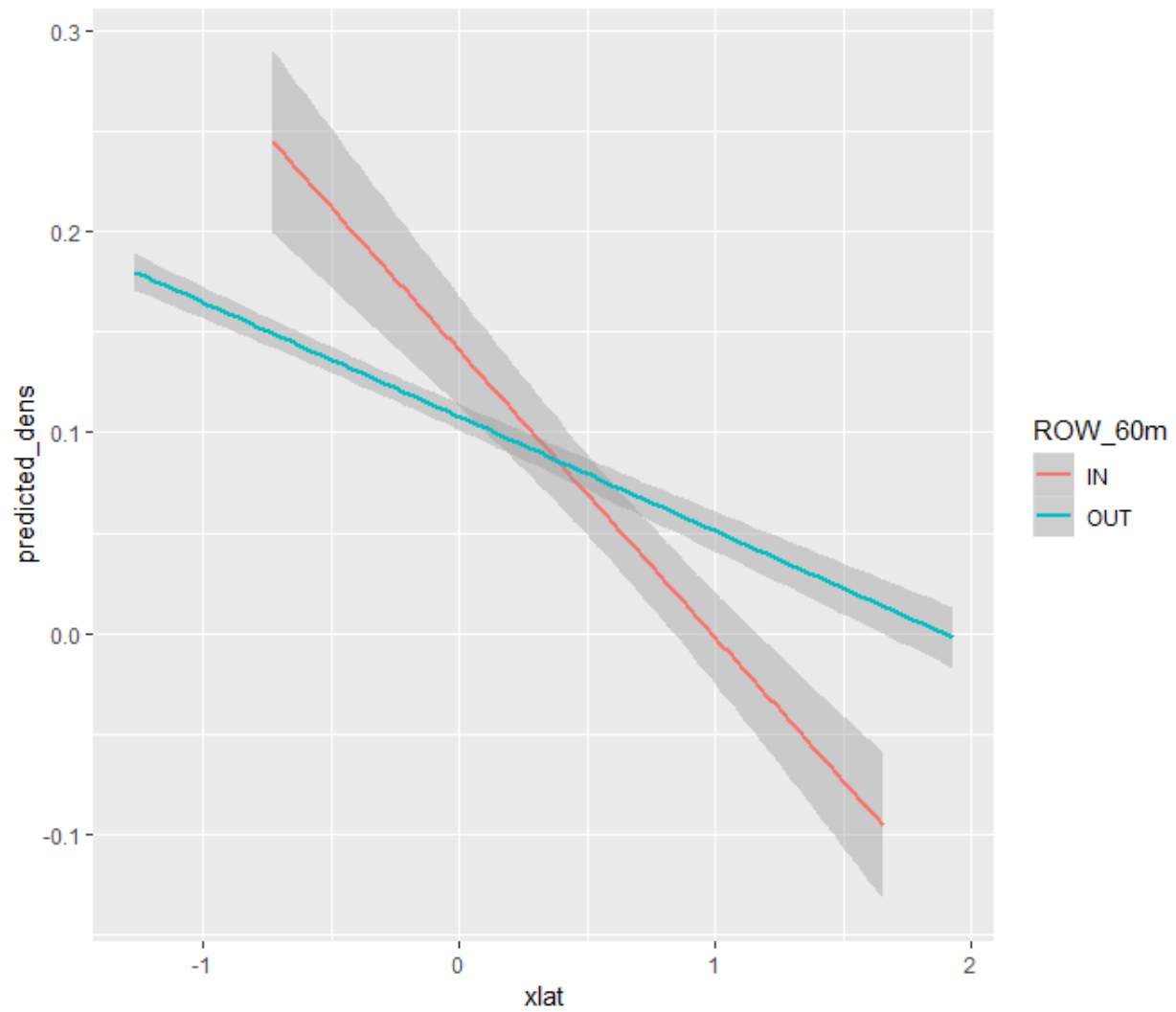


Figure D-1: Alder Flycatcher Predicted Density in Response to Latitude (xlat) by Location (ROW).

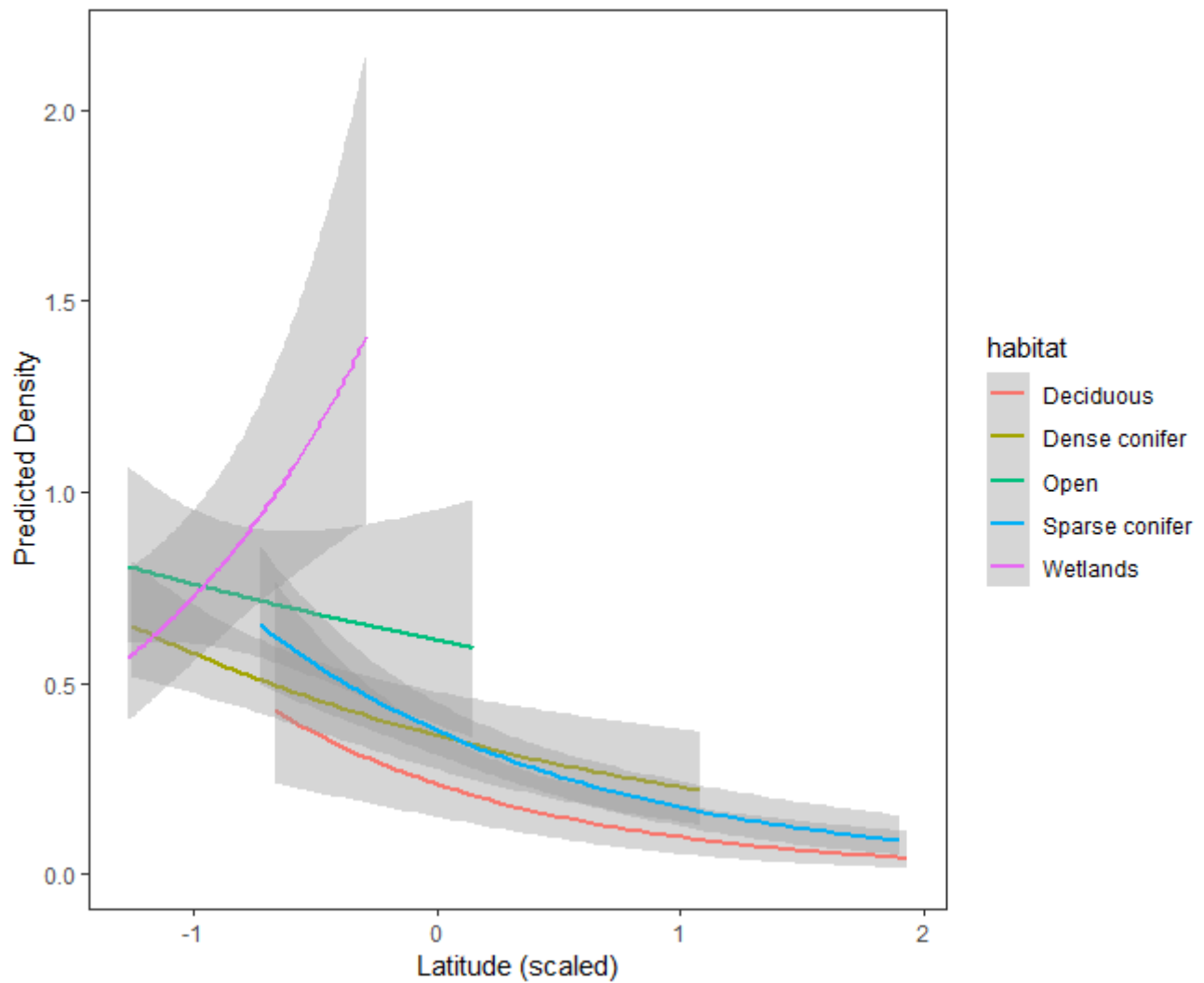


Figure D-2: American Robin Predicted Density in Response to Latitude by Habitat Type.

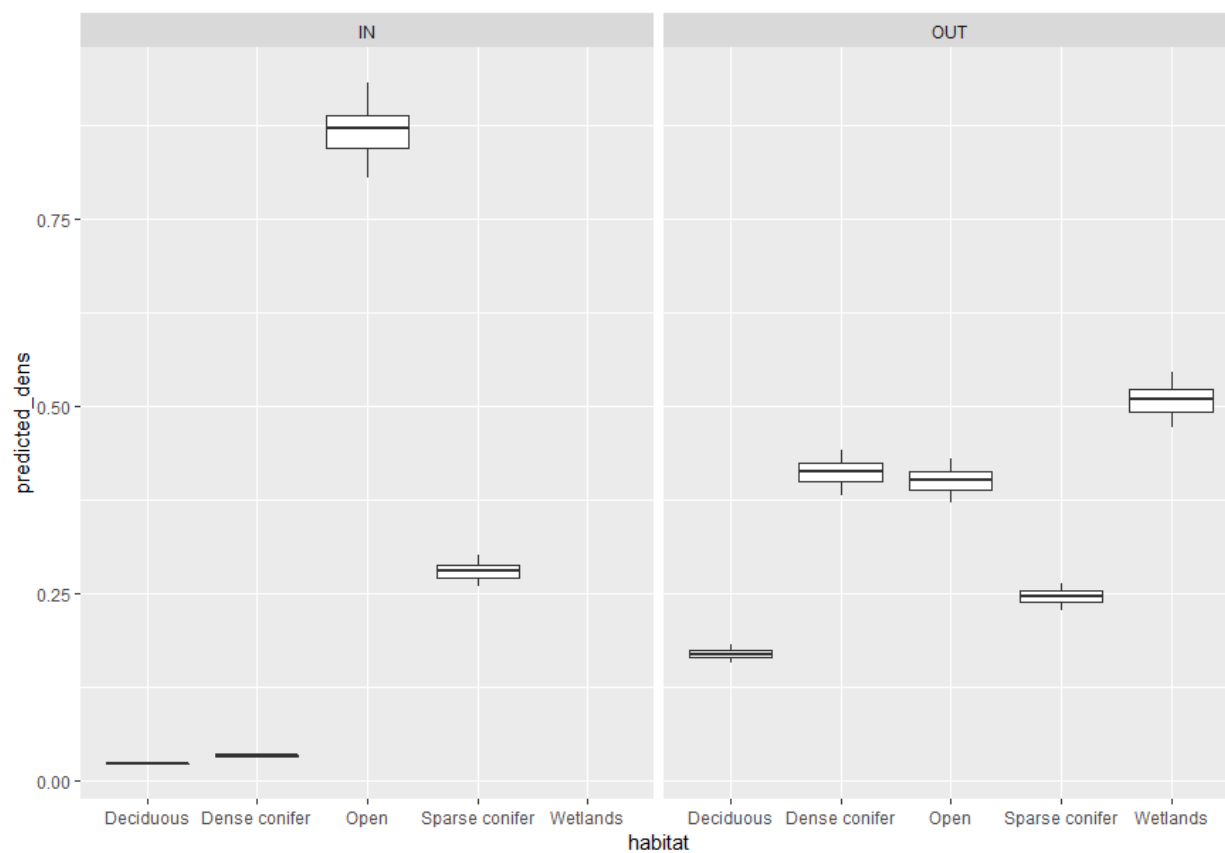


Figure D-3: Chipping Sparrow Predicted Density in Response to Habitat Type by Location (IN/OUT).

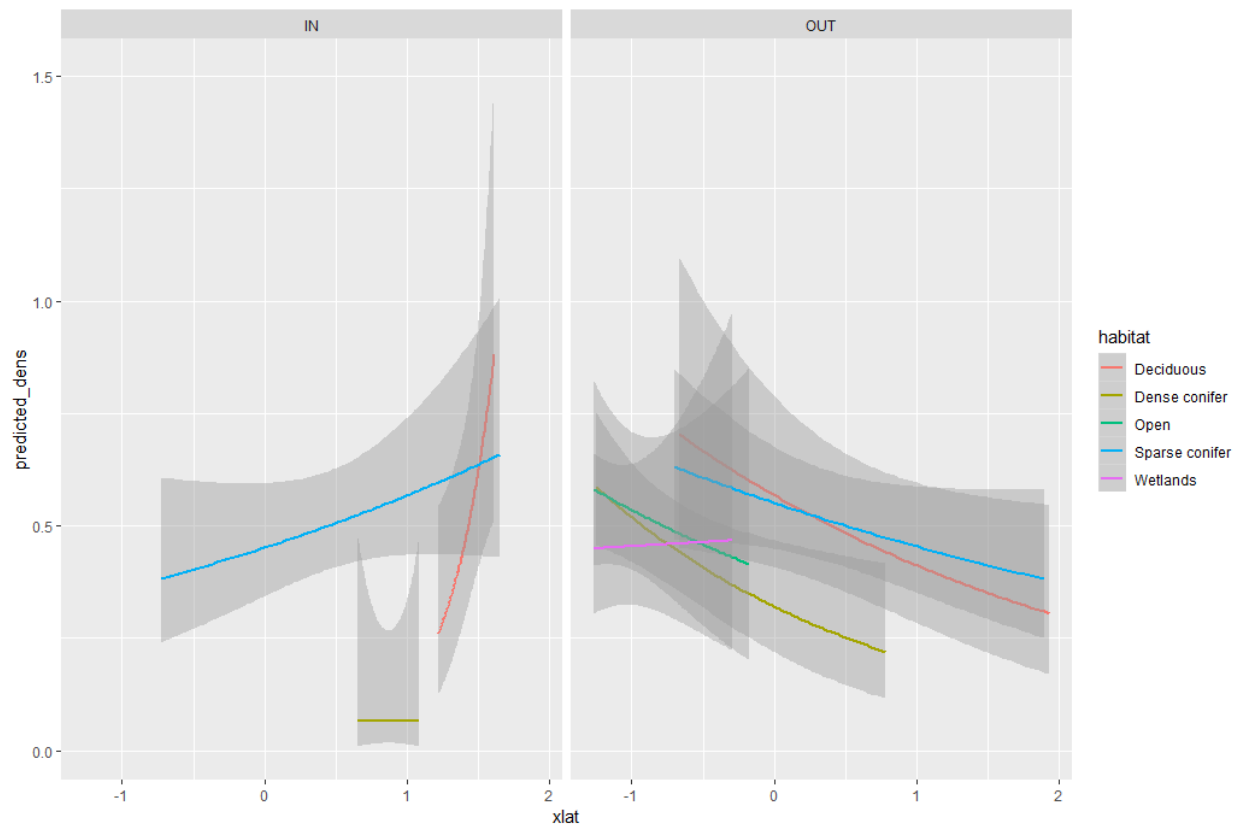


Figure D-4: Dark-eyed Junco Predicted Density in Response to Latitude (xlat) by Location (IN/OUT) and Habitat Type.

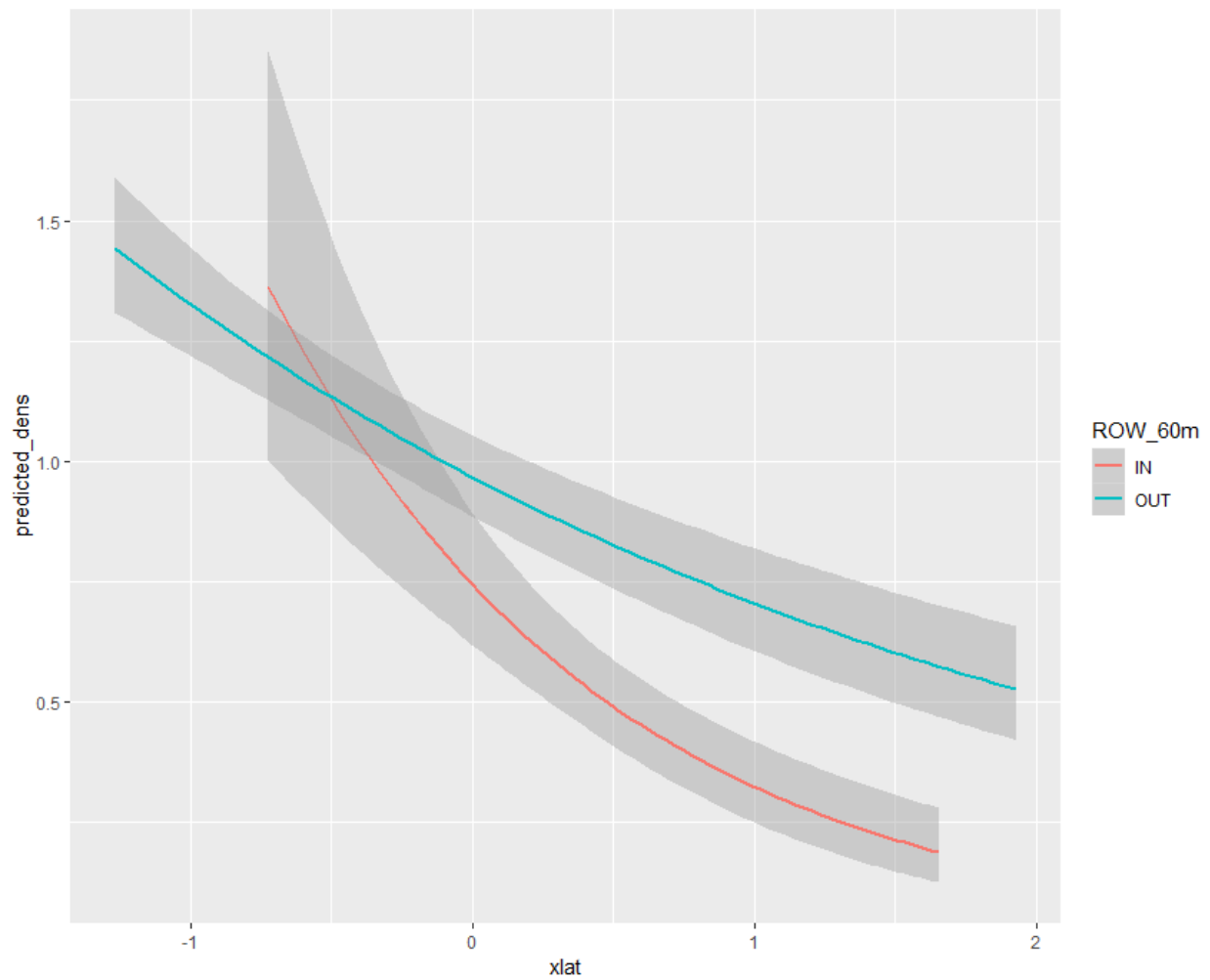


Figure D-5: Hermit Thrush Predicted Density in Response to Latitude (xlat) by Location (ROW).

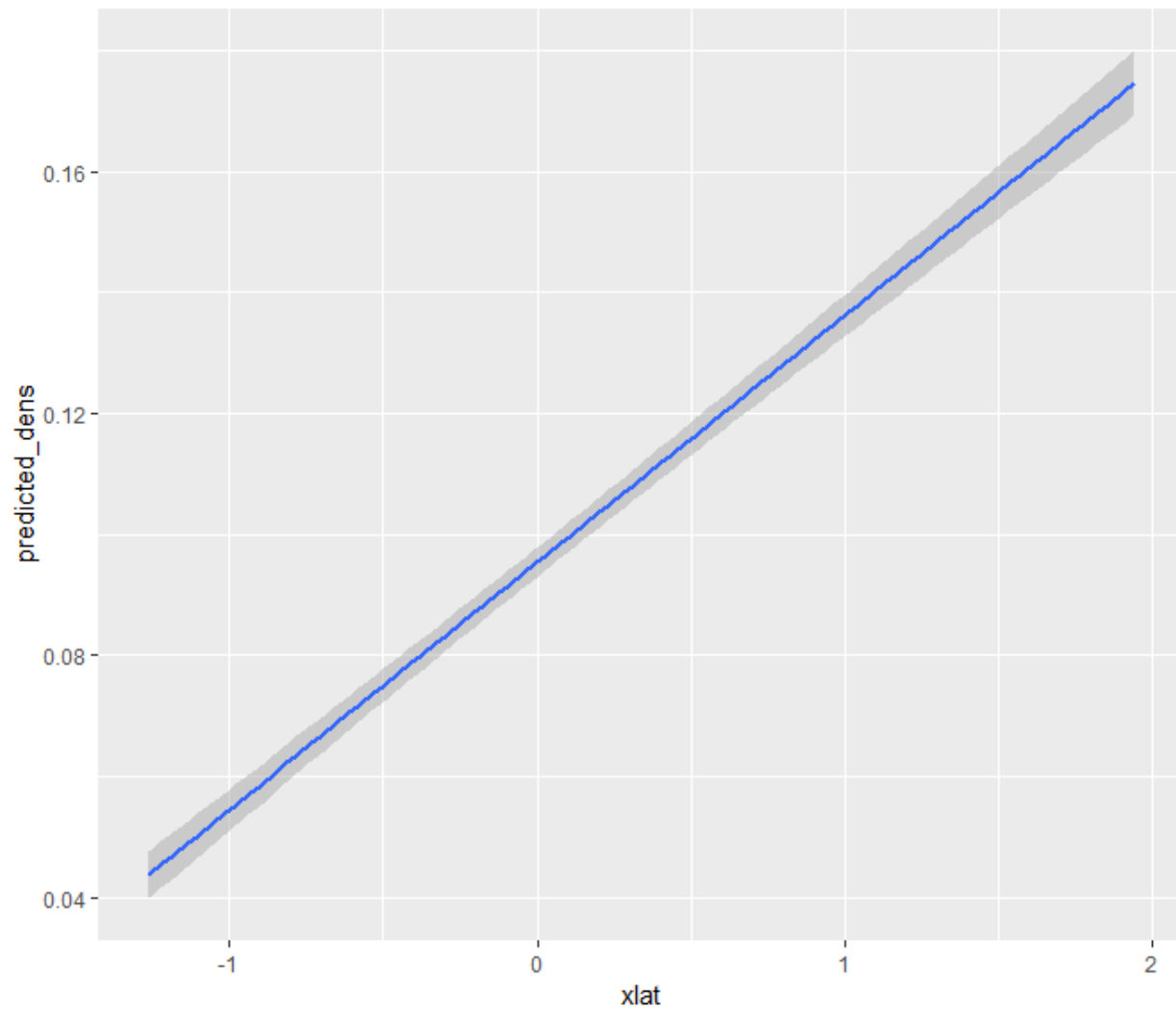


Figure D-6: Palm Warbler Predicted Density in Response to Latitude (xlat).

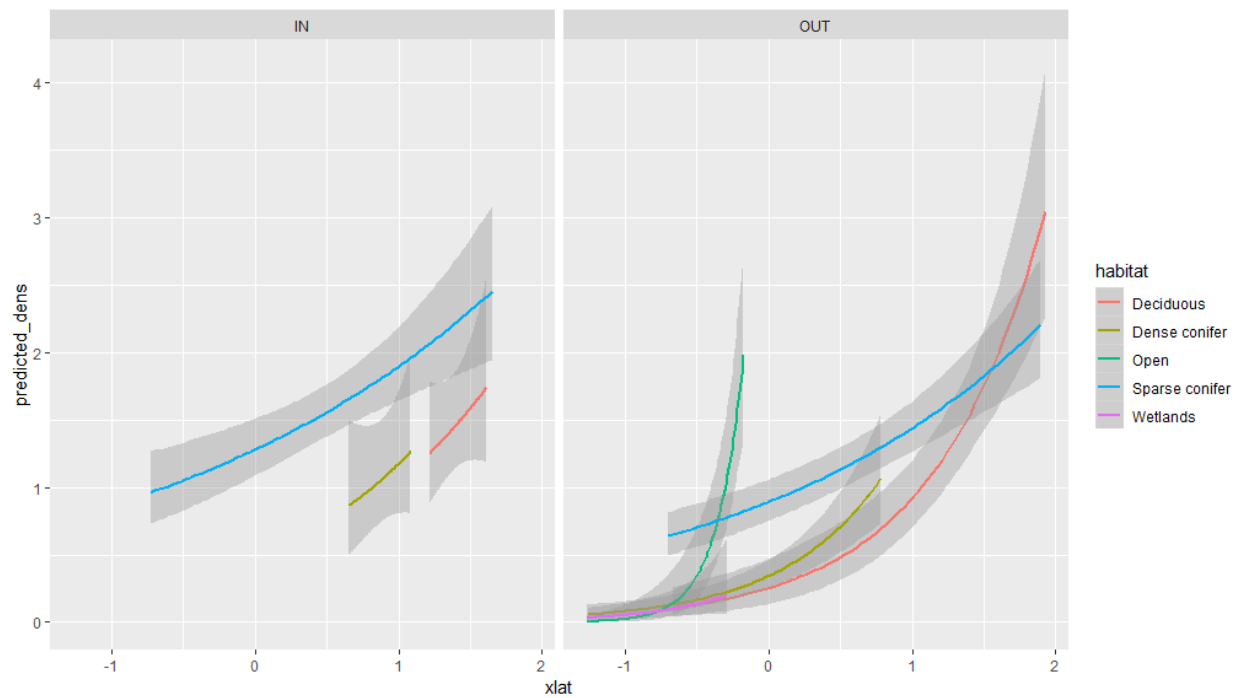


Figure D-7: Swainson's Thrush Predicted Density in Response to Latitude (xlat) by Location (IN/OUT) and Habitat Type.

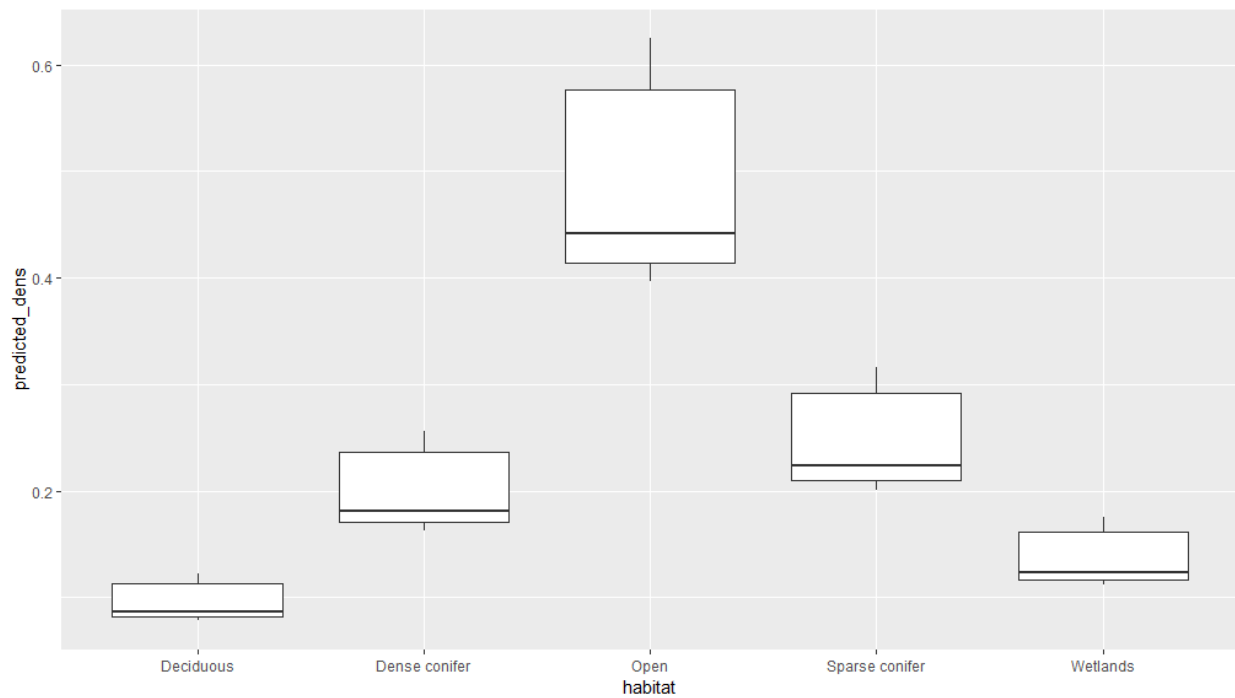


Figure D-8: Wilson's Snipe Predicted Density in Response to Habitat Type.

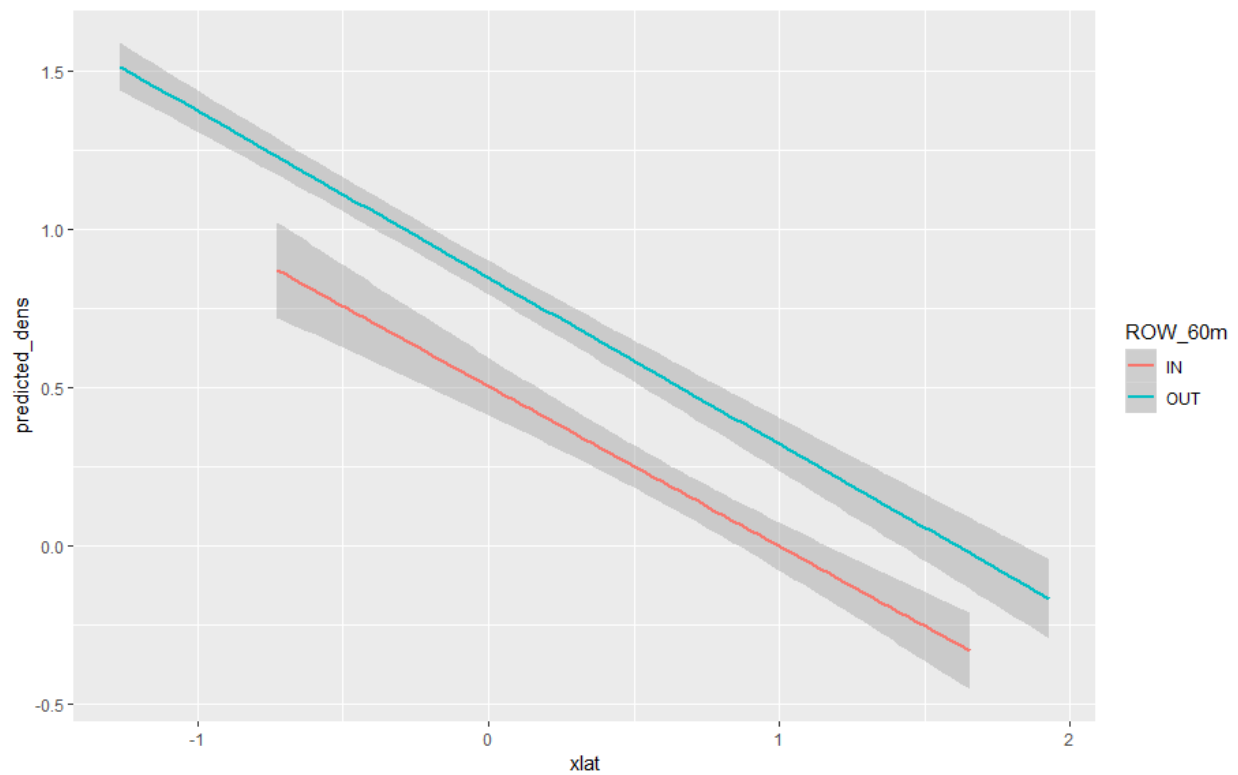


Figure D-9: White-throated Sparrow Predicted Density in Response to Latitude (xlat) by Location (ROW).

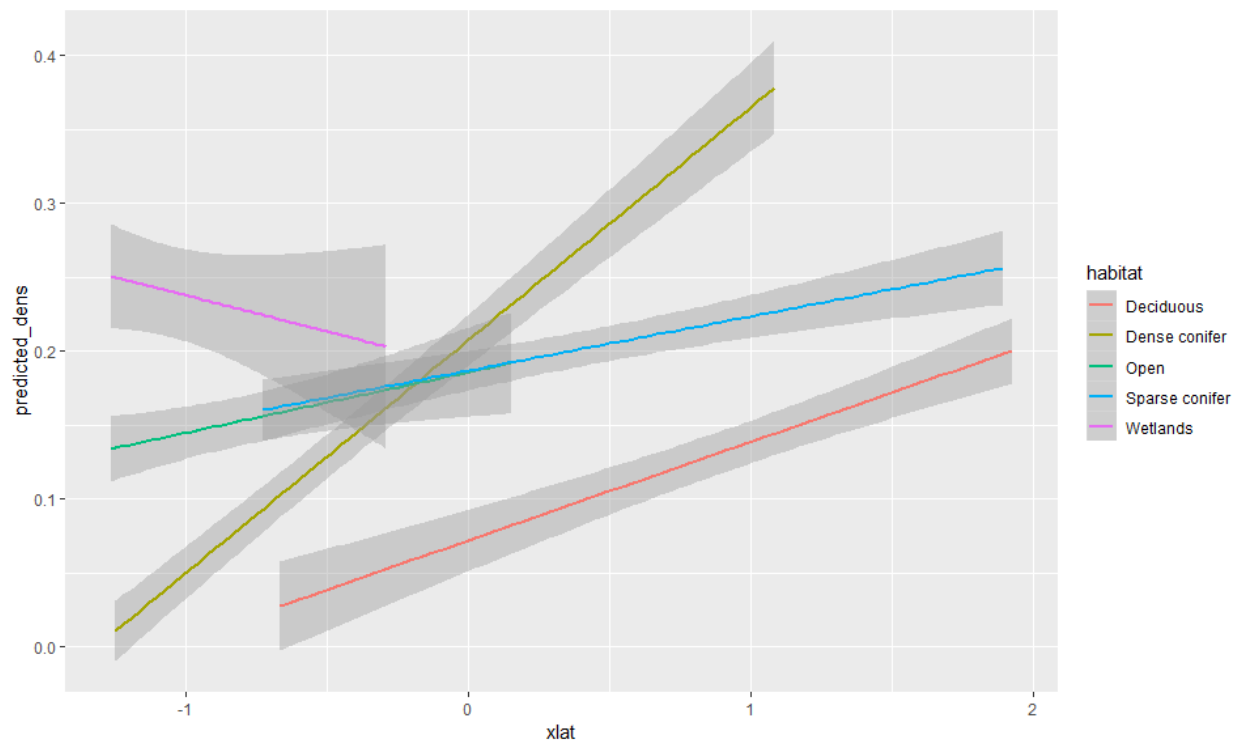


Figure D-10: Yellow-rumped Warbler Predicted Density in Response to Latitude (xlat) by Habitat Type.

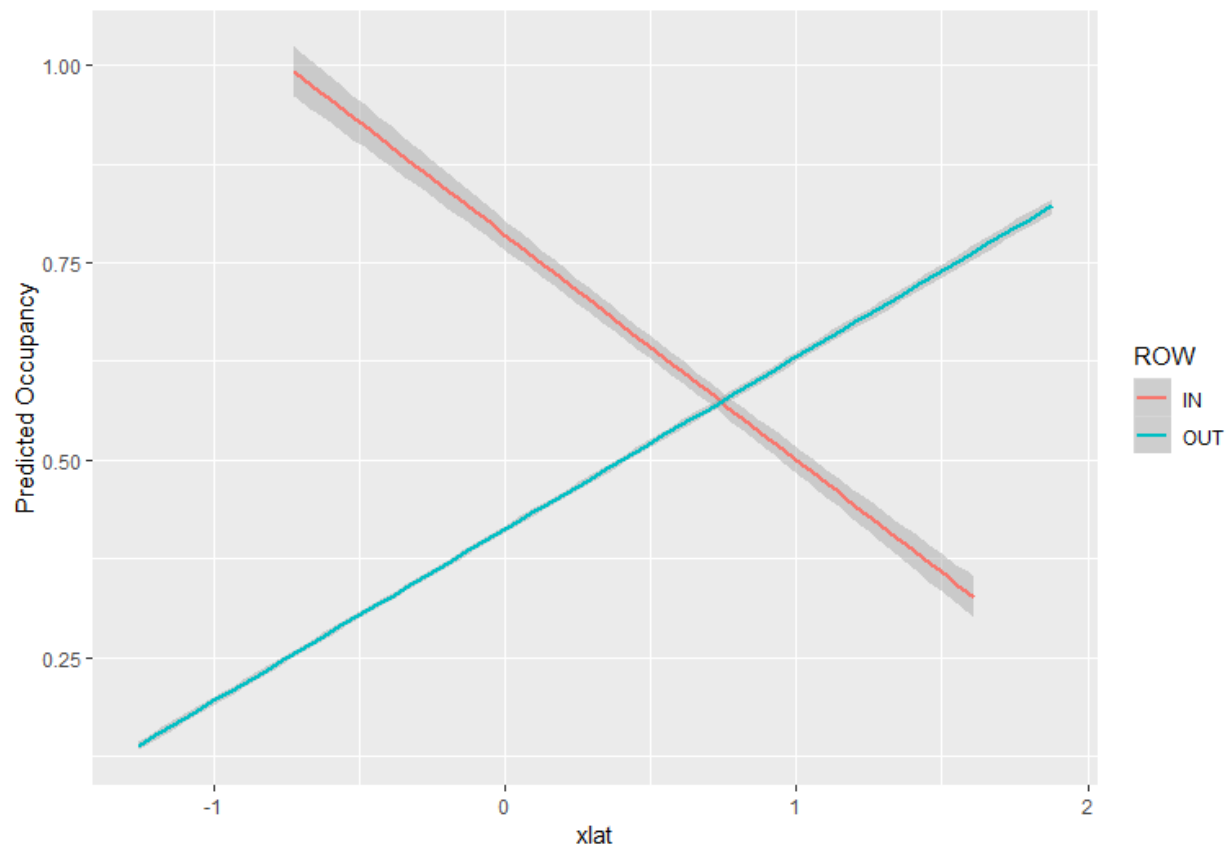


Figure D-11: Orange-crowned Warbler Predicted Occupancy in Response to Latitude (xlat) by Location (ROW).

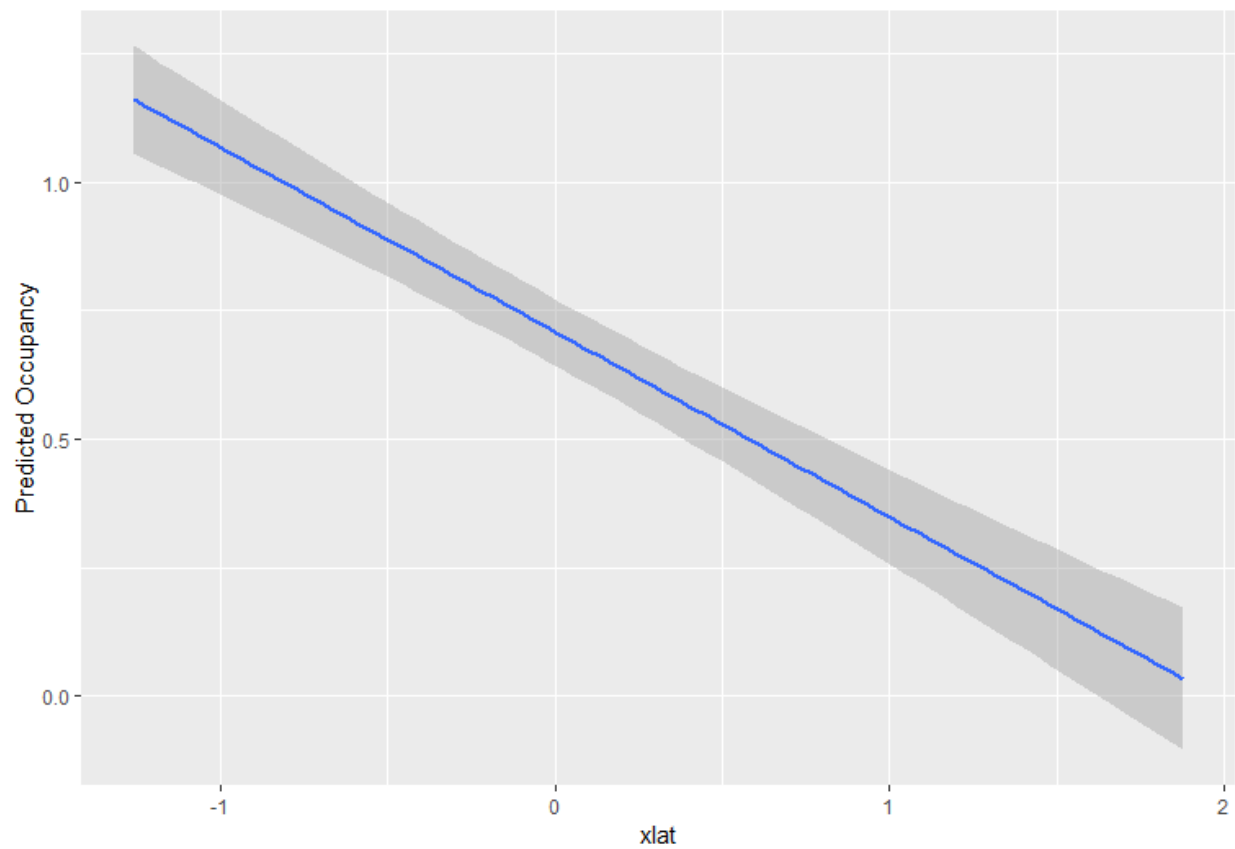


Figure D-12: Olive-sided Flycatcher Predicted Occupancy in Response to Latitude (xlat).

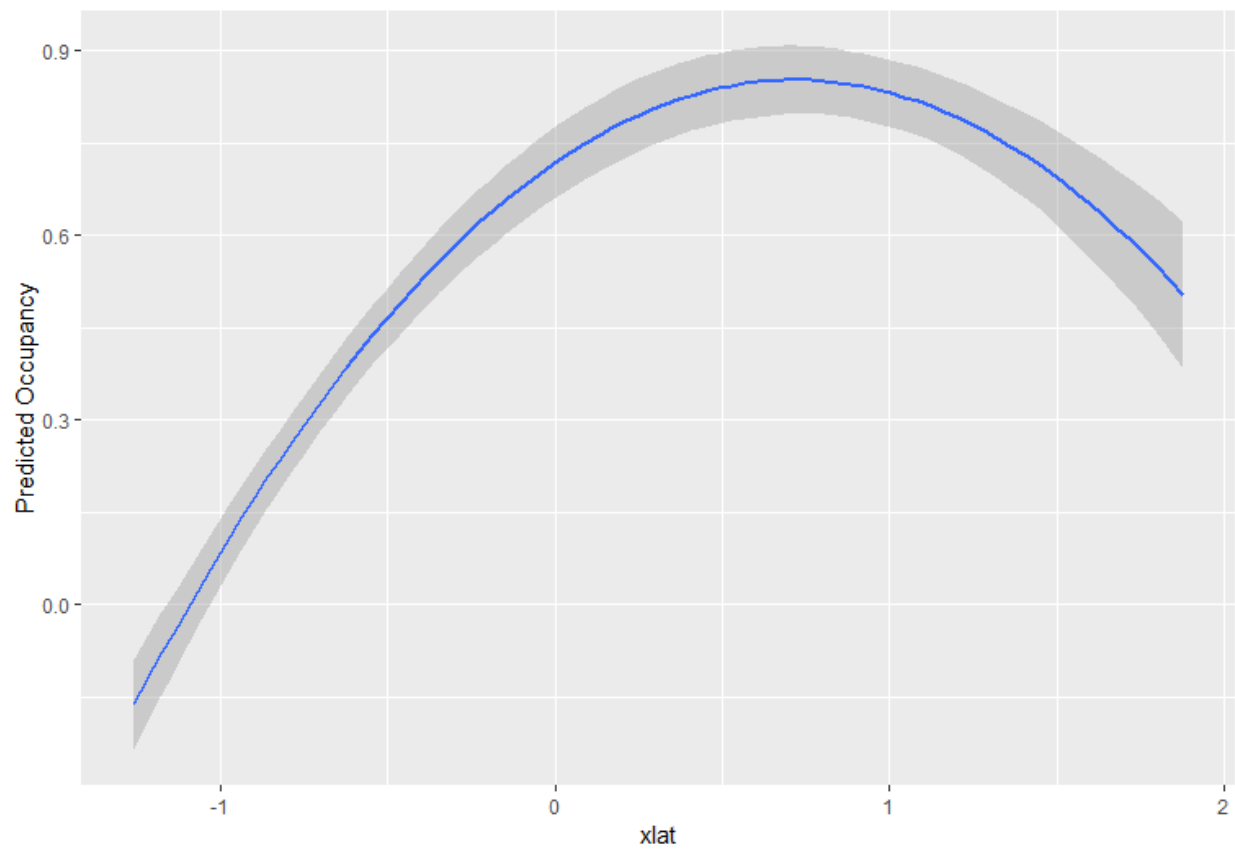


Figure D-13: Ruby-crowned Kinglet Predicted Occupancy in Response to Latitude (xlat).

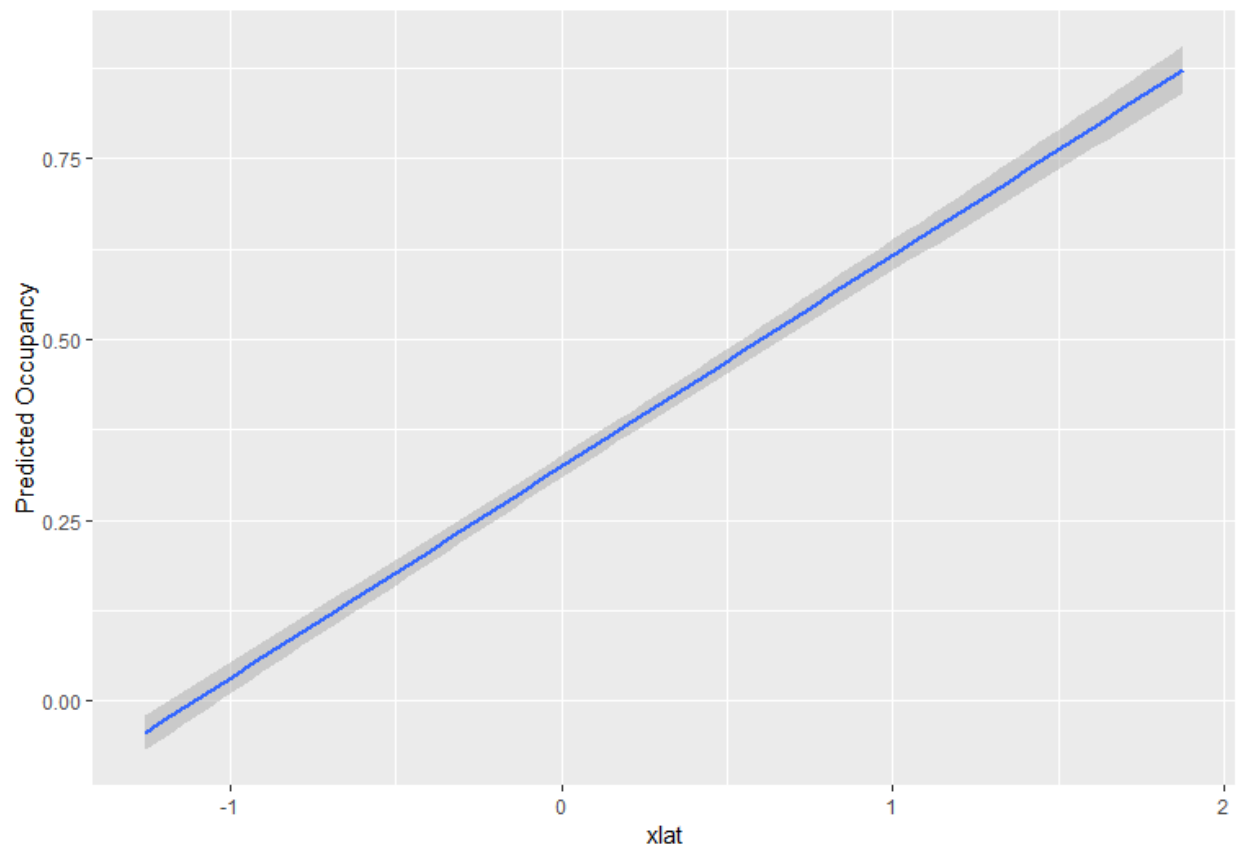


Figure D-14: Tennessee Warbler Predicted Occupancy in Response to Latitude (xlat).