Appendix 9-1

Wildlife Technical Report

PROJECT 4: WILDLIFE TECHNICAL REPORT

DECEMBER 18, 2015

(UPDATED- APRIL 14, 2016)

MANITOBA East Side Road AUTHORITY

Joro Consultants

EXECUTIVE SUMMARY

The Manitoba East Side Road Authority (ESRA) has implemented ongoing wildlife monitoring since 2011 in support all season road (ASR) development across the Local Area Transportation Network (LATN) on the east side of Lake Winnipeg. Baseline monitoring has included data collection on the distribution and abundance of moose, furbearers, boreal woodland caribou, grey wolves and birds. Specific studies using satellite collars on boreal woodland caribou and grey wolves have also been undertaken to assist in route selection, Environmental Impact Assessment (EIA) and effects monitoring on existing projects, including Project 1 (PR 304 to Berens River).

This *Project 4 (P4) Wildlife Technical Report* provides background information on the P4 study area, methods, results, and summary of findings from the various monitoring activities conducted. Many of the monitoring activities reported on are part of ongoing studies that are being used in ongoing route selection and effects monitoring for other ASRs. These have included: studies of wildlife distribution through multispecies aerial surveys, species-specific aerial surveys, identification of core use areas and identification of critical calving habitat. The data, analyses, and results presented are intended as supporting information in assessing the potential environmental effects on wildlife, resulting from the P4 development. The results of that assessment are contained in the P4 EIA. This report also contains cumulative effects assessments for boreal woodland caribou and moose which provides a summary of findings based on the analyses and data presented.

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GLOSSARY OF TERMS

Alluvial* **-** Loose soil or sediment that is eroded, deposited, and reshaped by water.

Brunisols - Soil formed under forest and is brown in color and may have either clay or aluminum and iron compounds, or both.

Colluvial* – A mass of sediments deposited by colluvial processes, most commonly loose rock debris.

Dystric Brunisols - Widely occurring, acid soil that lacks a well-developed mineral-organic surface horizon, usually on parent materials of low base status and typically under forest vegetation.

Ericaceous* – Plants in or related to the heather family (Ericaceae), typically found on acid soils.

Fibrisols - Organic soil contains mostly un-decomposed fibric organic material and occurs in peat deposits of *Sphagnum* mosses.

Glaciofluvial* – Pertaining to the channelized flow of glacier meltwater and deposits and landforms formed by meltwater streams.

Glaciolacustrine* – Pertaining to glacial lakes.

Gleysol - Soil developed under wet conditions and has a layer of mixed peat or a layer of fibric moss peat on the surface.

Hexagonal grid - a GIS (Geographic Information Systems) term used for ecological assessments to characterize land cover and disturbance patterns.

Luvisol - Well to imperfectly drained soil in sandy to loamy sites with a layer of silicate clay and are the base saturated parent material under forest vegetation.

Mesic - Organic material in an intermediate stage of decomposition with fibers present that can be identified to their botanical origin.

Mesisol – Organic soil found in peatlands at an intermediate stage of decomposition.

Moraines* – A landform that consists of un-stratified glacial drift that is usually till or, less commonly, of other drift.

Organic Cryosol – Developed primarily from organic material and are underlain by frozen subsoil within 1 m of the surface.

Physiography* – Pertains to the factors that influence the development of landforms or a landscape, such as relief and topography, bedrock geology and structure, and geomorphological history.

Surficial geology* – The geology of surficial materials.

Unioned – a GIS term that defines combining two or more spatial layers and their associated data.

*All definitions have been described in Dunster and Dunster (1996), the remainder as described in Smith *et al*. (1998).

LIST OF ACRONYMS

ALCES - A Land Use and Cumulative Effects Simulator

ARU - Autonomous Recording Units

ASR - All Season Road

CEA - Cumulative Effects Assessment

EIA - Environmental Impact Assessment

ESRA - East Side Road Authority

FMU - Forest Management Unit

FRI - Forest Resource Inventory

GHA - Game Hunting Area

GIS - Geographic Information Systems

GME - Geospatial Modeling Environment

GPS - Global Positioning System

LATN - Local Area Transportation Network

LCC - Land Cover Classification

LCCES - Land Cover Classification of Canada, East Side

LPSA - Local Project Study Area

MBWCMC - Manitoba Woodland Caribou Management Committee

MCP - Minimum Convex Polygon

MCWS - Manitoba Conservation and Water Stewardship

MESEA - Manitoba Endangered Species and Ecosystems Act

MU - Management Unit

P4 - Project 4

PF - Project Footprint

PR - Provincial Road

ROW - Right-of-way

RPSA - Regional Project Study Area

RTL - Registered Traplines

SAR - Species at Risk

SARA - Species at Risk Act

TK - Traditional Knowledge

VHF - Very High Frequency

VC - Valued Components

WR - Winter Road

1.0 INTRODUCTION

The Manitoba East Side Road Authority (ESRA) has initiated various wildlife monitoring programs in support of all-season road (ASR) development to provide safer and more reliable transportation service to communities throughout the east side of Manitoba. Wildlife monitoring is ongoing across the Large Area Transportation Network (LATN) and includes studies of boreal woodland caribou, wolves, moose, furbearers and birds (Map 1). In August of 2010, ESRA was issued an Environmental Act License (#2929) under the Manitoba Environment Act for the construction, operation, and maintenance of an ASR from Provincial Road (PR) 304 to Berens River First Nation (Project 1 (P1)).

The methodologies and results described are reviewed annually with ESRA and Manitoba Conservation and Water Stewardship (MCWS) Wildlife Branch, through targeted workshops to provide input and technical advice. This *Wildlife Technical Report* summarizes baseline wildlife monitoring data gathered between 2011 and 2015 to support route selection and environmental assessment for Project 4 (P4), which is an ASR from Berens River First Nation to Poplar River First Nation. The result of the baseline data and analyses are in support of the P4 Environmental Impact Assessment (EIA) to determine potential effects and mitigation identified in the EIA.

2.0 STUDY AREA

This report provides specific information as it relates to the P4 Local Project Study Area (LPSA) in Map 2. The Project Footprint (PF) for P4 is defined as the 100 m ASR right of way (ROW). The LPSA for P4 is defined as a 5 km buffer on either side of the proposed P4 ASR route. The LPSA is equivalent to the Local Assessment Area in the P4 EIA. The Regional Project Study Area (RPSA) (southern ASR Project Study Area) covers the area contained within 5 km south of Manigotagan northwards to 5 km north of Poplar River, east to the Manitoba/Ontario border and west to the edge of Lake Winnipeg. The area defined for the LPSA connects Poplar River with Berens River (Map 2). Administrative boundaries that best describe the LPSA are the Manitoba Conservation and Water Stewardship (MCWS), Wildlife and Ecosystem Protection Branch, Game Hunting Area (GHA) 17B (MCWS, 2015) or the MCWS, Forestry Branch, Forest Management Unit (FMU) 38 and 39 (MCWS, 2013) (Map 2). The GHA 17B was used as the administrative boundary to conduct the moose habitat analysis. It should be noted that the RPSA is larger than the Regional Assessment Area (RAA) described in the P4 EIA.

Currently, there is one major winter road (WR) near the LPSA which contains three sections: Road No. 710 (Section 30: WR 700 to Berens River, Section 40: Berens River to Leaf River, Section 50: Leaf River to Poplar River) (Map 3). Given that these WRs have been a part of the LPSA landscape for many years, boreal woodland caribou, moose, and other wildlife species have likely adapted through habitat use and predator avoidance strategies that would be similar for P7a.

2.1 Environmental Setting

The LPSA is located within the Boreal Shield Ecozone, which is the largest ecozone in Canada. In Manitoba it extends north from the southeast corner of the province, encompassing the area between Lake Winnipeg and the Ontario border, and proceeds across the northern extent of the Lake as a broad band from the Ontario to Saskatchewan borders (Smith *et al.,* 1998). The ecozone is dominated by broadly rolling uplands and lowlands. The **surficial geology**[1] is composed of Precambrian granite bedrock outcrops, **moraines**, **glaciofluvial**, and **colluvial** deposits. The climate is continental, characterized by relatively warm but short summers and cold, snowy winters. Soils are dominated by **luvisols** in the south and **brunisols** in the north (Zoladeski *et al*., 1995). The entire LPSA lies within the Lac Seul Upland (90) Ecoregion, which extends from the eastern shore of Lake Winnipeg to the Manitoba-Ontario Border. The majority of the ecoregion lies within Ontario, with only about 25% in Manitoba. The Project will traverse two ecodistricts: Berens River Ecodistrict (370) and Wrong Lake Ecodistrict (371) and both will be subsequently described.

2.1.1 The Berens River (370) Ecodistrict

Roughly one-third of the LPSA is located within Berens River (370) Ecodistrict, weaving in and out along the eastern border. This ecodistrict runs along the east side of Lake Winnipeg and stretches north of Manigotagan up to the southern end of the Norway House Ecodistrict (Smith *et al*., 1998). The mean annual temperature is 0.3°C with an average growing season of 166 days. The mean annual precipitation is approximately 540 mm, of which less than one-third falling as snow (Smith *et al*., 1998). The **physiography** of the region is mostly level and extensively peat-covered lowland, broken only by rare small to large uplands of Precambrian rock outcrops thinly covered by **glaciolacustrine** sediments deposits. Soils in this lowland environment are a complex of poorly drained Typic (deep) and Terric (shallow) **mesisol** organic soils with an underlay of clayey to loamy glaciolacustrine sediments (Smith *et al*., 1998). Mesisols and **fibrisols** are also found on flat bogs, with a mix of peat derived from moss and forest debris. Due to influence from glacial Lake Agassiz, local areas have **dystric brunisols** which occur on sandy, stony, water-modified till, and on wave-built sand or beaches (Smith *et al*., 1998). Because of poorly drained and organic nature of the ecodistrict, vegetation is dominated by brown mosses and sedges, with some interspersed dwarf birch shrubs (*Betula pumila var. glandulifera*) and stunted tamarack (*Larix laricina*). Black spruce (*Picea mariana*) and **ericaceous** shrubs and mosses are common in bog peatland areas, while uplands support black spruce, alder (*Alnus spp.*), and willow shrubs (*Salix spp.*) with a cover of feather moss or stands dominated by trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*), with a hazel (*Cornus sp.*) and alder shrub layer deposits.

[1] Words in bold are defined in the Glossary of Terms

2.1.2 The Wrong Lake (371) Ecodistrict

Roughly two-thirds of the LPSA is located within the Wrong Lake (371) Ecodistrict. The RPSA weaves in and out along the western border of the ecodistrict, which is bordered by the east shore of Lake Winnipeg and the Nopiming Ecodistrict, located along the Manitoba-Ontario border (Smith *et al*., 1998). Mean temperatures range from a low of -20.9°C in January to a high of 18.3°C in July with an average growing season of 168 days. The mean annual precipitation ranges from 460 mm to 600 mm with about one-third falling as snow (Smith *et al*., 1998). The physiography varies from gently to steeply sloping outcrops of Precambrian bedrock thinly covered by glacial drift deposits in the eastern portion to blankets and veneers of clayey and silty, glaciolacustrine sediments over bedrock in the western portion. Organic deposits increase from east to west and south to north, and are dominated by level to very gently sloping peat-covered depressions underlain by clayey glaciolacustrine sediments (Smith *et al*., 1998). Bedrock and well drained dystric brunisols on thin, discontinuous, very cobbly and stony morainal veneers are dominant in the eastern half. Significant areas of very poorly drained Typic (deep) and Terric (shallow) fibrisolic and mesisolic organic soils overlying loamy to clayey glaciolacustrine sediments occur in the peatlands, which are increasingly more widespread towards the west. Poorly drained gleysols and moderately well to imperfectly drained gray luvisolic soils are associated respectively with lowland and upland glaciolacustrine sediments (Smith *et al*., 1998). The predominate watercourses that cross the RPSA are Berens River and Leaf River which flow from east to west and drains into Lake Winnipeg. Jack pine (*Pinus banksiana*) and, to a lesser extent, trembling aspen are common on upland sites, due to extensive, repeated fires; however, black spruce is the dominant tree species and is especially widespread on imperfectly drained uplands and bog peat lands. In river valleys, around lakes and on south facing slopes, where drainage is good, white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), trembling aspen, and balsam poplar form mixed stands. Deciduous and mixed stands have diverse understory of shrubs and herbs, while coniferous stands tend to have feather moss ground cover. Bedrock outcroppings have patchy tree growth, dominated by jack pine, with an understory of low shrubs and groundcover of low ericaceous shrubs, mosses, and lichens. Map 4 represents the Ecological Land Classification of the LPSA.

2.1.3 Surficial Geology and Physiographic Setting

Manitoba's bedrock geology is dominated by the Precambrian Shield which covers three-fifths (60%) of Manitoba with the LPSA located in northern portion of the Superior Province (Bannatyne and Teller, 1984). The shield is composed of granite and minor **gabbro intrusions** (Bannatyne and Teller, 1984). The Superior Province closely follows the area outlined by the Hayes River Upland (89), Lac Seul Upland (90), and the Lake of the Woods (91) Ecoregions, as defined by Smith *et al*. (1998).

The surficial geology of the LPSA can be described as organic deposits found in bogs, fens, and swamp areas where organic material settles (LGRFN and OMNR, 2011) (Map 5). Soils within the LPSA are heavily influenced by the geology of the area. Gray surface horizons result as well as soils composed of luvisol, brunisol, organic, and localized **organic cryosol** (Mills, 1984). Map 6 presents the soil landscapes of the LPSA.

2.1.4 Forest Cover and Vegetation

The LPSA is located in the Boreal Forest Region. The Boreal Forest forms a continuous belt from Newfoundland to the Rocky Mountains and comprises the greater part of the forested area of Canada. The Boreal Forest is primarily coniferous with white and black spruce as characteristic species. Balsam fir and jack pine are prominent in the eastern and central portions and tamarack is only absent in the far north (LGRFN and OMNR, 2011). There is an admixture of broadleaf trees such as white birch (*Betula papyrifera*), trembling aspen, and balsam poplar; the latter two species play an important part in central portions of the region, particularly in the zone of transition to the prairie (LGRFN and OMNR, 2011). Within the LPSA, the Boreal Forest Region is further classified into the Manitoba Lowlands (B15) and Nelson River (B21) Forest Sections, located west to east respectively (Rowe, 1972).

The Manitoba Lowlands (B15) Forest Section surrounds Lake Winnipeg and therefore occurs along the entire east shore of the lake. Within the LPSA, the Manitoba Lowlands Forest Section is a low, level basin bounded by Lake Winnipeg on the west and the Precambrian Shield on the east. The area consists of flat, poorly drained land with forested patches of black spruce and tamarack occurring with intervening swamps and meadows. Stands of white spruce, trembling aspen, and balsam poplar, sometimes intermixed with white birch and balsam fir, occur on the better-drained **alluvial** areas bordering creeks and rivers. Other tree species, such as white elm, green ash (*Fraxinus pennsylvanica*) and Manitoba maple (*Acer negundo var. interius*) also occur locally (Rowe, 1972).

The Nelson River (21) Forest Section occurs on the east side of Lake Winnipeg and continues into central Manitoba. Within the LPSA, the Nelson River Forest Section is bordered by lakes from the Manitoba Lowlands on the west and by the rocky outcrops towards the north and east. The LPSA consists of low-lying swampy areas with poor drainage. This is reflected in the extensive stands of black spruce that make up the majority of the forest cover with interspersed tamarack. In areas with better drainage such as in riparian environments, on islands, or along low ridges, white spruce is dominant with some white birch, balsam poplar, trembling aspen, and balsam fir. Fire has repeatedly spread in these areas and has therefore, created a fragmented forest cover supporting early succession species (Rowe, 1972).

Coniferous stands tend to have a feather moss groundcover. Bedrock outcrops have patchy tree growth with an understory of low shrubs and a groundcover of low ericaceous shrubs, mosses, and lichens. Poorly to very poorly drained fens have sedge and brown moss vegetation and may have a shrub layer, or may support a tamarack-dominated tree cover with varying components of shrubs, herbs, and sedges. Poorly drained bogs generally support open to closed stands of stunted to medium tall black spruce, with an understory of dwarf birch, ericaceous shrubs, and a moss ground cover. Peatlands that are transitional in development from fen to bog are common and the vegetation reflects the transitional aspects in its community composition (Smith *et al*., 1998). The *Forest Ecosystem Classification for Manitoba, Field Guide* (Zoladeski *et al*., 1995) provides a detailed species relationship, for productive forest types, in terms of their commercial tree species compositions and common relationships for understory shrubs, herbs, and mosses.

In assessing habitat for multiple wildlife species across the broad geographic landscape on the east side of Lake Winnipeg, it was necessary to adopt a habitat-based assessment tool that would provide the most up-to-date imagery and land cover information over the entire region. Due to the large geographic extent of the various project areas, several spatial habitat datasets were assessed to determine their utility in evaluating and modeling and assessing wildlife habitat. The Manitoba Forest Resource Inventory (FRI) has been used in the development of Habitat Suitability Index Models (HSIs) for selected indicator species in Manitoba; however, FRI data are outdated and do not contain consistent attribute data between datasets and do not contain up to date forest fire history information. The Federal Government has developed a Land Cover Classification of Canada (LCC) spatial database. The LCC is a national database map layer that has been harmonized across the major federal departments involved in land management and land change detection. This includes Agriculture and Agri-Food Canada, the Canadian Forest Service, and the Canadian Centre for Remote Sensing. The LCC provides vegetated and non-vegetated land cover classes that identify the primary ecological and vegetation/habitat conditions of an area. Joro designed an enhanced version of the LCC which includes a further harmonization/integration of the National Stratification Working Group ecological framework database (Smith *et al*., 1998) to the ecodistrict scale and the addition of wetland features, Manitoba forest harvest layers, and forest fire layers. This layer, Land Cover Classification of Canada, East Side (LCCES) provides attribute data that defines the landform and soil conditions as well as fire and harvest records for the RPSA. The LCCES for the LPSA is provided in Map 7.

A listing of the known flora species for the Lac Seul River Ecoregion is provided in Appendix A. Note: the vegetation technical report for P4 Study Area should be referred to for detailed listings of flora.

2.1.5 Fire History

Natural disturbances, such as forest fires, are important for the health and succession of the boreal forest. Boreal forest fires play an important role in characterizing forest composition, energy cycles, and biochemical processes. Map 8 illustrates the fire activity within the RPSA over the last 84 years. Much of the LPSA was burnt in the 1920's and 1930's, although there is a small portion to the south, which has not been burnt at all within the last 84 years. There was a smaller patch burned in the 1990's along the LPSA and a patch burned just southeast of the line in the 2000's.

2.1.6 Wildlife and Habitat

The LPSA is composed of vegetation species that are adapted to the role of disturbance in succession and renewal of the forest. The ability to adapt and occupy forest habitats, at various stages of succession, extends to the wildlife species that inhabit this area. The area is composed of a mosaic of different aged forest stands, plant communities, and floral species that reflect the climate, topography, soils, drainage, disturbance history, and forest development of the region. Forests provide a structure in which wildlife live and the degree and complexity of this structure within the landscape determines, to some extent, the wildlife inhabiting the forest (Keenan *et al.*, 2009).

Wildlife species typical of this area include American marten (*Martes americana*), American mink (*Neovison vison*), American beaver (*Castor canadensis*), American black bear (*Ursus americanus*), boreal woodland caribou, ermine (*Mustela erminea*), fisher (*Martes pennanti*), grey wolf (*Canis lupus*), least chipmunk (*Eutamias minimus*), lynx (*Lynx canadensis*), moose, otter (*Lutra canadensis*), red squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), southern red-backed vole

(*Clethrionomys gapperi*), and wolverine (*Gulo gulo*). The following sections provide an overview of wildlife found in the RPSA.

BOREAL WOODLAND CARIBOU

Boreal woodland caribou are listed as threatened (Schedule 1) under the Species at Risk Act (SARA) (COSEWIC, 2002) and the Manitoba Endangered Species and Ecosystems Act (MESEA) (MBWCMC, 2015) and have been studied within the P4 LPSA and RPSA since 2011. In Manitoba's Boreal Woodland Caribou Recovery Strategy for 2015, a conservation status assessment was assigned as "medium risk" for the Atikaki-Berens Management Unit (MU), which occurs within the RPSA on the east side of Lake Winnipeg (MBWCMC, 2015). Within this MU occurs the Berens, Atiko, and Bloodvein caribou ranges, but only the Berens range overlaps with the P4 LPSA. Boreal woodland caribou are generally found within large, continuous tracts of habitat in order to avoid high densities that may attract predators during critical calving and rearing periods (Environment Canada, 2012). They generally inhabit mature to old growth boreal coniferous forests with an ample supply of lichen in the winter as well as muskegs and peatlands (Environment Canada, 2012).

MOOSE

Moose are distributed across much of forested Canada (Banfield, 1974) and are common within the boreal forest including most areas of Manitoba as well as the LPSA. Moose are most commonly found in swampy areas with aquatic plants rooted in mineral soils, and willows, which make up the majority of their diet (Renecker and Schwartz, 1998). Moose often select habitats of early successional vegetation such as shrubland areas and deciduous forests (Gillingham and Parker, 2008). Such successional vegetation often exists after disturbance, both natural (i.e. wildfire) and anthropogenic (i.e. forest removal) (Stewart *et al*., 2010). They are highly valued for licensed hunting and rights-based subsistence hunting and are an integral component of the ecosystem in their predator/prey relationship (MCWS, 2015). Moose population sustainability is a specific concern in several GHAs in eastern Manitoba; however, populations in GHA 17B are not a conservation concern as licensed hunting is permitted throughout.

WHITE-TAILED DEER

White-tailed deer (*Odocoileus virginianus*) may be present in the LPSA; however, their range is generally limited to south of the Bloodvein River due to harsh winter conditions and limited food supply (MCWS, 2015). They tend to inhabit both woodland and open areas, which are used for cover and forage (Reid, 2006).

GREY WOLVES

Grey wolves tend to inhabit forested areas with sufficient prey species such as moose, beaver, and snowshoe hare. Grey wolf populations are monitored by ESRA for their movement patterns and diet, in terms of prey species identification, as they are a primary predator of moose. MCWS licenses hunters for resident, non-resident, and foreign resident wolf hunting in GHA 17B (MCWS, 2015).

BLACK BEARS

Black bears are found across most wooded habitats in North America and are relatively common through the northern mixed and eastern deciduous forests (Kolenosky and Strathearn, 1987; Reid, 2006). Black bear densities tend to be highest in diverse forests at relatively early stages of development and lowest where soils are thinner and plant growth generally poorer (Kolenosky and Strathearn, 1987). Black bears are common in the LPSA and MCWS licenses registered outfitters for foreign resident bear hunting in GHA 17B (MCWS, 2015).

FURBEARERS

Furbearers of importance to trappers in the LPSA include beaver and muskrat (*Ondatra zibethicus*), fisher, marten, mink, ermine, otters, red fox (*Vulpes vulpes*), and red squirrel. Both fisher and marten can be found in most of Manitoba's boreal forest and generally inhabit mature coniferous or mixedwood forests. They feed on small mammals such as hares, some birds, fruit, nuts, and carrion (Reid, 2006). They also feed on rodents, hares, shrews, and insects. Mink also inhabit areas along streams, lakes, and wooded cover. They can be found in all of Manitoba and will primarily feed on small to medium mammals, crayfish, frogs, snakes, and birds (Reid, 2006). Otters can be found in most of Manitoba and within the LPSA near or in lakes, streams, rivers, or swamps. They feed on fish, frogs, crayfish, and shellfish (Reid, 2006). Commercial trapping of furbearers is administered by MCWS through the Registered Trapline (RTL) system (MCWS, 2014). There are 10 RTLs that intersect the LPSA.

SMALL MAMMALS

There are several species of small mammals that can be considered to be within or at the edge of their natural range. These include least weasel (*Mustela nivalis*), little brown myotis (*Myotis lucifugus*), masked shrew (*Sorex cinereus*), meadow jumping mouse (*Zapus hudsonius*), Northern bog lemming (*Synaptomys borealis*), porcupine (*Erethizon dorsatum*), pygmy shrew (*Sorex hoyi*), raccoon (*Procyon lotor*), short-tailed shrew (*Blarina brevicauda*), silver-haired bat (*Lasionycteris noctivagans*), striped skunk (*Mephitis mephitis*), and woodchuck (*Marmota monax*). A listing of potential mammals that can be found in the LPSA is presented in Appendix B.

HERPITILES (REPTILES AND AMPHIBIANS)

There are two species of turtles whose ranges overlap with the LPSA: the snapping turtle (*Chelydra serpentina*) and the western painted turtle (*Chrysemys picta belli*). Snapping turtles are classified under SARA (2008) as a species of Special Concern. The LPSA is on the northern extent of the snapping turtles range in Manitoba. These species inhabit the shallow areas of many types of permanent water bodies with muddy bottoms (Preston, 1982; Conant and Collins, 1991).

The red-sided garter snake (*Thamnophis sirtalis parietalis*) has the northernmost distribution of any species of snake in North America and is the only species found in the area (Preston, 1982; Cook, 1984; Conant and Collins, 1991). They prefer **mesic** woodlands where they can be often found at the margins of ponds (Preston, 1982). They will often hibernate within crevices in upland areas. The range of the red-sided garter snake extends throughout much of the Regional Project Study Area (Conant and Collins, 1991). A number of species of frogs and toads also may occur within the area and they include: American toad (*Bufo americanus*), boreal chorus frog (*Pseudacris triseriata maculata*), Green frog (*Lithobates clamitans*), northern spring peeper (*Hyla crucifer crucifer)*, northern leopard frog (*Rana pipiens*), and wood frog (*Rana sylvatica*) (Conant and Collins, 1991). These species generally require shallow ponds and puddles for breeding and moist environments in shrubby and wooded areas for the rest of the year. A listing of potential amphibians and reptiles that can be found in the LPSA is presented in Appendix C.

BIRDS

Waterfowl, raptors, upland game birds and songbirds comprise most of the 170 species that breed, along with the remaining 46 non-breeding transient species that occur, within the RPSA. Bird species present in the RPSA include, but are not limited to the bald eagle (*Haliaeetus leucocephalus*), common nighthawk (*Chordeiles minor*), gray jay (*Perisoreus canadensis*), great horned owl (*Bubo virginianus*), herring gull (*Larus argentatus*), northern hawk owl (*Surnia ulula*), olive-sided flycatcher (*Contopus cooperi*), osprey (*Pandion haliaetus*), raven (*Corvus corax*), red-tailed hawk (*Buteo jamaicensis*), sharp-tailed grouse (*Tympanuchus phasianellus*), short-eared owl (*Asio flammeus*), and spruce grouse among others (Bezener and De Smet, 2000; Peterson and Peterson, 2002; Manitoba Avian Research Committee, 2003). Geese, ducks, and other waterfowl are also found in the RPSA.

Bald eagles can be found in most of Manitoba and within the RPSA. It nests in tall shoreline trees along lakes, rivers, and open areas and primarily feed on waterbirds, small mammals, fish, and often carrion (Bezener and De Smet, 2000). Osprey can be found in most of Manitoba and within the RPSA, its habitat is located along slow flowing rivers, streams as well as lakes where it nests in tall trees or on artificial platforms, and its diet consists mostly of fish, though it will also take rodents, birds, and small vertebrates (Bezener and De Smet, 2000).

The summer range of the short-eared owl overlaps with the RPSA. It inhabits open areas including grasslands, marshes, muskeg, and tundra (Bezener and De Smet, 2000). The range of the olive-sided flycatcher overlaps with the RPSA. It inhabits semi-open mixed and coniferous forests near water or in burned areas and boggy sites with standing dead conifers (Bezener and De Smet, 2000). The common nighthawk can be found in most of Manitoba except the northern extremity of the province and may be found within the RPSA. It inhabits open and semi-open habitats such as forest gaps, meadows, and lakeshores. The bank swallow can be found in Manitoba and may be found in the RPSA. It inhabits open and semi-open habitats such as meadows, riverbanks, and wetlands. The olive-sided flycatcher, common nighthawk, and bank swallow are listed as threatened under SARA and the short-eared owl is listed under SARA Schedule 1 as special concern and threatened under MESEA.

A listing of potential bird species that can be found in the LPSA is presented in Appendix D.

2.1.7 Land and Resource Use

Two communities are located within the RPSA, Berens River First Nation and Poplar River First Nation. Both these communities utilize sections within the LPSA as traditional hunting and gathering areas. Moreover, there are a number of lodges and outposts scattered throughout the area which provide various services focused mainly on angling and hunting. Refer to Appendix E for a broad description of the land and resource uses that occur in the LPSA.

3.0 WILDLIFE VALUED COMPONENTS

The following table (Table 1) provides a summary of the wildlife Valued Components (VCs) selected for the assessment in the P4 EIA. The screening and selection process for wildlife VC selection is found in the P4 EIA.

These VCs include:

- Boreal Woodland Caribou;
- Moose;
- Marten;
- Beaver;
- Migratory Birds (forest birds and waterbirds);
- Ecologically Sensitive Wildlife Sites; and
- Herptiles (reptiles and amphibians).

Table 1 **Summary of Valued Components and Selection Rationale for the Project 4 Wildlife Data Collection**

Group	Valued Component	Rationale
Ungulates	Moose	Aboriginal/cultural importance Hunting value Prey for large carnivores
	Woodland Caribou	Ranked threatened under COSEWIC, SARA, MESEA Environmental Indicator
Furbearers	Marten	Valued economic species Important predator/prey species
	Beaver	Ecosystem engineer Representative aquatic furbearer
Ecologically Sensitive Wildlife Sites	Bat and snake hibernacula Terrestrial mammal dens (e.g. bears, wolves, wolverine) Rookeries Large stick nests Mineral licks	Critical wintering habitat Critical breeding habitat Species fidelity to dens and nests Culturally significant sites Raptors and heron rookeries Important mineral source for ungulates
Migratory Birds	Forest Birds (including Canada Warbler, Common Nighthawk, Eastern Whip-Poor-Will, Eastern Wood-Pewee, Olive-sided Flycatcher)	Some species listed as threatened or special concern under COSEWIC, SARA, and MESEA Culturally significant species
	Waterbirds (including Trumpeter Swan, Yellow Rail, Least Bittern, ducks and geese)	Some species listed as threatened or special concern under COSEWIC, SARA, and MESEA Culturally significant species Some economic-related valuable species
Herptiles Species at Risk	Common Snapping Turtle/Green Frog	Green Frog listed S1S2 under MESEA Common Snapping Turtle listed special concern under COSEWIC and SARA

4.0 TRADITIONAL KNOWLEDGE

Traditional Knowledge (TK) was collected through several means in the RPSA and LPSA. ESRA gathered TK through open house sessions and workshops within the communities of Berens River and Poplar River. TK on hunting, trapping, wildlife, and species of conservation concern in the LPSA was incorporated where possible to guide the wildlife studies and assessment of effects. A Trapper Participation Program is currently underway and involves the collaboration of local trappers with ESRA to acquire details on trapping traditions, furbearer distribution, and important local biophysical knowledge of the landscape. Information gathered as a part of the Trapper Participation Program was collected through personal interviews, pre- and post-trapping season qualitative surveys, hands-on collaborative field work with participating trappers, and furbearer/trapping data collection activities.

5.0 SPECIES PRESENCE IN STUDY AREA

The presence and distribution of species in the Project Study Area was assessed through various means. Trail cameras, in particular, were used to provide information on local wildlife, especially predators, and occupancy (presence/absence) along ROWs and within caribou calving complexes. Trail camera studies were designed to focus on larger prey and predator species. White-tailed deer (*Odocoileus virginianus*) occupancy is of concern due to the possible transmission of the *Parelaphostronglus tenuis*, a meningeal work known as "brainworm", which causes serious physical deterioration to moose and caribou (Wasel *et al.,* 2003; Kopcha *et al.*, 2012). A Minnesota Study looking at primary parasites of white-tailed deer identified liver flukes (*Fascioloides magna*), in addition to *P. tenuis*, as an incidental cause of mortality in moose (Vanderwaal *et al*., 2015). Habitat affected the species of parasite that infected white-tailed deer, such that deer present in upland mixed conifer areas were more susceptible to *P. tenuis*, while deer in lowland marsh areas were susceptible to *F. magna*. Woodland caribou were also found to be infected by *F. magna* through studies on a herd in Labrador (Lankester and Luttich, 1988).

Cameras were equipped with lithium batteries and 4-gigabyte memory cards and were programmed on the aggressive setting, to take 5 pictures of the target area per trigger (two pictures per second), when motion or infrared sensors were triggered. Camera sites were selected by placing a hexagonal grid over the study area. The diameter of each cell was 2.5 km, with no more than one camera placement per cell and with a minimum of 2.5 km between camera locations. Specific cells and location within the chosen cells were strategically chosen based on habitat type using the LCCES. General areas were selected for camera placement including along the proposed ASR, along existing natural and anthropogenic linear features, in key habitat for caribou, and lastly, within caribou calving complexes near the ASR as determined by caribou telemetry data.

5.1 Methods

As of January 31, 2015, there were 93 RECONYX ™ PC 900 HyperFire Professional trail cameras deployed to collect mammal presence, absence, and abundance data within the southern RPSA. Trail camera maintenance was performed in spring and fall, and during other aerial surveys as required. Cameras were checked for functional operation, SD cards were swapped, batteries were replaced, and the vegetation directly in front of the camera was cleared, when necessary, to reduce environmental triggering.

5.2 Results

Table 2 shows the species captured on the trail cameras deployed in the P4 Study Area, including the total number of species events and the total suspected individuals. The most common species events were sandhill crane, caribou, moose, and Canada goose and most common suspected individuals were moose, sandhill crane, bear, and caribou (Table 2).

Table 2 Results of the 2013-2015 Trail Camera studies in the Project 4 Study Area as of January 31, 2015

Species	Total Species Events	Total Suspected Individuals
Bear	46	43
Sandhill crane	66	44
Moose	62	47
Caribou	65	37
Wolf	32	21
Unknown	0	1
Lynx	4	4
Red squirrel	1	1
Hare	2	2
Spotted sandpiper	1	1
Canada goose	57	13
Beaver	2	2
Raven	1	1
Wood duck	3	2
Ringneck duck	1	1
Wigeon	2	1

5.3 Summary of Findings

- Trail camera data has augmented information on species distribution and occurrence in the RPSA and confirmed the presence of common species throughout the RPSA.
- White-tailed deer were not observed, suggesting no persistent range occupancy in the LPSA.

6.0 BASELINE HABITAT EVALUATION AND ANALYSIS

Wildlife baseline data research studies have been underway in the P4 LPSA and RPSA since 2011 to gather data to support site selection and the EIA for the proposed ASR from Berens River First Nation to Poplar River First Nation. The wildlife baseline research studies have been carefully designed to acquire wildlife data close to and away from the proposed project to assess potential effects of the project. The information derived from these baseline data and analyses has supported potential effects assessments and potential mitigation associated with project planning and design.

6.1 Methods

During the projected life span of the Project, the dynamic ecosystem in which the ROW is located will be constantly changing. As a part of baseline monitoring a habitat evaluation was conducted to determine the type of habitat currently surrounding the proposed P4 ASR. Once P4 is built, the existing WR will be decommissioned. The habitat removed to construct P4 will be in part offset by the habitat gained once the WR is decommissioned and the ROW regenerated.

Although vegetation recovery from winter road use has not been well researched, factors such as the amount of disturbance to ground vegetation (from clearing and travel), vegetation type removed, and natural plant succession will influence rate of regeneration. Primary sources of plants for recovery include those present on site, seeds dormant in the soil, and adjacent vegetation. Cover of vascular plants as well as bryophytes and lichens will return within 5 years to similar levels on the WR as soils are generally undisturbed. Slower growing conifer species are expected to invade into the disturbed area within 5 years, however, species such as black spruce will take decades to reach pre-disturbance height of adjacent forest (Campbell and Bergeron 2012). In Manitoba, monitoring of other RoWs where vegetation has been removed in boreal forest environments has shown that vegetation recovery begins the following growing season (K. Szwaluk, Szwaluk Environmental Consulting, pers. comm.). Grasses and forbs are often quick to re-establish in terrestrial habitats where ground disturbance is low. Some sites showed a >30% species cover increase over two growing seasons. Shrub cover (*Populus tremuoides, P. balsamifera, Salix* spp.) can achieve height growth over 1 m in the first two growing seasons. For winter roads in areas of deciduous forest, young forest cover is expected within about 10 years.

The LCCES covertype analysis provides insight into the amount of habitat available within the LPSA for various species and has been included in habitat modeling results provided in Section 12.1. P4 was buffered by 5 km on either side with 10 intervals of 500 m each representing the LPSA (10 x 500 m = 5 km per side of the ASR). Each 500 m interval was used to clip the LCCES data. The results were summarized as percentages of LCCES covertypes (habitat) within each buffer interval. For P4, the buffers were summarized by distance from the feature on both sides of the feature (for example: 0-500 m LCCES summary, 500-1,000 m LCCES summary, etc.). For the P4 footprint (PF; 100 m ROW) and

GHA17B, the LCCES was used to determine the amount of available land cover types (including their percentages) within this defined geographic area.

6.2 Results

The LCCES habitat analysis results showed that the most common covertype surrounding within the LPSA was shrubby wetland at 38% of the area. Dense coniferous forest was also a common covertype near the ASR covering over 24% of the area. There was very little exposed land, treed wetland, tall shrub, or open coniferous forest near P4 (see Table 3 -5 and Map 7).

Table 3 LCCES covertypes and area of coverage within the Local Project Study Area

LCCES Covertype	Habitat	Area (km^2)	Percentage (%)
82	Wetland Shrub	359.84	38.24
211	Coniferous Dense	223.46	23.74
231	Mixedwood Dense	131.07	13.93
83	Wetland Herb	62.46	6.64
221	Broadleaf Dense	48.14	5.11
20	Water	40.54	4.31
213	Coniferous Sparse	21.96	2.33
212	Coniferous Open	18.86	2.00
51	Shrub Tall	17.98	1.91
81	Wetland Treed	14.90	1.58
33	Exposed Land	1.89	0.20
Total		**941.08**	**100.00**

The LCCES habitat analysis results showed that the most common covertype within the P4 Footprint Area is wetland shrub at 38% of the area (Table 4). Dense coniferous forest was also a common covertype near the ASR covering nearly 24% of the area.

Table 4 **LCCES covertypes and area of coverage within the Project 4 Footprint**

LCCES Covertype	Habitat	Area (km^2)	Percentage (%)
82	Wetland Shrub	356.97	38.45
211	Coniferous Dense	219.99	23.70
231	Mixedwood Dense	128.26	13.82
83	Wetland Herb	62.26	6.71
221	Broadleaf Dense	46.44	5.00
20	Water	40.07	4.32
213	Coniferous Sparse	21.66	2.33
212	Coniferous Open	18.62	2.01
51	Shrub Tall	18.02	1.94
81	Wetland Treed	14.43	1.55
33	Exposed Land	1.59	0.17
Total		**928.30**	**100.00**

An analysis of the LCCES covertypes within the GHA 17B was also conducted. Based on these analyses, the LCCES covertype most commonly found within GHA 17B is wetland shrub at 42% (Table 5).

Table 5 **LCCES covertypes and area of coverage within GHA 17B**

Covertype	Habitat	Area (km^2)	Percentage (%)
82	Wetland Shrub	2924.42	41.65
211	Coniferous Dense	1350.47	19.23
83	Wetland Herb	831.64	11.84
231	Mixedwood Dense	585.22	8.33
212	Coniferous Open	287.67	4.10
20	Water	267.81	3.81
81	Wetland Treed	241.77	3.44
221	Broadleaf Dense	193.02	2.75
213	Coniferous Sparse	163.84	2.33
51	Shrub Tall	131.71	1.88
33	Exposed Land	34.50	0.49
223	Broadleaf Sparse	9.70	0.14
212	Broadleaf Open	0.20	0.00
232	Mixedwood Open	0.01	0.00
32	Rock/Rubble	0.01	0.00
Total		**7021.99**	**100.00**

6.3 Summary of Findings

- Habitat types found within the LSPA are abundant and similar to those commonly occurring in GHA 17-B.
- No unique or limiting habitats occur in the LPSA.

7.0 BOREAL WOODLAND CARIBOU

Boreal woodland caribou are listed as threatened under SARA and MESEA (as described in Section 2.1.6). This species has been monitored extensively for over 15 years within the RPSA through various collaring programs conducted as part of land and wildlife management planning activities. The results of past and current monitoring have provided valuable information to assist in the refinement of the current range and Management Unit as defined by the Manitoba Boreal Woodland Caribou Management Committee (MBWCMC 2015). The MBWCMC (2015) indicates a conservation status assessment assigned as “medium risk” for the Atikaki-Berens MU which is comprised of the Berens, Atiko, and Bloodvein caribou ranges. Only the Berens range overlaps with the P4 LPSA. The current Conservation Status Assessment for the Atikaki-Berens MU indicates the population size (acceptable), population trend (under review), natural disturbance (high), anthropogenic disturbance (moderate), and planned development (moderate) (MBWCAC 2015).

The following sections provide the methods and results of ongoing monitoring on boreal woodland caribou within the RPSA.

7.1 Monitoring Approach (Collaring)

As part of ongoing planning and monitoring for ASR development in the LATN area, boreal woodland caribou were captured and collared in the Berens and Round Lake sub-ranges using a contracted helicopter net-gun capture crew; this occurred under the authority and direction of MCWS on January 31 to February 3, 2011, February 5 and 7, 2012, February 2, 2013, and February 17-19, 2014. ESRA and MCWS staff were involved in collar initialization and testing, reconnaissance flights to locate target animals and groups, field logistics, and data management. Once animal groupings were located, the capture crew targeted select animals that were netted, restrained with hobbles, and blindfolded. No immobilizing drugs were used during any capture operations. Following non-chemical (physical) immobilization, measurements and samples were taken (blood, feces, and hair) and collars were fastened. Once the collars were secured and biological samples were collected, the animals were released.

The caribou were equipped with collars that begin to transmit data immediately post-release. GPS satellite technology collects collar data, triangulates the position of the caribou every three hours, and transmits data every 1.5 days via the Iridium satellite network. Collars also have very high frequency (VHF) radio beacons for relocation by radio tracking.

To keep the sample size at 20 collared animals within each of the target caribou sub-ranges, collars were deployed each year in both sub-ranges to account for collar failures and mortalities. Ideally, ungulate movement studies should aim to maintain a consistent annual sample size, and dependent on the research objectives, should be comprised of a minimum of 20 collared animals per cohort (McLoughlin *et al.,* 2003). The results of the collaring efforts are shown in Table 6 below.

Table 6 Total number of collars annually deployed, collar failures, animal mortalities and currently active collars as of January 31, 2015

Sub-range*	Collars Deployed 2011	Collars Deployed 2012	Collars Deployed 2013	Collars Deployed 2014	Number of Failures	Number of Mortalities	Recovered Drop Offs	Currently Active
Berens	14	16	3	14	17	10	3	17
Round Lake	26	3	8	13	20	10	4	16
Total	**40**	**19**	**11**	**27**	**37**	**20**	**7**	**33**

* One caribou switched from Berens River to Round Lake sub-range in winter 2012/13 however total numbers remain the same

Active collars refer to deployed collars that currently transmit data as scheduled. Any collar that fails to transmit data for 100 days of deployment is considered a failure and is deactivated. Mortalities refer to collared females that have died. Collars that are in mortality mode are found by locating the double pulsing VHF beacon that enters into mortality mode when a collar does not move for 24 hrs.

7.2 Group Counts

7.2.1 Methods

Winter aerial caribou telemetry and group count surveys were conducted on March 21, 2011, March 29, 2012, and March 19-21, 2013 in areas east of Loon Straits, Berens River, and Poplar River. The survey area encompassed portions of P1, P4, and P7-7a. Collared animals were located by Joro biologists using VHF telemetry equipment and a helicopter. Once animals were identified, the biologists recorded all observations of caribou identified with the collared animal. Age and sex information was recorded on detailed data sheets and hand-held GPS units for all caribou observations.

7.2.2 Results

There were 174 caribou observed among 14 groups during the March 21, 2011 aerial caribou telemetry and group count survey. There were 116 caribou observed among 27 groups during the March 29, 2012 aerial caribou telemetry and group count survey. There were 338 caribou observed among 26 groups during the March 19-21, 2013 aerial caribou telemetry and group count survey. Table 7 summarizes these results.

Table 7 **Results from the 2011-2013 aerial caribou telemetry and group count surveys within Project 1, Project 4, and Project 7-7a areas**

Year	Sub-range	Number of Active Collars	Count	Groups
2011	Berens	14	60	4
	Round Lake	26	114	10
	Total 2011	**40**	**174**	**14**
2012	Berens	25	74	18
	Round Lake	22	42	9
	Total 2012	**47**	**116**	**27**
2013	Berens	13	221	17
	Round Lake	13	117	9
	Total 2013	**26**	**338**	**26**

7.2.3 Summary of Findings

- Results from group counts support the Environment Canada's population size estimate of 300-500 (self-sustaining) for the Atikaki–Berens Management Unit (Environment Canada, 2012).
- Results from group counts also support the Current Provincial Conservation Status Assessment of the population being "acceptable" (MBWCMC, 2015).

7.3 Population Trend

7.3.1 Methods

Population trends (growth) are being assessed in the RPSA through ongoing monitoring of recruitment and adult female survival. The long-term objectives of current monitoring are related to understanding the potential effects of human development on neonatal mortality and adult female survival. Individual collared females are being monitored to determine location of calving site in relation to habitat type and anthropogenic features. Several studies have tracked ungulate neonates during the first months in life to determine cause of death, predators responsible (bears or wolves), habitat associations and proximity to natural and human features (Gustine *et al.*, 2006, Ballard *et al.*, 1981). Recruitment surveys were conducted to follow the survival success of each individual female's calf through the summer and into the fall period, prior to caribou grouping during winter. This method has been used to associate calf survival to individual females (Seip, 1992). As caribou group during winter, it is difficult to attribute calves to individual females during aerial surveys due to the various terrain and forest cover that exists across the RPSA. Recruitment and survival is expressed as Lambda (ʎ) and the following sections described the methods and results of recruitment, survival, rates in increase and observed Lambda rates across the Berens Range.

Recruitment

Recruitment surveys were conducted summer through fall for these monitoring and baseline studies as part of a longer-term monitoring program to assess calf survival in relation to disturbed and undisturbed habitats as well as in relation to existing winter and all season roads. These surveys identify the presence of calves with collared females. The last location of collared animals was calculated and plotted on a map and uploaded onto a hand-held GPS unit. Each collared caribou was located using the VHF frequency transmitted from the collar. Joro biologists use telemetry equipment mounted to the helicopter to triangulate the collared animal's location. A high altitude was maintained to reduce disturbance to the animals. Once the animal was identified, biologists determined if the female did or did not have a calf at heel. Calf and cow activity was also recorded. On subsequent recruitment flights, caribou that were identified with calf at heel were targeted again as well as a 10% random sample of other collared females that did not appear to have a calf previously to ensure there was no error in spotting calves during initial flights. Standard deviations for the overall **parturition** rate and for recruitment rates of each population was calculated from the binomial distribution (Sokal and Rohlf, 1981).

Caribou Survival Analysis

As part of baseline monitoring on boreal woodland caribou in the study area, collared female boreal caribou are being monitoring for survival rates and recruitment to assess population trends, potential increases in mortality, and decrease in recruitment as a result of natural and human disturbance. Caribou range animal survival rates were calculated from GPS collared animals (Stuart-Smith *et al*., 1997).

The mean calving date was calculated to be May 17. Annual survival was calculated for the biological year that ran from 17 May of one year to 16 May of the following year. Live days were calculated based on GPS collar data and was totalled independently for each year (termed exposure days). Mortalities were documented and exposure days from animals with collars that failed and whose fate was unknown were included up to the last recorded collar fix. Annual survival rates and 95% confidence intervals were calculated using the Mayfield (1975) in the computer program Micromort (Heisey and Fuller, 1985).

Caribou Rates of Increase

Using Rettie and Messier (1998), annual survival rates and September recruitment rates were combined to calculate Caughley's (1977) survival-fecundity rate of increase. Survival-fecundity rates of increase were transformed to **Lambda** values (Lambda being a measure of the intrinsic growth rate of a population with a value of 1.0 denoting a stable population, >1.0 an increasing population, and <1.0 a decreasing population). A total of 5000 Monte Carlo simulations were run to generate 95% confidence limits for Lambda values and their standard errors.

7.3.2 Results

Recruitment

Table 8 describes the results of the 2011 - 2014 recruitment surveys. (*Note: Studies are ongoing and lambda rates will be assessed over longer periods of time due to natural variability in recruitment and* *survival. With higher sample size, comparisons of Lambda for females calving near anthropogenic features will be compared to those away from features*).

Table 8 Results from the 2011-2014 aerial recruitment surveys of the Berens, Round Lake and Norway House caribou sub-ranges

Year	Area	Active Collared Females (July)	Calves Found in July	Calves Surviving till Fall
2011	Berens River	14	0	1
	Round Lake	26	4	5
	Total 2011	**40**	**4**	**6**
2012	Berens River	21	4	4
	Round Lake	20	1	0
	Norway House	17	2	2
	Total 2012	**58**	**7**	**6**
2013	Berens River	16	1	1
	Round Lake	19	0	0
	Norway House	20	5	3
	Total 2013	**55**	**6**	**4**
2014	Berens River	18	1	2
	Round Lake	17	1	3
	Norway House	29	5	6
	Total 2014	**64**	**7**	**11**

Caribou Survival Analysis

The values shown in Tables 9 and 10 represent the survival from May 17 of the nominal year until May 16 of the following year (values in parentheses are 95% confidence limits). A total of 10 caribou mortalities were recorded near P4 ASR as of January 31, 2015. One of these mortalities was recorded within the LPSA and was of an unknown cause. These findings have been incorporated into on-going recruitment and mortality studies.

Table 9 **Caribou survival rate for the Berens River, Round Lake, and Norway House Sub-ranges over a one-year period (May 17 to May 16) during 2011-2015**

Range	2011	2012	2013	2014	Pooled
Berens River	0.87 (0.71-1.00)	0.76 (0.57-0.94)	0.78 (0.59-1.00)	0.86 (0.69-1.00)	0.81 (0.72-0.91)
Round Lake	0.91 (0.81-1.00)	0.82 (0.53-0.96)	0.69 (0.50-0.95)	0.93 (0.80-1.00)	0.84 (0.76-0.93)
Norway House	N/A	0.74 (0.53-0.96)	1.00	1.00	0.91 (0.84-0.98)

Table 10 shows comparative annual survival rates for 2010, 2011, and pooled 2010 and 2011 from published sources.

Table 10 **Known comparative caribou annual survival rate from published sources*+****

Evaluation Range	2010	2011	Pooled 2010-11
Charron Lake*	1.00 (1.00 - 1.00)	0.84 (0.68 - 1.00)	0.88 (0.76 - 1.00)
Harding Lake*	0.91 (0.75 - 1.00)	0.80 (0.63 - 1.00)	0.85 (0.72 - 1.00)
Reed Lake*	1.00 (1.00 - 1.00)	0.78 (0.56 - 1.00)	0.88 (0.73 - 1.00)
The Bog*	0.94 (0.84 - 1.00)	0.77 (0.59 - 0.99)	0.85 (0.75 - 0.98)
Wabowden*	0.94 (0.83 - 1.00)	0.78 (0.59 - 1.00)	0.87 (0.75 - 1.00)
Wheadon*	0.88 (0.74 - 1.00)	0.94 (0.84 - 1.00)	0.91 (0.82 - 1.00)
Wimapedi-Wapisu*	1.00 (1.00 - 1.00)	0.80 (0.64 - 1.00)	0.90 (0.82 - 1.00)
Alberta+	0.85 (geometric mean across 14 populations and 17 years) (individual population from 0.77 to 0.91)		
Saskatchewan+	0.84 (averaged across 6 ranges)		
Berens 2011-2014**	0.81 (0.72-0.91)		
Round 2011-2014**	0.84 (0.76-0.93)		
NWH 2011-2014**	0.91 (0.84-0.98)		

*Joro Consultants. 2012a. Bipole III Transmission Project Caribou Supplemental Report. Prepared for Manitoba Hydro

+Joro Consultants. 2012b. Caribou presentation to the Manitoba Clean Environment Commission by Doug Schindler

**ESRA data

Caribou Rates of Increase

Table 11 represents the caribou herd annual growth rate calculated (expressed both as rs (recruitment survival) and Lamda (λ)) for 2011, 2012, 2013, 2014, and pooled for 2011-2014. The rs values above 0 indicate proportional annual increase and those below 0 indicate proportional annual decline (values in parentheses are 95% confidence limits) (Table 11).

Table 11 **Caribou growth rate for the Berens River, Round Lake, and Norway House Sub-ranges**

Range	2011		2012		2013		2014		Pooled	
	rs	ʎ	rs	ʎ	rs	ʎ	rs	ʎ	rs	λ
Berens River	-0.110	0.90 (0.73-1.06)	-0.180	0.83 (0.66-0.99)	-0.19	0.83 (0.59-1.06)	-0.08	0.93 (0.72-1.13)	-0.12	0.89 (0.57-1.19)
Round Lake	0.001	1.00	-0.200	0.82 (0.65-0.99)	-0.37	0.69 (0.46-0.91)	0.05	1.05 (0.86-1.24)	-0.09	0.91 (0.81-1.02)
Norway House	n/a	n/a	-0.240	0.79 (0.59-0.99)	0.10	1.11 (1.00-1.22)	0.22	1.25 (1.13-1.37)	0.06	1.06 (0.96-1.17)

7.3.3 Summary of Findings

- Lambda rates in the caribou Sub-Ranges are similar to those observed in other areas of the province during the reported periods indicating there are no unique aspects to boreal caribou population trends that may be of specific concern to the P4 Project.
- Long term monitoring of Lambda values are required to determine differences in population trends (increase or decrease), between individual ranges within the Atikaki-Berens and other MUs across the province.

7.4 Caribou Distribution

7.4.1 Methods

Intersection of Core Use Areas

In summer, boreal woodland caribou are broadly distributed and solitary during the calving and critical calf-rearing period, while throughout the winter they are aggregated. Core use areas can be defined as areas where wildlife (i.e. boreal woodland caribou) utilize habitat at significantly higher rates, for a larger length of time, within home ranges and are identified by the use of GPS data and surveys.

Spatial analysis of movement data from collared animals was performed to be utilized in evaluating potential effects that may result from the development of P4. Volume-density kernels were created in Environmental Systems Research Institute's (ESRI) ArcGIS (ESRI, 2011) using the Home Range Tools extensions with data collected during winter telemetry surveys and GPS data in the Berens and Round Lake sub-ranges from January 31, 2011 – March 31, 2011; December 1, 2011 - March 31, 2012; December 1, 2012 - March 31, 2013; and December 1 - March 31, 2014 (winter core use areas) and from GPS data in both sub-ranges from May 1 - August 15, 2011; May 1 - August 15, 2012; May 1 - August 15, 2013; and May 1 - August 15, 2014 (summer core use areas). Caribou winter and summer core use areas were determined to be within the boundary of the 70% contour of the areas of caribou concentrations (i.e. 70% of the telemetry point locations are concentrated in the 70% contour of the winter and summer core use area).

The proposed P4 ASR shapefile was plotted against the 70% winter and summer core use areas. Using the Environment Canada (2008) buffer width for linear feature disturbance the percent of core area disturbance was calculated for the winter and summer core use areas intersected by the P4 ASR.

Multispecies Surveys

Aerial multispecies distribution surveys were flown on January 10-11, 2011 between Berens River and Poplar River and March 6-7, 2011 between Loon Straits and Poplar River, to locate individuals and tracks to determine the distribution of wildlife species. Areas of species concentrations were developed using volume-density kernel estimates using the kernels analysis tool in the Home Range Tools for ArcGIS (ESRI, 2011). Prior to creating the kernels, 200 observations (either tracks or individuals) were determined as a minimum number of points per animal, as any fewer observations would create an uneven distribution. Winter volume-density kernels were determined to be the boundary of the 70% contour.

7.4.2 Results

Intersection of Core Use Areas

Spatial analysis of movement data showed that between January 31, 2011 and January 31, 2015, 37 collared caribou were found once or more within the LPSA. There were a total of 20,975 GPS points located within the LPSA of the total 342,589 location points (6.1%) from all 93 collared caribou in the Berens River and Round Lake sub-ranges.

Total area of summer core use is 2292.4 km, and the area of intersect of 1 km buffer through summer core use is 26.3 km^2, which is equal to 1.2% of the total summer core use area. Total area of winter core is 994.2 km, and the area of intersect of 1 km buffer through winter core use is 25.2 km^2, equal to 2.5% of the total winter core areas.

Multispecies Surveys

A total of 452 caribou and track observations were made during the January 2011 survey and 269 caribou track observations were made during the March 2011 survey. When compared, the caribou and track survey data kernels illustrate similar core use areas as calculated from telemetry data.

7.4.3 Summary of Findings

- The mapping of tracks and animals through kernel estimates of density support those identified through the assessment of telemetry data resulting in increased confidence in core area identification using the two methods.
- The P4 ASR intersects core winter and summer use areas including known and potential calving areas.

- The total disturbance within core areas is a small percentage of the overall core winter and summer areas.
- Boreal woodland caribou core use areas are widely dispersed across the RPSA.

7.5 Caribou Calving Habitat

Caribou calving sites and habitat were identified through ongoing baseline data collection efforts using GPS collar data from caribou within the RPSA. GPS collar data from the Berens and Round Lake Sub Ranges gathered from 2011 to 2015 were used in assessing calving site fidelity and modeling available calving habitat in the southern RPSA. These data facilitated the determination of potential effects associated with ASR development and operation on known calving sites and habitat within the LPSA.

The following sections describe the methods and results of studies undertaken across the larger Southern Study Area of the P4 ASR Project.

7.5.1 Methods

Calving Fidelity Analysis and Site identification

Spring calving season GPS collar location data from 2011 to 2015 on 29 (Round Lake Sub-Range) and 20 (Berens River Sub-Range) adult female caribou were used to determine calving sites. Fidelity analysis involved determining the distance between the annual calving locations (the date of least movement) to determine if caribou return to the same location to calve (Berglund *et al*., 2014). A box plot was used to show the median distance between calving site locations over consecutive calving years. Only data from animals that calved in consecutive years were used in this analysis.

Caving Habitat - Modelling

The LCCES was utilized to conduct the habitat selection analysis for the Berens and Round Lake Sub Ranges. The “cover type” field within the layer was used to determine the cover types within the range, which consisted of 13 different classes (Table 12). The layer was clipped to an area encompassing the Berens and Round Lake ranges using the ArcGIS 10.1. A **hexagonal grid**, consisting of 200 hectare (ha) hexagon grid cells, built using Geospatial Modeling Environment (GME) and was **unioned** to the habitat layer in order to associate and quantify the re-classified cover types for each unique hexagon within the two boreal woodland caribou ranges. Patch Analyst was run on the area using the Spatial Statistics tool within ArcGIS. The output spreadsheet calculated 15 different metrics (Table 13) for each cover type polygon within each unique hexagon. The amount of cover types was quantified by area (km^2) and proportion (%) and was joined to the patch metrics table.

A total of 114 unique calving hexagons were utilized in the analysis. The total number of calving events recorded between 2011 and 2015 exceeds this, however, a number of calving locations occurred within the same hexagon region over multiple years. Each known calving patch was matched with a random location (hexagon) and then overlaid on the LCCES landscape database. The random samples represent an "unused" landscape group in a use/disuse (use/available) design for the model. Landscape structure statistics were calculated for each hexagon on the LCCES using the ESRI ArcGIS 10 extension Patch

Analyst (Rempel *et al*., 2012). In total there were 13 landscape structure metrics calculated summarizing fragmentation, patch edge and shape complexity, and diversity. For each hexagon the percentage cover of 13 Land use/Landcover types was calculated using the LCCES database. All of the patch metrics, habitat metrics (km^2 and %), actual and random calving hexagons, and fire year were all joined to one database and was then processed in “R” to complete the habitat analysis.

Table 12 **LCC cover type classification used to quantify the area and percent of habitat within each 200 ha hexagon**

Habitat Metrics (km^2 and %)
Broadleaf Dense Forest
Broadleaf Open Forest
Broadleaf Sparse Forest
Coniferous Dense Forest
Coniferous Open Forest
Coniferous Sparse Forest
Exposed Land
Mixed wood Dense Forest
Shrub tall
Water
Wetland Herb
Wetland Shrub
Wetland Treed

Table 13 Patch analyst metrics and definitions

Patch Analyst Metrics	
CA	Class Area (Class = Hex_ID)
TLA	Total Landscape Area
NoP	Number of Patches
MPS	Mean Patch Size
MePS	Median Patch Size
PSCoV	Patch Size Coefficient of Variance
PSSD	Patch Size Standard Deviation
MSI	Mean Shape Index
AWMSI	Area Weighted Mean Shape Index
MPAR	Mean Perimeter-Area Ratio
MPFD	Mean Patch Fractal Dimension
AWMPFD	Area Weighted Mean Patch Fractal Dimension
TE	Total Edge
ED	Edge Density
MPE	Mean Patch Edge

See Appendix F for model development details.

7.5.2 Results

Calving Site Fidelity

The distances between successive calving locations are summarized in Figure 1. The top and bottom portions of the box plot represented the upper and lower quantiles (25% of the data resides within each of the sections of the box). The whiskers show the maximum and minimum values of the data excluding the outliers, which are open circles above the whiskers. These outliers are more than 1.5 times the upper quantile. The median distance between consecutive years, calving locations for the Berens River and Round Lake Sub Ranges are 8 km and 6 km respectively. The minimum distance between consecutive year calving locations for the Berens River herd is 0.015 km and the maximum distance is 89 km. Data shows one caribou did return to the same calving area on its third year of being collared, which was outside the P4 Project Study Area. The minimum distance between consecutive year calving locations for the Round Lake herd is 0.009 km and the maximum distance is 60 km.

Modelling

Based on the caribou calving habitat analysis, all of the hexagons were ranked based on the likelihood that they would be used as a potential calving hexagon based on all of the habitat types and metrics analysis (27 variables). Map 9 provides caribou predicted high quality calving habitat for the P4 Study

Area. A hexagon designated a value closer to one indicates a high probability that the hexagon meets the criteria for calving based on the combination of the 27 variables. Hexagons with values closer to zero are least likely to be selected for potential calving sites based on the habitat and metric variables.

The calving model map is based on likelihoods derived from a canonical analysis of combinations of dominant cover types and patch relationships with a 200 ha grid cell. Performance of the calving model was assessed using the predicted likelihood estimates and it was found that the majority of calving sites were associated with larger values. Based on this assessment the likelihoods were divided into high, medium and low quality categories and used to differentiate habitat quality for calving. As such, the low category does not predict that habitat cannot be used, but that the suite of habitat characteristics make it less likely and thus of lower overall quality. Intraspecific competition will typically always result in some animals selecting lower quality sites so there is no expectation that all animals will select the highest modelled habitat all of the time. The model does capture the habitat characteristics associated with higher use, and of inferred higher quality selected by most of the individuals most of the time.

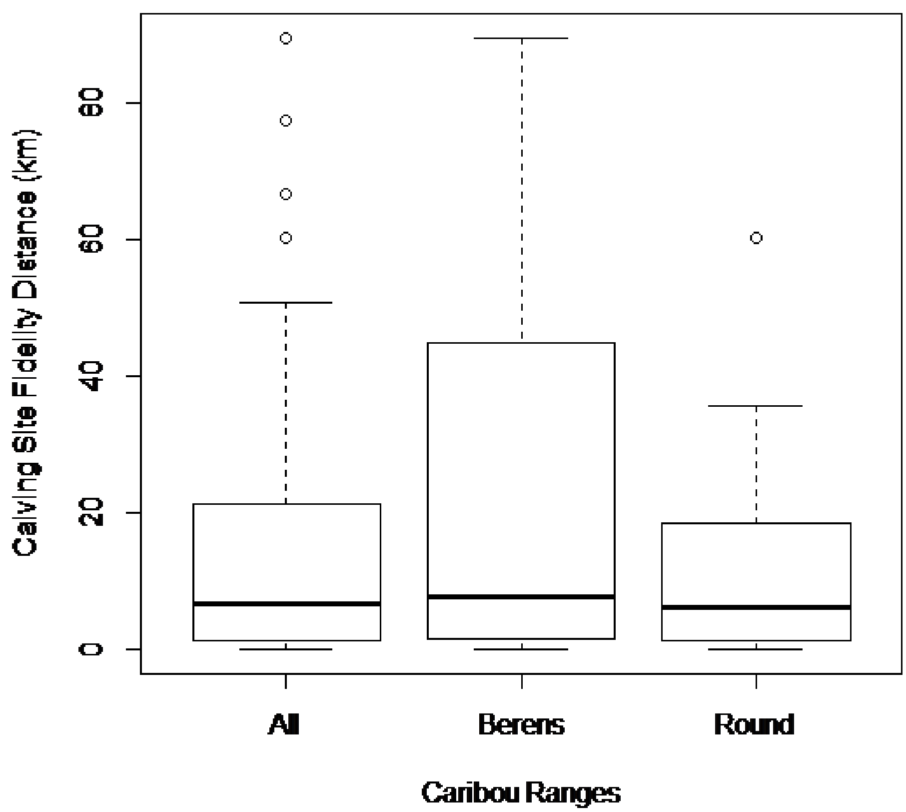


Figure 1 **Calving site fidelity from 2011 to 2014 for Berens River and Round Lake caribou ranges on the east side of Manitoba, boxplots showing the median distance between consecutive year calving locations**

7.5.3 Summary of Findings

- There is low fidelity to specific calving locations with females returning to within 6 to 8 kilometers of previous years calving sites.
- Based on the results of the calving habitat analyses, high quality calving habitat is not limiting across the ranges assessed.
- Site fidelity analysis suggests that potential disturbance associated with ASR construction and operation would not limit females in finding suitable calf and rearing habitat within the RPSA or LPSA.

7.6 Range Fragmentation

Range fragmentation along the ASR was assessed by calculating the point density and path trajectory for caribou presence and movement along and across the P4 ASR. An existing transmission line (section 1) and the existing WR (section 2) were examined for patterns in caribou movement including tendency to cross or avoid the proposed ASR and existing ROW.

7.6.1 Methods

Point Density Analysis

A point density analysis of caribou locations along WRs and transmission lines was performed in the RPSA. Single buffered features occurred where there was a single transmission line (Figure 2) or single WR (Figure 3). Selected linear features were buffered with 10 - 500 m intervals on either side of the feature creating a total of 20 separate buffer intervals or a total of 5 km on either side the feature for a total of a 10 km buffer.

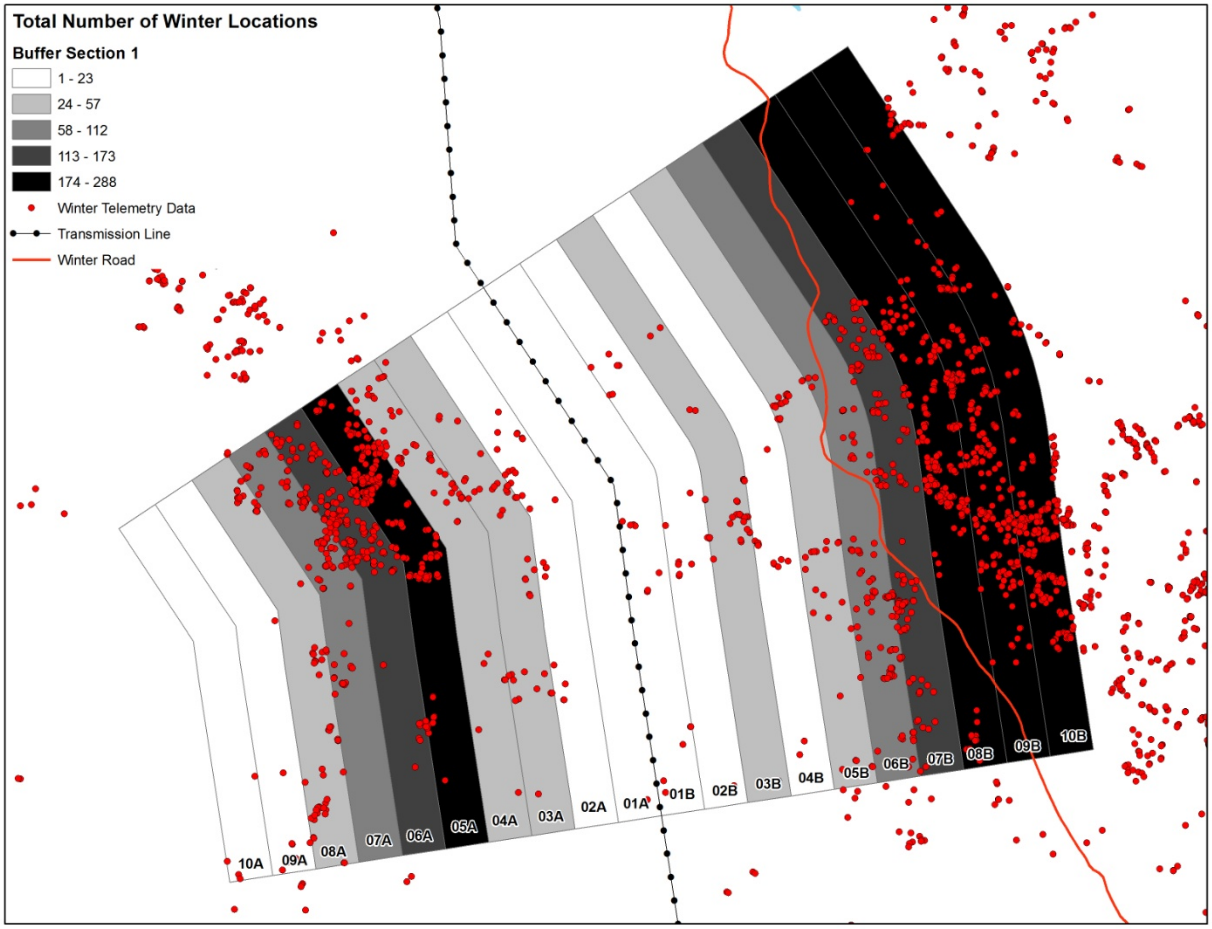


Figure 2 **Example of a single linear feature (transmission line) buffered by 500 m intervals for a total of 5 km on either side of the linear features**

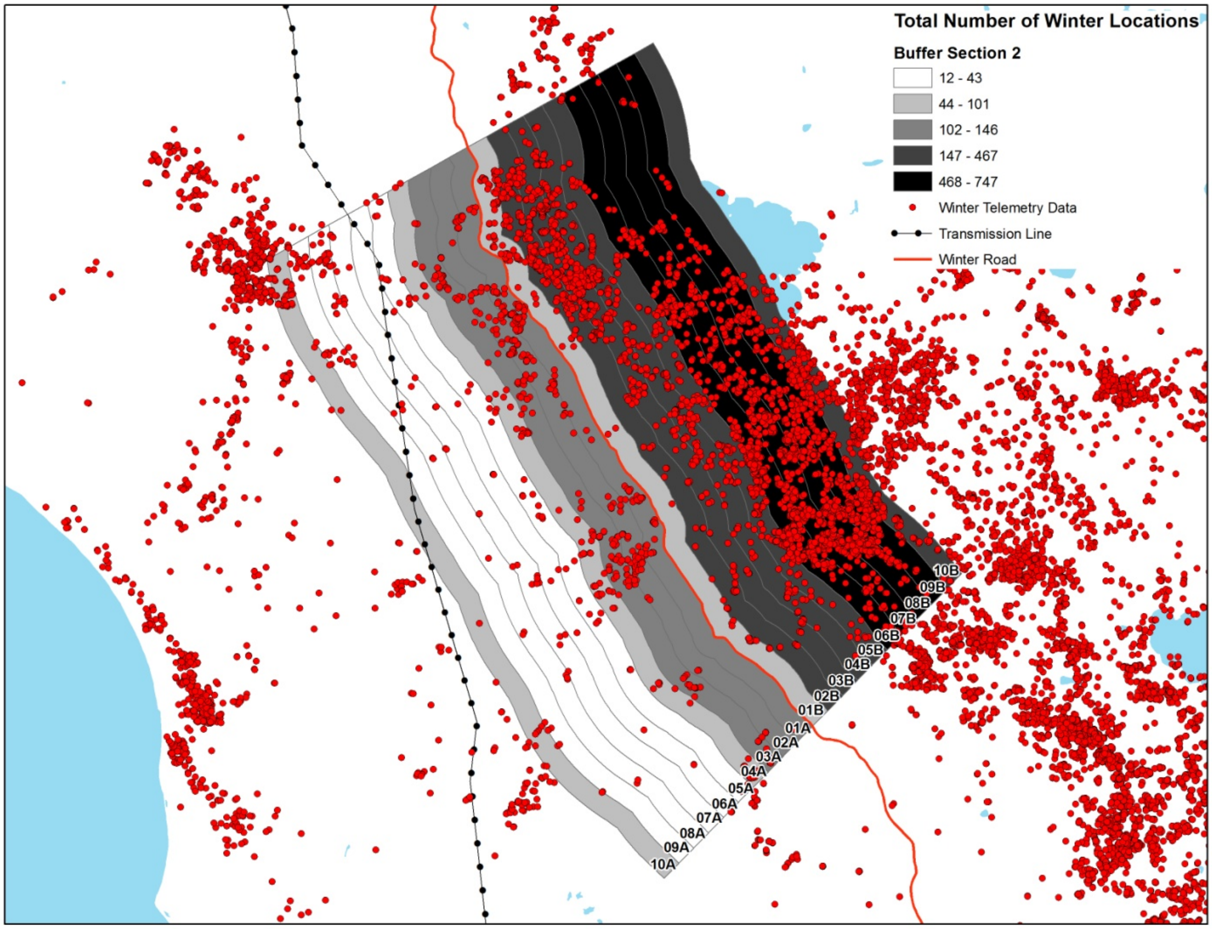


Figure 3 **Example of a single linear feature (winter road) buffered by 500 m intervals for a total of 5 km on either side of the linear feature**

The point density analysis was completed by overlaying all of the winter GPS location data (February 2, 2011 to January 31, 2015, inclusive) from collared caribou over the intervals of buffers. The winter season is defined as December 1 - March 31, inclusive. A 'Count Points in Polygons' tool within Hawth's Tools was used to calculate how many points were in the individual buffer sections. This created a field in the attribute table of the buffers with the total number of points within the buffer intervals for the P4 ASR.

Path Trajectory Analysis

Caribou response to linear features was assessed by using GPS tracking data to conduct crossing event analysis. Caribou GPS locations were converted into path segments by connecting successive locations. The movement rate of each segment was determined using the time and distance between locations. Crossing events were identified when path segments intersected linear features. Winter and summer datasets were used to compare overall movement rates in the Round Lake and Berens River sub-ranges with rates during crossing events of WRs and transmission lines.

Winter data included 112,573 locations from 92 caribou, from December 1 to January 31 (February 2, 2011 - January 31, 2015), inclusive (Table 14). Summer data for this analysis included 110,158 locations from 89 caribou, from May 1 to August 15 (2011 - 2015) (Table 14).

Table 14 Number of recorded location points and number of animals intersected linear features

Sub-range	Summer		Winter	
	Point Locations	Caribou	Point Locations	Caribou
Berens	51,531	43	51,820	44
Round Lake	58,627	46	60,753	48
Total	**110,158**	**89**	**112,573**	**92**

7.6.2 Results

Point Density Analysis

Winter point density data included 1,793 locations from 18 caribou for the transmission line and 5,231 locations from 26 caribou for the WR analysis during February 2, 2011 - January 31, 2015.

A single feature analysis was performed on the section 1-transmission line with the 5 km buffer on each side. Within the LPSA, there was 18 caribou near the transmission line (Table 15).

A graphical representation of the point density analysis for section 1 of the transmission line south of Poplar River can be found below (Figure 4). There were 18 caribou that crossed the transmission line within section 1 and the data suggests that animals were most often found within the buffer intervals 5A and 8B to 10B representing 2.5 km and 4-5 km from the transmission line. An existing WR traversed section 1 between 6B to 9B (Figure 2) and may have an influence with the movement patterns of the caribou to the east of the transmission line.

Table 15 **Number of recorded location points and number of animals per buffer interval at the single linear feature (section 1: transmission line)**

Buffer Intervals	10A	9A	8A	7A	6A	5A	4A	3A	2A	1A	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	Total
# points	4	11	57	112	173	211	56	38	23	1	12	16	32	14	40	95	148	223	288	239	**1,793**
# animals	3	4	7	7	8	7	8	5	4	1	5	2	7	7	7	11	11	11	15	15	**18**

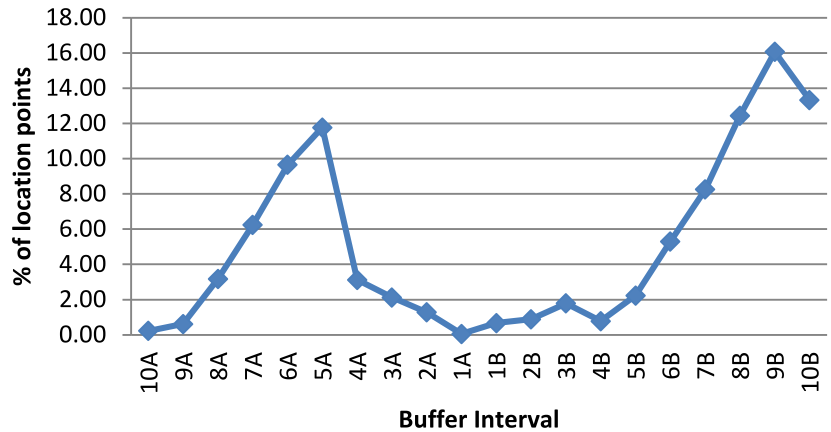


Figure 4 **Percent of point locations per buffer interval for section 1: transmission line (single feature) south of Poplar River**

A single feature analysis was performed on the section 2-existing WR with the 5 km buffer on each side. Within the LPSA, there was 26 caribou near the existing WR (Table 16).

A graphical representation of the point density analysis for section 2 of the existing WR south of Poplar River can be found below (Figure 5). There were 26 caribou that crossed the WR within section 2 and the data suggests that animals were most often found within the buffer intervals 6B to 9B representing 3 km to 4.5 km from the WR. An existing transmission line traversed section 2 between 5A to 10A (Figure 3) that may have an influence on the movement patterns of the caribou to the west of the WR.

Path Trajectory Analysis

Crossing event analysis for the LPSA utilized path trajectory data from the Berens River caribou sub-range to compare behaviours relative to WRs and transmission lines. There were 62 transmission line crossings by 14 caribou in the summer and 63 crossings by 19 caribou in the winter (Table 17). In summer, there were 59 WR crossings by 15 caribou and 105 crossings by 20 caribou in the winter (Table 17). Overall, there were more crossing events of the WR than the transmission line; however, there were seasonal differences in crossing events depending on linear feature with more crossings in summer of the transmission line and more crossings in winter of the WR.

Table 16 **Number of recorded location points and number of animals per buffer interval at the single linear feature (section 2: winter road)**

Buffer Intervals	10A	9A	8A	7A	6A	5A	4A	3A	2A	1A	1B	2B	3B	4B	5B	6B	7B	8B	9B	10B	Total
# points	68	41	41	32	12	43	94	132	146	133	101	326	467	340	350	747	660	621	530	347	**5,231**
# animals	9	9	9	8	10	12	14	14	13	10	12	14	18	20	22	21	22	22	23	22	**26**

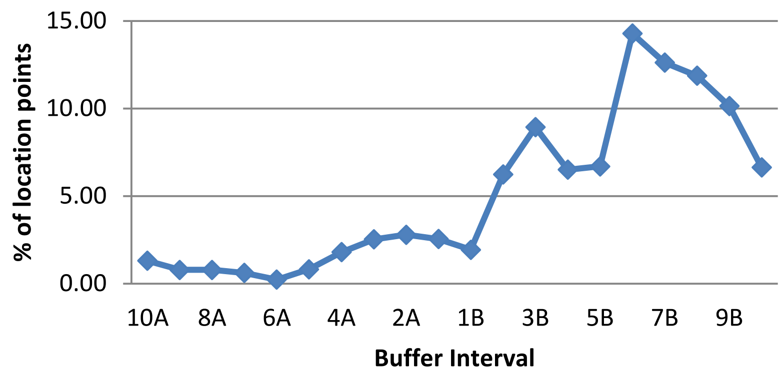


Figure 5 **Percent of point locations per buffer interval for section 2: existing winter road (single feature) south of Poplar River**

Table 17 **Crossing events by Berens River caribou 2011-2015**

	Transmission Line			Winter Road		
Season	**Crossing Events**	**Caribou with Crossings**	**Average Crossings Per Caribou**	**Crossing Events**	**Caribou with Crossings**	**Average Crossings Per Caribou**
Summer	62	14	4.4	59	15	3.9
Winter	63	19	3.3	105	20	5.3
Total*	**125**	**23**	**5.43**	**164**	**25**	**6.56**

* Number represents unique individual caribou (may be same caribou crossing in summer and winter)

Caribou moved at a higher rates when crossing features of both types, in winter and summer, compared with their average non-crossing movement rates (Table 18). Caribou moved 6 to 11 times faster than normal when crossing transmission lines and 8-16 times faster when crossing winter roads. WR and transmission line crossing speeds were up to two times faster in summer than winter.

Table 18 **Average crossing speed of Berens River caribou 2011-2015**

	Transmission Line			Winter Road		
Season	**Average Crossing Speed (km/hr)**	**Average Non-Crossing Speed(km/hr)**	**Crossing vs. Non-Crossing Difference (km/hr)**	**Average Crossing Speed (km/hr)**	**Average Non-Crossing Speed (km/hr)**	**Crossing vs. Non-Crossing Difference (km/hr)**
Summer	1.1	0.1	0.9	1.6	0.1	1.4
Winter	1.2	0.2	1.0	1.6	0.2	1.5

7.6.3 Summary of Findings

- Preliminary analysis of animal movement appears to be consistent with literature from other areas in that animals do cross these features, however, at higher rates of movement.
- Loss of functional habitat due to disturbance near the linear features examined is minimal in context to overall available habitat at the range level.
- Similar to findings for other linear features, the baseline study found that the caribou increased their rate of speed by approximately 1.2 km per hour during crossing events to 1.4 km per hour which is well below their average trotting speed of 14 km per hour or their top gallop speed of 80 km per hour (Russell *et al*., 1993; Henttonen and Tikhonov, 2008).

7.7 Caribou Cumulative Effects Assessment

7.7.1 Methods

Habitat Disturbance

The boreal woodland caribou MU included in this cumulative effects assessment (CEA) is the Atikaki-Berens MU. Map 10 represents this management unit as delineated in Manitoba's Boreal Woodland Caribou Recovery Strategy, 2015. The intent of this caribou CEA is to determine total habitat disturbance within the MU relative to the sustainable threshold of 65% undisturbed (35% disturbed) habitat identified by Environment Canada (2012). Disturbance was broken into two major components consistent with those described by Environment Canada (2012) and included natural disturbance (mainly fire less than 40 years old) and anthropogenic disturbance including linear features such as WRs, transmission lines, as well as other footprint disturbance including forestry and quarry development. It should be noted that this CEA analysis was based on available data.

The disturbance analysis was conducted on the defined Atikaki-Berens Management Unit which is contained entirely in Manitoba. The small portion of the Berens River range in Ontario includes remote and undisturbed habitat utilized by a small number of individual animals during summer. Fire history data (for natural disturbance calculations) were not available for that area, and there is no human disturbance footprint such as linear features or forest harvesting. Compatible habitat data were also not available for the Ontario portion of the range. Including the Ontario portion in the disturbance assessment would likely decrease the proportion of undisturbed range in the overall assessment. Therefore, as a precautionary approach, this area was not included.

The road layer used for this CEA consisted of the National Road Network Roads (federal data), access roads (Class 2 (year-round secondary gravel roads, graded and ditched), Class 3a (summer access high ground road, graded and gravelled when required)) community roads, highways, and park roads. The P1 WR was removed for the 2015 CEA with the P1 ASR used in its place (given the P1 WR is replaced by the ASR). The P4 WR was removed in the 2020 CEA (given by that timeline, the P4 WR will be decommissioned and replaced by the P4 ASR).

Natural disturbance area was calculated from fire data derived from the LCCES provincial fire data, to include the updated 1928-2013 fire layer with the time period of 1975-2013 for the 40-year timeframe. Anthropogenic disturbance was assessed using all linear development including transmission lines and WRs. These features were buffered by 500 m on either side of the feature based on the Environment Canada (2012) approach. Using the LCCES data, areas of harvested forests within the previous 40 years were identified and an area of disturbance was calculated for each range. Drill holes, obtained from Innovation, Energy, and Mines: Mineral Resources Division, were assigned a buffer with a radius of 250 m for the Atikaki-Berens MU.

Fire History

A fire history analysis was also conducted within the Atikaki-Berens MU to provide additional information on habitat cycling within the region. Spatial fire data obtained from the Manitoba Land Inventory website was clipped to the MU area. Burn years were classified into 5 year periods (1930-34, 1935-39, etc.) with the total area burned calculated and expressed in km^2.

7.7.2 Results

Habitat Disturbance

The Atikaki-Berens MU in 1960 has a total disturbance of 48.13%, whereas in 1980 the total disturbance measures 33.4%, in 2015 measures 34.66% (this includes P1 and P4 ASR), in 2020 measures 34.34% (this includes P1, P4, and P7a ASRs), and in 2025 total disturbance measures 34.62% (this includes P1, P4, P7a, and P7). In all cases, except for 1960, the disturbance threshold within the Atikaki-Berens MU is below the 35% disturbance threshold identified by Environment Canada (2012). In all cases, fire is the largest contributor of disturbance.

Based on these analyses, the overall loss of habitat due to the P4 ASR footprint is a small contributor to the overall effect with fire being the greatest contributor to disturbance. Analysis of caribou collar data indicates that animals are currently residing in proximity to the WR and moving across both the WR and transmission line. The WR currently runs though high quality caribou habitat and given caribou have coexisted with the operational activities associated with the existing WR, caribou are likely accustomed to the ROW and traffic associated with the road. Caribou recruitment close to the WR and project is not different from caribou recruitment away from the WR and project. Table 19 and Map 11-13 illustrates the disturbance factors and extent of disturbance of the Atikaki-Berens MU (based on available data).

Table 19 **Disturbance factors and extent of disturbance of the Atikaki-Berens Management Unit (based on available data)**

	1960		1980		2015		2020		2025	
	Area (km^2)	% of Disturbance	Area (km^2)	% of Disturbance	Area (km^2)	% of Disturbance	Area (km^2)	% of Disturbance	Area (km^2)	% of Disturbance
Disturbance										
Roads	239	1.20	397.30	1.99	167.71	0.84	167.71	0.84	167.71	0.84
Winter Roads	289	1.45	289.60	1.45	213.63	1.07	124.32	0.62	124.32	0.62
Transmission Lines	190	0.96	190.63	0.96	306.06	1.54	313.26	1.57	313.26	1.57
Drill Holes (less than 40 years)	2.91	0.01	6.06	0.03	13.75	0.07	13.75	0.07	13.75	0.07
Mines	3.96	0.02	1.94	0.01	2.96	0.01	2.96	0.01	2.96	0.01
Forestry Harvest Areas (less than 40 yrs)	0	0	0.00	0.00	363.19	1.82	363.19	1.82	363.19	1.82
Total Anthropogenic Disturbance	**726.28**	**3.64**	**885.54**	**4.44**	**1,067.30**	**5.36**	**985.19**	**4.94**	**985.19**	**4.94**
Natural Disturbance - Fire History (less than 40 yrs)	8,865.83	44.48	5,776.74	28.99	5,722.31	28.71	5,724.17	28.72	5,724.17	28.72
Total Natural Disturbance	**8,865.83**	**44.48**	**5,776.74**	**28.99**	**5,722.31**	**28.71**	**5,724.17**	**28.72**	**5,724.17**	**28.72**
ASRs										
P1	0	0	0	0	32.22	0.16	32.22	0.16	32.22	0.16
P4	0	0	0	0	86.74	0.44	86.74	0.44	86.74	0.44
P7a (2020)	0	0	0	0	0	0	14.79	0.07	14.79	0.07
P7 (2025)	0	0	0	0	0	0	0	0	57.23	0.29

	1960		1980		2015		2020		2025	
	Area (km^2)	% of Disturbance	Area (km^2)	% of Disturbance	Area (km^2)	% of Disturbance	Area (km^2)	% of Disturbance	Area (km^2)	% of Disturbance
Area of Management Unit	19,930.00		19,930.00		19,930.00		19,930.00		19,930.00	
Area of Management Unit (including water)	21585.00		21585.00		21585.00		21585.00		21585.00	
Total Overall Disturbance	**9,592.11**	**48.13**	**6,662.28**	**33.43**	**6,789.61**	**34.07**	**6,709.36**	**33.66**	**6,709.36**	**33.66**
Total Overall Disturbance including P1	n/a	n/a	n/a	n/a	**6,821.83**	**34.23**	**6,741.58**	**33.83**	**6,741.58**	**33.83**
Total Overall Disturbance including P1, P4	n/a	n/a	n/a	n/a	**6,908.57**	**34.66**	**6,828.32**	**34.26**	**6,828.32**	**34.26**
Total Overall Disturbance including P1, P4, P7a (2020)	n/a	n/a	n/a	n/a	n/a	n/a	**6,843.11**	**34.34**	**6,843.11**	**34.34**
Total Overall Disturbance including P1, P4, P7a (2020), P7 (2025)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**6,900.34**	**34.62**

Fire History

Figure 6 represents the results of the fire history analysis within the Atikaki-Berens MU. Based on the fire history collected between 1928-2013, it would appear that a major burn cycle occurs every 40 years with approximately 2700-2800 km^2 (12-13% of total area) being lost to fire each major burn cycle. If the 40-year major burn cycle is retained, we would anticipate another major burn cycle to occur in 2025 (40 years following the last major burn event, which occurred in 1985). A major burn event such as this would result in a significant level of natural disturbance within the Atikaki-Berens MU at that time. However, given the only available spatial fire history data was available from 1928 onward; there is limited information available to determine burn cycle events beyond the last 90-year period.

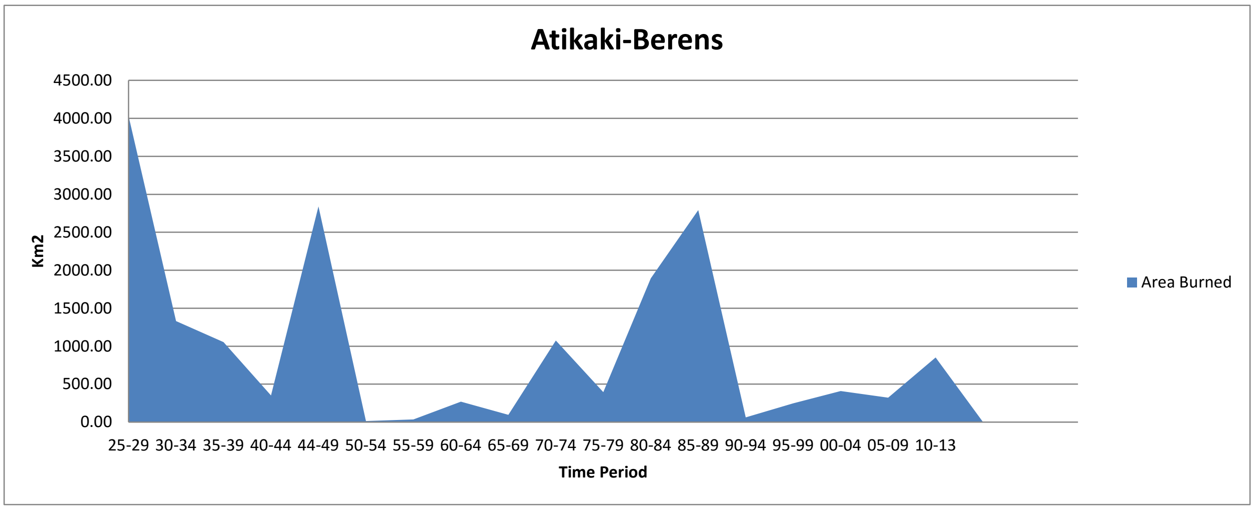


Figure 6 **Fire history within the Atikaki-Berens Management Unit**

7.7.3 Summary of Findings

- The P4 project accounts for a small percentage of the overall disturbance in the Atikaki-Berens Management Unit (< 1%) with natural disturbance being the major factor (28.7%).
- The total disturbance regime in this Management unit remains under the Environment Canada threshold (35%).

8.0 MOOSE

Moose are common within the boreal forest as well as the LPSA and RPSA P4 Study Area. They are highly valued for licensed hunting and rights-based subsistence hunting in GHA 17B and are an integral component of the ecosystem in their predator/prey relationship (MCWS, 2015). The following section outlines the moose baseline studies which have been underway since 2011.

8.1 Moose Distribution

8.1.1 Methods

Aerial multispecies distribution surveys were flown on January 10-11, 2011 between Berens River and Poplar River and March 6-7, 2011 between Loon Straits and Poplar River, to locate individuals and tracks to determine the distribution of wildlife species. The January 2011 survey was conducted by MCWS on behalf of Manitoba Infrastructure and Transportation using professional wildlife trackers in fixed wing aircraft. The March 2011 survey was conducted by Joro biologists on behalf of ESRA, using helicopters as well as professional wildlife trackers in two fixed wing aircraft. Flight transects for both surveys were spaced 2 km apart and flown in an east-west direction. Areas of species concentrations were developed through volume-density kernel estimates using the kernels analysis tool in the Home Range Tools for ArcGIS (ESRI, 2011). Prior to creating the kernels, 200 observations (either tracks or individuals) were determined as a minimum number of points per animal, as any fewer observations would create an uneven distribution. Winter volume-density kernels were determined to be the boundary of the 70% contour.

8.1.2 Results

A total of 270 moose and track observations were made during the January 2011 survey and 668 moose and track observations were made during the March 2011 survey. The tracks and individuals observed were widely distributed along the P4 ASR, with larger concentrations closer to Poplar River.

8.1.3 Summary of Findings

- Verifies broad distribution of moose and other species across the RPSA.

8.2 Aerial Surveys

8.2.1 Methods

A total area moose count survey was conducted in the P4 Study Area in March 3-6, 2014 to acquire information on areas of high moose concentration and provide an estimate of moose numbers, as well as distribution in the LPSA, prior to road construction. Prior to the surveys, a three-minute grid was applied to encompass blocks measuring 3.5 x 5.0 km and extending 10 km on each side of the proposed P4 alignment using ArcGIS (ESRI, 2012). The survey was flown at 100 percent coverage in a north/south direction using a Bell 206L Long Ranger along transects spaced at one km apart at an altitude of approximately 400 ft above ground level. The average air speed for the survey was 100 km/hr. The survey team comprised of two observers and one recorder. When fresh moose activity was encountered, a reasonable effort was made to find the animal(s) which created them. When moose were encountered, number, age and sex were recorded. The survey area was approximately 1800 km^2.

8.2.2 Results

During the P4 total count survey 43 moose and 51 track observations were recorded.

8.2.3 Summary of Findings

- Moose occur in low densities in the assessed areas (0.024 moose/ km^2). Moose densities are further described in Section 8.9.

8.3 Wolf Collaring – Effects on Moose

A total of 15 wolves were collared with Sirtrack Iridium collars between February 18-19, and February 21, 2014 within the RPSA. An additional 18 wolves were collared between February 4-7, and February 9-10, 2015. The purpose of this ongoing long-term monitoring program was to:

- determine wolf forage selection of caribou/moose and predation rates;
- evaluate prey selection and demographics (calves/adults);
- assess resource selection of wolves relative to habitat and anthropogenic development;
- determine wolf use of ROWs as travel corridors; and
- enumerate pack and home range sizes.

8.3.1 Wolf Core Use Areas and MCPs

8.3.1.1 Methods

As part of the moose and caribou monitoring studies, investigations of wolf kill sites were conducted in spring and summer of 2014. Twenty-four moose kill sites were determined by wolf collar GPS data location clustering and subsequent field investigations of clusters within 2-3 weeks of the clustering event. Of the 15 wolves collared in 2014, 4 collared wolves were from one pack in the Bloodvein area, 6 wolves were collared in the Berens River area, and 5 wolves were collared in the Poplar River area.

Home range of each wolf pack was calculated by the Minimum Convex Polygon (MCP) tool in ArcGIS (ESRI, 2011). A habitat analysis using LCCES was used to estimate the amount of habitat types within each of the wolf pack home ranges (MCPs).

8.3.1.2 Results

Table 20 shows the results of the MCP calculation for each wolf pack.

Table 20 Estimated size and home range of wolf pack

Area	Group Number	Area (km^2)	Estimated number of packs	Estimated number of wolves per group	Number of collars within group
Bloodvein	Group_1	2,584.96	2	8	4
Berens River	Group_2	1,803.96	2	10	6
Poplar River	Group_3	8,973.16	2	11	5*

*Collar 0820 was a long distance traveler and traversed all three areas, originally collared in group 3

Table 21 shows the results of the common habitat types within each wolf MCP.

Table 21 Amount of habitat types per wolf pack home range (MCP)

Habitat Type	Bloodvein (km^2)	Berens River (km^2)	Poplar River (km^2)	Total (km^2)
Wetland Shrub	882.27	703.97	4,234.73	5,820.96
Coniferous Dense	645.28	410.31	1,700.03	2,755.63
Wetland Herb	158.59	41.17	817.46	1,017.23
Shrub Tall	31.28	227.08	607.77	866.14
Water	125.45	135.61	529.83	790.89
Coniferous Open	399.73	119.28	185.46	704.47
Mixedwood Dense	89.44	55.39	439.24	584.07
Coniferous Sparse	46.98	106.08	179.73	332.79
Broadleaf Dense	79.89	3.74	197.27	280.90
Wetland Treed	124.88	0.00	52.26	177.14
Broadleaf Sparse	0.00	0.00	17.14	17.14
Exposed Land	1.16	1.31	12.21	14.69
Broadleaf Open	0.01	0.00	0.00	0.01
Mixedwood Open	0.00	0.00	0.01	0.01
Total Area	**2,584.96**	**1,803.96**	**8,973.16**	**13,362.07**

8.3.1.3 Summary of Findings

- Wolf home range size varies among the pack locations with the Berens River pack having the smallest MCP (1,803.96 km^2) and Poplar River having the largest (8,973.16 km^2).
- The most common habitat type associated with all of the MCPS was wetland shrub (5,820.96 km^2), followed by coniferous dense (2,755.63 km^2), and wetland herb (1,017.23 km^2).

8.4 Distance to Feature Analysis

A distance to feature analysis was performed to determine the distance of collared wolves (GPS location points) to different habitat types based on the LCCES layer. Actual median wolf locations were compared to random median wolf locations.

8.4.1 Methods

The home range MCPs were used for each wolf pack as described in Section 8.3.1. The spatial join function in ArcGIS 9.3 was used to join the habitat type polygons to the clipped GPS location point data set and to measure the distance from each GPS location point to the nearest habitat type polygon. This analysis was run on a number of randomly generated points within each pack (5 times the number of wolf location points) to identify similarities or difference between the actual location points to the random points for a statistical comparison. A Wilcoxon Rank Sum test was performed. The distance to, or points within data were generated and a statistical trend was determined to identify the presence of GPS location points and random points preference of habitat types. The results of the Wilcoxon Rank Sum Tests are summarized in the sections below. The p-values for the Wilcoxon Rank Sum Tests are provided for each feature (two sided) and an evaluation of the test is provided based on comparing the observed wolf and random medians ("Closer" = where the wolf median distance was calculated as smaller than random expectation, "Further" = where the wolf median distance was larger than random expectation and "No Difference"). This same analysis was also used to determine distance of wolf kill site to different habitat types by using the spatial join function to join the GPS location points of the wolf kill sites to the habitat type polygons.

8.4.2 Results

The distance to feature analysis of wolf locations to habitat types demonstrated that wolves are in general, closer to broadleaf dense, open, and sparse, coniferous dense, mixedwood dense, shrub tall, water, and wetland herb habitat types (Table 22).

Table 22 Distance of wolves to habitat types

Habitat Type	Median Wolf Locations (m)	Median Random Locations (m)	P Value	Evaluation
Broadleaf Dense	750.21	2,153.06	<0.05	closer
Broadleaf Open	44,068.77	45,410.68	<0.05	closer
Broadleaf Sparse	33,714.19	37,937.21	<0.05	closer
Coniferous Open	270.71	228.31	<0.05	further
Coniferous Dense	82.82	83.26	<0.05	closer
Coniferous Sparse	757.48	769.88	>0.05	no difference
Exposed Land	15,938.22	13,496.65	<0.05	further
Mixedwood Dense	365.40	838.09	<0.05	closer
Mixedwood Open	77,382.83	72,993.15	<0.05	further
Shrub Tall	3,216.72	4,010.94	<0.05	closer
Water	325.05	730.87	<0.05	closer
Wetland Herb	411.69	581.58	<0.05	closer
Wetland Shrub	81.64	65.74	<0.05	further
Wetland Treed	25,688.31	19,354.32	<0.05	further

The distance to feature analysis of wolf kill sites to habitat types demonstrated that wolves are in general, closer to broadleaf dense and water (Table 23). These habitat types are more typical to moose.

Table 23 Distance of wolf kill sites to habitat types

Habitat Type	Median Kill Site Locations (m)	Median Random Locations (m)	P-Value	Evaluation
Broadleaf Dense	1,091.38	2,750.28	<0.05	closer
Broadleaf Open	43,209.52	48,915.21	>0.05	no difference
Broadleaf Sparse	28,016.16	35,182.84	>0.05	no difference
Coniferous Open	46.36	46.62	>0.05	no difference
Coniferous Sparse	439.11	618.81	>0.05	no difference
Exposed Land	13,704.83	13,191.81	>0.05	no difference
Mixedwood Dense	518.86	927.64	<0.05	no difference
Mixedwood Open	66,818.34	77,301.56	>0.05	no difference
Shrub Tall	2,356.24	3,532.66	>0.05	no difference
Water	551.2	811.15	<0.05	closer
Wetland Herb	740.99	931.255	>0.05	no difference
Wetland Shrub	14.22	13.12	>0.05	no difference
Wetland Treed	28,769.1	22,175.76	>0.05	no difference

8.4.3 Summary of Findings

- The results are preliminary and are part of ongoing monitoring to assess the effects of ASRs on moose through increased predation near linear feature.
- Wolf habitat selection is consistent with moose habitat and not boreal woodland caribou.

8.5 Wolf Movement in Relation to Land Use Features

A distance to feature analysis was performed to determine the distance of collared wolves (GPS location points) to land use features such as linear features, communities, and water. Actual median wolf locations were compared to random median wolf locations.

8.5.1 Methods

The home range MCPs were used for each wolf pack. The spatial join function, used to measure the distance from each GPS location point to the nearest land use feature, was used to join the land use polygons and polylines to the clipped GPS location point data set. This analysis was run on a number of randomly generated points within each pack (5 times the number of wolf location points) to identify similarities or difference between the actual location points to the random points for a statistical comparison. A Wilcoxon Rank Sum test was performed. The distance to, or points within data were generated and a statistical trend was determined to identify the presence of GPS location points and random points preference of land use features. The results of the Wilcoxon Rank Sum Tests are summarized in the sections below. The p-values for the Wilcoxon Rank Sum Tests are provided for each feature (two sided) and an evaluation of the test is provided based on comparing the observed wolf and random medians ("Closer" = where the wolf median distance was calculated as smaller than random expectation, "Further" = where the wolf median distance was larger than random expectation and "No Difference"). This same analysis was also used to determine distance of wolf kill site to different land use features by using the spatial join function to join the GPS location points of the wolf kill sites to the land use polygons and polylines.

8.5.2 Results

The distance to feature analysis of wolf locations correlated to land use demonstrated that wolves are in general, closer to WRs (inactive PR700) and water (Table 24).

Table 24 Distance of wolves correlated to land use features

Land Use	Median Wolf Locations (m)	Median Random Locations (m)	P Value	Evaluation
All Season-Roads	74,781.79	69,132.1	<0.05	further
Trails	7,187.58	6,418.66	<0.05	further
Transmission Lines	21,247.87	21,210.53	<0.05	further
Winter Roads	12,689.73	13,810.21	<0.05	closer
Water	216.6	665.95	<0.05	closer

8.5.3 Summary of Findings

- Results are preliminary as part of an ongoing study to assess effects of linear development on wolf distribution and prey selection.
- Further monitoring and evaluation is ongoing to substantiate any avoidance or selection of use of linear features.

8.6 Wolf Kill Sites in Relation to Land Use Features

8.6.1 Methods

Wolf kill site investigations were conducted as described in Section 8.3.1. Distance to feature analysis was conducted according to the methods described in Section 8.4.1.

8.6.2 Results

The distance to feature analysis of wolf kill site locations correlated to land use demonstrated no linear land use feature was significantly used by wolves to predate on prey (Table 25).

Table 25 Distance of wolf kill sites to land use features for all areas

Feature Type	Median Kill Sites (m)	Median Random Locations (m)	P Value	Evaluation
All-Season Roads	75,724.69	70,782.86	>0.05	no difference
Trails	7,238.90	6,464.61	>0.05	no difference
Transmission Lines	22,712.18	22,017.30	>0.05	no difference
Winter Roads	11,471.57	13,920.22	>0.05	no difference

8.6.3 Summary of Findings

- Results are preliminary as part of an ongoing study to assess effects of linear development on wolf distribution and prey selection.
- Further monitoring and evaluation is ongoing to substantiate any avoidance or selection of use of linear features.

8.7 Moose Habitat Modelling

Kuhnke and Watkins (1999) reported on the selection of wildlife species and the integration of habitat supply models into forest wildlife planning in Manitoba. Of approximately 200 vertebrate species found within the boreal forest, they selected 19 to represent the habitat requirements for most species found. Moose habitat modelling was conducted using the LCCES in a Geographic Information. The potential habitat for moose was modelled for both winter and summer potential habitat using mixed wood, broadleaf, and shrub stands with shrub stands less than 10 years of age (using burn and harvest stands). The potential habitat quality was modeled using the queries based on the Manitoba Model Forest Region (which includes the P4 LPSA) and Habitat Suitability Models (TAEM, 1995). Potential moose habitat queries were conducted for the LPSA (5 km buffer), as well as the PF (100 m ROW), and GHA 17B, as well as the amount of habitat to be potentially reclaimed by the WR. These analyses were conducted for moose for both potential summer and potential winter habitat. See Map 14 for the local assessment area used to model quality moose habitat within GHA 17B. Based on Kuhnke and Watkins (1999), these modeling results represent the habitat requirements for many other species as moose are known to be habitat generalists, utilizing a broad spectrum of habitat types and successional states (Peek, 1998).

8.7.1 Methods

Moose habitat modelling was conducted in Geographic Information Systems (GIS) using the LCCES. The potential habitat for moose was modelled for both winter and summer potential habitat using mixed wood, broadleaf, and shrub stands with shrub stands less than 10 years of age (using burn and harvest stands). The potential for food source more than cover was incorporated into the model using the queries developed within the Manitoba Model Forest Region, Habitat Suitability Models (TAEM, 1995). Potential moose habitat models were conducted for the LPSA (5 km buffer), as well as the PF (100 m ROW), and GHA 17B, as well as the amount of habitat to be potentially reclaimed by the WR. These analyses were conducted for moose for both potential summer and potential winter habitat. See Map 14 for the local assessment area used to model quality moose habitat within GHA 17B.

8.7.2 Results

Tables 26-29 summarize the results of habitat modelling.

Table 26 Potential moose summer habitat within the Local Project Study Area

Habitat Type	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat after P4 Winter Road Reclamation (km^2)	Habitat in GHA 17B (km^2)
Broadleaf Dense	46.74	0.31	46.75	193.02
Mixedwood Dense	130.09	1.86	130.11	585.22
Shrub Tall	0.001	0.0000	0.001	0.39
Total	**176.83**	**2.16**	**176.86**	**778.64**

Table 27 Percentage of total moose summer habitat lost within the Local Project Study Area due to clearing of the project footprint and GHA 17B, and percentage of habitat gain due to P4 winter road reclamation

Habitat Type	% Habitat Lost Due to Project Footprint in the LSA	% Habitat Lost Due to Project Footprint in GHA 17B	Habitat Gain (P4 Winter Road Reclamation) in LSA
Broadleaf Dense	0.66%	0.16%	0.02%
Mixedwood Dense	1.43%	0.32%	0.02%
Shrub Tall	0.00%	0.00%	0.00%

Table 28 **Potential moose winter habitat within the Local Project Study Area**

Habitat Type	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat after P4 Winter Road Reclamation (km^2)	Habitat in GHA 17B (km^2)
Coniferous Dense	223.37	3.41	223.39	1313.15
Coniferous Sparse	21.96	0.30	21.96	163.84
Mixedwood Dense	130.09	1.86	130.11	585.22
Shrub Tall	18.02	0.0000	18.02	131.71
Total	393.44	5.57	393.45	2193.92

Table 29 **Percentage of total moose winter habitat lost within the Local Project Study Area due to clearing of the project footprint and GHA 17B, and percentage of habitat gain due to P4 winter road reclamation**

Habitat Type	% Habitat Lost Due to Project Footprint in LSA	% Habitat Lost Due to Project Footprint in GHA 17B	Habitat Gain (P4 Winter Road Reclamation) 5 km Buffer
Coniferous Dense	1.53%	0.26%	0.01%
Coniferous Sparse	1.37%	0.18%	0.01%
Mixedwood Dense	1.43%	0.32%	0.02%
Shrub Tall	0.00%	0.00%	0.00%

8.7.3 Summary of Findings

- Habitat for moose is not limiting within the LPSA or RPSA. The amount of moose habitat that will be lost as a result of the Project is a very small percentage of the overall moose habitat available within the LSA and RSA.

8.8 Access Density

8.8.1 Methods

An aerial survey of the existing WRs and ASRs in the RPSA was conducted on December 16-18, 2013 to identify ancillary trail development associated with these features in the RPSA. During these surveys, biologists also record any sightings of large bird stick nests, as well as any ecologically sensitive potential sites (such as bat or snake potential hibernacula sites, bird nesting colonies, mineral licks, and mammal denning). The access density survey was flown by following either the WR or planned ASR route using a

Bell 206L Long Ranger at approximately 500 ft above ground level, with an air speed ranging from 50 - 150 km/hr. If a trail was encountered during the flight, the start point (point of where the trail branched off the existing linear anthropogenic feature) was marked on a handheld GPS unit and flight speed reduced. Using the tracking feature on the GPS the helicopter followed the new path until the end of the trail was determined. The end point of the trail was marked by a waypoint on the GPS unit. Following the aerial access density survey, the GPS trail data was uploaded into ArcGIS 10.1 (ESRI, 2012) and each new access trail was digitized. All overlaps between the existing shapefile of access trails and roads provided by the FML data were removed and the remaining new access trails were summarized by total number of new trails identified during the survey as well as the length of each new access trail within each LPSA located within the southern RPSA.

8.8.2 Results

A total of 36 access trails were identified in the RPSA during the aerial access density survey conducted on December 16-18, 2013 (Table 30). Of the 36 access trails, 7 trails were identified within the Local P4 Study Area measuring a total length of 13.48 km. No ecologically sensitive sites, nor large stick nests were identified in the areas surveyed.

Table 30 Summary of access trails and their length identified in the Regional Project Study Area from December 16-18, 2013

Project Area	# of Access Trails Identified	Length (km)
P1	10	20.77
P4	13	41.05
P7-7a	13	27.03
Total	**36**	**88.86**

8.8.3 Summary of Findings

- Development of ancillary trails associated with WRs and ASRs is minimal and appear to be associated with trapping and hunting and other recreational purposes.
- Most trails are minor in nature, suitable for snowmobile and/or ATV access.

8.9 Moose Cumulative Effects Assessment

The purpose of this section is to describe the cumulative effects of P4 in concert with other activities and developments on moose. Moose populations in Manitoba are managed by MCWS on a GHA basis through licensing, cooperative management and various conservation measures (e.g. refuges, hunting closures and access management). Moose are highly valued by people living on the east side of Lake Winnipeg and the conservation and management of moose is also of significant interest to First Nations and licensed hunters. The P4 area is contained within the newly defined GHA 17B, formerly part of the larger GHA 17.

Past development in the area includes forestry operating areas and associated forest access, that consisted of small-scale, short term forestry roads that were used during summer and winter. More intensive forest harvesting occurred primarily in the Berens River First Nation area from the 1980's to around 2008. A number of small harvest blocks were located along parts of the existing WR from Berens River to Poplar River to access commercial stands of timber during this period. There are currently no known or anticipated future forestry, mining, or other developments planned in the PSA.

The potential cumulative effects associated with increased access include sensory disturbance via snowmobiles, ATVs, campers, hikers, trappers, and hunters who may gain access to wilderness areas that were previously difficult to access. The habitat adjacent to P4 is difficult to traverse and consists of swamps, marshes and rock outcrop areas. The predicted effect of increased access may be wildlife avoidance near P4 and potential increased mortality of moose and other wildlife as a result of hunting and trapping activities. Based on results of TK, and in consideration of the remoteness of this area, resource use in the region is not expected to increase dramatically, rather there could be a shift in resource use closer to the ASR. The results of community Land Use study in the LATN show use of rivers until road access is available. Where currently there are high use of rivers and lakes for moose hunting, there may be some shifting in resource use patterns based on accessibility. Trappers may also take advantage of increased opportunities to access their traplines resulting in shifts to traditional subsistence hunting areas.

The development of P4 is expected to take approximately 8 years. During this time, the existing WR will be in use, and as portions are cleared and constructed, use of the WR versus the alignment of P4, will be phased in and out depending on clearing and construction schedules. It is likely that during the mid-period of construction (approximately years 4 through 5), there will be a shift in road corridors, with use following the new ASR alignment. As the ASR construction advances, the use of WRs will be less.

The sustainability of moose in the area will require integrated strategies between MCWS, First Nations, and other resource users to establish harvest and management strategies that are mutually acceptable and effective. Access management, road refuges, and provincial harvest management strategies that regulate hunting will play an important role in conserving moose and wildlife populations.

Climate change conditions may include wetter springs and drier, hotter summers, which could negatively impact moose through ecosystem level changes in the food web and the availability of forage items. Milder winters may, however, benefit moose with reductions in winter-kill mortality. The potential for an increase in invasive species, such as white-tailed deer, is unknown, however the baseline wildlife monitoring conducted to date suggests that ASRs on the east side of Lake Winnipeg are not contributing to increased populations or enhanced persistence of white-tailed deer.

8.9.1 Project 1 Effects Monitoring

Monitoring of P1 effects on the distribution and abundance of moose has been undertaken by ESRA since 2011. Given P1 resides to the south of P4, results from ongoing monitoring in P1 provide some context for P4 cumulative effects. Moose numbers and distribution data collection to date has consisted, in part, of aerial surveys for the P1 Study Area (between PR 304 and Berens River First Nation). The aerial moose survey results for P1 indicate that moose numbers and distribution has not been negatively affected by construction and operation to date. These are long term monitoring activities that are intended to assess the effects of ASR development on moose, and will provide valuable information during the period of P4 construction and into operation.

8.9.2 Moose Densities

The results of past moose surveys conducted by MCWS provides additional context regarding the potential cumulative effects on moose in the region. An examination of historical moose surveys in eastern Manitoba illustrates lower densities of moose associated with GHA 17 B (formerly GHA 17, of which the P4 PSA is contained).

Additional context to moose densities in the PSA are supported from Ontario Ministry of Natural Resources (OMNR). The OMNR has developed an ecological framework to provide policy advice that addresses cervid (deer family, including moose) management at the landscape scale (OMNR, 2009). In northern latitudes, similar to the PSA, moose are considered to exist at lower densities compared to more southerly latitudes. Table 31 illustrates the relative densities of moose across eastern Manitoba, illustrating generally lower densities at more northern latitudes. Note that survey and sampling methods varied among the years reported which could conflict comparisons of densities between areas and years. However, these data provide a general overview of moose densities across the region, allowing for comparisons to fragmentation metrics described in Section 8.9.3.

Table 31 Summary of moose densities in eastern Manitoba based on aerial surveys conducted from 1995 – 2013.

GHA	Years	Moose/km^2
17 South*	1995-1996	0.0969
17 North*	1996-1997	0.1196
Average Density		**0.1083**
17A	2011	0.1493
17A	1999-2000	0.1770
17A	2006-2007	0.1460
Average Density		**0.1574**
26	1999-2000	0.2430
26	2006	0.2234
Average Density**		**0.2332**
26	2010	0.1069
26	2013	0.1677
Average Density***		**0.1373**

* Due to the size of the area, surveys were flown in subsequent years

**Pre-population decline period

***Moose recovery period

Source: Personal Communication: Kelly Leavesley, Regional Wildlife Manager, Eastern Region, Manitoba Conservation and Water Stewardship (February 2016)

8.9.3 Fragmentation

Roads are known to affect wildlife movement by providing human access to previously remote areas (Heckbert *et al*., 2010). There are both positive and negative aspects of increased access. Roads provide opportunities for sustainable traditional and recreational activities. Although moose have been extensively studied, there is little research on access or disturbance thresholds. Salmo *et al.* (2004) identified a target threshold for linear disturbance on a landscape scale at 0.4 km/km^2 and a critical threshold of 0.9 km/km^2 for moose based on studies across Canada. Beazley *et al*. (2004) identified a road density threshold of 0.6 km/km^2 for moose in Nova Scotia. Other examples include thresholds developed for sustainable forestry. A similar linear disturbance threshold was identified by the Greater Fundy Ecosystem Research Group (2005) for active roads as a Criteria and Indicator of sustainability. A similar threshold of 0.58 km/km^2 was developed for Forest Management Licence Area (FMLA) 1, through the Manitoba Model Forest initiative to identify Indicators of Sustainable in forest management (Keenan and Munn, 2008).

The density of access (winter and all weather roads) was calculated using A Land Use and Cumulative Effects Simulator (ALCES), to illustrate the degree of fragmentation for 4 GHAs in Eastern Manitoba using all available data for linear development and included; major roads, minor roads, WRs and transmission lines. Results of the analysis are presented in Table 32 and Figure 7, Figure 8, and Figure 9, and illustrate the low density of roads in GHA 17B compared to other GHAs in eastern Manitoba. The results indicate that the more northern areas have less disturbance than southern areas, with contrasting moose densities. Therefore, moose densities are not necessarily linked to disturbance, but more so to habitat productivity and climate.

Table 32 Comparison of linear footprint densities in eastern Manitoba Game Hunting Areas

GHA	Linear Footprint Density km/km^2
17 (Northerly)	0.05
17-B (Northerly)	0.09
17-A (Mid)	0.18
26 (Southerly)	0.26

The following figures provide a visual context to the linear density analysis.

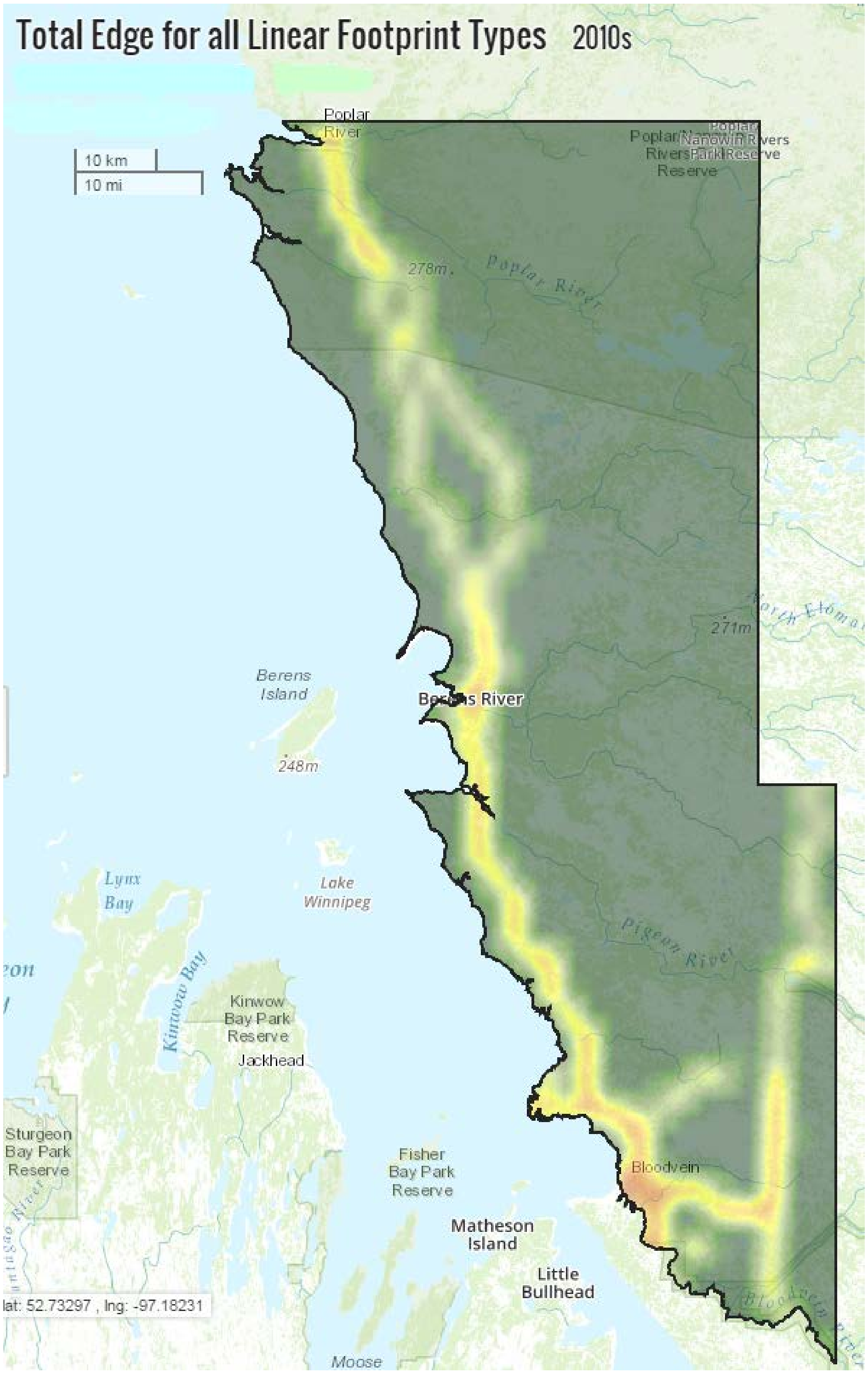


Figure 7 **GHA 17 B (Portion of GHA 17) - Low moose densities (0.1083 moose/km^2) and very low fragmentation metric (0.09 km/km^2)**

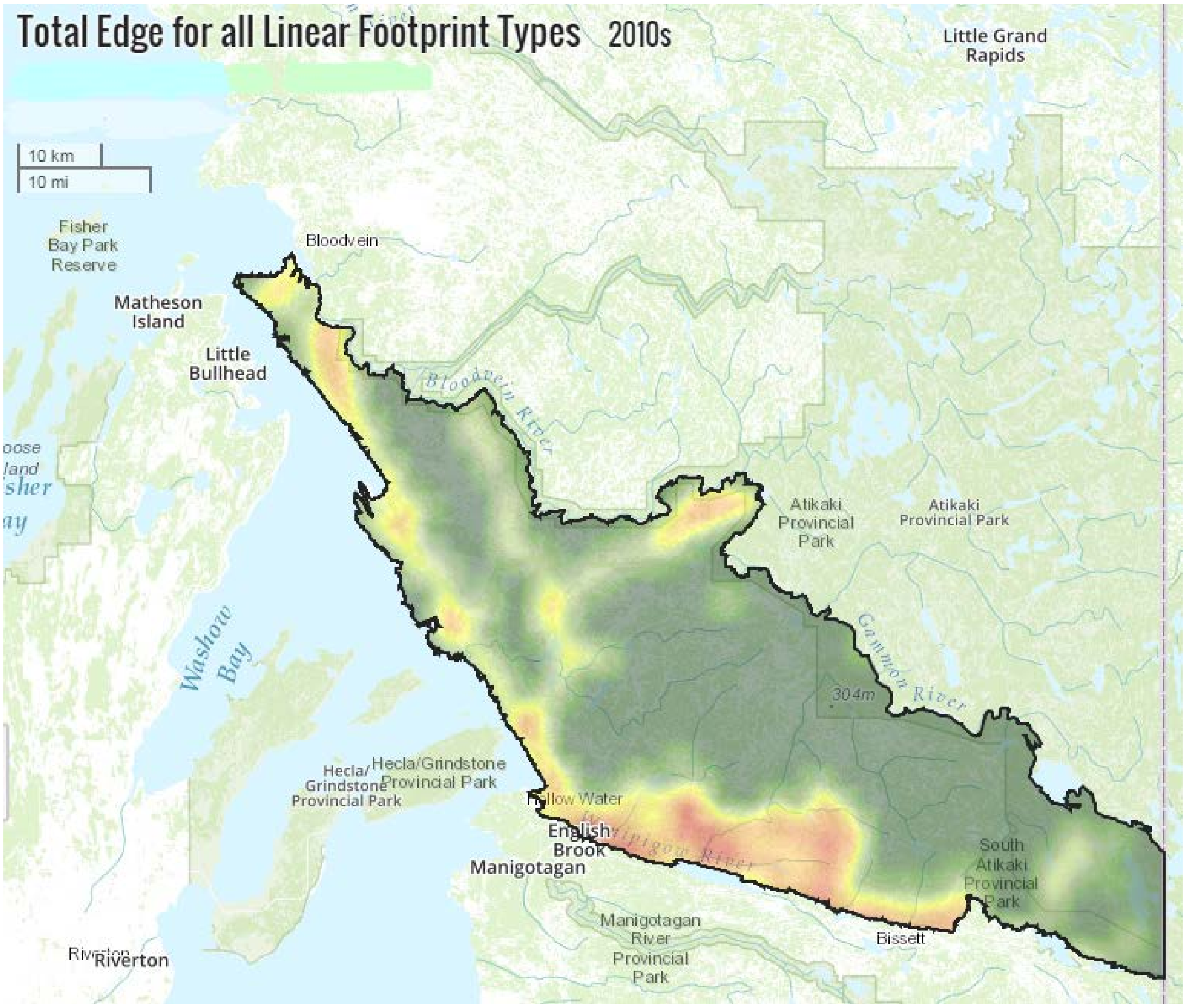


Figure 8 **GHA 17 A (Portion of GHA 17) - Low moose densities (0.1574 moose/km^2) and very low fragmentation metric (0.18 km/km^2)**

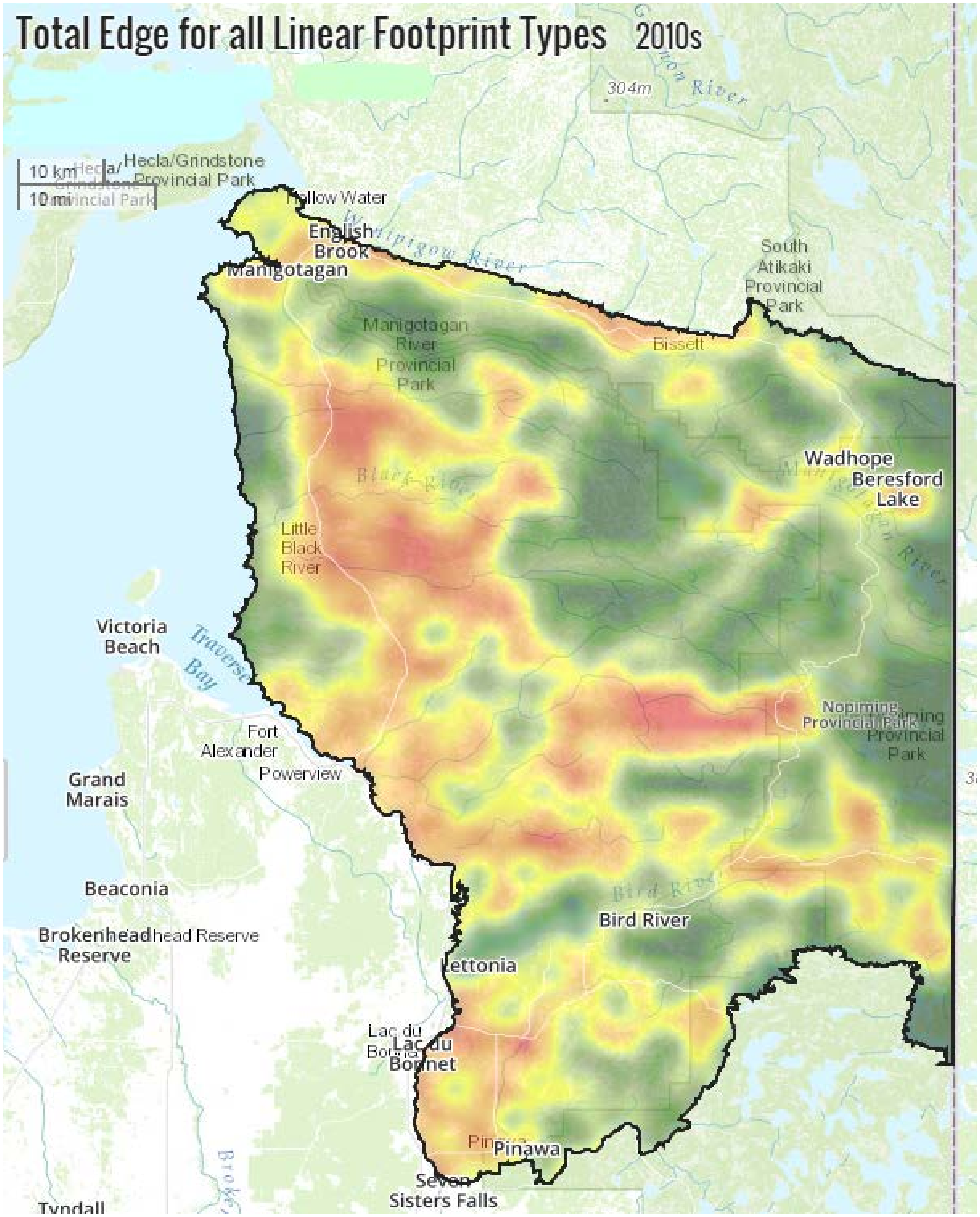


Figure 9 **GHA 26 - Higher moose densities* (0.2332 moose/km^2) and high fragmentation metric (0.26/km^2) *pre-decline (2000-2006)**

8.9.4 Moose Harvest

Several P1 monitoring activities were undertaken to assess hunting pressure and harvest rates. These initiatives included aerial moose surveys, mortality investigations and reporting by MESRA field staff on Wildlife Sighting Incident Reports including MCWS Conservation Officer (CO) investigations during hunting season. Conservation Officers conducted patrols along the Rice River Road and surrounding area in 2009, 2010, and 2012 in order to monitor moose harvest during both regular and late season hunting. Conservation Officer patrol of the area included investigations of hunting camps and vehicles to check the number of hunters and their harvest, if any. Mortality data for both licensed and rights-based hunters were documented. Based on the investigations conducted by the during 2009, 2010, and 2012 in the Rice River Road area, there was a slight increase in hunting efforts and success in 2010 and 2012 compared to 2009. No documentation of poaching was recorded in either year as a result of these investigations.

8.9.5 Moose Vehicle Collisions

There has only been one known moose-vehicle collision (February 2012 along the Rice River Road) and no caribou-vehicle collisions along P1. There are a number of activities that are underway in the PSAs including a number of on the ground inspectors, Joro wildlife studies, other discipline baseline research, numerous ESRA field staff, environmental monitors, contractors, and workers. During all of these activities, there have been no further reports of vehicle collisions. Regional planning for creation of access roads and lowering speed limits in active wildlife areas have previously shown to reduce the number of wildlife-vehicle collisions (Jalkotzy *et al*., 1997).

8.9.6 UNESCO Manitoba Boreal Forest World Heritage Site

Five First Nation Communities (Poplar River, Little Grand Rapids, Pauingassi, Bloodvein River and Pikangikum (Ontario) on the East Side of Lake Winnipeg have nominated their traditional lands in the boreal forest to be protected under a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site (WHS) called Pimachiowin Aki (Manitoba Wildlands, 2014). The Pimachiowin Aki WHS nomination consists of an area of 33,400 km^2 of boreal forest located within the Regional PSA. Within the nomination area, exists habitat for boreal woodland caribou, moose, as well as other wildlife and many archaeological sites important to First Nation history and culture (Manitoba Wildlands, 2014). In order for the area to be considered for a World Heritage Site designation, the area must contain habitats suitable for maintaining the most diverse fauna and flora characteristic of the bio-geographic province and ecosystems under consideration. Given the nomination, this RPSA represents a healthy intact ecosystem.

Should the Pimachiowin Aki site be successful in its WHS application, there are WHS Operational Guidelines that must be adhered to in order to protect the integrity of the boreal forest landscape. Integrity is a measure of the wholeness and intactness of the natural landscape and/or cultural heritage and its attributes and human activities within the site need to be ecologically sustainable. A regular review of the general state of conservation of properties is a part of a framework for monitoring World Heritage properties. IUCN's (International Union for Conservation of Nature, the international governing body for designation of a WHS) position is that mineral and oil and gas exploration and exploitation (including associated infrastructure and activities) is incompatible with the Outstanding Universal Value of World Heritage Sites and should not be permitted within these sites. Within the WHS will be an area designated as protected under the Manitoba Protected Areas Initiative. Land and water classified under the Manitoba Protected Areas Initiative is legally prohibited to activities such as logging, mining, hydroelectric development, oil and gas development, and other activities that harm habitat.

Should the designation for the WHS be granted, the designation area within the RPSA would have restrictions in place on the location and the extent to which anthropogenic disturbance would be possible. The limitations on the degree of anthropogenic disturbance allotted within this designation area is an important factor of consideration for potential future cumulative effects on moose and other wildlife populations within the RPSA.

8.9.7 Summary

- Moose densities in this region are inherently low and are likely to remain relatively remote, even with the presence of the new ASR.
- Existing patterns of land users are likely to shift as the ASR is constructed, however, these changes will occur over a long period of time while construction is underway.
- There are no other major developments planned such as forestry or mining operations that will result in additional road development.
- Local effects on moose may result from increased hunting pressure near the road and along rivers and creeks that are intersected by the ASR.
- Cooperative moose management is evolving, and there are currently discussions regarding the establishment of a road refuges and other conservation initiatives.
- The potential long-term protection resulting from the establishment of Pimachiowin Aki will also provide guidance in the development of conservation strategies and limitations on development.

9.0 BIRD STUDIES & OTHER WILDLIFE (AVIAN, HERPTILES, AND ECOLOGICALLY SENSITIVE SITES)

Autonomous recording units (ARUs) are an effective tool used to detect vocalizations from avian and herptile sources to supplement on-site bird surveys. ARUs offer the capability of determining presence of bird species in survey areas over longer time periods, without human interaction. Through the use of ARUs within P4 Study Area, Joro was able to maximize efficiencies and acquired a far more comprehensive assessment of birds within the area, birds that may only call during certain times of the day and that may be otherwise missed during on-site field surveys.

Joro owns several ARUs, model SM2+, supplied by Wildlife Acoustics, Inc. These ARUs are designed to provide long-term acoustic monitoring of birds, amphibians, and other wildlife. The recording device is encased in a weather-proof enclosure with two external microphones and is powered by batteries and can record up to 230 hours. The recording unit can be scheduled for specific start and shut off times to capture peak call times. The ARU records on as many as 4 flashcards. The ARU also records data on the geographic location and time of call. Sounds files that are recorded will be later interpreted on the computer by ornithologists by ear to identify bird and amphibian species or by using the Song Scope software. The Song Scope software offers an opportunity to visually view the audio files as spectrograms and comes programmed with a set of algorithms which allow us to scan the recordings for specific patterns of interest, such as specific bird or herptile species.

The use and application of bioacoustics monitoring (ARUs) has evolved in recent years with improved technology and battery life. Song recorders are used in bird and herptile studies ranging anywhere in scope from studying nest ecology, to the presence/absence of rare species or individuals, species richness, to estimating population parameters such as occupancy and abundance. This is in part due to the fact that bird sound is the most efficient means for surveying birds (Brandes, 2008). Based on peer reviewed research, acoustic surveying can be used for rapid assessment programmes and is proven to be an effective tool in assessing the presence/absence and abundance of bird and herptile species in a defined geographic area both before and after a “treatment” or development.

9.1 Methods

ARUs were deployed along and near the proposed P4 ASR route in April, 2014 and April, 2015. Units were equipped with lithium batteries to run the clock, 4 D-cell batteries, and 4 16-gigabyte memory cards and were programmed to record low frequency sounds (down to three Hz and the gain at 48 dB). The units were scheduled to record between 19h00 and 24h00 every day in the field with the hopes of capturing owl and potentially amphibian calls in the early to late spring. A summary of deployment activities and locations can be found in Table 33 and Table 34.

A total of 4 ARUs were deployed between April 1 - 9, 2014 beginning at Berens River and heading north towards Poplar River along the south P4 ASR route, and between April 9 - 28, 2014, 4 ARUs were deployed further north along P4 beginning at approximately 36 km north of Berens River to approximately 50 km north of Berens River (Table 33). Each recording unit was placed 4 km apart and the unit location was selected on a different habitat type to allow for recording a variety of wildlife species across the landscape. The focus of these units were to record nocturnal bird species in the area such as owls during their peak vocalization period.

A total of three ARUs were deployed on April 25, 2015 beginning at Berens River and heading north toward Poplar River within the P4 ASR route using the same methods described for 2014 above (Table 34). One additional unit scheduled to be deployed was not working at the time of deployment.

Table 33 List of autonomous recording unit deployments for 2014

Area	Dates Deployed	Unit	Land Cover*	Landscape Comments
P4 (south)	April 1 - 9, 2014	SongMeter1	Mixedwood	Beaver Flood
		SongMeter2	Open TM	-
		SongMeter3	Water	Beaver Flood
		SongMeter4	JP, Rock	-
P4 (north)	April 9 - 28, 2014	SongMeter1	TM/JP, Rock	Adjacent Rock Ridge
		SongMeter2	JP, Rock	-
		SongMeter3	JP/BS	Edge of Creek
		SongMeter4	JP, TM	Ridge

*JP = Jack Pine; BS = Black Spruce; TA = Trembling Aspen; TM = Tamarack

Table 34 List of autonomous recording unit deployments for 2015

Area	Date Deployed	Unit	Land Cover*	Landscape Comments
P4	April 25, 2015	SongMeter1	Mixedwood	Beaver Flood
		SongMeter2	JP, Rock	-
		SongMeter3+	-	-
		SongMeter4	Open Water	Beaver Flood

+ Did not deploy due to battery issues. *JP = Jack Pine

9.2 Results

A summary of bird species and number of calls heard in P4 Study Area was compiled in 2014 and in 2015 (Table 35 and Table 36). No species of concern amphibian calls were detected. The most commonly heard bird species call in P4 in 2014 was the great horned owl, black-capped chickadee, and woodpecker (Table 35), and sora rail, Canada goose, and white-throated sparrow in 2015 (Table 36). One bird species of conservation concern, the common nighthawk, was heard in 2015 (Table 36).

Table 35 Autonomous recording unit results for 2014

Local Project Study Area	Species Observation	# of Calls in Sequence
Project 4	Veery	1
	Woodpecker *sp.*	75
	Canada goose	16
	Black-capped chickadee	63
	American crow	6
	Great horned owl	123
	Sandhill crane	2
	Wilson's snipe	13

Table 36 Autonomous recording unit results for 2015

Local Project Study Area	Species Observation	# of Calls in Sequence
Project 4	Woodpecker *sp.*	14
	Canada goose	43
	Yellow-billed cuckoo	7
	Wilson's snipe	5
	Oven bird	25
	Great horned owl	6
	Connecticut warbler	15
	Mallard	14
	Swamp sparrow	28
	Hooded oriole	5
	Sora rail	61
	Nashville warbler	21
	Pine warbler	21
	Yellow-rumped warbler	22
	Violet-green swallow	11
	Yellow warbler	18
	Red-winged blackbird	13
	American redstart	15
	Common nighthawk	1
	Black-capped chickadee	15
	White-throated sparrow	30
	American crow	15
	Grey jay	15
	Blue jay	15
	Common loon	1

9.3 Summary of Findings

- Of all observed species, one was considered of conservation concern: Common nighthawk is listed as threatened under both MESEA and SARA.

10.0 MANITOBA BREEDING BIRD ATLAS

10.1 Methods

The Manitoba Breeding Bird Atlas (MBBA) completed a series of bird surveys in the summer of 2014 and recorded all bird observations within survey blocks contained within 100 m x 100 m survey squares (MBBA, 2010). These survey blocks encompassed the P4 Study Area as described in the *Manitoba Breeding Bird Atlas: Report to ESRA 2014 Surveys* (MBBA, 2014). Species abundance was determined through point-count surveys to provide a rough measure of how many birds were in each survey block (i.e., where they are breeding). Each point count involved standing in a pre-determined location (usually along the ROW, but a small number of off-road sites in different habitat types were also completed), waiting a 1-minute calming period prior to the survey, and recording all birds heard or seen in an exact 5-minute period (MBBA, 2010). A total of 15 point counts were completed per survey block.

10.2 Results

All the bird observations in the P4 Study Area are listed in Appendix G.

10.3 Summary of Findings

- Two species of concern were found in the P4 Study Area and included the Common nighthawk and the Olive-sided flycatcher, threatened under SARA and MESEA.

11.0 MULTISPECIES SURVEY

11.1 Methods

An aerial multispecies distribution survey was conducted according to the methods described in Section 7.4.1. Observations of furbearers and other species, along with any observation of tracks were recorded. During these surveys, biologists also record any sightings of large bird stick nests, as well as any ecologically sensitive potential sites (such as bat or snake potential hibernacula sites, bird nesting colonies, mineral licks, and mammal denning).

11.2 Results

There were 56 individual caribou and 396 locations of caribou tracks recorded during the January 10-11, 2011 aerial multispecies distribution survey. In addition, 26 moose and 244 moose tracks were recorded as well as 34 wolf tracks (Table 37). No ecologically sensitive sites, nor large stick nests were identified.

Table 37 **January 2011 aerial multispecies distribution survey within Project 4 and Project 1**

Species	Tracks	Observations
Caribou	396	56
Moose	244	26
Wolf	34	0

There was a total of 53 adult caribou observed during the aerial multispecies distribution survey in March 2011. There were also 21 adult moose with 6 calves, three red fox, one white-tailed deer, and one wolf observed along with tracks from caribou, coyote, fisher, lynx, marten, mink, moose, otter, hare, wolf, and wolverine (Table 38). White-tailed deer rarely extend into the southern ASR PSA (Reid, 2006).

Table 38 **Results from the March 2011 aerial multispecies distribution survey in Project 4 and the northern portion of Project 1**

Species	Tracks	Adults	Calves
Caribou	216	53	0
Coyote	20	0	0
Deer	0	1	0
Fisher	37	0	0
Fox	140	3	0
Lynx	238	0	0
Marten	639	0	0
Mink	101	0	0
Moose	641	21	6
Otter	131	0	0
Snowshoe Hare	435	0	0
Wolf	71	1	0
Wolverine	8	0	0

11.3 Summary of Findings

- Supports understanding of broad distribution and diversity of wildlife species across the RPSA.
- Supports conclusions regarding low moose densities in the RPSA.

11.4 Final Alignment Survey

Furbearer and other wildlife such as avian and herptile species presence as well as the presence of ecologically sensitive sites were assessed through aerial multispecies distribution survey in the P4 and P1 areas.

11.4.1 Methods

An aerial baseline survey was conducted on September 15, 2015 within the LPSA. The survey was conducted by biologists, using a Bell 206L Long Ranger helicopter on behalf of MFESRA. Flight transects were spaced 500 m apart across the ROW and flown in a north-south direction. This survey was carried out to record observations of avian stick nests, heron rookeries, and other-ecologically-sensitive sites, including ungulate wetland feeding areas, along with facilitating bird point counts in strategic wetland areas along the ROW and other incidental wildlife observations. Survey data were recorded using detailed data sheets and hand-held GPS devices and imported to GIS software for mapping and analysis. The results from this survey are discussed below.

11.4.2 Results

There were 6 trumpeter swans, listed as Endangered under MESEA, observed during the aerial baseline distribution survey in September 2015. Further, one stick nest, three ecologically sensitive wetland feeding areas for ungulates, three bald eagles, two owls, two turkey vultures, one woodpecker, and 180 ducks and geese were observed (Table 39). Additionally, point count surveys were conducted at 7 ecologically sensitive wetland locations and species observations were recorded in (Table 40).

Table 39 Results from the September 2015 aerial baseline distribution survey within the Project 4 Study Area

Species	Observations
Trumpeter swan	6
Stick Nest	1
Ecologically-Sensitive Wetland Feeding Areas	3
Bald Eagle	3
Owl sp.	2
Turkey vulture	2
Pileated Woodpecker	1
Lesser Scaup	30
Geese/Mallards	150

Table 40 **Results from the September 2015 point count surveys within the Project 4 Study Area**

Point Count Stop	Species Observations
1	1 Bald eagle, Mallards
2	2 Sandhill cranes
3	1 Canada goose
4	1 Chickadee
5	1 Sparrow, 1 Kingfisher
6	No birds
7	Unknown bird

11.4.3 Summary of Findings

- Survey verified a number of high quality riparian/wetland areas along the ASR that may be utilized by moose as aquatic feeding areas. These areas also provide habitat for waterfowl and may be used as both nesting and small staging areas.
- There was no evidence of Trumpeter swan nesting or breeding as all observations consisted of adult pairs with no cygnets (young).

12.0 LCCES - Habitat Evaluation

During the projected life span of the Project, the dynamic ecosystem in which the right-of-way (ROW) is located will be constantly changing. As a part of baseline monitoring a habitat evaluation was conducted to determine the type of habitat currently surrounding the proposed P4 ASR. Once P4 is built, the existing WR will be decommissioned. The habitat removed to construct P4 will be offset by the habitat gained once the WR is decommissioned and the ROW is regenerated. The LCCES covertype analysis provides insight into the amount of habitat available within the LPSA for various species.

12.1 Furbearer Habitat Modeling

12.1.1 Methods

Furbearer habitat modelling was conducted using the LCCES. The potential habitat for American beaver was modelled using broadleaf and mixed wood stands, using stands dominated by willow understory. The habitat was selected around creeks, rivers, and water bodies that were less than 8 ha in size. The potential habitat for American marten was modelled using mature coniferous and mixed wood stands that were older than 60 years. Fire layers were used to determine the age of the mature stands. The potential habitat for both of these species was modelled for the P4 FP (100 m ROW) as well as for the LPSA (5 km buffer).

12.1.2 Results

Beaver

Beaver (*Castor canadensis*) is a semi-aquatic furbearer species commonly found throughout Manitoba in riparian areas including lakes, creeks, rivers, and other water bodies. It is an ecosystem engineer and keystone species which modifies drainage regimes by cutting vegetation and building dams that have long-term effects on landscapes. Beavers feed on almost any herbaceous or wood plant but prefer willows, aspen, and other deciduous trees, and constructs lodges/dams from mud and sticks. This species mates for life and can produce a breeding colony of 2-12 members including breeding pair, yearlings, and kits. It is primarily nocturnal and travels far from home to food, overwintering under the ice for up to 6 months within the protection of their lodge. Table 41 and Table 42 summarize the results of modelling below.

Table 41 Potential beaver habitat within the Local Project Study Area

Habitat Type	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Broadleaf Dense	16.60	0.00	16.60
Mixedwood Dense	27.47	0.16	27.48
Wetland Shrub	27.12	0.30	27.13
Wetland Treed	1.44	0.01	1.44
Total	**72.63**	**0.47**	**72.65**

Table 42 Percentage of total beaver habitat lost within the project footprint and percentage of habitat gain due to P4 winter road reclamation

Habitat Type	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Broadleaf Dense	0.00%	0.03%
Mixedwood Dense	0.59%	0.03%
Wetland Shrub	1.12%	0.04%
Wetland Treed	0.59%	0.00%

Marten

Marten (*Martes americana*) is an economically important furbearer species for commercial trapping due to a relatively desirable coat and ease in capture. It is a solitary animal that spends most of its time in Manitoba's boreal forest, but absent from southern portions of the province. It is also an ecological indicator of mature coniferous forests featuring structural complexity; i.e. with high canopy closure and vertical and horizontal woody structure, and abundant in undisturbed forests. Marten is carnivorous and will feed avidly on mice and other small rodents, utilizing coarse woody debris for foraging and to access prey. It has very large home range sizes for its body mass, particularly for males versus females, and dens in forest habitat with rock crevices, and large logs and snags. Table 43 and Table 44 summarize the results of modelling below.

Table 43 Potential marten habitat within the Local Project Study Area

Habitat Type	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Broadleaf Dense	16.10	0.04	16.10
Coniferous Dense	31.54	0.39	31.54
Coniferous Open	2.69	0.04	2.69
Coniferous Sparse	3.37	0.07	3.37
Mixedwood Dense	34.39	0.30	34.39
Total	**88.09**	**0.84**	**88.09**

Table 44 Percentage of total marten habitat lost within the project footprint and percentage of habitat gain due to P4 winter road reclamation

Habitat Type	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Broadleaf Dense	0.23%	0.00%
Coniferous Dense	1.24%	0.00%
Coniferous Open	1.35%	0.00%
Coniferous Sparse	2.10%	0.00%
Mixedwood Dense	0.88%	0.00%

Table 45 provides ecological context for the mammal species that were modelled in addition to listing other wildlife species that are likely to be associated with the same or similar habitats. The wildlife species indicated are a summary list of only those species that have a close association with the same habitat types as the modelled species; information on habitat associations for birds are provided in Section 12.1.3.

Table 45 **Examples of habitat associations for mammal species that were modelled**

Mammal Species	Habitat Preference	Wildlife-Habitat Associations
Woodland Caribou	A forest containing a mixture of jackpine and treed muskeg provides good overall habitat for caribou. They are often associated with spruce stands where present.	Black bear, northern flying squirrel, silver haired bat, American tree sparrow, Lincoln's sparrow, mourning warbler, rusty blackbird, swamp sparrow, black backed woodpecker, boreal owl, Cooper's hawk, great grey owl, northern saw-whet owl, sharp-shinned hawk and spruce grouse
Moose	Moose often occur near streams and rivers and edges of shallow lake. In the summer they prefer cool, moist lowland habitat providing suitable forage and escape cover. They often travel further inland to rut and feed on shrubs in the fall. In late winter, they typically use dense coniferous forest.	Black bear, lynx, porcupine, racoon, wolf, wolverine, alder flycatcher, American kestrel, American redstart, black-and-white warbler, black-capped chickadee, blue jay, chipping sparrow, common raven, downy woodpecker, gray tree frog, wood frog
Beaver	Riparian areas including lakes, creeks, rivers, and other water bodies. Prefer habitat containing willows, aspen, and other deciduous trees for feeding and construction of dams and lodges.	Masked shrew, meadow vole, mink, pygmy shrew, otter, water shrew, yellow warbler, great blue heron, lesser yellowlegs, northern water thrush, sora rail, Virginia rail yellow rail, boreal chorus frog, wood frog, green frog, and northern leopard frog
Marten	Mature coniferous forests featuring structural complexity - high canopy closure and vertical and horizontal woody structure, particularly in undisturbed forests.	Ermine, fisher, black bear, porcupine, silver-haired bat, red squirrel, wolverine, wolf, three-toed woodpecker, spruce grouse, ruby crowned kinglet, northern hawk owl, gray jay, boreal owl, and common redpoll

Sources: Kunke and Watkins 1999, Schindler 2006, Austman 2015

12.1.3 Summary of Findings

- Habitat for beavers is not limiting within the LPSAs. The amount of beaver habitat that will be lost as a result of the Project is a very small percentage of the overall beaver habitat available within the LSA.
- Habitat for marten is not limiting within the LPSA. The amount of potential marten habitat that will be lost as a result of the Project is a very small percentage of the overall marten habitat available within the LSA.

12.2 Avian Species Habitat Modeling

12.2.1 Methods

A suite of avian VC species were modelled for potential habitat using the LCCES. The Forest Resource Inventory (FRI) was used to model for potential habitat for three species, the trumpeter swan, yellow rail, and the least bittern. The FRI, although dated to 1980, was determined to be a better base layer for modelling for these three species given the finer scale of the FRI and therefore enhanced detailed information on riparian vegetation species (such as cattails). Using LCCES, each avian species was modelled for potential habitat within the P4 FP, the LSA (5 km buffer) as well as to assess the amount of habitat that would become available again with the reclamation of the WR.

For the common nighthawk, dense and open coniferous stands with areas of open rock outcrop and exposed land were used to model potential habitat. For the Eastern whip-poor-will, the potential habitat was modelled with a focus on coniferous open, coniferous sparse, and exposed open rock outcrops. For the Eastern wood pewee, dense broadleaf and mixed wood stands were used to model potential habitat. The Canada warbler potential habitat was modelled focusing on all dense broadleaf and mixed wood stands found on mineral soils. The Olive-sided flycatcher was modelled for potential habitat with a focus on all coniferous and treed wet areas, wooded, to forested bogs that have greater than 10% tree cover.

The trumpeter swan was modelled for potential habitat using the FRI. Boreal leas, beaver floods, and open wet marshes were used to highlight potential habitat. Lakes from a 50,000 topographic layer were used to identify lakes potentially inhabited by swans. The potential habitat for the least bittern was modelled using the FRI with a focus on marshy areas where the major vegetation type being rush and grass cover. Beaver floods dominated by grassy vegetation were selected for. The yellow rail potential habitat was modelled using the FRI with a focus on wet marshy areas, dominated by grassy vegetation around beaver floods and wet treed areas.

12.2.2 Results

Olive-sided Flycatcher

Olive-sided flycatcher (*Contupus cooperi*) is a migratory songbird listed as threatened under SARA and threatened (S3S4B) under MESEA. Commonly it is found in open forest habitat (boreal wetland, western coniferous, or mixed wood forests); containing tall mature trees or snags for perching to enable foraging; open areas include natural forest-edge wetland areas, burned forest clearings, or old-growth stand openings, or harvested areas such as logged areas. Successful breeding habitat is more likely to be in natural openings rather than harvested areas. In Manitoba, it is located in lowland coniferous forest; Riding Mountain National Park in the west to Moose Lake in the southeast, and up into the Interlake to Hecla Island and Mantago Lake. This species has the longest migration of any North American flycatcher, travelling solitary to its wintering grounds; the majority of this species migrates to Panama and the northern Andes from northern Venezuela to western Bolivia, with high densities in Colombia. Table 46 and Table 47 summarize the modelling below.

Table 46 **Potential olive-sided flycatcher habitat within the Local Project Study Area**

Habitat Type Using the LCCES	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Coniferous Open	18.88	0.27	18.88
Coniferous Sparse	21.96	0.30	21.96
Wetland Shrub	14.05	0.10	14.05
Wetland Treed	14.61	0.18	14.61
Total	**69.50**	**0.85**	**69.49**

Table 47 **Percentage of total olive-sided flycatcher habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation**

Habitat Type Using the LCCES	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Coniferous Open	1.42%	0.02%
Coniferous Sparse	1.37%	0.01%
Wetland Shrub	0.69%	0.00%
Wetland Treed	1.21%	0.00%

Canada Warbler

Canada warbler (*Wilsonia canadensis*) is a migratory songbird listed as threatened under SARA/COSEWIC and threatened (S4B) under MESEA. It is found in various forest types, but is most abundant in wet, deciduous-coniferous forest with thick underbrush. Generally, this species is uncommon in Manitoba, but found breeding throughout the southern boreal forest (along the Manitoba Escarpment in western Manitoba to the Whiteshell and Nopoming Provincial Park boundaries in the southeast) and north toward the Pas in scattered locations. This species may spend no more than a few months on its summer breeding grounds (i.e. it is one of the last species to arrive and the first to leave), then rapidly migrating in pairs (males typically arrive slightly ahead of females), and at night to wintering grounds in southern Mexico and northwestern South America.

Table 48 and Table 49 summarize the results of modelling below.

Table 48 **Potential Canada warbler habitat within the Local Project Study Area**

Habitat Type Using the LCCES	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Broadleaf Dense	16.10	0.04	16.10
Mixedwood Dense	130.09	1.86	130.11
Total	**146.19**	**1.90**	**146.21**

Table 49 **Percentage of total Canada warbler habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation**

Habitat Type Using the LCCES	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Broadleaf Dense	0.23%	0.00%
Mixedwood Dense	1.43%	0.02%

Common Nighthawk

Common nighthawk (*Chordeiles minor*) is a migratory songbird listed as threatened under SARA/COSEWIC, and threatened (S3B) under MESEA. This species breeds in a wide range of open habitats (e.g. dunes, beaches, burnt, logged or recently harvested areas, rocky outcrops, rocky barrens, grasslands, pastures, or riparian areas), along with mixed and coniferous forests. Less common in southern Manitoba, it is still quite common in parts of northern Manitoba, and typically arrives late to spring breeding grounds. It winters in the tropics, but migratory patterns are difficult to distinguish from other nighthawks, which it mixes with in parts of the winter range; uniquely, females usually arrive several days ahead of males. Table 50 and Table 51 summarize the results of modelling below.

Table 50 **Potential common nighthawk habitat within the Local Project Study Area**

Habitat Type Using the LCCES	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Coniferous Open	18.88	0.27	18.88
Coniferous Sparse	21.96	0.30	21.96
Exposed Land	1.61	0.03	1.62
Total	**42.45**	**0.60**	**42.46**

Table 51 **Percentage of total common nighthawk habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation**

Habitat Type Using the LCCES	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Coniferous Open	1.42%	0.02%
Coniferous Sparse	1.37%	0.01%
Exposed Land	2.04%	0.44%

Eastern Whip-poor-will

Eastern whip-poor-will (*Antrostomus vociferus*) is a migratory songbird listed as threatened under SARA/COSEWIC and threatened (S3B) under MESEA. It prefers to breed in semi-open or patchy forests with clearings, such as regenerating disturbed areas, upland deciduous or mixed-wood forests; occurring in a variety of similar forest-structure areas in Manitoba, but not wide-open spaces or dense forests. The northern border of the breeding range is a diagonal stripe along the aspen parkland transition zone from southeastern Manitoba to eastern central Saskatchewan. Wintering grounds are in Mexico and Central America. Table 52 and Table 53 summarize the results of modelling below.

Table 52 **Potential eastern whip-poor-will habitat within the Local Project Study Area**

Habitat Type Using the LCCES	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Coniferous Open	2.58	0.04	2.58
Coniferous Sparse	21.96	0.30	21.96
Exposed Land	1.61	0.03	1.62
Total	**26.15**	**0.37**	**26.16**

Table 53 **Percentage of total eastern whip-poor-will habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation**

Habitat Type Using the LCCES	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Coniferous Open	1.41%	0.00%
Coniferous Sparse	1.37%	0.01%
Exposed Land	2.04%	0.44%

Eastern Wood-peewee

Eastern wood-peewee (*Contupus virens*) is a migratory songbird not listed under SARA or MESEA, but is listed as Special Concern by COSEWIC. It occurs commonly in mature deciduous woods such as large aspen stands and along edges of fairly open woods; it also occurs in riparian forests, beach ridge forests, and sometimes well-wooded urban and rural parks, and southern boreal transitional forest, with a deciduous component, or sometimes jack pine and more open boreal forest types. It is one of the last migrants in spring, and winters in the tropics of South America.

Table 54 and Table 55 summarize the results of modelling below.

Table 54 Potential eastern wood-peewee habitat within the Local Project Study Area

Habitat Type Using the LCCES	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Broadleaf Dense	46.74	0.31	46.75
Mixedwood Dense	130.09	1.86	130.11
Total	**176.83**	**2.17**	**176.86**

Table 55 Percentage of total eastern wood-peewee habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation

Habitat Type Using the LCCES	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Broadleaf Dense	0.66%	0.02%
Mixedwood Dense	1.43%	0.02%

Trumpeter Swan

Trumpeter swan (*Cygnus buccinators*) is a migratory waterbird not listed under SARA/COSEWIC and is threatened (S1S2B) under MESEA. It prefers nesting in shallow wetlands with stable water levels, abundant and elevated nest sites, abundant and diverse aquatic invertebrates and/or plants, and low levels of human disturbance. Trumpeter swan typically mates for life, with females laying an egg every second day until they have a full clutch (avg. 5-6 eggs). Migration to wintering grounds is complex and flown in short segments with long layovers and very few long flights; birds from western Canada fly east of the Rockies to the Yellowstone area following freeze up in late fall. Trumpeter swan sightings in Manitoba have increased in recent years; several breeding pairs now nest in Riding Mountain National Park, one pair was observed near Bissett, and a record was recently confirmed on the east side of Lake Winnipeg. Table 56 and Table 57 summarize the results of modelling below.

Table 56 Potential trumpeter swan habitat within the Local Project Study Area

Habitat Type Using the FRI	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Marsh/Wetland	0.15	0.00	0.15
Beaver Flood	30.09	0.30	30.11
Boreal Lakes	32.26	0.05	32.26
Total	**62.50**	**0.35**	**62.52**

Table 57 Percentage of total trumpeter swan habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation

Habitat Type Using the FRI	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Marsh/Wetland	0.00%	0.00%
Beaver Flood	0.99%	0.04%
Boreal Lakes	0.16%	0.00%

Yellow Rail

Yellow rail (*Coturnicops noveboracensis*) is a migratory marsh bird listed as Special Concern under SARA/COSEWIC and is not listed (S3S4B) under MESEA. It is typically found in marshes with little standing water (0-12 cm depth) and emergent vegetation (sedges, true grasses, and rushes, for example), but also inhabits damp fields and meadows, river and stream floodplains, herbaceous vegetation of bogs, and drier margins of estuarine- and salt marshes. Yellow rail breeds in most areas of Manitoba, particularly south, central, and Hudson Bay Lowlands areas of the province, where it is often associated with Le Conte's sparrow and sedge wren. It winters from Carolinas south to Florida and along the Gulf Coast, and rarely in southern California. Table 58 and Table 59 summarize the results of modelling below.

Table 58 Potential yellow rail habitat within the Local Project Study Area

Habitat Type Using the FRI	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Muskeg/Wetland	35.79	0.22	35.81
March/Wetland	0.15	0.00	0.15
Beaver Flood	30.09	0.30	30.11
Total	**66.03**	**0.52**	**66.07**

Table 59 **Percentage of total yellow rail habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation**

Habitat Type Using the FRI	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Muskeg/Wetland	0.61%	0.05%
March/Wetland	0.00%	0.00%
Beaver Flood	0.99%	0.04%

Least Bittern

Least bittern (*Ixobrychus exilis*) is a migratory marsh bird listed as threatened under SARA/COSEWIC and endangered (S2S3B) under MESEA. It prefers to breed only in marshes dominated by emergent vegetation such as cattails, surrounded by stable-level areas of open water, but will also breed in shrubby swamps. Dense vegetation is required for nesting to enable its nest to sit on a platform of stiff stems; open water is needed for foraging to allow it to ambush prey in shallow water near marsh edges; and access to clear water is essential to see its prey. Least bittern is secretive and most often detected only by its cuckoo-like call. It is found in southern Manitoba and winters mainly along the Gulf and Mexican coasts, south to Panama. Table 60 and Table 61 summarize the results of modelling below.

Table 60 **Potential least bittern habitat within the Local Project Study Area**

Habitat Type Using the FRI	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Marsh/Wetland	0.15	0.00	0.15
Beaver Flood	30.09	0.30	30.11
Total	**30.24**	**0.30**	**30.26**

Table 61 **Percentage of total least bittern habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation**

Habitat Type Using the FRI	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Marsh/Wetland	0.00%	0.00%
Beaver Flood	0.99%	0.04%

Short-eared Owl

Short-eared owl (*Asio flammeus*) is a migratory marsh or open-grassland bird that is listed as special concern under SARA/COSEWIC and threatened under MESEA. It makes use of a wide variety of open habitats, including arctic tundra, grasslands, peat bogs, marshes, sand-sage concentrations, and old pastures, with preferred nesting sites found in dense grasslands, as well as tundra with areas of small willows. The main factor influencing the preference of short-eared owl for open habitat is believed to be the abundance of food: especially meadow voles in the south and collared lemmings in the north, and often associated with spring concentrations of rough-legged hawks and northern harriers, which are positive indicators of rodent abundance. Short-eared owls breed mainly in southern farmland and northern tundra in Manitoba, and in the boreal plains, they are sparsely distributed and breed in extensive marshes and fens; wintering grounds are south throughout the United States to Central America. Table 62 and Table 63 summarize the results of modelling below.

Table 62 Potential short-eared owl habitat within the Local Project Study Area

Habitat Type Using the FRI	Total Modeled Habitat (LSA) (km^2)	Habitat Lost Due to Project Footprint (km^2)	Total Habitat Due to P4 Winter Road Reclamation (km^2)
Treed Wetland	35.79	0.22	35.81
Marsh/Tall Grass	0.15	0.00	0.15
Beaver Flood	30.09	0.30	30.11
Total	**66.03**	**0.52**	**66.07**

Table 63 Percentage of total short-eared owl habitat lost due to clearing within the project footprint and percentage of habitat gain due to P4 winter road reclamation

Habitat Type Using the FRI	% Habitat Lost Due to Project Footprint	Habitat Gain (P4 Winter Road Reclamation)
Treed Wetland	0.61%	0.05%
Marsh/Tall Grass	0.00%	0.00%
Beaver Flood	0.99%	0.04%

Table 64 provides some of the relevant ecological context for the bird species that were modelled. Each of the species modelled occurs in habitat types that are frequented by many other bird species (as well as other wildlife). Table 64 provides some of the most likely bird species to be associated with the same or similar habitats to those birds modelled. This is not an exhaustive list of the birds that are expected to be associated with those habitat types nor does it include other wildlife groups (mammals, amphibians and reptiles) that may also have a preference to use the same habitat types. The results of the models indicate that habitat is not a limiting factor for each of the bird species modelled.

Table 64 Examples of habitat associations for bird species that were modelled

Bird Species	Habitat Preference	Bird-Habitat Associations
Olive-sided flycatcher	Open coniferous forests near edge of bogs/wetlands	American tree sparrow, eastern kingbird, Lincoln's sparrow, mourning warbler, rusty blackbird, swamp sparrow, beaver, black bear, masked shrew, meadow jumping mouse, meadow vole, moose, red squirrel, silver haired bat, star-nosed mole, water shrew, common snapping turtle
Canada warbler	Often on sloping terrain near lake in dense shrubbery in/near deciduous or mixed-wood	Blue jay, black-capped chickadee, chipping sparrow, clay-colored sparrow, great horned owl, red-eyed vireo, yellow warbler, coyote, ermine, fisher, lynx, shrew, meadow vole, otter, star nosed mole
Common nighthawk	Forests with extensive rock outcrops, clearings or burns	Common redpoll, killdeer, black bear, coyote, deer mice, ermine, striped skunk, red sided garter snake
Eastern Whip-poor-will	Open upland deciduous and mixed-wood forest	Alder flycatcher, American goldfinch, black-and-white warbler, black-capped chickadee, blue jay, Canada warbler, cedar waxwing, clay colored sparrow, common snipe, downy woodpecker, eastern kingbird, eastern wood-pewee, red-tailed hawk, ruby-crowned kinglet, ruffed grouse, red-eyed vireo, sharp-tailed grouse, song sparrow, spruce grouse, Swainson's thrush, veery, warbling vireo, western wood-pewee, white-breasted nuthatch, white-throated sparrow, yellow warbler, coyote, ermine, fisher, mink, moose, shrew
Eastern Wood-pewee	Deciduous woods, large aspen bluffs, beach ridges, riparian sites and open tall jack pine stands	Blue jay, Canada warbler, eastern kingbird, house wren, red-eyed vireo, ruffed grouse, song sparrow, tree swallow, winter wren, wood thrush, ermine, fisher, least chipmunk, lynx, meadow vole, mink, moose, red backed vole, shrew
Trumpeter Swan	Shallow wetlands with stable water levels are preferred nesting sites	17 species of ducks (especially dabblers) and 34 species of other waterbirds and shorebirds, e.g., loons
Yellow rail	Wetlands – shallow, grassy marsh or sedge fen	Le Conte's sparrow, sedge wren and Virginia rail, beaver, black bear, coyote, meadow jumping mouse, meadow vole, mink, otter, shrew, common snapping turtle, western painted turtle, American toad, boreal chorus frog, Cope's gray treefrog, gray treefrog, green frog, mink frog, northern leopard frog, northern spring peeper, wood frog
Least bittern	Marshes with emergent vegetation such as cattail, shrubby swamps, beaver floods	American bittern, great blue heron, rusty blackbird, horned grebe, and several other waterbirds and shorebirds as well as the mammals, amphibians and reptiles associated with yellow rail
Short-eared owl	Breed in extensive marshes and fens in boreal plains	Northern harriers and northern hawk owl, beaver, otter, meadow jumping mouse, meadow vole, mink, otter, shrew, boreal chorus frog, mink frog, northern leopard frog, wood frog

Sources: Altman and Sallabanks. 2000, Avery 1995, Bookhout and Stenzel 1987, Bookhout 1995, Clark 1975, Conway 1999, Godfrey 1986, Holland and Taylor 2003a,b, Koonz and Taylor 2003, Kunke and Watkins 1999, Nero and Taylor 2003, Poulin *et al*. 1996, Taylor 2003, Taylor and Holland 2003, Wilson and Watts 2008. See Section 12.2.2 of Appendix 9.1 of Project 4 EIS

12.2.3 Summary of Findings

- Habitat for olive-sided flycatcher is not limiting within the LPSA. The amount of potential olive-sided flycatcher habitat that will be lost as a result of the Project is a very small percentage of the overall olive-sided flycatcher habitat available within the LPSA.
- Habitat for Canada warbler is not limiting within the LPSA. The amount of potential Canada warbler habitat that will be lost as a result of the Project is a very small percentage of the overall Canada warbler habitat available within the LPSA.
- Habitat for common nighthawk is not limiting within the LPSA. The amount of potential common nighthawk habitat that will be lost as a result of the Project is a very small percentage of the overall common nighthawk habitat available within the LPSA.
- Habitat for eastern whip-poor-will is not limiting within the LPSA. The amount of potential eastern whip-poor-will habitat that will be lost as a result of the Project is a very small percentage of the overall eastern whip-poor-will habitat available within the LPSA.
- Habitat for eastern wood-peewee is not limiting within the LPSA. The amount of potential eastern wood-peewee habitat that will be lost as a result of the Project is a very small percentage of the overall eastern wood-peewee habitat available within the LPSA.
- Habitat for trumpeter swan is not limiting within the LPSA. The amount of potential trumpeter swan habitat that will be lost as a result of the Project is a very small percentage of the overall trumpeter swan habitat available within the LPSA.
- Habitat for yellow rail is not limiting within the LPSA. The amount of potential yellow rail habitat that will be lost as a result of the Project is a very small percentage of the overall yellow rail habitat available within the LPSA.
- Habitat for least bittern is not limiting within the LPSA. The amount of potential least bittern habitat that will be lost as a result of the Project is a very small percentage of the overall least bittern habitat available within the LPSA.
- Habitat for short-eared owls is not limiting within the LPSA. The amount of potential short-eared owl habitat that will be lost as a result of the Project is a very small percentage of the overall short-eared owl habitat available within the LPSA.

13.0 REFERENCES

13.1 Literature Cited

Altman, B and R. Sallabanks. 2000. Olive-sided flycatcher (*Contropus cooperi*). In The Birds of North America. No. 502. Edited by A. Poole and F. Gil. The Birds of North America, Inc., Philadelphia, P.A.

Austman, B. 2015. The Mighty Moose of Manitoba. Manitoba Model Forest.

Avery, M.L. 1995. Rusty blackbird (*Euphagus caroli*nus). In The Birds of North America. No. 200. Edited by A. Poole and F. Gil. The Birds of North America, Inc., Philadelphia, P.A.

Ballard, W.B., Spraker, T.H., and P. Kenton. Taylor. 1981. Causes of Neonatal Moose Calf Mortality in South Central Alaska. The Journal of Wildlife Management 45(2): 335-342.

Banfield, A.W.F. 1974. The Mammals of Canada. University of Toronto Press. Toronto, Ontario.

Bannatyne, B.B., and J.T. Teller. 1984. Geology of Manitoba before the Ice Age; in Teller J.T. (editor). Natural Heritage of Manitoba: Legacy of the Ice Age. ISBN 0-920704-14-X. Manitoba Museum of Man and Nature, and Manitoba Nature Magazine. Winnipeg, Manitoba.

Beazley, K., Snaith, T., MacKinnon, F. and C. David. Road density and potential impacts on wildlife species such as American moose in mainland Nova Scotia. Proceedings of the Nova Scotian Institute of Science. 42(2):339-357

Berglund, N.E., Racey, G.D., Abraham, K.F., Brown, G.S., Pond, B.A., and L.R. Walton. 2014. Woodland caribou (Rangifer tarandus caribou) in the Far North of Ontario: Background information in support of land use planning. DRAFT. Technical Report TR-147, Ministry of Natural Resources, Thunder Bay, Ontario. 160 pp

Bezener, A., and K. De Smet. 2000. Manitoba Birds. Lone Pine Publishing, Edmonton, AB.

Bookhout, T.A. 1995. Yellow rail (*Coturnicus noveboracensis*). In The birds of North America. No. 139. Edited by A. Poole and F. Gil. The Birds of North America, Inc., Philadelphia, P.A.

Bookhout, T.A. and J.R. Stenzel. 1987. Habitat and movement of breeding yellow rails. Wilson Bulletin 99(3): 441-447.

Brandes, T.S. 2008. Automated sound recording and analysis techniques for bird surveys and conservation. Bird Conservation International 18: S163-S173.

Campbell, D. And Bergeron, J. 2012. Arctic, Antarctic, and Alpine Research. Vol. 44, No. 2. Pp. 155-163.

Caras, R.A. 1967. North American Mammals- Fur-bearing Animals of the United States and Canada. Meredith Press. University of Minnesota, MN.

Caughley, G. 1970. Eruption of ungulate populations, with emphasis on Himalayan than in New Zealand. Ecology 51: 53-72.

Clark, R.J. 1975. A field study of the short-eared owl, *Asio flammeus* (Pontoppidian) in North America. Wildlife Monographs No. 47: 3-67.

Conant, R., and J.T. Collins. 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Co. Boston, MA.

Conway, C.J. 1999. Canada warbler (Wilsonia canadensis). *In* The birds of North America. No. 421. Edited by A. Poole and F. Gil. The Birds of North America, Inc., Philadelphia, P.A.

Cook, F.R. 1984. Introduction to Canadian Amphibians and Reptiles. National Museums of Canada. Ottawa, Ontario.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2002. COSEWIC assessment and update status report on the woodland caribou Rangifer tarandus caribou in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Xi + 98 pp.

Dunster, J., and K. Dunster. 1996. Dictionary of Natural Resource Management. ISBN 0-7748-0503-X. UBC Press. University of British Columbia. Vancouver, B.C.

Environment Canada. 2008. Scientific Review for the Identification of Critical Habitat for Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada. Ottawa: Environment Canada. 72 pp.

Environment Canada. 2012. Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi + 138 pp.

ESRI. 2011. ArcGIS Desktop: Release 9.3 Redlands, CA: Environmental Systems Research Institute.

ESRI. 2012. ArcGIS Desktop: Release 10.1 Redlands, CA: Environmental Systems Research Institute.

Gillingham, M. P., and K. L. Parker. 2008. The Importance of Individual Variation in Defining Habitat Selection by Moose in Northern British Columbia. Alces 44:7–20.

Godfrey, W.E. 1986. The birds of Canada. National Museum of Natural Sciences (Canada).

Greater Fundy Ecosystem Research Group, 2005. Forest management guidelines to protect native biodiversity in the greater Fundy ecosystem. Edited by Betts, M.G. and G.J. Forbes. 2nd edition. Faculty of Forestry and Environmental Management, University of New Brunswick. 127 pp.

Gustine, D.G., Parker, K.L., Lay, R.J., Gillingham, M.P., and D.C. Heard. 2006. Calf Survival of Woodland Caribou in a Multi-Predator Ecosystem Wildlife Monographs Number 165 :1-32. 2006

Heckbert, S., Adamowicz, W., Boxall, P., and D. Hanneman. 2010. Cumulative Effects and Emergent Properties of Multiple-Use Natural Resources. In Multi-Agent-Based Simulation X. Edited by Di Tosto, G. and H. Van Dyke Parunak. International Workshop, MABS 2009, Budapest, Hungary.

Heisey, D.M., and T.K. Fuller. 1985. Evaluation of survival and cause-specific mortality rates using telemetry data. Journal of Wildlife Management 49: 668-674.

Henttonen, H. and A. Tikhonov. 2008. Rangifer tarandus. The IUCN Red List of Threatened Species 2008

Holland, G.E. and P. Taylor. 2003a. Short-eared owl. In The birds of Manitoba, Manitoban Avian Research Committee. Edited by P. Taylor. Manitoba Naturalists Society, Winnipeg, MB, pp. 235.

Holland, G.E. and P. Taylor. 2003b. Yellow rail. In The birds of Manitoba, Manitoban Avian Research Committee. Edited by P. Taylor. Manitoba Naturalists Society, Winnipeg, MB, pp. 156.

Jalkotzy, M.G., Ross, P.I., and M.D. Nasserden. 1997. The effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature. Report: 1-354. Prepared for Canadian Association of Petroleum Producers. Arc Wildlife Services Ltd. Calgary, AB.

Joro Consultants. 2012a. Bipole III Transmission Project Caribou Supplemental Report. Prepared for Manitoba Hydro

Joro Consultants. 2012b. Caribou presentation to the Manitoba Clean Environment Commission by Doug Schindler.

Keenan, V. and T. Munn. 2008. Local level indicators of sustainable forest management for FML 01. Prepared for Tembec Enterprises. Forest Resource Management, Pine Falls Operations.

Keenan, V.T., Philippot, D., Fraser, J., Day, S., and J. Lidgett. 2009. Forest Management Licence 01, 2010 – 2029 Forest Stewardship Plan of the Tembec Forest Resource Management, Pine Falls Operations. Tembec Industries Inc. Pine Falls, Manitoba.

Kolenosky, G.B., and S.M. Strathearn. 1987. Black Bear; in Novak, M., J.A. Baker, M.E. Obbard and B. Malloch. (Eds.). Wild Furbearer Management and Conservation in North America. Ontario Ministry of Natural Resources. Toronto, Ontario. pp. 443-454.

Koonz, W.H. and P. Taylor. 2003. Olive-sided flycatcher. In The birds of Manitoba, Manitoban Avian Research Committee. Edited by P. Taylor. Manitoba Naturalists Society, Winnipeg, MB, pp. 252-253.

Kopcha, M., Rook, J.S., and D. Hostetler. 2012. P. tenuis – The White-tailed Deer Parasite. Michigan State University. http://old.cvm.msu.edu/extension/Rook/ROOKpdf/brainwormkaren.PDF. Accessed August 13, 2012.

Kunke, D.H. and W. Watkins. 1999. Selecting wildlife species for integrating habitat supply models into forest management planning in Manitoba. Canadian Forest Service, Northern Forestry Centre.

Lankester, M.W., and S. Luttich. 1988. *Fascioloides magna* (Trematoda) in woodland caribou (*Rangifer tarandus caribou*) of the George River herd, Labrador. Canadian Journal of Zoology 66(2): 475-479.

Legendre, P., and L. Legendre. 1998. Numerical Ecology, Second English Edition. Elsevier, B.V., Amsterdam, the Netherlands. pp. 616-625.

LGRFN and OMNR (Little Grand Rapids First Nation and Ontario Ministry of Natural Resources). 2011. Little Grand Rapids Community Based Land Use Plan - Little Grand Rapids - Ontario Planning Area. http://serdc2.dpdsoftware.com/communities/little-grand-rapids

Manitoba Avian Research Committee. 2003. The Birds of Manitoba. Manitoba Avian Research Committee. Manitoba Naturalists Society. Friesens Printers. Winnipeg, Manitoba.

Manitoba Conservation. 2011. Action Plans for Boreal Woodland Caribou Ranges in Manitoba. Draft. 53pp.

Manitoba Wildlands. 2014. Manitoba World Heritage Site. http://manitobawildlands.org (accessed October 7, 205).

Mayfield, H. 1975. Suggestions for calculating nest success. Wilson Bulletin 87: 456-466.

MBBA (Manitoba Breeding Bird Atlas). 2010. Guide for Point Counters. Winnipeg, Manitoba. 8pp. http://www.birdatlas.mb.ca/download/Point_Counting_Guide_April_22.pdf

MBBA. 2014. Manitoba Breeding Bird Atlas: Report to ESRA 2014 Surveys.

MBCDC (Manitoba Conservation Data Centre). 2013. Lac Seul list of species of conservation concern.http://www.gov.mb.ca/conservation/cdc/ecoreg/lacseul.html

MBWCMC (Manitoba Boreal Woodland Caribou Management Committee). 2015. Conserving the icon of the Boreal, Manitoba's Boreal Woodland Caribou (Rangifer tarandus caribou) Recovery Strategy. Manitoba Conservation and Water Stewardship. Winnipeg, Manitoba. 30 pp.

McLoughlin, P. D., Dzus, E.H., Wynes, B., and S. Boutin. 2003. Declines in population of woodland caribou. Journal of Wildlife Management, 67(4), 755–761.

MCWS (Manitoba Conservation and Water Stewardship). 2012. Unpublished provincial trapping data. Provided by Dean Berezanski, Provincial Furbearer Biologist, Manitoba Conservation and Water Stewardship.

MCWS. 2013. Manitoba Forest Management Units. Manitoba Conservation and Water Stewardship, Forestry Branch. Winnipeg, Manitoba. http://www.gov.mb.ca/conservation/forestry/pdf/manage/fmu_feb2013_map.pdf

MCWS. 2014. 2014-2015 Trapping Guide. Manitoba Conservation, Wildlife and Ecosystem Protection Branch. Winnipeg, Manitoba.

MCWS. 2015. Manitoba Hunting Guide 2015. Manitoba Conservation and Water Stewardship, Wildlife and Ecosystem Protection Branch. Winnipeg, Manitoba.

Mills, G.F. 1984. Soils of Manitoba; in Teller J. T. (ed.). Natural Heritage of Manitoba: Legacy of the Ice Age. ISBN 0-920704-14-X. Manitoba Museum of Man and Nature, and Manitoba Nature Magazine. Winnipeg, Manitoba.

MLOA (Manitoba Lodges and Outfitters Association). 2013. About the Manitoba Lodges and Outfitters Association. http://www.mloa.com (Accessed October 28, 2013).

Nero, R.W. and P. Taylor. 2003. Rusty blackbird. In The birds of Manitoba, Manitoban Avian Research Committee. Edited by P. Taylor. Manitoba Naturalists Society, Winnipeg, MB, pp.378-379.

Ontario Ministry of Natural Resources (OMNR). 2009. Cervid Ecological Framework. 19 pp.

Paddle Manitoba. 2010. Manitoba Canoe Routes. http://www.paddle.mb.ca/resources/routes/maps/ (Accessed March 26, 2012).

Peek, J. M. Habitat relationships. In the Ecology and Management of the North American Moose. Chapter 11. Compiled and edited by A.W. Franzmann and C.C. Schwartz. Smithsonian Institution Press.

Peterson, R.T., and V.M. Peterson. 2002. A Field Guide to the Birds of Eastern and Central North America. Houghton Mifflin Harcourt. New York, N.Y.

Poulin, R.G., Grindal, S.D., and R.M. Brigham. 1996. Common nighthawk (*Chordeiles minor*). In The birds of North America. No. 213. Edited by A. Poole and F. Gil. The Birds of North America, Inc., Philadelphia, P.A.

Preston, W.B. 1982. The Amphibians and Reptiles of Manitoba. Manitoba Museum of Man and Nature. Winnipeg, Manitoba.

R Core Team. 2014. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Reid, F.A. 2006. A Field Guide to the Mammals of North America. Houghton Mifflin Harcourt. New York, N.Y.

Rempel, R.S., Kaukinen., D., and A.P. Carr. 2012. Patch Analyst and Patch Grid. Ontario Ministry of Natural Resources. Centre for Northern Forest Ecosystem Research, Thunder Bay, Ontario.

Renecker, L.A., and C.C. Schwartz. 1998. Food Habits and Feeding Behaviour in Ecology and Management of the North American Moose. Franzmann and Schwartz (eds.) Smithsonian Institution Press. Washington, U.S.A. p.403-439.

Rettie, W.J. and F. Messier. 1998. Dynamics of woodland caribou populations at the southern limit of their range in Saskatchewan. Canadian Journal of Zoology. 76(2): 251-259.

Rowe, J.S. 1972. Forest Regions of Canada. Canadian Forest Service, Dept. of the Environment, Information Canada. Publication No. 1300. Ottawa, Ontario.

Russell, D.E., Martell, A.M., and W.A.C. Nixon. 1993. *Range ecology of the Porcupine caribou herd in Canada.* Rangifer. Supplement: Special Issue no. 8. Pages 1-167.

Salmo Consulting Inc., AXYS Environmental Consulting Ltd., Forem Technologies, and Wildlife & Company Ltd. 2004. Deh Cho Cumulative Effects Study Phase 1: Management Indicators and Thresholds. Calgary, AB. Prepared for Deh Cho Land Use Planning Committee. 172 pp.

SARA (Species at Risk Act). 2013. Species at Risk Public Registry. http://www.sararegistry.gc.ca/default_e.cfm

Seip, D.R., 1992. Factors limiting woodland caribou populations and their interrelationships with wolves and moose in southeastern British Columbia. Canadian Journal of Zoology 70(8):1494-1503.

Schindler, D. 2006. Home range and core area determination, habitat use and sensory effects of all weather access on boreal woodland caribou (Rangifer tarandus caribou) in Eastern Manitoba. The University of Manitoba.

Science Team Report. 2002. Manitoba's Ecosystem Based Management Pilot Project. Ecoregion 90: Lac Seul Upland Ecoregion Summary Technical Report. Manitoba Dept. of Natural Resources. 123 pp.

Smith, R.E., Veldhuis, H., Mills, G.F., Eilers, R.G., Fraser, W.R., and G.W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, An Ecological Stratification of Manitoba's Natural Landscapes. Technical Bulletin 1998-9E. Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada. Winnipeg, Manitoba.

Sokal, R.R., and F.J. Rohlf. 1981. Biometry: the principles and practice of statistics in biological research. W.H. Freeman and Company, New York, New York.

Stewart, A., Komers, P.E., and D.J. Bender. 2010. Assessing Landscape Relationships for Habitat Generalists. Ecoscience 17:28–36.

Stuart-Smith, A.K., Bradshaw, C.J.A., Boutin, S., Hebert, D.M., and A.B. Rippin.1997. Woodland Caribou Relative to Landscape Patterns in Northeastern Alberta. The Journal of Wildlife Management 61(3): 622-633.

Taylor, P. 2003. Common nighthawk. *In* The birds of Manitoba, Manitoban Avian Research Committee. Edited by P. Taylor. Manitoba Naturalists Society, Winnipeg, MB, pp 238.

Taylor, P. and G.E. Holland. 2003. Whip-poor-will. In The birds of Manitoba, Manitoban Avian Research Committee. Edited by P. Taylor. Manitoba Naturalists Society, Winnipeg, MB, pp 239.

Terrestrial and Aquatic Environmental Engineers (TAEM). 1995. Habitat Suitability Index Models within the Manitoba Model Forest Region, Moose (Alces alces) Version 2.0 Final Report.

Vanderwaal, K.L., Windels, S.K., Olson, B.T., Vanatta, J.T., and R. Moen. 2015. Landscape influence on spatial patterns of meningeal worm and liver fluke infection in white-tailed deer. Parasitology 142: 706-718.

Wasel, S. M., W. M. Samuel, and V. Crichton. 2003. Distribution and ecology of meningeal worm, Parelaphostrongylus tenuis (Nematoda), in northcentral North America. Journal of Wildlife Diseases. 39: 338-346.

Wilson, M.D. and B.D. Watts. 2008. Landscape configurations effects on distribution and abundance of whip-poor-wills. The Wilson Journal of Ornithology 120: 778-783.

Zoladeski C.A., Wickware, G.M., Delorme, R.J., Sims, R.A., and I.G.W. Corns. 1995. Forest ecosystem classification for Manitoba: field guide. Natural Resources Canada, Canadian Forest Service, Northwest Region, North Forestry Centre, Edmonton, Alberta. Special Report 2.

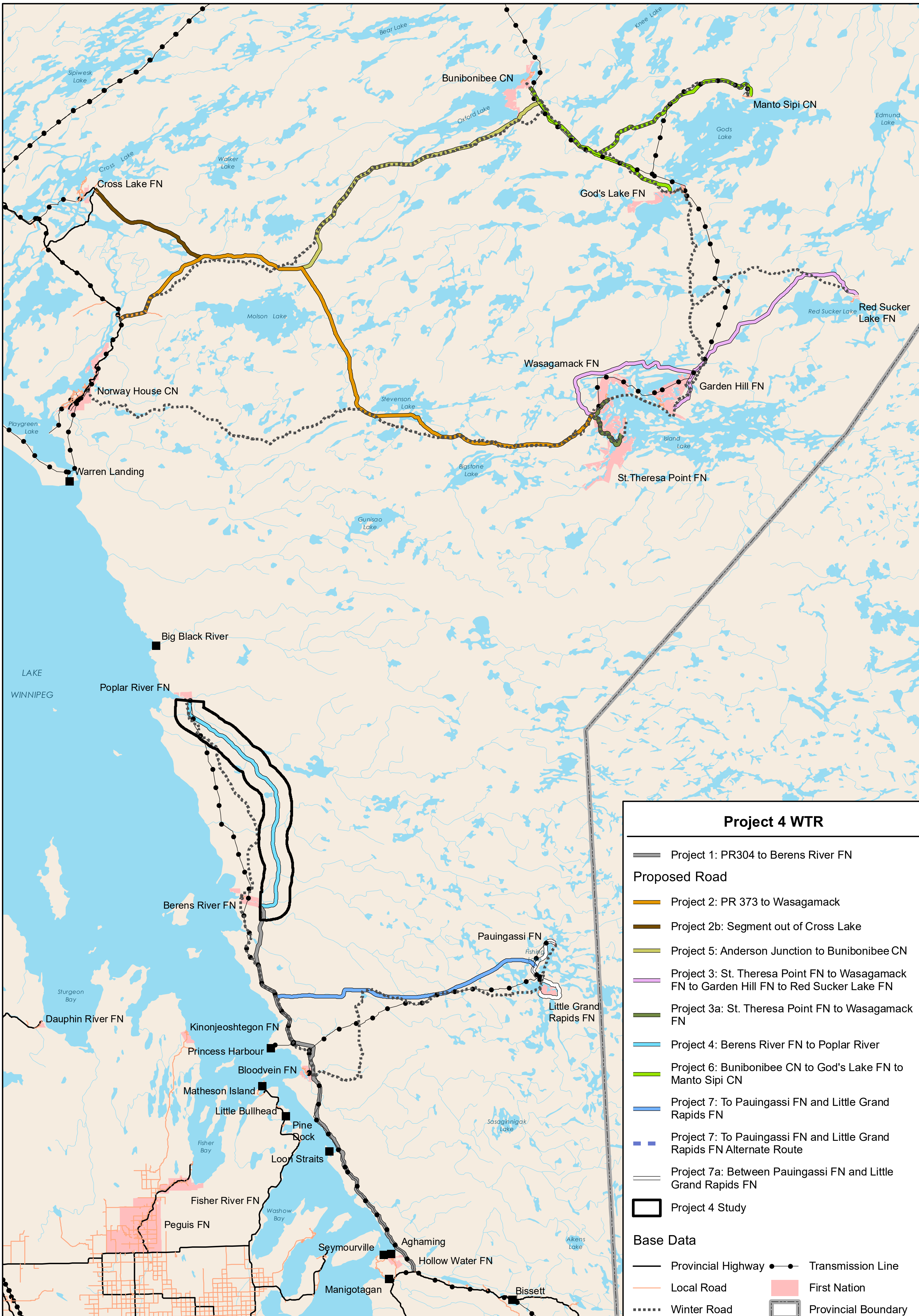
13.2 Personal Communications

Mathewson, Chris. 2015. Regional Forester, Manitoba Conservation, Forestry Branch. Lac du Bonnet, Manitoba.

Leavesley, Kelly. 2016. Regional Wildlife Manager, Eastern Region, Manitoba Conservation and Water Stewardship.

Szwaluk, Kevin. 2016. Szwaluk Environmental Consulting Ltd.

14.0 REPORT MAPS



Coordinate System: UTM Zone 14N NAD83
Data Source: MESRA
Date Created: March 08, 2016

0 10 20 Kilometres
0 10 20 Miles

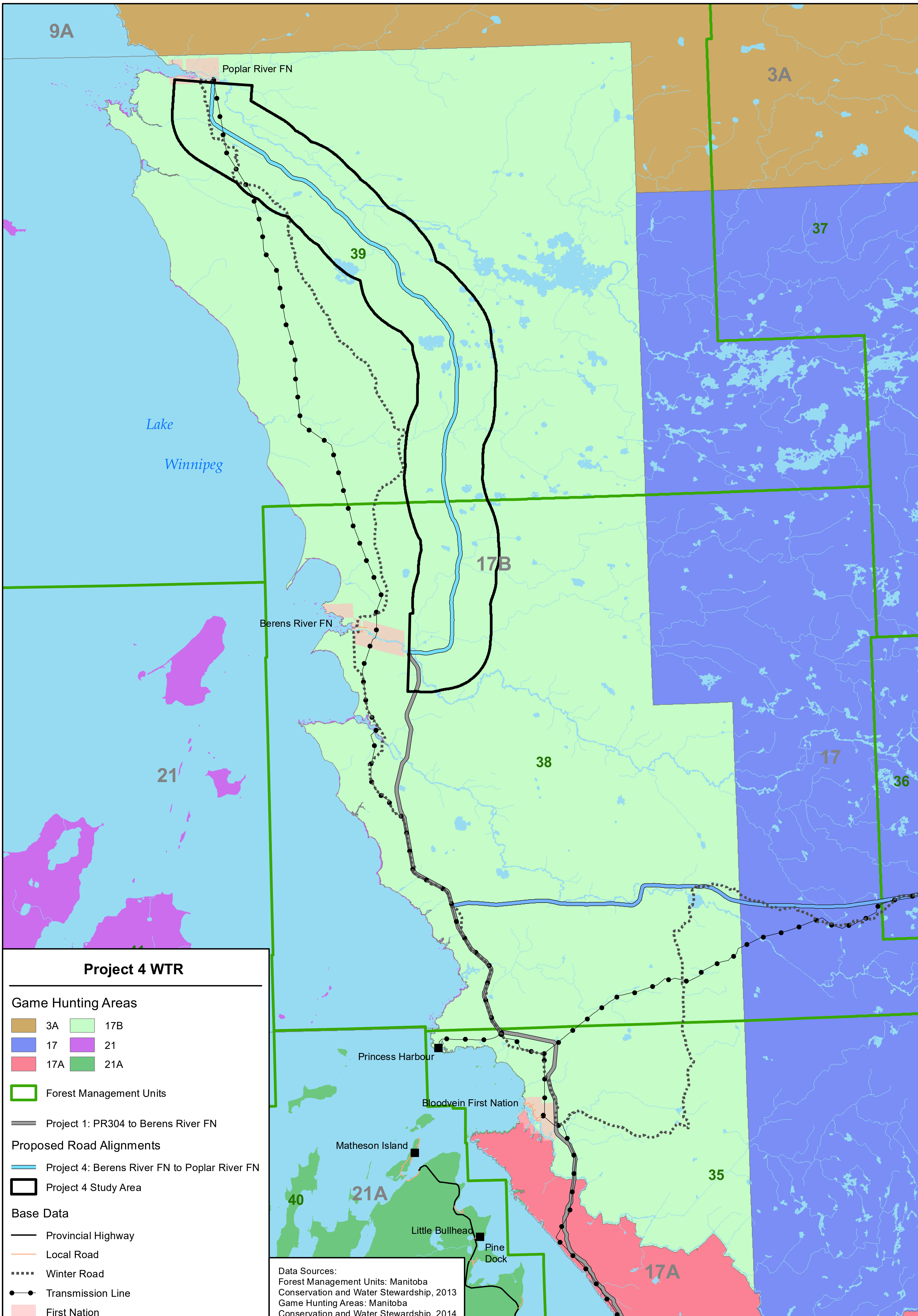
1:1,250,000

N

Project 4 Wildlife Technical Report

All Season Road (ASR) Network for the East Side of Lake Winnipeg

Map 01



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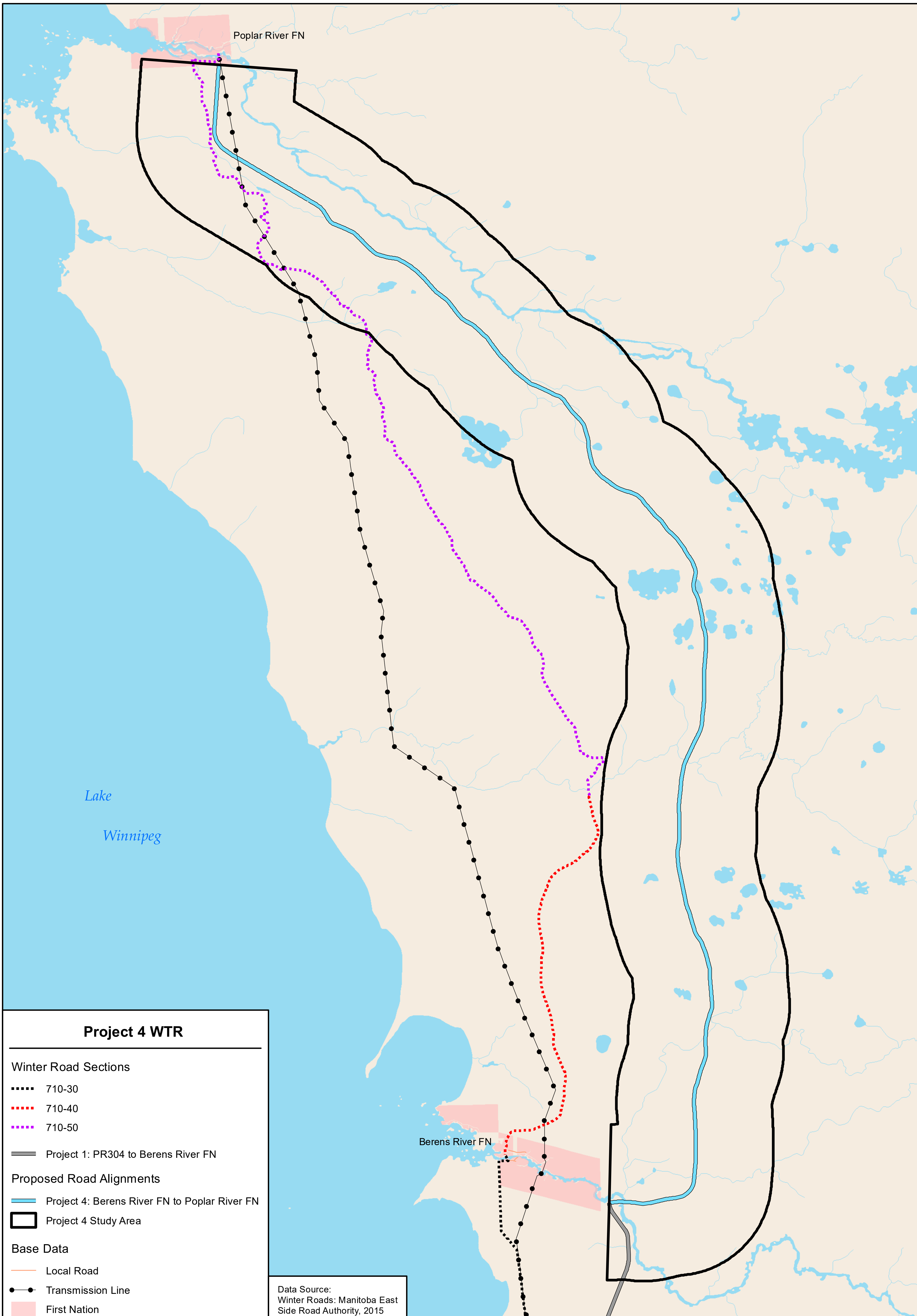
1:450,000

N

Project 4 Wildlife Technical Report

Local Project Study Area including Game Hunting Areas and Forest Management Units

Map 02



Manitoba East Side Road Authority

Joro Consultants

Coordinate System: UTM Zone 14N NAD83
Data Source: MESRA, Joro, MCWS
Date Created: March 08, 2016

0 2 4 Kilometres

0 2 4 Miles

1:225,000

N

Project 4 Wildlife Technical Report

Winter Road Network in the Project 4 Study Area

Map 03