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# 13.0 CUMULATIVE EFFECTS

## 13.1 Introduction

As indicated in the CEA Agency guidelines for this Project (CEA Agency 2015a) and in the scoping document submitted by ESRA to MCWS (MFESRA 2014), an assessment of cumulative effects is required for the proposed Berens River First Nation to Poplar River First Nation All-Season Road Project. The purpose of this cumulative effects assessment is to identify and assess residual adverse Project effects on VCs that may become significant when they interact with potential effects of regional past, present, and future physical activities in the Regional Assessment Area.

The CEA Agency defines cumulative effects as "*changes to the environment due to the project combined with the existence of other past, present and reasonably foreseeable physical activities*" (CEA Agency 2015a). Further, the Agency notes that cumulative effects may result if:

- Implementation of the project being studied may cause direct residual adverse effects on the Valued Components, taking into account the application of technically and economically feasible mitigation measures; and
- The same Valued Components may be affected by other past, present, or reasonably foreseeable physical activities (CEA Agency 2015a).

Per the CEA Agency's technical guidance (CEA Agency 2014b), the assessment of cumulative effects follows a five-step approach:

**Step 1** – Scoping of the assessment of cumulative effects to determine the VCs to be considered in the analysis and to orient and focus the cumulative effects assessment;

**Step 2** – Analysis of how physical activities of the Project, combined with past, present, and reasonably foreseeable physical activities, may affect selected VCs within the spatial and temporal boundaries of the cumulative effects assessment;

**Step 3** – Identification of technically and economically feasible mitigation measures to eliminate, reduce or control adverse cumulative effects;

**Step 4** – Determining the significance of adverse environmental effects remaining after the application of mitigation measures (i.e., residual effects) that are likely to result from the Project in combination with other physical activities; and

**Step 5** – Development of a Follow-up program to verify the accuracy of the EIA and effectiveness of mitigation measures applied to address both Project-specific environmental effects and cumulative effects.

In accordance with CEA Agency guidance1 on scoping and assessment methods for cumulative effects, this Chapter provides an assessment of the anticipated cumulative effects of the Project.

## 13.2 Scoping

As described above, the scoping step helps to orient and focus the cumulative effects assessment. Scoping for the Project-specific assessment of cumulative effects was undertaken following the assessment of potential environmental effects from the Project and the identification of predicted residual effects on VCs. Specifically, the scoping of the cumulative effects assessment included:

- Identifying Valued Components (VCs) for which adverse residual environmental effects from the Project are expected (**Section 13.2.1**) (Note: In accordance with CEA Agency guidance, VCs that would be affected positively by the Project are omitted from the cumulative effects assessment [CEA Agency 2015a]);
- Determining the spatial and temporal boundaries to capture potential cumulative environmental effects on VCs that may experience residual effects; and
- Identifying the past, present, and future physical activities that are anticipated to contribute to the residual environmental effects of the Project on VCs.

**Appendix 13-1** provides a list of the VCs for which Project residual adverse effects were assessed, summarizes the spatial and temporal level of residual Project effects and indicates which VCs may potentially experience adverse cumulative effects.

The scoping steps are described in **Sections 13.2.1** to **13.2.3**.

### 13.2.1 Valued Components

Per the CEA Agency Guidelines for this Project (CEA Agency 2015a), the cumulative effects assessment includes, but is not limited to, consideration of cumulative effects on the following VCs:

- Fish and fish habitat, including valued fish species;
- Migratory birds;
- Species at Risk; and
- Aboriginal peoples.

These were the same VCs considered during the VC selection process for the focused assessment of potential environmental effects of the Project as previously described in the Environmental Impact Assessment Scope and Approach (**Chapter 6, Section 6.4.1**). If a VC is not expected to experience residual adverse effects of the Project, that VC may be screened-out from further analysis. As well, VCs expected to experience residual adverse effects of the Project may also be screened-out from further analysis when assessed against the VC scoping criteria (CEA Agency 2014b).

[1] Guidance documents included: CEA Agency Guidelines for this Project (CEA Agency 2015a); CEA Agency's Operational Policy Statement entitled Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2015b) and the guide entitled Technical Guidance for Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2014b).

The cumulative effects assessment focuses on potential adverse cumulative effects on VCs that are expected to experience residual environmental effects caused by the Project (CEA Agency 2015a), regardless of whether those residual environmental effects are predicted to be significant (CEA Agency 2014b). Through the assessment of Project effects on VCs[2] presented in **Chapters 7** to **10**, and including potential effects of the environment on the Project (**Chapter 11**) and potential effects of accidents and malfunctions (**Chapter 12**), residual environmental effects of the Project following the application of mitigation were identified for the VCs. **Appendix 13-1** lists the VCs that are anticipated to experience residual environmental effects from the proposed Project.

To determine if there is the potential for adverse cumulative effects to VCs that would warrant further assessment, scoping criteria were applied (see **Figure 13-1)**. In reference to the criteria outlined in CEAA guidance (CEA Agency 2015b), for a VC to be carried forward for further cumulative effects analysis the VC must be:

- Affected by residual effects of the Project;
- Likely to be adversely affected by other past, present, or future physical activities within the spatial and temporal boundaries defined in **Sections 13.2.2** and **13.2.3** that follow; and
- Warranted by one or more screening criteria such as: potential for significant adverse cumulative effects to the VC; feedback from the APEP; level of uncertainty in predictions of cumulative effects; and/or need for mitigation measures or follow-up[3].

[2] Refer to **Chapter 6** (Environmental Impact Assessment Scope and Approach), **Appendix 6-1** for a complete list of VCs that were the focus of the assessment of potential environmental effects of the Project.

[3] The answer to this questions would be 'yes' if additional mitigation measures or follow-up beyond what is proposed for this Project is required to reduce the potential for significant adverse cumulative effects within the spatial and temporal boundaries of the cumulative effects assessment.

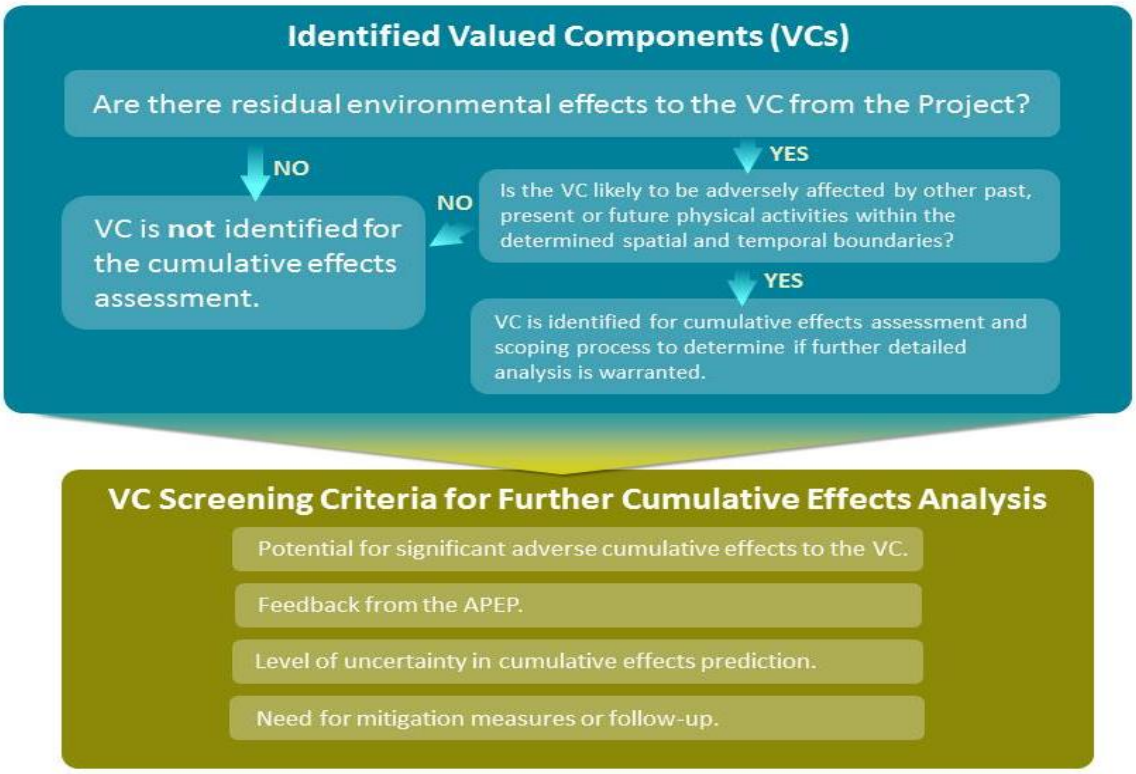



**Figure 13-1: Approach to Scoping and Screening of VCs for further Cumulative Effects Analysis**

VCs that will experience adverse residual Project effects (**Appendix 13-1**) were evaluated using the scoping and screening process illustrated in **Figure 13-1**. Results of the scoping process, including the rationale for screening out or carrying forward VCs for further cumulative effects analysis is presented in **Appendix 13-2**. The following VCs were identified as requiring further cumulative effects analysis:

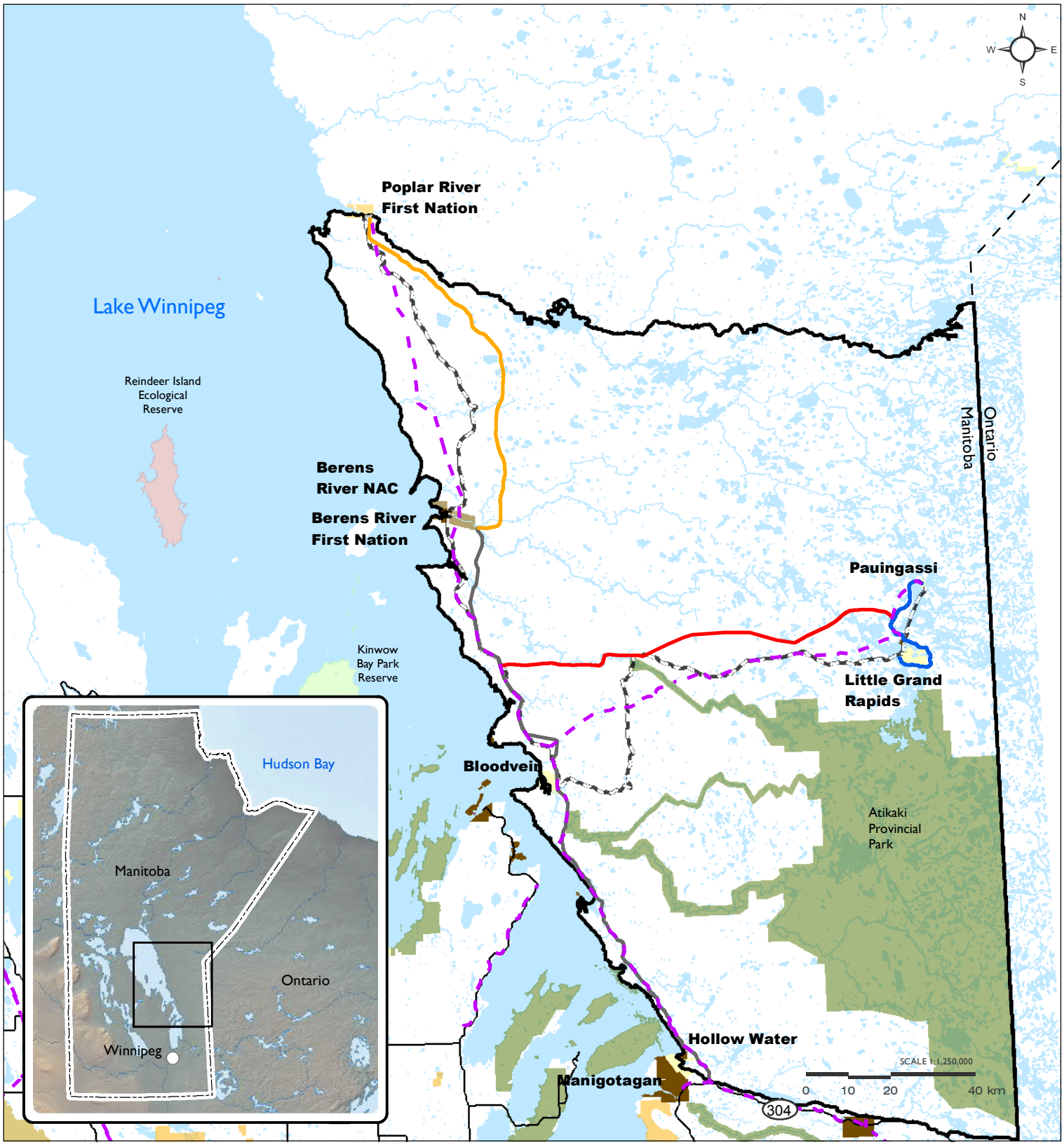
- Air quality;
- Moose; and
- Boreal woodland caribou.

For the VCs listed above, the approach and level of effort applied to assessing cumulative environmental effects is established on a case-by-case basis taking into consideration:

- The characteristics of the Project;
- The risks associated with the potential cumulative environmental effects;
- The state (health, status, or condition) of VCs that may be impacted by the cumulative environmental effects;
- The potential for mitigation and the extent to which mitigation measures may address potential environmental effects; and
- Feedback received through the Aboriginal and Public Engagement Program (CEA Agency 2015b).

### 13.2.2 Spatial and Temporal Boundaries

The planned East Side Large Area Transportation Network of all-season roads discussed in **Chapter 1** (Introduction), **Section 1.2**, that will connect the east side of Lake Winnipeg communities with the existing southern Manitoba road network partially forms the cumulative effects assessment spatial boundaries (**Figure 13-2**). The extent of the planned east side of Lake Winnipeg roads constitutes the largest regional area within which planned physical activities will occur in the foreseeable future. The spatial boundary for the cumulative effects assessment area is also based on a VC-centered spatial boundary approach whereby the area reflects the province's management unit for the Atikaki-Berens woodland caribou population (Manitoba Boreal Woodland Caribou Management Committee 2014). The cumulative effects assessment considered the potential for this woodland caribou population to experience potential adverse cumulative effects and the management unit for this species generally reflects the largest area where cumulative effects of other VCs are anticipated and potentially measurable (**Figure 13-2**). It should be noted that that potential cumulative effects to VCs may extend beyond specific boundary-defined areas such as the cumulative effects assessment area shown in **Figure 13-2**. Equally, potential cumulative effects to VCs may be limited to only a small portion of the cumulative effects area.




Project 4 - All-Season Road Connecting Berens River to Poplar River First Nation

**Figure 13-2**

**Cumulative Effects Spatial Area**

| | | |
|---|---|---|
| P4 All-Season Road Alignment | 2013/2014 Manitoba Winter Road | Northern Affairs Community |
| P1 All-Season Road (South of Berens to PTH 304) - Under Construction | Transmission Line | Provincial Park |
| Future P7 All-Season Road | Berens River First Nation Reserve | Cumulative Effects Spatial Area |
| Future P7a All-Season Road | Poplar River First Nation Reserve | |

The spatial area for cumulative effects shown in this map reflects a Valued Component-centered spatial boundary approach whereby the area shown reflects the Atikaki-Berens woodland caribou population that may experience potential cumulative effects and is generally the largest area where cumulative effects are anticipated and potentially detectable. The spatial area for cumulative effects also reflects the area encompassing the planned interconnected East Side Large Area Transportation Network of all-season roads

Map Drawing Information:
ESRI Base Layers, Province of Manitoba, CanVec, GeoGratis, Dillon Consulting Limited

Map Created By: ECH
Map Checked By: MG/PS/LD
Map Projection: NAD 1983 UTM Zone 14N

DATE: 4/9/2016

MANITOBA East Side Road AUTHORITY

The temporal boundary for the cumulative effects assessment extends over an approximate 37-year period commencing in 2000, with initial Large Area Transportation Network planning initiatives for the east side of Lake Winnipeg, and concluding in 2037. The year 2037 represents 10 years beyond the completion of the last road project. Considering that construction of the P4 Project is anticipated to be completed in 2024 (Project Description **Chapter 3, Section 3.11**), it is expected that the 37-year period, which includes 10 years post-construction of the P4 Project, is an adequate temporal boundary to assess whether significant adverse cumulative effects may potentially occur for the selected VCs. Baseline information for the VCs being considered in this cumulative effects assessment also exists within this timeframe.

Some cumulative effects may occur in association with the timing of development phases of a physical activity (e.g., timing of clearing activities). Therefore, physical activity-centred temporal boundaries and overlapping periods for the cumulative effects assessment have also been considered and are presented in **Appendix 13-3**.

### 13.2.3 Physical Activities

The cumulative effects assessment has considered past and existing physical activities, as well as future physical activities that are certain and reasonably foreseeable, in consideration of the spatial and temporal bounds of this cumulative effects assessment. Current baseline conditions represent the cumulative effects from previous and existing land use practices and natural processes that have shaped the biophysical, cultural, and socio-economic components of the area during the period of human settlement. Currently, there are no available, certain and reasonably foreseeable plans by natural resource industries, such as mining and forestry companies, to carry out projects or activities within the spatial or temporal boundaries of this cumulative effects assessment. Regarding commercial forestry, the Forest Management Licence #1 and independent wood supply areas, which formerly overlapped with the cumulative effects assessment area, have been dissolved. Operational infrastructure that once supported this industry (rail line and pulp mill at Pine Falls) have since been decommissioned, which will impede any future revival of large scale forestry activities in this area (**Chapter 10, Section 10.1.5**). Past, present and future physical activities known to occur, that have occurred or will occur within the cumulative effects spatial and temporal boundaries are listed in **Table 13.1** and are described further in **Sections 13.2.3.1** and **13.2.3.2**.

**Appendix 13-4** outlines the VCs that have been identified for further cumulative effects analysis and the past, existing and future physical activities that are anticipated to potentially affect those VCs.

## Table 13.1: Past, Present and Future Physical Activities Considered in the Cumulative Effects Assessment

| Category of Physical Activities | Specific Physical Activity | Description of Physical Activity |
|---|---|---|
| **Past or Present Physical Activities that have been Carried Out** | | |
| Infrastructure development | ESRA's P1 all-season road project from PR 304 to Berens River communities[4]. | Currently under construction (see **Figure 13-2** for location). |
| | Existing infrastructure within and immediately adjacent to First Nation communities within the cumulative effects spatial boundary. | Refer to **Figure 13-2** for locations of First Nation communities and **Chapter 10**, **Sections 10.1.4** and **10.1.5** for a description of existing land use and infrastructure. |
| | Existing winter road use and maintenance. | Refer to **Figure 13-2** for locations of winter roads and **Chapter 2**, **Section 2.1.1** for a description of available travel days. |
| | Past forestry roads. | Forestry roads that occur in the cumulative effects assessment area are no longer used for commercial forestry activities and are largely abandoned. These abandoned roads may be accessed to a limited extent by snowmobile and/or ATV depending on location and connection with other travel routes and degree of natural revegetation that has occurred. Refer **to Chapter 9, Appendix 9-1** for a map illustrating former forestry roads. |
| | Manitoba Hydro transmission lines. | Refer to **Figure 13-2** for location of transmission line. |
| Mining and quarry activities | Mineral dispositions related to mining and quarry activities. | **Appendix 13-6** |
| Hunting | Traditional/subsistence and licenced hunting activities. | Refer to **Chapter 10**, **Section 10.1.6.** |
| Trapping | Licenced trapping of furbearing animals for commercial sale. | Refer to **Chapter 10**, **Section 10.1.6.** |
| Fishing | Traditional/subsistence, sport, and commercial fishing. | Refer to **Chapter 10**, **Section 10.1.6.** |
| **Future Physical Activities that are Certain and Reasonably Foreseeable** | | |
| Infrastructure development | Planned all-season roads east of Lake Winnipeg as part of the Large Area Transportation Network initiative by ESRA. | ▪ Construction, operations and maintenance of the proposed network of all-season gravel roads connecting isolated First Nations reserves and other northern communities with Manitoba's existing southern road network.<br>▪ **Figure 13-2** illustrates the planned ESRA road network.<br>▪ **Table 13.2** provides approximate lengths of planned east side of Lake |

[4] The first 48 km of the P1 all-season road was an existing road that is being rebuilt (i.e., Hollow Water First Nation to Loon Straits).

| Category of Physical Activities | Specific Physical Activity | Description of Physical Activity |
|---|---|---|
| | | Winnipeg roads and anticipated development schedules which are preliminary and subject to change.<br>▪ Cleared limit for road rights-of-way will be 60 m.<br>▪ Roadways will be 10 m wide with two 3.7 m lanes, 1.0 m shoulders and 0.3 m shoulder rounding allowance. |
| | Poplar River First Nation community access road (433 m) linking the proposed Project with the community. | ▪ Construction is expected to begin in 2016 and conclude in 2017. |
| | Poplar River community airport. | ▪ Relocation of existing Poplar River airport to new location on provincial Crown land just northeast of the Poplar River First Nation. |
| Decommissioning of existing winter roads | Decommissioning and rehabilitation, as required, of existing winter roads as they are replaced by the planned all-season roads east of Lake Winnipeg as part of the Large Area Transportation Network initiative by ESRA. | ▪ Existing winter roads will be abandoned as the series of planned all-season roads are sequentially completed.<br>▪ Winter road points of access will be blocked (e.g., with boulders) as required to discourage public access and encourage regeneration of vegetation. |
| Hunting | Traditional/subsistence and licenced hunting activities. | Refer to **Chapter 10**, **Section 10.1.6.** |
| Trapping | Licenced trapping of furbearing animals for commercial sale. | Refer to **Chapter 10**, **Section 10.1.6.** |
| Fishing | Traditional/subsistence, sport and commercial fishing. | Refer to **Chapter 10**, **Section 10.1.6.** |

#### *13.2.3.1 Past and Present Physical Activities*

**Table 13.1** lists the past and present physical activities that are anticipated to potentially contribute to cumulative effects on VCs carried forward for assessment. The remote nature of the cumulative effects assessment area defined in **Section 13.2.2** has resulted in the limitation of past and present physical activities to:

- Current construction of ESRA's P1 all-season road project between PR 304 and Berens River First Nation (**Figure 13-2**);
- Existing infrastructure on and immediately adjacent to First Nation communities;
- Existing winter road use and maintenance (**Figure 13-2**);
- Past forestry roads (**Chapter 9, Appendix 9-1**);
- Mineral dispositions (mining claims, quarries; **Appendix 13-6**);
- Manitoba Hydro transmission lines (**Figure 13-2**); and
- Traditional land and resource use including hunting, fishing, and trapping.

Additional information on physical activities in the regional area, including land and resource use is provided in **Chapter 10** (Socio-economic and Cultural Environment).

#### *13.2.3.2 Future Physical Activities*

**Table 13.1** above lists the future physical activities that are certain and reasonably foreseeable, and that are anticipated to potentially contribute to cumulative effects on VCs carried forward for assessment. Future physical activities with potential to contribute to cumulative environmental effects include:

- The planned all-season roads east of Lake Winnipeg as part of the Large Area Transportation Network initiative by ESRA (**Chapter 1**, **Figure 1-4**);
- The future Poplar River First Nation community access road (433 m) linking the proposed Project with the community (**Chapter 1**, **Figure 1-3**);
- The future relocation of the Poplar River community airport;
- The planned future decommissioning of the existing seasonal winter roads between east side of Lake Winnipeg First Nation communities (**Figure 13-2**) by the planned all-season roads; and
- Continued traditional resource use activities, including fishing, hunting, and trapping.

**Table 13.2** lists the future planned ESRA all-season roads within the cumulative effects assessment area, including anticipated start and completion dates.

### Table 13.2: Other ESRA All-Season Road Projects and Schedule

| All-Season Road Projects | Length (km) | Start | Completion |
|---|---|---|---|
| PR 304 to Berens River First Nation (P1) | 156 | 2012 (under construction) | ~2020 |
| Pauingassi to Little Grand Rapids First Nation (P7A) | 36.4 | 2016 | ~2020 |
| P1 to Little Grand Rapids First Nation and Pauingassi First Nation (P7) | 131 | 2020 | ~2027 |

Start dates are dependent upon a number of factors such as community feedback and environmental approvals. Construction periods for each road segment will be approximately 6 to 10 years depending upon a number of factors including length of road, number of watercourse crossings, and construction challenges (e.g., terrain, weather). Maintenance of winter roads will be ongoing throughout the construction of the ESRA all-season road network.

Although discussions with east side of Lake Winnipeg communities have occurred regarding potential future Manitoba Hydro transmission line development, no certain, and reasonably foreseeable Manitoba Hydro physical activities are currently planned within the spatial boundaries of this cumulative effects assessment.

## 13.3 Analysis of Potential Cumulative Effects

**Sections 13.3.1** to **13.3.4** provide the cumulative effects assessment for each VC carried forward for further analysis, and for the effects of those past, present, and future physical activities that have been identified in **Table 13.1** as having the potential to combine with the Project effects on those VCs. Each section describes assumptions and uncertainties inherent in the assessment of cumulative effects.

*A cumulative effect would be considered significant after application of mitigation measures if the overall magnitude of the cumulative adverse effect is considered to be high within, or potentially beyond, the cumulative effects assessment temporal and spatial boundaries.*

The rationale explaining why some VCs are carried forward for further cumulative effects analysis, while others are not, is explained in the scoping methodology outlined in **Section 13.2** and as provided in **Appendix 13.2**. For example, the 'Fish Habitat' VC is not carried forward for further, detailed cumulative effects analysis because under the *Fisheries Act*, Fisheries and Oceans Canada requires fish habitat offsetting (i.e., compensation) for this Project and other present and future physical activities that result in "serious harm" (i.e., permanent alteration to, or destruction of) fish habitat. Therefore, potential for cumulative effects to fish habitat will be prevented. Also, prior to fish habitat offsetting measures, the potential for significant adverse effect to fish habitat (and associated effects to fish and harvest fish) is considered low due to the minimal amount of fish habitat that will be permanently altered or destroyed (maximum of 206.5 $m^2$ of instream habitat and 180 m of riparian zone habitat).

A cumulative adverse effect would be considered significant after application of mitigation measures (discussed in **Section 13.4**) if the overall magnitude of the cumulative effect is considered to be high within, or potentially beyond, the temporal and spatial boundaries of the assessment (**Section 13.2.2**).

For the VCs carried forward for cumulative effects assessment, **Table 13.3** describes the specific criteria by which the magnitude of adverse cumulative effects are categorized within the spatial and temporal boundaries of the cumulative impact assessment for each VC.

### Table 13.3: Criteria for Magnitude of Adverse Cumulative Effects for VCs

| VC | Magnitude of Adverse Cumulative Effect | | |
|---|---|---|---|
| | Low | Moderate | High |
| Air Quality (GHGs) | Cumulative contributions of greenhouse gases to the global atmosphere are minor and do not result in a detectable increase in greenhouse gas accumulations within the global atmosphere. | Cumulative contributions of greenhouse gases to the global atmosphere result in a measurable increase in greenhouse gas accumulations within the global atmosphere, with the potential to have a minor to moderate overall influence to climate change. | Cumulative contributions of greenhouse gases to the global atmosphere result in a measurable increase in greenhouse gas accumulations within the global atmosphere, with the potential to have a substantial overall influence to climate change. |
| Moose | Cumulative effects are not likely to have a definable, detectable, or measurable potential effect above baseline (i.e., potential effect is within a normal range of variation). | Cumulative effects are anticipated to have a measurable potential effect that can be detected with a well-designed monitoring program; but is only marginally beyond a threshold of acceptable change. | Cumulative effects are anticipated to be easily observed, measured, and described (i.e., readily detectable without a monitoring program) and are well beyond a threshold of acceptable change. |
| Boreal Woodland Caribou | Cumulative effects are not likely to have a definable, detectable, or measurable potential effect above baseline (i.e., potential effect is within a normal range of variation) and habitat change does not exceed the sustainable threshold of 65% undisturbed (35% disturbed) habitat identified by Environment Canada (2012). | Cumulative effects are anticipated to have a measurable potential effect that can be detected with a well-designed monitoring program; but habitat change is only marginally beyond the sustainable threshold of 65% undisturbed (35% disturbed) habitat identified by Environment Canada (2012). | Cumulative effects are anticipated to be easily observed, measured, and described (i.e., readily detectable without a monitoring program), and habitat change is well beyond the sustainable threshold of 65% undisturbed (35% disturbed) habitat identified by Environment Canada (2012). |

### 13.3.1 Air Quality: Greenhouse Gases

A cumulative effects assessment (**Appendix 13-5**) for greenhouse gas was completed to estimate the total direct and indirect greenhouse gas emissions attributable to the Project and other physical activities (Project Scenario) compared with the greenhouse gas emissions (direct and indirect) of the current Baseline Scenario (i.e., without the Project and other physical activities). In addition to the proposed P4 Project, physical activities considered in the cumulative greenhouse gas assessment included the future ESRA all-season roads (P7 and P7a) and the completed P1 all-season road currently under construction (**Figure 13-2**). These road projects represent the physical activities that would contribute to greenhouse gas emissions.

The Baseline Scenario cumulative effects assessment for greenhouse gas resulted in total annual emissions estimates of 17,580 and 21,432 tonnes CO2e during the hypothetical periods of time when the construction phases and operations and maintenance phases, respectively, of the four all-season road projects (P4, P1, P7 and P7a) would have been occurring at the same time (i.e., worst-case). The Projects Scenario was estimated to emit a total of approximately 29,123 and 15,301 tonnes CO2e

annually for the same periods. While a temporary increase in greenhouse gas emissions is predicted during the construction phase of the Projects, the net cumulative change in greenhouse gas emissions due to the combined Projects was estimated to be a reduction of approximately 6,128 tonnes CO2e annually. Details of the greenhouse gas cumulative effects assessment, including assumptions, are provided in **Appendix 13-5**.

In summary, under the worst case scenario of all planned all-season roads in the cumulative effects assessment area being under construction at the same time, the Project is estimated to contribute to a temporary increase of the provincial construction-based greenhouse gas emissions by approximately 12%. Once the all-season roads are operational, an estimated reduction of approximately 0.1% of the Province's total GHG emissions attributed to road transportation will be realized[5]. Given that there would be a temporary overall increase in greenhouse gas emissions during the construction phase of the all-season roads, but an overall decrease in greenhouse gas emissions during the operational years of the all-season roads, the change in greenhouse gas emissions would not result in a detectable increase in greenhouse gas accumulations within the global atmosphere and therefore would not influence climate change.

### 13.3.2 Moose

A cumulative effects assessment for moose has been completed and is presented in **Appendix 9-1** of the Terrestrial Environment **Chapter 9**. In summary, moose densities in the cumulative effects assessment area are inherently low and the area will remain relatively remote, even with the presence of the future all-season roads. Existing patterns of resource use are likely to shift with the establishment of future all-season roads however, these changes will occur over a long period of time while construction is underway. Based on results of Traditional Knowledge studies, and in consideration of the remoteness of the cumulative effects assessment area, resource use in the region is not expected to increase dramatically. Rather, there could be a shift in resource use closer to the future all-season roads and away from major waterways that are traditionally used to access moose hunting areas. There are no other major developments planned in the cumulative effects assessment area, such as forestry or mining operations, that will result in additional roads for resource development purposes that would provide access, cause disturbance or change habitats. Studies referenced and discussed in the Wildlife Technical Report (Joro Consultants 2015a in **Chapter 9**, **Appendix 9-1**) indicate that moose densities are not necessarily linked to disturbance, but more so to habitat productivity and climate conditions more suitable for the species. The Wildlife Technical Report (Joro Consultants 2015a) indicates that although more northern areas in Manitoba have fewer disturbances (less development) than southern areas, moose populations are generally denser in southern areas of Manitoba which are generally more developed/disturbed. Local effects on moose may result from increased hunting pressure near the future roads and along rivers and creeks that are intersected by the all-season roads, but activities are not expected to have an effect on regional moose populations.

[5] The 1% reduction is based on Province's most recent total GHG emissions estimate of 5.13 Mt CO2e due to road transportation in 2008.

Due to the anticipated low traffic volumes on the future all-season roads relative to the provincial highway system, moose-vehicle collisions are expected to have a negligible influence on the cumulative effects to the moose population within the cumulative effects assessment area. The Wildlife Technical Report (Joro Consultants 2015a in **Chapter 9, Appendix 9-1**) indicates that only one known moose-vehicle collision has occurred along the open section of the P1 all-season road since monitoring began in 2011 (i.e., Rice River Road segment which is an existing forestry road between the Manigotagan and Bloodvein rivers) suggesting the risk of a collision is low.

### 13.3.3 Boreal Woodland Caribou

A cumulative effects assessment for the boreal woodland caribou (Atikaki-Berens management unit) has been completed based on available data for the cumulative effects assessment area (Joro Consultants 2015a in **Chapter 9, Appendix 9-1**). The intent of the caribou cumulative effects assessment was to determine total habitat disturbance within the management unit 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 (primarily fire less than 40 years old) and anthropogenic disturbance including linear features such as winter roads, transmission lines, as well as other footprint disturbance such as forestry and quarry development.

The road layer used for this cumulative effects assessment 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 graveled when required]) community roads, highways, and park roads. The winter road within the P1 project area was removed from the cumulative effects assessment and replaced with the P1 all-season road which is currently under construction. The winter road connecting Berens River and Poplar River was removed in the 2020 cumulative effects assessment considering the winter road will be decommissioned and replaced by the P4 all-season road within the timeline for this cumulative effects assessment.

Natural disturbance area was calculated from fire data derived from the Land Cover Classification of Canada - East Side (LCCES) fire data to include the updated 1928-2013 fire layer with the time period of 1975-2013 for the 40 year cumulative effects assessment timeframe.

Anthropogenic disturbance was assessed using all linear developments including transmission lines and winter roads. 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 management unit. Table 18 and maps 1-3 in **Appendix 9-1** of **Chapter 9** illustrate the disturbance factors and extent of disturbance of the Atikaki-Berens management unit based on available data.

**Table 13.4** provides the total percentage of cumulative habitat disturbance for the Atikaki-Berens management unit in 1960, 1980, 2015, 2020, and 2025. In all cases, except for 1960, the disturbance threshold within the Atikaki-Berens management unit is below the 35% disturbance threshold identified by Environment Canada (2012) and in all cases, fire is the largest contributor of disturbance.

### Table 13.4: Total Percentage of Cumulative Habitat Disturbance over Time for the Atikaki-Berens Boreal Woodland Caribou Management Unit

| Year | Total Percentage of Habitat Disturbance | Above or Below the Environment Canada (2012) Caribou Habitat Disturbance Threshold of 35%? | All-Season Roads Included in the Habitat Disturbance Calculation |
|---|---|---|---|
| 1960 | 48.1% | Above | None (note that forest fire was a substantial influence on habitat disturbance). |
| 1980 | 33.4% | Below | None. |
| 2015 | 34.7% | Below | P1 and P4 all-season roads. |
| 2020 | 34.3% | Below | P1, P4 and P7A all-season roads |
| 2025 | 34.6% | Below | P1, P4, P7A and P7 all-season roads. |

Based on these analyses, the overall loss of habitat due to the P4 all-season road 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 winter road and moving across both the winter road and transmission line corridor. The winter road currently runs though high quality caribou habitat and given caribou have coexisted with the operational activities associated with the existing winter road, caribou have likely become accustomed to the winter road right-of-way and traffic.

## 13.4 Mitigation

Mitigation of adverse cumulative effects of greenhouse gas accumulation is expected to occur over time with the continued development of more fuel-efficient vehicles and the gradual shift from hydrocarbon-based fuels to renewable fuel system technologies. Current projections include a decline in energy consumption by passenger vehicles of 0.6 per cent per year based on factors such as new passenger vehicle emission standards from 2017-2025, which are expected to improve vehicle fuel efficiency (National Energy Board 2013). The greenhouse gas cumulative effects assessment (**Appendix 13-5**) recommends adherence to applicable best management practices to minimize greenhouse gas emissions, corresponding with ESRA's commitment to the application of construction and operations and maintenance best management practices (**Chapter 5**). Additionally, the decommissioning of winter roads as all-season roads are completed will also contribute to the reduction of greenhouse gas emissions within the cumulative effects assessment area (**Appendix 13-5**).

For physical activities that involve the permanent alteration or destruction of fish habitat potentially resulting in serious harm to fish that are part of or support a commercial, recreational, or Aboriginal fishery, habitat offsetting (compensation) may be required in an authorization under the federal *Fisheries Act*. Therefore, adverse cumulative effects to the habitat of fish and harvested fish species is expected to be mitigated through habitat offsetting plans, as required. There are no plans to incorporate boat ramps, docks or other structures or modifications to the all-season roads to facilitate access to fish-bearing watercourses. Therefore, convenient fishing opportunities at fish-bearing water crossings along the all-season road routes will be limited by the design of the all-season roads. The decommissioning of the winter roads system as the new all-season roads are completed will reduce potential damage to the habitat of fish and harvested fish species where winter roads cross watercourses. Manitoba Conservation and Water Stewardship is responsible for the management and enforcement of fishing and control of invasive aquatic species in the province.

Adverse cumulative effects on caribou and moose are expected to be primarily mitigated through government conservation initiatives such as the designation of wildlife refuge areas under *The Wildlife Act* on either side of the all-season roads proposed and currently under construction east of Lake Winnipeg within the spatial area of this cumulative effects assessment. These cooperative management initiatives are evolving and are currently under discussion. On-going monitoring and enforcement of hunting limits by MCWS will also contribute to the overall management strategy for moose in the cumulative effects assessment area. The potential long-term habitat protection resulting from the proposed establishment of a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site (WHS) called Pimachiowin Aki will also provide guidance in the development of conservation strategies and limitations on development. 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, caribou, and other wildlife populations within the cumulative effects assessment area. Mitigation inherent in the design of the ESRA all-season roads expected to minimize potential vehicle collisions with moose and caribou includes incorporating appropriate sight lines into the all-season road right-of-way designs, posting speed limits, and installing wildlife crossing signage as recommended by MCWS.

## 13.5 Significance Conclusions

Based on the cumulative effects assessment criteria explained in **Section 13.3**, the analyses and descriptions of expected cumulative effects (**Sections 13.3.1** to **13.3.4**) and the mitigation measures outlined in **Section 13.4** applied for each of the four VCs assessed, significant adverse cumulative effects to moose, caribou and air quality (i.e., greenhouse gas emissions) are not expected to be significant. This conclusion and rationale is summarized in **Table 13.5** for each VC and is based on the criteria that adverse cumulative effects are not considered significant if the magnitude of those effects are assessed as being low or moderate in magnitude.

### Table 13.5: Cumulative Environmental Effects Significance Conclusions for Air Quality, Moose and Caribou

| VC | Cumulative Effects Analysis | Magnitude of Adverse Cumulative Effect* | Cumulative Effect Significance Conclusion |
|---|---|---|---|
| Air Quality (GHGs) | Although a temporary overall cumulative increase in greenhouse gas emissions would occur during the construction phase of the planned all-season roads, greenhouse gas emissions produced by vehicles using the all-season roads during the operations and maintenance phase are expected to offset emissions from the continued use of other modes of travel (e.g., air travel) if the all-season roads were not constructed. The result is expected to be an overall decrease in greenhouse gas emissions within the cumulative effects assessment area during the all-season road operational years resulting in no significant influence to global atmospheric greenhouse gases and no significant influence on climate change. | Low | Not Significant |
| Moose | Overall moose habitat loss and fragmentation due to past, present and future physical activities would be negligible in relation to the abundance of undisturbed moose habitat within the cumulative effects assessment area. From the perspective of moose habitat loss, the cumulative effect of the Project would be of low magnitude and low extent and therefore not be considered to be significant. In terms of adverse cumulative effects to moose populations within the cumulative effects assessment area, with the application of government conservation initiatives and on-going monitoring and enforcement of hunting limits by Manitoba Conservation and Water Stewardship, a decline in the moose population is not anticipated. | Low | Not Significant |
| Boreal Woodland Caribou | Overall caribou habitat loss and fragmentation due to past, present and future physical activities would be negligible in relation to the abundance of undisturbed habitat within the cumulative effects assessment area. Therefore, the cumulative effect of the Project in terms of the potential caribou habitat loss would not be considered to be significant based on the low magnitude and low extent of the cumulative habitat losses. With the application of government conservation initiatives and on-going monitoring and enforcement of Species at Risk protection by Manitoba Conservation and Water Stewardship, significant decline in the caribou population within the cumulative effects assessment area, specifically the Atikaki-Berens caribou management unit, is not anticipated. | Low | Not Significant |

*See definitions of Magnitude of Adverse Cumulative Effect in Table 3.3

## 13.6 Follow-up

Considering no significant adverse cumulative environmental effects are anticipated from past, present and reasonably foreseeable future physical activities, it is not expected that additional follow-up studies will be required other than follow-up studies proposed in **Chapter 14** to verify the accuracy of the environmental assessment of this Project and to determine the effectiveness of mitigation measures incorporated into the design, construction and operations and maintenance phases of the Project. Each

proposed successive east side of Lake Winnipeg all-season road project will have commitments to mitigation measures and follow-up studies which will be revised and adapted, as required. Pre-construction and follow-up studies associated with each proposed all-season road project, such as moose and caribou monitoring, provide for the monitoring of potential cumulative effects of the series of east side of Lake Winnipeg roads. If unexpected adverse cumulative effects were identified in the future, then additional measures can be discussed with Manitoba Conservation and Water Stewardship.

# CHAPTER 13 APPENDICES

# Appendix 13-1

## Scoping of VCs Predicted to Experience Residual Effects of the Project

## Appendix 13-1: Scoping of VCs Predicted to Experience Residual Environmental Effects of the Project

| Valued Component | Location of Project Effects Assessment Information in EIS | Summary of Residual Project Effects | Spatial Extent of Residual Effect[1] | Temporal Extent (Duration) of Residual Effect[1] | Potential for Significant Adverse Cumulative Effects? |
|---|---|---|---|---|---|
| Surface Water | **Chapter 7, Sections 7.2** and **7.3.1** | ▪ Minor and localized alteration of surface drainage patterns adjacent to the P4 all-season road.<br>▪ Minor alterations of ice dynamics at waterbody crossings. | Low (Level I) | High (Level III) | Low |
| Air Quality | **Chapter 7, Sections 7.2** and **7.3.2** | ▪ Minor and temporary increase in fugitive dust and vehicle/machinery emission levels (greenhouse gases and VOCs) due to Project construction and operations and maintenance activities (e.g., clearing and woody debris burning, blasting, roadbed construction and maintenance works).<br>▪ Minor and localized fugitive dust and emissions (greenhouse gases and VOCs) from vehicles using the road during the operations and maintenance phase.<br>▪ Minor loss of carbon sink (i.e., removal of vegetation) for permanent Project components (i.e., the P4 all-season road and quarries required for on-going maintenance) and on-going vegetation maintenance along the all-season road right-of-way. | Low to Moderate (Level II to III) | High (Level III) | Low |
| Noise and Vibration | **Chapter 7, Sections 7.2** and **7.3.3; Chapter 9, Section 9.2.5** | ▪ Minor and temporary sensory disturbance to wildlife due to noise and/or vibrations.<br>▪ Minor and temporary sensory disturbance to local communities/people due to noise and/or vibrations. | Moderate (Level II) | Low (Level I) | Low |
| Fish Habitat, Fish and Harvested Fish, and Aquatic Species at Risk | **Chapter 8, Sections 8.2** and **8.3** | ▪ Permanent destruction of a maximum of 206.5 $m^2$ of instream habitat and 180 m of riparian zone habitat. | Low (Level I) | High (Level III) | Low |
| Vegetation Communities | **Chapter 9, Section 9.2.4.1** | ▪ Loss or impairment of vegetation communities in the Project Footprint due to clearing of vegetation.<br>▪ Introduction and spread of non-native and invasive species in | Low to Moderate (Level II to III) | High (Level III) | Low |

| Valued Component | Location of Project Effects Assessment Information in EIS | Summary of Residual Project Effects | Spatial Extent of Residual Effect[1] | Temporal Extent (Duration) of Residual Effect[1] | Potential for Significant Adverse Cumulative Effects? |
|---|---|---|---|---|---|
| | | the Project Footprint or Local Assessment Area. | | | |
| Plant Species of Cultural Importance | **Chapter 9, Section 9.2.4.2** | ▪ Loss or impairment of plants species of cultural importance in the Project Footprint due to clearing of vegetation.<br>▪ Introduction and spread of non-native and invasive species in the Project Footprint or Local Assessment Area. | Low to Moderate (Level I to II) | High (Level III) | Low |
| Ungulate: Moose | **Chapter 9, Section 9.2.5.1** | ▪ Loss, alteration and fragmentation of moose habitat.<br>▪ Temporary sensory disturbance. | Low (Level I) | Low to High (Level I to III) | Low |
| Ungulate: Boreal Woodland Caribou | **Chapter 9, Section 9.2.5.2** | ▪ Loss, alteration and fragmentation of habitat.<br>▪ Temporary sensory disturbance. | Low (Level I) | Low to High (Level I to III) | Low |
| Furbearer: Beaver | **Chapter 9, Section 9.2.5.3** | ▪ Loss, alteration and fragmentation of habitat.<br>▪ Temporary sensory disturbance. | Low (Level I) | High (Level III) | Low |
| Furbearer: Marten | **Chapter 9, Section 9.2.5.4** | ▪ Loss, alteration and fragmentation of habitat.<br>▪ Temporary sensory disturbance. | Low (Level I) | High (Level III) | Low |
| Migratory Birds: Forest Birds | **Chapter 9, Section 9.2.5.5** | ▪ Loss, alteration and fragmentation of habitat.<br>▪ Temporary sensory disturbance. | Low (Level I) | High (Level III) | Low |
| Migratory Birds: Waterbirds | **Chapter 9, Section 9.2.5.6** | ▪ Loss, alteration and fragmentation of habitat.<br>▪ Temporary sensory disturbance. | Low (Level I) | High (Level III) | Low |
| Environmentally Sensitive Wildlife Sites | **Chapter 9, Section 9.2.5.7** | ▪ Loss, alteration or physical disturbance of overwintering dens, heron rookeries, hibernacula, large stick nests or mineral licks.<br>▪ Temporary sensory disturbance. | Low (Level I) | Low to High (Level I to III) | Low |
| Herptiles (Amphibians and Reptiles) | **Chapter 9, Section 9.2.5.8** | ▪ Increased mortality due to vehicle collisions.<br>▪ Loss or alteration of breeding or feeding habitat due to construction or operations and maintenance activities located near waterbody or bog and fen areas having suitable habitat | Low (Level I) | Low to High (Level I to III) | Low |

| Valued Component | Location of Project Effects Assessment Information in EIS | Summary of Residual Project Effects | Spatial Extent of Residual Effect[1] | Temporal Extent (Duration) of Residual Effect[1] | Potential for Significant Adverse Cumulative Effects? |
|---|---|---|---|---|---|
| | | for the species. | | | |
| Tourism* | **Chapter 10, Sections 10.2.4.1** and **10.3** | ▪ Potential for Increase in tourism business opportunities in the Local assessment area.<br>▪ Temporary reduced interest in tourist activities due to disturbance of tourism-related activities in the Local or Regional Assessment Areas. | Low (Level I) for temporary disturbance effect; Moderate (Level II) for increased tourism opportunities | Low (Level I) for temporary disturbance effect; High (Level III) for increased tourism opportunities | Low |
| Hunting, Trapping, Fishing and Gathering | **Chapter 10, Sections 10.2.4.2** and **10.3** | ▪ During project construction, temporary impairment of traditional resource use (hunting, trapping, fishing and gathering) and licensed resource use (hunting, fishing) including limited access or detoured access to land trails and waterways used to access those resources use areas.<br>▪ Increased access to new areas for hunting, trapping, fishing and gathering areas for edible, medicinal and cultural plants. | Low (Level I) for temporary disturbance effect; Moderate (Level II) for increased access effect | Low (Level I) for temporary impairment effect; High (Level III) for access improvement effect | Low |
| Travel Routes | **Chapter 10, Sections 10.2.4.3** and **10.3** | ▪ Temporary limited access or detoured access to travel routes including land trails and waterway routes that intersect with the Project right-of-way (during project construction and maintenance activities).<br>▪ The Project represents a substantial additional travel route (P4 all-season road) that is connected to the southern Manitoba road network.<br>▪ The Project provides access to new potential travel routes that may be established off the P4 all-season road. | Low (Level I) | Moderate (Level II) | Low |
| Cultural Heritage and | **Chapter 10, Sections 10.2.4.4** | ▪ Refer to the above VCs regarding hunting, trapping, fishing, gathering and travel routes as aspects of cultural heritage | N/A (no adverse | N/A (no adverse | N/A |

| Valued Component | Location of Project Effects Assessment Information in EIS | Summary of Residual Project Effects | Spatial Extent of Residual Effect[1] | Temporal Extent (Duration) of Residual Effect[1] | Potential for Significant Adverse Cumulative Effects? |
|---|---|---|---|---|---|
| Archaeological Resources | and **10.3** | resources.<br>▪ No residual adverse effects on cultural, heritage, and archaeological resources are anticipated. | residual effects anticipated) | residual effects anticipated) | |
| Human Health and Safety | **Chapter 10, Sections 10.2.4.5** and **10.3** | ▪ Minor risk to health of road users from accidents or collisions.<br>▪ The Project provides a substantial improvement and benefit to all-season travel for community members. | Low (Level I) | Low (Level I) | Low |
| | | ▪ Minor risk to health of community members and road users from changes to drinking water quality, air quality and noise exposure levels | High (Level III) | Low to High (Level I to III) | Low |
| | | ▪ Minor risk to the health of community members from changes to the availability or quality of country foods (short-term during construction and long-term operation). | Low to High (Level I to III) | Low to High (Level I to III) | Low |

[1] **See column #2 for location of temporal ('duration') and spatial ('extent') assessment information for each VC and see Chapter 6, Table 6.3 for those assessment criteria definitions. Chapter 15, Appendix 15-1 provides a summary of residual effects for each VC.**

**Note**: *Potential effects to tourism are considered positive. Therefore, the 'tourism' VC is not carried forward in the cumulative effects analysis.

# Appendix 13-2

## VC Screening for Cumulative Effects Analysis

## Appendix 13-2: VC Screening for Cumulative Effects Analysis

| Valued Component | Cumulative Effects Analysis Screening Summary[i] | VC Carried Forward for Further Cumulative Effects Analysis?[ii] |
|---|---|---|
| | **Example Screening Criteria:**<br>• **Potential for significant adverse cumulative effects to the VC**<br>• **Feedback from the APEP**<br>• **Level of uncertainty in predictions of cumulative effects**<br>• **Need for additional mitigation measures or follow-up** | |
| Surface Water | The application of standard mitigation measures and best management practices will minimize potential adverse effects on surface water of this Project combined with past, present and future projects. No significant adverse effects are predicted from the Project construction or operation. Feedback from the APEP centred on the importance of effective mitigation measures during construction. Potential cumulative effects on surface water are generally understood and predictable. No additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) is required. | **No** |
| Air Quality | The application of standard mitigation measures and best management practices will minimize potential adverse effects of the proposed Project on air quality. Other physical activities may result in adverse environmental effects on air quality. A short-term increase of greenhouse gases, including contributions from this Project combined with past, present and future projects within the spatial and temporal boundaries of the cumulative effects assessment study area, is expected to result from Project construction. The increase is not expected to result in significant adverse cumulative effects. A reduction in greenhouse gases is predicted over the long-term. The federal government is committed to developing a framework for combating climate change therefore thorough federal review of physical activities that contribute to greenhouse gas emissions is expected to be a priority. | **Yes – see Section 13.3.1 for further cumulative effects analysis** |
| Noise and Vibration | The application of standard mitigation measures and best management practices will minimize potential adverse effects of the proposed Project on noise and vibration. APEP feedback was associated with potential short-term noise effects of blasting on wildlife. Residual adverse environmental effects of noise and vibration from this Project and other past, present or future physical activities are expected to be localized, generally understood and predictable, and not expected to result in significant adverse cumulative environmental effects. No additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) is required to reduce the potential for significant adverse cumulative environmental effects from noise and vibration. | **No** |
| Fish Habitat | The CEA Agency Guidelines for this Project (CEA Agency 2015) request that fish habitat be considered, which is reflected in this VC scoping process. The application of standard mitigation measures and best management practices will minimize potential adverse effects of the proposed Project on fish habitat. Other physical activities may result in adverse environmental effects on fish habitat. Residual adverse effects on fish habitat from this Project and other past, present or future physical activities are expected to be localized, generally understood and predictable, and not expected to result in significant adverse cumulative environmental effects on the watershed. Should Fisheries and Oceans Canada determine that fish habitat offsetting is required for this Project and other present and future physical activities, fish habitat constructed to offset habitat losses will require monitoring to determine habitat performance. Should habitat performance fall below requirements, adaptive management/additional compensation measures may be required. | **No** |
| Fish and Harvested Fish | The CEA Agency Guidelines for this Project (CEA Agency 2015a) request that fish (including valued fish species) be considered, which is reflected in this VC scoping process. The application of standard mitigation measures and best management practices will minimize potential adverse effects of the proposed Project on harvested fish species. Potential adverse effects to harvested fish species due to increased access to watercourses was noted in feedback from the APEP. The past present and future projects, combined with this Project, are not anticipated to result in significant adverse cumulative effects on harvested fish species considering access to fish-bearing watercourses will not be extensive within the cumulative effects assessment area, boat launch sites will not be constructed as part of any physical activities for past, present and future physical activities and provincial government-regulated limits on fish harvesting will minimize potential adverse | **No** |

| Valued Component | Cumulative Effects Analysis Screening Summary[i] | VC Carried Forward for Further Cumulative Effects Analysis?[ii] |
|---|---|---|
| | **Example Screening Criteria:**<br>• **Potential for significant adverse cumulative effects to the VC**<br>• **Feedback from the APEP**<br>• **Level of uncertainty in predictions of cumulative effects**<br>• **Need for additional mitigation measures or follow-up** | |
| | cumulative effects on harvested fish species. Potential cumulative effects to harvested fish species are also directly linked to potential cumulative effects on fish habitat. As indicated above for the 'fish habitat' VC, the potential for significant adverse cumulative effects to fish habitat will be prevented through the application of standard mitigation measures, best management practices, and fish habitat offsetting and monitoring that may be required by Fisheries and Oceans Canada. Prior to fish habitat offsetting measures, the potential for significant adverse effects to fish habitat (and associated effects to fish and harvest fish) is considered low due to the minimal amount of fish habitat that will be permanently altered or destroyed (maximum of 206.5 $m^2$ of instream habitat and 180 m of riparian zone habitat). | |
| Aquatic Species at Risk | The CEA Agency Guidelines for this Project (CEA Agency 2015a) request that Species at Risk be considered, which is reflected in this VC scoping process. The application of standard mitigation measures and best management practices will minimize potential adverse effects of the proposed Project on fish Species at Risk (i.e., lake sturgeon and mapleleaf mussel). Other physical activities may result in some potential adverse effects on fish Species at Risk. The past, present and future projects, combined with this Project, are not anticipated to result in significant adverse cumulative effects on fish Species at Risk considering access to fish-bearing watercourses known to support fish Species at Risk (i.e., Berens River and Poplar River) will not be extensive within the cumulative effects assessment area, boat launch sites will not be constructed as part of any physical activities for past, present and future physical activities and legislation protecting fish Species at Risk will minimize potential adverse cumulative effects on fish Species at Risk. Harvest of lake sturgeon by recreational and commercial fishers is prohibited and subsistence harvest is effectively managed by MCWS (MCWS 2012a). No additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) is required. | **No** |
| Vegetation Communities | The application of standard mitigation measures and best management practices will minimize potential adverse effects of the proposed Project on vegetation communities. Residual adverse environmental effects from this Project and other past, present or future physical activities are expected to be minimal, localized and are not expected to result in significant adverse cumulative effects to vegetation communities. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to vegetative communities. | **No** |
| Plant Species of Cultural Importance | The CEA Agency Guidelines for this Project (CEA Agency 2015a) request that Species at Risk (which includes Plant Species of Cultural Importance) be considered, which is reflected in this VC scoping process. The application of standard mitigation measures and best management practices will minimize potential adverse effects of the proposed Project on plant species of cultural importance. Residual adverse environmental effects from this Project and other past, present or future physical activities are expected to be minimal, localized and are not expected to result in significant adverse cumulative effects to plant species of cultural importance. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to plant species of cultural importance. | **No** |
| Ungulate: Moose | Although mitigation measures, best management practices and provincial hunting regulations will minimize potential adverse effects on moose, other physical activities may result in additional residual effects to moose. Potential adverse effects to moose due to increased access to the cumulative effects assessment area resulting in increased moose hunting opportunities and protection of moose habitat was noted in feedback from the APEP. Residual adverse cumulative effects on the moose population within the cumulative effects assessment area from this Project and other past, present or future physical activities are not expected to result in a significant decline in the regional moose population. Moose densities in the RAA are inherently low compared to densities reported in Game Hunting Areas to the south and the majority of the regional area will remain relatively remote even with the existing winter road being replaced with the planned all-season | **Yes - see Section 13.3.2 for cumulative effects analysis** |

| Valued Component | Cumulative Effects Analysis Screening Summary[i] | VC Carried Forward for Further Cumulative Effects Analysis?[ii] |
|---|---|---|
| | **Example Screening Criteria:**<br>• **Potential for significant adverse cumulative effects to the VC**<br>• **Feedback from the APEP**<br>• **Level of uncertainty in predictions of cumulative effects**<br>• **Need for additional mitigation measures or follow-up** | |
| | roads east of Lake Winnipeg. Additional rationale is provided by Joro Consultants (2015a) (**Chapter 9, Appendix 9-1**). The level of uncertainty regarding cumulative effects too moose is not considered high. However, effective management of moose populations are dependent on the expected implementation of Manitoba Conservation and Water Stewardship's (MCWS) cooperative moose conservation initiatives and measures for the regional area, as required. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to moose. Specific Moose monitoring and follow-up activities will be determined with MCWS. | |
| Ungulate: Boreal Woodland Caribou | Although mitigation measures, best management practices, legislative protection and Manitoba's Boreal Woodland Caribou Recovery Strategy will minimize potential adverse effects on caribou, other physical activities may result in additional residual effects to caribou. Protection of caribou habitat was noted in feedback from the APEP (**Chapter 4**) and is a provincial government priority as per Manitoba's Boreal Woodland Caribou Recovery Strategy. The CEA Agency Guidelines for this Project (CEA Agency 2015a) request that Species at Risk be considered, which includes boreal woodland caribou, and is reflected in this VC scoping process. Residual adverse cumulative effects on the caribou population within the cumulative effects assessment area from this Project and other past, present or future physical activities are not expected to result in a significant decline in the regional caribou population considering the total cumulative caribou habitat disturbance is estimated to be below the 35% disturbance threshold identified by Environment Canada (2012). Additional rationale is provided by Joro Consultants (2015a) (**Chapter 9, Appendix 9-1**). The level of uncertainty is not considered high due to the legislative protection status and recovery strategy for this Species at Risk, and minimal observed effects of existing linear disturbances (including the existing winter road) east of Lake Winnipeg on caribou. Additional rationale is provided by Joro Consultants (2015a) (**Chapter 9, Appendix 9-1**). Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to caribou. Specific caribou monitoring and follow-up activities will be determined with Manitoba Conservation and Water Stewardship (MCWS). | **Yes - see Section 13.3.3 for cumulative effects analysis** |
| Furbearer: Beaver | The application of mitigation measures, best management practices and provincial trapping regulations will minimize potential adverse effects to beavers from this Project and other past, present or future physical activities. Residual adverse cumulative effects on the beaver population within the cumulative effects assessment area are not expected to result in a significant decline in the regional beaver population primarily due to government regulation of fur trapping, and beaver habitat is not limited in the regional area (**Chapter 9**). The level of uncertainty is not considered high regarding the potential for significant adverse cumulative effects to beaver due to past, present and future projects. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to beaver. | **No** |
| Furbearer: Marten | The application of mitigation measures, best management practices and provincial trapping regulations will minimize potential adverse effects to marten from this Project and other past, present or future physical activities. Residual adverse cumulative effects on the martin population within the cumulative effects assessment area are not expected to result in a significant decline in the regional martin population primarily due to government regulation of fur trapping, and martin habitat is not limited in the regional area (**Chapter 9**). The level of uncertainty is not considered high regarding the potential for significant adverse cumulative effects to martin due to past, present and future projects. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to martin. | **No** |
| Migratory | The CEA Agency Guidelines for this Project (CEA Agency 2015a) request that migratory birds including Species at Risk be considered, which is | **No** |

| Valued Component | Cumulative Effects Analysis Screening Summary[i] | VC Carried Forward for Further Cumulative Effects Analysis?[ii] |
|---|---|---|
| | **Example Screening Criteria:**<br>• **Potential for significant adverse cumulative effects to the VC**<br>• **Feedback from the APEP**<br>• **Level of uncertainty in predictions of cumulative effects**<br>• **Need for additional mitigation measures or follow-up** | |
| Birds: Forest Birds | reflected in this VC scoping process. The application of mitigation measures and best management practices will minimize potential adverse effects on forest birds. However, this project combined with other past, present and future physical activities may result in additional disturbances to forest birds and loss or disturbance of forest bird habitat. Residual adverse cumulative effects on forest bird populations within the cumulative effects assessment area from this Project and other past, present or future physical activities are not expected to result in a significant decline in the regional forest bird populations primarily due to the limited scope and scale of past, present and future physical activities in terms of forest bird habitat loss (e.g., < 5% in the P4 Project Local Assessment Area; **Chapter 9**) and the amount of habitat gain due to the reclamation of winter roads in the cumulative assessment area (Joro Consultants 2015a). Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to forest birds. | |
| Migratory Birds: Waterbirds | The CEA Agency Guidelines for this Project (CEA Agency 2015a) request that migratory birds be considered, which is reflected in this VC scoping process. The application of mitigation measures and best management practices will minimize potential adverse effects on waterbirds. However, this project combined with other past, present and future physical activities may result in additional disturbances to waterbirds and loss or disturbance to waterbird habitat. Residual adverse cumulative effects on waterbird populations within the cumulative effects assessment area from this Project and other past, present or future physical activities are not expected to result in a significant decline in regional waterbird populations primarily due to the limited scope and scale of past, present and future physical activities in terms of waterbird habitat loss (e.g., < 2% in the P4 Project Local Assessment Area; **Chapter 9**) and the amount of habitat gain due to the reclamation of winter roads in the cumulative assessment area (Joro Consultants 2015a). Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to waterbirds. | **No** |
| Ecologically Sensitive Wildlife Sites: bat and snake hibernacula; terrestrial mammal dens; rookeries; large stick nests; and mineral licks | The CEA Agency Guidelines for this Project (CEA Agency 2015a) request that ecologically sensitive wildlife sites as they relate to migratory birds and Species at Risk be considered, which is reflected in this VC scoping process. The application of mitigation measures and best management practices (such as conducting pre-construction surveys [described in **Chapter 9, Section 9.2.5.7**]) will minimize potential adverse effects on ecologically sensitive wildlife sites. Other physical activities may result in additional disturbances to ecologically sensitive wildlife sites. Residual adverse cumulative effects to ecologically sensitive wildlife sites within the cumulative effects assessment area from this Project and other past, present or future physical activities are not expected to result in either a significant decline in those sites or decline in the species utilizing those sites. This conclusion is primarily based on either the low probability of the presence of such sites in the cumulative effects assessment area, or alternate habitat is available for the species that use these sites (**Chapter 9**). Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to ecologically sensitive wildlife sites. | **No** |
| Herptile Species at Risk | The CEA Agency Guidelines for this Project (CEA Agency 2015a) request that Species at Risk be considered, which is reflected in this VC scoping process. The application of mitigation measures, best management practices and legislation protecting Species at Risk will minimize potential adverse effects on amphibian and reptile (i.e. herptile) Species at Risk potentially occurring in the cumulative effects assessment area (i.e., common snapping turtle). Other physical activities may result in some potential adverse effects on this Species at Risk. The past present and future projects, combined with this Project, are not anticipated to result in significant adverse cumulative effects on herptile Species at Risk considering that watercourse and wetland habitat for these species is not limited in the cumulative effects assessment area | **No** |

| Valued Component | Cumulative Effects Analysis Screening Summary[i] | VC Carried Forward for Further Cumulative Effects Analysis?[ii] |
|---|---|---|
| | **Example Screening Criteria:**<br>• **Potential for significant adverse cumulative effects to the VC**<br>• **Feedback from the APEP**<br>• **Level of uncertainty in predictions of cumulative effects**<br>• **Need for additional mitigation measures or follow-up** | |
| | and legislation protecting Species at Risk will minimize potential adverse cumulative effects on herptile Species at Risk. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative effects to herptile Species at Risk. | |
| Hunting, Trapping, Fishing and Gathering | The application of mitigation measures and best management practices, including Manitoba Conservation and Water Stewardship's (MCWS) cooperative moose conservation initiatives, will be applied to minimize adverse effects to: wildlife species that are hunted (e.g., moose) and trapped (e.g., marten), vegetation species that are gathered (e.g., blueberries), and harvested fish species (e.g., walleye, including maintaining access to areas where these traditional resource use activities take place. ESRA will discuss the timing of clearing and construction with the trapper(s) maintaining the trapline intersected by the all-season road to agree on feasible mitigation methods to avoid unacceptable adverse economic effects potentially related to decreased trapping success.Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative environmental effects on hunting, trapping, fishing and gathering. | **No** |
| Travel Routes | The application of mitigation measures and best management practices will be applied to minimize adverse effects to travel routes such as navigable waterways (e.g., crossing structures that allow for navigation of watercraft). Other physical activities may result in potential adverse effects on travel routes. Minor alterations in travel routes resulting from this Project combined with past, present and future projects within the spatial and temporal boundaries of this cumulative effects assessment are not expected to result in significant adverse cumulative effects. Potential adverse effects on travel routes other past, present or future physical activities are expected to be understood and predictable as is the case with this Project. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative environmental effects on travel routes. | **No** |
| Cultural, Heritage and Archaeological Resources | Pre-construction surveys and Aboriginal and public engagement has identified known cultural, heritage and archaeological resources so they can be avoided and/or protected. Other physical activities may result in some potential adverse effects on this VC. The potential for significant residual adverse effects on cultural, heritage and archaeological resources from this Project and other past, present or future physical activities are not expected considering the location of such sites are typically known, or the potential presence of unknown sites (e.g., archaeological sites) can be predicted with reasonable accuracy based on terrain features and historical records (AMEC Foster Wheeler 2015a,b,c). Potential sites can be investigated to confirm the presence of these sites prior to commencement of physical activities. Therefore, the level of uncertainty regarding potential adverse cumulative effects on this VC is not considered high. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative environmental effects on cultural, heritage and archaeological resources. | **No** |
| Human Health | The application of mitigation measures and best management practices will be applied to minimize adverse effects to human health of road users. Other physical activities may result in potential adverse effects on human health. Minor risks associated with all-season road travel resulting from this Project combined with past, present and future projects within the spatial and temporal boundaries of this cumulative effects assessment are not expected to result in significant adverse cumulative effects. Potential adverse effects on human health of other past, present or future physical activities are expected to be understood and predictable as is the case with this Project. Additional mitigation measures or follow-up beyond what is proposed for this Project (**Chapter 14**) are not required to reduce the potential for significant adverse cumulative environmental effects on human health of road users. | **No** |

[i] Refer to **Section 13.2.1** for a description of the VC scoping and screening process
[ii] Refer to **Section 13.3** for the analyses of cumulative effects on VCs that have been carried forward for cumulative effects analyses.

# Appendix 13-3

## Temporal Distribution of Projects and Activities

## Appendix 13-3: Temporal Distribution of Projects and Activities

| Activities | Pre-Project (2000 – 2015) | 2016-2019 | 2020-2024 | 2025-2029 | 2030-2037 |
|---|---|---|---|---|---|
| **Past or Present Physical Activities** | | | | | |
| ESRA's P1 all-season road project from PR 304 to Berens River communities[1]. | Construction | | Operations and Maintenance | | |
| Existing infrastructure within and immediately adjacent to First Nation communities within the cumulative effects spatial boundary. | | | | | |
| Existing winter road use and maintenance. | | | | | |
| Forestry roads (unmaintained). | | Minor use of some past forestry roads (snowmobiles etc.); not maintained by forestry companies; gradual revegetation. | | | |
| Existing Manitoba Hydro transmission lines. | | | | | |
| Mining and quarry activities | | | | | |
| Traditional/subsistence and licenced hunting activities. | | | | | |
| Licenced trapping of furbearing animals for commercial sale. | | | | | |
| Commercial and non-commercial (subsistence and sport) fishing. | | | | | |
| **Future Physical Activities** | | | | | |
| Other planned all-season roads east of Lake Winnipeg as part of the Large Area Transportation Network initiative by ESRA with the cumulative effects spatial boundary: | | | | | |

[1] The first 48 km of the P1 all-season road was an existing road that is being rebuilt (i.e., Hollow Water First Nation to Loon Straits).

| Activities | Pre-Project (2000 – 2015) | 2016-2019 | 2020-2024 | 2025-2029 | 2030-2037 |
|---|---|---|---|---|---|
| ▪ Pauingassi to Little Grand Rapids First Nation (P7A). | | Construction | Operations and Maintenance | | |
| ▪ P1 to Little Grand Rapids First Nation and Pauingassi First Nation (P7). | | | Construction | Operations and Maintenance | |
| Poplar River First Nation community access road (433 m) linking the proposed Project with the community. | | Construction activities during one of these years | Operations and Maintenance | | |
| Poplar River community airport. | | Construction activities during one of these years | Operations and Maintenance | | |
| Decommissioning and rehabilitation, as required, of existing network of winter roads not required after the construction of planned all-season roads east of Lake Winnipeg as part of the Large Area Transportation Network initiative by ESRA. | | | | | |
| Traditional/subsistence and licenced hunting activities. | | | | | |
| Licenced trapping of furbearing animals for commercial sale. | | | | | |
| Commercial and non-commercial (subsistence and sport) fishing. | | | | | |

# Appendix 13-4

## VCs Potentially Affected by Past, Existing and Future Physical Activities

## Appendix 13-4: VCs Potentially Affected by Past, Existing and Future Physical Activities

| Physical Activities | Valued Components Carried Forward for Cumulative Effects Analysis | | | Physical Activity Carried Forward due to Expected Adverse Cumulative Effects on VCs? |
|---|---|---|---|---|
| | Air Quality (Greenhouse Gases) | Moose | Boreal Woodland Caribou | |
| ESRA's P1 all-season road project from PR 304 to Berens River communities. | ✓ | ✓ | ✓ | **Yes** - The P1 all-season road is currently under construction and has the potential to affect these VCs within the spatial and temporal boundaries defined for this cumulative effects analysis. Considering the similarities of these two road projects (Project Description **Chapter 3**), similar effects pathways are predicted for the P4 all-season road as were predicted for the P1 all-season road project. Therefore, the environmental effects of the P1 all-season road will be considered further in the cumulative effects analysis (**Section 13.3**). |
| Existing infrastructure within and immediately adjacent to First Nation communities within the cumulative effects spatial boundary. | ✓ | ✓ | ✓ | **Yes** – The existing infrastructure for Berens River First Nation and Poplar River First Nation communities has influenced each VC through pathways such as: removal of habitat and sensory disturbance to moose and caribou; increased greenhouse gases through vehicle and machinery use in the communities; and increased/convenient fishing opportunities at the watercourses within each community. Therefore, the environmental effects of the existing infrastructure within and immediately adjacent to the First Nation communities will be considered further in the cumulative effects analysis (**Section 13.3**). |
| Existing winter road use and maintenance. | ✓ | ✓ | ✓ | **Yes** - The existing winter road network will continue to contribute to greenhouse gas emissions, and influence moose and caribou (e.g., through sensory disturbance, habitat alteration/loss, access for hunters), until such time as the winter roads are decommissioned in sequence with the completion of the future east side all-season roads. Therefore, the existing winter roads and their use/maintenance will be considered further in the cumulative effects analysis on greenhouse gas emissions and cumulative effects on moose and caribou (**Section 13.3**). The influence of the winter road on commercial fishing and effects to harvested fish populations is not considered due to the commercial fishing operations in the area being considered an 'open water' fishery with fish caught in the area being delivered by boat to Matheson Island for delivery by truck to the Freshwater Fish Marketing Corporation Transcona plant in Winnipeg (MCWS 2013b). |
| Past forestry roads. | | ✓ | ✓ | **Yes** – Considering previously established forestry roads are no longer used for commercial forestry activities, are largely abandoned (in varying states of natural revegetation) and may be accessed to a limited extent by snowmobile and/or ATV, the past forestry roads will continue to influence moose and caribou (e.g., through sensory disturbance, habitat alteration/loss, access for hunters/predators) within the spatial and temporal boundaries of this cumulative effects assessment. These past forestry roads may also be used to access watercourses for fishing. However, accurate information |

| Physical Activities | Valued Components Carried Forward for Cumulative Effects Analysis | | | Physical Activity Carried Forward due to Expected Adverse Cumulative Effects on VCs? |
|---|---|---|---|---|
| | Air Quality (Greenhouse Gases) | Moose | Boreal Woodland Caribou | |
| | | | | regarding the extent of vehicle use and type of vehicle use of these past forestry roads is not available due to the largely abandoned condition of these former roads and expected minimal vehicle use of these former roads. Therefore potential cumulative effects of vehicle use of past forestry roads and resulting greenhouse gas emissions is not assessed. The past forestry roads will be considered further in the cumulative effects analysis for moose, caribou and harvested fish (**Section 13.3**). |
| Mining and quarry activities | | ✓ | ✓ | **Yes –** Mining, mineral exploration activities and quarry activities will continue to result in site-specific and occasional disturbance to moose and caribou that may be within the vicinity of activities when they are occurring. Use of existing and future roads and other modes of transportation for various purposes, including mining and quarry related activities, are considered in the cumulative contributions to greenhouse gases. |
| Manitoba Hydro transmission lines. | | ✓ | ✓ | **Yes –** The existing transmission line corridors potentially provide access to hunters using snowmobiles or ATVs and will continue to influence moose and caribou (e.g., through sensory disturbance, habitat alteration/loss, access for hunters/predators) within the spatial and temporal boundaries of this cumulative effects assessment. However, information regarding the extent of vehicle use and type of vehicle use of transmission line corridors is not available due to undocumented vehicle use of the corridors which are not intended for vehicle use. Therefore potential cumulative effects of vehicle use of transmission line corridors and resulting greenhouse gas accumulation is not assessed. No information is available regarding the use of transmission line corridors to access watercourses for fishing; however, fishing opportunities at the easily accessible Poplar and Berens rivers adjacent to the communities and future access to other fish-bearing watercourses via future all-season roads are expected to be the primary influences on harvested fish species in the cumulative effects assessment area compared to potential use of transmission line corridors to access fishing sites. Therefore, hydro transmission line corridors are not carried forward in the consideration of cumulative effects to harvested fish species. The potential effects of transmission line corridors will be considered further in the cumulative effects analysis for moose and caribou (**Section 13.3**). |
| Traditional/subsistence and licenced hunting activities (past, present and future). | ✓ | ✓ | ✓ | **Yes** - Past, present and future traditional/subsistence and licenced hunting activities have influenced and will continue to influence moose and caribou populations within the spatial and temporal boundaries of this cumulative effects assessment. Use of existing and future roads, and other modes of transportation for various purposes (e.g., hunting) are considered in the cumulative contributions to greenhouse gases. Therefore, past, present and future traditional/subsistence and licenced hunting activities are considered in the assessment of these VCs in **Section 13.3**. |

| Physical Activities | Valued Components Carried Forward for Cumulative Effects Analysis | | | Physical Activity Carried Forward due to Expected Adverse Cumulative Effects on VCs? |
|---|---|---|---|---|
| | Air Quality (Greenhouse Gases) | Moose | Boreal Woodland Caribou | |
| Licenced trapping of furbearing animals for commercial sale (past, present and future). | ✓ | | | **Yes** – The activity of licenced trapping of furbearing animals for commercial sale is being considered with respect to the estimated contributions to greenhouse gases from various modes of transportation to carry-out various activities such as access to trapping areas and transportation of fur to commercial/distribution centres. Therefore, the activity of licenced trapping of furbearing animals for commercial sale in terms of greenhouse gas emitting modes of transportation required to carry out this activity is considered in the assessment of this VC in **Section 13.3**. |
| Traditional/subsistence, sport and commercial fishing (past, present and future). | ✓ | ✓ | | **Yes** – The activity of traditional/subsistence, sport and commercial fishing is being considered with respect to expected effects to harvested fish populations and the estimated contributions to greenhouse gases from various modes of transportation to carry-out various activities such as access to fishing areas and transportation of fish to commercial/distribution centres. Therefore, the activity of commercial and non-commercial (subsistence and sport) fishing is considered in the assessment of the cumulative contributions to greenhouse gases and cumulative effects to harvested fish populations in **Section 13.3**. |
| Planned all-season roads east of Lake Winnipeg as part of the Large Area Transportation Network initiative by ESRA. | ✓ | ✓ | ✓ | **Yes** - The planned all-season roads east of Lake Winnipeg have the potential to affect these VCs within the spatial and temporal boundaries defined for this cumulative effects analysis. Considering the similarities of these future road projects in terms of potential environmental effects, similar effects pathways are predicted for the future all-season roads as were predicted for the P4 all-season road Project. Therefore, the environmental effects of the future all-season roads will be considered further in the cumulative effects analysis (**Section 13.3**). |
| Future Poplar River First Nation community access road (433 m) linking the proposed Project with the community. | ✓ | | ✓ | **Yes** - The planned Poplar River First Nation community access road (433 m) linking the proposed Project with the community will have a minor contribution to the loss of moose and caribou habitat and potential sensory disturbance to moose and caribou. Therefore this small future road segment is considered in the cumulative effects analysis on moose and caribou (**Sections 13.3.3 and 13.3.4**). Future vehicle use of this community access road is assessed in terms of the overall estimated contribution to greenhouse gas emissions by vehicle use (**Section 13.3.1**). The planned community access road does not cross fish-bearing streams. Therefore, no cumulative effects to harvested fish species are anticipated to result from the construction and operation of this future community access road. |
| Future Poplar River community airport. | ✓ | | ✓ | **Yes** - The planned Poplar River community airport is considered in terms of expected change in air travel compared to future all-season road use and implications to expected changes to greenhouse gas emissions within the spatial and temporal cumulative effects assessment boundaries (**Section 13.3.1**). The construction and |

| Physical Activities | Valued Components Carried Forward for Cumulative Effects Analysis | | | Physical Activity Carried Forward due to Expected Adverse Cumulative Effects on VCs? |
|---|---|---|---|---|
| | Air Quality (Greenhouse Gases) | Moose | Boreal Woodland Caribou | |
| | | | | operation of the airport adjacent to Poplar River First Nation is anticipated to result in minor contributions to the overall cumulative effects of physical activities on moose and caribou within the spatial and temporal cumulative effects assessment boundaries (**Section 13.3**) |
| Decommissioning and rehabilitation, as required, of existing network of winter roads not required after the construction of planned all-season roads east of Lake Winnipeg as part of the Large Area Transportation Network initiative by ESRA. | ✓ | ✓ | ✓ | **Yes** – Although the future decommissioning of the existing network of winter roads is not considered to have adverse environmental effects, the resulting reestablishment of natural vegetation within former winter road corridors and cessation of the annual cycle of sedimentation of watercourses as the winter roads are recreated is considered in the cumulative effects assessment for harvested fish species, moose and caribou (e.g., change/improvement in available habitat). The change in vehicle use from seasonal winter road use to all-season roads also influences the cumulative contributions of greenhouse gas emissions. The influence of the decommissioning of winter roads on the cumulative effects assessment of greenhouse gas emissions, and influence on cumulative effects to moose and caribou, is assessed in **Section 13.3**. |

# Appendix 13-5

## Greenhouse Gas Emissions Assessment for East Side Road Authority All-Season Road Projects

# Greenhouse Gas Emissions Assessment for East Side Road Authority All-Season Road Projects

November 2015 – 15-1726

# Table of Contents



## Figures



## Tables

# 1.0 Introduction

## 1.1 Background

This greenhouse gas assessment of the Manitoba East Side Road Authority (ESRA) All-Season Road (ASR) projects east of Lake Winnipeg provides information to inform the provincial and federal environmental impact assessment processes as required. Federally, the Canadian Environmental Assessment Agency (CEAA, 2003) in its guidance document recommends that practitioners address greenhouse gas (GHG) considerations that include:

1. Preliminary scoping for GHG considerations. This preliminary scoping assesses whether there are likely GHG considerations associated with the project.
2. Identify GHG considerations. This process considers the potential GHG emissions profile of the project in comparison to the industry profile.
3. Assess GHG considerations. This process determines the direct and indirect GHG emissions of the project, the impacts on carbon sinks, and comparison with industry, provincial / territorial and national inventories.
4. GHG management plans. Development of a GHG management plan to mitigate and / or offset emissions if the project results in medium or high emissions.
5. Monitoring, follow-up and adaptive management. This process monitors and verifies the GHG emissions forecast and determines the effectiveness of the GHG abatement / offset measures. Modification of the GHG management plan may be required during this process.

This GHG assessment addresses CEAA considerations 1, 2, and 3 above. Considerations of steps 4 and 5 are addressed by way of recommendations on developing mitigation plans and policies, monitoring, data collection and verification. Provincial requirements related to climate change implications are also addressed. The GHG assessment presented in this report generally follows the principles of CAN/CSA-ISO 14064 suite of protocols in quantifying and reporting GHG emissions and removals.

## 1.2 Greenhouse Gas Considerations

The proposed ESRA All-Season Road projects (Projects) will have GHG emissions associated with the construction and operational phases of the Projects due to vehicular emissions from the use of the ASRs.

The Projects involve the construction and operation of four all-seasons roads (ASRs) east of Lake Winnipeg within the cumulative effects assessment area with a total road length of approximately 419.5 km (**Section 2**). The Manitoba Infrastructure and Transportation (MIT,

2010a) constructs and maintains approximately 19,000 km of all-weather roads and 2,200 km of winter roads. The Projects will contribute to an increase of less than 2 % of the total roads in Manitoba.

Environment Canada (2010) provides annual national and provincial GHG emissions per sector since 1990. The most recent GHG inventory year of 2008 indicated that for construction activities in Manitoba, approximately 0.098 Mt $CO_2e$ were emitted in 2008 and the total emissions for road transportation in the province was approximately 5.13 Mt $CO_2e$. Since 1990, the GHG emissions due to construction have increased in Manitoba by approximately 56 % and for road transportation the increase has been approximately 31 %.

Nationally, GHG emissions from the construction sector in 2008 was estimated to be approximately 1.26 Mt $CO_2e$, and for the road transportation sector it was estimated at approximately 135 Mt $CO_2e$ (Environment Canada, 2010). The emissions due to construction decreased in 2008 by 33 % from 1990 levels and for the road transportation sector there was an increase of approximately 37 %. Manitoba contributed less than 8 % to the national GHG emissions due to construction and less than 4 % to the national road transportation GHG emissions in 2008.

The Projects will contribute to an increase in annual GHG emissions for the Province. Therefore, in order to determine the magnitude of the GHG emissions associated with the Projects, a cumulative GHG assessment is needed.

# 2.0 The Projects

The GHG assessment study area, shown in **Figure 2.1**, is along the eastern shoreline of Lake Winnipeg and extends from the southern limit of the Hollow Water traditional lands north to Poplar River and east to Pauingassi and Little Grand Rapids First Nation on the Ontario border.

All ESRA ASR projects are summarized in **Table 2-1**. The P1 project which links PR304 to Berens River First Nation is currently under construction. All other ASR projects are proposed future projects.

**TABLE 2-1: ESRA ALL-SEASON ROAD PROJECTS AND SCHEDULE**

| All-Season Road Projects | Length (km) | Start | Completion |
|---|---|---|---|
| PR304 to Berens River First Nation (P1) | 156 | 2012 (under construction) | ~2020 |
| Pauingassi to Little Grand Rapids First Nation (P7A) | 36.4 | 2016 | ~2020 |
| P1 to Little Grand Rapids First Nation and Pauingassi First Nation (P7) | 131 | 2020 | ~2027 |
| Berens River First Nation to Poplar River First Nation (P4) | 94.1 | 2018 | ~2025 |

**FIGURE 2.1: STUDY AREA**


Project 4 - All-Season Road Connecting Berens River to Poplar River First Nation

**Cumulative Effects Spatial Area**

The spatial area for cumulative effects shown in this map reflects a Valued Component-centered spatial boundary approach whereby the area shown reflects the Atikaki-Berens woodland caribou population that may experience potential cumulative effects and is generally the largest area where cumulative effects are anticipated and potentially detectable. The spatial area for cumulative effects also reflects the area encompassing the planned interconnected East Side Large Area Transportation Network of all-season roads

- P4 All-Season Road Alignment
- P1 All-Season Road (South of Berens to PTH 304) - Under Construction
- Future P7 All-Season Road
- Future P7a All-Season Road
- 2013/2014 Manitoba Winter Road
- Transmission Line
- Berens River First Nation Reserve
- Poplar River First Nation Reserve
- Northern Affairs Community
- Provincial Park
- Cumulative Effects Spatial Area
- Manitoba / Ontario Border

Map Drawing Information: ESRI Base Layers, Province of Manitoba, CanVec, GeoGratis, Dillon Consulting Limited

Map Created By: ECH
Map Checked By: MG/PS/DM
Map Projection: NAD 1983 UTM Zone 14N

DATE: 11/10/2015

MANITOBA East Side Road AUTHORITY

## 2.1 Existing Conditions

The area to the north of Bloodvein and east of Lake Winnipeg (**Figure 2-1**) is not currently served by an ASR connecting to the southern Manitoba all-season road network (East Side Road Authority, 2010). The remoteness of communities in the area, their size and lack of economic development has resulted in dependence on a costly and limited transportation system. These communities included the Southeast Tribal Council (SERCA) communities of Poplar River, Berens River, Bloodvein, Little Grand Rapids, and Pauingassi, and the Island Lake Tribal Council (ILTC) communities of St. Theresa Point, Wasagamack, Garden Hill, and Red Sucker Lake. For the communities of Poplar River and Berens River, this transportation system relies on air service, seasonal ferry service during the non-winter months, and a seasonal winter road.

Air service is from Winnipeg and from Matheson Island. Ferry and barge service to Bloodvein occurs from April/May to October inclusive and is from Islandview and Pine Dock harbours. The seasonal road network consists of: an ice road across Lake Winnipeg from Pine Dock to Bloodvein; a winter road from PR 304 north to Bloodvein; a winter road from Bloodvein north to Berens River and then to Poplar River; and another winter road runs from Bloodvein to Little Grand Rapids and Pauingassi. This latter winter road is also connected to another winter road network that connects the communities of the ILTC. Matheson Island, Islandview and Pine Dock can be accessed from Winnipeg via Provincial Trunk Highway (PTH) 8 and Provincial Road (PR) 234 (a gravel road). PR 304 is a paved provincial trunk road and connects to Winnipeg via Highway 59.

## 2.2 Projects Description

The proposed ASR projects (**Table 2-1**) will be gravel roads for the entire length. The roadways will be 10 m in width with two 3.7 m wide lanes, 1.0 m shoulders and a 0.3 m shoulder rounding allowance. The roadways will be centred within a 100 m right of way (ROW) and the cleared limit of the roadways will be 60 m within this ROW. Further clearing will be on as required basis to maintain line of sight.

The proposed construction schedules and lengths of ASR projects are listed in **Table 2-1**.

# 3.0 GHG Emissions Assessment Methodology

In order to evaluate the change in GHG emissions due to the Projects, the estimated annual GHG emissions for the Baseline scenario without the Projects were compared to the scenario with the Projects. In both scenarios the annual GHG emissions were projected for the construction period and 10 years of operation of the Projects. The ASR will impact the communities of Berens River, Bloodvein, Poplar River Little Grand Rapids and Pauingassi, and transportation activities between these communities and Winnipeg. Therefore, this assessment focuses on the GHG implications associated with the transportation infrastructure linking all these communities to Winnipeg.

The natural ecosystem sources and sinks are also included in the assessment to demonstrate their contribution to the overall GHG profile of the Baseline and Project scenarios. The detailed methodologies for GHG quantification are the same as was completed for the PR304 to Berens River All-Season Road and are detailed in "PR304 to Berens River All-Season Road Environmental Impact Assessment Greenhouse Gas Emission Assessment Dillon Report No. 10-3402", July 2011 (Dillon 2011 Report).

This approach was taken based on the limited data availability for the P4, P7 and P7a projects, and to allow for consistency across all project assessments. In general, assumptions made within the P1 detailed assessment were applied to P4, P7 and P7a, unless project specific information was available. The assessment should therefore be reviewed as more project specific information becomes available for P4, P7 and P7a.

## 3.1 GHG Emissions Assessment for P1

The GHG emission assessment for P1 has been documented in the Dillon 2011 Report. Briefly, the P1 baseline scenario (i.e., business as usual, no P1 project) included the GHG emissions and sinks/removals and the resulting cumulative GHG emissions. The summary of the key components of the cumulative calculation is as follows:

*Annual Baseline GHG Emissions (tonnes $CO_2e$/yr) =*

*Carbon sequestration due to forest cover along the proposed P1 ASR (tonnes $CO_2e$/yr)*
*+ Net GHG emissions due to wetlands along the proposed P1 ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to air travel to Bloodvein and Berens River (tonnes $CO_2e$/yr)*
*+ GHG emissions due to ferry crossing from Islandview/Pine Dock to Bloodvein (tonnes $CO_2e$/yr)*

*+ GHG emissions due to transportation between Winnipeg and Islandview/Pine Dock (tonnes $CO_2e$/yr)*
*+ GHG emissions due to the construction and maintenance of seasonal road (tonnes $CO_2e$/yr)*
*+ GHG emissions due to vehicular travel during winter (tonnes $CO_2e$/yr).*

The P1 ASR scenario GHG emissions and sinks / removals and the resulting cumulative GHG emissions were estimated as follows:

*Annual Project GHG Emissions (tonnes $CO_2e$/yr) =*
*GHG emissions due to land clearing along the proposed P1 ASR (tonnes $CO_2e$/yr)*
*+ Methane emissions due to the wetlands along the proposed P1 ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to construction of the P1 ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to air travel to Bloodvein and Berens River (tonnes $CO_2e$/yr)*
*+ GHG emissions due to ferry crossing from Islandview/Pine Dock to Bloodvein (tonnes $CO_2e$/yr)*
*+ GHG emissions due to transportation on PTH 8 and PR234 (tonnes $CO_2e$/yr)*
*+ GHG emissions due to transportation between Winnipeg and Berens River (tonnes $CO_2e$/yr)*
*+ GHG sequestration due to reforestation of disturbed land (tonnes $CO_2e$/yr)*

Methodologies that are used to quantify the emissions for individual activities are described in the Dillon 2011 Report.

## 3.2 GHG Emissions Assessment for P4

Following the same methodologies as described in the Dillon 2011 Report, the P4 baseline scenario (i.e., business as usual, no P4 project) GHG emissions and sinks / removals and the resulting cumulative GHG emissions were estimated as follows:

*Annual Baseline GHG Emissions (tonnes $CO_2e$/yr) =*
*Carbon sequestration due to forest cover along the proposed P4 ASR (tonnes $CO_2e$/yr)*
*+ Net GHG emissions due to wetlands along the proposed P4 ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to air travel to Poplar River (tonnes $CO_2e$/yr)*
*+ GHG emissions due to the construction and maintenance of seasonal road (tonnes $CO_2e$/yr)*
*+ GHG emissions due to vehicular travel during winter (tonnes $CO_2e$/yr).*

The P4 ASR scenario GHG emissions and sinks/removals and the resulting cumulative GHG emissions were estimated as follows:

*Annual Project GHG Emissions (tonnes $CO_2e$/yr) =*

*GHG emissions due to land clearing along the proposed P4 ASR (tonnes $CO_2e$/yr)*
*+ Methane emissions due to the wetlands along the proposed P4 ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to construction of the P4 ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to air travel to Poplar River (tonnes $CO_2e$/yr)*
*+ GHG emissions due to transportation between Poplar River and Berens River (tonnes $CO_2e$/yr)*
*+ GHG sequestration due to reforestation of disturbed land (tonnes $CO_2e$/yr)*

As the ferry and/or barge traffic is not expected to change significantly with the construction of P4, the GHG emissions associated with ferry and/or barge traffic were not quantified[1].

All air movements from Poplar River Airport were assumed to be between Poplar River and Winnipeg. An 80% reduction in air movements were assumed when the P4 is in operation.

## 3.3 GHG Emissions Assessment for P7a

Without the Project 7a, access to Pauingassi and Little Grand Rapids First nations will continue to be by air, water and winter road, for the foreseeable future. Access between the two First Nation Communities is currently by air, water and all-terrain vehicles during the summer, and during the winter, spring and fall by air, snowmobile and all-terrain vehicle. With the Project 7a in operation, the major change in transportation means is a reduction (assumed 80% reduction) in helicopter use and an increased vehicle use on P7a ASR. Accordingly, the GHG emissions associated with air movement from Little Grand Rapids to Winnipeg is considered in Project 7a. With P7a in operation, transportation between the two First Nation Communities using water and snowmobile are not expected to change significantly. Accordingly, GHG emissions associated with these activities were not quantified.

The P7a baseline scenario (i.e., business as usual, no P7a project) GHG emissions and sinks/removals and the resulting cumulative GHG emissions were estimated as follows:

*Annual Baseline GHG Emissions (tonnes $CO_2e$/yr) =*

*Carbon sequestration due to forest cover along the proposed P7a ASR (tonnes $CO_2e$/yr)*
*+ Net GHG emissions due to wetlands along the proposed P7a ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to air travel (helicopters) between Little Grand Rapids and Pauingassi (tonnes $CO_2e$/yr)*

[1] Subsequent to the completion of this report the daily ferry service to Bloodvein was terminated (November 2015) as the community is being serviced by an all-season road.

*+ GHG emissions due to the construction and maintenance of seasonal road (tonnes $CO_2e$/yr)*
*+ GHG emissions due to vehicular travel during winter (tonnes $CO_2e$/yr).*

The P7a ASR scenario GHG emissions and sinks/removals and the resulting cumulative GHG emissions were estimated as follows:

*Annual Project GHG Emissions (tonnes $CO_2e$/yr) =*
*GHG emissions due to land clearing along the proposed P7a ASR (tonnes $CO_2e$/yr)*
*+ Methane emissions due to the wetlands along the proposed P7a ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to construction of the P7a ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to air travel (helicopters) between Little Grand Rapids and Pauingassi (tonnes $CO_2e$/yr)*
*+ GHG emissions due to transportation on P7a (tonnes $CO_2e$/yr)*
*+ GHG sequestration due to reforestation of disturbed land (tonnes $CO_2e$/yr)*

## 3.4 GHG Emission Assessment for P7

With P7 in operation, the winter road between Little Grand Rapids and Bloodvein Communities will be replaced, and the air movements from Little Grand Rapids Airport to Winnipeg should be reduced significantly (assumed 80% reduction).

The P7 baseline scenario (i.e., business as usual, no P7 project) GHG emissions and sinks/removals and the resulting cumulative GHG emissions were estimated as follows:

*Annual Baseline GHG Emissions (tonnes $CO_2e$/yr) =*
*Carbon sequestration due to forest cover along the proposed P7 ASR (tonnes $CO_2e$/yr)*
*+ Net GHG emissions due to wetlands along the proposed P7 ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to air travel between Little Grand Rapids and Winnipeg (tonnes $CO_2e$/yr)*
*+ GHG emissions due to the construction and maintenance of seasonal road (tonnes $CO_2e$/yr)*
*+ GHG emissions due to vehicular travel during winter (tonnes $CO_2e$/yr).*

The P7 ASR scenario GHG emissions and sinks / removals and the resulting cumulative GHG emissions were estimated as follows:

*Annual Project GHG Emissions (tonnes $CO_2e$/yr) =*
*GHG emissions due to land clearing along the proposed P7 ASR (tonnes $CO_2e$/yr)*
*+ Methane emissions due to the wetlands along the proposed P7 ASR (tonnes $CO_2e$/yr)*
*+ GHG emissions due to construction of the P7 ASR (tonnes $CO_2e$/yr)*

*+ GHG emissions due to air travel between Little Grand Rapids and Winnipeg (tonnes $CO_2e$/yr)*
*+ GHG emissions due to transportation on P7 (tonnes $CO_2e$/yr)*
*+ GHG sequestration due to reforestation of disturbed land (tonnes $CO_2e$/yr)*

## 3.5 Cumulative GHG Emission Assessment

The differences in GHG emissions between the ASR Projects and baseline (without the ASR Projects) for individual ASR Projects were quantified according to the approaches described above. The sum of the differences is the cumulative GHG emissions, i.e.

*Cumulative annual net GHG Emission (tonnes $CO_2e$/yr) =*
*Annual P1 Project GHG emissions (tonnes $CO_2e$/yr)–annual P1 baseline GHG emissions (tonnes $CO_2e$/yr)*
*+ Annual P4 Project GHG emissions (tonnes $CO_2e$/yr)–annual P4 baseline GHG emissions (tonnes $CO_2e$/yr)*
*+Annual P7 Project GHG emissions (tonnes $CO_2e$/yr)–annual P7 baseline GHG emissions (tonnes $CO_2e$/yr)*
*+ Annual P7a Project GHG emissions (tonnes $CO_2e$/yr)–annual P7a baseline GHG emissions (tonnes $CO_2e$/yr)*

The cumulative annual net GHG emission were compared with the provincial GHG emissions due to transportation.

# 4.0 GHG Emissions Estimates

**Tables 4-1** through **4-8** summarize the GHG emissions under the Baseline scenario and ASR scenario, for all individual ASR Projects during the construction periods and 10 years of operation.

**Table 4-9** lists the cumulative net change in annual GHG emissions for all ASR Projects.

As shown in **Table 4-9**, the annual GHG emissions under ASR scenario for each individual project are expected to be above those for the corresponding baseline scenario, due to the GHG emissions from construction activities during the construction periods. However, based on the available information for the new projects, during the ASR operational periods all individual projects except P1 will expect reductions in annual GHG emissions. When all four projects are in operation, the annual GHG emissions will be reduced by a total of 6,128 tonnes CO2e.

Therefore, there will be an increase in annual GHG emissions during the construction periods for each individual project, ranging from 1,514 tonnes CO2e for P7a to 4,295 tonnes CO2e for P7. Approximately after 13 years of operation of all four projects, a net reductions in annual GHG emissions by 5,794 tonnes CO2e, which is about a reduction of 0.1% of the Province's total GHG emissions of 5.13 Mt CO2e due to road transportation, will be realized.

It is important to note that the calculation approaches used in the determination above are the same as was used in the detailed assessment of P1 (Dillon 2011). This approach was taken based on the limited data availability for the P4, P7 and P7a projects, and to allow for consistency across all project assessments. In general, assumptions made within the P1 detailed assessment were applied to P4, P7 and P7a, unless project specific information was available. The assessment should therefore be reviewed as more project specific information becomes available for P4, P7 and P7a.

### TABLE 4.1: BASELINE SCENARIO GHG EMISSIONS FOR P1 PROJECT

| PERIOD CORRESPONDING TO PROJECT SCENARIO | GHG EMMISIONS (Tonnes CO2e) | | | | | | | | | | TOTAL PER YEAR (Tonnes CO2e) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Seasonal Rd Construction | Seasonal Rd Maintenance | Vehicular Use Highway 8 | Vehicular Use PR 234 | Vehicular Use Seasonal Road | Ferry Operation | Air Travel | Land Clearing | Forest Carbon Sequestration | Wetland Net GHG Emissions | |
| **Construction*** | | | | | | | | | | | |
| 2010 | 83 | 74 | 296 | 214 | 7,805 | 73 | 1,054 | 0 | -45 | 668 | 10,223 |
| 2011 | 83 | 74 | 275 | 199 | 7,805 | 73 | 977 | 0 | -45 | 668 | 10,109 |
| 2012 | 83 | 74 | 253 | 183 | 7,805 | 73 | 905 | 0 | -45 | 668 | 9,999 |
| 2013 | 83 | 74 | 231 | 167 | 7,805 | 73 | 838 | 0 | -45 | 668 | 9,894 |
| **Operation** | | | | | | | | | | | |
| 2014 | 83 | 74 | 209 | 151 | 7,805 | 73 | 776 | 0 | -45 | 668 | 9,794 |
| 2015 | 83 | 74 | 209 | 151 | 7,805 | 73 | 719 | 0 | -45 | 668 | 9,737 |
| 2016 | 83 | 74 | 209 | 151 | 7,805 | 73 | 667 | 0 | -45 | 668 | 9,685 |
| 2017 | 83 | 74 | 209 | 151 | 7,805 | 73 | 620 | 0 | -45 | 668 | 9,638 |
| 2018 | 83 | 74 | 209 | 151 | 7,805 | 73 | 577 | 0 | -45 | 668 | 9,596 |
| 2019 | 83 | 74 | 209 | 151 | 7,805 | 73 | 540 | 0 | -45 | 668 | 9,559 |
| 2020 | 83 | 74 | 209 | 151 | 7,805 | 73 | 508 | 0 | -45 | 668 | 9,527 |
| 2021 | 83 | 74 | 209 | 151 | 7,805 | 73 | 481 | 0 | -45 | 668 | 9,500 |
| 2022 | 83 | 74 | 209 | 151 | 7,805 | 73 | 459 | 0 | -45 | 668 | 9,478 |
| 2023 | 83 | 74 | 209 | 151 | 7,805 | 73 | 442 | 0 | -45 | 668 | 9,461 |
| Total per Mode | 1,158 | 1,033 | 3,148 | 2,274 | 109,273 | 1,028 | 9,562 | 0 | -630 | 9,356 | |
| **Overall Total (tonnes $CO_2e$)** | | | | | | | | | | | **136,201** |

*-Construction was assumed to begin in 2010 and complete in 2013 in the Dillon 2011 Report. The Project P1 is under construction and expected to complete in 2020.

### TABLE 4.2: ASR SCENARIO GHG EMISSIONS FOR P1 PROJECT

| PERIOD | GHG EMMISIONS (Tonnes CO2e) | | | | | | | | | | TOTAL PER YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ASR Road | Vehicular Use | Vehicular Use | Vehicular Use | Ferry | Air | Land | Forest | Forest | Wetland | |
| | Construction | ASR | Winnipeg Connect. | PTH 8 + PR 234 | Operation | Travel | Clearing | Biomass Decomposition | Carbon Sequestration | Net GHG Emissions | (Tonnes CO2e) |
| **Construction** | | | | | | | | | | | |
| 2010 | 11,685 | 0 | 0 | 0 | 0 | 0 | 1,361 | 637 | 0 | 488 | 14,170 |
| 2011 | 11,685 | 0 | 0 | 0 | 0 | 0 | 1,361 | 0 | 0 | 488 | 13,533 |
| 2012 | 11,685 | 0 | 0 | 0 | 0 | 0 | 1,361 | 0 | 0 | 488 | 13,533 |
| 2013 | 11,685 | 0 | 0 | 120 | 49 | 838 | 1,361 | 0 | 0 | 488 | 14,541 |
| **Operation** | | | | | | | | | | | |
| 2014 | 0 | 5,921 | 4,274 | 69 | 24 | 155 | 0 | 0 | -13 | 488 | 10,918 |
| 2015 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| 2016 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| 2017 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| 2018 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| 2019 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| 2020 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| 2021 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| 2022 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| 2023 | 0 | 5,921 | 4,274 | 0 | 0 | 0 | 0 | 0 | -13 | 488 | 10,670 |
| Total per Mode | 46,739 | 59,213 | 42,735 | 189 | 74 | 993 | 5,443 | 0 | -132 | 6,830 | |
| **Overall Total (tonnes $CO_2e$)** | | | | | | | | | | | **162,720** |

*-Construction was assumed to begin in 2010 and complete in 2013 in the Dillon 2011 Report. The Project P1 is under construction and expected to complete in 2020.

### TABLE 4.3: BASELINE SCENARIO GHG EMISSIONS FOR P4 PROJECT

| PERIOD | GHG ESTMATE (TONNE CO2e) | | | | | | | | TOTAL PER YEAR (TONNE CO2e) |
|---|---|---|---|---|---|---|---|---|---|
| | Ice & Winter Rd Construction | Ice & Winter Rd Maintenance | Vehicular Use Ice Road & Winter | Air Travel | Land Clearing | Forest Biomass decomp | Forest Carbon Sequestration | Wetland Methane Emissions | |
| **Construction** | | | | | | | | | |
| Year 1 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 2 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 3 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 4 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 5 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 6 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 7 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| **Operation** | | | | | | | | | |
| Year 1 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 2 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 3 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 4 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 5 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 6 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 7 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 8 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 9 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Year 10 | 80 | 73 | 806 | 3,116 | 0 | 0 | -27 | 403 | 4,450 |
| Total per Mode | 1,356 | 1,233 | 13,702 | 52,969 | 0 | 0 | -461 | 6,853 | |
| **Overall Total (tonne CO2e)** | | | | | | | | | **75,651** |

### TABLE 4.4: ASR SCENARIO GHG EMISSIONS FOR P4 PROJECT

| PERIOD | GHG ESTMATE (TONNE CO2e) | | | | | | | TOTAL PER |
|---|---|---|---|---|---|---|---|---|
| | ASR Road | Vehicular Use | Air | Land | Forest | Forest | Wetland | YEAR |
| | Construction | ASR | Travel | Clearing | Biomass decomp | Carbon Sequestration | Methane Emissions | (TONNE CO2e) |
| **Construction** | | | | | | | | |
| Year 1 | 4,028 | 0 | 3,116 | 469 | 384 | 0 | 294 | 8,291 |
| Year 2 | 4,028 | 0 | 3,116 | 469 | 0 | 0 | 294 | 7,907 |
| Year 3 | 4,028 | 0 | 3,116 | 469 | 0 | 0 | 294 | 7,907 |
| Year 4 | 4,028 | 0 | 3,116 | 469 | 0 | 0 | 294 | 7,907 |
| Year 5 | 4,028 | 0 | 3,116 | 469 | 0 | 0 | 294 | 7,907 |
| Year 6 | 4,028 | 0 | 3,116 | 469 | 0 | 0 | 294 | 7,907 |
| Year 7 | 4,028 | 0 | 3,116 | 469 | 0 | 0 | 294 | 7,907 |
| **Operation** | | | | | | | | |
| Year 1 | 0 | 717 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 2 | 0 | 717 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 3 | 0 | 7174 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 4 | 0 | 7174 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 5 | 0 | 717 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 6 | 0 | 717 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 7 | 0 | 717 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 8 | 0 | 717 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 9 | 0 | 717 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Year 10 | 0 | 717 | 623 | 0 | 0 | -8 | 294 | 1,626 |
| Total per Mode | 28,193 | 7,169 | 28,042 | 3,283 | 384 | -80 | 5,002 | |
| **Overall Total (tonne CO2e)** | | | | | | | | **71,994** |

### TABLE 4.5: BASELINE SCENARIO GHG EMISSIONS FOR P7 PROJECT

| PERIOD | GHG ESTMATE (TONNE CO2e) | | | | | | | | TOTAL PER YEAR (TONNE CO2e) |
|---|---|---|---|---|---|---|---|---|---|
| | Ice & Winter Rd Construction | Ice & Winter Rd Maintenance | Vehicular Use Ice Road & Winter | Air Travel | Land Clearing | Forest Biomass decomp | Forest Carbon Sequestration | Wetland Methane Emissions | |
| **Construction** | | | | | | | | | |
| Year 1 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 2 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 3 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 4 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 5 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 6 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 7 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| **Operation** | | | | | | | | | |
| Year 1 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 2 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 3 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 4 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 5 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 6 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 7 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 8 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 9 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Year 10 | 119 | 108 | 1,701 | 4,065 | 0 | 0 | -38 | 561 | 6,516 |
| Total per Mode | 2,019 | 1,836 | 28,910 | 69,103 | 0 | 0 | -642 | 9,540 | |
| **Overall Total (tonne CO2e)** | | | | | | | | | **110,765** |

### TABLE 4.6: ASR SCENARIO GHG EMISSIONS FOR P7 PROJECT

| PERIOD | GHG ESTMATE (TONNE CO2e) | | | | | | | TOTAL PER |
|---|---|---|---|---|---|---|---|---|
| | ASR Road | Vehicular Use | Air | Land | Forest | Forest | Wetland | YEAR |
| | Construction | ASR | Travel | Clearing | Biomass decomp | Carbon Sequestration | Methane Emissions | (TONNE CO2e) |
| **Construction** | | | | | | | | |
| Year 1 | 5,607 | 0 | 4,065 | 653 | 535 | 0 | 410 | 11,269 |
| Year 2 | 5,607 | 0 | 4,065 | 653 | 0 | 0 | 410 | 10,734 |
| Year 3 | 5,607 | 0 | 4,065 | 653 | 0 | 0 | 410 | 10,734 |
| Year 4 | 5,607 | 0 | 4,065 | 653 | 0 | 0 | 410 | 10,734 |
| Year 5 | 5,607 | 0 | 4,065 | 653 | 0 | 0 | 410 | 10,734 |
| Year 6 | 5,607 | 0 | 4,065 | 653 | 0 | 0 | 410 | 10,734 |
| Year 7 | 5,607 | 0 | 4,065 | 653 | 0 | 0 | 410 | 10,734 |
| **Operation** | | | | | | | | |
| Year 1 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 2 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 3 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 4 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 5 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 6 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 7 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 8 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 9 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Year 10 | 0 | 1,701 | 813 | 0 | 0 | -11 | 410 | 3,001 |
| Total per Mode | 39,249 | 28,910 | 36,584 | 4,570 | 535 | -111 | 6,964 | |
| **Overall Total (tonne CO2e)** | | | | | | | | **105,687** |

**TABLE 4.7: BASELINE SCENARIO GHG EMISSIONS FOR P7A PROJECT**

| PERIOD | GHG ESTMATE (TONNE CO2e) | | | | | | | TOTAL PER |
|---|---|---|---|---|---|---|---|---|
| | Ice & Winter Rd | Ice & Winter Rd | Vehicular Use | Air | Land | Forest | Wetland | YEAR |
| | Construction | Maintenance | Ice Road & Winter | Travel | Clearing | Carbon Sequestration | Methane Emissions | (TONNE CO2e) |
| **Construction** | | | | | | | | |
| Year 1 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 2 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 3 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 4 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| | | | | | | | | |
| **Operation** | | | | | | | | |
| Year 1 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 2 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 3 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 4 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 5 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 6 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 7 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 8 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 9 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Year 10 | 14 | 13 | 203 | 492 | 0 | -11 | 156 | 868 |
| Total per Mode | 198 | 181 | 2,843 | 6,889 | 0 | -147 | 2,183 | |
| **Overall Total (tonne CO2e)** | | | | | | | | **12,147** |

**TABLE 4.8: ASR SCENARIO GHG EMISSIONS FOR P7A PROJECT**

| PERIOD | GHG ESTMATE (TONNE CO2e) | | | | | | | TOTAL PER |
|---|---|---|---|---|---|---|---|---|
| | ASR Road | Vehicular Use | Air (Helicopter) | Land | Forest | Forest | Wetland | YEAR |
| | Construction | ASR | Travel | Clearing | Biomass decomp | Carbon Sequestration | Methane Emissions | (TONNE CO2e) |
| **Construction** | | | | | | | | |
| Year 1 | 1,558 | 0 | 492 | 181 | 149 | 0 | 114 | 2,494 |
| Year 2 | 1,558 | 0 | 492 | 181 | 0 | 0 | 114 | 2,345 |
| Year 3 | 1,558 | 0 | 492 | 181 | 0 | 0 | 114 | 2,345 |
| Year 4 | 1,558 | 0 | 492 | 181 | 0 | 0 | 114 | 2,345 |
| | | | | | | | | |
| **Operation** | | | | | | | | |
| Year 1 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 2 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 3 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 4 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 5 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 6 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 7 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 8 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 9 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Year 10 | 0 | 107 | 98 | 0 | 0 | -3 | 114 | 316 |
| Total per Mode | 6,232 | 1,070 | 2,952 | 726 | 0 | -31 | 1,594 | |
| **Overall Total (tonne CO2e)** | | | | | | | | **12,691** |

**TABLE 4.9: CUMULATIVE NET CHANGE IN ANNUAL GHG EMISSIONS**

| Project | Period | ASR ANNUAL GHG EMISSIONS (TONNE CO2e) | BASELINE ANNUAL GHG EMISSIONS (TONNE CO2e) | DIFFERENCE BETWEEN ASR AND BASELINE (TONNE CO2e)** |
|---|---|---|---|---|
| P1 | Construction* | 7,968 | 5,746 | 2,222 |
| | Operation | 10,694 | 9,598 | 1,097 |
| P4 | Construction | 7,962 | 4,450 | 3,511 |
| | Operation | 1,626 | 4,450 | -2,824 |
| P7 | Construction | 10,811 | 6,516 | 4,295 |
| | Operation | 3,001 | 6,516 | -3,515 |
| P7a | Construction | 2,382 | 868 | 1,515 |
| | Operation | 316 | 868 | -551 |
| ALL PROJECTS | Construction | 29,123 | 17,580 | 11,543 |
| | Operation | 15,637 | 21,432 | -5,794 |

* Construction was assumed to begin in 2010 and completed in 2013 in the Dillon 2011 Report. The Project P1 is under construction and expected to be completed in 2020. The annual GHG emissions were prorated from 4 years to 7 years.
** Negative number indicates reduction in GHG emissions with ASR in operation.

# 5.0 Recommendations for Mitigation and Monitoring

GHG emissions due to the construction and operational phases of the Projects can be partially mitigated through the adoption of best management practices and GHG offsets. The following sections explore some of the potential options for the reduction of GHG emissions due to the Projects.

## 5.1 Construction Phase

During the construction of the ASR, construction best management practices should be followed in order to abate GHG emissions (US EPA, 2009) and include but are not limited to:

- Maintenance and upkeep of all construction equipment in order to meet performance standards set by the manufacturers of the equipment. This will result in efficient use of fuel when the equipment is in operation. Poorly maintained equipment will result in the inefficient use of fuel and the associated increase in GHG emissions.
- Properly size the equipment for the task. Over-sizing or under-sizing the equipment results in excess fuel being consumed and burned.
- Replacing or rebuilding old equipment with more fuel efficient new equipment. The fuel economy, emission rates, and maintenance costs will then be brought up to the current standard resulting in overall lower GHG emissions.
- Driver/operator training for the correct/optimal operation of equipment under different operating conditions. Fuel savings and hence reductions in GHG emissions can be realized through driver/operator training in order to correctly position, operate, and optimize the equipment under different operating conditions. The US EPA (2009) estimated that a typical excavator can save approximately 3 – 8 % in fuel use per year with correct operator training.
- Anti-idling policy for all mobile equipment. Idling of equipment when not in use will result in unnecessary fuel being burned and GHG emissions. Anti-idling policies typically limit the maximum idling time to between 3 and 5 minutes. This policy is especially effective in mitigating GHG emissions during the non-winter months. The installation of fuel-efficient auxiliary power for comfort heating and cooling for equipment operators can also be used in order to abate GHG emissions.
- Bussing of construction crew to the construction site and the remote work camp accommodation will reduce the use of private or individual vehicle travel to such sites on a daily basis thereby reducing overall GHG emissions.
- Alternatives to diesel generators. Use of dual fuel (natural gas / propane and diesel) generators can significantly reduce GHG emissions in comparison to diesel generators.

The US EPA (2009) estimated an approximate 30 % reduction in emissions for a large 500 kW generator.

- Materials selection, procurement and shipping should be optimized in order to minimize the environmental impact of such activities. It is noted that the aggregate and potentially other materials for the construction of the ASR is accessed from nearby site(s). This will therefore help to abate the GHG emissions associated with transportation.

## 5.2 Operations Phase

GHG emissions during the operation of the ASR can be partially mitigated or offset through the following:

- Inter-community Transit. Private bus transit between Winnipeg and First Nation Communities may potentially become economical. Such commuting has the potential to reduce the number of vehicles using the ASR.
- On-going maintenance of the ASR to provide an optimal (i.e., smooth) running surface.
- Carbon offsets through afforestation/revegetation. The GHG emissions due to the Projects have included a carbon offset due to afforestation/revegetation of disturbed land.
- It is recommended that the wetland areas within the ROW remain as wetlands in order to maintain their carbon sequestration potential. Provisions for the management of flows (e.g. equalization culverts) should be considered to protect and preserve the wetlands systems through appropriate design measures.

## 5.3 Monitoring

In order to improve upon the accuracy of this GHG assessment and to determine the effect of potential mitigation plans and offsets, it is recommended that monitoring of the Projects with respect to GHG emissions inventory calculations and verification be conducted. This procedure includes the development of Best Management Practices for the construction and operational phase of the Projects as outlined above.

This program to collect data pertaining to the construction phase should be extended to include data on air, water and vehicle travel volumes and statistics once the ASR is open to the public (i.e., during the operations phase of the Projects). This will allow for the recalculation of the GHG inventory of the operations phase of the Projects and evaluate potential abatement measures as outlined above.

The reassessment of the GHG emissions inventory will assist in evaluating the potential for carbon offsets, if considered necessary, as well as the potential to participate in any future Provincial, regional (e.g., Western Climate Initiative), and national carbon cap and trade system.

# 6.0 Conclusions and Limitations

The GHG assessment estimated the total direct and indirect GHG emissions due to the Projects and compared this estimate with the GHG emissions (direct and indirect) under the business as usual Baseline scenario (i.e., without the Projects). The assessment was conducted over the time period of construction and 10 years of operation of the ASR.

The Baseline scenario resulted in a total of approximately 17,580 and 21,432 tonnes CO2e being emitted annually during the periods of time when the construction phases and operational phases, respectively, would have been occurring for the four projects (assuming all four projects would have been under construction and operation at the same time, i.e., 'worst-case scenario'). The Projects scenario was estimated to emit a total of approximately 29,123 and 15,301 tonnes $CO_2e$ annually for the same periods. The net cumulative change in GHG emissions due to the Projects was therefore estimated to be approximately -6,128 tonnes (kt) $CO_2e$ annually. The significant portions of the GHG emission during the construction period are due to the construction of the ASR. The construction of the ASR was estimated to increase the Province's construction based GHG emissions by approximately 12 % based on the 2008 estimates of 0.098 Mt $CO_2e$. This increase is temporary so that once construction of the ASR has been completed it would result in the reduction of the Province's construction-based GHG emissions. Another increase is the estimated vehicular traffic between Winnipeg and Poplar River. However, the anticipated improvements in future vehicular technology that result in emissions reductions have not been included in this assessment. Approximately after 13 years of operation of all four projects, a net reductions in annual GHG emissions by 6,128 tonnes CO2e, which is about a reduction of 0.1% of the Province's total GHG emissions of 5.13 Mt CO2e due to road transportation in 2008, will be realized. Given that there would be a temporary overall increase in GHG emissions during the construction phase of the ASRs, but an overall decrease in GHG emissions during the operation years of the ASRs, the change in GHG emissions would not result in a detectable increase in greenhouse gas accumulations within the global atmosphere and therefore would not influence climate change.

Potential GHG emissions abatement and / or offsets during the construction and operational phases of the Projects were suggested. In particular, construction best management practices may help to reduce the GHG emissions associated with this phase of the Projects. For the operational phase of the projects, preservation of the wetland areas surrounding the ASR, revegetation of disturbed areas, inter-community transit service, and on-going maintenance of a smooth running surface on the gravel road may potentially reduce the GHG emissions during this phase of the Projects. Recommendations on developing mitigation plans and policies, monitoring and data collection, and verification were provided. This will help to verify the initial estimates of the GHG emissions associated with the Projects provided in this report and

assist in positioning the Province to participate in future provincial, regional and federal carbon trading mechanisms.

It should be noted that the assessment was limited by the assumptions made in the study methodology as a result of data limitations. These assumptions included those made in the calculations of the biogenic sources and sinks, calculations related to the construction of the seasonal (winter and ice) road, seasonal road traffic volumes, and the changes in air and vehicular traffic volumes as a result of the operation of the ASR. The study also did not consider the changes in travel patterns, potential development along the PR 304 and other routes from Winnipeg, and potential development within the First Nation Communities as a result of the increased ease in commuting on the resulting GHG emissions due to the Projects. Calculations of GHG emissions from the biogenic sources and sinks, construction and maintenance activities for P4, P7 and P7a were prorated based on the detailed calculations for Project P1. The projects will not be in operation at the same time. However, the differences in GHG emissions in different years were not considered.

# 7.0 Closure

This GHG assessment report has been prepared based on the information provided and/or approved by the East Side Road Authority. This report is intended to provide a high level assessment of net GHG emissions resulting from the construction of the ASR Projects, based on the limited available data. This report was prepared by Dillon for the sole benefit of the East Side Road Authority as supporting documentation for the EA Approvals process. The material in the report reflects Dillon's judgment in context of the limited information available to Dillon at the time of this report preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

# 8.0 References

Dillon 2011 Report, PR304 to Berens River All-Season Road Environmental Impact Assessment Greenhouse Gas Emission Assessment Dillon Report No. 10-3402, July 2011.

Manitoba Infrastructure and Transportation (MIT), Government of Manitoba: Aircraft Movement for 2000, http://www.gov.mb.ca/mit/namo/air/movement.html, accessed September 2015.

US EPA, 2009: Potential for Reducing Greenhouse Gas Emissions in the Construction Sector, February 2009, 45 pp.

# Appendix 13-6

## Mineral Disposition Sites

# Project 4
## - Cumulative Effects Assessment Spatial Area -
## - Mineral Dispositions -

N

Poplar River FN

Poplar River

Berens River FN

Berens River

Pigeon River

Lake Winnipeg

Pauingassi FN

Little Grand Rapids FN

Bradbury River

Princess Harbour NAC

Bloodvein FN

Longbody Creek

Bloodvein River

Loon Straits NAC

Loon Creek

Atikaki Provincial Park

Hollow Water FN

Wanipigow River

304

304

P4 Cumulative Effects Assessment Spatial Area

Casual Quarry Permitted Area in P4 Cumulative Effects Assessment Spatial Area

Mine Site in P4 Cumulative Effects Assessment Spatial Area

Mining Claim in P4 Cumulative Effects Assessment Spatial Area

Quarry Lease in P4 Cumulative Effects Assessment Spatial Area

P4 All-Season Road Alignment

P1 - PR 304 to Berens River All-Season Road Alignment

P7a All-Season Road Alignment

Future P7 All-Season Road

2015/16 Manitoba Winter Road

First Nation Reserve Land

Northern Affairs Community (NAC)

0 10 20 30 40 50 Kilometres

MANITOBA East Side Road AUTHORITY

4 April 2016