Bipole III Transmission Project

Transportation Technical Report

MMM Group Limited
November 2011

BIPOLE III TRANSPORTATION TECHNICAL REPORT

Prepared for:

Manitoba Hydro

Submitted by:

MMM Group Limited

November 2011

5509033.002.502

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EXECUTIVE SUMMARY

This transportation study assessed the potential traffic and travel impacts associated with the construction of the Bipole III project, which has been defined herein as three primary components: (1) the Keewatinoow Converter Station; (2) the Riel Converter Station; and (3) the Bipole III HVDC transmission line. The smaller components also considered in this study include the Keewatinoow construction power line, the AC collector lines, the electrode lines, switchyard upgrades at Long Spruce and Henday, and the Keewatinoow Construction Power Station.

Existing Transportation Infrastructure

The existing transportation infrastructure in Manitoba and surrounding provinces is an integral part of the construction and operation of the Bipole III project. Significant workforce numbers and large quantities of materials are required to be transported into and throughout Manitoba by road, rail and air for the duration of the construction period. A summary of the likely transportation methods for the materials and workforce is provided below. The major transportation components required for the Bipole III project, including road, rail and air infrastructure, are illustrated on **Figures 2.1** and **6.1**. Constraints relating to truck weight restrictions and critical bridge clearances are discussed in **Section 2.1.3**.

Delivery of Materials:

- **Keewatinoow Converter Station**: Granular, steel, pre-cast concrete and other miscellaneous materials will likely be delivered by road using the provincial road network. The primary truck route between Winnipeg (at the Riel site) and the Keewatinoow site is illustrated on **Figure 2.1**. Large system electrical items such as transformers will be delivered by rail to the Henday Transfer Yard, using the Canadian National (CN) and Hudson Bay Railway (HBR) rail network, then by road along the Conawapa Access Road.

- **Riel Converter Station**: Materials will be delivered by rail using the Canadian Pacific (CP) and CN rail network or by road using the Trans-Canada Highway and the provincial road network.

- **Transmission Lines**: Materials will be delivered by road from the Riel marshalling yard to the various marshalling yard locations along the transmission line right-of-way. Assumed marshalling yard locations and associated truck routes have been identified in **Section 6.2** and illustrated on **Figure 6.1**.

Workforce Travel:

- **Keewatinoow Converter Station**: Daily workforce travel will be by bus or private vehicle. Significant weekly / monthly travel will also be expected by air via the Gillam and Thompson airports. Rail travel is expected to be minimal.

- **Riel Converter Station**: The majority of workforce travel to and from the site will be by private vehicle, with the majority of the workforce being based in Winnipeg. Some activity by air through the Winnipeg International Airport is anticipated for specialized trades, although this volume is expected to be minimal.

- **Transmission Lines**: Daily workforce travel will be by bus or private vehicle. Air travel is expected through various airports, depending on the location of the transmission line construction segment, with the majority of activity occurring at the start and end of each construction period.

Historical Flows

A review of recent and historical traffic volumes on Provincial Trunk Highway (PTH) 6, Provincial Road (PR) 280 and PR 290 was undertaken to gain an understanding of the traffic fluctuations that have occurred on the critical roads due to other large Manitoba Hydro projects completed in northern Manitoba. Based on the historical traffic flows, large Manitoba Hydro projects (in particular the Limestone Generating Station) appear to have generated a significant increase in base traffic volumes on provincial roads PR 280 and PR 290. Although some fluctuations have occurred on PTH 6 in the vicinity of Thompson, PTH 6 appears to be less sensitive to increased Manitoba Hydro traffic in comparison to other provincial roads in northern Manitoba. Similar proportional increases in traffic, although at a lower order of magnitude, are expected to be generated by the Bipole III project. Further discussion on the historical data and potential relationships is included in **Section 2.1.5**.

Collision Analysis

A collision analysis was undertaken for PR 280 and PR 290 to identify any road segments that have had poor historical collision levels. The analysis was limited to PR 280 and PR 290 as they are likely to be most impacted by the proposed Bipole III project due to the sustained and differential increase in traffic volumes over and following the construction period. The analysis was based on data collected by Manitoba Infrastructure and Transportation (MIT) between the years 1994 and 2006. Eight road segments of varying lengths along PR 280, and one road segment along PR 290, were assessed. The road segments are illustrated on **Figure 3.3**.

Based on the Annual Average Daily Traffic (AADT) and the number of collisions between 1994 and 2006, it was determined that PR 280 northwest of PR 290 has collision rates ranging from 1.7 million vehicle-kilomteres of travel (MVKT) to 2.0 MVKT (two of the eight segments on PR 280), which are above the generally accepted rate of 1.5 MVKT. Given that the remainder of the corridor is below 1.5 MVKT, these segments therefore require further investigation as to the higher collision rates. It is noted that the data provided by MIT did not include details on collision type or collision configuration (i.e., type of accident and potential cause). In order to provide a recommendation on the appropriate course of action, a detailed site investigation and review of the raw collision data would be required.

The collision rates on PR 280 (southwest of Split Lake), PR 280 (between Gillam and PR 290) and PR 290 are below 1.5 MVKT and are therefore considered satisfactory. It is noted that although the collision rate on PR 280 (southwest of Split Lake) is approaching 1.5 MVKT on some sections, surface improvements are being undertaken at various locations along this stretch of road (up to the Keeyask Generating Station access) as part of a funding agreement between Manitoba Hydro and MIT. These works may contribute to increased safety along the road corridor.

Traffic Impact - Construction

The daily traffic volumes for workforce and hauling traffic were estimated for each project component and are summarized in **Table 7.1**. From the analysis, the peak daily construction trips for each component of the project have been estimated as follows:

- **Keewatinoow Converter Station**: 335 light vehicle and 405 heavy vehicle daily trips in 2013.
- **Riel Converter Station**: 435 light vehicle and 30 heavy vehicle daily trips in 2014.
- **Transmission Lines**: 650 light vehicle and 10 heavy vehicle daily trips in 2015.

The total trips generated by workers and material delivery were combined and assigned to the provincial road network according to which routes are likely to be most attractive. For the purpose of this and other studies, the impact on the provincial road network has been reported by geographical area as construction overlap between each project component occurs throughout the construction period. For example, the construction traffic associated with the northern transmission lines overlaps with and is in addition to the construction traffic associated with the Keewatinoow Converter Station.

The geographical areas and the potential traffic impact, defined by MIT's design capacity (which does not reflect and is typically lower than actual capacity) of a road segment, are summarized as follows:

Keewatinoow Study Area (Refer to Figure 7.1)

The total daily traffic volumes are expected to be within the acceptable design capacities, as defined by MIT, of PR 280 and PR 290 for the majority of the construction season. During peak construction times, however, it is anticipated that the design capacity of a five to six kilometre section of PR 280 just east of Gillam (determined to be 500 vehicles per day (vpd)) could be exceeded by just 35 vpd. As these peak volumes are only expected over a relatively short time period during the construction period, and as the actual carrying capacity of PR 280 would be well beyond 500 vpd, the increased construction traffic volume resulting from Bipole III is not considered to warrant any significant road upgrades on this section of road, or any other provincial roads in the Keewatinoow study area.

Although no significant road works are warranted at this stage, it is recommended that PR 280 and PR 290 are monitored during the construction period for potential safety and maintenance issues. This includes regular monitoring of traffic volumes, particularly during the peak construction years of 2013 and 2014. A safety audit along the PR 280 corridor is also recommended to confirm that volumes slightly beyond the design capacity of 500 vpd are deemed acceptable. This audit may also highlight any potential road improvements that may be required in the short term to increase driver safety. Funding for any such road improvements should be reviewed on a case-by-case basis and would be subject to further discussions between MIT and Manitoba Hydro.

The total traffic volumes on the Conawapa access road during the peak construction season are significant, particularly truck traffic associated with hauling raw materials between the identified granular material sources (refer to **Appendix C**) and the Keewatinoow construction site. As this road was primarily designed to cater for large volumes of heavy vehicles, no capacity concerns are likely to arise due to the additional construction traffic. Appropriate design speeds and traffic signage should be erected in conjunction with the implementation of a traffic monitoring and maintenance program to ensure traffic is controlled and safety is maximized.

Riel Study Area (Refer to Figure 7.2)

MIT has recently upgraded PTH 15 between PTH 101 and PR 207, including the signalization of the PTH 15 and PR 207 intersection. These works are likely to alleviate any concerns associated with the additional Bipole III traffic, particularly the critical left-turn movement from PR 207 onto PTH 15.

Therefore, taking into consideration the above works and the anticipated construction traffic volumes, no additional works on the provincial road network are considered necessary in the Riel Study Area as a result of the Bipole III project.

A detailed review of volumes on PTH 101 and Trans-Canada Highway 1 was not undertaken as these highways have been designed to cater for high volumes of light and heavy vehicles and would be more than sufficient to manage any short-term increases in traffic associated with the construction of the Bipole III project.

Remainder of the Bipole III Transmission Line

The additional traffic generated during the peak construction period of the Bipole III project would result in an increase in traffic, of varying degrees, throughout the provincial road network.

Although the increase in daily traffic may be high on some roads (typically those roads with low background volumes), only PTH 10 between PTH 60 and PR 268 is likely to carry volumes in excess of its design capacity. However, given the future road works along PTH 10, the short-term duration of construction traffic, and the fact that the traffic volumes are only marginally over the design capacity, this section of PTH 10 would be expected to adequately accommodate the additional Bipole III traffic during the peak construction period. It is important to note that the design capacity on this road segment was exceeded prior to any additional construction traffic associated with Bipole III.

Therefore, it can be concluded that no additional works on the provincial road would be required as a consequence of the Bipole III project.

Traffic Impact - Operations and Maintenance Phase

The increase in traffic associated with the operations and maintenance phase of the Bipole III project is not expected to have a significant impact to the safety and efficiency of the provincial road network and, as such, no upgrades to the network are warranted.

Traffic Mitigation Measures and Monitoring

Based on the traffic volumes estimated in this report, the impact on the overall provincial road network is unlikely to be significant over the extended construction period. There will, however, be occasions where increased truck traffic volumes are experienced on the network when large quantities of material are required for a certain construction phase of the project. In order to minimize the impact of increased construction traffic on the road network, mitigation measures such as additional signage at truck access points (in accordance with Manual of Uniform Traffic Control Devices for Canada guidelines), appropriate access location and control, communication with the local governments and communities, and the preparation of a transportation plan highlighting driver protocol, truck traffic volumes and times, and road constraints (such as bridge clearances) and conditions on the identified routes, are recommended.

Throughout the construction period, and potentially during the initial stages of the operational and maintenance phase, it is recommended that a traffic monitoring and maintenance program be implemented. This could include regular traffic counts during the peak construction periods on selected roads in the vicinity of Keewatinoow Converter Station / Gillam and Riel Converter Station. The data obtained from the counts, such as vehicle type, direction of travel and frequency, could be used to assist in managing the movement of heavy vehicles on the road network and to better understand the potential capacity and safety implications of increased traffic during peak construction and hauling periods associated with the Bipole III project.

Monitoring and recording of collisions and/or near misses should also be undertaken throughout the construction period to try and establish any potential relationships between incidents and increased Bipole III construction traffic. Again, any found relationships could be used to potentially reduce collisions on the provincial road network as a consequence of the Bipole III project and any future projects proposed in Manitoba of a similar scale.

Monitoring of road conditions at all access points off the provincial and local road network, including a base inventory of existing conditions, is also recommended to ensure that all public roadways are maintained to an acceptable level and to ensure that all damaged road pavement is restored back to its original condition.

Rail Deliveries and Potential Impact

Construction

The HBR owns and operates a rail network comprised of approximately 1,300 km of rail line in central and northern Manitoba. The main line spans between The Pas and Churchill via the communities of Wabowden, Thompson, Pikwitonei, Kelsey, Ilford and Gillam. It is effectively a continuation of the CN rail line which terminates at The Pas. The CN line (up to The Pas) and the main HBR line will be used to transport the heavier electrical system components to the Limestone Transfer Yard, where the items will be transferred from rail to truck and then transported to the Keewatinoow Converter Station site.

The electrical system components required to be transported by rail to the Riel Converter Station site will primarily be achieved through the CN and CP railway networks.

Manitoba Hydro advised that approximately 60 electrical system components for the Riel and Keewatinoow converter stations will be transported by rail. Of this total, it was identified that approximately 40 components exceed the weight limits of the CN Rail network. These items will need to be transported using specially designed depressed rail cars.

The logistics of transporting these items requires further discussion between Manitoba Hydro, OmniTrax (the owners of HBR), CN rail, CP rail, suppliers of heavy duty rail cars, and the manufacturer/s of the identified components.

In relation to the existing rail operations, it would be expected that the transporting of all heavy items would be undertaken at low speeds and, as such, detailed scheduling would be required to ensure the impact to day-to-day operations, and particularly passenger rail operations, is minimized.

Operations and Maintenance

Putting aside any future requirement for the replacement of any electrical items, the additional demand on the existing rail network during the operation and maintenance phase is expected to be minimal and unlikely to interfere with the operation of any existing services. The transportation of any additional large items will need to be coordinated with the relevant railway agencies to ensure the impact on the existing commercial and passenger services are kept to a minimum.

Impact on Air Travel

Construction

Many of the workers travelling to and from the Keewatinoow Converter Station construction site are expected to travel by air via the Gillam airport. A significant amount of the work for the Keewatinoow Converter Station will require specialized trades from Winnipeg or other southern population centres. It is therefore expected that there will be a significant amount of passenger movement by air between Winnipeg and Gillam.

To ensure that capacity on the scheduled flights is still available for local residents, it is recommended that a regular charter service (weekly, bi-weekly or other regular time) to accommodate the bulk of the Bipole III project workforce be implemented. A similar strategy was implemented for the construction of the Wuskwatim Generating Station. A charter service would require close coordination between Manitoba Hydro and the relevant air carrier/s to ensure availability of the charter aircraft during the peak transfer times. Allowing a year lead time between coordination with the air carrier and the start of construction has proven to be effective for the Wuskwatim project and is recommended for the proposed Bipole III project.

An increase in passenger numbers between Winnipeg and Thompson, and potentially between Winnipeg and The Pas, due to the construction of the Bipole III Transmission Line is also expected. This increase, on average, is expected to be adequately accommodated on the scheduled air service. Charter services may be necessary for occasionally transporting larger groups; however, these services would mainly be warranted at either the start or end of construction of a transmission line segment.

Operation and Maintenance

An increase in air passengers between Winnipeg, Thompson, Gillam, and potentially The Pas is expected to marginally increase as part of operations and maintenance of the Bipole III infrastructure. This increase in passenger demand is unlikely to warrant additional flights and should be accommodated within the scheduled passenger flight services.

Cumulative Impact of Major Manitoba Hydro Projects

The preliminary construction schedules of the Bipole III Transmission Line, Keewatinoow Converter Station, Keeyask Generating Station and Conawapa Generating Station were reviewed to understand the peak activity time periods for the construction of other current and proposed Manitoba Hydro projects. **Table 10.1** outlines the potential schedules for these projects and identifies critical time periods. As highlighted in this table, the period between 2014 and 2020 would be the most critical when considering the traffic impact on the provincial road network, particularly in the vicinity of Gillam, PR 280 and PR 290.

As determined in this report, PR 280 between PR 290 and the access to the proposed Keeyask Generating Station has been identified as having a high historical crash rate. Also, it was estimated that a five to six kilometre section of PR 280 just east of Gillam may exceed its design capacity during peak construction times of the Bipole III project. In order to ensure the safety of all road users in the Keewatin study area as part of Bipole III project, further review of the critical sections of PR 280, and potentially PR 290, is recommended.

Demand on air travel will also be exacerbated when considering the cumulative impacts of all Manitoba Hydro projects proposed in northern Manitoba. It is unlikely that the additional passenger demand associated with all future projects can be accommodated within the scheduled flight services. Therefore, similar to the recommendation for the Bipole III project, an implementation of a regular charter service will most likely be required. The frequency of this service would be subject to actual demand.

Material quantities and method of transportation for the Keeyask and Conawapa generating stations have not been reviewed in detail within this report. It is therefore unknown what level of train traffic would be generated by these projects. Similar to the recommendations for the Bipole III project, detailed scheduling with the relevant authorities would be required to ensure the impact on day-to-day operations, and particularly passenger rail operations, is minimized.

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1.0 INTRODUCTION

This study provides an overall review of the transportation and travel aspects associated with the proposed Bipole III transmission project. It assesses the potential traffic and travel impacts from the following three main components, and associated activities, of the project:

- Keewatinoow Converter Station;
- Riel Converter Station; and
- The Bipole III HVDC transmission line.

The smaller components also considered in this study include the Keewatinoow construction power line, the AC collector lines, the electrode lines, switchyard upgrades at Long Spruce and Henday, and the Keewatinoow Construction Power Station.

The construction of each component is distinct when relating to traffic volumes, traffic types, travel patterns and mode choice. With reference to *"Bipole III Transmission Project: A Major Reliability Improvement Initiative Project Description"* (referred to herein as the Project Description), and by utilizing data provided by Manitoba Hydro, additional workforce and truck traffic volumes for each year of construction were estimated, and the likely impact of this traffic on the operational efficiency and safety of the provincial road network was assessed. A review of load restrictions for hauling large items and materials has also been included within this report.

This study also provides a general overview of the likely impact to the rail and air infrastructure and any limitations that may exist for transporting either materials or people to and from the construction sites.

This study is to be used for planning purposes only and is not to be used for implementation. It is important to note that many assumptions adopted herein were based on limited supporting data as some data would only be available at the discretion of the actual contractor (yet to be awarded) for each component of the project. This study may be refined once further information regarding the dynamics of certain aspects of the project is made available.

The Summary of Findings is included in **Section 11** of this report. A glossary of relevant transportation terms and acronyms is included in Appendix A.

2.0 EXISTING TRANSPORTATION INFRASTRUCTURE

The existing transportation infrastructure in Manitoba and surrounding provinces is an integral part of the construction and operation of the Bipole III project. Significant workforce numbers and large quantities of materials are required to be transported into and throughout Manitoba by road, rail or air for the duration of the construction period. A summary of the likely transportation methods for the materials and workforce is provided below. The major transportation components required for the Bipole III project, including road, rail and air infrastructure, are illustrated on **Figures 2.1** and **6.1**.

Delivery of Materials:

- **Keewatinoow Converter Station**: Granular, steel, pre-cast concrete and other miscellaneous materials will likely be delivered by road using the provincial road network. The primary truck route connecting Winnipeg to Keewatinoow is illustrated on **Figure 2.1**. Large system electrical items such as transformers will be delivered by rail to the Henday Transfer Yard, using the Canadian National (CN) and Hudson Bay Railway (HBR) rail networks, then by road along the Conawapa Access Road.
- **Riel Converter Station**: Materials will be delivered by rail using the Canadian Pacific (CP) and CN rail network or by truck using the TransCanada Highway and provincial road network.
- **Transmission Lines**: Materials will be delivered by road from the Riel marshalling yard to the various marshalling yard locations along the transmission line right-of-way (ROW). Assumed marshalling yard locations and associated truck routes have been identified in **Section 6.2** and illustrated on **Figure 6.1**.

Workforce Travel:

- **Keewatinoow Converter Station**: Daily workforce travel will be by bus or private vehicle. Significant weekly/monthly travel by air via the Gillam and Thompson airports is also expected. Rail travel is expected to be minimal.
- **Riel Converter Station**: The majority of workforce travel to and from the site will be by private vehicle, with the majority of the workforce being based in Winnipeg. Some activity by air through the Winnipeg International Airport is anticipated for specialized trades, although this volume is expected to be minimal.
- **Transmission Lines**: Daily workforce travel will be by bus or private vehicle. Air travel is expected through various airports depending on the location of transmission line construction segment, with the majority of activity occurring at the start and end of each construction period.

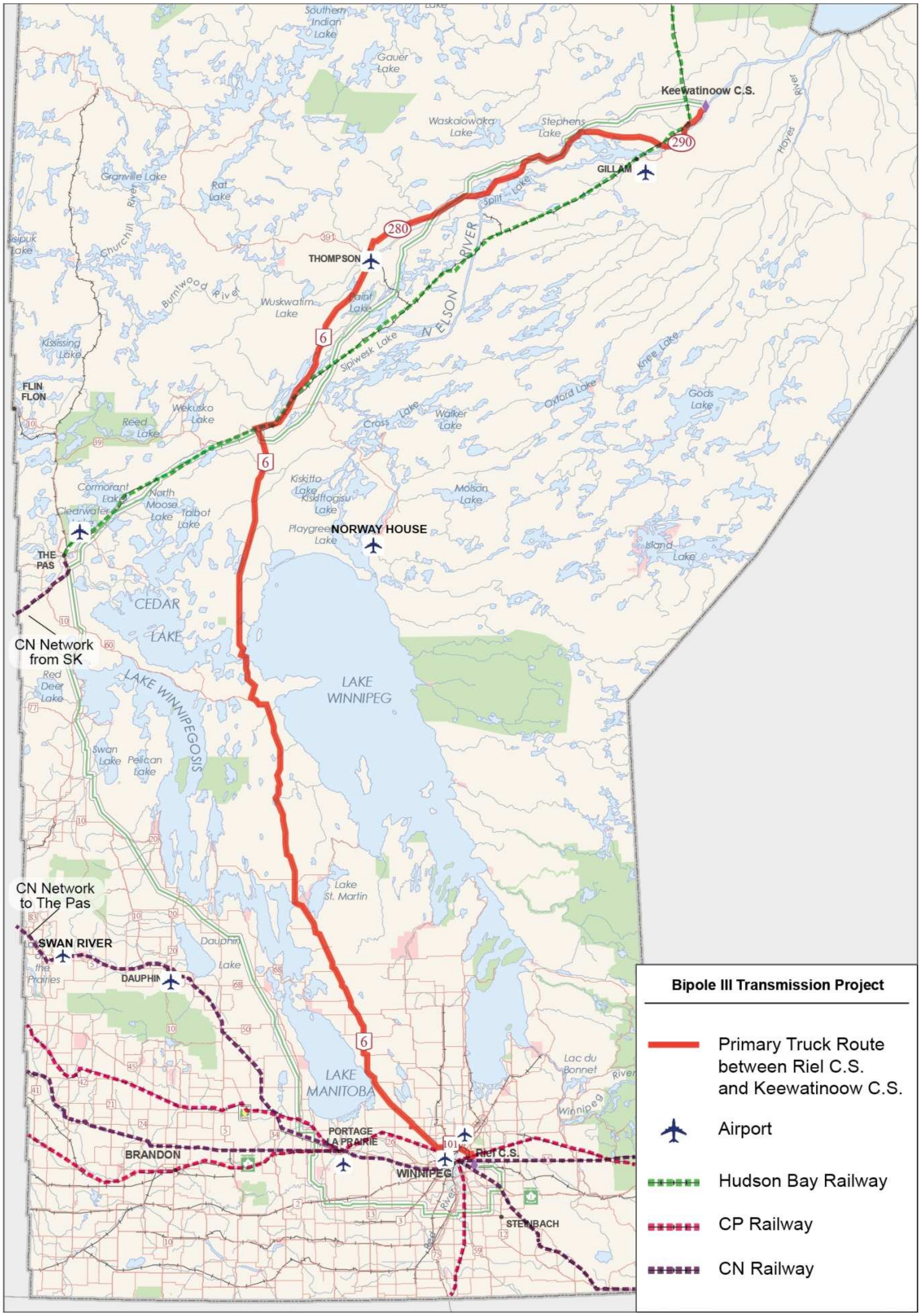

Figure 2.1: Existing Major Transportation Infrastructure Relevant to Bipole III

2.1 Traffic

2.1.1 Existing Provincial Road Network

The primary roads required for the construction of the Bipole III project include Provincial Road (PR) 207, Provincial Trunk Highway (PTH) 15, PTH 101, PTH 6, PR 391, PR 280, and PR 290 (refer to **Figure 2.1**). In addition to the primary routes, a number of other provincial roads will be required for the construction of the central and southern sections of the transmission line. These roads include, but are not limited to, PTH 1, PTH 5, PTH 10, PTH 16, PTH 20, PTH 50 and PTH 60. These roads are highlighted on **Figure 6.1** in this report. A complete list of the relevant provincial roads are expected to be used during construction of the Bipole III project is included in **Appendix E**. The provincial road network is illustrated in **Appendix D** of this report.

A brief description of each of the provincial roads forming the primary truck route for the Bipole III project is provided below:

PR 207 is a two-lane paved road that is classified by Manitoba Infrastructure and Transportation (MIT) as a Collector “A”. Direct vehicular access to the Riel Converter Station site is available off PR 207, south of PTH 15.

PTH 15 is a two-lane paved roadway that is classified by MIT as a Primary Arterial. It is an east-west road located just north of the Riel Converter Station site.

PTH 6 is a two-lane paved roadway that is classified by MIT as a Primary Arterial. This highway is the only route between Winnipeg and Thompson and also serves to connect Winnipeg with most of the communities north of the Interlake area.

PR 391 between Thompson and PR 280 is a two-lane roadway with a paved surface and is classified by MIT as a Secondary Arterial. This highway connects Thompson to PR 280, and is part of the route between Thompson and Gillam.

PR 280 is a two-lane gravel roadway and is classified by MIT as a Secondary Arterial. Along with PR 391, PR 280 serves as the only connection between Thompson and Gillam and runs roughly parallel to the route of Bipole III, with the proposed transmission line passing over the highway in three locations.

PR 290 is a two lane gravel roadway and is classified by MIT as a Secondary Arterial. This highway connects PR 280 (just north of the Long Spruce Generating Station) to a number of Manitoba Hydro facilities in the area and the Conawapa Access Road. The Conawapa Access Road provides access to the Keewatinoow Converter Station site and the starting point of the proposed Bipole III transmission line.

2.1.2 Current and Identified Highway Renewal Projects

A number of provincial highways have been upgraded between 2007 and 2011 as part of the Provincial Government's Highway Renewal Plan. Improvements have been completed on highways that will be used as haul routes by construction traffic. These improvements are summarized below:

- PTH 6: Surface restoration at a number of locations between Winnipeg and Thompson.
- PR 207: Surface restoration between PTH 15 and PTH 1.
- PR 280: Spot improvements at various locations between PR 391 and the access to the proposed Keeyask Generation Station.

The province recently announced a continuation of the Highway Renewal Plan to 2015. The following construction projects have been identified as part of the 2011-2015 Highway Renewal Plan:

- PTH 1: Various pavement work, structure rehabilitation and intersection improvements at PR 207.
- PTH 5: Paving from PR 261 to PTH 19.
- PTH 6: Various pavement work, structure rehabilitation and intersection improvements between Winnipeg and Thompson.
- PTH 10: Various paving work between Swan River and PTH 60.
- PTH 16: Paving and widening between PTH 50 and PTH 5.
- Perimeter Highway (PTH 100 and PTH 101): Various intersection improvements and structure rehabilitations.

In addition to the works identified in the Highway Renewal Plan, MIT has recently upgraded PTH 15 between PTH 101 and PR 207 including the signalization of the PTH 15 and PR 207 intersection.

2.1.3 Existing Road Constraints

Weight Constraints

All materials transported by truck on provincial highways are subject to provincial weight restrictions. Weight restrictions on all provincial highways are classified as RTAC, A1 or B1. RTAC routes allow the heaviest Gross Vehicle Weights (GVW) while B1 routes allow the lightest. The exact weight allowed varies by vehicle type based on the axle configuration. Maps illustrating the truck loading classification for all provincial roads in Manitoba can be sourced from the MIT website at - http://www.gov.mb.ca/mit/mcd/mcpd/twlm.html. Bridge structures are generally able to accommodate at least the maximum GVW allowed on their respective highway.

During the course of the Bipole III Transmission Line project, Manitoba Hydro may need to operate overloaded vehicles on provincial highways, either by choice or while hauling overweight materials that are unable to be dismantled to within the identified weight restriction. Overweight vehicles can operate on provincial roads by one of the following three options:

Option 1 – Overweight Permit: Overweight Permits can be applied for and obtained from MIT for a fee in order to operate heavy vehicles on lower class highways. These permits would be appropriate for occasional trips or limited-time operations of overweight vehicles.

Option 2 – Trucking Productivity Improvement Fund (TPIF): The TPIF is a user-pay program that allows increased loading on lower class highways. The overweight trips result in accelerated infrastructure deterioration, which mean increased maintenance and restoration expenditures for MIT. An application describing the proposed operation and route must be submitted to MIT. The route would be analyzed and evaluated and a cost determined to offset the impact resulting from the overweight vehicles. If the application is approved, Manitoba Hydro would be responsible for paying a fee for every overweight vehicle trip on the provincial highway network. The TPIF would be appropriate for frequent operation of overweight vehicles on a certain route.

Option 3 – Highway Upgrades: Overweight haulers may also pay design and construction costs to MIT to upgrade a provincial highway to the desired weight classification. This is not recommended for the Bipole III project because all overweight hauling would be temporary and unlikely to warrant such an upgrade.

In addition to the RTAC, A1 and B1 loading classifications, vehicle weights on Manitoba highways are also dictated by Spring Road Restrictions (SRR) and an increased winter weight allowance. These restrictions are implemented to limit the weights on highways in the spring months when the subgrade of the pavement structure is saturated, causing the driving surface to be more susceptible to damage. The exact dates of the restrictions can vary by year depending on data collected by MIT and whether the highway in question is located in the northern or southern zone. In 2011, SRR were in place for both the northern and southern zones from March 31 to May 31. Every year, MIT publishes a list of highway segments indicating the level of restriction being imposed. Weights can either be restricted to Level 1 (90 percent of normal loading on non-steering axles) or Level 2 (65 percent of normal loading on non-steering axles).

During the winter months when the sub-grade layer is frozen, the pavement structure is able to support more weight. The winter weight allowance permits vehicles to increase their gross weight by ten percent from December 1 until February 28 or 29 with payment of the applicable fees to MIT.

Geometric Constraints

In addition to the general weight restrictions on Manitoba highways, vertical and horizontal clearances must be considered when transporting oversized equipment.

Specifically of interest are the cross-sectional road width of PR 280 and the vertical and horizontal clearances of the bridge structures over Odei River and Assean River. MIT provided information on the limitations of PR 280, indicating that the driving surface width of PR 280 is 9.8 m between PR 391 and Split Lake, reducing to 7.3 m between Spilt Lake and the Gillam area. MIT also provided the horizontal and vertical limitations of the two critical bridge structures along this route, as shown in **Table 2.1**.

Table 2.1: PR 280 Bridge Dimensions

Bridge	Location	Vertical Clearance (metres)	Horizontal Clearance (metres)
Odei River Bridge	42 kilometres east of PR 391	6.7	7.3
Assean River Bridge	16 kilometres east of Split Lake	6.7	7.3

It is noted that PR 280 is a Class A1 route; however, all bridges allow RTAC loading (additional loading permitted only through MIT approval).

No other geometric constraints were identified during the desk-top analysis; however, once the routes for transporting materials for the Bipole III project have been identified (when the marshalling yard locations have been confirmed), it is recommended that a detailed investigation of the geometric and loading constraints on all bridges and roads on the provincial and municipal road networks (and other relevant access roads) be undertaken.

2.1.4 Existing Traffic Flows

Current and historical traffic volumes in the study area were obtained from the Manitoba Highway Traffic Information System (MHTIS) website. They have been used to gain an understanding of the traffic flows on the provincial network and, as discussed in **Section 2.1.5**, how large construction projects, such as the Limestone Generating Station completed in the early 1990s, influenced the Annual Average Daily Traffic (AADT) volumes on the adjacent provincial road network.

The 2009 AADT volumes (the latest available traffic data) along the primary traffic route between Winnipeg and the Keewatinoow Converter Station, as well as the critical road segments likely to be impacted by the construction of the Riel Converter Station near Winnipeg, are summarized in **Table 2.2**. The background AADT volumes for all provincial highways expected to carry Bipole III traffic (including the primary route) are shown in **Appendix E**.

Table 2.2: 2009 AADT Volumes

Provincial Road	Location of Count	2009 AADT Volumes
PR 207	Between PTH 15 and Trans-Canada Highway 1	1,700
PTH 15	East of PR 207	8,150
	West of PR 207	9,810
PTH 101	South of PTH 15	8,190
	North of PTH 15	6,530
PTH 6	Northwest of PR 236 (near Winnipeg)	3,880
	South of PR 513	1,290
	South of PTH 39	380
	North of PTH 39	510
	South of Thompson	2,170
PR 391	South of Airport Access	3,180
	Between Airport Access and PR 280	1,230
PR 280	North of PR 391	190
	South of the Split Lake Reserve Access	160
	Northwest of PR 290, north of the Nelson River	70
	Southwest of PR 290, south of the Nelson River	170
	East of Radisson Converter Station	210
	East of Gillam	290
PR 290	East of PR 290	150
	PR 290 west of Sundance Creek (between the Limestone Generating Station and Sundance)	50

2.1.5 Historical Flows in Northern Manitoba Influenced by Manitoba Hydro Projects

Historical volumes obtained from the MHTIS website have been assessed to gain an understanding of the traffic fluctuations that have occurred on the critical roads due to other large Manitoba Hydro projects completed in northern Manitoba. The selected count stations are considered to adequately represent the historical traffic variations on the relevant roads in northern Manitoba. The change in AADT volumes for PTH 6, PR 280 and PR 290 are illustrated on **Figure 2.2**, **Figure 2.3 and Figure 2.4,** respectively.

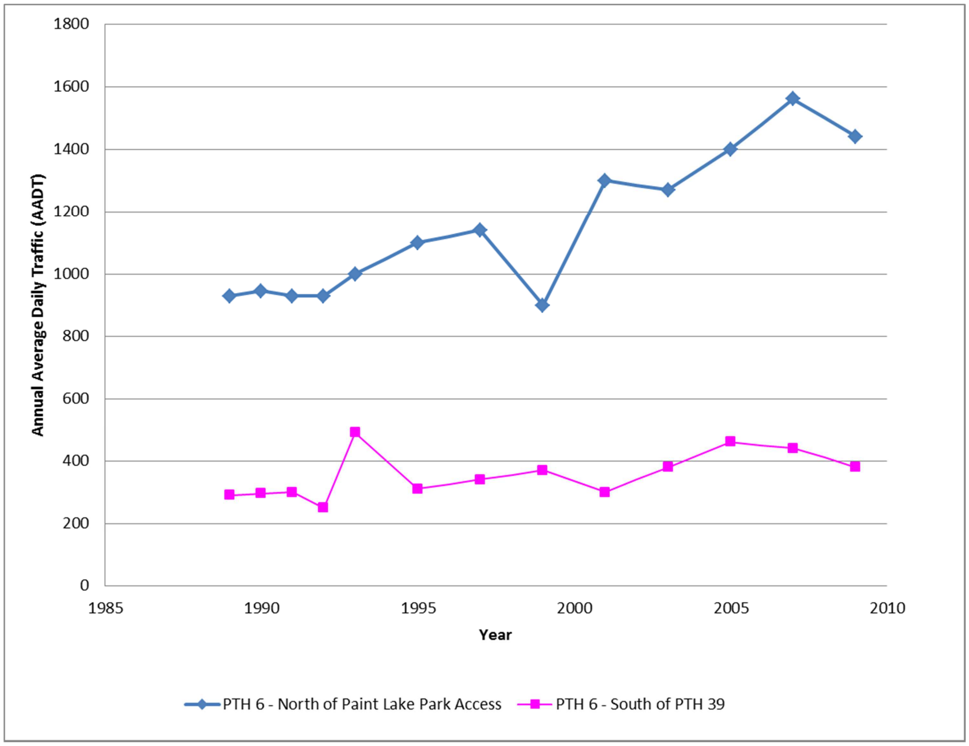

Figure 2.2: PTH 6 Historical AADT Volumes

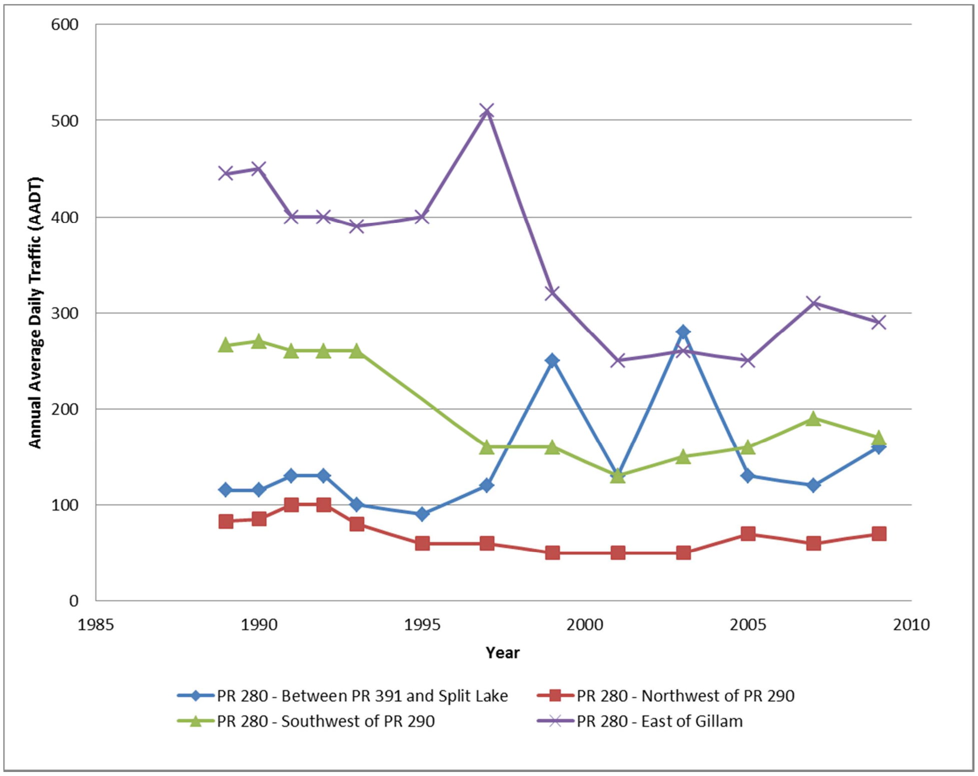

Figure 2.3: PR 280 Historical AADT Volumes

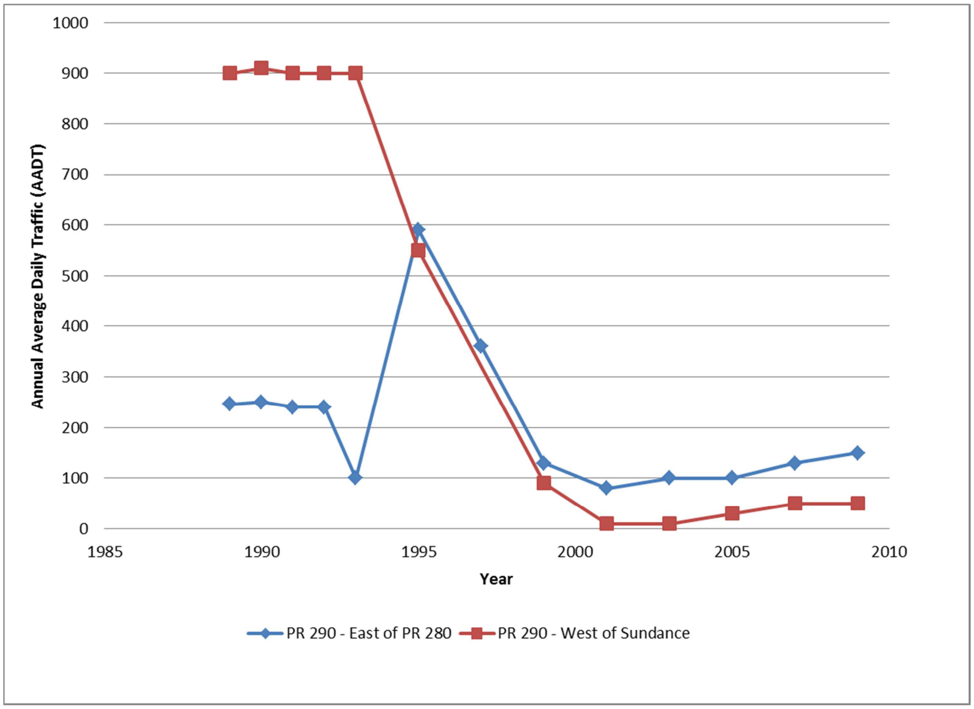

Figure 2.4: PR 290 Historical AADT Volumes

Construction periods of known major Manitoba Hydro projects in northern Manitoba between the mid-1980s and the present are provided below (source: Manitoba Hydro website, http://www.hydro.mb.ca/corporate/history/history_timeline.html):

- 1985 to 1992: Construction of the Limestone Generating Station.
- 1991: Start of construction for the 28 km access road to Conawapa.
- 1993: Construction of the 138-kV transmission line between Split Lake and Kelsey Generating Station.
- 2009: Start of construction of the Wuskwatim Generation Project.

As depicted in the above figures, large Manitoba Hydro projects have had a significant impact on traffic volumes on the provincial road network, in particular PR 280 and PR 290. Although some fluctuations have occurred on PTH 6, **Figure 2.2** illustrates that the traffic growth has been relatively consistent over the past 20 years. PTH 6 is less sensitive to increased Manitoba Hydro traffic than other provincial roads in northern Manitoba, primarily due to its higher road classification and higher background traffic volumes.

Due to its similar location, the increase in traffic volumes due to the construction of the Limestone Generating Station (refer to **Figure 2.3** and **Figure 2.4**), which officially opened in 1991 and was fully operational in 1992, is considered the most relevant when estimating the expected increase in traffic due to the construction of the Keewatinoow Converter Station and northern sections of the transmission line. It is also noted that construction of the Conawapa

Access Road began in 1991 which would have also influenced the volumes on PR 280 and PR 290.

A summary of the possible increase in traffic on PR 280 and PR 290 due to the construction of the Limestone Generating Station is included in **Table 2.3**.

Although it is difficult to draw direct comparisons between the two projects due to a number of unknowns, particularly for truck traffic, similar proportional traffic increases from the Bipole III project on the surrounding road network could be expected. Based on information provided by Manitoba Hydro, the total number of employees (excluding management and supervisory staff) working on the Limestone Generating Station project on March 31, 1990, was 413 employees, including Manitoba Hydro staff.

Based on the information provided by Manitoba Hydro, the peak quarterly workforce numbers expected in the vicinity of Gillam and the Keewatinoow Converter Station would be in the order of 650 employees, including Manitoba Hydro staff.

Therefore, on a pro-rata basis, which basically assumes that all trip characteristics and dynamics between the two projects are identical, the traffic increases on the surrounding road network during the peak quarter of the Bipole III project could be as shown in **Table 2.3**. It is important to note these volumes are for comparative purposes only and have not been used to assess the impact of the proposed Bipole III project on the surrounding road network. Detailed daily traffic generation estimates based on expected trip generating characteristics have been estimated through **Sections 4.0** to **7.0** in this report.

Table 2.3: Historical Traffic Volumes During the Construction of the Limestone Generating Station

Road	Count Location	AADT Volume in 1990 (During Limestone Construction Period)	Average AADT for Base Conditions (After Limestone Construction Period)[1]	Estimated Traffic Increase Due to Limestone Generating Station (AADT)	Traffic Increase from Bipole III Assuming the Same Trip Characteristics as Limestone
PR 280	Northwest of PR 290	85	60	25	39
	Southwest of PR 290	270	160	110	151
	East of Gillam	450	280	170	234
PR 290	East of PR 280	250	115	135	186
	West of Sundance	910	40	870	1197

1. These values depict the average daily volumes between 1999 and 2009, a period with minimal influencing traffic from the construction of major Manitoba Hydro or other projects. It is noted that limited counts were available for the years of 1994 to 1998 and that all available counts during this period, particularly between Gillam and Sundance, were likely influenced by other construction activities in the area.

The data shows that during the construction period:

- General increases in traffic (i.e., between 40 and 70 percent on top of base non-construction conditions) occurred on the identified segments of PR 280 in the vicinity of Gillam and PR 290.
- A general increase in traffic of approximately 70 percent occurred on PR 290, just east of its intersection with PR 280.
- A substantial increase in traffic (i.e., up to 18 times base non-construction conditions) occurred on PR 290 to the west of Sundance, the name adopted for the Limestone Generating Station construction camp. The significant increase was a result of the data collection point being located between the construction camp and the generating station worksite.

It is noted that a traffic comparison on PR 280 between PR 391 and Split Lake was not undertaken due to traffic influences from other activities / projects such as planning for the proposed Keeyask Generating Station, and potentially the increase in traffic from the winter road access to York Landing and Ilford (located near the Split Lake access).

2.2 Rail Network - Existing Infrastructure

The Hudson Bay Railway (HBR) owns and operates a rail network comprising of approximately 1,300 km of rail line in central and northern Manitoba. It is an important service for the movement of goods such as minerals, wood, wheat/grain, and petroleum products, as well as providing passenger service among regional communities. HBR is wholly owned by railroad holding company OmniTRAX.

The primary line runs between The Pas and Churchill via the communities of Wabowden, Thompson, Pikwitonei, Kelsey, Ilford and Gillam. A shorter line exists between The Pas and Flin Flon connecting the communities of Atik, Cranberry Portage, Sherritt Junction, and Channing. The primary HBR line connects to the CN rail network at The Pas.

The existing traffic volume on the HBR rail network is in the order of 17,000 to 19,000 car loads/year. At present, approximately 6,000 to 7,000 car loads per year of wheat/grain are transported to the Port of Churchill, which is expected to increase to approximately 9,000 car loads/year in the short term, independent of the Bipole III project. The busiest time of the year for rail traffic usually occurs between August and November when wheat/grain rail traffic is most active.

It is known that some system electrical components will be transported by rail using both the CN and HBR rail networks directly to the existing Henday Transfer Yard. The electrical components will then be transferred to truck and transported to the Keewatinoow Converter Station site.

Materials required to be transported by rail to the Riel Converter Station will be delivered directly to the Riel site via the CP and CN rail network (refer to **Figure 2.1** on page 3).

2.3 Air - Existing Infrastructure and Services (Northern Manitoba)

Thompson Airport

Thompson Airport is owned by the Thompson Regional Airport Authority (TRAA) and is the main transfer point for air travel in Northern Manitoba. It provides weekday and some weekend connections to regional destinations throughout Manitoba, as well as frequent, regular service to and from Winnipeg.

As part of the Airport Capital Assistance Program (ACAP), Thompson Airport is receiving in the order of $8.7 million for 2010 - 2011 safety related improvements. Completed ACAP projects at Thompson Airport include (but are not limited to) rehabilitation and paving of taxiways and runways, the upgrade of airport building amenities and airport systems, and the purchasing of airside maintenance equipment. [Reference: Thompson Airport official website, January 2011, http://www.thompsonairport.ca/news.html].

Passenger airlines that typically operate through Thompson Airport include Calm Air International (Calm Air), Perimeter Aviation LP (Perimeter Air), Missinippi Airways, and Fast Air Executive Aviation Services (Fast Air). Charter services are provided by all four airlines but only Calm Air and Perimeter Air provide scheduled service to and from Thompson. Cargo services are currently available through Calm Air, and Perimeter Air, and Missinippi Airways. Fast Air focuses on business travel and provides an air ambulance service (MedEvac) out of Thompson, Norway House and Winnipeg. Bases for Custom Helicopters, RCMP Air Division and the Manitoba Government also exist at the Thompson Airport.

Gillam Airport

The Gillam airport features a gravel runway and serves mostly commercial aircraft. The operations manager of the Gillam Airport was interviewed regarding the current operation and future capacity of the airport and it was indicated that an average of approximately 60 people arrive or depart from the airport on a daily basis. The facility is currently able to accommodate an increase in the number of airlines and flights. A significant increase to the population of Gillam may warrant an increase in airport staff and public parking. Increased air travel may also warrant a shuttle service to/from the airport, which was provided in the past but was discontinued due to lack of demand.

The peak activity time for the airport is in the autumn when students are returning to school.

Recent airport improvements include a new variety shop and upgraded runway lighting.

Airline Information and Schedule

Calm Air and Perimeter Air both offer scheduled services between Winnipeg, Thompson and Gillam. These services are summarized in **Table 2.4**. In addition to the scheduled services, a number of other airlines provide charter services to and from northern Manitoba.

Table 2.4: Existing Scheduled Flights between Winnipeg, Thompson and Gillam

Route	Airline	Number of Return Flights per Week	Approximate Passenger Capacity per Week (two-way)
Winnipeg / Thompson	Calm Air	60	2,312
	Perimeter Air *	10	370
Winnipeg / Gillam	Calm Air	12	408
Thompson / Gillam	Calm Air	10	340

* Perimeter flights between Winnipeg and Thompson travel via Oxford House.

Based on the scheduled information provided above, the passenger capacity on scheduled flights to and from the Gillam airport is approximately 748 passengers (two-way) per week.

3.0 COLLISION ANALYSIS

Traffic collision data was obtained from MIT along PR 280 and PR 290. The collision analysis was limited to these two provincial roads as they are likely to be most impacted by the proposed Bipole III project and proposed Keewatinoow Converter Station. Data was collected from MIT for the years 1994 to 2006. Collision trends by year and time of year are illustrated in **Figure 3.1** and **Figure 3.2**, respectively. Collision severity is summarized in **Table 3.1**.

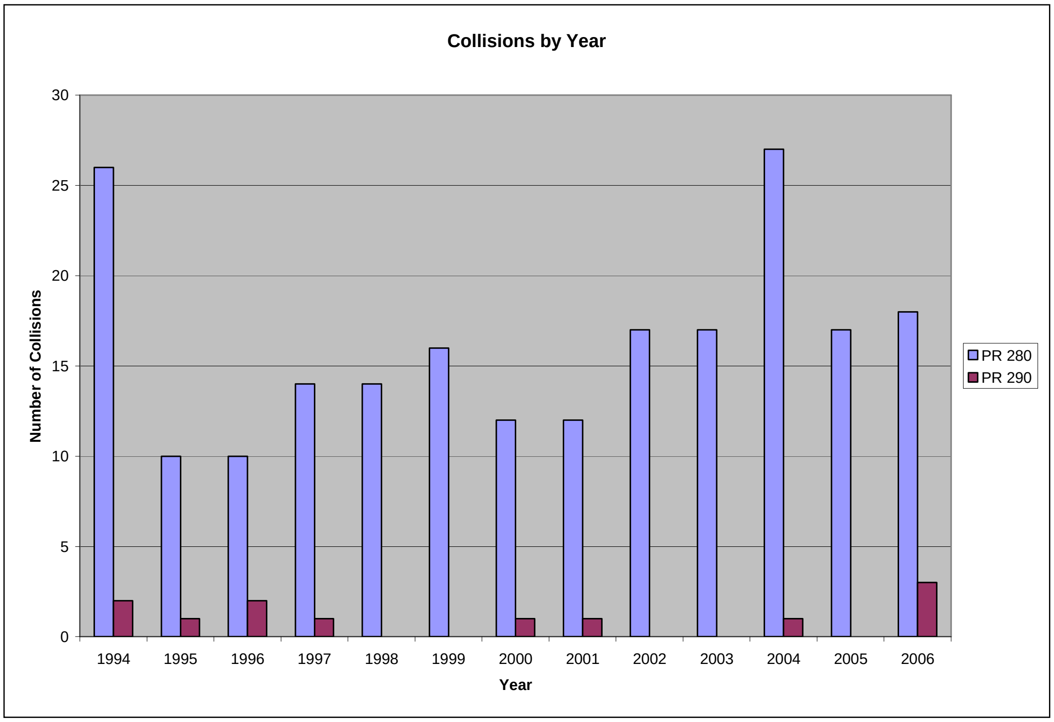

Figure 3.1: Collisions by Year

There were a total of 210 collisions along PR 280 and 12 collisions along PR 290 between 1994 and 2006. Collisions during the summer and fall months (September, October and November) were most frequent, accounting for 59 percent of all collisions over the 13-year period.

The majority of collisions along PR 280 and PR 290 caused property damage (62 percent), followed by 76 collisions resulting in non-fatal injuries (36 percent), and three fatalities (one percent) over the 13-year analysis period.

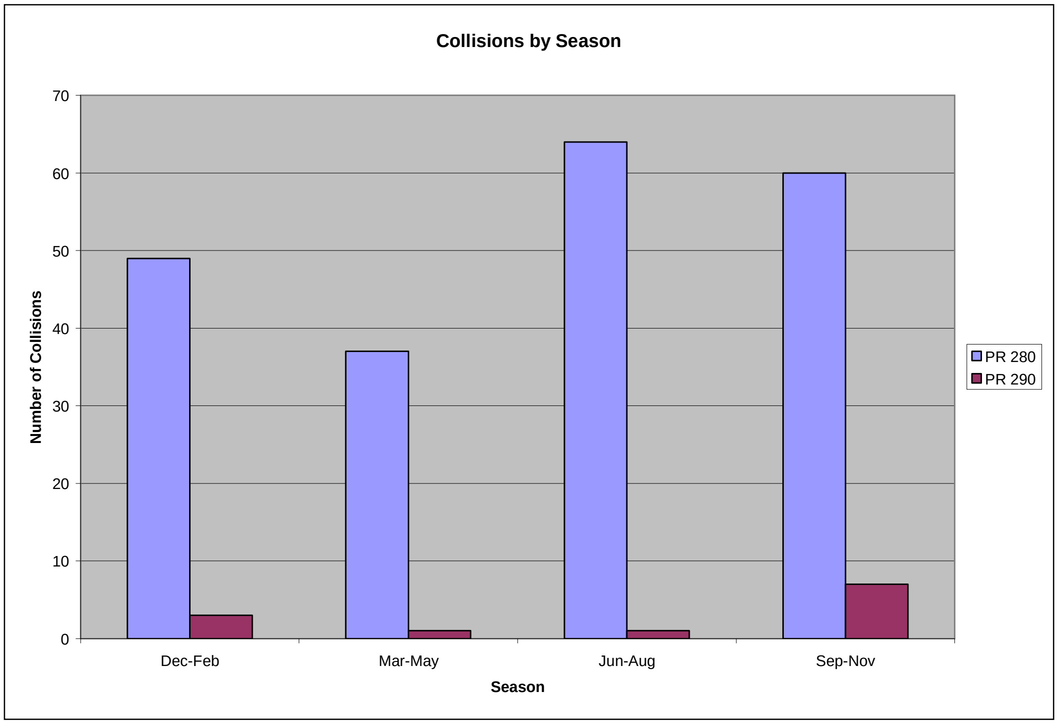

Figure 3.2: Collisions by Season

Table 3.1: Collision Severity

Year	PR 280			PR 290		
	Property Damage	Non-Fatal Injury	Fatality	Property Damage	Non-Fatal Injury	Fatal
1994	14	11	1	1	1	0
1995	3	5	2	0	1	0
1996	6	4	0	2	0	0
1997	8	6	0	1	0	0
1998	10	4	0	0	0	0
1999	9	7	0	0	0	0
2000	5	7	0	1	0	0
2001	8	4	0	0	1	0
2002	12	5	0	0	0	0
2003	10	7	0	0	0	0
2004	22	5	0	1	0	0
2005	13	4	0	0	0	0
2006	11	7	0	1	2	0
Total	**131**	**76**	**3**	**7**	**5**	**0**

Collision rate is a measure of the risk faced by the road user and is based on the number of collisions that occurred and the volume of traffic on a roadway section during a specified period. Collision rate is measured as the number of collisions per million vehicle-kilometres of travel (MVKT) on a roadway section during the designated analysis period, which in this case is the 13-year period from 1994 to 2006. Traffic volumes used in calculating the collision rate are the average of the AADT volume recorded each year over the thirteen year period. AADT volumes for PR 280 and PR 290 were obtained from the MHTIS website for the analysis years. Many agencies consider road sections with collision rates exceeding 1.5 incidents per MVKT as warranting further review, and potential road improvements.

For the purposes of this analysis, the collision rate has been determined for eight road segments of varying lengths along PR 280, and one road segment along PR 290. It is noted that the selected road segments are the same as those used by MIT for collision data collection. Each road segments (i.e., control section), is defined by MIT, and illustrated on **Figure 3.3**. The road links, road link lengths, average AADT volumes and the resultant collision rate for each segment are shown in **Table 3.2**.

Table 3.2: Collision Rates on PR 280 and PR 290

Road	Road Segment	MIT Control Section	Link Length (km)	Total Collisions	Average Collisions per Year	AADT (Average Over 13 Years)[1]	Collision Rate (MVKT)
280	PR 391 (near Thompson) to Split Lake	05280010	42.12	33	2.5	137	1.2
		05280020	29.88	28	2.2	137	1.4
		05280030	54.35	41	3.2	137	1.2
	Split Lake Winter Road Access to PR 290	05280040	16.27	14	1.1	147	1.2
		05280050	59.9	31	2.4	147	0.7
		05280060	30.81	17	1.3	58	**2.0**
		05280070	27.17	13	1.0	58	**1.7**
	PR 290 to Gillam	05280080	29.84	33	2.5	167	1.4
290	Entire length	05290010	22.43	12	0.9	185	0.6

Notes: 1. The lowest AADT over that respective road segment has been used.
2. MVKT is million vehicle-kilometres of travel.

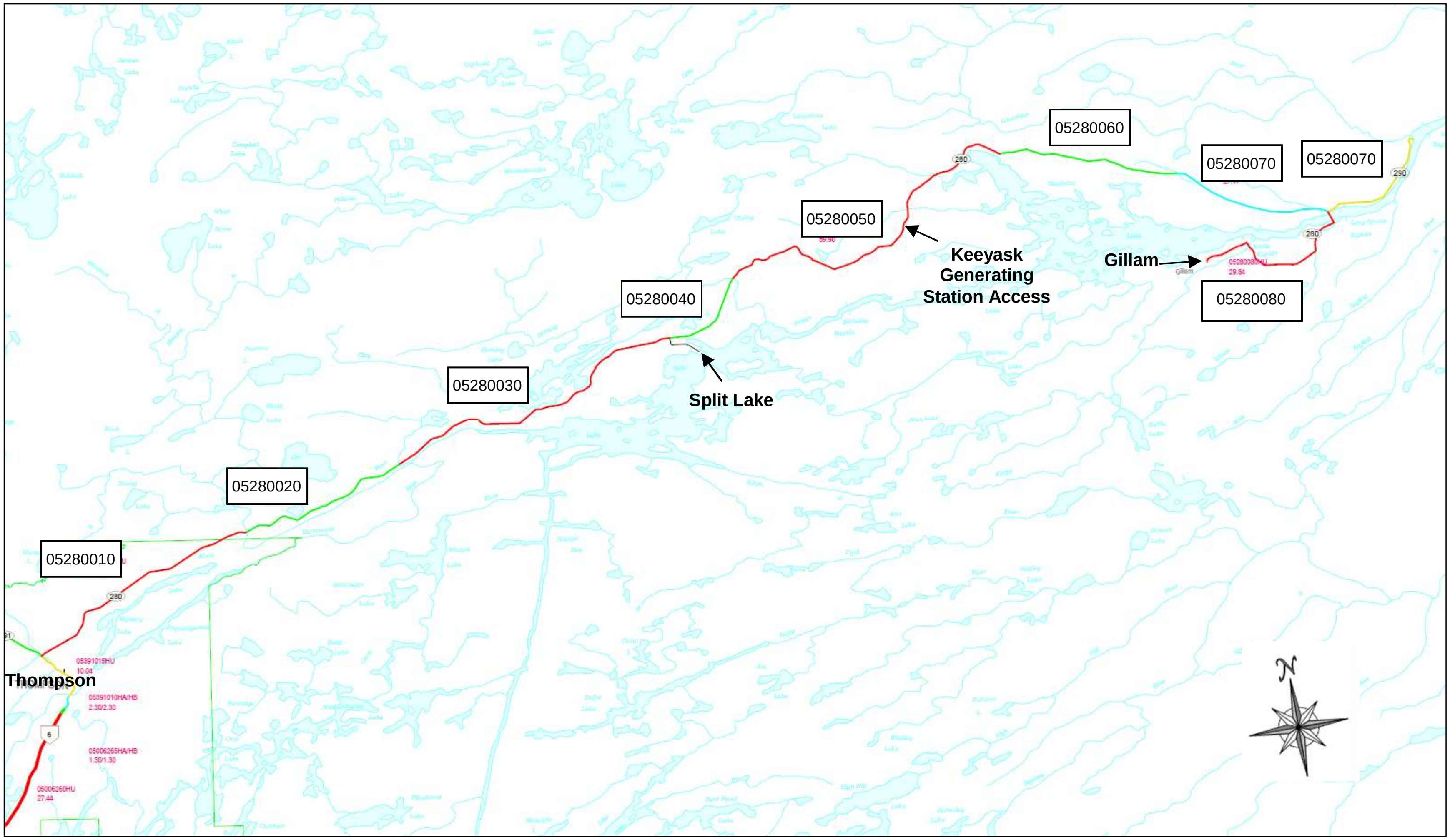

Figure 3.3: MIT Control Sections

*Base map sourced from control sections map provide by MIT entitled "Province of Manitoba, Provincial Trunk Highways and Provincial Roads, Showing Control Section.

Based on the AADT and the number of collisions between 1994 and 2006, PR 280 northwest PR 290 has collision rates ranging from 1.7 MVKT to 2.0 MVKT (two of the eight segments on PR 280), which are above the generally accepted rate of 1.5 MVKT. Given that the remainder of the corridor is below 1.5 MVKT, these segments therefore require further investigation as to the higher collision rates. It is noted that the data provided by MIT did not include details on collision type or collision configuration (i.e., type of accident and potential cause). In order to provide a recommendation on the appropriate course of action, a detailed site investigation and review of the raw collision data would be required.

Without a more detailed review, it is difficult to determine if the increase in traffic from the proposed Bipole III project is likely to negatively impact the safety of the road. However, considering the crash data from a cumulative impacts perspective (i.e., with construction traffic associated with Bipole III plus the construction traffic associated with the proposed the Keeyask and the Conawapa generating stations), upgrades to certain segments of PR 280 may be required (refer to **Table 10.1** for the proposed timing of the known significant Manitoba Hydro projects in Northern Manitoba).

The collision rates on PR 280 (southwest of Split Lake), PR 280 (between Gillam and PR 290) and PR 290 are below 1.5 MVKT and are therefore considered satisfactory. It is noted that although the collision rate on PR 280 (southwest of Split Lake) is approaching 1.5 MVKT on some sections, road improvements at various locations along PR 280 are being undertaken up to the Keeyask Generating Station access as part of a funding agreement between Manitoba Hydro and MIT. These improvements may contribute to increased safety along the road corridor.

4.0 TRAFFIC: KEEWATINOOW CONVERTER STATION

4.1 Workforce Travel

Manitoba Hydro provided draft workforce estimates (dated February 28, 2011) for the construction of the Keewatinoow Converter Station. These workforce estimates include average worker numbers per quarter for all trades expected over the construction phase of the project. The numbers have been separated into three labour groups: (1) construction support and service trades; (2) non-designated trades; and (3) designated trades (i.e., those trades requiring apprentice training regulated through the Apprenticeship and Trades Qualification Act). The estimated workforce numbers (trades only) for the construction of the Keewatinoow Converter Station are included in **Appendix B**. Based on the information provided, the estimated person-years for the construction phase are as follows:

- Designated trades: 451 person-years.
- Non-designated trades: 252 person-years.
- Construction support and service trades: 219 person-years.
- Total: 922 person-years.

Manitoba Hydro advised that an additional 20 percent on top of the above estimates would be expected for non-trade workers, which include supervisory, management and Manitoba Hydro staff.

Workforce estimates for the smaller project components including the Keewatinoow construction power line, the AC collector lines, the electrode line, switchyard upgrades at Long Spruce and Henday, and the Keewatinoow Construction Power Station have also been included in the workforce estimates for the Keewatinoow study area (in addition to those listed above).

For the purpose of this study, the traffic expected to be generated by the Keewatinoow Converter Station and ancillary components has been based on the highest quarterly average workforce numbers for that respective year. The highest quarterly workforce numbers for each construction year and the workforce estimates for non-trade jobs (i.e., Manitoba Hydro staff, supervisory, management, etc.) are summarized in **Table 4.1** below.

Table 4.1: Average Construction Workforce Numbers, Keewatinoow Converter Station and Ancillary Components (Quarterly Peak)

Year of Construction	Average Workforce Numbers (Quarterly Peak)		
	Trades	Non-trades	Total
2012	218	50	268
2013	405	94	499
2014	488	86	574
2015	251	66	317
2016	165	48	213
2017	112	22	134
2018	17	3	20

Note 1: Non-trades include supervisory, management and Manitoba Hydro staff.

In order to quantify the additional workforce traffic expected during the construction of the Keewatinoow Converter Station, assumptions regarding worker origin (defined as either local, northern Manitoba or southern Manitoba), place of residence during construction, mode choice, vehicle occupancy, and trip types were made. It is important to note that these assumptions were based on limited supporting data and can be refined once further information regarding the dynamics of the workforce and construction camp becomes available. The following trip types were adopted for this study:

- **Worker Trips to Construction Site**: These trips include workforce trips to and from the construction site. The mode choice for travel would depend on worker origin and residence during construction. For example, a worker from southern Manitoba living at the construction camp would most likely catch a bus to and from the construction site, six days per week.
- **Trips to Gillam:** These trips relate mostly to social trips between the construction camps and Gillam.
- **Trips to Thompson and Beyond:** These trips are more specific to workers originating from Thompson and surrounding communities who may visit home on a weekly basis. It also considers the occasional social trip between the construction camp and Thompson.

Table 4.2 summarizes the parameters adopted for estimating the trip generation volumes during the construction of the Keewatinoow Converter Station.

Table 4.2: Traffic Generation and Assignment Parameters - Keewatinoow CS

Trip Destination	Worker Origin	Percentage of Workers	Residence During Construction	Mode[1]		Vehicle Occupancy (workers / vehicle)	Round Trips Per Week
				Car	Bus[2]		
Worker Trips to Construction Site	Local	15%	Home	90%	10%	1.2	6
	Northern Manitoba	15%	Construction Camp	70%	30%	2	6
	Southern Manitoba and beyond	70%	Construction Camp	10%	90%	2	6
Trips to Gillam	Local	15%	Home	-	-	-	-
	Northern Manitoba	15%	Construction Camp	70%	30%	2	1
	Southern Manitoba and beyond	70%	Construction Camp	10%	90%	2	1
Trips to Thompson and Beyond	Local	15%	Home	-	-	-	-
	Northern Manitoba	15%	Construction Camp	70%	-	1.2	1
	Southern Manitoba and beyond	70%	Construction Camp	5%	-	1.2	1

Notes

1: The option to travel by private vehicle is limited for workers originating from Southern Manitoba and beyond.

2: Assumed bus capacity is 15 workers.

Based on the above assumptions, daily workforce trips from the Keewatinoow Converter Station on the surrounding road network have been estimated and are summarized in **Table 4.3**.

Table 4.3: Estimated Daily Workforce Trips during the Construction of the Keewatinoow Converter Station

Road	Road Segment	Workforce Trips (AADT Volumes)						
		2012	2013	2014	2015	2016	2017	2018
Access Road	Camp to Work Site	64	119	144	74	49	33	5
PR 290	Near Sundance	129	241	250	160	112	61	9
PR 290	East of PR 280	129	241	250	160	112	61	9
PR 280	East of Gillam (N. Acc. Rd)	122	229	236	153	107	58	9
PR 280	East of Radisson CS	122	229	236	153	107	58	9
PR 280	West of PR 290	122	229	236	153	107	58	9
PR 280	Northeast of Gillam	7	12	15	8	5	3	1
PR 280	North of Split Lake Access	7	12	15	8	5	3	1
PR 280	80km from 391	7	12	15	8	5	3	1
PR 280	just north of 391	7	12	15	8	5	3	1
PR 391	South of PR 280	7	12	15	8	5	3	1

Note: AADT is Annual Average Daily Traffic.

A review of the traffic impact of the Keewatinoow Converter Station and associated components on the surrounding road network has been undertaken in **Section 7.0**.

4.2 Shipping of Materials

4.2.1 Materials

The Converter Station Construction Department of Manitoba Hydro provided estimates of primary material types, quantities and delivery schedules for the construction of the Keewatinoow Converter Station. Based on that information, the materials are expected to arrive from a variety of locations from local, provincial, national and/or international sources. Raw materials for concrete will be batched at the construction site. **Table 4.4** provides a general material list for the construction of the Keewatinoow Converter Station site.

A map illustrating granular material sources within the Keewatinoow study area is included in **Appendix C**.

Table 4.4: Materials Required for Construction of Keewatinoow Converter Station

Material	Quantity per Year (metric tonnes)					Source
	2013	2014	2015	2016	Total	
Precast Concrete	5,445	26,780	14,530	1,255	48,010	Winnipeg
Fine Concrete Aggregate	2,150	10,570	5,735	495	18,950	Nearby Aggregate Sources
Course Concrete Aggregate	3,390	16,670	9,045	780	29,885	Limestone Generating Station Marshalling yard
Cement	990	4,880	2,645	225	8,740	Ontario or Alberta
Reinforcing Steel	630	3,095	1,680	145	5,550	Winnipeg or Ontario
Steel and Misc. Metals	170	565	310	10	1,055	Winnipeg
Building Materials	25	1,700	55	10	1,790	Winnipeg
Mechanical	15	925	235	200	1,375	Winnipeg
Electrical	5	230	205	140	580	Winnipeg
System Electrical	0	5,830	5,150	70	11,050	Out of Province/ Country
Equipment	140	20	15	20	195	Winnipeg
Misc.	5	0	0	0	5	Winnipeg

4.2.2 Shipping by Rail

Within the System Electrical material identified in **Table 4.4**, a number of items have been confirmed as being delivered by rail from Winnipeg. These items represent some of the larger, heavier components that need to be shipped to the construction site. Rail delivery will be made from the Riel to the Henday Transfer Yard near the Limestone Generating Station. The items will then be transferred onto trucks and transported to the Keewatinoow construction site via PR 290 and the existing Conawapa Access Road. **Table 4.5** outlines the dimensions and weights of the primary items to be shipped by rail.

Table 4.5: System Electrical Parts for Keewatinoow Converter Station Expected to be Delivered by Rail

Component	Weight (metric tonnes)	Number of Units	Width (metres)	Height (metres)	Length (metres)
Converter Transformer	218 (256.84 with fittings)	14	4.60	4.11	10.80
Station Service	13.65 (15.85 with fittings)	3	2.83	3.95	7.76
DC Smoothing Reactor Coil	54.35	7	4.39	4.14	4.39

4.2.3 Shipping by Road

Based on the provincial and national road network, it is expected that construction materials will arrive by road in one of the following ways:

- From Winnipeg (or Ontario through Winnipeg) via PTH 6, PR 391, PR 280, PR 290 and the Conawapa Access Road.
- From Alberta via PTH 10, PTH 39, PTH 6, PR 391, PR 280, PR 290 and the Conawapa Access Road. Note that this route would only be used if cement required for the site was sourced from Alberta. For the purposes of this report, however, it has been assumed that cement would be sourced from Ontario and would be hauled via Winnipeg.
- From Henday Transfer Yard and local aggregate sources via the Conawapa Access Road.

All roads listed above are rated to RTAC loading with the exception of PR 280 and PR 290 which are rated to A1 loading. As the weight restrictions on PR 280 and PR 290 are classified as A1, all trucks travelling to the site from Thompson and beyond have been assumed to be restricted to A1 loading.

Trucks are permitted to exceed the weight limits set by the Province by applying for and receiving an over-weight truck permit. A fee associated with this permit is determined by MIT, based on the cost of the damage the overweight load is expected to cause to the road. This depends on pavement structure and sub grade conditions.

Loaded trucks limited to the existing Conawapa access road (primarily for hauling raw materials between the identified borrow pits and the Keewatinoow construction site) would not be subject to provincial weight restrictions as this road does not fall under MIT jurisdiction. Weight restrictions on the existing access road will likely be governed by bridge and culvert loading. A detailed review of the load limits of the existing access road to the Keewatinoow Converter Station is not included in this report.

Table 4.6 outlines the total number of truck trips generated by the delivery of materials for the duration of the converter station construction period. An A1 loading class was assumed for all vehicles using the provincial highway system. Capacities of 10 cubic metres for semi-trailers and 13 cubic metres for rock trucks were assumed for vehicles limited to the existing Conawapa access road.

Table 4.6: Truck Trips during Construction of Keewatinoow Converter Station

Route	Year	Total Truck Trips per Year[1]	AADTT[2]
Winnipeg to/from Conawapa Access Road	2014	620	2
	2015	3,520	10
	2016	1,910	5
	2017	10	0
Conawapa Access Road to/from Converter Station	2013	148,410	405
	2014	11,520	32
	2015	3,520	10
	2016	6,010	16
	2017	4,110	11

Note: 1. Values include empty return trips.

2. AADTT is Annual Average Daily Truck Traffic

5.0 TRAFFIC: RIEL CONVERTER STATION

5.1 Workforce Travel

Construction of the Riel Converter Station for the Bipole III Project is expected to commence in 2012, after environmental licensing, with a completion date of early 2017. Draft workforce projections (dated February 28, 2011) were provided by Manitoba Hydro for its construction. Similar to the Keewatinoow Converter Station, the workforce projections for the Riel Converter Station include average worker numbers per quarter for all trades expected during the construction of the project. The estimated workforce numbers (trades only) for the construction of the Riel Converter Station are included in **Appendix B**. Based on the information provided, the estimated person-years for the construction phase are as follows:

- Designated trades: 419 person-years.
- Non-designated trades: 179 person-years.
- Construction support and service trades: 45 person-years.
- Total trades: 643 person-years.

Manitoba Hydro advised that an additional 20 percent on top of the above estimates would be expected for non-trade workers, which include supervisory, management and Manitoba Hydro staff.

Additionally, workforce estimates for the construction of the electrode line have also been considered in the Riel study area estimates (in addition to those listed above).

Similar to the Keewatinoow Converter Station analysis, the traffic expected to be generated by the Riel Converter Station workforce has been based on the highest quarterly average workforce numbers for that respective year. The highest quarterly workforce numbers for each construction year and the workforce estimates for non-trade jobs are summarized in **Table 5.1**.

Table 5.1: Average Construction Workforce, Riel Converter Station (Quarterly Peak)

Year of Construction	Average Workforce Numbers (Quarterly Peak)		
	Trades	Non-trades	Total
2012	54	11	65
2013	229	46	275
2014	253	51	304
2015	204	41	245
2016	86	17	103
2017	104	21	125
2018	2	0	2

Note 1: Non-trades include supervisory, management and Manitoba Hydro staff.

For the purpose of quantifying the potential workforce traffic generated during the construction of the Riel Converter Station, the following assumptions have been made:

- All workers will travel to and from the site by car.
- An average car occupancy of 1.2 workers/vehicle.
- All workers will travel once to the site and once from the site, six days a week.

The assignment of trips to and from the construction site has been estimated as follows:

- South on PR 207: 30 percent
- East on PTH 15 via PR 207: 5 percent
- North on PTH 101 via PR 207 and PTH 15: 35 percent
- West on Dugald Road (City Route 115) via PR 207 and PTH 15: 25 percent
- South on PTH 101 via PR 207 and PTH 15: 5 percent

Based on the above, the additional daily workforce volumes expected on the surrounding road network has been estimated and is summarized in **Table 5.2**.

Table 5.2: Estimated Daily Workforce Trips During the Construction of the Riel Converter Station

Road	Road Segment	Workforce Trips (AADT Volumes)						
		2012	2013	2014	2015	2016	2017*	2018
PR 207	South of Access	28	118	130	105	44	53	1
PR 207	North of Access	65	275	304	245	103	125	2
PTH 15	East of PR 207	5	20	22	17	7	9	0
PTH 15	West of PR 207	60	255	282	227	96	116	2
PTH 15	West of PTH 101	32	137	152	122	52	62	1
PTH 101	South of PTH 15	5	20	22	17	7	9	0
PTH 101	North of PTH 15	23	98	108	87	37	45	1

Note: AADT is Annual Average Daily Traffic.
* Bipole III in-service day

As summarized in the above table, the peak workforce trips associated with the construction of the Riel Converter Station would be approximately 304 vehicles per day (vpd) on PR 207 north of the proposed access to the site. This peak would most likely occur in 2014.

A review of the traffic impact of the Riel Converter Station on the surrounding road network has been undertaken in **Section 7.0**.

5.2 Shipping of Materials

5.2.1 Materials

The Converter Station Construction Department of Manitoba Hydro advised that the quantities provided for the Riel Converter Station would be similar to the quantities for the Keewatinoow Converter Station, with the exception of System Electrical. The difference in material hauling for the two sites is that concrete for Riel will be batched in Winnipeg and delivered to the construction site as needed, whereas the required concrete for the Keewatinoow Converter Station will be batched on-site. **Table 5.3** provides a general list of primary materials for the Riel Converter Station.

Table 5.3: Materials Required for Riel Converter Station

Material	Quantity per Year (metric tonnes)					Source
	2013	2014	2015	2016	Total	
Concrete	18,140	89,245	48,425	4,175	159,985	Winnipeg
Steel and Misc. Metals	170	565	310	10	1,055	Winnipeg
Building Materials	25	1,700	55	10	1,790	Winnipeg
Mechanical	15	925	235	200	1,375	Winnipeg
Electrical	5	230	205	140	580	Winnipeg
System Electrical	0	5,830	6,280	1,060	13,170	Out of Province/ Country
Equipment	140	20	15	20	195	Winnipeg
Misc.	5	0	0	0	5	Winnipeg

5.2.2 Shipping by Rail

Within the System Electrical material identified in **Table 5.3**, a number of items will be delivered directly to the construction site by rail. These items represent some of the larger, heavier components that need to be shipped to the construction site. It is understood that rail delivery would be made to the Riel Transfer Yard located adjacent to the Riel Converter Station construction site. **Table 5.4** outlines the dimensions and weights of the items to be shipped by rail.

Table 5.4: System Electrical Parts Delivered by Rail

Component	Weight (metric tonnes)	Number of Units	Width (metres)	Height (metres)	Length (metres)
Synchronized Rotor	150	4	2.47	3.14	9.21
Synchronized Stator	195	4	4.25	5.00	7.14
Synchronized Unit Transformer	174.15 (218.20 with fittings)	4	4.06	5.50	7.44
Converter Transformer	218 (256.84 with fittings)	14	4.60	4.11	10.80
Station Service	13.65 (15.85 with fittings)	3	2.83	3.95	7.76
DC Smoothing Reactor Coil	54.35	7	4.39	4.14	4.39

5.2.3 Shipping by Road

The majority of material required for the Riel Converter Station will arrive by road. PR 207 will be the only access route to the construction site and vehicles will access PR 207 to/from Winnipeg via PTH 15 or PTH 1.

All routes directly accessing and in the vicinity of the Riel site are suitable for RTAC loading, with PR 207 having recently been upgraded from an A1 classification.

Due to the proximity of the site to the Riel marshalling yard and the availability of RTAC routes, it is unlikely there will be a need for overweight loading. Any trucks accessing the construction site with a Gross Vehicle Weight (GVW) greater than RTAC loading will require an overweight permit from MIT.

Table 5.5 outlines the total number of truck trips generated by the delivery of materials for the duration of the construction period. RTAC loading was assumed for all vehicles with three-axle cement mixers and tandem-axle semi-trailers being used to deliver material.

Table 5.5: Truck Trips during Construction of Riel Converter Station

Year	Total Truck Trips[1]	AADTT
2014	2,250	6
2015	11,520	32
2016	6,250	17
2017	545	1

Note: 1. Values include empty return trips.

2. AADTT is Annual Average Daily Truck Traffic.

6.0 TRAFFIC: TRANSMISSION LINES

The construction of the Bipole III transmission line will generate additional trips on an extensive area of the provincial road network. This section estimates the increase in traffic associated with the transmission line and identifies those provincial roads most likely to experience an increase in traffic. This section focuses on the traffic generated during only the construction phase, as the traffic likely to be generated by the transmission line during the operational and maintenance phase would be minimal and is only expected for routine checks and maintenance.

6.1 Methodology

Three trip types have been identified as being associated with the construction of the transmission lines: local traffic, workforce traffic and material delivery traffic. The following sections identify the methodology and assumptions used to estimate the growth of each traffic generation source.

It is important to note that since some details for the construction of the transmission lines are largely unknown, such as the number and location of the mobile camps and marshalling yards, the following analysis is for high-level purposes only and is subject to change. Wherever possible, assumptions have adopted the more conservative approach (i.e., those likely to result in a greater impact on the provincial road network).

6.1.1 Local Traffic

For the purpose of this study, local traffic has been defined to include the following activities:

- Social trips (i.e., workers travelling to/from/within towns and cities).
- Construction support services such as the delivery of food and equipment to and from camp sites.
- Delivery of concrete from local concrete batching plants.
- Diesel fuel delivery to the work site.

A brief discussion on the above trip types, and the likely traffic impact on the surrounding road network, has been provided below.

Workers – Social Trips

Social trips include all non-work related trips by workers such as trips to commercial areas, restaurants and activity centres. This traffic increase is difficult to quantify but is assumed to be insignificant and within the day-to-day traffic volume fluctuations for typical provincial and municipal roads. In most cases, social trips would be undertaken on weekends or weekday evenings and outside of normal morning and afternoon peak hour conditions.

Construction Support Services

It would be expected that support services such as maintenance support, aid and the delivery of materials and goods will be required throughout the construction period of each transmission line section. As the work site and mobile camps will be continuously relocating and in most cases will be self-supporting, the overall impact of this traffic on the external road network is unlikely to be noticeable.

Delivery of Concrete

The northern section of the line will require minimal concrete with bags of ready-mix likely to be used. These ready-mix concrete bags may not require specific delivery trips and could be included with general deliveries to the marshalling yards and transmission line access locations.

For the southern portion, concrete will most likely be supplied from local businesses as required. Since the amount of concrete required and the exact travel route for transporting this material cannot be accurately determined at this point, it has been assumed that concrete will be batched at existing plants located near the right-of-way (ROW) of the southern section of the line and will be delivered to the most convenient ROW access points. Existing concrete batching plants in the vicinity of the study area are located at Swan River, Dauphin, Ste. Rose du Lac, Neepawa and Portage la Prairie.

The increased concrete production at these plants during transmission line construction may increase the amount of traffic delivering raw concrete materials to each batching plant. This traffic is difficult to quantify at this time and is also likely to be minimal.

Delivery of Fuel to the Worksite

Based on the assumption that 4,000,000 L (Manitoba Hydro Construction Group) of diesel fuel will be required for ROW clearing and transmission line construction, it has been estimated that an additional 220 truck trips will deliver fuel to the construction site. This traffic is not significant given that it will be spread over the five year construction schedule and the entire length of the transmission line.

6.1.2 Workforce Traffic

The assumed work schedule and workforce numbers for the construction of the transmission lines are based on information provided in the Draft Project Description prepared by MMM and the workforce projections provided by Manitoba Hydro (**Appendix B**). As discussed in the Draft

Project Description, the transmission line will likely be divided into eight construction sections: four northern sections, two central sections and two southern sections (**Appendix D**).

In order to quantify the traffic generated by the workforce component, a number of assumptions were made for the mobile camps regarding length of stay and locations, and transportation between the designated camp locations and the job site. The following assumptions for workforce traffic have been adopted for this study:

- Although mobile camps will likely be used for the northern sections of the line, it has been assumed that the camps will be stationary until that respective line section has been constructed. Camps will be located on the provincial road network within or adjacent to local communities and existing infrastructure. This is considered conservative as it is likely that the mobile camps, particularly for the northern sections, will often be located within the transmission line ROW, effectively limiting worker trips to the work sites and reducing the need for workers to travel on the existing local or provincial road network. The assumed camp sites adopted for this study are illustrated on **Figure 6.1** in the following section.

- Ten potential camp locations have been identified as illustrated on **Figure 6.1**. Each work camp is associated with a material marshalling yard / ROW access location with the assumption that workers will make daily trips between the camp and the marshalling yard/ROW access.

- All workers originating from Winnipeg would travel by air (via Gillam, Thompson or The Pas) to and from the northern camp sites and by road to the central and southern camp sites.

- Workers will remain at their camp for the majority of the time to complete the clearing or construction of their section. Manitoba Hydro advised that workers would be permitted two to three breaks throughout each construction period. This results in an insignificant number of trips between Winnipeg and the work camps, over and above the initial arrival and departure from the camp at the beginning and end of the construction season.

- As workers stationed at camp sites will not be making multiple trips to and from Winnipeg, the worker traffic on these routes is assumed to be small, especially when averaged over the multiple months of the construction season.

- Average vehicle occupancy of 3.0 people per vehicle has been adopted for trips between each camp and relative marshalling yards/ROW access.

- Each worker travels only once to the work site in the morning and once from the work site in the afternoon or evening.

Construction of the line is comprised of two main components: clearing the ROW (with associated hauling and removal of waste) and constructing the transmission towers. A summary of the construction schedule for the transmission line, provided by Manitoba Hydro and dated January 2011, is outlined in **Table 6.1.**

Table 6.1: Assumed Construction Schedule

Construction Segment	Construction Season	ROW Clearing		Tower Construction	
		Timeline	Peak Workforce	Timeline	Peak Workforce
North – 1	Winter (December to April)	Dec. 2012 - April 2014	40	Dec. 2013 - Mar. 2015	200
North – 2	Winter (December to April)	Dec. 2012 - April 2014	40	Dec. 2013 - Mar. 2015	200
North – 3	Winter (December to April)	Dec. 2012 - April 2014	40	Dec. 2013 - Mar. 2015	200
North – 4	Winter (December to April)	Dec. 2014 - April 2016	40	Dec. 2015 - Mar. 2017	200
Central – 1	Winter (December to April)	Dec. 2015 - April. 2016	20	Dec. 2015 - April. 2016	130
Central – 2	Winter (December to April)	Dec. 2014 - April 2015	20	Dec. 2014 - April 2015	130
South – 1	Summer (June to October)	June 2015 – Oct 2015	20	June 2015 - Oct. 2015	130
South - 2	Summer (June to October)	June 2014 – Oct 2014	20	June 2014 - Oct. 2014	130

The increase in daily traffic expected on the provincial road network due to the workforce trips associated with the construction of the Bipole III transmission line is included in the overall traffic summaries and analyses in **Section 7.0** of this report.

6.2 Shipping of Materials

Manitoba Hydro has indicated that all tower materials will be stored within the marshalling yard at the Riel site where they will be distributed by truck to the various marshalling yard locations along the proposed transmission line. The exact number and location of each marshalling yard has not yet been identified but Manitoba Hydro has advised that one or two marshalling yards will be sufficient for each transmission line construction section. Based on this information, ten marshalling yards in addition to the marshalling yard at Riel have been identified along the transmission line ROW, generally in close proximity to the provincial highway network. The identified construction access locations and transmission line construction segments are illustrated on the maps included in **Appendix D**. The assumed marshalling yard locations for the construction of the transmission line, as well as the most practical truck route to each marshalling yard location, are illustrated on **Figure 6.1**.

The movement of material from Riel to the identified marshalling yards will result in an increase in traffic, albeit over a short time frame. The quantity of construction materials required for the entire length of the transmission lines was extracted from the Lifecycle Green House Gas (GHG) analysis prepared for the Bipole III project. Material to be shipped from the Riel marshalling yard includes steel for the towers, aluminum for the conductors, cable for communications, miscellaneous hardware, and ceramics for the insulators.

It was assumed that all of the material listed above will be transported to the site on 53-foot, flatbed tandem-axle trailers. Depending on the location of the transmission line marshalling yard, vehicles transporting material from Winnipeg could be restricted to RTAC, A1 or B1 loading. In addition, Spring Road Restrictions (SRR) and winter weight bonuses could impact the maximum allowable loads, depending on the time of the year.

In order to be conservative, B1 loading was assumed for the transportation of all Bipole III material. This results in the following material and vehicle weight per truck:

- Maximum GVW: 34,500 kg.
- Vehicle Tare Weight: 14,000 kg (Source: Montufar, J. and Clayton, A. (2001) *Seasonal Weight Limits on Prairie Region Highways: Opportunities for Rationalization and Harmonization*).
- Payload: 20,500 kg.

A sensitivity analysis was conducted which determined that a change in the maximum allowable weight of the hauling vehicles results in only a minor change to overall traffic volumes. Traffic volumes generated by daily worker trips between worksites and camps are expected to be far greater than truck volumes generated by transporting materials from Winnipeg to the marshalling yard locations.

Figure 6.1: Bipole III Project – Primary Truck Routes, Marshalling Yards and Camp Sites

Material quantities and the number of trips required to deliver this material to the marshalling yard sites are outlined in **Table 6.2.**

Table 6.2: Transporting of Materials for Bipole III Transmission Line

Material	Component	Quantity (metric tonnes)	Metric Tonnes per Truck	Total Truck Trips *
Steel	Towers	30,000	20.5	2,925
Aluminum	Conductors, Misc. Hardware	20,000	15.9**	2,515
Ceramic	Insulators	2,500	20.5	245
Cable	--	--	--	120
Total	--	52,500	--	5,805

Note: * These values include empty return trips.
** Assumes material is transported as two reels per truck, reaching volume capacity before weight limit.

The increase in truck traffic expected on the provincial road network, due to the transporting materials required for the Bipole III Transmission Line, is included in the overall traffic summaries and analyses in **Section 7.0** of this report.

7.0 TRAFFIC IMPACT

7.1 Traffic Generation Volumes by Project Component

The total trips generated by workers and material delivery were combined and applied to the provincial road network according to which routes would be the most practical. The highest daily volumes (both light and heavy vehicles) expected during each year of construction on any particular road section are shown in **Table 7.1**.

Table 7.1: Total Traffic Generation Volumes during Construction of the Bipole III Project

Project Component	Vehicle Type	Daily Traffic Generation Volumes (AADT)						
		2012	2013	2014	2015	2016	2017*	2018
Keewatinoow Converter Station	Light	180	335	360	215	150	85	10
	Heavy	0	405	30	10	15	10	0
	All	180	740	390	225	165	95	10
Riel Converter Station	Light	95	395	435	350	145	180	5
	Heavy	0	5	30	15	<5	0	0
	All	95	400	465	365	150	180	5
Bipole III Transmission Line	Light	--	75	535	650	285	60	--
	Heavy	--	--	10	10	5	<5	--
	All	--	75	545	660	290	65	--
All Components	Light	175	805	1,330	1,215	580	325	15
	Heavy	0	410	70	35	25	15	0
	All	175	1,215	1,400	1,250	605	540	15

* 2017 – represents the scheduled year of completion for the Bipole III project.

7.2 Traffic Generation Volumes by Geographical Area

Section 7.1 estimates the traffic volumes likely to be generated by each of the three main components of the Bipole III project. For the purpose of this and other studies, this section breaks down the traffic volumes by geographical area as construction overlap between each project component occurs throughout the construction period. For example, the construction traffic associated with the northern transmission lines overlaps with and is in addition to the construction traffic associated with the Keewatinoow Converter Station. The geographical areas have been defined as follows:

Keewatinoow Study Area: This area is illustrated in **Figure 7.1** and includes the Keewatinoow Converter Station and construction camp, part of the northern Bipole III transmission line (part of construction section "N1"), the AC collector lines, the Keewatinoow construction power line, the electrode line, the Conawapa access road, PR 290, part of PR 280, and the town of Gillam.

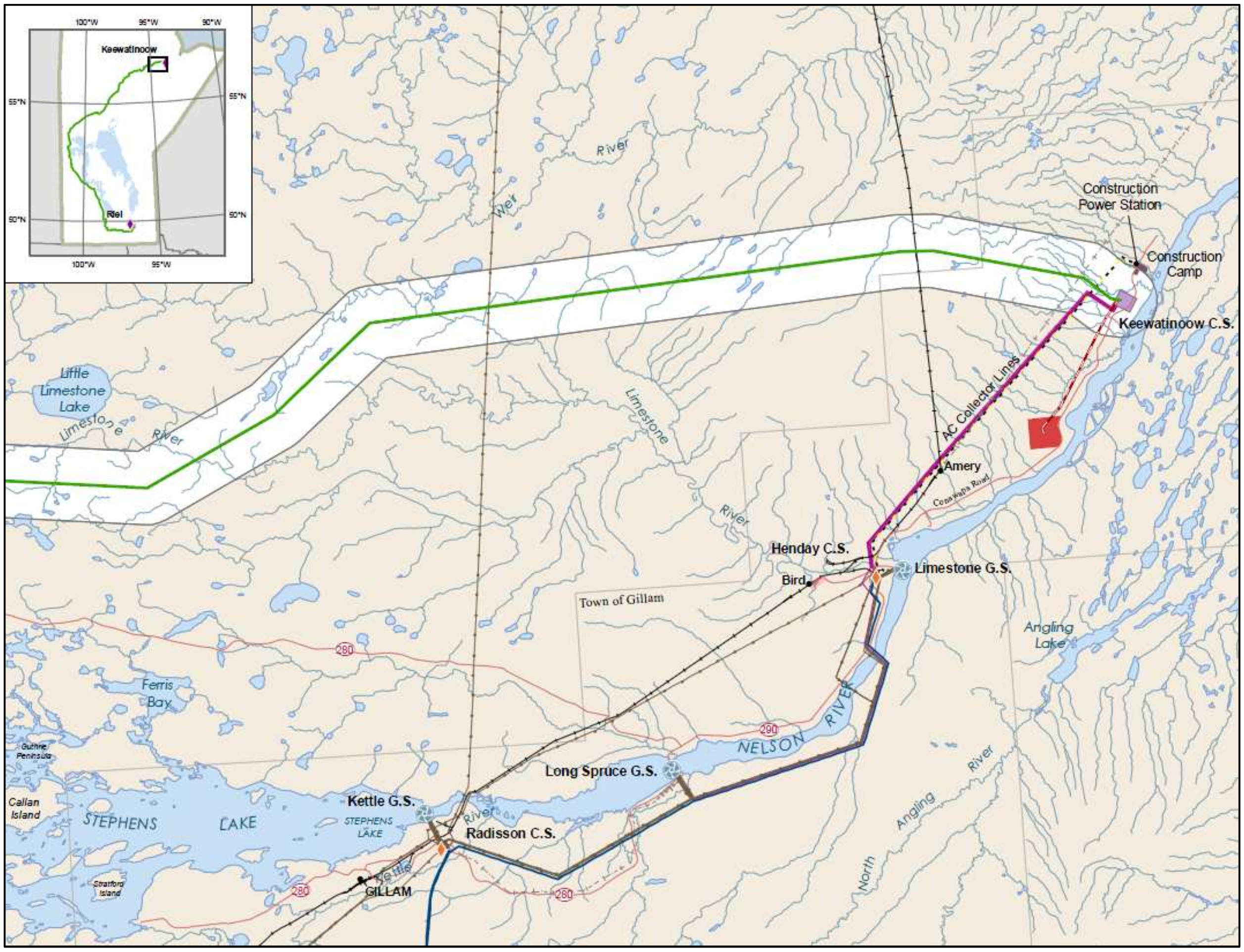

Figure 7.1: Keewatinoow Study Area

Riel Study Area: This area is illustrated in **Figure 7.2** and focuses on the Riel Converter Station, part of the southern Bipole III transmission line (construction section "S2"), and surrounding roads including part of PR 207, PTH 15, PTH 101 and Trans-Canada Highway 1.

Remainder of the Bipole III Transmission Line: This area includes the remainder of the Bipole III transmission line and all affected roads in Manitoba outside of the Keewatinoow and Riel study areas.

The traffic generation volumes on the affected roads in the identified study areas are included in the following sections.

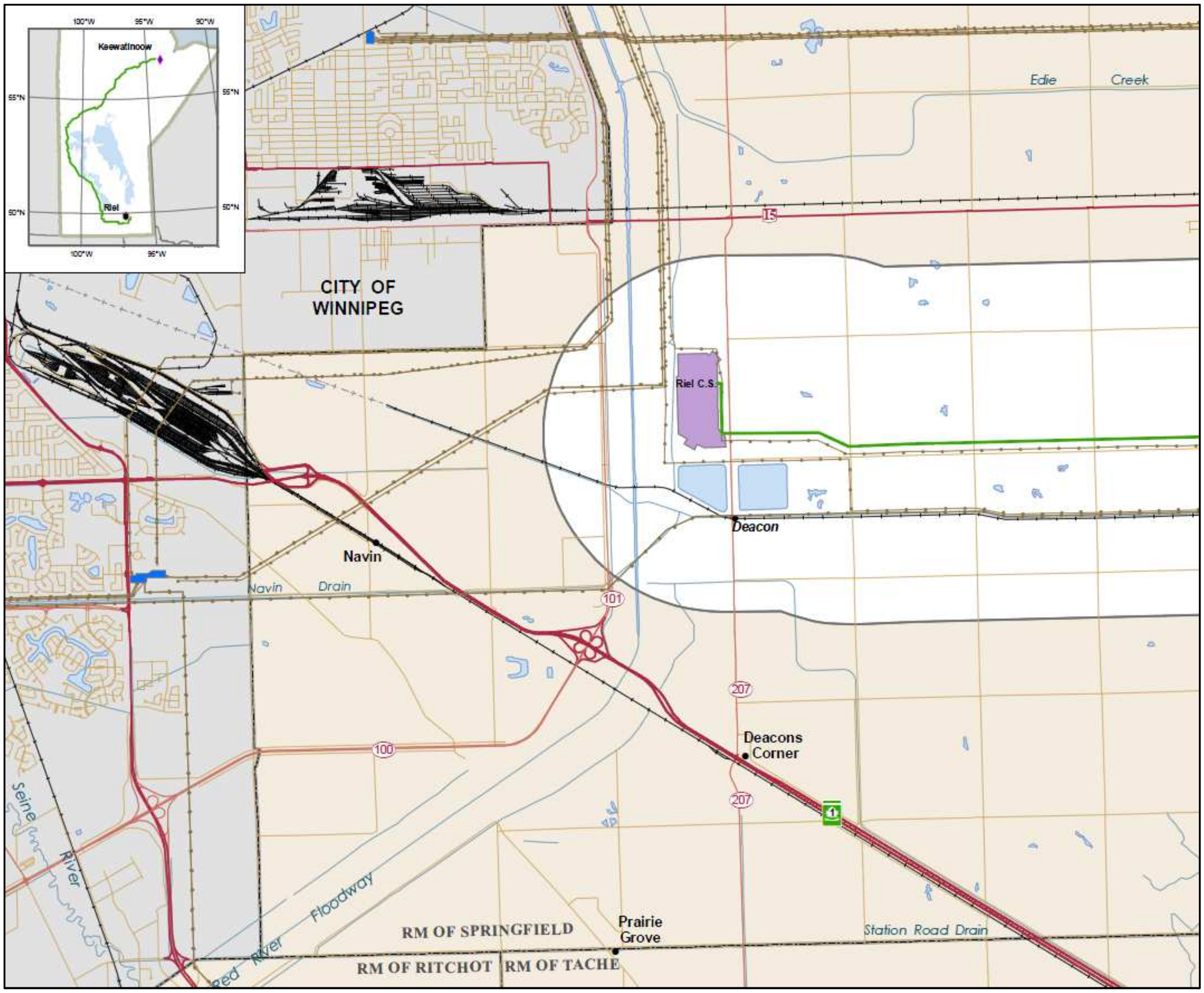

Figure 7.2: Riel Study Area

7.2.1 Keewatinoow Study Area Traffic Volumes

The roads affected by the construction of the Bipole III project in the Keewatinoow Study Area include the Conawapa access road, PR 290 and PR 280 between Gillam and the Keeyask Generating Station access road (refer to **Figure 7.1**). The daily traffic volumes in the Keewatinoow Study Area for the peak quarter of each year of construction are shown in **Table 7.2.**

Table 7.2: Peak Quarterly Traffic Generation Volumes in the Keewatinoow Study Area

Road	Vehicle Type	Daily Traffic Generation Volumes (Peak Quarter)						
		2012	2013	2014	2015	2016	2017*	2018
Conawapa Access Road	Light	65	120	145	75	50	35	5
	Heavy	0	405	40	10	15	10	0
	All	65	525	185	85	65	45	5
PR 290	Light	130	240	250	160	110	60	10
	Heavy	0	0	10	10	5	0	0
	All	130	240	260	170	115	60	10
PR 280 (Between Gillam and PR 290)	Light	110	230	235	155	105	60	10
	Heavy	0	0	0	0	0	0	0
	All	110	230	235	155	105	60	10
PR 280 (Between PR 290 and Keeyask G.S. Access Road)	Light	5	10	15	10	5	5	<5
	Heavy	0	0	10	10	5	0	<5
	All	5	10	25	20	10	5	5

* 2017 – represents the scheduled year of completion for the Bipole III project.

Based on the data provided in the above table, the following can be concluded regarding construction traffic in the Keewatinoow Study Area:

- Traffic activity peaks in 2013 and 2014.
- Construction traffic on PR 280 between PR 290 and the Keeyask generating station will be minimal (five to 25 trips per day).
- Construction traffic on PR 280 near Gillam is expected to peak at 235 trips per day in 2014.
- Aggregate mining activity for the construction of the Keewatinoow Converter Station is scheduled for 2013 and 2014. This results in a peak of 405 truck trips per day on the Conawapa Access Road in 2013.

7.2.2 Riel Study Area Traffic Volumes

The roads most affected by the construction of the Bipole III project in the Riel Study Area include PR 207 and PTH 15. A detailed review of volumes on PTH 101 and Trans-Canada Highway 1 has not been undertaken as these highways have been designed to cater for high volumes of light and heavy vehicles and are expected to sufficiently manage any short-term increases in light and heavy vehicular traffic associated with the construction of the Bipole III project. The daily traffic volumes (over the peak quarter of each construction year) in the Riel Study Area for each year of construction are shown in **Table 7.3.**

Table 7.3: Peak Quarterly Traffic Generation Volumes in the Riel Study Area

Road	Vehicle Type	Daily Traffic Generation Volumes (Peak Quarter)						
		2012	2013	2014	2015	2016	2017*	2018
PR 207 (South of Riel)	Light	30	120	130	105	45	55	<5
	Heavy	0	<5	10	5	<5	0	0
	All	25	110	130	100	40	25	<5
PR 207 (North of Riel)	Light	65	275	305	245	105	125	<5
	Heavy	0	5	30	20	<5	0	0
	All	60	280	330	265	110	125	<5
PTH 15 (East of PR 207)	Light	5	20	35	15	5	10	0
	Heavy	0	0	0	0	0	0	0
	All	5	20	35	15	5	10	0
PTH 15 (West of PR 207)	Light	60	255	295	225	95	115	<5
	Heavy	0	5	35	20	<5	0	0
	All	60	260	330	245	100	115	<5

* 2017 – represents the scheduled year of completion for the Bipole III project.

Based on the data provided in the above table, the following can be concluded regarding construction traffic in the Riel study area:

- Traffic activity peaks in 2014.
- Construction traffic in the Riel study area will be a combination of workers and material delivery for the Riel Converter Station and trucks distributing the transmission line materials to various marshalling yards along the line.
- Construction traffic volumes are most significant on PR 207 north of the Riel Converter Station and PTH 15 west of PR 207 as these segments will be the primary route for

workforce traffic to/from Winnipeg, and truck traffic to/from PTH 101. This will result in a significant volume of traffic turning left from PR 207 onto PTH 15, which is a critical movement within the Riel Study Area.

- PTH 15 and other provincial roads east of PR 207 are expected to experience minimal amounts of construction traffic, peaking at 35 vehicles per day (vpd) on PTH 15.

7.2.3 Remainder of the Bipole III Project

Although a large number of roads will be used throughout Manitoba for the construction of the Bipole III project outside of the Keewatinoow and Riel study areas, the overall impact on the majority of roads used solely for the construction of the Bipole III transmission line component is likely to be insignificant. This is partly due to the temporary nature of construction traffic in addition to the use of mobile camps, which in some cases will "trap" the workforce within the transmission line ROW and reduce the amount of trips on the surrounding road network.

The roads likely to notice an increase in traffic would be those used to transport materials for all major components of the Bipole III project, such as between Winnipeg (and Riel), the northern transmission line segments and the Keewatinoow Study Area. These roads include PTH 6, PR 391, PR 280 and PR 290. Based on the analysis undertaken in **Section 6.0** of this report, other roads outside of the Keewatinoow and Riel study areas likely to result in increased truck movements during construction are illustrated on **Figure 6.1** in **Section 6.2.**

It is generally accepted when determining the impact of a new development on the regional road network that a detailed review of an intersection or road segment is not required if the increase in traffic is small, and within the typical day-to-day fluctuations of traffic flow. This is supported by the Institute of Traffic Engineers (ITE) in their document entitled "Transportation and Land Development, 2nd Edition", dated 2002, which suggests that for large-scale developments:

> *"The study area (influence area) is typically estimated by judgment and then refined during the study process. This influence area might be defined as extending to the most distant intersections at which a measurable impact can be found – such as an increase in an approach 100 vph, a five percent increase in an approach volume, or a change in the volume/capacity (v/c) ratio of two percent or more."*

Therefore, for the purpose of this report, this study only assesses the impact on those roads with a daily increase of five percent or more over background traffic volumes. This is considered satisfactory given the extensive construction area, the level of assumptions made herein due to a number of unknowns (such as the marshalling yard and camp locations), and the temporary nature of construction traffic throughout the transmission line construction period.

For this analysis a Passenger Car Equivalency (PCE) factor of 2.5 (as referenced by MIT in the *Warrants and Standards for Intersection of Rural Two-Lane Highways* dated May 2001) was applied to all heavy vehicle trips related to the Bipole III project to account for the greater impact large vehicles have on roadway capacity. An additional factor of 1.5 was also applied to all Bipole III heavy vehicle trips to account for daily fluctuations in truck activity. By increasing the average daily truck volumes by this factor, the analysis captures a time period with above average projected truck volumes. A fluctuation factor was not applied to the light vehicle estimates as the daily worker trips are anticipated to be more uniform on a day-to-day basis.

A review of the increased traffic volumes within the geographical study area was undertaken and it was established that the roads shown in **Table 7.4** could result in a daily traffic increase during the construction period of five percent or more of background volumes. The results of this analysis are included in **Appendix E** of this report.

Table 7.4: Provincial Roads Outside of the Keewatinoow and Riel Study Areas with a Daily Traffic Generation Increase of Five Percent or More

Road	Location	Peak Bipole III Daily Traffic Volume During Construction*	Peak Year of Construction Traffic	Background Daily Traffic During Peak Year of Construction	Percentage Increase in Traffic
PTH 6	Thompson to PTH 39	155	2014	540	28.7%
PTH 10	PTH 60 to The Pas	60	2015	1,080	5.6%
PTH 10	PR 268 to PTH 60	105	2016	1,070	9.8%
PTH 50	PTH 16 to PTH 5	35	2015	350	10.0%
PR 248	PTH 2 to Bipole ROW	20	2015	160	12.5%
PR 261	PTH 50 to Bipole ROW	35	2015	130	26.9%
PR 268	PTH 10 to PTH 10	65	2017	250	26.0%
PR 271	PTH 20 to PR 489	35	2016	30	116.7%
PR 287 (Paved)	PR 384 to Cormorant	85	2014	1,110	7.7%
PR 287 (Gravel)	PTH 10 to PR 387	70	2014	380	18.4%
PR 364	PR 276 to PTH 20	40	2016	260	15.4%
PR 373	PTH 6 to Bipole ROW	40	2015	160	25.0%
PR 384	PR 287 to Bipole ROW	40	2015	200	20.0%
PR 596	PTH 39 to Bipole ROW	60	2014	10	600.0%

* Assumes a Passenger Car Equivalency (PCE) factor of 2.5 for all heavy vehicle trips related to the Bipole III project. An additional factor of 1.5 was also applied to all Bipole III heavy vehicle trips to account for daily fluctuations in truck activity.

Further review of the above roads has been included in the following sections.

7.3 Road Design Capacity

In order to establish whether the provincial road network is adequate to cater for the Bipole III construction traffic, comparison to the current or proposed (if identified in MIT's short-term highway renewal plans as discussed in **Section 2.1.2**) design capacity of each road segment has been undertaken. The design capacity of each relevant road segment has been established by adopting the Design Standards in the MIT supplement to the Transportation Association of Canada (TAC) Design Guide. It should be noted that "design capacity" does not reflect absolute capacity of a roadway but, rather, reflects a capacity established by a road authority offering a level of service that an average road user would find acceptable during peak traffic conditions. In reality, higher volumes are acceptable, especially over relatively short durations.

A summary of the design, background and construction traffic volumes for the affected provincial roads is presented in **Table 7.5**.

Table 7.5: Summary of Design, Background and Construction Traffic Volumes on the Provincial Roads Identified in Section 7.2

Road	Location	Classification	Design Capacity Volume	Daily Bipole III Traffic Volume at Peak Construction*	Background Daily Traffic During Peak Year of Construction	Daily Volumes (Background Plus Construction Traffic)	Percentage Increase in Traffic
Keewatinoow Converter Station Study Area							
PR 280	Northwest of PR 290	Secondary Arterial	500	45	70	90	64%
PR 280	Gillam to PR 290	Secondary Arterial	**500**	235	300	**535**	**78%**
PR 290	PR 280 to Conawapa Access Road	Secondary Arterial	500	280	160	440	175%
Conawapa Access Road	PR 290 to Construction Camp	--	--	1,645	No Data Available	No Data Available	--
Riel Converter Station Study Area							
PR 207	Riel Access Road to PTH 15	Collector	7,000	435	1,800	2,235	24%
PR 207	Riel Access Road to PTH 1	Collector	7,000	165	1,800	1,965	9%
Remainder of the Bipole III Study Area							
PTH 6	Thompson to PTH 39	Primary Arterial	1,000	155	540	695	29%

Road	Location	Classification	Design Capacity Volume	Daily Bipole III Traffic Volume at Peak Construction*	Background Daily Traffic During Peak Year of Construction	Daily Volumes (Background Plus Construction Traffic)	Percentage Increase in Traffic
PTH 10	PTH 60 to The Pas	Primary Arterial	6,000	60	1,080	1,140	6%
PTH 10	PR 268 to PTH 60	Primary Arterial	**1,000**	105	1,070	**1,175**	**10%**
PTH 50	PTH 16 to PTH 5	Secondary Arterial	1,000	35	350	385	10%
PR 248	PTH 2 to Bipole ROW	Collector	300	20	160	180	13%
PR 261	PTH 50 to Bipole ROW	Collector	1,000	35	130	165	27%
PR 268	PTH 10 to PTH 10	Collector	1,000	65	250	315	26%
PR 271	PTH 20 to PR 489	Collector	300	35	30	65	117%
PR 287 (Paved)	PR 384 to Cormorant	Collector	7,000	85	1,110	1,195	8%
PR 287 (Gravel)	PTH 10 to PR 387	Collector	1,000	70	380	450	18%
PR 364	PR 276 to PTH 20	Collector	1,000	40	260	300	15%
PR 373	PTH 6 to Bipole ROW	Collector	500	40	160	200	25%
PR 384	PR 287 to Bipole ROW	Collector	300	40	200	240	20%
PR 596	PTH 39 to Bipole ROW	Collector	500	60	10	40	400.0%

* Assumes a Passenger Car Equivalency (PCE) factor of 2.5 for all heavy vehicle trips related to the Bipole III project. An additional factor of 1.5 was also applied to all Bipole III heavy vehicle trips to account for daily fluctuations in truck activity.

7.3.1 Discussion – Traffic Impact During Construction

Keewatinoow Study Area

As summarized in **Table 7.5**, the additional traffic generated during the peak construction period of the Bipole III project is significant, with a 65 to 75 percent increase in trips on PR 280 and nearly triple the trips on PR 290.

Although significant increases in traffic are expected, the total daily traffic volumes are expected to be within the acceptable design capacities, as defined by MIT, of PR 280 and PR 290 for the majority of the construction season. During peak construction times, however, it is anticipated that the design capacity of a five to six kilometre section of PR 280 just east of Gillam (determined to be 500 vpd) could be exceeded by just 35 vpd. As these peak volumes are only expected over a relatively short time period during the construction period, and as the actual carrying capacity of PR 280 would be well beyond 500 vpd, the increased construction traffic volume resulting from Bipole III is not considered to warrant any significant road upgrades on this section of road, or any other provincial roads in the Keewatinoow study area.

Although no significant road works are warranted at this stage, it is recommended that PR 280 and PR 290 are monitored during the construction period for potential safety and maintenance issues. This includes regular monitoring of traffic volumes, particularly during the peak construction years of 2013 and 2014. A safety audit along the PR 280 corridor is also recommended to confirm that volumes slightly beyond the design capacity of 500 vpd are deemed acceptable. This audit may also highlight any potential road improvements that may be required in the short term to increase driver safety. Funding for any such road improvements should be reviewed on a case-by-case basis and would be subject to further discussions between MIT and Manitoba Hydro.

The total traffic volumes on the Conawapa Access Road during the peak construction season are significant, particularly truck traffic associated with hauling raw materials between the identified granular material sources (refer to **Appendix C**) and the Keewatinoow construction site. As this road was primarily designed to cater for large volumes of heavy vehicles, no capacity concerns exist for the movement of approximately 1,645 PCE vpd, which would equate to approximately 165 PCE vehicles in the peak hour of the peak construction period. Appropriate design speeds and traffic signage should be erected, in conjunction with the implementation of a traffic monitoring and maintenance program, to ensure traffic is controlled and safety is maximized.

Riel Study Area

MIT has recently upgraded PTH 15 between PTH 101 and PR 207, including the signalization of the PTH 15 and PR 207 intersection. These works are likely to alleviate any concerns associated with the additional Bipole III traffic, particularly the critical left-turn movement from PR 207 onto PTH 15.

Therefore, taking into consideration the above works and the anticipated construction traffic volumes, no additional works on the provincial road network are considered necessary in the Riel Study Area as a result of the Bipole III project.

Remainder of the Bipole III Project (outside of Keewatinoow and Riel Study Areas)

As summarized in **Table 7.5**, the additional traffic generated during the peak construction period of the Bipole III project would result in an increase in traffic, of varying degrees, throughout the provincial road network.

Although the increase in daily traffic may be high on some roads (typically those roads with low background volumes), only PTH 10 between PTH 60 and PR 268 is likely to carry volumes in excess of its design capacity. It is important to note that the design capacity on this road segment was exceeded even prior to any additional construction traffic associated with Bipole III. This roadway was assigned a design capacity of 1,000 vpd based on a lack of partially paved shoulders (0.6 to 0.8 metres). In addition, during a desktop review of the pavement condition, some sections were found to be in poor condition with longitudinal and transverse cracking. However, the Manitoba Highway Renewal Plan has identified the older sections of PTH 10 for resurfacing sometime between 2011 and 2015. Following this resurfacing, the design capacity of the roadway would likely be upgraded to 6,000 vpd and would therefore be more than adequate to accommodate the background plus anticipated Bipole III construction traffic.

The desktop review noted that some sections of PTH 10 (not yet identified for renewal) still lack partially paved shoulders and, as such, maintain a design capacity of 1,000 vph. These sections appear to still feature good surface conditions with adequately sized gravel shoulders (2.5 to 3 metres) and would be more than adequate to carry volumes in excess of the design capacity as defined by MIT.

Given the future road works along PTH 10, the short-term duration of construction traffic, and the fact that the traffic volumes are only marginally over the design capacity, it can be concluded that no additional works on PTH 10 between PTH 60 and PR 268 or on any other provincial road would be required as a consequence of the Bipole III project.

7.4 Mitigation Measures

Based on the traffic volumes estimated in this report, the impact on the overall provincial road network is unlikely to be significant over the extended construction period. There will be occasions, however, where increased truck traffic volumes are experienced on certain road segments during the peak construction period when large quantities of material are required for a certain phase of the project.

In order to minimize the impact of increased construction traffic on the road network, the following general mitigation measures should be considered:

- To better plan for increases in truck traffic on the provincial and local road network, consideration should be given to the preparation of a transportation plan detailing the number of trucks, truck routes, and times of day and week of truck operations throughout the construction of the Bipole III project. The transportation plan could highlight driver protocols and identify road constraints (such as bridge clearances) and conditions for each identified route to reduce the impact of truck traffic on the network. The preparation of this plan could be a joint effort between the contractor and Manitoba Hydro, with approval required through MIT.

- All construction access points along the transmission line ROW and at the two converter station sites should include appropriate warning signage in accordance with the Manual of Uniform Traffic Control Devices for Canada, such as the TC-54 (R or L) Truck Entrance Sign, to ensure drivers are well informed of the increase in construction traffic on the network.
- All access points should be located such that sight distances are maximized, and in accordance with the requirements of MIT. Adequate turning radii and widths are required at all proposed access points to minimize impact on the through traffic flow and damage to adjacent utilities. Auxiliary lanes may need to be considered at busy access points off major roads.
- Marshalling yards along the transmission line ROW should be located off or as close as practically possible, without comprising safety, to a major highway with RTAC or A1 loading. This would reduce the likelihood of a driver on a minor or lower order road unexpectedly experiencing a high volume of truck traffic. It also reduces the potential for road rehabilitation as a consequence of the increased truck volumes.
- The local municipality should be contacted by the contractor prior to any local road being used for hauling materials or large equipment. This will give the municipality the opportunity to identify additional mitigation and maintenance requirements and to ensure that the local road structure has been designed to withhold high volumes of truck traffic.
- Once the location of the marshalling yards are known, their operation should be communicated to the local community through public consultation (if appropriate, depending on the selected locations), community newspapers and other media outlets to advise of the increased truck movements in the vicinity of these yards, timing of activity, the additional noise or light levels that could be expected from the site, and to warn the public to stay off the property.

7.5 Monitoring

Throughout the construction period, and potentially during the initial stages of the operational and maintenance phase, it is recommended that a traffic monitoring and maintenance program be implemented.

The traffic monitoring program could include regular traffic counts during the peak construction periods on selected roads in the vicinity of Keewatinoow Converter Station / Gillam and Riel

Converter Station. The data obtained from the counts, such as vehicle type, direction of travel and frequency, could be used to assist in managing the movement of heavy vehicles on the road network and to better understand the potential capacity and safety implications of increased traffic during peak construction and hauling periods associated with the Bipole III project. The obtained data could also be used to assist in transportation planning studies for future Manitoba Hydro projects within the province.

It is also recommended that monitoring and recording of collisions and/or near misses should also be undertaken throughout the construction period to try and establish any potential relationships between traffic incidents and increased Bipole III construction traffic. Again, any found relationships could be used to potentially reduce collisions on the provincial road network as a consequence of the Bipole III project and any future projects proposed in Manitoba of a similar scale.

Monitoring of road conditions at all access points off the provincial and local road network, including a base inventory of existing conditions, is also recommended to ensure that all public roadways are maintained to an acceptable level and to ensure that all damaged road pavement, where relevant, is restored to its original condition.

7.6 Operation and Maintenance Traffic Impact

Keewatinoow Converter Station

It has been estimated that 42 Manitoba Hydro staff will be required for the operation and maintenance of the Keewatinoow Converter Station. According to the Draft Project Description, approximately 30 of these employees will be required at the station on a typical weekday. In addition, approximately 30 contract staff may be present at the site during station maintenance periods.

It would be expected that all Manitoba Hydro employees would be based in Gillam with some traveling to and from the site on a daily basis and some lodging at the site during the work week. During maintenance periods, contract staff would most likely camp at the site, and as such, daily vehicle trips to and from Gillam would be limited.

During peak maintenance conditions, and on the conservatively high assumption that all 60 employees (30 Manitoba Hydro staff and 30 contract staff) travel between the Keewatinoow Converter Station site and Gillam on a daily basis, the daily peak volume expected on PR 280, PR 290 and the Conawapa Access Road would be approximately 120 vehicle trips per day. Considering only Manitoba Hydro employees, the daily volume would be expected to be approximately 60 vpd. These calculations assume one trip to the site, one trip from the site, and a vehicle occupancy of one person per vehicle. In reality, however, carpooling is likely to occur which would marginally reduce the overall daily trips associated with the Keewatinoow Converter

Station. Typical trip generation rates as provided in the ITE manual “Trip Generation” (8th edition) are not considered relevant for the Keewatinoow Converter Station due to the remoteness of the site, ultimately reducing the volume of worker drop-off trips, courier trips and local trips to nearby commercial and activity centres.

The 2009 Traffic Flow Map produced by the University of Manitoba Transport Information Group, dated June 2010, shows that the maximum AADT volume on PR 280 between Gillam and PR 290 is 290 vpd and the maximum AADT volume on PR 290 is 150 vpd. Adopting a one percent per annum (compound) growth rate for background traffic, which is consistent with Manitoba’s future population growth rate up to 2028 (Ref: “Manitoba’s Future Population Growth, 2009 to 2028, A Conservative View”, Manitoba Bureau of Statistics, September 2028), the AADT volumes on PR 280 and PR 290 would increase to approximately 315 vpd and 160 vpd, respectively, by 2017 (in-service date), and approximately 380 vpd and 200 vpd, respectively, by 2037 (i.e., the 20-year design horizon beyond the in-service date).

With the additional traffic associated with the operation and maintenance of the Keewatinoow Converter Station, the peak AADT volumes in the design-horizon year of 2037 would be expected to be in the order of 440 vpd to 500 vpd on PR 280 and 260 vpd to 320 vpd on PR 290. These estimates are equal to or less than the design capacity of both PR 280 and PR 290 of 500 vpd, as determined from MIT’s guidelines for provincial highways. Therefore, no upgrades on both PR 280 and PR 290 are required due to the traffic generated by the operational and maintenance phase of the Bipole III transmission line project.

Riel Converter Station

It has been advised that approximately 45 Manitoba Hydro employees will be required for the operation and maintenance of the Riel Converter Station. According to the Draft Project Description, related employment opportunities will include staff positions for power supply workers (multi-skilled), operators, electrical and mechanical technicians, and maintenance utility workers.

The daily traffic generation volumes likely to be generated by the operation and maintenance phase of the Riel Converter Station have been estimated by adopting the daily trip rates included in ITE’s document “Trip Generation” (8th edition). The land use most relevant to the operation of the Riel Converter Station is considered to be Light Industry. For this land use, a daily trip generation rate on a weekday (the peak conditions for both the surrounding traffic and Riel Converter Station) of 3.02 trips per worker is provided. Applying this rate to the Manitoba Hydro employee estimates equates to approximately 140 vpd for the operation and maintenance phase of the Riel Converter Station.

The 2009 Traffic Flow Map produced by the University of Manitoba Transport Information Group, dated June 2010, shows that the maximum AADT volume on PR 207 past the Riel site is 1,700 vpd and the AADT volume on PTH 15 west of PR 207 is 9,810 vpd. Adopting a one percent per annum (compound) growth rate for background traffic, the AADT volumes on PR 207 and PTH 15 would increase to approximately 1,840 vpd and 10,600 vpd, respectively, by 2017 (in-service date), and approximately 2,250 vpd and 13,000 vpd, respectively, by 2037 (i.e., the 20-year design horizon beyond the in-service date).

With the additional traffic associated with the operation and maintenance of the Riel Converter Station, the peak AADT volumes in the design-horizon year of 2037 could increase to approximately 2,390 vpd on PR 207. This estimate is well below the design capacity of PR 207 of 7,000 vpd, which was determined from MIT's guidelines for provincial highways.

The increase in traffic on PTH 15 is expected to be less than 1.5 percent, which is unlikely to have a significant impact to the safety and efficiency of the corridor. The impact on all other surrounding roads and highways, including PTH 1, PTH 101 and Dugald Road, is also expected to be minimal.

Therefore, no upgrades on the surrounding road network are required due to the traffic generated by the operational and maintenance phase of the Riel Converter Station component of the project.

Remainder of the Bipole III Project (Outside of Keewatinoow and Riel Study Areas)

Manitoba Hydro advised that the operational and maintenance workforce for the transmission line will be 11.5 persons, which is an average annual estimate. It is estimated that up to three workers would be Manitoba Hydro workers, with the remainder being contract workers.

The increase in traffic associated with the operational and maintenance phase of the Bipole III transmission line component is expected to be minimal, and for the most part, its impact will be unnoticeable. Similar to the requirements for temporary construction access, all permanent access points to the transmission line ROW are required to be designed with adequate sight distances and turning radii for large vehicles.

8.0 IMPACT ON RAIL

8.1 Construction Period

Manitoba Hydro has identified a number of electrical system components for the Riel and Keewatinoow converter stations that will be transported by rail. These components are listed in **Table 8.1**. The electrical components for the Riel Converter Station will be transported by rail directly to the Riel marshalling yard, whereas the electrical components for the Keewatinoow Converter Station will be delivered directly to the existing Henday Transfer Yard and transported by truck to the Keewatinoow Converter Station site. It is noted that heavier components will need to be transported using specially designed depressed rail cars.

Table 8.1: Deliveries by Rail

Component	Weight (metric tonnes)	Number of Units	
		Keewatinoow Converter Station	Riel Converter Station
Synchronized Rotor	150	-	4
Synchronized Stator	195	-	4
Synchronized Unit Transformer	174.15 (218.20 with fittings)	-	4
Converter Transformer	218 (256.84 with fittings)	14	14
Station Service	13.65 (15.85 with fittings)	3	3
DC Smoothing Reactor Coil	54.35	7	7
TOTAL	**-**	**24**	**36**

Based on the above data, approximately 60 components are required to be transported by rail, with 40 of these components exceeding the weight limits of the CN rail network.

The logistics of transporting these items requires further discussion between Manitoba Hydro, OmniTrax, CN rail, CP rail, suppliers of heavy duty rail cars, and the manufacturers of the identified components.

In relation to existing rail operations, it would be expected that the transporting of all heavy items would be undertaken at low speeds and, as such, detailed scheduling would be required to ensure the impact on day-to-day operations, and particularly passenger rail operations, is minimized.

8.2 Operations and Maintenance – Impact on Rail

Putting aside any future requirement for the replacement of any electrical items, the additional demand on the existing rail network during the operation and maintenance phase is expected to be minimal and unlikely to interfere with the operation of any existing services. The transportation of any additional large items will need to be coordinated with the relevant railway agencies to ensure the impact on the existing commercial and passenger services are kept to a minimum.

9.0 IMPACT ON AIR TRAVEL

9.1 Construction Period

Many of the workers travelling to and from the Keewatinoow Converter Station construction site are expected to travel by air via the Gillam Airport. A significant amount of the work for the Keewatinoow Converter Station will require specialized trades from Winnipeg or other southern population centres. It is therefore expected that there will be a significant amount of passenger movement by air between Winnipeg and Gillam.

Calm Air International Ltd. (Calm Air) was contacted regarding the service currently provided to Manitoba Hydro for the construction of the Wuskwatim Generating Station project. It was indicated that Manitoba Hydro funds a charter between Winnipeg and Thompson at least once a week. The charter aircraft used is either a SAAB 340 or ATR-3000 with a capacity of 30 to 37 people, depending on the aircraft and amount of equipment being transported. Any additional traffic beyond the capacity of the weekly charter is accommodated on the regular scheduled service on any of the available airlines to and from Thompson.

Calm Air further indicated that Manitoba Hydro, as part of the Wuskwatim project, provided approximate passenger numbers at least a year in advance of construction, which allowed Calm Air to reserve the required aircraft and schedule the regular and charter service accordingly. Based on the charter arrangement for Manitoba Hydro staff, Calm Air indicated that there does not appear to be a shortage of seats for non-Manitoba Hydro passengers on the scheduled services between Winnipeg and Thompson.

The ongoing Wuskwatim project has a larger peak workforce than Keewatinoow but with similar work schedules. For the construction of the Keewatinoow GS, craft labour workers will be on a four week in and one week out rotation and supervisory personnel will be on a three week in and one week out rotation. To ensure that capacity on the scheduled flights is still available for local residents, implementation of a regular charter service (weekly, bi-weekly or other regular time) to accommodate the bulk of the Bipole III project workforce is recommended. If this strategy is implemented, close coordination between Manitoba Hydro and the relevant air carrier/s is recommended to ensure availability of the charter aircraft during the peak transfer times. A charter aircraft dedicated to Manitoba Hydro workers would likely reduce the incidence of delays, costs and inconvenience to regular passengers. Allowing a year lead time between coordination with the air carrier and the start of construction has proven to be effective for the Wuskwatim project and is recommended for the proposed Bipole III project.

An increase in passenger numbers between Winnipeg and Thompson, and potentially between Winnipeg and The Pas, is also expected due to the construction of the Bipole III Transmission Line. This increase, on average, is expected to be adequately accommodated on the scheduled services. It is noted, however, that charter services may occasionally be necessary for transporting larger groups. These services would mainly be warranted at either the start or end of construction of a transmission line segment.

9.2 Operations and Maintenance - Impact on Air Services

An increase in passenger numbers between Winnipeg, Thompson, Gillam, and potentially The Pas is expected as part of operations and maintenance of the Bipole III infrastructure. This increase in passenger demand is unlikely to warrant additional flights and should be accommodated within the scheduled (at the time) passenger flight services.

10.0 CUMULATIVE TRANSPORTATION IMPACTS

The preliminary construction schedules of the Bipole III Transmission Line, Keewatinoow Converter Station, Keeyask Generating Station and Conawapa Generating Station were reviewed to better understand the peak activity periods for the construction of other current and proposed Manitoba Hydro projects. **Table 10.1** outlines the potential schedules for these projects and identifies critical time periods using total person-years. Considering all future projects, the period between 2014 and 2020 would be the most critical when considering the traffic impact in the vicinity of Gillam, PR 280 and PR 290.

As determined in this report, PR 280 between PR 290 and the access to the proposed Keeyask Generating Station has been identified as having a high historical crash rate. Also, it was estimated that a five to six kilometre section of PR 280 just east of Gillam may exceed its design capacity during peak construction times of the Bipole III project. In order to ensure the safety of all road users in the Keewatin study area as part of Bipole III project, further review of the critical sections of PR 280, and potentially PR 290, is recommended.

Demand on air travel will also be exacerbated when considering the cumulative impacts of all Manitoba Hydro projects proposed in northern Manitoba. It is unlikely that the additional passenger demand associated with all future projects can be accommodated within the scheduled flight services. Therefore, similar to the recommendation for the Bipole III project, an implementation of a regular charter service will most likely be required. The frequency of this service would be subject to actual demand.

Material quantities and method of transportation for the Keeyask and Conawapa generating stations have not been reviewed in detail within this report. It is therefore unknown what level of train traffic would be generated by these projects. Similar to the recommendations for the Bipole III project, detailed scheduling with the relevant authorities would be required to ensure the impact on day-to-day operations, and particularly passenger rail operations, is minimized.

Table 10.1: Construction Schedules for Major Existing and Future Manitoba Hydro Projects

Activity Hub	Project	Total Person Years (Approx.)	Yearly Workforce Level											
			2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Gillam	Keewatinoow Converter Station	922	Medium	High	High	Medium	Low	Low (Y)	-	-	-	-	-	-
	Bipole III Transmission Line	185	Low	Medium	High	High	-	(Y)	-	-	-	-	-	-
	Conawapa Generating Station[1]	13,000	-	-	Low	Low	Low	Medium	Medium	High	High	High	High	Medium (Y)
	Keeyask Generating Station[2]	4,500	-	Low	Low	High	High	Medium	Medium	Low	Low (Y)	-	-	-
Thompson	Wuskwatim Generating Station[3]	-	Low (Y)	-	-	-	-	-	-	-	-	-	-	-
	Bipole III Transmission Line	185	Low	Medium	High	High	-	(Y)	-	-	-	-	-	-
The Pas	Bipole III Transmission Line	365	Low	Medium	High	High	High	High (Y)	-	-	-	-	-	-
Winnipeg (southeast)	Riel Converter Station	643	Low	High	High	High	Medium	Low (Y)	-	-	-	-	-	-
	Riel Sectionalization Project[4]	200	High	Medium	Low (Y)	-	-	-	-	-	-	-	-	-
	Bipole III Transmission Line	180	-	-	-	High	Medium	(Y)	-	-	-	-	-	-

Y – In-Service Year.

(1) Source: hydro.mb.ca/projects/conawapa – Person years include direct and indirect employment.

(2) Source: Keeyask Environmental Impact Assessment, Public Involvement Program, Round 1

(3) Source: hydro.mb.ca/projects/wuskwatim

(4) Source: Riel Reliability Improvement Initiative Project: Environmental Impact Statement, January 2009

11.0 CONCLUSIONS AND RECOMMENDATIONS

This study provides an overall review of the transportation and travel aspects associated with the proposed Bipole III transmission project. As determined throughout this report, the following conclusions and recommendations have been made:

Collision Analysis

The collision analysis that identified that PR 280, northwest PR 290, has historical collision rates exceeding the generally accepted rate of 1.5 MVKT. This warrants further investigation. It is noted that the data provided by MIT did not include details on collision type or collision configuration (i.e., type of accident and potential cause). In order to provide a recommendation on the appropriate course of action, a detailed site investigation and review of the raw collision data would be required.

Surface improvements are being undertaken at various locations along this stretch of road (up to the Keeyask Generating Station access) as part of a funding agreement between Manitoba Hydro and MIT. These works may contribute to increased safety along that segment of the road corridor.

Traffic Impact - Keewatinoow Study Area

The total daily traffic volumes (background plus Bipole III traffic) in the Keewatinoow study area have been calculated to be within the acceptable design capacities, as defined by MIT, of PR 280 and PR 290 for the majority of the construction season. During peak construction times, however, it is anticipated that the design capacity of a five to six kilometre section of PR 280 just east of Gillam (determined to be 500 vpd), could be exceeded by just 35 vpd. As the design capacity is likely to be exceeded for only a relatively short time period, and as the actual carrying capacity of PR 280 would be well beyond 500 vpd, the increased traffic volume resulting from the Bipole III construction traffic is not considered to warrant any significant road upgrades on this section of road.

Although no significant road works are warranted at this stage, it is recommended that PR 280 and PR 290 are monitored during the construction period for potential safety and maintenance issues. This includes regular monitoring of traffic volumes, particularly during the peak construction years of 2013 and 2014. A safety audit along the PR 280 corridor is also recommended to confirm that volumes slightly beyond the design capacity of 500 vehicles per day are deemed acceptable. This audit may also highlight any potential road improvements that may be required in the short term to increase driver safety. Funding for any such road improvements should be reviewed on a case-by-case basis and would be subject to further discussions between MIT and Manitoba Hydro.

The total traffic volumes on the Conawapa access road during the peak construction season are significant, particularly truck traffic associated with hauling raw materials between the identified granular material sources (refer to **Appendix C**) and the Keewatinoow construction site. As this road was primarily designed to cater for large volumes of heavy vehicles, no capacity concerns exist for the movement of the anticipated traffic flows during the peak construction periods (estimated at approximately 1,645 PCE vpd, which would equate to approximately 165 PCE vehicles in the peak hour). Appropriate design speeds and traffic signage should be erected, in conjunction with the implementation of a traffic monitoring and maintenance program, to ensure traffic is controlled and safety is maximized.

Traffic Impact - Riel Study Area

MIT has recently upgraded PTH 15 between PTH 101 and PR 207, including the signalization of the PTH 15 and PR 207 intersection. These works are likely to alleviate any concerns associated with the additional Bipole III traffic, particularly the critical left-turn movement from PR 207 and PTH 15. Therefore, taking into consideration the above works and the anticipated construction traffic volumes, no additional works on the provincial road network are considered necessary in the Riel Study Area as a consequence of the Bipole III project.

A detailed review of volumes on PTH 101 and Trans-Canada Highway 1 was not undertaken as these highways have been designed to cater for high volumes of light and heavy vehicles, and would be more than sufficient to manage any short-term increases in light and heavy vehicular traffic associated with the construction of the Bipole III project.

The additional traffic generated during the peak construction period of the Bipole III project would result in an increase in traffic, of varying degrees, throughout the provincial road network.

Traffic Impact - Bipole III Study Area (excluding the study areas of Keewatinoow and Riel)

With reference to the Bipole III study area (excluding the study areas of Keewatinoow and Riel), no additional works on the provincial road network are warranted as a direct result of increased traffic associated with the construction of the transmission line.

Traffic Impact - Operations and Maintenance

The increase in traffic associated with the operations and maintenance phase of the Bipole III project is not expected to have a significant impact to the safety and efficiency of the provincial road network and, as such, no upgrades to the network are warranted.

Traffic Mitigation Measures

In order to minimize any potential impacts of increased construction traffic on the road network, mitigation measures such as additional signage at truck access points (in accordance with Manual of Uniform Traffic Control Devices for Canada guidelines), appropriate access location and control, communication with the local governments and communities, and the provision of a transportation plan (from the contractor) highlighting driver protocol, truck traffic volumes and times, and road constraints and conditions on the identified routes are recommended.

Traffic Monitoring

Throughout the construction period, and potentially during the initial stages of the operational and maintenance phase, it is recommended that a traffic monitoring and maintenance program be implemented. This could include regular traffic counts on selected roads in the vicinity of Keewatinoow Converter Station / Gillam and Riel Converter Station to closely monitor the construction traffic generated by the Bipole III project.

Monitoring and recording of collisions and/or near misses should also be undertaken throughout the construction period to try and establish any potential relationships between incidents and increased Bipole III construction traffic. Again, any found relationships could be used to potentially reduce collisions on the provincial road network as a consequence of the Bipole III project and any future projects proposed in Manitoba of a similar scale.

Monitoring of road conditions at all access points off the provincial and local road network, including a base inventory of existing conditions, is also required to ensure that all public roadways are maintained to an acceptable level and to ensure that all damaged road pavement is restored back to its original condition.

Impact on Rail

Manitoba Hydro advised that approximately 60 electrical system components for the Riel and Keewatinoow converter stations will be transported by rail. Of this total, it was identified that approximately 40 components exceed the weight limits of the CN Rail network. These items will need to be transported using specially designed depressed rail cars. The logistics of transporting these items requires further discussion between Manitoba Hydro, OmniTrax (the owners of Hudson Bay Railway), CN rail, CP rail, suppliers of heavy duty rail cars, and the manufacturer/s of the identified components.

In relation to the existing rail operations, it would be expected that the transporting of all heavy items would be undertaken at low speeds and, as such, detailed scheduling would be required to ensure the impact to day-to-day operations, and particularly passenger rail operations, is minimized.

Putting aside any future requirement for the replacement of any electrical items, the additional demand on the existing rail network during the operation and maintenance phase is expected to be minimal and unlikely to interfere with the operation of any existing services. The transportation of any additional large items will need to be coordinated with the relevant railway agencies to ensure the impact on the existing commercial and passenger services are kept to a minimum.

Impact on Air

A significant amount of the work for the Keewatinoow Converter Station and associated components will require specialized trades from Winnipeg or other southern population centres. It is therefore expected that there will be a significant amount of passenger movement by air between Winnipeg and Gillam. To ensure that capacity on the scheduled flights is still available for local residents, it is recommended that a regular charter service (weekly, bi-weekly or other regular time) to accommodate the bulk of the Bipole III project workforce be implemented.

An increase in passenger numbers between Winnipeg and Thompson, and potentially between Winnipeg and The Pas, due to the construction of the Bipole III Transmission Line is also expected. This increase, on average, is expected to be adequately accommodated on the scheduled air service. Charter services may be necessary for occasionally transporting larger groups; however, these services would mainly be warranted at either the start or end of construction of a transmission line segment.

An increase in air passengers between Winnipeg, Thompson, Gillam, and potentially The Pas is expected to marginally increase as part of operations and maintenance of the Bipole III infrastructure. This increase in passenger demand will be irregular and is unlikely to warrant additional flights and should be accommodated within the scheduled (at the time) passenger flight services.

Cumulative Impact of Major Manitoba Hydro Projects

When considering the additional traffic associated with future proposed Manitoba Hydro projects, such as the Keeyask Generating Station and the Conawapa Generating Station, the cumulative impacts on the road network would be exacerbated and upgrades to certain road segments in the vicinity of the Keewatinoow study area and beyond would be expected. The potential schedules for these projects are outlined in **Table 10.1**. As shown in this table, the period between 2014 and 2020 would be the most critical when considering the cumulative traffic impact on the surrounding road network, particularly in the vicinity of Gillam, PR 280 and PR 290. Any specific road infrastructure improvements due to cumulative impacts are considered to be outside the scope of this planning study and would be the subject of additional analysis and review.

Demand on air travel will also be exacerbated when considering the cumulative impacts of all Manitoba Hydro projects proposed in northern Manitoba It is unlikely that the additional passenger demand associated with all future projects can be accommodated within the scheduled flight services. Therefore, similar to the recommendation for the Bipole III project, an implementation of a regular charter service will most likely be required. The frequency of this service would be subject to actual demand.

Material quantities and method of transportation for the Keeyask and Conawapa generating stations have not been reviewed in detail within this report. It is therefore unknown what level of train traffic would be generated by these projects. Similar to the recommendations for the Bipole III project, detailed scheduling with the relevant authorities would be required to ensure the impact on day-to-day operations, and particularly passenger rail operations, is minimized.

APPENDIX A – Glossary

Transportation Study - Glossary

A1 Loading: Loading restrictions which apply to vehicles travelling on Class A1 highways as set out in the Manitoba Regulation 575/88.

B1 Loading: Loading restrictions which apply to vehicles travelling on Class B1 highways as set out by the Manitoba Regulation 575/88.

Annual Average Daily Traffic (AADT): The total volume of traffic passing a point or segment of a highway facility in both directions for one year divided by the number of days in the year. (Highway Capacity Manual, 2000)

Average Annual Daily Truck Traffic (AADTT): The total volume of truck traffic passing a point or segment of a highway facility in both directions for one year divided by the number of days in the year. (Highway Capacity Manual, 2000)

Canadian National (CN): A Canadian transportation company which owns an extensive railway network that extends across Canada and into the United States.

Gross Vehicle Weight (GVW): the total weight of a vehicle or combination of vehicles, including its load, transmitted to the road by its axles. (MIT, 2011)

Hudson Bay Railway (HBR): A 627 mile railway in northern Manitoba from The Pas to Hudson Bay. The HBR was previously owned by CN and is currently owned by OmniTrax Inc.

Keewatin Railway Company (KWC): A partnership between three Manitoba First Nations to own and operate the Sherridon Rail Line, a 185 mile railway which extends from Sherritt Junction to Lynn Lake, Manitoba.

Manitoba Highway Traffic Information Website (MHTIS): A website which provides highway traffic information for Provincial Trunk Highways and Provincial Roads in Manitoba, including traffic data from 2009. (MHTIS, 2010)

Manitoba Infrastructure and Transportation (MIT): A department of the Province of Manitoba which is responsible for the development of transportation policy and legislation, and for the management of the province's infrastructure network. (MIT, 2011)

Million Vehicle-Kilometres of Travel (MVKT): The total number of kilometers travelled by all vehicles on a roadway or road network over a given time period divided by one million.

Passenger Car Equivalents (PCE): A traffic volume unit of measurement that represents the impact a vehicle has on the transportation system.

Provincial Road (PR): A highway declared to be a provincial road according to the Manitoba Highways and Transportation Act.

Provincial Trunk Highway (PTH): A highway declared to be a provincial trunk highway according to the Manitoba Highways and Transportation Act.

Regional Transportation Advisory Committee (RTAC): In Manitoba, a committee formed with the purpose of reviewing issues related to a given region's transportation priorities in order to support the management of the provincial transportation system. (RTAC ToR, 2007)

RTAC Loading: Weight restrictions for roadways designated as RTAC routes according to Schedule B of the Manitoba Regulation 575/88.

Spring Road Restrictions (SRR): SRR reduce the allowable weights on highways in the spring months when the subgrade of the pavement structure is saturated, causing the driving surface it be more susceptible to damage.

Transportation Association of Canada (TAC): A Canadian non-profit organization which provides a forum for the exchange of technical information and design guidelines related to transportation.

Trucking Productivity Improvement Fund (TPIF): A voluntary user-pay program which may allow increased loading on lower class highways. (MIT, 2011)

Vehicle Tare Weight: Weight of an empty vehicle.

References

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APPENDIX B – Workforce Estimates

Keewatinoow Converter Station - DRAFT
Quarterly Construction Site Workforce Forecast
Contractor Site Craft Personnel
February 28, 2011

Labor Group	Total (person-years)	Y-6				Y-5				Y-4				Y-3				Y-2				Y-1				Y				Y+1			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
CONSTRUCTION SUPPORT AND SERVICE TRADES	219	0	0	0	0	0	0	1	39	41	44	53	50	52	46	37	39	35	41	52	52	43	44	42	35	32	32	31	19	11	8	6	2
NON-DESIGNATED TRADES	252	0	0	0	0	0	0	0	55	72	64	85	114	118	92	57	62	51	46	64	53	18	19	19	14	7	7	7	5	3	0	0	0
DESIGNATED TRADES	451	0	0	0	0	0	0	0	32	73	105	115	145	198	174	96	106	84	86	121	136	94	96	83	28	23	25	23	11	3	0	0	0
TOTAL CONTRACTOR CRAFT PERSONNEL	**922**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**126**	**186**	**213**	**253**	**309**	**368**	**312**	**190**	**207**	**170**	**173**	**237**	**241**	**155**	**159**	**144**	**77**	**62**	**64**	**61**	**35**	**17**	**8**	**6**	**2**

Notes:

1) The above forecasts are based on Manitoba Hydro's forecast of workforce and a construction schedule based on a October 2017 in-service date of the Bipole III Complex.

2) The above information represents a forecast only, based on current regulations, present project plans, and experience with similar projects. Contractors will determine specific job requirements when the project is being built. Actual employment requirements will vary from the forecast presented above.

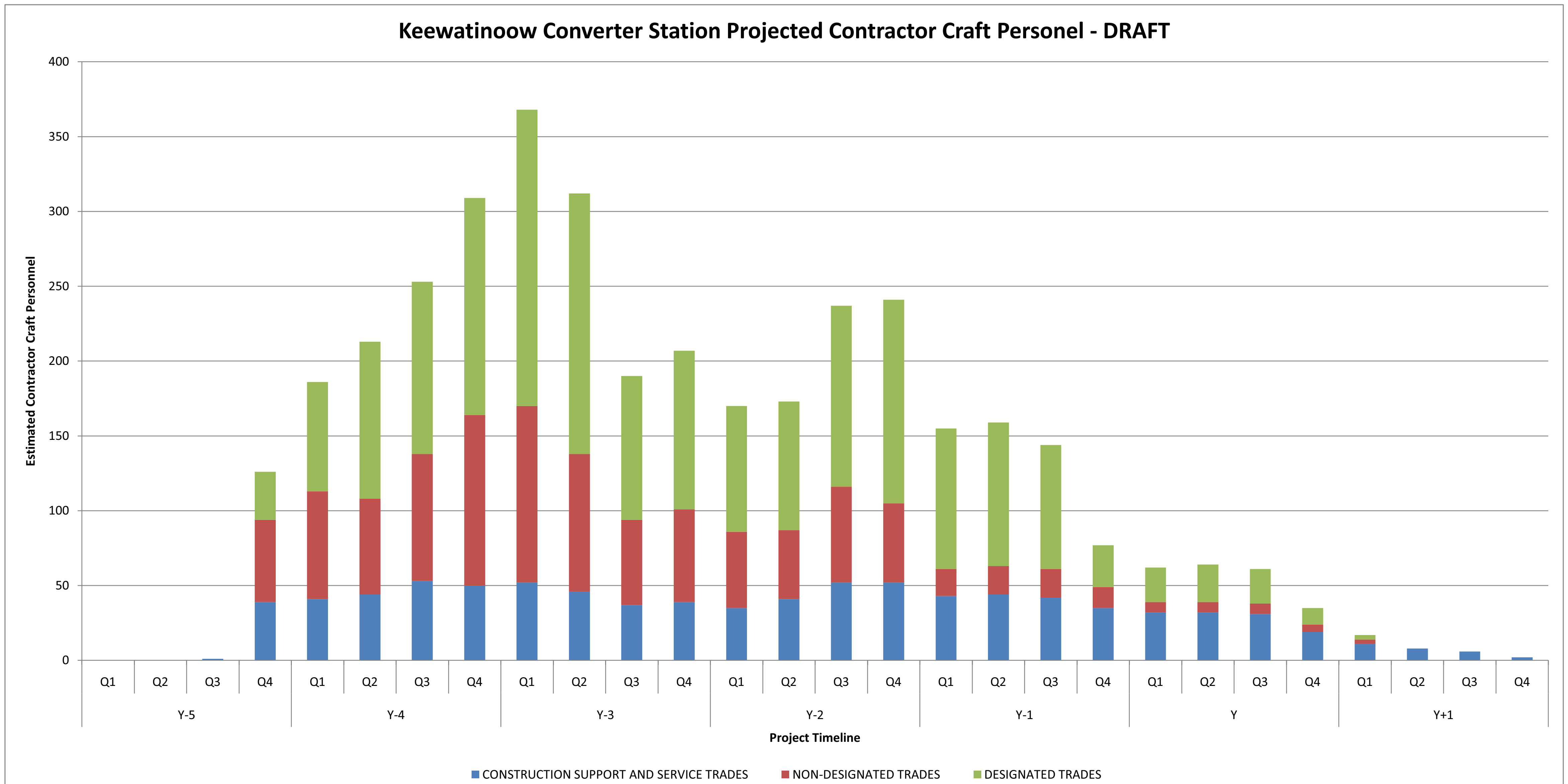
3) "TOTAL CONTRACTOR CRAFT PERSONNEL" refers to the average number of people on site within the quarter specified based on a monthly estimate, rounded to the nearest whole number.

4) The above information indicates contractor craft site personnel (not including supervisory and management positions). The above forecasts also do not include Manitoba Hydro staff, or workforce for the construction of Substations and Transmission Lines.

5) **Designated Trades** are those trades which apprenticeship training and certification requirements are regulated by the Government of Manitoba in accordance with the Apprenticeship and Trades Qualification Act.

6) Total (person-years) are calculated based on the estimate of person-months, where one person year is equivalent to 12 person-months.

7) Estimate represents projected number of workers needed on site during the specified time period and does not account for turnarounds.



Riel Converter Station - DRAFT
Quarterly Construction Site Workforce Forecast
Contractor Site Craft Personnel
February 28, 2011

Labor Group	Total (person-years)	Y-6				Y-5				Y-4				Y-3				Y-2				Y-1				Y				Y+1			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
CONSTRUCTION SUPPORT AND SERVICE TRADES	45	0	0	0	0	0	0	0	5	6	6	6	9	9	9	9	9	9	9	10	9	10	9	10	9	10	9	9	9	2	0	0	0
NON-DESIGNATED TRADES	179	0	0	0	0	0	0	0	31	43	49	34	83	87	76	58	42	40	40	35	31	19	18	12	14	12	6	3	2	0	0	0	0
DESIGNATED TRADES	419	0	0	0	0	0	0	0	18	58	103	83	137	157	127	145	124	152	155	140	111	57	48	37	39	32	10	4	3	0	0	0	0
TOTAL CONTRACTOR CRAFT PERSONNEL	**643**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**54**	**107**	**158**	**123**	**229**	**253**	**212**	**212**	**175**	**201**	**204**	**185**	**151**	**86**	**75**	**59**	**62**	**54**	**25**	**16**	**14**	**2**	**0**	**0**	**0**

Notes:

1) The above forecasts are based on Manitoba Hydro's forecast of workforce and a construction schedule based on a October 2017 in-service date of the Bipole III Complex.

2) The above information represents a forecast only, based on current regulations, present project plans, and experience with similar projects. Contractors will determine specific job requirements when the project is being built. Actual employment requirements will vary from the forecast presented above.

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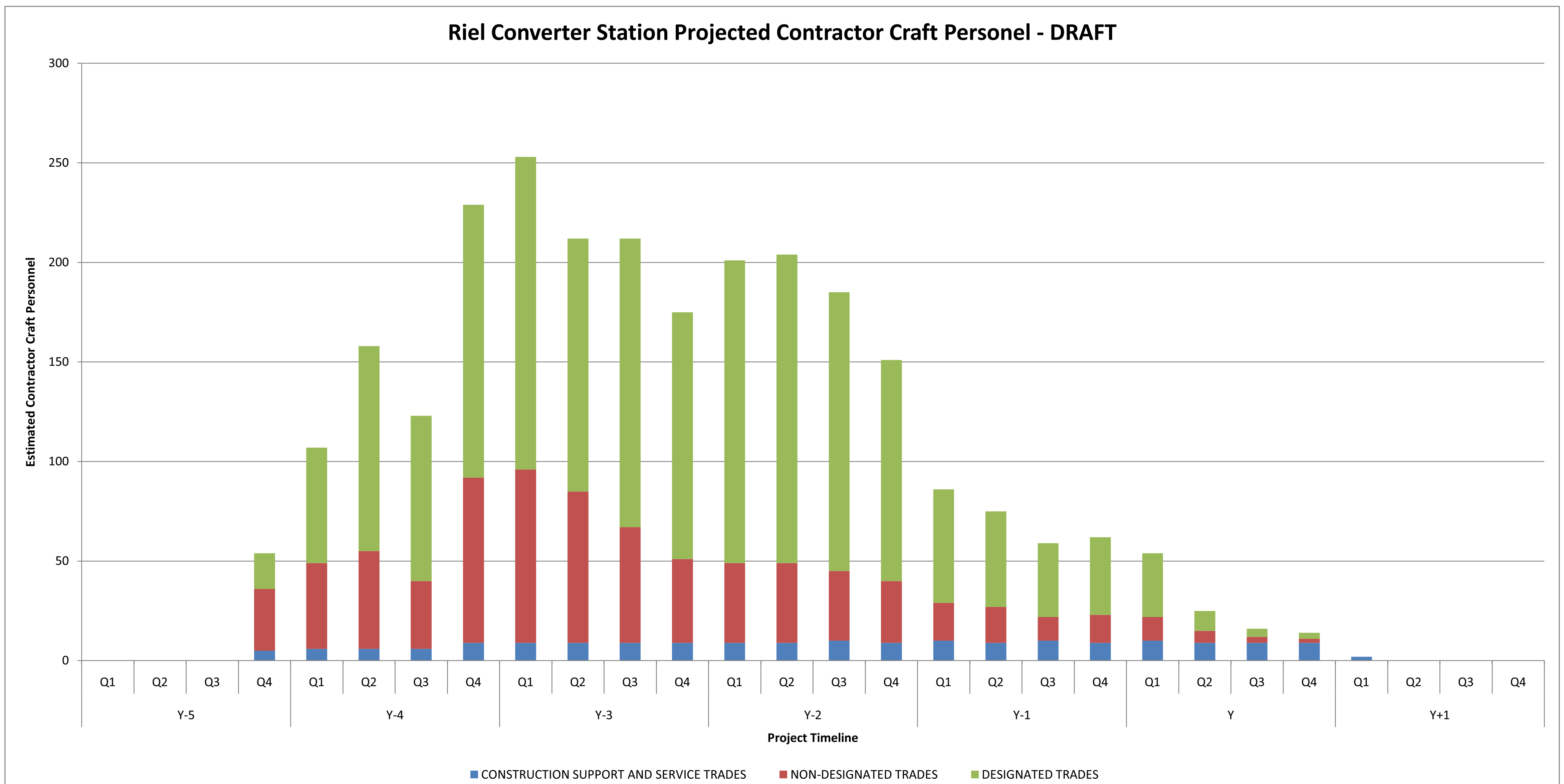
5) **Designated Trades** are those trades which apprenticeship training and certification requirements are regulated by the Government of Manitoba in accordance with the Apprenticeship and Trades Qualification Act.

6) Total (person-years) are calculated based on the estimate of person-months, where one person year is equivalent to 12 person-months.

7) Estimate represents projected number of workers needed on site during the specified time period and does not account for turnarounds.



Manitoba Hydro Workforce Projections

	2012 Q4	2013 Q1	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2
Bi Pole III																			
N1 - Clearing	4	6	---	---	4	6	---	---	---	---	---	---	---	---	---	---	---	---	---
N2 - Clearing	4	6	---	---	4	6	---	---	---	---	---	---	---	---	---	---	---	---	---
N3 - Clearing	4	6	---	---	4	6	---	---	---	---	---	---	---	---	---	---	---	---	---
N1 - Construction	---	---	---	4	6	18	4	4	6	18	4	---	---	---	---	---	---	---	---
N2 - Construction	---	---	---	4	6	18	4	4	6	18	4	---	---	---	---	---	---	---	---
N3 - Construction	---	---	---	4	6	18	4	4	6	18	4	---	---	---	---	---	---	---	---
N4 - Clearing	---	---	---	---	---	---	---	---	4	6	---	---	4	6	---	---	---	---	---
N4 - Construction	---	---	---	---	---	---	---	---	---	---	---	4	6	18	4	4	6	18	4
C1 - Clearing/Construction	---	---	---	---	---	---	---	---	---	---	---	---	4	18	12	---	---	---	---
C2 - Clearing/Construction	---	---	---	---	---	---	---	---	4	18	12	---	---	---	---	---	---	---	---
S1 - Clearing/Construction	---	---	---	---	---	---	---	---	---	---	4	18	12	---	---	---	---	---	---
S2 - Clearing/Construction	---	---	---	---	---	---	4	18	12	---	---	---	---	---	---	---	---	---	---
Totals (BP III Only)	12	18	0	12	30	72	16	30	38	78	28	22	26	42	16	4	6	18	4
Keewatinoow Construction Power (138 kV) (KN 36 Extension)																			
Clear & Construct - 30 km X 1	4	12	4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Keewatinoow AC Collector Lines (230 kV)																			
Clear & Construct - 4 X 30 km & 1 X 56 km	4	12	4	---	6	12	6	---	4	10	4	---	---	---	---	---	---	---	---
Electrode Lines																			
North (~ 15 km)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	4	10	4
South (~ 20 km)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	4	10	4

Contractor Workforce Projections

Bi Pole III

	2012 Q4	2013 Q1	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2
N1 - Clearing	15	40	---	---	15	40	---	---	---	---	---	---	---	---	---	---	---	---	---
N2 - Clearing	15	40	---	---	15	40	---	---	---	---	---	---	---	---	---	---	---	---	---
N3 - Clearing	15	40	---	---	15	40	---	---	---	---	---	---	---	---	---	---	---	---	---
N1 - Construction	---	---	---	10	75	200	20	20	75	200	20	---	---	---	---	---	---	---	---
N2 - Construction	---	---	---	10	75	200	20	20	75	200	20	---	---	---	---	---	---	---	---
N3 - Construction	---	---	---	10	75	200	20	20	75	200	20	---	---	---	---	---	---	---	---
N4 - Clearing	---	---	---	---	---	---	---	---	15	40	---	---	15	40	---	---	---	---	---
N4 - Construction	---	---	---	---	---	---	---	---	---	---	---	10	75	200	20	20	75	200	20
C1 - Clearing/Construction	---	---	---	---	---	---	---	---	---	---	---	---	20	150	150	---	---	---	---
C2 - Clearing/Construction	---	---	---	---	---	---	---	---	20	150	150	---	---	---	---	---	---	---	---
S1 - Clearing/Construction	---	---	---	---	---	---	---	---	---	---	100	150	150	---	---	---	---	---	---
S2 - Clearing/Construction	---	---	---	---	---	---	100	150	150	---	---	---	---	---	---	---	---	---	---
Totals (BP III Only)	**45**	**120**	**0**	**30**	**270**	**720**	**160**	**210**	**410**	**790**	**310**	**160**	**260**	**390**	**170**	**20**	**75**	**200**	**20**

Keewatinoow Construction Power (138 kV) (KN 36 Extension)

	2012 Q4	2013 Q1	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2
Clear & Construct - 30 km X 1	50	120	50	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

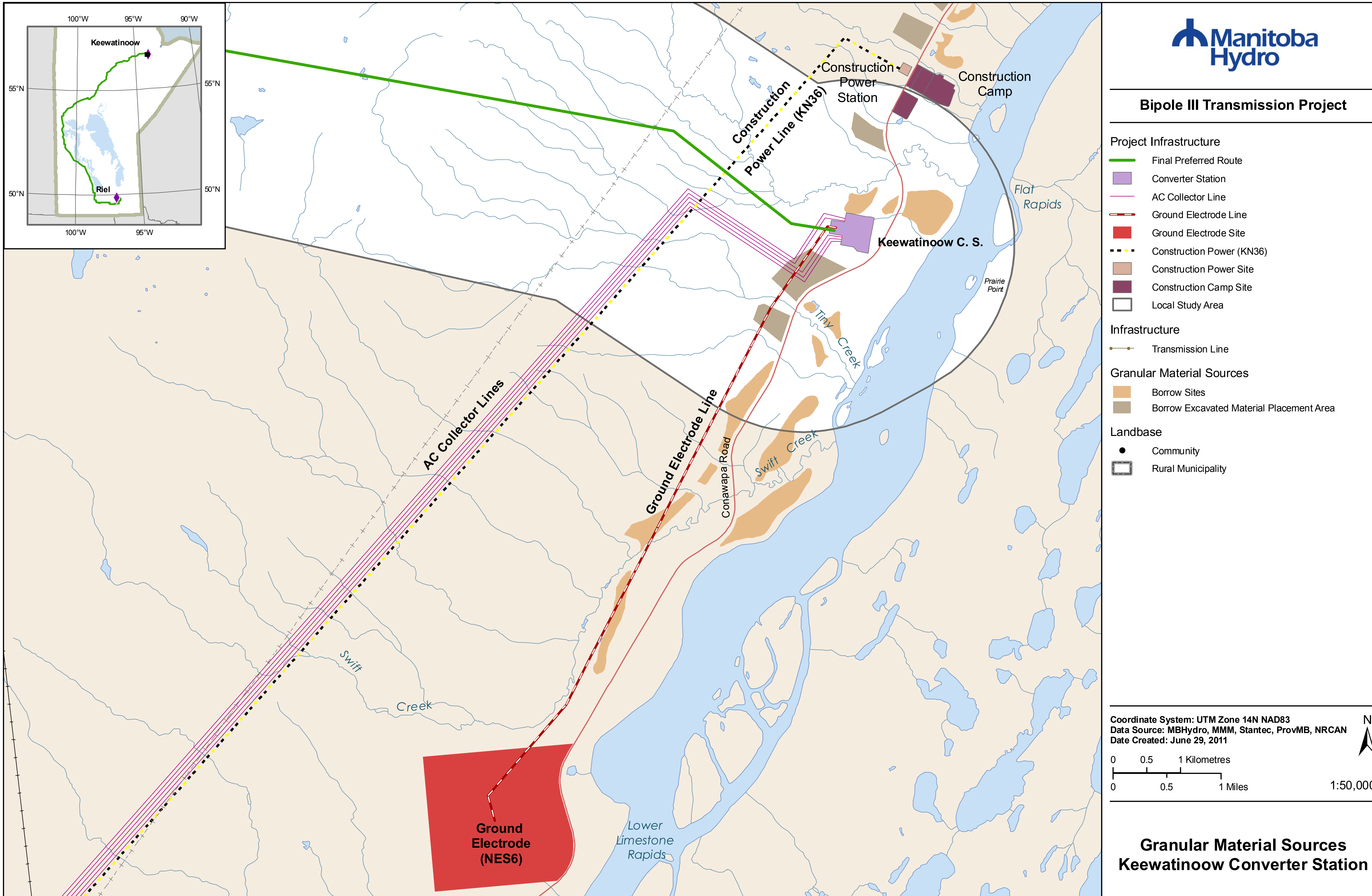
Keewatinoow AC Collector Lines (230 kV)

	2012 Q4	2013 Q1	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2
Clear & Construct - 4 X 30 km & 1 X 56 km	30	70	30	---	50	120	50	---	20	50	20	---	---	---	---	---	---	---	---

Electrode Lines

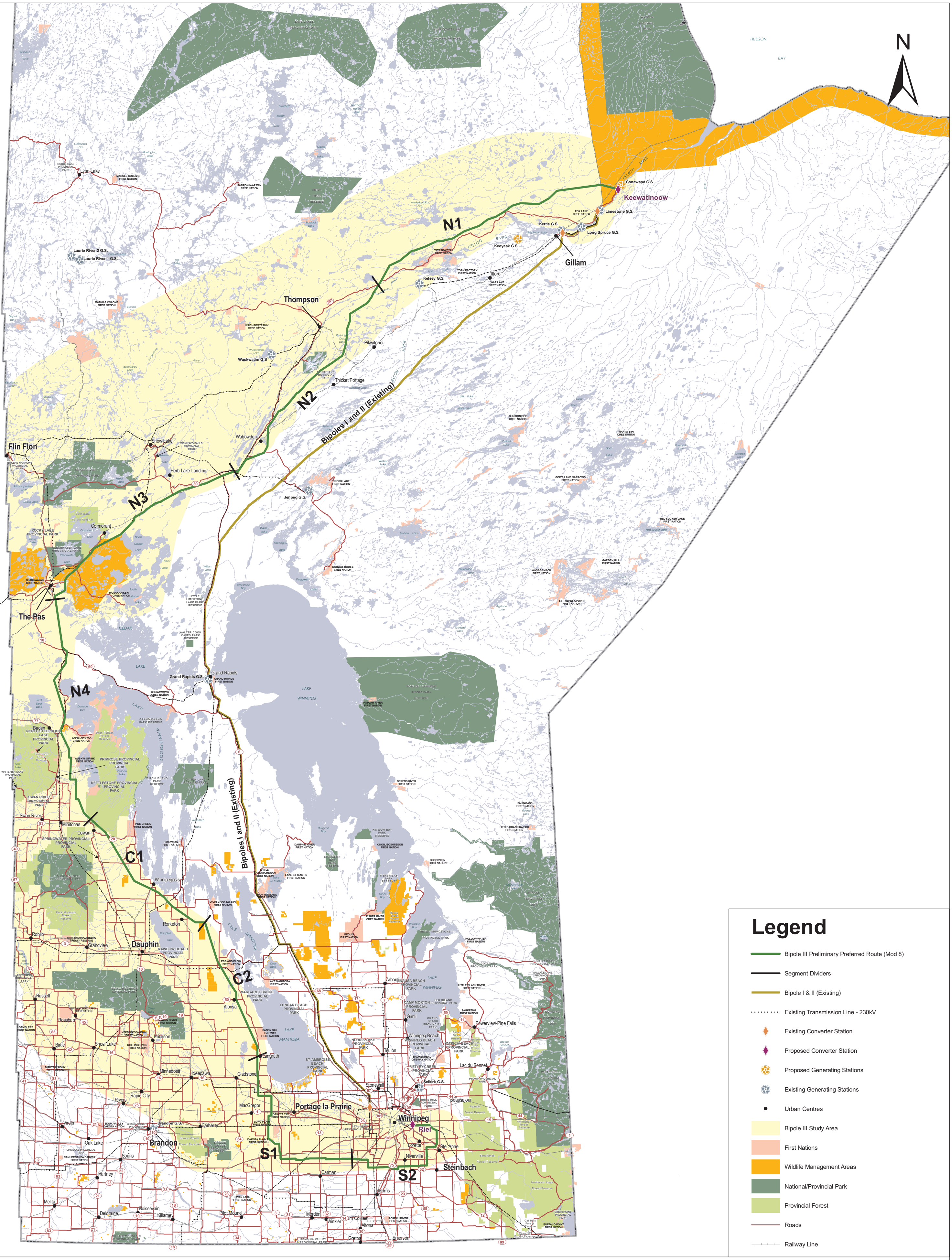
	2012 Q4	2013 Q1	2013 Q2	2013 Q3	2013 Q4	2014 Q1	2014 Q2	2014 Q3	2014 Q4	2015 Q1	2015 Q2	2015 Q3	2015 Q4	2016 Q1	2016 Q2	2016 Q3	2016 Q4	2017 Q1	2017 Q2
North (~ 15 km)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	20	50	20
South (~ 20 km)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	20	50	20

APPENDIX C – Granular Material Sources Map



Keewatinoow
Riel
100°W
95°W
90°W
55°N
50°N
Construction Power Station
Construction Camp
Construction Power Line (KN36)
Keewatinoow C. S.
Flat Rapids
Prairie Point
Tiny Creek
AC Collector Lines
Ground Electrode Line
Conawapa Road
Swift Creek
Ground Electrode (NES6)
Lower Limestone Rapids
Manitoba Hydro
Bipole III Transmission Project
Project Infrastructure
Final Preferred Route
Converter Station
AC Collector Line
Ground Electrode Line
Ground Electrode Site
Construction Power (KN36)
Construction Power Site
Construction Camp Site
Local Study Area
Infrastructure
Transmission Line
Granular Material Sources
Borrow Sites
Borrow Excavated Material Placement Area
Landbase
Community
Rural Municipality
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCAN
Date Created: June 29, 2011
N
0 0.5 1 Kilometres
0 0.5 1 Miles
1:50,000
Granular Material Sources Keewatinoow Converter Station

APPENDIX D – Bipole III Construction Segments and Access Points

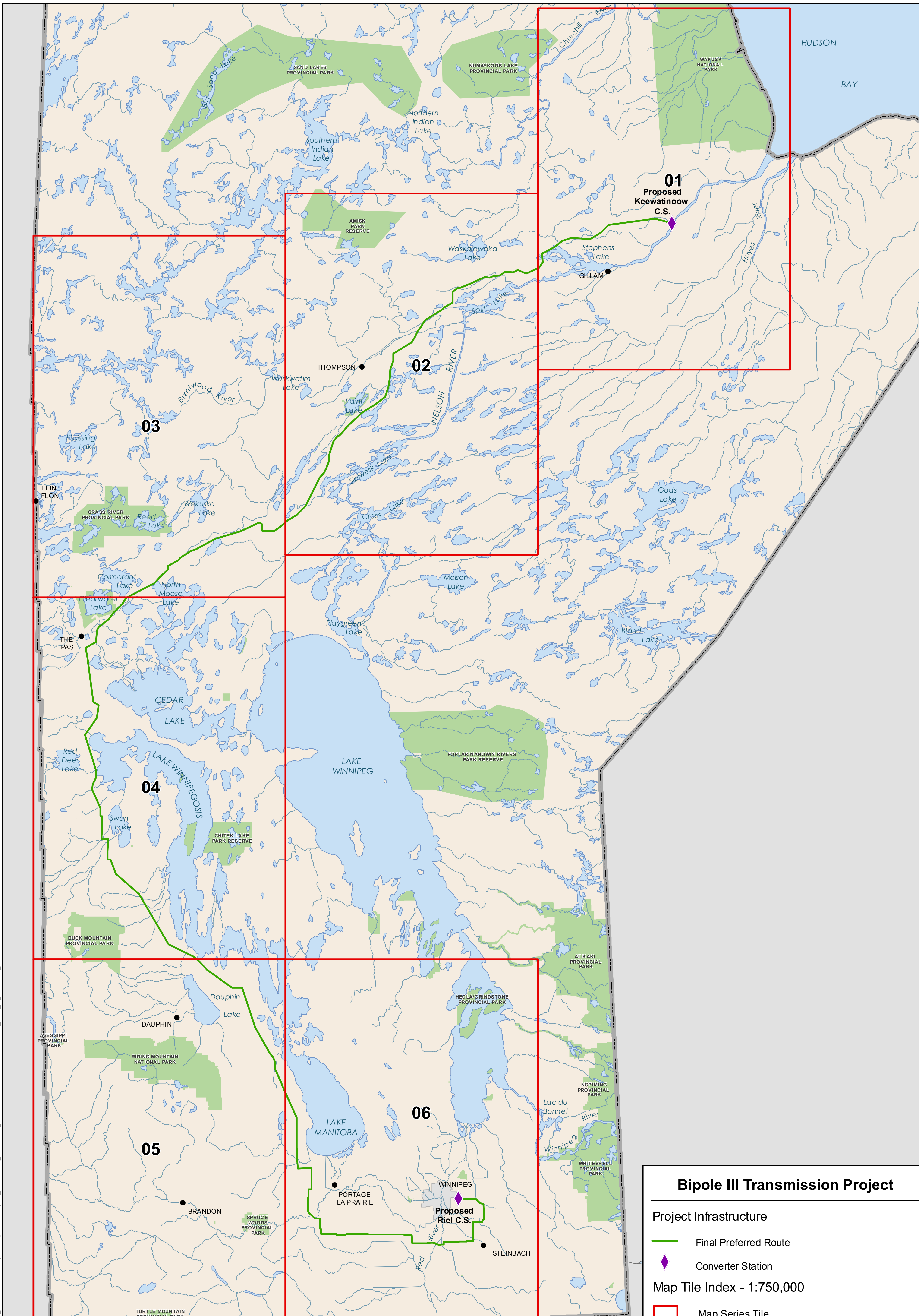


Manitoba Hydro

0 10 20 40 60 80 Kilometers
0 10 20 40 60 80 Miles

Coordinate System: UTM Z14, NAD 83
Data Source: ProvMB, MBHydro, MMM
Date Created: January 5, 2011

Bipole III Transmission Line Construction Planning Segments



Coordinate System: UTM Zone 14N NAD83
Data Source: MB Hydro, MMM, ProvMB
Date Created: May 12, 2011

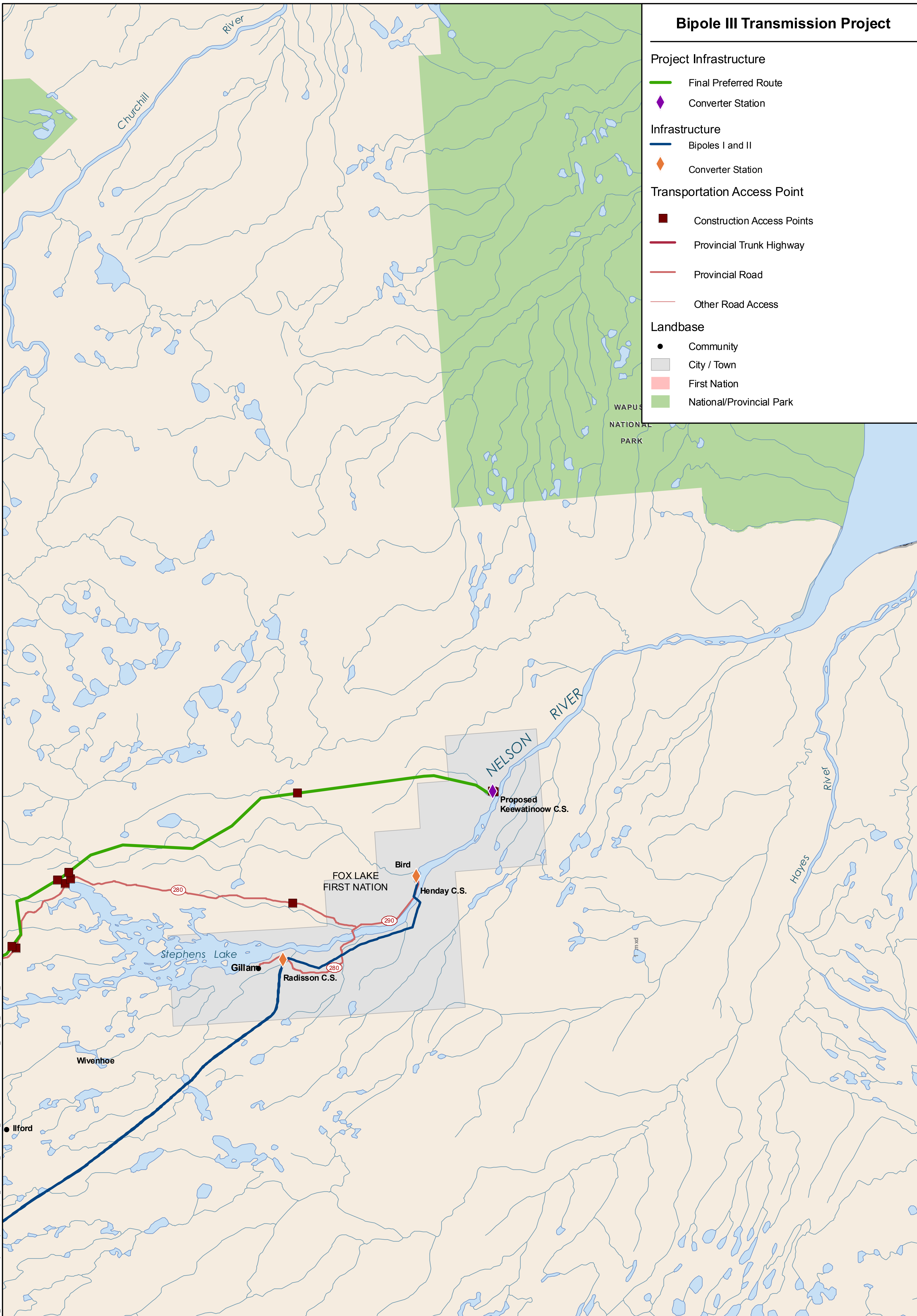
0 25 50 Kilometres
0 25 50 Miles
1:2,750,000

Index of Map Series

Construction Access Points Index

Draft: For Discussion Purposes Only

Manitoba Hydro



Manitoba Hydro

Coordinate System: UTM Zone 14N NAD83
Data Source: MB Hydro, MMM, ProvMB, Stantec
Date Created: May 12, 2011

0 6 12 Kilometres
0 6 12 Miles

N

1:750,000

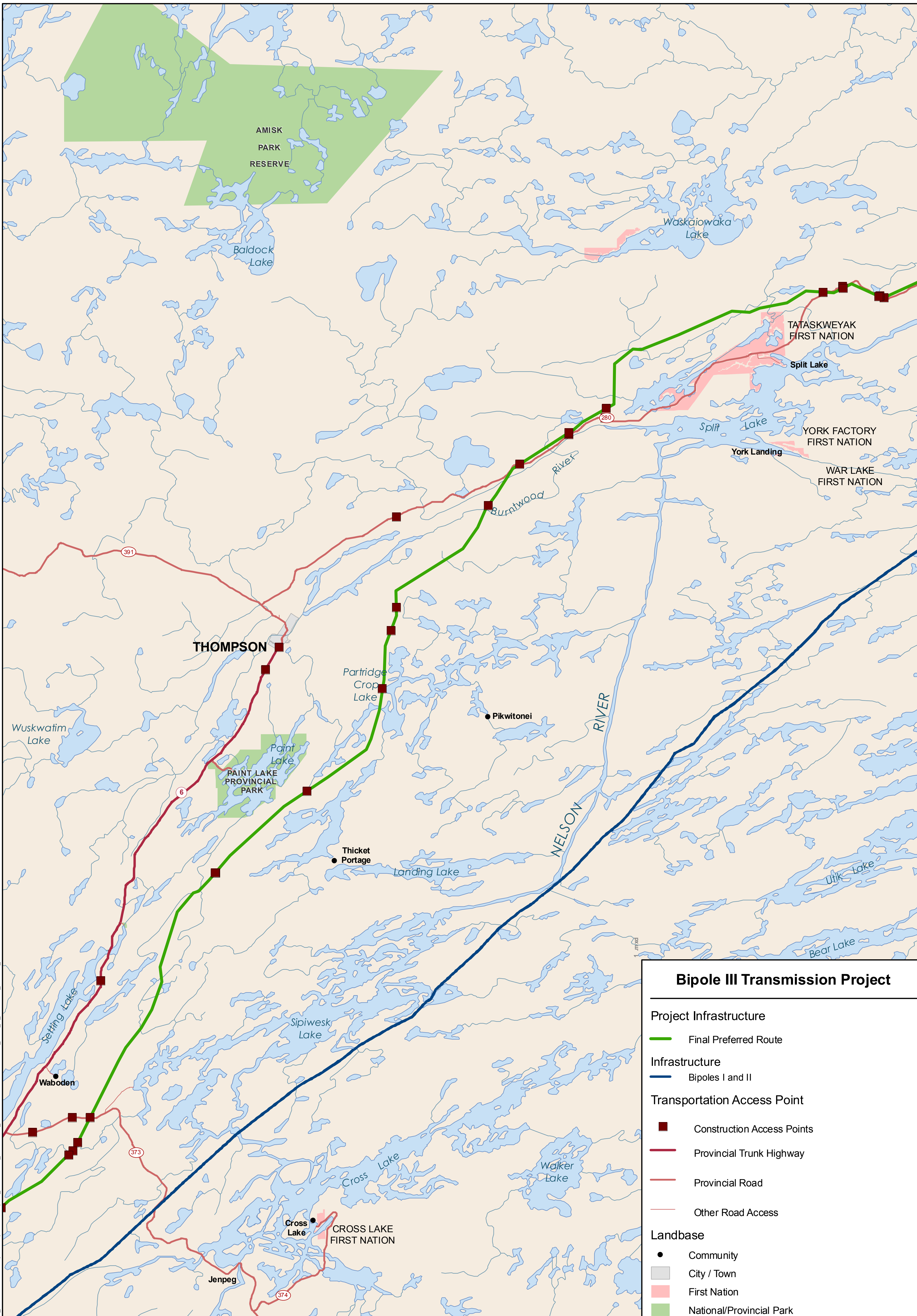
Construction Access Points

TILE 01

Draft: For Discussion Purposes Only

Map #

U:\Projects\5509033_BipoleIII\MASTER_JDM\Technical Report Maps 2\Transport_MMM\BPIII_TECHREP_ConstructionAccessPoints_750k_B_20110512_DRAFT_



Manitoba Hydro

Coordinate System: UTM Zone 14N NAD83
Data Source: MB Hydro, MMM, ProvMB, Stantec
Date Created: May 12, 2011

0 6 12 Kilometres

0 6 12 Miles

1:750,000

N

Construction Access Points

TILE 02

Draft: For Discussion Purposes Only

Map #

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Manitoba Hydro

Coordinate System: UTM Zone 14N NAD83
Data Source: MB Hydro, MMM, ProvMB, Stantec
Date Created: May 12, 2011

0 6 12 Kilometres

0 6 12 Miles

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Construction Access Points

TILE 03

Draft: For Discussion Purposes Only

Map #

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Coordinate System: UTM Zone 14N NAD83
Data Source: MB Hydro, MMM, ProvMB, Stantec
Date Created: May 12, 2011

0 6 12 Kilometres

0 6 12 Miles

1:750,000

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Manitoba Hydro

Construction Access Points

TILE 04

Draft: For Discussion Purposes Only

Map #

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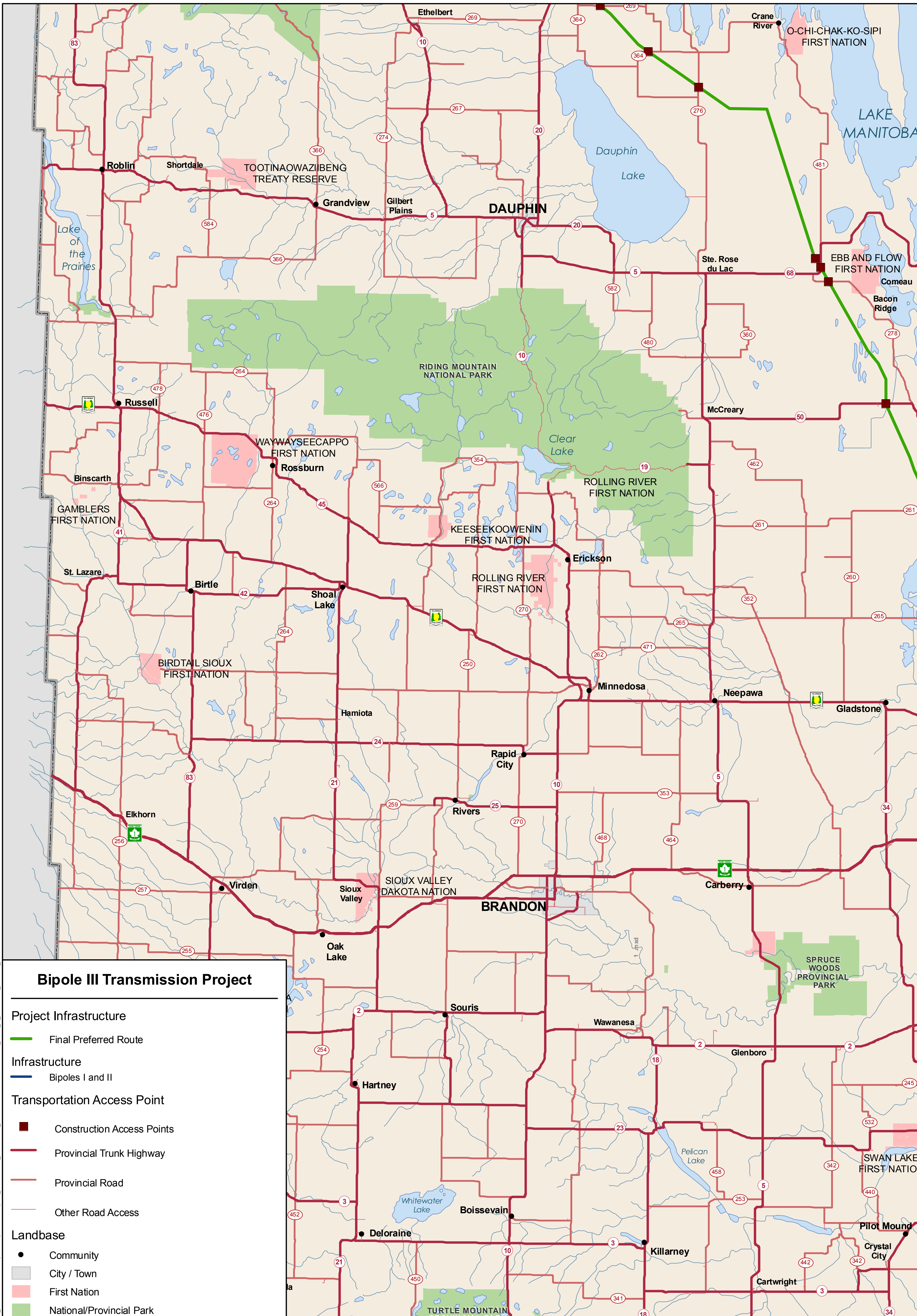

Bipole III Transmission Project

Project Infrastructure

- Final Preferred Route

Infrastructure

- Bipoles I and II

Transportation Access Point

- Construction Access Points
- Provincial Trunk Highway
- Provincial Road
- Other Road Access

Landbase

- Community
- City / Town
- First Nation
- National/Provincial Park

Manitoba Hydro

Coordinate System: UTM Zone 14N NAD83
Data Source: MB Hydro, MMM, ProvMB, Stantec
Date Created: May 12, 2011

0 6 12 Kilometres

0 6 12 Miles

1:750,000

N

Construction Access Points

TILE 05

Draft: For Discussion Purposes Only

Map #

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Manitoba Hydro

Coordinate System: UTM Zone 14N NAD83
Data Source: MB Hydro, MMM, ProvMB, Stantec
Date Created: May 12, 2011

0 6 12 Kilometres

0 6 12 Miles

1:750,000

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Construction Access Points

TILE 06

Draft: For Discussion Purposes Only

Map #

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APPENDIX E – Calculations

Bipole III Project – Percentage Increase in Traffic Volumes by Geographical Area

Road	Location	Peak Daily Traffic Volume during Construction (in Passenger Car Equivelents*)	Peak Year of Construction Traffic	Background Daily Traffic during Peak Year of Construction	Percentage Increase in Traffic
Keewatinoow Study Area					
PR 280	Northwest of PR 290	45	2014	70	64.3%
PR 280	Gillam to PR 290	235	2014	300	78.3%
PR 290	PR 280 to Conawapa Access Road	280	2014	160	175.0%
Conawapa Access Road	PR 290 to Construction Camp	1,645	2014	No Data Available	--
Riel Study Area					
PTH 15	PR 207 to PTH 101	425	2014	10,315	4.1%
PTH 15	PR 207 to PR 206	35	2014	8,575	0.4%
PR 207	Riel Access Road to PTH 15	435	2014	1,800	24.2%
PR 207	Riel Access Road to PTH 1	165	2014	1,800	9.2%
Remainder of the Bipole III Study Area					
PTH 2	PTH 100 to PR 305	85	2015	2,450	3.5%
PTH 3	PTH 100 to PR 305	15	2014	5,120	0.3%
PTH 5	Ste. Rose to PTH 10	20	2016	1,430	1.4%
PTH 5	PTH 16 to Ste. Rose	25	2016	1,880	1.3%
PTH 6	Thompson to PTH 39	155	2014	540	28.7%
PTH 6	PTH 68 to PTH 60	65	2015	1,500	4.3%

Road	Location	Peak Daily Traffic Volume during Construction (in Passenger Car Equivelents*)	Peak Year of Construction Traffic	Background Daily Traffic during Peak Year of Construction	Percentage Increase in Traffic
PTH 6	PTH 101 to PTH 68	65	2015	3,620	1.8%
PTH 10	PTH 60 to The Pas	60	2015	1,080	5.6%
PTH 10	PR 268 to PTH 60	105	2016	1,070	9.8%
PTH 10	Swan River to PR 268	90	2016	2,190	4.1%
PTH 13	PTH 2 to Bipole ROW	45	2015	2,215	2.0%
PTH 16	PTH 1 to PTH 5	40	2015	3,670	1.1%
PTH 20	PTH 5 to PR 271	10	2016	1,070	0.9%
PTH 50	PTH 16 to PTH 5	35	2015	350	10.0%
PTH 59	PR 210 to Bipole ROW	30	2014	10,570	0.3%
PTH 60	PTH 6 to PTH 10	15	2014	480	3.1%
PTH 68	PTH 6 to PTH 5	55	2015	1,630	3.4%
PR 206	PTH 15 to Bipole ROW	5	2014	610	0.8%
PR 210	PTH 59 to PR 206	15	2014	1,200	1.3%
PR 248	PTH 2 to Bipole ROW	20	2015	160	12.5%
PR 261	PTH 50 to Bipole ROW	35	2015	130	26.9%
PR 268	PTH 10 to PTH 10	65	2017	250	26.0%
PR 271	PTH 20 to PR 489	35	2016	30	116.7%
PR 276	PTH 20 to PR 364	5	2016	500	1.0%

Road	Location	Peak Daily Traffic Volume during Construction (in Passenger Car Equivelents*)	Peak Year of Construction Traffic	Background Daily Traffic during Peak Year of Construction	Percentage Increase in Traffic
PR 280	PR 391 to PR 290	75	2014	180	41.7%
PR 285	PTH 10 to Bipole ROW	30	2015	1,260	2.4%
PR 287 (Paved)	PR 384 to Cormorant	85	2014	1,110	7.7%
PR 287 (Gravel)	PTH 10 to PR 387	70	2014	380	18.4%
PR 305	PTH 3 to Bipole ROW	5	2014	170	2.9%
PR 311	PTH 59 to Bipole ROW	5	2014	2,260	0.2%
PR 330	PTH 100 to Bipole ROW	10	2014	3,450	0.3%
PR 364	PR 276 to PTH 20	40	2016	260	15.4%
PR 373	PTH 6 to Bipole ROW	40	2015	160	25.0%
PR 384	PR 287 to Bipole ROW	40	2015	200	20.0%
PR 391	Thompson to PR 280	85	2015	3,380	2.5%
PR 501	PTH 1 to Bipole ROW	10	2014	740	1.4%
PR 596	PTH 39 to Bipole ROW	60	2014	10	600.0%