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ENVIRONMENT & ENGINEERING

ENVIRONMENTAL ASSESSMENT
TWO CREEKS PIPELINE PROJECT

Report Prepared for:
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November 2015
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ENVIRONMENTAL ASSESSMENT

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Report prepared for Tundra Energy Marketing Limited, November 2015

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EXECUTIVE SUMMARY

Tundra Energy Marketing Limited (TEML) is proposing to construct 20 km of pipeline within a 25 m wide Right-of-way (RoW) that will be used to transport crude oil from existing battery facilities to the Cromer terminal.

TEML is constructing approximately 20 km of pipeline within a 25 m wide RoW that will be used to transport product from a new TEML LACT facility at an existing Elcano Exploration Inc. (Elcano) battery facility to the TEML Virden Pipeline System. The pipeline will connect an Elcano battery located in 03-34-012-27 W1M to a new riser located in 08-16-011-26 W1M.

The baseline environmental and socio-economic conditions that may be affected by the project are well understood based on field assessment and focused desktop studies completed in September and October 2015 on vegetation, wildlife, wildlife habitat, and wetlands. The proposed construction and operation methods for the project are standard practices used for similar projects in southern Manitoba. Potential environmental and socio-economic effects associated with the construction and operations of the project are typical of small pipeline projects and can be mitigated by standard environmental protection measures. Project-related residual effects are anticipated to be reversible in the short to long-term and are generally of low magnitude. The assessment determined that a high probability occurrence of permanent and/or long-term residual effects of high magnitude can be mitigated. As a result, residual effects associated with the project are predicted to be not significant.

The project may act cumulatively with past, present or future projects or activities in the vicinity of the project. Cumulative residual effects of the project are minimal and are anticipated to be reversible in the short to long-term and are of low magnitude. The assessment determined that a high probability occurrence of permanent and/or long-term residual effects of high magnitude can be mitigated. Consequently, cumulative residual effects associated with the project are predicted to be not significant.

TEML has developed general and Project-specific mitigation measures including contingency plans, reclamation and monitoring activities to minimize effects of the Project and ensure the recommended mitigation measures and commitments made in the environmental assessment are implemented throughout the construction and operations phases of the project.

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1 INTRODUCTION

Tundra Energy Marketing Limited (TEML) is proposing to construct approximately 20 km of pipeline within a 25 m wide right-of-way (RoW). The pipeline will be comprised of a 168 mm (nominal 6 inch) diameter steel pipe that will connect a new TEML Lease Automatic Custody Transfer (LACT) facility at an existing Elcano Exploration Inc. (Elcano) battery facility to the TEML Virden Pipeline System. The pipeline will connect an Elcano battery located in 03-34-012-27 W1M to a new riser located in 08-16-011-26 W1M. Drawings showing the pipeline construction alignment are provided as Figures 1 to 17 and site photographs are provided as Appendix A.

Prior to the construction of this pipeline an Environmental Assessment (EA) is required under the *Manitoba Environment Act*. This EA is conducted in accordance with *Environment Act Proposal Report Guidelines* (Manitoba Conservation and Water Stewardship 2015a), derived from the *Licensing Procedures Regulation* (Manitoba Regulation 163/88).

Environmental and socio-economic considerations for this project were identified through a variety of methods. A scoping assessment, which involved the review of literature, mapping resources, and other historic documentation, was completed to identify environmental and socio-economic components that may be affected by or may affect the project. Sources used to conduct the scoping assessment included:

- literature reviews, standards and guidelines produced by government agencies, academic institutions and industry study groups
- quantitative and qualitative environmental and ecological information available for the assessment areas
- current, publicly available information about past, present and future projects and activities in the assessment areas
- municipal, provincial and federal government databases

The environmental and socio-economic considerations identified were factors used to refine the proposed pipeline route and develop budgets, schedule, and planning details necessary for the completion of the EA. The current (baseline) environmental setting for the project was defined by completing desktop assessment and field studies.

Site-specific baseline field data was collected in September and October 2015 for the following environmental and social elements:

- vegetation
- water quality and quantity
- fish and fish habitat
- wetlands
- wildlife and wildlife habitat

- acoustic environment
- heritage resources
- species at risk (where applicable)

Data for other environmental and social elements was collected through the desktop studies.

1.1 Purpose

This EA has been prepared to fulfill the requirements of *Environment Act Proposal Report Guidelines* (Manitoba Conservation and Water Stewardship 2015a), under the *Manitoba Environment Act*.

The EA document is divided into the following sections:

1. **Introduction:** Provides background information pertaining to the project, the regulatory framework and the purpose of the document.
2. **Project Description:** Describes the project components and project phases.
3. **Public Consultation:** Describes TEML's consultation with provincial regulatory agencies with respect to the EA and consultations with landowners affected by the proposed pipeline.
4. **Current Environmental and Socio-economic Setting:** Describes the biophysical and socio-economic conditions and current state of the environment present where the project will occur.
5. **Environmental and Socio-economic Effects Assessment:** Describes the potential environmental and socio-economic method used and effects that may result from the project, mitigation measures to eliminate or reduce the effects and predicted residual effects. An evaluation of significance is provided for each residual effect.
6. **Cumulative Effects Assessment:** Describes potential cumulative effects that may arise when effects from past, present and future projects interact in time or space with residual effects from the project. An evaluation of significance is provided for the project's contribution to the cumulative effect assessment.
7. **Construction and Reclamation Planning:** Describes construction and reclamation activities that are associated with the project. Construction activities and post-construction reclamation activities are described.
8. **Follow-up and Monitoring:** Describes the environmental inspection, education and monitoring procedures to be applied during the construction and operation of the project, as well as proposed follow-up programs, as required.
9. **Conclusions**: Provides conclusions related to the significance of potential residual environmental and cumulative effects associated with the project.

1.2 Project Need

The proposed pipeline will allow TEML to transport crude oil product from the Elcano battery location to the TEML Virden Pipeline System via underground pipeline. It will also allow for additional battery facilities to connect to the system in the future. The construction of the pipeline will reduce the reliance on the use of transportation trucks to move the product from individual batteries to the terminal location.

1.3 Regulatory Framework

The Project constitutes a Class 2 development as the pipeline is greater than 10 km in length and will be constructed in areas sensitive to environmental disturbance, as defined by the Classes of Development Regulation under the *Manitoba Environment Act* (MEA). The filing of an Environment Act Proposal Form under the MEA will initiate a formal regulatory review process.

2 PROJECT DESCRIPTION

2.1 Route Selection

The following criteria and/or factors were considered when determining the pipeline route:

- input from landowners, the public and regulatory agencies, where practical
- avoidance or minimization of wetland crossings
- avoidance of rural residences, farm buildings, well sites and water wells
- avoidance, to the extent possible, of steep or unstable terrain
- parallel existing pipelines, existing rights-of-way or other linear developments
- minimize crossings of native grassland
- avoidance of special land use areas and environmentally sensitive areas such as wildlife management areas, Manitoba Habitat Heritage Corporation (MHHC) land, protected areas, Provincial Parks, Regional Parks and archaeological or historical sites, where possible
- ensure the crossing of windbreaks, roads and rail lines, to the extent possible, at right angles to minimize the width of the right-of-way

2.2 Construction Timeline

It is anticipated that construction will begin in December, 2015, if all approvals and clearances are in place. Construction is anticipated to be completed, with the exception of final clean-up and reclamation, by March 15, 2016.

2.3 Construction Activities

The progression of construction including activity type and order of construction along the RoW is summarized in Table 2.1. The construction timeline is dependent on receiving all regulatory approvals. The timeline is also approximate and subject to change.

At any given time, it is anticipated that construction activities will be occurring at several different locations along the pipeline RoW.

TABLE 2.1 Pipeline Construction Timeline

Proposed Timeline	Project Activities
December 2015	• RoW boundaries are staked by surveyors.
December 2015 to March 5, 2016	• Workforce and equipment are mobilized. • Cross fences are modified with bracing and gates to control access. • Traffic control measures are implemented. • Snow removal and minor mulching of trees on pipeline RoW is performed as required. • Centerline of trench is staked. • Topsoil is stripped from over trench and stored at edge of RoW. Conditions at the time of construction may require that topsoil also be removed from the subsoil spoil pile area and the equipment work area. • Pipe is hauled in and strung along the RoW. • Pipe joints are welded together between crossings. • Pipe joins are radiographically inspected to assure quality welds. • Shrink sleeves or brushed on epoxy are applied as corrosion protection at each welded join. • Completed pipeline sections are electronically tested to assure undamaged coating. • The trench is prepared using a tracked backhoe with ripping as required by frost conditions. • Bell holes are excavated at crossings, and a channel between bell holes is created by boring or punching or directional drilling. • Crossing strings are welded up, radiographically inspected, shrink sleeved, and installed through the crossing. • Pipeline sections are lowered into the trench. • Tie-in joins at crossings are welded. • Pipe is covered with select backfill material (without rocks/frozen lumps). • Subsoil is returned to trench and compacted lightly, similar to original density. • Topsoil is mounded over trench. • Risers at pipeline ends are fabricated, installed and supported. • A test head and pig barrel are installed at pipeline ends. • A sizing pig is pushed through the pipeline with compressed air to assure the pipeline has not been damaged when backfilling. • Pipeline warning signs are installed.

Proposed Timeline	Project Activities
March 5 to March 15, 2016	• The pipeline is filled with a water/methanol test medium mixture and allowed to stabilize to ground temperature. • The pipeline is pumped up to the required leak and test pressures which are maintained for a time period required by code. • Pressure test data is recorded. • The test medium is removed and returned to storage. • The pipeline is dewatered using foam pigs pushed by compressed air and dried by pushing through a slug of methanol. The methanol is captured and stored. • The pipeline is ready to be purged and put into service. • Fences are returned to their original condition, or better. • Contractor demobilizes equipment and removes surplus material.
Spring 2016	• Final clean-up occurs after spring break up, at which time the RoW is returned to a condition suitable to the original land use. • The cathodic protection system is installed.

2.4 Pipe Specifications

Table 2.2 summarizes the technical specifications of the proposed pipeline.

TABLE 2.2 Pipeline Project Technical Summary

Pipeline Segment	Segment 1
Start Point	03-34-012-27 W1M Elcano Battery
End Point	08-16-011-26 W1M header
Material	Steel
Outside Diameter	168.3 mm
Wall Thickness	4.8 mm
Grade	Grade 359 Cat II Sour
Coating	YJ or YJ2K as required
Manufacturing Code	CSA Z245.1-14

2.5 Trench Specifications

It is anticipated that the trench will be approximately 0.5 m (20 inches) to 0.6 m (24 inches) wide and 1.65 m (5 feet 6 inches) deep. Only the trench line will be stripped in areas of native grassland or modified grassland.

2.6 Pipeline Testing

It is proposed to hydrotest the pipeline to at least 1.25 times the maximum operating pressure, as required by code. The test will consist of a leak test followed by a strength test. Total time of the test, including temperature stabilization, is anticipated to be 24 hours, and is most likely to occur in early March 2016.

TEML proposes to use a mixture of methanol and water as the test medium. The test medium will be from TEML test medium stock or rented if required, utilized, and then recovered and returned to stock upon completion of the test. Procedures will be in place to prevent spills and a spill response plan will be in place to address any spills or releases (refer to Section 8.1.1.1).

2.7 Temporary and Permanent Facilities

The pipeline contractor will have temporary facilities in at least one location. The contractor will be responsible for obtaining permits and other arrangements for using these locations as temporary facilities. The temporary facilities will be used as staging areas for personnel and construction equipment, and will consist of storage and maintenance areas and temporary office facilities.

As part of this project, a new LACT facility will be installed at the existing Elcano battery on 03-34-012-27 W1M. In addition a new riser site will be constructed on 08-16-11-26 W1M to connect the terminal end to the Virden Pipeline System.

2.8 Work Force

The Project work force may fluctuate throughout the construction timeline.

2.9 Construction Equipment

It is anticipated that the following equipment may be required for construction:

- vehicles for personnel transportation
- mulcher for a limited amount of over growth mulching (the majority of the RoW is open farmland)
- hydrovac trucks for exposing underground infrastructure
- snow removal equipment
- bulldozers and graders for RoW preparation, spoil pile management and trench line ripping
- flatbed tractor trailer units for hauling equipment and pipe
- welding trucks
- x-ray units
- tracked backhoes for trenching, bell hole excavation, and back filling
- boring equipment for crossings
- side booms for handling pipe strings
- water trucks for dust control (if necessary) and pressure testing trucks

3 PUBLIC CONSULTATION

As part of the project, TEML contacted and consulted with local landowners and is currently is in the process of acquiring and finalizing RoW agreements with the land owners. Special conditions requested by the land owners have been documented and will be provided to regulators as required. TEML will

adhere to the local land owners' requests. To date, TEML is not aware of any land owner complaints associated with the project.

4 ENVIRONMENTAL AND SOCIO-ECONOMIC EXISTING ENVIRONMENT

4.1 Objective

The objective of the environmental and socio-economic setting section is to describe the baseline environmental and socio-economic conditions that exist prior to the development of the project and to determine the effects that exist from past or present projects or activities. Baseline information is presented by different environmental and socio-economic components for the project and is summarized in Table 4.1.

TABLE 4.1 Environmental and Socio-economic Components

Environmental Components	
Physical Environment	Fish and Fish Habitat
Soil and Soil Productivity	Water Quality and Quantity
Vegetation Communities	Air Quality
Wildlife and Wildlife Habitat	Acoustic Environment
Watercourses and Wetlands	
Socio-economic Components	
Heritage Resources	Social and Cultural Well-being
Traditional Land Use	Employment and Economy
Human Occupancy and Resource Use	

4.2 Spatial Boundaries

Two spatial areas were selected to describe the environmental and socio-economic existing environment. The local study area (LSA) was selected to account for the pipeline and includes the 25 m pipeline RoW as well as a 200 m buffer on either side of the RoW. The LSA boundary will be used to examine baseline conditions for all environmental elements and heritage resources, where there is a reasonable possibility for direct and indirect environmental and socio-economic effects (Figure 1).

A larger regional study area (RSA) was selected to account primarily for socio-economic elements that may be affected beyond the LSA. The RSA will also be used to account for regional past, present and future projects and activities that have the potential to interact cumulatively with the Project. The RSA boundary includes the former boundary of the Rural Municipality (RM) of Wallace which is now part of the larger amalgamated RM of Wallace-Woodworth (Wikipedia 2015) and was delineated to a larger geographical and ecological area to evaluate cumulative environmental and socio-economic effects (Figure 2).

4.3 Methods

The existing environment in the LSA was described along the proposed pipeline RoW including a 200 m buffer zone along either side of the pipeline RoW to account for construction activities. Information was acquired from a variety of sources and included a desktop review of existing studies, if available, environmental databases, baseline data, ecological land classification, and traditional ecological knowledge, if applicable.

The following environmental and socio-economic components will be assessed in the LSA using desktop studies:

- description of the prevailing physical environment, including climate and meteorological conditions
- description of the local area and regional setting including important terrain
- identification and description of surface water-bodies and description of the regional groundwater conditions
- description of the aquatic environment including fish resources and fish habitat, wetlands and watercourses
- description of the terrestrial environment including soil, vegetation, wildlife and wildlife habitat
- identification and description of any provincial or federal species at risk (SAR) or any important or sensitive species and/or habitats
- identification and description of the existing land and resource uses
- identification of existing air and acoustic conditions
- description of the socio-economic environment

The field studies assessed topsoil, terrestrial vegetation, wetlands, and wildlife habitat in the LSA. A preliminary soil survey was conducted to characterize the upper 30 cm of topsoil in each quarter section along the proposed RoW and to assist in the development of construction mitigation and post-construction reclamation. A preliminary vegetation range assessment of grasslands on the RoW was also conducted as a baseline reference for future re-assessment after post construction reclamation. Concurrently with the grassland assessment, a qualitative assessment was conducted for potential SAR wildlife habitat. The field studies were completed along the proposed pipeline RoW on September and October 2015 and included:

- ground-verification and classification of wetlands using Steward and Kantrud (1971) ranking
- documentation of native terrestrial vegetation communities (i.e., grassland, shrubland, or woodland)
- identification of important wildlife habitat
- identification of potential environmentally sensitive areas

4.4 Physical Environment

4.4.1 Physiography

The project is located in the Aspen Parkland Ecoregion of the Prairie Ecozone in Manitoba. The Aspen Parkland Ecoregion is associated with black Chernozemic soils and a climate with short, warm summers and long, cold winters. The ecoregion is covered with undulating to kettled glacial till with moderate slopes (2% to 5%) and level lacustrine deposits. Landscapes include open grassland areas and knob and kettle areas with tree-ringed ponds and sloughs that provide habitat for waterfowl and migratory birds (Ecological Stratification Working Group 1995).

The pipeline is located in the Melville ecodistrict (Smith et al. 1998) and is characterized by undulating to rolling topography. The majority of the land use along the pipeline RoW is agricultural (i.e., cropland, cultivated land, hayland, tame pasture). A detailed description of the terrestrial vegetation communities is provided in Section 4.6.

4.4.2 Surficial Geology

Surficial geology in the LSA is comprised of calcareous clay diamicton that is between 1 to 75 m thick, with subglacial deposits primarily derived from Mesozoic Shale (Blais-Stevens and Fulton 1998).

4.4.3 Bedrock Geology

The LSA is located in the Western Canadian Sedimentary Basin and is underlain by the Riding Mountain Formation. This is a Cretaceous-aged strata consisting of the Coulter, Millwood, Odanah, Morden, Boyne, and Pembina members (Manitoba Department of Mines, Resources and Environmental Management 1979).

4.4.4 Climate

The climate in the LSA is characterized by short, warm summers and cold winters with annual precipitation between 467 to 473 mm (Environment Canada 2015). The mean May to September temperature along the proposed route is 11.8°C to 12.3°C. The LSA has on average 105 to 115 frost-free days a year indicating a relatively short growing season (Agriculture and Agri-Food Canada 2015). The majority of the LSA is outside of historical flooding areas (Natural Resources Canada 2010).

4.5 Soils and Soils Productivity

4.5.1 Soil Characteristics

Soils in the LSA are generally described as well drained, medium textured, loamy till dominated by Black Chernozems in upland areas (Eilers R.G. and G.W. Lelyk 1966). A significant area of salinized and poorly

structured Solonetzic soils occurs to the northeast of Elkhorn in the Two Creeks-Willen area (Smith et al. 1998). Soils in the LSA are considered to be low risk of erosion (Agriculture and Agri-Food Canada 2015).

Topsoil characteristics and depth, up to a maximum depth of 30 cm, were examined approximately every quarter section along the proposed pipeline RoW. Topsoil is predominantly loam to clay loams with a depth ranging from 12 cm to greater than 30 cm. Topsoil along the pipeline are rated fair or poor, predominantly due to increased proportions of coarse fragment content.

Black Chernozemic soils of the Newdale soil series are the dominant soils along the proposed route (Manitoba Agriculture, Food and Rural Initiatives 2010 and Agriculture and Agri-Food Canada 2015). The Newdale series is characterized by an Orthic Black Chernozems on moderately to strongly calcareous, loam to clay loam morainal till derived from limestone, granitic and shale (Manitoba Agriculture, Food and Rural Initiatives 2010). These soils are moderately well to well drained and occur in mid to upper slope positions of undulating to hummocky landscapes. Surface runoff is moderate to moderately rapid; permeability is moderately slow. Most of these soils are presently cultivated and have formed under intermixed aspen grove and grassland vegetation.

4.5.2 Soil Capability for Agriculture

The LSA is located in the Southwest Agricultural Region of Manitoba and is dominated by agricultural land uses that include crop production, hayland and pasture lands. The Agricultural Soil Capability in the LSA is described as Class 2 and 3 (Agriculture and Agri-Food Canada 2015). Class 2 soils are suitable for sustained production of common cultivated field crops. Class 3 soils are also suitable for sustained production of field crops. However, they have moderate limitations that restrict the range of crops or require special conservation practices.

4.5.3 Soil Productivity

Soils in the LSA have a Soil Productivity Rating of D3, E3, F3, G3, and H3 in upland cultivated areas (MASC 2015) with the majority of the soils being E3 in the south part of the LSA and G3 and H3 in the north part of the LSA. Soil productivity ratings range from highest (A) to lowest (J) yielding soils with each subsequent class representing a slightly less productive class than the previous class. The numbers associated with the productivity ratings denote Risk Areas and are grouped according to similar soils and/or climate factors. Therefore, an "E" soil in Risk Area 3 may not have the same productivity as an "E" soil in Risk Area 4.

4.6 Vegetation Communities

4.6.1 Ecological Land Classification

The pipeline is located in the Aspen Parkland Ecoregion of Canada (Environment Canada 2000). This ecoregion is a transitional area between the boreal forest and grasslands ecoregions. A large proportion of this ecoregion has been converted to agricultural land uses; however patches of aspen parkland

remain in a native condition. Native patches are characterized by stands of trembling aspen, bur oak, Manitoba maple and mixed tall shrubs intermixed with fescue grasslands. Stands of trembling aspen, Manitoba maple, and tall shrubs occur throughout the region on a variety of sites while grasslands occupy increasingly drier sites. Stands of Bur oak are typically associated with richer soils located along bottomland habitats such as riparian areas and floodplains.

4.6.2 Vegetation Community Types

The LSA is dominated by agriculture land uses intermixed with small stands of trembling aspen and tall shrubs, native grasslands and wetlands. The areas impacted by the RoW have been identified as one of three land types in Figures 1 to 17:

1) **Cultivated Land**- Land which is currently tilled for the purposes of annual agriculture or land which has recently been tilled by and has now been seeded to grass for hay or pasture.

2) **Native Grassland**- Land which appears to have never been broken, containing a diverse mix of native grasses, forbs and shrubs.

3) **Modified Grassland**- Grassland areas that appear to have been broken at one time in the distant past or are heavily invaded and dominated by non-native species.

Table 4.2 describes the vegetation community types observed in the LSA. Table 4.3 is a list the 67 different plants recorded on the grassland segments of the RoW on October 13 and 14, 2015. The distribution of vegetation communities in the LSA is provided in Figures 3 to 9).

TABLE 4.2 Vegetation Community Types in the Local Study Area

Vegetation Community	Description
Cultivated Land (CU)	Cultivated land occurs where the land area tends to be flat and well drained. The land has been broken and tilled and used for cropland. Cropping practices include rotational (fallow [unplanted]) and continuous as part of an annual crop rotation.
Windbreaks (WB)	Linear features dominated by native trees and shrubs
Hayland (HA)	Land used for growing animal fodder (e.g., legumes and grasses). Hayland tends to be located on flat upland sites with the most locally productive soils and lowest incidence of frost within the growing season. Fertilizers are sometimes applied to these areas early in the growing season. Plants are harvested at proper growth stage, cured and baled. The baled hay is major source of roughage for livestock during the dormant season (Vallentine 1989).
Tame Pasture (TP)	Includes perennial pasture and agronomic rotation pasture and annual pasture used temporarily for the production of pasture used for grazing. The land area tends to be flat and well drained and may have previously been used for hay or annual crops (Vallentine 1989).
Native Grasslands (NG)	Grass-dominated plant communities that have evolved primarily under the influence of climate, fire and herbivory (Wright and Bailey 1982). This is further defined as uncultivated land that will provide the necessities of life for grazing and browsing animals (Vallentine 1989).
Woodlands (WD)	Aspen (*Populus tremuloides*) dominated woodland communities.
Shrubland (SH)	Shrublands are located in low-lying areas and wetlands. Willow (*Salix* sp.) and western snowberry (*Symphoricarpos occidentalis*) are the characteristic species.

Vegetation Community	Description
Riparian community (RI)	Vegetation communities associated with running water systems found along rivers, streams and drainage ways (Thompson and Hansen 2001).
Wetlands (WL)	Land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity, which are adapted to a wet environment.
Ephemeral drainage (EP)	Low area that can be saturated at different times of the year depending on the season. Intermittently conveys surface water.
Dugouts (DG)	Dugouts are used to intercept overland flow of water and provide storage while making water available to livestock and wildlife. Most dugout areas are <0.5 ha, steep-sided and characterized by rectangular basins, with water depths exceeding 2 m (Vallentine 1989).
Disturbed Areas (DI)	Existing roads, industrial sites and other human disturbed areas that are mainly composed of introduced species and weeds and invasive species.

TABLE 4.3 Grassland Plant Species on Grassland Segments of the Pipeline Right-of-Way

Plant Species		Twp. 12, Rge. 27 W1M							
Common name	Scientific name	NW 27	S½ 27	NE 22	NW 23	SW 23	N½ 14	SE 14	N½ 12
Common cattail	*Typha latifolia*	√		√		√	√	√	√
Quack-grass	*Agropyron repens*		√			√			√
Slender wheatgrass	*Agropyron trachycaulum*	√	√	√	√	√	√	√	√
Awned wheatgrass	*Agropyron subsecumdum*	√	√	√	√	√	√	√	√
Rough hair-grass	*Agrostis scabra*	√	√	√	√	√	√	√	√
Northern reed grass	*Calamagrostis inexpansa*			√		√		√	
Foxtail barley	*Hordeum jubatum*	√	√	√			√	√	√
Little bluestem	*Andropogon scoparius*	√		√	√			√	
Blue grama	*Bouteloua gracilis*	√						√	
Smooth brome	*Bromus inermis*	√	√	√	√	√	√	√	√
Prairie muhly	*Muhlenbergia cuspidata*					√	√		√
Timothy	*Phleum pratense*						√	√	√
Kentucky bluegrass	*Poa pratensis*	√	√	√	√	√	√	√	√
Alkali cord grass	*Spartina gracilis*	√		√		√		√	
Flixweed	*Descurainia sophia*		√	√			√		
Three-leaved sedge	*Carex filifolia*	√		√		√	√	√	√
Prairie onion	*Allium textile*	√	√	√	√	√	√	√	√
Trembling aspen	*Populus tremuloides*	√	√	√	√	√	√	√	√
Diamond willow	*Salix discolor*	√	√				√	√	
Chokecherry	*Prunus virginiana*	√	√				√	√	
Mountain maple	*Acer spicatum*							√	
Wolf willow	*Elaeagnus commutata*	√	√	√		√	√	√	
Buffalo berry	*Shepherdia argentea*			√			√		
Red osier dogwood	*Cornus stolonifera*						√	√	
Western snowberry	*Symphoricarpos occidentalis*	√	√	√	√	√	√	√	√
Yellow toadflax	*Comandra umbellata*	√	√	√	√	√	√	√	√
Field dock	*Rumex pseudonatronatus*	√	√	√	√	√	√	√	√
Russian thistle	*Salsola pestifer*			√			√		
Veiny meadow-rue	*Thalictrum venulosum*	√	√	√	√	√	√	√	√
Common peppergrass	*Lepidium densiflorum*	√	√	√	√	√	√	√	√

Plant Species		Twp. 12, Rge. 27 W1M							
Common name	Scientific name	NW 27	S½ 27	NE 22	NW 23	SW 23	N½ 14	SE 14	N½ 12
Stinkweed	*Thalspi arvense*		√			√	√		
Wild strawberry	*Fragaria virginiana*	√	√	√	√	√	√	√	√
Silverweed	*Potentilla anserina*		√	√			√		
Rough cinquefoil	*Potentilla norvegica*	√		√		√	√	√	
Prickly rose	*Rosa acicularis*	√	√	√	√	√	√	√	√
Wild red raspberry	*Rubus ideaus*							√	
Meadowsweet	*Spiraea alba*	√	√	√	√	√	√	√	√
Wild licorice	*Glycyrrhiza lepidota*	√	√	√	√	√	√	√	√
Black medic	*Medicago lupulina*			√					√
Alfalfa	*Medicago sativa*						√	√	
White sweet clover	*Melilotus alba*	√	√	√	√	√	√	√	√
Silverleaf psoralea	*Psoralea agrophylla*	√				√			√
Alsike clover	*Trifolium hybridum*								√
Common plantain	*Plantago major*	√	√	√	√	√	√	√	√
Northern bedstraw	*Galium boreale*	√	√	√	√	√	√	√	√
Common yarrow	*Achillea millefolium*	√	√	√	√	√	√	√	√
Absinth	*Artemisia absinthium*		√						
Perennial ragweed	*Ambrosia psilostachya*	√	√	√	√	√	√	√	√
Pasture sage	*Artemisia frigida*	√	√	√	√	√	√	√	√
Many-flowered aster	*Aster ericoides*	√	√	√	√	√	√	√	√
Smooth aster	*Aster laevis*	√	√	√	√	√	√	√	√
Pussytoes	*Antennaria aprica*	√	√	√	√	√	√	√	√
Canada thistle	*Cirsium arvense*	√	√	√	√	√	√	√	√
Bull thistle	*Cirsium vulgare*	√	√	√	√	√	√	√	√
Narrow-leaved hawk's beard	*Crepis tectorum*							√	
Rough fleabane	*Erigeron asper*	√	√	√	√	√	√	√	√
Gumweed	*Grindelia squarrosa*	√		√		√	√	√	
Common burdock	*Arctium minus*	√	√				√	√	
Ox-eye daisy	*Chrysanthemum leucanthemum*	√	√			√			
Redroot pigweed	*Amaranthus retroflexus*		√				√	√	
Blue lettuce	*Lactuca tatarica*			√		√		√	
Low goldenrod	*Solidago missouriensis*	√	√	√	√	√	√	√	√
Velvety goldenrod	*Solidago mollis*							√	
Stiff goldenrod	*Solidago rigida*	√	√	√	√	√	√	√	√
Perennial sow thistle	*Sonchus arvensis*	√	√	√	√	√	√	√	√
Common dandelion	*Taraxacum officinale*	√	√	√	√	√	√	√	√
Cocklebur	*Xanthium strumarium*		√			√			

4.6.3 Species at Risk or Species of Special Status

Plant SAR that could potentially occur in the LSA were identified by searching the following databases:

- Manitoba Conservation Data Centre (MBCDC 2015)
- *Endangered Species and Ecosystems Act* (Government of Manitoba 2015)

- Federal Species at Risk (COSEWIC 2015)
- *Species at Risk Public Registry* (Government of Canada 2015a)

The Manitoba Conservation Data Centre (MBCDC) was also contacted directly to acquire updated site-specific information for the LSA (MBCDC 2015). MBCDC uses a ranking system for rare plants that ranks species on a scale of 1 (rarest) to 5 (common) at a provincial (S) and global (G) scale. A species may be ranked S1 provincially and G5 globally, meaning that it is considered rare in Manitoba but secure globally. Under SARA, SAR are classified from highest to lowest critical status as extirpated, endangered, threatened, or special concern.

A list of potentially occurring plant SAR in the LSA is provided in Appendix B.

A search of the MBCDC database resulted in no SAR plant occurrences in the area of the LSA. No provincially ranked S1 or S2 species, SARA and/or COSEWIC species (endangered or threatened) were identified during field surveys completed in September and October 2015.

4.6.4 Environmentally Significant and Protected Areas

The pipeline RoW does not cross any National Parks, National Wildlife Areas, municipal conservation areas, proposed or existing Provincial Parks, Ecological Reserves, Provincial Forests, recreation areas, Conservation Lands (i.e., The Nature Conservancy of Canada, Ducks Unlimited Canada or Manitoba Wildlife Federation Habitat Trust land), Resource Management Areas or Special Conservation Areas (Manitoba Agriculture, Food and Rural Initiatives 2011).

4.7 Wildlife and Wildlife Habitat

The wildlife and wildlife habitat baseline assessment for the LSA identifies wildlife species and wildlife habitat that may be encountered in the LSA.

4.7.1 Provincial Wildlife Management Areas

Provincial wildlife management areas in Manitoba are Crown land and are regulated by the Manitoba *Wildlife Act* (1981). The LSA is not located in any provincial wildlife management areas, special conservation areas or wildlife refuges. A Crown agency, the MHHC own wildlife conservation lands and are considered private property. Development on MHHC lands is restricted to specific activities and must include appropriate mitigations (e.g., Sopuck 2015, Pers. Comm.). No MHHC land is crossed by the pipeline.

4.7.2 Species at Risk or Species of Special Status

This section identifies wildlife Species at Risk (SAR) whose habitat may overlap with the LSA. SAR are generally considered to be rare or at risk of becoming rare. A desktop study was conducted to identify potential wildlife SAR in the LSA. Potential wildlife SAR information is provided in Table 4.4.

Bird, mammal, amphibian, and reptile SAR that could potentially occur in the LSA were identified by searching the following databases:

- *Endangered Species and Ecosystems Act* (Government of Manitoba 2015)
- *Canadian Species at Risk* (COSEWIC 2015)
- *Species at Risk Public Registry* (Government of Canada 2015a)

Wildlife desktop studies included evaluation of some species that are not SAR. It included the following activities:

- Obtaining historical wildlife occurrence data including SAR within 10 km of the LSA from the MBCDC
- Compiling a list of wildlife SAR that potentially occur within southwest Manitoba and within habitat types expected to occur in the LSA using published and unpublished literature sources (including reports for past projects in the area)
- Delineating wetlands and vegetation communities important to wildlife species that may occur along the pipeline RoW and within the LSA

TABLE 4.4 Provincial or Federal Status of the Potential Species at Risk in the Local Study Area

Common Name	Scientific Name	MBCDC 2015 Rank[1]	Manitoba Conservation 2015 Status[2]	COSEWIC 2015 Status[3]	SARA 2015 Status[4]
Amphibians and Reptiles					
Great Plains Toad	*Bufo cognatus*	S2	Threatened	Special Concern	Schedule 1
Northern Leopard Frog	*Lithobates pipiens*	---	---	Special Concern	Schedule 1
Snapping Turtle	*Chelydra serpentine*	S3	---	Special Concern	---
Western Hognose Snake	*Heterodon nasicus*	S1S2	Threatened	---	---
Smooth Green Snake	*Liochlorophis vernalis*	S3S4	---	---	---
Northern Red-bellied Snake	*Storeria occipitomaculata*	S3S4	---	---	---
Northern Prairie skink	*Eumeces septentrionalis*	S1	Endangered	Endangered	Schedule 1
Birds					
Cooper's hawk	*Accipter cooperii*	S4S5B	---	---	---
Black crowned night heron	*Nycticorax nycticorx*	S3S4B	---	---	---
Barred owl	*Strix varia*	S3S4	---	---	---
Ferruginous Hawk	*Buteo regalis*	S2B	Endangered	Threatened	Schedule 3
Piping Plover	*Charadrius melodus circumcinctus*	S1B	Endangered	Endangered	Schedule 1
Long-billed Curlew	*Numenius americanus*	---	Extirpated	Special Concern	Schedule 1
Burrowing Owl	*Athene cunicularia*	S1B	Endangered	Endangered	Schedule 1
Short-eared Owl	*Asio flammeus*	---	Threatened	Special Concern	Schedule 3

Common Name	Scientific Name	MBCDC 2015 Rank[1]	Manitoba Conservation 2015 Status[2]	COSEWIC 2015 Status[3]	SARA 2015 Status[4]
Common Nighthawk	*Chordeiles minor*	---	Threatened	Threatened	---
Chimney Swift	*Chaetura pelagic*	---	Threatened	Threatened	Schedule 1
Red-headed Woodpecker	*Melanerpes erythrocephalus*	---	Threatened	Threatened	Schedule 1
Sprague's Pipit	*Anthus spragueii*	S2B	Threatened	Threatened	Schedule 1
Loggerhead Shrike *excubitorides* subspecies	*Lanius ludovicianus excubitorides*	S2B	Endangered	Threatened	Schedule 1
Baird's Sparrow	*Ammodramus bairdii*	S1S2B	Endangered	Not at Risk	---
Chestnut-collared Longspur	*Calcarius ornatus*	---	Endangered	Threatened	---
Bobolink	*Dolichonyx oryzivorus*	---	---	Threatened	---
Rusty Blackbird	*Euphagus carolinus*	---	---	Special Concern	Schedule 1
Grasshopper sparrow	*Ammodramus savannarum*	S2B	---	---	---
Sharp-tailed grouse	*Tympanuchus phasianellus*	---	Game bird	----	----
Mammals					
Mule Deer	*Odocoileus hemionus*	S3	Threatened	---	---
Insects					
Monarch	*Danaus plexippus*	---	---	Special Concern	Schedule 1

Sources:
[1] MBCDC 2015
[2] Manitoba conservation and water stewardship 2015c
[3] COSEWIC 2015
[4] Government of Canada 2015a
--- - not applicable

There is some native grassland and modified grassland located in the north portion of the route. These areas are identified in Figures 1 to 17, The majority of the proposed pipeline RoW is cultivated land and not generally suitable for SAR wildlife. No federally listed SAR was observed in the pipeline RoW during field surveys during September and October 2015. There is some potential habitat in the native grassland and modified grassland areas for SAR wildlife. The timing of construction should help to mitigate the potential for negative impact of these species.

On the pipeline RoW on NW ¼ 13-012-27 W1M, a sharp-tailed grouse breeding ground (lek) was identified. The lek was located on a knoll within cultivated land. Following construction the integrity of the knoll will be maintained. TEML will ensure the area is not leveled during reclamation.

One inactive raptor stick nest was observed adjacent to the RoW on SW ¼ 21-011-26 W1M

4.7.3 Wildlife Habitat

Habitat along the pipeline RoW is primarily cultivated land. Wetlands of Class I to V are located along the RoW (Figures 3 to 9). Wetland classes IV and V provide the most suitable habitat for waterfowl and

amphibians, although amphibians can be expected to occur in other wetland classes as well. Habitat quality of wetlands varied and depended on the extent of previous disturbance and presence of weed species.

Some native aspen parkland is present along the proposed RoW and is comprised of aspen woodland intermixed with shrubland and grassland. The largest and most contiguous native parkland is located in the northern portion of the proposed route and is identified in Figures 1 to 17

Tame pasture, haylands and windbreaks provide less suitable habitat for wildlife species. Tame pasture contains a mix of native and agronomic species that provide limited nesting and denning habitat opportunities for wildlife species. No dens or nesting areas were observed along the RoW in these habitat types. Windbreaks were composed of trembling aspen and tall shrubs with grasses and forbs in the understory. These areas provide limited cover for mammal species but during the field surveys, these areas contained abandoned passerine nests.

No critical wildlife habitat was observed along the RoW. The presence of native grassland in the north portion of the route does provide habitat for a diversity of species. Potential bird SAR habitat within the LSA is limited, modified and fragmented.

4.8 Watercourses and Wetlands

4.8.1 Watercourses

No major watercourses will be crossed during construction.

4.8.2 Wetlands

Wetlands were classified based on vegetation criteria following Stewart and Kantrud wetland classification (1971; Table 4.5). The presence or absence of characteristic vegetation assemblages and the spatial patterning of zones are the primary factors distinguishing wetland classes in this classification system.

In each zone, characteristic plants may be found as a general mixture or may be represented by one or more distinct associations, each consisting of one or more species. These zones are closely related to differences in water permanence, modified by permeability of bottom soils and influence of ground water. Certain wetlands contain only one zone, while others contain two or more zones. In wetlands with two or more zones, one zone usually occupies the central, deeper part of the pond basin, while the others occur as concentric peripheral bands. The presence or absence and the distributional pattern of the zones are the primary factors used in distinguishing the seven major classes of wetlands.

There are seven primary classes of wetlands in natural basins (Table 4.5; Each class is distinguished by the vegetation zone occurring in the central or deeper part of the wetland and occupying 5% or more of

the total wetland being classified. Characteristic species typical of the Canadian prairies are included in the wetland description.

TABLE 4.5 Stewart and Kantrud (1971) Wetland Classification

Wetland Class	Vegetation Zone	Description
Class I - Ephemeral Pond	Low-prairie	Ephemeral Ponds have free surface water for only a short period of time after snowmelt or storm events in early spring. Because of the porous condition of the soils, the rate of water seepage from ephemeral wetlands is very rapid after thawing of the underlying frost seal. They may be periodically covered by standing or slow moving water. Water is retained long enough to establish some wetland or aquatic processes. They are typically dominated by Kentucky bluegrass, goldenrod and other wetland or low prairie species.
Class II - Temporary Ponds	Wet-meadow	Temporary Ponds have wetlands that are periodically covered by standing or slow moving water. They typically have open water for only a few weeks after snowmelt or several days after heavy storm events. Water seepage is fairly rapid, but surface water usually lingers for a few weeks after spring snowmelt and for several days after heavy rainstorms at other times of the year. Water is retained long enough to establish wetland or aquatic processes. They are dominated by wet meadow vegetation such as fine-stemmed grasses, sedges and associated forbs.
Class III - Seasonal Ponds of Lakes	Shallow-marsh	Seasonal ponds or lakes are characterized by shallow marsh vegetation, which generally occurs in the deepest zone (usually dry by midsummer). These wetlands are typically dominated by emergent wetland grasses, sedges and rushes.
Class IV - Semi-permanent Ponds or Lakes	Deep-marsh	Semi-permanent ponds or lakes are characterized by marsh vegetation, which dominates the central zone of the wetland, as well as coarse emergent plants or submerged aquatics, including cattails, bulrushes and pondweeds. These wetlands frequently maintain surface water throughout the growing season, i.e., from May to September.
Class V - Permanent Ponds or Lakes	Permanent Open-water	Permanent ponds or lakes have permanent open water in central zone that is generally devoid of vegetation. Submerged plants may be present in the deepest zone, while emergent plants are found along the edges. Plants commonly present in these wetlands include cattails, red sapphire and spiral ditch grass.
Class VI – Alkali Ponds or lakes	Intermittent Alkali	Alkali Ponds and Lakes are wetlands where deep water is typically not permanently present. Alkali wetlands are characterized by a pH above 7 and a high concentration of salts. The dominant plants are generally salt tolerant and include red sapphire and spiral ditch grass. These wetlands are especially attractive for shore birds.
Class VII – Fen Ponds	Alkaline Fen	Fen Ponds are wetlands in which fen vegetation dominates the deepest portion of the wetland area. This wetland type often has wet meadow and low prairie vegetation present on the periphery. The soils are normally saturated by alkaline groundwater seepage. Fen ponds often have quaking or floating mats of emergent vegetation, which includes sedges, grasses and other herbaceous plants.

Wetland classification in the pipeline RoW was conducted in September and October, 2015. One large inaccessible wetland was surveyed with a UAV on October 9, 2015 to obtain more detailed images and for pipeline planning purposes. Wetlands in the LSA were surveyed and representative plant species

identified in the different zones. The locations of all wetlands in the RoW were identified using a GPS. Table 4.6 summarizes the wetlands identified in pipeline RoW and within 50 m of the pipeline RoW. Detailed wetland breakdown can be found in Table 1 (attached). The locations of surveyed wetlands are provided in Figures 3 to 9 (refer to end of report).

TABLE 4.6 Summary of Wetlands Surveyed along the Pipeline Right-of-way

Type	Total Number of Wetlands or Waterways Identified Within 50m of the RoW	Number of Wetlands or Waterways Impacted by Construction
Class I	36	22
Class II	29	9
Class III	18	8
Class IV	7	3
Class V	0	0
Seasonal Waterways	5	4

4.9 Fish and Fish Habitat

No fish bearing waterways will be impacted by construction of the proposed pipeline.

4.10 Water Quantity and Quality

4.10.1 Surface Water

The pipeline is located in the Oak Lake (AR05) watershed of the Assiniboine River drainage basin (Agriculture and Agri-Food Canada 2015). The Assiniboine River basin covers an area of 17,300 km^2 (Saskatchewan Watershed Authority 2006) with the headwaters originating approximately 50 km northwest of Preeceville in the Porcupine Hills.

4.10.2 Groundwater

Groundwater movement in Manitoba is predominantly from west to east with discharge occurring in the outcrop area beneath Lake Winnipeg (Betcher et al. 1995). In the area surrounding the LSA, there are lenses of sand and gravel with minor sand and gravel aquifers. No bedrock aquifers are encountered at less than 150 m depths (Rutulis 1986a) in the LSA or along the pipeline RoW (Rutulis 1986b). The pipeline does not cross the Oak Lake Aquifer Management Plan Area (Oak Lake Aquifer Technical Advisory Group 2000).

A search of Manitoba Water Stewardship's database (2011) of water well drilling records was completed as part of the RoW survey program. The locations of the water wells on lands crossed by the pipeline are provided in Figures 1 to 17. No springs were observed along the RoW and a detailed listing of springs within Manitoba is not publicly available.

Groundwater water quality in shallow unconfined surficial aquifers is highly variable. In general, total dissolved solids (TDS) concentrations in these aquifers are at levels below the Canadian Drinking Water Quality (CDWQ) aesthetic objective of 500 mg/L and therefore meet drinking water quality standards. Concentrations of sulphate, chloride and TDS may exceed the respective CDWQ aesthetic objectives in areas where Solonetzic soils are abundant. Deeper, confined sand and gravel aquifers typically have water quality with TDS concentrations greater than 1,000 mg/L and sulphate concentrations above drinking water guidelines (Enbridge 2010). Therefore, the taste, smell or colour of the shallow groundwater may be naturally impaired.

4.11 Air Quality

A desktop qualitative study was completed to evaluate air quality conditions and potential greenhouse gas emissions (GHG) associated with the construction phase of the project. Some localized air monitoring has taken place in southwest Manitoba (Manitoba Conservation and Water Stewardship 2005) but no regional monitoring program exists.

The project is located mainly in rural areas, and there are no major industrial activities along the pipeline RoW. Agriculture (cropland, cultivated, hayland and tame pasture) is the primary land use (Figures 3 to 9). Air emissions, including GHGs, in the vicinity of the project are related to agricultural activities, oil and gas operations, vehicular traffic and some natural sources. Emissions include ammonia (NH_3) from fertilizers and livestock, sulphur dioxide (SO_2) and nitrogen oxides (NO_X) from fuel combustion in farm equipment, and particulate matter (PM). The principal compounds emitted from vehicular traffic include SO_2, NO_X, PM, carbon monoxide (CO), as well as trace amounts of metals, volatile organic compounds, polycyclic aromatic hydrocarbons, and total reduced sulphur compounds (Enbridge 2010).

4.12 Acoustic Environment

Background noise in the LSA is primarily associated with vehicle traffic. Existing oil infrastructure, such as pump jacks and battery facilities are located in the LSA. Local residences and communities are potential receptors to noise effects associated with the construction and operation of the pipeline.

4.13 Traditional Land Use

The project traverses the western portion of Treaty 2 area in Manitoba. The Treaty 4 territory includes parts of southwestern Manitoba.

The Manitoba Métis Federation is the political representative organization for the Métis people throughout Manitoba. Regionally, Métis people residing in the southwestern portion of the province are represented by the Southwest Region office.

Given the high proportion of agricultural land use in the LSA, impacts of the project on traditional land use, if any, will be minimal. No First Nations communities are located adjacent or near to the pipeline RoW. Sweetgrass (*Heirochloe odorata*) is a native plant used for traditional aboriginal ceremonies and is

collected across the aspen parkland region by First Nations peoples in the fall. No sweetgrass was observed, however in the private land native grassland areas along this pipeline. The current land tenure consists entirely of privately owned property and land use would appear to preclude the possibility of traditional activities being practiced on these lands.

4.14 Human Occupancy and Resource Use

4.14.1 Human Occupancy

The project RSA is largely rural, encompassing one main population centre and one rural municipality (summarized in Table 4.7):

- Virden, Manitoba
- Former Rural Municipality of Wallace (which is now amalgamated with the former RM of Woodworth), Manitoba

TABLE 4.7 Population of Communities in the Regional Study Area

Community/Rural Municipality	2006	2011	% Population Change (2001 to 2006)
Virden, Manitoba	3,010	3,114	+3.5
Rural Municipality of Wallace, Manitoba*	1,501	1,526	+1.7

* Only the former RM of Wallace is referenced here as it is the boundary of the project RSA
Source: Statistics Canada 2011a and 2011b

4.14.2 Natural Resource Use

The entire pipeline traverses privately-owned agricultural lands and is located in Mineral Exploitation Zone A. The pipeline does not traverse any coal dispositions, mining claims, potash licenses, quarry leases or withdrawals, or mining restricted lands (Manitoba Mineral Resources 2015).

The Canada Land Inventory (1971) has rated most of the lands along the pipeline as ranging from having moderately low (Class 5) to low (Class 6) capability for outdoor recreation. The pipeline is located in FMU 6 and does not traverse any Forest Management Licenses or Integrated Wood Supply Areas (Agriculture and Agri-Food Canada 2015). No community pastures or grazing leases are traversed by the pipeline (Agriculture and Agri-Food Canada 2015).

The pipeline traverses Open Area Trapping Zone 1 area (Manitoba Conservation 2015d). Trapping in this Open Area requires a Manitoba Trapper's License which allows a person to trap anywhere in the Open Area, with permission from the landowner. Furbearer species of interest for trapping in Open Area Zone 1 include beaver, muskrat, coyote, and raccoon. There are no registered traplines located along the pipeline (Manitoba Mineral Resources 2015). Outfitters within Manitoba are not assigned geographical areas and need permission from the landowner on private lands. Outfitting may occur in the Oak Lake area and on private lands along the pipeline. The pipeline lies within the Southern Fishing

Division where the fishing season is open from May 9 until March 31 (Manitoba Conservation and Water Stewardship 2015b).

4.14.3 Land Use and Recreation

The pipeline RoW is primarily located on existing agricultural land that is being used for commonly grown crops such as wheat, oats, rye, canola, mustard, barley, and flax. Arable land predominates with wetlands, some native grassland and limited areas of aspen woodlands. Other land uses in the RSA include resource extraction and residences. Due to the predominance of private agricultural land in the area, access to the pipeline RoW for recreational use is considered to be limited.

The LSA is located in Game Hunting Area (GHA) 27, Deer Hunting Zone (DHZ) E and Game Bird Hunting Zone (GBHZ) 4 in Manitoba (2015 Manitoba Hunting Guide; Manitoba Conservation and Water Stewardship 2015d). The big game hunting seasons in Manitoba varies by animal and extends from early September to early December (Tables 4.12). The project is located predominantly on privately owned land where access for hunting and trapping is controlled by the land owner.

The LSA is located in Open Area Trapping Zone 1. Licensed trappers in Manitoba can harvest furbearers on any lands to which they have the right of access, such as private land and most provincial wildlife management areas (Manitoba Conservation and Water Stewardship 2015e).

The pipeline RoW lies within the Southern Fishing Division where the fishing season is open from May 14 until March 31 of the following year (Manitoba Anglers' Guide 2015; Manitoba Conservation and Water Stewardship 2015b).

TABLE 4.8 Hunting Seasons in Manitoba

Animal	Season Date	Applicable Area or Zone
Moose	November 30 to December 6	GHA 27
White-tailed Deer	September 7 to November 22	DHZ E
Upland Game Birds	September 8 to December 18	GBHZ 4
Wild Turkey	April 25 to May 17; October 3 to 18	GHA 27
Ducks, Coots, Snipe, Dark Geese and White Geese	September 1 to November 30	GBHZ 4
Sandhill Crane	September 1 to November 30	GBHZ 4
Conservation Snow Geese	March 15 to May 31	GBHZ 4
Gray Wolf and Coyote	August 31 to February 29	All GHAs except GHA 38

4.14.4 Infrastructure and Services

4.14.4.1 Services

Temporary accommodations are available in Virden, Manitoba. Virden has a large number of campsites in and around the town and four hotels or motels in town (Town of Virden 2014).

The LSA is located in the Assiniboine Regional Health Authority. The Virden Health Centre and the Virden Health Unit provide acute care services, emergency medical services (EMS) and public health services (Assiniboine Regional Health Authority 2011).

Fire and emergency services support in Virden, Manitoba, are provided by the Virden-Wallace/Woodworth Volunteer Fire department, which is run by 25 paid, on-call fire fighters (Town of Virden 2014). The fire department is responsible for the town of Virden and the surrounding region. The department provides fire and rescue services including responding to all types of fire, vehicle incidents, and rescue services, including hazardous materials (Town of Virden 2014). Twenty-four hour ambulance service is provided through the Virden Health Centre, which is the closest health centre to the proposed pipeline. In addition, air ambulance service is available through the local airport.

The town of Virden, Manitoba has a Petroleum Industry Waste Treatment and Disposal Facility operated by HAZCO Environmental Services. Solid waste can be disposed at the Virden Waste disposal grounds. The nearest hazardous waste disposal site in Manitoba is located in Letellier, approximately 75 km south of Winnipeg.

4.14.4.2 Transportation Corridors

There are a number of primary and secondary highways and rural municipality roads that can be used to access the LSA. Primary access is by highways #1, #83, #257 and existing rural Municipality roads. Industrial traffic use of local municipality roads has increased due to increased industrial activity in the Rural Municipality of Wallace-Woodworth. Increased drilling results in movement of rigs and the trucking of product until pipeline infrastructure can be installed. Local municipalities are responsible to maintain and upkeep rural roads.

4.15 Social and Cultural Well Being

The Rural Municipality of Wallace-Woodworth has an aging but increasing population. The influx of younger skilled permanent workers associated with the oil and gas sector has generated community renewal. The downturn in the oil economy may result in some exodus from the area. The availability of construction contractors is better than in the previous few years.

Resource based construction activities have been ongoing for several years in these municipalities. Therefore, there has been an increase in localized trucking from construction and operation of well sites. A mobile workforce has become a more common part of the social structure of these areas resulting in lower availability of temporary accommodation.

4.16 Employment and Economy

The description of economic conditions in the RSA is focused on the larger communities (i.e., Virden) because there is limited data and information available from the smaller communities in the RSA. There are several reasons for the lack of information available. First, as the communities closest to the project

have smaller populations and limited services, it is anticipated that much of the potential economic effect from the project will be in the larger regional service centres. In addition, Statistics Canada does not provide specific information on smaller communities to protect the privacy of the residences, and therefore pools the information from these communities into the larger rural municipalities in which they are located.

4.16.1 Regional Employment

The economy of southwestern Manitoba has a range of businesses and occupations, but is mostly centred on the agriculture and resource extraction industries. Virden, Manitoba, has a diverse business section including service sector, retail trade, agriculture and resource-based industries. Virden, Manitoba, also serves sectors directly related to natural resource extraction including oil industry service companies, surveying, engineering, heavy construction and trucking (Town of Virden 2014).

The area of southwestern Manitoba has recently experienced an increase in economic activity largely related to oil and gas exploration and production, particularly in the Bakken Formation.

5 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

This section of the EA identifies potential effects that might be caused by the project. This is achieved by relating the baseline description of the environmental and socio-economic setting (Section 4.0), including the current state of the environment within the LSA, to the overall project description. The environmental and socio-economic effects assessment uses the baseline information to:

- Identify the important environmental and socio-economic components in the LSA
- Develop appropriate site-specific mitigative measures that are technically and economically feasible
- Identify and evaluate residual effects of the project attributed to each environmental and socio-economic component evaluated
- Identify the effects of the environment on the project

This assessment also determines the significance of the potential adverse residual effects resulting from construction and operation activities after taking into consideration proposed mitigation, where required.

5.1 Methods

This assessment evaluated the environmental and socio-economic effects of construction, operation, decommissioning and abandonment phases of each component of the project. The assessment methods included the following tasks:

- determination of spatial and temporal boundaries of the assessment
- identification of environmental and socio-economic components

- identification of potential environmental and socio-economic impacts
- development of technically and economically feasible mitigation
- identification of anticipated residual effects
- determination of significance of adverse residual effects

This method was developed based on the Manitoba Conservation *Environmental Act Proposal Report Guidelines* (Manitoba Conservation and Water Stewardship 2015a) and the Canadian Environmental Assessment Agency's *Cumulative Effects Assessment Practitioners Guide* (Hegmann et al. 1999).

5.1.1 Spatial and Temporal Boundaries

5.1.1.1 Spatial Boundaries

The LSA is defined as the area directly disturbed by the project construction and related work construction work spaces. This includes the permanent 25 m RoW and a 200 m buffer to account for temporary construction workspaces, temporary stockpile sites, temporary staging areas and facility sites. Effects within this LSA are described as isolated in this assessment.

Areas outside the LSA could be potentially affected by the construction and reclamation of the project. The extent of the LSA may vary with the environmental and socio-economic component being assessed.

The RSA extends beyond the LSA. The boundary of the RSA is consistent across all disciplines for this assessment and includes the boundary of the former Rural Municipality of Wallace which was recently amalgamated with the former RM of Woodworth in January 2015 (Wikipedia 2015).

5.1.1.2 Temporal Boundaries

The project is examined in phases: construction, operation, decommissioning and abandonment. The construction period including clearing, grading, trenching, testing and initial reclamation for the pipeline is planned to occur in the winter and spring of 2016. A detailed construction schedule is provided in Section 2.0 of this EA. A change in the construction schedule will not affect the recommendations in this EA as the assessment has considered construction during either frozen or unfrozen soil conditions. The operations phase will commence in 2016. Decommissioning and abandonment will occur at an undefined period in the future when operations are complete.

5.1.2 Environmental and Socio-economic Components

The potential environmental and socio-economic components interacting with the project were identified through the following processes:

- Public and government consultation process
- Regulatory guidelines

- Experience gained through Canadian Environmental Assessment Agency (CEAA) environmental screenings
- Experience gained through environmental impacts assessments in Manitoba and other jurisdictions that are based on a similar process as those under the Manitoba Conservation *Environmental Act Proposal Guidelines*
- Reference to other environmental impact assessment (EIA) or EA submissions (e.g., Provident NGL Pipeline and Bakken Pipeline)
- Professional judgement of the assessment team

The environmental and socio-economic components interacting with the project include:

- Physical components such as physical environment, soil capability, water quality and quantity, air quality and acoustic environment
- Biological components including: fish and fish habitat, wetlands, vegetation, and wildlife and wildlife habitat
- Socio-economic components including heritage resources, traditional land use, human occupancy and resource use, social and cultural well-being, infrastructure and services, and employment and economy

The EA also evaluates effects from accidents and malfunctions, and effects of the environment on the project.

5.1.3 Potential Environmental and Socio-economic Effects

The environmental and socio-economic effects were identified through the same processes and resources as indicated for identification of the environmental and socio-economic elements. The potential environmental and socio-economic effects arising from the construction and operation of the proposed pipeline are identified in Section 5 of this EA.

5.1.4 Mitigation Measures

Various federal and provincial standards were considered when developing mitigation measures (Section 5.19, Table 5.3). Past pipeline projects within southwestern Manitoba including Tundra Oil and Gas pipelines were reviewed and applicable protection measures were included in this EA. Environmental inspectors will be retained by TEML to ensure that the mitigation measures within the LSA are properly implemented during construction.

5.1.5 Residual Effects

Residual effects are the net environmental and socio-economic effects remaining after mitigation measures have been implemented. In some cases no residual effects will remain after mitigation while in other cases some residual effect will occur. Residual effects may also be induced through mitigation

(for example weeds could be introduced through the process of completing erosion control measures). If no residual effects remain from a given element then no further analysis is required.

5.1.6 Significance Analysis of Residual Effects

The significance analysis followed the protocols outlined in the Federal Environmental Assessment Review Office (CEAA 1994), and the Canadian Environmental Assessment's *Cumulative Effects Assessment Practitioners' Guide* (Hegmann et al. 1999). The main methods used for evaluating the significance of effects included:

- Use of established environmental standards and guidelines
- Quantitative and qualitative assessment of adverse residual effects

The determination of significance is based on the following selected list of parameters:

- direction
- magnitude
- duration
- frequency of occurrence
- spatial extent
- reversibility
- probability of occurrence
- prediction of confidence

These parameters are defined in Section 5.19.3, Table 5.3 of this EA.

For each environmental and socio-economic residual effect, the impact balance or direction was established. A positive effect is a net benefit on the environment, a neutral effect is no net benefit or loss to the environment, and a negative effect is where there is a net loss to the environment.

The assessment team evaluated each adverse residual effect relative to the significance assessment criteria. Only negative residual effects were evaluated for significance whereas positive or neutral effects were not considered. A summary of the significance evaluation for negative residual effects predicted from construction and operation of the pipeline are identified in Section 5.19.3, Table 5.4 of this EA.

Based on the assessment methodology described in this Section, the subsections below evaluate the potential environmental and socio-economic effects associated with the construction and operation of the project.

5.2 Physical Environment

The potential effects on the physical environment associated with the construction of the Pipeline include:

- slope instability
- changes to local topography
- identification or exposure of historical soil contamination

5.2.1 Slope Instability

As the local topography along the pipeline RoW ranges from undulating to kettled glacial till and with some level to undulating lacustrine and glaciofluvial deposits, construction of the pipeline is not anticipated to directly affect slope stability throughout the majority of the pipeline RoW.

In the LSA, the risk of material sloughing due to slope instability is low. The magnitude of slope instability effects are considered to be low due to the lack of abrupt slope changes or steep slopes, as confirmed by the field surveys, along most of the RoW.

5.2.2 Changes to Local Topography

Construction of the pipeline may affect topography from the settling of replaced soil material, resulting in subsidence over the trench. This may cause localized depressions, which have the potential to damage farm machinery used in hayland and cultivated fields. Localized depressions could also act as water collection areas, impeding vegetation growth or promoting rutting from passage of farm machinery.

TEML will ensure that the trench line is compacted through the use of appropriate equipment once backfilling activities are completed. Trench compaction will be conducted prior to topsoil replacement to ensure that the pipeline will have minimal post reclamation settling. Therefore, the effect of settling due to construction of the pipeline is considered to be low.

5.2.3 Identification or Exposure of Historical Soil Contamination

Construction activities to install the pipeline may identify or expose soil contamination from historical spills, leaks or fueling of construction or farming equipment. Any contaminated soils that are encountered will be segregated and managed appropriately as per Manitoba regulatory guidelines. Mitigation procedures are provided in Section 5.19, Table 5.2 and further details on addressing contamination are provided in Section 5.3.7 of this EA.

5.2.4 Mitigation

Mitigation measures were designed to address the potential effects of pipeline construction and operation on the physical environment including changes to slope stability, changes to local topography

and previous contamination. Section 5.19, Table 5.2 summarizes mitigation measures that will be implemented to reduce impacts to the physical environment. Soil erosion and soil compaction are further described in Section 5.3.

5.2.5 Evaluation of Significance

Table 5.4 indicates that there are no situations where there is a high probability of occurrence of a permanent or long-term physical environment residual effect of high magnitude that cannot be mitigated; therefore, residual effects are determined to be not significant.

5.3 Soils and Soils Productivity

The potential for residual Soil and Soil Productivity effects occurs mainly during the construction phase of the pipeline; there will be minimal residual effects during the operation phase. The following sections discuss the potential effects and residual effects after mitigation. Mitigation measures for each potential effect are presented in Table 5.2.

Potential direct and indirect effects from the construction of the pipeline are related to changes in soil quality and changes to terrain. Residual effects to soil quality are generally limited to reductions in soil capability for agriculture. Vehicle traffic on the RoW may lead to soil compaction and increase the potential for wind erosion due to soil pulverization. However, reclamation suitability could also be affected by:

- mixing of topsoil and subsoil
- trench instability
- increased surface stoniness
- soil compaction
- wind erosion
- pulverization of soil and sod
- soil contamination

5.3.1 Mixing of Topsoil and Subsoil

Mixing of topsoil (organic material and surface mineral material) with a lower quality or less fertile subsoil material (including saline subsoils), or mixing of upper subsoil with poor quality lower subsoil, may occur during salvage and clean-up operations. Once soil mixing (admixing) occurs, it is irreversible.

Effects of admixing include:

- dilution of organic matter
- changes to soil texture and structure
- upward movement of salt in the soil profile

- increases in stoniness in the surface layers

Each of these potential effects may lower the soil capability for agriculture and lower the reclamation suitability. Admixing may contribute to reduced capability to support vegetation growth by causing redistribution and loss of nutrients by exposing unfavourable subsoil (e.g., gravelly or saline subsoil), and/or altering soil physical properties and drainage regimes. Soil quality and land capability can be negatively affected if salts originally found deep in the soil profile are replaced immediately below the topsoil within the soil's rootzone.

The objective of soil salvage is to strip, store and protect sufficient soil materials for future replacement and reclamation. Conserved soil is to be used exclusively for reclamation of the site from which the soil was salvaged. Planning and mitigation during construction and reclamation activities that require soil handling or disturbance can prevent or minimize unintentional admixing; therefore, the likelihood of admixing is low.

The residual effect of reduced soil capability and reclamation suitability from admixing would be confined to areas of active disturbance.

5.3.2 Trench Instability

Areas with coarse-textured soils or a seasonal high water table within trench depth may contribute to trench instability. Trench wall failures may result in the loss of topsoil and increases the potential for soil mixing. With the implementation of mitigation measures, such as construction in winter, the likelihood of trench wall failure is low.

Soil mixing due to trench wall failure may also result in reduced soil capability and reclamation suitability. This residual effect would be confined to the trench and area immediately adjacent to it. The duration of this effect would range from short to long-term, depending on the extent of admixing and the quality of the subsoil.

5.3.3 Increased Surface Stoniness

Where soil types characterized by gravel or coarse fragments are located in the subsoil there is a possibility that gravelly subsoils can be mixed with topsoil or upper subsoils, resulting in an increase in stones and gravels in the reclaimed topsoil and changing the soil structure and porosity. This may affect the soil capability for agriculture. The use of appropriate mitigation measures will prevent or minimize an increase in surface stoniness. Therefore, the likelihood of an increase in surface stoniness is low.

Residual effects in terms of reduced soil capability and reclamation suitability from increased surface stoniness would be confined to the RoW.

5.3.4 Soil Compaction

Construction activities (e.g., vehicle traffic, salvage) on moderately fine-textured soils may result in compaction and loss of structure if they are handled when wet, resulting in a loss of soil structure and a reduction in soil permeability and aeration. This reduces the soil capability for agriculture and reclamation suitability. Mitigation measures to prevent, minimize, or correct compaction (e.g., delaying certain construction activities to prevent compaction or deep ripping to alleviate compaction) will be used during construction. Therefore, there is a low likelihood that soil compaction will be an issue.

Residual effects in terms of reduced soil capability and reclamation suitability from soil compaction would be confined to the pipeline RoW.

5.3.5 Wind and Water Erosion

Soil handling and disturbance can lead to soil erosion, which can change soil capability. Once soil salvage has occurred and the material is stockpiled, the wind erosion risk is rated as moderate for loam textured soils, and high for sandy soils. There are two time frames with respect to erosion control: short-term control during the construction phase and long-term control of disturbed areas post-construction. To reduce erosion, soil exposure must be minimized. With the use of mitigation measures noted in Table 5.3, the likelihood of wind erosion is moderate.

Water erosion by surface runoff is not anticipated during construction is planned during the winter season, under frozen soil conditions. However, erosion of soil is possible after spring break-up when soils cleared of vegetation are exposed to rain events.

The residual effect is reduced soil capability for agriculture and reclamation suitability from soil erosion.

5.3.6 Pulverization of Soil and Sod

Construction activities (e.g., vehicle traffic) during dry conditions may result in the pulverization of soil and sod along the RoW. Pulverization breaks down topsoil and subsoil aggregates to a size that is more susceptible to siltation by wind or transport by water. Loss of topsoil reduces soil capability for agriculture by reducing nutrient availability, organic matter content and soil moisture holding capacity. With the use of mitigation techniques, such as minimizing vehicle traffic and maintaining vegetation cover wherever possible, to prevent or minimize pulverization, the likelihood of reduced soil capability for agriculture is low.

The residual effect of reduced soil capability for agriculture and reclamation suitability from soil pulverization would be confined to the pipeline.

5.3.7 Soil Contamination

Soil contamination may result from an accidental spill along the RoW. While the likelihood of an accidental release during operation is low, such an event has the potential to affect soil productivity

until the spill has been cleaned up and remediated. Additional details related to soil contamination are provided in Section 6.4.7 Accidents and Malfunctions of this EA.

Rapid response is critical to minimize impact from spills. Spills will be promptly cleaned up and documented. Although procedures and preventative maintenance programs during the construction of the pipeline will be in place to prevent such occurrences, accidental spills and leaks of fuel, lubricants, hydraulic fluids, and petroleum hydrocarbons may still occur.

Most of the potential effects on Soil and Soil Productivity will be minimized by implementing mitigation measures (Table 5.2). However residual effects could include soil contamination.

5.3.8 Mitigation

Salvaged topsoil and subsoil will be stored in separate locations. Salvaged material will be stored on like material (i.e., topsoil will be stored on topsoil and upper subsoil will be stored on subsoil material [B or C horizon]). Section 5.19, Table 5.2 summarizes mitigation measures that will be implemented to reduce impacts to soils and soil capability.

TEML will retain Environmental Inspectors to ensure that the mitigation measures presented within the EA are properly implemented during construction.

5.3.9 Evaluation of Significance

Table 5.4 indicates that there are no situations where there is a high probability of occurrence of a permanent or long-term soils and soils capability residual effect of high magnitude that cannot be mitigated, therefore, residual effects are determined to be not significant.

5.4 Vegetation Communities

The potential effects on vegetation communities associated with the construction of the pipeline are associated with vegetation removal and include:

- introduction and establishment of weed, non-native and invasive species
- temporary loss of vegetation communities with high rare plant potential (native grassland and riparian vegetation)
- temporary loss of habitat that is important for wildlife and habitat fragmentation

5.4.1 Introduction and Establishment of Weed, Non-native and Invasive Species

The ground disturbance that occurs during vegetation removal may expose buried weed, non-native or invasive seeds and create open ground, providing ideal conditions for colonization by these species. During construction, the introduction and establishment of these species may be further increased by the potential for them to be transported to the site from construction vehicles and clothing and boots of workers and site visitors. In native vegetated areas, annual weeds compete with native species and may

out-compete native species for space and nutrients. Native grasslands are expected to take several years to develop following reclamation and are vulnerable to invasion by weed, non-native and invasive species. However, native grassland species are assumed to take less time to colonize than wooded uplands species, because trees and shrubs need longer to achieve a size and structure similar to what was present prior to disturbance.

5.4.2 Temporary Loss of Vegetation Communities with High Rare Plant Potential

Vegetation removal could also temporarily reduce the total area of vegetation communities with high rare plant potential, such as native grasslands and woodlands, and habitat that is important for wildlife. Small, short-term losses of habitat can have large effects on populations of rare species. Wetlands, riparian areas and native grasslands in the LSA have a high potential for rare plants (Naiman and Décamps 1997; Olsen et al. 2007). Table 5.1 summarizes the vegetation community types, area (ha) and their rare plant potential in the RoW. Native grasslands in the LSA are identified in Figures 1 to 17.

No rare plants were identified along the pipeline RoW during field surveys. Provincial species of conservation concern or federal SAR are not anticipated to be affected since topsoil will be salvaged and stripping will be limited to the trench line (maximum 1.8 m width) minimizing disturbances to the seed bank. Impacts are not expected to exceed current impacts in native communities associated with agriculture and cattle grazing.

5.4.3 Habitat Fragmentation

Habitat fragmentation occurs where disturbance breaks relatively large patches of habitat into smaller patches. Although the majority of the LSA is cultivated and hayed land, fragmentation of small patches of native vegetation such as native grasslands, woodlands and wetlands may further reduce available habitat for rare plant species and wildlife. The direct loss or alteration of vegetation communities in the LSA will potentially remove habitat or reduce the quality of habitats for these wildlife species.

5.4.4 Mitigation

Minimizing vegetation clearing and construction in areas with native vegetation such as grasslands, woodlands, wetlands will reduce the potential for the removal and loss of rare plants, reduce fragmentation of native vegetation communities and wildlife habitat. Reclamation of native vegetation communities using certified, and Manitoba sourced, native seed mixes and weed control methods will allow for native plants to re-vegetate these areas. TEML will retain an Environmental Inspector to ensure that the mitigation measures presented within the EA (Section 5.19, Table 5.3), are properly implemented during and post-construction.

5.4.5 Evaluation of Significance

There is a high probability of occurrence of residual effects to vegetation communities; however, there are no situations where a permanent or long-term residual effect of high magnitude will occur that

cannot be mitigated (Table 5.4). Therefore it is concluded that the residual effects to vegetation communities during construction and operation of the pipeline will not be significant.

5.5 Wildlife and Wildlife Habitat

The potential for residual wildlife and wildlife habitat effects occurs during both the construction and operation phases of the pipeline. Most of the project occurs on agricultural land (i.e., cropland or hayland) and is highly fragmented by existing oil and gas infrastructure, homesteads, roads, railways and other human developments. Only small remnant areas of native habitat remain. Therefore, the LSA and the RSA have already been altered by past human activities limiting the presence and distribution of many wildlife species.

Potential direct and indirect effects on wildlife from construction of the pipeline may occur from the individual or combined effects of:

- habitat loss and alteration
- sensory disturbance and reduced habitat effectiveness
- project-related wildlife mortality

The nature of these effects are described for wildlife in general, and subsequently discussed for the following wildlife groups:

- amphibians and reptiles
- birds
- mammals

5.5.1 Habitat Loss and Alteration

The project will result in direct loss or alteration of habitat. Direct habitat loss results from the physical clearing of vegetation and soils at highly localized locations associated with the pipeline RoW. Minor habitat alteration will occur along the pipeline RoW where native grasslands and woodlands will be removed. Alteration may be short-term in grassland areas or long-term in woodland areas where trees and shrubs will be cleared for pipeline construction. No habitat features of significance to regional population of wildlife were identified in the LSA. No raptor nests will be directly affected by construction activities. No dens, hibernacula or other nesting sites were observed within the pipeline RoW. SAR will not be directly affected by the project because construction will be carried out outside of critical migration, nesting and breeding periods for all species.

Wildlife species in the LSA are adapted to living in open habitat and it is unlikely that the reclaimed 25 m-wide pipeline RoW alone will lead to the isolation of grassland habitat. Similarly, woodland habitats in the project consist primarily of small patches of aspen/shrub woodlands and aspen bluffs and therefore residual effects of fragmentation on wildlife are not expected.

5.5.2 Sensory Disturbance and Reduced Habitat Effectiveness

Habitat effectiveness may be reduced during construction of the pipeline. Reduced habitat effectiveness results when wildlife use of habitat is reduced due to project influences, with wildlife response to a disturbance variable between species. Pipeline construction is not expected to cause temporary reductions in habitat effectiveness because construction is planned for winter, when most species have either migrated or are in hibernation. Delays in construction beyond the winter months could result in sensory disturbances to migratory birds, including waterfowl, and their nests as well as breeding amphibians and reptiles.

5.5.3 Project- Related Wildlife Mortality

Wildlife mortality may occur through collisions with vehicles or through disturbance of wildlife or habitat features (e.g., nests, dens) during construction.

5.5.4 Amphibians and Reptiles

Amphibians and reptiles (e.g., Great Plains toad, northern leopard frog, western hognose snake, smooth green snake, red-bellied snake, western plains garter snake) have relatively specialized reproductive and/or overwintering habitat requirements or localized summer habitats. Such habitats include denning sites, breeding and hibernating wetlands.

These localized habitat features may be affected by various pipeline construction activities including physical disturbance during clearing or trenching. Critical habitat may also be affected by other activities that may affect water quality such as spills, use of fresh water for pipeline hydrostatic testing and discharge sites. Wetland habitats may be affected if they are not avoided, either through vegetation removal, grading or trenching of wetland margins. The effect of habitat fragmentation is not likely to occur since the reclaimed pipeline RoW will not be a barrier to amphibian movement. Other potential project effects throughout the construction phase could include mortality of individuals through clearing, grading and trenching activities.

No amphibian or reptile observations were made in wetlands; however many of the Class IV wetlands surveyed along the RoW would provide suitable foraging and hibernating habitat. The wetlands identified as Class IV wetland, are capable of providing overwintering habitat. The pipeline minimizes direct crossings of wetlands in the LSA. the one Class IV wetland that will be directly crossed will be bored to minimize impact; therefore, the pipeline is not expected to have a negative effect on amphibians.

5.5.5 Birds

There were no colonial bird nesting areas observed in the LSA as no great blue heron rookeries were found. There are no areas identified as important at a National, Regional or Local level for moulting and staging ducks, breeding and staging Canada geese, or breeding and non-breeding areas for colonial waterfowl. No effects to this group of birds is expected because construction will occur during winter

and trenching will not occur through any wetland areas with nesting and breeding potential (i.e., Class III, IV, and V wetlands). Collisions and sensory disturbances are not expected to this group of birds since construction will occur in winter.

Raptor SAR (e.g., ferruginous hawk, short-eared owl, and burrowing owl) may occur in the LSA, although there are no historical records of these species near the LSA and no birds or nests were found during surveys conducted in September 2015. Project effects to these species may include loss or alteration of grassland and woodland habitat. Sensory disturbance will not occur given that construction is planned for winter. No active raptor nests were observed within or adjacent to the pipeline RoW in woodlands and windbreak habitats.

A number of other avian species were observed or may occur in the LSA. Species detected were common and resilient to human development (Section 4.7.2, Table 4.4). No other avian SAR was detected during field surveys in 2015 (e.g., red-headed woodpecker, loggerhead shrike, Sprague's pipit and chestnut collared longspur). Although, bird SAR have been documented within the RSA, potential bird SAR habitat within the LSA is limited, modified and fragmented. Construction will also occur outside of the critical timing window for these species.

5.5.6 Mammals

Mammal SAR (e.g., mule deer) are year-round residents that may be affected by loss or alteration of habitat. Since these species are adapted to open habitats and agricultural areas, effects are expected to be low. Winter range is critical wildlife ungulate habitat; however, there are no critical winter ranges within or adjacent to the pipeline RoW.

Wildlife responses to human activities vary between and within species due to behavioural and population differences, and varying relations to the landscape, habitats and anticipated sources of disturbance. Construction is planned to occur outside of the sensitive reproductive season; however construction will occur in the winter when wildlife are more susceptible to disturbance. Potential effects of sensory disturbance to large mammals are considered to be low and localized near woodland habitats, where large mammals (i.e., moose) may be sheltered.

Construction may obstruct movements, especially by deer and moose, for short periods of time as construction proceeds along the pipeline RoW. Strung pipe, welded pipe, spoil piles, and open trenches can cause blockage for wildlife movements.

Mammalian mortalities are most likely to result from vehicle/animal collisions on higher speed public access roads leading to and from the pipeline. Actual vehicle travel speeds along the construction RoW will be too slow for the potential of large mammal kills.

5.5.7 Mitigation

TEML will employ mitigation measures during pipeline planning, construction, and operations to reduce effects to wildlife and wildlife habitat. No SAR or critical wildlife was observed in the LSA; therefore no provincial and federal guidelines requiring setbacks for development are expected. General mitigation measures to minimize effects on wildlife are included in Table 5.2.

5.5.8 Evaluation of Significance

There is a high probability of occurrence that habitat will be lost or altered as a result of the project; however, the magnitude is low and medium-term in duration. There are no other situations where there is a high probability of occurrence of a permanent or long-term wildlife and wildlife habitat residual effect of high magnitude that cannot be mitigated. Overall, residual effects are determined to be not significant (Table 5.4).

5.6 Watercourses and Wetlands

5.6.1 Watercourses

No major watercourses are present in the LSA.

There are some seasonal waterways located in the LSA. These drainages are characterized by channels with shallow gradients, seasonal water flows, and meandering courses. No residual effects are anticipated with the construction and operation of the pipeline across ephemeral drainages or drainage ditches.

5.6.2 Wetlands

The potential for residual wetlands effects occurs mainly during the construction phase of the pipeline; there will be minimal residual effects during the operation phase.

Potential direct and indirect wetlands effects associated with construction of the pipeline include:

- wetland vegetation removal
- alteration of wetland hydrology

5.6.2.1 Wetland Vegetation Removal

The principle concerns related to the removal of vegetation in wetlands are:

- introduction and establishment of weed, non-native or invasive species
- loss of rare plants
- temporary loss of habitat that is important for wildlife

The ground disturbance that occurs during wetland vegetation removal may expose buried weed, non-native or invasive seeds and create open ground, providing ideal conditions for colonization by annual weeds. In some cases, the introduction of undesirable plant species may have a negative impact on established wetland communities or rare plant habitat. During construction, the introduction and establishment of these species may be further increased by the potential for seeds or propagules to be transported to the site from construction vehicles and clothing and boots of workers and site visitors. Weed control will be a necessary strategy for the project post-construction.

Wildlife may experience negative effects from vegetation removal or habitat fragmentation if the composition or physical structure of the disturbed wetland community provides resources such as cover, reproduction and foraging space. The direct alteration of wetland vegetation communities in the RoW will occur along the fringes of wetlands or through open cut trenching. At total of 95 wetland and seasonal waterways are located within the 50 m pipeline RoW and may be temporarily affected by construction. Construction will not permanently remove wetlands, wetland habitat or reduce the quality of wildlife habitats. Table 5.2 summarizes the wetlands that will be temporarily affected by construction of the pipeline. A total of 46 wetlands and seasonal waterways will be impacted by the pipeline RoW. Locations of wetlands crossed in the LSA are provided in Figures 1 to 17.

TABLE 5.1 Wetlands Affected by the Construction of the Pipeline

Type	Total Number of Wetlands or Waterways Identified Within 50 m of the RoW	Number of Wetlands or Waterways Impacted by Construction
Class I	36	22
Class II	29	9
Class III	18	8
Class IV	7	3
Class V	0	0
Seasonal Waterways	5	4
Total	**85**	**46**

5.6.2.2 Alteration of Wetland Hydrology

Construction activities may result in the changes to wetland hydrology through alterations or impedance of natural flow and water level fluctuations. Alteration or impedance of natural flow may also result in increased wetland area through flooding on the areas peripheral edge of the wetland. These changes may alter species composition if hydrologic conditions for growth are no longer within their range of tolerance. Some species may be unable to grow, whereas others may be outcompeted by invasive species better suited to the new conditions. However, if hydrology and soils are not significantly altered by the disturbance, native vegetation will re-establish from the seed bank and other propagule material over time (Native Plant Working Group 2000).

5.6.2.3 Mitigation

Field surveys were completed to identify wetlands along the pipeline RoW. Wetlands were avoided to the extent possible with disturbances associated with construction primarily limited to the peripheral edge of wetland margins. In some instances a boring method will be used to cross under the wetland to prevent impacts to the wetland community and surface hydrology. Mitigation for each identified wetland can be found in Table 1 (attached). During construction, disturbance to wetlands will be minimized where practicable and reclaimed where disturbance is unavoidable. Any disturbance that does occur will persist only over the relatively short time period required to install the pipeline and reclaim the wetland area that was disturbed (Table 5.2). Impacts are not expected to exceed existing disturbances associated with existing agricultural practices.

5.6.2.4 Evaluation of Significance

There are no situations where there is a high probability of occurrence of permanent or long-term watercourses and wetlands residual effect of high magnitude that cannot be mitigated, therefore, residual effects are determined to be not significant (Table 5.4).

5.7 Fish and Fish Habitat

There will be no impacts to fish bearing waters or fish habitat in the construction of this pipeline.

5.7.1 Evaluation of Significance

There are no residual effects to fish and fish habitat; therefore, no evaluation of significance is required.

5.8 Water Quantity and Quality

The potential for residual water quality and quantity effects occurs mainly during the construction phase of the pipeline RoW; there will be minimal residual effects during the operation phase. The following sections discuss the potential effects and residual effects after mitigation.

Potential direct and indirect water quality and quantity effects associated with construction of the pipeline include:

- alteration of natural drainage patterns until trench settlement is complete
- reduction in water quality and quantity from water withdrawal and release for hydrostatic testing
- reduction in surface water quality due to an accidental spill or release of hazardous materials

Potential direct and indirect effects on groundwater quality and quantity associated with the construction and operation of the project are related to:

- accidental releases of hazardous materials

- disruption of springs

Potential direct and indirect effects from operations activities are related to the potential for an accidental spill, which could affect surface water quality if the release occurred in or near a watercourse, and could affect groundwater quality if the release occurred in close proximity to shallow wells. While the likelihood of an accidental release during operation is low, such an event has the potential to affect surface water or groundwater quality until the spill has been cleaned up and remediated.

5.8.1 Alteration of Natural Drainage Patterns until Trench Settlement is Complete

Mitigation will ensure that disruption of surface flow patterns following construction will be minor along the RoW.

5.8.2 Reduction of Water Quality and Quantity from Water Withdrawal and Release for Hydrostatic Testing

There is a risk that the quality of the water used for hydrostatic testing could reduce the water quality through additives to the test water such as methanol, biocides or corrosion inhibitors [CAPP 2012], additives used to prevent freezing of the hydrostatic test water or physical particulates from the pipe itself. A spill contingency plan will be in place, which will provide an environmental response plan in the event of a spill. Therefore, the probability of direct effects to water quality is considered to be low.

5.8.3 Accidental Spills or Releases of Hazardous Materials

Potential effects to surface water and groundwater quality associated with the project are related to accidental spills or releases of hazardous materials during construction and operation of the pipeline. The pipeline will be installed at a depth of 1.5 m to the top of the pipe. This depth is generally estimated to be above the groundwater table and bedrock aquifers in the LSA. Therefore, the probability of direct effects to groundwater quality is considered to be low.

5.8.4 Disruption of Springs

Pipeline construction that intercepts shallow groundwater springs may cause groundwater to flow to surface. While the field surveys did not identify the presence of springs, it is possible that springs may be encountered during construction of the pipeline.

5.8.5 Mitigation

Mitigation measures to be implemented during construction to reduce any potential effects to water quality and quantity are presented in Section 5.19, Table 5.2.

5.8.6 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term water quality and quantity residual effect of high magnitude that cannot be mitigated; therefore, residual effects are determined to be not significant (Table 5.4).

5.9 Air Quality

The subsections below summarize the potential air quality effects in the Project RSA. The potential air quality and greenhouse gas emissions effects associated with the construction and operation of the project include:

- greenhouse gas emissions associated with vehicles and construction equipment and clearing of vegetation
- dust (particulates) during construction

The operation phase of the project will not result in any continuous emissions of GHGs. However, during periodic maintenance activities of short-term duration, emissions from vehicles and equipment will occur. Depending on the location and season of the work, dust may result during maintenance activities.

5.9.1 Greenhouse Gas Emissions

The main sources of GHG emissions associated with the project are predicted to be combustion of fossil fuels associated with all vehicles, directional drilling equipment and heavy duty construction equipment to transport equipment and material to the pipeline construction area and the operation of the equipment during construction. A small proportion of the pipeline RoW will requiring clearing of native vegetation, therefore the emissions from vegetation clearing are considered to be negligible.

An assessment of the direct and indirect GHG emissions associated with the pipeline was not undertaken. The GHG emissions associated with construction were considered a one-time occurrence and of low magnitude.

Where practical GHG emissions associated with the construction of the pipeline will be minimized by using multi-passenger vehicles to transport workers to and from construction sites. No direct GHG emissions are anticipated to arise from the proposed operation of the pipeline.

5.9.2 Dust (Particulates) During Construction

There is potential for increased dust emissions during construction of the pipeline and from increased traffic on unpaved access roads. Dust emissions are predicted when construction occurs in dry, unfrozen conditions. However construction is planned for winter, resulting in a considerably reduced risk of dust. This type of construction-related emission is reversible in the short-term and predicted to be of low magnitude. No mitigation is proposed for winter frozen conditions.

Operation of the pipeline is expected to reduce dust emissions, as the use of transportation trucks to transport oil from pump jack sites to upgrading facilities will be replaced by the operation of the pipeline.

5.9.3 Mitigation

Mitigation measures (Section 5.19, Table 5.2) will be implemented during construction and operations to reduce any potential effects to air quality from GHG and dust emissions.

5.9.4 Evaluation of Significance

There are no residual effects to air quality; therefore, no evaluation of significance is required.

5.10 Acoustic Environment

The potential for residual acoustic environment effects occurs mainly during the construction phase of the pipeline.

Noise resulting from construction activities is will occur as construction progresses along the pipeline. A short-term increase in noise will be limited to areas in proximity to permanent residences. The linear progression of pipeline construction will result in approximately 1 to 2 weeks duration of concentrated construction activity at any given location from December 2015 to March 15, 2016. The residual effect of construction noise on nearby residents is of low magnitude and immediately reversible.

The effect of noise on wildlife is provided in Section 5.19, Table 5.3.

Noise resulting from the operation of the pipeline will be undetectable and is not expected to add to baseline noise levels; therefore no assessment is required.

5.10.1 Mitigation

Mitigation measures (Section 5.19, Table 5.2) will be implemented during construction and decommissioning to reduce any potential effects to the acoustic environment.

5.10.2 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term acoustic environment residual effect of high magnitude that cannot be mitigated; therefore, residual effects are determined to be not significant (Table 5.4).

5.11 Heritage Resources

Heritage Resource impacts and mitigation work is being completed by AtlHeritage Corp. and will be forwarded as a secondary report.

5.12 Traditional Land Use

As discussed in Section 4.13 the current land tenure and land use would appear to preclude the possibility of traditional activities being practiced on the lands in question. The project is within lands that are entirely privately-owned, rather than on Crown land. Therefore, the project is not expected to affect traditional land use in the LSA.

5.12.1 Mitigation

There are no effects predicted to affect traditional land use; therefore, no mitigation measures are proposed.

5.12.2 Evaluation of Significance

There are no residual effects to traditional land use; therefore, no evaluation of significance is required.

5.13 Human Occupancy and Resource Use

The potential effects on human occupancy and resource use include:

- conflicts with other natural resource extraction activities
- disruption of ranching and farming operations
- disruption of current land use and recreation activities
- increased demand on local and regional infrastructure and services

5.13.1 Conflicts with other Natural Resource Extraction Activities

The pipeline does not traverse any coal dispositions, mining claims, potash licenses, quarry leases or withdrawals, mining restricted lands or Forest Management Licenses or Integrated Wood Supply Areas.

5.13.2 Disruption of Ranching and Farming Operations

Ranchers and farmers along the route may experience disruptions to their activities during the short-term duration of construction of the pipeline. These disruptions are expected to be limited because pipeline construction will occur outside of the productive peak agricultural period. Cattle grazing is occurs on native grasslands in the LSA, and if the cattle are still present at construction, they may be moved. Advanced notification of the pipeline construction schedule to all affected ranchers and farmers will lessen the effects on ranchers and farmers. The construction of the pipeline will not affect the sustainability of ranching and farming activities along the pipeline RoW or in the LSA.

5.13.3 Disruption of Current Land Use and Recreation Activities

The project is located on predominantly private land and does not intersect any regional, provincial, or national parks, community pastures, or designated recreation areas. Because construction is proposed for the winter season, hunting and trapping, which is only allowed with permission from the landowner,

will not be affected. No effects to other recreational activities (i.e., fishing) will be impacted by winter construction activities.

5.13.4 Increased demand on local and regional infrastructure and services

The potential effects on infrastructure and services use as a result of construction include:

- shortfall of accommodations
- increased pressure on medical, emergency and protective services
- increased traffic
- increase in waste flow

Currently available temporary accommodation (i.e., hotel/motel rooms) is generally limited in the regional area (i.e., Virden), due to limited supply and high use by current temporary workforce personnel. The demand on temporary accommodation by the construction workforce may result in short-term competition for limited accommodation.

Emergency and protective service requirements are not anticipated to increase as a result of the project. It is expected that demands for these services during project construction activities will be similar to those that presently exist as a result of the presence of a mobile workforce associated with on-going development of the Bakken Formation.

Traffic during construction from trucks and passenger vehicles will increase on area roads. Major excavation equipment and pipe will be delivered by truck and workers will arrive at site in personal vehicles. The increase in traffic will be short-term and for the duration of construction. Additional traffic is not expected during operations.

The construction of the pipeline will generate waste products that will require transfer to landfill sites. TEML will reduce waste quantities to the lowest levels practical and implement a waste management plan. Waste generated by the project will be hauled to an appropriate landfill site in the region.

5.13.5 Mitigation

Mitigation measures will be implemented to reduce any potential effects to human occupancy and resource use. The mitigation measures are summarized in Table 5.2.

5.13.6 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term human occupancy and resource use residual effect of high magnitude that cannot be mitigated; therefore, residual effects are determined to be not significant (Table 5.4).

5.14 Social and Cultural Well-being

The construction of the pipeline will result in a temporary increase in population, which will most likely affect the town of Virden to the east, as it has sufficient services to accommodate workers. The operation of the project will likely not create any permanent jobs; however, if jobs are created they are expected to be long-term residents of the region. There may also be associated benefits of temporary workers, including an increase in spending in local communities (i.e., Virden; Nichols Applied Management 2007).

The well-being of adjacent landowners is not expected to be affected by the construction of the pipeline as the progression of pipeline construction is linear, with construction workers and heavy equipment present for a relatively short-period of time, including worker and service vehicles travelling on roads. The operations activities will be greatly reduced relative to the construction phase, with limited service vehicle trips.

5.14.1 Mitigation

Mitigation measures will be implemented to reduce any potential effects to social and cultural well-being. The mitigation measures are summarized in Table 5.2.

5.14.2 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term social and cultural well-being residual effect of high magnitude that cannot be mitigated; therefore, residual effects are determined to be not significant (Table 5.4).

5.15 Employment and Economy

The potential economic effects of the construction and operation of the project include:

- benefits to local businesses and residents
- generation of revenue for municipal, provincial and federal governments

5.15.1 Mitigation

There are no negative residual effects predicted to affect employment and economy; therefore, no mitigation measures are proposed.

5.15.2 Evaluation of Significance

There are no residual effects to employment and economy; therefore, no evaluation of significance is required.

5.16 Accidents and Malfunctions

The following potential residual effects could take place as a result of accidental events during construction of the pipeline:

- localized spills, once remediated will have little adverse residual effect
- rupture of water, sewage, or gas lines could result in interruption in services, contamination of soil and water, depending on location and severity of the rupture
- fires in the case of gas could occur while electrical cable damage could lead to interrupted service of the utility to a local communities or residences
- release of drilling mud on land, once cleaned up and reclaimed would be expected to have minimal residual effect
- release of drilling mud into a watercourse could affect aquatic ecosystems in the short to medium-term
- a pipeline failure could adversely affect adjacent soils, vegetation, wildlife habitat and aquatic ecosystems, including aquifers

To minimize the risk of adverse effects from accidents, to minimize the risk of adverse effects from accidents, TEML will implement industry best practice technology and safety measures to minimize the probability of accidents occurring. Therefore, the potential is low for accidents to occur during construction that would have substantial adverse effects.

5.16.1 Spills of Hazardous Materials During Construction

Spills onto land during construction will generally be limited to and small within the RoW. Since light hydrocarbons (e.g., gasoline, light diesel) tend to disperse readily and break down, the potential for adverse residual effects are reversible in the short-term.

A spill on an ice-covered water body is generally localized and can be readily remediated through scraping of the contaminated ice surface. Spills that occur under the ice are more difficult to contain and clean-up because of the presence of ice cover. The adverse residual effects associated with a large spill under ice of a water body could be considered significant; however the probability of a significant adverse residual effect is low.

5.16.2 Rupture or Damage to Foreign Lines, Pipelines and Cables During Construction

Rupture of a water line, buried electrical cable, or telephone line along the route would result in inconvenience for nearby residences but would likely have an overall low magnitude and reversibly effect in the immediate to short-term as repair would be relatively easy. Rupture of a sewer line would be an inconvenience and could contaminate soils in the vicinity of the rupture. This contamination could be remediated relatively quickly with minimal to no adverse residual effect.

If a high pressure gas line were to be ruptured there would be risk of explosion and risk to human health would be considered significant. As high pressure pipelines are easily located because they are composed of metal and are of sufficient size and strength that ruptures are extremely unlikely, the probability of significant adverse effect resulting from an explosion of existing gas pipelines is low. An oil line rupture would have similar consequences and probability.

Rupture of an existing pipeline during construction of the pipeline resulting in severe contamination of lands or water could be considered a significant adverse effect. As TEML will follow industry standards, government regulations, and company protocols, the probability of a significant adverse effect resulting from working in the vicinity of the existing pipelines is low.

5.16.3 Release of Drilling Mud during Horizontal Directional Drilling

The release of drilling mud during directional drilling of a watercourse is rare. In the event of a release on land or in a watercourse, effects will be minimal since the mud is inert and can often be cleaned up and the area rapidly reclaimed. The introduction of clay based drilling mud into the environment will have variable effects depending on the location, volume and level of clean-up applied. Monitoring programs during directional drilling programs allows any release to be detected quickly. The ability to stop the flow rapidly limits the volume of drilling mud released. Drilling mud released into a watercourse will dissipate in the watercourse in a short period. The reversibility of an adverse residual effect on a riparian area depends on the length of time it takes for vegetation to recolonize the area disturbed by the mud and clean-up activities; it is likely to be short to medium-term.

5.16.4 Pipeline Failure during Operations

Pipelines are the safest and most efficient manner for transporting large volumes of crude oil and other liquid petroleum products over long distances. The type of product spilled, volume of product spilled, and sensitivity of the location of the failure will determine the significance of the failure. For example, if an incident is contained within a bermed pump station, the residual effect of the release would likely be considered not significant; alternatively if the released product affected wildlife habitat during a critical life stage, sensitive aquatic ecosystems (including aquifers) or downstream municipal water intakes, the residual effect would likely be considered significant.

5.16.5 Mitigation

Mitigation measures to be implemented during construction to reduce any potential effects to accidents and malfunctions are presented in Section 6.4.7, Table 6.2.

5.16.6 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term accidents or malfunctions residual effect of high magnitude that cannot be mitigated, therefore, residual effects are determined to be not significant (Table 5.4).

5.17 Decommissioning and Abandonment

When TEML is considering decommissioning and/or abandonment of this project they will review current options, issues, and regulatory requirements of the day. The decommissioning and/or abandonment plan will comply with the acceptable regulatory standards of the day and will be developed in consultation with stakeholders with an interest in the decommissioning or abandonment work.

Regardless of approach, the activities are expected to include removal of aboveground infrastructure and reclaiming of the site to as close to pre-disturbance condition as is practical. The environmental and socio-economic components likely to interact with this program are:

- Physical components such as physical environment (surface erosion), soil capability (admixing of topsoil/subsoil), water quality and quantity (sedimentation), air quality (nuisance health effect - dust, vehicle emissions) and acoustic environment (nuisance health effect - noise).

- Biological components including fish and fish habitat (alteration of habitat, sedimentation), wetlands (alteration of habitat function), vegetation (weed introduction), wildlife and SAR (nesting habitat and auditory disturbance).

- Socio-economic components such as human occupancy, and resource use (disruption of agricultural activities), infrastructure and services (transport of workers and supplies); and accidents and malfunctions.

With the implementation of standard mitigation of the day, it is expected that any adverse residual effects would be of similar of lesser magnitude compared with those which are described for construction of the project.

5.18 Potential Effects from the Environment

The potential environmental conditions identified that could adversely affect the project either during construction or operations is severe weather including high wind speeds, heavy/persistent precipitation or extreme temperatures, lightning and temperature inversions.

5.18.1 High Winds

High winds could lead to a suspension of some construction activities including topsoil handling, clearing, slash burning, and welding. The pipeline, once buried, will not be adversely affected by high winds. Therefore, no adverse effects on the project are expected to result from high winds.

5.18.2 Heavy/Persistent Precipitation

Changes in precipitation may have an impact on construction techniques and timing. Precipitation changes may also have an impact on surface runoff that in turn may affect the design and maintenance of access roads.

5.18.3 Inclement Weather

Persistent or high levels of precipitation could result in a delay in the construction of the project if topsoil salvage activities have not been completed or if wet soil conditions create safety or transportation problems.

During the operations phase, persistent or high levels of precipitation or extreme temperatures are not expected to adversely affect the pipeline once buried. Therefore, no adverse effects on the project are expected to result from inclement weather.

5.19 Mitigation

5.19.1 Alternate Routes

During the RoW construction selection process, a preliminary reconnaissance of the route was completed to identify potential environmental constraints. Where possible wetlands were avoided or only the peripheral edge of the wetland was intersected by the RoW..

5.19.2 General and Specific Mitigation Measures

General and specific mitigation measures, including project planning, project design, construction techniques, operational practices, reclamation techniques and scheduling principles that will be applied to prevent or minimize adverse effects are summarized in Table 5.3. The Construction and Reclamation Plan (Section 7.0) details additional mitigations and best practices that will be considered during construction and implemented post-construction to reduce impacts and reclaim disturbances, where required. Follow-up Plans and Monitoring (Section 8.0) will be further implemented during and post-construction to ensure reclamation is proceeding successfully.

TABLE 5.2 Potential Environmental and Socio-economic Effects, Mitigative Measures, and Residual Effects

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
PHYSICAL ENVIRONMENT			
Slope instability	Pipeline, specifically slopes at watercourse crossings	• Ensure cuts and fills along the trench line are properly back sloped. • Maintain or re-establish surface and/or subsurface drainage patterns. • Follow site-specific recommendations of a geotechnical engineer in areas where unstable slopes are anticipated. • Recontour the pipeline and restore the grade to pre-construction conditions, as practicable.	• No residual effect identified.
Changes to Local Topography	Pipeline	• Recontour the pipeline and restore the grade to pre-construction conditions, as practicable.	• No residual effect identified.
Identification or Exposure of Historical Soil Contamination	Pipeline	• Contact appropriate regulatory authorities and dispose of contaminated soils as per Manitoba regulations and guidelines.	• No residual effect identified.
SOILS AND SOILS CAPABILITY			
Mixing of topsoil with subsoil	Pipeline	**Topsoil Stripping (General)** • Where topsoil is less than 30 cm, salvage topsoil to colour change, bottom of sod or duff layer, plough layer or 10 cm, whichever is deepest. • Only the trench line will be stripped on native grassland and modified grassland. • Salvage all topsoil stripped along the trench line. • Salvage topsoil from all areas that require grading. Avoid overstripping. Avoid grading of native grassland, bush, hay lands or pasture lands on level terrain, where practicable. In areas of native grassland, minimize the amount of stripping, where practicable and strip soil only from travel lane, trench line and spoil. • Under wet/thawed soils conditions where wheelslip, mud build-up on tires and cleats, water ponding and ruts are occurring, the decision to temporarily shut down construction activities will be made based on the plasticity of the surface soil to a depth of 10 to 20 cm, the depth of the wetting front and/or ruts in relation to the A and B horizons and the type of construction operations proposed for that day.	• Minor amount of topsoil and subsoil mixing during topsoil salvage. • Reduced soil capability for agriculture and reclamation suitability due to soil mixing.

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
Mixing of topsoil with subsoil	Pipeline	**Topsoil Stripping (Frozen)** • Frozen soil conditions are in effect when frost has reached the depth of the interface between topsoil and subsoil. • If practicable, maintain snow cover over the area to be stripped as long as possible. Remove snow just before stripping. • If practicable, remove or pack snow on the work side to increase frost penetration onto the soil. In mid to late winter, pack snow on the work side to avoid premature thawing of the upper soils. • If practicable, windrow snow over the trench line to prevent deep frost penetration along the trench line. • If practicable, grade snow over the travel lane to improve driving conditions and either grade the spoil pile area or grade snow over the spoil pile area on cultivated lands to smooth furrows and facilitate removal of spoil during backfilling. • Use equipment capable of practically separating topsoil from subsoil during topsoil stripping activities during frozen conditions. • Where practicable, complete backfilling of lowered-in pipe by nightfall during winter construction. • Avoid mixing snow with spoil during backfilling. • Postpone compaction of frozen trench spoil until final clean-up and non-frozen conditions. • If practicable, begin clean-up along segments of the pipeline constructed during frozen conditions as soon as possible after backfilling and before spring break-up. • If practicable, conduct three-lift soil handling under frozen conditions to minimize admixing of lower subsoil into the upper subsoil or topsoil.	• Same as above
Mixing of topsoil with subsoil	Pipeline	**Topsoil Replacement** • Postpone replacing topsoil during wet weather, frozen conditions or high winds to prevent damaging soil structure, placing topsoil on compacted subsoils or erosion of topsoil. • Replace topsoil evenly over all portions of the trench line that were stripped. • Avoid scalping of the sod layer on hay and pasture lands when moving the topsoil pile during backfilling.	• Same as above

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
Increased surface stoniness	Pipeline	• Conduct three-lift soil handling on lands with a higher gravel content in the lower subsoil than the upper subsoil to minimize increases of gravel and stones from the lower subsoil into the upper subsoil or topsoil. • Store the first lift of trench subsoil on the spoil side, either next to the trench or back far enough to store the second lift. Maintain a separation between the topsoil pile and the subsoil piles, and also between subsoil piles. • Remove stones to achieve equivalence with the surrounding subsoil/topsoil as well as stones from the upper 30 cm of soil that will interfere with topsoil replacement or cultivation (i.e., stones larger than 10 cm in diameter). • Dispose of stones at locations approved by the landowner or government land authority. Do not dispose of stones in wetlands.	• Reduced soil capability for agriculture and reclamation suitability. • Increased surface stoniness.
Soil compaction	Pipeline	• During winter construction, ensure the frost is deep enough to proceed without causing excessive rutting and soil compaction. • Use clearing equipment that minimizes surface disturbance, soil compaction and topsoil loss. • Confine traffic to the work lane and work along the work lane of the pipeline to the extent practicable to reduce the area subjected to potential soil compaction. • Suspend construction activities, as identified by the Environmental Inspector, when there is the indication of wet or thawing soils combined with the potential for compaction, which should be determined using the depth of the wetting front and/or ruts relative to the depth of the topsoil layer. • Rip compacted subsoil, temporary access trails and soils damaged during wet weather to the depth of compaction. • Employ a sub-soiler plough (e.g., para-tiller) along segments of the pipeline where topsoil salvage did not occur and subsoil compaction is severe. Do not use a sub-soiler plough on native grassland or bush lands.	• Soil compaction

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
Wind and water erosion	Pipeline	• Avoid scalping of the sod layer on pasture, shrublands, hay lands and native grassland when moving the topsoil and spoil piles during backfill. Use equipment (e.g., clean-up bucket) for final pass of backfilling that will minimize scalping. • Rollback small diameter slash on wooded non-agricultural lands. Over-picking small diameter (less than 4 cm in diameter) slash will be avoided on wooded areas with sandy soils where slash rollback is not allowed or is not practical. • Walk down topsoil windrow and windrow snow over the windrow to minimize the risk of wind erosion during frozen conditions. • For intensely grazed lands, fence the pipeline if requested by the landowner until vegetation is well established and to prevent damage from livestock.	• Minor surface erosion of topsoil can be expected until vegetative cover is established. • Re-vegetation of coarse-texture soils after disturbance may be inhibited.
Soil Contamination	Pipeline	• Train staff on proper fuel dispensing methods and use industry best practice technology and safety measures. • In the event of an accidental spill, immediately implement measures to stop, and control the migration of, and clean-up the spilled substance.	• Minor amount of soil contamination may occur during fueling due to spills or leaks.
VEGETATION COMMUNITIES			
Introduction or establishment of weeds, non-native and invasive species	Pipeline	• Only the trench line will be stripped. Minimize clearing and grading in areas with native grassland, woodlands. • Minimize grading along wetland margins. Clean equipment prior to site access to prevent spread of existing and imported weeds. • Conduct post-construction weed monitoring and mechanically and/or chemically control weeds in spring of 2016, as required.	• A minor introduction of weed, non-native and invasive species may occur.
Reduction in the area of native grassland, riparian vegetation and potential rare plant habitat through vegetation removal.	Pipeline	• Only the trench line will be stripped. Minimize and, where possible, avoid areas with high rare plant habitat, such as native grassland and riparian areas. • Reduce RoW and/or work lane in native grassland, shrubland and woodland, where practicable. • Construction to occur during the winter to minimize effects to vegetation. • Restore native vegetation communities according to site conditions and use approved and Manitoba sourced native seed mixes. • Allow natural regeneration to occur in wetlands, unless post-construction monitoring indicates re-vegetation is required.	• Temporary decline in extent of native grassland vegetation.

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
Fragmentation of patches of native grassland through vegetation removal	Pipeline	• Mitigation measures are the same as described above to minimize the residual effects of loss of native grassland.	• Temporary increase in amount of habitat edge and therefore increased area of habitat exposed to edge effects.
WILDLIFE AND WILDLIFE HABITAT			
Habitat alteration and loss	Pipeline, where native grasslands, hayfields, woodlands, or wetlands occur	• If a tree to be cleared contains an active bird nest, or if a ground nest, burrow or den is discovered during clearing, suspend the work activity, fence or flag off the area, and contact the Environmental Inspector. • Where possible, avoid the vegetated margins of wetlands. • Restore pre-construction profile in wetlands during reclamation. • Re-vegetate disturbed non-cultivated portions of the pipeline with an appropriate, Manitoba sourced, native seed mix. • Supplemental field studies may be completed for SAR and their habitat in the event that construction occurs in spring/summer.	• Long-term habitat alteration will occur where forested areas are cleared. • Medium-term habitat alteration will occur in grassland areas that will be reclaimed following construction.
Sensory disturbance and reduced habitat effectiveness	Pipeline	• No critical ungulate winter range occurs along the pipeline RoW or in the LSA. • No waterfowl or other migratory birds will be in the LSA during the planned winter construction. • Minimize construction vehicles travelling to and from worksite (e.g., use multi-passenger vehicles to transport workers).	• Short-term sensory disturbance during late winter period January 15 to March 30.
Project-related wildlife mortality	Pipeline, primarily in non-agricultural lands (excluding collisions)	• Establish construction traffic speed limits and post speed limits on access roads to reduce the risk of collisions with wildlife. • Minimize construction vehicles travelling to and from worksite (e.g., use multi-passenger vehicles to transport workers). • Report any incidents or collisions with wildlife to the Environmental Inspector, whom will notify local wildlife authorities and the police as appropriate. • Collect construction garbage daily and dispose of in approved disposal locations to prevent attracting nuisance wildlife.	• With mitigation, potential effects will be minimized
WATERCOURSE AND WETLANDS			
Wetland vegetation removal	Pipeline	• Allow native wetland vegetation to re-establish on its own from the seed bank or from root material. • Conduct post-construction weed monitoring and mechanically and/or chemically control weeds as required.	• Minor loss of wetland vegetation.

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
Alteration of wetland hydrology	Pipeline	• Construction in wetland areas will occur during frozen ground conditions. • Where necessary, install a shoofly around wetlands. Restrict access through wetlands to the shoofly to the extent practical. • Minimize removal of vegetation and disturbance of soil to areas directly adjacent to wetlands • Minimize the width of grubbing through wet areas during construction to facilitate the restoration of shrub communities. • Restrict grading as much as practical. Conduct grading away from the wetland to the extent practical to reduce the risk of sediment and other material entering the wetland. • Keep wetland soils separate from upland soils. • If construction occurs during wet conditions, install trench breakers, where warranted, at the edge of perched wetlands to prevent the pipe trench from acting as a drain. • Do not dewater any permanent wetland.	• With mitigation, potential effects will be minimized.
FISH AND FISH HABITAT			
No effects identified		• No fish habitat will be impacted by construction.	
WATER QUALITY AND QUANTITY			
Alteration of natural drainage patterns	Pipeline	• Install trench breakers, where warranted, at the edge of perched wetlands to prevent the pipe trench from acting as a drain. • Compact backfill to the extent feasible and crown trench to prevent channelized flow along the trench. Avoid excessive trench crown height. • Feather-out excess spoil over the stripped portion of the trench line to minimize the creation of a permanent mound. • Restore pipeline drainage patterns to as close to pre-construction contours as practical during reclamation.	• Localized alteration of natural drainage patterns may occur until trench settlement is complete.

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
Reduction in surface water quality	Pipeline	• Restrict grading to trench line and work areas where practicable. • Direct grading away from watercourses and drainages to reduce the risk of material entering the watercourse or drainages. • In the event of an accidental spill, immediately implement measures to stop, control the migration of, and clean up the spill. • Install erosion control structures between wetlands and disturbed areas to prevent siltation of surface water. Ensure erosion control structures have been installed properly. •	• Only in the case of an accidental spill or release would surface quality potentially be affected.
Reduction in groundwater quality due to accidental release	Pipeline	• Field verify the locations of all registered or known water wells within 200 m of pipeline construction excavation or drilling activities. Ensure adequate cathodic protection of the pipe. • In the event of an accidental spill, immediately implement measures to stop, control the migration of, and clean-up the spilled materials. • Develop a plan to identify alternate water supplies and commit to provide alternate water sources to affected parties, if warranted, in the event of an accidental release.	• Only in the case of an accidental spill or release would groundwater quality potentially be affected.
AIR QUALITY			
Greenhouse gas emissions associated with vehicles and construction equipment and clearing of vegetation	LSA	• Use multi-passenger vehicle to transport workers to construction site whenever practicable. • Limit idling of construction and operations equipment where practicable. Where reasonable, vehicles and equipment will be turned off when not in use unless weather and/or safety conditions dictate the need for them to remain turned on. • Vehicle and equipment engines will be properly maintained according to the manufacturers' specifications.	• No residual effects identified
Dust (particulates) during construction	LSA	• Suspend topsoil stripping and replacement during strong winds to prevent wind-blown dust emissions. • Limit the potential for wind erosion by: ✦ shortening the time between stripping and replacement as much as possible ✦ contouring and compacting topsoil berms and storage piles with a low profile to reduce erosion potential ✦ limiting construction activities to the surveyed trench line and workspace	• No residual effects identified

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
ACOUSTIC ENVIRONMENT			
Noise from construction and operation of the Pipeline	LSA	• Plan construction activity to occur between the hours of 07:00 and 22:00, when applicable, to reduce the potential effect of construction noise. • Advise nearby residents of noise-causing activities and schedule these events to reduce disruption to them. • Ensure all internal combustion engines are fitted with appropriate muffler systems. • Limit the use of engine retarders in close proximity to residences. • Should a valid complaint be made during construction, TEML will respond expeditiously and take appropriate action to ensure that the issue has been managed responsibly.	• Temporary increase in noise during construction.
TRADITIONAL LAND USE			
No effects identified		• No mitigation.	• No residual effects identified.
HUMAN OCCUPANCY AND RESOURCE USE			
Conflicts with other natural resource extraction activities	Pipeline	• No mitigation.	• No residual effects identified.
Disruption of ranching and farming operations	Pipeline	• TEML will obtain land access agreements from all landowners along the pipeline. • TEML will communicate its construction schedule to landowners. • Construction equipment and vehicles will be confined to the pipeline RoW, existing public roads and approved temporary access roads. • Complete clean-up as soon, as practicable, to minimize disturbance to ranching and farming operations.	• Temporary disruption of ranching and farming operations.
Disruption of current land use and recreation activities	Pipeline	• TEML will communicate expectations regarding proper conduct when using community facilities to all construction workers, inspectors and support personnel during the project orientation.	• No residual effects identified.

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
Increased demand on local and regional infrastructure and services	Pipeline	• If crew accommodation cannot be found, TEML will consider camp options, which will mitigate lack of vacancy in the area. • A Waste Management Plan will be implemented during construction to reduce waste quantities to the lowest levels practical. Waste generated by the project will be hauled to an appropriate landfill site in the region. • The contractors for the project will be required to outline appropriate behaviour expectations of its construction workers in the community to help diminish conflicts with local residents.	• Temporary increase in demand for accommodation and services.
SOCIAL AND CULTURAL WELL-BEING			
Reduction of social and cultural well-being due to temporary workers and construction activities	LSA	• TEML will communicate: ✦ The project construction schedule to all adjacent landowners and a TEML representative will be available to discuss the project for the duration of the construction period. ✦ TEMLs expectations regarding proper conduct when using community facilities to all construction workers, inspectors and support personnel during the project orientation.	• No negative residual effects.
EMPLOYMENT AND ECONOMY			
Benefits to local businesses and residents	Regional area	• No mitigation.	• No negative residual effect, only an economic benefit.
Generation of revenue for municipal, provincial and federal governments	Regional area	• No mitigation.	• No negative residual effect, only an economic benefit.

Environmental or Socio-economic Element/Potential Effect	Spatial Boundary	Recommendations/Mitigation Measures	Residual Effect(s)
ACCIDENTS AND MALFUNCTIONS			
Accidental spills	LSA	• All contractor and subcontractor will be required to have a construction Spill Response Plan. • Staff will be trained on proper fuel dispensing methods and use industry best practice technology and safety measures. • TEML will identify restrictions and procedures for fuel storage locations, fueling activities, and construction equipment maintenance. • Project contractor and subcontractors will be required to comply with applicable environmental and safety laws and regulations. • In the event of an accidental spill, TEML will immediately implement measures to stop, control the migration of, and clean-up the spilled substance as per Spill Response Plan. • TEML takes responsibility for all reclamation and remediation necessary to restore any damaged land to its pre-spill condition.	• An accidental release may result in residual effects on soils, vegetation, wildlife habitat, aquatic ecosystems, and groundwater.
Release of drilling mud into a watercourse	Pipeline, specifically at watercourse crossing locations	• Use an inert, non-toxic bentonitic clay-based material as drilling mud. • The drilling contractor will be required to have a contingency plan in place for directional drilling operations. • Drilling mud will be disposed of following applicable government standards.	• No residual effects identified.

5.19.3 Evaluation of Significance

Conclusions for the effects criteria are based on both quantitative and qualitative assessments.

- Quantitative assessments include the results of measurable predictions or objective comparisons of residual effects with established limits.

Qualitative assessments are subjective and consider evaluations based on best professional judgement when environmental objectives are not available or quantitative predictions are not feasible.

A summary of the effects assessment criteria is provided in Table 5.3.

The integration of the various effects criteria result in a final significance impact rating for each potential project effect, resulting in an impact rating that is either not-significant or significant.

Table 5.4 provides a final significance rating to predicted residual effects for all criteria evaluated in this EA. The final significance rating relates to effects remaining after the application of mitigation using the defined effects assessment criteria for the project.

TABLE 5.3 Effects Assessment Criteria

Rating	Description
Direction	Describes if there is a net benefit, net loss or a net balance to the resource or affected party as result of the impact.
Positive	Project has a net benefit
Neutral	Project has a net balance
Negative	Project results in a net loss, or otherwise referred to as an adverse effect
Magnitude	Describes the size and severity of the effect.
Negligible	No discernible contribution
Low	Within acceptable protective standards and/or causes no detectable change to the resource
Medium	Within acceptable protective standards and/or causes a detectable change to the resource
High	Exceeds protective standards and/or causes a detectable change to the resource beyond the range of tolerance
Duration	Describes how long the effect will occur. The time span of duration will be defined as required by each discipline; so the definitions below may be appropriate for some terrestrial disciplines but may not be appropriate for noise or air quality.
Short-term	Less than one year
Medium-term	One to ten years
Long-term	Greater than ten years

Rating	Description
Frequency of occurrence	Describes how often an effect occurs within a set time period.
Isolated	Occurs at a specific time
Occasional	Intermittent and sporadic
Regular	Occurs recurrently during the assessment period
Continuous	Occurs continually during the assessment period
Spatial Extent	Describes the area within which the effect occurs.
Isolated	Effects are those confined to the area directly disturbed by project activities.
Local	Occur beyond the construction right-of-way and are restricted to within 200 m of the project (i.e., 200 m on either side of the pipeline [centreline]).
Regional	Those that are beyond the local effects and within 10 km
Reversibility	Describes the potential for the recovery or reversibility of an effect.
Reversible in short-term	Time period to be defined by each discipline
Reversible in medium-term	Time period to be defined by each discipline
Irreversible (permanent)	Time period to be defined by each discipline
Probability of occurrence	Describes the likelihood of a residual effect.
Low	Unlikely to occur
High	Likely to occur
Prediction confidence	Describes the certainty of the effect assessment and considers data quality, rigor of the assessment/measurement approach, and/or the certainty of prescribed mitigation measures.
Low	Poor understanding of cause-effect relationships and coarse or low resolution data.
Medium	Good understanding of cause effect relationships and coarse or low resolution data or high resolution quality data but poor understanding of cause-effect relationships.
High	Good understanding of cause-effect relationships and high resolution data.
Significance	Describes the probability of occurrence of a permanent or long-term residual effect. A significant impact would be anything that Matrix would rate as having a “moderate” or “high” impact if this were an EIA.
Not significant	Low probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated or economically compensated.
Significant	High probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated or economically compensated.

TABLE 5.4 Project Residual Effects Assessment

Residual Effects	Direction	Magnitude	Duration	Frequency of Occurrence	Spatial Extent	Reversibility	Probability of Occurrence	Prediction Confidence	Significance
PHYSICAL ENVIRONMENT									
No residual effects									
SOIL AND SOIL PRODUCTIVITY									
Lowering of topsoil capability due to mixing of topsoil with subsoil	Negative	Negligible	Long-term	Isolated	Isolated	Irreversible	Low	High	Not significant
Lowering of topsoil capability due to mixing of topsoil and subsoil due to trench instability	Negative	Negligible	Long-term	Isolated	Isolated	Irreversible	Low	High	Not significant
Lowering of topsoil capability due to increased surface stoniness	Negative	Negligible	Short-term	Isolated	Isolated	Reversible in the short-term	Low	High	Not significant
Lowering of soil capability due to increased soil compaction from construction traffic	Negative	Negligible	Short-term	Isolated	Isolated	Reversible in the short-term	Low	High	Not significant
Lowering of topsoil capability due to loss of topsoil from wind erosion	Negative	Negligible	Long-term	Isolated	Isolated	Reversible in the long-term	Low	High	Not significant
Lowering of topsoil capability due to loss of topsoil from water erosion	Negative	Negligible	Long-term	Isolated	Isolated	Reversible in the long-term	Low	High	Not significant
Lowering of topsoil capability due to pulverization of soil	Negative	Negligible	Short-term	Isolated	Isolated	Reversible in the short-term	Low	High	Not significant
Reduced soil capability due to soil contamination	Negative	Low	Medium-term	Isolated	Isolated	Reversible in the medium-term	Low	High	Not significant

Residual Effects	Direction	Magnitude	Duration	Frequency of Occurrence	Spatial Extent	Reversibility	Probability of Occurrence	Prediction Confidence	Significance
VEGETATION COMMUNITIES									
Introduction of new or establishment of present weed, non-native or invasive species	Negative	Low	Medium-term	Isolated	Local	Reversible in the medium-term	High	High	Not significant
Temporary loss of vegetation communities with high rare plant potential	Negative	Low	Medium-term	Isolated	Local	Reversible in the medium-term	High	High	Not significant
Temporary loss of habitat	Negative	Low	Medium-term	Isolated	Local	Reversible in the medium-term	High	High	Not significant
WILDLIFE AND WILDLIFE HABITAT									
Habitat loss and Alteration	Negative	Low	Medium-term	Continuous	Isolated	Medium-term	High	High	Not significant
Sensory disturbance and Reduced habitat effectiveness	Neutral to Negative	Negligible to low	Short-term	Regular	Local	Short-term	Low	Medium	Not significant
Project related wildlife mortality	Negative	Negligible	Short-term	Occasional	Regional	Short-term	Low	High	Not significant
WATERCOURSES AND WETLANDS									
Watercourses	No residual effects								
Wetland vegetation removal	Neutral to Negative	Low	Medium-term	Isolated	Local	Reversible in the medium-term	Low	High	Not significant
Alteration of wetland hydrology	Negative	Low	Medium-term	Isolated	Local	Reversible in the medium-term	Low	High	Not significant
FISH AND FISH HABITAT									
No residual effects									
WATER QUANTITY AND QUALITY									
Localized alteration of natural drainage patterns	Negative	Low	Short-term	Isolated	Isolated to local	Reversible in the short-term	Low	High	Not significant

Residual Effects	Direction	Magnitude	Duration	Frequency of Occurrence	Spatial Extent	Reversibility	Probability of Occurrence	Prediction Confidence	Significance
Reduction in water quality due to accidental spills or release of hazardous materials	Negative	Low to high	Medium to long-term	Isolated	Local	Medium to Long-term	Low	High	Not significant
Disruption of springs	Negative	Low	Short-term	Isolated	Local	Short-term	Low	High	Not significant
AIR QUALITY									
Increase in GHG emissions during construction	No residual effects								
dust during construction	No residual effects								
ACOUSTIC ENVIRONMENT									
Temporary increase in noise during construction	Negative	Low	Short-term	Isolated	Local	Reversible in the short-term	Low	High	Not significant
HERITAGE RESOURCES									
No residual effects									
TRADITIONAL LAND USE									
No residual effects									
HUMAN OCCUPANCY AND RESOURCE USE									
Conflicts with other natural resource extraction activities	No residual effects								
Disruption of ranching and farming operations	Negative	Negligible to low	Short-term	Occasional	Local	Reversible in the short-term	Low	Medium	Not significant
Disruption of current land use and recreation activities	No Residual Effects								
Increased demand on local and regional infrastructure and services	Negative	Negligible	Short-term	Occasional	Regional	Reversible in the short-term	Low	Medium	Not significant
SOCIAL AND CULTURAL WELL BEING									
Change to social and cultural well- being	Neutral to Positive	Low	Short-term	Occasional	Regional	Reversible in the short-term	Low	Low	Not significant

Residual Effects	Direction	Magnitude	Duration	Frequency of Occurrence	Spatial Extent	Reversibility	Probability of Occurrence	Prediction Confidence	Significance
EMPLOYMENT AND ECONOMY									
No negative residual effects									
ACCIDENTS AND MALFUNCTIONS									
An accidental release may result in residual effects on soils, vegetation, wildlife habitat, aquatic ecosystems, and groundwater	Negative	Low to high	Medium to Long-term	Isolated	Local	Reversible in the medium to long-term	Low	High	Not significant
Release of drilling mud into a water body may result in a residual effect on the aquatic ecology of the water body.	Negative	Low to medium	Short to medium-term	Occasional	Isolated to Local	Reversible in the short-term	Low	Medium	Not significant

6 CUMULATIVE EFFECTS ASSESSMENT

Cumulative effects assessment differs from Project-specific EA by considering a larger geographic study area to include interactions between past, present and future projects or activities, located in the vicinity of a project, with the residual effects identified from the project. This section of the EA provides the environmental and socio-economic cumulative effects assessment for the project by:

- describing residual effects of the project as identified in EA (Section 5)
- identifying past, present, and future projects and activities with actual or potential residual effects that may act in combination with the identified residual effects of the project
- identifying the project's contribution to potential cumulative effects
- describing technically and economically feasible mitigation measures for potential cumulative effects
- determining the significance of the potential residual cumulative effects

If there are no predicted interactions between project activities and an environmental or socio-economic element, then no further analysis (i.e., cumulative effects) is necessary.

6.1 Methods

Determining the significance of the project's potential contribution to regional cumulative effects is the final step in the cumulative effects assessment. The effectiveness of mitigation procedures performed during construction, operational and post operational phases will determine the cumulative effects on the criteria described previously (Sections 4 and 5 of this EA; Hegmann et al. 1999). The cumulative effects assessment is considered a conservative assessment of environmental and socio-economic conditions, since the future projects and activities included in the assessment may not proceed. For the purpose of the cumulative effects assessment all projects are assumed to proceed.

All three assessment scenarios in this EA describe cumulative effects:

- baseline (Section 4) - conditions that exist including effects resulting from past and present projects or activities
- project effects assessment (Section 5) - baseline conditions with the effects of the project added
- cumulative effects assessment (Section 6) - the environmental conditions that would exist as a result of the interaction of the project with past, present and future projects and activities

Residual effects related to the construction and operation of the project was identified as part of the effects assessment (Section 5). The project-related residual effects were carried forward for analysis of potential cumulative effects.

Project-related accidents and malfunctions may act cumulatively with the residual effects from other projects and activities in the vicinity of the project; therefore the cumulative residual effects were analyzed where applicable.

A desktop study was completed to identify past, present and future projects and activities and collect any available information (e.g., location and construction schedule) to support the cumulative effects assessment. The literature review focused on publicly available documents from:

- Federal listings
    - *Regulatory Document Index* (NEB 2015)
    - *Canadian Environmental Assessment Regi*stry (CEAA 2015)
    - Major Projects Management Office Tracker (MPMO 2012)
- Manitoba province-wide listings
    - *Public Registries* (Manitoba Conservation and Water Stewardship 2015f)
- Municipal listings

The future projects and activities list includes only those future projects and activities planned to be constructed in 2011 or later and therefore are considered to have the potential for overlap in time and space with the project. Planned projects for 2011 were defined as “past projects and activities” for the purpose of this cumulative effects assessment.

6.2 Spatial and Temporal Boundaries

The spatial boundary used in the cumulative effects assessment was selected to provide a larger geographical and ecological framework to evaluate residual effects of the project in combination with other past, present and future projects and activities. For the purposes of this project, the cumulative effects assessment area was defined as the RSA (Figure 2). The RSA is defined by the boundary of the former Rural Municipality of Wallace only (and not the new amalgamated boundary of the RM of Wallace-Woodworth) and the town of Virden. This area was considered large enough for the cumulative effects assessment as it encompassed all of the environmental and socio-economic components associated with the LSA.

Temporal boundaries for each component are based on the timing of the project phases (Section 2.3) in combination with component-specific considerations.

6.3 Other Projects

Past projects and activities in Manitoba include settlement and development activities such as:

- agricultural activities
- transportation activities (e.g., vehicular and railway traffic, as well as maintenance activities on roadways, bridges, and railways)
- power generation and transmission, and utility activities
- petroleum production transport (e.g., pipeline and facility maintenance and line patrol)
- oil and gas industry construction projects
- mining activities

Future projects in the RSA are provided in Table 6.1.

TABLE 6.1 Recent Past, Present, and Future Projects and Activities in the Regional Study Area

Project	Status	Information
Pipelines	2012	Construction of the Enbridge Bakken Oil pipeline began on August 1, 2012. Construction will proceed from the Steelman terminal near Steelman, Saskatchewan to the Cromer terminal in Cromer, Manitoba.
Oil/Gas Well Drilling	2011 and future	The total number of wells drilled in Manitoba in 2015 (January 1 to October 19) was 183, down from 385 in 2011, and from 400 in the same period in 2010 (Manitoba Innovation, Energy and Mines, Petroleum Branch 2015)
Former Rural Municipality of Wallace, Manitoba	2011	No applicable information available on the former Rural Municipality of Wallace, Manitoba, internet site (www.rmofwallace.ca)
Manitoba Infrastructure and Transportation (MIT)	2015	Numerous road upgrades and culvert re-installations funded by the Rural Infrastructure funding program
Canadian Pacific Railway (CPR)	2015	Rail line maintenance and tie replacement

6.4 Potential Cumulative Effects

The cumulative effects assessment is completed only for the components with residual effects (Section 5.19, Table 5.2) and that have the potential to overlap in time and space with the potential effects of other projects and activities. Environmental and socio-economic criteria that have the potential to interaction with potential effects from other projects include:

- soil and soil productivity
- vegetation and wetland communities (including SAR or Species of Special Status)
- wildlife and wildlife habitat (including SAR or Species of Special Status)
- water quality and quantity
- acoustic environment

- other socio-economic elements

6.4.1 Soil and Soil Productivity

Potential residual soil and soil productivity effects (Section 5.19) included:

- Reduced soil capability due to construction activities:
    - lowering of topsoil capability due to admixing of topsoil and subsoil
    - lowering of topsoil capability due to admixing of topsoil and subsoil due to trench instability
    - lowering of topsoil capability due to increased surface stoniness
    - lowering of soil capability due to increased soil compaction from construction traffic
    - lowering of topsoil capability due to loss of topsoil from wind erosion
    - lowering of topsoil capability due to loss of topsoil from water erosion
    - lowering topsoil capability due to pulverization of soil
    - reduced soil capability due to soil contamination

Project construction is scheduled to occur in the winter, under frozen conditions, with standard, proven mitigation measures that will minimize the potential for reduced soil capability. In general, no additional soil mitigation is warranted given the anticipated effectiveness of the proposed soils handling and other soils-related mitigation outlined in Section 5.19 of this EA.

Accidental spills may have adverse effects on soils, vegetation and water quality. However, once remediated, Project-related soil contamination will have little residual effect and are not predicted to contribute to cumulative effects.

6.4.1.1 Mitigation

With the implementation of mitigation measures, most Project-related residual effects are expected to be mitigated within two years after construction and are predicted to have a negligible contribution to cumulative effects.

6.4.1.2 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term soil and soil productivity cumulative residual effect of high magnitude that cannot be mitigated (Table 6.2). Consequently, it is concluded that the cumulative residual effects of construction and operation of the project on soil capability will be not significant.

6.4.2 Vegetation and Wetland Communities

Potential residual vegetation (Section 5.4) or wetlands (Section 5.6) effects included:

- Land clearing resulting in:
    - decline in vegetation communities
    - loss of vegetation communities with high rare plant potential
    - fragmentation of wildlife habitat
- Introduction of new or establishment of present weed, non-native or invasive species.

Residual effects specific to wetlands included:

- wetland vegetation removal
- alteration of wetland hydrology or water quality

6.4.2.1 Land Clearing

The pipeline will result in the temporary clearing of primarily cropland and other agricultural land during pipeline construction. Reclamation of agricultural land is expected to be straightforward, as it will be returned to agricultural land in the growing season following construction. The project will contribute to a temporary decline in the area of the non-agricultural communities (i.e., native grassland and woodlands) in the RSA, until the disturbed communities have re-established. Where land clearing results in a reduction in wetland habitat with a high potential to support rare plants, there may be reduced opportunities for the establishment of new populations of these plant species. Effects of land clearing to wildlife and wildlife habitat are discussed in Section 6.4.3.

Loss or fragmentation of native grasslands due to pipeline construction will be a temporary effect, and can have a negative effect on wildlife until the habitat can be functionally reclaimed. However, most wildlife present in the RSA is habituated to anthropogenic disturbances as the majority of the area has been disturbed historically through agriculture and other developments. Therefore, a negligible increase in fragmentation of wildlife habitat is expected to occur.

6.4.2.2 Introduction of weed, non-native or invasive species

The presence of weed, non-native and invasive plant species can lower the quality of native vegetation communities and crops. It is assumed that activities, primarily associated with agriculture, have been proportionally the greatest contributor to the introduction and establishment of weed, non-native and invasive plant species. TEML will implement a vegetation management plan to prevent the introduction of new weed, non-native and invasive plant species and control the distribution and composition of present species along the RoW. It is assumed that proponents of present and future project and activities will also implement similar vegetation management strategies.

6.4.2.3 Wetland vegetation removal

Construction of the pipeline is expected to result in the temporary disturbance of some wetlands, primarily along the wetland margins. However, the project will impact 46 wetlands and seasonal waterways, primarily Class I (ephemeral), Class II (temporary), and Class III (seasonal), during construction. Winter construction combined with appropriate soil salvage techniques will minimize permanent effects to wetlands. Organic topsoil will be replaced providing a seed bank for natural regeneration to occur. A suitable compensation ratio for lasting impacts to wetlands, if any, will be determined in consultation with the MHHC, Manitoba Conservation and others, as required. Therefore, a negligible decrease in wetlands in the RSA is expected to occur.

6.4.2.4 Alteration of wetland hydrology or water quality

Many of the wetlands in the RSA have been disturbed through past agricultural activities. Future projects and activities (e.g., infrastructure) are anticipated to also disturb wetlands. Therefore, a negligible increase in alteration of wetland hydrology or water quality is expected to occur.

6.4.2.5 Mitigation Measures

Mitigation measures that can be implemented to mitigate the project's contribution to adverse cumulative vegetation and wetlands effects are the same as those described for the effects assessment (Table 5.2). Therefore, no additional mitigation measures were determined to be required for the project.

6.4.2.6 Evaluation of Significance

There are no situations where there is a high probability of occurrence of permanent or long-term cumulative vegetation and wetland community residual effect of high magnitude that cannot be mitigated (Table 6.2).

6.4.3 Wildlife and Wildlife Habitat

Potential adverse wildlife and wildlife habitat effects included:

- habitat loss and alteration
- sensory disturbance
- mortality

Habitat loss and alteration, and sensory disturbance have been discussed in Section 5.5.

Pipeline construction is scheduled for winter; therefore the potential for wildlife mortality of amphibians, reptiles, and birds is minimal. Mortality of mammals may occur through collisions with vehicles or through disturbance of wildlife or habitat features (e.g., nests, dens) during construction.

Present oil and gas and transportation infrastructure are on-going activities that will occur at the same time the project is under construction. Therefore, there is potential for mortality from those projects to act cumulatively with similar effects from the project. With mitigation, the project's contribution to cumulative effects is predicted to be negligible.

6.4.3.1 Mitigation Measures

Mitigation measures that can be implemented to mitigate the project's contribution to adverse cumulative wildlife and wildlife habitat effects are the same as those described for the effects assessment (Table 5.2). Therefore, no additional mitigation measures were deemed warranted for the project.

6.4.3.2 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term cumulative wildlife and wildlife habitat residual effect of high magnitude that cannot be mitigated (Table 6.2).

6.4.4 Water Quantity and Quality

Potential residual surface water and groundwater quality and quantity effects (Section 5.8) included:

- localized alteration of natural drainage patterns
- reduction in water quality due to accidental release
- disruption of springs

6.4.4.1 Localized Alteration of Natural Drainage Patterns

Project-related, localized alteration of natural drainage patterns and disruption of springs are predicted to be limited to temporary disturbance of the landscape for pipeline construction. Construction is not expected to act cumulatively on water quantity and quality with other projects and activities in the RSA. Therefore, assessment of cumulative effects was not warranted.

6.4.4.2 Reduction in Water Quality Due to Accidental Spills

Accidental spills or releases are discussed in Section 5.8. Project-related accidental releases are expected to have minimal residual effects once remediated; a negligible effect to groundwater quality is expected to occur.

6.4.4.3 Mitigation Measures

Mitigation measures that can be implemented to mitigate the project's contribution to adverse cumulative water quality and quantity effects are the same as those described for the effects

assessment (Table 5.2). Therefore, no additional mitigation measures were deemed warranted for the project.

6.4.4.4 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term cumulative water quality or quantity residual effect of high magnitude that cannot be mitigated (Table 6.2).

6.4.5 Acoustic Environment

Potential residual acoustic environment effects (Section 5.10) include a temporary increase in noise during pipeline construction

6.4.5.1 Temporary Increase in Noise during Pipeline Construction

Construction activities will result in a temporary increase in noise due to traffic and equipment operation. Construction may act cumulatively with noise from existing oil and gas activity in the RSA, such as the Cromer terminal, existing pipeline facilities and oil extraction facilities (i.e., batteries, pressure stations). However, during operations, traffic noise will decrease as fewer transportation trucks will be required to transport oil from battery stations.

6.4.5.2 Mitigation Measures

Mitigation measures that can be implemented to mitigate the project's contribution to cumulative effects are the same as those described for the effects assessment (Table 5.2). Therefore, no additional mitigation measures were deemed warranted for the project.

6.4.5.3 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term cumulative acoustic environment residual effect of high magnitude that cannot be mitigated (Table 6.2).

6.4.6 Socio-economic Components

The subsections below summarize the potential cumulative effects on other socio-economic components in the project RSA with a focus on specific communities that may be affected by changes in temporary population or temporary use of services. Residual effects from socio-economic components (Sections 5.13, 5.14 and 5.15) included:

- Human occupancy and resource use:
    - Disruption of land use activities during construction
    - Increased demand on local and regional infrastructure and services

- Social and cultural well-being:
    - Change of social and cultural well-being

6.4.6.1 Disruption of Land Use Activities during Construction

The project will act cumulatively with oil and gas development, and agricultural activities to potentially disrupt land use activities during construction. Current development of the Bakken Formation is anticipated to continue in southwestern Manitoba. Many companies hold mineral rights in the RSA and each may have future development plans for resource leases.

Mitigation measures are outlined in Section 5.19 of this EA, and include appropriate notification to landowners and occupants and, if applicable, compensation for directly-affected landowners, in accordance with the land acquisition agreements. Landowners will also be notified of the approximate timing of construction and, if applicable, of the precautions that landowners may need to take during the short construction period. These mitigation measures are expected to reduce the residual effects resulting from the construction of the project on agricultural land.

Operation of the project will have minimal interaction with other land uses. The pipeline design incorporated the weight of agricultural equipment for crossing and is addressed in the pipeline design so that no additional mitigation is required for normal agricultural practices. The pipeline depth (minimum 1.2 m of cover) exceeds regulatory requirements and is sufficient to mitigate any interaction with agricultural practices.

6.4.6.2 Infrastructure and Services

The project will act cumulatively with other future construction projects and oil and gas projects in the RSA. The potential overlap in timing with other present and future projects and activities (i.e., oil and gas drilling) may increase demand on infrastructure and services during construction by contributing to an increase:

- in traffic on highways and local roads during construction
- use of waste facilities
- demand for accommodation
- medical facilities and services

6.4.6.3 Social and Cultural Well-Being

The temporary workforce required for the construction of the project may act cumulatively with other temporary workers required for construction and energy development projects in southwestern Manitoba. Examples of other future projects or activities that may require temporary workforce include oil and gas well drilling.

6.4.6.4 Mitigation Measures

Mitigation measures that can be implemented to mitigate the project's contribution to adverse cumulative socio-economic effects are the same as those described for the effects assessment (Table 5.2). Therefore, no additional mitigation measures were deemed warranted for the project.

6.4.6.5 Evaluation of Significance

There are no situations where there is a high probability of occurrence of a permanent or long-term cumulative socio-economic residual effect of high magnitude that cannot be mitigated (Table 6.2).

6.4.7 Accidents and Malfunctions

It is possible that substantial adverse effects could occur as a result of an accident or malfunction related to the construction or operation of the project. The potential risk is considered low for an accident or malfunction that would have substantial cumulative environmental effects. TEML will have in place an Emergency Response Plan which outlines methods to immediately respond to accidents and malfunctions as well as to contain and clean-up after these incidents. Therefore an evaluation of significance is not deemed warranted.

6.4.7.1 Mitigation Measures

Mitigation measures that can be implemented to mitigate the project's contribution to cumulative effects are the same as those described for the effects assessment (Table 5.2). Therefore, no additional mitigation measures were deemed warranted for the project.

6.4.7.2 Evaluation of Significance

As the project will not contribute to cumulative effects related to accidents and malfunctions, no evaluation of significance was conducted.

TABLE 6.2 Cumulative Effects Assessment

Predicted Cumulative Effects	Direction	Magnitude	Duration	Frequency of Occurrence	Spatial Extent	Reversibility	Probability of Occurrence	Prediction Confidence	Significance
SOILS AND SOILS CAPABILITY									
Reduced soil capability due to construction activities	Negative	Negligible	Short-term	Isolated	Local	Reversible in the short to medium-term	Low	High	Not significant
Reduced soil capability due to soil contamination	Negative	Negligible	Medium-term	Isolated	Regional	Reversible in the medium-term	Low	High	Not significant
VEGETATION AND WETLAND COMMUNITIES									
Land clearing	Negative	Negligible	Medium to Long-term	Isolated	Local	Reversible in the long-term	High	Medium	Not significant
Introduction of new and establishment of present weed, non-native or invasive species	Negative	Low	Medium-term	Isolated	Local	Reversible in the medium-term	High	Medium	Not significant
Alteration of wetland hydrology or water quality	Negative	Negligible	Medium-term	Isolated	Local	Reversible in the medium-term	Low	Medium	Not significant
WILDLIFE AND WILDLIFE HABITAT									
Amphibians mortality	No residual effects								
Reptiles mortality	No residual effects								
Avifauna mortality	No residual effects								
Mammal mortality	Negative	Negligible	Short-term	Occasional	Regional to extra-regional	Reversible in the short-term	Low	High	Not significant
WATER QUANTITY AND QUALITY									
Reduction in water quality due to accidental spill	Negative	Negligible	Medium-term	Isolated	Local	Reversible in the medium-term	Low	Medium	Not significant

Predicted Cumulative Effects	Direction	Magnitude	Duration	Frequency of Occurrence	Spatial Extent	Reversibility	Probability of Occurrence	Prediction Confidence	Significance
ACOUSTIC ENVIRONMENT									
Temporary increase noise during construction	Negative	Negligible	Short-term	Isolated	Local	Reversible in the short-term	High	High	Not significant
SOCIO-ECONOMIC ELEMENTS									
Disruption of land use activities during construction	Negative	Negligible to Low	Short-term	Occasional	Local	Reversible in the short-term	Low	Medium	Not significant
Increased demand on local and regional infrastructure and services	Neutral to negative	Negligible to Low	Short-term	Occasional	Regional	Reversible in the short-term	Low	Medium	Not significant
Change of social and cultural wellbeing	Neutral to negative	Low	Short-term	Occasional	Regional	Reversible in the short-term	Low	Medium	Not significant

7 CONSTRUCTION AND RECLAMATION PLAN

7.1 Construction

7.1.1 Stripping and Stockpiling Topsoil

7.1.1.1 Topsoil Salvage Depth

- Where topsoil is less than 30 cm, salvage topsoil to (1) colour change, (2) bottom of sod or duff layer, (3) plough layer or (4) 10 cm depth, whichever is deepest. Increase minimum stripping depth to 15 cm where work side topsoil salvage is conducted.

- Where soil horizon differentiation is not readily distinguishable by colour, the Environmental Inspector will provide direction based on an evaluation of soil texture, structure and top soil depth.

- Where required, conduct three-lift soil handling under frozen conditions to minimize admixing of lower subsoil into the upper subsoil or topsoil.

7.1.1.2 Topsoil Salvage Width

Only the trench line will be stripped of topsoil in areas of native grassland and modified grassland.

Other considerations include:

- salvage topsoil from all areas that require grading
- salvage a greater width of topsoil at sharp side bends and at crossings of watercourses, roads and foreign lines to accommodate a wider and deeper trench and larger workspace
- salvage topsoil where heavy traffic is anticipated as well as extremely dry areas to reduce loss of soil structure
- where grading is required in treed areas, salvage strippings to a depth of approximately 15 to 20 cm
- limit the topsoil salvage width to reduce the potential for bringing stones to the surface

7.1.1.3 Topsoil Storage

Maintain separation between the topsoil and subsoil stockpiles. At locations where topsoil salvage is conducted to accommodate grading requirements, identify the topsoil stockpiles from the graded materials with a suitably marked survey stake or sign to minimize the risk of confusion at the time of restoration.

- Leave gaps in the soil windrows at obvious drainage courses and where requested to accommodate surface runoff.

- Leave gaps in the soil windrows to allow farm machinery, livestock and wildlife to cross the construction RoW.

- Monitor the topsoil piles and other soil stockpiles for weed growth frequently, if construction activities occur during the growing season. Implement weed control measures on topsoil stockpiles, where warranted.

7.1.2 Excavate Trench and Subsoil Stockpile

- Store excavated material in a manner that does not interfere with natural drainage patterns.

- Inspect the trench at the start of each day and remove any trapped animals from the trench before conducting construction activities.

- Reduce the length of open trench and reduce the time the trench is left open to limit the amount of trench sloughing, frost penetration and interference with wildlife, landowners and livestock. Use reasonable efforts to limit the length of time that any one segment of trench is open.

- As trenching proceeds, identify locations where trench wall instability affects non-salvaged topsoil areas. If non-salvaged topsoil areas are sloughing into the trench, suspend trenching operations until the topsoil is salvaged wide enough to prevent loss.

- Where indicated on landowner line lists and/or Environmental Alignment Sheets, additional soil conservation activities may be required during trenching by excavating and storing different types of soils. Store topsoil and trench spoil separately.

- If construction occurs during wet conditions, prevent the flow of water along the trench, by leaving hard or soft plugs at strategic locations, where dewatering could occur.

7.1.3 Backfill

- Inspect the trench prior to backfilling for small mammals, reptiles, skids, refuse, welding rods and other debris, and remove if present. Inspect the backfill material to ensure it is free of debris, rock or other material that could damage the pipeline.

- Backfill the trench without mixing spoil with the topsoil stockpile. Do not walk machinery on the topsoil stockpile while backfilling spoil.

- Avoid scalping of the sod layer on tame pasture lands, woodlands, hay lands and native grassland when moving the spoil pile during backfill.

- Do not backfill large rocks in the upper 0.5 m of the trench on agricultural lands.

- Compact backfilled trench to the extent feasible, using suitable equipment along the trench line (e.g., grader). Avoid excessive trench crown height.

7.1.4 Crown Trench and Excess Trench Spoil

- Crown the trench with remaining spoil to allow for settlement. The height of the crown depends on land use, degree of compaction desired, swell coefficient of backfill and soil temperature. An inspector will also monitor backfilling and compaction activities throughout construction.

- Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to minimize interference with natural drainage.

- Compact backfill where breaks have been left.

7.1.5 Re-contour Right-of-Way

After spring break-up:

- Feather-out excess spoil over the salvaged portion of the construction RoW to minimize the creation of a permanent mound.

- Re-contour the construction RoW and restore the pre-construction grades and drainage channels.

7.2 Clean-up and Reclamation

7.2.1 Clean-up

- Remove equipment crossing structures, where required, before spring break-up unless otherwise approved.

- Collect and dispose of all construction-related garbage, debris, wastes and hazardous material from the construction RoW in designated containers or at approved disposal facilities.

7.2.2 Reclamation for Soils and Subsoils

- Rip compacted subsoils, temporary access trails and soils damaged during wet weather to a depth of 30 cm. If soils are moist, postpone ripping of subsoils until soils dry to ensure that the soils fracture when ripped.

- Employ a subsoiler plough (e.g., paratiller) along segments of the construction RoW where topsoil salvage did not occur and subsoil compaction is severe. Do not use a subsoiler plough on native vegetation communities such as grasslands and shrublands.

- Blade rutted subsoils flat prior to topsoil replacement, where required.

- Dispose of excess rock displaced from the trench as directed by the landowner and/or appropriate regulatory authority. Do not dispose of rocks in wetlands.

- Remove stones from disturbed subsoil to achieve equivalence with the surrounding subsoil as well as stones from the upper 30 cm of the trench and grade spoil that will interfere with topsoil replacement or cultivation (i.e., stones larger than 10 cm in diameter). Dispose of stones at locations approved by the landowner or appropriate regulatory authority.

- Immediately before replacing topsoil, cut a clean edge with a grader. Distribute edge cut material evenly over the prepared subsoil surface.

- Replace topsoil/strippings as evenly as possible over areas of the construction RoW where topsoil/stripping salvage was conducted.

7.2.3 Regrading and Recontouring

- Re-grade areas with vehicle ruts, erosion gullies or where the trench has settled.

- Re-contour the construction RoW to restore surface drainage and the approximate pre-construction profile.

7.2.4 Vegetation

- Cultivate the construction RoW where it crosses fields or bush to a depth adequate to alleviate surface compaction and in a manner acceptable to the landowner. Do not cultivate into the subsoil. Limit cultivation in areas of fine textured soils to prevent pulverization of the soil.

- Disc and harrow only if the site is to be seeded immediately; otherwise leave the ripped topsoil in a rough condition until immediately prior to seeding to reduce the wind erosion potential.

- Cultivate hay and tame pasture land if the sod layer is broken or badly compacted.

- Restore the pre-construction contours of wetlands and remove any excess backfill to an upland area approved by the landowner.

- Re-vegetate native grassland, shrublands and woodlands using an approved Manitoba-sourced native seed mix.

8 INSPECTION AND MONITORING

8.1 Mitigation Measures During Construction

Mitigation measures to eliminate or minimize the effects on the environment during each phase of the project are described for each environmental and socio-economic component in Section 5.19, Table 5.3 of this EA. Additional mitigation measures to address the cumulative effects that may result from the project's interactions between past, present and future projects, developments and land uses located in the vicinity of the project, with residual effects from the project, are provided in Section 5. of this EA. The majority of these mitigation measures are based on industry standard mitigation and specific requirements of regulatory agencies, including:

- *Guidelines for Alternate Soil Handling Procedures during Pipeline Construction* (PettaPiece and Dell 1996)
- *Petroleum Industry Activity Guidelines for Wildlife Species at Risk in the Prairie and Northern Region* (Environment Canada 2009)
- *The Heritage Resources Act* (Government of Manitoba 1985)
- *National Energy Board, Onshore Pipeline Regulations*, SOR/99-294 (Government of Canada 2015b)

8.1.1 Environmental Contingency Plans and Procedures for Construction

TEML or contractors hired by TEML, will develop project-specific environmental contingency plans and procedures that provide guidelines for construction activities where mitigation described either in Section 5 or 6 of this EA, will require alternative/additional actions such as:

- accidental spills
- directional drilling procedures
- construction waste management

8.1.1.1 Accidental Spills

As part of the construction bid process, contractors will be required to submit a management plan for spills and releases during construction. The plan will address potential spills and releases of test fluid (e.g., hydro-testing) and operating fluids (e.g., fuel, lubricants, etc.) as well as including proactive measures in place to prevent them. The plan will be evaluated as part of the contractor selection process, and where deemed inadequate, the plan will be required to be modified.

8.1.1.2 General Measures

The contractor's contingency plan will:

- Ensure that supervisory personnel are aware of the contingency plan prior to commencement of drilling activity.
- Ensure that drilling mud composition is limited to bentonite mud drilling systems, fresh water and, if warranted, other inert additives. No toxic additives will be allowed. The contractor will provide Material Data Safety Sheets (MSDS) to TEML prior to the commencement of drilling.
- Ensure there is adequate capacity to capture anticipated volumes of drilling mud that could be released during pullback and other drilling operations at the entry and exit points (i.e., sump or holding tanks).
- Prepare a clean-up plan prior to drilling. The plan will be prepared by the drilling contractor in consultation with TEML.
- Follow applicable provincial and federal regulations and guidelines.

8.1.1.3 Emergency Response and Clean-up Procedures

The loss of drilling mud into seams of coarse material, fissures, etc. (i.e., 'frac out') routinely occurs during drilling operations. Since drilling fluid does not always flow to the surface, a loss does not necessarily indicate that the drilling mud has been released onto near shore areas or into a watercourse.

In the event a 'frac out' is observed or suspected, the following measures will be implemented:

- Suspend drilling operations immediately if excessive loss of drilling mud is noted and conduct a detailed examination of the drill path and surrounding area for evidence of a release at the surface or in the waterway.
- Immediately notify the Site Engineer and the Environmental Inspector if a drilling mud release and/or excessive drilling mud loss is observed.
- If the drilling mud release enters a watercourse or wetland, the Environmental Inspector will immediately notify TEML.
- Contain and further prevent drilling mud from entering the watercourse from near shore areas by installing a berm of subsoil, sandbags or other material approved by the Environmental Inspector.

Drilling will only be allowed to resume if the potential for significant adverse impacts on the environment is low, as determined by the Site Engineer and Environmental Inspector. Clean-up procedures will be subject to site-specific conditions during the time of release.

8.1.2 Construction Waste Management

The contractor will be required to provide a project specific waste management plan. The plan will ensure compliance with all local and provincial regulations governing the handling of waste material. The plan will be evaluated as part of the contractor selection process, and where deemed inadequate, the plan will be required to be modified. The plan will be enforced by construction inspection personnel during construction.

8.1.3 Company Management Plans for Construction

TEML will employ existing operations and maintenance procedures for the operation of the project and will include:

- General reference procedures, including topics such as regulatory compliance, incident reporting, public awareness, record keeping and training;
- Safety procedures, including topics such as safe work practices, hazard assessment, confined space entry, fire protection, lock-out/tag-out, personal protective equipment, etc.;
- Pipeline facility procedures, including work planning and preparation, environmental protection, right-of-way maintenance, foreign crossings, pipe repair and testing;
- Welding procedures, including welder qualification requirements;
- Emergency response procedures, including pre-emergency preparedness, emergency response responsibilities and actions, product containment, recovery and cleanup, local release control point mapping and mitigation measures.

8.2 Construction Personnel Roles and Responsibilities

Construction personnel for the project may include:

- Non-supervisory personnel
- Supervisory construction personnel
- Environmental Inspector
- Site Engineer

All personnel will be expected to:

- understand how their respective job duties may impact the environment
- maintain a positive attitude toward environmental protection

- report all incidents that have the potential to impact the environment

8.3 Environmental Training and Orientations for Construction Personnel

Prior to construction, all employees and contractors will receive environmental awareness training and orientations, to promote understanding of:

- the environmental conditions at the project
- the environmental management requirements of the project
- the roles and responsibilities of employees and contractors related to the environmental management requirements
- disciplinary measures that will be taken if employees and contractors disregard the environment protection and mitigation measures

Issue-specific or site-specific training or refresher training will also be conducted when necessary. Experts for the various environmental and socio-economic components will be available to provide additional training and support to the Environmental Inspector. TEML will retain records of environmental awareness training provided to workers and visitors.

TEML will provide the Environmental Inspector with relevant documentation such as the EA Report and Permits and Approvals obtained for the project.

8.4 Environmental Inspection and Monitoring During Construction

The core responsibilities of the Environmental Inspector are to monitor construction activities, oversee the implementation of environmental mitigation and reclamation measures, and conduct compliance monitoring. The Environmental Inspector will have the authority to shut down a construction crew for environmental reasons, if deemed necessary.

The Environmental Inspector will primarily be responsible for the enforcement of environmental compliance outlined in the EA, and all permit/approval conditions and environmental laws and guidelines, and other environmental commitments. Environmental Inspectors will report to TEMLs Construction Supervisor.

In general, the Environmental Inspector will:

- take a proactive approach so that potential environmental issues can be avoided
- work directly with other activity inspectors and supervisory personnel to assist in the understanding and application of environmental mitigation and reclamation
- identify and monitor activities that have the potential to adversely affect the environment
- identify new relevant environmental issues and recommend appropriate mitigation measures

- provide input into environmental decisions that deal with situations that may require a stoppage of work
- stop work if situations with serious environmental implications are imminent
- implement contingency plans and ensure compliance with their specifications as required
- report any accidental releases in accordance with federal and/or provincial regulations
- provide advice regarding the clean-up and disposal of the released material and any affected soils or vegetation
- coordinate and facilitate any water, soil and biological monitoring, if required
- maintain and document communication with government agencies, as stipulated in permit conditions, and respond to any potential non-compliance issues raised by the agencies
- track environmental issues, including potential non-compliance issues

Environmental Inspectors will have the following qualifications:

- a minimum of three years of relevant experience
- an excellent understanding of pipeline construction techniques
- a positive approach toward environmental protection
- experience in successfully resolving environmental issues

In addition, post-secondary education in the natural sciences or other relevant training will be preferred.

8.5 Post-construction Monitoring Programs

TEML will undertake a post construction assessment and resulting monitoring, if necessary, to:

- evaluate the reclamation of areas disturbed through construction of the project
- assess the status of outstanding environmental issues documented through environmental inspection
- identify any outstanding or new environmental issues that may be present
- recommend remedial measures and coordinate their implementation to address any outstanding or new environmental issues
- document monitoring results and post-construction remedial measures

8.5.1 Post-construction Monitor

The post-construction monitoring program will be conducted, as required, by a Post-construction Monitor, who will have the following qualifications:

- a minimum of three years of relevant experience
- a strong understanding of pipeline reclamation techniques

- a positive approach toward environmental protection
- experience in successfully resolving reclamation issues

Experts will be consulted if issues related to a specific environmental or socio-economic component should arise. The appropriate expert will be involved in developing recommendations, and overseeing implementation of any remedial measures as well as conducting follow-up site inspections.

8.5.2 Post-construction Soil Assessment

A post-construction soil assessment will be conducted during the first growing season after reclamation where:

- sites along the pipeline RoW have been identified through environmental inspection as having issues
- reclamation problems have been identified through landowner consultation, operation and maintenance reports, or ground reconnaissance

Where issues are identified in the post-construction soil assessment, every effort will be made to implement mitigation measures when feasible.

8.5.3 Post-construction Vegetation Monitoring

The pipeline RoW will be visually inspected by the Post-construction Monitor during the first growing season following construction for vegetation issues such as weed infestations or poor vegetation establishment. The vegetation assessment timing will be in the late summer/early fall when vegetation is mature enough for accurate identification and evaluation. Attention will be given to areas of terrain instability that may be susceptible to erosion. Detailed vegetation assessments will be conducted, if warranted, at sites where reclamation problems are identified.

8.5.4 Post-construction Wetland and Waterway Monitoring

Under the direction of a qualified specialist, TEML will conduct a post-construction reclamation assessment program to assess the reclaimed disturbances in wetlands and waterways along the pipeline RoW. The qualified specialist will determine if additional reclamation treatments are required beyond the first year after reclamation.

8.5.5 Landowner Consultation

TEML, or a TEML authorized representative, will consult with each landowner along the pipeline RoW during the first growing season after construction of the project is complete. The purpose of the consultation is to discuss the progress of the reclamation on each landowner's land and to attempt to resolve any applicable reclamation issues raised, if any.

9 CONCLUSIONS

TEML is proposing the TEML Pipeline project, which will include the construction of a two sections of pipeline, approximately 20 km in length, within a 25 m right-of-way that will be used to transport crude oil from existing battery facilities to the Cromer terminal.

The baseline environmental and socio-economic conditions that may be affected by the project are well understood, based on field studies completed in 2015 (soils, vegetation, wildlife and wildlife habitat, wetlands) as well as focused desktop studies conducted for the baseline environmental and socio-economic assessment for all elements. The construction and operation methods that will be used for the project are standard practices for similar projects in southern Manitoba. Potential environmental and socio-economic effects associated with the construction and operation of the project are typical and can be mitigated by standard environmental protection measures. By timing the construction of the pipeline from December to March has mitigated most environmental effects. Project-related residual effects are anticipated to be reversible in the short- to long-term and are generally of low magnitude. There are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be mitigated. As a result, residual effects associated with the project are predicted to be not significant.

The project may act cumulatively with past, present or future projects or activities in the vicinity of the project including agriculture (e.g., farming activities), transportation (e.g., roads and railways), and utilities (e.g., transmission lines), petroleum production transport (pipeline and facility maintenance), oil and gas development (e.g., pipelines, associated facilities), as well as rural residences. Cumulative residual effects of the project are anticipated to be reversible in the short- to long-term and are generally of low magnitude. Additional mitigation measures will be implemented, if warranted, to minimize potential cumulative effects. There are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be mitigated. Consequently, cumulative residual effects associated with the project are predicted to be not significant.

TEML has developed general and project-specific programs to ensure that the recommended mitigation measures and commitments made in the EA are implemented throughout the construction and operations phases of the project. Examples of project-specific programs that will be incorporated include environmental protection planning, environmental training programs, environmental inspection, contingency plans and post-construction monitoring plans. Through the implementation of these programs, the EA concludes that the project can be constructed and operated without causing significant adverse environmental effects.

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Easting (m)

349500 349750 350000 350250

Northing (m)

5546500 5546250 5546000 5545750 5545500

SW-34-012-27W1

SE-34-012-27W1

Access to 10-34-012-27W1

Access to 14-27-012-27W1

ID: 1
Class:3

ID: 2
Class:3

ID: 3
Class:1

ID: 4
Class:1

ID: 5
Class:2

NW-27-012-27W1

NE-27-012-27W1

SW-27-012-27W1

SE-27-012-27W1

Twp. 12

Rg. 27
W1M

N

Water Body
Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 1

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Easting (m)

350250 350500 350750 351000

Northing (m)

5545250 5545000 5544750 5544500 5544250

NW-27-012-27W1

NE-27-012-27W1

SW-27-012-27W1

SE-27-012-27W1

NW-22-012-27W1

NE-22-012-27W1

Access to 02-27-012-27W1

ID: 6
Class:3

ID: 7
Class:4

ID: 8
Class:2

ID: 9
Class:2

N

Twp. 12

Rg. 27
W1M

Water Body
Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 2

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Easting (m)

350750 351000 351250 351500

Northing (m)

5544500 5544250 5544000 5543750 5543500

Twp. 12

Rg. 27 W1M

N

SE-27-012-27W1

SW-26-012-27W1

ID: 6
Class:3

ID: 8
Class:2

NE-22-012-27W1

ID: 9
Class:2

ID: 10
Class:3

NW-23-012-27W1

ID: 11
Class:2

ID: 12
Class:2

SW-23-012-27W1

ID: 13
Class:4

SE-22-012-27W1

Water Body
Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000
40 0 40 80 m
NAD 1983 UTM Zone 14N

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Figure 3

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Easting (m)

351000 351250 351500

Northing (m)

5544000 5543750 5543500 5543250 5543000 5542750

Twp. 12

Rg. 27
W1M

NE-22-012-27W1
NW-23-012-27W1
SE-22-012-27W1
SW-23-012-27W1
NE-15-012-27W1
NW-14-012-27W1

ID: 11
Class:2

ID: 12
Class:2

ID: 13
Class:4

ID: 14
Class:4

N

Water Body
Watercourse
Road
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 4

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Easting (m)

351500 351750 352000 352250

Northing (m)

5543000 5542750 5542500 5542250 5542000

Twp. 12

Rg. 27

W1M

SW-23-012-27W1

SE-23-012-27W1

NW-14-012-27W1

NE-14-012-27W1

SW-14-012-27W1

SE-14-012-27W1

ID: 15
Class:

ID: 16
Class:

N

Water Body
Watercourse
Road
Approximate Wetland Site

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000

40 0 40 80 m

NAD 1983 UTM Zone 14N

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Figure 5

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Easting (m)

352250 352500 352750 353000

Northing (m)

5542250 5542000 5541750 5541500 5541250 5541000

Twp. 12

Rg. 27
W1M

NE-14-012-27W1
NW-13-012-27W1
SE-14-012-27W1
SW-13-012-27W1
NE-11-012-27W1
NW-12-012-27W1

ID: 17
Class:2

ID: 18
Class:2

ID: 19
Class:2

ID: 20
Class:4

ID: 21
Class:

Sharp-tailed Grouse LEK

ID: 22
Class:3

ID: 23
Class:4

ID: 24
Class:4

ID: 25
Class:1

N

Water Body
Watercourse
Approximate Wetland Site
Sharp-tailed Grouse LEK
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 6

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Easting (m)

353250 353500 353750 354000

Northing (m)

5541500 5541250 5541000 5540750 5540500 5540250

Twp. 12

Rg. 27

W1M

N

SW-13-012-27W1

SE-13-012-27W1

NW-12-012-27W1

NE-12-012-27W1

SW-12-012-27W1

SE-12-012-27W1

ID: 25
Class:1

ID: 26
Class:3

ID: 27
Class:4

ID: 28
Class:1

ID: 29
Class:1

ID: 30
Class:2

ID: 31
Class:2

ID: 32
Class:3

ID: 33
Class:2

ID: 34
Class:1

ID: 35
Class:1

Water Body
Watercourse
Approximate Wetland Site

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 7

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Easting (m)

354000 354250 354500 354750

5541000 5540750 5540500 5540250 5540000 5539750

Northing (m)

N

NE-12-012-27W1

NW-07-012-26W1

SE-12-012-27W1

SW-07-012-26W1

ID: 36
Class:1

ID: 37
Class:3

ID: 38
Class:3

ID: 39
Class:1

ID: 40
Class:1

ID: 41
Class:1

83

Twp. 12

Rg. 27 Rg. 26

W1M

Watercourse
Highway
Approximate Wetland Site

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
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Figure 8

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Easting (m)

355000 355250 355500 355750

Northing (m)

5540750 5540500 5540250 5540000 5539750 5539500

N

NW-07-012-26W1 NE-07-012-26W1

SW-07-012-26W1 SE-07-012-26W1

NW-06-012-26W1 NE-06-012-26W1

ID: 42
Class:3

ID: 43
Class:1

ID: 44
Class:1

ID: 45
Class:1

ID: 46
Class:2

ID: 47
Class:3

ID: 48
Class:2

ID: 49
Class:2

Twp. 12

Rg. 26
W1M

Water Body
Watercourse
Road
Approximate Wetland Site

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000
m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 9

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Easting (m)

355000 355250 355500 355750

Northing (m)

5539500 5539250 5539000 5538750 5538500

Twp. 12

Rg. 26 W1M

SW-07-012-26W1 SE-07-012-26W1 SW-08-012-26W1

NW-06-012-26W1 NE-06-012-26W1 NW-05-012-26W1

SE-06-012-26W1 SW-05-012-26W1

ID: 48 Class:2

ID: 49 Class:2

ID: 50 Class:3

ID: 51 Class:2

ID: 52 Class:2

ID: 53 Class:2

ID: 54 Class:2

ID: 55 Class:1

ID: 56 Class:1

ID: 57 Class:1

ID: 58 Class:1

N

Water Body
Watercourse
Road
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000

m 40 0 40 80

NAD 1983 UTM Zone 14N

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Figure 10

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Easting (m)

355250 355500 355750 356000

Northing (m)

5538500 5538250 5538000 5537750 5537500 5537250

ID: 56
Class:1

ID: 57
Class:1

ID: 58
Class:1

ID: 59
Class:2

ID: 60
Class:1

ID: 61
Class:2

ID: 62
Class:1

ID: 63
Class:1

ID: 64
Class:2

SE-06-012-26W1

SW-05-012-26W1

NE-31-011-26W1

NW-32-011-26W1

Twp. 12

Twp. 11

Rg. 26
W1M

N

Water Body
Watercourse
Road
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 11

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Easting (m)

355500 355750 356000 356250

Northing (m)

5537250 5537000 5536750 5536500 5536250 5536000

Twp. 11

Rg. 26

W1M

NE-31-011-26W1

NW-32-011-26W1

SW-32-011-26W1

SE-31-011-26W1

NE-30-011-26W1

NW-29-011-26W1

ID: 65
Class:4

ID: 66
Class:2

ID: 67
Class:

Access to 12-32-011-26W1

Access to 05-32-011-26W1

Access to 01-31-011-26W1

Access to 04-32-011-26W1

Access to 13-29-011-26W1

N

Water Body
Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000

40 0 40 80 m

NAD 1983 UTM Zone 14N

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Figure 12

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Easting (m)

355750 356000 356250 356500

Northing (m)

5536000 5535750 5535500 5535250 5535000

N

NE-29-011-26W1

NE-30-011-26W1

NW-29-011-26W1

SE-30-011-26W1

SW-29-011-26W1

SE-29-011-26W1

Access to 16-30-011-26W1

Access to 13-29-011-26W1

Access to 14-29-011-26W1

Access to 01-29-011-26W1

Access to 09-30-011-26W1

Access to 12-29-011-26W1

Access to 11-29-011-26W1

Access to 06-29-011-26W1

Access to 01-30-011-26W1

ID: 68
Class:1

ID: 69
Class:3

ID: 70
Class:2

ID: 71
Class:1

ID: 72
Class:1

ID: 73
Class:1

ID: 74
Class:1

Twp. 11

Rg. 26
W1M

Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 13

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Easting (m)

356500 356750 357000 357250

Northing (m)

5535000 5534750 5534500 5534250 5534000

ID: 73
Class:1

ID: 74
Class:1

SW-29-011-26W1

SE-29-011-26W1

ID: 75
Class:1

Access to 04-28-011-26W1

ID: 76
Class:1

ID: 77
Class:1

SW-28-011-26W1

ID: 78
Class:2

NW-21-011-26W1

Access to 14-20-011-26W1

ID: 79
Class:2

NW-20-011-26W1

ID: 80
Class:2

NE-20-011-26W1

ID: 81
Class:1

ID: 82
Class:2

ID: 83
Class:2

Twp. 11

Rg. 26
W1M

N

Water Body
Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000

40 0 40 80 m

NAD 1983 UTM Zone 14N

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Figure 14

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Easting (m)

357250 357500 357750

Northing (m)

5534000 5533750 5533500 5533250 5533000

ID: 82
Class:2

ID: 83
Class:2

ID: 84
Class:3

ID: 85
Class:1

ID: 86
Class:3

ID: 87
Class:4

ID: 88
Class:1

ID: 89
Class:3

NE-20-011-26W1

NW-21-011-26W1

SW-21-011-26W1

SE-20-011-26W1

NE-17-011-26W1

NW-16-011-26W1

Access to 01-20-011-26W1

Access to 04-21-011-26W1

Access to 05-21-011-26W1

Access to 06-21-011-26W1

Access to 07-21-011-26W1

Access to 03-21-011-26W1

Access to 13-16-011-26W1

Access to 11-16-011-26W1

Twp. 11

Rg. 26
W1M

Water Body
Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000
m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 15

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Easting (m)

358000 358250 358500

Northing (m)

5533250 5533000 5532750 5532500 5532250 5532000

N

SW-21-011-26W1

SE-21-011-26W1

Access to 06-21-011-26W1

Access to 03-21-011-26W1

Access to 02-21-011-26W1

Access to 02-21-011-26W1

ID: 90
Class:1

ID: 91
Class:1

Access to 15-16-011-26W1

Access to 16-16-011-26W1

ID: 92
Class:2

Access to 11-16-011-26W1

NE-16-011-26W1

NW-16-011-26W1

ID: 93
Class:1

Access to 11-16-011-26W1

Access to 09-16-011-26W1

Access to 06-16-011-26W1

ID: 94
Class:1

ID: 95
Class:2

ID: 96
Class:2

SW-16-011-26W1

SE-16-011-26W1

Twp. 11

Rg. 26
W1M

Water Body
Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated

1:4,000 m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 16

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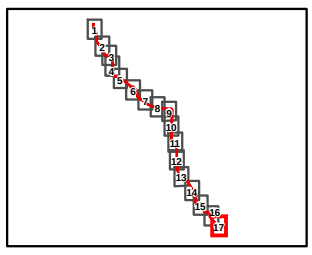
Water Body
Watercourse
Road
Pipeline
Approximate Wetland Site
Well (Surface Hole)

ROW and Land Use Type
Native
Modified Pasture
Cultivated



1:4,000
m
40 0 40 80
NAD 1983 UTM Zone 14N

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Figure 17

Table 1. Wetland Information

Wetland ID	Wetland Type[1]	Condition at Assessment	Impacted (I) / Not Impacted (NI)	Mitigation Required	Comments
1	III	wet	NI	none	
2	III	wet	NI	none	
3	I	dry	I	construction under dry or frozen conditions	
4	I	dry	I	construction under dry or frozen conditions	
5	III	wet	I	construction under dry or frozen conditions	
6	III	dry	NI	none	
7	IV with dugout	wet	NI	none	
8	II	dry	NI	none	
9	II	wet	I	construction under dry or frozen conditions	
10	III	wet	NI	none	
11	II	dry	I	construction under dry or frozen conditions	
12	II	dry	NI	none	
13	Seasonal Waterway	wet	I	bore	functioning like a class IV
14	Seasonal Waterway	wet	NI	none	
15	Seasonal Waterway	wet	I	construction under dry or frozen conditions or bore	
16	Seasonal Waterway	wet	I	construction under dry or frozen conditions or bore	
17	II	wet	NI	none	
18	II	wet	NI	none	
19	II	dry	NI	none	
20	IV	wet	NI	none	
21	Seasonal Waterway	wet	I	construction under dry or frozen conditions or bore	
22	III	wet	NI	none	
23	IV	wet	NI	none	
24	IV	wet	NI	none	
25	I	dry	I	construction under dry or frozen conditions	
26	III	wet	NI	none	
27	IV	wet	I	construction under dry or frozen conditions	riparian fringe impacted
28	I	wet	I	construction under dry or frozen conditions	
29	I	dry	I	construction under dry or frozen conditions	
30	II	dry	NI	none	
31	II	dry	I	construction under dry or frozen conditions	
32	III	wet	NI	none	
33	II	wet	I	construction under dry or frozen conditions	
34	I	dry	I	construction under dry or frozen conditions	
35	I	dry	NI	none	
36	I	dry	I	construction under dry or frozen conditions	
37	III	wet	NI	none	
38	III	wet	I	construction under dry or frozen conditions	riparian fringe impacted
39	I	dry	NI	none	
40	I	dry	I	construction under dry or frozen conditions	
41	I	dry	I	construction under dry or frozen conditions	
42	III	wet	I	construction under dry or frozen conditions	
43	I	dry	NI	none	
44	I	dry	I	construction under dry or frozen conditions	
45	I	dry	I	construction under dry or frozen conditions	
46	II	wet	NI	none	
47	III	wet	I	construction under dry or frozen conditions	
48	II	wet	NI	none	
49	II	wet	NI	none	
50	III	wet	NI	none	
51	II	wet	NI	none	
52	II	wet	NI	none	
53	II	wet	NI	none	
54	II	wet	NI	none	
55	I	wet	I	construction under dry or frozen conditions	
56	I	wet	NI	none	
57	I	wet	NI	none	
58	I	wet	NI	none	
59	III	wet	I	construction under dry or frozen conditions	riparian fringe impacted
60	I	wet	NI	none	
61	II	wet	NI	none	
62	I	wet	I	construction under dry or frozen conditions	
63	I	dry	NI	none	
64	II	wet	I	construction under dry or frozen conditions	riparian fringe impacted
65	IV	wet	I	construction under dry or frozen conditions	area of impact appears traditionally cultivated
66	II	wet	NI	none	
67	Scallion Creek	wet	I	construction under dry or frozen conditions or bore	approx 4 m of riparian area impacted
68	I	wet	I	construction under dry or frozen conditions	riparian fringe impacted
69	III	wet	I	construction under dry or frozen conditions	
70	II	wet	I	construction under dry or frozen conditions	
71	I	wet	NI	none	
72	I	wet	I	construction under dry or frozen conditions	
73	I	wet	I	construction under dry or frozen conditions	
74	I	wet	NI	none	
75	I	dry	I	construction under dry or frozen conditions	
76	I	dry	I	construction under dry or frozen conditions	
77	I	dry	I	construction under dry or frozen conditions	
78	II	wet	NI	none	
79	II	wet	NI	none	
80	II	dry	NI	none	
81	I	dry	NI	none	
82	II	wet	I	construction under dry or frozen conditions	riparian fringe impacted
83	II	wet	I	construction under dry or frozen conditions	
84	III	wet	I	construction under dry or frozen conditions	
85	I	dry	NI	none	
86	III	wet	NI	none	
87	IV	wet	I	construction under dry or frozen conditions or bore	
88	I	dry	I	construction under dry or frozen conditions	
89	III	wet	I	construction under dry or frozen conditions	
90	I	wet	NI	none	
91	I	dry	NI	none	
92	II	wet	NI	none	
93	I	dry	I	construction under dry or frozen conditions	
94	I	dry	I	construction under dry or frozen conditions	
95	II	wet	I	construction under dry or frozen conditions	
96	II	dry	NI	none	

[1] Stewart and Kantrud 1973

APPENDIX A
Site Photographs

1. Impacted Class I Wetland (ID-#3)

Matrix Supplied – Sept/Oct, 2015

2. Impacted Class I Wetland (ID-#4)

Matrix Supplied – Sept/Oct, 2015

3. Impacted Class III Wetland (ID-#5)

Matrix Supplied – Sept/Oct, 2015

4. Impacted Class II Wetland (ID-#9)

Matrix Supplied -Sept/Oct, 2015

5. Impacted Class II Wetland (ID-#11)

Matrix Supplied – Sept/Oct, 2015

6. Impacted Seasonal Waterway (ID-#13)

Matrix Supplied – Sept/Oct, 2015

7. Impacted Seasonal Waterway (ID-#15)

Matrix Supplied – Sept/Oct, 2015

8. Impacted Seasonal Waterway (ID-#16)

Matrix Supplied – Sept/Oct, 2015

9. Impacted Seasonal Waterway (ID-#21)

Matrix Supplied – Sept/Oct, 2015

10. Impacted Class I Wetland (ID-#25)

Matrix Supplied – Sept/Oct, 2015

11. Impacted Class IV Wetland (ID-#27)

Matrix Supplied – Sept/Oct, 2015

12. Impacted Class I Wetland (ID-#28)

Matrix Supplied – Sept/Oct, 2015

13. Impacted Class I Wetland (ID-#29)

Matrix Supplied – Sept/Oct, 2015

14. Impacted Class II Wetland (ID-#31)

Matrix Supplied – Sept/Oct, 2015

15. Impacted Class II Wetland (ID-#33)

Matrix Supplied – Sept/Oct, 2015

16. Impacted Class I Wetland (ID-#34)

Matrix Supplied – Sept/Oct, 2015

17. Impacted Class I Wetland (ID-#36)

Matrix Supplied – Sept/Oct, 2015

18. Impacted Class III Wetland (ID-#38)

Matrix Supplied – Sept/Oct, 2015

19. Impacted Class I Wetland (ID-#40)

Matrix Supplied – Sept/Oct, 2015

20. Impacted Class I Wetland (ID-#41)

Matrix Supplied – Sept/Oct, 2015

21. Impacted Class III Wetland (ID-#42)

Matrix Supplied – Sept/Oct, 2015

22. Impacted Class I Wetland (ID-#44)

Matrix Supplied – Sept/Oct, 2015

23. Impacted Seasonal Waterway (ID-#45)

Matrix Supplied – Sept/Oct, 2015

24. Impacted Class III Wetland (ID-#47)

Matrix Supplied – Sept/Oct, 2015

25. Impacted Class I Wetland (ID-#55)

Matrix Supplied – Sept/Oct, 2015

26. Impacted Class III Wetland (ID-#59)

Matrix Supplied – Sept/Oct, 2015

27. Impacted Class I Wetland (ID-#62)

Matrix Supplied – Sept/Oct, 2015

28. Impacted Class II Wetland (ID-#64)

Matrix Supplied – Sept/Oct, 2015

29. Impacted Class IV Wetland (ID-#65)

Matrix Supplied – Sept/Oct, 2015

30. Impacted Scallion Creek (ID-#67)

Matrix Supplied – Sept/Oct, 2015

31. Impacted Class I Wetland (ID-#68)

Matrix Supplied – Sept/Oct, 2015

32. Impacted Class III Wetland (ID-#69)

Matrix Supplied – Sept/Oct, 2015

33. Impacted Class II Wetland (ID-#70)

Matrix Supplied – Sept/Oct, 2015

34. Impacted Class I Wetland (ID-#72)

Matrix Supplied – Sept/Oct, 2015

35. Impacted Class I Wetland (ID-#73)

Matrix Supplied – Sept/Oct, 2015

36. Impacted Class I Wetland (ID-#75)

Matrix Supplied – Sept/Oct, 2015

37. Impacted Class I Wetland (ID-#76)

Matrix Supplied – Sept/Oct, 2015

38. Impacted Class I Wetland (ID-#77)

Matrix Supplied – Sept/Oct, 2015

39. Impacted Class II Wetland (ID-#79)

Matrix Supplied – Sept/Oct, 2015

40. Impacted Class II Wetland (ID-#81)

Matrix Supplied – Sept/Oct, 2015

41. Impacted Seasonal Waterway (ID-#83)

Matrix Supplied – Sept/Oct, 2015

42. Impacted Class III Wetland (ID-#84)

Matrix Supplied – Sept/Oct, 2015

43. Impacted Class IV Wetland (ID-#87)

Matrix Supplied UAV Aerial view – Sept/Oct, 2015

43. Impacted Class I Wetland (ID-#88)

Matrix Supplied – Sept/Oct, 2015

44. Impacted Class III Wetland (ID-#89)

Matrix Supplied – Sept/Oct, 2015

45. Impacted Class I Wetland (ID-#93)

Matrix Supplied – Sept/Oct, 2015

46. Impacted Class I Wetland (ID-#94)

Matrix Supplied – Sept/Oct, 2015

47. Impacted Class II Wetland (ID-#95)

Matrix Supplied – Sept/Oct, 2015

47. Representative photo of RoW In NE 27-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

48. Representative photo of RoW in SW 27-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

49. Representative photo of RoW in SE 27-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

50. Representative photo of RoW in NE 22-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

51. Representative photo of RoW in NW 23-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

52. Representative photo of RoW in SW 23-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

53. Representative photo of RoW in NW 14-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

54. Representative photo of RoW in NE 14-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

55. Representative photo of RoW in SE 14-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

56. Representative photo of RoW in SW 13-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

57. Representative photo of RoW in NW 12-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

58. Representative photo of RoW in NE 12-12-27 W1M

Matrix Supplied – Sept/Oct, 2015

59. Representative photo of RoW in NW 07-12-26 W1M

Matrix Supplied – Sept/Oct, 2015

60. Representative photo of RoW in SW 07-12-26 W1M

Matrix Supplied – Sept/Oct, 2015

61. Representative photo of RoW in SE 07-12-26 W1M

Matrix Supplied – Sept/Oct, 2015

62. Representative photo of RoW in NE 06-12-26 W1M

Matrix Supplied – Sept/Oct, 2015

63. Representative photo of RoW in SE 06-12-26 W1M

Matrix Supplied – Sept/Oct, 2015

64. Representative photo of RoW in SW 05-12-26 W1M

Matrix Supplied – Sept/Oct, 2015

65. Representative photo of RoW in NW 32-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

66. Representative photo of RoW in SW 32-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

67. Representative photo of RoW in NW 29-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

68. Representative photo of RoW in SW 29-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

69. Representative photo of RoW in SE 29-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

70. Representative photo of RoW in NE 20-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

71. Representative photo of RoW in SE 20-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

72. Representative photo of RoW in SW 21-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

73. Representative photo of RoW in SE 21-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

74. Representative photo of RoW in NE 16-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

75. Representative photo of RoW in SE 16-11-26 W1M

Matrix Supplied – Sept/Oct, 2015

APPENDIX B
Manitoba Conservation Data Centre Search Results

Dwayne Donald

From: Friesen, Chris (CWS) <Chris.Friesen@gov.mb.ca>
Sent: Tuesday, September 22, 2015 8:26 AM
To: Dwayne Donald
Subject: RE: TEML proposed Pipeline
Attachments: MBCDC bird setbacks_full document_2015_06_24.pdf

Dwayne

Thank you for your information request. I completed a search of the MB Conservation Data Centre rare species database which resulted in the following occurrences:

SW 23-12-27W
Baird's Sparrow (Ammodramus bairdii), S1B, ESEA: Endangered, COSEWIC: Special Concern

NW 23-12-27W
Sprague's Pipit (Anthus spragueii), S2B, ESEA: Threatened, SARA: Threatened, COSEWIC: Threatened
Sharp-tailed Grouse (Tynmpanuchus phasianellus), S5, lek site

NE 22-12-27W
Sprague's Pipit (Anthus spragueii), S2B, ESEA: Threatened, SARA: Threatened, COSEWIC: Threatened

SW 27-12-27W
Sharp-tailed Grouse (Tynmpanuchus phasianellus), S5, lek site

NW 27-12-27W
Sprague's Pipit (Anthus spragueii), S2B, ESEA: Threatened, SARA: Threatened, COSEWIC: Threatened

Further information on this ranking system can be found on our website at http://www.gov.mb.ca/conservation/cdc/consranks.html and these designations can be found at http://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php, http://www.cosewic.gc.ca/ and http://www.sararegistry.gc.ca/default_e.cfm.
I've attached Manitoba's recommended setbacks distances for birds.

The information provided in this letter is based on existing data known to the Manitoba CDC of the Wildlife and Ecosystem Protection Branch at the time of the request. These data are dependent on the research and observations of our scientists and reflects our current state of knowledge. **An absence of data does not confirm the absence of any rare or endangered species.** Many areas of the province have never been thoroughly surveyed, however, and the absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present. The information should, therefore, not be regarded as a final statement on the occurrence of any species of concern nor should it substitute for on-site surveys for species or environmental assessments. Also, because our Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request.

Please contact the Manitoba CDC for an update on this natural heritage information if more than six months passes before it is utilised.

Third party requests for products wholly or partially derived from the Biotics database must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data

contributors on any map or publication using data from our database, as the Manitoba Conservation Data Centre; Wildlife Branch, Manitoba Conservation and Water Stewardship.

This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information contact me directly at (204) 945-7747.

Chris Friesen
Coordinator
Manitoba Conservation Data Centre
204-945-7747
chris.friesen@gov.mb.ca
http://www.gov.mb.ca/conservation/cdc/

From: Dwayne Donald [mailto:ddonald@matrix-solutions.com]
Sent: September-10-15 8:59 AM
To: Friesen, Chris (CWS)
Subject: TEML proposed Pipeline

Chris,

Tundra Energy and Marketing Ltd (TEML) is proposing to construct a new pipeline north of Virden. I have attached a survey of the proposed route. Can you please let me know if there are any species at risk occurrence along the route as well as any lands with special designations. If you have any questions please let me know.

Dwayne Donald, P. Biol., AAg
Biologist

MATRIX SOLUTIONS INC.
Environment & Engineering
Box 279, 1780 Railway Avenue Weyburn, Saskatchewan S4H 0X7
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Recommended Development Setback Distances from Birds
Manitoba Conservation Data Centre
June 24, 2015

Introduction

The Manitoba Conservation Data Centre (MBCDC) developed these recommendations and setback distances in order to provide industry proponents with consistent, readily available guidelines that can be applied in situations where sensitive species may be present in or near the project area. The setback distances were established by reviewing relevant literature and guidelines from other jurisdictions, and consulting local ornithologists.

General Recommendations

In most cases, disturbance or potentially deleterious activity outside of the breeding season is preferential to activity during the breeding season. The breeding season begins with territory establishment and ends when the young are fledged and the nesting territory is abandoned.

Where the activity will occur in suitable habitat for these species (eg: native grassland for the grassland birds), minimal clearing/disturbance techniques should be employed during or even outside of the breeding season. Any suitable habitat unavoidably disturbed should be reclaimed/rehabilitated as soon as possible.

If these species have been recorded in or near the project area, it is recommended that the proponent develop an environmental protection plan to submit to the MBCDC for review. At minimum the plan should:

a) describe the project, including a timeline of activities, a description of the location and current land use, and a description of the wildlife values in the area, including any species of concern identified by the MBCDC;
b) identify potential impacts of the project to wildlife values, especially to any species of concern identified by the MBCDC; and
c) propose impact management and mitigation measures to avoid or manage the identified impacts, including reclamation/rehabilitation efforts.

In some cases, MBCDC may also recommend the development of a monitoring program designed to assess species of concern that may occur in the area, impacts on wildlife values and/or the effectiveness of mitigation measures.

Disturbance Categories

Low
e.g.: foot traffic; occasional/infrequent/short-term small vehicle (<1 ton) or ATV use; operating oil or gas wells without flaring; operating pipelines

Foot-traffic only (FTO) is indicated for certain taxa, in which case all activities normally considered low disturbance (other than foot traffic) are considered medium disturbance.

Medium
e.g.: trucks>1 ton (gravel, oil, grain), regular/frequent/long-term small vehicle (<1 ton) or ATV use, pipeline construction (diameters <1 foot), operating compressor station or battery without flaring

High
e.g., road construction, roads, drilling rigs, mines and quarries, construction of compressor station or battery, forest harvest, large diameter pipeline construction, seismic exploration, blasting, rock crushing, asphalt batching, gravel pit, operating compressor station or battery or oil/gas well with flaring

Nest Site
In many cases it will be difficult to identify the exact location of a nest, and intensive efforts to do so may disturb breeding birds and/or their nests. In such cases, determining the main home range, territory and/or song perches through auditory song/call surveys and low-intensity visual observation, are recommended to determine the approximate location of nest sites. The set-back distance should then be applied to this approximate location.

Species	Key Wildlife Feature	Restricted Activity Period	Recommended Set-back Distance by Disturbance Category (metres)		
			Low	Medium	High
Baird's Sparrow	Nest Site	May 15 - August 15	100	250	500
Bald Eagle	Active or Traditional Nest Site	March 15 - July 15	250	500	1000
Bank Swallow	Nesting Colony	May 15 - July 31	50	150	300
Barn Swallow	Nest Site	May 15 - September 30	50	100	100
Barred Owl	Active or Traditional Nest Site	March 15 - July 15	250	500	1000
Bobolink	Nest Site	May 15 - August 15	100	250	400
Boreal Owl	Nest Site	March 1 - July 15	250	500	1000
Buff-breasted Sandpiper	Migratory Stop-over Site	May 20 - June 5, July 20 - Oct 10	100	200	400
Burrowing Owl	Active or Traditional Nest Site	April 1 - August 15	200	300	500
		August 16 - March 31	50	250	500
Canada Warbler	Nest Site	May 1 - July 31	200	300	450
Chesnut-collared Longspur	Nest Site	May 1 - August 15	100	250	650
Chimney Swift	Nest or Roost Site	May 1 - July 31	50	150	300
Common Nighthawk	Nest Site	May 1 - August 31	100	200	300
Eastern Screech Owl	Nest Site	March 15 - July 15	200	300	500
Eastern Wood-Pewee	Nest Site	May 15 - Aug 15	50	150	300
Ferruginous Hawk	Active or Traditional Nest Site	March 15 - July 31	500	750	1000
Golden-winged Warbler	Nest Site	May 15 - August 6	200	300	450
Golden Eagle	Active or Traditional Nest Site	March 15 - July 15	500	750	1000
Grasshopper Sparrow	Nest Site	May 16 - August 21	100	250	650
Great Gray Owl	Active or Traditional Nest Site	Feb 15 - July 15	250	500	1000
Horned Grebe	Nest Site	May 1 - Sep 15	100	200	400
Least Bittern	Nest Site	May 1 - July 31	100	200	400
Loggerhead Shrike	Nest Site	May 1 - August 15	100	250	500
Northern Hawk Owl	Nest Site	Feb 15 - July 15	250	500	1000
Olive-sided Flycatcher	Nest Site	May 1 - August 31	50	150	300
Peregrine Falcon[1]	Nest Site	April 1 - August 15	250	500	1000
Piping Plover	Active or Traditional Nest Site	April 15 - August 15	200	400	600
Red-headed Woodpecker	Nest Site	April 15 - August 15	50	100	200
Red Knot	Migratory Stop-over Site	May 20 - June 5, July 20 - Oct 10	100	200	400
Ross's Gull	Nest Site	May 15 - August 15	500	1000	1500
Rusty Blackbird	Nest Site	May 1 - July 31	50	150	300
Sharp-tailed Grouse[2]	Lek	Mar 15 - May 15	200	500	1000
Short-eared Owl	Nest Site	April 15 - September 15	200	300	500
Sprague's Pipit	Nest Site	May 1 - August 15	100	250	650
Trumpeter Swan	Nest Site	April 1 - July 31	500	750	1000
Eastern Whip-poor-will	Nest Site	May 15 - July 16	100	200	300
Whooping Crane	Staging Area	May 1 - November 1	500	750	1000
Yellow Rail	Nest Site	May 1 - July 15	100	150	350
American White Pelican	Nesting Colony	April 1 - August 31	500	750	1000
Double-crested Cormorant	Nesting Colony	April 1 - August 31	400	500	750
Herons	Nesting Colony	April 1 - August 31	400	500	750
Colonial Nesting grebes	Nesting Colony	May 15 - July 15	100	200	400
Colonial Nesting gulls/terns	Nesting Colony	May 1 - July 15	400	500	750

[1]Non-urban occurrences only

[2]Low disturbance is foot traffic only.

June 24, 2015

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

ENVIRONMENTAL PROTECTION PLAN
TUNDRA ENERGY MARKETING LIMITED
TWO CREEKS PIPELINE PROJECT

Report Prepared for:
TUNDRA ENERGY MARKETING LIMITED

Prepared by:
MATRIX SOLUTIONS INC.

November 2015
Virden, Manitoba

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Virden, MB, Canada R0M 2C0
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ENVIRONMENTAL PROTECTION PLAN

TUNDRA ENERGY MARKETING LIMITED

TWO CREEKS PIPELINE PROJECT

Report prepared for Tundra Energy Marketing Limited, November 2015

Dan Chranowski, M.Env., Certified Wildlife Biologist®
Senior Environmental Scientist

reviewed by
Dwayne Donald, P.Biol., AAg
Biologist

DISCLAIMER

We certify that this report is accurate and complete and accords with the information available during the site investigation. Information obtained during the site investigation or provided by third parties is believed to be accurate but is not guaranteed. We have exercised reasonable skill, care, and diligence in assessing the information obtained during the preparation of this report.

This report was prepared for Tundra Energy Marketing Limited. The report may not be relied upon by any other person or entity without our written consent and that of Tundra Energy Marketing Limited. Any uses of this report by a third party, or any reliance on decisions made based on it, are the responsibility of that party. We are not responsible for damages or injuries incurred by any third party, as a result of decisions made or actions taken based on this report.

TABLE OF CONTENTS

1 INTRODUCTION

Tundra Energy Marketing Limited (TEML) is constructing approximately 20 km of pipeline within a 25 m pipeline right-of-way (RoW) that will be used to transport product from an existing battery facility to the TEML Virden Pipeline System.

The pipeline will connect a new lease automatic custody transfer (LACT) facility at an existing Elcano Exploration Inc. battery located in 03-34-012-27 W1M to the a new riser site in 08-16-11-26 W1M.

This pipeline environmental protection plan (EPP) describes the environmental protection procedures, mitigation measures, and monitoring commitments to be implemented during the construction of the Pipeline. The environmental assessment was completed as per the *The Environmental Act* and in accordance with the *Information Bulleting - Environment Act Proposal Report Guidelines* (Manitoba CWS 2015).

2 PURPOSE

This pipeline EPP describes the environmental protection procedures, mitigation measures, and monitoring commitments to be implemented during the construction of the pipeline.

This EPP addresses the potential effects from pipeline construction identified in the Environment Act Proposal (EAP) and from regulatory responses. The environmental protection measures and contingency plans used in the development of this EPP include but are not limited to the project EAP, commitments made in responses to Manitoba Conservation and Water Stewardship (Manitoba CWS), and industry best management practices.

2.1 Project Environmental Setting

The pipeline is located in the Aspen Parkland Ecoregion of Canada in the St. Lazare ecodistrict (Environment Canada 2000, Smith et al. 1998). The Aspen Parkland ecoregion is a transitional area between the Boreal Forest and Grassland ecoregions. A large proportion of this ecoregion has been converted to agricultural land uses; however, patches of aspen parkland habitat remain in a native condition. The ecodistrict consists of a subdued undulating to hummocky till plain. Native patches are characterized by stands of trembling aspen, bur oak, Manitoba maple, and mixed tall shrubs intermixed with fescue grasslands. Stands of trembling aspen, Manitoba maple, and tall shrubs occur throughout the region on a variety of sites while grasslands occupy increasingly drier sites. Stands of bur oak are typically associated with richer soils located along bottomland habitats such as riparian areas and floodplains.

2.2 Extent and Limits of the Environmental Protection Plan

Unforeseen conditions or circumstances during construction may warrant the revision of a specific mitigation measure noted in this EPP or require additional mitigation measures in order to satisfactorily mitigate the effects of the construction program. In the event that an unforeseen condition or circumstance arises during construction for which no mitigation measures have been approved, the project manager, contractor and the environmental monitor will develop an action plan, including mitigation measures, in consultation with the appropriate regulator, if necessary.

2.3 Change Management

If a conflict arises between the construction contract documents and the environmental requirements (including applications, the EPP, approvals, permits, and/or licence conditions) regarding an environmental protection measure or environmental requirement, the more rigorous protection measure will take precedence.

During construction, if it is determined an EPP requirement cannot be met or new procedures are required to address site conditions not anticipated in the EPP:

- contact the environmental monitor immediately
- develop mitigation to address the change in cooperation with the construction manager, environmental monitor, project manager, and the contractors
- the change management procedure must not conflict with regulatory approval, permitting, licence, and/or authorization conditions
- the change will be discussed with the appropriate regulator, as required

Revisions to permits, approvals or authorizations may be required as construction time scheduling and/or construction methods are refined. The contractor and construction management will be responsible for complying with revised requirements.

3 ENVIRONMENTAL COMPLIANCE

Environmental compliance is a critical component for project success. TEML will ensure compliance with environmental commitments, procedures, mitigation measures and conditions of permits, approvals, licences or authorizations, and applicable environmental regulations.

3.1 Environmental Inspection During Construction

Environmental monitors will be retained by TEML on an as needed basis to ensure that the mitigation measures presented in this EPP, the EAP, alignment sheets, permits, licences, and approvals are properly implemented.

3.2 Identification and Reporting of Environmental Incidents

The incident and the person who witnesses the incident shall report it immediately to the environmental monitor and construction manager or designate. Environmental incidents may include:

- Any release or leak, onsite or offsite, directly related or attributable to the project.
- Any activity that is not in compliance with environmental regulations, permits, authorizations, approvals, company environmental procedures, this pipeline EPP, and/or project environmental commitments (as communicated to an external stakeholder or regulator).
- Any incident that results in an impact to fish, wildlife, or the environment (air, land, or water).

The project manager will work with the environmental monitor and construction manager or designate to direct corrective and/or emergency action to be taken in the field, and will determine what regulatory reporting is required. If the incident requires regulatory reporting, the environmental monitor shall conduct the appropriate reporting, within the appropriate timeframes.

TABLE 1 Emergency Contact Information

Organization	Number
Manitoba Conservation and Water Stewardship Environmental Emergency Line	204.944.4888
Environment Canada Environmental Emergencies - Manitoba	403.468.8020

TABLE 2 Regulator Contact Information

Organization	Contact	Contact Number	Position
Manitoba Department of Conservation and Water Stewardship	Peter Crocker	204.726.6156	Regional Supervisor, Environment Officer
Manitoba Department of Conservation and Water Stewardship	Eugene Kozera	204.946.7474	Water Control Systems Management Branch
Manitoba Department of Conservation and Water Stewardship	Rob Matthews	204.945.6118	Water Use Licensing
Manitoba Department of Conservation and Water Stewardship	Laureen Janusz	204.945.7789	Fisheries Biologist
Manitoba Department of Conservation and Water Stewardship	Wendy Ralley	204.945.8146	Water Quality Management
Manitoba Department of Conservation and Water Stewardship	Bruno Bruderlin	204.726.6452	Regional Fisheries Biologist
Manitoba Department of Conservation and Water Stewardship	Darren Nicklin	204.572.7265	Senior Water Resource Officer
Department of Fisheries and Oceans (DFO)	Todd Schwartz	204.983.4231	Senior Habitat Biologist

4 PIPELINE CONSTRUCTION ENVIRONMENTAL PROTECTION MEASURES

Unless otherwise noted, the contractor will be responsible for implementing the mitigation measures noted in this section of the pipeline EPP.

4.1 Decision Criteria

TEML and the construction contractor will consider the following criteria when deciding which protection measure(s) and/or procedures to implement during construction of the pipeline:

- site conditions during construction (e.g., soil texture, water table depth)
- weather conditions during construction (e.g., wind, precipitation, air temperature)
- equipment and/or material availability during construction
- contractor experience with conducting specific construction techniques

In the event that an unforeseen environmental issue arises during construction for which no mitigative measures have been approved, the environmental monitor will determine a plan of action in consultation with the appropriate government agencies, if necessary. Refer to Section 2.3 Change Management for information regarding how unforeseen environmental issues will addressed during construction.

4.2 General Mitigation Measures

General mitigation measures, where warranted, have been developed to address both the resource-specific and general issues identified during the environmental assessment. The following subsections describe how the results of environmental assessment have been incorporated into management and protection measures for the project and to ensure they are implemented during construction of the pipeline.

4.2.1 Wildlife

- A qualified biologist will complete a reconnaissance level investigation to identify potential impacts to wildlife and wildlife habitat.

- Prohibit construction personnel from harming, harassing, or feeding wildlife. Do not allow pets, firearms, or recreational use of all-terrain vehicles or snowmobiles on site during construction of the pipeline.

- Establish construction traffic speed limits and post speed limits on access roads to reduce the risk of collisions with wildlife.

- Report any incidents or collisions with wildlife to the environmental monitor, who will notify local wildlife authorities and the local police department as appropriate.

- Remove trapped animals from the trench at the start of each day before conducting construction activities.

- Collect construction garbage daily and dispose of in approved locations to prevent attracting nuisance wildlife. Report scavenging or dangerous wildlife along with the location and details to regional wildlife authorities and, if appropriate, the local police department.

4.2.2 Spill Prevention and Management

Spills of hazardous materials during construction have the potential to affect environmental resources such as soil, wetlands, vegetation, wildlife habitat, and aquatic ecosystems.

- Ensure that no fuel, lubricating fluids, hydraulic fluids, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground or into any watercourse.

- Maintain appropriate spill equipment at all worksites. Assess the risk potential for site-specific spills to determine the appropriate type of response equipment to be stored onsite and a suitable location for storage.

- Refuel and service mobile equipment a minimum of 100 m from water bodies.

- Employ the following measures to reduce the risk of fuel spills:
  - all containers, hoses, and nozzles are free of leaks
  - operators are stationed at both ends of the hose during fuelling unless the ends are visible and readily accessible by one operator
  - fuel remaining in the hose is returned to the storage facility

- Report all spills, regardless of size, to the environmental monitor, who will determine if the spill is reportable under the requirements of *The Dangerous Goods Handling and Transportation Act, Environmental Accident Reporting Regulation.*

- Do not dispose of petroleum products or waste into waterways or on the ground.

4.2.3 Waste Management

TEML is committed to the proper management of all company wastes, which are generated through normal operational, construction, and emergency activities. The following waste management mitigations will be implemented:

- Collect waste from work site on a daily basis and dispose of at an approved facility to avoid the attraction of nuisance animals. Waste containers shall accompany each working unit. No waste shall be disposed of in the trench.
- Transport and dispose all wastes in accordance with provincial and federal regulatory requirements and local guidelines (e.g., WHMIS and TDG).
- Ensure the construction site is left in a tidy and organized condition at the end of each day.
- Burning of construction wastes or domestic garbage is prohibited.
- Locate temporary toilets at convenient locations on/along the construction site.
- Report all incidents involving waste and hazardous material to the environmental monitor.

4.2.4 Clearing and Grubbing

- Disturbance in native vegetation communities will be minimized.
- No vegetation clearing or other construction activities will occur in native vegetation communities between April 1 and August 31 in any year.
- Do not allow clearing or grubbing beyond the staked boundary of the pipeline RoW unless additional workspace rights have been obtained.
- If a tree to be cleared contains an active bird nest, or if a ground nest, burrow, or den is discovered during clearing, suspend the work activity, fence or flag off the area, and contact the environmental monitor.

4.2.5 Topsoil Salvage

- Maintain separation between the topsoil pile and the subsoil piles.
- Where topsoil is less than 30 cm, salvage topsoil to colour change, bottom of sod or duff layer, plough layer, or 10 cm, whichever is deepest.

- Salvage topsoil from all areas that require grading. Avoid over-stripping. Avoid grading of native grassland, bush, hay lands, or pasture lands on level terrain, where practicable. In areas of native grassland, minimize the amount of stripping, where practicable, and strip soil only from travel lane, trench line, and spoil.

- Under wet/thawed soils conditions where wheel-slip, mud build-up on tires and cleats, water ponding, and ruts are occurring, the decision to temporarily shut down construction activities will be made based on the plasticity of the surface soil to a depth of 10 to 20 cm, the depth of the wetting front and/or ruts in relation to the A and B horizons and the type of construction operations proposed for that day.

4.2.6 Grading

- Reduce grading throughout the pipeline RoW, especially at watercourses and wetlands, and on hay, tame pasture, native prairie, and treed lands with a competent sod layer. Reduce the width of grading in order to limit the potential for erosion and subsoil compaction.

- Follow-up grading will be conducted in areas affected by settling after construction.

4.2.7 Pressure Testing

Industry standards and government regulations require that pipelines and other facilities are pressure tested before commissioning for integrity purposes.

- Only withdraw water from approved locations. Avoid water withdrawal sites with known environmental sensitivities (i.e., steep slopes or other sensitive areas).

- Recover all methanol, ethylene glycol, and water contaminated by freezing depressants in tanks. Do not allow contaminants to enter natural bodies of water or soils.

- Recover all water contaminants with drying agents (e.g., methanol), if used, in tanks and return to the supplier or dispose of contaminated test water at approved sites/facilities.

4.2.8 Erosion Control

Permanent soil erosion and sedimentation control begins as soon as possible upon completion of backfilling. Erosion control is also necessary at some locations to maintain soil capability and habitat quality, to reduce siltation in watercourses and wetlands, and to avoid creating a nuisance to nearby landowners and land users.

- Select the appropriate erosion and sediment control option for the site-specific conditions in consultation with the environmental monitor.

- Prevent or control soil erosion and water siltation to the satisfaction of the environmental monitor and the applicable regulatory authority. Make available personnel and equipment to control erosion when warranted.

- To reduce drifting soils and loss of topsoil in areas prone to wind erosion, options include sowing a fast growing cover crop or the application of a tackifier.

- Place erosion control matting, rollback, or tackifier on steep slopes or exposed sites that will be difficult to stabilize as directed by the environmental monitor.

- After final grading, stabilize disturbed steep slopes in areas other than cultivated land with permanent erosion control structures, especially if heavy runoff or heavy storms are likely and there is a risk of substantial soil erosion. Consider any of the following:

    - install netting or silt fencing
    - apply tackifier
    - hydromulch
    - hydroseed
    - weed an annual native cover crop
    - plant native shrubs or willow cuttings

- During construction, restoration, operation, and maintenance all necessary measures will be implemented to prevent erosion of soil into water bodies and watercourses.

4.2.9 Watercourse Crossings

- No fish bearing watercourses or major waterways will be crossed during construction.

4.2.10 Wetlands

Pipeline construction has the potential to affect habitat, hydrologic, and water quality functions of wetlands. This section describes mitigation measures to minimize and prevent impacts of pipeline crossings of wetlands along the pipeline RoW:

- TEML, in consultation with the environmental monitor, will assess whether to bore under wetlands, with permanent open water zones or capable of providing overwintering habitat for northern leopard frog (*Lithobates pipiens*; e.g., Class IV and V wetlands [Stewart and Kantrud 1971]).

- TEML, in consultation with the environmental monitor, will assess whether to discontinue trenching activities in wetlands where water is encountered and determine appropriate mitigation.

- No construction will occur in wetlands and in riparian areas between April 1 and August 31 in any year, unless environment assessment indicates that construction is acceptable if necessary. Additional mitigation measures may be required.

- Minimize traffic through wetlands to the extent possible. Where warranted, use shoo-fly access to divert construction traffic around wetlands.

- Install a temporary sediment barrier (e.g., silt fence), where warranted, to eliminate the flow of sediment from clean spoil piles and disturbed areas into nearby wetlands.

- Inspect the temporary erosion control structures on a daily basis and repair, if warranted, before the end of each working day.

- Where feasible, salvage the upper surface material on all wetlands to maintain the root stock for replacement. Salvage surface material to a maximum depth of 40 cm, or to the depth of colour change where there is less than 40 cm of surface material, or as directed by the environmental monitor.

- Adhere to the boundaries of wetlands and stripping widths during construction, unless otherwise directed by the environmental monitor.

- Store salvaged surface material at a sufficient distance from the trench so that it does not slump or flow into the trench.

Where wetland reclamation is required post-construction, the following reclamation activities will be implemented:

- Remove any sediment barriers or other erosion control materials that remain after the disturbed area is revegetated and the area is stable.

- Replace salvaged organic topsoil and upper soil material over the stripped area. Ensure wetland contours and drainage channels are restored and a permanent trench crown is not created. Replace salvaged topsoil or upper surface material as evenly as possible over the stripped area.

- Re-contour the wetland and restore surface hydrology patterns to as close to the pre-construction profile as practical during reclamation.

- Wetlands generally revegetate naturally. Where warranted, revegetate disturbed wetland areas with native wetland vegetation, unless there is standing water or permanent planting.

- In the event that natural revegetation does not occur in a timely manner, apply a native aquatic plant seed mix using species present on site at the time of reclamation. Native seed will be tested

for viability and purity prior to application. Application of the native seed will occur in appropriate weather conditions and the appropriate season.

- Do not apply fertilizer, lime, or mulch in wetlands.
- Replant salvaged trees/shrubs along the disturbed margin(s) of the wetland as directed by the environmental monitor.
- Where practicable, allow wetlands to naturally regenerate following construction.
- Install willow staking along the wetland to stabilize disturbances and reduce sedimentation risk to wetland where shrubs were present prior to construction and where directed by the environmental monitor.

4.2.11 Re-vegetation

Re-vegetation of the construction RoW involves preparing the seed bed and seeding disturbed areas to establish a permanent ground cover. Poor re-vegetation may result in reduced agricultural, recreational, and other land use capabilities, reduced wildlife habitat, and elevated risk of erosion and weed infestations. In addition, public relations with landowners and regulatory authorities may be adversely affected if re-vegetation does not meet expectations.

- Till or cultivate any severely compacted or rutted areas on cultivated, hay, or tame pasture lands with deep tillage device or chisel plough to loosen compacted soils.
- All re-vegetation in native communities shall implement a seed mix native to the area to prevent the spread of invasive species.
- Consult with landowners for the appropriate seed mix for the land to be re-vegetated. Use only Certified Canada No. 1 seed from a local source and retain the certificates of analysis for future documentation.
- Ensure seed mixes used to re-vegetate the construction RoW are free of noxious weed seed. All seed mixes must have certificates of analysis for weed and undesirable species content, and germination tests for each lot of each species in the mix.

5 POST-CONSTRUCTION MONITORING

TEML will undertake post-construction monitoring as required to:

- evaluate the reclamation of areas disturbed through construction of the project

- assess the status of outstanding environmental issues documented through environmental inspection
- identify any outstanding or new environmental issues that may be present
- recommend remedial measures and coordinate their implementation to address any outstanding or new environmental issues
- document monitoring results and post-construction remedial measures

Post-construction monitoring will include the following elements:

- follow-up monitoring, re-seeding, maintenance, and weed control until the disturbed areas are re-vegetated and approved by Manitoba Conservation
- initiate a wetland monitoring program to assess the natural regeneration of wetlands impacted by the pipeline

6 REFERENCES

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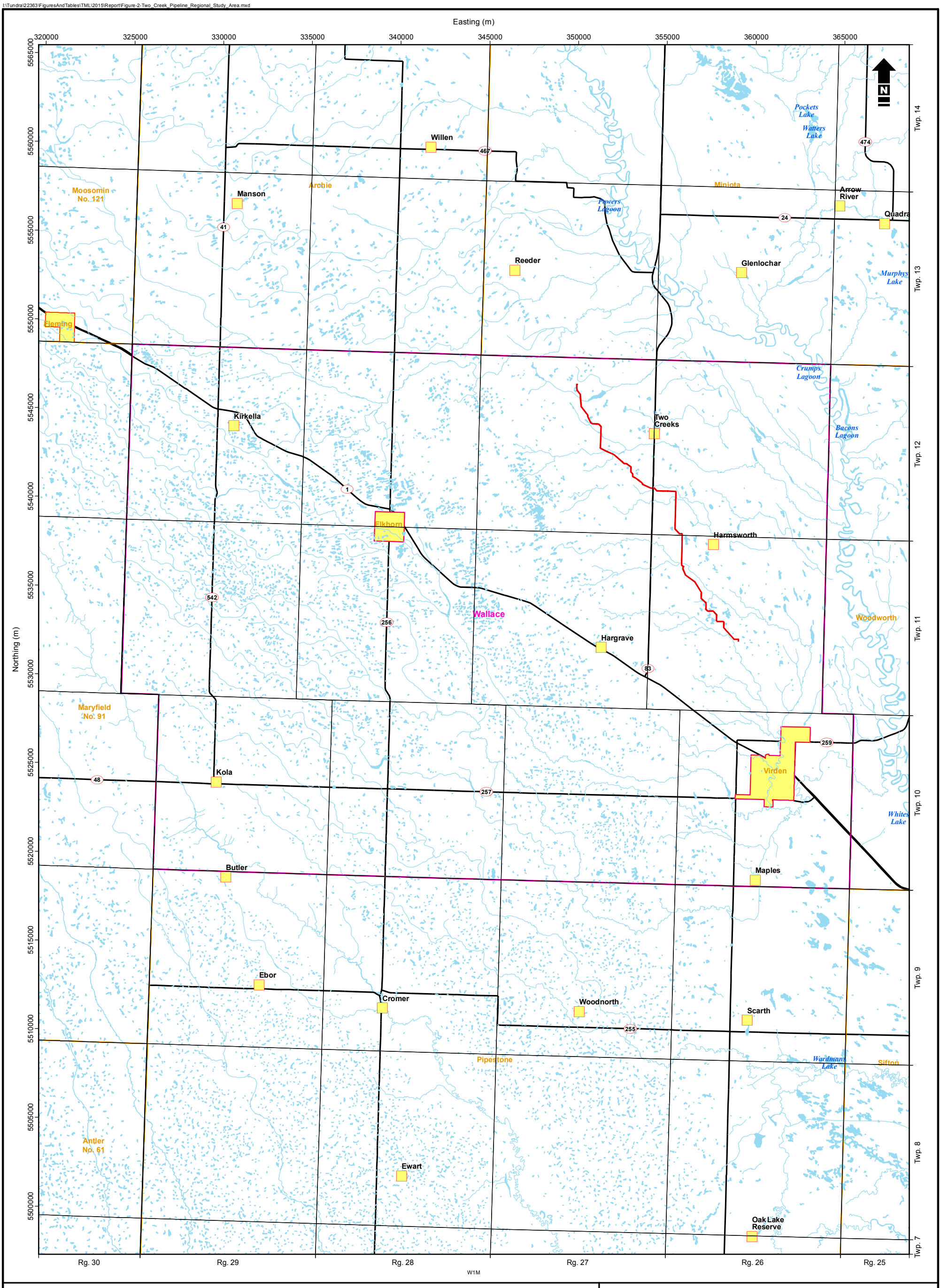

ROW
Regional Study Area (RSA)
Community
Municipal Boundary
Water Body
Watercourse
Highway

1:200,000
m
1,900 0 1,900 3,800
NAD 1983 UTM Zone 14N

Reference: Data obtained from GeoBase® used under license. GDM midstream and transportation infrastructure data provided by IHS © 2015 used under license.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

Tundra Oil & Gas Partnership
Two Creek Pipeline

Regional Study Area

Date:	Project:	Technical:	Reviewer:	Drawn:
08 Dec 2015	22363-501	D. Donald	D. Donald	T. Talavlikar

Figure 2