

ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

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5.0 ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

The following subsections describe the environmental setting along the proposed Waskada to Pierson Pipeline route. The information used to determine the current environmental and socio-economic setting along the proposed route and associated facilities was compiled from the following sources:

- existing published literature including topographic maps, aerial photography, scientific papers, reference books as well as municipal, provincial and federal government maps, reports, guides, information letters and databases; and
- personal communications with regulatory agencies, landowners, local stakeholders, local and municipal government and provincial government agencies and the general public.

Methods of obtaining resource material included searching libraries, receiving documents directly from government agencies and using the Internet. All references used in the preparation of the environmental and socio-economic setting of the EA are cited in Section 5.4.

5.1 Pipeline

This subsection describes the environmental and socio-economic setting along the proposed pipeline route as described in Section 2.1 of this EA.

5.1.1 Physical Environment

This subsection presents a summary of the physical environment setting of the proposed route. It describes areas of geotechnical concern identified in the vicinity of the pipeline route. Where warranted, this information was supplemented with materials listed in Section 5.4 of this EA. Potential pipeline construction-related effects and mitigation are presented in Section 6.2.1 and Section 6.6 of this EA. Photographs of the proposed route are provided in Appendix 5A of this EA.

5.1.1.1 Physiography

Physiographic characteristics assist in the identification of topographic features and surficial deposits traversed by the proposed pipelines. The proposed route traverses the Saskatchewan Plains Division in the south-western part of the Interior Plains of the Borderlands physiographic region (Natural Resources Canada (NRC) 2011a).

The Saskatchewan Plains is characterized by predominantly flat terrain with occasionally rolling terrain.

5.1.1.2 Geology

This subsection identifies the types of bedrock that may be encountered along the route and the characteristics of the formations as they may affect pipeline construction activities. Along with glaciation, bedrock geology is the precursor to surficial deposits and soils and, consequently, may have an influence on the chemistry of the soil profile within trench depth.

The geologic formation underlying the proposed route contains marine sedimentary rock (Geological Survey of Canada and Manitoba Minerals Division 1994).

The Odanah Member of the Pierre Formation underlies the proposed pipeline route. This Cretaceous-aged stratum consists of hard grey siliceous shale rocks (Manitoba Mineral Resources Division 1979).

5.1.1.3 Surficial Geology

This subsection identifies the surficial deposits that may be encountered within trench depth along the proposed route. Characteristics of the surficial deposits are related to potential concerns such as compaction and rutting, trench instability, erosion hazard and steep topography.

Surficial deposits encountered along the proposed pipeline route are mainly distal glaciofluvial sediments which consist of fine sand, minor gravel, thin silt and clay interbeds, up to 75 m thick. These sediments formed on subaqueous outwash fans deposited in glacial Lake Agassiz by meltwater turbidity currents (Manitoba Department of Energy and Mines 1981).

The proposed route does not encounter any areas of permafrost or ground instability such as earthquake-prone or landslide-prone areas (NRC 2011b, c, d).

5.1.1.4 Climate

This section describes the climatic setting along the proposed route. The climate in the region of the route is characterized by short, warm summers and cold winters with annual precipitation (rainfall and snowfall) range of 467.2 mm to 473.3 mm (Environment Canada 2011a). There are no historical records of flooding along the proposed route (NRC 2011e). Average snow fall for the proposed route was highest in December and January. The mean May to September temperature along the proposed route is 11.4°C to 19.4°C (Table 5.1).

TABLE 5.1 SNOWFALL, RAINFALL AND TEMPERATURE AVERAGES (1971-2000) FOR MANITOBA

Station Location	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
AVERAGE RAINFALL (mm)													
Brandon	0.2	0.7	5.1	20.1	50.1	74.4	75.8	69.2	49.9	22.2	4.2	1.2	373.1
Pierson	0.3	0.5	4.7	21.3	52.9	76.8	67.6	51.8	46.7	24.1	5.3	0.8	352.7
Souris	0.6	1.6	8.2	17.2	57.8	87.1	77.8	57.2	44.4	29.6	7	0.9	389.4
Virден	0.2	0.5	6.9	17.2	46.1	77.2	66.1	61	49.2	23.1	4.9	1.3	353.5
AVERAGE SNOWFALL (cm)													
Brandon	22.1	15.6	18.1	10.7	2.7	0	0	0	0.3	5.8	15.9	21	112
Pierson	23.2	17.5	17.2	10.2	1.8	0	0	0	0.1	8.2	17.5	21	116.6
Souris	23	17.6	19.3	11.1	3.3	0	0	0	0.4	8.7	20.7	22.2	126.1
Virден	22.4	17.2	20.3	13.3	3.5	0	0	0	0.6	8	17.9	21.7	124.9
AVERAGE DAILY TEMPERATURES (°C)													
Brandon	-18	-13.8	-6.4	3.5	11.4	16.1	18.4	17.5	11.4	4.4	-6.1	-14.9	1.9
Pierson	-15.9	-11.5	-4.7	4.7	12.3	17	19.4	18.6	12.6	5.4	-4.8	-13	3.3
Souris	-16	-12.5	-5.3	4.3	11.5	16.3	18.4	18	11.7	4.5	-6.2	-14.2	2.5
Virден	-16.7	-12.2	-5.3	4.2	11.9	16.6	19	18	11.9	5.2	-5.1	-13.7	2.8

Source: Environment Canada 2011a.

5.1.2 Soil Capability

This subsection presents a summary of published soil surveys and identifies the soil types that are encountered along the proposed pipeline route. A soils assessment was conducted for the proposed route during the spring/summer of 2011. Project-related effects and mitigation are presented in Section 6.2.2 of this EA.

5.1.2.1 Soil Characteristics

In total, a soil complex of 34 soil series have been mapped along the proposed route (Figure 5.1). A summary of the soil types crossed by the proposed route are presented in Table 5.2 and Appendix 5B of this ESA.

Gleyed Rego Black Chernozemic soils are the dominant soils along the proposed route. Underlying parent material along the proposed route is mainly lacustrine over till. Description of soil profile for the 34 soil series is provided in Appendix 5B (Manitoba Agriculture, Food and Rural Initiatives 2011; Manitoba Agriculture, Food and Rural Initiatives 2006).

The quality of soil along the proposed pipeline route is varied. The CLI (1966) has rated the soils as ranging from having no limitations (Class 1) to very severe (Class 5 and Class 6) limitations to agriculture (see Table 5.2).

TABLE 5.2 SUMMARY OF CHARACTERISTICS OF SOILS ALONG THE PROPOSED PIPELINE ROUTE

Route Legal Location	Soil Code	Soil Series	Soil Type	Dominant Texture	Drainage Class	Top Soil Depth (cm)	Current Land Use	Agricultural Capability Class (CLI 1966) **
NE-21-1-25 WPM	HRY	Hartney	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam	imperfect	15	cultivated	2W
NW-21-1-25 WPM	MOT	Montgomery	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	imperfect	15	cultivated	2W
NE-20-1-25 WPM	HRY	Hartney	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam	imperfect	15	cultivated	2W
NE-20-1-25 WPM	EBL	Emblem	Rego Humic Gleysol	very fine sandy loam, silt loam	poor	25	wetland	5W
NE-20-1-25 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	12	cultivated	2X
NW-20-1-25 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	15	cultivated	2X
NW-20-1-25 WPM	EBL	Emblem	Rego Humic Gleysol	very fine sandy loam, silt loam	poor	20	wetland	5W
NE-19-1-25 WPM	RYS	Ryerson	Orthic Black Chernozem	gritty clay loam, silty clay loam	well	10	cultivated	2X
NE-19-1-25 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	20	cultivated	2X
NW-19-1-25 WPM	TWC	Two Creeks	Gleyed Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	imperfect	10-20	cultivated	2W
NE-24-1-26 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	13	cultivated	2X
NW-24-1-26 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	20	cultivated	2X
NW-24-1-26 WPM	MOT	Montgomery	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	imperfect	16	cultivated	2W
NW-24-1-26 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	12	cultivated	2X
NE-23-1-26 WPM	HRY	Hartney	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam	imperfect	10	cultivated	2W
NE-23-1-26 WPM	WSW	Wassewa	Rego Humic Gleysol	clay loam over gritty clay loam	poor	25	wetland	5W
NW-23-1-26 WPM	MAW	Maskawata	Rego Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	10	cultivated	2X
SE-27-1-26 WPM	ELV	Elva	Orthic Black Chernozem	clay loam, silty clay loam	well	15	cultivated	1
SE-27-1-26 WPM	PPT	Pipestone	Gleyed Rego Black Chernozem	silty clay, clay	imperfect	17	cultivated	2W
SW-27-1-26 WPM	PPT	Pipestone	Gleyed Rego Black Chernozem	silty clay, clay	imperfect	50	cultivated	2W
SW-27-1-26 WPM	CLL	Croll	Gleyed Rego Black Chernozem	clay loam over gritty clay loam	imperfect	12	cultivated	2W
SE-28-1-26 WPM	CLL	Croll	Gleyed Rego Black Chernozem	clay loam over gritty clay loam	imperfect	10	cultivated	2W
SE-28-1-26 WPM	TWC	Two Creeks	Gleyed Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	imperfect	20	cultivated	2W
SW-28-1-26 WPM	MAW	Maskawata	Rego Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	10	cultivated	2X
SW-28-1-26 WPM	BOW	Bower	Gleyed Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	imperfect	20	cultivated	2M
SE-29-1-26 WPM	ELV	Elva	Orthic Black Chernozem	clay loam, silty clay loam	well	10	cultivated	1
NE-20-1-26 WPM	RYS	Ryerson	Orthic Black Chernozem	gritty clay loam, silty clay loam	well	10	cultivated	2X
NW-20-1-26 WPM	NWS	Newstead	Orthic Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	well	12	pasture	3M
NW-20-1-26 WPM	\$ER	Eroded slopes	Orthic Regosol	gritty clay loam	well	10	native prairie	6TE
NW-20-1-26 WPM	NEI	Neelin	Gleyed Cumulic Regosol	clay loam, clay	imperfect	40	native prairie	3I
NW-20-1-26 WPM	LYT	Lyleton	Orthic Black Chernozem	very fine sand, fine sandy loam	well	20	native prairie	3M
NW-20-1-26 WPM	CHF	Chesterfield	Gleyed Black Solonetz	sandy clay loam, clay	imperfect	10	native prairie	4D
NE-19-1-26 WPM	LNA	Lena	Rego Humic Gleysol	sandy clay loam, clay	poor	10	native prairie	5W
SW-30-1-26 WPM	\$ER	Eroded slopes	Orthic Regosol	gritty clay loam	well	10	native prairie	6TE
SW-30-1-26 WPM	NWS	Newstead	Orthic Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	well	10-15	native prairie	3M

TABLE 5.2 SUMMARY OF CHARACTERISTICS OF SOILS ALONG THE PROPOSED PIPELINE ROUTE (CONT'D)

Route Legal Location	Soil Code	Soil Series	Soil Type	Dominant Texture	Drainage Class	Top Soil Depth (cm)	Current Land Use	Agricultural Capability Class (CLI 1966) **
SE-25-1-27 WPM	RYS	Ryerson	Orthic Black Chernozem	gritty clay loam, silty clay loam	well	15	cultivated	2X
SE-25-1-27 WPM	CLL	Croll	Gleyed Rego Black Chernozem	clay loam over gritty clay loam	imperfect	25	cultivated	2W
SW-25-1-27 WPM	AXD	Alexander	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	imperfect	20	cultivated	2M
SW-25-1-27 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	20	cultivated	2X
SE-26-1-27 WPM	HHY	Hathaway	Rego Black Chernozem	gritty clay loam, silty clay loam	well	10	hay	2X
SE-26-1-27 WPM	WSW	Wassewa	Rego Humic Gleysol	clay loam over gritty clay loam	poor	20	wetland	5W
SE-26-1-27 WPM	MAW	Maskawata	Rego Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	15	hay	2X
SE-26-1-27 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	12	hay	2X
SW-26-1-27 WPM	NWS	Newstead	Orthic Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	well	11	cultivated	3M
SW-26-1-27 WPM	AXD	Alexander	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	imperfect	10	cultivated	2M
SW-26-1-27 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	11	cultivated	2X
SW-26-1-27 WPM	TWC	Two Creeks	Gleyed Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	imperfect	15	cultivated	2W
NW-26-1-27 WPM	TWC	Two Creeks	Gleyed Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	14	cultivated	2W
NW-26-1-27 WPM	NWS	Newstead	Orthic Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	well	10	cultivated	3M
SW-35-1-27 WPM	NWS	Newstead	Orthic Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	well	8	cultivated	3M
SW-35-1-27 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	15	cultivated	2X
NW-35-1-27 WPM	RYS	Ryerson	Orthic Black Chernozem	gritty clay loam, silty clay loam	well	15	cultivated	2X
NW-35-1-27 WPM	AXD	Alexander	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	imperfect	15	cultivated	2M
SW-2-2-27 WPM	BOW	Bower	Gleyed Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	imperfect	10	hay	2M
SE-3-2-27 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	15	cultivated	2X
SE-3-2-27 WPM	\$ER	Eroded slopes	Orthic Regosol	gritty clay loam	well	5	pasture	6TE
SE-3-2-27 WPM	LIG	Liege	Gleyed Cumulic Regosol	very fine sandy loam, silt loam	imperfect	10	hay	3I
SW-3-2-27 WPM	CSE	Coatstone	Gleyed Rego Black Chernozem	gritty clay loam, silty clay loam	imperfect	20	cultivated	2W
SW-3-2-27 WPM	AHW	Ashdown	Gleyed Black Chernozem	fine sand, loamy fine sand over gritty clay loam	imperfect	17	cultivated	2M
SE-4-2-27 WPM	BEL	Bella Lake	Rego Humic Gleysol	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	poor	20	wetland	5W
SE-4-2-27 WPM	WKD	Waskada	Orthic Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	well	20	cultivated	2X
SW-4-2-27 WPM	NWS	Newstead	Orthic Black Chernozem	very fine sandy loam, silt loam over sand & gravel over gritty clay loam	well	13	cultivated	3M
SW-4-2-27 WPM	MNH	Mentieth	Gleyed Rego Black Chernozem	very fine sand, fine sandy loam over gritty clay loam	imperfect	30	cultivated	2M

TABLE 5.2 SUMMARY OF CHARACTERISTICS OF SOILS ALONG THE PROPOSED PIPELINE ROUTE (CONT'D)

Route Legal Location	Soil Code	Soil Series	Soil Type	Dominant Texture	Drainage Class	Top Soil Depth (cm)	Current Land Use	Agricultural Capability Class (CLI 1966) **
SE-5-2-27 WPM	LUD	Lauder	Gleyed Black Chernozem	fine sand, loamy fine sand	imperfect	30	cultivated	3MW
SE-5-2-27 WPM	AHY	Ashbury	Gleyed Black Chernozem	very fine sand, fine sandy loam over gritty clay loam	imperfect	20	cultivated	2M
SW-5-2-27 WPM	STU	Stanton	Orthic Black Chernozem	fine sand, loamy fine sand	well	30	cultivated	4M
SW-5-2-27 WPM	HRY	Hartney	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam	imperfect	25	cultivated	2W
SE-6-2-27 WPM	MOT	Montgomery	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	imperfect	10	cultivated	2W
SE-6-2-27 WPM	CDW	Cauldwell	Gleyed Rego Black Chernozem	very fine sand, fine sandy loam over sand & gravel over gritty clay loam	imperfect	10	cultivated	3M
SW-6-2-27 WPM	GPE	Gopher	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam over sand & gravel	imperfect	15	cultivated	3M
SW-6-2-27 WPM	BED	Bede	Orthic Black Chernozem	sand and gravel	well-rapid	35	cultivated	5M
SE-1-2-28 WPM	NPK	Napinka	Gleyed Rego Black Chernozem	sand and gravel	imperfect	20	cultivated	4M
SW-1-2-28 WPM	CRG	Carniege	Gleyed Rego Black Chernozem	fine sand, loamy fine sand over sand & gravel over gritty clay loam	imperfect	15	cultivated	3M
SW-1-2-28 WPM	MOT	Montgomery	Gleyed Rego Black Chernozem	very fine sandy loam, silt loam over gritty clay loam	imperfect	20	cultivated	2W
SW-1-2-28 WPM	CDW	Cauldwell	Gleyed Rego Black Chernozem	very fine sand, fine sandy loam over sand & gravel over gritty clay loam	imperfect	12	cultivated	3M

** Source: CLI 1966.

Land Capability Class Descriptions for Agriculture: The classes indicate the degree of limitation imposed by the soil in its use for mechanized agriculture. The subclasses indicate the kinds of limitations that individually or in combination with others, are affecting agricultural land use.

Class Description

- 1 Soils in this class have no significant limitations in use for crops.
- 2 Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.
- 3 Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.
- 4 Soils in this class have severe limitations that restrict the range of crops or require special conservation practices.
- 5 Soils in this class have very severe limitations that restrict their capability in producing perennial forage crops, and improvement practices are feasible.
- 6 Soils in this class are capable only of producing perennial forage crops, and improvement practices are not feasible.

Agricultural Capability Subclass Limitations

- D = Undesirable soil structure and/or low permeability
- E = Erosion
- I = Inundation by streams or lakes
- M = Moisture limitation
- T = Topography
- W = Excess water
- X = Cumulative minor adverse characteristics

Manitoba Agricultural Services Corporation (2011a, b, c) has placed the soils along the proposed route into six of ten classes (A to J) by comparing ten-year average crop yields to those of benchmark soils (see Table 5.3 of this EA). Soils having the highest yields are classed as A and the lowest yielding soils are rated as J. The productivity rating incorporates land productivity concepts including climate, soil texture, depth of topsoil, organic matter, drainage, salinity, topography and erosion. This soil productivity rating system is considered to provide a more detailed account of agricultural capability of the soils encountered along the route than the CLI classification.

TABLE 5.3 SOIL PRODUCTIVITY RATINGS ALONG THE PROPOSED PIPELINE ROUTE

Route Legal Location	Soil Rating*	Municipal Government
NE-21-1-25 WPM	E ₂	RM of Brenda
NW-21-1-25 WPM	E ₂	RM of Brenda
NE-20-1-25 WPM	E ₂	RM of Brenda
NW-20-1-25 WPM	E ₂	RM of Brenda
NE-19-1-25 WPM	E ₂	RM of Brenda
NW-19-1-25 WPM	E ₂	RM of Brenda
NE-24-1-26 WPM	E ₂	RM of Arthur
NW-24-1-26 WPM	E ₂	RM of Arthur
NE-23-1-26 WPM	E ₂	RM of Arthur
NW-23-1-26 WPM	E ₂	RM of Arthur
SW-27-1-26 WPM	D ₂	RM of Arthur
SE-28-1-26 WPM	E ₂	RM of Arthur
SW-28-1-26 WPM	E ₂	RM of Arthur
SE-29-1-26 WPM	E ₂	RM of Arthur
NE-20-1-26 WPM	E ₂	RM of Arthur
NW-20-1-26 WPM	E ₂	RM of Arthur
NE-19-1-26 WPM	J ₁	RM of Arthur
SW-30-1-26 WPM	H ₁	RM of Arthur
SE-25-1-27 WPM	G ₁	RM of Arthur
SW-25-1-27 WPM	G ₁	RM of Arthur
SE-26-1-27 WPM	G ₁	RM of Arthur
SW-26-1-27 WPM	G ₁	RM of Arthur
NW-26-1-27 WPM	G ₁	RM of Arthur
SW-35-1-27 WPM	G ₁	RM of Arthur
NW-35-1-27 WPM	G ₁	RM of Arthur
SW-2-2-27 WPM	E ₁	RM of Arthur
SE-3-2-27 WPM	E ₁	RM of Arthur
SW-3-2-27 WPM	H ₁	RM of Arthur
SE-4-2-27 WPM	G ₁	RM of Arthur
SW-4-2-27 WPM	G ₁	RM of Arthur
SE-5-2-27 WPM	G ₁	RM of Arthur
SW-5-2-27 WPM	I ₁	RM of Arthur
SE-6-2-27 WPM	I ₁	RM of Arthur
SW-6-2-27 WPM	I ₁	RM of Arthur
SE-1-2-28 WPM	I ₁	RM of Edward
SW-1-2-28 WPM	I ₁	RM of Edward

Sources: Manitoba Agricultural Services Corporation 2011a, b, c.

Note: * 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. Numbers denote Risk Areas, which place areas with similar soils and/or climate into a common group. An "I" soil in Risk Area 3 may not have the same productivity as an "I" soil in Risk Area 4.

5.1.3 Water Quality and Quantity

This subsection presents a summary of the findings related to water quality and quantity and describes the hydrological resources and related contaminants of concern along the proposed route. Where warranted, this information was supplemented with materials listed in Section 5.4 of this EA. Potential pipeline construction-related effects and mitigation are presented in Section 6.2.3 of this EA.

5.1.3.1 Surface Water

The proposed pipeline route is located in the Souris River watershed of the Assiniboine River drainage basin (Manitoba Agriculture, Food and Rural Initiatives 2011).

The Assiniboine River basin covers an area of 17,300 km² (Saskatchewan Watershed Authority (SWA) 2006). The headwaters of the Assiniboine River are about 50 km northwest of Preeceville in the Porcupine Hills. The Whitesand River originates in the Beaver Hills northwest of Yorkton, Saskatchewan and joins the Assiniboine River near Kamsack. The Assiniboine River continues southeast for another 45 km before entering Lake of the Prairies near the Manitoba border (SWA 2006).

A total of two watercourses with defined bed and banks (Souris River and Antler River) will be crossed by the proposed pipeline route. As all watercourses will be bored, no fish or fish habitat assessments were conducted. There are no designated or nominated Canadian Heritage Rivers crossed by the proposed pipeline route (Canadian Heritage Rivers System 2011).

5.1.3.2 Water Quality

Surface water quality for watercourses crossed by the proposed route is publicly available for the Souris River and the Antler River. The Souris River water quality monitoring station WQ0371 is located in the town of Souris. Total nitrogen (TN) and total phosphorous (TP) data for the trend analysis were obtained from 1978 to 1997 (the site was not sampled beyond 1997). Flow data for the analysis of the TN and TP data were provided by hydrometric station MB05NG021, which is located in the immediate vicinity of WQ0371. The analysis results showed that there was a substantial trend of increasing TN concentrations at the site from 1978 to 1997. No significant trend in the TP concentrations was found (Jones and Armstrong 2001).

The mean daily sediment loads (tonnes) for the Souris River recorded between 1980 and 1994 have ranged from a sediment load less than 0.0001 tonnes in January 1990 to a high sediment load of 1740.07 tonnes in April 1983 (Environment Canada 2011b).

Total nitrogen and total phosphorous data for the Antler River were not reported. The mean daily sediment loads (tonnes) for the Antler River recorded between 1976 and 1987 have ranged from a sediment load less than 0.0001 tonnes in January 1990 to a high sediment load of 1740.07 tonnes in April 1983 (Environment Canada 2011b).

5.1.3.3 Groundwater

Groundwater movement in Manitoba is predominantly from west to east with discharge occurring in the outcrop area beneath Lake Winnipeg. A large area of anomalously high head is found in extreme southwestern Manitoba, creating a local northerly component to groundwater movement in this area. Fresh water recharge to the aquifer occurs in southeastern Manitoba where the outcrop area underlies a series of upland moraines. Groundwater movement is to the west and northwest from this recharge area. Westward moving recharge is eventually deflected northward along a fresh water-saline water boundary and migrates toward Lake Winnipeg (Betcher et al. 1995).

No bedrock aquifers are encountered at less than 150 m depths (Manitoba Conservation 1986a) along the proposed pipeline route.

The proposed pipeline route traverses lands within the Souris River aquifer. In any case, there are no mitigation recommendations within this aquifer management plan which apply to pipeline construction.

A search of Manitoba Water Stewardship's database of water well drilling records will be conducted prior to construction to determine water wells in the quarter-sections crossed by the proposed route. A detailed listing of springs within Manitoba is not publicly available.

Sand and gravel aquifers along the proposed pipeline route are very few widely scattered minor sand and gravel aquifers. Bedrock is at or near the ground surface or surficial deposits consist mainly of low permeability materials e.g., clay and till (Manitoba Conservation 1986b).

5.1.4 Greenhouse Gases and Air Quality

This subsection addresses air quality concerns in the Local Study Area (LSA) and Regional Study Area (RSA) defined below. For discussion on potential impacts and mitigation pertaining to air quality refer to Section 6.2.4 of this EA.

The LSA consists of the area which could potentially be affected by construction and reclamation activities as well as associated works and activities beyond the Footprint area. The local boundary varies with the discipline and issue being considered (e.g., for assessment of the effects of noise on wildlife, the area affected by noise (i.e., 2 km buffer) from the source is included in this boundary).

The RSA consists of the area extending beyond the LSA boundary. The boundary for the regional area also varies with the discipline and the issue being considered (e.g., for socio-economic analysis, regional boundaries include large communities that will be used as construction offices or regional MD boundaries).

The proposed route is located in an area that is relatively protected from industrial and commercial development. This contributes to the high baseline air quality found in the RSA. Air quality in the LSA is primarily a function of anthropogenic sources of emissions. Substance release sources in the LSA, include emissions from vehicle traffic and rail traffic as well as agriculture and industrial activities.

Potential sources of emissions from vehicle traffic are identified in Table 5.14 of Section 5.1.16.1 of this EA. Emissions will result from pipeline construction equipment and traffic during the construction phase, however, an increase in airborne emissions will not occur during operations or maintenance. Potential receptors to nuisance air emissions in the LSA include local residences and communities. Locations of these communities are identified in Table 5.13 of Section 5.1.11 of this EA.

5.1.5 Acoustic Environment

This subsection examines the acoustic environment in the LSA. Noise generated by the operation of the pipelines is undetectable and is not anticipated to contribute to the background noise levels in the vicinity of the pipelines. As a result, this subsection focuses on noise generated by construction activities. Potential impacts and mitigation pertaining to the acoustic environment are discussed in Section 6.2.5 of this EA.

Background noise in the LSA is primarily caused by vehicle traffic identified in Table 5.14 of Section 5.1.16.1 of this EA. Potential receptors to nuisance noise emissions include local residences and communities. Locations of these communities are identified in Table 5.13 of Section 5.1.11 of this EA. An elevated level of noise will result from equipment and traffic during construction of the proposed pipelines. However, an increase in noise levels over existing levels will not occur during operations.

5.1.6 Fish and Fish Habitat

A total of two watercourses with defined bed and banks (Souris River and Antler River) will be crossed by the proposed pipelines. As all watercourses will be bored, no fish or fish habitat assessments were conducted.

Additional information on water bodies along the route is provided in Section 5.1.3 of this EA. Potential impacts arising from the construction of the proposed pipelines and mitigation pertaining to fish and fish habitat are discussed in Section 6.2.6 of this EA.

Bellhole excavation for boring activities will be conducted outside of the riparian zone of all watercourses, therefore disturbance to fish or fish habitat will be avoided. Pre-construction site assessments will be conducted on both sides of each watercourse crossing where bell excavation will be required. In addition, photographic records of proposed water crossings of the proposed route will be provided.

Table 5.4 of this EA provides a summary of the watercourses that will be crossed by the proposed pipeline route.

TABLE 5.4 WATERCOURSES CROSSED BY THE PROPOSED PIPELINE ROUTE

Watercourse	Legal Location
Natural Drainage (Dry)	NW-21-01-25 WPM
Natural Drainage (Dry)	NW-21-01-25 WPM
Natural Drainage (Dry)	NE-19-01-25 WPM
Natural Drainage (Dry)	NW-24-01-26 WPM
Natural Drainage (Dry)	NE-23-01-26 WPM
Natural Drainage dry	SE-28-01-26 WPM
Natural Drainage dry	SW-28-01-26 WPM
Souris River	Between NE-19 & SE-30-01-26 WPM
Antler River	SE-03-02-27 WPM
Natural Drainage dry	SE-05-02-27 WPM

5.1.7 Wetlands

This subsection presents a summary of the wetlands identified along the proposed pipeline route. Potential effects on wetlands related to the construction and operation of the proposed pipelines are presented in Section 6.2.7 of this EA.

The proposed route traverses the Continental Prairie Wetland Region where common wetlands are marshes and shallow waters, usually in association with shallow basin, kettle or shore water. The climate is semi-arid with cold winters and hot summers (Government of Canada 1986). This wetland region represents an area within which similar characteristic wetlands develop in locations that have similar topography, hydrology and nutrient regimes, thereby resulting in wetland habitat.

The Continental Prairie Wetland Region is also referred to as the Prairie Pothole Region. The wetlands in this region were formed by glacial action during the Pleistocene. This region, because of the numerous shallow lakes and marshes, the rich soils, and the warm summers, is described as being one of the most important wetland regions in the world (Weller 1981). It is estimated that 50-75% of all North American waterfowl, in any given year, come from this region (Leitch and Danielson 1979). In addition, the greatest threat to the health of the region results from ongoing draining or altering of prairie potholes for agricultural reasons (Leitch 1981).

Most of the wetland habitat in the RSA is low-lying prairie and wet meadow where wet conditions persist at times of high-water (*i.e.*, in the spring or during wet years). Wetland areas were identified as per Stewart and Kantrud (1971) during the route selection process.

Wetlands were avoided as a result of routing criteria (*e.g.*, avoidance of wetlands, minimizing impact) for the proposed pipeline route.

The proposed pipeline route is not proximal to any named lakes, Important Bird areas or NAWMP priority areas.

5.1.8 Vegetation

This subsection presents a summary of the findings related to ecosystem classification, non-native and invasive species as well as rare vascular plants and communities. Potential Project-related impacts and mitigation pertaining to vegetation are discussed in Section 6.2.8 of this EA.

5.1.8.1 Ecosystem Classification

The proposed pipeline route is located in the Aspen Parkland Ecoregion of Canada (Environment Canada 2011c). The Aspen Parkland Ecoregion extends in a broad arc from southwestern Manitoba, north and west through Saskatchewan to its northernmost point in central Alberta. This ecoregion is a transitional area between the boreal forest to the north and the grasslands to the south. Most of the ecoregion is now farmland. In its native state, the landscape was characterized by trembling aspen, oak groves, mixed tall shrubs and intermittent fescue grasslands. Open stands of trembling aspen and shrubs occur on most sites, and bur oak and grassland communities occupy increasingly drier sites on loamy Black Chernozemic soils. Poorly-drained, Gleysolic soils support willow and sedge species (Environment Canada 2011c).

The majority of the proposed pipeline route is located on cultivated land. Non-cultivated portions of the proposed pipeline route are summarized in Table 5.5.

TABLE 5.5 NON-CULTIVATED LANDS ALONG THE PROPOSED PIPELINE ROUTE

LOCATION (WPM)	LAND TYPE
NE-30-01-26 WPM (east bank Souris River)	Native pasture
Portion of SE & SW-30-01-26 WPM (west bank Souris River)	Native pasture
SW-25-01-27 WPM	Hayland/Native pasture
NW 20-01-26 WPM (east bank Souris River)	Native pasture
Between Sections 19 and 30 -01-26 WPM (east bank Souris River)	Undeveloped road allowance; native prairie
Between Sections 20 and 29 -01-26 WPM (east bank Souris River)	Undeveloped road allowance; native prairie
NW-20-01-26 WPM (east bank Souris River)	Native pasture
NE-19-01-26 WPM (east bank Souris River)	Native pasture
NW-19-01-26 WPM (west bank Souris River)	Native pasture
SE-26-1-27 WPM	Wetland

5.1.8.2 Non-native and Invasive Species

Vegetation surveys in non-cultivated areas along the proposed pipeline route were conducted in spring/summer 2011 (Table 5.5). A list of vegetation species observed in non-cultivated areas is provided in Appendix 5C. A list of vegetation species with potential to occur in the project area is provided in Appendix 5D. A weed survey was conducted concurrently along the entire route. The results of the weed survey are provided in Appendix 5E.

Weeds of management concern listed in the Manitoba *Noxious Weeds Act* and *Noxious Weeds Regulation* were reviewed prior to the 2011 vegetation reconnaissance. The Regulation states that Noxious weeds and Noxious weed seeds must be destroyed. Introduced species encountered during the

survey were also noted. Although these species have no designation under the Manitoba *Noxious Weeds Act* or *Noxious Weeds Regulation*, the density of the infestation or the invasive nature of the plant may warrant mitigation.

Municipal agricultural weed specialists in the Project area were contacted to determine certain weed species of management concern in the project area. Potential weed species in the Project area are included in Appendix 5E.

Weed species observed along the proposed route varied with current land use. Annual weeds were encountered mainly on cropland with abundance at shore and around wetlands, and in low areas. Perennial weeds were observed mostly on tame hayland, improved pasture, native pasture and around wetlands.

A total of 98 weed species were observed during the summer 2011 weed survey (Appendix 5E). Leafy spurge, Canada thistle, foxtail barley and kochia were identified by the municipal agricultural weed specialists as weeds of concern along the proposed pipeline route. Other noted weeds of concern along the pipeline route included leafy spurge, creeping thistle, perennial sow-thistle, common tansy, cleavers, kochia, and burdock species.

5.1.8.3 Rare Vascular Plants

A vegetation reconnaissance was conducted along non-cultivated segments (Table 5.5) of the proposed pipeline route in the spring/summer of 2011. Early season surveys were conducted between June 27 and 29, 2011. Late season surveys were conducted between August 4 and 9, August 27 and 28, between September 15 and 16 and between October 1 and 2, 2011.

Prior to the field assessment, a literature review was conducted to identify rare plant species and plant communities with potential to occur in the project area (Appendix 5D). Tables of potential rare vascular plant species and rare plant communities were produced using data available from the Manitoba Conservation Data Centre (MB CDC).

The MB CDC provides tables of rare species and plant communities by ecoregion (MB CDC 2011a). The MB CDC data were supplemented with range information based on the distribution maps in *The Rare Vascular Plants of Manitoba* and the published volumes of the Flora of North America (FNA) (White and Johnson 1980, FNA Editorial Committee 1993+). Vascular plant species of special conservation status within the vicinity of the proposed pipeline route, their habitat as well as federal and provincial status are listed in Appendix 5D.

The proposed pipeline route lies within the range and potentially provides preferred habitat for 6 listed plant Species at Risk under Schedule 1 of SARA (Environment Canada 2011d): rough purple false-foxglove (Endangered); hairy (silky) prairie-clover (Threatened); Buffalo grass (Threatened); western spiderwort (Threatened); small white lady's-slipper (Endangered) and smooth goosefoot (Special Concern) (COSEWIC 2011). The MB CDC has records of at least 12 rare plant species occurring within 1 km of the proposed route (see Table 5.6 of this EA).

TABLE 5.6 RARE PLANT SPECIES RECORDED BY MANITOBA CONSERVATION DATA CENTRE WITHIN 1 KM OF THE PROPOSED PIPELINE ROUTE

COMMON NAME	SCIENTIFIC NAME	G/S RANK	MB EA	COSEWIC	SARA
Cushion Milkvetch	<i>Astragalus gilviflorus</i>	G5/S1	- (*)	-	-
Narrow-leaved Milkvetch	<i>Astragalus pectinatus</i>	G5/S2S3	-	-	-
Buffalograss	<i>Buchloe dactyloides</i>	G4G5/S1	Threatened	Threatened	Threatened Schedule 1
Hall's Sedge	<i>Carex hallii</i>	G4?Q/S3	-	-	-
Plains Rough Fescue	<i>Festuca hallii</i>	G4/S3	-	-	-
Yellow Stargrass	<i>Hypoxis hirsuta</i>	G5/S4	-	-	-
Turion Duckweed	<i>Lemna turionifera</i>	G5/SU	-	-	-
White-flowered Parsley	<i>Lomatium orientale</i>	G5/S1	-	-	-
Tall Lungwort	<i>Mertensia lanceolata</i>	G5/S2	-	-	-
Green Needle Grass	<i>Nassella viridula</i>	G5/S3	-	-	-
Slender Beard-tongue	<i>Penstemon procerus</i>	G5/S1?	-	-	-
Golden Bean	<i>Thermopsis rhombifolia</i>	G5/S2	-	-	-

Source: MB CDC 2011b.

Note: Provincial ranks are defined in the footnotes of Appendix 5D of this EA.

(*) "-" = not listed

No MB CDC-listed rare plant communities were recorded along surveyed segments of the proposed pipeline route. Table 5.7 presents rare plant species identified along the proposed pipeline route during the field surveys in spring and summer 2011. Identified Buffalograss individuals were avoided by re-routing the proposed pipeline at the Souris River crossing location. A summary of vascular plant species observed along the proposed pipeline route are provided in Appendix 5C.

TABLE 5.7 RARE PLANT SPECIES (RANK S1 TO S3) IDENTIFIED ALONG THE PROPOSED PIPELINE ROUTE DURING VEGETATION SURVEYS IN SPRING AND SUMMER 2011

SPECIES	Common Name	S RANK	LEGAL DESCRIPTION (WPM)
<i>Buchloë dactyloides</i>	Buffalograss	S1	NE 30-1-26 (E bank of Souris River) SW 29-1-26 (E bank of Souris River) NW 20-1-26 (E bank of Souris River) NE 19-1-26 (E bank of Souris River)
<i>Bouteloua curtipendula</i>	Side-oats grama	S2	NW-19-1-26 (W bank of Souris River)
<i>Polygala verticillata</i>	Whorled milkwort	S2	NW-19-1-26 (W bank of Souris River)
<i>Thermopsis rhombifolia</i>	Golden bean	S2	NE 19-1-26 (E bank of Souris River)
<i>Nasella viridula</i>	Green Needle Grass	S3	NW-19-1-26 (W bank of Souris River)
<i>Linum rigidum</i>	Large-flowered yellow flax	S3	SW-29-1-26- (E bank of Souris River)
<i>Echinacea angustifolia</i>	Narrow-leaved purple coneflower	S3	SW-29-1-26 (E bank of Souris River) NW 20-1-26 (E bank of Souris River) NW-19-1-26 (W bank of Souris River) SW-30-1-26 (W bank of Souris River)
<i>Utricularia minor</i>	Lesser bladderwort	S3	SE-26-1-27
<i>Carex filifolia</i>	Thread-leaved sedge	S3/S4	NE 19-1-26 (E bank of Souris River)
<i>Lilium philadelphicum</i>	Prairie lily	S3/S4	SW-30-1-26 (W bank of Souris River)
<i>Onosmodium molle</i>	False gromwell	SU	SW-30-1-26 (W bank of Souris River)

5.1.9 Wildlife and Wildlife Habitat

This subsection identifies representative wildlife species and wildlife habitats that may be encountered in the vicinity of the proposed pipeline route. This information assists in identifying the potential need for special measures to be implemented during construction. These measures could include modifications to the construction schedule, access control, adjustments to the construction right-of-way width, visual screening, habitat restoration / replacement and others depending on the site-specific circumstance. Potential impacts and mitigation pertaining to wildlife are discussed in Section 6.2.9.

5.1.9.1 Wildlife Species and Habitat of Concern

The proposed pipeline route does not traverse any DU wetland projects or Manitoba Habitat Heritage Corporation (MHHC) Conservation Agreements (CAs).

The North American Waterfowl Management Plan has designated priority areas which are particularly important to waterfowl in Manitoba. None of the proposed pipeline route will be located within these priority areas. Some important areas are the small wetlands and their associated uplands which serve as valuable waterfowl breeding habitat.

The proposed route does not traverse any Wetlands of International Importance, Migratory Bird Sanctuaries or World Biosphere Reserves (Bureau of the Convention on Wetlands 2011, Environment Canada 2011e, UNESCO 2011).

During the breeding season, passerine diversity is high in the vicinity of the pipeline route. Species known to occur include: loggerhead shrike (western subspecies), grasshopper sparrow, chestnut-collared longspur, horned lark, European starling, flycatchers, blackbirds, meadow lark and Baird's sparrow. Burrowing owl and ferruginous hawk are two raptors known to breed in the region. The migratory bird restricted activity period for lands in the vicinity of the proposed pipeline route extends from April 1 to July 31.

The proposed route does not traverse any existing or currently proposed ecological reserves or wildlife management areas where there are restrictions on energy development.

The proposed pipeline route traverses migratory bird habitat subregions as defined by Poston et al. (1990) for burrowing owl and ferruginous hawk. Habitat subregions are landscape divisions based primarily on soils, however, there are also distinct on the basis of elevation, relief, landform, drainage and general substrate.

The proposed pipeline route lies within the range and potentially provides preferred habitat for eight listed Species at Risk under Schedule 1 of SARA (Environment Canada 2011d). A summary of mammals and birds identified within 1 km of the proposed pipeline right-of-way by the Manitoba Conservation Data Centre is provided in Table 5.8.

**TABLE 5.8
STATUS OF WILDLIFE SPECIES IDENTIFIED BY THE MANITOBA CONSERVATION DATA CENTER
WITHIN 1 KM OF THE PROPOSED PIPELINE ROUTE**

COMMON NAME	SCIENTIFIC NAME	G ² /S ¹ RANK	MB ESA ³	COSEWIC ⁴	SARA ⁵
Baird's Sparrow	<i>Ammodramus bairdii</i>	G4/S1S2B	Endangered	Not at Risk	not listed
Burrowing Owl	<i>Athene cunicularia</i>	G4/S1B	Endangered	Endangered	Endangered Schedule 1
Chestnut-collared Longspur	<i>Calcarius ornatus</i>	G5/S1S2	not listed	Threatened	No status
Ferruginous Hawk	<i>Buteo regalis</i>	G4/S2B	Threatened	Threatened	Special Concern Schedule 3
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	G5/S2B	not listed	Not at Risk	not listed
Great Plain Toad	<i>Anaxyrus cognatus</i>	G5/S2	Threatened	Special Concern	Special Concern Schedule 1
Horned Lark	<i>Eremophila alpestris</i>	G5T2/S3	not listed	not listed	not listed
Loggerhead Shrike	<i>Lanius ludovicianus excubitorides</i>	G4T4/S2B	Endangered	Threatened	Threatened Schedule 1
Sprague's Pipit	<i>Anthus spragueii</i>	G4/S2B	Threatened	Threatened	Threatened Schedule 1

Sources: MB CDC 2011b

Notes:

- Provincial (S) ranks are based solely on the species' status within the province, and range from 1 (5 or fewer occurrences) to 5 (demonstrably secure under present conditions) (NatureServe 2011).
 S1 = Critically Imperilled: because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation. Typically 5 or fewer occurrences or very few remaining individuals (<1,000).
 S2 = Imperilled: because of rarity or because of some factor(s) making it very vulnerable to extirpation. Typically 6-20 occurrences or few remaining individuals (1,000-3,000).
 S3 = Vulnerable: because rare and uncommon, or found in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21-100 occurrences or between 3,000 and 10,000 individuals.
 S4 = Apparently Secure: uncommon but not rare, and usually widespread in the province. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.
 S5 = Secure: common, widespread, and abundant in the province. Essentially ineradicable under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.
 S#S# = Range Rank: a numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the element.
 B = Breeding: basic rank refers to the breeding population of the element.
 NR = Not ranked.
 NA = Conservation Status Not Applicable (NatureServe 2011).
- Global (G) ranks are based on species status world-wide and follow a system parallel to that for Provincial Ranks (Note 1), ranging from 1 (5 or fewer occurrences) to 5 (demonstrably secure under present conditions). Only Global Ranks of concern (G1 to G3) or questionable ranks are displayed (NatureServe 2011).
- Manitoba *Endangered Species Act*
Endangered: any native Manitoba species that is threatened to disappear throughout all or most of its Manitoba range.
Threatened: any native Manitoba species likely to become endangered or at risk due to low or declining numbers in Manitoba if the factors affecting it do not improve.
- COSEWIC (2011). Species listed as 'Extirpated', 'Not at Risk' or 'Data Deficient' were generally not included in the table without other noteworthy factors being present.
Endangered: A species facing imminent extirpation or extinction.
Threatened: A species likely to become endangered if limiting factors are not reversed.

Special Concern: A species that is particularly sensitive to human activities or natural events, but is not an endangered or threatened species.

5. *Species At Risk Act.* The *Act* establishes Schedule 1 as the list of species to be protected on all federal lands in Canada. The *Act* also applies to all lands in Canada for Schedule 1 bird species cited in the *Migratory Birds Convention Act* and Schedule 1 aquatic species as determined by DFO

Endangered: a species that is facing imminent extirpation or extinction.

Threatened: a species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

Special Concern: a species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

Field investigations of wildlife and wildlife habitat along remnant native vegetation segments of the proposed pipeline route were conducted in June and July 2011. A systematic field investigation on foot was conducted to observe native habitats along and immediately adjacent to the proposed pipeline right-of-way. The proposed route was examined for the potential presence of wildlife habitats and features that may be limited and/or locally important to wildlife species of concern (e.g., snags, rock outcrops, burrows, dens, wildlife trees with cavities, stick nests, wetlands and watercourses, mineral licks, or other important features). No conflicts with wildlife Species at Risk dens, nests or other preferred habitat features were identified. All mammals, birds, amphibians and reptiles identified by sight, sound or sign were noted and identified. Table 5.9 presents wildlife species identified along the proposed pipeline route during the field surveys in June and July 2011.

TABLE 5.9 WILDLIFE SPECIES IDENTIFIED ALONG THE PROPOSED PIPELINE ROUTE DURING FIELD SURVEYS IN JUNE AND JULY 2011

COMMON NAME	SCIENTIFIC NAME	G ² /S ¹ RANK	MB ESA ³	COSEWIC ⁴	SARA ⁵
Birds					
Alder Flycatcher	<i>Empidonax alhorum</i>	G5/S5B	- (*)	-	-
American Avocet	<i>Recurvirostra americana</i>	G5/S4B	-	-	-
American Coot	<i>Fulica americana</i>	G5/S5B	-	Not at Risk	-
American Goldfinch	<i>Spinus tristis</i>	G5/S5B	-	-	-
Barn Swallow	<i>Hirundo rustica</i>	G5/S5B	-	Threatened	No status
Black tern	<i>Chlidonias niger</i>	G4/S3S4B	-	Not at Risk	-
Blue-winged Teal	<i>Anas discors</i>	G5/S5B	-	-	-
Bobolink	<i>Dolichonyx oryzivorus</i>	G5/S4B	-	Threatened	No status
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	G5/S5B	-	-	-
Brown-headed Cowbird	<i>Molothrus ater</i>	G5/S5B	-	-	-
Canvasback	<i>Aythya valisineria</i>	G5/S4B	-	-	-
Clay-Colored Sparrow	<i>Spizella pallida</i>	G5/S5B	-	-	-
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	G5/S5B	-	-	-
Common Grackle	<i>Quiscalus quiscula</i>	G5/S5B	-	-	-
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	G5/S4B	-	Not at Risk	-
Eastern Kingbird	<i>Tyrannus tyrannus</i>	G5/S5B	-	-	-
European Starling	<i>Sturnus vulgaris</i>	G5/SNA	-	-	-
Ferruginous Hawk	<i>Buteo regalis</i>	G4/S2B	Threatened	Threatened	Threatened Schedule 1
Gadwall	<i>Anas strepera</i>	G5/S5B	-	-	-
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	G5/S2S3B	-	-	-
Hooded Merganser	<i>Lophodytes cucullatus</i>	G5/S5B	-	-	-
Horned Lark	<i>Eremophila alpestris</i>	G5/S5B	-	-	-

TABLE 5.9 WILDLIFE SPECIES IDENTIFIED ALONG THE PROPOSED PIPELINE ROUTE DURING FIELD SURVEYS IN JUNE AND JULY 2011 (CONT'D)

COMMON NAME	SCIENTIFIC NAME	G ² /S ¹ RANK	MB ESA ³	COSEWIC ⁴	SARA ⁵
Killdeer	<i>Charadrius vociferus</i>	G5/S5B	-	-	-
Lark Sparrow	<i>Chondestes grammacus</i>	G5/S4B	-	-	-
Least Flycatchers	<i>Empidonax minimus</i>	G5/S5B	-	-	-
Lesser Scaup	<i>Aythya affinis</i>	G5/S5B	-	-	-
Mallard	<i>Anas platyrhynchos</i>	G5/S5B	-	-	-
Mourning Dove	<i>Zenaida macroura</i>	G5/S5B	-	-	-
Northern Flicker	<i>Colaptes auratus</i>	G5/S5B	-	-	-
Northern Harrier	<i>Circus cyaneus</i>	G5/S5B	-	Not at Risk	-
Northern Pintail	<i>Anas acuta</i>	G5/S4B	-	-	-
Northern Shoveler	<i>Anas clypeata</i>	G5/S5B	-	-	-
Pied-billed Grebe	<i>Podilymbus podiceps</i>	G5/S4S5B	-	-	-
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	G5/S5B	-	-	-
Ring-billed Gull	<i>Larus delawarensis</i>	G5/S5B	-	-	-
Savannah Sparrow	<i>Passerculus sandwichensis</i>	G5/S5B	-	-	-
Says's Phoebe	<i>Sayornis saya</i>	G5/S3B	-	-	-
Sedge Wren	<i>Cistothorus platensis</i>	G5/S5B	-	-	-
Semi-palmated Sandpiper	<i>Calidris pusilla</i>	G5/S4B	-	-	-
Song Sparrow	<i>Melospiza melodia</i>	G5/S5B	-	-	-
Sora	<i>Porzana carolina</i>	G5/S5B	-	-	-
Spotted Sandpiper	<i>Actitis macularius</i>	G5/S5B	-	-	-
Swainson's Hawk	<i>Buteo swainsoni</i>	G5/S3S4B	-	-	-
Swamp Sparrow	<i>Melospiza georgiana</i>	G5 /S5B	-	-	-
Tree Swallow	<i>Tachycineta bicolor</i>	G5/S5B	-	-	-
Upland Sandpiper	<i>Bartramia longicauda</i>	G5/S3S4B	-	-	-
Vesper Sparrow	<i>Pooecetes gramineus</i>	G5/S5B	-	-	-
Western Kingbird	<i>Tyrannus verticalis</i>	G5/S5B	-	-	-
Western Meadowlark	<i>Sturnella neglecta</i>	G5/S4S5B	-	-	-
Willet	<i>Tringa semipalmata</i>	G5/S4B	-	-	-
Wilson's Snipe	<i>Gallinago delicata</i>	G5/S5B	-	-	-
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	G5/S5B	-	-	-
Mammals					
Meadow Vole	<i>Microtus pennsylvanicus</i>	G5/S5	-	-	-
Pigmy Shrew	<i>Microsorex hayi</i>	G5/S5	-	-	-
Badger	<i>Taxidea taxus</i>	G5/S4	-	Not at risk	-
Richardson's Ground Squirrel	<i>Citellus richardsonii</i>	G5/S5	-	-	-
Coyote	<i>Canis latrans</i>	G5/S5	-	-	-
Amphibians					
Northern Leopard Frog	<i>Rana pipiens</i>	G5/S4	-	Special concern/ Not at risk (Eastern population, including Manitoba)	Special concern Schedule 1/ -
Canadian Toad	<i>Bufo americanus hemiophrys</i>	G4/S4S5	-	Not at risk	-
Boreal Chorus Frog	<i>Pseudacris triseriata</i>	G5/S5	-	-	-

TABLE 5.9 WILDLIFE SPECIES IDENTIFIED ALONG THE PROPOSED PIPELINE ROUTE DURING FIELD SURVEYS IN JUNE AND JULY 2011 (CONT'D)

COMMON NAME	SCIENTIFIC NAME	G ² /S ¹ RANK	MB ESA ³	COSEWIC ⁴	SARA ⁵
Invertebrates					
Monarch Butterfly	<i>Daaus plexippus</i>	G5/S5	-	Special concern	Special concern Schedule 1
Cabbage Butterfly	<i>Artogeia rapae</i>	G5/SNA	-	-	-

1, 2, 3, 4, 5: see Notes for Table 5.9.

(*) "-" = not listed.

5.1.9.2 Ecosystem Classification

The Aspen Parkland Ecoregion extends in a broad arc from southwestern Manitoba, northwest through Saskatchewan to its northern apex in central Alberta. The ecoregion is considered transitional between the boreal forest to the north and the grasslands to the south. Associated with the rougher hummocky glacial till, landscapes are numerous tree-ringed, small lakes, ponds and sloughs that provide important habitat for waterfowl. The ecoregion also provides a major breeding habitat for waterfowl and includes habitat for white-tailed deer, coyote, snowshoe hare, cottontail, red fox, northern pocket gopher, Franklin's ground squirrel, sharp-tailed grouse and black-billed magpie (Environment Canada 2011c).

5.1.9.3 Land Capability

Lands along the proposed pipeline route have been rated by the CLI (1970a) as having moderately severe (Class 5) to severe (Class 6) limitations to the production of ungulates. The proposed pipeline route avoided winter range habitat located in creek and river valleys.

Lands along the proposed pipeline route generally provide poor waterfowl habitat. Most of the lands have been rated by the CLI (1970b) as having moderate (Class 4) to severe (Class 6) limitations to the production of waterfowl due to the lack of or permanency of wetlands.

5.1.10 Species at Risk

This subsection identifies plant and animal species listed under Schedule 1 of SARA, whose range and habitat potentially occur along the proposed route. Recorded locations of species at risk occurrences in the vicinity of the proposed route were obtained through a Conservation Database search (MB CDC 2011b) and wildlife surveys conducted during previous construction projects in the area.

Lists of rare species and plant communities potentially occurring in the vicinity of the proposed route are presented in Appendix 5D of this EA.

Potential pipeline-related impacts and mitigation pertaining to the species at risk are discussed in Section 6.2.10 of this EA.

The proposed pipeline route is within the range and habitat of 14 SARA listed species at risk: loggerhead shrike *excubitorides* subspecies (Threatened); ferruginous hawk (Threatened); piping plover (Endangered); Sprague's pipit (Threatened); burrowing owl (Endangered); northern prairie skink (Endangered); common snapping turtle (Special Concern); monarch (Special Concern); rough purple false-foxglove (Endangered); hairy (silky) prairie-clover (Threatened); Buffalo grass (Threatened); western spiderwort (Threatened); small white lady's-slipper (Endangered) and smooth goosefoot (Special Concern) (COSEWIC 2011).

An overview of the above Schedule 1 listed SARA species is provided below.

5.1.10.1 Vascular Plant Species at Risk

There are six vascular plant SARA listed species whose ranges and habitats occur in the vicinity of the proposed route.

Rough Purple False-foxglove

The rough purple false-foxglove (*Agalinis aspera*) is of special status under SARA (Endangered), COSEWIC (Endangered) and in Manitoba (S1S2). It is a slender annual herb with narrow linear roughened leaves that are opposite to sub-opposite. Manitoba plants grow up to 35 cm tall and exhibit very little branching. Flowers are borne in a short raceme on stalks that are slender but nearly erect. Only one or two of the showy pink flowers are seen at a time because they only last for a day. The fruit is a dark brown oval-shaped capsule containing numerous tiny diamond-shaped seeds (Environment Canada 2011d). The species ranges through the central plains from Manitoba to Texas. The Canadian range is restricted to 11 known sites from five rural municipalities in southern Manitoba. The rough purple false-foxglove is a prairie species found in low wet meadows that are often at risk due to drainage or heavy grazing. This species occurs where vegetation is sparse and the soil is alkaline. The Canadian sites represent remnant prairie habitats found primarily along roadsides (Environment Canada 2011d).

Hairy Prairie-Clover

The hairy prairie-clover (*Dalea villosa* var. *villosa*) is of special status under SARA (Threatened), COSEWIC (Threatened) and in Manitoba (Threatened on the Manitoba *Endangered Species Act* and S2). This perennial species is found in the great plains from the Upper Peninsula of Michigan west to southcentral Saskatchewan and south to central Texas. In Canada, it seems to be confined to one site in Saskatchewan and two sites in southwestern Manitoba.

In Manitoba, the most successful population, in the Lauder Hills, is in the low thousands, while the other one, in Spruce Woods Provincial Park, has between 1,000-1,500 plants (Environment Canada 2011d). Canadian populations of this plant occur in the Mixed Grassland region, where they are restricted to the sand hill complex.

The species appears to be best adapted to active sand or sand hill blowouts, although it is also found on partially stabilized sand in dune slack areas. The region's climatic zone is characterized by low annual precipitation (30-40 cm), high evaporation rates and fast runoff. Two-thirds of the precipitation falls as rain in the spring. In Canada, the plants flower from late July to late August, setting seed in September (Environment Canada 2011d). Since the species requires at least partly active sand dunes to survive, it is threatened where dunes tend to stabilize.

Grazing and fires play an important role in the dynamics of dune systems and affect populations of the plant. More than two-thirds of the mixed grasslands have been destroyed by cultivation and further conversion of hairy prairie-clover habitat is a threat. In Spruce Woods Provincial Park, hairy prairie-clover habitat is interlaced with hiking trails, and hiking is not restricted to the trails. This type of pressure, which includes the use of all-terrain vehicles (ATVs) in the Dundurn Sand Hills, for example, is also detrimental (Environment Canada 2011d).

Buffalo Grass

Buffalo grass (*Buchloe dactyloides*) is of special status under SARA (Threatened), COSEWIC (Threatened), and in Manitoba (Threatened on the Manitoba *Endangered Species Act* and S1). This perennial species reaches the northernmost limit of its range in southeastern Saskatchewan (near Estevan) and southwestern Manitoba (near Coulter), along the Souris River Valley. South of the border the species extends south to south-central Mexico.

In Manitoba, where 90% of the Canadian Buffalo grass occurs, the single population represents about 4,800 clones and covers one hectare (Environment Canada 2011d). The proposed pipelines are not within the range of this plant. Buffalo grass is a grayish-green, curly-leaved grass that forms dense, matted sods. Male plants have slender, erect stems 6-12 cm high, bearing 1-3 short spikes about 1 cm long, consisting of two-flowered spikelets. The female plants have very short, often prostrate stems beneath the leaves, bearing tight clusters of one-flowered spikelets that form hard globular burs of 1-5 seeds. The plants can also reproduce by above-ground trailing stems (stolons) (Environment Canada 2011d).

Buffalo grass is not very tolerant to shade, and is seemingly dependant on clay or clay-loam substrate; early season moisture with subsequent drying; moderate erosion, or cattle-trampling and grazing; and no competition from other mixed-grass prairie species. It begins growth in mid-spring and flowers in summer, setting seed soon thereafter. The heavy toothed burs are more effectively dispersed by ungulates and water than by wind. Only half the seeds germinate the first year, the others requiring one or more years of dormancy. Populations form circular clonal patches of 0.5-3.0 m in diameter (Environment Canada 2011d).

Major threats to Buffalo grass in Canada are the destruction of its habitat for agricultural use, road or dam building, and clay pit-mining or coal strip-mining. Fire-suppression might also be limiting the species (Environment Canada 2011d).

Western Spiderwort

The western spiderwort (*Tradescantia occidentalis*) is of special status under SARA (Threatened), COSEWIC (Threatened) and in Manitoba (Threatened on the Manitoba *Endangered Species Act* and S1). It is a perennial flowering plant of sand dunes. In Canada, the western spiderwort is at the northern limit of its range. It occurs at only four sites in the southern part of the Prairies: Pakowki Lake Sand Hills in southeastern Alberta, Douglas Provincial Park in Saskatchewan, and Lauder and Routledge sand hills in southwestern Manitoba. The two sites in Manitoba are connected to the main range of the species in the US (Environment Canada 2011d).

Surveys from 1996 to 2002 indicate that the western spiderwort population in Canada has fluctuated from a low of about 15,000 to a high of about 50,000 plants, with the majority found at two Manitoba sites. In 2001, a year with low precipitation, the Alberta site had only 7 plants; in 2002, under more favourable conditions, 7,450 plants were counted. Above average moisture in the summer increases both population size and the length of the flowering period. After flowering, the above-ground parts of the plant dry up and new shoots grow from the base of the stem. These aboveground shoots require a protective layer of snow to survive the winter and resume growing the following spring (Environment Canada 2011d).

The western spiderwort grows on partly stabilized sand dune ridges, usually on the crests and steeper south-facing slopes. It is typically associated with areas of active, drifting sand, where vegetation is relatively sparse. In Manitoba, the western spiderwort has also been known to grow in meadows and in shaded habitat, especially in grazed areas (Environment Canada 2011d). Loss of habitat is the main factor in the decline in western spiderwort populations. The conversion of native prairie into agricultural lands has greatly decreased the amount of suitable habitat for the species. Petroleum exploration and extraction in Manitoba is also threatening to wipe out the largest population in Canada. Leafy spurge (*Euphorbia esula*), an exotic weed that spreads very quickly and forms dense stands, is a threat to some western spiderwort populations. The increased vegetation that occurs when dunes are stabilized causes shading, and results in a habitat that is unsuitable for western spiderwort.

High levels of grazing by cattle can seriously threaten populations of western spiderwort, but light to moderate grazing prevents vegetation from encroaching and helps to maintain the active dune habitat (Environment Canada 2011). The western spiderwort is protected under the federal SARA. The western spiderwort is listed as Threatened under the Manitoba *Endangered Species Act*. It is illegal to kill, harm, possess, interfere with or damage the habitat of listed species in Manitoba. In Saskatchewan, the western

spiderwort is designated as Endangered under the provincial *Wildlife Act* and is protected from being disturbed, collected, harvested, captured, killed or exported (Environment Canada 2011d).

Small White Lady's-Slipper

The small white lady's-slipper (*Cypripedium candidum*) is of special status under SARA (Endangered), COSEWIC (Endangered) and in Manitoba (Endangered on the Manitoba *Endangered Species Act* and S1). The small white lady's-slipper is a terrestrial perennial orchid which measures 20-36 cm in height. It grows from a rhizome and forms a bunch of 3-60 stems. About 3 or 4 long straight leaves grow from the centre of the stem. The flower of this plant resembles a small slipper, hence its name. This small white flower is sometimes coloured by a delicate purple line; the opening and the interior of the flower are speckled with darker purple; the petals are twisted (Environment Canada 2011d). In the past, the small white lady's-slipper occurred in open tall grass prairies, dry-mesic hillsides, low calcareous prairies and calcareous fens. Today, due to agricultural development and urbanization in the western provinces, it is found in prairie openings in wooded grasslands, or on more open sites with a southerly aspect and calcareous sandy loam soil. The few plants which survive in the eastern part of the country are found in marshes, in marshy limestone meadows, or prairie areas and on the edges of brush (Environment Canada 2011d).

Smooth Goosefoot

The smooth goosefoot (*Chenopodium subglabrum*) is of special status under SARA (Threatened), COSEWIC (Threatened) and in Manitoba (S1). The smooth goosefoot is a shallow-rooted annual with many ascending, branched stems, 2-8 dm tall. Leaves are alternate, linear, entire, fleshy, one-veined and glabrous (i.e. hairless). The habitat of smooth goosefoot contains some element of active sand. It is commonly found on the stabilizing edges of active (i.e. moving) dunes as well as dune blowouts, and occasionally on bare or recently disturbed sand plains. It has also been found on river sand bars and sandy floodplain terraces (Environment Canada 2011d). This species is rare temporally as well as spatially. In Manitoba, plants were finally observed again in 2004 in the Routledge Sand Hills; the last observation was made 45 years ago. Whether a population boom occurred at other sites in 2004 is unknown but given similar climate conditions all over the prairies it seems likely. The germination of this species is therefore erratic, likely in response to climatic conditions; this makes the overall population trend difficult to determine. The estimated population in Canada is likely between 5,200 and 10,000 individuals (Environment Canada 2011d).

5.1.10.2 Wildlife Species at Risk

The following provides information for eight wildlife species whose range and habitat occur in the vicinity of the proposed route.

Loggerhead Shrike *excubitorides* Subspecies

The loggerhead shrike *excubitorides* subspecies (*Lanius ludovicianus excubitorides*) is of special status under SARA (Threatened), COSEWIC (Threatened), and in Manitoba (Endangered on the *Endangered Species Act* and S3S4B). In Canada, the loggerhead shrike *excubitorides* subspecies breeds in north-central, central and southern Alberta, central and southern Saskatchewan, and southern Manitoba. It winters in the southern United States (COSEWIC 2004).

This subspecies seems to have been declining since the turn of the century; the greatest declines have occurred in the last 25 or more years. The population in Manitoba and eastern Saskatchewan is declining (COSEWIC 2004). Loggerhead shrikes inhabit open areas with scattered shrubby growth. They are found in open country, savannah, desert scrub and open woodland where they seem to prefer pastures and open areas with telephone poles and fence posts. They do not adapt well to changes in their habitat. Loggerhead shrikes begin breeding in their first spring and tend to use the same territory year after year. In Canada, second broods are rare, probably because of the short breeding season. Clutches contain 4-6

eggs. Loggerhead shrikes have a high rate of reproductive success; however, this is currently exceeded by their rate of mortality (COSEWIC 2004).

Pesticides are an important factor in the decline of loggerhead shrikes. As a predator at the top of the food chain, the loggerhead shrike accumulates chemicals in its tissues. In the prairie provinces, new agriculture practices, including the removal of hedgerows, shrubs and trees and the draining of potholes and sloughs have had the effect of shrinking the habitat available for loggerhead shrikes. Road mortalities are a major cause of death, especially for juveniles, since these birds often nest and forage close to roads. The young are also susceptible to heavy rainfall and cold temperatures (COSEWIC 2004).

Ferruginous Hawk

The ferruginous hawk (*Buteo regalis*) is of special status under SARA (Threatened), COSEWIC (Threatened) and in Manitoba (Threatened on the *Endangered Species Act* and S2B). This species is a large, open country, diurnal raptor that occurs in western North America. The ferruginous hawk has broad, long wings with rounded tips and a fan-shaped tail. Two colour phases occur; a more common pale phase in which hawks have brown upper parts (with extensive orange-cinnamon and white markings on the shoulders and back), white under-parts with brown streaks and a white to greyish tail. The less common dark-phased birds have dark brown plumage (some feathers are edged with cinnamon) and a white, pinkish or grey tail (COSEWIC 2008a).

The ferruginous hawk is found in the grasslands, shrublands and deserts of the western United States and western Canada. In Canada it breeds in southern Alberta, southern Saskatchewan and southern Manitoba; a few pairs have nested in southern British Columbia, at least historically. Canada holds about 10% of the world's breeding distribution of the ferruginous hawk and that range is contracting; it now occupies only 48% of its historical range in Canada (COSEWIC 2008a). The distribution of the ferruginous hawk retracted at the northern edge of the range in Canada during the early 1900s because of agriculture and invasion of trembling aspen into the remaining mesic native prairie grassland due to fire suppression. Ferruginous hawks are very sensitive to habitat loss and are considered a native grassland specialist (COSEWIC 2008a).

Piping Plover *circumcinctus* Subspecies

The piping plover (*Charadrius melodus circumcinctus*) is of special status under SARA (Endangered), COSEWIC (Endangered) and in Manitoba (Endangered on the *Endangered Species Act* and S2B). In Canada, the *circumcinctus* subspecies breeds in central Alberta, southern Saskatchewan, southern Manitoba, and used to breed in southern Ontario. It winters along the Atlantic coast, from south Carolina to Florida, and along the coast of the Gulf of Mexico (Environment Canada 2006).

Piping plovers nest just above the normal high-water mark on exposed sandy or gravelly beaches. On the prairies, nesting occurs on gravel shores of shallow, saline lakes and on sandy shores of larger prairie lakes. Seeps also provide important foraging habitat on the prairies. Clutches usually contain four eggs. Both parents participate in the incubation of eggs and care of nestlings, although the young are able to find their own food within hours of hatching. Females can begin to breed at one year of age and will re-nest once or twice in a season if the eggs are destroyed, but raise only one brood per year (Environment Canada 2006).

The most important limiting factor for the piping plover *circumcinctus* subspecies is loss of habitat due to human use of beaches and the consequent disturbance of nesting sites (Environment Canada 2006).

Sprague's Pipit

The Sprague's pipit (*Anthus spragueii*) is of special status under SARA (Threatened), COSEWIC (Threatened), and in Manitoba (S2S3B). This ground-nesting songbird is endemic to the Canadian prairies and northern great plains of the US. It breeds from the foothills of the Rocky Mountains in southern and central Alberta, to west-central and southern Manitoba, and south to southern Montana,

northern South Dakota and northwestern Minnesota. Sprague's pipits winter in the southern US and the northern two-thirds of Mexico (COSEWIC 2010).

The species remains common in suitable habitat, particularly on the Canadian prairies. However, breeding bird survey data collected over the past 30 years show that populations are declining rapidly in many parts of the range, particularly during the last 15 years (COSEWIC 2010).

Native grassland is an important habitat for Sprague's pipit. The species is rarely found in cultivated lands, or in areas where native grasses have been replaced with introduced forages. In general, the pipits prefer native vegetation of intermediate height and density, with moderate amounts of litter. Such areas tend to occur where habitats are lightly to moderately grazed, or where fires periodically remove vegetation. Areas of suitable habitat must be less than 150 ha to be attractive as breeding sites for this species (COSEWIC 2010). Less than one in three nesting attempts is successful, with depredation of eggs or young being the most usual cause of failure. Productivity might also be reduced by brown-headed cowbirds, which have been known to parasitize (lay their eggs in) up to 25% of Sprague's pipit nests (COSEWIC 2010).

Habitat loss is the primary cause of decline in this species. Other factors which may reduce habitat suitability are: intensive grazing which removes vegetation and may cause reproductive failure due to disturbance and trampling of nests; haying; fragmentation of habitat; and reduction in fire frequency, which encourages encroachment of woody vegetation and promotes excessive growth of vegetation and accumulation of litter. The use of pesticides to control grasshoppers may also impact Sprague's pipit populations, since grasshoppers are an important food item for the adults and nestlings during the breeding season. The most significant 'natural' limiting factor for the species is probably drought, which affects nesting habitat and possibly food supply at the local level (COSEWIC 2010).

Burrowing Owl

The burrowing owl (*Athene cunicularia*) is of special status under SARA (Endangered), COSEWIC (Endangered), and in Manitoba (Endangered on the *Endangered Species Act* and S1B). This owl occurs in western North America in open country from southern Canada to Mexico. Most of the Canadian population occurs in a belt from Regina, Saskatchewan to Lethbridge, Alberta, and infrequently in BC's southern interior (11). Historically, the species occurred east to Winnipeg, west to Calgary, and north to Dauphin, Prince Albert and Wetaskawin. The winter range is the southern United States and Mexico. The Canadian population has always been limited by the extent of grasslands. Over 75% of the prairies have been cultivated and much of the remaining grasslands have been altered by other human activities. An estimated 2000 pairs occurred in Canada in 1977: 100 in Manitoba; 1,300 in Saskatchewan; 600 in Alberta; and a few in British Columbia. The Canadian population fell to an estimated 1,685 to 1,010 pairs in 1995. In the 1990's landowners reported a decline of 22% per year. There are now less than 800 pairs in the Canadian prairies (COSEWIC 2006). The species is now absent or rare in regions where it was once common.

The burrowing owl requires treeless plains largely free of visual obstructions, such as grasslands grazed by livestock. It uses burrows abandoned by ground-dwelling mammals (e.g., badgers, gophers and prairie dogs) for nesting, roosting and caching food. Short or sparse vegetation and permanent cover are preferred around the burrows. Grasslands with thicker vegetation support the small mammals that they eat. Consequently, the owls need a mosaic of grass densities to successfully breed. The species is sometimes found on roadsides, crop lands and in urban areas where mowing keeps expanses of grass short (COSEWIC 2006).

The availability of suitable burrows is essential to burrowing owl habitation. In addition to serving as nesting sites, burrows provide shelter from wind, rain, sun, and predatory hawks. Unfortunately, cultivation of pastures, extermination of ground squirrels, and other agriculture techniques have combined to reduce the number of suitable burrows. The use of chemical pesticides to control grasshoppers and other insects reduces an important food supply. When shortage of food forces the birds to forage far from their nesting sites, they become more susceptible to predation. Other factors that can contribute to the

decline of this species include inclement weather, illegal shooting, and collisions with motor vehicles. They have difficulty finding burrows during migration since 99% of prairie dog colonies have been destroyed in the great plains. In winter, most of their habitat is cultivated and burrows may be in short supply.

Northern Prairie Skink

The northern prairie skink (*Eumeces septentrionalis*) is of special concern under SARA (Endangered), COSEWIC (Endangered) and in Manitoba (S2). In Canada, this small lizard is found only in southwestern Manitoba (Environment Canada 2011d). The northern prairie skink inhabits sandy areas located close to a water source such as a river or a swamp. These skinks emerge from hibernation in April or early May. In Canada, breeding occurs during the last week of May and the first week of June. Females lay only one clutch a year (Environment Canada 2011d).

Severe weather conditions may affect breeding and, thereby limit the populations of northern prairie skinks. Loss of habitat is an important limiting factor for the species (Environment Canada 2011d).

Common Snapping Turtle

The common snapping turtle (*Chelydra serpentina serpentina*) is of special status under SARA (Special Concern), COSEWIC (Special Concern) and in Manitoba (S3). This species, Canada's largest freshwater turtle, is brown, black or olive, and the cross-shaped plastron is much reduced compared with other turtles, leaving the limbs and sides of the body exposed. The snapping turtle's head is large with a hooked upper jaw, the neck is relatively long, and the tail is approximately as long as the carapace. The snapping turtle has the greatest latitudinal distribution of any turtle in North America, ranging from southern Manitoba south to Texas. In Canada, the species is present in mainland Nova Scotia, southern New Brunswick, southern and central Quebec, southern and central Ontario, southern Manitoba and southeastern Saskatchewan (COSEWIC 2008b).

The preferred habitat for the snapping turtle is characterized by slow-moving water with a soft mud bottom and dense aquatic vegetation. Established populations are most often located in ponds, sloughs, shallow bays or river edges and slow streams, or areas combining several of these wetland habitats. Although individual turtles will persist in developed areas (e.g. golf course ponds, irrigation canals), it is unlikely that populations persist in such habitats. Snapping turtles can occur in highly polluted waterways, but environmental contamination is known to limit reproductive success. Snapping turtle habitat is diminishing in both quantity and quality in Canada with losses primarily due to conversion of wetlands to agriculture and urban development (COSEWIC 2008b).

Although the snapping turtle is one of Canada's more widespread turtle species, long-term studies of two populations in Ontario have demonstrated that even large and apparently secure populations are vulnerable to increases in adult mortality and do not recover quickly from declines. Life-history models indicate that only slight increases (0.1) in annual adult mortality rate (such as from road mortality or harvesting) will cause a population to be halved in under 20 years. The snapping turtle remains relatively abundant in eastern Canada, but is less often encountered in Saskatchewan and Manitoba (COSEWIC 2008b).

Monarch

The monarch (*Danaus plexippus*) is of special status under SARA (Special Concern), COSEWIC (Special Concern). The monarch is not considered of concern provincially in Manitoba (S5) (NatureServe 2011). This butterfly is widely distributed from Central America to southern Canada and from coast to coast. There are three populations of the monarch: western, central, and eastern. The eastern population of the monarch is the largest of the three, and includes all monarchs that occur east of the Rocky Mountains, from the Gulf coast to southern Canada, and from the great plain states and prairie provinces east to the Atlantic coast (Environment Canada 2011d).

The eastern and western populations of the monarch annually migrate south, beginning in August and continuing until mid-October. The eastern monarch population overwinters annually at approximately 12 sites in the Transverse Neovolcanic Belt, a mountain range in central Mexico. In March and early April, the monarchs begin their migration north. They fly to the Gulf Coast where the females lay eggs, and it is these offspring that continue the migration back to the northern breeding range. It takes several generations of butterflies to reach the northern part of the range, each generation responding to the availability of milkweed plants (Environment Canada 2011d).

Monarchs in Canada occur primarily wherever milkweed (*Asclepius spp.*) and other wildflowers (such as goldenrod, asters and purple loosestrife) exist. This includes abandoned farmland, along roadsides and other open spaces where these plants grow. The distribution of the monarch has gradually shifted eastward over the past century, due to a combination of clearing of deciduous forests and loss of habitat to agricultural development (Environment Canada 2011d).

Environmental conditions and loss of breeding habitat pose threats to all monarchs. However, the eastern population of the monarch is limited by loss of habitat to logging, human disturbance and predation, especially while wintering in Mexico. Widespread and increasing use of herbicides in North America is another significant threat, which kills both the milkweed needed by the caterpillars and the nectar producing wildflowers needed by the adults (Environment Canada 2011d).

5.1.11 Human Occupancy and Resource Use

This subsection describes the current state of human occupancy and resource use in the vicinity of the proposed pipeline route in terms of population and demographics, development and land use planes, environmentally significant and protected areas, natural resource use, and surface dispositions. Potential impacts related to the construction of the proposed pipelines and mitigation pertaining to Human Occupancy and Resource Use are discussed in Section 6.2.11 of this EA.

5.1.11.1 Population and Demographics

Few communities are found in the vicinity of the proposed pipeline route, ranging from towns and villages to unincorporated settlements. Tables 5.10 of this EA present a list of communities in the vicinity of the route. Only the main communities potentially affected by the construction of the pipelines are provided in this table. The proposed route traverses three Rural Municipalities (RMs): the RM of Edward, the RM of Arthur and the RM of Brenda.

TABLE 5.10 COMMUNITIES IN THE VICINITY OF THE PROPOSED PIPELINE ROUTE

Community	Population	Distance to Proposed Route
Deloraine	977	22.5 km northeast
Waskada	199	4 km north
Melita	1,051	20 km north
Coulter	440 (RM of Arthur)	0.5 km east
Pierson	200	10 km northwest

5.1.11.2 Environmentally Significant and Protected Areas

The proposed pipeline route does not encounter any lands under Parks Canada jurisdiction, Conservation Areas, proposed or existing provincial parks, Ecological Reserves, Provincial Forests, recreation areas, Conservation Lands, Resource Management Areas or Special Conservation Areas (Manitoba Agriculture, Food and Rural Initiatives 2011).

5.1.11.3 Natural Resource Use

The entire proposed pipeline route traverses privately-owned agricultural lands and is located in Mineral Exploitation Zone A. The proposed pipeline route does not traverse any coal dispositions, mining claims, potash licenses, quarry leases or withdrawals, or mining restricted lands (Manitoba Industry, Economic Development and Mines 2011).

The CLI (1971) has rated most of the lands along the proposed route as ranging from having moderately low (Class 5) to low (Class 6) capability for outdoor recreation.

The proposed pipeline route is located in FMU 6 and does not traverse any Forest Management Licenses or Integrated Wood Supply Areas (Manitoba Agriculture, Food and Rural Initiatives 2011). No community pastures or grazing leases are traversed by the proposed pipeline route (Manitoba Agriculture, Food and Rural Initiatives 2011).

The proposed pipeline route traverses Game Hunting Area (GHA) No. 28. The big game hunting season for moose in GHA 28 extends from mid September to mid-October, and a short period in early December. The proposed route lies within Deer Hunting Zone E. The white-tailed deer hunting season in Zone E extends from late August to early December (Manitoba Conservation 2011a).

The proposed route lies within Game Bird Hunting Zone (GBHZ) 4. The game bird hunting season extends from early September to late November for ducks, coots and snipe as well as geese, and from early September to late November for sandhill cranes. Upland game bird hunting seasons begin in early September and extend to mid-December for grouse and gray (Hungarian) partridge. The wild turkey hunting season extends from late April to late May and early to mid-October (Manitoba Conservation 2011a).

The proposed pipeline route traverses Open Area Zone 1 trapping area (Manitoba Conservation 2011b). Trapping in this Open Trapline District requires a Manitoba Trapper's Licence 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 fisher, marten, muskrat and raccoon. There are no registered traplines located along the proposed pipeline route (Manitoba Industry, Economic Development and Mines 2011). Outfitters within Manitoba are not assigned geographical areas and need permission from the landowner on private lands. Outfitting may occur on private lands along the proposed route. The proposed pipeline route lies within the Southern Fishing Division where the fishing season is open from May 14 until March 31 (Manitoba Conservation 2011c).

5.1.11.4 Surface Dispositions

The entire proposed pipeline route traverses privately-owned agricultural lands. The proposed pipeline route does not traverse any provincial or federal Crown lands (Manitoba Industry, Economic Development and Mines 2011).

5.1.12 Heritage Resources

This subsection describes the known heritage resources (e.g., archaeological sites, palaeontological potential areas) along proposed pipeline route. Potential impacts related to the construction of the proposed pipelines and mitigation pertaining to Heritage Resources are discussed in Section 6.2.12 of this EA.

5.1.12.1 Archaeological Overview

In order to identify potential conflicts with archaeological sites, a file search of the site inventory records held by the Historic Resource Branch of Manitoba Culture, Heritage, Tourism and Sport (MB CHTS) was conducted. Archaeological Site Inventory Data forms obtained from the file search were consulted with

regard to a site's proximity to the present developments, site type, artifacts collected/observed, previous disturbance and the site recommendations of the Permit Holder.

The records showed no previously recorded sites within the Regional Study Area (RSA), here defined as the file search area: Townships 01 to 02, Ranges 25 to 28, West of the Principal Meridian.

5.1.12.2 Archaeological Site Potential and Recommendations

The majority of the proposed pipeline route crosses cultivated lands. Review of the archaeological site inventory and experience in the region indicates there is low potential for intact archaeological components.

Based on the above, a historical resources impact assessment will not be conducted for the proposed EOG Pipeline Project.

5.1.13 Traditional Land and Resource Use

Since all of the proposed route traverses patented lands presently used for agricultural purposes, the use of lands along the route by Aboriginal groups for traditional purposes is limited. The nearest First Nations community is Oak Lake, approximately 75 km northeast of the proposed pipeline route.

EOG has therefore not initiated consultation with Aboriginal groups to determine interest with regard to the proposed Project and the need for traditional land use studies.

5.1.14 Social and Cultural Well-being

This subsection presents information on the social and cultural well-being related to an influx of workers during the construction phase of the proposed pipelines. Potential effects related to the construction of the proposed pipelines are presented in Section 6.2.14 of this EA. Information related to social and cultural well-being is found throughout Section 5.0 of this EA. Specifically, information on predominant cultural groups is found in Section 5.1.12 and Section 5.1.13 of this EA. Demographic features of the local population and workforce are located in Section 5.1.11 and Section 5.17 of this EA.

The village of Waskada is located approximately 4 km north of the proposed pipeline route. In 2006, the total population of Waskada was reported as 199. In 2006, approximately 31% of the Waskada population was between 45 and 64 years old, which represents the largest age demographic. The median age of the population was 46 years. Waskada had a workforce of 85 people in 2006. The main industries include agriculture, fishing and hunting, health care and social services, mining & oil and gas extraction, and public services (Manitoba Bureau of Statistics 2008).

The unincorporated center of Coulter is located approximately 0.5 km east of the proposed pipeline route in the RM of Arthur No. 141. No detailed statistics are available for this community from Statistics Canada. In 2006, the total population of the RM of Arthur was reported as 440. In 2006, approximately 31% of the RM of Arthur population was between 45 and 64 years old, which represents the largest age demographic. The median age of the population was 45 years. The RM of Arthur had a workforce of 340 people in 2006. The main industries include agriculture, retail trade, health care and social services, educational services, construction, manufacturing, transport and warehousing, accommodation and food services, and construction (Manitoba Bureau of Statistics 2008).

The town of Melita is located approximately 17 km northeast of the proposed pipeline route in the RM of Arthur No. 141. In 2006, the total population of Melita was reported as 1,051. In 2006, approximately 25% of the Melita population was between 20 and 44 years old, which represents the largest age demographic. The median age of the population was 45 years. Melita had a workforce of 515 people in 2006. The main industries include accommodation and food services, retail trade, education services,

health care and social services, transport and warehousing, mining & oil and gas extraction, and construction (Manitoba Bureau of Statistics 2008).

The unincorporated center of Pierson is located approximately 10 km northwest of the proposed pipeline route. No detailed statistics are available for this community from Statistics Canada. The population of Pierson is approximately 200. Pierson is located within the RM of Edward No. 302. In 2006, the total population of the RM of Edward was reported as 621. In 2006, approximately 30% of the RM of Edward population was between 45 and 64 years old, which represents the largest age demographic. The median age of the population was 45 years. The RM of Edward had a workforce of 400 people in 2006. The main industries include agriculture, retail trade, health care and social services, construction, manufacturing, transport and warehousing and accommodation and food services (Manitoba Bureau of Statistics 2008).

5.1.15 Human Health

This subsection identifies the location of potential receptors of nuisance air and noise emissions that could potentially be sources of adverse human health effects during the construction and operational phases of the proposed pipelines. Potential impacts arising from the construction and operation of the proposed pipelines, and mitigation pertaining to Human Health are discussed in Section 6.2.15 of this EA. Information related to water quality, air quality, and acoustic environment is presented in Sections 5.1.3, 5.1.4 and 5.1.5 of this EA.

5.1.16 Infrastructure and Services

This subsection identifies infrastructure and services in the vicinity of the proposed pipeline route. Potential effects on infrastructure and services arising from the construction of the proposed pipelines are presented in Section 6.2.16 of this EA.

5.1.16.1 Transportation and Transmission

The proposed pipeline route crosses a primary highway and a secondary highway (Table 5.11 of this EA). Networks of primary and secondary highways, as well as local and municipal roads, provide access throughout the rural areas in the vicinity of the proposed route. Commercial air passenger and air freight services are provided by a number of Canadian and US carriers at the Winnipeg International Airport.

TABLE 5.11 TRANSPORTATION INFRASTRUCTURE CROSSED BY THE PROPOSED PIPELINE ROUTE

Transportation Infrastructure	Legal Location
Medium Grade Gravel Road	Between NE-20 & NW-21-01-25 WPM
High Grade Gravel Road	Between NE-19 & NW- 20-01-25WPM
Medium Grade Gravel Road	Between NW-19-01-25 WPM & NE-24-01-26 WPM
Medium Grade Gravel Road	Between NE-23 & NW-24-01-26 WPM
Medium Grade Gravel Road	Between NW- 23 & SW-26-01-26 WPM
Medium Grade Gravel Road	Between SW-26 & SE-27-01-26 WPM
Medium Grade Gravel Road	Between SW-27 & SE-28-01-26 WPM
Medium Grade Gravel Road	Between SW-28 & SE-29-01-26 WPM
Low Grade Gravel Road	Between NE-20 & SE-29-01-26 WPM
Undeveloped Government Road Allowance	Between NE-19 & NW-20-01-26 WPM
Undeveloped Government Road Allowance	Between NE-19 & SE-30-01-26 WPM
Undeveloped Government Road Allowance	Between SE-25-01-27 WPM & SW-30-01-26 WPM
Medium Grade Gravel Road	Between SW-25 & SE-26-01-27 WPM
Low Grade Gravel Road	Between NW-26 & SW-35-01-27 WPM
Paved Highway No. 251	Between SW-02-02-27 WPM & NW-35-01-27 WPM

TABLE 5.11 TRANSPORTATION INFRASTRUCTURE CROSSED BY THE PROPOSED PIPELINE ROUTE (CONT'D)

Transportation Infrastructure	Legal Location
High Grade Gravel Road	Between SW-02 & SE-03-02-27 WPM
Medium Grade Gravel Road	Between SW-03 & SE-04-02-27 WPM
Paved Highway No. 83	Between SW-04 & SE-05-02-27 WPM
Government Road Allowance	Between SW-05 & SW-06-02-27 WPM
Undeveloped Government Road Allowance	Between SW-06-02-27 WPM & SE-01-02-28 WPM

5.1.16.2 Waste Management

Waste disposal facilities along the proposed pipeline route are presented in Table 5.12 of this EA. Most landfills only accept wastes generated within their respective Rural Municipality. The closest landfills to the proposed route in the RM of Brenda, the RM of Arthur and the RM of Edwards are located in Waskada, Melita and Pierson, respectively. The nearest hazardous waste disposal site in Manitoba is in Letellier, approximately 75 km south of Winnipeg (Province of Manitoba 2011).

TABLE 5.12 WASTE DISPOSAL GROUNDS LOCATED ALONG THE PROPOSED PIPELINE ROUTE

Site Name	Legal Location	Type of Waste
Reston Waste Disposal Grounds	NW 04-07-27 WPM	Accepts construction waste ¹
Viriden Waste Disposal Grounds	SE 24-11-26 WPM	Accepts construction waste but metals should be separated from other waste ²

5.1.17 Employment and Economy

This subsection describes local and regional economic and employment in communities in the vicinity of the proposed pipeline route. Potential impacts on employment and economy arising from the construction and operation of the proposed pipeline route, and mitigation pertaining to employment and economy are discussed in Section 6.2.17 of this EA.

5.1.17.1 Existing Local and Regional Employment

The village of Waskada had a workforce of 85 people in 2006. The proportion of the Waskada's labour force that is skilled was higher than in Manitoba as a whole. The percentage of individuals between the ages of 25 and 64 years of age with a trade, post-secondary certificate or diploma or university degree during the 2006 census was 60% compared to 53% in Manitoba. Most employed individuals in Waskada work in primary industry (38%), while the remaining work in health (16%); management (12%); business/finance and administration (12%); and processing, manufacturing and utilities (12%). The employment and unemployment rates for Waskada were reported by the Manitoba Bureau of Statistics at 53.1% and 0% respectively, compared to 67.3% and 5.5% for Manitoba as a whole. Statistics for the median total annual income of individuals over age 15 and the median household income in Waskada are not available (Manitoba Bureau of Statistics 2008).

The RM of Brenda had a workforce of 360 people in 2006. The proportion of the RM of Brenda's labour force that is skilled was higher than in Manitoba as a whole. The percentage of individuals between the ages of 25 and 64 years of age with a trade, post-secondary certificate or diploma or university degree during the 2006 census was 56% compared to 53% in Manitoba. Most employed individuals in the RM of Brenda work in primary industry (56%), while the remaining work in sales and service (13%); trades, transportation and as equipment operators (8%); business/finance and administration (10%); management (3%) and health care (8%). The employment and unemployment rates for the RM of Brenda

were reported by the Manitoba Bureau of Statistics at 80.9% and 2.8% respectively, compared to 67.3% and 5.5% for Manitoba as a whole. The median total annual income of individuals over age 15 in the RM of Brenda was reported to be \$16,039 and the median household income was reported to be \$37,609 (Manitoba Bureau of Statistics 2008).

The RM of Arthur had a workforce of 340 people in 2006. The proportion of the RM of Arthur's labour force that is skilled was higher than in Manitoba as a whole. The percentage of individuals between the ages of 25 and 64 years of age with a trade, post-secondary certificate or diploma or university degree during the 2006 census was 57% compared to 58% in Manitoba. Most employed individuals in the RM of Arthur work in primary industry (47%), while the remaining work in sales and service (20%); business/finance and administration (10%); trades, transportation and as equipment operators (3%); management (3%); social science, education, government service and religion (5%) and health care (5%). The employment and unemployment rates for the RM of Arthur were reported by the Manitoba Bureau of Statistics at 91.9% and 4.4% respectively, compared to 67.3% and 5.5% for Manitoba as a whole. The median total annual income of individuals over age 15 in the RM of Arthur was reported to be \$23,355 and the median household income was reported to be \$50,697 (Manitoba Bureau of Statistics 2008).

The town of Melita had a workforce of 515 people in 2006. The proportion of the Melita's labour force that is skilled was higher than in Manitoba as a whole. The percentage of individuals between the ages of 25 and 64 years of age with a trade, post-secondary certificate or diploma or university degree during the 2006 census was 83% compared to 75% in Manitoba. Most employed individuals in Melita work in trades, transportation and as equipment operators (24%), while the remaining work in sales and service (22%); primary industry (15%); business/finance and administration (12%); social science, education, government, religion (12%); management (10%) and health (5%). The employment and unemployment rates for Melita were reported by the Manitoba Bureau of Statistics at 64.4% and 1.9% respectively, compared to 67.3% and 5.5% for Manitoba as a whole. The median total annual income of individuals over age 15 in Melita was reported to be \$21,188 and the median household income was reported to be \$52,789 (Manitoba Bureau of Statistics 2008).

The RM of Edward had a workforce of 400 people in 2006. The proportion of the RM of Edward's labour force that is skilled was higher than in Manitoba as a whole. The percentage of individuals between the ages of 25 and 64 years of age with a trade, post-secondary certificate or diploma or university degree during the 2006 census was 60% compared to 55% in Manitoba. Most employed individuals in the RM of Edward work in primary industry (46%), while the remaining work in sales and service (16%); trades, transportation and as equipment operators (14%); business/finance and administration (4%); management (4%) and health care (10%). The employment and unemployment rates for the RM of Edward were reported by the Manitoba Bureau of Statistics at 74.1% and 2.5% respectively, compared to 67.3% and 5.5% for Manitoba as a whole. The median total annual income of individuals over age 15 in the RM of Edward was reported to be \$25,574 and the median household income was reported to be \$61,202 (Manitoba Bureau of Statistics 2008).

5.1.17.2 Local Employment Development Plans

There are no employment development plans for any of the RMs along the proposed pipeline route.

5.1.17.3 Anticipated Levels of Local and Regional Economic Participation

Local businesses are anticipated to participate to some degree in the construction of the pipelines by providing various goods and services required for the construction of the pipelines. However, communities within the LSA of the proposed pipeline route are relatively small and are not expected to have the capacity to provide some of the highly specialized skills required for pipeline construction. Therefore, there is likely to be an influx of skilled workers from the RSA (including larger communities such as Brandon and Virden) as well as other parts of Manitoba.

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APPENDIX 5A
PHOTOPLATES OF THE PROPOSED PIPELINE ROUTE

APPENDIX 5B
DESCRIPTIONS OF SOIL SERIES ALONG THE PROPOSED PIPELINE ROUTE

APPENDIX 5B DESCRIPTIONS OF SOIL SERIES ALONG THE PROPOSED PIPELINE ROUTE

Source: Manitoba Agriculture, Food and Rural Initiatives. 2010. Soil Series Descriptions.

(AHW) Ashdown Series

The Ashdown series consists of imperfectly drained Gleyed Black Chernozem soils of the Terence Association, developed on thin (25 to 100 cm) weakly to moderately calcareous, coarse textured (FS, LCoS, LS, LFS), lacustrine sediments overlying strongly calcareous, medium to moderately fine textured, glacial till. A very thin (0 to 5 cm) gravelly stratum may occur at the contact. These soils occur on gently undulating topography. They are generally non-saline, moderately permeable and have moderate surface runoff. The water table is usually within 1.5 metres of the surface during the growing season. The surface texture is usually loamy fine sand. The less permeable underlying till causes these soils to be periodically saturated because of the restricted downward drainage.

The Ashdown series is similar to the Eramosh series from the Carnegie Association, except that the Eramosh series has a very coarse gravelly stratum at the contact between the coarse textured lacustrine sediments and the medium to moderately fine textured glacial till. A representative profile of the Ashdown series is described below.

- Ah - 0 to 18 cm, black (10YR 2/1 moist), very dark gray (10YR 3/1 dry) loamy fine sand; granular; loose, moist; clear, wavy boundary; pH 6.9.
- Bmgj - 18 to 40 cm, dark brown (10YR 3.5/3 moist) loamy fine sand; granular; loose, moist; clear, smooth boundary; pH 7.6.
- Ccasg - 40 to 50 cm, gray brown (2.5Y 5/2 moist); very fine sandy clay loam; loose, moist; clear, smooth boundary; moderately calcareous; pH 8.1.
- Cskg - 50 to 64 cm, light olive brown (2.5Y 5/3 moist) fine sandy loam; loose, moist; clear, smooth boundary; moderately calcareous; pH 8.2.
- II Ckg - 64 cm +, light olive brown to light yellowish brown (2.5Y 5.5/4 moist) clay loam; friable moist; very strongly calcareous; pH 8.3.

(AHY) Ashbury Series

The Ashbury series consists of imperfectly drained, Gleyed Black Chernozem soils of the Mentieth Association, developed on thin (25 to 100 cm), moderately calcareous, coarse to moderately coarse to medium textured (FS, LCoS, LFS, VFS, LVFS, FSL) lacustrine sediments overlying strongly calcareous medium to moderately fine textured (VFSL, L SiL to SCL, CL, SiCL) glacial till. The profile may contain a very thin (less than 5 cm) pebble line at the till contact. Ashbury soils generally occur on lower slope positions in areas of gently sloping topography. They have moderate permeability and slow surface runoff. The proximity of the underlying till causes these soils to be imperfectly drained. The occurrence of salinity is rare in these soils. The surface texture is usually loamy very fine sand.

This soil is characterized by a dark gray Ap horizon 10 to 15 cm thick, occasionally a dark gray Ah horizon, 5 to 10 cm thick, a gray brown to brown Bmg horizon, 20 to 25 cm thick and a white Cca horizon, 18 to 25 cm thick, immediately overlying a yellowish brown II Ckg horizon. The depth of the coarse textured surface soil is quite variable but glacial till commonly occurs within a depth of 100 cm. A representative profile of the Ashbury series is described below.

- Ap - 0 to 13 cm, very dark gray (10YR 3/1 moist), dark gray (10YR 4/1 dry) very fine sandy loam; single grained; very friable, moist; abrupt, smooth boundary; pH 7.6.
- Ah - 13 to 20 cm, very dark gray (10YR 3/1 moist), dark gray (10YR 4/1 dry), very fine sandy loam; single grained; friable, moist; clear, wavy boundary; pH 7.6.
- Bmgj - 20 to 46 cm, dark grayish brown to very dark grayish brown (10YR 3.5/2 moist), brown to grayish brown (10YR 5/2.5 dry), very fine sandy loam; moderate, very coarse prismatic breaking to moderate medium subangular blocky; friable, moist; gradual, irregular boundary; pH 7.6.
- Ckgj - 46 to 76 cm, light brownish gray to pale brown (10YR 6/2.5 moist), white (10YR 8/1 dry) loam; friable, moist; gradual, irregular boundary; very strongly calcareous; pH 8.1.
- II Ckg - 76 cm +, yellowish brown to light yellowish brown (10YR 5.5/4 moist), white (10YR 8/2 dry) silt loam; very friable, moist; very strongly calcareous; pH 8.1.

(AXD) Alexander

The Alexander series consists of imperfectly drained, Gleyed Rego Black Chernozem soils of the Newstead Association developed on thin (25 to 87 cm), strongly calcareous, medium textured lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. A coarse textured layer (5 to 75 cm) of gravel and sand occurs above the till. Alexander soils are characterized by gently undulating topography, moderately slow surface runoff and moderately rapid permeability. The underlying glacial till restricts downward drainage and the coarse layer at the till contact allows for some lateral flow of water. Some iron staining and mottling occurs in the soil profile which is usually associated with restricted internal drainage. Alexander soils occur in areas of complex surface deposits usually in the transition areas between glacial till and lacustrine deposits. It is occasionally cultivated, but most often it is left as native land or pasture.

(BED) Bede Series

The Bede series consists of well drained Orthic Black Chernozem soils of the Bede Association, developed on strongly calcareous, coarse textured (sand and gravel) deltaic, beach and outwash deposits. This soil commonly has complex, very gently sloping topography, good drainage, very rapid permeability and minimal surface runoff. The depth of water table is estimated to be at about 3 metres during the growing season. This soil is non-saline and when cropped, tends to be droughty for most of the growing season. Most cereal crops and even some deep rooting forage crops can be severely affected by early summer heat and lack of moisture because of the low water holding capacity of the soil.

The surface texture of this soil ranges from a sandy loam to loamy sand grading to coarser materials with depth. The soil profile usually consists of a black Ah horizon 5 to 10 cm thick, a very dark brown Bm horizon 15 to 20 cm thick and a pale brown, very coarse textured C horizon. The Bm horizon is usually well developed as indicated by the strong prismatic to sub-angular blocky structure. A transitional BC and a prominent Cca horizon are also common in these soils. A representative Bede soil is described below (Soils of the Boissevain - Melita Area, 1978).

- Ah - 0 to 13 cm, black (10YR 2/1 moist), very dark gray (10YR 3/1 dry) loamy sand; structureless single grained to weak medium granular; loose; abrupt, smooth boundary; non-calcareous; pH 7.3.
- Bm - 13 to 30 cm, dark brown (10YR 3/3 moist), dark brown to brown (10YR 4/3 dry) sandy loam; weak, medium prismatic breaking to medium subangular blocky; very friable, moist; loose, dry; abrupt, smooth boundary; non-calcareous; pH 7.1.
- BC - 30 to 38 cm, reddish brown (5YR 4/4 moist), yellowish brown (10YR 5/6 dry) gravelly sandy loam; weak medium prismatic breaking to weak, medium subangular blocky; very friable, moist; loose, dry; clear, smooth boundary; moderately calcareous; pH 7.4.
- Cca - 38 to 48 cm, grayish brown to light brownish gray (10YR 5/2 to 6/2 moist), light gray (10YR 7/2 dry) gravelly, sandy loam; weak, fine granular; very friable, moist; loose, dry; clear, smooth boundary; strongly calcareous; pH 7.5.
- Ck - 48 cm +, yellowish brown (10YR 5/4 moist), light gray (10YR 7/2 dry) gravelly coarse sand; structureless to amorphous; loose; moderately calcareous; pH 7.6.

(BEL) Bella Lake Series

Bella Lake series consists of poorly drained, Rego Humic Gleysol carbonated soils of the Newstead Association developed on thin (25 to 95 cm), strongly calcareous, medium to moderately fine textured lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. A coarse textured layer (5 to 75 cm) occurs at the contact. This soil is characterized by a fine sandy loam surface texture, nearly level to depressional topography, a water table at approximately 1.5 m during the growing season, slow surface runoff and moderate permeability. The proximity of the less permeable underlying till and the depressional topography cause this soil to be poorly drained for most of the year. This weakly carbonated soil is rarely saline. The natural vegetation is hydrophytic. Bella Lake soils commonly occur in drainage channels of creeks and streams.

The Bella Lake series closely resembles the Deloraine series of the Waskada Association. The major difference from the Deloraine series is the presence of the coarse gravelly layer at the till contact.

(BOW) Bower Series

The Bower series consists of imperfectly drained Gleyed Black Chernozem soils of the Newstead Association, developed on thin (25 to 100 cm), strongly calcareous, medium to moderately fine textured, lacustrine sediments overlying strongly calcareous, medium to moderately fine textured, glacial till. A coarse textured layer (5 to 75 cm) thick occurs at the contact. Bower soils are characterized by a fine sandy loam surface texture, gently undulating topography, moderately slow permeability and slow surface runoff. Bower soils are imperfectly drained and generally

occur in areas adjacent to creeks and ephemeral stream channels. The coarse textured layer may impede downward percolation and facilitate lateral water flow both of which will affect the moisture status of this soil. Although many of these soils are used for cereal crops, crop growth is more variable than on soils of uniform texture. This variability is attributed to the presence of the coarse textured layer which may inhibit root development and thereby render the plants more susceptible to moisture stress during dry periods. The degree to which the crops are affected will likely increase with increasing thickness of this coarse stratum.

(CDW) Cauldwell Series

The Cauldwell series is the imperfectly drained, Gleyed Carbonated Rego Black Chernozem member of the Griswold Association, developed on thin (25 to 97 cm), moderately calcareous, coarse to moderately coarse textured, lacustrine sediments overlying strongly calcareous, medium to moderately fine textured, glacial till with a coarse textured gravelly layer (5 to 76 cm) occurring at the contact. These soils have a loamy very fine sand surface texture, gently undulating topography, moderately rapid permeability and moderate surface runoff. The presence of the coarse gravel lens and the underlying till restrict downward drainage and cause water to move laterally along the surface of the till resulting in an imperfectly drained profile. These soils are non-saline, non-stony and are generally cultivated. The Cauldwell series resembles the Linklater series of the George Lake Association. The only difference is that the Cauldwell series is underlain by glacial till (Soils of the Boissevain - Melita Area, 1978).

(CHF) Chesterfield Series

The Chesterfield series consists of imperfectly drained Gleyed Black Solonetz soils of the Chesterfield Association, developed on thin (< 0.9 m) weakly to moderately calcareous, moderately fine to fine textured (SCL, CL, SiCL to SiC, C), saline sediments usually underlain by shaly clay or soft, fragmented shale bedrock. They have level to depressional topography, slow permeability and slow surface runoff. They are imperfectly drained and saline in the lower Bnt and C horizons. Salinity increases with depth. Occasionally, these soils are cultivated but in the undisturbed sites native vegetation such as alkali grass, *Distichlis* sp., cord grass, *Spartina* sp., yarrow, *Achillea* spp., foxtail, *Hordeum jubatum* and Indian paintbrush, *Castilleja sessiliflora* is often found.

Chesterfield soils are characterized by black, occasionally eroded, Ah horizons 5 to 25 cm thick; platy, gray, Ae horizons 2 to 5 cm thick which also may be partially eroded or lost when cultivated; black to very dark gray Bnt horizons 10 to 15 cm thick; grayish brown, transitional BC horizons 10 to 15 cm thick and a dark grayish brown C horizon. A very dark gray shaley II C horizon may occur within 1 m of the surface. The ground surface is commonly pitted as in small blow out areas. Chesterfield soils are closely associated with Antler River soils which occur in better drained areas and with Lena soils which occur in poorly drained areas. The relief between these three soils is sometimes very subtle.

(CLL) Croll Series

The Croll series consists of imperfectly drained Gleyed Carbonated Rego Black Chernozem soils of the Waskada Association developed on thin (25 to 100 cm), strongly calcareous, moderately fine textured (SCL, CL, SiCL), discontinuous aeolian and lacustrine mantle overlying strongly calcareous, medium to moderately fine textured, glacial till. The surface texture is dominantly loam to clay loam, the topography is gently undulating, permeability is slow and runoff is moderate. This soil is imperfectly drained and may be weakly saline. The estimated depth to water table during the growing season is 2 metres. The Croll series is associated with the imperfectly drained Gleyed Calcareous Black Chernozem Desford series and the well drained Bearford series (Soils of the Boissevain - Melita Area, 1978).

(CRG) Carnegie Series

The Carnegie series consists of imperfectly drained Gleyed Rego Black Chernozem soils developed on thin (25 to 100 cm), weakly to moderately calcareous coarse textured lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. A coarse textured gravelly layer (5 to 75 cm) occurs at the contact of the lacustrine and till deposits. This soil usually has a fine sandy surface texture and occurs in areas of mixed surface deposits adjacent to creeks and ephemeral streams. The topography is gently undulating, permeability is moderate and surface runoff is slow. Its lower slope position and the proximity of the underlying till impedes drainage and results in gleyed, dull colored, iron stained profiles.

(CSE) Coatstone Series

The Coatstone series consists of imperfectly drained, Gleyed Rego Black Chernozem, carbonated soils of the Ryerson Association, developed on deep, strongly calcareous, medium to moderately fine textured, glacial till. The till

is composed of material derived from shale, limestone and granitic rock. The surface 25 cm may vary slightly in texture. Coatstone soils usually have a clay loam surface texture, very gently sloping topography, moderately slow permeability, and moderate surface runoff. They are imperfectly drained and occasionally slightly stony. They may be weakly to moderately saline. The estimated depth to water table is 1.5 m. Coatstone soils usually occur in intermediate to level positions between the better drained Ryerson and Medora soils and the poorer drained Ewart, Tilston and Stoney Creek soils. Gleyed Calcareous Black Chernozem soils are closely associated with Coatstone soils and may be found in the same vicinity. In undisturbed areas where native vegetation exists aspen is quite common.

Coatstone soils are characterized by black Apk horizons 8 to 13 cm thick, dark gray AC horizons 5 to 10 cm thick, weakly mottled light brownish gray Cca horizons 10 to 13 cm thick, and gleyed prominently iron mottled, brown to yellowish brown Ckg horizons.

(CWG) Cartwright Series

The Cartwright series consists of imperfectly drained Gleyed Black Chernozem soils of the Bede Association developed on strongly calcareous, deep, coarse textured (FS, LCoS, LS, LFS), gravelly, deltaic, beach and outwash deposits. The solum is usually developed in a thin coarse sandy loam to loamy sand surface layer. The soil has gently undulating topography, rapid permeability and very slow surface runoff. These soils have imperfect drainage as a result of a high water table which is estimated at less than 1 metre for much of the growing season. These soils commonly occur in level areas of large kettled, outwash deposits or in stream channels. Some of these soils are cultivated but most are used for native hay and pasture (Soils of the Boissevain - Melita Area, 1978). A representative profile description is presented below.

- Ah - 0 to 23 cm, very dark gray (10YR 3/1 moist), very dark grayish brown to dark grayish brown (10YR 3.5/2 dry) sand; weak, fine granular; loose; mildly alkaline; non-calcareous; clear, smooth boundary.
- Bmgj - 23 to 46 cm, dark grayish brown (10YR 4/2 moist), dark yellowish brown (10YR 4/4 dry) gravelly, sand; weak, fine granular; loose; some dark brown (7.5YR 4/4 dry) iron concretions; moderately alkaline; non-calcareous; clear, smooth boundary.
- BC - 46 to 61 cm, brown (10YR 5/3 moist), light gray (10YR7/2 dry) gravelly sand; structureless single grained; loose; moderately alkaline; moderately alkaline; moderately calcareous; diffuse, wavy boundary.
- Ckgj - 61 cm +, brown (10YR 5/3 moist), light gray (10YR7/2 dry) gravelly fine sand; structureless; loose; moderately alkaline; moderately calcareous.

(EBL) Emblem Series

The Emblem series consists of poorly drained carbonated Rego Humic Gleysols of the Cameron Association developed on deep, strongly calcareous, loamy lacustrine sediments. These soils usually have depressional to level topography, loam surface textures; moderate permeability and very slow surface runoff. These soils are poorly drained due to a combination of depressional topography and high groundwater levels. The estimated depth to water table is less than 1.5 m during the growing season. These soils occur in drainage channels and depressions and are frequently flooded by ponded or flowing water. Emblem soils support hydrophytic vegetation, are non-stony and rarely cultivated.

(ELV) Elva Series

The Elva series consists of well drained, Orthic Black soils of the Elva Association, developed on deep, strongly calcareous, moderately fine textured (SCL, CL, SiCL), lacustrine sediments. This soil has a clay loam surface, nearly level to gently undulating topography, slow to moderate permeability, and moderate surface runoff. Elva soils are moderately well drained, non-saline, non-stony, generally cultivated and have an estimated depth to water table of 2 to 3 m during the growing season. These are highly productive soils. They occur generally in the Souris Basin in the vicinity of Elva and Hartney and have a limited occurrence in the Whitewater Basin area. This soil is associated with the imperfectly drained Goodlands, Cranmer, Minto and Ninga series; and the poorly drained Naples, Bunclody and Fairfax series (Soils of the Boissevain - Melita Area, 1978).

(GPE) Gopher Creek Series

The Gopher Creek series is the imperfectly drained, carbonated, Gleyed Rego Black Chernozem soils of the Dromore Association, developed on thin (25 to 100 cm), strongly calcareous, medium textured (VFSL, L, SiL), lacustrine sediments overlying coarse textured (FS, LCoS, LFS), gravelly deltaic and outwash deposits. This soil is characterized by nearly level topography, moderately slow permeability, and low surface runoff. The dominant

surface texture is very fine sandy loam. Some of these soils are cultivated and some are used as pasture. The estimated depth to water table during the growing season is 2 metres.

Associated soils are the well drained Dromore and Breadon series, the imperfectly drained Glenview series, and the poorly drained William series. The Gopher Creek series resembles the Alexander series except that the Alexander series is underlain by glacial till (Soils of the Boissevain - Melita Area, 1978).

(HHY) Hathaway Series

The Hathaway series consists of well drained Rego Black Chernozem soils of the Ryerson Association, developed on deep, strongly calcareous, medium to moderately fine textured glacial till. The till is composed mainly of mixed materials derived from shale, limestone and granitic rocks. The surface horizons are usually very thin as a result of erosion by wind, water and cultivation. These soils have a loam to clay loam surface texture, gently undulating topography, moderate permeability and rapid surface runoff. Hathaway soils usually occur in the upper slope and knoll positions, and usually have a lighter gray surface color than adjacent, deeper soils. The light color is due to carbonates. Depth to water table ranges from 2 to 3 metres. These soils are usually strongly calcareous and low in organic matter. This soil is characterized by a gray non-leached Apk horizon 10 to 20 cm thick, a dark gray to gray AC horizon 20 to 50 cm thick overlying a light yellowish brown Ck horizon. Morphological data for a representative profile are presented below.

- Apk - 0 to 20 cm, black (10YR 2/1, moist), gray (10YR 5/1, dry), loam; weak, fine, subangular blocky, very friable; clear smooth boundary; strongly calcareous; pH 7.8.
- AC - 20 to 50 cm, dark gray (10YR 4/1, moist), gray (10YR 5/1, dry), loam; weak, fine subangular blocky, very friable; clear irregular boundary; strongly calcareous; pH 8.2.
- Ck - 50 to 76 cm, yellowish brown to light yellowish brown (10YR 5.5/4, moist), light yellowish brown (10YR 6/4, dry), loam; weak fine subangular blocky, very friable; clear smooth boundary; strongly calcareous; pH 8.1.
- Ckgj1 - 76 to 100 cm, dark yellowish brown to yellowish brown (10YR 7/4, dry), loam; weak fine subangular blocky, very friable; clear smooth boundary; strongly calcareous; pH 7.9.
- Ckgj2 - 100 to 160 cm, dark yellowish brown to yellowish brown (10YR 4.5/4, moist), pale brown (10YR 6/3, dry), loam; weak medium subangular blocky, friable; strongly calcareous; common, medium prominent, dark red (10YR 3/6), iron concretions; pH 7.8.

(HRY) Hartney Series

The Hartney series consists of the imperfectly drained, Gleyed Rego Black Chernozem carbonated member of the Cameron Association developed on deep, strongly calcareous, loamy lacustrine sediments. This soil has level to very gently sloping complex topography, moderate permeability, slow surface runoff and a loam surface texture. The estimated depth to water table is less than 2 m during the growing season. This soil is used for crop production.

Hartney soils are characterized by black Apk horizons 10 to 12 cm thick, dark gray AC horizons 5 to 7 cm thick, light olive gray Cca horizons 7 to 10 cm thick overlying a pale olive to pale yellow Ckgj horizon.

(LIG) Liege Series

The Liege series is the imperfectly drained Gleyed Cumulic Regosol member of the Melita Association, developed on deep, moderately calcareous, loamy alluvial sediments. These deposits are stratified and contain numerous dark colored bands of former surface horizons. These soils generally have a silt loam to very fine sandy loam surface texture, nearly level to gently undulating topography, moderate permeability and moderate surface runoff. The drainage is imperfect and the estimated depth to water table is less than 2 m. These soils are very susceptible to spring flooding due to high water levels in the creeks and Souris River. Some of these soils are cultivated and produce excellent crops.

This soil is characterized by dark gray Ap horizons 7 to 12 cm thick, gleyed carbonated dark gray Ahkgj horizons 5 to 7 cm thick, gleyed gray brown Ckgj horizons overlying dark gray brown Ahk horizons and light brownish gray to gray brown Ckgj horizons.

(LNA) Lena Series

The Lena series is the poorly drained carbonated Rego Humic Gleysol member of the Chesterfield Association, developed on thin (< 1m), weakly calcareous, moderately fine to fine textured (SCL, CL, SiCL to SiC, C), alluvial sediments underlain by shaley clay or soft shale bedrock. These soils have very gently sloping topography, imperfect

to poor drainage, dominantly a clay loam surface texture, slow permeability, and slow surface runoff. This soil has a very dark gray LH horizon 0 to 3 cm thick overlying a black Ah horizon 10 to 30 cm thick, a dark gray horizon 15 to 20 cm thick and a dark gray Ckg horizon.

(LUD) Lauder Series

The Lauder series is the imperfectly drained Gleyed Black Chernozem member of the Souris Association, developed on deep, weakly to moderately calcareous, coarse textured lacustrine sediments. Lauder soils generally have a loamy fine sand to fine sand surface texture, level topography, moderately rapid permeability and very little surface runoff. These soils are non-stony, rarely saline and have an estimated depth to water table of less than 2 metres during the growing season. Most are cultivated and produce cereal crops.

The profile is characterized by black Ah horizons 10 to 25 cm thick, gleyed, faintly mottled very dark brown Bmgj horizons 20 to 51 cm thick light gray, gleyed Ccagj horizons 15 to 25 cm thick and light brownish gray Ckg horizons with iron staining and mottling. Data for a representative profile of the Lauder series is presented.

- Ah - 0 to 23 cm, very dark gray (10YR 3/1, moist), very dark gray to dark gray (10YR 3.5/1, dry), loamy medium sand; weak fine granular; very friable when moist and dry; clear smooth boundary; pH 7.9.
- Bmgj - 23 to 46 cm, dark yellowish brown (10YR 4/4), dark grayish brown (10YR 4/2, dry), medium sand; single grained; loose when moist and dry; clear smooth boundary; pH 7.9.
- Cca - 46 to 61 cm, brown (10YR 5/3, moist), light gray (10YR 7/2, dry), medium sand; single grained; loose when moist and dry; diffuse wavy boundary; moderately calcareous; pH 8.2.
- Ckg - 61 cm +, very pale brown (10YR 7/4, moist), light gray (10YR 7/2, dry), fine sand; single grained; loose when moist and dry; moderately calcareous; pH 8.4.

(LYT) Lyleton Series

The Lyleton series is the well drained Orthic Black Chernozem member of the Lyleton Association, developed on deep, moderately calcareous, coarse loamy (VFS, LVFS, FSL) lacustrine sediments. This soil usually has sandy loam to loamy very fine sand surface texture, complex gently sloping to gently undulating topography, moderately rapid permeability and moderate surface runoff. The depth to groundwater is estimated at 2 m during the growing season. The surface is non-stony and non-saline. Under cultivation these soils are moderately susceptible to erosion, somewhat droughty and generally low in natural fertility. The majority of these soils occur in the southwestern portion of the Souris River Basin.

The profiles are often deep and consist of black to very dark brown Ap horizons 12 to 15 cm thick, very dark gray to black Ah horizons 18 to 25 cm thick, very dark grayish brown Bm horizons 12 to 18 cm thick, light brownish gray Cca horizons 15 to 20 cm thick and calcareous, light brownish gray Ck horizons.

(MAW) Maskawata Series

The Maskawata series consists of well-drained Rego Black Chernozem soils of the Waskada Association, developed on thin (25 to 100 cm), strongly calcareous, medium textured, discontinuous eolian and lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. The dominant surface texture is a fine sandy loam, topography is gently undulating, permeability and surface runoff moderate. They are moderately well drained soils and usually occur in the upper mild slope position. Maskawata soils are found in close association with Waskada soils. The estimated depth to water level is 3 metres during the growing season. In the cultivated state these soils are moderately eroded and in many of these soils, most of the Ah horizon has been eroded by accelerated removal by wind and water as a result of cultivation. The surface soils have a general gray color due to the incorporation of AC and Ck horizons in the Ap.

Recognition of the overlay in these soils is sometimes difficult because the underlying till is relatively stone free. The Maskawata series is similar to the Argue series of the Cameron Association, except for the underlying glacial till.

(MNH) Mentieth Series

The Mentieth series is the imperfectly drained, Gleyed Rego Black Chernozem, carbonated member of the Mentieth Association, developed on thin moderately calcareous, coarse loamy lacustrine sediments overlying strongly calcareous loamy glacial till. A very thin (< 5 cm) gravelly pebble line may occur at the contact. This soil has a very fine sand to loamy very fine sand surface texture, nearly level topography, moderate permeability and moderately slow surface runoff. These soils are imperfectly drained because of their position in the landscape and the proximity

of the underlying less permeable till. Although ponded surface waters are not common the profile is frequently saturated due to the high water table. The surface is non-stony and cultivated.

The Mentieth series resemble the Switzer series of the Souris Association, the difference is that Mentieth series is underlain by glacial till.

(MOT) Montgomery Series

The Montgomery series is the imperfectly drained, carbonated Gleyed Rego Black Chernozem member of the Waskada Association, developed on thin (25 to 100 cm), strongly calcareous, medium to moderately fine textured, discontinuous aeolian and lacustrine sediments overlying strongly calcareous medium to moderately fine textured glacial till. A very thin (<5cm), pebbly stratum may occur at the contact. This soil has a fine sandy loam surface texture, gently sloping to depressional topography, moderate permeability and moderate surface runoff. This soil has an estimated depth to water table within 2 metres. The cultivated surface may be slightly stony. The soil consists of very dark gray Apk horizons 10 to 20 cm thick, light gray Ccagj horizons 20 to 30 cm thick, light gray Ckgj horizons 25 to 33 cm thick overlying light brownish gray, loam to clay loam, II Ckgj horizons.

(NEI) Neelin Series

The Neelin series is the imperfectly drained, Gleyed Cumulic Regosol member of the Coulter Association, developed on deep, moderately calcareous, moderately fine to fine (CL, SiCL to SiC, C) textured recent alluvial sediments. Neelin soils are frequently stratified with layers ranging in texture from very fine sand to clay. The topography is level to depressional, surface runoff is very slow, and permeability is slow. The depth to water table is estimated to be within 2 metres. Some of these soils are cultivated, others are still in their native state with vegetation consisting of elm, oak, poplar, and various shrubs and grasses. Soluble salts may occur to a moderate degree in some of the Neelin soils. This soil usually consists of dark gray Ah horizons less than 20 cm thick, and light brownish gray, stratified and banded Ck horizons.

(NPK) Napinka Series

The Napinka series is the imperfectly drained, carbonated, Gleyed Rego Black Chernozem member of the Bede Association, developed on deep, strongly calcareous, coarse textured (FS, LCoS, LS, LFS) gravelly deltaic, beach and outwash deposits. The topography varies from nearly level to gently sloping; permeability is rapid and surface runoff is slow. Drainage is imperfect due to seasonally high water tables estimated to be between 1 to 2 m during the growing season. Few of these soils are cultivated due to their low moisture holding capacity and low fertility. Many Napinka soils are used for pastures; however the carrying capacity for animals is low because of the poor growth of native grasses.

A typical profile consists of black Ahk horizons 13 to 20 cm thick, light gray Ccagj horizons 20 to 30 cm thick and light yellowish brown Ckgj horizons. Analytical and morphological data are presented below.

- Apk - 0 to 13 cm, black (10YR 2/1 moist), dark gray (10YR 4/1 dry), medium sandy clay loam; friable, moist, abrupt smooth boundary; moderately calcareous; pH 7.9.
- Ccagj - 13 to 15 cm, gray to light gray (10YR 6/1 moist), white (10YR 8/1 dry), medium sandy clay loam, friable when moist; clear wavy boundary: very strongly calcareous; pH 8.1.
- II Ccagj - 15 to 23 cm, gray (10YR 6/1 moist), white (10YR 8/1 dry), gravelly coarse sandy clay loam, common mottles: friable, moist, very strongly calcareous; clear, wavy boundary; pH 8.1.
- II Ckgj - 23 cm +, gravelly loamy very coarse sand; single grained, loose when moist, strongly calcareous: pH 8.0.

(NWS) Newstead Series

The Newstead series is the well drained, Orthic Black Chernozem member of the Newstead Association, developed on thin (25 to 95 cm), strongly calcareous, medium to moderately fine textured lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. A coarse textured layer (5 to 75 cm) occurs at the contact. Newstead soils commonly have loam to fine sandy loam surface textures, gently sloping to very gently sloping topography; moderate permeability and slow surface runoff. The depth to water table is at about 3 metres during the growing season. These soils commonly occur in areas adjacent to the channels where outwash material deposited on the till is covered by finer textured alluvial and lacustrine material.

A typical profile has a black Ap horizon 5 to 13 cm thick, a very dark grayish brown Bm horizon 20 to 30 cm thick, very coarse textured pale brown II Ck horizon and a light yellowish brown III Ck horizon.

(PPT) Pipestone Series

The Pipestone series is the imperfectly drained, carbonated, Gleyed Black Chernozem member of the Pipestone Association, developed on deep (> 100 cm), weakly to moderately calcareous, fine textured (SiC, C) lacustrine and alluvial sediments. These soils have nearly level topography, light clay surface texture, very slow permeability and slow surface runoff. This soil has an estimated depth to water table of 2 to 3 metres. These soils are usually cultivated and produce excellent crops. Weak to moderate salinity may be present in some areas.

The Pipestone, sand substrate variant, PPT1, differs from the modal Pipestone by having sandy sediments, commonly occurring at 75 to 100cm below the surface.

(RYS) Ryerson Series

The Ryerson series is the well drained, Orthic Black Chernozem member of the Ryerson Association, developed on deep (> 100 cm), strongly calcareous, medium to moderately fine textured (L, CL, SiCL) glacial till. Coarse fragments in the till are composed of shale, limestone, and granite rocks. The surface 25 cm may have a variable texture although the most common textures range from loam to clay loam. These soils are found in the upper and mid slope of undulating to gently rolling topography. This soil has moderate permeability and moderate surface runoff. In some areas it is slightly to moderately stony. The depth to water table is estimated at 3 to 4 metres during the growing season.

(STU) Stanton Series

The Stanton series is the well drained, Orthic Black Chernozem member of the Souris Association, developed on deep (> 1 m), weakly to moderately calcareous, sandy lacustrine sediments. This soil has a fine sand to loamy fine sand surface texture, complex undulating topography, good internal drainage, rapid permeability and low surface runoff. The depth to water table is estimated to be 3 m during the growing season. These soils are susceptible to wind erosion.

Stanton soils usually have deep profiles consisting of black Ap horizons, 10 to 15 cm thick, very dark gray Ah horizons, 20 to 25 cm thick, dark brown to brown Bm horizons 25 to 50 cm thick, and stratified grayish brown Ck horizons. Stanton is equivalent to the Stockton soils in climatic subregion MBT2.

(TWC) Two Creeks

The Two Creeks series is the imperfectly drained, Gleyed Black Chernozem member of the Waskada Association. It is developed on thin (25 to 100 cm), strongly calcareous, medium to moderately fine textured discontinuous eolian and lacustrine sediments overlying strongly calcareous, medium to moderately fine textured glacial till. A very thin (less than 5 cm), gravelly pebble line may occur at the contact. This soil has complex, very gently sloping topography, a fine sandy loam to loam surface texture, moderately slow permeability and slow surface runoff. The estimated depth to water table is 2 to 3 metres during the growing season. These soils are usually cultivated. A typical profile has a very dark gray Ap horizon, 8 to 15 cm thick, a dark grayish brown Bmgj horizon, 13 to 18 cm thick, a gleyed light gray Cca horizon, 8 to 15 cm thick and light olive brown II Ckgj horizon.

(WKD) Waskada Series

The Waskada series is the well drained, Orthic Black Chernozem member of the Waskada Association and is developed on thin (<1 m), strongly calcareous, loamy (VFSL, L, SiL) lacustrine sediments overlying strongly calcareous, loamy glacial till. A very thin (< 5 cm), gravelly pebble line may occur at the contact. These soils have complex, gently sloping topography, moderately good drainage, loam to clay loam surface texture, moderate permeability and moderate surface runoff. The depth to water table is approximately 3 m during the growing season. Most of these soils are cultivated for crop production. Waskada soils usually occur in intermediate and upper slope positions. The knolls are sometimes slightly to moderately eroded. The Waskada series resembles the Cameron series of the Cameron Association. The only difference is the Waskada series is underlain by glacial till. The presence of few stones in the till makes it difficult to determine the depth of overlay.

A typical profile has very dark gray Ap horizons 10 to 15 cm thick, dark brown Bm horizons, 12 to 15 cm thick; sometimes a brown BC horizon occurs above the pale brown II Ck horizon. Analytical and morphological data are presented below.

- Ap - 0 to 18 cm, very dark grayish brown (10YR2.5/2 moist), very dark gray (10YR 3/1 dry) loam; weak, fine to medium granular; friable when moist; slightly hard when dry; abrupt, smooth boundary; pH 7.1.
- Bm - 18 to 33 cm, dark brown (7.5YR 3.5/2 moist), brown (7.5YR 4.5/2 dry) loam; weak, coarse prismatic breaking to moderate, medium sub-angular blocky; friable when moist; slightly hard when dry; clear, smooth boundary; pH 7.1.
- BC - 33 to 43 cm, brown (10YR4.5/3 moist), brown (10YR5/3 dry), silt loam; moderate, medium subangular blocky; friable when moist; hard when dry; clear, smooth boundary; moderately calcareous; pH 7.5.
- II Cca - 43 to 66 cm, pale brown (10YR 6/3 moist), light gray (10YR 7/2 dry), loam till; moderate, medium granular breaking to weak, fine granular; friable when moist; hard when dry; clear, smooth boundary; strongly calcareous; pH 8.1.
- II Ck - 66 cm +, grayish brown to light brownish gray (10YR 5/2 to 6/2 moist), light brownish gray to light gray (10YR 6/2 to 7/2 dry), loam till; pseudo, weak fine granular; firm when moist; hard when dry; strongly calcareous; pH 8.0.

(WSW) Wassewa Series

The Wassewa series is the poorly drained, carbonated Rego Humic Gleysol member of the Croll Association, developed on thin (24 to 100 cm), strongly calcareous, moderately fine textured (SCL, CL, SiCL), discontinuous lacustrine sediments overlying strongly calcareous, medium to moderately fine textured (VFSL, L, SiL to SCL, CL, SiCL) glacial till. A very thin (less than 5 cm), gravelly stratum may occur at the till contact. This soil has depressional topography, silty clay loam to clay loam surface texture; no surface runoff and very slow permeability. The depth to water table is estimated at less than 1 metre during the growing season. Under dry conditions these soils may be cultivated, but due to frequent flooding and surface ponding, they rarely produce a crop. In some instances, these soils may be weakly saline.

This soil has a black Ahk horizon, 10 to 25 cm thick, and a dark olive gray Ck horizon. A thin black Ap horizon may be present in some soils. A typical profile description is given below.

- Apk - 0 to 15 cm, black (10YR 2/1 moist), very dark gray (10YR 3/1 dry) clay loam; weak, fine sub-angular blocky; slightly sticky when wet; slightly hard when dry; abrupt smooth boundary; weakly calcareous.
- Ahkg - 15 to 25 cm, black (10YR 2/1 moist), very dark gray (10YR 3/1 dry) clay loam; amorphous; slightly sticky when wet; slightly hard when dry; clear, irregular boundary; moderately calcareous.
- Ckg -25 cm +, dark olive gray (5Y 3/2 moist), olive gray (5Y4/2 dry), clay loam; amorphous; slightly sticky when wet; very hard when dry; strongly calcareous.

(\$ER) Eroded Slope Complex

This soil complex includes all the land occupied by the eroded slopes of river valleys and walls, incised stream channels and ravines that have down-cut through the surface deposits and shale bedrock. These are generally well drained, strongly to steeply sloping landforms that have variable soil development on materials that are variable in composition, depending on the nature of the surrounding deposits. Due to its complexity, this is a miscellaneous land type rather than a unit of normal soil. These areas are typically influenced by mass wasting processes such as slump, creep, solifluction and erosion.

The soils range from Orthic Black Chernozems to Regosols. The slopes are characterized by numerous major seepage zones where the water table intersects the slope walls or scarps, generally in the mid to lower slopes. The maintenance of vegetation on the Eroded Slopes is essential for their stability.

APPENDIX 5C
VEGETATION SPECIES OBSERVED ALONG THE PROPOSED PIPELINE ROUTE

TABLE 5C-1 VASCULAR PLANT SPECIES IDENTIFIED ALONG THE PROPOSED PIPELINE ROUTE DURING VEGETATION SURVEYS IN SPRING AND SUMMER 2011

Genus	species	subspecies	Common Name
<i>Acer</i>	<i>negundo</i>		Manitoba maple
<i>Achillea</i>	<i>millefolium</i>		yarrow
<i>Agropyron</i>	<i>cristatum</i>		crested wheatgrass
<i>Agropyron</i>	<i>smithii</i>		Western wheat-grass
<i>Agrostis</i>	<i>scabra</i>		tickle grass, hair grass
<i>Allium</i>	<i>stellatum</i>		prairie onion
<i>Ambrosia</i>	<i>psilostachya</i>		perennial ragweed
<i>Ambrosia</i>	<i>trifida</i>		giant ragweed
<i>Andropogon</i>	<i>gerardii</i>		big bluestem
<i>Anemone</i>	<i>canadensis</i>		Canada anemone
<i>Anemone</i>	<i>cylindrica</i>		thimbleweed
<i>Antennaria</i>	<i>Parvifolia</i>		small-leaved pussytoes/ everlasting
<i>Apocynum</i>	<i>cannabinum</i>		Indian hemp
<i>Artemisia</i>	<i>frigida</i>		pasture sage
<i>Artemisia</i>	<i>ludoviciana</i>		prairie sage
<i>Asclepias</i>	<i>ovalifolia</i>		oval-leaved milkweed
<i>Asclepias</i>	<i>syriaca</i>		common milkweed
<i>Aster</i>	<i>ericoides</i>	<i>pansus</i>	many-flowered aster
<i>Aster</i>	<i>laevis</i>		smooth aster
<i>Astragalus</i>	<i>adsurgens</i>		ascending milk-vetch
<i>Astragalus</i>	<i>bisulcatus</i>		two-grooved milk-vetch
<i>Astragalus</i>	<i>crassicaupus</i>		ground plum
<i>Astragalus</i>	<i>pectinatus</i>		narrow-leaved milk vetch
<i>Bouteloua</i>	<i>curtipendula</i>		side-oats grama
<i>Bouteloua</i>	<i>gracilis</i>		blue grama
<i>Bromus</i>	<i>ciliatus</i>		downy brome
<i>Bromus</i>	<i>inermis</i>		smooth brome
<i>Bromus</i>	<i>tectorum</i>		fringed brome
<i>Buchloë</i>	<i>dactyloides</i>		buffalo grass
<i>Calamagrostis</i>	<i>inexpansa</i>		northern reed grass
<i>Calamagrostis</i>	<i>neglecta</i>		reed grass
<i>Campanula</i>	<i>rotundifolia</i>		hairbell
<i>Carex</i>	<i>filifolia</i>		thread-leaved sedge
<i>Cerastium</i>	<i>arvense</i>		field chick-weed
<i>Chenopodium</i>	<i>album</i>		lamb's-quarters
<i>Chrysopsis</i>	<i>villosa</i>		hairy golden-aster
<i>Cicuta</i>	<i>maculata</i>		water hemlock
<i>Cirsium</i>	<i>arvense</i>		Canada thistle
<i>Cirsium</i>	<i>drummondii</i>		short-stemmed thistle
<i>Cirsium</i>	<i>flodmanii</i>		Flodman's thistle
<i>Cirsium</i>	<i>vulgare</i>		bull thistle
<i>Crepis</i>	<i>tectorum</i>		narrow-leaved hawkweed
<i>Dalea</i>	<i>purpurea</i>		purple prairie-clover
<i>Descurainia</i>	<i>sophia</i>		flixweed
<i>Echinacea</i>	<i>angustifolia</i>		narrow-leaved purple coneflower
<i>Echinochloa</i>	<i>crus-galli</i>		barnyard grass
<i>Echinocystis</i>	<i>lobata</i>		wild cucumber
<i>Elaeagnus</i>	<i>commutata</i>		wolf willow

Genus	species	subspecies	Common Name
<i>Epilobium</i>	<i>palustre</i>		marsh willowherb
<i>Erigeron</i>	<i>philadelphicus</i>		Philadelphia fleabane
<i>Euphorbia</i>	<i>esula</i>		leafy spurge
<i>Euphorbia</i>	<i>glyptosperma</i>		thyme-leaved spurge
<i>Fagopyrum</i>	<i>tataricum</i>		tartary buckwheat
<i>Festuca</i>	<i>sp</i>		fescue species
<i>Fraxinus</i>	<i>pennsylvanica</i>		green ash
<i>Gaillardia</i>	<i>aristata</i>		Indian blanket flower
<i>Galium</i>	<i>boreale</i>		Northern bedstraw
<i>Gaura</i>	<i>coccinea</i>		scarlet gaura
<i>Geum</i>	<i>triflorum</i>		three-flowered avens
<i>Glaux</i>	<i>maritima</i>		sea milkwort
<i>Glyceria</i>	<i>striata</i>		fowl manna grass
<i>Glycyrrhiza</i>	<i>lepidota</i>		licorice root
<i>Grindelia</i>	<i>squarrosa</i>		curly-cup gumweed
<i>Helianthus</i>	<i>laetiflorus</i>	<i>subrhomboideus</i>	beautiful sunflower
<i>Helianthus</i>	<i>maximiliani</i>		narrow-leaved sunflower
<i>Heuchera</i>	<i>richardsonii</i>		alum-root
<i>Hordeum</i>	<i>jubatum</i>		foxtail barley
<i>Juncus</i>	<i>balticus</i>		Baltic rush
<i>Kochia</i>	<i>scoparia</i>		summer cypress
<i>Koeleria</i>	<i>crinata</i>		June grass
<i>Lactuca</i>	<i>tatarica</i>	<i>puchella</i>	wild lettuce
<i>Lathyrus</i>	<i>ochroleucus</i>		pale vetchling
<i>Lemna</i>	<i>minor</i>		lesser duckweed
<i>Lepidium</i>	<i>densiflorum</i>		common pepper-grass
<i>Liatris</i>	<i>ligulistylis</i>		meadow blazing star
<i>Liatris</i>	<i>punctata</i>		dotted blazing star
<i>Lilium</i>	<i>philadelphicum</i>		prairie lily
<i>Linum</i>	<i>lewisii</i>		blue flax
<i>Linum</i>	<i>rigidum</i>		large-flowered yellow flax
<i>Lithospermum</i>	<i>canescens</i>		hoary puccoon
<i>Lobelia</i>	<i>spicata</i>		pale spiked lobelia
<i>Lygodesmia</i>	<i>juncea</i>		skeleton weed
<i>Malva</i>	<i>neglecta</i>		common mallow
<i>Medicago</i>	<i>lupulina</i>		black medick
<i>Medicago</i>	<i>sativus</i>		alfalfa
<i>Melilotus</i>	<i>alba</i>		white sweet clover
<i>Melilotus</i>	<i>officinalis</i>		yellow sweet clover
<i>Mentha</i>	<i>arvensis</i>		wild mint
<i>Monarda</i>	<i>fistulosa</i>		bergamot
<i>Muhlenbergia</i>	<i>asperifolia</i>		scratch grass
<i>Nasella</i>	<i>viridula</i>		green needle-grass
<i>Oenothera</i>	<i>biennis</i>		yellow evening primrose
<i>Oenothera</i>	<i>nuttallii</i>		Nuttall's evening primrose
<i>Onosmodium</i>	<i>molle</i>		false gromwell
<i>Opuntia</i>	<i>fragilis</i>		prickly pear cactus
<i>Orthocarpus</i>	<i>lutea</i>		owl's clover
<i>Oxytropis</i>	<i>splendens</i>		showy loco-weed
<i>Panicum</i>	<i>virgatum</i>		switchgrass

Genus	species	subspecies	Common Name
<i>Penstemon</i>	<i>gracilis</i>		lilac-flowered beard-tongue
<i>Phalaris</i>	<i>arundinacea</i>		reed canary grass
<i>Phleum</i>	<i>pratense</i>		timothy
<i>Phragmites</i>	<i>australis</i>		reed grass
<i>Plantago</i>	<i>major</i>		common plantain
<i>Poa</i>	<i>compressa</i>		Canada bluegrass
<i>Poa</i>	<i>pratensis</i>		Kentucky bluegrass
<i>Polygala</i>	<i>verticillata</i>		whorled seneca root
<i>Polygala</i>	<i>senega</i>		seneca snake-root
<i>Prunus</i>	<i>virginiana</i>		chokecherry
<i>Psoralea</i>	<i>argophylla</i>		silver-leaf scurf pea
<i>Psoralea</i>	<i>esculenta</i>		Indian bread-root
<i>Ratibida</i>	<i>columnifera</i>		long-headed coneflower
<i>Rosa</i>	<i>acicularis</i>		prickly rose
<i>Rosa</i>	<i>arkansana</i>		prairie rose
<i>Rumex</i>	<i>salicifolius</i>		narrow-leaved dock
<i>Salicornia</i>	<i>rubra</i>		slender glasswort/ jointed glasswort/ red samphire
<i>Salix</i>	<i>exigua</i>		sandbar willow
<i>Schizachyrium</i>	<i>scoparium</i>		little bluestem
<i>Senecio</i>	<i>Aureus</i>		golden ragwort
<i>Setaria</i>	<i>viridis</i>		green foxtail
<i>Sisyrinchium</i>	<i>montanum</i>		blue-eyed grass
<i>Sium</i>	<i>sauve</i>		water parsnip
<i>Solidago</i>	<i>canadensis</i>		Canada goldenrod
<i>Solidago</i>	<i>nemoralis</i>		low goldenrod
<i>Solidago</i>	<i>rigida</i>		stiff goldenrod
<i>Spartina</i>	<i>gracilis</i>		alkali cord grass
<i>Spartina</i>	<i>pectinata</i>		prairie cordgrass/ slough grass
<i>Spiraea</i>	<i>alba</i>		narrow-leaved meadow-sweet
<i>Sporobolus</i>	<i>heterolepis</i>		prairie dropseed
<i>Stachys</i>	<i>palustris</i>		marsh hedge-nettle
<i>Stipa</i>	<i>comata</i>		needle-and-thread grass
<i>Stipa</i>	<i>spartea</i>		porcupine grass
<i>Suaeda</i>	<i>maritima</i>		sea blite
<i>Symphoricarpos</i>	<i>albus</i>		snowberry
<i>Symphoricarpos</i>	<i>occidentalis</i>		Western snowberry
<i>Taraxacum</i>	<i>officinale</i>		dandelion
<i>Thalictrum</i>	<i>venulosum</i>		veiny meadow rue
<i>Thermopsis</i>	<i>rhombifolia</i>		golden-bean
<i>Thlaspi</i>	<i>arvense</i>		stinkweed/ field penny-cress
<i>Tragopogon</i>	<i>dubius</i>		goat's-beard
<i>Typha</i>	<i>latifolia</i>		common cattail
<i>Urtica</i>	<i>dioica</i>		stinging nettle
<i>Utricularia</i>	<i>minor</i>		lesser bladderwort
<i>Vicia</i>	<i>sp.</i>		vetch species
<i>Xanthium</i>	<i>strumarium</i>		rough cockle-bur
<i>Zigadenus</i>	<i>elegans</i>		smooth camas
<i>Zizia</i>	<i>aurea</i>		golden alexander

APPENDIX 5D
RARE PLANT SPECIES AND PLANT COMMUNITIES AND RARE WILDLIFE SPECIES WITH
POTENTIAL TO OCCUR IN THE PROJECT AREA

TABLE 5D-1 POTENTIAL RARE VASCULAR PLANT SPECIES IN THE ASPEN PARKLAND ECOREGION OF MANITOBA

Scientific Name	Common Name	Preferred Habitat	Provincial Rank ₁	Additional Designations
<i>Achnatherum hymenoides</i> (<i>Oryzopsis hymenoides</i>)	Indian rice grass	dry prairies and sand hills	S2	---
<i>Agalinis aspera</i>	rough purple agalinis	gravelly loam	S1S2	Endangered ₃
<i>Alisma gramineum</i>	narrow-leaved waterplantain	shallow water and mud shores	S1	---
<i>Andropogon hallii</i>	sand bluestem	dry prairies and sand hills	S2	---
<i>Arnica fulgens</i>	shining arnica	moist meadows and gravelly prairies	S2	---
<i>Artemisia cana</i>	silver sagebrush, hoary sagebrush	deep loam and sandy soils on floodplains, uplands and rocky open sites	S2	---
<i>Asarum canadense</i>	wild ginger	rich upland aspen, balsam poplar and elm woods, often calcareous	S3?	---
<i>Asclepias lanuginosa</i>	hairy milkweed	sandhills	S1	---
<i>Asclepias verticillata</i>	whorled milkweed	dry open woods and slopes	S2	---
<i>Asclepias viridiflora</i>	green milkweed	dry hillsides	S3	---
<i>Astragalus givviflorus</i>	cushion milkvetch	dry prairies	S1	---
<i>Astragalus pectinatus</i>	narrow-leaved milkvetch	arid grasslands	S2S3	---
<i>Atriplex argentea</i>	saltbrush, silvery atriplex	alkaline soils	S2	---
<i>Bidens amplissima</i>	beggar-ticks	moist edges of pond or lakes	SNA	---
<i>Boltonia asteroides</i> var. <i>recognita</i>	white boltonia	shores	S2S3	G5T3T5 ₂
<i>Botrychium multifidum</i>	leathery grape-fern	acid sandy grasslands and fields	S3	---
<i>Bouteloua curtipendula</i>	side-oats grama	dry prairies	S2	---
<i>Bromus porteri</i>	Porter's chess	woodlands	S3?	---
<i>Bromus pubescens</i>	Canada brome grass	moist streambanks, meadows, riparian thickets and forests	SNA	---
<i>Buchloë dactyloides</i>	buffalo grass	dry prairies	S1	Threatened _{3,4}
<i>Calamagrostis montanensis</i>	plains reed	grass dry grasslands	S3	---
<i>Callitriche heterophylla</i>	larger water-starwort	wetlands	S2	---
<i>Carex bicknellii</i>	Bicknell's sedge	dry prairies, barren rocky areas	SH	---
<i>Carex cryptolepis</i> northeastern	sedge	moist areas around streams, ponds and lakes	S1	---
<i>Carex gravida</i>	heavy sedge	calcareous soils in open forests and prairies	S1	---
<i>Carex hallii</i>	Hall's sedge	wet meadows	S3	---
<i>Carex hystericina</i>	porcupine sedge	marshes and wetlands	S3?	---
<i>Carex parryana</i>	Parry's sedge	moist areas around streams, ponds and lakes	S3?	---
<i>Carex prairea</i>	prairie sedge	moist wetland soils	S4?	--- ₂
<i>Carex sterilis</i> dioecious	sedge	fens, openings in swamps, lake and river shores, wet calcareous areas	S2	---
<i>Carex supina</i> var. <i>spaniocarpa</i>	weak sedge	moist areas around streams, ponds and lakes	S2?	G5T3T5 ₂
<i>Carex tetanica</i>	rigid sedge	dry calcareous woods	S2	---
<i>Carex torreyi</i>	Torrey's sedge	moist meadows and thickets	S4	---
<i>Carex tribuloides</i>	prickly sedge	wet woodlands and moist meadows	SNA	---
<i>Carex xerantica</i>	white-scaled sedge	grasslands and openings in dry forests	S3?	---
<i>Celtis occidentalis</i>	hackberry, nettle-	well drained sand and gravel	S1	---

Scientific Name	Common Name	Preferred Habitat	Provincial Rank ¹	Additional Designations
	tree	beach ridges		
<i>Chenopodium subglabrum</i>	smooth goosefoot	active sand dunes	S1	G3G4 ₂ , Threatened ₃
<i>Clematis ligusticifolia</i>	western virgin's-bower	moist places in arid areas	S1	---
<i>Coreopsis tinctoria</i>	common tickseed	grassy clearings	SH	---
<i>Comus alternifolia</i>	alternate-leaved dogwood	forest margins and understory	S3	---
<i>Cryptotainia canadensis</i>	honewort	rich damp woods	S2	---
<i>Cycloloma atriplicifolium</i>	winged pigseed	sandy sites	S2	---
<i>Cymopterus acaulis</i>	plains cymopterus	marshy ground	S2S3	---
<i>Cyperus schweinitzii</i>	Schweinitz's flatsedge	dry sandy soil and active dunes	S2	---
<i>Cypripedium candidum</i>	small white lady's-slipper	calcareous prairie openings in wooded grasslands and open south facing slopes	S1	Endangered _{3,4,5}
<i>Dalea villosa</i> var. <i>villosa</i>	silky prairie-clover	dry, sandy prairie sites	S2	Threatened _{3,4}
<i>Desmodium canadense</i>	beggar's-lice	moist open forests and edges	S2	---
<i>Drosera anglica</i>	oblong-leaved sundew	swamps and bogs	S3	---
<i>Eleocharis engelmannii</i>	Engelmann's spike-rush	wet muddy places	S1	---
<i>Elymus hystrix</i>	bottle-brush grass	rich moist woods	S2	---
<i>Eragrostis hypnoides</i>	creeping teal love grass	wetlands	S4	---
<i>Erigeron caespitosus</i>	tufted fleabane	sandy hillsides and prairies	S2	---
<i>Escoba vivipara</i> (<i>Coryphantha vivipara</i>)	pincushion cactus	dry plains and sandhills	S2	---
<i>Festuca hallii</i>	plains rough fescue	dry grassland	S3	---
<i>Galium aparine</i>	cleavers, goosegrass	moist woods	SU	---
<i>Hackelia floribunda</i>	large flowered stickseed	rocky slopes, grasslands and shrub lands	SU	---
<i>Helianthus nuttallii</i> ssp. <i>rydbergii</i>	tuberous-rooted sunflower	dry silty and sandy sites	S2	---
<i>Heliotropium curassavicum</i>	seaside heliotrope	alkaline shores	SH	---
<i>Hypoxis hirsuta</i>	yellow stargrass	wet to dry woodlands and prairies	S3	---
<i>Juncus interior</i>	inland rush	moist prairies, marshy sites and forest edges	S1	---
<i>Krascheninnikovia lanata</i> (<i>Eurotia lanata</i>)	winterfat	prairies and foothills	S2	---
<i>Leersia oryzoides</i>	rice cutgrass	marshes and lowlands around rivers	S3?	---
<i>Lemna turionifera</i>	duckweed	ponds and marshes	SU	---
<i>Lomatium macrocarpum</i>	long-fruited parsley	dry open hillsides	S3	---
<i>Lomatium orientale</i>	white-flowered parsley	dry plains and bluffs	S1	---
<i>Lomatogonium rotatum</i>	marsh felwort	wet alkaline soil	S2S3	---
<i>Lotus purshianus</i>	prairie trefoil	roadsides, open dry disturbed areas	S2S3	---
<i>Malaxis brachypoda</i>	white adder's	moist damp woods and bogs	S2?	---
<i>Malaxis paludosa</i>	bog adder's-mouth	wet sphagnum bogs	S1	---
<i>Mentzelia decapetala</i>	gumbo-lily	bare, wind eroded soil	SH	---
<i>Mertensia lanceolata</i>	tall lungwort	steppes	S2	---
<i>Mimulus glabratus</i>	smooth monkeyflower	shady boggy springs	S1	---
<i>Mimulus glabratus</i> var. <i>jamesii</i>	smooth monkeyflower	wet lime rich soils	S1	---
<i>Musineon divaricatum</i>	leafy musineon	dry hillsides	S2	---
<i>Myosurus minimus</i> ssp. <i>minimus</i>	least mousetail	calcareous and alkaline soils	S1	---
<i>Nassella viridula</i> (<i>Stipa viridula</i>)	green needle	grass dry prairie grassland	S3	---
<i>Orobanche ludoviciana</i>	Louisiana broom-rape	dry hills and sand dunes	S2	---

Scientific Name	Common Name	Preferred Habitat	Provincial Rank ₁	Additional Designations
<i>Osmorhiza claytonii</i>	woolly or hairy sweet cicely	deciduous woods	S2	---
<i>Ostrya virginiana</i>	hop-hornbeam	rich woods	S2	---
<i>Parietaria pennsylvanica</i>	American pellitory	shaded gravelly places and disturbed areas	S4	---
<i>Penstemon nitidus</i>	smooth blue beard-tongue	sandy or gravelly prairies	S2	---
<i>Penstemon procerus</i>	slender beard-tongue	moist prairies	S1?	---
<i>Phryma leptostachya</i>	lopseed rich	woods, slopes, ravines moist thickets	S3	---
<i>Plagiobothrys scouleri</i> var. <i>scouleri</i>	Scouler's allocarya	wetlands and moist areas	S1	G5TNR ₂
<i>Plantago elongata</i> ssp. <i>elongata</i>	linear leaved-plantain	wetlands	S2	---
<i>Piptatherum micranthum</i> (<i>Oryzopsis micrantha</i>)	little-seed rice grass	open woods or rocky ridges or slopes	S2	---
<i>Platanthera orbiculata</i>	round-leaved bog orchid	woods	S3	---
<i>Poa arida</i>	plains bluegrass	dry grasslands	S4	---
<i>Poa cusickii</i>	mutton grass	dry prairie and sand hills	S2?	---
<i>Poa fendleriana</i>	mutton grass	open prairie	S2	---
<i>Polanisia dodecandra</i> ssp. <i>dodecandra</i>	clammyweed	sandy or gravelly soil	S1	---
<i>Polanisia dodecandra</i> ssp. <i>trachysperma</i>	clammyweed	sandy or gravelly soil, often on disturbed or eroding sites	S1	---
<i>Polygala verticillata</i>	whorled milkwort	prairie and dry hills	S2	---
<i>Polygala verticillata</i> var. <i>isocycla</i>	whorled milkwort	prairie and dry hills	S2	---
<i>Potamogeton amplifolius</i>	large-leaved pondweed	lakes and streams	S2?	---
<i>Potamogeton illinoenses</i>	Illinois pondweed	lakes and streams	S2?	---
<i>Potentilla flabelliformis</i> (<i>P. gracilis</i> var. <i>flabelliformis</i>)	graceful cinquefoil	meadows and prairies	S1	---
<i>Potentilla plattensis</i>	low cinquefoil	moist meadows and prairies	S2	---
<i>Ranunculus cymbalaria</i> var. <i>saximontanus</i>	seaside crowfoot	lake and stream edges	S1S2	---
<i>Rhynchospora capillacea</i>	horned beakrush	bogs	S2	---
<i>Salix brachycarpa</i>	short-capsuled willow	coastal tundra and estuaries	S3	---
<i>Sanguinaria canadensis</i>	blood-root rich	woods	S2	---
<i>Schedonnardus paniculatus</i>	tumble-grass	plains and dry alkaline prairies	S2	---
<i>Sisyrinchium campestre</i>	white-eyed grass	prairies, meadows and roadsides	SU	---
<i>Sporobolus neglectus</i>	annual dropseed	dry sandy soils	S3?	---
<i>Thermopsis rhombifolia</i>	golden bean	dry prairies	S2	---
<i>Townsendia exscapa</i>	silky townsend-daisy	sandhills	S2	---
<i>Tradescantia occidentalis</i>	western spiderwort	in sandy soils on open to partially stabilized dune systems	S1	Threatened _{3,4,5}
<i>Uvularia sessilifolia</i>	small bellwort	rich woods and thickets	S2	---
<i>Verbena bracteata</i>	bracted vervain	sandy prairie, roadsides	N/A yes S3 ---	

Sources: TERA Environmental Consultants. 2007. Alberta Clipper Expansion Project - EIS. Prepared for Enbridge Pipelines Inc.

Notes:

- Provincial (S) ranks are based solely on the species' status within the province, and range from 1 (5 or fewer occurrences) to 5 (demonstrably secure under present conditions) (NatureServe 2011).
S1 = Critically Imperilled: because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation. Typically 5 or fewer occurrences or very few remaining individuals (<1,000).
S2 = Imperilled: because of rarity or because of some factor(s) making it very vulnerable to extirpation. Typically 6-20 occurrences or few remaining individuals (1,000-3,000).
S3 = Vulnerable: because rare and uncommon, or found in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21-100 occurrences or between 3,000 and 10,000 individuals.
S4 = Apparently Secure: uncommon but not rare, and usually widespread in the province. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.

S5 = Secure: common, widespread, and abundant in the province. Essentially ineradicable under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.
 S#S# = Range Rank: a numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the element.
 Q = Questionable taxonomy: taxonomic status is questionable; numeric rank may change with taxonomy.
 T = Designates a rank associated with a subspecies.
 NA = Not Applicable: a conservation status is not applicable because the species is not a suitable target for conservation activities.
 H = Historical occurrence; usually not verified in the last 20 years, but with some expectation that it may be rediscovered.
 U = Unrankable: currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
 ? = Inexact numeric rank: denotes inexact numeric rank.

2. Global (G) ranks are based on species status world-wide and follow a system parallel to that for Provincial Ranks (Note 1), ranging from 1 (5 or fewer occurrences) to 5 (demonstrably secure under present conditions). Only Global Ranks of concern (G1 to G3) or questionable ranks are displayed (NatureServe 2011).
3. COSEWIC (2011). Species listed as 'Extirpated', 'Not at Risk' or 'Data Deficient' were generally not included in the table without other noteworthy factors being present.
Endangered: A species facing imminent extirpation or extinction.
Threatened: A species likely to become endangered if limiting factors are not reversed.
4. SARA. The Act establishes Schedule 1 as the list of species to be protected on all federal lands in Canada.
Endangered: a species that is facing imminent extirpation or extinction.
Threatened: a species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
5. Manitoba *Endangered Species Act*
Endangered: any native Manitoba species that is threatened to disappear throughout all or most of its Manitoba range.
Threatened: any native Manitoba species likely to become endangered or at risk due to low or declining numbers in Manitoba if the factors affecting it do not improve.
6. N/A - Indicates that range information for this species or subspecies/variety, in this province, is not available.

TABLE 5D- 2 POTENTIAL RARE PLANT COMMUNITIES FOR THE ASPEN PARKLAND ECOREGION TRAVERSED BY THE PROPOSED PROJECT

Scientific Name	Common Name	Provincial Rank ₁	Global Rank ₂
<i>Andropogon scoparius</i> (<i>Schizachyrium scoparium</i>)- <i>Bouteloua</i> spp. (<i>Curtipendula, gracilis</i>)- <i>Carex filifolia</i> herbaceous vegetation	little bluestem-grama grass (blue, sideoats)-thread-leaved sedge herbaceous vegetation	S3	GNR
<i>Fraxinus pennsylvanica</i> -(<i>Ulmus Americana</i>)- <i>Acer negundo</i> forest	green ash-(American elm)-Manitoba maple forest	S3	GNR
<i>Juniperus horizontalis</i> / <i>Andropogon scoparius</i> (<i>Schizachyrium scoparium</i>) dwarf-shrubland	creeping juniper/little bluestem dwarf shrubland	S3?	GNR
<i>Quercus macrocarpa</i> / <i>Amelanchier alnifolia</i> / <i>Aralia nudicaulis</i> - <i>Carex assiniboensis</i> forest	bur oak/Saskatoon serviceberry /sarsaparilla-assiniboia sedge forest	S3?	GNR
<i>Stipa comata</i> - <i>Bouteloua gracilis</i> - <i>Carex filifolia</i> herbaceous vegetation	needle-and-thread - blue grama – threadleaved sedge herbaceous vegetation	S3	GNR

TABLE 5D- 3 POTENTIAL RARE WILDLIFE SPECIES IN THE ASPEN PARKLAND ECOREGION TRAVERSED BY THE PROPOSED PIPELINE ROUTE IN MANITOBA

Scientific Name	Common Name	Preferred Habitat	Provincial Rank ₁	Additional Designations
MAMMALS				
<i>Odocoileus hemionus</i>	mule or black-tailed deer	Open coniferous forests, subclimax brush, aspen parklands, steep broken terrain, and river valleys.	S3 ₂	Threatened ₆
<i>Onychomys leucogaster</i>	northern grasshopper mouse	Open grasslands interspersed with sagebrush.	S3 ₁	---
<i>Perognathus fasciatus</i>	olive-backed pocket mouse	Open grasslands; sandy soil.	S3 ₁	---

Scientific Name	Common Name	Preferred Habitat	Provincial Rank ¹	Additional Designations
<i>Sorex haydeni</i>	Hayden's prairie shrew	Dense vegetation, shrubby areas and meadows.	S3S4 ₁	---
<i>Sylvilagus floridanus</i>	Eastern cottontail	Meadows, orchards, fence rows and weedy/shrubby areas near woodlots.	S3 ₁	---
<i>Taxidea taxus</i>	badger	Open prairies, farm land and parkland, not forests.	S3S4 ₁	---
BIRDS				
<i>Accipiter cooperii</i>	Cooper's hawk	Aspen groves, parkland woodlots; wooded coulees and riparian forests of grasslands.	S4B, S2M, S2N ₁ , S4B ₂	---
<i>Aechmophorus clarkii</i>	Clark's grebe	Larger lakes with emergent vegetation.	S1B ₁	---
<i>Ammodramus bairdii</i>	Baird's sparrow	Dry grassy, shrubby fields.	S2S3B ₂	Endangered ₆
<i>Ammodramus savannarum</i>	grasshopper sparrow	Hayfields and prairies.	S2S3B ₂	---
<i>Anthus spragueii</i>	Sprague's pipit	Native grassland.	S2S3B ₂	Threatened _{4,5}
<i>Ardea herodias</i>	great blue heron	Open shallow water, edges of bays, streams, river margins, sloughs, lakes, ponds, ditches, mud flats, and marshes, nests on deciduous, coniferous and mixed wood land sometimes at considerable distances from water.	S3B ₁	Special Concern ₄
<i>Athene cunicularia</i>	burrowing owl	Dry, open short-grass country.	S1B ₂ , S2B ₁	Endangered _{4,5,6,7}
<i>Buteo regalis</i>	ferruginous hawk	Open, arid habitats dominated by grasses or sagebrush. It requires an elevated nest site.	S2B ₂ , S4B, S4M ₁	Special Concern ₄ , Threatened ₆
<i>Caprimulgus vociferus</i>	whip-poor-will	Ungrazed mixed, deciduous or open coniferous woods.	S3B ₁	---
<i>Cathartes aura</i>	turkey vulture	Various types of terrain, except heavy unbroken forest.	S3B, S2M, S2N ₁	---
<i>Chaetura pelagica</i>	chimney swift	Open water or land.	S3B ₁	---
<i>Charadrius alexandrinus</i>	snowy plover	Flat sandy beaches, salt flats and sandy areas with little vegetation.	S1B ₁	---
<i>Charadrius melodus circumcinctus</i>	piping plover <i>Circumcinctus</i> subspecies	Nest on gravel shores of shallow, saline lakes and on sandy shores of larger prairie lakes. Seeps also provide important foraging habitat on the Prairies.	S2B ₂ , S3B ₁	G3 ₃ , Endangered _{4,5,6,7}
<i>Charadrius montanus</i>	mountain plover	Heavily grazed or recently burned mixed grassland in flat upland areas.	S1B ₁	G2 ₃ , Endangered _{4,5}
<i>Charadrius semipalmatus</i>	semipalmated plover	Mudflats, sandy or muddy beaches, flat open margins of ponds, lakes and rivers.	S1B, S5M ₁	---
<i>Chlidonias niger</i>	black tern	Watery marshes, lakes, ponds, sloughs, and rivers in either treeless or wooded country.	S3S4B ₂	---
<i>Coturnicops noveboracensis</i>	yellow rail	Marshes, damp fields, meadows and on the floodplains of rivers and streams.	S3B, S2M ₁	Special Concern _{4,5}
<i>Cygnus buccinator</i>	trumpeter swan	Small to medium-sized shallow, isolated lakes with well developed emergent and submergent plant communities.	S1B ₁	---
<i>Cygnus columbianus</i>	tundra swan	Migratory species.	S5M ₁	---
<i>Dendroica caerulescens</i>	black-throated blue warbler	Deciduous and mixedwood with shrub or sapling understory, old clearings and logged areas.	S2B ₁	---
<i>Egretta thula</i>	snowy egret	Larger waterbodies.	S1B ₁	---
<i>Falco mexicanus</i>	prairie falcon	Canyons and coulees of the badlands; cliffs of river valleys.	S3B, S3M, S3N ₁	---
<i>Falco peregrinus anatum</i>	peregrine falcon <i>Anatum</i> subspecies	Nest on cliff ledges on steep cliffs, usually near wetlands. Prefer open habitats such as wetlands, tundra, savannah, sea coasts and mountain meadows, but will also hunt over open forest.	S1B, S4M, S2N ₁	Threatened _{4,5} , Endangered ₆
<i>Gavia stellata</i>	red-throated loon	Freshwater ponds and lakes in forested areas.	S1B ₁	---
<i>Grus americana</i>	whooping crane	Open marshy areas.	SXB, S1M ₁	G1 ₃ , Endangered _{4,5,6,7}
<i>Haliaeetus leucocephalus</i>	bald eagle	Common breeder in north Saskatchewan, uncommon breeder and transient in south	S5C, S4M, S4N ₁	---

Scientific Name	Common Name	Preferred Habitat	Provincial Rank ¹	Additional Designations
		Saskatchewan; uses uplands and open water in winter.		
<i>Lanius excubitor</i>	Northern shrike	Open woods, shrubby swamps, open grasslands with fence posts and scattered trees.	S1B, S4M ₁	---
<i>Lanius ludovicianus excubitorides</i>	loggerhead shrike <i>Excubitorides</i> subspecies	Open country with trees, shrubs, poles or post for lookout and nesting.	S3S4B ₂ , S4B ₁	Threatened ^{4,5} , Endangered ⁶
<i>Limnodromus griseus</i>	short-billed dowitcher	Muskegs, bogs and marshes with low vegetation.	S1B, S4M ₁	---
<i>Melanerpes erythrocephalus</i>	red-headed woodpecker	Requires multiple snags for nesting, roosting, and foraging. Habitats used are: opendeciduous and riparian woodlands, savannah-like grasslands, forest edges and flooded bottomland forests.	S1B, S1M ₁	Special Concern ⁴
<i>Numenius americanus</i>	long-billed curlew	Large tracts of open grassland with low vegetative cover for nesting.	S4B, S4M ₁	Special Concern ^{4,5}
<i>Numenius borealis</i>	Eskimo curlew	Open native grassland and tundra, burned prairies, meadows and pastures.	SHM ₁	G1 ₃ , Endangered ^{4,5,6}
<i>Oporornis agilis</i>	Connecticut warbler	Spruce and tamarack bogs; dry ridges and knolls with open poplar woods; open immature jack pine woods.	S2B ₁	---
<i>Pelecanus erythrorhynchos</i>	American white pelican	Freshwater lakes in both treeless and forested areas.	S3B ₁	G3 ₃
<i>Phalaenoptilus nuttallii</i>	common poorwill	Semi-arid sagebrush benchlands or grassy openings in dry open woods.	S3B ₁	---
<i>Pinicola enucleator</i>	pine grosbeak	Open coniferous forest openings and edges; deciduous forest, shade trees around towns, apple orchards and tall shrubbery.	S2B, S4N ₁	---
<i>Piranga olivacea</i>	scarlet tanager	Mature deciduous woods, mixedwoods and pine woods.	S1B ₁	---
<i>Sialia sialis</i>	Eastern bluebird	Nests in eastern parklands, occasionally north to the Saskatoon and Greenwater Lake districts.	S4B ₁	---
<i>Sterna caspia</i>	Caspian tern	Large lakes with emergent vegetation and sandy beaches.	S2B, S2M ₁	---
<i>Strix nebulosa</i>	Great gray owl	Mixedwoods near water sources.	S3B, S3N ₁	---
<i>Strix varia</i>	barred owl	Mature woodlands preferably near water bodies.	S3S4 ₂ , S3B, S3N ₁	---
<i>Sumia ulula</i>	Northern hawk-owl	Open coniferous or mixedwoods, muskeg, or burnt areas with standing stumps.	S3B, S5N ₁	---
<i>Vireo flavifrons</i>	yellow-throated vireo	Mature deciduous woods along hillsides and riparian woods.	S2B, S3N ₁	---
HERPTILES				
<i>Bufo cognatus</i>	Great plains toad	Deserts, grasslands, semi-desert shrublands, open floodplains, and agricultural areas; typically in stream valleys. Burrows underground when inactive.	S2S3 ₂ , S3 ₁	Special Concern ^{4,5} , Threatened ⁶
<i>Chelydra serpentina</i>	snapping turtle	Prefer slow moving and shallow waters, can be found living on the edge of deep lakes and rivers.	S3 ₁	---
<i>Eumeces septentrionalis</i>	Northern prairie skink	Sandy areas located close to a water source such as a river or a swamp.	S2 ₂	Endangered ^{4,5}
<i>Liochlorophis vernalis</i>	smooth green snake	Meadows, grassy marshes, stream borders, abandoned farmland.	S3S4	---
<i>Rana pipiens</i>	Northern leopard frog	Streams or larger ponds that do not freeze solid with vegetation 15 to 30 cm tall.	S3 ₁	G5TNR ₃ , Special Concern ^{4,5}
<i>Storeria occipitomaculata</i>	redbelly snake	Wooded hilly regions and at the edge of clearings near bogs.	S4 ₂	---
FISH				
<i>Acipenser fulvescens</i>	lake sturgeon	Bottom of gravelly tributary, streams of rivers and lakes.	S2S3 ₂ , S2 ₁	G3G4 ₃ , Endangered ⁴
<i>Ambloplites rupestris</i>	rock bass	Well-oxygenated, hard water walleye lakes	S2S3 ₁	---

Scientific Name	Common Name	Preferred Habitat	Provincial Rank ¹	Additional Designations
		with boulder and sand bottoms.		
<i>Ameiurus nebulosus</i>	brown bullhead	Clear water in deep pools with submerged vegetation.	S3 ₁	---
<i>Hiodon tergisus</i>	mooneye	Clear water of large streams, rivers and lakes.	S3 ₁	---
<i>Ichthyomyzon castaneus</i>	chestnut lamprey	Medium and large rivers.	S3S4 ₂	Special Concern ₄
<i>Ictalurus punctatus</i>	channel catfish	Rivers and large creeks in slow to moderate current over sand, gravel or rocks; ponds, lakes, reservoirs.	S2S3 ₁	---
<i>Ictiobus cyprinellus</i>	bigmouth buffalo	Lowland lakes, sloughs and large rivers with slow to still waters and bottoms of mud, silt, sand and gravel.	S3 ₁	Special Concern ₄
<i>Macrhybopsis storeriana</i>	silver chub	Large, moderate flow rivers with a substrate of silt or sand, but sometimes gravel, rubble, boulder or bedrock.	S3 ₂	Special Concern _{4,5}
<i>Notropis dorsalis</i>	bigmouth shiner	Runs and pools of shallow open headwaters, creeks, and small to medium rivers with bottom predominantly sand, often overlain with silt, sometimes also in lakes.	S3 ₂	---
INVERTEBRATES				
<i>Danaus plexippus</i>	monarch	Wherever milkweed and wildflowers exist. This includes abandoned farmland, along roadsides, and other open spaces where these plants grow.	S5 ₂ , S3B ₁	Special Concern _{4,5}
<i>Hesperia dactotae</i>	Dakota skipper	Native tall-grass prairies.	S2S3 ₂ , S1 ₁	G2 ₃ , Threatened _{4,5,6}

Sources: TERA Environmental Consultants. 2007. Alberta Clipper Expansion Project - EIS. Prepared for Enbridge Pipelines Inc.

Notes:

- Provincial (S) ranks are based solely on the species' status within the province of Manitoba, and range from 1 (5 or fewer occurrences) to 5 (demonstrably secure under present conditions) (NatureServe 2011).
S1 = Critically Imperilled: because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation. Typically 5 or fewer occurrences or very few remaining individuals (<1,000).
S2 = Imperilled: because of rarity or because of some factor(s) making it very vulnerable to extirpation. Typically 6-20 occurrences or few remaining individuals (1,000-3,000).
S3 = Vulnerable: because rare and uncommon, or found in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21-100 occurrences or between 3,000 and 10,000 individuals.
S4 = Apparently Secure: uncommon but not rare, and usually widespread in the province. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.
S5 = Demonstrably Secure: common; widespread and abundant, though it may be rare in parts of its range. Usually more than 1000 occurrences.
S#S# = Range Rank: a numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the element.
B = Breeding: basic rank refers to the breeding population of a migratory species in the element.
- Global (G) ranks are based on species status world-wide and follow a system parallel to that for Provincial Ranks (Note 1), ranging from 1 (5 or fewer occurrences) to 5 (demonstrably secure under present conditions). Only Global Ranks of concern (G1 to G3) or questionable ranks are displayed (NatureServe 2011).
- COSEWIC (2011). Species listed as 'Extirpated', 'Not at Risk' or 'Data Deficient' were generally not included in the table without other noteworthy factors being present.
Endangered: A species facing imminent extirpation or extinction.
Threatened: A species likely to become endangered if limiting factors are not reversed.

APPENDIX 5E
RESULTS OF WEED SURVEY FOR THE PROPOSED PIPELINE ROUTE

TABLE 5E-1 POTENTIAL WEED SPECIES ALONG THE PROPOSED PIPELINE ROUTE AND THEIR CHARACTERISTICS

Common Name	Scientific Name	Provincial Designation	Life Cycle	Reproduction By	Problematic In
absinth	<i>Artemisia absinthium</i>	noxious	perennial	seed	pasture
American dragonhead	<i>Dracocephalum parviflorum</i>	noxious	annual	biennial	seed crops
annual sow-thistle	<i>Sonchus oleraceus</i>	noxious	annual	seed	crops, pasture, road sides
black medick	<i>Medicago lupulina</i>	noxious	annual, winter annual, biennial	seed	crops pastures, waste areas
bluebur	<i>Lappula echinata (squamata)</i>	noxious	annual, winter annual	seed	crops, pasture, waste areas
blueweed	<i>Echium vulgare</i>	noxious	biennial	seed	crops
burdock sp.	<i>Arctium sp.</i>	noxious	biennial	seed	crops, pasture, waste areas
bull thistle	<i>Cirsium vulgare</i>	noxious	perennial	rhizomes, seed	pasture
Canada fleabane	<i>Erigeron Canadensis</i>	noxious	annual, winter annual, biennial	seed	crops, pasture
cleavers	<i>Galium aparine & G. spurium</i>	noxious	annual, winter annual	seed	crops
common chickweed	<i>Cerastium arvense</i>	noxious	annual, winter annual	seed	crops
common knotweed	<i>Polygonum arenastrum</i>	noxious	annual	seed	crops, road sides
common plantain	<i>Plantago major</i>	noxious	annual, biennial perennial	seed	crops, pastures, lawns
common tansy	<i>Tanacetum vulgare</i>	noxious	perennial	rhizomes, seed	pasture
creeping thistle	<i>Cirsium arvense</i>	noxious	perennial	deep rhizomes seed	crop, pasture
curled dock	<i>Rumex crispus</i>	noxious	perennial	seed	crops pasture
dandelion	<i>Taraxacum officinale</i>	noxious	perennial	seed	pastures, lawns, crops
downy brome	<i>Bromus tectorum</i>	noxious	annual, winter annual	seed	crops, road sides
field bindweed	<i>Convolvulus arvensis</i>	noxious	perennial	rhizomes, seed	crops
field horsetail	<i>Equisetum arvense</i>	noxious	perennial	rhizomes, seed	crops
flixweed	<i>Descurainia sophia</i>	noxious	annual, winter annual, biennial	seed	crops
foxtail barley	<i>Hordeum jubatum</i>	noxious	perennial	seed	pasture
goosefoot sp.	<i>Chenopodium sp.</i>	noxious	annual	seed	crops
green foxtail	<i>Setaria viridis</i>	noxious	annual	seed	crops
green smartweed	<i>Polygonum lapathifolium</i>	noxious	annual	seed	crops
hemp-nettle	<i>Galeopsis tetrahit</i>	noxious	annual	seeds	crops
henbit	<i>Lamium amplexicaule</i>	noxious	annual, biennial	seed	crops
kochia	<i>Kochia scoparia</i>	noxious	annual	seed	crops
lamb's-quarters	<i>Chenopodium album</i>	noxious	annual	seed	crops
leafy spurge	<i>Euphorbia esula</i>	noxious	perennial	rhizomes, seed	pasture
narrow-leaved hawk's-beard	<i>Crepis tectorum</i>	noxious	annual, winter annual	seed	crops, pasture, road sides
night-flowering catchfly	<i>Silene noctiflora</i>	noxious	annual, winter annual	seed	crops, pastures

TABLE 5E-1 POTENTIAL WEED SPECIES ALONG THE PROPOSED PIPELINE ROUTE AND THEIR CHARACTERISTICS (CONT'D)

Common Name	Scientific Name	Provincial Designation	Life Cycle	Reproduction By	Problematic In
perennial sow-thistle	<i>Sonchus arvensis</i>	noxious	perennial	rhizomes, seed	crops, pasture, road sides
Philadelphia fleabane	<i>Erigeron philadelphicus</i>	noxious	perennial biennial	seed	pasture
pineapple-weed	<i>Matricaria matricarioides</i>	noxious	annual	seed	road sides, waste areas
prickly lettuce	<i>Lactuca serriola</i>	noxious	annual, winter annual, biennial	seed	crops, pastures
prairie rose	<i>Rosa acicularis</i>	noxious	perennial	rhizomes, seed	pasture, road sides

TABLE 5E-2 SUMMARY OF WEED SURVEY FOR THE PROPOSED PIPELINE ROUTE

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
NE-21-1-25	Cultivated- cereal	volunteer canola	4	492	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		Canada fleabane	7	492	
NW-21-1-25	Chem. fallow	Canada thistle	3	493; very disturbed, recently sprayed	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		narrow-leaved dock	5	493	
		volunteer flax	1	493	
		marsh willowherb	4	493	
		foxtail barley	6	493	
		volunteer oats	1	493	
		Canada fleabane	1	493	
		common mallow	1	493	
		kochia	1	493	
		annual sowthistle	1	493	
		common cattail	6	493	
		goatsbeard	2	494; species as at wpt 493, plus:	
		smooth brome	9	at edge	
		redroot pigweed	4	494	
NE-20-1-25	Chem. fallow	foxtail barley	6	495	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		volunteer canola	4	495	
		marsh willowherb	4	495	
		field bindweed	1	495	
		Canada thistle	6	495	
		Canada fleabane	4	495	
NW-20-1-25	Chem. fallow	foxtail barley	6	496	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		water plantain	7	496	
		common cattail	7	496	
NW-20-1-25 cont'd		Canada thistle	1	496	
		marsh willowherb	4	496	
		annual sowthistle	2	496	
		volunteer canola	7	497; wetland edge, has been cultivated repeatedly in the past; species as at wpt 496, plus:	
		perennial ragweed	6	665, 666	
		redroot pigweed	1	666	
		narrow-leaved dock	9	668	
		Canada bluegrass	9	668	666 large patch D=20m Suggested re-route through this point; disturbed, weedy & no SARA-listed species found
NE-19-1-25	Cultivated- cereal	smooth brome	9	498; brome co-dominant w/ bluegrass in ditch	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
	Chem. fallow	Kentucky bluegrass Indian hemp Canada goldenrod foxtail barley marsh willowherb redroot pigweed narrow-leaved dock field penny-cress Canada thistle	9 4 3 9 4 2 2 1 3	ditch ditch ditch 499 499 499 499 499 500; single large patch (~15m), knocked back by herbicide	
NW-19-1-25	Cultivated	smooth brome quackgrass Canada thistle annual sowthistle narrow-leaved dock sloughgrass barnyard grass foxtail barley rough false sunflower foxtail barley canola (standing) narrow-leaved dock annual sowthistle smooth brome marsh willowherb common reed grass	9 9 3 3 6 7-9 7-9 9 1 6 6 6 2 3 3 3	501 (ditch) co-dominant with smooth brome, 1m roadside strip wetland has undergone long-term cultivation 501 501 in wetter areas 501 in drier areas surrounding wetland 501 502; 502 502 502 502 wetland to N of line 503; along roadside, not on pipeline route	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
NE24-1-26	Cultivated- cereal	smooth brome Canada fleabane Canada thistle	9 1 3	504; very clean crop; weeds only at roadside 504 504	
NW-24-1-26	Cultivated- cereal	sloughgrass smartweed green foxtail Canada fleabane volunteer sunflower smooth brome narrow-leaved dock volunteer sunflower	6 4 2 7 3 9 1 1	505; very clean crop; low dry area w/ indications of wet conditions in recent past 505 505 505 505 along ditch 506, at road 506	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
NW-24-1-26, continued	Fallow- stubble	volunteer oats	1	507	
		field penny-cress	1	507	
		marsh willowherb	2	507	
		annual sowthistle	2	507	
NE-23-1-26	Fallow	smooth brome	9	brome in 1m strip along ditch	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs must be treated - spray or hand-pull
		Canada thistle	1	508	
		Canada fleabane	4	508	
		marsh willowherb	4	508	
		smartweed	2	508	
		volunteer sunflower	1	508	
		foxtail barley	4	508	
		redroot pigweed	2	508	
		common mallow	1	508	
		field bindweed	1	508	
		Canada fleabane	3	508	
		leafy spurge	3	at wpt 508, wetland edge by access road; small patch (D~1m)	
		narrow-leaved dock	3	508	
		quackgrass	3	along access road; heard Sora call (Porzana carolina)	
NW-23-1-26	Fallow- stubble	smooth brome	9	509; smooth brome in ditch south of road	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		Canada thistle	4	509	
		narrow-leaved dock	3	509	
SW-26-1-26		smooth brome	9	509; strip of veg. north of road; cultivated to north	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		Canada thistle	4	509	
		quackgrass	4	509	
		smooth brome	9	510; East of road 152W; sm. brome on roadside	
		Kentucky bluegrass	9	roadside	
		pasture sage	1	510	
SE-27-1-26	Cultivated- cereal	smooth brome	9	510; West of road 152W; sm. brome on roadside	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		Canada thistle	4	510	
		volunteer oats	2	510	
		annual sowthistle	2	510	
SW-27-1-26	Cultivated- cereal (stubble)	common reed grass	9	512; corner is under water; reed grass and n-l dock in concentric rings at edges of water	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		narrow-leaved dock	9	512	
		common cattail	1	512	

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
		water plantain	9	with n-l dock at edge of water; wet area entirely cultivated	
		Indian hemp	9	at wet edge of ditch	
		quackgrass	9	in strip at edge of ditch	
SE-28-1-26	Cultivated- cereal	smooth brome	9	513; sm brome in ditch	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
SW-28-1-26	Cultivated- cereal	smooth brome	9	514; east of rd 154W; sm. brome in ditch	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		volunteer sunflower	1	514	
		green foxtail	5	514	
		sloughgrass	2	514	
		marsh willowherb	2	514	
		annual sowthistle	1	514	
		field bindweed	1	514	
SE-29-1-26	Cultivated- barley	smooth brome	9	514; west of rd 154W; smooth brome in ditch	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		field bindweed	2	514	
		redroot pigweed	2	514	
		annual sowthistle	2	514	
		smartweed	2	514	
		Canada fleabane	2	514	
		alfalfa	1	514	
		goosefoot	1	514	
		narrow-leaved dock	2	515	
		volunteer sunflower	2	515	
		field penny-cress	2	515	
SW-30-1-26 (W bank Souris R).	Pasture- currently grazed	leafy spurge	6	533, ~15m-wide strip runs along bank across width of proposed pipeline RoW; 535, patch D= ~5m; 536, patch D=~5m; 538, patch D=~3m;	herbicide application (spring-fall); otherwise, bore in winter to minimize any disturbance which will spread rootstocks
		perennial ragweed	1	533	- Post-Construction Monitoring
		perennial ragweed	1	534	- Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		bluegrass	9	536	
		smooth brome	2; 6-9;	540; 541	
SW-29-1-26 (E bank of Souris R.)	Pasture- currently grazed; MHHC conservation land (surveyed as potential alternative route)	Kentucky bluegrass	9	639	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		goatsbeard	1	640	
		perennial ragweed	3	641, 642 (D=20)	
		yellow sweetclover	1	641	
		curly-cup gumweed	4	642	
		field sow-thistle	6	643	
		foxtail barley	6	643	

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
		Kentucky bluegrass	6	643	
NE-20-1-26 NE-20-1-26, continued	Cultivated- canola	smooth brome	9	516; smooth brome (9) in ditch	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		field penny-cress	2	recent herbicide application; most veg necrotic	
		narrow-leaved dock	2	516	
		foxtail barley	2	516	
		marsh willowherb	2	516	
		smooth brome	2	516	
				639; govt. road allow. @ gate (NE part of NE20)	
NE-19-1-26 (E bank Souris R.)	Pasture- currently grazed	perennial ragweed	4	522; Wpt 701; in govt road allow. between NE19 & NW20; 100s of sandhill cranes staging on banks of Souris R.	Clean equipment, work in winter, remove and burn standing dead vegetation if practical
		Canada thistle	4	522	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		licorice root	6	522	
		leafy spurge	5	544, two patches D≈2m each, extend parallel to bank to the south of the waypoint; 547, marks W edge of patch, runs across ROW ~50m to water's edge at time of survey (receding after flooding)	
NW-19-1-26 (W bank Souris R.)	Pasture- currently grazed	Kentucky bluegrass	7	545 543-548	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
NW-20-1-26 (E bank Souris R.)	Pasture- currently grazed	smooth brome	9	517; buffer of tame hay around native pasture; -531;	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		alfalfa	9	531	Clean equipment, work in winter, remove and burn standing dead vegetation - Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		yellow sweet clover	9	531	
		dandelion	1	531	
		licorice root	4	Wpt. 694; in govt road allow. between NE19 & SE30	
		yellow sweet clover	4	633; in govt. road allow. Betw. NW20 & SW29	
		curly-cup gumweed	4	633	
		perennial ragweed	4	633	
		smooth brome	6	633	
		marsh willowherb	1	634 (S. boundary of road allow.)	
		bull thistle	3	634	
		alfalfa	2	635 (N. boundary of road allow.)	

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation	
NW-20-1-26 (E bank Souris R.), continued		smooth brome	6	635	mow and remove prior to construction	
		Canada thistle	3	636- large patch D=10m E-W along S side of govt. ROW		
		narrow-leaved dock	2	636	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs	
		field sow-thistle	3	636- large patch D=10m E-W along S side of govt. ROW		
		stinging nettle	3	637		
		smooth brome	9	637		
		foxtail barley	3	637		
		baltic rush	3	637		
		narrow-leaved dock	7	651		adjacent to S boundary fence of govt. road allow.
		foxtail barley	7	651		heavily used by cattle, 80% bare ground, heavily rutted and disturbed
common cattail	4	651	grazed off			
NE-24-1-27	Fallow	foxtail barley	6, 2	549 (between N and S proposed routes; 6 to South, 2 to North)		- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		narrow-leaved dock	4	549 (4 to S & N)		
		Canada fleabane	4	549 (4 to S & N)		
SE25-1-27	Fallow	volunteer wheat	7	550 - N/S deflection to S route; 551	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs	
		volunteer oats	7	551		
		Canada fleabane	7	551		
		smartweed	2	551		
		field penny-cress	2	551		
		foxtail barley	2	551		
		volunteer sunflower	2	551		
SW-25-1-27	Fallowed corn field; fenced for pasture	redroot pigweed	2-4	552-554, 556	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs	
		green foxtail	2-4	552, 553		
		flixweed	7	552		
		marsh muhly	2-3	552		
		silverweed	2	552		
		wild mustard	1	552		
		Canada thistle	1	552		
		field bindweed	2-4	552, 553		
		foxtail barley	1	552		
		portulaca	2-4	552, 553		
		dandelion	2	552		
		volunteer oats	1	552		
		volunteer canola	1	552		

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
	Pasture	leafy spurge volunteer com smooth brome Northern wheatgrass Kentucky bluegrass perennial ragweed white sweet clover	4 2 4 4 8 3 2	553 553 554 554 554 554 554	herbicide - Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
SE-26-1-27	Tame hayland - alfalfa Wetland- E side fenceline Fallow- W side fenceline	smooth brome white sweet clover narrow-leaved dock smooth brome smooth brome pondweed common cattail leafy spurge water plantain smooth brome prairie cordgrass lesser bladderwort sandbar willow reed grass pondweed water plantain lesser bladderwort common cattail fowl manna grass narrow-leaved dock lady's thumb water parsnip narrow-leaved meadow sweet	9 4 2 9 9 at edge 9 (shallow flats) 3 3 5 5 5 3 3 6 9 5 5 5 5 4 5 5 2	555 (ditch), 627 555 555 556 (ditch) 626 (fenceline betw. SE & SW26) 627 627 627 (patch - D=2m on road allowance to south) 627 627 627 627 627 629 (E edge of wetland) 629 629 629 629 629 629 629	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
SW-26-1-27	Cultivated- canola (fallow)	green foxtail field penny-cress marsh willowherb narrow-leaved dock foxtail barley field bindweed Canada fleabane Canada thistle	3 4 9 7 6 4 7 1	628 628 628 628 628 628 628 628	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
NW-26-1-27	Cropland- stubble, chem. fallow	foxtail barley	4	557	<ul style="list-style-type: none"> - Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		narrow-leaved dock	4	557	
		marsh willowherb	7-9	557	
		redroot pigweed	4	557	
		field bindweed	4	557	
		volunteer wheat	4	557	
		smooth brome	9	557 (ditch)	
		Canda thistle	4	557 (ditch)	
SW-35-1-27	Chem. fallow	smooth brome	9	558 (ditch)	<ul style="list-style-type: none"> - Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
SW-35-1-27, continued		common cattail	7	558 (adj. to ditch)	
		narrow-leaved dock	4	558	
		water-plantain	5	558	
		marsh muhly	4	558	
		Indian hemp	4	558	
		volunteer sunflower	2	559	
		volunteer wheat	4	559	
		volunteer canola	6	559	
		field penny-cress	2	559	
		Canada fleabane	4	559	
		flixweed	4	559	
		common pepper-grass	2	559	
		Canada thistle	2	559	
field bindweed	4	559			
NW-35-1-27	Cropland- fallow	marsh willowherb	9	560	<ul style="list-style-type: none"> - Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		Canada thistle	5	560	
		narrow-leaved dock	2	560	
		field sow-thistle	2	560	
		Canada fleabane	2	560	
		volunteer sunflower	4	560	
		green foxtail	4	560	
		marsh muhly	2	560	
		field bindweed	2	560	
SW-2-2-27	Cropland- fallow	smooth brome	9	564	<ul style="list-style-type: none"> - Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		Canada thistle	5	564	
		narrow-leaved dock	2	564	
		field sow-thistle	2	564	
		Canada fleabane	2	564	

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
		marsh willowherb	4	564	
		green foxtail	4	564	
		marsh muhly	2	564	
		field bindweed	2	564	
		yellow sweet clover	4	564	
SE-3-2-27 (E side of Antler R.)	Tame hayland	smooth brome	9	561; no permission to enter; surveyed from roadside. 562-563	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		yellow sweet clover	4	561	
		white sweet clover	4	561	
		Flodman's thistle	2	561	
		many-flowered aster	2	561	
		Indian hemp	2	561	
(W side of Antler R.)	Tame hayland	smooth brome	9	562 - cultivated right to top of bank	
		yellow sweet clover	7	562	
		Canada fleabane	4	562	
		black medick	4	562	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		Canada thistle	5	562	
		green foxtail	2	562	
SE-3-2-27 (W side of Antler R.), continued		Americian dragonhead	2	562	
		bull thistle	2	562	
		rough cockle-bur	2	562	
		smooth brome	9	563 (bottom of bank, very disturbed)	
		snowberry	4	563	
		Manitoba maple	2	563	
		green ash	2	563	
		chokecherry	2	563	
SW-3-2-27	Cultivated- fallow	rough cockle-bur	4	566	
		marsh willowherb	7	566	
		volunteer wheat	4	566	
		foxtail barley	7	566	
		Canada fleabane	4	566	
		narrow-leaf hawksbeard	2	566	
		white sweet clover	2	566	
		narrow-leaved dock	2	566	
		green foxtail	2	566	
		Canada thistle	3	566	
SE-4-2-27	Cultivated- fallow	common plantain	2	567	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		foxtail barley	4	567	
		Canada fleabane	7	567	

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
		volunteer wheat	4	567	
		narrow-leaved dock	2	567	
		narrow-leaved hawk's-beard	4	567	
		field bindweed	2-4	567	
		white sweet clover	2	567	
		Canada thistle	4	567	
		smooth brome	7	567	
		quackgrass	4	567	
SW-4-2-27	Cultivated- canola (stubble)	volunteer cereal	9	568; clean field	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
SE-5-2-27	Chem. fallow	field sow-thistle	9	569	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		Canada fleabane	9	569	
		volunteer canola	7	569	
		smooth brome	9	569 (ditch)	
		water plantain	5	570	
		prairie cordgrass	5	570	
		Canada thistle	2	570	
		reed canary grass	3	570	
		northern reed grass	3	570	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
SW-5-2-27	Cultivated- fallow	foxtail barley	9	571	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
SW-5-2-27, continued		Canada fleabane	9	571	
		evening primrose	1	571	
		green foxtail	4	571	
		marsh willowherb	4	571	
		rough cockle-bur	2	571	
		volunteer oats	1	571	
SE-6-2-27	Cultivated- fallow	volunteer wheat	9	572	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		foxtail barley	9	572	
		field sow-thistle	4	572	
		Canada thistle	4	572	
		narrow-leaved dock	4	572	
		volunteer sunflower	2-4	572	
		marsh willowherb	4	572	
SW-6-2-27	Cultivated- wheat (standing)	foxtail barley	7-9	573	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		marsh willowherb	4	573	

Legal Location (WPM)	Land Use	Weed Species	Density ¹	Waypoints/Comments	Recommended Mitigation
SE-1-2-28	Cultivated- wheat (standing)	foxtail barley	9	574	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		licorice root	4	574	
		marsh willowherb	4	574	
		volunteer sunflower	2	574	
		volunteer oats	2	574	
	roadside	green foxtail	4	574	
		common cattail	9	575 (heard sora)	
		prairie cordgrass	9	575	
SW-1-2-28	wetland	prairie cordgrass	3	576	- Post-Construction Monitoring - Consultation with landowners in spring 2012 re: proposed landowner weed control programs
		common cattail	8	576	
		large bur-reed	3	576	
		hard-stemmed bulrush	3	576	
		pondweed	2	576	
	Chem. fallow	water smartweed	2	576	
		marsh willowherb	4	577	

Notes: 1:

BC MINISTRY OF FORESTS WEED DISTRIBUTION CODES

CLASS	DENSITY DISTRIBUTION	SAMPLE
1	Rare individual, a single occurrence	
2	A few sporadically occurring individuals	
3	A single patch or clump of a species	
4	Several sporadically occurring individuals	
5	A few patches or clumps of a species	
6	Several well spaced patches or clumps	
7	Continuous uniform occurrence of well spaced individuals	
8	Continuous occurrence of a species with a few gaps in the distribution	
9	Continuous dense occurrence of a species	

Source: Luttmerding et al. 1990.