6.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

The description of the environmental and socio-economic setting, and current state of the environment within the Project area (Section 5.0 of this ESA), are compared in this section of the ESA against the Project Description (Section 2.0 of this ESA) to identify potential effects that might be caused by the Alberta Clipper Project. The environmental and socio-economic effects assessment uses the information provided in the environmental and socio-economic setting to:

- evaluate the environmental and socio-economic elements of importance in the Project area;
- formulate appropriate site-specific mitigative measures that are technically and economically feasible;
- identify and evaluate Project residual effects associated with each environmental and socio-economic element of importance; and
- identify the effects of the environment on the Project.

In addition, the environmental and socio-economic effects assessment has determined the significance of potential adverse residual effects resulting from construction and operation activities after taking into consideration proposed mitigation and, where warranted, compensation measures.

6.1 Methodology

The assessment evaluated the environmental and socio-economic effects of the construction, operation, decommissioning and abandonment phases of each component of the Project (*i.e.,* pipeline, pump additions, tanks, temporary facilities for construction). The assessment method included the following components:

- determination of spatial and temporal boundaries for this assessment;
- identification of biophysical and socio-economic elements;
- identification of potential environmental and socio-economic impacts;
- development of technically and economically feasible mitigation and, where appropriate, compensation measures;
- identification of anticipated residual effects; and
- determination of the significance of adverse residual effects.

This environmental and socio-economic effects assessment methodology has been developed based on the CEA Agency's *The Authority's Guide to the Canadian Environmental Assessment Act* (CEA Agency 1994), the CEA Agency's *Cumulative Effects Assessment Practitioners Guide* (Hegmann *et al.* 1999), the *CEA Act* and the NEB *Filing Manual* (NEB 2004).

The environmental and socio-economic effects assessment associated with the construction and operation of the Project was a collaborative effort of several qualified professionals with element-specific expertise, under the guidance of representatives of TERA.

6.1.1 Spatial and Temporal Boundaries

Spatial Boundaries

The spatial boundaries considered one or more of the following study areas:

- A Footprint Study Area made up of the area directly disturbed by the Project construction and clean-up activities, including associated physical works and activities (*i.e.,* permanent right-of-way,

temporary construction workspace, temporary stockpile sites, temporary staging areas, and facility sites).

- An LSA consisting 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). For pump stations/terminals, the LSA consists of a 1 km radius centred on the pump station/terminal site. For the tank installation at the Hardisty Terminal, the LSA consists of a 2 km radius centred on the terminal site.

- An RSA consists of the area extending beyond the LSA boundary. The boundary for the RSA 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 municipal district boundaries).

- A Provincial Area which extends beyond regional or administrative boundaries, but confined to Alberta, Saskatchewan and Manitoba (*e.g.,* provincial permitting boundaries, etc.).

- A Transboundary Area which extends outside Canada.

The ecological boundary is described within the discussions of each element. Spatial ecological boundaries were determined by the distribution, movement patterns and potential zones of interaction between an element and the Project. The ecological boundary may be limited to the Footprint (*e.g.,* pipeline construction right-of-way, valve site or pump station) or extend beyond the physical boundaries of the area of the Project component since the distribution or movement of an element can be local, regional, provincial or transboundary in extent.

Temporal Boundaries

The time frames used in the assessment of the Project include the planning, construction, operations, and decommissioning and abandonment phases. The construction period (includes clearing, grading, trenching, testing and reclamation) for the pipeline, pump additions and tank installation is assumed to occur between early 2008 and late Q4 2009. A detailed construction schedule for the Project is provided in Section 2.4.12 of this ESA. Construction delays will not affect the overall assessment of environmental and socio-economic effects since the assessment has considered construction during both frozen and nonfrozen soil conditions, and it is assumed that pipeline construction will occur during these conditions in a subsequent year. The operations phase was considered to commence in late Q4 2009 following construction and extend an estimated 50+ years.

6.1.2 Biophysical and Socio-Economic Elements

Potential biophysical and socio-economic elements interacting with the Project were identified through the public and government consultation process, through experience gained during past construction programs along the Enbridge mainline system (*e.g.*, CEP, SEP II, Terrace Phases I, II and III), through experience gained during other construction programs in areas with similar conditions (*e.g.*, Alliance Pipeline Project near Regina where the Alberta Clipper route parallels from KPR 0.0 to KPR 23.9 and TransCanada PipeLines Limited pipeline where the Alberta Clipper pipeline route parallels from KPR 42.9 to KPR 77.4), as well as the professional judgment of the assessment team. Key to determining element interactions with the Project was the identification of issues noted during public consultation with federal, provincial and municipal government agencies, local industry people, interested stakeholders and the general public (Section 3.0 of this ESA).

Biophysical and socio-economic elements potentially interacting with the Project include:

- physical elements such as physical environment, soil capability, water quality and quantity, GHG and air quality, and acoustic environment;

- biological elements such as fish and fish habitat, wetlands, vegetation, wildlife and wildlife habitat, and species at risk; and

- socio-economic elements such as human occupancy and resource use, heritage resources, traditional land and resource use, social and cultural well-being, human health, infrastructure and services, and employment and economy.

Effects arising from accidents and malfunctions, and effects of the environment on the Project were also considered.

Those biophysical and socio-economic elements which are not considered to interact with pump additions, new tank installations and temporary facilities are identified and justified in Sections 6.3, 6.4 and 6.5 of this ESA respectively. As per Guide A.2.5 of the NEB *Filing Manual*, no further analysis is necessary for those elements where interactions between the Project component and a biophysical or socio-economic element are not predicted.

6.1.3 Potential Environmental and Socio-Economic Effects

The potential environmental and socio-economic effects resulting from the Project were identified through the public and government consultation process, through experience gained during past construction programs along the Enbridge mainline system (*e.g.*, CEP, SEP II, Terrace Phases I, II and III), through experience gained during other construction programs in the area (*e.g.*, Alliance Pipeline and TransCanada) as well as in nearby areas with similar conditions, and most importantly, through the professional judgment of the assessment team. The potential environmental and socio-economic effects arising from the construction and operation of the pipeline and associated pipeline facilities are identified in Section 6.2 of this ESA. Those effects arising from pump additions, tank installation and temporary facilities are identified in Sections 6.3, 6.4 and 6.5 of this ESA.

6.1.4 Mitigative Measures

To ensure that potential environmental and socio-economic effects are minimized during pipeline and facility construction and operation, a number of general and site-specific mitigative measures have been proposed based upon current industry-accepted standards, consultation with government agencies and interested groups and individuals, and the professional judgement of the assessment team.

Mitigative measures presented in Enbridge's *EGC* (Enbridge 2003) will be adopted for the Alberta Clipper Project. The *EGC* is currently on file with the NEB. The *EGC* is complemented by site-specific mitigative measures outlined in Sections 6.2, 6.3 and 6.4 of this ESA. Various federal and provincial government, and industry standards and guidelines (*e.g.,* AENV 1998, Alberta EUB 2007, Canadian Association of Petroleum Producers (CAPP) 1996, 1999, 2005, CAPP *et al*. 2005, DFO 1995, 1999 and 2003, Manitoba Natural Resources 1996, provincial COPs and federal operational position statements [DFO 2006a,b]) have been taken into consideration in the ESA. The Environmental As-Built Report and the first, second and third-year after post-construction monitoring reports for CEP, SEP II, Terrace Phases I and II were reviewed and applicable protection measures are included within this ESA (Interprovincial Pipe Line Inc. (IPL) 1995, 1998; Enbridge 2000, 2002; TERA 1995, 1996, 1999, 2000, 2001a, 2002, 2003, 2004). In addition, the applicable environmental alignment sheets for the Alliance Pipeline Project and TransCanada PipeLines Limited as well as the first-year post-construction monitoring report for Spread 8SB of the Alliance Pipeline Project were reviewed and the applicable protection measures are included within this ESA (TERA 2001b). Accompanying the ESA are Photomosaic Environmental Alignment Sheets which identify where specific mitigative measures are to be applied (see Volume III). Highly qualified Environmental Inspectors will be retained by Enbridge to ensure that the mitigative measures within the ESA and *EGC* are properly implemented during construction. Environmental inspection is further described in Section 8.0 of this ESA.

6.1.5 Residual Effects

Residual effects are the net environmental and socio-economic effects remaining following the implementation of mitigative measures. In some situations, the recommended mitigative measures will completely mitigate the potential adverse effects while in other situations, the mitigative measures will lessen the effects, but not entirely eliminate them. Residual effects may also be induced effects (*e.g.,* the introduction of weeds through mitigative effects to control erosion). Potential impacts of an element for which no residual effects are predicted require no further analysis.

6.1.6 Significance Analysis of Residual Effects

The determination of significance of adverse residual effects generally followed the guidelines and principles of the NEB *Filing Manual*, the Federal Environmental Assessment Review Office (1994), and the CEA Agency's *Cumulative Effects Assessment Practitioners Guide* (Hegmann *et al.* 1999). The agencies identify several possible methods for the determination of whether residual adverse environmental or socio-economic effects are significant. These include:

- the use of established environmental standards, guidelines or objectives in relation to potential adverse residual effects;
- the use of quantitative risk assessment;
- quantitative assessment of adverse residual effects; and
- qualitative assessment of the residual adverse effects.

Some noise, air and water quality issues can be assessed using the standards and guidelines method. However, only the qualitative method was considered to be appropriate for determining the significance of most anticipated adverse residual effects. Consequently, the determination of significance was evaluated by developing a set of qualitative criteria based on those identified by Hegmann *et al.* (1999). These six criteria are identified below and their definitions are presented in Table 6.1 located at the end of Section 6.0 of this ESA. In some cases, the definitions were modified to accommodate discipline-specific parameters. Ecological context is not included in Table 6.1. However, a discussion of the ecological context of potential environmental issues is provided for each applicable biological element.

- Spatial context (*i.e.,* Footprint, LSA, RSA, provincial, transboundary).
- Temporal context (*i.e.,* duration and frequency of the event causing the residual effect, reversibility of the residual effect).
- Ecological context (*e.g.,* levels of existing disturbance; resilience of the receiving environment).
- Magnitude (*i.e.,* severity of effect in relation to environmental and/or social standards or tolerance).
- Level of confidence or uncertainty (*i.e.,* availability of data to substantiate the assessment conclusion, previous success of mitigative measures, etc.).
- Probability or likelihood of occurrence of residual effect.

For each environmental and socio-economic residual effect, the impact balance or direction (*i.e.,* determination as to whether the effect is positive or negative) was also established. A positive impact balance is considered to have a net benefit to the environment. A neutral balance is defined as no net benefit or loss to the environment, while a negative balance is considered to be a net loss or detriment to the environment.

All significance assessment criteria (*e.g.,* temporal context, magnitude, etc.) were considered by the assessment team for each adverse residual environmental or socio-economic effect. Where appropriate, the key or most influential assessment criteria used to determine the significance of each adverse residual effect(s) are noted. Positive and neutral residual effects have not been assessed for significance. A summary of the significance evaluation for adverse residual effects arising from the construction and operation of the pipeline and associated pipeline facilities are identified in Section 6.2 of this ESA while the significance evaluation for adverse residual effects arising from pump additions, tank installations and temporary facilities for construction are identified in Sections 6.3, 6.4 and 6.5 of this ESA.

6.2 Effects Assessment - Pipeline and Associated Pipeline Facilities Construction and Operation

Using the assessment methodology described in Section 6.1 of this ESA, the following subsections evaluate the potential environmental and socio-economic effects associated with the construction and operation of the proposed pipeline from Hardisty to the US border near Gretna as well as the associated pipeline facilities (*i.e.*, block valves, scraper traps).

Biophysical and socio-economic elements potentially interacting with the pipeline component of the Alberta Clipper Project include:

- physical elements such as physical environment, soil capability, water quality and quantity, GHG and air quality, and acoustic environment;
- biological elements such as fish and fish habitat, wetlands, vegetation, wildlife and wildlife habitat, and species at risk;
- socio-economic elements such as human occupancy and resource use, heritage resources, traditional land and resource use, social and cultural well-being, human health, infrastructure and services, and employment and economy; and
- accidents and malfunctions.

The potential environmental and socio-economic effects associated with the pipeline component of the Project as well as the accompanying proposed mitigative measures and resulting residual effects are presented in Table 6.2 located at the end of Section 6.0 of this ESA.

A summary of the significance evaluation for adverse residual effects arising from the construction and operation of the pipeline and associated pipeline facilities is provided in Table 6.6 located at the end of Section 6.0 of this ESA. The following subsections describe the evaluation of significance using the criteria presented in Table 6.1 for the adverse residual effects associated with the applicable biophysical and socio-economic elements.

6.2.1 Physical Environment

The potential residual effects (see Table 6.2 of this ESA) associated with the construction and operation of the pipeline on the physical environment include:

- localized rill erosion could occur prior to the re-establishment of vegetation;
- areas of minor instability may occur in fill materials as a result of terrain instabilities; and
- topography may be altered at locations where cut slopes are too steep to be replaced.

The potential effects of the environment on the Project (such as flooding, wildfires, climate change and severe weather) are discussed in Section 6.7 of this ESA.

Localized Erosion

Rill erosion of topsoil could occur at localized areas prior to the re-establishment of vegetation. This residual effect is discussed in more detail in relation to Section 6.2.2, Soil Capability of this ESA.

Minor Terrain and Fill Instabilities

During the construction of the pipeline, minor areas of terrain and fill instabilities may occur as a result of material slumping. These areas are largely confined to the valley slopes of the larger watercourses along the route.

Slope stability conditions along the proposed route are considered to be good, based on observations and operating experience of the existing Enbridge mainline system to date. The construction of the pipeline will comply with measures outlined in Table 6.2 of this ESA and, therefore, is not expected to trigger slumping events. Areas of potential terrain instability will be routinely monitored and promptly remediated, where warranted, to protect pipeline integrity. This residual effect is of low magnitude and reversible in the short-term. Effects of the environment on the Project (*i.e.*, slumping) are discussed in Section 6.7 of this ESA.

Alterations of Local Topography

As a result of construction, topography along the proposed route may be altered at locations where cut slopes are too steep to be replaced. Although this unavoidable consequence will be permanent in localized areas and of high probability, the magnitude is considered to be low.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on the physical environment will be not significant.

6.2.2 Soil Capability

Most of the potential impacts on soil capability associated with the construction and operation of the pipeline are alleviated through the application of mitigative measures (see Table 6.2 of this ESA). The resulting residual effects associated with the construction and operation of the pipeline on soil capability may include:

- minor mixing of topsoil and subsoil will likely occur during topsoil salvage, storage and replacement activities, including those related to mitigating issues associated with trench instability, shallow topsoil depth, poor colour change, and compaction and rutting;
- some localized undesirable lower subsoils may be unexpectedly encountered and admixed with upper subsoil horizons;
- minor surface erosion of topsoil can be expected until a vegetative cover has been established;
- revegetation of some disturbed wind erodible soils may be difficult (*e.g.,* soils within the Sounding Dunes, Elbow PFRA Community Pasture, Oak Lake Sand Hills and Souris Sand Hills);
- revegetation of soils saline to the surface may be difficult;
- stone picking and bedrock slab removal may result in disposal issues and the use of sand as bedding and padding material can result in reduced capability of soils adjacent to the trench;
- pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions; and
- minor trench subsidence may occur or a crown over the trench may remain.

Minor Topsoil / Subsoil Mixing

During the construction of the pipeline and, to a lesser extent, during maintenance activities, it is likely that a minor amount of topsoil and subsoil mixing will occur along all segments of the route. This residual effect is confined to the Footprint, reversible in the medium-term and of low magnitude.

Minor Undesirable Lower Subsoil / Upper Subsoil Mixing

Lower subsoils with a high salt or gravel content may be unexpectedly encountered within a localized area during construction activities and admixed with upper subsoil horizons exhibiting less salt or gravel content. The detailed soil survey will ensure that the three-lift soil handling technique will be implemented at most locations to minimize the risk of mixing undesirable lower subsoils with topsoil, thereby maintaining the agricultural capability of the soil. This residual effect is confined to the Footprint and of low magnitude.

Minor Surface Erosion

Construction and maintenance activities which disturb the soil will likely result in some minor surface erosion of topsoil until a stable vegetative cover can be established, particularly on slopes which are more susceptible to water erosion. It is expected that a vegetative cover can be established on noncultivated disturbed slopes within a year, with the application of a quick-catching cover crop in addition to the appropriate seed mix for the location. This residual effect is confined to the Footprint, reversible in the short to long-term and of low magnitude.

Revegetation of Wind Erodible Soils

Due to the origin of the parent material (eolian, glaciofluvial) and sandy texture, some of the soils located along the route have a high wind erosion potential when disturbed by short-term construction or maintenance activities. This residual effect is confined to the Footprint, reversible in the medium to long-term and of medium magnitude.

Highly wind-erodible soils of the Sounding Dunes area in Alberta, the Elbow PFRA Community Pasture in Saskatchewan and the Oak Lake Sand Hills and Souris Sand Hills in Manitoba will require increased revegetation efforts at these locations. The specialized reclamation measures provided in Detail 6A-50 of the Construction and Reclamation Plan (Appendix 6A of this ESA) will result in a stable vegetative cover in the medium-term. Post-construction monitoring of the route through these areas will ensure that any identified revegetation issues will be remediated in a timely manner. This residual effect is confined to the Footprint, reversible in the medium to long-term and of medium magnitude.

Revegetation of Soils Saline to the Surface

High salinity of surface soil may hinder revegetation efforts along the proposed route. The seeding of appropriate saline tolerant seed mix on noncultivated lands will assist in revegetation of these areas. Post-construction monitoring of the route through these areas will ensure that any identified revegetation issues will be remediated in a timely manner. No concerns regarding revegetation efforts or crop growth on saline soils at the surface were noted in the post-construction monitoring of CEP, Terrace Phases I or II (TERA 1995, 1996, 2000, 2001a, 2002, 2003, 2004). Poor growth from KP 509.8 to KP 510.4 observed during the post-construction monitoring program was attributed to salinity from an old irrigation ditch, not pipeline construction. This residual effect is confined to the Footprint, reversible in the short-term and of low magnitude.

Stone and Excess Bedrock Disposal

Picking of stones from the top of the backfilled subsoil and from the topsoil as well as excess bedrock removed from the trench by ripping or blasting may result in disposal issues with landowners depending on the volume accumulated. In the event that sand to be used for bedding or padding in rocky areas is windrowed on unstripped topsoil, reduced soil capability could result. These residual effects are of low magnitude.

Pulverization in Dry Conditions

Construction activities during dry conditions may result in pulverization of soil and sod along the pipeline route which could lead to increased fugitive dust and loss of soil structure. The first-year after post-construction monitoring report of Terrace Phase II indicated that the mitigative measures implemented

during reclamation activities to minimize erosion associated with pulverized soils (*i.e.*, straw crimping) were effective and no erosion was evident (TERA 2002). The reversibility of this residual effect ranges from short to medium-term. This residual effect is confined to the Footprint and is of low magnitude.

Minor Trench Subsidence or Remnant Crown

Construction activities may result in localized areas of trench subsidence and/or a remnant crown over the trench along the route. This residual effect is confined to the Footprint, reversible in the short to medium-term and of low magnitude.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on soil capability will be not significant.

6.2.3 Water Quality and Quantity

The potential impacts of high water table and withdrawal and release, if conducted, of hydrostatic test water (*i.e.*, interbasin water transfer) will be alleviated through the application of mitigative measures (see Table 6.2 of this ESA). Potential issues related to aquifer contamination are discussed under Accidents and Malfunctions (see Section 6.2.18 and Table 6.2 of this ESA). The resulting potential residual effects associated with the construction and operation of the pipeline on water quality and quantity include:

- minor localized alteration of natural drainage patterns until trench settlement is complete;
- reduction in surface water quality due to suspended solids during instream construction;
- although unlikely, the disruption of water well flows may occur; and
- disruption of shallow groundwater flow where springs are encountered.

Minor Localized Alteration of Natural Drainage Patterns

With proper implementation of the mitigation measures proposed, disruption of surface flow patterns following construction is likely to be minor along the route. In the event that construction or maintenance activities result in changes in surface water regimes, corrective action in consultation with the appropriate authorities will be undertaken to resolve the issue. The residual effect is reversible in the short-term and of low to medium magnitude.

Reduction in Surface Water Quality

The selection of appropriate waterbody crossing techniques and implementation of surface erosion controls and riparian vegetation restoration are likely to substantially reduce the potential for adverse effects on surface water quality at watercourses crossed by the route. No immediate sedimentation is anticipated during the pipeline crossing of a watercourse using an open cut method, since the use of this crossing method will generally be confined to those watercourses that are either dry or frozen to the bottom of the bed at the time of construction. Similarly, no sedimentation is expected at crossings where an HDD can be successfully undertaken since there is no instream construction associated with that method. Isolated crossings are proposed for all remaining waterbodies where water is present and crossing construction will occur outside of the restricted activity period. During a completely isolated crossing, a minor sediment release is expected during installation of the dams prior to the isolation and during removal of the dams at the conclusion of the isolation. In addition, minor releases of sediment may be associated with the installation and removal of the temporary vehicle crossings. Although elevated suspended sediment concentrations may result from instream construction and vehicle crossing use, pulses of suspended solids are generally expected to settle out of the water column within the zone of influence in a timeframe measuring from minutes to a few hours. Recent evidence demonstrates that

smaller waterbodies that lack substantial subsurface flow can be readily isolated with minimal sediment introduction when proper design, construction, and mitigation measures are applied (Reid and Anderson 2000, CAPP *et al.* 2005). Consequently, it is anticipated that average total suspended solid (TSS) levels during instream construction at these sites will be below the CCME guideline for short-term (24 hour) exposure of 25 mg/L above background levels (CCME 1999). Residual effects are reversible in the immediate to short-term and of low to medium magnitude.

An open cut method within flowing water releases more sediment than a completely isolated crossing, and measures will be incorporated during crossing design and construction to reduce the magnitude and duration of the sediment pulse. A review of the effects of open cut pipeline water crossings over the past 25 years has indicated that although sediment released during instream construction can cause short-term changes to downstream aquatic life and their habitats, effects are generally reversible within a year of construction (Reid and Anderson 1999). Residual effects on water quality at sites where a trenched method within flowing water is to be used are anticipated to be reversible in the short-term and potentially of medium to high magnitude.

Disruption of Water Well Flows

Disruption of groundwater flows caused by trenching and soil replacement that result in the reduction of flow rates in a water well could be of substantial concern to the owner if this is a critical water supply. However, the probability of disruption of flows to water wells during construction of the pipeline is low considering the proposed burial depth (*i.e.*, 0.9 m typical) and that blasting was not warranted during CEP, SEP II, Terrace Phases I or II (IPL 1995, 1998, Enbridge 2000, 2002). Furthermore, the mitigation provides for well replacement and, if warranted, the replacement of water of equal or better quality and quantity until replaced. Consequently, the residual effect is reversible in the short-term and of low magnitude.

Disruption of Springs

If springs are encountered along the proposed route, disruption of shallow groundwater flow may occur during the short-term construction period. Monitoring of spring flow during construction will detect any disruption to flows and measures (*e.g.*, subdrains, trench breakers) will be implemented to restore groundwater flow regimes. Alternate water supplies for domestic or livestock use will be provided until the flow in the spring is restored. No springs were encountered during the construction of CEP or Terrace Phase II (IPL 1995, Enbridge 2002). During construction of Terrace Phase I, springs were only encountered at KP 616.0 (Enbridge 2000). No problems were evident at this location during the post-construction monitoring program in summer 2000 (TERA 2000). This residual effect is reversible in the short-term, of low magnitude and low probability.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on water quality or quantity will be not significant.

6.2.4 Greenhouse Gases and Air Quality

The potential residual effects (see Table 6.2 of this ESA) associated with the construction and operation of the Alberta Clipper pipeline contributing to GHG emissions and on air quality include:

- incremental increase in the GHG emissions associated with the Enbridge mainline system will occur;
- increase in vehicle emissions from construction equipment will occur during pipeline construction;
- increase in dust arising from construction traffic on the right-of-way or access roads;
- increase in smoke arising from burning of slash will occur; and
- slight increase in vehicle emissions during maintenance activities.

Greenhouse Gas Emissions

Sources of GHG emissions identified as being associated with Alberta Clipper pipeline for the Project include:

- combustion of fossil fuels associated with pipeline construction activities; and
- emissions associated with the temporary and longer-term clearing of site vegetation (in particular, tree cover) and changes in land-use and vegetative cover.

An assessment of the direct and indirect incremental GHG emissions associated with the Alberta Clipper Project was undertaken by Clearstone Engineering Ltd. (see Appendix I of this ESA). No direct GHG emissions were attributed to the proposed operation of the pipeline or pump stations/terminals.

Construction-related GHG emissions were omitted from the assessment since these are a onetime occurrence and would be small compared to ongoing indirect emissions from the operation of the pumps. Nevertheless, the amount of GHG emissions associated with construction activities will be minimized by utilizing multi-passenger vehicles for the transport of crews to and from job sites to the extent practical. Similarly, the emissions associated with clearing of vegetation will be reduced since the proposed route largely traverses cleared lands and follows existing rights-of-ways for approximately 98% of its length, thereby minimizing the amount of clearing required.

The residual effect of GHG emissions during pipeline construction is considered to be neutral and, consequently, does not require an evaluation of significance.

Vehicle Equipment Emissions During Construction

Although nuisance emissions arising from construction equipment will occur along the entire route, the residual effect of an increase in vehicle emissions will be limited to areas in proximity to human receptors (*i.e.*, permanent residences). This residual effect is reversible in the short-term and, as a result of the proposed mitigation measures to minimize air emissions during construction, is of low magnitude.

Dust During Construction

With respect to increased dust along the construction right-of-way and unpaved access roads, this residual effect is confined to those portions of the pipeline built during relatively dry nonfrozen conditions. This residual effect is immediately reversible and, as a result of proposed mitigation measures to minimize dust during construction, is of low magnitude.

Smoke During Construction

Smoke will be associated with the burning of slash along discrete segments of the proposed route. This residual effect is reversible in the short-term and, as a result of proposed mitigation measures outlined in Table 6.2 of this ESA, is immediately reversible and of low magnitude.

Air Emissions During Operations

The operation of the Alberta Clipper pipeline will not result in any continuous air emissions. However, during periodic maintenance activities of immediate to short-term duration, emissions from equipment will occur and, depending on the location and season of the work, dust may result during the activity. Nevertheless, the residual effect of routine maintenance activities on air quality is anticipated to be of limited areal extent, reversible in the short-term and of negligible to low magnitude.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of Alberta Clipper pipeline construction and operation on GHG and air quality will be not significant.

6.2.5 Acoustic Environment

The potential residual effects (see Table 6.2 of this ESA) associated with the construction and operation of the pipeline on the acoustic environment include:

- increase in noise will occur during pipeline construction; and
- slight rise in noise levels will occur during site-specific maintenance activities.

Noise During Construction

Noise arising from construction activities is unavoidable and will occur over the entire route. However, the residual effect of a short-term increase in noise will be limited to areas in proximity to human receptors (*i.e.*, permanent residences, urban areas). The linear progression of pipeline construction results in approximately four weeks duration of concentrated construction activity at any given location. Confining pipeline activities to adhere to local noise by-laws will also reduce noise concerns in populated areas. The residual effect of construction noise on nearby residents is of low magnitude and immediately reversible. The effect of construction noise on wildlife is discussed in Section 6.2.9 of this ESA.

Noise During Operation

The operation of the pipeline will generally not result in an increase in noise levels over existing levels. However, during site-specific periodic maintenance activities of immediate to short-term duration, a slight rise in noise will likely occur from vehicles or equipment used during the activity. Nevertheless, the residual effect of routine maintenance activities on the acoustic environment is anticipated to be limited in areal extent, immediately reversible and of negligible to low magnitude.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on the acoustic environment will be not significant.

6.2.6 Fish and Fish Habitat

6.2.6.1 Ecological Context

Fish populations and aquatic habitat protection in Alberta, Saskatchewan and Manitoba fall under the jurisdiction of the federal government through DFO and the *Fisheries Act*. Most of the watercourses crossed by the proposed pipeline route are part of the Saskatchewan River, Qu'Appelle River, Souris River, Assiniboine River and Red River drainage basins. There are 93 watercourses crossed by the pipeline route. All of these watercourses have been previously crossed during pipeline construction projects.

Two watercourses, one part of the Battle River watershed and the other part of the Sounding Lake basin, are crossed by the proposed pipeline route in Alberta. The crossings were deemed to have nil to poor fish habitat potential and no fish were captured during field surveys completed for CEP (Environmental Management Associates (EMA) 1993) and Terrace Phase II (RL&L 2000). One crossing has an instream restricted activity period of April 16 to June 30. The proposed pipeline route in Alberta lies within the Parkland-Prairie Fish Management Zone where the fishing season is open from May 19 to March 31.

Sixty-one watercourses are crossed by the proposed pipeline route in Saskatchewan. They form part of the Battle River, Eagle Creek, North and South Saskatchewan River, Upper Qu'Appelle River, Wascana Creek, and Upper and Lower Souris River watersheds. Five crossings were identified as having the potential for fish habitat concerns with instream restricted activity period of April 1 to May 31. An instream restricted activity period of October 1 to May 31 will apply to instream activity (if any) in the South

Saskatchewan River. The remaining crossings require further field investigations in spring/summer 2007. A total of nine fish species were documented in Saskatchewan during investigations undertaken for CEP (EMA 1993), Terrace Phase I (Golder Associates Ltd. (Golder) 1996, RL&L 1998), the Alliance Pipeline Project (Golder 1997), and TransCanada PipeLines Limited 1991 and 1992 and 1993 - 94 Facilities Applications (TransCanada PipeLines Limited 1990, 1992). Three species of sport fish (*i.e.*, lake whitefish, rainbow trout and walleye) were captured during the surveys. The proposed pipeline route lies within the Southern Fishing Zone of Saskatchewan where the fishing season is open from May 6 until March 31.

Thirty watercourses are crossed by the proposed pipeline in Manitoba. They are part of the Assiniboine River and Red River watersheds, where channels typically have shallow gradients, low to moderate water velocities and meandering course. The Assiniboine River and Red River watersheds support approximately 65 and 70 species, respectively. Biophysical information for watercourses crossed by the pipeline route in Manitoba is presented in AAR (2007). Eight crossings were deemed to have no fish habitat potential, five crossings require further field investigation in spring/summer 2007, eight crossings were identified as having the potential for fish habitat concerns with instream restricted activity period of April 1 to June 15 and one crossing was identified as having the potential for fish habitat concerns with instream restricted activity period of April 1 to July 31. The remaining watercourses with fish habitat potential do not have an instream restricted activity period. A total of 22 fish species were documented during investigations undertaken for the Southern Lights Project (AAR 2007). Two species of sport fish (northern pike and walleye) were captured during the 2006 survey. In addition, one rare species (pumpkinseed) was also captured during the 2006 survey. However, this species was introduced into the system and, consequently, is not protected under any provincial or federal legislation. The proposed pipeline route lies within the Southern Fishing Division of Manitoba where the fishing season is open from May 10 until March 31.

Fish and fish habitat sensitivity are generally highest during spawning and emergence, and other times when fish concentrate in spatially restricted habitats. During the spawning and emergence period, fish require suitable habitat, and eggs and fry are most likely to be affected by sedimentation. Overwintering habitat is often limited to large, deep, isolated pools rather than locations where waterbodies are ice-covered or frozen to the bottom.

6.2.6.2 Significance

The potential residual effects (see Table 6.2 of this ESA) associated with the construction and operation of the pipeline on fish and fish habitat include:

- clearing or disturbance of riparian vegetation within the right-of-way and temporary workspace at watercourse crossings will occur;
- alteration of instream habitat within the zone of influence at trenched crossings will occur;
- increase in suspended solid concentrations during instream construction at trenched crossings within the zone of influence will occur;
- blockage of fish movement may occur;
- increased fish and bivalve mortality due to suspended solid concentrations may occur;
- contamination from spills during construction and operations may occur; and
- potential fish and bivalve species of concern (*i.e.,* chestnut lamprey, maple leaf mussel, bigmouth buffalo) may be affected by increased suspended solid concentration and habitat alteration within the zone of influence at select watercourse crossings.

Disturbance of Riparian Vegetation

Riparian vegetation within the right-of-way and temporary workspace will be disturbed at all trenched watercourse crossings and watercourses where a temporary vehicle crossing will be installed. Disturbed riparian areas will be seeded with the appropriate native seed mix along with a quick establishing cover crop. Post-construction monitoring of watercourses along CEP during the one-year after monitoring indicated that while all watercourses appeared to be stable, revegetation was incomplete (TERA 1995). The problem with revegetation growth was attributed to the lack of moisture early in the 1995 growing season and in 1996, under normal soil moisture conditions, the revegetation all watercourses was well-established (TERA 1996). In addition, post-construction monitoring of watercourses along Terrace Phases I and II as well as at Eagle Creek along SEP II, noted that during the one-year after monitoring, all watercourse crossings appeared to be stable and vegetation was well-established (TERA 1999, 2000, 2002). No surface water erosion or revegetation issues at watercourses along the route from KPR 0.0 to KPR 23.9 were noted in the post-construction monitoring report for the Alliance Pipeline (TERA 2001b). The residual effect of pipeline activities on clearing of vegetation in the riparian area is reversible over the medium-term and is of low magnitude.

Alteration of Instream Habitat

Habitat alteration in the form of a modified substrate and recontouring of the banks will occur as a result of any trenched pipeline crossing. Most of the watercourse crossings along the pipeline route have been rated as having nil to low fish habitat potential (see Table 6.3 of this ESA). For those watercourses deemed to have low to high potential for fish habitat, the appropriate crossing technique given the characteristics of the watercourse, fish species present, instream restricted activity periods and timing of construction has been selected to minimize impacts to potential fish habitat (Tables 6.2 and 6.3). The implementation of the proposed mitigative measures will minimize the potential for the harmful alteration, disruption or destruction of fish or fish habitat (HADD). Nevertheless, compensation will be implemented should HADD occur as a result of construction activities at selected watercourses. This residual effect is reversible in the short to medium-term and of low magnitude.

Increased Suspend Solid Concentrations During Instream Construction

An evaluation of increased suspended solid concentrations during instream construction is provided in Water Quality and Quantity in Section 6.2.3 of this ESA. Through the selection of appropriate watercourse crossing techniques, vehicle crossing techniques and the implementation of surface erosion controls and riparian vegetation restoration as outlined in Table 6.3 of this ESA, the potential for adverse effects on aquatic systems along the route due to suspended solids in the water column is greatly reduced. Residual effects are reversible in the immediate to short-term and of low to medium magnitude.

An open cut method within flowing water releases more sediment than a completely isolated crossing, and measures will be incorporated during crossing design and construction to reduce the magnitude and duration of the sediment pulse. In addition, suspended sediment concentrations will be monitored at these locations to confirm that averages remain below the CCME standard of 25 mg/L above background (CCME 1999). Residual effects on water quality at sites where a trenched method within flowing water is to be used are anticipated to be reversible in the short-term and potentially of medium to high magnitude.

Blockage of Fish Movements

The mitigative measures outlined in Tables 6.2 and 6.3 of this ESA will greatly reduce the potential for blockage of fish movements by instream construction. The residual effect of the construction of the pipeline on blockage of fish movements is considered to be reversible in the short-term and of low magnitude.

Fish and Bivalve Mortality

With the implementation of mitigative measures outlined in Table 6.2 of this ESA, the likelihood of fish mortality arising from an isolated crossing is low. Similarly, no mortality of bivalve species of concern are

anticipated should the contingency measures outlined in the Fish and Bivalve Species of Concern Discovery Contingency Plan in Appendix 6B of this ESA be implemented.

Suspended sediment released at watercourse crossings with fish habitat potential during instream activities where water is present (*i.e.*, South Saskatchewan River in the event of an open cut, Qu'Appelle River in the event of an isolation, Souris River in the event of a two-stage isolation) could cause behavioural or sublethal/lethal effects on fish within the zone of influence. Suspended sediment concentrations will be monitored at these crossings to confirm that averages remain below the CCME standard of 25 mg/L above background (CCME 1999). This is the level at which mortality of the most sensitive life history stage (salmonid fry) has been reported (Newcombe 1994). This residual effect is considered to be of low probability.

Contamination from Spills

In the event of a large spill such as a fuel truck rollover in a stream, the adverse residual effects could be of high magnitude with long lasting ramifications to the health of the stream. Although spill contingency and clean-up measures would reduce the magnitude and reversibility of the residual effects, such an incident could be considered significant due to the adverse residual effects in a highly sensitive environment. Since events such as this rarely occur within the construction right-of-way and even more rarely occur instream, the probability of a significant adverse residual effect is low. See also Accidents and Malfunctions, Section 6.2.18 of this ESA.

Fish and Bivalve Species of Concern

Although the pipeline route lies within the home range of several fish species of concern (*i.e.*, lake sturgeon, silver chub, big mouth shiner, chestnut lamprey, bigmouth buffalo), none of these species have been found in watercourses crossed by the proposed route during past fish and aquatic habitat surveys nor during the survey conducted in fall of 2006. Similarly, although maple leaf mussels have been documented at the confluence of the Assiniboine and Souris rivers, none were found in the Souris River during the survey in the fall of 2006. Potential effects on these fish and bivalve species and their habitat have been reduced by the mitigation and restoration measures summarized in Tables 6.2 and 6.3 of this ESA. Should a fish or bivalve species of concern be discovered during additional fish surveys or during construction, the implementation of contingency measures outlined in Appendix 6B of this ESA will ensure that the residual effects on these species is reduced to a level such that local populations are not placed at risk.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on the fish and fish habitat will be not significant.

6.2.7 Wetlands

6.2.7.1 Ecological Context

The proposed pipeline route encounters wetland habitats within the Aspen Parkland and Grassland regions of the Continental Prairie Wetland Region. The greatest threat to the health of wetlands in this region results from agricultural practices of draining or altering prairie potholes. Agricultural conversion of wetlands has been a common practice in the prairies for the past century and it is estimated that only 40-50% of the original wetlands remain untouched (Leitch 1981).

Most of the lands along the proposed route abut the existing Enbridge pipeline corridor that has been in use by Enbridge since the early 1950s. Previously disturbed wetlands within the local area have proven to be resilient and have re-established themselves along the existing pipeline corridor. The most common alterations of wetlands have been draining and filling of wetlands during subsequent agricultural practices and/or modification to the hydrologic regime.

6.2.7.2 Significance

The proposed pipeline route is designed to avoid impacts on wetlands to the maximum extent feasible. However, most of the potential effects associated with the construction and operation of the proposed pipeline on wetlands that cannot be avoided will be minimized through the application of mitigative measures (see Table 6.2 of this ESA). Potential residual effects associated with the construction of the pipeline include:

- alteration of wetland habitat function;
- alteration of hydrologic function of wetlands; and
- alteration of water quality function in wetlands.

Alteration of Wetland Habitat Function

Construction and maintenance activities within wetlands along the route will likely result in some minor disruption to the habitat function of wetlands. Examples of potential adverse environmental effects on wetland habitat function are: potential changes in species composition; stress on rare plant species; interruption of wildlife movements; and fragmentation of natural habitats. With proper construction and mitigative measures, these adverse effects can be successfully minimized. For example, Zimmerman and Wilkey (1992) monitored wetlands for impacts to vegetation for 20-years post-disruption from pipeline construction. Findings of these long-term monitoring programs show that: adjacent natural wetland areas were not altered in type; no non-native plant species invaded natural areas; and the right-of-way increased diversity. Additional studies on wetland vegetation (Shem *et al.* 1993, Van dyke *et al.* 1994) record the following observations.

- Wetland community impacts: at most sites, many plants from adjacent natural areas re-establish themselves on the right-of-way; and properly constructed rights-of-way appear to have little impact on vegetation in the natural areas.
- Wetland species diversity: often, a greater number of wetland plants are observed on the right-of-way than in the adjacent natural area; and rights-of-way increase the number and types of habitats in the wetlands.
- Construction and management practices: vegetative cover on right-of-way sites in wetlands is generally well-established within 1-3 years after the pipeline construction. However, minor differences in the final right-of-way surface elevation can strongly influence the type of vegetation that re-establishes on the right-of-way.

The effects of construction of a natural gas pipeline right-of-way on wetland vegetation and bird communities were investigated up to two-years following construction by Santillo (1993). Results showed that: at two-years post-construction, wetlands were dominated by native hydrophytic graminoids; there was a fairly high similarity of species composition and structure among study wetlands at two-years post construction, regardless of wetland type, except for a wetland with standing water; and no new bird species were introduced as a result of the different habitat provided by the right-of-way.

In addition, past construction projects through the pipeline area have successfully minimized impacts to wetlands as indicated through the absence of environmental issues pertaining to wetland habitat restoration in the As-Built Environmental Report or the first, second and third-year after post-construction monitoring reports for CEP and Terrace Phases I and II programs (IPL 1995; Enbridge 2000, 2002; TERA 1995, 1996, 2000, 2001a, 2002, 2003, 2004). By utilizing the proven and effective mitigative measures from past projects in the area, it is anticipated that wetland habitat function along the pipeline route will be effectively restored within the short-term.

Mitigative measures will be employed to minimize the residual effects on wetlands, depending on site-specific conditions and requirements. With the implementation of the proposed mitigation measures and in consideration of past monitoring programs, the potential disruption or alteration of wetland habitat function is considered to be reversible in the short-term and of low magnitude.

Alteration of Wetland Hydrologic Function

Potential changes to hydrologic flow (*i.e.,* surface or groundwater flow) of a wetland may include wetland drainage, water diversion and natural flow impedance. Excessive wetland drainage or diversion will result in an unnatural decrease to wetland area while flow impedance (*i.e.,* inadequate drainage) creates wetland habitat. However, each of these alterations is an interruption to the natural hydrologic regime and is considered an adverse environmental effect. Among the most important considerations for limiting disturbances to hydrologic function is assuring that preconstruction elevations and contours are achieved (Gartman 1991) and that there will be no unnatural impedance to flow. Short-term disturbances to wetlands are expected during construction of the pipeline. If the right-of-way is restored to its preconstruction profile and the bed and bank of all channels are carefully reconstructed, then long-term impacts on wetland function are not expected.

Standard pipeline construction and operational activities are designed to avoid circumstances which result in drainage, diversion and/or unnatural retention of water. Terrace Phases I and II are examples of the successful implementation of mitigative measures pertaining to wetland hydrologic function. No issues related to wetland drainage, diversion or unnatural retention of water on the right-of-way were noted in the As-Built Environmental Report or the first, second or third-year after post-construction monitoring reports (Enbridge 2000, 2002; TERA 2000, 2001a, 2002, 2003, 2004). By utilizing the proven and effective mitigative measures from past projects in the area, it is anticipated that wetland hydrologic function along the pipeline route will be effectively restored within the short-term.

Consequently, the residual effect of the pipeline on wetland hydrology is reversible in the short-term and of low magnitude.

Alteration of Wetland Water Quality Function

Activity in or near wetlands during pipeline construction along the proposed route may result in an increased sediment supply and turbidity of surface waters thereby decreasing overall water quality function. Other possible impacts to water quality include the potential for loss of groundwater quality as a result of interference with shallow (within trench depth) groundwater movement, changes to nutrient levels due to flow impedance from an active river channel and, in the event of a major fuel spill from a piece of equipment or fuel truck, infiltration into surficial deposits and the near surface groundwater are probable.

Mitigative measures will be employed during construction and maintenance activities to ensure that all practical measures will be utilized to minimize impacts on water quality in wetlands. With the implementation of these measures, the residual effects of the pipeline on wetland water quality are considered to be of low magnitude and reversible in the short-term.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on wetlands and wetland function will be not significant.

6.2.8 Vegetation

6.2.8.1 Ecological Context

Previous disturbances of native vegetation in the vicinity of the pipeline route have included clearing and breaking of native prairie and wooded areas for agricultural purposes since the late 1880s to present. Development of road and rail transportation networks from the late 1880s to present has also substantially affected native vegetation.

It has been estimated that 90% of the native landscapes on the Canadian prairies have been altered, primarily by agricultural activities (Grilz and Romo 1995). Native vegetation in the Mixed Grassland, Moist Mixed Grassland, Boreal Transition and Lake Manitoba Plain ecoregions is generally limited to wetlands, major river valleys, and stream channels as well as areas with soils or topography unsuitable for agricultural use. Improved pasture, which often contains elements of native plant communities, also forms a part of the landscape. The Aspen Parkland ecoregion contains very productive agricultural soils and native vegetation is generally limited to areas where topography is not favourable for cultivation.

From the 1950s to present, Enbridge has constructed several pipelines that the proposed pipeline parallels for almost its entire length. Clearing, grading, soils handling, trenching and revegetation efforts during construction and operation of the existing pipelines have affected native vegetation along the route.

The relationship of native vegetation with other ecosystem components is that it provides protection of: gene pools for future use; protection of native plant and wildlife species and their habitats; preservation of climax ecosystems and native biodiversity; and conservation of representative samples of different habitats characteristic of the region. Areas of remnant native vegetation are also economically important to the agricultural community since they provide grazing lands for livestock.

6.2.8.2 Significance

The potential residual effects on vegetation (see Table 6.2 of this ESA) associated with construction and operation of the pipeline include:

- alteration of approximately 390 ha of native vegetation, including 220 ha of native prairie;
- if mitigative measures do not completely protect the site, some loss or alteration of the local population of S1, S2 and/or S3 rare vascular plants may occur;
- transplanted or propagated rare vascular plant specimens may not survive;
- if the sensitive plant community cannot be avoided and access restrictions and temporarily covering the site do not completely protect the community, then a narrow strip of the community will be disturbed resulting in some loss or alteration of the community;
- alteration of approximately 607 ha of vegetation important to wildlife;
- weed introduction and spread may occur; and
- ornamental trees, wind breaks or shelterbelts may be removed as a result of construction activities.

The potential residual effects associated with revegetation of high wind erosion potential soils including dune sands and other soils within the Sounding Dunes, Elbow PFRA Community Pasture, Oak Lake Sand Hills and Souris Sand Hills, of soils saline to the surface, and of saline upper soils are discussed in Section 6.2.2 of this ESA.

Alteration of Native Vegetation

The proposed route follows existing rights-of-ways for approximately 98% of its length, maximizing the use of previously disturbed areas and minimizing the total amount of disturbance. Approximately 390 ha of native vegetation consisting of 220 ha of native prairie and 170 ha of bush and bush-pasture will be disturbed or cleared during construction of the pipeline. These figures are a conservative estimate since they include lands that formed temporary workspace of previous pipeline construction and would have been previously cleared or disturbed. Disturbed areas through native vegetation segments will be seeded with the appropriate native seed mix. No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be judged. This residual effect is limited to the Footprint, reversible in the medium to long-term and of low to medium magnitude.

Rare Vascular Plant Species of Concern

Protection measures and environmental management techniques for rare plants will be based on site-specific conditions and species sensitivity criteria. Final decisions on mitigative measures will be made by Enbridge in consultation with botanical experts, ANHIC, SK CDC, MB CDC and where appropriate, the land authority. Mitigative measures for vascular plant species of concern are outlined in Detail 6B-1 of the Plant Species of Concern Discovery Contingency Plan (see Appendix 6B of this ESA) and generally fall into categories of avoidance, minimizing disturbance and alternative reclamation techniques. These proposed mitigative measures have been used previously on other major pipeline construction projects with good success. Following are some examples.

Indian grass (*Sorghastrum nutans*) was found south of the Terrace Phase I right-of-way at KP 1005.0. During construction, the Indian grass was flagged and avoided (Enbridge 2000).

Narrowing down of the right-of-way was undertaken at several locations during construction of the Alliance Pipeline Project in 1999. For example, in central Alberta, Douglas hawthorn (*Crataegus douglasii*) (S3W) was fenced and the right-of-way narrowed down. During post-construction monitoring in summer 2000, the Douglas hawthorn was thriving and showed no signs of impact due to construction (Fryer *et al.* 2002).

During construction of the Alliance Pipeline in central Alberta, disturbance of low milkweed (*Asclepias ovalifolia*) (S2) was avoided by extending the length of a bore of the highway, railway and creek that were in the vicinity of the rare plant (Alliance Pipeline Limited Partnership (Alliance) 2000a).

Turned sedge (*Carex retrorsa*) (S2S3) was found on the Alliance Pipeline near Whitecourt (Alliance 2000b). The area was ramped over by cutting and laying down willows, covering them with geotextile, and then ramping with subsoil. Upon completion of construction, the ramp was removed. During post-construction monitoring in 2001, the plant was found in very large numbers both on and off the right-of-way (Alliance 2002).

Few-flowered aster (*Aster pauciflorus*) (S3) and lotus flowered milk-vetch (*Astragalus lotiflorus*) (S2S3) were found along the proposed Terrace Phase I route. Both plants were transplanted to a similar habitat off of the right-of-way using hand methods or a backhoe prior to construction in 1998. The transplanted few-flowered aster and lotus flowered milk vetch were observed alive and thriving during post-construction monitoring in the summer of 2000 and 2001 (TERA 2000, 2001a).

In order to protect sand millet (*Panicum wilcoxianum*) (S1) during construction of Terrace Phase II in 2001, the work site was narrowed by ~5 m, no grading was allowed and a blade width of sod was salvaged and placed on straw matting. The sod was then replaced and straw from the matting was then spread over the replaced sod. During post-construction monitoring in 2004, approximately 3,000 sand millet plants were found (TERA 2004).

During construction of CEP in 1994, seed from sand nutgrass (*Cyperus schweinitzii*) (S2) in the Hardisty, Alberta area was collected and stratified for dispersal following construction. During the post-construction monitoring program, numerous sand nutgrass plants were found where the collected seed was sown (IPL 1995, Fryer pers. comm.). The site was revisited yearly for several years after construction and the sand nutgrass was thriving (Fryer pers. comm.).

Based on the assessment of the rare vascular plants that will be encountered during construction, the proven mitigative measures described above are considered to be appropriate and applicable to the vascular species encountered by the pipeline route. However, if mitigative measures do not completely protect the site, a loss or alteration of a portion of the local population of S1, S2, and/or S3 rare vascular plants may occur. By basing mitigation on species ranking, abundance, growth habit and habitat, in addition to its location on the right-of-way, any loss or alteration of the local rare plant population, particularly S1 local populations, would be reduced to a level such that the local population is not placed at risk. Consequently, the residual effects of the construction of the pipeline on rare vascular plant species are reversible in the short to medium-term and of medium magnitude.

Sensitive Plant Communities

Protection measures and environmental management techniques for sensitive plant communities will be based on site-specific conditions and species sensitivity criteria. Final decisions on mitigative measures will be made by Enbridge in consultation with botanical experts, ANHIC, SK CDC, MB CDC and where appropriate, the land authority. Mitigative measures for sensitive plant communities are outlined in Detail 6B-1 of the Plant Species of Concern Discovery Contingency Plan (see Appendix 6B of this ESA).

The mitigative measures proposed in Detail 6B-1 (Appendix 6B of this ESA) have been used successfully on other major pipeline construction projects. For example, narrowing down of the right-of-way for sensitive communities was successfully done during construction at several locations on the Alliance Pipeline Project (Alliance 2000a,b,c). At the South Saskatchewan River, shrubby vegetation important for wildlife was temporarily covered with geotextile pads during construction (Alliance 2000c). In addition, sensitive grasslands with thorny buffaloberry (*Shepherdia argentea*), considered important for wildlife, was ramped over during construction. The thorny buffaloberry was cut low to the ground and the root mat preserved (Alliance 2000c).

Covering the rare plant community with geotextile or ramping over the community are measures that will be easier to undertake during construction in frozen conditions when the plants are dormant and snow can be used to protect the vegetation.

The mitigative measures described above are considered to be appropriate and applicable to the proposed pipeline. However, if the plant community cannot be avoided, then a narrowed strip of the S1, S2 or S3 community will be disturbed resulting in some loss or alteration of the community. In addition, temporarily covering of the site and implementing construction traffic restrictions may not completely protect the community. By basing mitigation on community ranking and abundance, in addition to its location on the right-of-way and the community type, any loss or alteration of the local community, particularly S1 local communities, will be reduced to a level such that the local community is not placed at risk. Consequently, the residual effects of the pipeline on rare plant communities are confined to the Footprint or the LSA, are reversible in the medium to long-term and of medium magnitude.

Alteration of Vegetation Important to Wildlife

The proposed route follows existing rights-of-ways for approximately 98% of its length, maximizing the use of previously disturbed areas and minimizing the total amount of disturbance. Approximately 607 ha of vegetation important to wildlife (*i.e.*, pasture, bush-pasture, bush and native prairie) will be altered as a result of construction of the pipeline. These figures are a conservative estimate since they include lands that formed temporary workspace of previous pipeline construction and may have been previously cleared or disturbed. Disturbed areas through native vegetation or pasture segments will be seeded with the appropriate native or agronomic seed mix unless otherwise requested by the landowner. No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be judged. This residual effect is limited to the Footprint, reversible in the short to long-term and of low magnitude.

Weeds

Several locations of weed infestations were noted along the route from KP 959.3 to KP 1245.2 during the vegetation reconnaissance conducted in fall 2006. A preconstruction weed survey will be conducted in 2007 along the entire proposed pipeline route (see Section 9.0 of this ESA). Mitigative measures outlined

in Table 6.2 of this ESA are proven and effective industry standard measures to minimize the introduction and spread of weeds. Past experience during construction programs along the route have revealed that, while weed infestations were encountered, the implementation of appropriate mitigative measures during construction resulted in limited weed issues (IPL 1995, Enbridge 2000, 2002). Furthermore, as noted in the post-construction monitoring reports, all weed issues along the proposed route were resolved at the end of the first-year after post-construction monitoring program for Alliance Pipeline (TERA 2001b), at the end of the second-year after post-construction monitoring program for CEP and Terrace Phase I (TERA 1996, 2001a) and at the end of the third-year after post-construction monitoring program for Terrace Phase II (TERA 2004). It is anticipated that weed introduction and spread arising from the construction of the pipeline will be limited in areal extent, reversible in the short to medium-term and of low magnitude.

Ornamental Trees, Windbreaks and Shelterbelts

During past construction programs along the route, the construction right-of-way generally was narrowed at shelterbelt locations to minimize the number of trees to be removed or the shelterbelt was bored (IPL 1995, Enbridge 2000). Landowners will be consulted with regard to ornamental trees, windbreaks and shelterbelts on their property potentially being affected by construction activities. Some of these features may be removed as a result of the construction of the pipeline. However, considering that such removal would have the approval of the landowner, this residual effect is considered to be neutral and, consequently, does not require an evaluation of significance.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on vegetation will be not significant.

6.2.9 Wildlife

6.2.9.1 Ecological Context

In Alberta and Saskatchewan, the proposed pipeline route traverses habitats within the Aspen Parkland and Moist Mixed Grassland Ecoregions. In Saskatchewan, the proposed route also traverses habitats within the Mixed Grassland Ecoregion. In Manitoba, the proposed pipeline route traverses habitats within the Aspen Parkland, Manitoba Plain, and Boreal Transition Ecoregions.

Most of the lands along the proposed route abut the existing Enbridge pipeline corridor that has been in use by Enbridge since the early 1950s. Existing disturbances arising predominantly from agricultural activities within the local area have resulted in direct habitat losses and alterations in the past.

Habitat for many of the wildlife species in the vicinity of the pipeline route generally coincides with areas of native vegetation. The loss of native vegetation within the vicinity of the pipeline route directly affects use of native habitats by wildlife and the location, distribution, and viability of many species at risk. Some wildlife species have also adapted to, or acclimated to various levels of human activity.

6.2.9.2 Significance

The potential residual effects on wildlife and wildlife habitat (see Table 6.2 of this ESA) associated with construction and operation of the pipeline include:

- alteration of 607 ha of wildlife habitat including habitat within DU project areas, CAs, NAWMP priority areas, PFRA community pastures, *WHPA* lands, Kendal Game Preserve lands, and Fish and Game Development Fund areas;

- displacement of wildlife away from the pipeline route during construction with resultant use of potentially suboptimal habitat during noncritical periods;

- potential for vehicle/wildlife collisions on access roads and along the right-of-way during construction; and

- potential for mortality due to the physical disturbance of undiscovered nests, burrows, dens or other localized habitat on the right-of-way.

Alteration of Wildlife Habitat

The proposed route follows existing rights-of-ways for approximately 98% of its length, maximizing the use of previously disturbed areas and minimizing the total amount of disturbance. Approximately 607 ha of wildlife habitat (*i.e.*, pasture, bush-pasture, bush and native prairie) will be altered as a result of construction of the pipeline including habitat within DU project areas, CAs, NAWMP priority areas, PFRA community pastures, *WHPA* lands, Kendal Game Preserve lands, and Fish and Game Development Fund areas. This figure is a conservative estimate since it includes lands that formed temporary workspace of previous pipeline construction and may have been previously cleared or disturbed. Disturbed areas through native vegetation and pasture segments will be seeded with the appropriate native or agronomic seed mix unless otherwise requested by the landowner. No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be judged. This residual effect is limited to the Footprint, reversible in the short to long-term and of low magnitude.

Sensory Disturbance of Wildlife

Noise arising during the construction of the pipeline may displace wildlife in the vicinity of the right-of-way. However, scheduling construction activities outside of the peak breeding season will substantially minimize the potential to disturb wildlife species during their sensitive life history phases. Due to the linear progression of pipeline construction, construction at any given location along the route will be limited to approximately one month and, therefore, is of short-term duration. This residual effect is of low magnitude and of short-term reversibility.

Wildlife Mortality

Although vehicle speed will be limited on the roads to the pipeline right-of-way as well as on the right-of-way (see Traffic Control Plan in Appendix 6C of this ESA), a slight increase in potential for vehicle/wildlife collisions may occur during the construction and, to a lesser extent, during the operation of the pipeline. In addition, no vehicle/wildlife collisions during the construction of Terrace Phases I or II were noted in the As-built reports (Enbridge 2000, 2002). Consequently, the probability of such a collision is low.

Similarly, the application of mitigative measures from Table 6.2 of this ESA regarding pre-construction wildlife surveys and measures to be taken during construction to reduce the potential for wildlife mortality (*e.g.*, removing trapped animals from the trench) will substantially reduce the potential of wildlife mortality associated with the construction of the pipeline.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on wildlife and wildlife habitat will be not significant.

6.2.10 Species at Risk

The potential residual effects on species at risk (see Table 6.2 of this ESA) associated with construction and operation of the pipeline include:

- potential fish species at risk may be affected by increased suspended sediment concentration and habitat alteration within the zone of influence at select watercourse crossings;

- if mitigative measures do not completely protect the site, some loss or alteration of the local population of S1, S2 and/or S3 vascular plant species at risk may occur; and

- alteration of habitat used by wildlife species of concern, including northern leopard frogs, loggerhead shrike and long-billed curlew as well as sensory disturbance and potential mortality during construction if mitigative measures cannot protect some individuals.

Fish Species at Risk

Although the pipeline route in eastern Saskatchewan and Manitoba lies within the home range of a fish species at risk (*i.e.*, silver chub), this species has not been found in watercourses crossed by the proposed route during past fish and aquatic habitat surveys nor during the survey conducted in fall of 2006. Potential effects on fish species at risk and their habitat have been reduced by the mitigation and restoration measures summarized in Tables 6.2 and 6.3 of this ESA. Should a fish species at risk be discovered during additional fish surveys or during construction, the implementation of contingency measures outlined in Appendix 6B of this ESA will ensure that the residual effects on these species is reduced to a level such that local populations are not placed at risk.

Vascular Plant Species at Risk

Although the pipeline route in Saskatchewan and Manitoba lies within the home range of five vascular plant species at risk (*i.e.*, buffalo grass, slender mouse-ear cress, hairy prairie-clover, western spiderwort and small white lady's slipper), these species have not been found along the proposed route during past vegetation surveys. Potential effects on vascular plant species at risk and their habitat have been reduced by the mitigation and restoration measures summarized in Table 6.2 of this ESA. Should a vascular plant species at risk be discovered during additional vegetation surveys, the implementation of contingency measures outlined in Appendix 6B of this ESA will ensure that the residual effects on these species is reduced to a level such that local populations are not placed at risk.

Wildlife Species at Risk

Although the pipeline route lies within the home range of 14 wildlife species at risk, only four of these species (*i.e.*, northern leopard frog, loggerhead shrike, long-billed curlew and burrowing owl) have been identified using habitat along the proposed route or within the setback distance of the proposed route during past wildlife surveys.

Northern leopard frogs are considered species of Special Concern under *SARA* in Alberta, Saskatchewan and Manitoba. This species has been rated as S2S3 (imperilled to vulnerable) in Alberta, S3 (vulnerable) in Saskatchewan and S4 (apparently secure) in Manitoba. The population of northern leopard frogs is increasing and stable. During past wildlife surveys along the proposed route, northern leopard frogs were previously identified in Saskatchewan and Manitoba from KP 655.0 and KP 656.0, from KP 988 and KP 993 and at the Souris River (KP 1073.4) as well as in the vicinity of the Cypress River (KP 1131.6) and at Deadhorse Creek (KP 1196.6). No leopard frogs or their habitat have been identified along the proposed route in Alberta during past wildlife surveys or during past construction programs. During construction of Terrace Phase I, northern leopard frogs were encountered only in Manitoba from KP 988 to KP 993 and at the Souris River (Enbridge 2000). In excess of two hundred northern leopard frogs were removed from the construction right-of-way prior to the initiation of activities resulting in minimal impacts. Provincial authorities in Manitoba determined at the time that no additional mitigative measures were required (Enbridge 2000). During consultation with Manitoba Conservation and Environment Canada representatives for the Alberta Clipper Project, the northern leopard frog was deemed to be of no concern to these agencies (Chranowski, Moran, Duncan pers. comm.). Potential effects on this species and its habitat will be reduced by the mitigation and restoration measures summarized in Table 6.2 of this ESA. Should northern leopard frogs be identified during additional studies in 2007 or during construction, the implementation of contingency measures will reduce the effects on this species to a level such that the local populations are not placed at risk. Consequently, the residual effects of the construction of the pipeline on northern leopard frogs are reversible in the short to medium-term and of low to medium magnitude.

Loggerhead shrikes are considered a Threatened species under *SARA* in Alberta, Saskatchewan and Manitoba. This species has been rated as S3B (vulnerable) in Alberta, S4B (apparently secure) in Saskatchewan and S3S4B (apparently secure to vulnerable) in Manitoba. The population of loggerhead shrikes have been declining, particularly in Saskatchewan and Manitoba. During past wildlife surveys along the proposed route, loggerhead shrikes and their habitat have been previously identified at several locations. Impacts on loggerhead shrikes were minimized through scheduling of construction to avoid sensitive spring nesting, narrowing down the right-of-way or boring to avoid site-specific habitat (*e.g.*, thorny buffaloberry shrubs) (Enbridge 2000). Potential effects on this species and its habitat will be reduced by the mitigation and restoration measures summarized in Table 6.2 of this ESA. Should loggerhead shrikes be identified during additional studies in 2007 or during construction, the implementation of contingency measures will reduce the effects on this species to a level such that the local populations are not placed at risk. Consequently, the residual effects of the construction of the pipeline on loggerhead shrikes are reversible in the short to medium-term and of low to medium magnitude.

Long-billed curlew are considered species of Special Concern under *SARA* in Alberta and Saskatchewan. This species has been rated as S3B (vulnerable) in Alberta and S4B (apparently secure) in Saskatchewan. The number of breeding long-bill curlews has been relatively stable over the past 10 years. Although long-billed curlew habitat has been identified from KP 560.4 to KP 566.3, no nesting long-bill curlews have been identified along the proposed route or within setback distances to the route during past wildlife surveys. Potential effects on this species and its habitat will be reduced by the mitigation and restoration measures summarized in Table 6.2 of this ESA. Should long-billed curlews be identified during additional studies in 2007 or during construction, the implementation of contingency measures would reduce the effects on these species to a level such that the local populations are not placed at risk. Consequently, the residual effects of the construction of the pipeline on long-billed curlews are reversible in the short to medium-term and of low magnitude.

Although burrowing owls are considered an Endangered species under *SARA* in Alberta, Saskatchewan and Manitoba, the proposed route lies within the range of this species in only Alberta and Saskatchewan. This species has been rated as S2B (imperilled) in Alberta and in S1B (critically imperilled) in Saskatchewan. The population of burrowing owls is declining. Although no burrowing owls have been recorded along the route or in the vicinity of the route in Alberta, the proposed route lies within the setback distance to several historic burrowing owl records in Saskatchewan. During construction of CEP, 22 artificial burrowing owl nest boxes were installed in the vicinity of the right-of-way. Potential effects on this species and its habitat will be reduced by the mitigation and restoration measures summarized in Table 6.2 of this ESA. Should burrowing owls be identified during additional studies in 2007 or during construction, the implementation of contingency measures would reduce the effects on these species to a level such that the local populations are not placed at risk. Consequently, the residual effects of the construction of the pipeline on burrowing owls are reversible in the short to medium-term and of medium magnitude.

Should other wildlife species of concern be identified during additional studies in 2007 or during construction, the implementation of contingency measures will reduce the effects on the species to a level such that the local populations are not placed at risk. Consequently, the combined residual effects of the construction of the pipeline on wildlife species at risk are reversible in the short to medium-term and of low to medium magnitude.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on species at risk will be not significant.

6.2.11 Human Occupancy and Resource Use

The potential residual effects on human occupancy and resource use (see Table 6.2 of this ESA) associated with construction and operation of the pipeline includes:

- disruption of ranching and farming operations, including irrigation activities, may occur during pipeline construction;
- disruption of grazing activities on PFRA / community pasture lands and grazing leases may occur during pipeline construction;
- disruption of local hunting and guide outfitting activities may occur during pipeline construction;
- the navigability of watercourses deemed to be a navigable waterway may be affected during pipeline construction;
- disruption of golfing activities may occur during pipeline construction;
- disruption of recreational activities at Kemoca Regional Park during pipeline construction;
- alteration of lands along the proposed route within the Sounding-Sunken Environmentally Significant Area will occur; and
- a decrease in the quality of the outdoor recreation experience may occur at select locations during pipeline construction.

Disruption of Ranching and Farming Operations

Ranchers and farmers along the route may experience disruptions to their activities during the short-term duration of construction of the pipeline. Scheduling of the pipeline component outside of peak agricultural activity periods, including peak irrigation period, where feasible, will lessen the effects on ranchers and farmers. Furthermore, advanced notification of the pipeline activity schedule to all affected ranchers and farmers, and compensation for disrupted activities and crop loss will further minimize these effects. It is anticipated that the construction of the pipeline will not affect the sustainability of ranching and farming activities in the vicinity of the pipeline route nor the livelihood of the local rancher or farmer. The residual effect is reversible in the short-term and of low to medium magnitude.

Disruption of Grazing Activities on PFRA / Community Pasture Lands and Grazing Leases

Grazing activities within PFRA pastures, community pastures and grazing leases along the route may be disrupted during the short-term duration of construction of the pipeline. Scheduling of the pipeline component outside of peak grazing periods, where feasible, will lessen the effects on landowners or land managers. Furthermore, advanced notification of the pipeline activity schedule to the landowners or land managers may result in moving cattle to other portions of the PFRA pasture, community pasture or grazing lease during construction, thereby further lessening the effect on the operation of the pasture. The residual effect is reversible in the short-term and of low to medium magnitude.

Disturbance of Hunting and Guide Outfitting Activities

The proposed route is located in an agricultural setting on predominately private lands where hunting is only allowed with the permission of the landowner. The effect of the construction of the pipeline on hunting activities will be negligible for segments of the route constructed during winter and summer. However, local hunters and guide outfitters may experience some minor disturbance of their activities along segments of the route constructed during autumn. The residual effect is reversible in the short-term and of negligible to low magnitude.

Navigable Waters

For past construction programs along the Enbridge system from Hardisty to the US border near Gretna, six watercourses were deemed to be a navigable watercourse, namely Eagle Creek, the South Saskatchewan River, the Qu'Appelle River, Wascana Creek, Chapleau Lake and the Souris River. Enbridge will follow all permit conditions for these watercourses and any other watercourses deemed navigable by Transport Canada. The navigability of some watercourses along the route may be affected if open water conditions occur during construction of a trenched crossing or installation of a temporary vehicle crossing. With advanced public notification of affected watercourses through the placement of notices in the local and regional newspapers and on radios, along with the installation of signs at boat launches and measures to be implemented during instream construction, the residual effect on recreational use of navigable waters is immediately reversible and of low magnitude.

Disturbance of Golfing Activities

Golfers using the three golf courses traversed by the pipeline route may experience disruptions to their activities during the short-term duration of construction of the pipeline. If feasible, scheduling of the pipeline component until after fall closure of the golf course will lessen the effects on these local businesses. Furthermore, compensation for disrupted activities will further minimize these effects. The residual effect is reversible in the short-term and of negligible to medium magnitude.

Disruption of Activities Within the Kemoca Regional Park

An Urban Construction Plan for Kemoca Regional Park (KP 791.5 to KP 791.8 and KP 792.3 to KP 792.7) will be prepared to minimize disturbance to the park and its users. If feasible, scheduling of the pipeline component during fall or winter will lessen the effects on the park users. Furthermore, compensation for disrupted activities will further minimize these effects. The residual effect is reversible in the short-term and of negligible to medium magnitude.

Sounding-Sunken Environmentally Significant Area

The proposed route from KP 217.5 to KP 230.9 traverses the Sounding-Sunken Environmentally Significant Area. In Alberta, the delineation of environmentally significant areas has been conducted on behalf of the municipal agencies and, in some cases, provincial authorities, to assist in planning development in the respective areas. Lands designated as environmentally significant areas do not have development restrictions placed upon them. The environmentally significant areas designation is, however, intended to guide proposed developments in an appropriate manner. Through the mitigation noted in Table 6.2 of this ESA, including plant and wildlife surveys, and appropriate reclamation measures, the magnitude of the alteration of lands through the Sounding-Sunken Environmentally Significant Area is considered to be low.

Outdoor Recreational Experiences

Outdoor recreational experiences such as wildlife viewing and fishing may be affected by noise and visual disturbances associated with the construction of the pipeline during nonfrozen conditions. The proposed mitigation measures will restrict the amount of dust and noise associated with the construction of the pipeline. This residual effect is of negligible to low magnitude and is immediately reversible.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on human occupancy and resource use will be not significant.

6.2.12 Heritage Resources

The potential residual effects on heritage resources (see Table 6.2 of this ESA) associated with construction and operation of the pipeline include:

- identified surface and burial sites may be disturbed during construction;
- previously unidentified buried heritage resources may be disturbed during construction; and
- palaeontological resources may be disturbed as a result of construction activities.

Disturbance of Heritage Resource Sites

Heritage resources provide a window into past human experiences and by their very nature, are non-renewable and once disturbed the resource may be altered or even lost. Consequently, the primary mitigative measure in protecting heritage resources is avoidance. Yet, to further the understanding of the past, disturbing the cultural resources through excavations is an acceptable practice for archaeologists and, in many cases, the only method to collect *in situ* information to add to the archaeological record. Regardless of whether the excavation of the site is for academic or development purposes, the loss of heritage resource sites is generally offset by the recovery of knowledge about the site gained through meticulous identifying, cataloguing, and preserving of artifacts and features.

A total of 101 previously identified heritage resources have been identified in the vicinity of the proposed route. Some sites will be avoided by narrowing down the construction right-of-way or fencing off the feature. The Thornhill Mounds site will be investigated in spring 2007 to ensure that the proposed route avoids this high value heritage resource site.

Should any heritage resources be discovered during the HRIAs in Alberta and Saskatchewan and the site investigations in Manitoba scheduled for spring 2007, appropriate mitigative measures will be selected from the Heritage Resources Discovery Contingency Plan in Appendix 6B of this ESA so that the magnitude of the loss of heritage sites, if any, is low. At some locations, no special mitigation will be warranted and at some sites that cannot be avoided, the site will be thoroughly documented. The magnitude of the loss of these heritage sites is low. Furthermore, the knowledge gained from such documentation is viewed as adequately compensating for impacts to heritage resources.

No previously undiscovered heritage resources were identified during construction of CEP, SEP II, Terrace Phase I or Phase II (IPL 1995, 1998; Enbridge 2000, 2002). Consequently, the probability of discovering a previously undiscovered heritage resource during construction of the pipeline is considered to be low. Nevertheless, should any previously unidentified buried sites be encountered during construction of the pipeline, activity at that site will be stopped and contingency measures outlined the Heritage Resource Discovery Contingency Plan (Appendix 6B of this ESA) will be implemented. Since knowledge of the site will be recovered prior to resumption of construction activity, the addition of information to the archaeological record is viewed as generally compensating for the loss of heritage resources and magnitude is considered to be low.

Discovery of Palaeontological Resources

Past studies of the Enbridge corridor associated with CEP, SEP II, Terrace Phases I and II did not identify any palaeontological resources within the Footprint. In addition, no palaeontological resources were identified along the Alliance Pipeline route. No palaeontological resources were discovered during the construction of CEP, SEP II, Terrace Phases I or II (IPL 1995, 1998; Enbridge 2000, 2002). Consequently, the probability of encountering palaeontological resources along the route is considered low.

A palaeontological assessment of the valleys of High Hill, Cottonwood and Deadhorse creeks will be undertaken during spring 2007. If there is a high likelihood of encountering palaeontological resources, the construction of the pipeline may allow for the unique opportunity to advance the understanding of the palaeontological history of the area through monitoring of trenching activities at this location. Should the

palaeontologist monitor discover palaeontological resources during trenching activities along these segments, work at that location will cease and samples will be taken under the direction of the palaeontologist, after which, trenching activities will resume. These segments of the route have the potential to add to the knowledge base if palaeontological resources are identified and samples recovered during construction for data analysis. The potential to contribute to the understanding of the regional palaeontological resources as a result of the construction of the pipeline is a positive residual effect and, consequently, does not require an evaluation of significance.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on heritage resources will be not significant.

6.2.13 Traditional Land and Resource Use

The potential residual effect associated with the construction and operation of the pipeline on traditional land and resource use identified is disruption of farming activities on the Swan Lake Indian Reserve No. 7 may occur during construction (see Table 6.2 of this ESA). Scheduling of the pipeline construction to outside of peak agricultural activity periods, where feasible will lessen the effects to the local farmer. Furthermore, advanced notification of pipeline activity schedule to the local farmer and compensation of disrupted activities or crop loss will further minimize these effects. It is anticipated that the construction of the pipeline will not affect the sustainability of farming activities on the Swan Lake Indian Reserve No. 7 nor the livelihood of the local farmer. The residual effect is reversible in the short-term and of low magnitude.

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effect of pipeline construction and operation on traditional and land resource use will be not significant.

6.2.14 Social and Cultural Well-Being

The potential residual effect associated with the construction and operation of the pipeline on social and cultural well-being is primarily a temporary increase in the local community population resulting from construction of the pipeline (see Table 6.2 of this ESA). Only those communities with sufficient services will be selected for locating temporary field offices and accommodating the anticipated 450-550 person workforce during construction (*e.g.*, Hardisty, Kerrobert, Kindersley, Rosetown, Moose Jaw, Regina, Kipling, Brandon, Virden, Morden, Winkler, Altona). As part of the Alberta Clipper Project orientation, construction workers, inspectors and support personnel will receive a presentation on the expectations regarding code of conduct for Alberta Clipper Project workers when using community facilities and services.

The linear progression of pipeline construction results in activities occurring for a relatively short period in any given location along the route. Therefore, no impacts on social and cultural well-being are anticipated as a result of the pipeline since construction activities occur too briefly to influence the well-being of communities along the pipeline route.

Consequently, the residual effect of the construction of the pipeline on social and cultural well-being is anticipated to be neutral, and therefore, does not require an evaluation of significance.

6.2.15 Human Health

The potential residual effects on human health (see Table 6.2 of this ESA) associated with construction and operation of the pipeline include:

- short-term increase in nuisance air emissions (*e.g.*, dust, vehicle exhaust, smoke) during construction; and
- short-term increase in nuisance noise during construction.

The evaluation of significance for nuisance air emissions is discussed in Section 6.2.4 of this ESA under GHG and Air Quality while construction noise is evaluated in Section 6.2.5 of this ESA under Acoustic Environment.

6.2.16 Infrastructure and Services

The potential residual effects on infrastructure and services (see Table 6.2 of this ESA) associated with construction and operation of the pipeline includes:

- increased traffic on highways and local roads used to access the proposed pipeline right-of-way will occur during construction;
- temporary increase in waste flow to regional landfill sites will occur;
- some local or regional tourist accommodations will be temporarily occupied by Alberta Clipper Project workers, including those on the pipeline; and
- despite best intentions and work practices, incidents arising during construction may warrant the use of some emergency services.

Increased Traffic on Highways and Local Roads

Alteration of traffic patterns, movements and volumes during construction along major highways and local roads is an unavoidable residual effect. Through the implementation of such mitigative measures as using multi-passenger vehicles and obeying traffic, road-use and safety laws, the residual effect of construction activities on traffic movements is considered to be of low magnitude.

Temporary Increase in Waste Flow

Enbridge will reduce waste quantities to the lowest levels practical through Project design and the implementation of their Waste Management Plan during construction. All waste generated from the Project during construction will be hauled to the appropriate landfill sites in the region depending on the type of waste. Receptacles for recycling various products (*e.g.*, paper, cardboard, glass, tin, etc.) will be available at the construction offices and will be hauled to appropriate recycling depots. This residual effect is of immediate to short-term reversibility and of low to medium magnitude.

Use of Regional Tourist Accommodations

Enbridge or its contractor(s) are planning to install a temporary construction camp near Hardisty due to limited available accommodation in the regional area. This construction camp will be used to house pipeline construction personnel and may also house other Project personnel (*e.g.,* tank or pump station construction personnel). The use of a construction camp by Project personnel will alleviate the strain on local and regional accommodation in the Hardisty area, thereby minimizing the displacement of tourists, especially during the peak tourist season. Some regulatory inspectors and company personnel will require lodgings in Hardisty or the regional area (*e.g.*, Killam, Provost) during the construction of the Project which might have otherwise been utilized by tourists.

Elsewhere along the proposed route, pipeline construction crews, company personnel, regulatory inspectors will require lodging communities in the region during the construction of the proposed pipeline which might have otherwise been utilized by tourists. Construction activities scheduled during fall and winter will occur outside of the peak tourist season. This would allow for the use of regional accommodations while minimizing the displacement of tourists. Advanced bookings of lodging for the construction workforce during summer construction will ensure that people associated with the pipeline construction for the Alberta Clipper Project are accommodated and will allow tourists to pursue other available regional accommodations.

Consequently, this residual effect is of immediate to short-term reversibility. The magnitude of the residual effect ranges from low where construction camps are used and where construction occurs during the off-season to medium where construction occurs during peak tourist season. Off-season use of regional accommodation and services is likely to be considered a positive benefit.

Usage of Emergency Services

Enbridge is committed to constructing the proposed pipeline, in a safe and responsible manner. There are several contingency plans, management plans, and systems either in place or that will be in place to prevent accidents and minimize risk of injury to workers during construction. The plans include the Emergency Response, Spill Contingency and Fire Contingency plans. All workers and visitors to the job site will have to participate in a safety orientation, and upon successful completion, display the valid safety sticker on their hardhat before permission to access the job site is granted. Safety issues will be discussed onsite daily during tailgate meetings.

Despite these measures and best intentions, incidents during the construction of the pipeline may arise in which emergency services are warranted (*e.g.*, ambulance, fire, police, hospital). Twenty-one communities in the local and regional area have sufficient services to respond to the emergency situations that may arise during construction of the pipeline (*i.e.,* Hardisty, Provost, Kerrobert, Kindersley, Rosetown, Outlook, Davidson, Craik, Moose Jaw, Lumsden, Regina, Montmartre, Kipling, Virden, Brandon, Souris, Somerset, Morden, Winkler, Altona, Gretna). Given the proximity of the pipeline to these communities and to local grid roads and highways, it is conservatively estimated that response to an emergency would likely take no longer than one hour from any point along the proposed route. The residual effect of potentially using emergency services during the short-term construction period is of low magnitude and low probability.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects of pipeline construction and operation on infrastructure and services will be not significant.

6.2.17 Employment and Economy

The potential residual effects (see Table 6.2 of this ESA) associated with the construction and operation of the Alberta Clipper Project, including pipeline and associated pipeline facilities, pump additions and Hardisty Terminal tank installation on employment and economy include:

- local businesses and residents will benefit from the Project through employment opportunities; and
- the Project will generate revenue for municipal, provincial and federal governments.

An economic effects analysis of the Alberta Clipper Project was undertaken by Decision Economic Consulting Group. The costs associated with the Project were categorized on a provincial basis and submitted to Statistics Canada where a custom run of the "Open Interprovincial Input-Output Model" was undertaken. The methodology and related assumptions used in the economic effects analysis are described in Appendix III of this ESA.

Estimates were prepared for the following economic metrics:

- Output - measures the total value of the goods and services produced within the economy to meet the demands of the project.
- Gross Domestic Product (GDP) - measure of the value of goods and services produced in the economy; as compared to output, it measures only the value added in the economy.
- Employment - measured in full-time person-years of employment.
- Labour Income - comprises total earnings of employees: wages and salaries plus contributions to pension funds, unemployment insurance funds and workman compensation funds.
- Federal taxes - include corporate and personal income taxes, Goods and Services Tax (GST) plus other indirect taxes (such as excise and fuel taxes).
- Provincial taxes - include corporate and personal income taxes, provincial sales tax plus other indirect taxes (such fuel tax).
- Municipal property taxes - will become payable upon completion of the Project in late 2009.

In terms of spatial boundaries, data were assessed at the provincial level in the four provinces (Alberta, Saskatchewan, Manitoba and Ontario) where expenditures are expected to be made as well as at the federal and municipal levels for tax revenues.

In terms of temporal boundaries, the duration of these impacts will extend from pre-construction (site selection, planning and design) through completion of construction (including site restoration).

Results

Construction expenditures for the Alberta Clipper Project expenditures are estimated to total $1,522 million (in 2007 Canadian dollars), excluding provincial sales taxes. Of this amount, $1,490 million (98%) will be spent in Canada on goods and services with $32 million (2%) spent on direct imports.

As presented in Table 6.7 (located at the end of Section 6.0 of this ESA), expenditures are estimated at $56.5 million in Ontario, $206.4 million in Manitoba, $917.4 million in Saskatchewan and $310 million in Alberta. Some of these amounts will flow indirectly to other provinces and other countries for manufacturing inputs.

The Alberta Clipper Project is estimated to result in increased Canadian output valued at $2,171.7 million. This amount includes direct effects plus indirect effects, the latter being the ripple effects as firms purchase additional inputs from other firms. Of this increased output, $300.1 million is estimated to be produced in Ontario, $265.2 million in Manitoba, $854.4 million in Saskatchewan and $752.1 million in Alberta.

The Project is estimated to result in increased Canadian GDP of $812.2 million. This amount includes direct effects plus indirect effects, the latter being the ripple effects as firms purchase additional inputs from other firms. Of this increased GDP, $136.8 million is estimated to be generated in Ontario, $104.0 million in Manitoba, $251.2 million in Saskatchewan and $320.2 million in Alberta.

Construction of the Project is estimated to result in an increase in Canadian employment of 11,827 person-years. This amount includes direct effects plus indirect effects, the latter being the ripple effects as firms purchase additional inputs from other firms. Of this increased employment, 1,866 person-years is estimated to be created in Ontario, 1,725 person-years in Manitoba, 4,306 person-years in Saskatchewan and 3,931 person-years in Alberta.

As presented in Table 6.7 of this ESA, the Project is estimated to result in increased labour income of $553.2 million. This amount includes direct effects plus indirect effects, the latter being the ripple effects as firms purchase additional inputs from other firms. Of this increased labour income, $90.7 million is

estimated to be generated in Ontario, $67.2 million in Manitoba, $187.0 million in Saskatchewan and $208.3 million in Alberta.

With regard to federal tax revenues, the Project is estimated to result in increased federal tax revenues of $142.4 million. This amount includes direct effects plus indirect effects, the latter being the ripple effects as firms purchase additional inputs from other firms. Of this amount, $48.2 million will be generated by corporate income tax, $61.8 million by personal income tax and $32.4 million in indirect taxes.

The Project is estimated to result in increased provincial tax revenues of $117.8 million. This amount includes direct effects plus indirect effects, the latter being the ripple effects as firms purchase additional inputs from other firms. Of this increased tax revenue, $13.6 million is estimated to be generated in Ontario, $15.7 million in Manitoba, $64.7 million in Saskatchewan and $23.8 million in Alberta.

Municipal property taxes will become payable upon completion of the Project in late 2009. It is estimated that, using 2007 dollars and tax rates, the Alberta Clipper Project will result in increased municipal property taxes of $6.3 million annually. Of this increased tax revenue, $1.6 million is estimated to be generated in Manitoba, $2.9 million in Saskatchewan and $1.8 million in Alberta.

Summary

Construction of the Alberta Clipper Project is estimated to result in expenditures on goods and services in Canada of approximately $1,490 million. This expenditure is estimated to lead to increased GDP of $812.2 million, labour income of $553.2 million and 11,827 person-years of employment.

Further, this economic activity is estimated to generate increased tax revenues of $142.4 million for the Government of Canada, $13.6 million for the Government of Ontario, $15.7 million for the Government of Manitoba, $64.7 million for the Government of Saskatchewan and $23.8 million for the Government of Alberta. A further $6.3 million in annual municipal property taxes will also be generated in Manitoba, Saskatchewan and Alberta.

The economic analysis undertaken for the Alberta Clipper Project demonstrates the effects of the Project on output, GDP, employment, labour income and tax revenues, all of which are considered to be positive residual effects on employment and economy, and, consequently, do not require an evaluation of significance.

6.2.18 Accidents and Malfunctions

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

- spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident;
- despite vigilance, fires may adversely affect adjacent vegetation and, in very rare situations, affect wildlife and adjacent property;
- rupture of water, sewage or gas lines could lead to interruption of services, contamination of soil and water depending on the location and severity of the rupture, and fires in the case of gas while cable damage can lead to interrupted service of the utility to communities and local residences;
- release of drilling mud on land, once cleaned-up and reclaimed, will have little residual effect;
- depending on the volume and location of the release, a release of drilling mud into a watercourse may affect aquatic ecosystems in the short to medium-term; and
- a pipeline failure may adversely affect adjacent soils, vegetation, wildlife habitat and aquatic ecosystems, including aquifers.

While substantial adverse effects could occur as a result of an accident during the construction of the pipeline, Enbridge will implement the best available technology and safety measures to minimize the probability of accidents occurring. Therefore, the potential is low for an accident to occur during construction that would have substantial adverse effects.

Spills of Hazardous Materials During Construction

Terrestrial spills during construction will generally be very small and localized within the Footprint. Since light hydrocarbons (*i.e.,* diesel and hydraulic oils) tend to disperse readily and break down, the potential adverse residual effects are reversible in the short-term.

A spill on an ice-covered waterbody will generally be localized and readily remediated through scraping of the contaminated ice surface. However, spills which occur under the ice are more difficult to contain and clean-up given the presence of the ice cover. The adverse residual effects associated with a large spill under the ice of a waterbody could be considered significant. However, the probability of a significant adverse residual effect is low.

In the event of a large spill such as a fuel truck rollover in a stream, the adverse residual effects could be of high magnitude with long lasting ramifications to the health of the stream. Although spill contingency and clean-up measures would reduce the magnitude and reversibility of the residual effects, such an incident could be considered significant due to the adverse residual effects in a highly sensitive environment. Since events such as this rarely occur within the construction right-of-way and even more rarely occur instream, the probability of a significant adverse residual effect is low.

Fire During Construction

The significance of a fire will depend greatly on the size and what it consumes. Since small fires within the Footprint and off of the Footprint are of minor and moderate concern respectively, and can be extinguished quickly, they are not likely to cause a significant adverse residual effect. Large fires that spread off the Footprint and result in loss of resources and property are likely to be considered a significant adverse residual effect. The likelihood of large fires developing is extremely low since the construction crews will have firefighting equipment and training, and most of the pipeline route lies in close proximity to fire fighting services.

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

Rupture of a water line, buried cable or telephone line along the route may be inconvenient but the adverse residual effects would likely be of low magnitude, and reversible in the immediate to short-term since repair would be relatively easy. Rupture of a sewer line would firstly, be an inconvenience and secondly, could contaminate the soils and trench in the vicinity of the rupture. Contamination of the soils and trench could be remedied relatively quickly with minimal to no residual effect.

In the event of a rupture of a high-pressure gas line, the risk of explosion and risk to human health could be considered significant. Since high pressure pipelines are easily located (as opposed to some low-pressure plastic distribution lines) and are of sufficient size and strength that rupture is extremely unlikely, the probability of a significant adverse effect resulting from an explosion of existing gas pipelines is low.

The rupture of an existing Enbridge or foreign pipeline during construction of the pipeline resulting in severe contamination to lands or water could be considered a significant adverse effect. Since Enbridge will be adhering to industry standards, regulatory regulations and company protocols, the probability of a significant adverse effect resulting from working in the vicinity of the existing Enbridge pipelines and foreign pipelines is low.

Release of Drilling Mud during Horizontal Directional Drilling

The release of drilling mud during HDD of a watercourse is not uncommon and, in most cases, is relatively benign since the mud is inert and can often be cleaned-up and the areas reclaimed. The introduction of a clay based drilling mud into the environment will have variable effects depending on the location, volume released and the level of clean-up that is appropriate. Monitoring programs throughout a HDD program allow a release of drilling mud to be detected soon after a release occurs. The ability to stop the flow of mud quickly also aids in limiting the total volume of drilling mud. Since the total volumes

of drilling mud released during an inadvertent release are generally limited, drilling mud released into a watercourse will be dissipated into a watercourse in a short period. Schmidt *et al.* (2001) evaluated the effect of a release of mud during HDD on wetlands at five sites and determined that none displayed significant long-term impacts as a result of bentonite discharge and further noted that the level of observed impact was in part related to the nature of clean-up procedures. The reversibility of the adverse residual effect on the riparian area will depend on the length of time it takes for vegetation to recolonize the area disturbed by the mud and clean-up activities but is likely to be short to medium-term.

Pipeline Failure During Operations

Pipelines are the safest and most efficient method of transporting large volumes of crude oil and other liquid petroleum products over long distances. The significance of a failure of the pipeline system will depend greatly on the type of product spilled, volume of product spilled and sensitivity of location of the failure. For example, if the incident was contained within a bermed pump station, the residual effect of the release would likely be considered not significant whereas, if the released product affected important wildlife habitat during critical life stages, sensitive aquatic ecosystems (including aquifers) or downstream municipal water intakes, the residual effect would likely be considered significant.

Enbridge has operated their existing pipelines with diligence over the past 50 years. Enbridge is committed to maintaining the pipeline right-of-way and operating the pipeline and associated facilities with a continuing high standard of excellence. Through such programs as pipeline integrity management and emergency response, the risk of a spill resulting in a significant adverse effect is low.

Summary

Based on Table 6.6 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects arising from an accident or malfunction during construction and operation for the pipeline will be not significant.

6.2.19 Pipeline Facilities

Since the associated pipeline facilities (*i.e.*, block valves and scraper traps) will be located within the pipeline construction right-of-way or within existing pump stations/terminals, many of the mitigative measures described previously for the pipeline will apply to the pipeline facilities. Rather than restating the effects and mitigation associated with each element, see Table 6.2 of this ESA for the applicable mitigative measures for the element in question. The following provides an assessment summary for the associated pipeline facilities.

The potential residual effects associated with the construction and operation of the pipeline facilities include:

- minor topsoil / subsoil mixing may occur (see Section 6.2.2 Soil Capability of this ESA);
- incremental loss or alteration of native vegetation or vegetation important to wildlife will occur (see Section 6.2.8 Vegetation of this ESA);
- weed introduction and/or spreading from disturbance may occur (see Section 6.2.8 Vegetation of this ESA);
- incremental loss or alteration of potential wildlife habitat will occur (see Section 6.2.9 Wildlife and Wildlife Habitat of this ESA);
- although the likelihood of such an event is low, an oil release may affect other resources (see Section 6.2.18 Accidents and Malfunctions of this ESA); and
- despite vigilance, fires may adversely affect adjacent vegetation and, in very rare situations, affect wildlife and adjacent property (see Section 6.2.18 Accidents and Malfunctions of this ESA).

The evaluation of significance of the above potential residual effects is as described in the applicable subsection of Section 6.2 of this ESA for the construction and operation of the pipeline.

6.3 Effects Assessment - Pump Additions

Using the assessment methodology described in Section 6.1 of this ESA, the following subsection evaluates the potential environmental and socio-economic effects associated with pump additions at the following eight existing pump stations/terminals:

Hardisty	Craik	Glenboro
Kerrobert	Glenavon	Gretna
Milden	Cromer	

Construction activities at the above pump stations/terminals will be undertaken as part of the Alberta Clipper Project. The work, consisting of the addition of aboveground pump and new electrical services building, will required minimal ground disturbance and will, with one exception, be confined to the existing pump station/terminal boundary. A new pump station, the Rowatt Pump Station, is required in support of the Alberta Clipper Project. The Rowatt Pump Station will require new lands and ground disturbance.

The need for additional electrical facilities at the pump stations/terminals, including Rowatt Pump Station, is presently being assessed. The assessment of power lines to the pump stations/terminals will be deferred to the applicable provincial electrical companies (*i.e.*, AltaLink, ATCO, SaskPower and Manitoba Hydro) who, if warranted, will be applying to the provincial regulators for electrical facilities necessary to connect with provincial transmission lines.

Biophysical and socio-economic elements potentially interacting with pump additions include:

- physical elements such as physical environment, soil capability, water quality and quantity, GHG and air quality, and acoustic environment;
- biological elements such as wetlands, vegetation, wildlife and wildlife habitat, and species at risk; and
- socio-economic elements such as human occupancy and resource use, and infrastructure and services; and
- accidents and malfunctions.

Biophysical and socio-economic elements which are not considered to interact with the pump additions and the construction of the Rowatt Pump Station are listed and justified in Table 6.8 located at the end of Section 6.0 of this ESA.

The potential environmental and socio-economic impacts associated with pump additions and the construction of the Rowatt Pump Station as well as the accompanying proposed mitigative measures and resulting residual effects are presented in Table 6.9 located at the end of Section 6.0 of this ESA and are presented below. These include:

- minor topsoil / subsoil mixing may occur at the Rowatt Pump Station (see Section 6.2.2 Soil Capability of this ESA);
- indirect GHG emissions will increase during operation of new pumps;
- increase in vehicle emissions will occur during pump additions and the construction of the Rowatt Pump Station (see Section 6.2.4 GHG and Air Quality of this ESA);
- increase in noise will occur during pump additions and the construction of the Rowatt Pump Station (see Section 6.2.5 Acoustic Environment of this ESA);
- ambient noise levels at existing stations/terminals and at the Rowatt Pump Station may increase during operations;
- weed introduction and/or spreading from disturbance may occur at the Rowatt Pump Station (see Section 6.2.8 Vegetation of this ESA);

- displacement of wildlife away from station/terminal during pump additions or station construction with resultant use of potentially suboptimal habitat during noncritical conditions (see Section 6.2.9 Wildlife and Wildlife Habitat of this ESA);

- increase in noise levels in the immediate vicinity of the station/terminal will likely displace wildlife over the short to long-term;

- potential for vehicle/wildlife collisions on access routes and at the station/terminal (see Section 6.2.9 Wildlife and Wildlife Habitat of this ESA);

- the installation of aboveground facilities (*i.e.,* pump installation) will form part of the visual landscape at the pump station/terminal over the long-term;

- the installation of aboveground facilities (*i.e.,* buildings, fences, piping) will form part of the visual landscape at the Rowatt Pump Station over the long-term;

- local farmer may experience disturbances of their activities during construction of the Rowatt Pump Station (see Section 6.2.11 Human Occupancy and Resource Use of this ESA);

- increased traffic on highways and local roads used to access the pump stations/terminals will occur during the proposed pump additions (see Section 6.2.16 Infrastructure and Services of this ESA);

- temporary increase in waste flow to regional landfill sites will occur (see Section 6.2.16 Infrastructure and Services of this ESA);

- some local or regional tourist accommodations near Hardisty will be temporarily occupied by regulatory inspectors and company personnel (see Section 6.2.16 Infrastructure and Services of this ESA);

- spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident (see Section 6.2.18 Accidents and Malfunctions of this ESA); and

- despite vigilance, fires may adversely affect adjacent vegetation, and in very rare situations, affect wildlife and adjacent property (see Section 6.2.18 Accidents and Malfunctions of this ESA).

The evaluation of significance of most of the above potential residual effects is as described in the applicable subsection of Section 6.2 of this ESA for the construction and operation of the pipeline. A discussion of the potential residual effects pertaining to indirect GHG emissions during operations, noise during operations and aesthetics at the pump stations/terminals is provided below. The significance of the adverse residual effects associated with pump additions is summarized in Table 6.10 located at the end of Section 6.0 of this ESA.

Greenhouse Gas Emissions During Operations

The pump additions associated with the Alberta Clipper Project is anticipated to increase indirect GHG emissions by 390 kilotonnes (kt) per year during operation of the pumps (see Appendix I of this ESA). This represents approximately 0.052% of Canada's total GHG in 2004 (Clearstone Engineering Ltd. 2007). Of the 390 kt, over 99% of the net increase in indirect GHG emissions is attributed to pump operation in Saskatchewan and Alberta where pump stations are dependent on coal-generated electricity. Conversely, less than 1% of the estimated increase in indirect GHG emissions will occur in Manitoba where the source of the electricity to the pumps originates from hydroelectric power. The residual effect of pump operation on indirect GHG emissions is considered to be of low magnitude.

Noise During Operations

Ambient noise levels at each pump station/terminal may increase during the operation of the facility. The Rowatt Pump Station, along with existing stations/terminals if the stations/terminals were not subject to noise surveys as part of the Enbridge Southern Access Project, will be subject to noise testing prior to being placed in service. Enbridge is proposing to conduct to noise surveys at all stations/terminals where new pumps occurred for the Alberta Clipper Project (see Section 9.0 of this ESA). These surveys will be conducted when the stations/terminals are in-service in order to confirm compliance with Alberta EUB Noise Directive 038 (Alberta EUB 2007). Therefore, noise associated with the pump additions component of the Alberta Clipper Project is expected to be within acceptable limits at each pump station/terminal and the residual effect of this component of the Alberta Clipper Project on the acoustic environment will be of low magnitude.

Noise arising during the operation of the new pumps will likely displace wildlife in the vicinity of the pump station/terminal over the short to long-term depending on the species. Given the agricultural setting of these pump stations/terminal, the magnitude of this residual effect is low.

Aesthetics

The installation of aboveground facilities (*i.e.,* pump installation) will form part of the visual landscape at each existing pump station/terminal over the long-term. However, the aboveground components will be generally located within existing industrial sites which presently consist of buildings, piping, fences and, for some sites, tanks. The addition of the components associated with the pump additions will not substantially alter the local viewscape at any of the existing pump stations/terminals.

Given that the location of the Rowatt Pump Station is largely obscured from the viewscape of the local residence and that the station cannot be viewed from an existing highway, the addition of facilities will not substantially alter the local viewscape.

Consequently, the magnitude of this residual effect is negligible to low, depending on the station/terminal.

Summary

Based on Table 6.10 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects arising from the proposed pump additions will be not significant.

6.4 Effects Assessment - Hardisty Terminal Tank Installation

Using the assessment methodology described in Section 6.1 of this ESA, the following subsection evaluates the potential environmental and socio-economic effects associated with the installation of six tanks and associated facilities (*e.g.*, booster pumps, meter station, mainline pumps, firewater area) at the Hardisty Terminal.

Two other activities form part of the tank installation component, namely the installation of power lines and the relocation of the Penn West pipeline. The assessment of power lines to the pump stations/terminals will be deferred to the applicable provincial electrical company (*i.e.*, AltaLink, ATCO) who, if warranted, will be applying to the provincial regulators for electrical facilities necessary to connect with provincial transmission lines. In addition, the assessment of the relocation of the Penn West pipeline will be undertaken once details of the location and timing of the relocation are available.

Biophysical and socio-economic elements potentially interacting with the Hardisty Terminal tank installation include:

- physical elements such as physical environment, soil capability, water quality and quantity, GHG and air quality, and acoustic environment;

- biological elements such as vegetation, wildlife and wildlife habitat, and species at risk; and
- socio-economic elements such as human occupancy and resource use, heritage resources, and infrastructure and services; and
- accidents and malfunctions.

Biophysical and socio-economic elements which are not considered to interact with the tank installation at Hardisty Terminal are listed and justified in Table 6.11 located at the end of Section 6.0 of this ESA.

The potential environmental and socio-economic impacts associated with the Hardisty Terminal tank installation as well as the accompanying proposed mitigative measures and resulting residual effects are presented in Table 6.12 located at the end of Section 6.0 of this ESA. These include:

- minor topsoil / subsoil mixing may occur at the Hardisty Terminal due to tank installation (see Section 6.2.2 Soil Capability of this ESA);
- indirect GHG emissions will increase during operation of new pumps (see Section 6.3 Pump Additions of this ESA);
- increase in vehicle emissions will occur during tank installation at the Hardisty Terminal (see Section 6.2.4 GHG and Air Quality of this ESA);
- odours may be emitted from new tanks;
- increase in noise will occur during tank installation at the Hardisty Terminal (see Section 6.2.5 Acoustic Environment of this ESA);
- ambient noise levels at the Hardisty Terminal may increase during operations (see Section 6.3 Pump Additions of this ESA);
- loss of approximately 17 ha of vegetation important to wildlife, including approximately 10 ha of native vegetation;
- weed introduction and/or spreading from disturbance may occur at the Hardisty Terminal (see Section 6.2.8 Vegetation of this ESA);
- loss of approximately 17 ha of wildlife habitat;
- displacement of wildlife away from the Hardisty Terminal during tank installation with resultant use of potentially suboptimal habitat during noncritical conditions (see Section 6.2.9 Wildlife and Wildlife Habitat of this ESA);
- increase in noise levels in the immediate vicinity of the Hardisty Terminal will likely displace wildlife over the short to long-term (see Section 6.3 Pump Additions of this ESA);
- potential for vehicle/wildlife collisions on access routes and at the Hardisty Terminal (see Section 6.2.9 Wildlife and Wildlife Habitat of this ESA);
- loss of potential habitat supporting wildlife species at risk and displacement of wildlife species at risk away from the Hardisty Terminal during tank installation (see Section 6.2.10 Species at Risk of this ESA);
- the installation of aboveground facilities (*i.e.,* buildings, fences, piping, tanks) will form part of the visual landscape at the Hardisty Terminal over the long-term;
- identified surface sites and previously unidentified burial sites may be disturbed during construction (see Section 6.2.12 Heritage Resources of this ESA);
- increased traffic on highways and local roads used to access the Hardisty Terminal will occur during tank construction (see Section 6.2.16 Infrastructure and Services of this ESA);

- temporary increase in waste flow to regional landfill sites will occur (see Section 6.2.16 Infrastructure and Services of this ESA);

- some local or regional tourist accommodations near Hardisty will be temporarily occupied by regulatory inspectors and company personnel (see Section 6.2.16 Infrastructure and Services of this ESA);

- spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident (see Section 6.2.18 Accidents and Malfunctions of this ESA);

- although the likelihood of such an event is low, a large-scale oil release may affect other resources (see Accidents and Malfunctions 6.2.18); and

- despite vigilance, fires may adversely affect adjacent vegetation, and in very rare situations, affect wildlife and adjacent property (see Section 6.2.18 Accidents and Malfunctions of this ESA).

The evaluation of significance of most of the above potential residual effects is as described in the applicable subsection of Section 6.2 of this ESA for the construction and operation of the pipeline or in Section 6.3 of this ESA for the pump additions. A discussion of the potential residual effects pertaining to odours during operations, loss of wildlife habitat and aesthetics is provided below. The significance of the adverse residual effects associated with the tank installation at the Hardisty Terminal is summarized in Table 6.13 located at the end of Section 6.0 of this ESA.

Odours During Operations

Atmospheric emissions in the form of evaporative losses from storage tanks include vapours of various hydrocarbons and sulphur compounds. Air Quality Modelling of H_2S, benzene and mercaptan emissions will be undertaken by air quality experts from Jacques Whitford/AXYS Environmental Consulting Ltd. for the Hardisty Terminal expansion component of the Alberta Clipper Project in Q2 2007 (see Section 9.0 of this ESA).

Under normal operations, minimal off-site air emissions are expected to result from the proposed addition of tanks at the Hardisty Terminal since these tanks will feature external floating roofs to manage evaporation losses. Events causing potential odourous emissions are anticipated to occur intermittently and sporadically throughout the life of the tanks. Odourous events are expected to occur during peak tank operation and are expected to be reversible in the immediate to short-term.

Extrapolating from the results of previous air modelling at the Enbridge Hardisty Terminal for the provincially regulated Enbridge Midstream Inc. Hardisty Merchant Tank Project (Jacques Whitford Limited 2006), and the TransCanada Keystone Pipeline GP Ltd. Project (Jacques Whitford/AXYS Environmental Consulting Ltd. 2006) it is anticipated that after the proposed tank expansion, impacts associated with this Project will only slightly increase. Also, the ground-level concentrations associated with expected increases in emissions are anticipated to be less than the corresponding national and provincial ambient objectives and criteria for the substances of interest.

Consequently, the magnitude of this residual effect on air quality is considered to be low.

Loss of Wildlife Habitat

The proposed tanks will be installed on Enbridge-owned property at the Hardisty Terminal. Approximately 17 ha of wildlife habitat (*i.e.*, native prairie, bush and hay) will be removed as a result of the installation of the tanks. No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be judged. Although the area is considered suitable wildlife habitat for various species, including species at risk, the habitat features within the proposed tank development site also occur through much of the surrounding area and are not considered locally unique (Appendix IV of this ESA). Disturbed areas outside of the fenced tank boundary will be seeded with a native seed mix. This residual effect is limited to the Footprint, reversible in the long-term and of low magnitude.

Aesthetics

The installation of tanks at the Hardisty Terminal will form part of the visual landscape over the long-term. However, the aboveground components will be located within Enbridge's terminal property presently consisting of buildings, piping, fences and tanks. With the provision of a vegetative screen on the west side of the tank expansion, the addition of the tanks will not substantially alter the local viewscape of the nearest residence to the terminal. Consequently, the magnitude of this residual effect is low.

Summary

Based on Table 6.13 of this ESA, there are no situations where there is a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically compensated. Consequently, it is concluded that the residual effects arising from the Hardisty Terminal tank installation will be not significant.

6.5 Effects Assessment - Temporary Facilities for Construction

The following subsection evaluates the potential environmental and socio-economic effects associated with the installation and operation of temporary facilities associated with the construction of the Alberta Clipper Project.

Hardisty Construction Camp

Enbridge or its contractor(s) are planning to install a temporary construction camp near Hardisty due to limited available accommodation in the regional area. This construction camp will be used to house pipeline construction personnel and may also house other Project construction personnel (*e.g.,* tank or pump station personnel). No other construction camps are planned although Enbridge's contractors may elect to use construction camps.

Siting criteria outlined in Section 4.3 of this ESA will be used in the selection of an appropriate location of the camp that will minimize potential environmental and socio-economic effects. Preliminary discussions with the Town of Hardisty, County of Flagstaff and MD of Provost representatives have indicated a positive response to hosting a temporary construction camp and the desire to work closely with Enbridge and its contractor as details of the construction camp (*e.g.*, location, size of camp, number of workers, duration of facility operation) become available (O'Connor, Hoyland, Larson, Long pers. comm.).

All applicable municipal and provincial government approvals for the temporary construction camp will be acquired prior to use. Depending on the land use at the facility site, general mitigative measures applicable to the construction and operation of the construction camp may include those described in Table 6.2 of this ESA pertaining to the following environmental and socio-economic elements: soil capability (*e.g.*, topsoil/subsoil mixing); GHG and air quality (*e.g.*, nuisance air emissions); acoustic environment (*e.g.*, nuisance noise emissions); wildlife and wildlife habitat (loss or alteration of wildlife habitat); social and cultural well-being (*e.g.*, influx of temporary workers); and infrastructure and services (*e.g.*, transport of workers, worker accommodation, waste management and emergency services). Additional mitigation may be warranted as detailed plans for the construction camp are developed. The level of mitigation applied will ensure that any adverse residual environmental effects associated with the temporary construction camp at Hardisty are reduced to a level that is not significant.

Temporary Facilities for Pipeline Construction

Other temporary facilities which may be required prior to or during pipeline construction of the Alberta Clipper Project include:

- shoo-flies / temporary access roads;
- equipment storage sites (marshalling yards);
- pipe stockpile sites;

- bone yards;
- borrow pits; and
- construction office sites.

The need for and the respective general location of these sites are the responsibility of the pipeline construction contractor. However, all temporary facility site locations will require the approval of Enbridge's Environmental Inspector or Environment, Health and Safety staff.

The evaluation of potential temporary facility sites will be conducted as far in advance of its intended use as practical in order to allow an adequate time to chose and evaluate any alternate sites. In the event that specific mitigation is warranted for the site, the measures developed will be documented in the Environmental As-built Report (see Section 8.4.4 of this ESA). General provisions will be included in the contract documents that commit contractors to site protection / restoration measures at sites identified, evaluated and used during the construction program. Mitigative measures to be used at temporary facility sites will be as described in Section 6.2 of this ESA. All applicable landowner as well as municipal, provincial and federal government approvals for the temporary facility site will be acquired prior to use of the site or area. The level of mitigation applied will ensure that any adverse residual environmental effects associated with the temporary facilities for construction are reduced to a level that is not significant.

6.6 Effects Assessment - Decommissioning and Abandonment

At some time in the future, certain components associated with the Alberta Clipper Project may be removed from service for a short period of time (*i.e.*, less than 12 months). During that time, the component would be in stand by or idle mode until the component is placed back into service or deactivated. For the latter, an application under Section 44 of the NEB's Onshore Pipeline Regulations would be required. A deactivated component may be reactivated and would require an application under Section 45 of the NEB's Onshore Pipeline Regulations. The remainder of this subsection describes the decommissioning and abandonment phase where decommissioning means the permanent cessation of the operation of a pipeline without discontinuance of service and abandonment means the permanent cessation of the operation of a pipeline which results in the discontinuance of service.

At the time of decommissioning and/or abandonment of the Alberta Clipper Project, Enbridge will review and consider current options, issues, and regulatory requirements of the day. The decommissioning and/or abandonment plan will comply with the acceptable regulatory standards of the day, and will be developed in consultation with stakeholders holding an interest in the proposed decommissioning or abandonment work.

Although the NEB has considered amending the *Onshore Pipeline Regulations* (1999) to provide a regulatory process for applications to decommission pipelines (NEB 2003), such a process has yet to be implemented. However, contemporary studies by regulators and the pipeline industry do exist that examine the technical, environmental and legal issues related to pipeline abandonment (Pipeline Abandonment Steering Committee 1996, Pipeline Abandonment Legal Working Group 1997). The following briefly outlines how abandonment would be addressed under current practices and procedures. The following are three categories under which pipeline abandonment may fall.

- **Abandonment-in-place:** the pipeline is purged, cathodic protection of the pipeline is discontinued and measures (*e.g.*, insertion of concrete, foam or other materials) are taken to maintain the structural integrity of the abandoned pipeline at specific locations such as rail, road and water crossings; surface appurtenances are removed and the right-of-way restored to as close to predisturbance condition as is practical;
- **Pipeline removal:** the entire pipeline, including all surface appurtenances, are removed in their entirety and the right-of-way restored to as close to predisturbance condition as is practical; and
- **Combination of abandonment-in-place and pipeline removal:** involves use of both options with the choice influenced by present and future land use.

The abandonment plan will comply with current and acceptable regulatory standards of the day, and will be developed in consultation with stakeholders holding an interest in the land disposition. Appropriate applications will be filed (*e.g.*, Section 74 of the *NEB Act*, environmental screening under *CEA Act*). Public safety and environmental protection will be key components of the plan.

Regardless of which method of abandonment will be used, activities associated with the abandonment of the pipeline are anticipated to include dismantling and removing surface facilities, and reclaiming of the sites to as close to predisturbance condition as is practical. Consequently, the biophysical and socio-economic elements interacting with the Alberta Clipper Project would likely include:

- physical elements such as physical environment (surface erosion), soil capability (admixing of topsoil/subsoil), water quality and quantity (sedimentation), air quality (nuisance health effect – dust, vehicle emissions), and acoustic environment (nuisance health effect – noise);
- biological elements such as fish and fish habitat (alteration of habitat, sedimentation), wetlands (alteration of habitat function), vegetation (weed introduction), wildlife (auditory disturbance), species at risk (auditory disturbance); and
- socio-economic elements such as human occupancy and resource use (disruption of ranching and farming activities), infrastructure and services (transport of workers and supplies); and accidents and malfunctions.

Upon implementation of standard mitigation of the day, it is anticipated that any adverse residual effects would be of similar or lesser magnitude to those which are described above for construction of the pipeline or facility.

6.7 Effects of the Environment on the Project

Enbridge has been operating a pipeline system and associated facilities in the Alberta Clipper Project area for over 50 years and is aware of the normal as well as the range of unusual environmental conditions experienced along the proposed pipeline route and at the facility sites. This knowledge is reflected in the engineering design and mitigative measures proposed to address these environmental conditions (see Section 3 of the Alberta Clipper Project Application). In addition, existing environmental and socio-economic conditions were taken into consideration when developing the construction schedule for the Project.

As alluded to in Section 6.2 of this ESA, environmental conditions may have other impacts on the Project. Where warranted, mitigative measures are identified to eliminate or reduce the severity of these potential adverse effects. The following environmental conditions were considered to have the potential to adversely affect the Alberta Clipper Project either during construction or operations or both:

- slumping;
- flooding;
- wildfires;
- changing climatic conditions; and
- severe weather including high wind speeds, heavy/persistent precipitation or extreme temperatures, lightning and temperature inversions.

6.7.1 Slumping

Engineering and design of the pipeline has taken into consideration the potential slumping along the proposed pipeline route. Areas of potential terrain instability will be monitored during regular aerial patrols during operations and remedial action will be promptly undertaken where warranted. Mitigative measures will be implemented where the potential for localized terrain instability exists (see Section 6.2.1 of this ESA). Post-construction monitoring of the CEP, Terrace Phases I or II route indicated no areas of

slumping after the completion of the project (TERA 1995, 1996, 2000, 2001a, 2002, 2003, 2004). Consequently, slumping events are unlikely to affect the integrity of the buried pipeline. Aboveground facilities such as valves have been located in areas with low potential for slumping. Therefore, the probability of a significant adverse environmental effect on the pipeline resulting from slumping is low (see Table 6.6 of this ESA).

6.7.2 Flooding

An extreme flood event, either during construction or operations, could result in a loss of cover over the pipeline along floodplains and in watercourses along the pipeline route. The potential effects of flooding and associated mitigation vary depending upon the timing of the event. A flood event that occurs immediately prior to the commencement of instream construction at a water crossing could delay construction activities and, in extreme cases, threaten the integrity of the temporary vehicle crossing. The duration of use will be considered during the selection of the type of temporary vehicle crossing to be installed while the design and sizing (*e.g.,* culvert diameter) and freeboard (*e.g.,* single span structure) of the vehicle crossing will meet or exceed the requirements identified in the applicable provincial and federal regulations. These structures will be designed and installed to handle the anticipated flow conditions during the period of use.

Should flooding occur during construction of a trenched watercourse crossing, the increased flows could exceed the capability of the dams, pumps or flumes used to isolate the construction area or erode onshore spoil piles. In the unlikely event that flooding occurs during instream construction, water quality would likely be somewhat reduced due to an incremental increase in TSS over the slightly elevated TSS levels that are commonly associated with some phases of instream construction. The Flood and Excessive Flow Contingency Plan outlined in Appendix 6B of this ESA would be implemented to minimize the impacts of high water levels during instream construction. The risk of a flood occurring during instream construction is considered to be low for watercourses to be crossed during the late fall or winter periods. Along the remainder of the route, the risk of a flood occurring during instream construction is also considered low since the weather forecast applicable to the watershed for the anticipated crossing construction period is routinely reviewed immediately prior to commencement of crossing construction enabling the timely implementation of measures to mitigate any concerns. No flood events occurred during the construction of CEP, SEP II, Terrace Phases I or II (IPL 1995, 1998; Enbridge 2000, 2002).

The pipeline will be buried deep enough to minimize the potential effects of flooding as well as associated erosion and scouring. Nevertheless, line patrols during operations will pay particular attention to the bed and banks of watercourse crossings following floods to further ensure the integrity of the pipeline and minimize impacts on the aquatic environment. Remedial measures will be taken immediately, where warranted, following receipt of applicable approvals. No erosion or scouring due to flooding was noted during the post-construction monitoring of CEP, SEP II, Terrace Phases I or II (TERA 1995, 1996, 1999, 2001a, 2002, 2003, 2004). Consequently, the probability of a flood resulting in a significant adverse environmental effect is low (see Table 6.6 of this ESA).

6.7.3 Wildfires

A wildfire in the immediate vicinity of the pipeline during the construction phase, although unlikely, could delay construction activities along bush/wooded areas of the proposed route. Construction activities and/or construction-related traffic would be suspended if conditions were considered to be unsafe by Enbridge's Chief Inspector or if requested by the appropriate authority (*e.g.*, ASRD, SENV, Manitoba Conservation). The short delay of construction activities due to wildfire would generally be considered as having a minor affect on the pipeline component.

During the operations phase, fires are unlikely to adversely affect the buried pipeline. The proposed route traverses predominantly cleared, cultivated lands, thereby minimizing the potential for adverse effects as a result of a wildfire. Enbridge has in place emergency procedures to shutdown and evacuate the pump stations/terminals in the event of immediate fire risk.

An assessment of the effects arising from construction activities is provided in Sections 6.2, 6.3 and 6.4 of this ESA while contingency measures identified in the Fire Contingency Plan (Appendix 6B of this ESA)

have been prepared to ensure that appropriate and effective procedures and materials are in place in the event of a fire accidentally caused during construction of the Alberta Clipper Project. As described in Section 6.2.18 of this ESA, the probability of a fire resulting in a significant adverse environmental effect is low (see Table 6.6 of this ESA).

6.7.4 Climate Change

Changes to climatic conditions during operations of the Alberta Clipper Project may manifest in several ways. Increases in snow pack in winter and warmer temperatures during spring may extend and intensify runoff and alter hydrologic regimes within watercourses including timing and duration of peak flows. Changes in summer temperatures and rainfall patterns could lead to an increase in wildfires. During operations of the pipeline, Enbridge will be adaptive in their management of the pipeline and schedule maintenance activities to suit local environmental conditions (*e.g.*, conducting activity in the riparian area during periods of low flow and least risk) so as to minimize the potential environmental impact. By utilizing adaptive management practices which are responsive to changing conditions, the effects of climate change on the project are anticipated to be neutral and, consequently, do not require an evaluation of significance.

6.7.5 Severe Weather

High Winds

High winds could result in the suspension of some construction activities along the pipeline route such as topsoil handling, clearing, slash burning and welding. The buried pipeline will not be adversely affected by high winds and aboveground facilities such as valves and scraper traps will be designed to withstand anticipated wind loads. New pump station buildings and associated structures will be designed and built in accordance with provincial and National Building Codes, and, consequently, no adverse effects on facility structures are anticipated due to wind, regardless of the wind direction.

Inclement Weather

Heavy or persistent precipitation could result in the delay of the construction of the pipeline and tank additions if topsoil salvage activities have not been completed or if wet soil conditions create safety or trafficability problems. This potential effect pertains to those segments of the proposed route which are to be constructed during nonfrozen soil conditions. High water tables will not affect the minimum depth of cover.

During the operations phase, heavy or persistent precipitation or extreme temperatures are not anticipated to adversely affect the pipeline (when buried) or aboveground facilities. New buildings will house sensitive instruments and equipment as well as provide shelter to Enbridge personnel. Equipment, instruments, piping and structures not located within buildings will be constructed of materials suitable for low temperature service and will be insulated and/or heat traced. As a result, no adverse effects on the Alberta Clipper Project are anticipated to result from inclement weather.

Lightning

Since lightning has the potential to affect the power supply and damage equipment, buildings and, where warranted, aboveground equipment, will be equipped with lightning arrestors or lightning rods in accordance with provincial and National Building Codes to minimize the risk of damage due to lightning. Consequently, no adverse environmental effects on the Alberta Clipper Project are anticipated to result from lightning.

6.8 Summary of Environmental and Socio-Economic Effects Assessment

6.8.1 Summary of the Assessment of Potential Effects of the Project on the Environment

The environmental and socio-economic effects associated with the construction and operation of the Alberta Clipper Project (*i.e.*, pipeline and associated pipeline facilities, pump additions, Hardisty Terminal tank installation, temporary facilities for construction) are not unlike those routinely encountered during pipeline and associated facility construction in an agricultural setting.

Numerous potential environmental and socio-economic effects associated with the Alberta Clipper Project were identified through: consultation with the federal and provincial government representatives, Aboriginal people, other stakeholders and the general public; review of existing literature; field studies; and the professional judgement of the assessment team. These potential effects were related to biophysical and socio-economic elements including:

- physical elements such as physical environment, soil capability, water quality and quantity, GHG and air quality, and acoustic environment;
- biological elements such as fish and fish habitat, wetlands, vegetation, wildlife and wildlife habitat, and species at risk;
- socio-economic elements such as human occupancy and resource use, heritage resources, traditional land and resource use, social and cultural well-being, human health, infrastructure and services, and employment and economy; and
- accidents and malfunctions.

Most potential effects arising from the Alberta Clipper Project are associated with the construction of the pipeline. Pump additions are generally confined to the existing station/terminal boundary; however, new lands will be required for the Rowatt Pump Station and lands supporting native vegetation at the Hardisty Terminal will be disturbed. A temporary construction camp at Hardisty is planned.

Several mitigative strategies have been employed to avoid or minimize the impacts of the Alberta Clipper Project including: avoidance through pipeline route selection; scheduling of activities to avoid sensitive periods; development of detailed, practical and effective mitigative measures to address numerous site-specific and general issues; inspection during construction to ensure that planned mitigation is implemented and effective; and conducting the maintenance and operation of the pipeline system with a high standard of environmental excellence.

Species at risk or their habitat previously encountered along the proposed pipeline route include northern leopard frogs, loggerhead shrike, long-billed curlew and burrowing owl. Given the mitigative measures identified above, the residual effect of the construction and operation of the pipeline on species at risk is considered to be of low magnitude and not significant.

Through the implementation of the mitigative strategies, the residual effects associated with the construction and operation of the Alberta Clipper Project, including pipeline, pump additions and tank components, on the other biophysical and socio-economic elements were considered to be not significant.

6.8.2 Summary of the Assessment of Potential Effects of the Environment on the Project

Environmental conditions such as slumping; flooding; wildfires; changing climatic conditions; and severe weather including high wind speeds, heavy/persistent precipitation or extreme temperatures and lightning were considered to have the potential to adversely affect the Alberta Clipper Project either during construction or operations or both. However, through routing of the pipeline, implementation of contingency plans, and burial of the pipe, the potential impacts of the environment on the construction or operation of the Alberta Clipper Project will be minimized and are considered to be not significant.

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TABLE 6.1

EVALUATION OF THE SIGNIFICANCE OF RESIDUAL EFFECTS - ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT CRITERIA[1]

Assessment Criteria		Definition
SPATIAL CONTEXT - location of effect		
Footprint		The land area disturbed by the Project, construction and reclamation activities, including associated physical works and activities (*i.e.,* permanent pipeline right-of-way, temporary construction workspace, temporary stockpile sites, temporary staging areas, facility sites).
Local		The area which could potentially be affected by construction and reclamation activities beyond the construction right-of-way including associated physical works and activities. 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).
Region		The area extending beyond the local boundary. The boundary for the region 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 municipal district boundaries).
Province		The area extending beyond regional or administrative boundaries, but confined to Manitoba, Saskatchewan or Alberta (*e.g.,* provincial permitting boundaries, etc.).
Transboundary		The area extending outside Canada.
TEMPORAL CONTEXT		
Duration (period of the event causing the effect)	Immediate	Event duration is limited to less than or equal to two days.
	Short-term	Event duration is longer than two days but less than or equal to one year.
	Medium-term	Event duration is longer than one year but less than or equal to ten years.
	Long-term	Event duration extends longer than ten years.
Frequency (how often would the event that caused the effect occur)	Accidental	Occurs rarely over assessment period.
	Isolated	Confined to specified period.
	Occasional	Occurs intermittently and sporadically over assessment period.
	Periodic	Occurs intermittently but repeatedly over the construction and operations period.
	Continuous	Occurs continually over the construction and operations period.
Reversibility (period of time over which the residual effect extends)	Immediate	Residual effect is alleviated in less than or equal to two days.
	Short-term	Greater than two days and less than or equal to one year to reverse residual effect.
	Medium-term	Greater than one year and less than or equal to ten years to reverse residual effect.
	Long-term	Greater than ten years to reverse residual effects.
	Permanent	Residual effects are irreversible.
MAGNITUDE [2] - of the residual effect		
Negligible		Residual effects are not detectable.
Low		Potential effects are detectable, but well within environmental and/or social standards or tolerance.
Medium		Potential effects are detectable and approaching, but below environmental and/or regulatory standards or tolerance.
High		Potential effects are beyond environmental and/or social standards or tolerance.
PROBABILITY OF OCCURRENCE - likelihood of residual effect		
High		Likely.
Low		Unlikely.
LEVEL OF CONFIDENCE [3] - degree of certainty related to significance evaluation		
Low		Determination of significance based on incomplete understanding of cause-effect relationships and incomplete data pertinent to the project area.
Moderate		Determination of significance based on good understanding of cause-effect relationships using data from outside the project area or incompletely understood cause-effect relationships using data pertinent to the project area.
High		Determination of significance based on good understanding of cause-effect relationships and data pertinent to the project area.

Notes: 1 Significant Adverse Residual Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated or economically compensated.

2 In consideration of magnitude, there is no environmental standard, guideline or objective for many of the construction/operation issues under evaluation. Therefore, the determination of magnitude of the adverse residual effect often entailed an historical consideration of the assessment of magnitude made by regulators, land authorities, lessees, other stakeholders and the assessment team to adverse effects. The assessment team was also aware of the increasingly stringent societal norms related to environmental impact.

3 Level of confidence was affected by availability of data, precedence, degree of scientific uncertainty or other factors beyond the control of the assessment team.

TABLE 6.2

POTENTIAL BIOPHYSICAL AND SOCIO-ECONOMIC EFFECTS, MITIGATIVE MEASURES AND RESIDUAL EFFECTS OF ALBERTA CLIPPER PIPELINE CONSTRUCTION AND OPERATION

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
1. PHYSICAL ENVIRONMENT				
1.1 Terrain instability arising from slumping	Moderate to steep slopes and sidehills	Footprint	• Enbridge has commissioned geotechnical engineering experts to assess the proposed crossing of Deadhorse Creek (west side of valley, approximately KP 1196.6 to KP 1197.7). • Utilise the following standard mitigation where unstable areas are encountered: slope back right-of-way cuts; maintain or re-establish surface and/or subsurface drainage patterns; install drainage and erosion controls such as berms, trench breakers and subdrains; armour streambanks where warranted. • Follow site-specific recommendations of a geotechnical engineer in areas where unstable slopes are anticipated. • Follow mitigative measures outlined in the Detailed Crossing Construction Plan for the South Saskatchewan River Valley to be undertaken by Enbridge prior to construction (see Section 9.0 of the ESA). • Recontour the right-of-way and restore the preconstruction grades and drainage channels. [EGC 03-3] Where restoration of the preconstruction grade is not feasible due to risk of failure of fill on slopes, recontour to grades not exceeding 1:3 (rise over run), or as directed by Enbridge's engineer. [EGC 03-3] • Monitor the right-of-way on a routine basis for the life of the pipeline. Issues related to slope instability will be reported to Enbridge's Environment, Health and Safety staff. Enbridge will employ applicable remedial measures on a timely basis.	• Areas of minor terrain instabilities may occur. • Topography maybe altered at locations where cut slopes are too steep to be replaced.
1.2 Loss of depth of cover due to flooding and erosion	Watercourses	Footprint	• Construct watercourse crossings during periods of low flow in order to minimize the risk of encountering high flows and flooded low areas during construction, where feasible. • Implement the Flooding and Excessive Flow Contingency Plan (Appendix 6B) if excessive flows are anticipated within the instream construction window of watercourses that are planned to be crossed using a trenched technique or if excessive flow or flood conditions should occur during watercourse crossing construction. • Proposed pipeline burial depths at watercourses have taken into consideration flood events and scouring of the bed in order that risk to the integrity of the pipeline due to such events is minimal. • Siltation of watercourses as a result of flooding or excessive flows is discussed under *Fish and Fish Habitat* element 6.3 of this table.	• See Effects of the Environment on the Project (Section 6.7 of the ESA) for a discussion on floods.
1.3 Wildfire	Bush/Wooded Areas	Footprint to Region	• Ensure appropriate and effective procedures and materials are in place in the event of a wildfire during construction. Implement the Fire Contingency Plan (see Appendix 6B). See also Effects of the Environment on the Project in Section 6.7 of the ESA. • See *Accidents and Malfunctions* element 18.2 of this table for discussion regarding potential fire caused by Alberta Clipper pipeline construction activities. • Note that a wildfire is not expected to affect the operation of the buried pipeline.	• See Effects of the Environment on the Project (Section 6.7 of the ESA) for a discussion on wildfire.
1.4 Climate change	Entire route	Footprint to Region	• Consider the changes to climatic conditions (*e.g.*, snow pack conditions, timing and intensity of runoff and discharge within watercourses, amount of rainfall) within the Alberta Clipper pipeline area when scheduling maintenance activities along the route.	• See Effects of the Environment on the Project (Section 6.7 of the ESA) for a discussion on climate change.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
1.5 Previous site contamination	Isolated Sites (*e.g.*, 1154.8) Landfill (KP 365.4; KP 1245.1) Sites identified during past construction: KP 176.4 KP 407.5 to KP 407.7 KP 434.0 to KP 434.5 KP 435.0 to KP 435.05 KP 443.0 to KP 443.1 KP 517.7 KP 534.1 KP 573.2 to KP 573.25 KP 993.2 (salt water) KP 990.23 (hydrocarbon) KP 998 (hydrocarbon) KP 1005.5 (hydrocarbon) KP 1045.5 (hydrocarbon) KP 1061.05 (hydrocarbon) KP 1065.5 (hydrocarbon) KP 1065.8 (hydrocarbon) See also Tables 5.13 and 5.14 of the ESA	Footprint	• Notify Enbridge's Environment, Health and Safety staff in the event that contaminated soils are encountered during ground disturbance activities. Enbridge's Environment, Health and Safety staff will be responsible for determining the appropriate course of action using their established guidelines on file with the NEB (*i.e.*, Enbridge Operating & Maintenance Procedures (O&MP), Book 3: Contaminated Soil Management, Section 04-02-024). • Follow the mitigative measures recommended in the geotechnical assessment report for construction at the landfill at KP 365.4 and at the inactive landfill at KP 1245.1. • Narrow down temporary workspace and minimize area of disturbance at the landfills. • Install trench breakers at the edges of the landfills if coarse-textured substrate or groundwater seepage is present to contain any contaminated water that may be encountered and prevent movement of the water along the trench (Detail 6A-20).	• No residual effect identified.
2. SOIL CAPABILITY				
2.1 Lowering of topsoil capability through topsoil /subsoil mixing				
2.1(a) lowering of topsoil capability through topsoil stripping	Entire route	Footprint	**<u>Topsoil Depth</u>** • Salvage the total depth of topsoil to a maximum depth of 40 cm, unless otherwise requested by landowner, using the Environmental Alignment Sheets as a guide. [EGC 02-5] • Where topsoil is less than 40 cm, salvage topsoil to colour change, plow layer or 10 cm, whichever is deepest. Increase minimum stripping depth to 15 cm where work side topsoil salvage is conducted. [EGC 02-5] • For Dune Sand Series, salvage a minimum of 15 cm of material even though the topsoil depth may be considerably less. • For Hilton, Flat Lake and Grill Lake Series where topsoil or surface organic material is absent or intermittent, salvage a minimum of 10 cm. • Maintain a minimum of 0.76 m cover over hot lines, reducing the depth of topsoil stripping if necessary. Where there is 0.83 m or less of cover over the existing pipeline before stripping, suspend stripping. Place a protective covering over the topsoil in the spoil area to prevent topsoil and subsoil mixing (*e.g.*, matting, sheeting, straw). [EGC 02-5] **<u>Topsoil Stripping (General)</u>** • Accommodate topsoil salvage preferences of the landowner. • Salvage topsoil from areas to be graded and windrow to the closest edge of the construction right-of-way. Avoid overstripping. The area stripped is to correspond to area to be graded. • Retain sod on native prairie lands and on bush, hay and pasture lands if a competent sod layer exists. Grade only where safety considerations dictate in order to minimize disturbance to sod. No grading of native prairie, bush, hay lands or pasture lands shall be permitted on level terrain. • Salvage a greater width of topsoil at sharp sidebends and at crossings of watercourses, roads, rail lines, drains and foreign lines to accommodate a wider and deeper trench. [EGC 02-5]	• Mixing of topsoil and subsoil will likely occur.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.1(a) lowering of topsoil capability through topsoil stripping (cont'd)	Same as above	Same as above	**Topsoil Stripping (General) (cont'd)** • Strip topsoil from the full right-of-way during nonfrozen soil conditions at all bored crossings on cultivated lands (Detail 6A-7 in the Construction and Reclamation Plan (Appendix 6A)). • Strip topsoil from an area larger than the bellhole on well-sodded lands during nonfrozen conditions to allow feathering-out of spoil over the stripped area (Detail 6A-7). [EGC 02-8] • When stripping topsoil over adjacent hot lines, use (a) a grader with basic operating weight not exceeding 40,500 lbs and a maximum axle lading of 18,000 lbs per axle, or (b) a company approved equivalent. [EGC 02-5] • Do not strip topsoil within 6 m of a protective sleeve. [EGC 02-5] • Maintain a 1 m (min) separation between the base of a topsoil pile and the base of a subsoil pile. [EGC 02-5] • Minimize grading on native prairie and where blade width topsoil salvage is to be conducted on hay and pasture lands to minimize disturbance to the sod. • Grade the right-of-way on sidehill terrain as per Detail 6A-8. • During wet/thawed conditions, implement the Wet/Thawed Soil Contingency Plan outlined in Appendix 6B. [EGC 02-5, 02-16] • Implement the Soil Handling Contingency Plan outlined in Appendix 6B during topsoil stripping if any of the following are encountered: uneven boundary between topsoils and subsoils; uneven surface on native prairie or pasture; wetlands; or requests for alternate topsoil handling methods by a landowner. • Follow measures in the Traffic Control Plan (Appendix 6C) to minimize the potential for topsoil/subsoil mixing during salvage operations. **Topsoil Stripping (Nonfrozen)** • Salvage topsoil from the trench and spoil area (Detail 6A-11) on cultivated lands and poorly sodded hay and pasture lands as indicated on the Environmental Alignment Sheets. • Salvage a blade width of topsoil centred over the trench (Detail 6A-10) on well sodded hay, pasture, bush-pasture and bush lands as well as native prairie as indicated on the Environmental Alignment Sheets. Disc well sodded lands prior to blade width stripping in order to facilitate topsoil stripping operations. • Follow Criteria for Progressively Increased Topsoil Stripping Widths outlined in Appendix 6B for determining under which circumstances topsoil stripping widths may be altered on a particular land use. • Begin clean-up of segments of the route constructed during nonfrozen conditions as soon as possible after backfilling and before freeze-up, if possible. [EGC 03-3] • Postpone clean-up on wet ground until soils dry out. [EGC 03-3] **Topsoil Stripping (Frozen)** • Prestrip topsoil prior to freeze-up if feasible. Attempt to have all topsoil stripping completed prior to October 31. • Maintain snow cover over the area to be stripped as long as possible. Remove snow just before stripping and windrow to the edges of the right-of-way. [EGC 02-5] • Remove or pack snow on the work side to increase frost penetration onto the soil. In mid to late winter, pack snow on the work side to avoid premature thawing of the upper soils. • Windrow snow over the trench line to prevent deep frost penetration along the trench line. [EGC 02-7]	• Same as above

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.1(a) lowering of topsoil capability through topsoil stripping (cont'd)	Same as above	Same as above	**Topsoil Stripping (Frozen) (cont'd)** • Grade snow over the travel lane to improve driving conditions and either grade the spoil pile area or grade snow over the spoil pile area on cultivated lands to smooth furrows and facilitate removal of spoil during backfilling. • Leave 3 m wide gaps every 400 m in the snow windrow greater than 0.75 m in height on pasture lands and areas of native vegetation to allow wildlife and livestock movement. [EGC 02-7] • Limit removal of snow from the spoil side area. Excess snow that could interfere with backfilling operations is to be removed while an 8-10 cm buffer layer of snow is to be left in place to avoid topsoil/subsoil mixing during backfilling. [EGC 02-7] • Frozen soil conditions are in effect when frost has reached the depth of the interface between topsoil and subsoil. • Follow measures outlined in Detail 6A-22 should grade or topsoil replacement be delayed. • Salvage a blade width of topsoil centred over the trench (Detail 6A-10) on all land uses as indicated on the Environmental Alignment Sheets. Limit topsoil stripping activities during frozen conditions to specialized equipment capable of accurately separating topsoil from subsoil. • Ensure backfilling of lowered-in pipe is completed by nightfall during winter construction. [EGC 03-2] • Avoid mixing snow with spoil during backfilling. [EGC 03-2] • Postpone compaction of frozen trench spoil until final clean-up in mid to late spring. [EGC 03-2] • Begin rough clean-up along segments of the route constructed during frozen conditions as soon as possible after backfilling and before spring break-up. [EGC 03-3] • Begin final clean-up of segments of the route constructed during frozen conditions as soon as possible after break-up (Detail 6A-21). [EGC 03-3] **Topsoil Replacement** • Postpone replacing topsoil during wet weather or high winds to prevent damaging soil structure or erosion of topsoil. [EGC 03-3]. • Replace topsoil evenly over all portions of the right-of-way that were stripped. [EGC 03-3] • Avoid scalping of the sod layer on hay and pasture lands when moving the topsoil pile during backfilling. [EGC 03-2] • Strip a wider area of topsoil, if warranted, in the late spring on cultivated, hay or pasture lands where topsoil salvage was conducted during frozen conditions to allow excess trench spoil to be feathered-out over the stripped area (Detail 6A-21). [EGC 03-2]	• Same as above
2.1(b) lowering of topsoil capability through trench instability during trenching	**Soil Series**: Agassiz, Asquith, Biggar, Birkenhead, Bradwell, Cathkin, Cazlake, Chaplin, Desjarlais, Dolcy, Dune Sand, Glenavon, Glenboro, Gnadenthal, Haight, Hatton, Hairy Hill, Joyale, Metiskow, Neunenberg, Oak Lake, Osborne, Ramada, Scarth, Scollard, Stockton, Swift Creek, Vandal, Wainwright, Whitesand, Windthorst, Wingello	Footprint	• Suspend trenching and strip a wider area of topsoil if the trench walls slough into the ditch and the potential for topsoil/subsoil mixing exists. Back slope the trench walls until stable. Equip hoe with a swamp bucket, or equip trenching wheel with slope cutters, if practical, to minimize trench sloughing. [EGC 02-5, 02-8] • If possible, salvage topsoil from under the new spoil pile on the spoil side and relocate to the edge of the extra working space. [EGC 02-5] • For sandy soils and dunes (*e.g.*, Dune Sand Series), strip an extra width of topsoil to allow for slumping of trench walls, or where trench walls are sloped. [EGC 02-5]. • Weld up pipe prior to trenching at locations with soils prone to sloughing in order to minimize the time the trench is left open. Equip trenching wheel with slope cutters, if warranted, to minimize the risk of trench sloughing. • Minimize the length of open trench and the amount of time between trenching and backfilling operations to limit the amount of trench sloughing.	• Minor amount of topsoil/subsoil mixing may occur due to trench instability.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.1(c) lowering of topsoil capability through mixing with saline lower subsoil	scCoronation Series (KP 248.9 to KP 250.1) scElstow Series (KP 280.9 to KP 281.3) (KP 300.0 to KP 301.5) (KP 310.2 to KP 310.5) (KP 312.3 to KP 312.8) scGnadenthal Series (KP 1224.4 to KP 1225.3) scHughenden Series (KP 207.8 to KP 208.2) scMetiskow Series (KP 248.4 to KP 248.9) scRegina Series (KP 356.0 to KP 358.3) (KP 654.4 to KP 655.9) scScott Series (KP 307.5 to KP 309.2) (KP 311.4 to KP 311.7) (KP 320.8 to KP 321.6) (KP 499.1 to KP 499.6) (KP 500.4 to KP 500.8) (KP 501.1 to KP 502.8) (KP 543.0 to KP 544.3) (KP 602.3 to KP 602.9) scWeyburn-Scott Series (KP 527.2 to KP 527.5) (KP 528.9 to KP 529.4) (KP 532.7 to KP 533.3) (KP 603.2 to KP 604.3) scWeyburn Series (KP 536.5 to KP 538.0) (KP 539.4 to KP 539.9) (KP 568.4 to KP 568.9) (KP 579.2 to KP 580.0) (KP 590.5 to KP 590.7) (KP 590.7 to KP 591.0) (KP 603.3 to KP 604.5) (KP 638.0 to KP 638.5) (KP 746.2 to KP 746.7) (KP 752.7 to KP 753.2)	Footprint	• Conduct three-lift soil handling on lands with a higher salt content in the lower subsoil than the upper subsoil as indicated on the Environmental Alignment Sheets (Details 6A-15 and 6A-16). • Strip upper subsoils from an area twice the width of the trench and to the depth indicated on the Environmental Alignment Sheets. • Store topsoil on the spoil side of the trench next to the stripped area. [EGC 02-5] • Salvage and store the upper subsoil separately from the lower subsoil at locations where three-lift soils handling is required and grading is necessary. • Store the first lift of trench subsoil on the spoil side, either next to the trench or back far enough to store the second lift. Maintain a separation between the topsoil pile and the subsoil piles, and also between subsoil piles. [EGC 02-5] • Backfill each lift in the correct sequence to ensure that saline lower subsoils do not contaminate upper subsoil horizons. • Overstrip scWeyburn soils from KP 590.5 to KP 590.7 to a total depth of 20-25 cm as indicated on the Environmental Alignment Sheets.	• Undesirable lower subsoils may be unexpectedly encountered and admixed with upper subsoil horizons. • Revegetation of soils saline to the surface may be difficult.
2.1(d) lowering of topsoil capability through mixing with gravely lower subsoils	Scollard Series (KP 180.3 to KP 180.7) Birkenhead Series (KP 1190.0 to KP 1190.2) (KP 1193.3 to KP 1193.9) (KP 1198.2 to KP 1198.6)	Footprint	• Conduct three-lift soil handling on lands with a higher gravel content in the lower subsoil than the upper subsoil as indicated on the Environmental Alignment Sheets (Details 6A-15, 6A-16). • Strip upper subsoils from an area twice the width of the trench and to the depth indicated on the Environmental Alignment Sheets. Note that the trench may be prone to trench sloughing in areas of gravely subsoils. • Store topsoil on the spoil side of the trench next to the stripped area. [EGC 02-5]	• Undesirable lower subsoils may be unexpectedly encountered and admixed with upper subsoil horizons.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.1(d) lowering of topsoil capability through mixing with gravely lower subsoils	Same as above	Same as above	• Salvage and store the upper subsoil separately from the lower subsoil at locations where three-lift soils handling is required and grading is necessary. • Store the first lift of trench subsoil on the spoil side, either next to the trench or back far enough to store the second lift. Maintain a separation between the topsoil pile and the subsoil piles, and also between subsoil piles. [EGC 02-5] • Backfill each lift in the correct sequence to ensure that gravely lower subsoils do not contaminate upper subsoil horizons.	• Same as above
2.1(e) lowering of topsoil capability through mixing of sands with clayey lower subsoils	shallow Stockton Series (KP 1083.7 to KP 1084.2) (KP 1197.7 to KP 1200.1)	Footprint	• Conduct three-lift soil handling on lands characterized by sands overlying clays at shallow depths as indicated on the Environmental Alignment Sheets to maintain upper subsoil texture (Details 6A-15, 6A-16). • Strip upper subsoils from an area twice the width of the trench and to the depth indicated on the Environmental Alignment Sheets. • Store topsoil on the spoil side of the trench next to the stripped area. [EGC 02-5] • Salvage and store the upper subsoil separately from the lower subsoil at locations where three-lift soils handling is required and grading is necessary. • Store the first lift of trench subsoil on the spoil side, either next to the trench or back far enough to store the second lift. Maintain a separation between the topsoil pile and the subsoil piles, and also between subsoil piles. [EGC 02-5] • Backfill each lift in the correct sequence to ensure that lower clayey subsoils do not mix with sandy upper subsoil horizons.	• Clayey lower subsoils may be unexpectedly encountered and admixed with upper sandy subsoil horizons.
2.1(f) lowering of topsoil capability through mixing due to shallow topsoils	Flat Lake Series (KP 324.6 to KP 325.4) (KP 326.3 to KP 327.1) (KP 327.3 to KP 327.5) (KP 330.0 to KP 330.5) (KP 330.7 to KP 330.9) Glenavon Series (KP 817.2 to KP 817.9) Grill Lake Series (KP 213.3 to KP 213.9) (KP 215.5 to KP 215.8) (KP 272.0 to KP 272.3) (KP 347.4 to KP 348.9) (KP 350.7 to KP 350.9) Hilton Series (KP 1120.3 to KP 1120.4) Hughenden Series (KP 215.8 to KP 216.1) Kelstern Series (KP 325.3 to KP 326.3) (KP 327.1 to KP 327.3) (KP 327.5 to KP 328.2) Oxbow Series (KP 796.5 to KP 797.4) (KP 807.8 to KP 808.2) (KP 814.1 to KP 814.3) (KP 819.0 to KP 820.1) (KP 886.0 to KP 886.4)	Footprint	• Overstrip shallow topsoils (*i.e.*, where topsoils are less than 10 cm deep) to include some of the upper subsoil, to a total depth of 10 cm (see Environmental Alignment Sheets). • For Dune Sand Series, salvage a minimum of 15 cm of upper material.	• Minor amount of topsoil/subsoil mixing may occur due to shallow topsoil depths.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.1(f) lowering of topsoil capability through mixing due to shallow topsoils (cont'd)	Scott Series (KP 289.7 to KP 290.0) (KP 290.2 to KP 290.5) Swift Creek Series (KP 820.3 to KP 820.5) Weyburn Series (KP 573.8 to KP 574.0) All locations of Dune Sand Series	Same as above	• Same as above	• Same as above
2.1(g) lowering of topsoil capability through mixing due to poor colour change	**Soil Series**: Cathkin, Chaplin, Dune Sand, Gilroy, Grill Lake, Hanley, Hatton, Haverhill, Kelstern, Kettlehut, Oliver, Regina, Rosemae, Wingello	Footprint	• Where soils are not readily distinguishable by colour, the Environmental Inspector will provide direction based on an evaluation of soil texture and structure as well as the recommended depths noted on the Environmental Alignment Sheets. [EGC 02-5]	• Minor amount of topsoil/subsoil mixing may occur due to poor colour change between topsoil and subsoil.
2.2 Degradation of soil structure and lowering of soil capability through compaction and rutting	**Soil Series:** Cazlake, Deadhorse, Desjarlais, Flat Lake, Glenavon, Glenboro, Gnadenthal, Grill Lake, Haight, Hairy Hill, Joyale, Knudson, Neunenberg, Oak Lake, Oliver, Osborne, Ramada, Regina	Footprint	• Confine traffic to the trench area and work side of the right-of-way to the extent practical to reduce the area subjected to potential soil compaction. • During wet/thawed conditions, implement the Wet/Thawed Soil Contingency Plan outlined in Appendix 6B. [EGC 02-5, 02-16] • Suspend all affected construction activity immediately upon indication of wet or thawing soils. Resume construction activities only after soils have sufficiently dried or frozen. [EGC 02-16] • Strip the full right-of-way on cultivated lands and poorly-sodded hay, pasture, native prairie and bush-pasture lands if activity cannot be suspended during wet or thawing soil conditions (Detail 6A-12). [EGC 02-16] • Postpone heavy traffic until soils dry or freeze if excessive rutting is expected. • Determine locations where subsoil compaction has occurred by comparing compaction levels on and off right-of-way. Sites compared should be in close proximity and have similar drainage, soil moisture, aspect and land use. • Rip compacted subsoils, temporary access trails and soils damaged during wet weather with a multishank ripper to a depth of 30 cm. [EGC 03-3] • Employ a subsoiler plow (*e.g.,* Paratiller) along segments of the right-of-way where topsoil salvage did not occur and subsoil compaction is severe. Do not use a subsoiler plow on native prairie or bush lands. • Cultivate compacted areas of the right-of-way where it crosses fields, bush or woodlands to a depth adequate to alleviate surface compaction and in a manner acceptable to the landowner. Do not pulverize the soil. [EGC 03-3] • Cultivate hay and pasture land if the sod layer is broken or badly compacted. [EGC 03-3] • If soils are moist, postpone ripping of subsoils until soils dry to ensure that the soils fracture when ripped. If trench spoil is frozen, postpone compaction until final clean-up in mid to late spring. [EGC 03-2] • Use a disk plow or cultivator on ripped subsoils to break up lumps and to smooth the surface. [EGC 03-3] • Till or cultivate any severely compacted or rutted areas on cultivated, hay or non-native pasture lands with deep tillage device or chisel plow to loosen compacted soils. [EGC 03-3] • Blade rutted subsoils flat prior to soil replacement. • Lightly cultivate and reseed rutted soils under a vegetated cover. • Regrade areas with vehicle ruts. [EGC 03-3]	• Minor amount of topsoil/subsoil mixing will occur during subsoil plowing or ripping to relieve compaction. • Minor amount of topsoil/subsoil mixing may occur due to rutting.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.3 Loss of topsoil through wind erosion				
2.3(a) general	Entire route	Footprint to Local	• Do not salvage topsoil under extremely windy conditions. • Suspend topsoil handling operations if drifting or topsoil loss is evident. • Implement the Soil Erosion Contingency Plan (Appendix 6B) when wind erosion of the topsoil windrow is a concern. • Avoid scalping of the sod layer on pasture, bush, bush-pasture, hay lands and native prairie when moving the topsoil and spoil piles during backfill. Use equipment (*e.g.,* clean-up bucket) for final pass of backfilling that will minimize scalping and that is approved by the Environmental Inspector. [EGC 03-2] • Rollback small diameter slash or thinly spread wood chips on wooded non-agricultural lands to provide microsites to promote germination of seed on dry or wind exposed sites of approved by the landowner. [EGC 03-3] • Avoid overpicking small diameter (less than 4 cm in diameter) slash will be avoided on wooded areas with sandy soils where slash rollback is not allowed or is not practical. • Refer to Details 6A-18, 6A-24, 6A-40 to 6A-49 for general soil erosion control measures.	• Minor surface erosion of topsoil can be expected until a vegetative cover has been established.
2.3(b) wind erosion prone soils	**Soil Series:** Agassiz, Asquith, Alluvium, Biggar, Birkenhead, Bradwell, Cathkin, Chaplin, Deadhorse, Desjarlais, Dolcy, Dune Sand, Forget, Hatton, Knudson, Metiskow, Oak Lake, Regina, Scarth, Scollard, Stockton, Swift Creek, Vandal, Wainwright, Whitesand, Windthorst, Wingello PNT 780915 (KP 195.9 to KP 196.8) PNT 780363 (KP 196.8 to KP 197.7) PNT 731909 (KP 220.4 to KP 220.6 and KP 227.1)	Footprint to Local	• Postpone topsoil stripping until 3 days prior to trenching if drifting soils or topsoil loss is evident. [EGC 02-5] If this is not practical: – limit the time between topsoil stripping and final clean-up; – suspend topsoil stripping and backfill operations during high winds; – apply a tackifier to the topsoil pile; and – install wind barriers (*e.g.*, slat fences, snow fences). • Tackify or apply water or pack the topsoil windrow with a sheepsfoot packer or other approved equipment, if the assessment by the Environmental Inspector indicates that soils are likely to be prone to erosion by wind. • Walk down topsoil windrow and windrow snow over the windrow to minimize the risk of wind erosion during frozen conditions. Consider tackifying or watering down the topsoil windrow if snow is not available (Detail 6A-18). • To minimize drifting soils and loss of topsoil in areas prone to wind erosion [EGC 03-3]: – spread wood chips or straw crimp; – sow a fast growing cover crop; and/or – walk down tree and shrub debris (*i.e.*, small diameter slash) over exposed soils. • Avoid scalping of the sod layer when moving the topsoil and subsoil piles during backfilling. [EGC 03-2] • Spread and incorporate straw into the upper soil horizon with a straw crimper on noncultivated lands with a high potential for wind erosion and on noncultivated lands that are difficult to revegetate and are, therefore, prone to erosion (Detail 6A-45). • Rollback small diameter slash or thinly spread wood chips on wooded non-agricultural lands to provide microsites to promote germination of seed on dry or wind exposed sites if approved by the landowner (Details 6A-5 and 6A-41). • Avoid overpicking of small diameter slash in wooded areas with erodible soils. • For intensely grazed lands, fence the right-of-way if practical until seedlings are well established and to prevent damage from livestock. [EGC 03-4]. • Monitor the right-of-way on a routine basis for the life of the pipeline. Issues related to erosion on slopes will be reported to Enbridge's Environment, Health and Safety staff. Enbridge will employ applicable remedial measures on a timely basis.	• Revegetation of some disturbed high wind erodible soils may be difficult.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.4 Loss of topsoil through surface water erosion				
2.4(a) general	Entire route PNT 780915 (KP 195.9 to KP 196.8) PNT 780363 (KP 196.8 to KP 197.7) PNT 800392 (KP 233.7)	Footprint	• Restrict root grubbing to the trench line, if feasible, to minimize surface disturbance. • Minimize grading throughout the route, especially at watercourses, wetlands and on native prairie, pasture, bush and bush-pasture lands with a competent sod layer. Minimize the width of grading in order to limit the potential for erosion and subsoil compaction. [EGC 02-7] • Backfill the trench in lifts and compact after each lift, if warranted, at locations where a wider than normal trench (*e.g.,* sharp sidebends, bell holes) is necessary. • Crown the trench with remaining spoil to allow for settlement. [EGC 03-2] • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to minimize interference with natural drainage. Leave breaks in the crown at frequent intervals where sidehill is encountered. Compact backfill where breaks have been left. [EGC 02-8, 03-2] • Feather out excess spoil over the stripped area to create a smooth mound. • Recontour the right-of-way and restore the preconstruction grades and drainage channels. [EGC 03-3] • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled. [EGC 03-3] • Implement the Soil Erosion Contingency Plan (Appendix 6B) when water erosion of the topsoil windrow is a concern.	• Minor surface erosion of topsoil can be expected until a vegetative cover has been established.
2.4(b) surface water erosion on moderately steep slopes	Moderate to Steep Slopes See Environmental Alignment Sheets	Footprint	• Restrict root grubbing on steep erosion prone slopes in order to minimize soil disturbance and erosion. • Minimize grading on moderately steep slopes. [EGC 02-7] • Install temporary berms on approach slopes to watercourses and erect silt fences near the base of approach slopes to watercourses following grading (Detail 6A-24). Inspect the temporary erosion control structures on a daily basis and repair, if warranted, before the end of each working day. [EGC 02-13, 02-14] • Install trench breakers (sack, foam or bentonite) where warranted on moderately steep and steep slopes to control subsurface flow (Detail 6A-20). Exact location of breakers will be determined in the field. However, general locations where breakers may be needed are shown on the Environmental Alignment Sheets. Mark location of each breaker prior to backfilling to facilitate correct placement of diversion berm immediately downslope of the breaker. [EGC 02-13, 02-15, 03-2] • Install subdrains as directed by Enbridge's engineer where there is evidence of seepage or flowing spring on a slope once the trench is excavated (Detail 6A-19). [EGC 02-13, 03-2] • Follow mitigative measures outlined in the Detailed Crossing Construction Plan for the South Saskatchewan River Valley to be undertaken by Enbridge prior to construction (see Section 9.0 of the ESA). • Install cross ditches and berms on moderately steep slopes on pasture, bush and bush-pasture lands in order to prevent run-off along the right-of-way and subsequent erosion (Detail 6A-23). Exact locations of berms will be determined in the field. However, general locations where berms will be installed are shown on the Environmental Alignment Sheets. Tie berms into existing erosion control structures on adjacent right-of-way. Install berms immediately downslope of all breakers on moderately steep slopes. [EGC 02-13, 03-9] • When replacing sidehills or other graded areas is not practical due to the risk of slope failure or ovalling of the pipe, recontour slopes to grades not exceeding 1:3 (rise over run) or as advised by a geotechnical engineer. [EGC 03-3]	• Minor surface erosion of topsoil can be expected until a vegetative cover has been established.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.4(b) surface water erosion on moderately steep slopes (cont'd)	Same as above	Same as above	• Revegetate moderately steep noncultivated slopes with a cover crop and a seed mix appropriate for the location (Details 6A-46, 6A-49). [EGC 03-4] • Employ straw crimping where warranted on lands with high water erosion potential (Detail 6A-45). • Monitor the right-of-way on a routine basis for the life of the pipeline. Issues related to erosion on slopes will be reported to Enbridge's Environment, Health and Safety staff. Enbridge will employ applicable remedial measures on a timely basis.	• Same as above
2.5 Increased stoniness in surface horizons	Entire route	Footprint	• Attempt to use conventional equipment to strip topsoil. Employ backhoe, if above measure is ineffective. [EGC 02-5] • Remove stones to achieve equivalence with the surrounding subsoil/topsoil as well as stones from the upper 30 cm of soil that will interfere with topsoil replacement or cultivation (*i.e.*, stones larger than 10 cm in diameter). [EGC 03-3] • Dispose of stones at locations approved by the landowner or government land authority. Do not dispose of stones in wetlands. [EGC 03-3] • Monitor the right-of-way during operations for presence of stones at the surface and remediate if stoniness interferes with agricultural practices.	• Stone picking may result in disposal issues.
2.6 Bedrock or large boulders within trench depth	Entire route Lands adjacent to canal at KP 498.4	Footprint	• Rip bedrock within trench depth, if encountered and if feasible. Ripping is preferred over blasting. • Use a trenched crossing method at the canal located at KP 498.4 if large boulders preclude a trenchless crossing method. • Do not backfill large rocks in the upper 0.5 m of the trench on agricultural lands during final clean-up. • Ensure that bedding or padding material is not deposited on unstripped topsoil prior to placement in the trench unless otherwise approved by the appropriate land authority. • Dispose of excess rock displaced from the trench or from blasting by windrowing, scattering, placing in discrete piles or as directed by the landowner or government land authority. Do not dispose of rocks in wetlands. [EGC 02-8, 03-2, 03-3] • Import additional or replacement backfill if warranted from locations approved by the applicable regulatory authority.	• Removal of bedrock slab or large boulders from trench depth may result in disposal issues. • Use of sand as bedding and padding material may result in reduced capability of soils adjacent to the trench.
2.7 Pulverization of soil and sod	Entire route	Footprint	• Restrict construction traffic where the potential for pulverization of soil or sod is high. • Provide alternate access to the right-of-way, if feasible, to avoid unnecessary travel. • Strip topsoil or water-spray areas where heavy traffic is anticipated as well as extremely dry areas to minimize loss of topsoil. • Lightly cultivate, harrow, seed and straw crimp pulverized sod if necessary (Soil/Sod Pulverization Contingency Plan in Appendix 6B).	• Pulverization resulting in fugitive dust and loss of soil can be expected during dry conditions. • Pulverization of soil due to rutting may result in minor topsoil/subsoil mixing.
2.8 Disturbance of soils in the Sounding Dunes, Elbow PFRA, Oak Lake Sand Hills and Souris Sand Hills	Sounding Dunes (KP 217.5 to KP 230.8) Elbow PFRA (KP 560.3 to KP 566.4) Oak Lake Sand Hills (KP 1009 to KP 1011.8) Souris Sand Hills (KP 1020.9 to KP 1026.0)	Footprint	• Follow measures outlined in Detail 6A-50 for construction and reclamation of these areas. • Follow measures outlined in the Environmental Assessment Plan for the Elbow PFRA Community Pasture (see Appendix V of the ESA).	• Revegetation of soils within the Sounding Dunes, Elbow PFRA Community Pasture, Oak Lake Sand Hills and Souris Sand Hills may be difficult.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
2.9 Disturbance of previously contaminated soil	See *Physical Environment* element 1.5 of this table	Footprint	• Identify hydrocarbon-impacted soils by odour or visual inspection. • Notify Enbridge's Environment, Health and Safety staff in the event that contaminated soils are encountered during ground disturbance activities. Enbridge's Environment, Health and Safety staff will be responsible for determining the appropriate course of action using their established guidelines on file with the NEB (*i.e.*, Enbridge Operating & Maintenance Procedures, Book 3: Contaminated Soil Management, Section 04-02-024). • See *Physical Environment* element 1.5 of this table for landfill measures.	• See *Physical Environment* element 1.5 of this table.
2.10 Pivot irrigated lands	Locations identified during Terrace Phase I and CEP and during fall 2006 overflight: KP 511.4 to KP 513.0 KP 513.3 to KP 514.3 KP 514.9 to KP 517.1 KP 660.1 to KP 660.9 KP 1088.3 to KP 1088.7 KP 1089.9 to KP 1090.7 KP 1092.4 to KP 1093.2	Footprint	• See *Water Quality and Quantity* element 3.6 and *Human Occupancy and Resource Use* element 11.1(e) of this table.	• See *Water Quality and Quantity* element 3.6 and *Human Occupancy and Resource Use* element 11.1(e) of this table.
2.11 Flood irrigated lands	Locations identified during Terrace Phase I and CEP: KP 509.7 to KP 510.5 KP 510.5 to KP 511.3 KP 513.0 to KP 513.3 KP 514.3 to KP 514.9 KP 654.4 to KP 654.8 Additional locations identified by Saskatchewan Watershed Authority: KP 301.2 to KP 301.5	Footprint	• See *Water Quality and Quantity* element 3.7 and *Human Occupancy and Resource Use* element 11.1(f) of this table.	• See *Water Quality and Quantity* element 3.7 and *Human Occupancy and Resource Use* element 11.1(f) of this table.
2.12 Trench subsidence	Entire route	Footprint	• Compact backfilled trench to the extent feasible, using suitable equipment along the trenchline (*e.g.,* grader) during nonfrozen conditions. Alternative methods of compaction may be used if approved by Enbridge's engineer. • Leave a slight crown over the trench to compensate for settlement. A larger crown will be needed during frozen conditions, to compensate for settlement after thawing.	• Minor trench subsidence or a remnant crown may occur.
3. WATER QUALITY AND QUANTITY				
3.1 Alteration of natural flow patterns	Entire route	Footprint to Local	• Note that standard pipeline construction activities are designed to avoid circumstances that result in diversion and/or unnatural retention of water along the right-of-way. • Leave gaps in the topsoil windrow, if warranted, at obvious drainage courses to accommodate surface runoff. [EGC 02-8] • Follow measures in Detail 6A-22 should grade or topsoil replacement be delayed. • Install trench breakers, where warranted, at the edge of perched wetlands to prevent the pipe trench from acting as a drain (Detail 6A-20). • Compact backfill to the extent feasible and crown trench to prevent channelized flow along the trench. Avoid excessive trench crown height. [EGC 03-2] • Feather-out excess spoil over the stripped portion of the right-of-way to minimize the creation of a permanent mound. [EGC 03-2] • Leave breaks in the trench crown at drainages, on sidehill terrain and wherever seepage occurs. [EGC 03-2]	• Minor localized alteration of natural drainage patterns may occur until trench settlement is complete.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
3.1 Alteration of natural flow patterns (cont'd)	Same as above	Same as above	• Remove swamp mats or geotextile material where used to gain access across localized wet areas as part of final clean-up. • Restore right-of-way drainage patterns to as close to preconstruction contours as practical during reclamation. [EGC 03-3] • Regrade areas with vehicle ruts, erosion gullies or where the trench has settled. [EGC 03-3] • Unless culverts were installed during surface preparation activities, remove bar ditch ramps to prevent blockage of spring runoff in ditches during rough clean-up along segments of the route constructed during frozen conditions. During final clean-up, remove any remaining bar ditch ramps, then seed and fertilize accordingly. • See also *Wetlands* element 7.2 of this table.	• Same as above
3.2 Locations with high water table	**Soil Series**: Cathkin, Cazlake, Desjarlais, Deadhorse, Flat Lake, Gnadenthal, Grill Lake, Haight, Hairy Hills, Neuenberg, Oak Lake, Osborne	Footprint to Local	• Dewater the trench using sumps and pump where warranted into bar ditches or stable vegetation. Slope trench walls to maintain stability as necessary. [EGC 02-17] • Use buoyancy controls for the pipe as required. • Remove all mats and ramps used to enable work and travel through wet areas and all bar ditch ramps in order that they do not impede the restoration of natural flow patterns. • See also *Wetlands* element 7.2 of this table.	• No residual effect identified.
3.3 Disruption of streamflow	Waterbodies	Footprint to Local	• Prevent the felling of trees into watercourses during clearing. Immediately remove any trees that fall across or into watercourses. [EGC 02-4] • Maintain flow during instream construction at all watercourses where water is present and not frozen to the bottom by isolating the work areas (*e.g.*, dam and pump or flume) or utilizing a trenchless crossing technique (*e.g.*, HDD) (Details 6A-31 to 6A-36). Store spoil on banks unless otherwise approved by the appropriate authority. Complete instream construction as quickly as possible. • Install appropriate crossing method for vehicles and construction equipment over watercourses so that flow is not impeded (see Table 6.3). • Disruption of streamflow due to withdrawal of hydrostatic test water is addressed in *Water Quality and Quantity* element 3.10 of this table. • Disruption of streamflow and the potential impact to navigability of watercourses are addressed in *Human Occupancy and Resource Use* element 11.1(j) of this table.	• No residual effect identified.
3.4 Disruption of flow in drains	Rosenheim Drain (KP 1220.2) Buffalo Drain (KP 1224.3)	Footprint to Local	• Obtain crossing permits for drain crossings. Follow all permit conditions. • Determine the pipe burial depth at drains in consultation with the appropriate authority. • Restore trenched drain crossings to preconstruction conditions.	• No residual effect identified.
3.5 Alteration of canals and drainage ditches	Canals: KP 498.4, KP 507.8, KP 509.5, KP 510.0, KP 510.3, KP 511.2, KP 512.4, KP 513.3, KP 514.5, KP 515.0 Drainage Ditches: KP 416.2 KPR 40.9	Footprint to Local	• Obtain crossing permits for canals and drainage ditches. Follow all permit conditions. • Notify water management groups of the details regarding their project prior to construction. • Bore canals and other ditches, where practical, to prevent the alteration of drainage projects. (Detail 6A-34). Past construction programs at the canal at KP 498.6 have encountered large boulders at this location resulting in a trenched crossing. • Determine the pipe burial depth at canals and drainage ditches in consultation with the appropriate authority. • Restore trenched canals and drainage ditch crossings to preconstruction conditions.	• No residual effect identified.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
3.6 Pivot irrigated systems	Locations identified during Terrace Phase I and CEP, and during fall 2006 overflight: KP 511.4 to KP 513.0 KP 513.3 to KP 514.3 KP 514.9 to KP 517.1 KP 660.1 to KP 660.9 KP 1088.3 to KP 1088.7 KP 1089.9 to KP1090.7 KP 1092.4 to KP 1093.2	Footprint	• Schedule construction to avoid the irrigation season if practical. • Refer to Detail 6A-9 for detailed mitigation measures for pivot irrigated lands. • Take particular care to ensure adequate compaction of the trench at pivot wheel crossings during backfilling. Install a steel plate at pivot wheel crossings if adequate compaction cannot be accomplished. [EGC 03-2] • Inspect and monitor trench before and during the first irrigation season to determine the success of the trench compaction and levelling. [EGC 03-2]	• See *Human Occupancy and Resource Use* element 11.1(e) of this table.
3.7 Flood irrigated systems	Locations identified during Terrace Phase I and CEP: KP 509.7 to KP 510.5 KP 510.5 to KP 511.3 KP 513.0 to KP 513.3 KP 514.3 to KP 514.9 KP 654.4 to KP 654.8 Additional locations identified by Saskatchewan Watershed Authority: KP 301.2 to KP 301.5	Footprint	• Schedule construction to avoid the irrigation season if practical. • Refer to Detail 6A-9 for detailed mitigation measures for flood irrigated lands. • Prepare a surveyed right-of-way profile prior to construction on flood irrigated lands. • Install trench breakers on flood irrigated lands, where warranted, to force groundwater seepage along the pipeline trench to the surface. • Install temporary sack trench breakers on long slopes on flood-irrigated fields, where warranted, when built during frozen conditions. • Backfill the trench on flood irrigated land in two (min.) separate lifts. Compact after each lift. • Recontour the right-of-way to preconstruction condition profile and re-establish border dikes. [EGC 03-3] • Inspect and monitor trench before and during the first irrigation season to determine the success of the trench compaction and levelling. [EGC 03-2]	• See *Human Occupancy and Resource Use* element 11.1(f) of this table.
3.8 Reduction of surface water quality	Waterbodies	Footprint to Local	• Follow the recommended pipeline crossing techniques and vehicle crossing method for each watercourse encountered along the route (see Table 6.3). Recommended crossing techniques were selected based on the sensitivity of each watercourse to the introduction of silt and to increased potential for sedimentation and turbidity as well as the channel configuration and streamfow (Details 6A-25 to 6A-36). • Restrict grading to trench line and work areas where practical. [EGC 02-7] • Direct grading away from watercourse to reduce the risk of material entering the watercourse. Do not place fill material in a watercourse during grading. [EGC 02-7] • Minimize grading within 16 m buffer of undisturbed vegetation on each stream bank. If grading within the buffer, install temporary sediment barriers to prevent sediment from flowing back into the stream. [EGC 02-7] • Adhere to the following spill prevention measures: prohibit fuel storage, refuelling or servicing of equipment near watercourses except where secondary containment is provided; and ensure equipment used for instream construction is well maintained and free of fluid leaks. [EGC 02-2] • In the event of a spill, immediately implement measures to stop, control the migration of, and clean-up the spilled substance as outlined in the Spill Contingency Plan in Appendix 6B (see also *Accidents and Malfunctions* element 18.1 of this table). • Install berms, cross ditches and/or silt fences between wetlands and disturbed areas to prevent siltation of surface water (Details 6A-23 and 6A-24). Ensure silt fences have been installed properly, are solid and filter fabric is tight. • See also *Wetlands* element 7.3 of this table.	• Reduction in surface water quality due to suspended solids during instream construction.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
3.9 Reduction of groundwater quality and quantity				
3.9(a) general	Entire route	Footprint to Local	• Monitor all registered or known water wells within 200 m of any blasting before and after blasting. Provide alternate water supply, if warranted, where well monitoring indicates that a reduction in water quality or quantity has occurred due to blasting. • Adhere to the following spill prevention measures: prohibit fuel storage, refuelling or servicing of equipment near watercourses except where secondary containment is provided; and ensure equipment used for instream construction is well maintained and free of fluid leaks. [EGC 02-2] • In the event of a spill, immediately implement measures to stop, control the migration of, and clean-up the spilled substance as outlined in the Spill Contingency Plan in Appendix 6B (see also *Accidents and Malfunctions* element 18.1 of this table). • Implement the Directional Drilling Procedures and Instream Drilling Mud Release Contingency Plan outlined in Appendix 6B in the event of a release during instream construction at locations where a HDD is to be used (see also *Accidents and Malfunctions* element 18.4 of this table).	• Although unlikely, the disruption of water well flows may occur. • See *Accidents and Malfunctions* element 18.4 of this table for discussion of the residual effect associated with a release of instream drilling mud.
3.9(b) aquifers	Oak Lake Aquifer (KP 975 to KP 1034) Assiniboine Delta Aquifer (KP 1080 to KP 1110) KP 1119 to KP 1142 (near Swan Lake Indian Reserve) Winkler Aquifer (KP 1207 to KP 1219)	Footprint to Local	• A specialized integrity assessment program is recommended that encompasses the design, construction and operation phases of the pipeline segments near the Oak Lake, Assiniboine and Winkler aquifers as well as the aquifer near the Swan Lake Indian Reserve. The integrity assessment program should ensure that the Alberta Clipper pipeline in the vicinity of aquifers is designed, constructed and operated in a manner that limits the potential for product release into an aquifer and minimizes the effect should a release occur. The program should include, at a minimum, an evaluation of the following potential mitigative strategies and the selection of measures appropriate for the proposed Alberta Clipper pipeline project: – increase the minimum depth of cover to 1.5 m to limit the potential for third party damage; – increase the frequency of internal corrosion checks; – optimize valve location and spacing to limit the amount of product that could be released; – increase the wall thickness of the pipe; and – ensure adequate cathodic protection of the pipe. • Confirm that the Enbridge Emergency Response Plan has measures in place to promptly and effectively respond to a release of product in the vicinity of an aquifer. • Develop a plan to identify alternate water supplies and commit to provide alternate water sources to affected parties, if warranted, in the event an accidental release of product by Enbridge that adversely affects an aquifer.	• No residual effect identified.
3.9(c) springs	KP 616.0 KP 1242.5 to KP 1245.2	Footprint to Local	• Recontour slopes to pre-construction profile. • If springs are encountered along the route, install trench breakers to force groundwater seepage along the pipeline trench to the surface. [EGC 03-2] Install subdrains if warranted, to divert shallow groundwater flow from the right-of-way. [EGC 03-2]	• Potential minor short-term disruption of groundwater flow where springs are encountered.
3.9(d) disruption of groundwater flow in areas characterized by sands overlying clays at shallow depths	shallow Stockton Series (KP 1083.7 to KP 1084.2) (KP 1197.7 to KP 1200.1)	Footprint	• Conduct three-lift soil handling on lands characterized by sands overlying clays at shallow depths as indicated on the Environmental Alignment Sheets to maintain groundwater flow (Details 6A-15, 6A-16). • Strip upper subsoils from an area twice the width of the trench and to the depth indicated on the Environmental Alignment Sheets. • Store topsoil on the spoil side of the trench next to the stripped area. [EGC 02-5]	• No residual effect identified.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
3.9(d) disruption of groundwater flow in areas characterized by sands overlying clays at shallow depths (cont'd)	Same as above	Same as above	• Salvage and store the upper subsoil separately from the lower subsoil at locations where three-lift soils handling is required and grading is necessary. • Store the first lift of trench subsoil on the spoil side, either next to the trench or back far enough to store the second lift. Maintain a separation between the topsoil pile and the subsoil piles, and also between subsoil piles. [EGC 02-5] • Backfill each lift in the correct sequence to ensure that lower clayey subsoils do not mix with sandy upper subsoil horizons.	• Same as above
3.10 Withdrawal and release of hydrostatic test water	Test locations	Footprint to Local	• Conduct all hydrostatic testing activities in accordance with the NEB Onshore Pipeline Regulations, provincial regulations as well as the latest version of CSA Z662. • Shunt test water ahead from test section to test section to the extent possible to minimize water hauling, water usage and number of dewatering points. • Collect and analyze water samples from potential sources of water and hydrostatic test water. • Screen and locate test water intakes to prevent the intake of fish and fish eggs. [EGC 02-18] • Isolate fill pumps from bodies of water with an impermeable lined dike or depression to prevent spills of fuels or lubricants from entering a body of water. • The withdrawal rate and volume will not exceed 5% of the flow rate of the watercourse or of the volume of the body of water unless otherwise approved by the appropriate authority. [EGC 02-18] • Ensure water hauling trucks for test water, if used, are clean and inspected prior to use. • Discharge water into bar ditches where feasible. • If test water is released into a natural water body, ensure that the appropriate testing and treatment measures are implemented in accordance with provincial regulations related to discharging hydrostatic test water. • Release the source water within the same watershed from where it was withdrawn. [EGC 02-18] • Discharge water must not be more than 2°C warmer or cooler than a receiving body of water if the receiving body of water supports sport fish. [EGC 02-18] • Control the discharge rate of test water to reduce the potential for soil erosion. [EGC 02-18] • Install energy diffusers and plywood sheeting, tarpaulins or other similar material to reduce the risk of soil erosion. Reduce the discharge rate if erosion becomes evident. [EGC 02-18] • See *Human Occupancy and Resource Use* element 11.1(k) of this table for discussion on potential affect of withdrawal of hydrostatic test water on downstream water users.	• No residual effect identified.
4. GREENHOUSE GASES AND AIR QUALITY				
4.1 Project contribution to greenhouse gas emissions	Entire route	---	• Utilize multi-passenger vehicles for the transport of crews to and from job sites to the extent practical to minimize emissions during construction. • Minimize the amount of GHG emissions associated with clearing of vegetation by following existing linear disturbances where feasible.	• Incremental increase in GHG emissions during pipeline construction.
4.2 Airborne emissions from equipment during construction	Entire route	Footprint to Local	• Use well maintained equipment to minimize emissions. • Minimize unnecessary idling of equipment. • Use multi-passenger vehicles to transport crew to site to the extent practical to limit the amount of traffic and accompanying emissions.	• Increase in vehicle emissions will occur during pipeline construction.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
4.3 Dust during construction	Entire route	Footprint to Local	• Apply water to exposed soil piles if wind erosion occurs. [EGC 02-2] Water is preferred over chemical dust suppressant applications. • Apply water to the right-of-way and access roads if traffic and wind conditions result in pulverized soils and dust problems. [EGC 02-2] • Suspend topsoil stripping and replacement during strong winds to control dust. [EGC 02-2]	• Increase in dust arising from pipeline construction traffic on the right-of-way will occur.
4.4 Smoke during construction	Bush/wooded areas	Footprint to Local	• Obtain applicable permits prior to burning slash. • Avoid locating burn piles on topsoil within agricultural lands. Locate burn piles on exposed mineral soils stripped of their topsoil or in a burning sloop. [EGC 02-4] • Locate burn piles at least 100 m from a waterbody. [EGC 02-4]	• Increase in smoke arising from burning of slash along the pipeline route will occur.
4.5 Emissions during operations and maintenance	Entire route	Footprint to Local	• Use well maintained equipment during maintenance activities to minimize emissions.	• Slight rise in air emissions will occur during site-specific maintenance activities along the route.
5. ACOUSTIC ENVIRONMENT				
5.1 Noise from construction equipment	Entire route	Footprint to Local	• Ensure that noise abatement equipment (*e.g.*, mufflers) on machinery is in good working order to control noise levels. Take reasonable measures to control construction related noise near residential areas. Alter equipment, erect noise barriers, or change the work schedule if excessive noise becomes a nuisance to nearby residents. [EC 02-2] • Schedule hours of work within communities between 7 AM and 8 PM, or as specified in the community bylaws. [EGC 01-3] • Schedule construction to avoid periods of peak use of facilities within communities or special events, if practical. • Schedule hours of work at locations along the route where residences are located within 250 m to the period from 7 AM and 7 PM.	• Increase in noise will occur during pipeline construction.
5.2 Noise during operations and maintenance	Entire route	Footprint to Local	• An increase in noise emissions during the operation of the pipeline is not expected. • Confine maintenance work to between 7 AM and 7 PM in proximity to permanent residences unless otherwise stated in the local bylaws or as approved by the appropriate authority. • Maintain equipment used to conduct maintenance activities to minimize unnecessary noise (*e.g.*, mufflers).	• Slight rise in noise levels during site-specific maintenance activities along the route.
6. FISH AND FISH HABITAT				
6.1 Riparian habitat loss and alteration				
6.1(a) general	All watercourse crossings	Footprint to Local	**General** • Adhere to all approvals, permits and authorizations issued by regulatory authorities. Any alternatives or alterations to crossing requirements specified in approvals, permits and authorizations must be approved prior to commencement of crossing construction. [EGC 02-11] • Use the vehicle and pipeline crossing methods recommended for each crossing (Table 6.3), which have been selected using data collected during field investigations and the public consultation program, as well as previous construction programs, to reduce direct and indirect effects on productive fish habitat. [EGC 01-5, EGC 02-2, EGC 02-11, EGC 02-12]	• Clearing or disturbance of riparian vegetation associated with watercourses within right-of-way and temporary work space will occur.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
6.1(a) general (cont'd)	Same as above	Same as above	**Vehicle Crossings** • Install vehicle crossings on adjacent previously disturbed right-of-way, if practical, in order to minimize clearing and grading requirements at the proposed crossing. [EGC 02-7, EGC 02-11] • Remove vehicle crossing structures when no longer required. Restore and stabilize streambeds, banks and other disturbed areas. [EGC 02-12] • Remove vehicle crossing structures prior to freeze-up during summer construction and prior to break-up during winter construction. **Clearing and Grading** • Minimize grading when constructing temporary bridges or snow/ice fill crossings. [EGC 02-7, EGC 02-11] • Postpone clearing of watercourse approach slopes and banks until immediately prior to crossing construction except, if required, to install vehicle crossing structures. Where earlier clearing is approved by the appropriate authority, leave the vegetative ground mat and root structure intact. [EGC 02-4] • Leave a temporary uncleared buffer zone extending back from the crest of erosion prone approach slopes where practical. [EGC 02-4] • Restrict grading to the trench line and work area where feasible. [EGC 02-7, EGC 02-11] Only permit grading in the vicinity of watercourses if required to ensure that silt laden surface water flow does not enter a watercourse. • Grade away from watercourses in order to reduce the risk of material entering a watercourse. [EGC 02-7] • Store graded material away from the flood plain of the watercourse. [EGC 02-7] • Minimize clearing and ground disturbance within 16 m of the high water mark of all waterbodies to the degree practical. [EGC 02-4] Locate extra work space a minimum of 16 m away from the water's edge, if practical. [EGC 01-6] **Pipeline Crossings** • Ensure all necessary equipment and materials are on site and ready for installation prior to commencing water crossing construction. Complete pipe stringing, welding, pretesting (if necessary), coating and weighting prior to commencement of instream construction. **Restoration of Banks** • Salvage surface organic material (*e.g.*, low vegetation, leaf litter, partially decomposed organic matter) with the upper topsoil (to the depth of the root zone) from watercourse banks for reclamation, if it can be removed intact. • Stabilize banks and approach slopes and install temporary berms, silt fences, or cross ditches in any location where run-off from the right-of-way may flow into a watercourse (Details 6A-23 and 6A-24). [EGC 02-13, EGC 02-14] • Install temporary erosion control measures within 24 hours of backfilling crossings. [EGC 02-11] Commence clean-up immediately following backfill and erosion control operations. • Recontour banks with salvaged surface organic material (if removed intact), and protect with coconut matting or equivalent, if necessary to stabilize. Plant willow stakes to anchor matting and provide additional stability where shrubs existed prior to construction (Details 6A-42, 6A-38). [EGC 03-4, EGC 03-7]	• Same as above

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
6.1(a) general (cont'd)	Same as above	Same as above	**Restoration of Banks** • Seed riparian areas with an approved native cover crop and seed mix as soon as feasible after construction (prior to spring freshet wherever possible) (Details 6A-49, 6A-46). [EGC 03-5] • Transplant shrubs or install willow stakes during reclamation of streambanks where shrubbery is present prior to construction (Detail 6A-38). [EGC 03-3, EGC 03-7] • Armour streambanks, where warranted, to provide adequate erosion control (Detail 6A-37). • Fence off reclaimed areas to prevent damage by cattle, where appropriate. • Follow mitigative measures outlined in the Detailed Crossing Construction Plan for the South Saskatchewan River Valley to be undertaken by Enbridge prior to construction (see Section 9.0 of the ESA). **Monitoring** • Inspect approach slopes and banks regularly, especially after heavy rainfalls and spring freshet for two years after construction. Continue monitoring at specific locations if chronic erosion occurs, or if riparian vegetation recovery is delayed. Take remedial action to address soil erosion problems or delayed vegetation recovery, as warranted.	• Same as above
6.2 Instream habitat loss and alteration	All watercourse crossings	Footprint to Local	**General** • Fish population and aquatic habitat inventories were conducted at watercourse crossings along the route for CEP, Terrace Phases I and II, and at select locations in October 2006 along the Alberta Clipper pipeline route from KP 959.3 to KP 1245.2. • Discussions with DFO regarding the proposed watercourse crossings are ongoing. Enbridge will, where warranted, request from DFO a letter of advice for determination of whether HADD of fish habitat could occur. • Adhere to all approvals, permits and authorizations issued by regulatory authorities. Any alternatives or alterations to crossing requirements specified in approvals, permits and authorizations must be approved prior to commencement of crossing construction. [EGC 02-11] • Use the vehicle and pipeline crossing methods recommended for each crossing (Table 6.3), which have been selected using data collected during field investigations and the public consultation program, as well as previous construction programs, to reduce direct and indirect effects on productive fish habitat (Details 6A-25 to 6A-36). [EGC 01-5, EGC 02-2, EGC 02-11, EGC 02-12] Refer to *Fish and Fish Habitat* element 6.1(a) of this table for additional measures relating to vehicle crossings. • Adhere to RAPs (see Table 6.3) [EGC 01-3] and limit instream work period to less than one working day wherever practical. [EGC 02-11] • Fall trees away from watercourses. Immediately remove trees, debris or soil inadvertently deposited below the high water mark of watercourses. [EGC 02-4] • Contour and stabilize banks and approach slopes, and install temporary berms, silt fences, or cross ditches at any location where run-off from the right-of-way may flow into a watercourse (Details 6A-24, 6A-23). [EGC 02-13, EGC 02-14] • Construct hard ditch plugs at least 3 m wide and leave in place to protect banks from sloughing at isolated and open cut crossings until construction of the crossing has been initiated. [EGC 02-8] • Complete welding, coating, weighting and, where applicable, pretesting, of the pipe prior to commencement of trenching and ensure that sufficient equipment is available to move long heavy sections of pipe efficiently at wide crossings.	• Alteration of instream habitat within zone-of-influence at trenched crossings will occur.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
6.2 Instream habitat loss and alteration (cont'd)	Same as above	Same as above	**Open Cut Crossing Technique** • Where use of an open cut crossing method is planned (see Table 6.3), salvage the upper substrate material and stockpile separately to cap the trench during backfilling (Detail 6A-30). [EGC 02-11, EGC 03-2] Trench through watercourse. Retain hard plugs at each bank until just prior to pipe installation. • If necessary to control subsurface water flow and trench sloughing, install temporary soft plugs and dewater the trench onto stable surfaces in a manner that does not cause erosion of soils, sedimentation of watercourses or where icing will not be a problem. [EGC 02-17] • Pile all spoil on the banks if feasible. Construct a temporary storage area for spoil above the high watermark of the watercourse if spoil is likely to be highly saturated. Excavate a pit or construct berms of packed earth, staked straw bales or swamp weights, if warranted, to prevent spoil or silty water from flowing back into the watercourse. Containment berms and spoil should be back from the streambank. Note that the vegetative buffers are to be maintained and, consequently, spoil may require stockpiling back from the banks. • Return salvaged streambed surface material (or material of equivalent quality) to top layer of backfill. [EGC 02-11, EGC 03-2] Where granular material is encountered at the surface during excavation, cap the trench with 0.5 m of clean granular material. • Maintain or restore natural drainage and channel configurations. [EGC 02-2, EGC 03-2] • Return aquatic vegetation and organic debris removed from the construction area following trench backfilling. **Isolation Crossing Technique** • Where an isolation crossing method is planned (see Table 6.3), implement the measures indicated on Details 6A-31, 6A-32, 6A-33 and 6A-36 to reduce sediment input, including the following: – ensure water from flumes, dam and pumps, diversions or other methods do not cause erosion or introduce sediment into the channel; [EGC 02-8] – construct a sump with berms, silt fences or straw bale filters to contain excavated instream spoil so that it does not re-enter the waterbody; [EGC 02-8] – do not use earthen berms to isolate the crossing construction area; – salvage upper substrate material and stockpile separately to cap the trench during backfilling; [EGC 02-11, EGC 03-2] – dewater the trench onto stable surfaces in a manner that does not cause erosion of soils, sedimentation of watercourse, or where icing will not be a problem; [EGC 02-17] – return salvaged streambed surface material (or material of equivalent quality) to top layer of backfill. [EGC 02-11, EGC 03-2] Where granular material is encountered at the surface during excavation, cap the trench with 0.5 m of clean granular material; and – maintain or restore natural drainage and channel configurations. [EGC 02-2, EGC 03-2]. • Replace aquatic vegetation and organic debris removed from the construction area following trench backfilling. **Trenchless Crossing Technique** • Implement standard trenchless crossing measures (Details 6A-34 and 6A-35) where a trenchless crossing is planned (see Table 6.3). [EGC 02-2, EGC 02-11] Ensure inspection and contractor staff is familiar with the Directional Drilling Procedures and Instream Drilling Mud Release Contingency Plan (Appendix 6B) prior to commencement of trenchless crossing construction so that measures can be implemented quickly in the event of a drilling mud frac-out or crossing failure.	• Same as above

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
6.3 Increased water column suspended sediment concentrations	All watercourse crossings	Footprint to Local	• Use the vehicle and pipeline crossing methods identified for each crossing (Table 6.3), which have been selected using data collected during field investigations and the public consultation program, as well as previous construction programs, to reduce sediment introduction based on waterbody sensitivity, streamflow and channel characteristics. [EGC 01-5, EGC 02-2, EGC 02-11, EGC 02-12] • Install, where warranted, temporary diversion berms on approach slopes to watercourses and silt fences near the base of approach slopes to watercourses following grading. [EGC 02-7, EGC 02-13, EGC 02-14, EGC 03-5] Repair damaged temporary erosion control structures before the end of each working day. • Schedule crossings of watercourses with moderate to high fish habitat potential during periods of low flow outside of the RAP (see Table 6.3). [EGC 01-3, EGC 02-11] • Postpone watercourse crossing construction if excessive flows or flood conditions exist or are anticipated, and construction methods cannot be modified to cope with the increased flow (see Flood and Excessive Flow Contingency Plan in Appendix 6B). [EGC 02-11] • Minimize clearing and ground disturbance within 16 m of the high water mark of all waterbodies to the degree practical. [EGC 02-4] • Adhere to instream construction windows and limit instream work period to less than one working day wherever practical. [EGC 01-3, EGC 02-11] • Place salvaged surface material above the high water mark in a manner that does not block drainage or runoff. [EGC 02-8] • Contour and stabilize banks and approach slopes and install temporary berms, silt fences, or cross ditches in any location where run-off from the right-of-way may flow into a watercourse. [EGC 02-13, EGC 02-14] • Seed with an approved native cover crop and seed mix prior to spring freshet wherever possible (Details 6A-46, 6A-49). [EGC 03-5] • Maintain or restore natural drainage and channel configurations. [EGC 02-2, EGC 03-2] • Isolate construction area where water is present in waterbodies with fish potential to reduce sediment input (see Table 6.3 for recommended crossing methods). [EGC 02-2] At these sites, implement measures outlined on Details 6A-31, 6A-32, 6A-33 and 6A-36 including the following: – ensure water from flumes, dam and pumps, diversions or other methods does not cause erosion or introduce sediment into the channel [EGC 02-8]; – construct a sump with berms, silt fences or straw bale filters to contain excavated instream spoil so that it does not re-enter the waterbody; [EGC 02-8] and – dewater the trench onto stable surfaces in a manner that does not cause erosion of soils, sedimentation of watercourses, or where icing will not be a problem. [EGC 02-17] • In fish bearing waterbodies, leave hard ditch plugs at least 3 m wide in place until the crossing has been initiated. [EGC 02-8] • In fish-bearing waterbodies, postpone clearing of slopes and banks until immediately prior to construction and leave a temporary uncleared buffer zone extending back from the crest of erosion prone slopes where practical. • Where earlier clearing is necessary, leave the vegetative ground mat and root structure intact.	• Increase in suspended solid concentration during instream construction at trenched crossings within the zone-of-influence will occur. • See also *Water Quality and Quantity* element 3.8 of this table.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
6.4 Blockage of fish movements	All watercourse crossings	Footprint to Region	• Adhere to instream RAPs (Table 6.3 of the ESA) and limit instream work period to less than one working day wherever practical. [EGC 01-3, EGC 02-11] • Maintain 100% of downstream flow throughout instream activity period in fish-bearing waterbodies. • Install temporary single span bridges to allow vehicles to cross relatively narrow watercourses where sedimentation must be minimized or fish passage allowed (Detail 6A-25) (see Table 6.3).	• Blockage of fish movements may occur.
6.5 Fish and bivalve mortality	All watercourse crossings	Footprint to Region	• Adhere to instream RAPs (Table 6.3 of the ESA) and limit instream work period to less than one working day wherever possible. [EGC 01-3, EGC 02-11] • Salvage fish from isolated instream construction area and any bypass structures prior to dewatering and trenching at designated crossings. • Ensure pump intakes do not disturb the streambed and are screened with a maximum mesh size of 2.54 mm and approach velocity of 0.038 m/s. • Restrict water removal for hydrostatic testing to less than 5% of volume at designated waterbodies unless otherwise approved by the appropriate authority. • Implement applicable measures from the Fish and Bivalve Species of Concern Discovery Contingency Plan (Appendix 6B) should fish or bivalve species of concern be discovered during additional studies in 2007. • Do not permit construction personnel to fish on the worksite.	• Increased fish and bivalve mortality due to suspended solids may occur.
6.6 Interbasin transfer of aquatic organisms	All watercourse crossings	Footprint to Region	• Return test water to its source watershed to prevent inter-basin transfer of aquatic organisms. [EGC 02-18]	• No residual effect identified.
6.7 Contamination from spills during construction and operations	All watercourse crossings	Footprint to Local	• Design pipeline, including valve locations, to minimize operational spill risk and volume that could reach waterbodies. • Adhere to Spill Contingency procedures included in Appendix 6B to avoid contaminant introduction to waterbodies during construction. These include the following: – do not dispose of petroleum products or waste into waterways or on the ground. Prepare contingency plans for fuel and hazardous waste spills and ensure that all fuel and service vehicles carry a spill kit; – ensure that all hazardous material storage and oil changes, refuelling, washing and lubrication of industrial equipment occurs more than 100 m from a waterbody except where secondary containment is provided [EGC 02-2]; and – use vegetable-based hydraulic oils in hydraulic systems working near watercourses, if practical. Inspect hydraulic, fuel and lubrication systems to ensure they are in good condition and free of leaks. [EGC 02-2]	• Contamination from spills during construction and operations may occur. • See *Accidents and Malfunctions* element 18.1 of this table.
6.8 Loss or alteration of riparian habitat for fish and bivalve species of concern	Watercourse crossings	Footprint to Local	• Fish population and aquatic habitat inventories were conducted at watercourse crossings along the route for CEP, Terrace Phases I and II, and in October 2006 along the Alberta Clipper pipeline route from KP 959.3 to KP 1245.2. [EGC 01-5] Although not captured during the field investigations, bigmouth buffalo (S3, Special Concern) is known to occur in the Qu'Appelle river (KP 657.1), chestnut lamprey (S3S4, Special Concern) is known to occur in the Souris River (KP 1073.4), and maple leaf mussel (Endangered) is known to occur in the Assiniboine River near the confluence with the Souris River (*i.e.*, approx. 13 km downstream from the proposed Souris River crossing at KP 1073.4). Bigmouth buffalo has the potential to occur at the Qu'Appelle River crossing while both chestnut lamprey and maple leaf mussel have the potential to occur at the proposed Souris River crossing.	• Potential fish and bivalve species of concern may be affected by increased suspended solid concentration and habitat alteration within the zone of influence at select watercourse crossings

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
6.8 Loss or alteration of riparian habitat for fish and bivalve species of concern (cont'd)	Same as above	Same as above	• An HDD method is recommended for both the Qu'Appelle River and Souris River crossings, if feasible, and unless otherwise approved by provincial and federal authorities. • Supplemental field studies may be required to determine the presence of fish and/or bivalve species of concern and critical aquatic habitat prior to construction (see Section 9.0 of the ESA). • In the event that bivalve species of concern are present in the vicinity of the Souris River, Oak Creek (KP 1109.3) and Deadhorse Creek crossings, implement contingency measures identified in Appendix 6B. • Implement one or more of the mitigative measures identified in Appendix 6B in the event that fish species of concern or critical habitat is discovered during either the supplemental field studies or during construction. [EGC 01-5] • Refer to *Fish and Fish Habitat* element 6.1 and 6.2 of this table for additional measures.	• Same as above
7. WETLANDS				
7.1 Potential alteration of habitat function (*e.g.*, habitat for wildlife, amphibians, waterfowl and vegetation)	Entire route	Footprint	• See Detail 6A-51 in Appendix 6A for more mitigative measures pertaining to wetland function. • During supplemental studies, follow measures in the Traffic Control Plan to minimize disturbance to wetlands (Appendix 6C). Restrict vehicle travel through wetland areas to one pass along the right-of-way where practical. • Adhere to all conditions of approvals, authorizations and permits for wetland crossings. [EGC 02-11] • Follow measures in the Traffic Control Plan (Appendix 6C) to minimize disturbance to wetland areas during construction. • Schedule construction within wetlands during frozen ground conditions, if feasible. [EGC 01-3] If construction occurs during nonfrozen conditions, attempt to schedule construction in wetlands during dry periods when water levels are low. [EGC 02-11] • Stake, flag or fence the right-of-way boundaries through all wetlands to prevent affecting the surrounding area. [EGC 02-3] • Install a shoo-fly around wetlands or construct a subsoil ramp if approved by appropriate regulatory authorities. Restrict access through wetlands to the shoofly or ramp to the extent practical. [EGC 02-2] Remove equipment crossing structures and restore to preconstruction contour during clean-up and restoration. [EGC 02-12] • Install swamp mats or geotextiles for heavy vehicle/equipment crossing wetlands during nonfrozen conditions. [EGC 02-8] Remove swamp mats or geotextiles immediately after construction activity at that location has been completed. • Use wide-track equipment or conventional equipment operated from swamp mats when working on saturated soils during nonfrozen conditions. • No activities are to occur within the migratory bird nesting period between April 1 to July 31, unless the area has been precleared or premowed or if no nests were observed during nest surveys conducted prior to clearing. See *Wildlife and Wildlife Habitat* element 9.2 of this table. • Minimize the removal of vegetation and the disturbance of soil adjacent to wetlands. [EGC 02-4, EGC 02-11] • Salvage live trees or shrubs from banks of wetlands if requested by landowners. Store salvaged trees and shrubs on the side of the right-of-way in a manner such that they do not dry out before replanting during restoration (Detail 6A-2). [EGC 02-4]	• Alteration of wetland habitat function will occur.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
7.1 Potential alteration of habitat function (*e.g.*, habitat for wildlife, amphibians, waterfowl and vegetation) (cont'd)	Same as above	Same as above	• Maintain low vegetation or vegetative ground mat within a 16 m buffer adjacent to wetlands to the extent practical by walking, storing and constructing over the undisturbed ground. [EGC 01-6, EGC 02-4] • Minimize the width of grubbing through wet areas during construction to facilitate the restoration of shrub communities. [EGC 02-4, EGC 02-11] • Restrict grading as much as practical. Conduct grading adjacent to wetlands away from the wetland to the extent practical to reduce the risk of sediment and other material entering the wetland. [EGC 02-7, EGC 02-11] Keep wetland soils separate from upland soils. [EGC 02-5] • Store excavated material in a manner that does not interfere with natural drainage patterns. [EGC 02-7] • Install berms, cross ditches and/or silt fences between wetlands and disturbed areas to prevent sedimentation of wetlands (Details 6A-23 and 6A-24). Ensure silt fences have been installed properly, are solid and filter fabric is tight. • Salvage surface material in unsaturated wetlands, giving extra attention to maintaining root stocks for replacement. Salvage surface material to a maximum depth of 40 cm, or to the depth of colour change where there is less than 40 cm of surface material, using the Environmental Alignment Sheets as a guide. • Do not dewater any permanent wetland. • Restore preconstruction profile in wetlands during reclamation. Remove any excess backfill to an upland location approved by the appropriate regulatory authorities. [EGC 03-2, EGC 03-3] • Seed wetland with an appropriate wetland mix as indicated on the Environmental Alignment Sheets (Detail 6A-46). • Where shrubs are present prior to construction, use willow staking along the wetland to stabilize disturbances and reduce sedimentation risk to wetland (Detail 6A-38). [EGC 03-7] • See Wildlife and *Wildlife Habitat* element 9.1(c) and (d) of this table for measures pertaining to DU projects, Conservation Agreements (CAs) and NAWMP priority areas along the route. • Schedule maintenance activities during frozen conditions to the extent feasible. Follow above measures for work in wetlands during operations.	Same as above

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
7.2 Potential alteration of hydrologic function	Entire route Houcher Lake and Provost South landscapes DU Project (KP 272.0 to KP 273.0) Cosine Lake Migratory Bird Concentration Site (KP 278.6 to KP 279.4) Chapleau Lakes Montmartre DU Project (KP 782.9 to KP 783.8) DU Wetland Projects (KP 784.5; KP 819.6 to KP 820.4; KP 928.1 to KP 930.9; KP 938.0 to KP 938.8) Game Bird Refuge (KP 985.0 to KP 990.0) Oak Lake/Plum Lakes Important Bird Area (KP 987.0 to KP 1004.0) Log Cabin DU Project (KP 1052.9 to KP 1053.7) Kozak and Rouire CA (NW 34-7-19 WPM) Cunningham CA (SW 36-7-19 WPM) Lizard Lake DU Project (KP 1174.3 to KP 1174.8) NAWMP priority areas (KP 959.8 to KP 977.0; KP 1052.0 to KP 1063.0)	Footprint	• See Detail 6A-51 in Appendix 6A for more mitigative measures pertaining to wetland function. • Implement the following mitigative measures appropriate for site- specific conditions as indicated in the Environmental Alignment Sheets. – Narrow down the proposed area of disturbance and protect the wetland by using fencing, clearly mark the wetland boundaries using flagging and limit traffic in the vicinity of the flagged area (Detail 6A-1). [EGC 02 3] – Minimize the width of grubbing through wet areas during construction to facilitate the restoration of shrub communities. – Leave an undisturbed organic mat as a buffer zone adjacent to large wetlands to limit the potential for sediment to enter wetlands, if practical. [EGC 01-6, EGC 02-4] – Install culverts, if warranted, to prevent grading or spoil from blocking natural drainage and causing ponding. [EGC 02-2] Follow measures listed under *Water Quality and Quantity* element 3.1 of this table. – Install temporary erosion control structures (*e.g.,* silt fences and/or straw bales) within 24 hours of backfilling the wetland crossing (Detail 6A-24). [EGC 02-7, EGC 02-11, EGC 02-14] Ensure silt fences have been installed properly, are solid and filter fabric is tight. – Install trench breakers, where warranted, at the edge of perched wetlands to prevent the pipe trench from acting as a drain (Detail 6A-20). – Adhere to the following spill prevention measures: prohibit fuel storage, refuelling or servicing of equipment within 100 m of wetlands except where secondary containment is provided; and ensure equipment used for construction within the wetland is well maintained and free of fluid leaks. In the event of a spill, immediately implement measures to stop, control the migration of, and clean up the spilled substance as outlined in the Spill Contingency Plan in Appendix 6B (see also *Accidents and Malfunctions* element 18.1 of this table). [EGC 02-2] – Restore wetland to preconstruction profile during reclamation. Remove any excess backfill to an upland location approved by the appropriate regulatory authorities. [EGC 03-2, EGC 03-3] – Do not dewater any permanent wetland. • Maintain water levels in all wetlands encountered within the game bird refuge and Oak Lake/Plum Lakes Important Bird Area (approximately KP 987.0 to KP 1004.0). Do not alter drainage or drain wetlands in this area unless otherwise requested/approved by provincial and federal authorities. Restore disturbed areas in wetlands to preconstruction profile during reclamation. Remove any excess backfill to an upland location approved by the appropriate regulatory authorities. [EGC 03-2, EGC 03-3] • Develop site-specific mitigative measures in consultation with the Manitoba Habitat Heritage Corporation and Canadian Wildlife Service to minimize impacts to CAs and NAWMP priority areas along the route.	• Alteration of hydrologic function of wetlands during pipeline construction will occur.
7.3 Potential loss or reduction of water quality function	Entire route	Footprint to Local	• See Detail 6A-51 in Appendix 6A for more mitigative measures pertaining to wetland function. • Narrow down the proposed area of disturbance and protect the wetland by using fencing, clearly mark the wetland boundaries using flagging and limit traffic in the vicinity of the flagged area. [EGC 02-3] • Follow measures outlined for locations with high water table (see *Water Quality and Quantity* element 3.2 of this table).	• Alteration of water quality function in wetlands during pipeline construction will occur.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
7.3 Potential loss or reduction of water quality function (cont'd)	Same as above	Same as above	• Conduct grading adjacent to wetlands away from the wetland to the extent feasible to reduce the risk of sediment and other material entering the wetland. • Install berms, cross ditches and/or silt fences between wetlands and disturbed areas to prevent sedimentation (Details 6A-23 and 6A-24). Ensure silt fences have been installed properly, are solid and filter fabric is tight. • Inspect and maintain sediment barriers regularly *(i.e.,* weekly or within 24 hours of substantial rainfall). Remove sediment barriers after the disturbed area is revegetated and the area is stable. [EGC 02-14] • Adhere to the following spill prevention measures: prohibit fuel storage, refuelling or servicing of equipment near wetlands except where secondary containment is provided; and ensure equipment used for construction within the wetland is well maintained and free of fluid leaks. In the event of a spill, immediately implement measures to stop, control the migration of, and clean up the spilled substance as outlined in the Spill Contingency Plan in Appendix 6B (see also *Accidents and Malfunctions* element 18.1 of this table). • Where shrubs are present prior to construction, use live plant staking (*e.g.,* willows) along the wetland to stabilize disturbances and reduce sedimentation risk to wetland (Detail 6A-38). [EGC 03-7]	• Same as above
8. VEGETATION				
8.1 Loss or alteration of native vegetation	Native prairie, bush/wooded areas, riparian areas and wetland areas See Tables 5.67 and 5.92 of the ESA for *WHPA* lands, PFRA lands and community pastures on Crown lands	Footprint	• The pipeline has been aligned to minimize the length and width of disturbance on areas supporting native vegetation. • Supplemental vegetation studies will be completed on lands along the route with native vegetation or bush areas that may support species of special conservation status prior to construction (see Section 9.0 of the ESA). • During supplemental field studies, follow measures in the Traffic Control Plan to minimize disturbance to native vegetation (Appendix 6C). Attempt to travel through areas of high sensitivity (*e.g.* native prairie) on foot. Restrict vehicle travel through native prairie and riparian areas to one pass along the right-of-way where practical. • Do not clear timber, stumps, brush and other vegetation beyond marked right-of-way boundaries. [EGC 02-4] • Ensure lands with native vegetation are seeded with a native seed mix. Avoid the use of highly invasive species on adjacent non-native lands. Use a native seed mix on roadside ditches adjacent to lands supporting native vegetation (Details 6A-46 to 6A-49).	• Alteration of approximately 390 ha of native vegetation, including 220 ha of native prairie.
8.2 Loss of vascular plant species of concern or significant vascular plant communities	Native prairie, bush/wooded areas, riparian areas and wetland areas See Tables 5.67 and 5.92 of the ESA for *WHPA* lands, PFRA lands and community pastures on Crown lands See Appendix 5D of the ESA	Footprint	• The proposed pipeline has been aligned to follow existing disturbances as much as possible and the right-of-way width kept to a minimum to minimize loss of potential habitat. • Avoid the sand-nut grass enclosure located on the north side of the existing Enbridge pipeline corridor from KP 196.7 to KP 197.8 (CNT 990025) by constructing the proposed pipeline adjacent to the south side of the corridor. • Additional field studies will be completed in the spring and summer of 2007 along segments of the route supporting native vegetation along major watercourse valleys and where unique features are encountered to identify locations of plant species or communities of concern (see Section 9.0 of the ESA). [EGC 01-5] • Implement one or more of the mitigative measures identified in Appendix 6B in the event of a discovery of vascular plant species of concern or rare plant communities of concern. [EGC 02-2]	• If mitigative measures do not completely protect the site, some loss or alteration of the local population may occur. • Transplanted or propagated specimens may not survive. • If the community cannot be avoided, then a narrow strip of the community will be disturbed resulting in some loss or alteration of the community.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
8.3 Alteration of vegetation important to wildlife				
8.3(a) general	Native prairie, bush/wooded areas, bush-pasture, pasture, riparian areas and wetland areas See Tables 5.67 and 5.92 of the ESA for *WHPA* lands, PFRA lands and community pastures on Crown lands	Footprint	• The pipeline has been aligned to minimize the length and width of disturbance on areas supporting vegetation important to wildlife. • Supplemental vegetation studies will be completed on lands along the route with native vegetation that may support species of special conservation status prior to construction (see Section 9.0 of the ESA). • Avoid or minimize the loss of important site-specific habitat by narrowing down the construction right-of-way through vegetation associations or habitat important for wildlife and implement measures from the Plant Species of Concern Discovery Contingency Plan (Appendix 6B), in conjunction with appropriate topsoil stripping procedures and seeding with suitable native seed mixes. [EGC 03-4] • Protect trees or shrubs adjacent to the right-of-way that are identified as being important to wildlife to prevent damage during construction. Protection measures include flagging, fencing, signing and/or covering roots within the dripline with a minimum of 75 cm of topsoil. [EGC 02-4] • Implement other reclamation techniques, such as natural recovery and seed bank salvage, if warranted, to restore ecological diversity and wildlife habitat capability as well as preserve rare or unique vegetation elements important to wildlife (Detail 6A-4).	• Alteration of approximately 607 ha of vegetation important to wildlife.
8.3(b) loss of thorny buffaloberry and other important shrubs/trees	KP 243.8 KP 500.3 KP 506.9 KP 517.2 KP 559.7 KP 564.6	Footprint	• Narrow down the construction right-of-way and temporary work space to preserve thorny buffaloberry and other important shrubs/trees (Detail 6A-1).	• No residual effect identified.
8.4 Revegetation of disturbed areas	Entire route	Footprint	• It is the responsibility of the landowner or occupant to seed and fertilize cultivated land segments of the right-of-way as part of their normal farming operations. Cultivated land refers to lands that are under annual crop or fallow at the time of construction. • Seed mixes have been developed for the Alberta Clipper pipeline route in consideration of site-specific environmental factors including steep slopes, riparian areas, native prairie and bush/wooded areas, and soil and moisture conditions (Details 6A-46 to 6A-49). [EGC 03-4] • Seed noncultivated disturbed areas as indicated on the Environmental Alignment Sheets as soon as weather and soil conditions permit following final clean-up [EGC 03-4]. • Follow reclamation measures outlined in Detail 6A-50 pertaining to sandy soils, including those soils within the Sounding Dunes, Elbow PFRA Community Pasture, Oak Lake Sand Hills and Souris Sand Hills. • Seed PFRA and community grazing co-op lands with the seed mix identified on the Environmental Alignment Sheets and in the PFRA Environmental Assessment Plans (see Appendix V of the ESA) unless otherwise requested by the pasture manager. • Implement appropriate reclamation measures as indicated on the Environmental Alignment Sheets to address site-specific conditions that may result in problems revegetating disturbed areas (*e.g.*, chipping slash and spreading over areas with very sandy soils; straw crimping on areas with high wind erosion potential or are otherwise difficult to revegetate; installation of diversion berms and ditches on slopes) (Details 6A-5, 6A-23 and 6A-45). [EGC 02-4, EGC 03-4] • Follow mitigative measures outlined in the Detailed Crossing Construction Plan for the South Saskatchewan River Valley to be undertaken by Enbridge prior to construction (see Section 9.0 of the ESA).	• Revegetation of some disturbed soils with high wind erosion potential may be difficult. See *Soil Capability* element 2.3(b) of this table. • Revegetation of soils within the Sounding Dunes, Elbow PFRA Community Pasture, Oak Lake Sand Hills and Souris Sand Hills may be difficult. See *Soil Capability* element 2.8 of this table. • Revegetation of soils saline to the surface may be difficult. See *Soil Capability* element 2.1(c) of this table.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
8.4 Revegetation of disturbed areas (cont'd)	Same as above	Same as above	• Restrict vehicle access over newly seeded areas. [EGC 03-4] • Monitor the effectiveness of revegetation efforts during post-construction monitoring of the right-of-way. Inspect moderate and steep slopes as well as areas with problem soils. Control weeds and reseed noncultivated lands until new vegetation is self-sustaining. Undertake additional remedial work where warranted.	• Same as above
8.5 Weed introduction				
8.5(a) general	Entire route	Footprint to Local	• A preconstruction weed survey will be completed along the route to identify noxious weed infestations (see Section 9.0 of the ESA). Contractors and Inspectors will be provided with information to help identify noxious weeds as part of the Environmental Training Program (see Section 8.0 of the ESA). [EGC 02-2] • Follow weed mitigation measures outlined in Detail 6A-6. • Flag areas identified as having noxious weed infestations prior to commencement of site preparation (*i.e.*, clearing, grading, topsoil stripping) activities. Remove noxious weed infestations (pick and remove to approved landfill location, or destroy with weed burners or herbicides) prior to commencement of right-of-way preparation activities. [EGC 02-2] • Clean all construction equipment prior to its arrival on site in order to minimize the spread of weeds. [EGC 02-2] • Minimize the construction equipment used and limit the number of passes equipment makes through weed infested areas. [EGC 02-2] • Place construction or swamp mats over infested areas to minimize construction equipment transporting weed or plant material, if practical. Where mats are used, ensure they are free of soil, vegetation and debris prior to removing from the site. [EGC 02-2] • Strip topsoil from the full right-of-way where localized weed infestation are encountered (use Environmental Alignment Sheets and Figure 6A-1 in Appendix 6A as guides) and contain the spoil pile containing noxious weeds to prevent mixing with the surrounding soil during regrading and final clean-up. [EGC 02-2] • Monitor topsoil piles for weed growth during the course of construction and implement corrective measures (*e.g.*, spraying) if warranted. • Clean equipment involved in clearing or topsoil handling activities in locations identified as having noxious weed infestations prior to moving to the next land parcel. Do not allow soil or water from cleaning equipment to flow to uninfested areas. [EGC 02-2] • Ensure straw and seed mixes used to revegetate disturbed areas are free of noxious weed seed. Use Certified Canada No. 1 or best available seed and retain the analysis certificate (Details 6A-45, 6A-46 and 6A-49). [EGC 03-4] • Record any sites where equipment was specifically cleaned due to concerns associated with weeds and monitor during the following growing season. Control growth of weeds as warranted (Detail 6A-6).	• Weed introduction and spread may occur.
8.5(b) registered seed growers	Locations identified during Terrace Phase I: KP 452.5 KP 819.8 to KP 822.2 KP 895.2	Footprint to Local	• Steam clean soils handling equipment prior to entry at these locations upon request of the landowner to minimize weed concerns regarding certified seed. • Strip the full right-of-way at the request of the landowner.	• Weed introduction and spread may occur.
8.6 Removal of ornamental trees, windbreaks or shelterbelts	Entire route	Footprint	• Save ornamental trees, wind breaks or shelterbelts to the extent practical if requested by the landowner (Detail 6A-2). [EGC 02-4] • Consider boring underneath these trees or replace them by transplanting with a tree spade if practical. [EGC 02-4]	• Ornamental trees, windbreaks or shelterbelts may be removed as a result of construction activities.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
8.6 Removal of ornamental trees, windbreaks or shelterbelts (cont'd)	Same as above	Same as above	• Narrow down the right-of-way if requested by the landowner and if practical (Detail 6A-1). • Protect ornamental or other important trees adjacent to the right-of-way from damage with flags, fencing, or signs, and if appropriate, by placing a minimum of 75 cm of topsoil covering the roots (Detail 6A-1). [EGC 02-4]	• Same as above
8.7 Loss of salvageable timber	Bush/wooded areas	Footprint	• Salvage and deck timber on privately owned lands where requested by the landowner. [EGC 02-4] • Do not bulldoze salvageable timber. If the owner of the timber rights does not want cleared timber, offer the timber to a commercial buyer. If a willing commercial buyer cannot be found, consider the timber nonmerchantable and dispose of it accordingly. [EGC 02-4].	• No residual effect identified.
9. WILDLIFE AND WILDLIFE HABITAT				
9.1 Loss or alteration of habitat				
9.1(a) general	Native prairie, bush/wooded, bush-pasture, pasture, shelterbelts	Entire route	• The pipeline has been aligned to minimize the length and width of disturbance on areas supporting vegetation important to wildlife. • Wildlife habitat field studies were conducted along selected segments of the route from KP 959.3 to KP 1245.2 in October 2006. Conduct additional wildlife studies in spring/early summer 2007 on segments of the Alberta Clipper route supporting native vegetation or pasture lands greater than 500 m in length to identify site-specific features associated with sensitive wildlife species in the vicinity of the Alberta Clipper pipeline route (see Section 9.0 of the ESA). • During supplemental field studies, follow measures in the Traffic Control Plan to minimize disturbance to native vegetation (Appendix 6C). Attempt to travel through areas of high sensitivity (*e.g.* native prairie) on foot. Restrict vehicle travel through native prairie and riparian areas to one pass along the right-of-way where practical. Avoid travel through wetlands. • If a tree to be cleared contains an active bird nest, or if a ground nest, burrow or den is discovered during clearing, suspend the work activity, fence or flag off the area, and contact the Environmental Inspector (see *Wildlife and Wildlife Habitat* element 9.1(b) of this table). [EGC 02-4] Implement the Wildlife Species of Concern Discovery Contingency Plan (Appendix 6B). • Notify the provincial Wildlife Biologists if construction will damage beaver ponds, dams and lodges, muskrat push-ups or other aquatic furbearer habitats, raptor nests, mineral licks or other evidence of special wildlife use in the area. [EGC 01-2] • Narrow down the construction right-of-way and temporary work space where nest sites or other critical site-specific habitats are encountered by the route to avoid habitat loss (Detail 6A-1). • At locations where narrowing down is not practical and the potential for loss of important habitat exists, implement measures to restore the lost habitat (*e.g.,* transplanting or planting of important shrubs, installing artificial nest boxes and platforms). [EGC 02-2] • Obtain approval from the applicable regulatory authority prior to beaver dam removal. • Restore preconstruction profile in wetlands during reclamation. • Reconstruct earthen islands, if encountered in wetlands. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to minimize interference with natural drainage. • Remove ramps and other vehicle crossing structures following construction in wetlands or sloughs with the potential for waterfowl production.	• Alteration of approximately 607 ha of potential wildlife habitat.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
9.1(a) general (cont'd)	Same as above	Same as above	• Revegetate disturbed noncultivated portions of the right-of-way along segments of the route with the appropriate native or agronomic seed mix as outlined in Detail 6A-46 and on the Environmental Alignment Sheets. • Follow mitigative measures outlined in the Detailed Crossing Construction Plan for the South Saskatchewan River Valley to be undertaken by Enbridge prior to construction (see Section 9.0 of the ESA). • Allow low-growing shrubs to re-establish along the right-of-way.	Same as above
9.1(b) disturbance of migratory bird nests	Noncultivated lands	Footprint	• No vegetation clearing or other construction activities involving heavy equipment are to occur within the migratory bird nesting period from April 1 to July 31. Construction activities may proceed within the nesting period where the area has been precleared or premowed prior to April 1 or with approval of Environment Canada. • In areas where preclearing/premowing activities have not been completed prior to April 1, a breeding bird survey will be undertaken by a qualified avian biologist prior to initiating the above noted activities within the migratory bird nesting period on segments of the route supporting native vegetation or pasture lands 500 m in length or greater, along valley slopes and at unique features. Environment Canada will review the proposed survey methods and results, and in the event that a nest is discovered, be consulted in the development of mitigation strategies. If adequate mitigative measures are not available, work in proximity to an active nest will be postponed until the nest is no longer active.	• No residual effect identified.
9.1(c) disturbance of DU projects	Farkas Project #3216 (approximately 500 m downstream of the Eyehill Creek crossing at KP 272.2) Houcher Lake and Provost South landscapes (KP 272.0 to KP 273.0) Chapleau Lakes Montmartre (KP 782.9 to KP 783.8) Wetland Projects at: KP 784.5 KP 819.6 to KP 820.4 KP 928.1 to KP 930.9 KP 938.0 to KP 938.8 Log Cabin (KP 1052.9 to KP 1053.7) Lizard Lake (KP 1174.3 to KP 1174.8)	Footprint	• No vegetation clearing or other construction activities involving heavy equipment are to occur within the migratory bird nesting period from April 1 to July 31. • Avoid disturbing constructed works (*e.g.*, dikes, ditches, dams, control structures, etc.) in wetlands maintained by DU. • Restore preconstruction profile in wetlands during reclamation. • Use pipeline and equipment crossing methods at Eyehill Creek that minimize sedimentation to avoid impacting the Farkas Project downstream of the crossing (see Table 6.3 of the ESA). • See additional measures in *Wetlands* element 7.1 and 7.2 of this table.	• Alteration of habitat within DU project areas. • See *Wildlife and Wildlife Habitat* element 9.1(a) of this table.
9.1(d) disturbance of CAs and NAWMP priority areas	Kozak and Rouire CA (NW 34-7-19 WPM) Cunningham CA (SW 36-7-19 WPM) NAWMP priority areas (KP 959.8 to KP 977; KP 1052.0 to KP 1063.0)	Footprint	• No vegetation clearing or other construction activities involving heavy equipment are to occur within the migratory bird nesting period from April 1 to July 31. • Develop site-specific mitigative measures in consultation with the Manitoba Habitat Heritage Corporation to minimize impacts to CAs along the route. • Develop site-specific mitigative measures in consultation with the Manitoba Habitat Heritage Corporation and Canadian Wildlife Service to minimize impacts to NAWMP priority areas along the route. • Restore preconstruction profile in wetlands during reclamation. See additional measures in *Wetlands* element 7.1 and 7.2 of this table.	• Alteration of habitat within CAs and NAWMP priority areas. • See *Wildlife and Wildlife Habitat* element 9.1(a) of this table.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
9.1(e) disturbance of PFRA Community Pastures, Kendal Game Preserve lands, *WHPA* lands, and Fish and Wildlife Development Fund areas	See Tables 5.67 and 5.92 of the ESA	Footprint	• Conduct wildlife studies in spring/early summer 2007 on segments of the Alberta Clipper route supporting native vegetation or pasture lands greater than 500 m in length to identify site-specific features associated with sensitive wildlife species in the vicinity of the Alberta Clipper pipeline route (see Section 9.0 of the ESA). • No vegetation clearing or other construction activities involving heavy equipment are to occur within the migratory bird nesting period from April 1 to July 31. • Adhere to restrictions on construction activities for identified sensitive wildlife species (Table 6.4) where the Kendal Game Preserve, *WHPA* lands and Fish and Wildlife Development Fund areas are encountered, unless otherwise approved by SENV Wildlife Biologists and federal wildlife authorities. • Develop site-specific mitigative measures in consultation with PFRA authorities to minimize impacts to wildlife habitat in community pastures along the route.	• Alteration of habitat within PFRA community pastures, Kendal Game Preserve, *WHPA* lands, and Fish and Wildlife Development Fund areas. • See *Wildlife and Wildlife Habitat* element 9.1(a) of this table.
9.2 Sensory disturbance of wildlife				
9.2(a) general	Entire route	Footprint to Local	• Conduct additional wildlife studies in spring/early summer 2007 on segments of the route supporting native vegetation or pasture lands greater than 500 m in length to identify site-specific features associated with sensitive wildlife species in the vicinity of the Alberta Clipper pipeline route (see Section 9.0 of the ESA). • Adhere to restrictions on construction activities for identified sensitive wildlife species as outlined in Table 6.4 unless otherwise approved by provincial and federal wildlife authorities. • Prohibit construction personnel from harming, harassing or feeding wildlife or livestock. Do not allow pets, firearms or recreational use of all-terrain vehicles or snowmobiles on the right-of-way. [EGC 02-2] • Educate the workforce by means of compulsory orientations, which will include environmental requirements, prior to starting work on the site. • Work expeditiously to maintain a tight construction spread (*i.e.,* limit interval between front end work activities such as grading and back end activities such as clean-up) to minimize potential barriers and hazards to wildlife.	• Displacement of wildlife away from the right-of-way during construction with resultant use of potentially suboptimal habitat during noncritical periods.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
9.2(b) disturbance to migratory birds and waterfowl	Entire route Houcher Lake and Provost South landscapes DU Project (KP 272.0 to KP 273.0) Cosine Lake Migratory Bird Concentration Site (KP 278.6 to KP 279.4) Chapleau Lakes Montmartre DU Project (KP 782.9 to KP 783.8) Kendal Game Preserve (KP 781.9 to KP 784.6) DU Wetland Projects (KP 784.5; KP 819.6 to KP 820.4; KP 928.1 to KP 930.9; KP 938 to KP 938.8) Game Bird Refuge (KP 985.0 to KP 990.0) Oak Lake/Plum Lakes Important Bird Area (KP 987.0 to KP 1004.0) Log Cabin DU Project (KP 1052.9 to KP 1053.7) Kozak and Rouire CA (NW 34-7-19 WPM) Cunningham CA (SW 36-7-19 WPM) Lizard Lake DU Project (KP 1174.3 to KP 1174.8) NAWMP priority areas (KP 959.8 to KP 977.0; KP 1052.0 to KP 1063.0) Sandhill crane staging area (KP 297.0 to KP 298.4) See Tables 5.67 and 5.92 of the ESA for locations of *WHPA* lands encountered by the route. See Tables 5.66, 5.71, 5.74 and 5.75 of the ESA for additional locations of nesting migratory birds observed during CEP, Terrace Phases I and II.	Footprint to Local	• Avoid construction within the April 1 to July 31 peak nesting period along segments of the route that traverse lands associated with bird use (*i.e.*, refuges, DU projects, CAs, NAWMP priority areas, *WHPA* lands) as well as large wetlands (Table 6.5 of the ESA) or areas with a high density of small potholes with habitat suitable for waterfowl production, unless otherwise approved by provincial and federal wildlife authorities. • If construction cannot be completed outside of April 1 to July 31, preclear and premow the right-of-way prior to April 1 to discourage nesting. If preclearing and premowing are not practical, complete a nesting bird survey prior to construction to identify nest locations along the right-of-way. Postpone construction activities in the vicinity of nest locations on the right-of-way until nestlings have fledged. • For Cosine Lake Migratory Bird Concentration Site, maintain a 250 m buffer from the perimeter of the water body, portion thereof or nesting colony for low, medium and high intensity activities during periods of peak use (*i.e.,* from May 1 to October 15). • Avoid construction along the sandhill crane staging area (KP 297.0 to KP 298.4) when birds are congregated on wetland and fields adjacent to the route in spring and fall. • See additional measures in *Wildlife and Wildlife Habitat* element 9.2(a) of this table.	• Displacement of wildlife away from the Alberta Clipper pipeline area during construction with resultant use of potentially suboptimal habitat during noncritical periods.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
9.2(c) disturbance of sharp-tailed grouse	Wildlife Key Area: KP 212.4 to KP 213.4 KP 225.1 to KP 225.6 KP 226.5 to KP 227.5 Leks noted during Enbridge CEP, Terrace Phases I and II: KP 324.6 to KP 332.2 KP 328.1 to KP 336.8 KP 505.0 to KP 507.1 KP 507.9 KP 511.3 to KP 511.6 KP 560.4 KP 566.0 to KP 567.5 KP 597.0 KP 627.5 KP 648.9 to KP 649.5 KP 662.5 to KP 664.0 KP 663.3 KP 782.0 KP 908.2 Critical Habitat: KP 324.8 to KP 326.0 KP 328.2 to KP 331.3 KP 331.5 to KP 333.1 KP 506.0 to KP 507.2 KP 507.5 to KP 508.3 KP 511.3 to KP 512.2 KP 563.3 to KP 567.3 KP 566.0 to KP 567.6 KP 586.3 to KP 587.5 KP 662.5 to KP 664.0 KP 781.7 to KP 784.2 KP 906.9 to KP 909.4 KP 940.1 to KP 945.0	Footprint to Local	• In Alberta, a year round RAP exists within 500 m of a lek (Table 6.4 of the ESA). Should any leks be identified within 500 m of the proposed route during supplemental surveys, consult with provincial wildlife authorities to determine appropriate mitigative measures. • In Saskatchewan, schedule construction within 400 m of a lek to avoid sensitive spring use period of dancing grounds (March 15 to May 15) unless otherwise approved by provincial and federal wildlife authorities. • See additional measures in *Wildlife and Wildlife Habitat* element 9.2(a) of this table.	• Displacement of sharp-tailed grouse from lek sites or nesting grounds near the Alberta Clipper pipeline route during construction with resultant use of potentially suboptimal habitat during noncritical periods.
9.2(c) disturbance of ungulates	KP 176.0 to KP 185.6 KP 218.7 to KP 230.0	Footprint to Local	• A winter RAP from January to March may apply to ungulate habitat along the proposed route in Alberta depending on the severity of winter conditions. Consult with provincial wildlife authorities to determine appropriate mitigative measures.	• Displacement of ungulates near the Alberta Clipper pipeline route during winter construction with resultant use of potentially suboptimal habitat during noncritical periods.
9.3 Direct and indirect mortality	Entire route	Footprint to Region	• Conduct additional wildlife studies in spring/early summer 2007 on segments of the route supporting native vegetation or pasture lands greater than 500 m in length to identify site-specific features associated with sensitive wildlife species in the vicinity of the Alberta Clipper pipeline (see Section 9.0 of the ESA). • Establish construction traffic speed limits and post speed limits on access roads to reduce the risk of collisions with wildlife (see Traffic Control Plan, Appendix 6C). • Minimize construction vehicles traveling to and from worksite (*e.g.,* use multi-passenger vehicles to transport workers).	• Potential for vehicle/wildlife collisions on access roads and along the right-of-way during construction. • Potential for mortality due to the physical disturbance of undiscovered nests, burrows, dens or other localized habitat on the right-of-way.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
9.3 Direct and indirect mortality (cont'd)	Same as above	Same as above	• Report any incidents or collisions with wildlife to the Environmental Inspector, who will notify local wildlife authorities and the police as appropriate (see Wildlife Encounter Contingency Plan in Appendix 6B). [EGC 02-2] • Remove trapped animals from the trench at the start of each day before conducting construction activities that may have the potential to harm an animal in the trench. • Remove shrub and tree vegetation, and mow grass from construction right-of-way prior to the nesting season (*i.e.*, before April 1) to discourage nesting along the right-of-way. • Collect construction garbage daily and dispose of in approved locations to prevent attracting nuisance wildlife. Do not dispose of waste in the trench. [EGC 02-2] Report scavenging or dangerous wildlife along with the location and details to regional wildlife authorities and, if appropriate, the local police department.	• Same as above
9.4 Blockage of antelope movement during operations	KP 268.7 to KPR 12	Footprint to Local	• If approved by the landowner, string the bottom fence wire at these locations no less than 40 cm above the ground to permit antelope passage. Elsewhere, string bottom wire at same elevation as adjacent fencing.	• No residual effect identified.
10. SPECIES AT RISK				
10.1 Loss or alteration of riparian habitat for fish species at risk	Watercourse crossings	Footprint to Local	• Fish population and aquatic habitat inventories were conducted at watercourse crossings along the route for CEP, Terrace Phases I and II, and in October 2006 along the Alberta Clipper pipeline route from KP 959.3 to KP 1245.2. [EGC 01-5] No fish species at risk have been found in watercourses along the pipeline route during past surveys. • Supplemental field studies may be required to determine the presence of fish species at risk and critical aquatic habitat prior to construction (see Section 9.0 of the ESA). In the event that fish species at risk are identified during supplemental field work, implement contingency measures identified in Appendix 6B.	• Potential fish species at risk may be affected by increased suspended solid concentration and habitat alteration within the zone of influence at select watercourse crossings.
10.2 Loss or alteration of vascular plant species at risk	Native vegetation area	Footprint	• The proposed pipeline has been aligned to follow existing disturbances as much as possible and the right-of-way width kept to a minimum to minimize loss of potential habitat. • No vascular plant species at risk have been identified along the proposed route during past vegetation surveys for CEP, Terrace Phases I and II. • Additional field studies will be completed in the spring and summer of 2007 along segments of the route supporting native vegetation along major watercourse valleys and where unique features are encountered to identify locations of vascular plant species at risk (see Section 9.0 of the ESA). [EGC 01-5] • Implement one or more of the mitigative measures identified in Appendix 6B in the event of a discovery of a plant species at risk. [EGC 02-2]	• If mitigative measures do not completely protect the site, some loss or alteration of the local plant species at risk population may occur.
10.3 Wildlife Species at Risk				
10.3(a) loss or alteration of site-specific habitat used by wildlife species at risk	Native prairie, bush/wooded, bush-pasture, pasture, shelterbelts	Footprint to Local	• The proposed pipeline has been aligned to follow existing disturbances as much as possible and the right-of-way width kept to a minimum to minimize loss of potential habitat. • Abide by construction timing and setback constraints applied to sensitive habitats for species with special conservation status (Table 6.4) unless otherwise approved by provincial and federal wildlife authorities. [EGC 01-3] • Field studies were completed prior construction of CEP, Terrace Phases I and II along the Alberta Clipper route and in select locations in October 2006 from KP 959.3 to KP 1245.2. • Refer to mitigative measures presented under *Wildlife and Wildlife Habitat* element 9.1(a) of this table.	• Alteration of potential habitat supporting wildlife species at risk. • See *Wildlife and Wildlife Habitat* element 9.1 of this table.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
10.3(a) loss or alteration of site-specific habitat used by wildlife species at risk (cont'd)	Same as above	Same as above	• Supplemental field studies will be completed in spring 2007 and, where warranted, prior to construction to determine the presence of any habitat use by species at risk. These studies will also verify whether the habitat features used by species at risk during the previous field investigations are currently providing habitat to species at risk (see Section 9.0 of the ESA). [EGC 01-5] • Narrow down and fence off the construction right-of-way and temporary work space to preserve thorny buffaloberry, willows or other shrubby habitat where loggerhead shrike nesting habitat is observed (Detail 6A-1). • Transplant willow or thorny buffaloberry shrubs that provide loggerhead shrike habitat, if they cannot be avoided by narrowing down and fencing off the construction right-of-way and temporary work space, as much as feasible. • Implement one or more of the mitigative measures identified in Appendix 6B in the event that a wildlife species of concern or critical habitat is discovered during either supplemental field studies or construction. [EGC 01-5]	• Same as above
10.3(b) auditory or visual disturbances of wildlife species at risk	Entire route KP 213.1 to KP 215.0 [LOSH][2] KP 235.6 to KP 236.9 [LOSH][2] KP 243.7 to KP 244.6 [LOSH][2] KP 293.7 [LOSH][2] KP 324.7 (20 m S) [BUOW][2] KP 325.2 (400 m S) [BUOW][2] KP 345.3 (<500 m) [BUOW][2] KP 383.3 (50 m S) [LOSH][2] KP 385.0 (<500 m) [BUOW][2] KP 390.3 [LOSH][2] KP 390.5 [LOSH][2] KP 411.1 (<500 m) [BUOW][2] KP 427.0 [BUOW][2] KP 428.0 (< 500 m) [BUOW][2] KP 431.2 (<500 m) [BUOW][2] KP 438.7 (460 m NE) [BUOW][2] KP 441.8 (410 m NE) [BUOW][2] KP 493.3 (<500 m) [BUOW][2] KP 553.1 to KP 553.7 [LOSH][2] KP 568.7 (<500 m) [BUOW][2] KP 605.7 to KP 606.1 [LOSH][2] KP 612.8 (>200 m S) [LOSH][2] KP 621.8 (15 m S) [LOSH][2] KP 626.4 (225 m S) [LOSH][2] KPR 4.4 (<500 m) [BUOW][2] KPR 15.0 (<500 m) [BUOW][2] KPR 19.5 (<500 m) [BUOW][2] KP 1131.6 (<50 m) [NLFR][2] KP 1196.6 (75 m S) [NLFR][2] See Table 5.72 for BUOW[2] nest boxes installed near the route during the Enbridge CEP.	Footprint to Local	• Abide by construction timing and setback constraints applied to sensitive habitats for species with special conservation status (Table 6.4) unless otherwise approved by provincial and federal wildlife authorities. [EGC 01-3] • Supplemental field studies will be completed in spring 2007 and, where warranted, prior to construction to determine the presence of species at risk within 500 m of the pipeline route (see Section 9.0 of the ESA). • Implement one or more of the mitigative measures identified in Appendix 6B in the event that a wildlife species of concern or critical habitat is discovered during either supplemental field studies or construction. [EGC 01-5] • Refer to mitigative measures presented under *Wildlife and Wildlife Habitat* element 9.2 and *Species at* Risk element 10.3(a) of this table.	• Displacement of wildlife species at risk away from the Alberta Clipper pipeline area during construction. • See *Wildlife and Wildlife Habitat* element 9.2 of this table.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
10.3(c) mortality of wildlife species at risk	Entire route	Footprint to Region	• Implement one or more of the mitigative measures identified in Appendix 6B in the event that a wildlife species of concern or critical habitat is discovered during either supplemental field studies or construction. [EGC 01-5] • Refer to mitigative measures presented under *Wildlife and Wildlife Habitat* element 9.3 of this table.	• Wildlife mortality rates may increase during construction as a result of wildlife-vehicle collisions. • There is potential for disturbance of hibernating amphibians or reptiles if riparian, wetland and aquatic habitats cannot be protected by mitigation. • See *Wildlife and Wildlife Habitat* element 9.3 of this table.
10.3(d) combined effects on northern leopard frog	Habitat identified in 1998: KP 655.0 to KP 656.0 KP 988.0 to KP 993.0 Souris River (KP 1073.4) Cypress River (KP 1131.6) Northern leopard frogs occurring on construction right-of-way during Terrace Phase I: KP 988.0 to KP 993.0 Souris River (KP 1073.4) Observations during October 2006 field studies: Oak Creek (KP 1087.0) Cypress River (KP 1131.6) Buffalo Creek (KP 1227.4)	Local, Regional	• Abide by construction timing and setback constraints applied to sensitive habitats for species with special conservation status (Table 6.4 of the ESA) unless otherwise approved by provincial and federal wildlife authorities. [EGC 01-3] • Field studies were completed in 1998 prior construction of Terrace Phase I and in select locations in October 2006 for the Alberta Clipper pipeline from KP 959.3 to KP 1245.2. • Supplemental field studies will be completed for amphibians and their habitat in spring/summer 2007(see Section 9.0 of the ESA). All locations along the route where northern leopard frogs or their habitat are identified will be noted on the Environmental Alignment Sheets and appropriate mitigation employed. • Implement one or more of the mitigative measures identified in Appendix 6B in the event that northern leopard frogs and/or their habitat are discovered along the route during supplemental field studies or during construction. [EGC 01-5]	• Alteration of wetland and riparian habitat as well as sensory disturbance and potential mortality during construction if mitigative measures cannot protect northern leopard frogs.
10.3(e) combined effects on loggerhead shrike, long-billed curlew and burrowing owl	Habitat identified along route during CEP, Terrace Phases I and II preconstruction surveys and construction activities: KP 293.7 [LOSH][2] KP 390.3 [LOSH][2] KP 560.4 to KP 566.3 [LBCU][2] KP 621.8 [LOSH][2] For burrowing owls identified within setback to route during previous surveys see 10.3(b) of this table	Footprint to Local	• Abide by construction timing and setback constraints applied to sensitive habitats for species with special conservation status (Table 6.4 of the ESA) unless otherwise approved by provincial and federal wildlife authorities. [EGC 01-3] • Field studies were completed prior construction of CEP, Terrace Phases I and II along the Alberta Clipper route and in select locations in October 2006 from KP 959.3 to KP 1245.2. • Supplemental field studies will be completed for birds and their habitat in spring/summer 2007 (see Section 9.0 of the ESA). All locations along the route where loggerhead shrike, long-billed curlew and burrowing owl or their habitat are identified will be noted on the Environmental Alignment Sheets and appropriate mitigation employed. • Implement one or more of the mitigative measures identified in Appendix 6B in the event that loggerhead shrikes, long-billed curlew or burrowing owls or their habitat are discovered during either supplemental field studies or construction. [EGC 01-5]	• Alteration of native prairie habitat as well as sensory disturbance and potential mortality during construction if mitigative measures cannot protect loggerhead shrikes, long-billed curlews and burrowing owls.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
11. HUMAN OCCUPANCY AND RESOURCE USE				
11.1 Resource Use				
11.1(a) general	Entire route	Footprint to Local	• The pipe will be buried with an adequate depth of cover to allow traffic associated with current land use to cross the right-of-way during normal conditions.	• No residual effect identified.
11.1(b) disruption of ranching operations during construction	Native prairie, pasture and bush-pasture	Footprint to Local	• Schedule construction activities to avoid peak livestock grazing periods where feasible. • Notify landowners of the proposed construction schedule so livestock can be shifted to adjacent fields. [EGC 01-2] • Incorporate landowners' special requests into the construction procedures, as indicated on the Line List. [EGC 01-3] • Narrow work space to avoid encroaching on dugouts, if requested by the landowner (*e.g.*, KP 1050.2) (Detail 6A-1). • Confine construction equipment and vehicles to the designated construction right-of-way, temporary workspace, existing public roads and approved temporary access roads (see Traffic Control Plan in Appendix 6C). [EGC 02-2] • Brace fences prior to cutting to maintain the tension in the rest of the fence. [EGC 02-9] • Install temporary gates and fencing prior to construction, if requested by the landowner, to prevent livestock from entering or leaving the property and from entering or accidentally falling into the trench. [EGC 02-4, EGC 02-9] • Dismantle and carefully store any unique fences for later reassembly. [EGC 02-4, EGC 02-9] • Replace fences with equal or better quality materials during clean-up. [EGC 02-9] • Maintain and keep closed all gates and fences. • Leave gaps in welded pipe, topsoil windrows, spoil piles and snow piles (if present) at intervals requested by landowner to permit movement of livestock across the right-of-way. • Install trench plugs and leave corresponding gaps in the spoil pile to permit movement of livestock to watering and feeding areas, where warranted. • Make arrangements with the landowner to provide temporary water supply on pasture lands where livestock are located if the livestock are reluctant to cross the right-of-way. • Leave 5 m to 6 m wide gaps in temporary fencing erected following construction at cattle and game trails. • Employ weed control measures listed in *Vegetation* element 8.5 of this table. • Seed disturbed lands used for grazing with the appropriate seed mix as outlined on the Environmental Alignment Sheets and in Detail 6A-46.	• Disruption of ranching operations may occur during construction.
11.1(c) disruption of farming activities during construction	Cultivated and hay lands	Footprint to Local	• Inform landowners of the route location and construction schedule. [EGC 01-2] Attempt to avoid peak activity periods where feasible. [EGC 01-3] • Incorporate landowners' special requests into the construction procedures, as indicated on the Line List. [EGC 01-3] • Conduct a preconstruction survey and narrow the temporary workspace, if warranted, to avoid encroaching on farmsteads, residences, granaries or sheds. • Delay final staking until immediately prior to construction. [EGC 02-3] • Leave breaks in topsoil windrow and spoil piles, welded pipe and snow piles (if present) where requested to permit landowners' equipment to cross the right-of-way. • Compensate landowners if disruption of farming activities or crop loss occurs. • Confine construction equipment and vehicles to the designated construction right-of-way, temporary workspace, existing public roads and approved temporary access roads (see Traffic Control Plan in Appendix 6C). [EGC 02-2] • Complete clean-up as soon as practical to minimize disturbance on farming operations.	• Disruption of farming activities may occur during pipeline construction.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
11.1(d) disruption of grazing on PFRA / community pasture lands and grazing leases	Grazing Leases: KP 182.3 to KP 183.6 KP 195.9 to KP 196.8 KP 196.8 to KP 197.7 KP 220.4 to KP 220.6 KP 224.3 to KP 225.2 KP 225.2 to KP 225.5 KP 227.0 to KP 227.1 Progress PFRA (KP 324.6 to KP 331.2; (KP 331.6 to KP 332.2) Mariposa PFRA (KP 347.2 to KP 348.9) Macrorie Grazing Co-op (KP 503.3 to KP 506.3) Elbow PFRA (KP 560.4 to KP 566.3) Community pasture (KP 585.1) Dry Creek Grazing Co-op (KP 587.3 to KP 590.8) Willow Bluff Grazing Co-op (KP 596.2 to KP 598.2)	Footprint to Local	• See *Human Occupancy and Resource Use* element 11.1(b). • Limit the construction period (stringing through backfilling) on intensely grazed areas, if requested by the landowner. • Install Texas gates at access points to the PRFA pastures, if requested by the PFRA manager. • On PFRA lands, fence work area unless otherwise directed by the PFRA manager. • An Environmental Assessment Plan for each PFRA community pasture traversed by the Alberta Clipper Project is provided in Appendix V of the ESA.	• Disruption of grazing activities may occur during pipeline construction on PFRA / community pasture lands or grazing leases.
11.1(e) pivot irrigated lands	Locations identified during Terrace Phase I and CEP and during fall 2006 overflight: KP 511.4 to KP 513.0 KP 513.3 to KP 514.3 KP 514.9 to KP 517.1 KP 660.1 to KP 661.9 KP 1088.3 to KP 1088.7 KP 1089.9 to KP 1090.7 KP 1092.4 to KP 1093.2	Footprint to Local	• Schedule construction to avoid the irrigation season if practical. • Refer to Detail 6A-9 for detailed mitigation measures for irrigated lands.	• Disruption of irrigation activities may occur during pipeline construction.
11.1(f) flood irrigated lands	Locations identified during Terrace Phase I and CEP: KP 509.7 to KP 510.5 KP 510.5 to KP 511.3 KP 513.0 to KP 513.3 KP 514.3 to KP 514.9 KP 654.4 to KP 654.8 Additional location identified by Saskatchewan Watershed Authority: KP 301.2 to KP 301.5	Footprint to Local	• Schedule construction to avoid the irrigation season if practical. • Refer to Detail 6A-9 for detailed mitigation measures for irrigated lands.	• Disruption of irrigation activities may occur during pipeline construction.
11.1(g) disruption of forestry and other natural resources extraction, and industrial use during construction	Entire route	Footprint to Local	• No adverse impacts are expected on resource extraction such as forestry, coal or other industrial operations. • Refer to *Physical Environment* element 1.5 of this table regarding contaminated soils if encountered at landfill site at KP 365.4 and KP 1245.1.	• No residual effect identified.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
11.1(h) disturbance of aggregate resources	KP 213.7 to KP 215.1 KP 595.6 to KP 596.1 KP 760.5 to KP 760.9 KP 763.9 KP 942.5 to KP 942.9 KP 1193	Footprint	• Narrow down temporary workspace and minimize area of disturbance. • From KP 595.6 to KP 596.1, narrow down temporary workspace and consult with pit operator.	• No residual effect identified.
11.1(i) disruption of hunting activities during construction	Entire route	Local	• Contact landowners and hunting guides prior to construction and provide maps and schedules of the proposed construction activities to enable them to select alternate areas of activity. • Place an announcement in local papers to notify hunters and guides of the location and timing of construction if scheduled during autumn. • No impacts on trapping activities are expected since there are no registered traplines located along the route.	• Local hunters and guide outfitters may experience some minor disturbance of their activities during pipeline construction.
11.1(j) interference with navigation on watercourses during construction	Eagle Creek (KP 393.6, KP 425.9) South Saskatchewan River (KP 505.2 to KP 506.1) Qu'Appelle River (KP 657.0) Wascana Creek (KPR 45.5) Chapleau Lakes (KP 783.3) Souris River (KP 1073.4)	Footprint to Local	• Enbridge is requesting a determination of navigability of watercourses not included in past projects along the Alberta Clipper route (*e.g.,* CEP, Terrace Phases I and II). • Schedule construction activities at waterways deemed navigable by Transport Canada during fall and winter, if feasible. • Obtain Navigable Waters approval from Transport Canada if an instream construction method is used or temporary bridge is installed for construction access. • Follow all conditions of Navigable Waters Approval and, at a minimum, implement the following measures: – notify the public of the hazards associated with water crossing construction and the schedule for crossing construction; – place warning signs up and downstream of the crossing. Signs are to be legible at a distance of 100 m; and – where warranted, place signs at boat launches, place notices in local and regional newspapers and on radio programs, place lights on banks and assign picket boats with bull horns. • The navigability of the watercourses deemed navigable will not be affected by the Alberta Clipper pipeline during operations since the pipeline will be buried under the watercourse and the temporary bridges, if used during construction, will be installed with an approved amount of freeboard and will be removed as per approval conditions.	• The navigability of watercourses deemed a navigable waterway may be affected during pipeline construction.
11.1(k) alteration of surface water supply and quality for downstream water users	see Tables 5.27 and 5.28 of the ESA	Footprint to Regional	• Notify water users up to 2 km downstream of the crossing a minimum of 10 days prior to instream activity at water crossings and withdrawal or discharge of hydrostatic test water. • Refer to *Water Quality and Quantity* element 3.10 of this table.	• No residual effect identified.
11.1(l) alteration of well water flow and quality	Entire route	Footprint	• Normal pipeline construction methods *(i.e.,* trenching) are not anticipated to affect any water wells identified in the vicinity of the Alberta Clipper pipeline route. • Monitor all registered or known water wells within 200 m of any blasting before and after blasting. Provide alternate water supply, if warranted, where well monitoring indicates that a reduction in water quality or quantity has occurred due to blasting.	• See *Water Quality and Quantity* element 3.9(a) of this table.
11.1(m) disturbance of golf course	Kerrobert Golf Course (KP 341.7 to KP 341.9) Kemoca Regional Park Golf Course (KP 792.3 to KP 792.7) Minnewasta Golf & Country Club (KP 1196.8 to KP 1197.0)	Footprint	• Prepare a detailed Urban Construction Plan for the golf course to address right-of-way and temporary workspace, the construction period, the workday hours, soils handling, fencing and other safety measures, reclamation measures and other special requests of the facility (see Section 9.0 of the ESA). • Postpone construction across the golf course until after fall closure, if practical. • Minimize temporary workspace and narrow down area of disturbance.	• Disruption of golfing activities may occur during pipeline construction.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
11.1(n) disturbance of Kemoca Regional Park	Kemoca Regional Park (KP 791.5 to KP 791.8; KP 792.3 to KP 792.7)	Footprint	• Prepare a detailed Urban Construction Plan for the park to address right-of-way and temporary workspace, the construction period, the workday hours, soils handling, fencing and other safety measures, reclamation measures and other special requests of the facility (see Section 9.0 of the ESA). • Schedule construction through the Kemoca Regional Park during the fall or winter, if practical.	• Disruption of recreational activities at Kemoca Regional Park may occur during pipeline construction.
11.1(o) disturbance of environmentally significant area	Sounding-Sunken (KP 217.4 to KP 230.9)	Footprint	• The proposed route follows existing linear disturbances for 100% of its length through the Sounding-Sunken Environmentally Significant Area. • Plant and wildlife field studies will be completed in the spring and summer of 2007 along segments of the route within the environmentally significant area supporting native vegetation, along major watercourse valleys and where unique features are encountered to identify locations of plant species or communities at risk (see Section 9.0 of the ESA). • Implement one or more of the mitigative measures identified in Appendix 6B in the event that a plant species at risk or wildlife species of concern or critical habitat is discovered during either supplemental field studies or construction. [EGC 01-5] • Seed noncultivated disturbed areas with the appropriate native or agronomic seed mix as indicated on the Environmental Alignment Sheets as soon as weather and soil conditions permit following final clean-up [EGC 03-4]. • Implement appropriate reclamation measures as indicated on the Environmental Alignment Sheets to address site-specific conditions that may result in problems revegetating disturbed areas (*e.g.,* chipping slash and spreading over areas with very sandy soils; straw crimping on areas with high wind erosion potential or are otherwise difficult to revegetate; installation of diversion berms and ditches on slopes) (Details 6A-5, 6A-23 and 6A-45). [EGC 02-4, EGC 03-4]	• Alteration of lands along the proposed route within the Sounding-Sunken Environmentally Significant Area will occur.
11.1(p) disturbance of *WHPA* lands	see Tables 5.67 and 5.92 of the ESA	Footprint	• See *Vegetation* element 8.1 and 8.3(a) of this table. • See *Wildlife and Wildlife Habitat* element 9.1(e) of this table.	• See *Vegetation* element 8.1 and 8.3(a) of this table. • See *Wildlife and Wildlife Habitat* element 9.1(e) of this table.
11.2 Human Occupancy				
11.2(a) disturbance of nearby residents and yards during construction	Entire route	Footprint	• Protect public safety near populated areas (*e.g.,* residences, Vibank, Fairlight, Schazenfeld, Nesbitt, Chortitz, Gretna) by controlling public access. See measures identified for disturbance or encroachment on urban areas element 11.2(b) of this table. Safety measures in these areas include: – fencing off all road and trail entrances to the worksite to avoid potential interactions with local traffic and pedestrians; – posting warning signs at approaches to the construction site from both directions; – keeping the construction spread tight (*i.e.*, minimizing length between trenching and backfilling activities) in close proximity to residences and communities to limit the duration of open trench, as much as practical; – allowing space for safe crossing by pedestrians and cyclists; and – implement 24-hr security, where warranted. • Contractor is to develop a Public Traffic Control Plan and implement measures to ensure public safety at road and highway crossings. [EGC 02-2] • See *Greenhouse Gases* and *Air Quality* element 4.2-4.4 and *Acoustic Environment* element 5.1 of this table for measures pertaining to nuisance air and noise emissions, respectively. • See *Vegetation* element 8.6 of this table for measures regarding ornamental trees, wind breaks and shelterbelts.	• See *GHG* and *Air Quality* element 4.2-4.4 and *Acoustic Environment* element 5.1 of this table. • See *Vegetation* element 8.6 of this table.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
11.2(b) disturbance or encroachment on urban areas	Town of Dodsland (KP 366.5 to KP 368.2) Village of Montmartre (KP 790.6 to KP 791.6) Village of Maryfield (KP 936.0 to KP 937.4) Town of Morden (KP 1195.1 to KP 1198.0)	Footprint to Local	• Prepare a detailed Urban Construction Plan for the urban area to address right-of-way and temporary workspace, the construction period, the workday hours, soils handling, fencing and other safety measures, reclamation measures and other special requests of the facility (see Section 9.0 of the ESA). The following measures will, where appropriate, form part of the Urban Construction Plan. – fencing off all road and trail entrances to the worksite to avoid potential interactions with local traffic and pedestrians; – posting warning signs at approaches to the construction site from both directions; – considering the use of small diameter or landscaping equipment where workspace is restricted; – removing topsoil and subsoil and store at a remote location if there is limited storage space – salvaging trees and shrubs, where encountered, for replanting or plant nursery stock; – keeping the construction spread tight (*i.e.*, minimizing length between trenching and backfilling activities) in close proximity to residences and communities to limit the duration of open trench, as much as practical; – allowing space for safe crossing by pedestrians and cyclists; and – implement 24-hr security, where warranted.	• See *Greenhouse Gases and Air Quality* element 4.2-4.4 and *Acoustic Environment* element 5.1 of this table.
11.2(c) encroachment on farmsteads, residences, granaries, sheds or dugouts	Entire route	Footprint	• Conduct a pre-construction survey and narrow down the temporary workspace if warranted or requested, to avoid encroaching upon farmsteads, residences, granaries, sheds or dugouts.	• No residual effect identified.
11.2(d) potential alteration of recreational experience during construction	Entire route	Footprint to Local	• Provide ASRD, SENV, Manitoba Conservation with proposed construction schedule and Alberta Clipper pipeline route maps, and install signs at recreational access points notifying users of construction activities in the vicinity. • Place notices to hunters in local newspapers indicating the route and proposed construction schedule along route segments scheduled for fall construction.	• A decrease in the quality of the outdoor recreation experience may occur at select locations during pipeline construction.
12. HERITAGE RESOURCES				
12.1 Disturbance of identified surface heritage resource sites prior to construction	FcOq 15 and FcOq 16 at Ribstone Creek crossing (KP 213.9) KP 511.4 to KP 511.5 (Historic Indian Reserve) See Tables 5.94 and 5.95 of the ESA for locations along the segments of the route in Saskatchewan and Manitoba	Footprint	• The route generally follows existing linear disturbances (*i.e.*, Enbridge pipeline corridor), thereby minimizing the potential for encountering historical resources. • Past HRIAs for Terrace Phases I and II identified several sites on or adjacent to the route. • An investigation of known sites in proximity to the proposed pipeline route will be undertaken (see Section 9.0 of the ESA). Implement appropriate measures identified in the Heritage Resources Discovery Contingency Plan (Appendix 6B) in the event of discovery of archaeological or historical sites during the investigation.	• Surface sites may be disturbed during HRIAs and site investigations.
12.2 Disturbance of previously unidentified heritage resource sites during construction	Entire route	Footprint	• Implement the Heritage Resources Discovery Contingency Plan in Appendix 6B in the event that previously unidentified archaeological or historical sites are discovered during construction. • Suspend construction activity in the vicinity of any historical, archaeological or palaeontological resources discovered during construction until authorized by provincial authorities. [EGC 02-2] • Resume work once permission has been granted from the provincial authorities.	• Previously unidentified buried heritage resources may be disturbed during pipeline construction.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
12.3 Disturbance of palaeontological resources	Lands with higher palaeontological potential including: High Hill Creek (KP 666.8 to KP 667.0) Cottonwood Creek (KPR 12.0 to KPR 12.5) Deadhorse Creek valley and adjacent lands (KP 1196.3 to KP 1197.0)	Footprint	• A palaeontological investigation of lands with higher palaeontological potential in Saskatchewan, including lands in the Kerrobert area, meltwater channels, High Hill and Cottonwood Creeks, and lands in the vicinity of Deadhorse Creek in Manitoba will be undertaken in spring 2007 prior to construction (see Section 9.0 of the ESA). • Implement contingency measures identified in the Heritage Resources Discovery Contingency Plan (Appendix 6B) in the event of discovery of palaeontological finds during the supplemental study. • Suspend construction activity in the vicinity of any palaeontological resources discovered during construction until authorized by provincial authorities. [EGC 02-2]	• Palaeontological resources may be disturbed as a result of pipeline construction activities.
13. TRADITIONAL LAND AND RESOURCE USE				
13.1 Disturbance of Swan Lake Indian Reserve No. 7 lands	KP 1138.4 to KP 1139.1	Footprint	• Present land use along the segment of the proposed route through the Swan Lake Indian Reserve No. 7 is hay. • Salvage a blade width of topsoil centred over the trench during both nonfrozen and frozen conditions (Detail 6A-10). • Follow applicable soil protection measures outlined in *Soil Capability* element 2 of this table. • Revegetate hay lands with the appropriate agronomic seed mix as indicated in Detail 6A-46 and on the Environmental Alignment Sheets. • See also *Human Occupancy and Resource Use* element 11.1(c) of this table.	• Disruption of farming activities on the Swan Lake Indian Reserve No. 7 may occur during pipeline construction.
13.2 Groundwater quality and quantity in nearby aquifer	KP 1119 to KP 1142	Local	• See mitigation described under *Water Quality and Quantity* element 3.9(b) of this table.	• No residual effect identified.
13.3 Site-specific traditional land use concerns	Entire route	Footprint to Local	• Enbridge has initiated consultation with Aboriginal groups with interest in the proposed Alberta Clipper Project including the Swan Lake Ojibway First Nation (see Section 6 of the Alberta Clipper Project Application). • Should any site-specific concerns arise during the ongoing consultation process, Enbridge will attempt to resolve the issue using the Indigenous Peoples Policy as a guide.	• No residual effect identified.
14. SOCIAL AND CULTURAL WELL-BEING				
14.1 Influx of temporary construction workers	Hardisty, Kerrobert, Kindersley, Rosetown, Moose Jaw, Regina, Kipling, Virden, Brandon, Morden, Winkler, Altona	Local to Region	• Local communities will be notified 21 days minimum prior to the scheduled establishment of construction offices or arrival of pipe. • During the Environmental Training Program, advise construction workers, inspectors and support personnel on the expectations regarding code of conduct for Alberta Clipper workers when using community facilities and services. • For the temporary Hardisty construction camp, Enbridge or its contractor must clearly define rules, reprimands, security protocols and other expectations of Project workers utilizing the camp. Implement 24-hr security at the construction camp to deter unruly behaviour.	• The construction of the Alberta Clipper Project will result in a temporary increase in the local community population.
15. HUMAN HEALTH				
15.1 Nuisance air emissions (*e.g.*, vehicle exhaust, dust, smoke)	Entire route	Footprint to Region	• See *Greenhouse Gases and Air Quality* element 4.2 of this table.	• See *Greenhouse Gases and Air Quality* element 4.2 of this table.
15.2 Nuisance noise emissions	Entire route	Footprint to Local	• See *Acoustic Environment* element 5.1 of this table.	• See *Acoustic Environment* element 5.1 of this table.
15.3 Public safety	Entire route	Footprint	• See *Human Occupancy and Resource Use* element 11.2(a) and (b) of this table.	• See *Human Occupancy and Resource Use* element 11.2(a) and (b) of this table.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
16. INFRASTRUCTURE AND SERVICES				
16.1 Infrastructure				
16.1(a) transportation of workers and supplies	Entire route	Footprint to Region	• Transport workers between the Hardisty construction camp and other muster areas to work-sites by multi-passenger vehicles to the extent practical. • Advise all Alberta Clipper-related vehicles to follow applicable traffic, road-use and safety laws. • The contractor will develop a traffic management plan to manage vehicular movements on highways and local roads.	• Increased traffic on highways and local roads used to access the proposed right-of-way will occur during pipeline construction.
16.1(b) disruption to transmission lines and pipelines	Entire route	Footprint to Region	• Locate and flag all existing buried utility lines and cables to be crossed by the pipeline prior to the commencement of ground disturbance activities by using "one call" services or direct contact with utility owners. • Expose all underground utility lines and cables to be traversed by the pipeline in accordance with prescribed methods as detailed in the construction specifications. • Use flagging and signage at overhead line crossings to alert equipment operators of hazards.	• See *Accidents and Malfunctions* element 18.3 of this table.
16.1(c) waste management during construction	Entire route	Footprint to Region	• Collect waste from work site on a daily basis to avoid the attraction of nuisance animals. Ensure waste containers accompany each working unit. Do not dispose of waste in the trench. [EGC 02-2] • Locate temporary toilets at convenient locations on/along the construction site. [EGC 02-2] • Ensure the construction site is left in a tidy and organized condition at the end of each day. [EGC 02-2] • Transport and dispose all wastes in accordance with provincial and federal regulatory requirements and local guidelines. • Follow criteria and regulations set out by WHMIS and the Transportation of Dangerous Goods. • Follow measures outlined in Enbridge's Waste Management Plan currently on file with the NEB.	• Temporary increase in waste flow to regional landfill sites will occur.
16.1(d) worker accommodation needs may displace tourists	Alberta	Local to Region	• Enbridge or its contractor is to install a temporary construction camp to accommodate Project workers associated with all components of the Alberta Clipper Project in the Hardisty area due to the limited availability of local and regional accommodation. • Treat sewage and grey water as per municipal and provincial permits. Dispose of waste in accordance with municipal and provincial permits as well as the Enbridge Waste Management Plan currently on file with the NEB. • Obtain approval from the applicable regulatory authority prior to withdrawing water from nearby water source for use in the temporary construction camp. Otherwise, haul fresh water to camps.	• Local or regional tourist accommodations along the proposed route will be temporarily occupied by Alberta Clipper Project workers primarily in Saskatchewan and Manitoba.
	Saskatchewan Manitoba	Local to Region	• In the event that accommodations are limited in any of the communities selected as construction offices, expand existing RV parks, set up temporary construction work camps, or work with local hotel/motel operators to increase the occupancy of the motel rooms.	
16.2 Services				
16.2(a) provision of emergency services	Entire route	Local to Region	• Provide key Alberta Clipper Project contact numbers, Alberta Clipper pipeline route maps, pump station/terminal maps and the construction schedule to the local and regional RCMP, fire departments, hospitals/medical facilities and ambulance services. • Adhere to all safety standards during the construction and operation of the Alberta Clipper Project. •	• Despite best intentions and work practices, incidents arising during construction may warrant the use of emergency services.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
16.2(a) provision of emergency services	Same as above	Same as above	• Train construction workers on fire prevention and control. Contractors are to follow the fire prevention measures outlined in the Fire Contingency Plan (Appendix 6B). • Ensure contractors provide First Aid attendants. • Contact local emergency medical services to ensure that services can be used if necessary. • Implement 24-hr security at the Hardisty construction camp to minimize strain on the local police force.	• Same as above
16.2(b) recreational opportunities for workers	Entire route	Local to Region	• Ample public recreation is available in the vicinity of the proposed pipeline route. Use of facilities by workers is unlikely to burden the facilities or displace local residents.	• No residual effect identified.
17. EMPLOYMENT AND ECONOMY				
17.1 Employment opportunities	Entire route	Region	• Local motel, gas station, hardware, restaurant and campground owners will receive increased business during the construction season. Some of the construction subcontractors may be local or employ local labourers. • No increase or decrease in local business opportunities or employment is anticipated during the operational phase. • Enbridge is committed to a procurement program that actively promotes local opportunity, including Aboriginal businesses.	• Local businesses and residents will benefit from the Alberta Clipper Project through employment opportunities.
17.2 Revenue	Entire route	Region	• Revenue payments by Enbridge are substantial and are considered beneficial by governments.	• The Alberta Clipper Project will generate revenue for municipal, provincial and federal governments.
18. ACCIDENTS AND MALFUNCTIONS				
18.1 Spills of hazardous materials during construction	Entire route	Footprint to Local	**Spill Prevention** • Place an impervious tarp when servicing equipment/vehicles with the potential for accidental spills (*e.g.*, oil changes, servicing of hydraulic systems). • Ensure that no fuel, lubricating fluids, hydraulic fluids, antifreeze, herbicides, biocides or other chemicals are dumped on the ground or into any watercourse. [EGC 02-2] • Ensure that bulk fuel trucks, service vehicles and pick-up trucks equipped with box-mounted fuel tanks carry spill prevention, containment and clean-up materials that are suitable for the volume of fuels or oils carried. Carry spill contingency material on bulk fuel and service vehicles that is suitable for use on land and water (*i.e.*, sorbent pads, sorbent boom and rope). Carry additional spill prevention and clean-up material, and equipment such as a tarp, shovel and heavy plastic bags in bulk fuel trucks, service trucks and pick-ups with box-mounted fuel tanks. • Do not store fuel, oil or hazardous material within 100 m of a waterbody except where secondary containment is provided. [EGC 02-2] • Refuel and service mobile equipment a minimum of 100 m from bodies of water and on road allowances, where feasible. • Inspect hydraulic, fuel and lubrication systems of equipment used in water crossing construction to ensure that the systems are in good condition and free of leaks. Clean equipment to be used instream or adjacent to a waterbody or otherwise ensure equipment is free of grease, oil or other fluids, mud, dirt and vegetation, both prior to and entering the waterbody and upon completion of instream activity. [EGC 02-2]	• Spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
18.1 Spills of hazardous materials during construction (cont'd)	Same as above	Same as above	**In the Event of a Spill** • Report spills immediately to the Chief Inspector and Environmental Inspector and, if warranted, appropriate government agencies in accordance with the Spill Contingency Plan in Appendix 6B. • Implement the Spill Contingency Plan outlined in Appendix 6B. The plan includes measures to be undertaken in the event of a spill on land, ice and in water.	• Same as above
18.2 Fire during construction	Bush/Wooded Areas	Footprint to Local	**Fire Prevention** • Note that all contractor personnel must participate in a safety and environmental training session, which will include instruction on the use of fire fighting equipment. • Allow landowners to harvest mature crops and mow any remaining crops prior to the initiation of construction activities. • Ensure that personnel are made aware of proper disposal methods for welding rods, cigarette butts and other hot or burning material. Do not burn when the fire hazard is high. • Do not smoke in the open on the right-of-way when the fire hazard is high. Smoke only within designated areas. • Ensure that exhaust and engine systems of equipment are in good working condition and inspect undercarriages periodically to ensure that grasses do not accumulate. Do not leave vehicles idling for extended periods of time when the fire hazard is high. [EGC 02-2] • When the fire hazard is rated high or extreme, the following are prohibited on the right-of-way: – vehicles parking on tall grass or stubble; – fires; – dropping cigarette butts and used welding rods on the ground. [EGC 02-2] • Maintain a fire truck on the right-of-way when the fire hazard is high or extreme and air temperatures allow. [EGC 02-2] • Ensure that each crew carries at a minimum, two shovels, one fire extinguisher, one two-way radio or cell phone as well as two pulaskis (see also the Fire Contingency Plan outlined in Appendix 6B). • Ensure that slash burning crews have fire fighting equipment on hand that is capable of controlling any fire that may occur as a result of their activities as regulated by provincial regulations and government agencies. • Do not burn slash if the fire hazard is high. If burning is delayed, store slash along the right-of-way, in natural clearings, or approved push-outs. Resume burning once the fire hazard is low. **In the Event of Fire** • Follow the fire suppression measures of the Fire Contingency Plan as outlined in Appendix 6B.	• Despite vigilance, fires may adversely affect adjacent vegetation, and, in very rare situations, affect wildlife and adjacent property.

TABLE 6.2 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Location	Project Boundary	Recommendations/Mitigative Measures [EGC Reference][1]	Residual Effect(s)
18.3 Damage to foreign lines, Enbridge pipelines and cables during construction	Entire route	Footprint	**Foreign Lines and Cables** • Locate and flag all known foreign lines and cables by using "one call" services. • Carefully expose all known locations of underground facilities in accordance with prescribed, safe methods. • Use flagging and signage at overhead line crossings to alert equipment operators of hazards. **Enbridge Pipeline System** • Conduct construction activities in the vicinity of existing Enbridge pipelines in compliance with all requirements of CSA Z662 and the NEB Onshore Pipeline Regulations for work close to an operating pipeline.	• Rupture of water, sewage, gas or other lines could lead to interruption of services, contamination of soil or water depending on the location and severity of the rupture and fires in the case of gas. Cable damage can lead to interrupted service of the utility to communities and local residences.
18.4 Release of drilling mud during horizontal directional drilling	South Saskatchewan River (KP 505.2 to KP 506.0) Qu'Appelle River (KP 657.1) Souris River (KP 1073.4)	Footprint to Local	• Utilize an inert, nontoxic bentonitic clay-based material as drilling mud. [EGC 02-11] • Implement the Directional Drilling Procedures and Instream Drilling Mud Release Contingency Plan in the event of a release (see Appendix 6B). • Dispose of drilling mud on cultivated privately-owned lands in accordance with EUB G-050 *Drilling Waste Management Guidelines* and ID 99-05 and other applicable provincial regulations and guidelines.	• Release of drilling mud on land, once cleaned-up and reclaimed, will have little residual effect. • Depending on the volume and location of the release, a release of drilling mud into a watercourse may affect aquatic ecosystems in the short to medium-term.
18.5 Line break caused by third party damage or corrosion	Entire route	Footprint to Local	• Enbridge has an integrity management system in place to minimize the risk of pipeline failure during operations. These company programs are discussed in detail in Section 8.0 of the ESA. • Enbridge has implemented a comprehensive Emergency Response Plan which is fully described in Section 8.0 of the ESA. • Select block valve locations to control spill volumes to acceptable levels. Consider use of remotely controlled valves. • In the event of a release into such watercourses as Eyehill Creek or the South Saskatchewan River, immediately implement Enbridge's Emergency Response Plan and request communities with water intakes downstream of the crossing to shut off intake valves (*e.g.,* Macklin, Outlook). Provide an alternate water source, if warranted, until regulatory agencies deem the water supply suitable for human consumption.	• A pipeline failure may adversely affect adjacent soils, vegetation, wildlife habitat and aquatic ecosystems, including aquifers.

Notes: 1 Detailed mitigative measures are outlined in Enbridge's EGC currently on file with the NEB.

2 Species codes: BUOW = burrowing owl; LOSH = loggerhead shrike; LBCU = long-billed curlew; NLFR = northern leopard frog.

TABLE 6.3

WATERCOURSE CROSSING SUMMARY FOR THE ALBERTA CLIPPER PROJECT

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
ALBERTA														
213.9	14 27-40-6 W4M	Ribstone Creek (tributary to Battle River)	NRPK, WHSC in lower stretches below multiple weirs	Nil	Class D No RAP	0.008 to 0.608	undefined	--	ford with swamp mats[6]	ford with swamp mats[6]/ snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present	recontour reseed[16]	N/A
272.2	7-35-37-01 W4M	Eyehill Creek (tributary to Manitou Lake)	NRPK, WHSC, LKWH, BRST, FTMN, American smelt	Nil to Poor given weir 500 m downstream	Class C Apr 16 – Jun 30	0.009 to 0.402	21.8 m	0.39 m (07/93)	temporary bridge[7] or existing vehicle crossing	ford with swamp mats[6] if dry/snow fill[10] or ice bridge[11]	trenchless[12]	isolate[13] if water present	recontour reseed[16]	N/A
SASKATCHEWAN														
288.5	5-5-37-27 W3M	Unnamed Drainage (drains into Cactus Lake)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
291.7	8-33-36-27 W3M	Unnamed Drainage (drains into Cactus Lake)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
352.2	16-27-33-22 W3M	Intermittent Drainage (drains into White Heron Lake)	--	TBD	No RAP[5]	[dry]	TBD	TBD	TBD	TBD	N/A	TBD	TBD	TBD
365.3	16-2-33-21 W3M	Unnamed Creek (tributary to Eagle Creek)	--	TBD	No RAP[5]	[dry]	TBD	TBD	TBD	TBD	N/A	TBD	TBD	TBD
366.9	7-1-33-21 W3M	Unnamed Creek (tributary to Eagle Creek)	--	TBD	No RAP[5]	[dry]	TBD	TBD	TBD	TBD	N/A	TBD	TBD	TBD
383.0	9-16-32-19 W3M	Unnamed Creek (tributary to Eagle Creek)	--	TBD	No RAP[5]	[dry]	TBD	TBD	temporary bridge[7]	culvert[9] or ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	stabilize with cross ditches and berms[17]
384.9	1-15-32-19 W3M	Unnamed Creek (tributary to Eagle Creek)	--	TBD	No RAP[5]	[dry]	TBD	TBD	temporary bridge[7]	culvert[9] or ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A
390.2	4-8-32-18 W3M	Unnamed Creek (tributary to Eagle Creek)	--	TBD	No RAP[5]	[dry]	TBD	TBD	temporary bridge[7]	culvert[9] or ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	stabilize with cross ditches and berms[17]
391.3	15-5-32-18 W3M	Intermittent Drainage (drains into Eagle Creek)	--	TBD	No RAP[5]	[dry]	TBD	TBD	temporary bridge[7]	culvert[9] or ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	stabilize with trench breakers, if required, cross ditches and berms[17]
393.6	5-3-32-18 W3M	Eagle Creek (tributary to North Saskatchewan River)	**BRST, LKCH, FTMN,** NRPK, YLPR, SHRD, PRDC, IWDR, LNDC, SPSH, RVSH, LNSC, WHSC	Low	April 1 – May 31	0.022 to 2.19	5.0 (wetted width)	0.28 (05/98)	temporary bridge[7,8]	temporary bridge[6] or existing bridge / snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present	Recontour, use geotextiles[17] to stabilize as necessary, reseed[16], fence	N/A

TABLE 6.3 Cont'd

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
410.8	9-18-31-16 W3M	Intermittent Drainage (drains into Eagle Creek)	--	TBD	TBD	[dry]	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	TBD	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A
416.2	9-10-31-16 W3M	Drainage Ditch (drains into Eagle Creek)	--	TBD	No RAP	[dry]	TBD	TBD	ford with swamp mats[6]	ford with swamp mats[6]	N/A	open cut[14]	N/A	N/A
421.3	8-6-31-15 W3M	Intermittent Drainage (drains into Eagle Creek)	--	TBD	TBD	[dry]	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	TBD	isolate[13] if water present open cut if dry or frozen to bottom	recontour reseed[16]	N/A
423.6	14-32-30-15 W3M	Intermittent Drainage (drains into Eagle Creek)	--	TBD	No RAP[5]	[dry]	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	stabilize with trench breakers, if required, cross ditches and berms[17]
426.0	2-33-30-15 W3M	Eagle Creek (tributary to North Saskatchewan River)	**BRST,** NRPK, YLPR FTMN, IWDR, LKCH, LNDC, LNSC, PRDC, RVSH, SHRD, SPSH, WHSC	Low	April 1 – May 31	0.022 to 2.19	8.0 (wetted)	0.38 (05/98)	temporary bridge[7,8]	snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present	recontour reseed[16], fence until established	temporary and permanent berms, silt fence on east slope[17]
KPM 3.0	14-09-29-11 W3M	MacDonald Creek (tributary to South Saskatchewan River)	--	Low	No RAP[5]	0.00 to 1.10	27.0	0.8 (05/98)	temporary bridge[7]	snow fill[10] or ice bridge[11]/ culvert[9] if dry	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	stabilize with cross ditches and berms[17], fence off east bank from cattle
498.4	13-4-28-8 W3M	Irrigation Canal (tributary to South Saskatchewan River)	**FTMN**	Nil	No RAP	0.00 to 8.5	16.5 (wetted)	1.05 (thalwag depth 07/93)	cross according to water crossing agreement					
505.2 - 506.0	NW 31-27-7 W3M	South Saskatchewan River (tributary to Saskatchewan River)	**RNTR, LKWH, WHSC, LNSC,** BRTR, BRST, BURB, CISC, EMSH, FTMN, FLCH, GOLD, IWDR, LKST, LKCH, LNDC, MOON, NRPK, QUIL, RVSH, SAUG, SHRD, SPSC, SPSH, TRPR, WALL, YLPR BKTR, MNWH, NRDC, SLRD	Moderate	Oct 1 – July 15 (for spring and fall spawners with lake sturgeon, no lake trout)	175 to 825	400 (wetted width)	0.6 (05/98)	existing bridge	existing bridge	HDD[12]	TBD / contingency open cut[14]	TBD	stabilize east slope with straw crimping, berms, silt fences, and coconut matting[17]
507.8	2-32-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[dry]	TBD	TBD	cross according to water crossing agreement					
509.5	11-28-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[dry]	TBD	TBD	cross according to water crossing agreement					
510.0	7-28-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[dry]	TBD	TBD	cross according to water crossing agreement					

TABLE 6.3 Cont'd

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
510.3	8-28-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[dry]	TBD	TBD	cross according to water crossing agreement					
510.4	8-28-27-7 W3M	Unnamed Creek (tributary to South Saskatchewan River)	--	TBD	No RAP[5]	TBD	TBD	TBD	temporary bridge[7]	snow fill[10] or ice bridge[11]/ ford with swamp mats[6] if dry	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A
511.2	3-27-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[dry]	TBD	TBD	cross according to water crossing agreement					
512.4	9-22-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[dry]	TBD	TBD	cross according to water crossing agreement					
513.3	6-23-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[dry]	TBD	TBD	cross according to water crossing agreement					
514.5	1-23-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[dry]	TBD	TBD	cross according to water crossing agreement					
515.0	13-13-27-7 W3M	Irrigation Canal (drains into South Saskatchewan River)	--	Nil	No RAP	[9.5]	20 (wetted)	1.3 (05/98)	cross according to water crossing agreement					
517.1	2-18-27-6 W3M	Unnamed Creek (tributary to South Saskatchewan River)	--	TBD	No RAP[5]	TBD	undefined	--	temporary bridge[7]	snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A
586.7	7-13-23-1 W3M	Iskwao Creek (tributary to Qu'Appelle River)	--	TBD	No RAP[5]	0.00 to 0.121	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	stabilize with trench breakers, if required, cross ditches and berms[17]
596.2	6-36-22-29 W2M	Unnamed Creek (tributary to Qu'Appelle River)	**BRST, FTMN**	Low	No RAP	[0.0012]	15 (wetted)	0.04 (05/98)	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A
614.5	15-28-21-27 W2M	Unnamed Drainage (drains into Qu'Appelle River)	--	TBD	No RAP[5]		undefined	--	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	stabilize with cross ditches and berms[17]
657.1	4-18-19-23 W2M	Qu'Appelle River (tributary to Assiniboine River)	**WALL, WHSC, CARP,** NRPK, bigmouth buffalo	Moderate - high	April 1 – May 31	1.06 to 22.6	13.2 (wetted)	1.77 (05/98)	existing / temporary bridge[7,8]	existing or temporary bridge[6]	HDD[12]	TBD	Recontour, install brush layers and use geotextiles to stabilize as necessary[17], reseed[16]	stabilize with trench breakers, if required, cross ditches and berms[17]
662.7	1-4-19-23 W2M	Unnamed Creek (tributary to Qu'Appelle River)	**FTMN, BRST**	Low	No RAP[5]	[0.004]	0.5 (wetted)	0.1 (05/98)	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A

TABLE 6.3 Cont'd

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
666.9	16-27-18-23 W2M	High Hill Creek (tributary to Qu'Appelle River)	**FTMN, BRST,** NRPK, YLPR, WALL	Low	Apr 1 - May 31	[0.008]	30 (ponded)	0.37 (05/98)	temporary bridge[7] / ford with swamp mats[6] if dry	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	bore[12]	isolate[13] if water present / open cut[14] if dry or frozen to bottom	recontour reseed[16], fence	stabilize with trench breakers, if required, cross ditches and berms[17]
KPR 12.1	SW 25-17-22 W2M	Cottonwood Creek (tributary to Qu'Appelle River)	BRST, FTMN, WHSC May contain NRPK, WALL in downstream stretches	Nil, many barriers	No RAP	0.002 to 2.26	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present	recontour reseed[16]	stabilize with trench breakers, if required, cross ditches, berms, and straw crimp[17]
KPR 15.7	SW 20-17-21 W2M	Unnamed Drainage (drains into Cottonwood Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 39.7	3-33-16-19 W2M	Unnamed Drainage (drains into slough)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 39.9	2-33-16-19 W2M	Unnamed Drainage (drains into slough)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 40.2	2-33-16-19 W2M	Unnamed Drainage (drains into slough)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 40.6	4-34-16-19 W2M	Unnamed Drainage (drains into slough)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 40.9	4-34-16-19 W2M	Drainage Ditch (drains into slough)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 45.5	NW 36-16-19 W2M	Wascana Creek (tributary to Qu'Appelle River)	WHSC, NRPK, CARP(?)	TBD	Apr 1 - May 31	0.497 to 10.4	TBD	TBD	temporary bridge[7,8]	snow fill[10] or ice bridge[11] / ford with swamp mats[6] if dry	bore[12]	isolate[13] if water present	recontour reseed[16]	N/A
KPR 51.0	13-34-16-18 W2M	Unnamed Creek (tributary to Wascana Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 60.7	13-27-16-17 W2M	Unnamed Creek (tributary to Wascana Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 67.1	5-29-16-16 W2M	Kronau Creek (tributary to Wascana Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 69.5	3-28-16-16 W2M	Kronau Creek (tributary to Wascana Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 72.0	16-22-16-16 W2M	Unnamed Creek (tributary to Manybone Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
KPR 73.7	16-23-16-16 W2M	Unnamed Creek (tributary to Manybone Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
746.1	6-20-16-15 W2M	Unnamed Drainage[4] (tributary to Kronau Creek)	--	Low	No RAP	[<0.02]	20.4 (wetted)	0.41 (05/98)	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A
773.7	6-14-15-13 W2M	Swale or Unnamed Drainage (drains into Chapleau Lakes)	--	TBD	No RAP[5]	[dry]	TBD	TBD	existing bridge	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A

TABLE 6.3 Cont'd

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
775.1	3-13-15-13 W2M	Unnamed Drainage (drains into Chapleau Lakes)	--	TBD	No RAP[5]	TBD	TBD	TBD	existing bridge	snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A
783.3	4-11-15-12 W2M	Chapleau Lakes	NRPK, YLPR, BLBL, WHSC, 9 non-sportfish	High	TBD	-	150 m (wetted)	TBD	TBD	TBD	open cut[14]	open cut[14]	recontour reseed[16]	N/A
785.3	14-1-15-12 W2M	Unnamed Drainage (drains into Chapleau Lakes)	--	TBD	No RAP[5]	[dry]	TBD	TBD	temporary bridge[7]	snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	N/A
820.3	8-17-14-8 W2M	Vipond Creek (tributary to Moose Mountain Creek)	**FTMN**	Low	TBD	0.001	4.3 (wetted)	0.49 (05/98)	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	TBD	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	stabilize with trench breakers, if required, cross ditches and berms[17]
868.7	7-7-13-3 W2M	Intermittent Creek (tributary to Pipestone Creek)	--	TBD	TBD	TBD	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	TBD	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	TBD
871.5	14-4-13-3 W2M	Montgomery Creek (tributary to Pipestone Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	culvert[9]	TBD	open cut[14]	recontour reseed[16]	N/A
873.0	5-3-13-3 W2M	Unnamed Creek (tributary to Montgomery Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
907.1	4-26-11-33 WPM	Little Pipestone Creek (tributary to Pipestone Creek)	LKCH	Low	TBD	0.03	4.2 (wetted)	0.19 (05/98)	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	TBD	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16], fence	TBD
932.3	9-23-10-31 WPM	Jackson Creek (tributary to Souris River)	BRST, FNDC, NRPK	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
942.5	7-11-10-30 WPM	Stony Creek (tributary to Souris River)	NRPK	TBD	TBD	TBD	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	TBD
MANITOBA														
951.6	9-34- 9-29 WPM	Pipestone Creek (tributary to Souris River)	NRPK, YLPR, WALL, IWDR, FTMN, PRDC, BRST	TBD	April 1 – June 15	TBD	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present	recontour reseed[16] TBD	stabilize with trench breakers, if required, cross ditches, berms and temporary silt fence[17]
952.4	12-35-9-29 WPM	Intermittent Drainage (drains into Pipestone Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

TABLE 6.3 Cont'd

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
955.0	10-25-9-29 WPM	Intermittent Creek (drains into Pipestone Creek)	--	TBD	TBD	TBD	TBD	TBD	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	TBD	open cut[14] if dry	recontour reseed[16]	stabilize with cross ditches, berms and temporary silt fence[17]
958.0	13-20-9-28 WPM	Intermittent Creek (drains into Pipestone Creek)	--	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
1065.8	5-25-7-18 WPM	Black Creek (tributary to Souris River)	**WHSC, NRPK**	Low	No RAP	[dry]	0.54	0.15	existing / temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	recontour stabilize with geotextiles[17] reseed[16]
1073.4	10-22-7-17 WPM	Souris River (tributary to Assiniboine River)	**NRPK, WALL, WHSC, BLDC, BLDR, LNDC, SHRD, SNSH, TRPR,** ROBA, CHLA **Bivalves**	Low-High	April 1 – July 31	0.922 to 39.2	45.5	0.35	existing / temporary bridge[7,8]	ice bridge[11]	HDD[12]	HDD[12,15]	if trenched, recontour banks and mid-channel gravel bar stabilize with geotextiles, live shrub stakes, brush layers[17] reseed[16] armour[18] if warranted	recontour stabilize with trench breakers, berms, subdrains[17], as required reseed[16]
KPW 5.1	16-18-7-16 WPM	Spring Brook (tributary to Oak Creek)	**NRPK, LKCH, CRCH, FTMN, PRDC, BRST**	Low-Moderate	April 1 – June 15	[0.14]	1.0 (wetted width)	0.5	temporary bridge[7]	snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	--
KPW 6.1	13-17-7-16 WPM	Unnamed Creek (tributary to Spring Brook)	**BRST**	Nil-Low	No RAP	[dry]	--	--	ford with swamp mats[6]	ford with swamp mats[6]/ snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour stabilize with geotextiles[17] reseed[16]	--
1083.6	8-15-7-16 WPM	Unnamed Creek (tributary to Oak Creek)	---	No fish habitat potential	No RAP	[dry]	undefined	--	ford or culvert[9]	ford	N/A	open cut[14]	reseed[16]	--
1087.0	1-13-7-16 WPM	Oak Creek (tributary to Souris River)	**NRPK, WHSC, PRDC, BLDC, EMSH, JHDR Northern leopard frog**	Low-High	April 1 – June 15	0.012 to 1.07	12.4	0.1	existing/ temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	stabilize with geotextiles and brush layers[17] reseed[16] fence off from cattle until vegetation re-established	--

TABLE 6.3 Cont'd

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
1109.3	7-31-6-13 WPM	Oak Creek (Tributary to the Souris River)	**WHSC,** NRPK, FTMN, CRCH **Bivalves**	Low-High	April 1 – June 15	0.012 to 1.07	12.0	0.3	temporary bridge[7]	ford with swamp mats[6] / ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	salvage and replace upper substrate and bank materials to allow natural revegetation of cattails and grasses	--
1110.3	4-32-6-13 WPM	Oak Creek (tributary to Souris River)	**WHSC, BRST, CRCH, IWDR,** FTMN, NRPK	Low-High	April 1 – June 15	0.012 to 1.07	48.0	0.3	existing/ temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	reseed[16] fence off from cattle until vegetation re-established	--
1120.1	15-18-6-12 WPM	Cypress River (tributary to Assiniboine River)	**WHSC, CMSH, LNDC, CRCH, SNSH, FNDC,CNMD, FTMN, JHDR**	Low-Moderate	April 1 – June 15	0.040 to 4.03	3.2 (wetted width)	0.2	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	--
1131.5	16-31-5-11 WPM	Cypress River (tributary to Assiniboine River)	**WHSC, BLDC, CMSH, LNDC, SNSH, LKCH, BLBL, PRDC, CRCH, EMSH, JHDR, FTMN,** NRPK **Northern leopard frog**	Low-High	April 1 – June 15	0.040 to 4.03	11.4	0.3	existing/ temporary bridge[7]	ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	reseed[16] fence off from cattle until vegetation re-established	recontour stabilize with trench breakers, berms, subdrains, as required[17] reseed16
1139.9	11-24-5-11 WPM	Intermittent Creek (tributary to Pembina River)	---	No fish habitat potential	No RAP	[0]	undefined	--	culvert[9]	ford with swamp mats[6]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour stabilize with geotextiles or silt fencing[17] reseed[16]	recontour stabilize with trench breakers, berms, cross ditches and subdrains, as required[17] reseed16
1141.3	SW 19-5-10 WPM	Intermittent Creek	NOT SAMPLED, NO LAND ACCESS	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
1164.0	14-18-4-8 WPM	Mary Jane Creek (tributary to Pembina River)	---	Nil-Low	No RAP	0.017 to 1.57	2.1 (wetted width)	0.1	ford with swamp mats[6]	ford with swamp mats[6]/ snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	--
1175.7	16-31-3-7 WPM	Unnamed Drainages (drains into Lizard Lake)	---	No fish habitat potential	No RAP	[0]	undefined	--	ford or culvert[9]	ford	N/A	open cut[14]	reseed[16]	--
1183.5	13-24-3-7 WPM	Unnamed Creek (tributary to Thornhill Coulee)	**FTMN, LKCH** (suspected to have come from nearby dugout during precipitation event)	Low	No RAP	[< 0.002]	undefined	--	ford with swamp mats[6]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour stabilize with geotextiles[17] reseed[16]	--

TABLE 6.3 Cont'd

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
1186.3	2-19-3-6 WPM	Thornhill Coulee (tributary to Shannon Creek)	**FTMN, BRST**	Low-High	April 1 – June 15	[0.04]	4.0 (wetted width)	0.1	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour stabilize with geotextiles and brush layers[17] reseed[16]	recontour stabilize with silt fences, trench breakers, berms and cross ditches, subdrains, as required[17] reseed[16]
1196.6	16-35-2-6 WPM	Deadhorse Creek (tributary to Red River)	**PUMP, CRCH, WHSC, WALL, FTMN, LKCH,** BRST, BLCR, NRPK	Low-High	April 1 – June 15	0.007 to 1.32	9.0	0.5	temporary bridge[7]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	HDD[12]	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour stabilize with geotextiles and brush layers[17] reseed[16]	recontour stabilize with trench breakers, berms, cross ditches, silt fencing and subdrains, as required[17]
1205.4	1-26-2-5 WPM	Unnamed Drainage (drains into Hespeler Creek)	---	No fish habitat potential	No RAP	[dry]	undefined	--	ford or culvert[9]	ford	N/A	open cut[14]	reseed[16]	--
1206.5	15-24-2-5 WPM	Unnamed Drainage (drains into Hespeler Creek)	---	No fish habitat potential	No RAP	[dry]	undefined	--	ford or culvert[9]	ford	N/A	open cut[14]	reseed[16]	--
1211.1	13-16-2-4 WPM	Hespeler Creek (tributary to Deadhorse Creek)	---	Low-High	No RAP	[0]	2.8	0.00	temporary bridge[7] drive around to south side of residential properties	snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour stabilize with geotextiles[17] reseed[16]	--
1220.1	12-5-2-3 WPM	Rosenheim Drain (tributary to Red River)	---	Nil-Low	No RAP	[dry]	undefined	--	ford with swamp mats[6]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	reseed[16] fence off from cattle until vegetation re-established	--
1224.4	10-34-1-3 WPM	Buffalo Drain (Tributary to Buffalo Creek)	---	No fish habitat potential	No RAP	[dry]	undefined	--	ford with swamp mats[6]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry	reseed[16]	---
1227.4	13-25-1-3 WPM	Buffalo Creek (tributary to Red River)	**BLBL, CRCH Crayfish, northern leopard frog**	Low for sports fish	No RAP	[0]	2.3	0.2	culvert[9] or ford with swamp mats[6]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16] fence off from cattle until vegetation re-established	---
1231.6	10-20-1-2 WPM	Drainage Channel (tributary to Buffalo Creek)	**BLBL, CRCH, WHSC**	Low-High	No RAP	[0]	7.5	0.2	existing/ temporary bridge[7] culvert[9] ford with swamp mats[6]	ford with swamp mats[6] / snow fill[10] or ice bridge[11]	N/A	isolate[13] if water present open cut[14] if dry or frozen to bottom	recontour reseed[16]	--

TABLE 6.3 Cont'd

Location (KP)	Legal Location	Watercourse	Reported Fish Presence[1,2]	Fish Habitat Potential[3]	Instream RAP	Mean Monthly Streamflow (m^3/s) [Sampled Flow][4]	Channel Width (m)	Mean Water Depth (m)	Vehicle Crossing		Pipeline Crossing		Bank Restoration	Approach Slope Mitigation
									If Water Present	If Dry / Frozen	Within RAP	Outside RAP		
1239.5	9-12-1-2 WPM	Drainage Channel (tributary to Buffalo Creek)	---	No fish habitat potential	No RAP	[dry]	undefined	--	ford or culvert[9]	ford	N/A	open cut[14]	reseed[16]	--
1241.4	8-7-1-1 WPM	Drainage Channel (tributary to Buffalo Creek)	---	No fish habitat potential	No RAP	[dry]	undefined	--	ford or culvert[9]	ford	N/A	open cut[14]	reseed[16]	--

Notes:

1 Fish species listed in bold text include those species that were captured during field investigations conducted in 1993, (EMA 1993), 1996 (Golder 1996), 1998 (RL&L 1998), and 2006 (AAR 2007). The remaining species listed are those that have been reported to occur in the watercourse, but were not captured during sampling.

2 Species Codes:

BLBL	Black bullhead	CHLA	Chestnut lamprey	IWDR	Iowa darter	NRDC	Northern redbelly dace	RVSH	River shiner
BLCR	Black crappie	CNMD	Central mudminnow	JHDR	Johnny darter	NRPK	Northern pike	SNSH	Sand shiner
BLDC	Western blacknose dace	CMSH	Common shiner	LKCH	Lake chub	PRDC	Pearl dace	SHRD	Shorthead redhorse sucker
BLDR	Blacksided darter	CRCH	Creek chub	LKWH	Lake whitefish	PUMP	Pumpkinseed	SPSC	Spoonhead sculpin
BRST	Brook stickleback	EMSH	Emerald shiner	LKST	Lake sturgeon	QUIL	Quillback	SPSH	Spottail shiner
BRTR	Brook trout	FLCH	Flathead chub	LNDC	Longnose dace	RNTR	Rainbow trout	TRPR	Trout-perch
BURB	Burbot	FNDC	Finescale dace	LNSC	Longnose sucker	ROBA	Rock bass	WALL	Walleye
CARP	Common carp	FTMN	Fathead minnow	MNWH	Mountain whitefish	SAUG	Sauger	WHSC	White sucker
CISC	Cisco	GOLD	Goldeye	MOON	Mooneye	SLRD	Silver redhorse	YLPT	Yellow perch

3 Fish habitat potential was determined during field investigations Refer to Section 5.1.6 for additional fish habitat information.

4 Historical streamflow data were used to determine the range of mean monthly streamflow (Environment Canada 2006). Where historical data is not available, discharge rates measured during field investigations conducted in the spring of 1998 and fall of 2006 are indicated in square brackets (AAR 2007 and RL&L 1998). Refer to Section 5.1.3.4 for additional streamflow information.

5 No timing constraint previously applied

6 See Detail 6A-26 for mitigative measures to be implemented if swamp mats are used to provide forded construction access.

7 See Detail 6A-25 for mitigative measures to be implemented if a temporary single span bridge is installed for construction access.

8 Obtain Navigable Waters approval from Transport Canada if a temporary bridge is installed for construction access at Eagle Creek (KP 393.6 and KP 426.0),the Qu'Appelle River (KP 657.1), Wascana Creek (KPR 45.5) or Souris River (KP 1073.4).

9 See Detail 6A-29 for mitigative measures to be implemented if a ramp and culvert is used to provide construction access.

10 See Detail 6A-28 for mitigative measures to be implemented if a snow fill is used to provide construction access.

11 See Detail 6A-27 for mitigative measures to be implemented if an ice bridge is used to provide construction access.

12 Where a trenchless crossing method is required, use a horizontal directional drill (Detail 6A-35) or bore and punch (Detail 6A-34) technique.

13 Use a flume or dam and pump isolation technique outside the instream restricted activity period (where applicable) if the watercourse is flowing (Details 6A-31 and 6A-32). A high volume dam and pump isolation technique may be used where warranted (Detail 6A-33).

14 Use an open cut pipeline installation technique outside the restricted activity period (where applicable) (Detail 6A-30).

15 Use a channel diversion isolation technique outside the restricted activity period at the Souris River in the event that a horizontal directional drill method is not successful (Detail 6A-36).

16 Seed disturbed watercourse banks and approach slopes with an approved native cover crop and seed mix as soon as feasible after construction (prior to spring freshet wherever possible) (Details 6A-49, 6A-46).

17 Implement bank and slope stabilization measures according to the following details: live shrub staking (Detail 6A-38), hedge/brush layering (Detail 6A-39), erosion control matting (Detail 6A-40), silt fences (Detail 6A-24), subdrains (Detail 6A-19), trench breakers (Detail 6A-20), and cross ditches/berms (Detail 6A-23).

18 Install riprap armour to protect banks if risk of erosion or slumping is high (Detail 6A-37).

TBD = to be determined

TABLE 6.4

TIMING CONSTRAINTS AND SETBACKS FOR SENSITIVE WILDLIFE RECOMMENDED BY FEDERAL AND PROVINCIAL AGENCIES

Species[1] (Critical Habitat, *e.g.*, Nests or Dens)	Recommended Guidelines					
	Timing Restriction			Setback Distance		
	AB	SK	MB	AB	SK	MB
HERPETILE						
snapping turtle	---	March 15 - June 30 (Nest sites)[3]	---	---	400 m[3]	---
prairie rattlesnake	year round (hibernacula)[2]	April 1 - Sept. 30 (hibernacula)[3]	---	200 m[2]	200 m[3]	---
		Oct. 1 - March 31 (hibernacula)[3]			200 m[3]	
western hognose snake	year round (hibernacula)[2]	April 1 - Sept. 30 (hibernacula)[3]	---	200 m[2]	200 m[3]	---
		Oct. 1 - March 31 (hibernacula)[3]			200 m[3]	
smooth green snake	---	April 1 - Sept. 30 (hibernacula)[3]	---	---	200 m[3]	---
		Oct. 1 - March 31 (hibernacula)[3]			200 m[3]	
eastern yellow-bellied racer	year round (hibernacula)[5]	year round (hibernacula)[3]	year round (hibernacula)[4]	150 m[5]	1,000 m[3]	150 m[4]
short-horned lizard	year round (suitable habitat)[2]	March 15 - Nov. 15 (eroded slopes, blue-shale outcrops)[3]	March 15 - Nov. 15[4]	100 m[2]	200 m[3]	100 m[4]
AMPHIBIAN						
Canadian toad	year round (ponds used for living, breeding or hibernating)[2]	---	---	100 m[2]	---	---
great plains toad	year round[5]	year round (ponds used for breeding, living, or hibernating)[3]	year round[4]	200 m[5]	500 m[3]	200 m[4]
northern leopard frog	April 1 - Oct. 31 (breeding and dispersal, pre-winter)[5]	April 1 - Oct. 31 (ponds used for breeding, living, or hibernating)[3]	April 1 - Oct. 31 (breeding and dispersal, pre-winter)[4]	100 m[5]	500 m[4]	100 m[4]
plains spade foot toad	year round (ponds used for living, breeding or hibernating)[2]	year round (ponds used for breeding , living, or hibernating)[3]	---	100 m[2]	90 m[3]	---
BIRD						
American bittern	---	May 1 - July 31 (nest site)[3]	---	---	400 m[3]	---
American white pelican	year round (nesting colony)[2]	April 1 - July 31 (nesting colony)[3]	---	1,000 m[2]	1,000 m[3]	---
bald eagle	year round (nest site)[2]	March 15 - July 15 (nest site)[3]	---	1,000 m[2]	1,000 m[3]	---
black-crowned night heron	---	April 1 - July 31 (nesting colony)[3]	---	---	1,000 m[3]	---
burrowing owl	year round (nest site)[2]	year round (nest site)[3]	April 15 - Aug. 15 (active nest)[4]	500 m[2]	500 m[3]	500 m[4]
			Aug. 15 - Sept. 15 (den)[4]			200 m[4]
			July 16 - Oct. 15 (dispersal, pre-migration)[4]			150 m[4]
			Oct. 16 - March 31 (winter)[4]			100 m[4]
Caspian tern	---	May 1 - July 15 (nesting colony)[3]	---	---	400 m[3]	---
common tern	---	May 1 - July 15 (nesting colony)[3]	---	---	400 m[3]	---
Cooper's hawk	---	April 1 - July 31 (nest site)[3]	---	---	400 m[3]	---
double crested cormorant	---	April 1 - July 31 (nesting colony)[3]	---	---	1,000 m[3]	---
eared grebe	---	May 15 - July 15 (nesting colony)[3]	---	---	200 m[3]	---

TABLE 6.4 Cont'd

Species[1] (Critical Habitat, *e.g.*, Nests or Dens)	Recommended Guidelines					
	Timing Restriction			Setback Distance		
	AB	SK	MB	AB	SK	MB
eastern screech owl	---	March 1 - July 15 (nest site)[3]	---	---	400 m[3]	---
ferruginous hawk	year round (nest site)[2]	March 15 - July 15 (nest site)[3]	March 15 - July 15 (nest site)[4]	1,000 m[2]	1,000 m[3]	500 m[4]
Forster's tern	---	May 1 - July 15 (nesting colony)[3]	---	---	400 m[3]	---
Franklin's gull	---	May 1 - July 15 (nesting colony)[3]	---	---	400 m[3]	---
golden eagle	year round (nest site)[2]	Feb. 15 - July 15 (nest site)[3]	---	1,000 m[2]	1,000 m[3]	---
great blue heron	year round (nesting colony)[2]	April 1 - July 31 (nesting colony)[3]	---	1,000 m[2]	1,000 m[3]	---
loggerhead shrike	May 1 - Aug. 15 (nest site)[5]	May 1- Aug. 15 (nest site)[3]	April 15 - July 15 (active nest)[4]	100 m[5]	400 m[3]	250 m[4]
			May 1 - Aug. 15 (nest site)[4]			100 m[4]
long-billed curlew	April 15 - July 15 (nest site)[2]	April 15 - July 15 (nest site)[3]	April 15 - July 15 (active nest)[4]	200 m[2]	200 m[3]	250 m[4]
mountain plover	May 1 - July 31 (nest site)[5]	May 1 - July 31 (nest site)[3]	May 1 - July 31 (nest site)[5]	300 m[5]	500 m[3]	300 m[5]
osprey	---	May 1 - Aug 15 (nest site)[3]	---	---	1,000 m[3]	---
peregrine falcon	year round (nest site)[2]	April 1 - Aug. 15 (nest site)[3]	April 1 - Aug. 15 (nest site)[4]	1,000 m[2]	1,000 m[3]	400 m[4]
piping plover	May 31 - July 31 (nesting beaches during nesting and brood rearing)[5]	May 1 - Sept. 30 (high water mark)[3]	May 31 - July 31 (nesting beaches during nesting and brood rearing)[4]	300 m[5]	600 m[3]	300 m[4]
	year round (high water mark)[2]		Aug. 1 - Sept. 30 (nesting beaches during dispersal and migration)[4]	200 m[2]		100 m[4]
prairie falcon	year round (nest site)[2]	March 15 - July 15 (nest site)[3]	---	1,000 m[2]	1,000 m[3]	---
red-headed woodpecker	April 15 - June 30 (nests)[5]	April 15 - June 30 (nest site)[3]	April 15 - July 15[4]	50 m[5]	100 m[3]	100 m[4]
greater sage grouse	year round (lek)[2]	year round (lek)[3]	March 1- July 15 (leks)[5]	1,000 m[2]	1,000 m[3]	750 m[5]
	April 15 - June 15 (nests)[5]	April 15 - June 15 (nest site)[3]	April 15 - June 15 (nests)[5]	250 m[5]	500 m[3]	250 m[5]
			July 16 - Feb. 29 (leks)[5]			500 m[5]
sage thrasher	year round (nest site)[2]	May 15 - June 30 (nest site)[3]	May 15 - June 30 (nest site)[4]	200 m[2]	200 m[3]	100 m[4]
sharp-tailed grouse	year round (lek)[2]	Mar 15 - May 15 (lek)[3]	---	500 m[2]	400 m[3]	---
short-eared owl	March 25 - Aug. 1 (nest site)[5]	March 25 - Aug. 1 (nest site)[3]	March 25 - Aug. 1 (nest site)[4]	200 m[5]	500 m[3]	200 m[4]
	April 1 - July 31 (nest site)[2]			400 m[2]		
snowy plover	---	May 1 - July 31 (nest site)[3]	---	---	500 m[3]	---
Sprague's pipit	April 15 - July 15 (nest site)[2]	April 21 - Aug. 31 (nest site)[3]	April 21 - Aug. 31 (nest site)[5]	100 m[2]	250 m[3]	100 m[5]
	April 21 - Aug. 31 (nest site)[5]			100 m[5]		
trumpeter swan	---	April 1 - July 31 (nest site)[3]	---	---	1,000 m[3]	---
western grebe	---	May 15 - July 15 (nesting colony)[3]	---	---	200 m[3]	---
whooping crane	May 1 - Aug. 15 Sept 15- Nov 1 (staging areas)[5]	May 1 - Aug. 15, Sept. 15 - Nov. 1 (staging)[5]	May 1 - Aug. 15, Sept 15 - Nov 1 (staging areas)[4]	1,000 m[5]	1,000 m[5]	1,000 m[4]
yellow rail	May 1 - July 15 (nests)[5]	May 1 - July 15 (nest site)[3]	May 1 - July 15 (nests)[5]	100 m[5]	350 m[3]	100 m[5]
MAMMAL						
swift fox	Feb. 15 - Aug. 31 (breeding, rearing, emergence)[5]	year round (den)[3]	Feb. 15 - Aug. 31 (breeding, rearing, emergence)[5]	500 m[5]	2,000 m[3]	500 m[5]
	year round (den)[2]		Sept. 1 - Feb. 14 (winter)[5]	500 m[2]		250 m[5]
black-tailed prairie dog	year round (colonies)[5]	year round (colony)[3]	year round (colonies)[5]	125 m[5]	500 m[3]	125 m[5]
Ord's kangaroo rat	April 1 - Aug. 15 (breeding)[5]	year round (den)[3]	April 1 - Aug. 15 (breeding)[5]	100 m[5]	500 m[3]	100 m[5]
	Aug. 16 - Nov. 15 (pre-winter)[5]		Aug. 16 - Nov. 15 (pre-winter)[5]	250 m[5]		250 m[5]
	Nov. 16 - March 31 (winter)[5]		Nov. 16 - March 31 (winter)[5]	100 m[5]		100 m[5]
	year round (den)[2]			100 m[2]		

TABLE 6.4 Cont'd

Notes: 1 Setback distances and timing restrictions are not available for all sensitive species with potential to occur in the project area. For a complete list of species of concern with potential to occur in the vicinity of the Project, see Appendix 5E of this ESA. Refer to the Wildlife Species of Concern Discovery Contingency Plan (Appendix 6B of this ESA) for mitigative measures to be implemented in the event of a sensitive wildlife species or habitat discovery, and Section 9.0 of this ESA for additional information on supplemental wildlife and wildlife habitat field studies to be undertaken prior to construction.

2 Setback distances and timing restrictions based on Alberta Fish and Wildlife Division 2001. *Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat Within Grassland and Parkland Natural Regions of Alberta*. July 26, 2001. Draft.

3 Setback distances and timing restrictions based on SK CDC 2003. *Saskatchewan Activity Restriction Guidelines for sensitive species in natural habitats*. September 2003.

4 Species specific guidelines are not available for southern Manitoba (Chranowski, Moran pers. comm.). Setback distances and timing restrictions based on Environment Canada guidelines for the prairie provinces (Gregoire pers. comm.) and *Development of Standardized Guidelines for Petroleum Industry Activities that Affect COSEWIC Prairie and Northern Region Vertebrate Species at Risk* (Scobie and Faminow 2000).

5 Setback distances and timing restrictions based on Scobie, D. and C. Faminow. 2000. *Development of Standardized Guidelines for Petroleum Industry Activities that Affect COSEWIC Prairie and Northern Region Vertebrate Species at Risk*. Prepared for Environment Canada. March 2000.

TABLE 6.5

LOCATIONS OF EXTENSIVE TRACTS OF NATIVE VEGETATION, LARGE WATERCOURSES AND OPEN WATER ALONG THE PROPOSED PIPELINE ROUTE

KP	Location	Land Use	Length (m)
ALBERTA			
KP 176.1 to KP 176.9		Bush-pasture	> 500
KP 176.9 to KP 177.4		Pasture	500
KP 177.4 to KP 178.5		Bush-pasture	> 500
KP 179.9 to KP 180.3		Pasture	< 500
KP 182.2 to KP 183.6		Bush-pasture	> 500
KP 187.3 to KP 188.3		Pasture	> 500
KP 190.2 to KP 190.9		Pasture	> 500
KP 190.9 to KP 194.1		Bush-pasture	> 500
KP 194.1 to KP 194.9		Pasture	> 500
KP 195.7 to KP 199.1		Bush-pasture	> 500
KP 202.7 to KP 203.2		Bush-pasture	500
KP 212.4 to KP 213.3	Active sharp-tailed grouse dancing ground		> 500
KP 212.9 to KP 213.3		Pasture	< 500
KP 213.6 to KP 213.7	Ribstone Creek	Hay	N/A
KP 213.9 to KP 217.8		Pasture	> 500
KP 217.8 to KP 225.0	White-tailed deer Wildlife Key Area		> 500
KP 217.8 to KP 225.9		Pasture and Bush-pasture	> 500
KP 225.0 to KP 226.0	Active sharp-tailed grouse dancing ground		> 500
KP 226.2 to KP 227.1		Pasture	> 500
KP 226.6 to KP 227.5	Active sharp-tailed grouse dancing ground		> 500
KP 227.3 to KP 228.1		Pasture	> 500
KP 227.5 to KP 229.5	White-tailed deer Wildlife Key Area		> 500
KP 228.1 to KP 229.6		Bush-pasture	> 500
KP 229.9 to KP 230.5		Bush-pasture	> 500
KP 234.5 to KP 237.1		Bush-pasture	> 500
KP 237.1 to KP 238.2		Pasture	> 500
KP 242.8 to KP 243.1		Open water	
KP 252.5 to KP 253.3		Pasture	> 500
KP 271.6 to KP 274.8	Eyehill Creek	Native prairie	> 500
SASKATCHEWAN			
KP 275.6 to KP 276.1		Native Prairie	500
KP 276.3 to KP 276.9		Native Prairie	> 500
KP 278.3 to KP 279.0		Native Prairie	> 500
KP 288.1 to KP 288.6		Pasture	500
KP 300.9 to KP 301.5	Eared grebe nesting colony		> 500
KP 315.5 to KP 316.0		Bush-pasture	500
KP 324.5 to KP 332.2		Native prairie	> 500
KP 324.8 to KP 326.0	Sharp-tailed grouse critical wildlife habitat		> 500
KP 324.9 to KP 325.6	Burrowing owl nesting area		> 500
KP 328.3 to KP 331.3	Sharp-tailed grouse critical wildlife habitat		> 500
KP 331.3 to KP 332.2		Native prairie	> 500
KP 331.5 to KP 333.2	Sharp-tailed grouse critical wildlife habitat		> 500
KP 333.3 to KP 334.0		Native prairie	> 500
KP 334.9 to KP 335.9		Pasture	> 500
KP 335.9 to KP 336.7		Native prairie	> 500
KP 347.2 to KP 348.8		Native prairie	> 500
KP 350.4 to KP 351.2		Pasture	> 500
KP 358.8 to KP 359.8		Native prairie	> 500
KP 382.9 to KP 383.4	Unnamed creek	Native prairie	< 500
KP 384.8 to KP 384.9	Unnamed creek	Native prairie	< 500
KP 392.5 to KP 392.9		Native prairie	< 500

TABLE 6.5 Cont'd

KP	Location	Land Use	Length (m)
KP 392.9 to KP 394.2	Eagle Creek	Pasture	> 500
KP 394.2 to KP 394.5		Native prairie	< 500
KP 414.0 to KP 415.0		Pasture	> 500
KP 424.5 to KP 426.2	Eagle Creek	Native prairie	> 500
KP 504.2 to KP 504.8		Pasture	> 500
KP 504.8 to KP 505.2		Native prairie	< 500
KP 505.2 to KP 505.9	South Saskatchewan River	River	> 500
KP 505.9 to KP 507.2	Mule deer, white-tailed deer and sharp-tailed grouse critical wildlife habitat		> 500
KP 505.9 to KP 508.9		Native prairie	> 500
KP 509.7 to KP 510.5		Pasture	> 500
KP 511.3 to KP 512.2	Mule deer, white-tailed deer and sharp-tailed grouse critical wildlife habitat		> 500
KP 556.5 to KP 557.5		Pasture	> 500
KP 559.4 to KP 566.2		Native prairie	> 500
KP 560.5 to KP 562.4	Long-billed curlew nesting habitat		> 500
KP 563.3 to KP 564.9	Sharp-tailed grouse critical wildlife habitat		> 500
KP 564.9 to KP 565.3	Long-billed curlew nesting habitat		> 500
KP 565.9 to KP 567.6	White-tailed deer and sharp-tailed grouse critical wildlife habitat		> 500
KP 566.7 to KP 567.3		Pasture	> 500
KP 575.2 to KP 577.2		Native prairie	> 500
KP 586.3 to KP 587.5	White-tailed deer, mule deer, pheasant and sharp-tailed grouse critical wildlife habitat		> 500
KP 586.3 to KP 590.8	Iskwao Creek	Native prairie	> 500
KP 593.9 to KP 594.5		Pasture	> 500
KP 595.0 to KP 595.4		Pasture	< 500
KP 595.8 to KP 598.3		Pasture	> 500
KP 616.6 to KP 617.5		Pasture	> 500
KP 619.7 to KP 620.2		Native prairie	500
KP 622.3 to KP 622.9		Native prairie	> 500
KP 624.0 to KP 625.6		Native prairie	> 500
KP 627.1 to KP 628.2		Native prairie	> 500
KP 648.4 to KP 649.4		Native prairie	> 500
KP 653.2 to KP 654.4		Native prairie	> 500
KP 655.9 to KP 656.5		Native prairie	> 500
KP 656.1 to KP 658.5	Beaver critical wildlife habitat		> 500
KP 656.5 to KP 657.0		Pasture	500
KP 657.0 to KP 657.1	Qu'Appelle River	River	
KP 657.1 to KP 657.4		Pasture	< 500
KP 657.7 to KP 660.1		Native prairie	> 500
KP 662.2 to KP 664.0	Sharp-tailed grouse critical wildlife habitat		> 500
KP 662.6 to KP 664.0		Native prairie	> 500
KP 663.0 to KP 664.0	White-tailed deer critical wildlife habitat		> 500
KP 666.8 to KP 667.1	High Hill Creek	Native prairie	< 500
KP 669.8 to KP 670.8		Pasture	> 500
KP 774.5 to KP 775.7		Pasture	> 500
KP 781.5 to KP 783.1		Native prairie	> 500
KP 781.7 to KP 784.2	Sharp-tailed grouse critical wildlife habitat		> 500
KP 783.1 to KP 783.4	DU - Chapleau Lakes	Lake	
KP 783.4 to KP 784.6	DU - Chapleau Lakes (KP 783.4-783.8)	Native prairie	> 500
KP 784.6 to KP 786.3		Pasture	> 500
KP 804.4 to KP 804.5		Open water	
KP 812.6 to KP 813.2		Pasture	> 500
KP 820.0 to KP 820.4	Unnamed creek	Native prairie	< 500
KP 822.5 to KP 823.8	White-tailed deer critical wildlife habitat		> 500
KP 822.5 to KP 823.8		Bush-pasture	> 500
KP 829.0 to KP 829.6		Pasture	> 500
KP 830.3 to KP 831.0		Pasture	> 500

TABLE 6.5 Cont'd

KP	Location	Land Use	Length (m)
KP 831.1 to KP 831.3		Open water	
KP 840.3 to KP 841.8	White-tailed deer critical wildlife habitat		> 500
KP 857.9 to KP 858.4		Open water	
KP 861.6 to KP 863.4		Pasture	> 500
KP 864.2 to KP 864.8		Pasture	> 500
KP 871.2 to KP 871.6	Montgomery Creek	Native prairie	< 500
KP 872.7 to KP 873.3	Unnamed Creek	Native prairie	> 500
KP 877.7 to KP 879.4		Bush-pasture	> 500
KP 882.0 to KP 883.5		Pasture	> 500
KP 884.3 to KP 884.8		Pasture	500
KP 884.8 to KP 885.5		Bush-pasture	> 500
KP 887.0 to KP 887.2		Open water	
KP 889.8 to KP 890.7		Bush-pasture	> 500
KP 891.5 to KP 891.6	Charles Lake (250 m south of proposed route)	Hay	N/A
KP 895.1 to KP 897.0	White-tailed deer critical wildlife habitat		> 500
KP 895.1 to KP 895.4		Pasture	< 500
KP 895.4 to KP 897.0		Bush-pasture	> 500
KP 897.4 to KP 897.9		Bush-pasture	500
KP 898.4 to KP 901.3	White-tailed deer and ruffed grouse critical wildlife habitat		> 500
KP 898.4 to KP 899.4		Bush-pasture	> 500
KP 899.4 to KP 900.0		Pasture	> 500
KP 900.0 to KP 901.3		Bush-pasture	> 500
KP 906.5 to KP 906.9	White-tailed deer and beaver critical wildlife habitat		< 500
KP 906.5 to KP 907.7	Little Pipestone Creek	Native prairie	> 500
KP 906.9 to KP 909.2	Sharp-tailed grouse critical wildlife habitat		> 500
KP 907.7 to KP 908.9		Pasture	> 500
KP 913.6 to KP 915.4		Pasture	> 500
KP 916.4 to KP 917.7		Pasture	> 500
KP 917.4 to KP 917.7	White-tailed deer critical wildlife habitat		< 500
KP 921.2 to KP 922.1		Bush-pasture	> 500
KP 923.1 to KP 923.7		Pasture	> 500
KP 925.8 to KP 927.4		Bush-pasture	> 500
KP 928.0 to KP 928.5		Bush-pasture	500
KP 932.1 to KP 933.8	Jackson Creek	Bush-pasture	> 500
KP 936.4 to KP 937.1		Bush	> 500
KP 938.6 to KP 939.3		Pasture	> 500
KP 940.0 to KP 944.9	Sharp-tailed grouse critical wildlife habitat		> 500
KP 941.5 to KP 942.4		Bush-pasture	> 500
KP 942.4 to KP 943.2	Stony Creek	Native prairie	> 500
KP 943.5 to KP 944.2		Native prairie	> 500
KP 944.5 to KP 944.9		Bush-pasture	< 500
MANITOBA			
KP 951.0 to KP 951.6	Pipestone Creek	Native Prairie	> 500
KP 951.6 to KP 951.8		Pasture	< 500
KP 952.3 to KP 953.8		Pasture	> 500
KP 955.2 to KP 955.8		Native prairie	> 500
KP 964.0 to KP 964.8		Pasture	> 500
KP 974.0 to KP 974.2		Open water	
KP 974.5 to KP 974.6		Open water	
KP 984.2 to KP 985.3		Pasture	> 500
KP 985.3 to KP 985.7		Native prairie	< 500
KP 988.2 to KP 1004.9	Canada goose refuge critical wildlife habitat		> 500
KP 988.2 to KP 993.0		Native prairie	> 500
KP 993.6 to KP 993.7	Oak Lake (200 m south of proposed route)	Hay	N/A
KP 993.9 to KP 994.7		Pasture	> 500
KP 997.2 to KP 997.4		Bush-pasture	< 500
KP 998.0 to KP 999.7		Bush-pasture	> 500

TABLE 6.5 Cont'd

KP	Location	Land Use	Length (m)
KP 1000.0 to KP 1001.3		Bush-pasture	> 500
KP 1000.1 to KP 1000.6	Plum Lakes (1 km south of proposed route)	Pasture	500
KP 1000.6 to KP 1001.3		Bush-pasture	> 500
KP 1002.3 to KP 1003.1		Bush-pasture	> 500
KP 1003.1 to KP 1003.8		Native prairie	> 500
KP 1004.3 to KP 1004.5		Pasture	< 500
KP 1004.5 to KP 1004.9		Native prairie	< 500
KP 1004.9 to KP 1005.2		Bush-pasture	< 500
KP 1005.4 to KP 1006.0		Native prairie	> 500
KP 1006.6 to KP 1007.4		Native prairie	> 500
KP 1007.4 to KP 1007.8		Pasture	< 500
KP 1008.9 to KP 1011.8		Bush	> 500
KP 1012.9 to KP 1013.3		Bush-pasture	< 500
KP 1013.3 to KP 1015.4		Native prairie	> 500
KP 1015.4 to KP 1017.1		Pasture	> 500
KP 1019.2 to KP 1020.0		Pasture	> 500
KP 1020.0 to KP 1080.8		Native prairie	> 500
KP 1020.8 to KP 1022.5		Bush-pasture	> 500
KP 1023.4 to KP 1024.0		Pasture	> 500
KP 1024.2 to KP 1025.1		Bush-pasture	> 500
KP 1025.4 to KP 1025.9		Pasture	500
KP 1029.1 to KP 1030.1		Bush	> 500
KP 1030.1 to KP 1030.7		Native prairie	> 500
KP 1050.1 to KP 1050.6		Pasture	500
KP 1050.6 to KP 1050.7		Open water	
KP 1050.7 to KP 1051.2		Native prairie	500
KP 1051.6 to KP 1052.1		Bush	500
KP 1052.5 to KP 1052.6		Open water	
KP 1052.9 to KP 1053.7	DU - Log Cabins (NW & NE 34-7-19 WPM) Kozak and Rouire CA (NW 34-7-19 WPM)	Bush, bush-pasture, pasture	> 500
KP 1056.3 to KP 1057.0	Cunningham CA (SW 36-7-19 WPM)	Pasture	< 500
KP 1072.6 to KP 1074.2	Souris River	Bush	> 500
KP 1086.8 to KP 1087.2		Bush-pasture	< 500
KP 1108.0 to KP 1108.4		Pasture	< 500
KP 1109.1 to KP 1111.0	Oak Creek	Pasture	> 500
KP 1112.6 to KP 1113.3		Pasture	> 500
KP 1124.5 to KP 1125.0		Pasture	500
KP 1131.4 to KP 1131.8	Cypress River	Bush-pasture	< 500
KP 1132.3 to KP 1132.8		Bush	500
KP 1153.4 to KP 1154.4		Pasture	> 500
KP 1156.4 to KP 1157.0		Pasture	> 500
KP 1160.6 to KP 1161.0		Native prairie	< 500
KP 1172.6 to KP 1173.0		Bush	< 500
KP 1174.3 to KP 1174.8	DU - Lizard Lake (SW 6-4-7 WPM, 400 m north of proposed route)	N/A	N/A
KP 1182.3 to KP 1182.7		Pasture	< 500
KP 1185.9 to KP 1186.4		Bush-pasture	500
KP 1190.4 to KP 1191.9		Pasture	> 500
KP 1193.4 to KP 1195.8		Pasture	> 500
KP 1196.2 to KP 1197.0	Deadhorse Creek; Lake Minnewasta (200 m south of proposed route)	Bush-pasture	> 500

Note: Land use along the Regina, Kipling and Morden reroutes will be evaluated during supplemental studies conducted in spring 2007, and are excluded from this table.

TABLE 6.6

SIGNIFICANCE EVALUATION OF ADVERSE RESIDUAL EFFECTS OF IDENTIFIED BIOPHYSICAL AND SOCIO-ECONOMIC ELEMENTS OF THE PIPELINE AND ASSOCIATED PIPELINE FACILITIES

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. PHYSICAL ENVIRONMENT									
1(a) Areas of minor terrain instabilities may occur.	negative	footprint	short-term	isolated	short-term	low	high	high	not significant
1(b) Topography may be altered at locations where cut slopes are too steep to be replaced.	negative	footprint	short-term	isolated	permanent	low	high	moderate	not significant
Physical Environment Summary *Residual effect summary assessment of all components of Physical Environment.*	negative	footprint	short-term	isolated	short-term to permanent	low	high	moderate to high	not significant
2. SOIL CAPABILITY									
2(a) Minor topsoil / subsoil mixing.	negative	footprint	short-term	isolated	medium-term	low	high	high	not significant
2(b) Undesirable lower subsoils may be unexpectedly encountered and admixed with upper subsoil horizons.	negative	footprint	short-term	isolated	medium- to long-term	low	high	high	not significant
2(c) Minor surface erosion of topsoil can be expected until a vegetative cover has been established.	negative	footprint	short-term	isolated	short- to long-term	low	high	high	not significant
2(d) Revegetation of some disturbed high wind erodible soils may be difficult (*e.g.*, soils within the Sounding Dunes, Elbow PFRA Community Pasture, Oak Lake Sand Hills and Souris Sand Hills).	negative	footprint	short-term	isolated	medium- to long-term	medium	high	high	not significant
2(e) Revegetation of soils saline to the surface may be difficult.	negative	footprint	short-term	isolated	short-term	low	high	high	not significant
2(f) Stone picking and bedrock slab removal may result in disposal issues and the use of sand as bedding and padding material may result in reduced capability of soils adjacent to the trench.	negative	footprint to region	short-term	isolated	short-term	low	high	high	not significant
2(g) Pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions.	negative	footprint	short-term	isolated	short- to medium-term	low	low to high	high	not significant
2(h) Minor trench subsidence or a remnant crown may occur.	negative	footprint	short-term	isolated	short- to medium-term	low	high	high	not significant
Soil Capability Summary *Residual effect summary assessment of all components of Soil Capability.*	negative	footprint to region	short-term	isolated	short- to long-term	low to medium	low to high	high	not significant
3. WATER QUALITY AND QUANTITY									
3(a) Alteration of natural drainage patterns may occur until trench settlement is complete.	negative	footprint to local	short-term	isolated	short-term	low to medium	high	high	not significant
3(b) Reduction in surface water quality due to suspended solids during an isolated crossing.	negative	footprint to local	short-term	isolated	immediate to short-term	low to medium	high	high	not significant
3(c) Reduction in surface water quality due suspended solids during a trenched crossing with flowing water.	negative	footprint to local	short-term	isolated	short-term	medium to high	high	high	not significant
3(d) Disruption of water well flows may occur.	negative	local	short-term	isolated	short-term	low	low	high	not significant
3(e) Disruption of shallow groundwater flow where springs are encountered.	negative	local	short-term	isolated	short-term	low	low	high	not significant

TABLE 6.6 Cont'd

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
Water Quality and Quantity Summary *Residual effect summary assessment of all components of Water Quality and Quantity.*	negative	footprint to local	short-term	isolated	immediate to short-term	low to high	low to high	high	not significant
4. GREENHOUSE GASES AND AIR QUALITY									
4(a) Increase in vehicle emissions will occur during pipeline construction.	negative	footprint to region	short-term	isolated	short-term	low	high	high	not significant
4(b) Increase in dust arising from construction traffic on the right-of-way will occur.	negative	footprint to local	short-term	isolated	immediate	low	high	high	not significant
4(c) Increase in smoke arising from burning of slash will occur.	negative	footprint to local	short-term	isolated	immediate	low	high	high	not significant
4(d) Slight rise in air emissions will occur during site-specific maintenance activities.	negative	footprint to region	immediate to short-term	periodic	short-term	negligible to low	high	high	not significant
Greenhouse Gases and Air Quality Summary *Residual effect summary assessment of all components of Greenhouse Gases and Air Quality.*	negative	footprint to region	immediate to short-term	isolated to periodic	immediate to short-term	negligible to low	high	high	not significant
5. ACOUSTIC ENVIRONMENT									
5(a) Increase in noise will occur during pipeline construction.	negative	footprint to local	short-term	isolated	immediate	low	high	high	not significant
5(b) Slight rise in noise levels during site-specific pipeline maintenance activities.	negative	footprint to local	immediate to short-term	periodic	immediate	negligible to low	high	high	not significant
Acoustic Environment Summary *Residual effect summary assessment of all components of Acoustic Environment.*	negative	footprint to local	immediate to short-term	isolated to periodic	immediate	negligible to low	high	high	not significant
6. FISH AND FISH HABITAT									
6(a) Disturbance of riparian vegetation along the right-of-way and temporary workspace.	negative	footprint	short-term	isolated	medium-term	low	high	high	not significant
6(b) Alteration of instream habitat within the zone-of-influence at trenched crossings will occur.	negative	footprint to local	short-term	isolated	short- to medium-term	low	high	high	not significant
6(c) Increased suspended solids during an isolated crossing.	negative	footprint to local	short-term	isolated	immediate to short-term	low to medium	high	high	not significant
6(d) Increase in suspended solids during a trenched crossing with flowing water.	negative	footprint to local	short-term	isolated	short-term	medium to high	high	high	not significant
6(e) Blockage of fish movement may occur.	negative	footprint to local	short-term	isolated	short-term	low	low	high	not significant
6(f) Potential for increased fish and bivalve mortality during trenched crossing with flowing water.	negative	footprint to local	short-term	isolated	short-term	low	low	moderate	not significant
6(g) Contamination from spills during construction and operations may occur.	negative	footprint to local	short-term	accidental	short-term	low to high	low	high	not significant
6(h) Potential fish and bivalve species of concern (*i.e.,* chestnut lamprey, maple leaf mussel, bigmouth buffalo) may be affected by increased suspended solid concentration and habitat alteration within the zone of influence at select watercourse crossings.	negative	footprint to local	short-term	isolated	short- to medium-term	low	low	high	not significant

TABLE 6.6 Cont'd

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
Fish and Fish Habitat Summary[2] *Residual effect summary assessment of all components of Fish and Fish Habitat.*	negative	footprint to local	short-term	isolated to accidental	immediate to medium-term	low to high	low to high	moderate to high	not significant
7. WETLANDS									
7(a) Alteration of wetland habitat following disturbance.	negative	footprint to local	short-term	isolated	short-term	low	high	high	not significant
7(b) Alteration of hydrologic function of wetlands during pipeline construction.	negative	footprint to local	short-term	isolated	short-term	low	high	high	not significant
7(c) Alteration of water quality function of wetlands during pipeline construction.	negative	footprint to local	short-term	isolated	short-term	low	high	high	not significant
Wetlands Summary *Residual effect summary assessment of all components of Wetlands.*	negative	footprint to local	short-term	isolated	short-term	low	high	high	not significant
8. VEGETATION									
8(a) Alteration of approximately 390 ha of native vegetation, including 220 ha of native prairie.	negative	footprint	short-term	isolated	medium- to long-term	low to medium	high	high	not significant
8(b) If mitigative measures do not completely protect the site, some loss or alteration of the local population of S1, S2, or S3 rare vascular plants may occur.	negative	footprint to local	short-term	isolated	short- to medium-term	medium	high	moderate	not significant
8(c) If the sensitive plant community cannot be avoided, then a narrow strip of the community will be disturbed resulting in some loss or alteration of the community.	negative	footprint to local	short-term	isolated	medium- to long-term	medium	low	moderate	not significant
8(d) Alteration of approximately 607 ha of vegetation important to wildlife.	negative	footprint	short-term	isolated	short- to long-term	low	high	high	not significant
8(e) Weed introduction and spread may occur.	negative	footprint to local	short-term	isolated	short- to medium-term	low	high	high	not significant
Vegetation Summary *Residual effect summary assessment of all components of Vegetation.*	negative	footprint to local	short-term	isolated	short- to long-term	low to medium	low to high	moderate to high	not significant
9. WILDLIFE AND WILDLIFE HABITAT									
9(a) Alteration of approximately 607 ha of wildlife habitat including habitat within Ducks Unlimited project areas, Conservation Agreements, NAWMP priority areas, PFRA community pastures, *WHPA* lands, Kendal Game Preserve, and Fish and Game Development Fund areas.	negative	footprint	short-term	isolated	short- to long-term	low	high	high	not significant
9(b) Displacement of wildlife away from the pipeline area during construction with resultant use of potentially suboptimal habitat during noncritical periods.	negative	footprint to local	short-term	isolated	short-term	low	high	high	not significant
9(c) Potential increase in mortality due to vehicle/wildlife collisions and undiscovered nests or dens during construction.	negative	footprint to region	short-term	isolated	short-term	low	low	high	not significant
Wildlife and Wildlife Habitat Summary *Residual effect summary assessment of all components of Wildlife and Wildlife Habitat.*	negative	footprint to region	short-term	isolated	short- to long-term	low	low to high	high	not significant
10. SPECIES AT RISK									
10(a) Potential fish species at risk may be affected by increased suspended solid concentration and habitat alteration within the zone of influence at select watercourse crossings.	negative	footprint to local	short-term	isolated	short- to medium-term	low	low	high	not significant
10(b) If mitigative measures do not completely protect the site, some loss or alteration of the local population of vascular plant species at risk may occur.	negative	footprint to local	short-term	isolated	short- to medium-term	medium	low	moderate	not significant

TABLE 6.6 Cont'd

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
10(c) Combined effects on wildlife species at risk, including northern leopard frogs, loggerhead shrikes, long-billed curlews and burrowing owls.	negative	footprint to local	short-term	isolated	short- to medium-term	low to medium	high	moderate	not significant
Species at Risk Summary *Residual effect summary assessment of all components of Species at Risk.*	negative	footprint to local	short-term	isolated	short- to long-term	low to medium	low to high	moderate to high	not significant
11. HUMAN OCCUPANCY AND RESOURCE USE									
11(a) Disruption of ranching and farming activities, including irrigation, may occur during pipeline construction.	negative	footprint to local	short-term	isolated	short-term	low to medium	high	high	not significant
11(b) Disruption of grazing activities may occur during pipeline construction on PFRA / community pasture lands and grazing leases.	negative	footprint to local	short-term	isolated	short-term	low to medium	high	high	not significant
11(c) Disruption of local hunting and guide outfitting activities may occur during pipeline construction.	negative	footprint to local	short-term	isolated	short-term	negligible to low	high	high	not significant
11(d) The navigability of watercourses deemed a navigable waterway may be affected during pipeline construction.	negative	footprint to local	short-term	isolated	immediate	low	high	high	not significant
11(e) Disruption of golfing activities may occur during pipeline construction.	negative	footprint to local	short-term	isolated	short-term	negligible to medium	high	high	not significant
11(f) Disruption of recreational activities at Kemoca Regional Park may occur during pipeline construction.	negative	footprint to local	short-term	isolated	short-term	negligible to medium	high	high	not significant
11(g) Alteration of lands along the proposed route within the Sounding-Sunken Environmentally Significant Area will occur.	negative	footprint	short-term	isolated	medium- to long-term	low	high	high	not significant
11(h) A decrease in the quality of the outdoor recreation experience may occur at select locations during pipeline construction.	negative	footprint to local	short-term	isolated	immediate	negligible to low	high	high	not significant
Human Occupancy and Resource Use Summary *Residual effect summary assessment of all components of Human Occupancy and Resource Use.*	negative	footprint to local	short-term	isolated	immediate to long-term	negligible to medium	high	high	not significant
12. HERITAGE RESOURCES									
12(a) Surface sites may be disturbed during HRIAs and site investigations.	negative	footprint	short-term	isolated	permanent	low	high	high	not significant
12(b) Previously unidentified buried heritage resources may be disturbed during pipeline construction.	negative	footprint	short-term	isolated	permanent	low	low	high	not significant
Heritage Resources Summary *Residual effect summary assessment of all components of Heritage Resources.*	negative	footprint	short-term	isolated	permanent	low	low to high	high	not significant
13. TRADITIONAL LAND AND RESOURCE USE									
Disruption of farming activities during pipeline construction on the Swan Lake Indian Reserve No. 7 may occur.	negative	footprint to local	short-term	isolated	short-term	low	high	high	not significant
14. SOCIAL AND CULTURAL WELL-BEING									
No adverse residual effect identified.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15. HUMAN HEALTH									
No adverse residual effect identified.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16. INFRASTRUCTURE AND SERVICES									
16(a) Increased traffic on highways and local roads used to access the proposed pipeline right-of-way will occur during pipeline construction.	negative	local to region	short-term	isolated	immediate	low	high	high	not significant

TABLE 6.6 Cont'd

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
16(b) Temporary increase in waste flow to regional landfill sites will occur.	negative	local to region	short-term	isolated	immediate to short-term	low to medium	high	high	not significant
16(c) Local or regional tourist accommodations along the proposed route will be temporarily occupied by Alberta Clipper Project workers primarily in Saskatchewan and Manitoba.	negative	local to region	short-term	isolated	immediate to short-term	low to medium	high	high	not significant
16(d) Despite best intentions and work practices, incidents arising during pipeline construction may warrant the use of some emergency services.	negative	local to region	short-term	isolated	immediate	low	low	high	not significant
Infrastructure and Services Summary *Residual effect summary assessment of all components of Infrastructure and Services.*	negative	local to region	short-term	isolated	immediate to short-term	low to medium	low to high	high	not significant
17. EMPLOYMENT AND ECONOMY									
No adverse residual effect identified.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18. ACCIDENTS AND MALFUNCTIONS									
18(a) Spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident.	negative	footprint to local	short-term	accidental	short-term	low to high	low	moderate	not significant
18(b) Fires may adversely affect adjacent vegetation and, in very rare situations, affect wildlife and adjacent property.	negative	footprint to local	immediate to short-term	accidental	short- to long-term	low to high	low	moderate	not significant
18(c) Rupture of water, sewage, gas or other lines could lead to interruption of services, contamination of soil or water depending on the location and severity of the rupture and fires in the case of gas. Cable damage can lead to interrupted service of the utility to communities and local residences.	negative	local to region	immediate to short-term	accidental	immediate to short-term	low to high	low	moderate	not significant
18(d) Depending on the volume and location of the release, a release of drilling mud into a watercourse may affect aquatic ecosystems.	negative	footprint to local	short-term	accidental	short- to medium-term	low to medium	low	moderate	not significant
18(e) A pipeline failure may adversely affect adjacent soils, vegetation, wildlife habitat and aquatic ecosystems, including aquifers.	negative	footprint to local	short-term	accidental	short- to long-term	low to high	low	moderate	not significant
Accidents and Malfunctions Summary *Residual effect summary assessment of all components of Accidents and Malfunctions.*	negative	footprint to region	immediate to short-term	accidental	immediate to long-term	low to high	low	moderate	not significant
19. EFFECTS OF THE ENVIRONMENT ON THE PROJECT									
19(a) Slumping may affect construction schedule.	negative	footprint to local	immediate	accidental	short- to long-term	low	low	high	not significant
19(b) Substantial loss of cover over the pipeline may occur in isolated areas as a result of an extreme flood event.	negative	footprint	short-term	accidental	short-term	low to high	low	high	not significant
19(c) A wildfire may affect the construction schedule.	negative	region	short-term	accidental	short-term	low	low	high	not significant
Effects of the Environment on the Project Summary *Residual effect summary assessment of all components of the Effects of the Environment on the Project.*	negative	footprint to region	immediate to short-term	accidental	short- to long-term	low to high	low	high	not significant

Notes: 1. Significant Adverse Residual Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated or economically compensated.

2. The evaluation of significance has included compensation considerations.

TABLE 6.7

ECONOMIC EFFECTS OF THE ALBERTA CLIPPER PROJECT

(in 2007 Canadian Dollars x 1,000, except for Employment in Person-Years)

	Ontario	Manitoba	Saskatchewan	Alberta	Total
Estimated Direct Project Expenditures:	56,500	206,440	917,420	309,990	1,490,350
Output:					
Direct	51,764	162,661	605,724	375,541	1,195,690
Indirect	248,301	102,552	248,676	376,523	976,052
Total	300,065	265,213	854,400	752,064	2,171,743
Gross Domestic Product (GDP):					
Direct	25,162	50,281	120,970	122,651	319,065
Indirect	111,626	53,742	130,195	197,542	493,104
Total	136,788	104,023	251,165	320,193	812,169
Employment (in Person-Years):					
Direct	399	760	2,499	1,810	5,468
Indirect	1,466	965	1,807	2,121	6,359
Total	1,866	1,725	4,306	3,931	11,827
Labour Income:					
Direct	17,680	28,671	106,179	97,855	250,386
Indirect	73,030	38,547	80,805	110,439	302,821
Total	90,710	67,219	186,984	208,294	553,207
Federal Taxes:					
Corporate Income Tax	9,130	5,242	10,782	22,997	48,153
Personal Income Tax	10,141	7,515	20,905	23,287	61,848
GST	284	3,319	12,494	3,512	19,610
Other Indirect Taxes	439	2,606	7,433	2,334	12,811
Total	19,995	18,682	51,614	52,131	142,422
Provincial Taxes:					
Corporate Income Tax	5,784	3,440	6,831	10,406	26,460
Personal Income Tax	4,218	4,611	12,353	10,585	31,767
PST	2,900	4,119	31,058	472	38,548
Other Indirect Taxes	715	3,501	14,495	2,363	21,074
Total	13,617	15,671	64,736	23,826	117,849
Municipal Taxes (Annual from 2010):	0	1,600	2,900	1,800	6,300

Sources:

Estimated Direct Project Expenditures	Enbridge
Gross Output	Statistics Canada
Gross Domestic Product	Statistics Canada
Employment	Statistics Canada
Labour Income	Statistics Canada
Federal Taxes	Statistics Canada, Decision Economics Consulting Group
Provincial Taxes	Statistics Canada, Decision Economics Consulting Group
Municipal Taxes	Enbridge

TABLE 6.8

ELEMENTS NOT INTERACTING WITH PUMP ADDITIONS COMPONENT OF THE ALBERTA CLIPPER PROJECT

Element	Justification
BIOLOGICAL	
Fish and Fish Habitat	Pump additions will not be undertaken within 30 m of a waterbody supporting fish habitat. Therefore, no interaction between fish and fish habitat and pump additions is anticipated.
SOCIAL	
Heritage Resources	There are no archaeological concerns associated with the existing pump stations/terminals. In addition, the new Rowatt Pump Station will be constructed on previously disturbed cultivated lands with low potential for heritage resources. Therefore, no interaction between heritage resources and pump additions is anticipated.
Traditional Land and Resource Use	Lands at each existing pump station/terminal have been used as industrial lands for decades while lands at the new Rowatt Pump Station have been under cultivation for years. The pump additions will not affect any traditional use of the lands at these sites.
Social and Cultural Well-Being	The pump additions of the Alberta Clipper Project will entail a comparatively small workforce using the services of local communities over a short period. Consequently, the following potential social and cultural well-being impacts noted on Table A-5 of the NEB Filing Manual do not apply to these components of the Project: • stresses on family and household cohesion; • alcohol and substance abuse; or • illegal or other potentially disruptive activities. This element is discussed under Section 6.2.14 of this ESA for the pipeline.
Human Health	An assessment of nuisance air emissions and noise during construction is provided under GHG and Air Quality and Acoustic Environment. Air emissions are not expected to increase during operations of the new pumps. Although noise levels at some of the pump stations/terminals may increase during operations of the Alberta Clipper Project, the level of noise emissions during operations will comply with regulatory standards. Therefore, no human health effects will be associated with pump additions.
Employment and Economy	An economic impact analysis for the Alberta Clipper Project, including pump additions, is discussed under Section 6.2.17 of this ESA.

TABLE 6.9

POTENTIAL BIOPHYSICAL AND SOCIO-ECONOMIC EFFECTS, MITIGATIVE MEASURES AND RESIDUAL EFFECTS OF PUMP ADDITIONS

Biophysical or Socio-Economic Element/Potential Effect	Pump Station(s)	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
1. PHYSICAL ENVIRONMENT					
1(a) Previous site contamination	All	Footprint	• Notify Enbridge's Safety and Environment department in the event that contaminated soils are encountered during ground disturbance activities. Enbridge Safety and Environment department will be responsible for determining the appropriate course of action using their established guidelines on file with the NEB.	Enbridge O&MPs, Book 3: Contaminated Soil Management, Section 04-02-024	• No residual effects identified.
2. SOIL CAPABILITY					
2(a) Topsoil / subsoil mixing during construction	Rowatt Pump Station	Footprint	• Salvage topsoil from all areas to be graded and work areas prior to grading and excavation based on the Pre-Disturbance Site Assessment to be conducted prior to construction (see Section 9.0 of this ESA). • Stockpile topsoil for use during final reclamation of the site upon abandonment. Windrow stockpiled topsoil in low berms. • Ensure that the locations of the topsoil storage berms are kept on file so that topsoil can be replaced upon abandonment of the site.	EGC 02-5 EGC 03-3	• Minor topsoil / subsoil mixing may occur at the Rowatt Pump Station.
2(b) Erosion control of topsoil pile during construction and operations	Rowatt Pump Station	Footprint	• Do not salvage topsoil material under extremely dry and windy conditions. • Store topsoil in low berms. • Seed the topsoil storage berms as soon as possible with the following seed mix to prevent wind or water erosion of topsoil during operations: **SPECIES** — **% BY SEED WEIGHT** northern wheatgrass 40 creeping red fescue 20 Canada bluegrass 20 perennial ryegrass 20 Broadcast at 25-30 kg/ha.	EGC 02-5	• Given that the proposed mitigative measures will ensure that agricultural capability of the soil is maintained, no residual effect has been identified.
3. WATER QUALITY AND QUANTITY					
3(a) Reduction of groundwater quality	All	Footprint to Local	• Enbridge has an existing groundwater monitoring system in place at most of the pump stations to monitor groundwater quality and quantity. • Ground disturbance associated with the additions at the pump station sites will be limited to shallow depths.	---	• No residual effects identified.
3(b) Withdrawal and release of hydrostatic test water, if conducted	All	Local to Region	• In the unlikely event that rental fluids cannot be used and water is withdrawn and released for hydrostatic testing, all testing activities will be conducted in accordance with the NEB Onshore Pipeline Regulations, provincial regulations, codes of practice, as well as the latest version of CSA Z662. • Screen and locate test water intakes to prevent the intake of fish and fish eggs. • Isolate fill pumps from bodies of water with an impermeable lined dike or depression to prevent spills of fuels or lubricants from entering a body of water.	EGC 02-18	• No residual effects identified.

TABLE 6.9 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Pump Station(s)	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
3(b) Withdrawal and release of hydrostatic test water, if conducted (cont'd)	All	Local to Region	• If test water is released into a natural waterbody, ensure that the appropriate testing and treatment measures are implemented in accordance with provincial regulations related to discharging hydrostatic test water. • The withdrawal rate and volume will not exceed 5% of the flow rate of the watercourse or of the volume of the body of water unless otherwise approved by the appropriate authority. • Control the discharge rate of test water to reduce the potential for soil erosion. • Install energy diffusers and plywood sheeting, tarpaulins or other similar material to reduce the risk of soil erosion. Reduce the discharge rate if erosion becomes evident.	EGC 02-18	• No residual effects identified.
3(c) Surface runoff	Rowatt Pump Station	Footprint	• Install an appropriately-sized berm on the downslope side of the site to control surface runoff and to provide containment in the event of a spill.	---	• Given that the proposed mitigative measure will ensure that onsite drainage will be controlled and offsite natural drainage patterns in the vicinity of the site are maintained, no residual effect has been identified.
4. GREENHOUSE GASES AND AIR QUALITY					
4(a) Indirect GHG emissions during operation of pumps	All	Footprint to Region	• Clearstone Engineering Ltd. undertook an assessment of direct and indirect GHG emissions associated with the Alberta Clipper Project (see Appendix I of this ESA). • Minimize the amount of indirect GHG emissions attributed to electrical power consumption requirements of new pumps associated with the Alberta Clipper Project by installing high efficiency pump motors.	---	• Indirect GHG emissions will increase during operation of new pumps.
4(b) Airborne emissions from equipment during construction	All	Footprint to Region	• Use well maintained equipment to minimize emissions. • Minimize unnecessary idling of construction equipment.	EGC 02-2	• Increase in vehicle emissions will occur during pump additions and construction of the Rowatt Pump Station.
5. ACOUSTIC ENVIRONMENT					
5(a) Noise from construction equipment	All	Footprint to Local	• Ensure that noise abatement equipment on machinery is in good working order. • Equip construction equipment with mufflers. • Abide by local noise by-laws where applicable.	EGC 02-2	• Increase in noise will occur during pump additions and construction of the new Rowatt Pump Station.
5(b) Noise during operations	All	Footprint to Local	• Stations/terminals will be subject to noise testing prior to being placed in service if the stations were not subject to noise surveys as part of the Enbridge Southern Access Project. • Enbridge is proposing to retain noise measurement specialists to conduct noise surveys at all stations/terminals where pump additions occurred and at the Rowatt Pump Station. These surveys will be conducted when the stations are in-service in order to confirm compliance with Alberta EUB Noise Directive 038.	---	• Ambient noise levels at existing stations/terminals and at the Rowatt Pump Station may increase during operations.
6. WETLANDS					
6(a) Potential sedimentation in nearby wetland	Craik Glenavon	Footprint	• Install a temporary sediment barrier (*e.g.,* silt fence) to eliminate the flow of sediment from clean spoil piles and disturbed areas into nearby wetland.	EGC 02-14	• No residual effects identified.

TABLE 6.9 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Pump Station(s)	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
7. VEGETATION					
7(a) Revegetation of disturbed areas during construction	Rowatt Pump Station	Footprint	• Seed topsoil storage berms with the seed mix in *Soil Capability* element 2(b) of this table as soon as possible. • Gravel disturbed areas within the fenced-in station boundary.	---	• No residual effects identified.
7(b) Weed introduction during construction and operations	Rowatt Pump Station	Footprint to Local	• Employ standard weed control measures such as cleaning equipment prior to arrival at the station as described in the EGC. • Monitor and control weeds during the operation of the Rowatt Pump Station.	EGC 02-2 EGC 02-4	• Weed introduction and/or spreading from disturbance may occur at the Rowatt Pump Station.
8. WILDLIFE AND WILDLIFE HABITAT					
8(a) Auditory or visual disturbances of wildlife during construction	All	Footprint to Local	• Prohibit personnel from harassing or feeding wildlife or livestock during pump modification activities. Pets or firearms will not be permitted at the site.	EGC 02-2	• Displacement of wildlife away from station/terminal during pump additions or station construction with resultant use of potentially suboptimal habitat during noncritical conditions.
8(b) Auditory disturbances of wildlife during operations	All	Footprint to Local	• Ensure that noise levels at the stations/terminals are in compliance with applicable provincial regulations.	EGC 01-4	• Increase in noise levels in the immediate vicinity of the station/terminal will likely displace wildlife over the short to long-term.
8(c) Direct and indirect mortality during construction	All	Footprint to Region	• Inform contractor that Alberta Clipper Project traffic is to obey all traffic laws. • Report encounters or collisions with wildlife to Fish and Wildlife authorities or the local police department (see Appendix 6B of this ESA). • Collect garbage on a daily basis and dispose of at an approved facility to minimize the attraction of wildlife during construction.	EGC 02-2	• Potential for vehicle/wildlife collisions on access routes and at the station/terminal.
9. SPECIES AT RISK					
9(a) Potential disturbance of wildlife species at risk in vicinity of pump station	Hardisty Kerrobert Craik Glenavon Cromer	Local	• If pump additions at the pump station/terminal are scheduled to be conducted during the breeding period, conduct a sweep for wildlife *SARA* species on noncultivated lands within 500 m of the station prior to the initiation of activities. Should a *SARA* species be identified, determine appropriate mitigative measures to minimize disturbance in consultation with Environment Canada. • Breeding periods for potential *SARA* bird species include: loggerhead shrike: April 15 - July 15 burrowing owl: April 15 - August 15 piping plover: May 1 - July 31 Sprague's pipit: April 15 - August 31 yellow rail: May 1 to August 15 long-billed curlew: April 15 - July 15	---	• No residual effects identified.
10. HUMAN OCCUPANCY AND RESOURCE USE					
10(a) Potential alterations to existing viewsheds	Existing stations/ terminal	Footprint to Local	• Installation of new aboveground components (*i.e.*, pump installation) at each pump station will be located within the existing pump station site.	---	• The installation of aboveground facilities (*i.e.*, pump installation) will form part of the visual landscape at the pump station/terminal over the long-term.

TABLE 6.9 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Pump Station(s)	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
10(a) Potential alterations to existing viewsheds (cont'd)	Rowatt Pump Station	Footprint to Local	• The view of the pump station from the nearest residence will be largely obstructed by a shelterbelt. • Follow measures outlined in Detail 6.1 for creating a vegetative screen along each side of the Rowatt Pump Station. • The pump station cannot be viewed from a major highway. • Minimize light intrusion on areas adjacent to the pump station by reducing the number of lights and light intensity as much as practical without compromising safety.	---	• The installation of aboveground facilities (*i.e.*, buildings, fences, piping) will form part of the visual landscape at the Rowatt Pump Station over the long-term.
10(b) Disruption of farming activities	Rowatt Pump Station	Footprint	• Notify local farmer of the Rowatt Pump Station component of the Alberta Clipper Project and activity schedule prior to commencement of construction activities.	---	• Local farmer may experience disturbances of their activities during construction of the Rowatt Pump Station.
11. INFRASTRUCTURE AND SERVICES					
11(a) transport of workers and supplies during construction	All	Footprint to Region	• Advise all Alberta Clipper-related vehicles to follow applicable traffic, road-use and safety laws. • The contractor will develop a traffic management plan to manage vehicular movements on highways and local roads.	---	• Increased traffic on highways and local roads used to access the pump stations/terminals will occur during pump additions.
11(b) Waste management during construction	All	Footprint to Region	• Collect waste from work site on a daily basis. • Transport and dispose of all wastes in accordance with provincial and federal regulatory requirements. • Locate temporary toilets at convenient location on the construction site. • Follow the measures outlined in Enbridge's Waste Management Plan on file with the NEB.	EGC 02-2 / Enbridge Waste Management Plan	• Temporary increase in waste flow to regional landfill sites will occur.
11(c) worker accommodation needs may displace tourists	Hardisty Terminal	Local to Region	• Enbridge or its contractor is to install a temporary construction camp to accommodate Project workers associated with all components of the Alberta Clipper Project in the Hardisty area due to the limited availability of local and regional accommodation. • Treat sewage and grey water as per municipal and provincial permits. Dispose of waste in accordance with municipal and provincial permits as well as the Enbridge Waste Management Plan currently on file with the NEB. • Obtain approval from the applicable regulatory authority prior to withdrawing water from nearby water source for use in the temporary construction camp. Otherwise, haul fresh water to camps.	---	• Some local or regional tourist accommodations near Hardisty will be temporarily occupied by regulatory inspectors and company personnel.
12. ACCIDENTS AND MALFUNCTIONS					
12(a) Spills of hazardous materials during construction	All	Footprint	• Report spills immediately to the Enbridge Representative and, if warranted, appropriate government agencies. • Implement Enbridge's Emergency Response Plan in the event of a spill or leak of hydrocarbons.	EGC 02-2 / Enbridge O&MPs, Book 7: Emergency Response, Section 03-02-02	• Spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident.
12(b) Fire during construction	All	Footprint	• Follow the measures identified within Enbridge's Emergency Response Plan in the event of an accidental fire.	EGC 02-2 / Enbridge O&MPs, Book 2: Safety Section 05	• Despite vigilance, fires may adversely affect adjacent vegetation, and in very rare situations, affect wildlife and adjacent property.

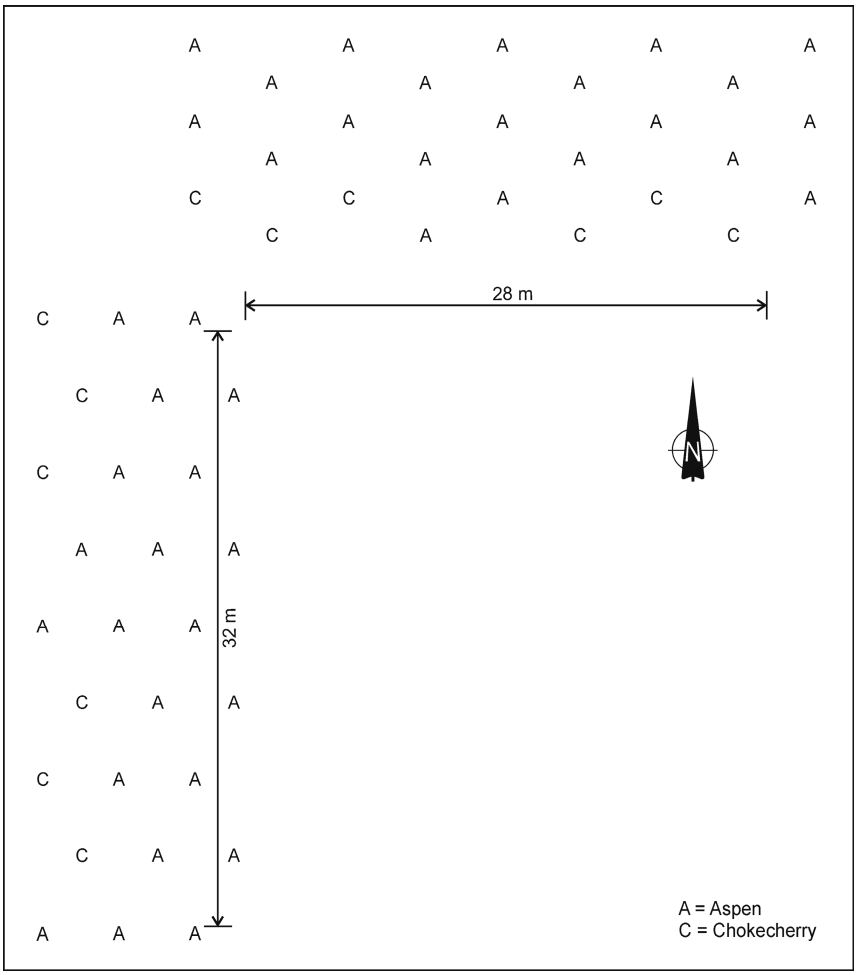
Note: 1 Detailed mitigative measures are outlined in Enbridge's EGC (2003) on file with the NEB.

CRITERIA FOR IMPLEMENTATION:

A vegetation screen will be planted around the perimeter of the Rowatt Pump Station to buffer the pump station from local residences.

Notes:

Planting a vegetation screen around the perimeter of the Rowatt Pump Station with native species will involve the following. Trembling aspen (*Populus tremuloides*) and chokecherry (*Prunus virginiana)* will be planted in an 8 m wide swath in the configuration below. All plantings will require weekly waterings for the first month following planting and bi-weekly waterings through the balance of the first growing season. Depending on spring and summer soil moisture levels, it is suggested that bi-weekly waterings continue into the second growing season.



Plant species 3.5 m apart from west to east and 4 m apart from north to south - stagger plants in an alternating configuration to maximize growing space and available light. Along the north and south side of the pump station, plant chokecherry shrubs as shown above on the south side of the swath. Along the east and west sides of the pump station, plant chokecherry shrubs as shown above on the west side of the swath.

At the above configuration and spacing, a 200 m linear distance would require approximately:
-148 Aspen and 42 Chokecherry

TABLE 6.10

SIGNIFICANCE EVALUATION OF ADVERSE RESIDUAL EFFECTS OF IDENTIFIED BIOPHYSICAL AND SOCIO-ECONOMIC ELEMENTS OF PUMP ADDITIONS

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. SOIL CAPABILITY									
Minor topsoil / subsoil mixing may occur at the Rowatt Pump Station.	negative	footprint	short-term	isolated	medium to long-term	low	high	high	not significant
2. GREENHOUSE GASES AND AIR QUALITY									
2(a) Indirect GHG emissions will increase during operation of new pumps.	negative	footprint to region	long-term	continuous	short-term	low	high	high	not significant
2(b) Increase in vehicle emissions will occur during pump additions and construction of the Rowatt Pump Station.	negative	footprint to region	short-term	isolated	short-term	low	high	high	not significant
Greenhouse Gases and Air Quality Summary *- Residual effect summary assessment of all components of Greenhouse Gases and Air Quality.*	negative	footprint to region	short to long-term	isolated to continuous	short-term	low	high	high	not significant
3. ACOUSTIC ENVIRONMENT									
3(a) Increase in noise will occur during pump additions and construction of the Rowatt Pump Station.	negative	footprint to local	short-term	isolated	immediate	low	high	high	not significant
3(b) Ambient noise levels at existing stations/terminals and at the Rowatt Pump Station may increase during operations.	negative	footprint to local	long-term	continuous	immediate	low	high	high	not significant
Acoustic Environment Summary *- Residual effect summary assessment of all components of Acoustic Environment.*	negative	footprint to local	short to long-term	isolated to continuous	immediate	low	high	high	not significant
4. VEGETATION									
Weed introduction and/or spreading from disturbance may occur at the Rowatt Pump Station.	negative	footprint to local	short-term	isolated	medium-term	low	high	moderate to high	not significant
5. WILDLIFE AND WILDLIFE HABITAT									
5(a) Displacement of wildlife away from station/terminal during pump additions or station construction with resultant use of potentially suboptimal habitat during noncritical conditions.	negative	footprint to local	short-term	isolated	short-term	low	high	high	not significant
5(b) Increase in noise levels in the immediate vicinity of the station/terminal will likely displace wildlife over the short- to long-term.	negative	footprint to local	long-term	continuous	short to long-term	low	high	moderate to high	not significant
5(c) Potential for vehicle/wildlife collisions on access routes and at the station/terminal.	negative	footprint to region	short-term	isolated	short-term	low	low	high	not significant
Wildlife and Wildlife Habitat Summary *- Residual effect summary assessment of all components of Wildlife and Wildlife Habitat.*	negative	footprint to region	short to long-term	isolated to continuous	short to long-term	low	low to high	moderate to high	not significant
6. HUMAN OCCUPANCY AND RESOURCE USE									
6(a) The installation of aboveground facilities (*i.e.*, pump installation) will form part of the visual landscape at the pump station/terminal over the long-term.	negative	local	long-term	continuous	long-term	negligible to low	high	high	not significant
6(b) The installation of aboveground facilities (*i.e.*, buildings, fences, piping) will form part of the visual landscape at the Rowatt Pump Station over the long-term.	negative	local	long-term	continuous	long-term	low	high	high	not significant

TABLE 6.10 Cont'd

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
6(c) Local farmer may experience disturbances of their activities during construction of the Rowatt Pump Station.	negative	footprint	short-term	isolated	short-term	low	high	high	not significant
Human Occupancy and Resource Use Summary - *Residual effect summary assessment of all components of Human Occupancy and Resource Use.*	negative	footprint to local	short to long-term	isolated to continuous	short to long-term	negligible to low	high	high	not significant
7. INFRASTRUCTURE AND SERVICES									
7(a) Increased traffic on highways and local roads used to access the pump stations/terminals will occur during the pump additions.	negative	footprint to region	short-term	isolated	short-term	low	high	high	not significant
7(b) Temporary increase in waste flow to regional landfill sites will occur.	negative	local to region	short-term	isolated	immediate to short-term	low	high	high	not significant
7(c) Some local or regional tourist accommodations near Hardisty will be temporarily occupied by regulatory inspectors and company personnel.	negative	local to region	short-term	isolated	immediate to short-term	low	high	high	not significant
Infrastructure and Services Summary - *Residual effect summary assessment of all components of Infrastructure and Services.*	negative	footprint to region	short-term	isolated	immediate to short-term	low	high	high	not significant
8. ACCIDENTS AND MALFUNCTIONS									
8(a) Spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident.	negative	footprint to local	short-term	accidental	short-term	low to high	low	moderate	not significant
8(b) Fires may adversely affect adjacent vegetation and, in very rare situations, affect wildlife and adjacent property.	negative	footprint to local	immediate to short-term	accidental	short to long-term	low to high	low	moderate	not significant
Accidents and Malfunctions Summary - *Residual effect summary assessment of all components of Accidents and Malfunctions.*	negative	footprint to local	immediate to short-term	accidental	short to long-term	low to high	low	moderate	not significant

Note: 1. Significant Adverse Residual Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated or economically compensated.

TABLE 6.11

ELEMENTS NOT INTERACTING WITH THE HARDISTY TERMINAL TANK INSTALLATION COMPONENT OF THE ALBERTA CLIPPER PROJECT

Element	Justification
BIOLOGICAL	
Fish and Fish Habitat	The new tanks will not be located within 30 m of a waterbody supporting fish habitat. Therefore, no interaction between fish and fish habitat and the tank installation is anticipated.
Wetlands	The new tanks will not be located within 30 m of a wetland. Therefore, no interaction between wetlands and the tank installation is anticipated.
SOCIAL	
Traditional Land and Resource Use	Lands at the Hardisty Terminal where the tanks will be installed are on privately-owned lands that have been used as agricultural lands *(i.e.,* pasture and bush-pasture) for years. The tank installation will not affect any traditional use of the lands at the terminal.
Social and Cultural Well-Being	The tank installation of the Alberta Clipper Project will entail a comparatively small workforce using the services of local communities over a short period. Consequently, the following potential social and cultural well-being impacts noted on Table A-5 of the NEB Filing Manual do not apply to these components of the Project: • stresses on family and household cohesion; • alcohol and substance abuse; or • illegal or other potentially disruptive activities. This element is discussed under Section 6.2.14 of this ESA for the pipeline.
Human Health	An assessment of nuisance air emissions and noise during construction is provided under Air Quality and Acoustic Environment elements. Odours may be released from the tanks during operations and are discussed under Air Quality. Although noise levels at the Hardisty Terminal are anticipated to increase during operations, the level of noise emissions during operations will comply with regulatory standards. Therefore, no human health effects will be associated with the tank component of the Alberta Clipper Project.
Employment and Economy	An economic impact analysis for the Alberta Clipper Project, including the tank component, is discussed under Section 6.2.17 of this ESA.

TABLE 6.12

POTENTIAL BIOPHYSICAL AND SOCIO-ECONOMIC EFFECTS, MITIGATIVE MEASURES AND RESIDUAL EFFECTS OF TANK INSTALLATION AND OPERATION AT HARDISTY TERMINAL

Biophysical or Socio-Economic Element/Potential Effect	Component	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
1. PHYSICAL ENVIRONMENT					
1(a) Previous site contamination	Tanks	Footprint	• Notify Enbridge's Safety and Environment department in the event that contaminated soils are encountered during ground disturbance activities. Enbridge Safety and Environment department will be responsible for determining the appropriate course of action using their established guidelines on file with the NEB.	Enbridge O&MPs, Book 3: Contaminated Soil Management, Section 04-02-024	• No residual effects identified.
2. SOIL CAPABILITY					
2(a) Topsoil / subsoil mixing during construction	Tanks	Footprint	• Salvage all available topsoil. A topsoil depth survey will be conducted on the facility site prior to construction to ensure that equivalent land capability would be maintained in the event that the site is returned to agricultural land use at the end of the life of the facility (see Section 9.0 of this ESA). • Salvage topsoil from all areas to be graded and work areas prior to grading and excavation. • Stockpile topsoil for use during final reclamation of the site upon abandonment. Windrow stockpiled topsoil in low berms. • Ensure that the locations of the topsoil storage berms are kept on file so that topsoil can be replaced upon abandonment of the site.	EGC 02-5 EGC 03-3	• Minor topsoil / subsoil mixing may occur at the Hardisty Terminal due to tank installation.
2(b) Compaction and rutting during construction	Tanks	Footprint	▪ Suspend topsoil handling if excessively wet soil conditions persist and will not commence until soils dry out. Implement the Wet/Thawed Soils Contingency Plan in Appendix 6B of this ESA.	EGC 02-16	• No residual effects identified.
2(c) Erosion control of topsoil pile during construction and operations	Tanks	Footprint	▪ Do not salvage topsoil material under extremely dry and windy conditions. ▪ Store topsoil in low berms. ▪ Seed the topsoil storage berms as soon as possible with the following seed mix to prevent wind or water erosion of topsoil during operations: **SPECIES** — **% BY SEED WEIGHT** meadow brome — 40 intermediate wheatgrass — 25 creeping red fescue — 15 orchard grass — 10 alfalfa or cicer milk-vetch — 10 Broadcast at 25-30 kg/ha	EGC 02-5	• No residual effects identified.
3. WATER QUALITY AND QUANTITY					
3(a) Interference with natural drainage patterns	Tanks	Footprint to Local	• Contour the tank site to direct site-sourced drainage into the runoff containment area. • Locate the topsoil stockpile sites in upslope positions to avoid disruption of natural drainage and drainage channels. • Install culvert along the proposed access road to the tanks where deemed necessary to maintain drainage patterns.	---	• No residual effects identified.

TABLE 6.12 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Component	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
3(b) Reduction of surface water	Tanks	Footprint to Local	• The tanks will not lie within 30 m of a waterbody. • Grade the facility site to ensure that site surface runoff is either contained within dikes or directed towards the runoff containment area. • Before using equipment near a waterbody, inspect hydraulic, fuel and lubrication systems to ensure they are in good condition and free of leaks. • Wash equipment or machinery at least 30 m from a waterbody. • Store fuel and conduct refuelling at least 30 m from a waterbody except where secondary confinement is provided. • Install appropriately sized berms to provide containment in the event of a leak. • Ensure that the diked areas/runoff containments areas have been sized with a capacity to handle a 1 in 100 year storm event with a 24 hr duration period. • Test surface runoff collected within diked areas/runoff containment areas to ensure satisfactory water quality prior to release. Waters collected within the diked areas/runoff containment areas will be released, when warranted, offsite after field tested in accordance with EUB Directive 055 requirements to ensure the quality of the water meets the following criteria: a) chloride content is less than or equal to 500 mg/L (using test strips or equal); b) pH value is 6.0 to 9.0 (using test strips and/or meter readings); c) no hydrocarbon sheen is visible; d) no other chemical contamination is present; and e) any other criteria associated with the approval of the facility. • Release surface runoff from diked areas/runoff containment areas with a manually operated valve. • Retain, test and where necessary, treat and release water accumulating within diked areas/runoff containment areas on site. • See also Section 2.0 of this ESA.	EGC 02-2	• No residual effects identified.
3(c) Reduction of groundwater quality	Tanks	Footprint to Local	• Design and install the proposed storage tanks in compliance with appropriate standards (including Canadian Council of Ministers of the Environment (CCME) *Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products*), regulations (*e.g.*, API Standard 650 reference by CSA Standard Z662), best industry practices and guidelines for permanent crude oil tanks. • Equip new tanks with an under-tank leak detection system and, to minimize corrosion of the tanks, install cathodic protection. • Secondary containment will consist of a compacted clay liner or a geosynthetic liner which will extend under the tank and up the slope of the containment dykes. At the tank, a geo-liner will be placed between the granular base above the liner (tank pad) and the liner to prevent granular material from disturbing the integrity of the secondary liner. The secondary containment will meet the requirements of Alberta EUB Directive 055 *Storage Requirements for the Upstream Petroleum Industry*. • Prepare a groundwater monitoring program at the site for the life of the tanks. • See also Section 2.0 of this ESA.	---	• No residual effects identified.

TABLE 6.12 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Component	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
3(d) Withdrawal and release of hydrostatic test water	Tanks	Local to Region	• Utilize water from the hydrostatic testwater pond located in LSD 15-29-42-9 W4M. Adhere to the requirements of the Alberta Environment Codes of Practice related to withdrawing and discharging hydrostatic test water. • Screen and locate test water intakes to prevent the intake of fish and fish eggs, if warranted. • Isolate fill pumps from bodies of water with an impermeable lined dike or depression to prevent spills of fuels or lubricants from entering a body of water if an alternate natural water source is used. • If test water is released into a natural water body, ensure that the appropriate testing and treatment measures are implemented in accordance with the Alberta Environment Code of Practice related to discharging hydrostatic test water. • The withdrawal rate and volume will not exceed 5% of the flow rate of the watercourse or of the volume of the body of water if an alternate natural water source is used unless Alberta Environment is notified. • Control the discharge rate of test water to reduce the potential for soil erosion. • Install energy diffusers and plywood sheeting, tarpaulins or other similar material to reduce the risk of soil erosion. Reduced the discharge rate if erosion becomes evident.	EGC 02-18	• No residual effects identified.
4. GREENHOUSE GASES AND AIR QUALITY					
4(a) Indirect GHG emissions during operation of pumps	Tanks	Footprint to Region	• Clearstone Engineering Ltd. conducted an assessment of direct and indirect GHG emissions associated with the Alberta Clipper Project, including the tank installation component (see Appendix I of this ESA). • Minimize the amount of indirect GHG emissions attributed to electrical power consumption requirements of new pumps associated with the Alberta Clipper Project by installing high efficiency pump motors.	---	• Indirect GHG emissions will increase during operation of new pumps.
4(b) Airborne emissions from equipment during construction	Tanks	Footprint to Region	• Use well maintained equipment to minimize emissions. • Minimize unnecessary idling of construction equipment. • Take reasonable measures to control construction-related dust as directed by Enbridge. Control measures for dust may include watering down work area and suspending topsoil stripping and replacement during strong winds.	EGC 02-2	• Increase in vehicle emissions will occur during tank installation at the Hardisty Terminal.
4(c) Odorous emissions during operations	Tanks	Footprint to Local	• Enbridge will request air quality experts to model anticipated air quality in the immediate vicinity of the proposed new tanks at Hardisty in the 2nd quarter of 2007(see Section 9.0 of this ESA). • Design and install the proposed storage tanks in compliance with appropriate standards (including CCME *Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products*), regulations, best industry practices and guidelines for permanent crude oil tanks. • Equip new tanks with an external floating roof with primary and secondary rim seals as well as guide pole and floating roof leg seals to minimize odorous emissions.	---	• Odours may be emitted from new tanks.

TABLE 6.12 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Component	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
4(c) Odorous emissions during operations (cont'd)	see above	see above	• Application of operating procedures to minimize the landing of the floating roof. • Application of good industry practice during the degassing and cleaning of the storage tanks. • Periodic inspections of the tanks in accordance with CCME and American Petroleum Institute (API) requirements. • Conduct post-construction headspace emissions monitoring two times per year during the operations phase of the tank. • Conduct post-construction air emissions monitoring to confirm that air quality objectives are met during operation of the tanks.	---	see above
5. ACOUSTIC ENVIRONMENT					
5(a) Noise from construction equipment	Tanks	Footprint to Local	• Ensure that noise abatement equipment on machinery is in good working order. • Equip construction equipment with mufflers. • Abide by local noise by-laws where applicable.	EGC 02-2	• Increase in noise will occur during tank installation at the Hardisty Terminal.
5(b) Noise during operations	Tanks	Footprint to Local	• Enbridge is proposing to retain noise measurement specialists to conduct noise surveys at the Hardisty Terminal when the tanks are in-service in order to confirm compliance with Alberta EUB Noise Directive 038.	---	• Ambient noise levels at the Hardisty Terminal may increase during operations.
6. VEGETATION					
6(a) Loss of vegetation important to wildlife	Tanks	Footprint	• A vegetation survey of the site was conducted in 2004 which revealed that a portion of the site is dominated by high quality native prairie and parkland (see Appendix IV of this ESA). • Minimize workspace area. • Dispose of slash in accordance with methods outlined in the EGC and municipal regulations. Do not burn slash.	---	• Approximately 17 ha of vegetation important to wildlife will be removed at the Hardisty Terminal.
6(b) Revegetation of disturbed areas during construction	Tanks	Footprint	• Seed topsoil storage berms with the seed mix in *Soil Capability* element 2(c) of this table as soon as possible. • Cover disturbed areas with appropriate cover material within the fenced-in tank farm boundary. ▪ Seed disturbed areas outside of the fenced boundary with the following native seed mix: **SPECIES** — **% BY SEED WEIGHT** northern wheatgrass 40 slender/awned wheatgrass 20 plains rough fescue 15 june grass 15 western porcupine 10 • Broadcast at 25-30 kg/ha • Use only Certified Canada No. 1 or the best available seed grade. Retain seed certificates for seed mixes and present, upon request, to government agencies. Do not accept seed mixes containing restricted or noxious weeds.	---	• No residual effects identified.

TABLE 6.12 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Component	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
6(c) Weed introduction during construction and operations	Tanks	Footprint to Local	• Patches of the noxious weed, leafy spurge were observed at the site during surveys in 2004 (see Appendix IV of this ESA). • Employ standard weed control measures such as cleaning equipment prior to arrival at the station as described in the EGC. • Monitor and control weeds during the operation of the tanks.	EGC 02-2 EGC 02-4	• Weed introduction and/or spreading from disturbance may occur at the Hardisty Terminal.
7. WILDLIFE AND WILDLIFE HABITAT					
7(a) Loss of wildlife habitat	Tanks	Footprint	• Minimize workspace area. • Dispose of slash in accordance with methods outlined in the EGC and municipal regulations. Do not burn slash.	---	• Approximately 17 ha of vegetation important to wildlife will be removed at the Hardisty Terminal.
7(b) Auditory or visual disturbances of wildlife during construction	Tanks	Footprint to Local	• Prohibit personnel from harassing or feeding wildlife or livestock during tank construction. Pets or firearms will not be permitted at the site. • Prohibit recreational use of all-terrain vehicles at the site by construction personnel.	EGC 02-2	• Displacement of wildlife away from Hardisty Terminal during tank installation with resultant use of potentially suboptimal habitat during noncritical conditions.
7(c) Auditory disturbances of wildlife during operations	Tanks	Footprint to Local	• Ensure that noise levels at the terminal are in compliance with applicable provincial regulations.	EGC 01-4	• Increase in noise levels in the immediate vicinity of the Hardisty Terminal will likely displace wildlife over the short to long-term.
7(d) Direct and indirect mortality during construction	Tanks	Footprint to Region	• Inform contractor that Alberta Clipper Project traffic is to obey all traffic laws. • Report encounters or collisions with wildlife to Fish and Wildlife authorities or the local police department (see Appendix 6B of this ESA). • Collect garbage on a daily basis and dispose of at an approved facility to minimize the attraction of wildlife during construction.	EGC 02-2	• Potential for vehicle/wildlife collisions on access routes and at the Hardisty Terminal.
7(e) Disturbance of migratory bird nesting during construction	Tanks	Footprint	• No vegetation clearing or other construction activities involving heavy equipment are to occur within the migratory bird nesting period from April 1 to July 31. Construction activities may proceed within the nesting period where the area has been precleared or premowed prior to April 1 or with approval from Environment Canada. • In areas where preclearing/premowing activities have not been completed prior to April 1, a breeding bird survey will be undertaken by a qualified avian biologist prior to initiating the above noted activities. Environment Canada will review the proposed survey methods and results, and in the event that a nest is discovered, be consulted in the development of mitigation strategies. If adequate mitigative measures are not available, work in proximity to an active nest will be postponed until the nest is no longer active.	---	• Given that the proposed mitigative measures will ensure that nests of migratory birds will not be disturbed by tank installation activities, no residual effects have been identified.
8. SPECIES AT RISK					
8(a) Loss of site-specific habitat used by wildlife species at risk	Tanks	Footprint to Local	• A wildlife survey was conducted at the Hardisty Terminal in NE and SE 19-42-9 W4M in spring 2004 (see Appendix IV of this ESA). No wildlife species at risk were observed nesting in or adjacent to the site. • Additional field studies will be completed in spring/summer of the year prior to construction at the site (see Section 9.0 of the ESA). • Implement one or more of the mitigative measures identified in Appendix 6B of this ESA in the event of a discovery of wildlife species at risk is discovered during either supplemental field studies or construction.	---	• Alteration of potential habitat supporting wildlife species. • See *Wildlife and Wildlife Habitat* element 7(a) of this table.

TABLE 6.12 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Component	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
8(b) Potential disturbance of wildlife species at risk in vicinity of Hardisty Terminal	Tanks	Local	• If tank installation is scheduled to be conducted during the breeding period, conduct a sweep for wildlife *SARA* species on noncultivated lands within 500 m of the terminal prior to the initiation of activities. Should a *SARA* species be identified, determine appropriate mitigative measures to minimize disturbance in consultation with Environment Canada. • Breeding periods for potential *SARA* bird species include: loggerhead shrike: April 15 - July 15 burrowing owl: April 15 - August 15 piping plover: May 1 - July 31 Sprague's pipit: April 15 - August 31 yellow rail: May 1 to August 15 long-billed curlew: April 15 - July 15	---	• No residual effects identified.
9. HUMAN OCCUPANCY AND RESOURCE USE					
9(a) Potential alterations to existing viewsheds	Tanks Buildings Fence	Footprint to Local	• Follow measures outlined in Detail 6.2 for creating a vegetative screen along the west side of the expansion site. • The new tanks cannot be viewed from a major highway. • Minimize light intrusion on areas adjacent to the pump station by reducing the number of lights and light intensity as much as practical without compromising safety.	---	• The installation of aboveground facilities (*i.e.*, buildings, fences, piping, tanks) will form part of the visual landscape at the Hardisty Terminal over the long-term.
10. HERITAGE RESOURCES					
10(a) Disturbance of identified surface heritage resource sites prior to construction and previously unidentified buried sites during construction	Tanks	Footprint	• An Historical Resources Overview will be undertaken at the site (see Section 9.0 of this ESA). Implement appropriate measures identified in the Heritage Resources Discovery Contingency Plan (Appendix 6B of this ESA) in the event of discovery of archaeological or historical finds during the HRIA if an HRIA is required. • Implement the Heritage Resources Discovery Contingency Plan in Appendix 6B of this ESA in the event that previously unidentified archaeological or historical finds are discovered during construction. • Suspend construction activity in the vicinity of any historical, archaeological or palaeontological resources discovered during construction until authorized by provincial authorities. • Resume work once permission has been granted from the provincial authorities.	EGC 02 2	• Identified surface sites and previously unidentified buried heritage resources may be disturbed during the proposed tank installation.
11. INFRASTRUCTURE AND SERVICES					
11(a) transport of workers and supplies during construction	Tanks	Footprint to Region	• Advise all Alberta Clipper-related vehicles to follow applicable traffic, road-use and safety laws. • The contractor will develop a traffic management plan to manage vehicular movements on highways and local roads.	---	• Increased traffic on highways and local roads used to access the Hardisty Terminal will occur during tank construction.
11(b) Waste management during construction	Tanks	Footprint to Region	• Collect waste from work site on a daily basis. • Transport and dispose of all wastes in accordance with provincial and federal regulatory requirements. • Locate temporary toilets at convenient location on the construction site. • Follow the measures outlined in Enbridge's Waste Management Plan on file with the NEB.	EGC 02-2 / Enbridge Waste Management Plan	• Temporary increase in waste flow to regional landfill sites will occur.

TABLE 6.12 Cont'd

Biophysical or Socio-Economic Element/Potential Effect	Component	Project Boundary	Recommendations / Mitigative Measures[1]	EGC/Enbridge Manual Reference	Residual Effect(s)
11(c) worker accommodation needs may displace tourists	Tanks	Local to Region	• Enbridge or its contractor is to install a temporary construction camp to accommodate Project workers associated with all components of the Alberta Clipper Project in the Hardisty area due to the limited availability of local and regional accommodation. • Treat sewage and grey water as per municipal and provincial permits. Dispose of waste in accordance with municipal and provincial permits as well as the Enbridge Waste Management Plan currently on file with the NEB. • Obtain approval from the applicable regulatory authority prior to withdrawing water from nearby water source for use in the temporary construction camp. Otherwise, haul fresh water to camps.	---	• Some local or regional tourist accommodations near Hardisty will be temporarily occupied by regulatory inspectors and company personnel.
12. ACCIDENTS AND MALFUNCTIONS					
12(a) Spills of hazardous materials during construction	All	Footprint	• Report spills immediately to the Environmental Inspector and, if warranted, appropriate government agencies. • Implement Enbridge's Emergency Response Plan in the event of a spill or leak of hydrocarbons.	EGC 02-2 / Enbridge O&MPs, Book 7: Emergency Response, Section 03-02-02	• Spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident.
12(b) Oil release during operations	All	Footprint to Local	• Design and install the proposed storage tanks in compliance with appropriate standards (including CCME *Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products*), regulations, best industry practices and guidelines for permanent crude oil tanks. • Equip new tanks with an under-tank leak detection system and, to minimize corrosion of the tanks, install cathodic protection. • Visually inspect tanks, diked areas and dykes on a monthly basis for evidence of problems, damage or leaks. A certified inspector is to conduct an external inspection of the storage tanks at least every five years. Take corrective action immediately and clean up any spills or leaks. Document abnormal circumstances. • Minimize the potential for malfunction of the facilities during operations by adhering to preventative measures outlined in Enbridge's Emergency Response Plan on file with the NEB. • In the unlikely event of a release, follow Enbridge's Emergency Response Plan currently on file with the NEB. Expand the Emergency Response Plan to include new tanks associated with the Alberta Clipper Project.	EGC 02-2 / Enbridge Operating & Maintenance Procedures, Book 7: Emergency Response, Section 03-02-02	• Although the likelihood of such an event is low, a large-scale oil release may affect other resources.
12(c) Fire during construction	All	Footprint	• Follow the measures identified within Enbridge's Emergency Response Plan in the event of an accidental fire.	EGC 02-2 / Enbridge O&MPs, Book 2: Safety Section 05	• Despite vigilance, fires may adversely affect adjacent vegetation, and in very rare situations, affect wildlife and adjacent property.

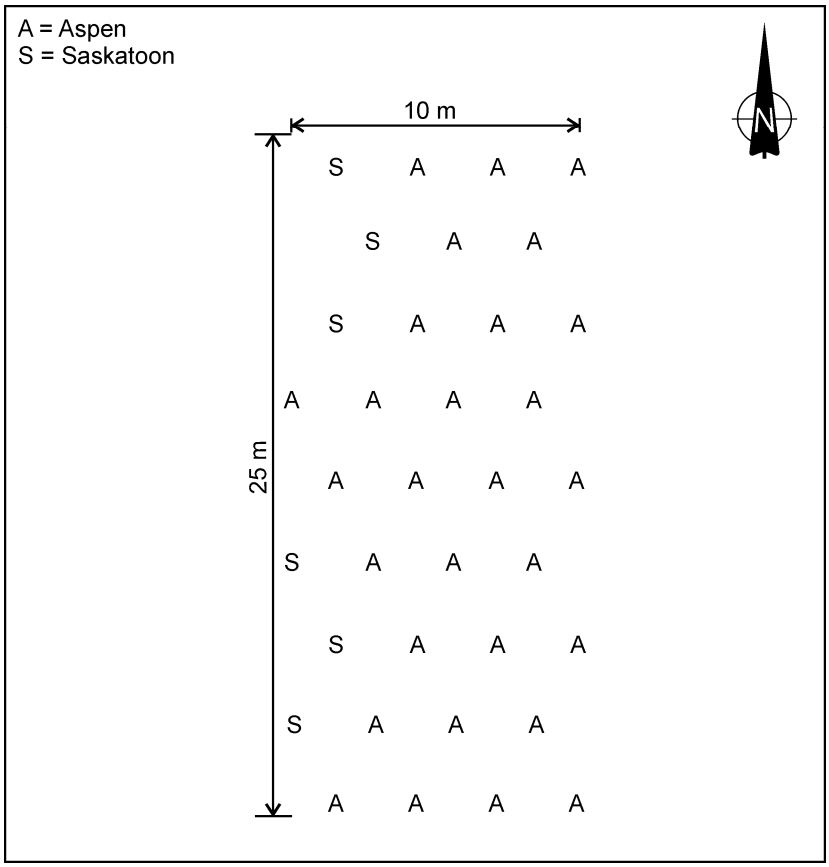
Note: 1 Detailed mitigative measures are outlined in Enbridge's EGC (2003) on file with the NEB.

CRITERIA FOR IMPLEMENTATION:

A vegetative screen will be planted on the west side of the Hardisty Terminal tank expansion area to act as a visual buffer to residences west of the site.

Notes:

Planting a vegetation screen on the west side of the tank expansion area with native species will involve the following. Trembling aspen (*Populus tremuloides*) and saskatoon (*Amelanchier alnifolia*) will be planted in a 10 m wide swath in the configuration below. All plantings will require weekly waterings for the first month following planting and bi-weekly waterings through the balance of the first growing season. Depending on spring and summer soil moisture levels, it is suggested that bi-weekly waterings continue into the second growing season.



Plant species 2.5 m apart from west to east and 3 m apart from north to south - stagger plants in an alternating configuration to maximize growing space and available light.

At the above configuration and spacing, a 100 m linear distance would require approximately:

-116 Aspen
-24 Saskatoon

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE ALBERTA CLIPPER PROJECT	
	HARDISTY TERMINAL TANK EXPANSION VEGETATION SCREEN	
	4462	April 2007	Detail 6.2

TABLE 6.13

SIGNIFICANCE EVALUATION OF ADVERSE RESIDUAL EFFECTS OF IDENTIFIED BIOPHYSICAL AND SOCIO-ECONOMIC ELEMENTS OF HARDISTY TERMINAL TANK INSTALLATION

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. SOIL CAPABILITY									
Minor topsoil / subsoil mixing may occur at the Hardisty Terminal due to tank installation.	negative	footprint	medium-term	isolated	long-term	low	high	high	not significant
2. GREENHOUSE GASES AND AIR QUALITY									
2(a) Indirect GHG emissions will increase during operation of new pumps.	negative	footprint to region	long-term	continuous	short-term	low	high	high	not significant
2(b) Increase in vehicle emissions will occur during tank installation at the Hardisty Terminal.	negative	footprint to region	medium-term	isolated	short-term	low	high	high	not significant
2(c) Odours may be emitted from new tanks.	negative	region	long-term	occasional	immediate to long-term	low	high	high	not significant
Greenhouse Gases and Air Quality Summary *- Residual effect summary assessment of all components of Greenhouse Gases and Air Quality.*	negative	footprint to region	medium to long-term	isolated to continuous	immediate to long-term	low	high	high	not significant
3. ACOUSTIC ENVIRONMENT									
3(a) Increase in noise will occur during tank installation at the Hardisty Terminal.	negative	footprint to local	medium-term	isolated	immediate	low	high	high	not significant
3(b) Ambient noise levels at the Hardisty Terminal may increase during operations.	negative	footprint to local	long-term	continuous	immediate	low	high	high	not significant
Acoustic Environment Summary *- Residual effect summary assessment of all components of Acoustic Environment.*	negative	footprint to local	medium to long-term	isolated to continuous	immediate	low	high	high	not significant
4. VEGETATION									
4(a) Loss of approximately 17 ha of vegetation important to wildlife at the Hardisty Terminal.	negative	footprint	medium-term	isolated	long-term	low	high	high	not significant
4(b) Weed introduction and/or spreading from disturbance may occur at the Hardisty Terminal.	negative	footprint to local	medium-term	isolated	medium-term	low	high	moderate to high	not significant
Vegetation Summary *- Residual effect summary assessment of all components of Vegetation.*	negative	footprint to local	medium-term	isolated	medium to long-term	low	high	moderate to high	not significant
5. WILDLIFE AND WILDLIFE HABITAT									
5(a) Loss of approximately 22 ha of wildlife habitat at the Hardisty Terminal.	negative	footprint	medium-term	isolated	long-term	low	high	high	not significant
5(b) Displacement of wildlife away from the Hardisty Terminal during tank installation with resultant use of potentially suboptimal habitat during noncritical conditions.	negative	footprint to local	medium-term	isolated	short-term	low	high	high	not significant
5(c) Increase in noise levels in the immediate vicinity of the Hardisty Terminal will likely displace wildlife over the short to long-term.	negative	footprint to local	long-term	continuous	short to long-term	low	high	moderate to high	not significant

TABLE 6.13 Cont'd

Adverse Residual Effects	Impact Balance	Spatial Context	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
5(d) Potential for vehicle/wildlife collisions on access routes and at the Hardisty Terminal.	negative	footprint to region	medium-term	isolated	short-term	low	low	high	not significant
Wildlife and Wildlife Habitat Summary- *Residual effect summary assessment of all components of Wildlife and Wildlife Habitat.*	negative	footprint to region	medium to long-term	isolated to continuous	short to long-term	low	low to high	moderate to high	not significant
6. SPECIES AT RISK									
Loss of potential habitat supporting wildlife species at risk and displacement of wildlife species at risk away from the Hardisty Terminal during tank installation.	negative	footprint to local	medium-term	isolated	long-term	low	low	moderate	not significant
7. HUMAN OCCUPANCY AND RESOURCE USE									
The installation of aboveground facilities (*i.e.*, tanks, buildings, piping, fencing) will form part of the visual landscape at the Hardisty Terminal over the long-term.	negative	local	long-term	isolated	long-term	low	high	high	not significant
8. HERITAGE RESOURCES									
Identified surface sites and previously unidentified buried heritage resources may be disturbed during the proposed tank installation.	negative	footprint	medium-term	isolated	permanent	low	low to high	high	not significant
9. INFRASTRUCTURE AND SERVICES									
9(a) Increased traffic on highways and local roads used to access the Hardisty Terminal will occur during tank construction.	negative	footprint to region	medium-term	isolated	short-term	low	high	high	not significant
9(b) Temporary increase in waste flow to regional landfill sites will occur.	negative	local to region	medium-term	isolated	immediate to short-term	low	high	high	not significant
9(c) Some local or regional tourist accommodations near Hardisty will be temporarily occupied by regulatory inspectors and company personnel.	negative	local to region	medium-term	isolated	immediate to short-term	low	high	high	not significant
Infrastructure and Services Summary- *Residual effect summary assessment of all components of Infrastructure and Services.*	negative	footprint to region	medium-term	isolated	immediate to short-term	low	high	high	not significant
10. ACCIDENTS AND MALFUNCTIONS									
10(a) Spot spills, once remediated, will have little adverse residual effect, although other resources could be affected or lost as a result of the accident.	negative	footprint to local	short-term	accidental	short-term	low to high	low	moderate	not significant
10(b) Although the likelihood of such an event is low, a large scale oil release may affect other resources.	negative	footprint to local	short-term	accidental	short-term to permanent	low to high	low	high	not significant
10(c) Fires may adversely affect adjacent vegetation and, in very rare situations, affect wildlife and adjacent property.	negative	footprint to local	immediate to short-term	accidental	short to long-term	low to high	low	moderate	not significant
Accidents and Malfunctions Summary - *Residual effect summary assessment of all components of Accidents and Malfunctions.*	negative	footprint to local	immediate to short-term	accidental	short to permanent	low to high	low	moderate to high	not significant

Note: 1. Significant Adverse Residual Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically mitigated or economically compensated.

APPENDIX 6A

PIPELINE CONSTRUCTION AND RECLAMATION PLAN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF DRAWINGS

1.0 CONSTRUCTION AND RECLAMATION PLAN

1.1 Scope

The Construction and Reclamation Plan is designed to complement the mitigative measures identified in Tables 6.2 and 6.3 of this ESA as well as Enbridge's EGC document. Mitigative measures and criteria for their implementation are provided with a sufficient level of flexibility to ensure that the most appropriate mitigative measures are implemented during the construction and reclamation phases of the pipeline portion of the Alberta Clipper Project.

The measures identified in Tables 6.2 and 6.3 of this ESA and the Construction and Reclamation Plan will be used in conjunction with the Environmental Alignment Sheets by Enbridge's inspection staff and contractor personnel during construction, clean-up and reclamation of the Project.

The measures and other work described in the Construction and Reclamation Plan will apply primarily to the Project at specific locations, however, in some cases, to the overall Project in general. Implementation of some measures included in the Construction and Reclamation Plan may commence prior to the construction phase and continue into the operations phase. Post-construction monitoring programs have been developed to ensure that the measures, activities and other works identified in the Construction and Reclamation Plan were effective (see Section 8.0 of the ESA).

1.2 Reclamation Plan Objectives and Goals

Environmental protection and reclamation measures have been specified in consideration of the existing land use and biophysical conditions along the route with the objective of returning the right-of-way as near to preconstruction conditions as feasible within a practical time frame. On agricultural lands, reclamation objectives emphasize controlling surface erosion and conserving soil quality for agricultural purposes. On native grasslands and riparian areas where the species composition of natural plant communities may be difficult to restore following disturbance, emphasis is placed on reducing the total area of disturbance and providing a reclaimed condition that will facilitate restoration of the native plant populations and communities.

1.3 Construction and Reclamation Plan Details

The following outlines the applicable Details for the construction of the pipeline, including watercourses, and weed control as well as measures to minimize the disturbance and promote restoration of special features like rare plants and areas potentially difficult to reclaim such as Dune Sand soil and other sandy areas.

Topsoil Stripping

The objectives of topsoil salvaging are to minimize impacts to topsoil capability, surface drainage patterns, land use and wildlife habitat. Criteria for topsoil salvage procedures during nonfrozen and frozen soil conditions are identified in Figure 6A-1 by specific circumstances and include:

- blade width topsoil salvage (Detail 6A-10);
- trench and spoil area topsoil salvage (Detail 6A-11);
- full right-of-way topsoil salvage (Detail 6A-12);
- trench and work lane topsoil salvage (Detail 6A-13);
- reduced salvage width (Detail 6A-14);
- three-lift soils handling on well-sodded land (Detail 6A-15);
- three-lift soils handling on cultivated land (Detail 6A-16); and
- trench, spoil and work land topsoil salvage (Detail 6A-17).

Figure 6A-1
Criteria for Topsoil Salvage Procedures

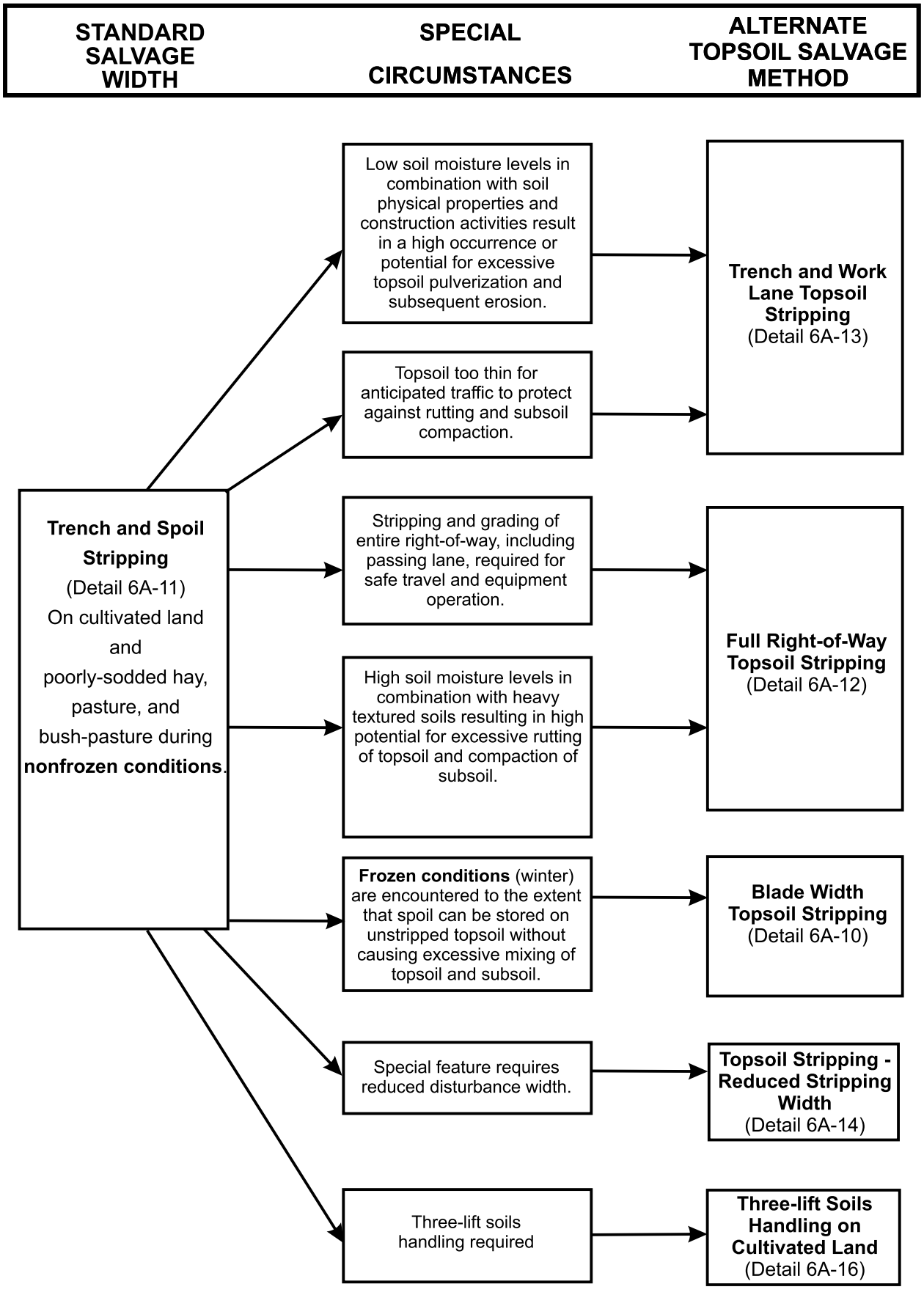
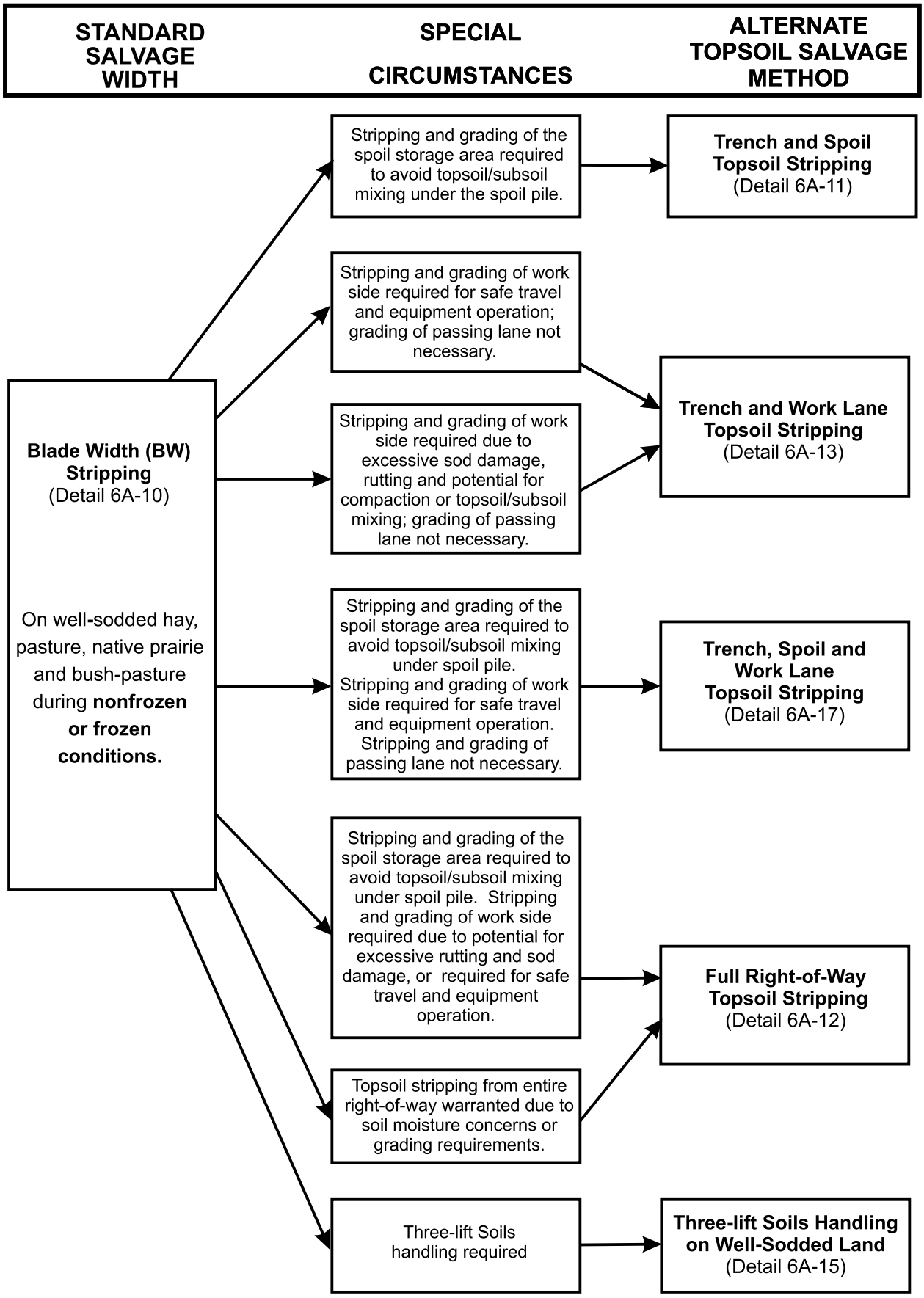


Figure 6A-1 (Cont'd)



In addition, measures for sidehill grading are included on Detail 6A-8 and for road and rail bores on Detail 6A-7. Detail 6A-21 describes measures for topsoil replacement during spring clean-up and Detail 6A-22 includes protection measures from soil erosion for delayed grade or topsoil replacement due to construction schedule considerations.

Vehicle Crossing Structures

Four vehicle crossing structures are proposed during the construction of the proposed pipeline:

- temporary bridge (Detail 6A-25);
- typical swamp mat ford (Detail 6A-26);
- ice bridge (Detail 6A-27);
- snow fill (Detail 6A-28); and
- ramp and culvert (Detail 6A-29).

Watercourse Crossing Construction

Watercourses along the route range from small non-fish bearing watercourses to moderately large and sensitive watercourses. Procedures for watercourse crossings include:

- open cut of small watercourses (Detail 6A-30);
- typical flume (Detail 6A-31);
- typical dam and pump (Detail 6A-32);
- high volume pump (Detail 6A-33);
- bore or punch (Detail 6A-34);
- large directional drill (Detail 6A-35); and
- channel diversion (Detail 6A-36).

Rare Plants

Rare plant surveys will be conducted in the spring and summer of 2007. General mitigation strategies have been developed for this Project to accomplish effective protection of any rare plant populations and communities that are found during the surveys (see Table 6.2 and the Plant Species of Concern Discovery Contingency Plan in Appendix 6B of this ESA). These measures include:

- narrowing down the right-of-way and flagging or fencing-off the feature of concern to avoid impact during construction (Detail 6A-1);
- salvaging and transplanting individual rare vascular plant species, when they are located in a position on the right-of-way that cannot be avoided (Detail 6A-2);
- placing protective structures or snow and ice work pads over the plants of concern where site-specific conditions, plant species characteristics and timing of construction allow for effective protection (Detail 6A-3); and
- collecting seed from mature vascular plants that are poor candidates for transplant and in a position on the right-of-way where disturbance cannot be avoided (Detail 6A-4).

Soil Erosion Control

Some areas of the right-of-way are susceptible to wind and/or water erosion. Detail 6A-18 includes measures to minimize wind erosion of the topsoil windrow during construction. Details 6A-19, 6A-20 and 6A-23 describe measures for the installation of subdrains, trench breakers and ditch plugs and cross-ditches and diversion berms. Measures related to general right-of-way revegetation also address soil erosion control.

Numerous methods are proposed for revegetation of the right-of-way and a number of special measures will be implemented depending on site-specific conditions. These measures include:

- salvaging shrubs, native seeds and rare plants for transplant onto the right-of-way following construction (Detail 6A-2);
- collecting native seed from local species that cannot be obtained from other sources (Detail 6A-4);
- seeding with seed mixes by natural subregion or ecoregion (by drill or broadcast seeding (Detail 6A-46, Detail 6A-47, Detail 6A-48);
- seeding with a cover crop (Detail 6A-49);
- track cleat imprinting and straw crimping on soils with a potential for wind erosion (Detail 6A-44, Detail 6A-45);
- placing erosion control matting, rollback, wood chipping, tackifier or staked logs along the right-of-way on steep slopes or exposed sites that will be difficult to stabilize (Detail 6A-42, Detail 6A-41, Detail 6A-5, Detail 6A-40, Detail 6A-43).

Measures for returning irrigated lands to equivalent land capability are outlined in Detail 6A-9.

Watercourses

Stabilization of the banks and slopes of watercourses and riparian areas prior to and immediately following construction is critical to the reclamation of the habitat at watercourses. Mitigation measures have been developed to enhance the restoration of watercourses. These measures involve the installation of numerous bank and slope protecting structures including:

- erosion control matting (Detail 6A-42);
- silt fences (Detail 6A-24);
- hedge-brush layering (Detail 6A-39);
- shrub staking and willow staking (Detail 6A-38); and
- riprap rock armouring (Detail 6A-37).

Other revegetation strategies include native seed mixes (Detail 6A-46) and cover crops (Detail 6A-49), where appropriate.

Wildlife

Several wildlife species of concern and species at risk or their habitat have been identified along the proposed route during previous wildlife surveys for CEP and Terrace Phases I and II. Additional wildlife studies will be conducted in spring/early summer 2007 on segments of the route supporting native vegetation or pasture lands greater than 500 m in length to identify site-specific features associated with sensitive wildlife species in the vicinity of the proposed route. General mitigation strategies have been developed for this Project to accomplish effective protection of critical or key wildlife habitat that are found during the surveys (see Table 6.2 of this ESA).

Avoid construction within the April 1 to July 31 peak nesting period along segments of the route that traverse lands associated for bird use (*i.e.,* refuges, DU projects, CAs, NAWMP priority areas, migratory bird concentration sites), native prairie, pasture lands greater than 500 m in length and large wetlands (Table 6.4) or areas with a high density of small potholes with habitat suitable for waterfowl production unless otherwise approved by provincial and federal wildlife authorities. If construction cannot be completed outside of April 1 to July 31, pre-clear and pre-mow the right-of-way prior to April 1 to discourage nesting. If pre-clearing and pre-mowing is not practical, complete a nesting bird survey prior to construction to identify nest locations along the right-of-way. Postpone construction activities in the vicinity of nest locations on or adjacent to the right-of-way until nestlings have fledged.

Maintain water levels in wetlands. Do not drain wetlands in this area unless otherwise approved/requested by provincial and federal authorities. Restore disturbed areas in wetlands to preconstruction profile during reclamation. Remove any excess backfill to an upland location approved by the appropriate regulatory authorities. [EGC 03-2, EGC 03-3]. In the DU wetland project areas, avoid disturbing constructed works (*e.g.,* dikes, ditches, dams, control structures, etc.) in wetlands.

Problem Soils Restoration

The topography and soils encountered along some segments of the proposed route may provide special challenges for restoration. Soil-related restoration issues due to steep slopes and relatively high susceptibility to wind and water erosion of soils occur in the Dune Sand soil and other sandy areas, including Sounding Dunes, Elbow PFRA Community Pasture, Oak Lake Sand Hills and Souris Sand Hills (Detail 6A-50).

Wetland Restoration

Mitigation measures to be implemented to restore wetland function at wetlands encountered along the proposed pipeline route are provided in Detail 6A-51.

Restoration on PFRA Lands

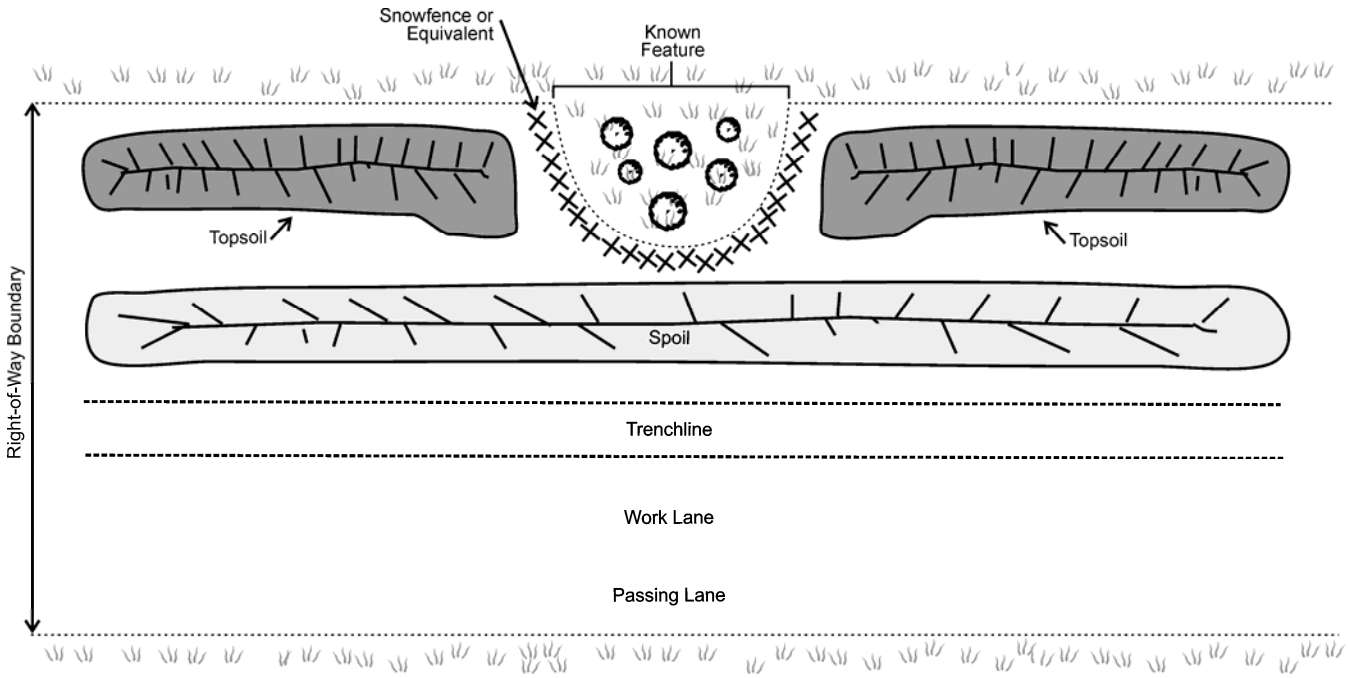
Site-specific restoration measures for the Progress, Mariposa and Elbow PFRA community pasture lands are detailed in Appendix V of the ESA.

Weed and Invasive Species Control

Management of invasive plant species is essential to maintaining the ecological integrity of lands supporting native vegetation and equivalent land capability for agricultural lands. Measures to reduce the spread of weeds are provided in Detail 6A-6.

DETAILS

CONSTRUCTION AND RECLAMATION PLAN DETAILS



Plan View
(Not to Scale)

CRITERIA FOR IMPLEMENTATION

The width of the construction right-of-way will be narrowed, where feasible and construction safety is not compromised, to avoid site-specific features such as archaeological sites, rare plants, significant plant communities, site-specific wildlife habitat as well as shelterbelts where requested by landowners. The specific features will be fenced or otherwise protected throughout the duration of construction.

Notes:

1. Identify and stake or flag the boundaries of the feature to be protected where it encroaches on the right-of-way.
2. Implement applicable measures in the Traffic Control Plan (Appendix 6C).
3. Install barrier fencing using material that will not be hazardous to livestock. In areas where livestock may be present, construct the barrier fence using posts and barbed wire, planks, or other Enbridge approved material, to prevent construction traffic from encroaching onto the protected area. Snow fence or construction guard fencing may be used at locations where no livestock will be present during the period the fence will be in place.
4. Where narrowing of the work side is sufficient to protect the feature, minimize the workspace to as narrow an area as safely practical.
5. Where further narrowing is required, develop site-specific plans to complete construction through the area while protecting the feature.
6. Maintain fencing and barriers until all construction and reclamation activities are completed.

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE **ALBERTA CLIPPER PROJECT**		
	NARROW DOWN FENCING		
	4462	April 2007	Detail 6A-1

CRITERIA FOR IMPLEMENTATION

Live plant material salvage will generally consist of two types of salvage:

- salvage of shrubs with rootball; and
- salvage and transplant of rare plants.

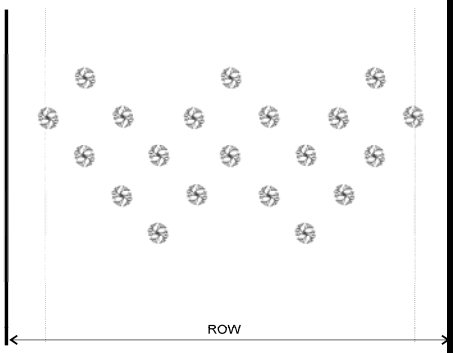
All collection, salvage and transportation of live plant material will be done following approval by the appropriate authority.

SALVAGE OF SHRUBS WITH ROOTBALL

Shrubs for salvage will be selected by qualified personnel and flagged prior to construction activities in that area.

1. To the extent possible, shrub salvage will be done during dormancy (mid September to bud break).
2. Shrub salvage will be timed to minimize period between salvage and restoration planting.
3. Prior to salvage, prune back shrub top growth as directed by qualified personnel. Salvage shrubs using a backhoe. Remove as large a rootball as feasible.
4. Cover the rootball of the salvaged plants with burlap or geotextile. Keep the covered rootball slightly moist (but not saturated) until the plants are replanted.

PROFILE
(Not to Scale)



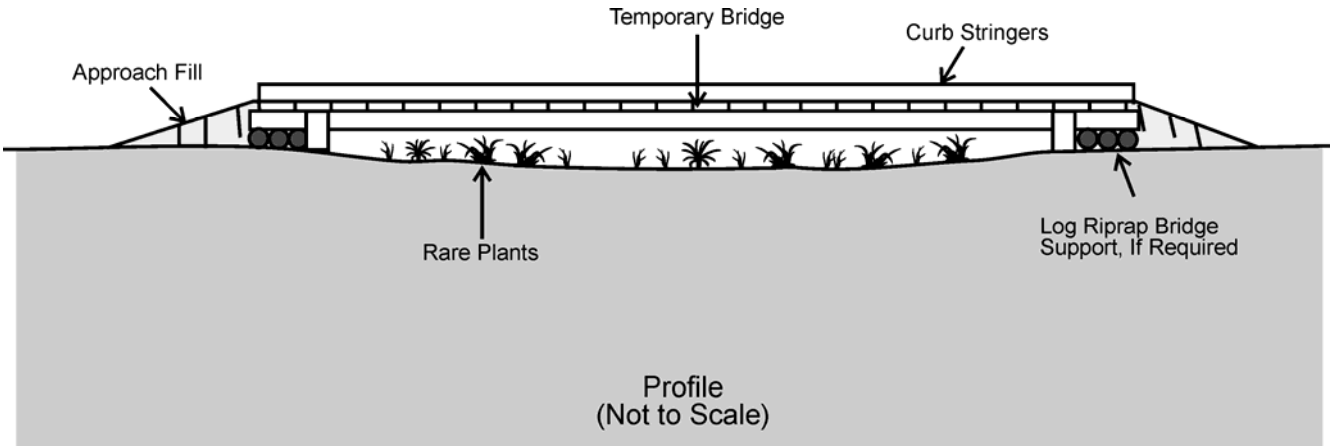
TYPICAL
PLAN VIEW
(Not to Scale)

RARE PLANTS

1. The rare plants along the right-of-way that require transplanting have been identified by a qualified botanical expert and will be flagged prior to clearing.
2. A qualified botanical expert will select a suitable receiving site for the plant. The receiving site should be adjacent to the construction right-of-way, in an area having a similar microsite to where the rare plant had been growing.
3. Delay salvaging activities until immediately prior to construction. Cut back or prune plants to be salvaged as directed by the Environmental Inspector in consultation with the botanical expert. Salvage designated plants using a shovel or backhoe. Remove as large a rootball as feasible. Cover the rootball of the salvaged plants with burlap or geotextile. Keep the covered rootball slightly moist (but not saturated) until the plants are replanted.
4. Replant the salvaged plant in the receiving site as soon as possible following salvage.

CRITERIA FOR IMPLEMENTATION - TEMPORARY BRIDGE

This procedure will be used when the rare plants are located on the work side of the right-of-way in an area that does not require topsoil salvage.

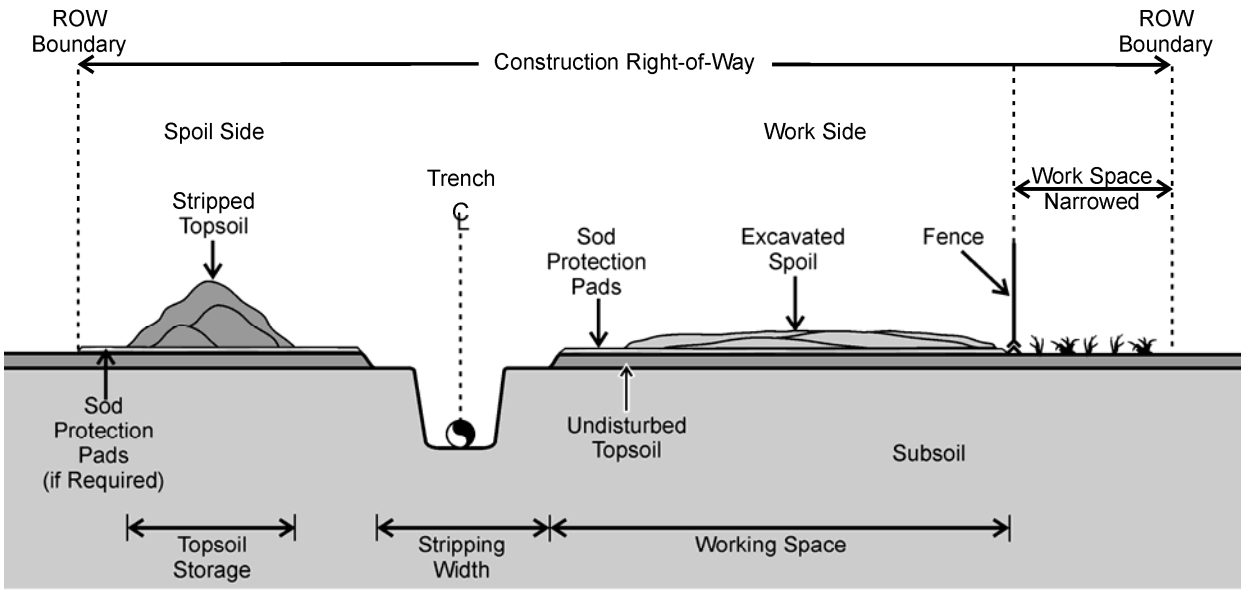


Notes:

1. Install a temporary bridge (*e.g.,* log, pre-fabricated span) to allow vehicles to cross over rare plants. Bridge length is generally limited to areas less than 30 m in length.
2. Utilize approach fills rather than cuts to minimize ground disturbance. Use a geotextile liner to prevent fine material sedimentation onto rare plants.
3. Install curb stringers of logs or plywood to ensure that fill material does not spill onto surrounding area, if required.
4. Remove bridge immediately after use. Remove support structures and approach fills.
5. Install other temporary bridge structures as approved by the Environmental Inspector.

CRITERIA FOR IMPLEMENTATION – DIRT RAMP

This procedure will be utilized on a trial basis at selected sites where narrowing down is insufficient as a mitigative measure for the protection of rare plant communities on the right-of-way. The decision to implement this procedure will be based on plant species, construction timing (*e.g.*, early or late summer) and suitability of other protection measures as determined by the Environmental Inspector and botanical expert.



Profile
(Not to Scale)

Notes:

1. Narrow down right-of-way to eliminate passing lane and fence off the feature of concern (Detail 6A-1) until ready to construct ramp.
2. Immediately prior to construction of this section, remove the mats, place geotextile pads, flexnet or swamp mats on work side and spoil side, as required, to protect rare plant population.
3. Strip topsoil from the trench area and place on geotextile on opposite side of trench from pipe lay-up and work lane.
4. Excavate trench spoil and place on geotextile on the work side. Spread spoil over the width of the geotextile-covered work lane to provide a work and travel area.
5. Avoid scalping vegetated ground surface when backfilling spoil, replacing topsoil and removing pads.

Native Seed Collection

CRITERIA FOR IMPLEMENTATION

Native seed will be collected from areas of undisturbed native vegetation, either on the right-of-way or at suitable locations off the right-of-way with the approval of the landowner and occupant, and appropriate government agency prior to construction. Seeds of select species will be collected and stored.

Notes:

1. Potential locations where native seed will be collected from the right-of-way will be determined from the results of field surveys.
2. Potential sites will be inspected in the field to assess for contamination with undesirable species and the presence of target desirable species.
3. Seed will be collected by a qualified botanical expert using an appropriate method. Collections will be conducted numerous times throughout the growing season, if feasible, in order to collect seed from as many species as possible.
4. All phases of native seed collection work will be documented for tracking, including: species collected; location; date; amounts; and storage location.
5. The seed will be processed and cleaned under the supervision of a botanical expert. Viability and weed content tests will be conducted.
6. The seed will be stored in appropriate facilities under the supervision of a botanical expert.
7. Seeding operations will be supervised by the Environmental Inspector. Seeding procedures, areas and rates will be determined by a botanical advisor based on site-specific conditions.

Rare Plant Seed Collection

CRITERIA FOR IMPLEMENTATION

Rare plant seed will be collected from rare plants along the right-of-way that cannot be avoided or protected during construction.

Notes:

1. Potential locations where rare plant seed will be collected from the right-of-way will be determined from the results of field surveys.
2. Seed will be collected by a qualified botanical expert using an appropriate method.
3. All phases of rare plant seed collection work will be documented for tracking, including: species collected; location; date; amounts; and storage location.
4. The seed will be processed, cleaned and stored in appropriate facilities under the supervision of a botanical expert.
5. Collected rare plant seed will be seeded at selected areas under the direct supervision of a botanical expert. Seeding operations will be supervised by the Environmental Inspector. Seeding procedures, areas and rates will be determined by a botanical expert based on site-specific conditions.

CRITERIA FOR IMPLEMENTATION

Chipping of nonmerchantable timber or slash will be conducted for erosion control on wind erodible (sandy) soils as directed by the Environmental Inspector.

Notes:

1. Retain slash and nonsalvageable timber, where warranted, for use as chip material on wind erodible (sandy) soils. The amount and location of timber retained for use as chip material will be determined by the Environmental Inspector.

2. Slash and nonsalvageable timber will be chipped using a truck or trailer-mounted chipper.

3. No chipping or spreading of chipped material will be permitted within 10 m of the high water mark of a watercourse.

4. Spread material evenly over the disturbed areas of the right-of-way to a depth of no more than 2.5 cm, following seeding of the reclamation seed mix.

5. Chip only sufficient amounts of slash and nonsalvageable timber to cover the desired area, as directed by the Environmental Inspector.

6. Burn or otherwise dispose of excess slash and woody debris.

CRITERIA FOR IMPLEMENTATION

Management of invasive plant species is of paramount concern to Enbridge. The goal of invasive species management for the Alberta Clipper Project is to prevent the introduction and spread of non-native plants and to eliminate or control them, as practical within the project area. To help achieve this goal, the following measures will be implemented during restoration.

1. All equipment shall arrive for work in a clean condition to minimize the risk of weed introduction. Any equipment which arrives in a dirty condition will not be allowed to work until it has been cleaned off at a suitable location.
2. Equipment passing through areas identified as having a weed problem will be shovel and compressed air cleaned prior to continuing work on the right-of-way.
3. Control the growth of noxious or nuisance weeds on topsoil storage piles by hand cultivating, brushing, moving or if necessary using selective, nonpersistent herbicides. Control will be initiated before weedy species mature – produce seed.
4. Weed growth will be monitored during restoration activities, and weed control measures applied on a site-specific basis.
5. The pipeline project area will be monitored for weed infestations as a part of the Post-Construction Monitoring Program.
6. Areas of poor plant cover will be reseeded and weed control measures will be applied if warranted.
7. All equipment cleaning station locations along the proposed route will be assessed in late spring. Weed species of concern that are identified at the sites will be treated. Manual removal of plants or chemical treatment will occur. If weeds are manually removed when in flower, the weed material will be disposed of in an approved land-fill facility.
8. Record all weed treatment and monitoring records.

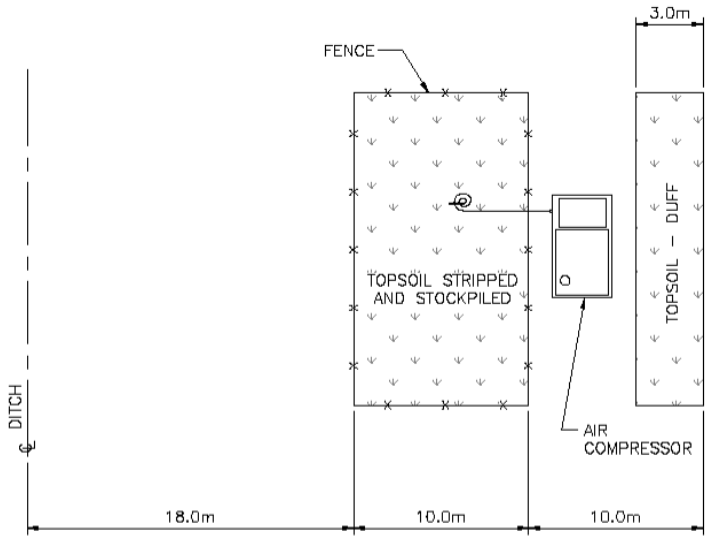
Notes:

1. Pull out or mow the plants from heavily infested areas and dispose of as directed by the Environmental Inspector.
2. Salvage topsoil from the full width of the right-of-way in areas of heavy infestations, as directed by the Environmental Inspector.
3. Store topsoil from the affected area separately.
4. Clean all topsoil handling equipment once past the area.
5. Record infestation areas and monitor during post-construction monitoring.
6. Clean all equipment at designated weed clean-off stations during nonfrozen conditions with shovels, compressed air, or high-pressure water.
7. Record location of clean-off site for future monitoring and, if warranted, weed control.

CRITERIA FOR IMPLEMENTATION

Weed clean-off stations using compressed air and manual truck cleaning for cleaning soil from construction equipment, may be set up where track cleaning by hand and other weed control measures are determined to be insufficient. Clean-off station locations will be determined by the Environmental Inspector prior to commencement of construction in the area. Clean-off requirements will apply to all construction equipment involved in topsoil handling operations.

Dry cleaning stations using high pressure compressed air for cleaning soil from construction equipment will be established along the proposed route at strategic locations to manage weed concerns. Clean-off requirements will apply to all construction equipment involved in topsoil handling operations. The diagram below is an example of how a dry cleaning station may be constructed. Final design should be determined by the Chief Inspector, in consultation with the Environmental Inspector, once a location has been determined.



PLAN

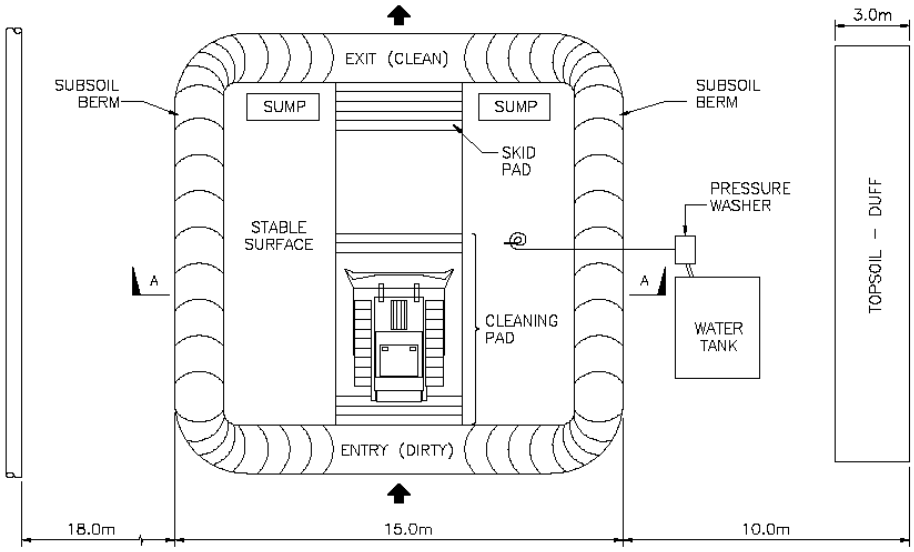
Notes:

1. Construct the dry type clean-off station (compressed air and manual truck cleaning) at an approved location by stripping topsoil throughout the station and stockpiling it as shown on the plan.
2. Cleaning shall be carried out under the supervision and to the satisfaction of the Environmental Inspector.
3. Use ropes or fencing material to designate the area where the cleaning is to occur.
4. Ensure that the size of the station is adequate to accommodate the maximum size of equipment.
5. Equipment is to consistently enter at one end and exit at another
6. Stockpile contaminated material.
7. Remove any soils contaminated by petroleum-based or other undesirable materials from clean-off stations in accordance with applicable requirements. Burn stockpiled debris, if approved by the appropriate authority.
8. Return topsoil and reclaim the area.

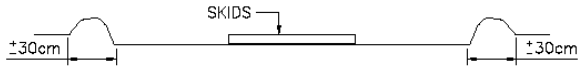
tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE **ALBERTA CLIPPER PROJECT**		
	TYPICAL WEED CLEAN-OFF STATION - AIR		
	4462	April 2007	Detail 6A-6b

CRITERIA FOR IMPLEMENTATION

Weed clean-off stations using high pressure water for cleaning soil from construction equipment, may be set up during nonfrozen construction where track cleaning by hand and other weed control measures are determined to be insufficient. Clean-off station locations will be determined by the Environmental Inspector prior to commencement of construction in the area. Clean-off requirements will apply to all construction equipment involved in topsoil handling operations. Final design should be determined by the Chief Inspector, in consultation with the Environmental Inspector, once a location has been determined.



PLAN

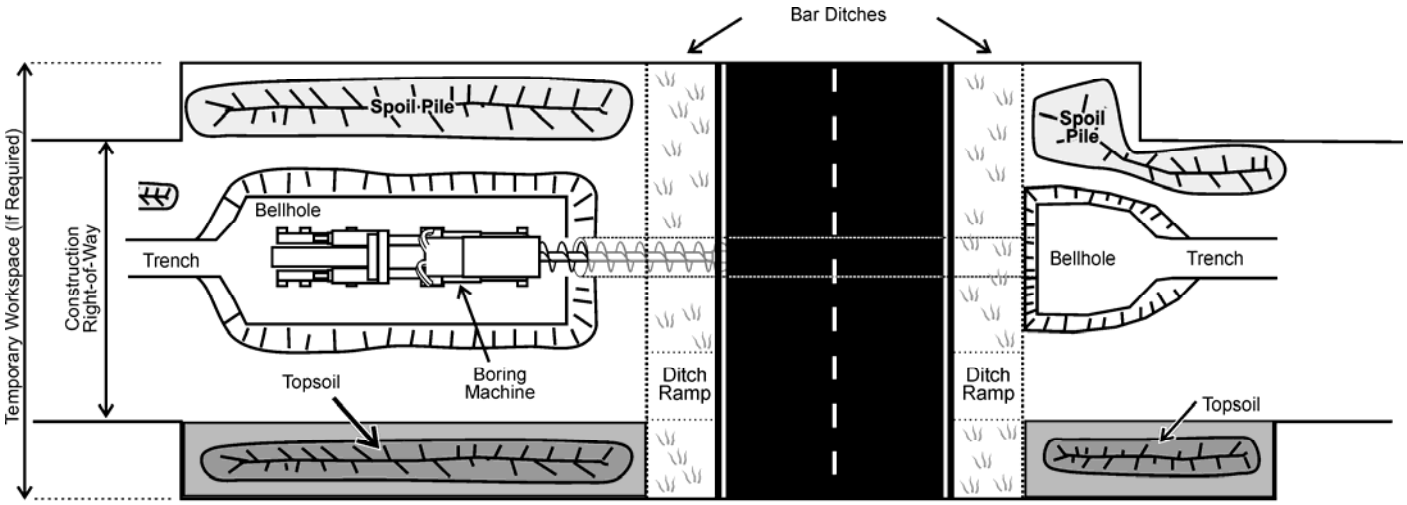


SECTION "A–A"

Notes:

1. During nonfrozen soil conditions, construct the clean-off station for high-pressure water cleaning at an approved location by stripping topsoil and constructing containment berms out of subsoil.
2. Water used for cleaning shall not be allowed to enter any waterbody, wetland or ditch.
3. Ensure that the size of the station is adequate to accommodate the maximum size of equipment.
4. Equipment is to consistently enter at one end and exit at another
5. Skids are to be cleaned between pieces of equipment.
6. The depression will be backfilled with bermed material. Any soils contaminated by petroleum-based or other undesirable materials from clean-off stations shall be removed in accordance with applicable requirements.
7. Topsoil will be returned and the area reclaimed.

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE **ALBERTA CLIPPER PROJECT**		
	TYPICAL WEED CLEAN-OFF STATION - HIGH PRESSURE WATER		
	4462	April 2007	Detail 6A-6c



Plan View
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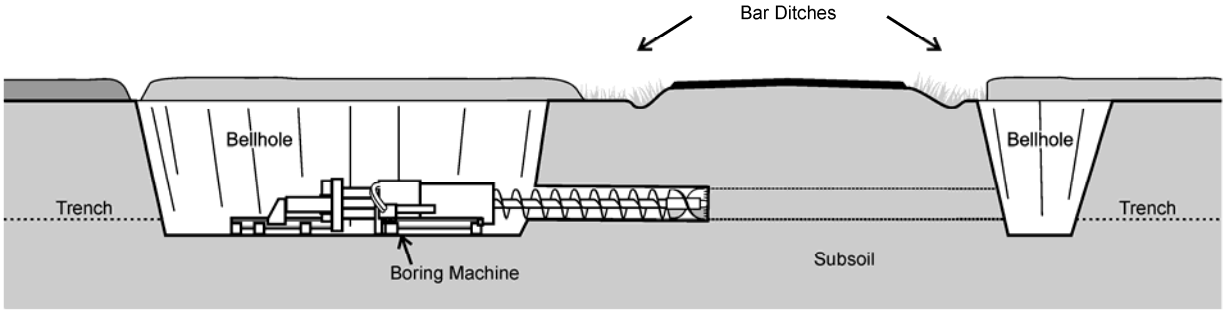
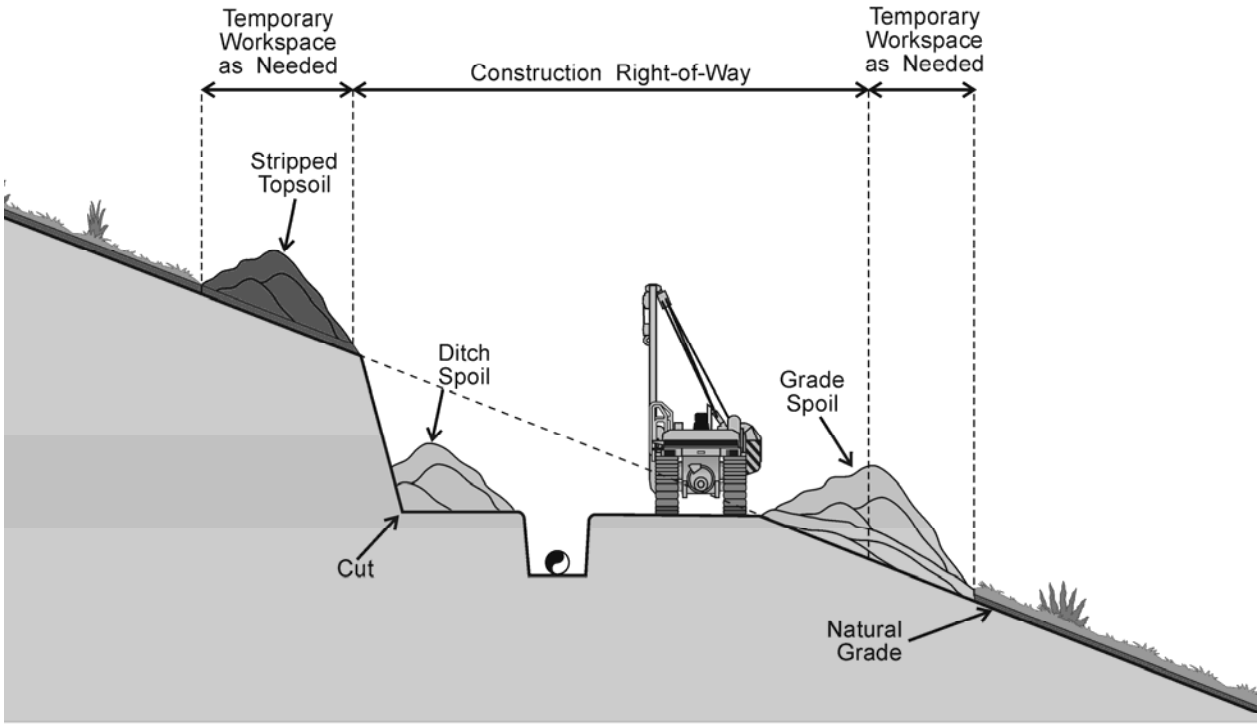


Profile
(Not to Scale)

Notes:

1. Acquire and mark additional temporary workspace.
2. Salvage topsoil from bellhole, spoil storage area and the work/travel lane. On well-sodded lands, restrict topsoil salvage to the general bellhole area and store spoil on sod. During frozen conditions, only strip area to be excavated.
3. Install subsoil ditch ramps.
4. Excavate bellhole. Store spoil on opposite side of right-of-way from topsoil or adjacent to topsoil maintaining adequate separation to avoid admixing topsoil and spoil.
5. After completion of pipe tie-ins, backfill and compact. Leave a crown to allow for subsidence.
6. Remove ditch ramps.
7. Replace topsoil.
8. Reseed and fertilize as appropriate.



Profile
(Not to Scale)

Notes:

1. As directed by the Chief Inspector and approved by the landowner, build a shoo-fly to minimize disturbance along the right-of-way.
2. Stake and clear extra temporary workspace for material storage, if required.
3. Salvage topsoil from areas of the right-of-way to be graded.
4. Make the cut on the high side of the right-of-way and place the grade spoil on the low side of the right-of-way. Install the pipe in the cut, not in the fill. Note, to do this, the direction of work may need to be reversed along the sidehill slope.
5. Employ erosion control measures such as trench breakers and subdrains, if warranted.
6. Leave breaks in the trench crown at frequent intervals on sidehill sloped terrain.
7. Use a backhoe to assist dozers with replacing cuts. Do not trespass off construction right-of-way. Recontour to a 3:1 grade unless otherwise directed by geotechnical engineer.
8. Replace topsoil on disturbed areas of the right-of-way.
9. Apply seed and fertilizer as required.

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	SIDEHILL GRADING		
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The location of flood and pivot irrigated lands are identified on the Environmental Alignment Sheets.

Note: During frozen conditions, minimize the time the trench is left open to avoid backfilling frozen spoil.

Flood Irrigation Lands

1. Prepare a surveyed right-of-way profile prior to construction on flood irrigated lands. The survey will be used in restoring these lands to their pre-construction contours so that irrigation operations are not disrupted following reclamation.

2. Install trench breakers on flood irrigated lands, where warranted due to the presence of slopes, to force groundwater seepage along the pipeline trench to the surface.

3. If constructing during frozen conditions on flood irrigated lands, install temporary sack trench breakers on long slopes, where warranted.

4. Remove, during final clean-up, the upper 0.75 m of any temporary sack trench breakers installed during the winter.

5. Backfill the trench on flood irrigated land in two (minimum) separate lifts. Compact after each lift.

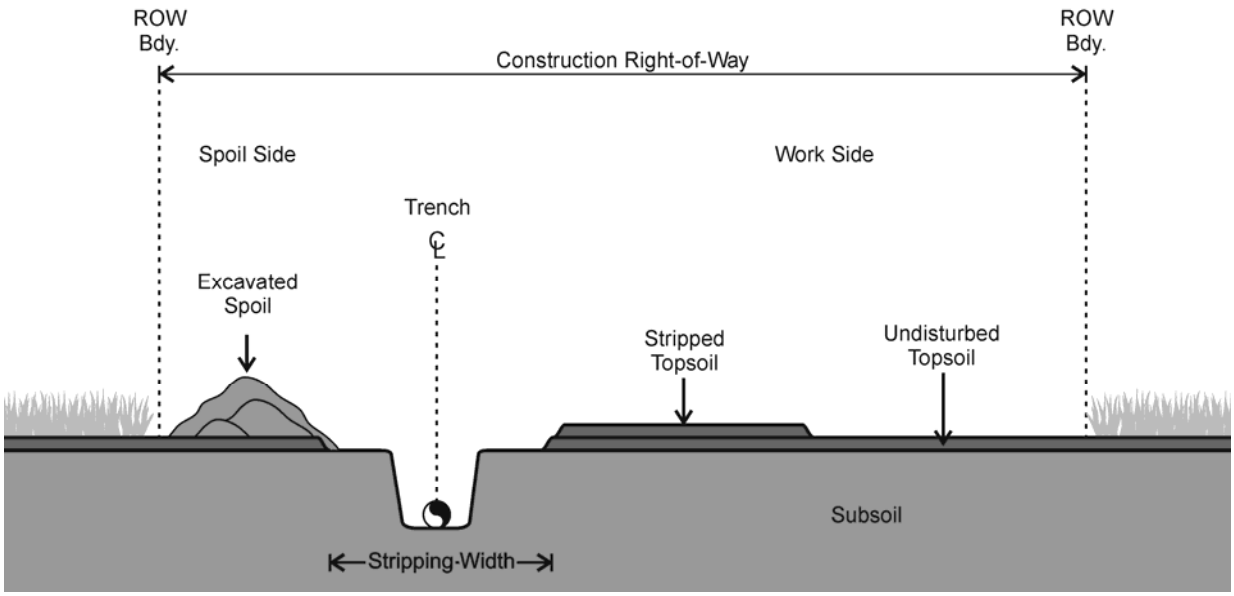
6. Ensure that no trench crown is left on flood irrigated lands and that right-of-way and border dikes are returned to their preconstruction profile.

7. Inspect and monitor the trench before and during the first irrigation season to determine the success of the trench compaction and right-of-way profile restoration.

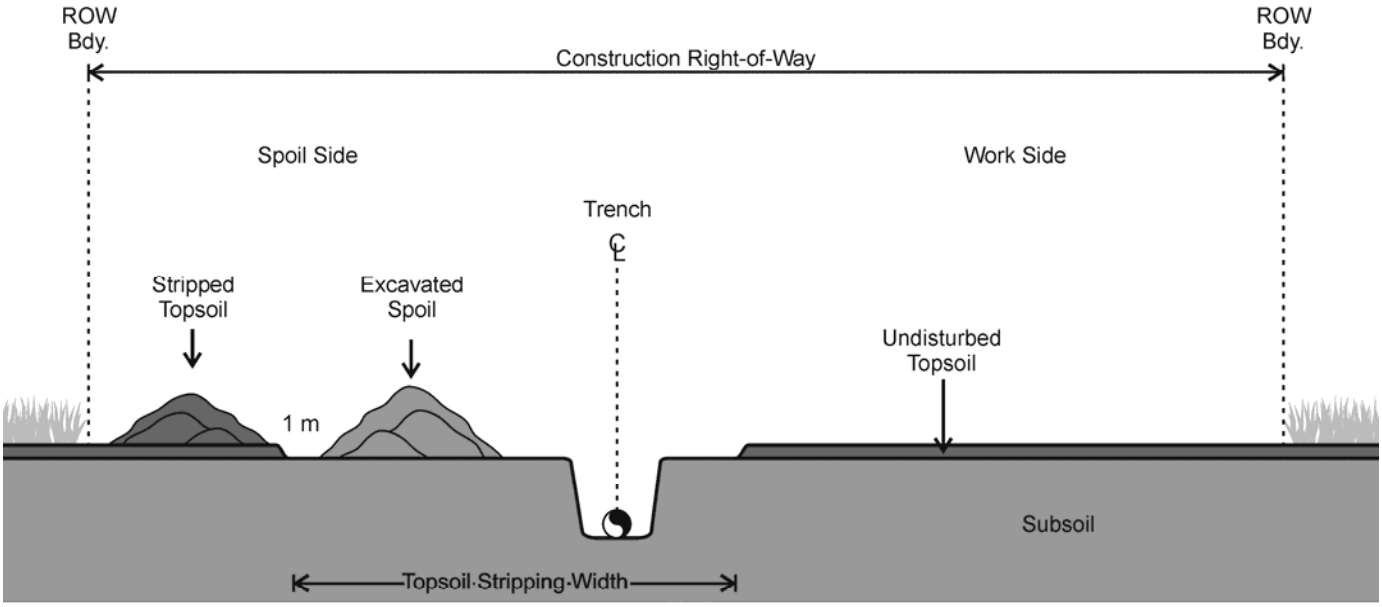
Pivot Irrigation Lands

1. Backfill the trench on pivot irrigated lands using appropriate trench compaction measures to avoid trench subsidence and to ensure grades are restored to preconstruction profile. Special attention to the pivot wheel crossing locations will be required to avoid future disruption of irrigation equipment operation. This may include compacting in lifts at these locations or the installation of a special crossing plate or other bridging material, if approved by landowner.

2. Inspect and monitor the trench before and during the first irrigation season to determine the success of the trench compaction and leveling.



Activity:	**Notes**:
1. Strip and Stockpile Topsoil	- Blade width topsoil stripping is to be conducted on well-sodded hay land, pasture, native prairie, bush-pasture and bush lands during both **nonfrozen and frozen conditions** as indicated on the Environmental Alignment Sheets. - Salvage topsoil from a strip approximately three times the width of the trench centred over the trench line. Area stripped should be sufficiently wide to accommodate the track of the ditcher. - Increase topsoil stripping width at locations where trench sloughing may occur; stockpile topsoil a greater distance from the trench at these sites. - Stockpile topsoil on work side and flatten to allow set-up of pipe. Windrowing of salvaged topsoil material on the spoil side is also acceptable. - Topsoil stripping requires accurate depth control of a road grader or equivalent machine to ensure that subsoils and topsoils are accurately separated. Strip topsoil to colour change. - Limit topsoil stripping activities during frozen conditions to specialized equipment capable of accurately separating topsoil from subsoil. - Suspend stripping during periods of high winds if soil drifting begins to occur or during excessively wet conditions. - Leave breaks in the topsoil windrow at obvious drainage courses.
2. Excavate Trench and Stockpile	- Place spoil on the spoil side of the trench. Maintain at least 1 m separation between topsoil and subsoil.
3. Backfill Trench	- Backfill and compact trench. Crown the trench, as warranted, to allow for settlement. - Avoid mixing subsoil with topsoil. Also avoid scalping sod layer by using a Prairie Protector, if necessary, or other piece of equipment capable of fine depth control. - Pick stones and debris from the trench area equivalent to the surrounding subsoil.
4. Replace Topsoil and Clean-up	- Evenly replace topsoil with grader or equivalent machine. Avoid scalping sod layer. Use Prairie Protector or Prairie Sweeper to minimize scalping of sod on native prairie if scalping is excessive. - Suspend replacement activities during periods of high winds if soil drifting begins to occur or during excessively wet conditions. - Pick stones equivalent to the surrounding topsoil.



Profile
(Not to Scale)

Activity:	**Notes**:
1. Strip and Stockpile Topsoil	- Conduct trench and spoil pile area topsoil stripping on cultivated lands during **nonfrozen conditions**. Strip the trench and spoil area on other land uses such as native prairie, hay, pasture, bush-pasture and bush lands as field circumstances dictate using Figure 6A-1 as a guide. - Topsoil stripping requires accurate depth control of a grader or equivalent machine to ensure that subsoils and topsoils are accurately separated. Multiple passes are preferred to a single pass. - Store topsoil on edge of spoil side of right-of-way. Storing topsoil on the work side and flattening it down to set pipe on is acceptable provided there is no mixing. - Suspend stripping during periods of high winds or when soils are excessively wet. - Leave breaks in the topsoil windrow at obvious drainage courses.
2. Excavate Trench and Stockpile	- Maintain at least 1 m separation between topsoil and subsoil.
3. Backfill Trench	- Backfill and compact trench. Crown the trench to allow for settlement. Leave breaks in the crown at obvious drainages. - Avoid mixing subsoil with topsoil.
4. Replace Topsoil and Clean-up	- Pick rocks and debris from the trench area equivalent to the surrounding subsoil prior to topsoil replacement on agricultural lands. - Evenly replace topsoil with grader or equivalent machine. - Suspend replacement activities during periods of high winds if soil drifting begins to occur or when soils are excessively wet. - Pick rocks and debris equivalent to the surrounding topsoil.

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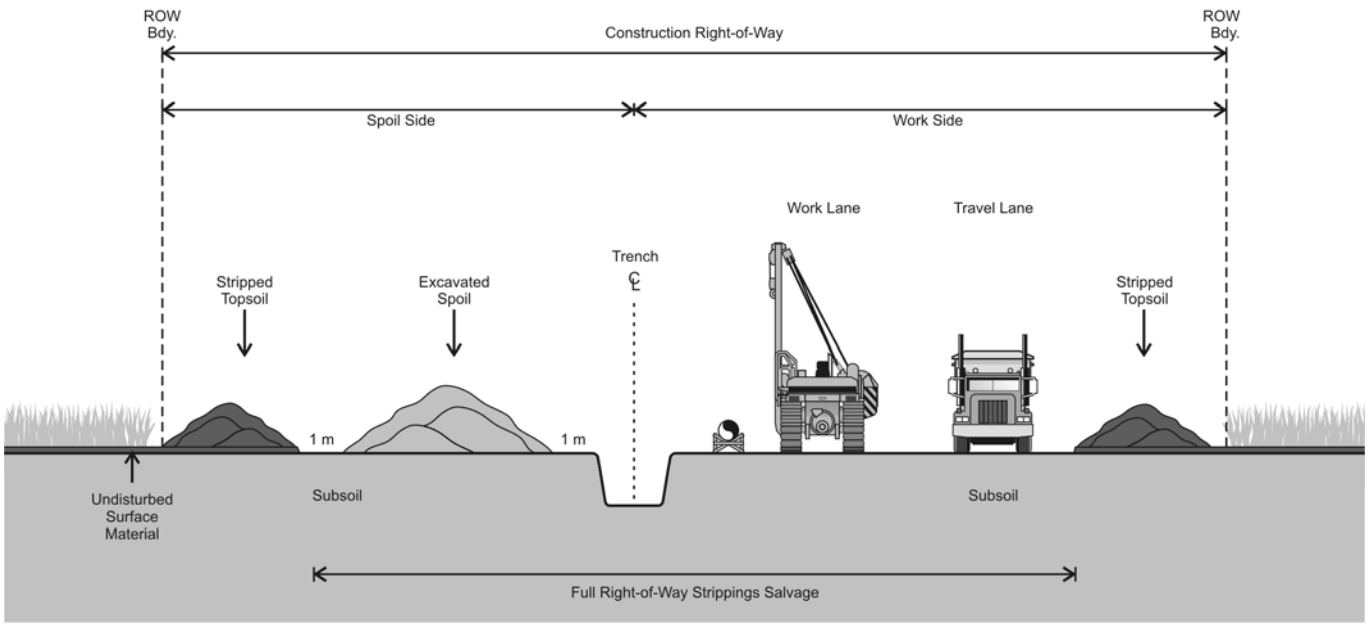
TOPSOIL SALVAGE – TRENCH AND SPOIL AREA

4462	April 2007	Detail 6A-11



Profile
(Not to Scale)

Activity:	**Notes:**
1. Strip and Stockpile Topsoil	- Salvage topsoil from over the proposed trench, spoil storage and work areas during **nonfrozen conditions** as field circumstances dictate using Figure 6A-1 as a guide. Topsoil storage on both sides of the right-of-way adjacent to the stripped area, as shown is preferred, however, storage of all salvaged topsoil on one side of the right-of-way is also acceptable. - Topsoil stripping requires accurate depth control of a grader or equivalent machine to ensure that subsoils and topsoils are accurately separated. - Suspend stripping during periods of high winds or during excessively wet conditions when soils are saturated. - Leave breaks in the topsoil windrow at obvious drainage courses.
2. Excavate Trench and Stockpile	- Maintain at least 1 m separation between topsoil and subsoil piles.
3. Backfill Trench	- Backfill and compact trench. Crown the trench to allow for settlement. Leave breaks in the crown at obvious drainages. - Avoid mixing subsoil with topsoil.
4. Replace Topsoil and Clean-up	- Rip compacted subsoils, if present, prior to topsoil replacement. - Ensure ripper teeth are of equal length. Disc subsoil if very lumpy prior to topsoil replacement. - Pick rocks and debris from the trench area equivalent to the surrounding subsoil prior to topsoil replacement on agricultural lands. - Evenly replace topsoil with grader or equivalent machine. - Suspend replacement activities during periods of high winds if soil drifting begins to occur or during excessively wet conditions when soils are saturated. - Pick rocks and debris equivalent to the surrounding topsoil.

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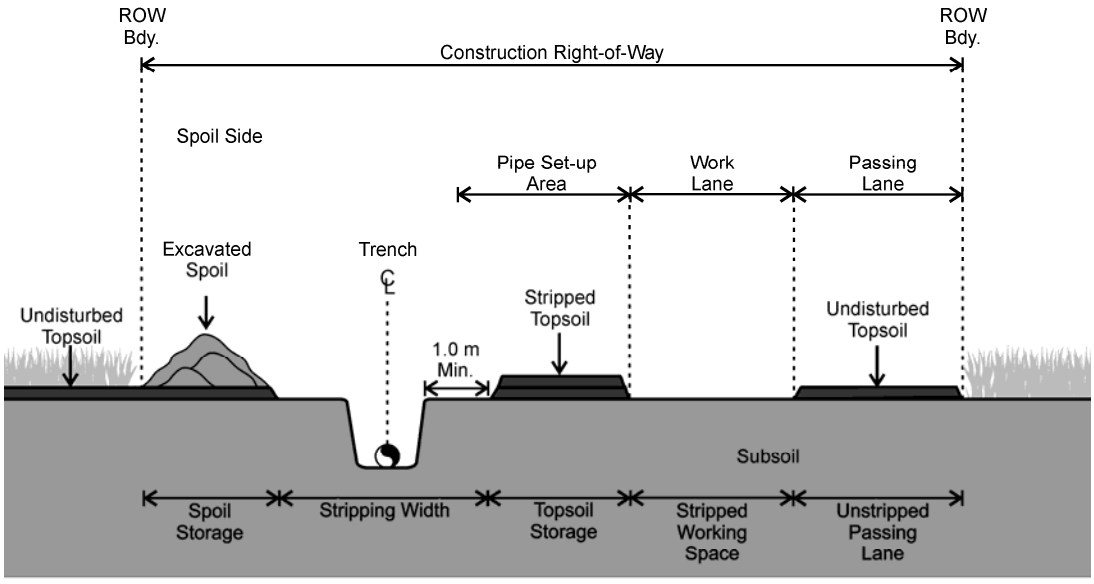
TOPSOIL SALVAGE – FULL RIGHT-OF-WAY

4462	April 2007	Detail 6A-12



Profile
Not to Scale

Activity:	**Notes**:
1. Strip and Stockpile Topsoil	- Trench and work lane topsoil stripping is to be conducted on well-sodded hay and pasture lands, wooded lands and native prairie as described in Figure 6A-1. - Salvage topsoil from a strip approximately three times the width of the trench centered over the trench line. Strip should be sufficiently wide to accommodate the track of the ditcher. - Increase topsoil stripping width at locations where trench sloughing may occur, stockpile topsoil a greater distance from the trench at these sites. - Stockpile topsoil on work side. Salvage topsoil from the work/travel lane and store in the pipe set-up area or on the passing lane side. Windrowing of salvaged topsoil material on the spoil side is also acceptable. - Topsoil stripping requires accurate depth control of a road grader or equivalent machine to ensure that subsoils and topsoils are accurately separated. Multiple passes are preferred to a single pass. Strip topsoil to colour change. - Suspend stripping during periods of high winds if soil drifting begins to occur or soils are excessively wet. - Leave breaks in topsoil pile at obvious drainage courses.
2. Excavate Trench and Stockpile	- Place spoil on the spoil side of the trench. Maintain at least 1 m separation between topsoil and subsoil.
3. Backfill Trench	- Backfill and pack trench. Crown trench as required to allow for settlement of fill. - Avoid mixing subsoil with topsoil. Also avoid scalping sod layer. - Pick stones and debris from the trench area equivalent to the surrounding subsoil.
4. Replace Topsoil and Clean-up	- Evenly replace topsoil with grader or equivalent machine. Avoid scalping sod layer. - Suspend replacement activities during periods of high winds if soil drifting begins to occur or soils are excessively wet. - Cultivate disturbed part of the right-of-way. - Pick stones equivalent to the surrounding topsoil.

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TOPSOIL SALVAGE – TRENCH AND WORK LANE

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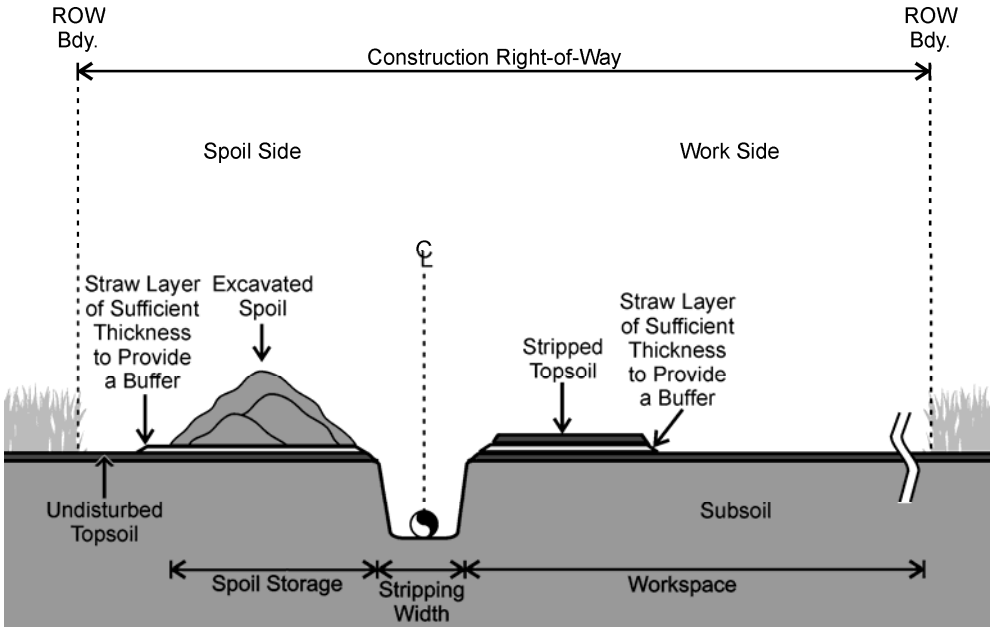


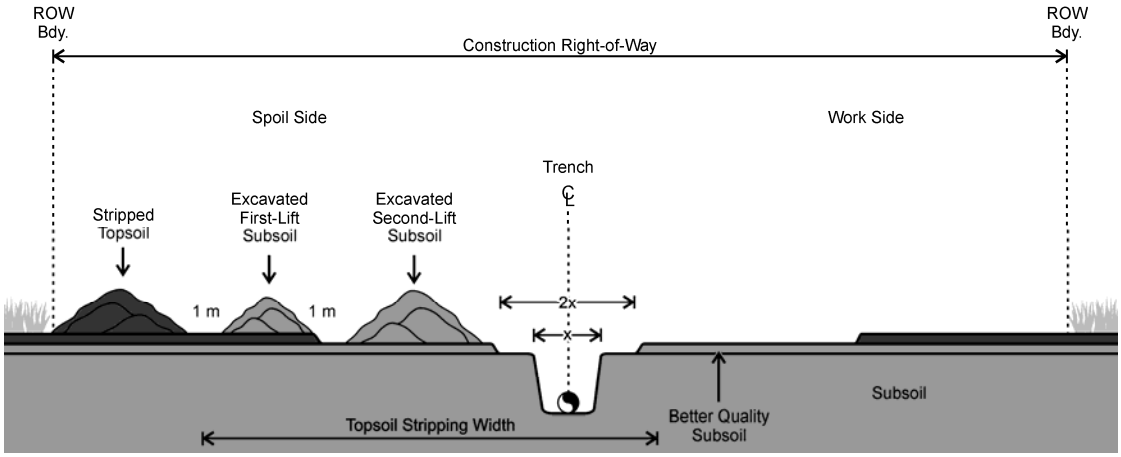
CRITERIA FOR IMPLEMENTATION

Reduced stripping width procedures will be employed in localized sensitive areas during frozen or nonfrozen conditions.

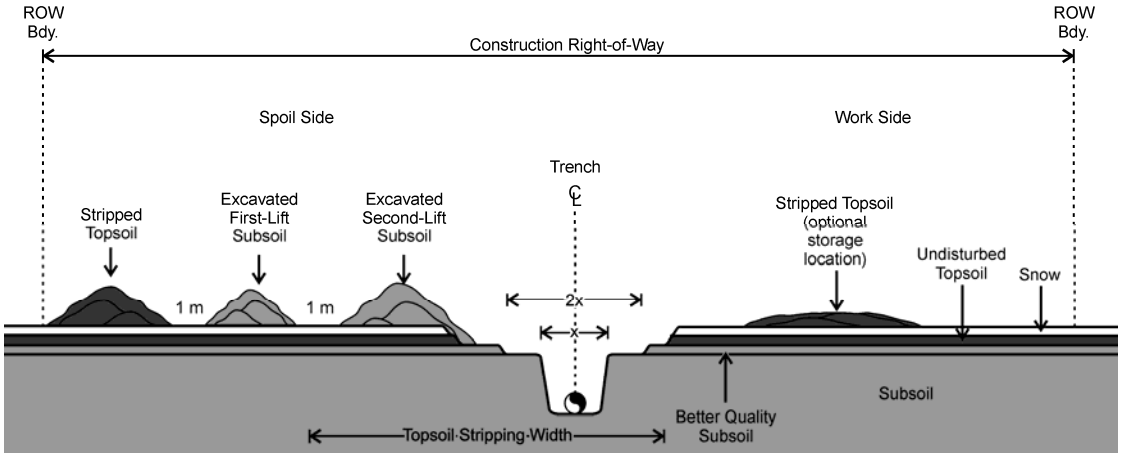
Notes:

1. Minimize traffic in the localized sensitive area.
2. Spread straw on the topsoil storage area to a sufficient thickness to minimize the risk of disturbance to the sod layer during topsoil replacement.
3. Salvage topsoil from the trenchline only. The work side topsoil pile may be flattened down to allow pipe to be set up on the salvaged topsoil. Stripping depth should be 15 cm, to colour change or as indicated on the Environmental Alignment Sheets.
4. Spread straw under the spoil pile area to a sufficient thickness to minimize the risk of disturbance to the sod layer during backfilling. Ensure that straw is free of weeds.
5. Excavate trench subsoil and store on straw that has been spread on the spoil side adjacent to the trench.
6. Complete lowering-in activities.
7. Backfill and compact trench to avoid having to feather excess spoil. Crown the trench, if warranted, to allow for settlement. Avoid mixing subsoil with topsoil and avoid scalping the sod layer. Leave remaining straw on undisturbed sod layer.
8. Evenly replace topsoil over the stripped area. Leave remaining straw and avoid scalping the sod layer.

Profile A - Nonfrozen



Profile B - Frozen



Activity:

Notes:

1. Strip and Stockpile Topsoil
   - Strip and stockpile topsoil and subsoil first-lift as shown above. Profile A is to be employed during nonfrozen soil conditions; Profile B, during frozen soil conditions.
   - Storing topsoil on the work side is an acceptable practice provided that mixing with subsoil is prevented.
2. Excavate Trench and Stockpile
   - Excavate first-lift of subsoil to the depth indicated on the Environmental Alignment Sheets unless otherwise specified by the Environmental Inspector and stockpile as shown above. Note: a bulldozer may be needed to move this subsoil to allow room for windrowing and subsequent backfilling of the second subsoil lift.
   - The width of the upper subsoil lift (subsoil first-lift) should be twice the width of the lower trench.
   - Excavate remainder of subsoil and stockpile as shown above.
   - Maintain at least 1 m separation between all stockpiles.
3. Backfill Trench
   - Return second-lift of trench spoil to the trench and compact. Scalp upper subsoil base under second-lift of trench spoil during backfilling to ensure that all second-lift subsoil is returned to the trench.
   - Return first-lift of subsoil to the trench and compact. Avoid mixing upper subsoil with topsoil during backfill during nonfrozen conditions and snow with topsoil during frozen conditions.

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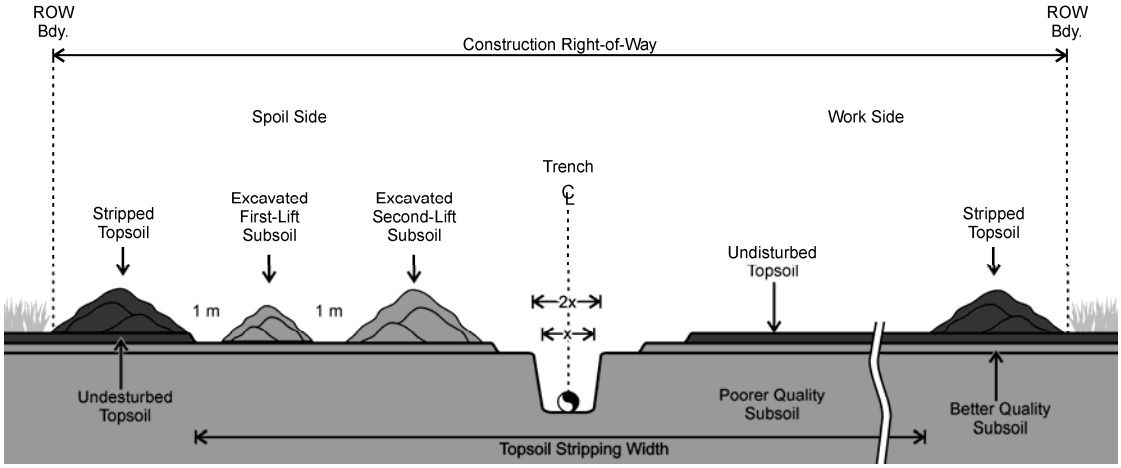
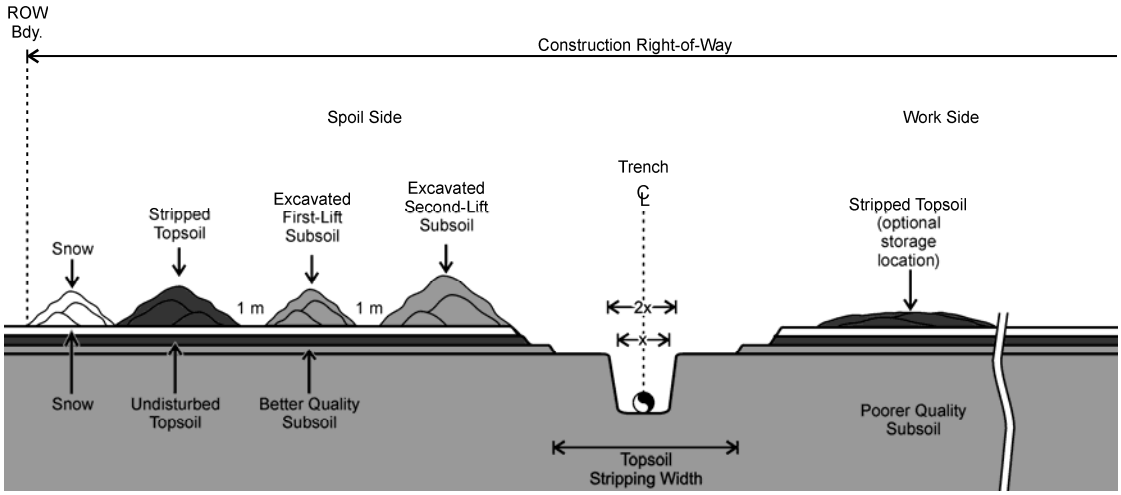
THREE-LIFT SOILS HANDLING - ON WELL-SODDED LAND

4462	April 2007	Detail 6A-15

Profile A - Nonfrozen



Profile B - Frozen



Activity:	**Notes**:
1. Strip and Stockpile Topsoil	- Strip and stockpile topsoil and subsoil first-lift as shown above during nonfrozen conditions (Profile A) and, if warranted, during frozen conditions (Profile B). - Topsoil stripping in frozen conditions requires specialized equipment capable of accurately salvaging frozen topsoil. - Storing topsoil on the work side is an acceptable practice provided that mixing with subsoil is prevented.
2. Excavate Trench and Stockpile	- Excavate first-lift of subsoil to the depth indicated on the Environmental Alignment Sheets unless otherwise specified by the Environmental Inspector and stockpile as shown above. Note: a bulldozer may be needed to move this subsoil to allow room for windrowing and subsequent backfilling of the second subsoil lift. - The width of the upper subsoil lift (subsoil first-lift) should be twice the width of the lower trench. - Excavate remainder of subsoil and stockpile as shown above. - Maintain at least 1 m separation between all soil stockpiles.
3. Backfill Trench	- Return second-lift of trench spoil to the trench and compact. Scalp upper subsoil base under second lift of trench spoil during backfilling to ensure that all second lift subsoil is returned to the trench. - Return first-lift of subsoil to the trench and compact. Avoid mixing upper subsoil with topsoil during backfill during nonfrozen conditions and with snow and topsoil during frozen conditions.

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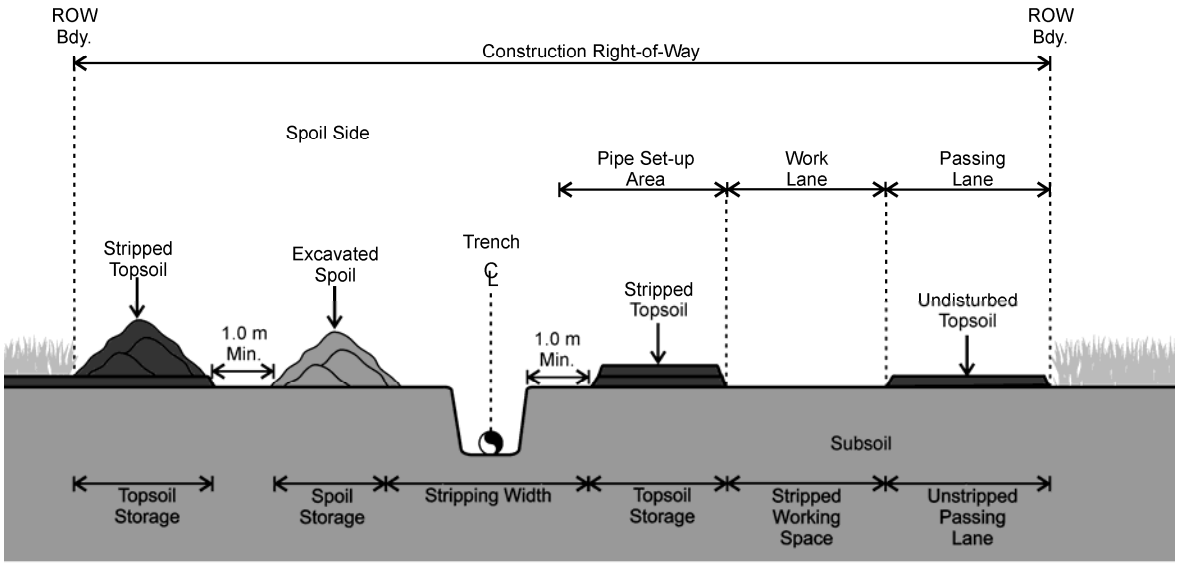
THREE-LIFT SOILS HANDLING - ON CULTIVATED LAND

4462	April 2007	Detail 6A-16



Profile
Not to Scale

Activity:	**Notes:**
1. Strip and Stockpile Topsoil	- Trench, spoil and work lane topsoil stripping is to be conducted on well-sodded hay and pasture lands, bush and native prairie as described in Figure 6A-1. - Increase topsoil stripping width at locations where trench sloughing may occur, stockpile topsoil a greater distance from the trench at these sites. - Stockpile topsoil from the trench and spoil area on the spoil side. Salvage topsoil from the work/travel lane and store in the pipe set-up area or on the passing lane side. - Topsoil stripping requires accurate depth control of a road grader or equivalent machine to ensure that subsoils and topsoils are accurately separated. Multiple passes are preferred to a single pass. Strip topsoil to colour change. - Suspend stripping during periods of high winds if soil drifting begins to occur or soils are excessively wet. - Leave breaks in topsoil pile at obvious drainage courses.
2. Excavate Trench and Stockpile	- Place spoil on the spoil side of the trench. Maintain at least 1 m separation between topsoil and subsoil.
3. Backfill Trench	- Backfill and pack trench. Crown trench as required to allow for settlement of fill. - Avoid mixing subsoil with topsoil. Also avoid scalping sod layer. - Pick stones and debris from the trench area equivalent to the surrounding subsoil.
4. Replace Topsoil and Clean-up	- Evenly replace topsoil with grader or equivalent machine. Avoid scalping sod layer. - Suspend replacement activities during periods of high winds if soil drifting begins to occur or soils are excessively wet. - Cultivate disturbed part of the right-of-way. - Pick stones equivalent to the surrounding topsoil.

CRITERIA FOR IMPLEMENTATION

The topsoil windrow will be tackified on wind erodible soils, where other erosion control measures (such as storing topsoil in low profile windrows and packing or the application of snow or water) are not feasible or effective. Locations where tackifier will be used will be determined during construction by the Environmental Inspector.

Notes:

1. Tackifier will be applied as specified by Enbridge.

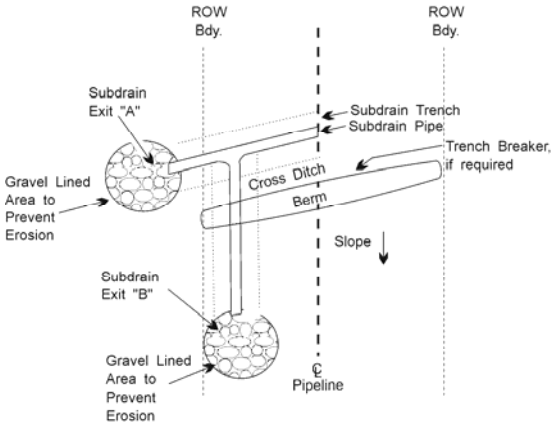
2. Tackifier will be biodegradable and non-toxic.

3. Apply tackifier on topsoil windrow immediately following stripping or immediately after identification of wind erosion potential.

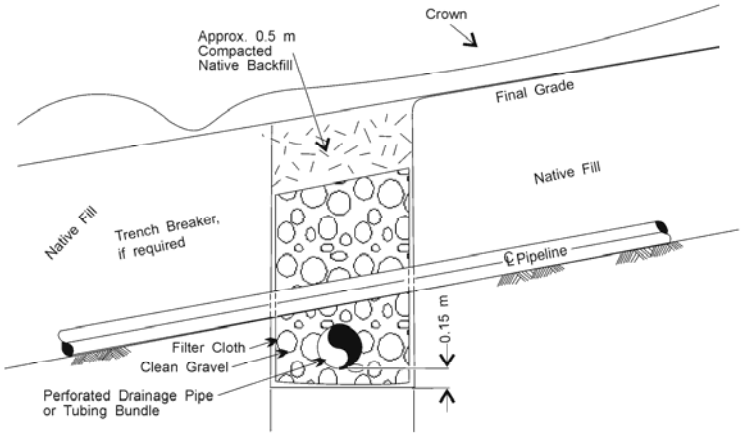
4. Apply tackifier at the manufacturer's recommended rate using a boom sprayer or cannon sprayer capable of providing even surface coverage of the entire topsoil windrow.

5. Avoid disturbance to the topsoil windrow after tackifier has been applied.

6. Reapply tackifier if disturbance of the topsoil windrow occurs and the potential for wind erosion reoccurs.



Plan View
(Not to Scale)



Profile
(Not to Scale)

Notes:

1. Install a subdrain to divert shallow groundwater flow away from the pipeline, to improve slope stability. Clean gravel and a filter cloth ditch liner, permits drainage aiding in retention of backfill. In certain circumstances, a parallel drain may be installed lengthwise down the slope underneath the pipeline. A geotechnical engineer can advise as to which method is most appropriate.
2. Install trench breaker downslope of drain, where drains cross pipeline trench, to prevent drain water flowing down pipe trench.
3. Determine the location of drain by on-site investigation considering such factors as groundwater conditions in trench, soil types, local topography, and drainage patterns. Discharge may either be off right-of-way on the downslope side of the subdrain (see Subdrain Exit "A"), or on right-of-way downslope of the berm (see Subdrain Exit "B"). Special permission will be required from the appropriate regulatory authority and landowner to construct a subdrain exit off right-of-way. Ensure discharge is into a well protected area with gravel, riprap or vegetation.
4. Skew cross drain 5^{o} off horizontal to ensure sufficient drainage.
5. The above drawing is a schematic diagram. A geotechnical engineer should be consulted for the detailed site specific drain design and the incorporation of the trench breaker.

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	SUBDRAIN		
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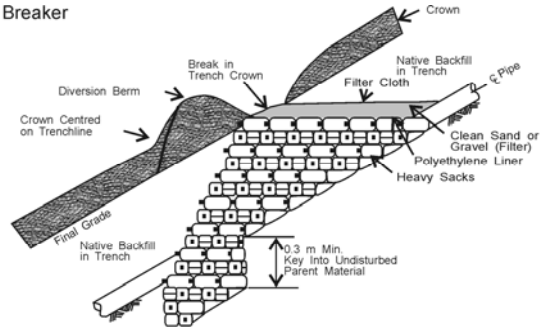
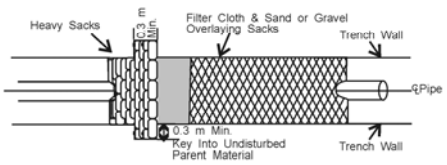
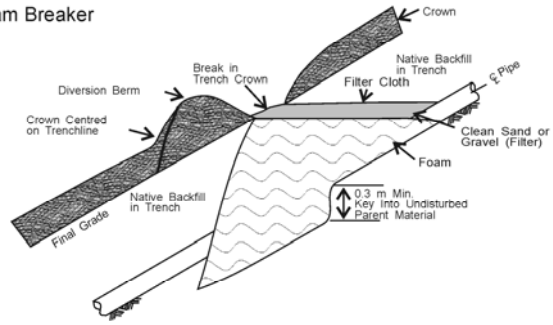
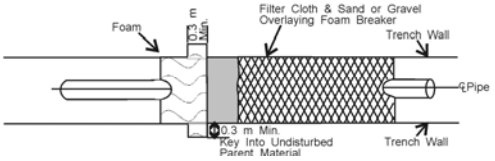
Sack Breaker



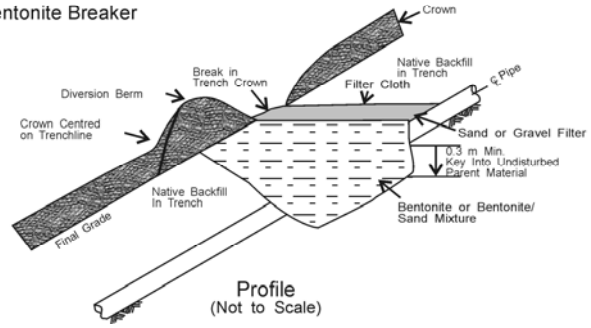


Foam Breaker





Bentonite Breaker



Profile
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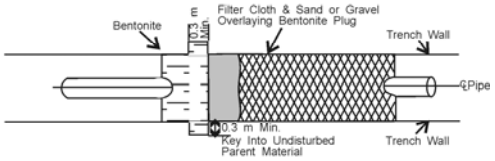

Plan View
(Not to Scale)

Notes:

1. Install trench breakers to control water seepage along the trench line and prevent erosion of backfill materials.
2. Trench breakers may be constructed using earth filled sacks, bentonite, foam or equivalent materials to provide a barrier to water seepage.
3. The drawings above provide a schematic representation of trench breaker installation. Final locations and design of trench breakers will be determined by the project engineer based on site specific conditions at the time of construction.
4. Dig keys into trench bottom and sides to the extent feasible for added stability.
5. Install a prefabricated drain or a layer of sand or gravel covered with filter cloth over the breaker.
6. Backfill native material and mark location of breaker.
7. Ensure cross ditches are located over the end of the drain.
8. Construct diversion berms downslope from the breaker but not over the end of the drain.
9. Ensure that trench crown does not encroach upon the breaker drain or cross ditch.
10. Backfill trench on downslope side of breaker before upslope side.

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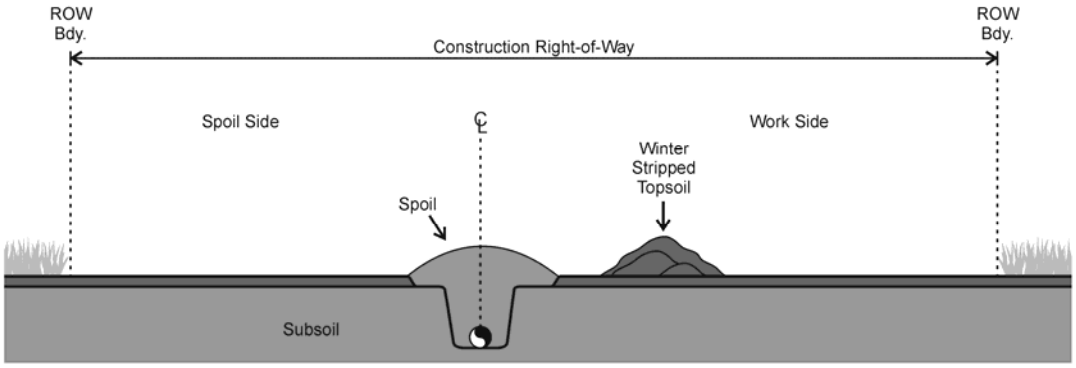
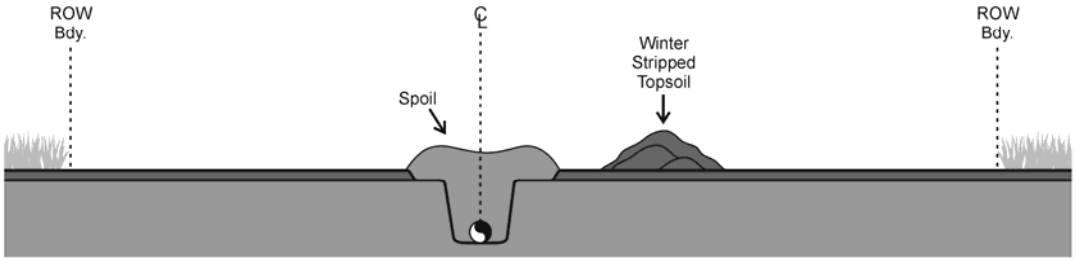
TRENCH BREAKERS / DITCH PLUGS

4462	April 2007	Detail 6A-20

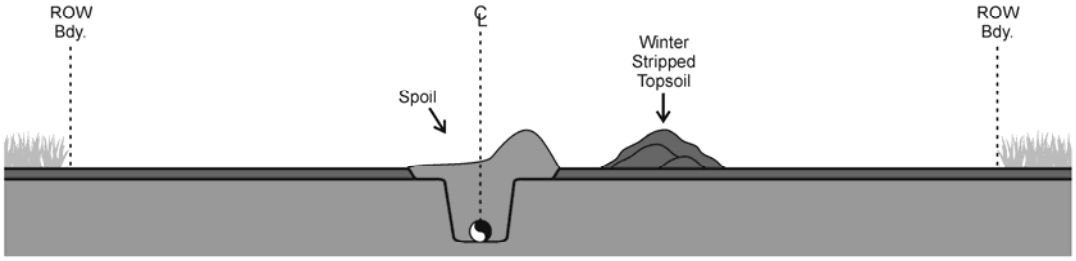
1. Trench configuration following winter backfilling. Crown trench to allow for subsidence during spring break-up.



2. Spring configuration following thaw and trench compaction operation. Postpone trench compaction operation until soils are thawed to trench depth.



3. Blade spoil after compaction into pile if crown height remains excessive.



Profile View
(Not to Scale)

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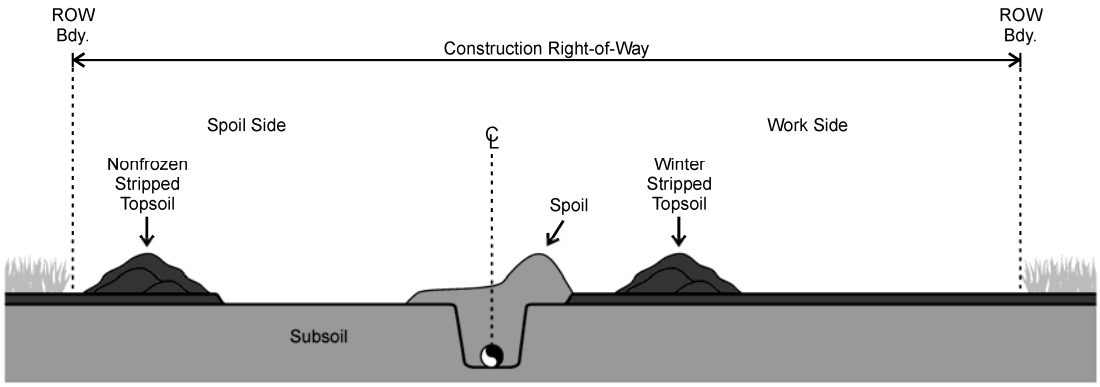
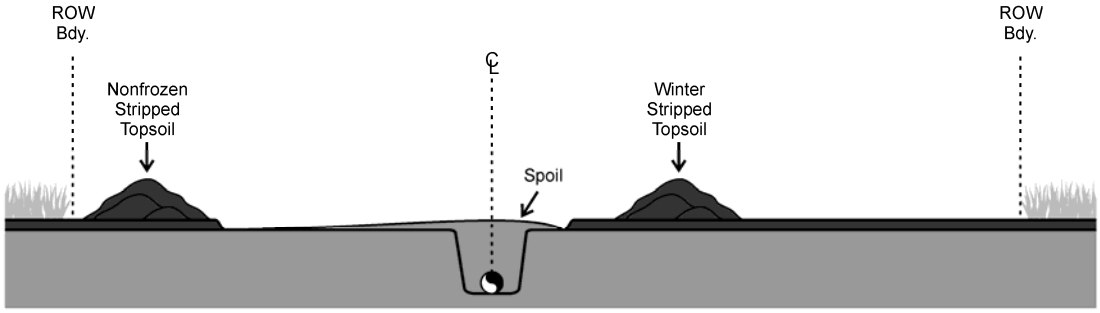
SPRING CLEAN-UP

4462	April 2007	Detail 6A-21a

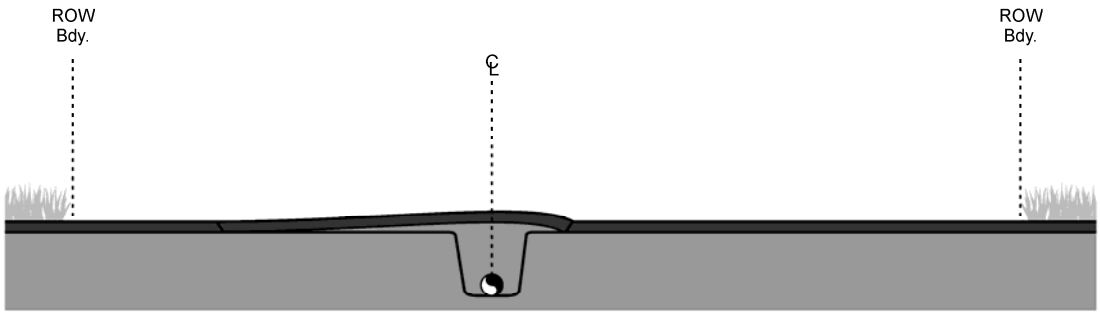
4. On cultivated, hay and pasture lands, if warranted, strip topsoil from the spoil pile area wide enough to allow excess spoil to be feathered out over stripped area.



5. Feather excess spoil material over stripped area to reduce the trench crown height.



6. Replace winter topsoil pile first over entire stripped area. Then replace topsoil stripped during nonfrozen conditions.



Profile View
(Not to Scale)

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ALBERTA CLIPPER PROJECT

SPRING CLEAN-UP

4462	April 2007	Detail 6A-21b

CRITERIA FOR IMPLEMENTATION

Where right-of-way recontouring and topsoil replacement are delayed until after spring break-up, the following measures will be implemented, as directed by the Environmental Inspector.

Notes:

1. Identify locations where cross drainage is needed. If feasible, consult with landowners to confirm locations where cross-drainage is needed.

2. Ensure grade material is well packed into its present position.

3. Create frequent breaks in the topsoil windrow at low areas, mid-slope and at obvious cross-drainage swales.

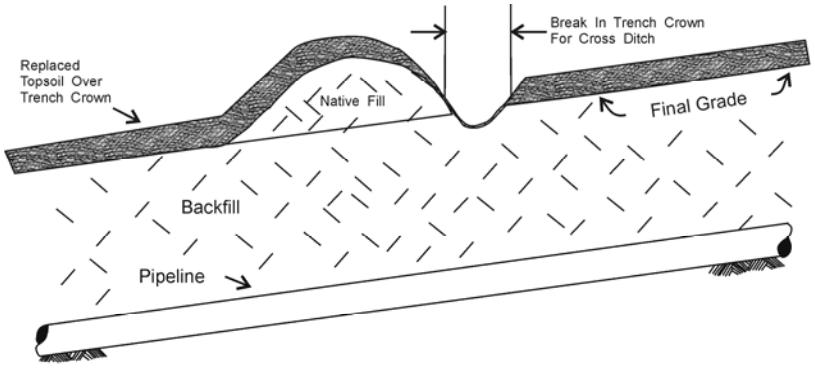
4. Compact the trench backfill downslope of the windrow breaks for a distance of at least 10 m using a compaction wheel or backhoe bucket. Install a temporary berm across the trench to minimize the channeling of any surface water flow.

5. Lay geotextile matting across the right-of-way through the windrow break. Ensure the matting provides drainage onto, across and off the work area.

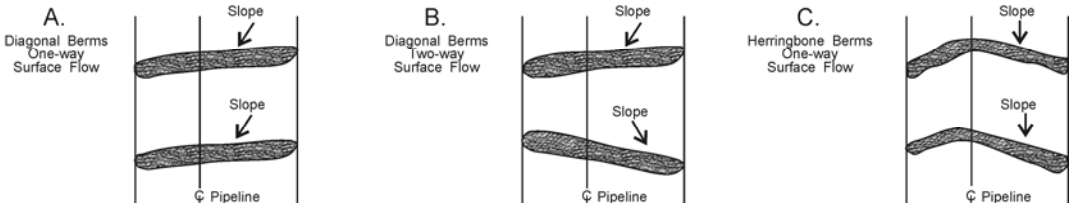
6. Stake geotextile in place according to manufacturer's instructions.

7. Apply tackifier to the topsoil windrow.

Profile
(Not to Scale)



Plan View
(Not to Scale)



Notes:

1. Install diversion berm and cross ditch on moderate and steep slopes to divert surface water off the right-of-way. Install berms immediately downslope of trench breakers to collect seepage forced to the surface.
2. Skew berm across the right-of-way at downhill gradient of 5-10%.
3. Construct diversion berm of compacted native subsoils where extensive disturbance of the sod layer has occurred. Diversion berms should be constructed of timbers, imported logs or sandbags if disturbance of the sod layer is limited. Avoid use of organic material. Where native material is highly erodible, protect upslope of berm and base of cross ditch by burying a geotextile liner 16-20 cm below the surface or armour upslope face of berm with earth-filled sand bags.
4. Typical diversion berm height and widths are approximately 0.75 m. Enbridge shall inspect berms after heavy rains and the first spring following construction; replace or restore berms, if warranted.
5. Leave a break in trench crown immediately upslope of diagonal berm and cross ditch to allow passage of water across the right-of-way.
6. Use diagonal berms where direction of slope and surface water movement is oblique to pipeline right-of-way.
7. Use herringbone berm and cross ditch where direction of slope and surface water movement is parallel to right-of-way so runoff does not cross ditch line.
8. Determine location and direction of berm based on local topography and drainage patterns. Also install berms immediately downslope of trench breakers. Skew berms with downhill gradient of 5-10%.
9. Typical diversion berm spacing is indicated below.

Slope Gradient (^{o} ;%)	Typical Spacing (m) Erosion Hazard*		
	High	Medium	Low
<7; <12	30-45	45-60	60 or more
7; 12	25	38	51
8; 14	22	33	44
9; 16	19	29	38
11; 19	16	24	32
14; 25	12	18	24
18; 33	9	14	18
27; 50	6	9	12

* High = fine sand silts; medium = clays and coarse sands; low = rock or gravel

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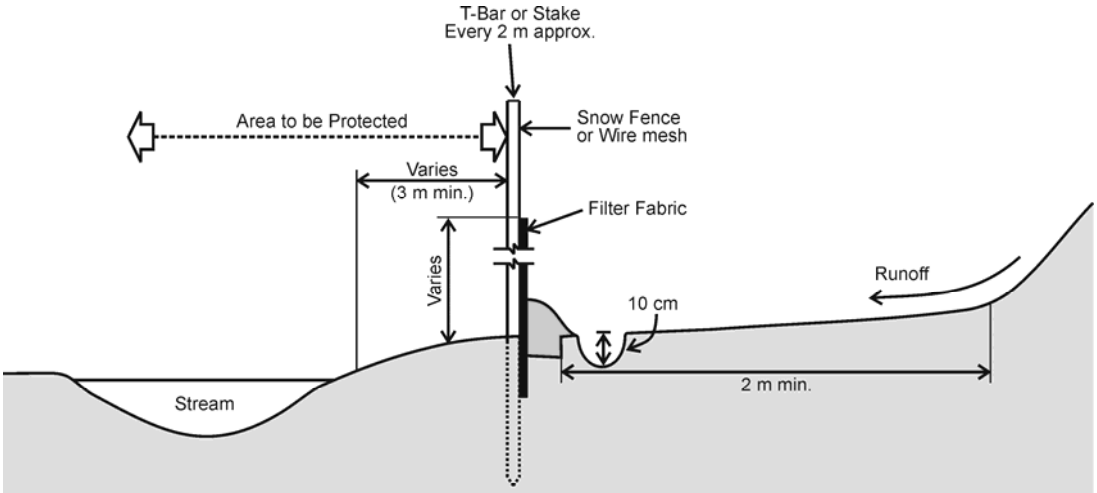
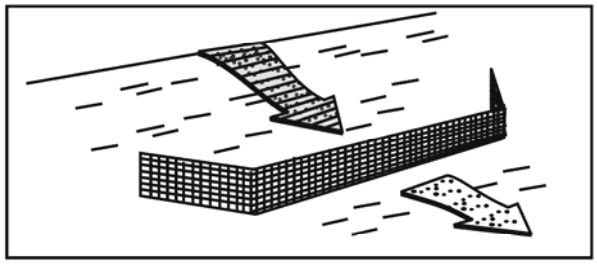
ALBERTA CLIPPER PROJECT

CROSS DITCHES AND DIVERSION BERMS

4462	April 2007	Detail 6A-23



Side View of Silt Fence
(Not to Scale)



Oblique View
(Not to Scale)

Notes:

1. Watercourses that have moderate to high sensitivity of fish habitat and/or have steep approach slopes at the proposed crossings may need silt fences during construction, as determined by the Environmental Inspector.
2. Install silt fences at the base of approach slopes following clearing and grading using the method and materials above or other approved designs.
3. Ensure silt fence is keyed into the substrate. Excavate a narrow trench, place the base of the silt fence in the trench and place the fill back into the trench, securing the silt fence in place.
4. Place silt fences a minimum 2 m, if feasible, from the toe of the slope in order to increase ponding volume.
5. Maintain silt fences throughout construction.
6. Ensure that silt fences, if removed or damaged, are reinstalled or repaired prior to the end of the work day.
7. Maintain silt fences in place at the base of the approach slopes until revegetation of the right-of-way is complete.
8. In areas with frequent traffic, install two or more silt fences in a staggered and overlapped configuration to allow vehicle passage without removal or opening of the silt fence.

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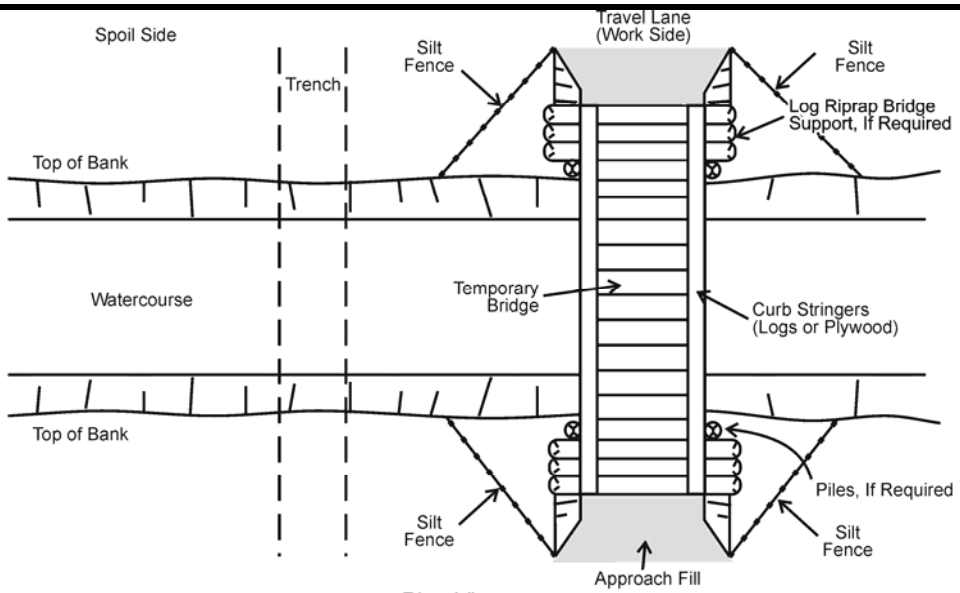
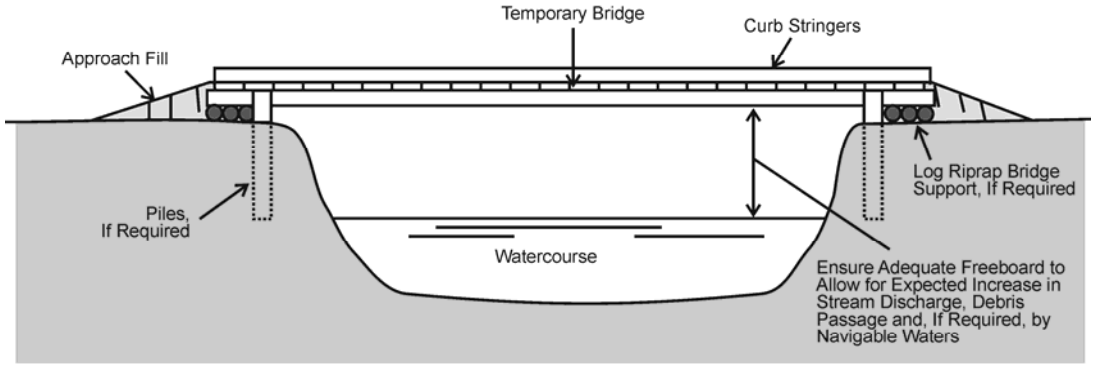
	SILT FENCE INSTALLATION		
	4462	April 2007	Detail 6A-24



Plan View
(Not to Scale)



Profile
(Not to Scale)

Notes:

1. Install a temporary bridge (*e.g.,* log, prefabricated span) to allow vehicles to cross watercourses that are sensitive or that have unstable bed and banks. Bridges are also used where watercourses are too deep, wide or fast to permit an alternative crossing structure. This method minimizes sedimentation of the watercourse, and bank and bed restoration work. It is generally limited to watercourses less than 30 m in width.
2. Utilize approach fills rather than cuts in banks to minimize erosion potential. Do not constrict flow with approach fill or support structures. Ensure adequate free-board to handle anticipated streamflows. Use a geotextile liner to prevent fine material from entering watercourse.
3. Remove bridge immediately after use. If bridge is to remain in place through spring break-up to access final clean-up, it must be designed for spring floods and ice jams. Remove support structures and approach fills. Restore and stabilize banks.
4. Install curb stringers of logs or plywood to ensure that fill material does not spill into the watercourse, where required.

Adapted from CAPP *et al.* (2005)

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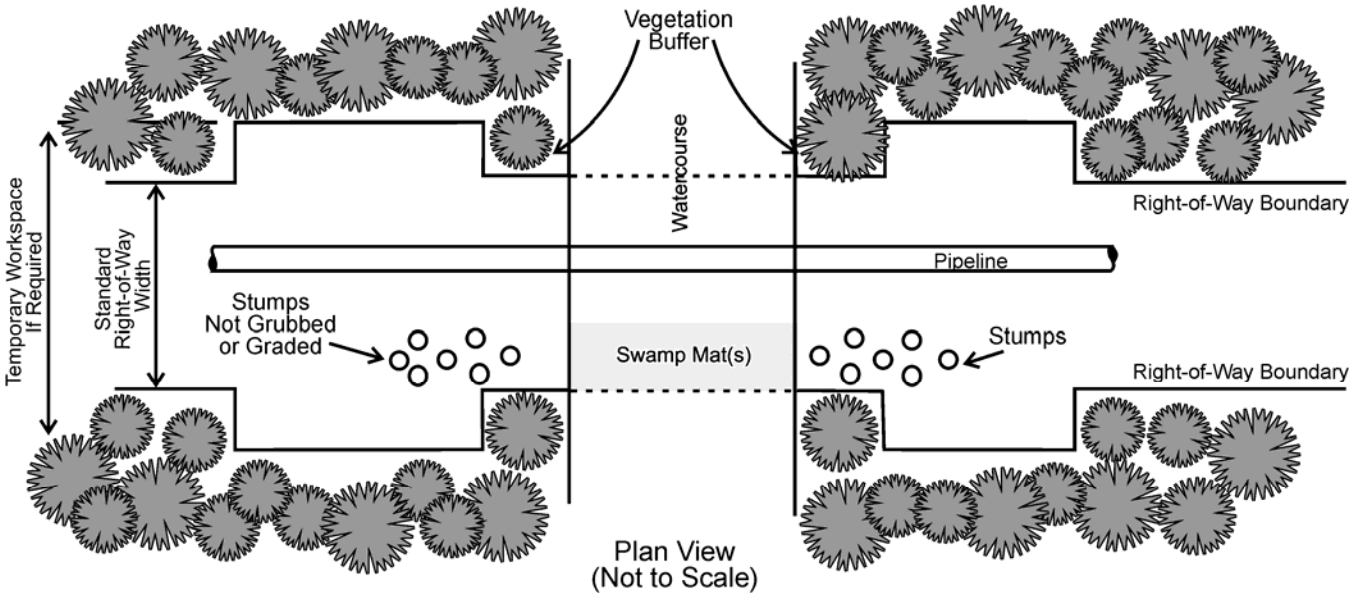
ALBERTA CLIPPER PROJECT

VEHICLE CROSSING - TYPICAL TEMPORARY BRIDGE

4462	April 2007	Detail 6A-25

A. Plan View



Notes:

1. Use swamp mats to provide vehicular access across relatively shallow or dry and narrow watercourses with stable banks. Where water depth, streambed composition or banks slopes could pose trafficability problems for rubber tired vehicles, limit swamp mat traffic to tracked equipment.
2. Minimize grading in proximity to watercourse. Grade and grub only along the trenchline and an area immediately adjacent to the trench line. Pull soil and debris away from watercourse, if banks require sloping.
3. Minimize use of crossing.
4. Stabilize banks and approaches with granular blanket underlain by a geotextile, if warranted.
5. Mark boundaries on both sides of crossing to confine all vehicle traffic to swamp mats.
6. Restore and stabilize beds and banks to original contour when crossing is no longer needed. Granular blanket need not be removed if it is not a barrier to fish during low flow conditions.

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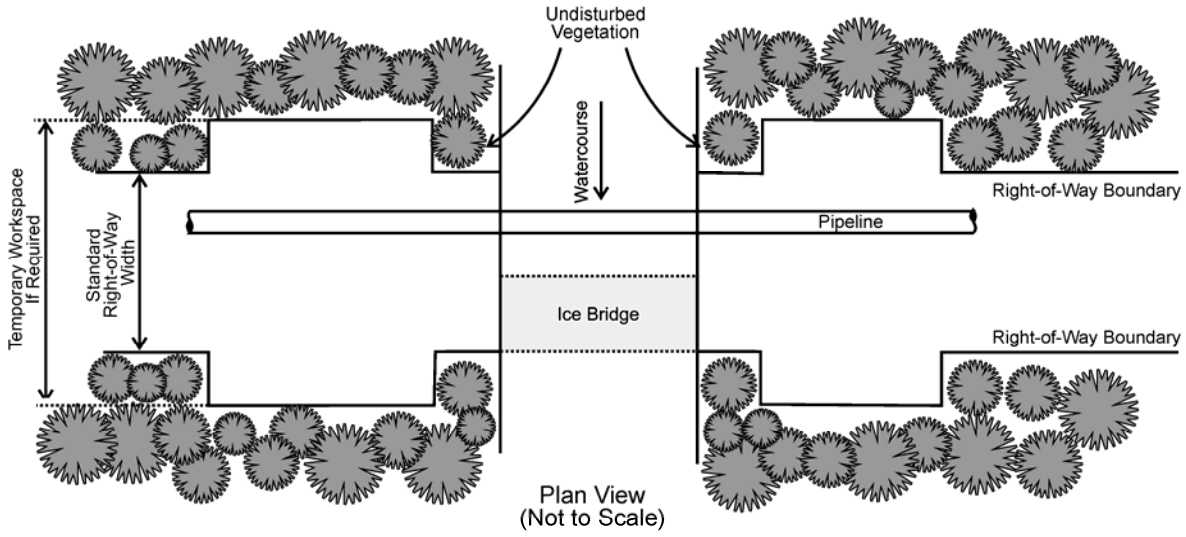
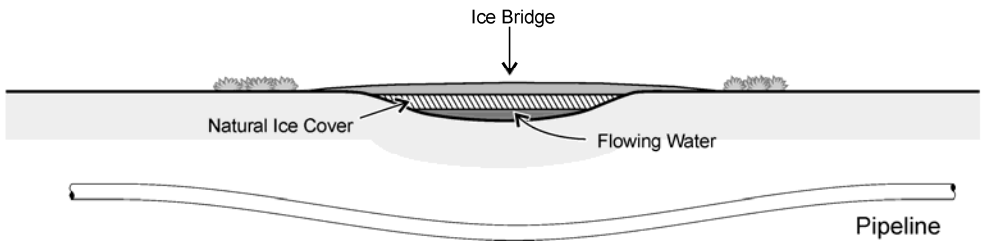
	VEHICLE CROSSING - TYPICAL SWAMP MAT FORD		
	4462	April 2007	Detail 6A-26

A. Plan View



B. Profile View



Notes:

1. Install ice bridges during winter construction when a safe ice thickness can be maintained.
2. Locate ice bridges at sites with gently sloping banks to minimize cuts in watercourse banks. Use snow and ice to slope approaches, rather than cut banks.
3. Flood ice surface with water and cover with snow to increase load bearing capacity. Logs may be used as a base to strengthen the bridge. The ice bridge should not impede flow.
4. Maintain ice regularly and remove all debris from the ice surface.
5. Remove broken ice from trench area to prevent ice jamming against and under the ice bridge.
6. Remove logs and breach ice bridge by physical means prior to spring break-up.
7. Restore and stabilize banks and approaches prior to spring break-up.

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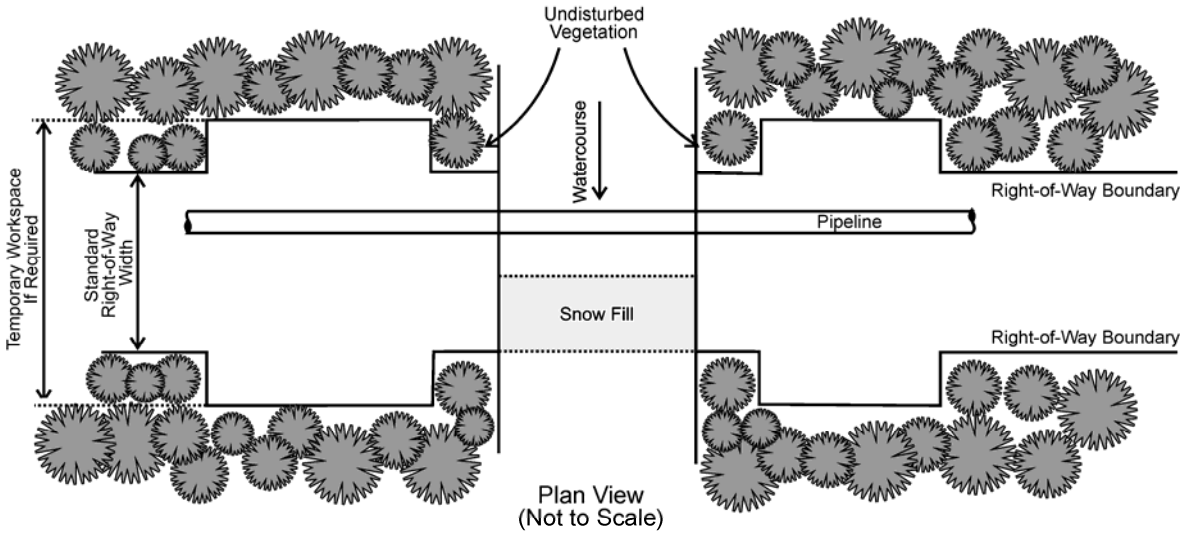
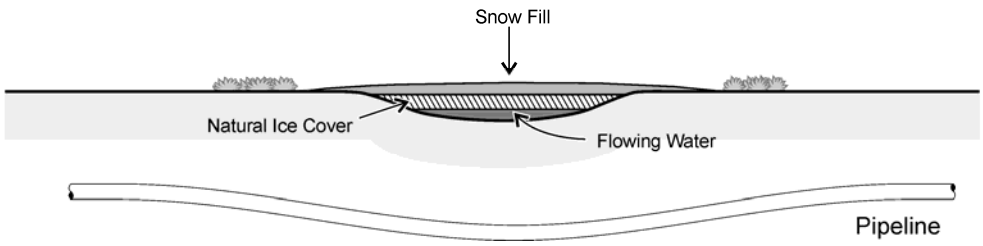
	VEHICLE CROSSING - TYPICAL ICE BRIDGE		
	4462	April 2007	Detail 6A-27

A. Plan View



B. Profile View



Notes:

1. Install ice bridges during winter construction when a safe ice thickness can be maintained.
2. Locate ice bridges at sites with gently sloping banks to minimize cuts in watercourse banks. Use snow and ice to slope approaches, rather than cut banks.
3. Fill with snow to increase load bearing capacity. Logs may be used as a base to strengthen the bridge. The snow fill should not impede flow.
4. Maintain snow fill regularly and remove all debris from the surface.
5. Remove broken ice from trench area to prevent ice jamming against and under the snow fill.
6. Remove logs and breach snow fill by physical means prior to spring break-up.
7. Restore and stabilize banks and approaches prior to spring break-up.

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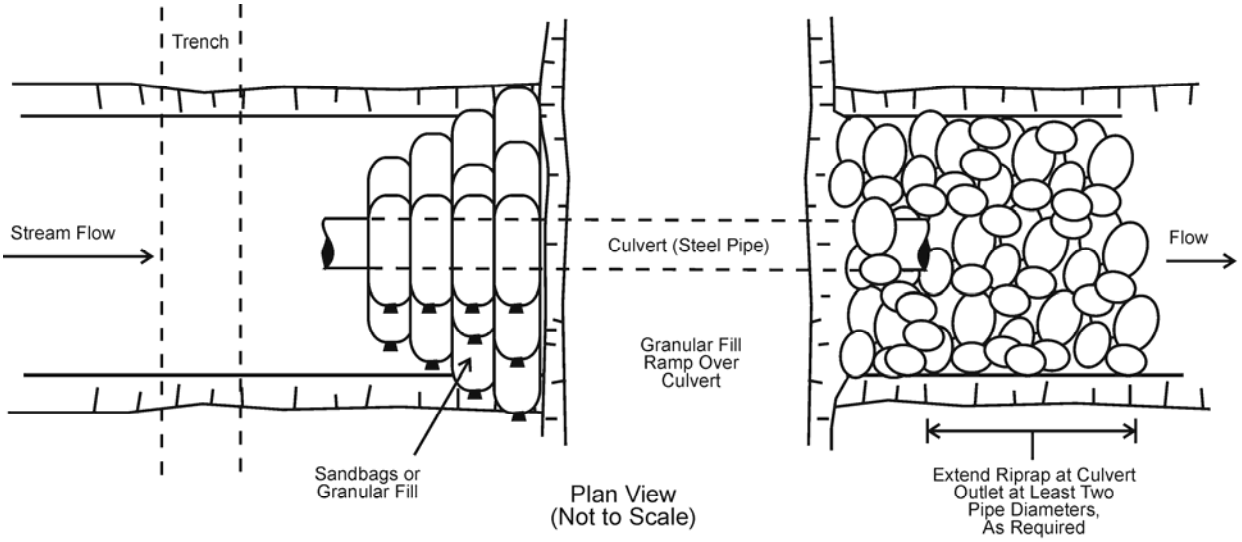
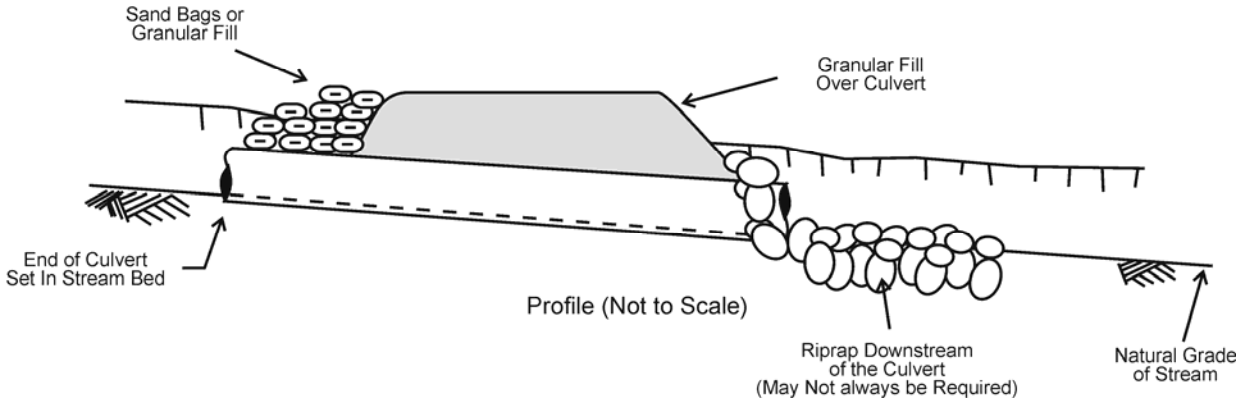
	VEHICLE CROSSING - SNOW FILL		
	4462	April 2007	Detail 6A-28





Notes:

1. Install ramp and culverts to allow vehicles to cross relatively narrow watercourses where sedimentation must be minimized or fish passage allowed.
2. Design culverts to handle 150% of maximum anticipated flows or to a five year flood level and according to specific guidelines where fish passage (*i.e.,* migration) is required. Contact government authorities for minimum water depth specifications, and maximum water velocities. Ensure dam is impermeable.
3. Place ends of culverts below the natural grade of watercourse at an angle that does not exceed normal watercourse gradient. Depth of placement is dependent upon bed type, culvert size and expected flow conditions.
4. Remove temporary culverts and ramp materials when no longer required. Remove culvert and ramp prior to freeze-up (summer construction) and prior to spring break-up (winter construction).
5. Restore and stabilize bed and banks.

Source: Adapted from CAPP *et al.* (2005)

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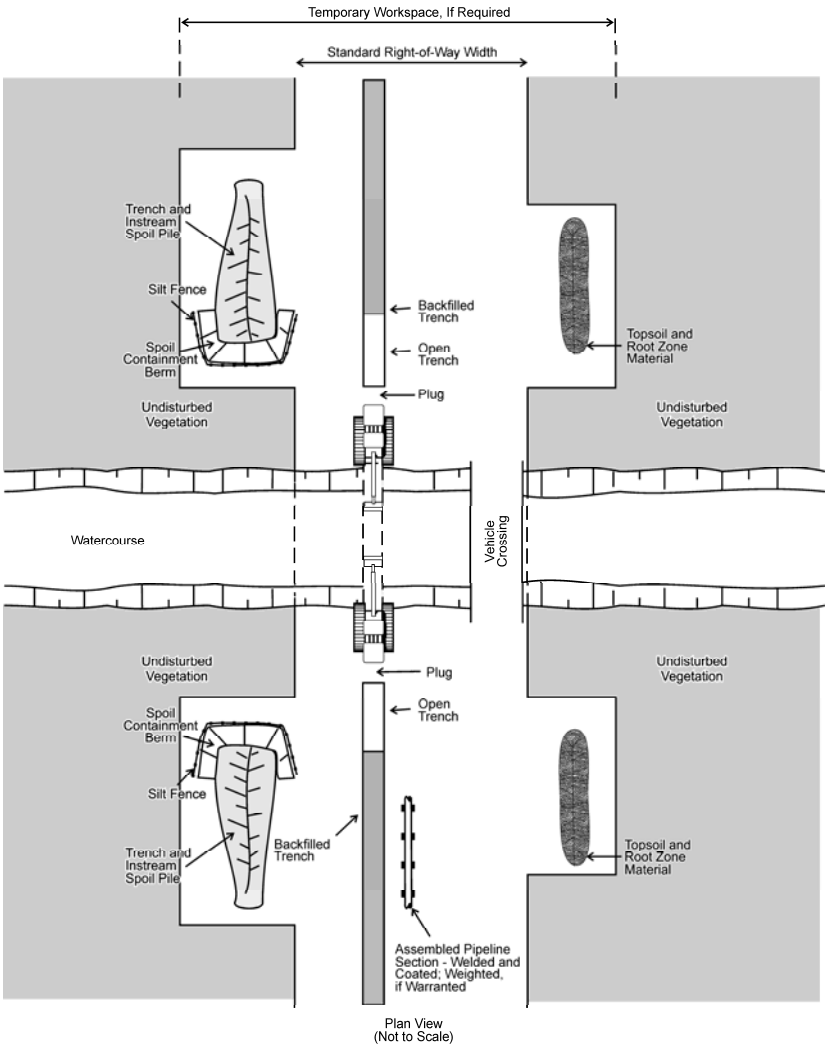
ALBERTA CLIPPER PROJECT

VEHICLE CROSSING - TYPICAL RAMP AND CULVERT

4462	April 2007	Detail 6A-29



Notes:

1. Install vehicle crossing if warranted.
2. Install sediment and erosion control structures, as required.
3. Leave plugs at end of standard trench.
4. Complete construction of the instream pipe section. Weight pipe, if warranted, prior to commencement of instream activity.
5. Trench through watercourse retaining hard plugs back from each bank until just prior to pipe installation. Stockpile all instream spoil on banks. Construct berms (*e.g.,* subsoil, saddle weights, shotrock) to prevent saturated spoil from flowing back into watercourse.
6. Lower-in and backfill immediately. Restore stream channel to approximate preconstruction profile and substrate. Attempt to complete all instream activity within 24 hours.
7. If necessary to control water flow and trench sloughing, install temporary soft plugs and dewater trench on to stable vegetated land, not directly to watercourse.
8. Restore, stabilize and reclaim watercourse banks and approaches to as close to preconstruction grade as practical.

Source: Adapted from CAPP *et al.* 2005

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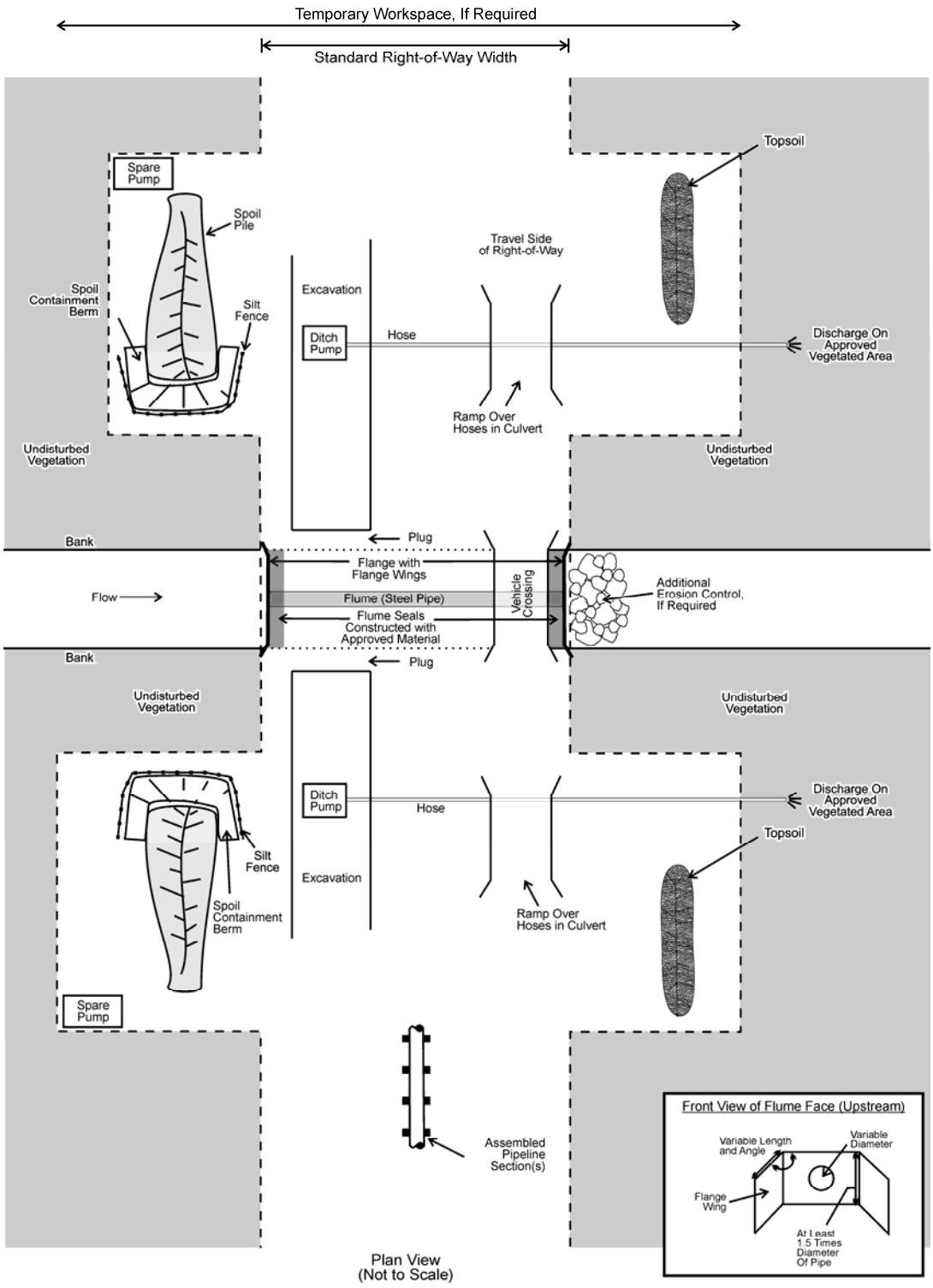
	WATERCOURSE CROSSING – OPEN CUT OF SMALL WATERCOURSES		
	4462	April 2007	Detail 6A-30



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ALBERTA CLIPPER PROJECT

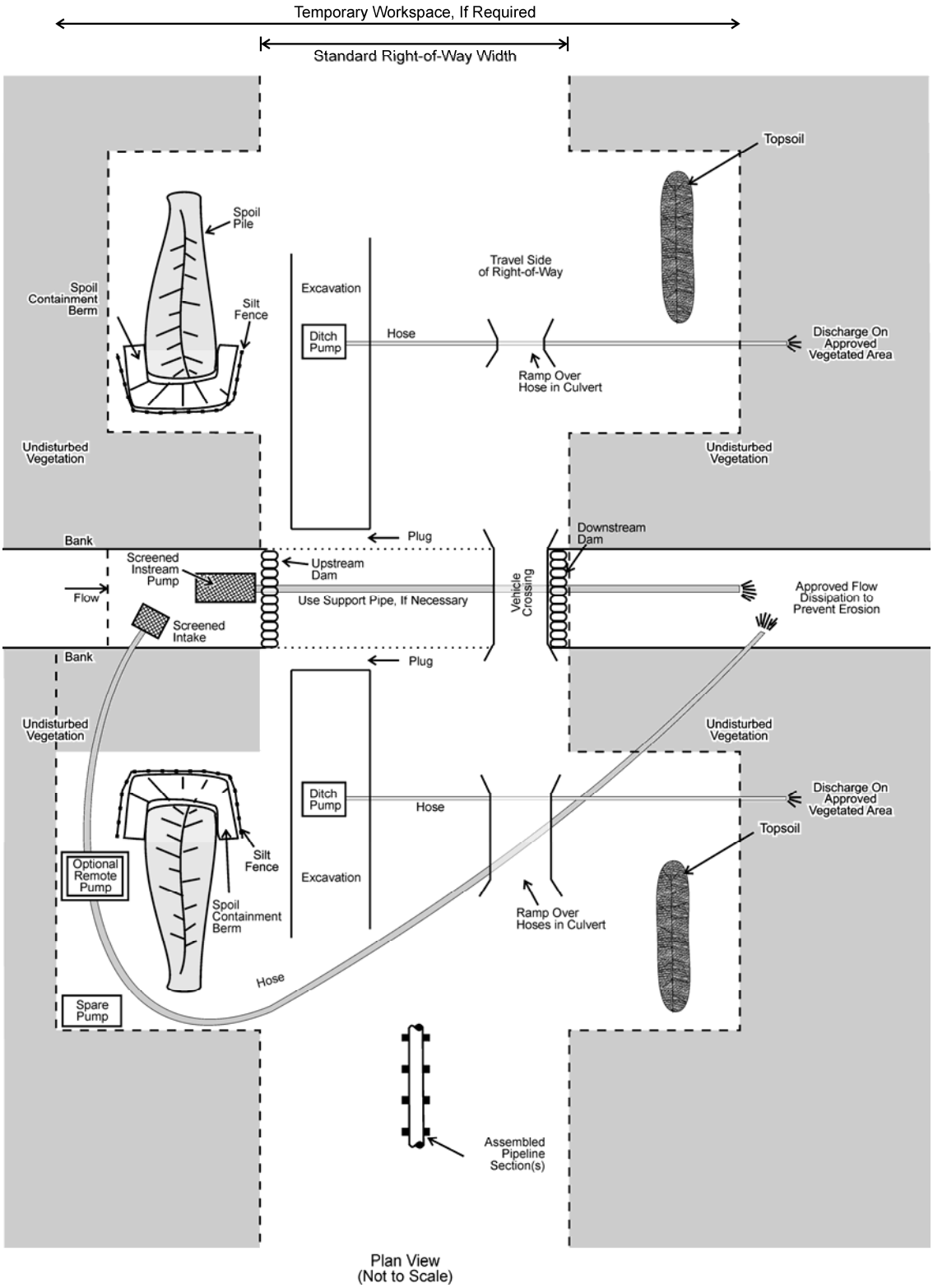
WATERCOURSE CROSSING – ISOLATION: FLUME

4462	April 2007	Detail 6A-31a

Notes:

1. Install the vehicle crossing, if required, on the work side edge of the right-of-way to allow for a wide excavation.
2. Size flume to handle anticipated flows.
3. Stockpile all required materials prior to beginning instream work. Complete construction of the instream pipe section. Weight and pretest pipe, if warranted, prior to commencing instream activity.
4. Install a pre-assembled flume, or construct a flume and install both an upstream and downstream dam.
5. Install additional erosion control, if required, downstream of the flume outlet.
6. Ensure a tight seal about the dam and flume prior to undertaking trench excavation. Beginning in the early morning, excavate the trench as quickly as practical placing spoil out of the stream channel. Create spoil containment sumps or berms, if warranted, to keep spoil from flowing back into the stream channel.
7. Pump excavation as required to prevent downstream flow of silted water. Direct the pumped water onto vegetated areas well back from the watercourse. Construct water containment sumps, if warranted.
8. Install pipe.
9. Backfill the stream channel first, squeezing the silted water into the bank excavations. Pump or drain the bank excavations while progressively backfilling from the stream channel outward.
10. Complete backfill and stabilize bed, leaving a small shallow (< 0.5 m) sump upstream of the downstream dam. Install a pump intake in this sump.
11. Slowly elevate corner of flume (or edge of dam) and/or shut down auxiliary bypass pumps, and allow isolated channel to be flushed with water. Silt-laden water will flow into the shallow sump and then be pumped onto well-vegetated area.
12. Once isolated channel is flushed, remove downstream seal materials.
13. Remove upstream seal materials.
14. Remove the flume.
15. Restore, stabilize and reclaim banks of stream channel to preconstruction profiles.

Adapted from CAPP *et al.* (2005)



Plan View
(Not to Scale)

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ALBERTA CLIPPER PROJECT

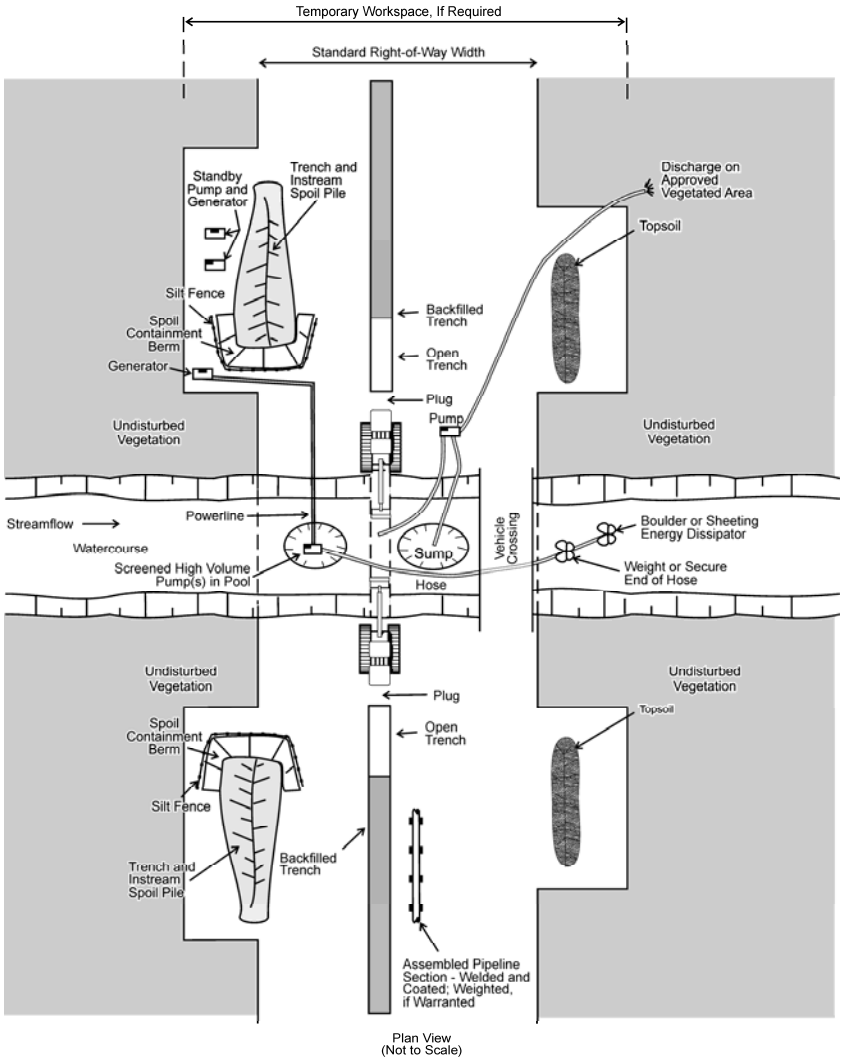
WATERCOURSE CROSSING – ISOLATION: DAM AND PUMP

4462	April 2007	Detail 6A-32a

Notes:

1. Install the vehicle crossing on the work side edge of the right-of-way to all for a wide excavation.
2. Stockpile all necessary materials and equipment onsite prior to beginning instream work.
3. Complete construction of the instream pipe section. Weight, coat and pretest pipe, if warranted, prior to commencement of instream activity.
4. Begin the operation in the early morning to allow for same day installation if practical.
5. Install pumps and check operation to equalize flow. Screen pump intakes with screen openings no larger than 2.54 mm. Size the screen to ensure that water approach velocities do not result in entrainment or entrapment of fish.
6. Construct the upstream dam. Dam should be constructed on the edge of the temporary workspace to allow for a wide excavation. Ensure dam is impermeable by installing a polyethylene liner. Dam may be constructed with sand bags, aquadam, sheet piling or other approved material that ensures a tight seal of the bed and banks.
7. Plug the vehicle crossing culvert or construct the downstream dam. Where a bridge is used, the dam should be constructed as close to the edge of the temporary workspace as practical to allow for a wide excavation.
8. Salvage the upper 0.5 m (minimum) of clean granular material, if present, and stockpile separately from the remainder of the trench spoil.
9. Excavate trench as rapidly as practical. Create spoil containment sumps, if warranted, to keep spoil from flowing back into the stream channel.
10. Install pipe.
11. Backfill the stream channel first pushing the silted water back into the bank excavations. Pump or drain the bank excavations while progressively backfilling from the stream channel outward. Construct water containment sumps if warranted.
12. Cap the upper 0.5 m (minimum) of the trench with the salvaged clean granular material.
13. Remove any accumulations of silt and sediment from the streambed.
14. Restore the banks of the stream channel to preconstruction profiles.
15. Remove the downstream dam or vehicle crossing plug then remove the upstream dam or vehicle crossing plug.

Source: Adapted from CAPP *et al.* 2005



Plan View
(Not to Scale)

Notes:

1. Install vehicle crossing, if required, on the work side edge of the right-of-way to allow for a wide excavation.
2. Ensure adequate electric power supply and adequately sized pumps to handle anticipated flow. Have standby pumps and generators capable of handling 100% of anticipated flow onsite and ready to be used if the operating pumps fail.
3. Install high volume pump in pool located upstream of the excavation. Excavate temporary upstream sump in the right-of-way if no natural pool exits. Add additional pumping capacity if required. Discharge water through or into an energy dissipator into the channel sufficiently downstream of the trench to prevent water flowing back into the excavation.
4. Immediately initiate fish salvage from isolated pools. Ensure fish salvage permit(s) are acquired prior to installing pump.
5. Excavate a small sump downstream of crossing to collect silt laden waters. Install small pumps in sump and trench to discharge silt-laden water on to well vegetated soils away from watercourse.
6. Excavate trench, complete installation and backfill trench. Move hose if warranted to maintain streamflow.
7. Wash backfilled trench area into sump. Pump silt-laden water from trench onto a well vegetated area off right-of-way. Complete this step each evening prior to shutting off upstream pump, if instream work is to occur on successive days.

Adapted from CAPP *et al.* (2005)

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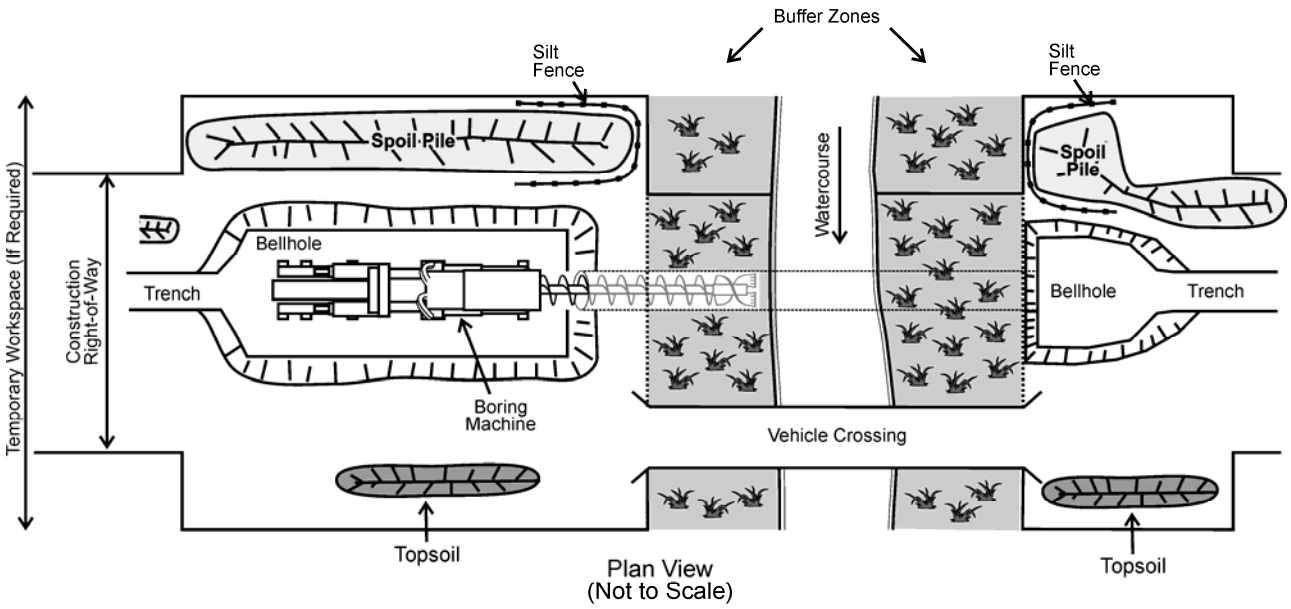
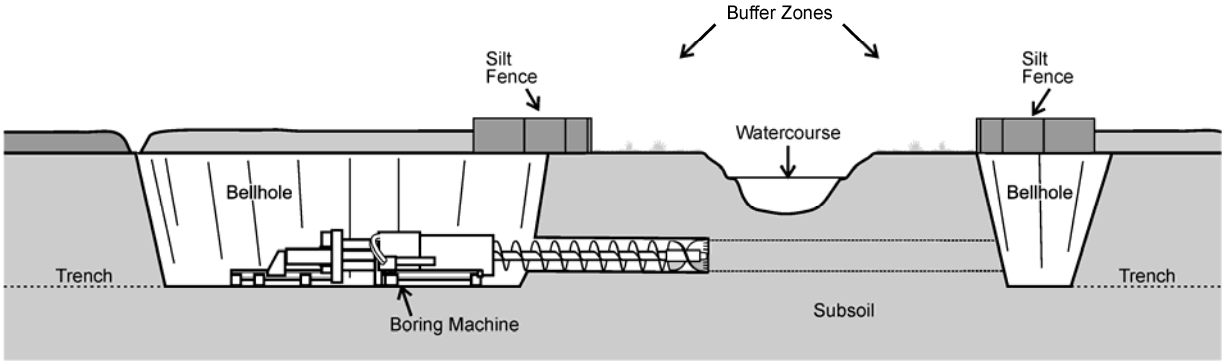
	WATERCOURSE CROSSING – HIGH VOLUME PUMP		
	4462	April 2007	Detail 6A-33



Plan View
(Not to Scale)



Profile
(Not to Scale)

Notes:

1. Set up equipment back from the edge of the watercourse; do not clear or grade within buffer zone except along the work side, if temporary vehicle crossing is installed.
2. Excavate bellhole. Store spoil on opposite side of right-of-way. Excavate dewatering sump within bellholes, if warranted.
3. Complete boring and tie-in to mainline.
4. Pump bellhole dry if seepage becomes a problem. Dewater bellholes onto stable, vegetated land, not directly back into watercourse.
5. Backfill and compact. Leave a crown to allow for subsidence.

Adapted from CAPP *et al.* (2005)

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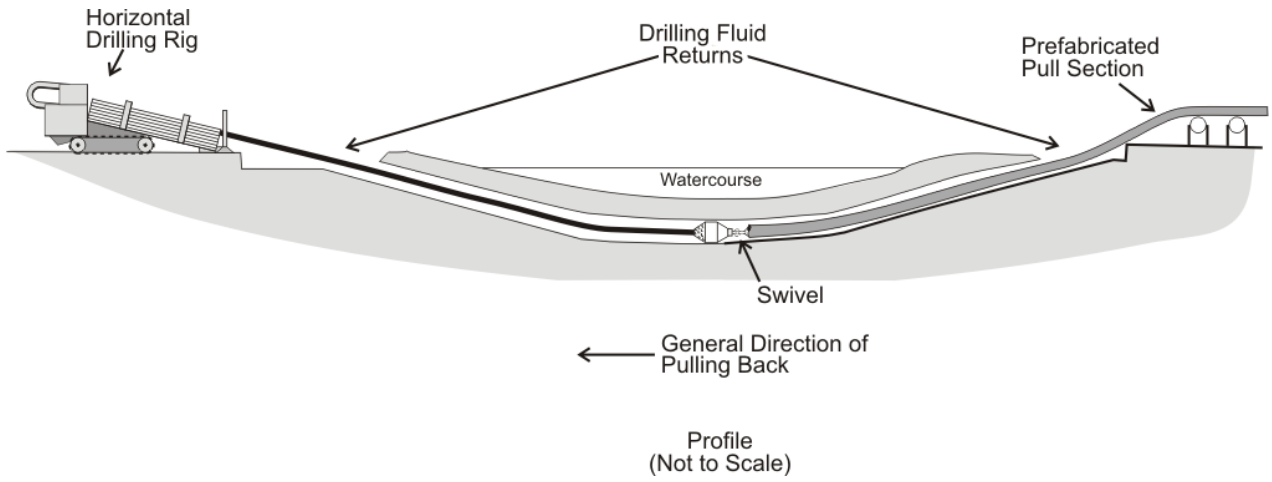
	WATERCOURSE CROSSING – TRENCHLESS: BORE / PUNCH		
	4462	April 2007	Detail 6A-34

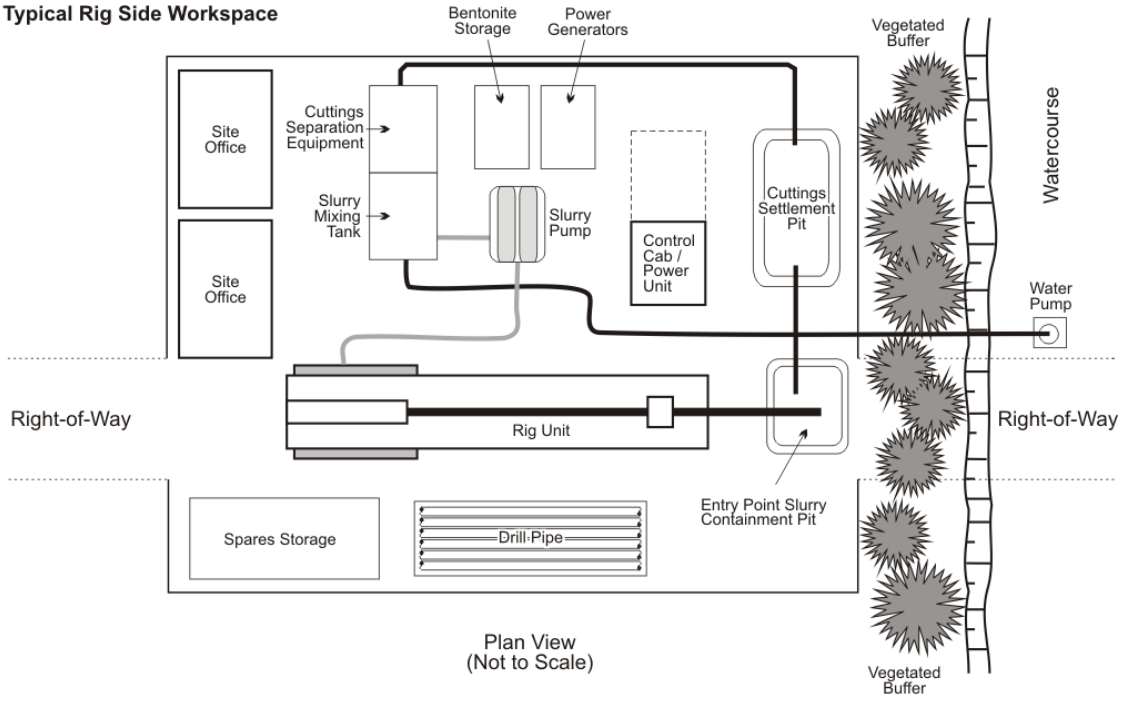


Notes:

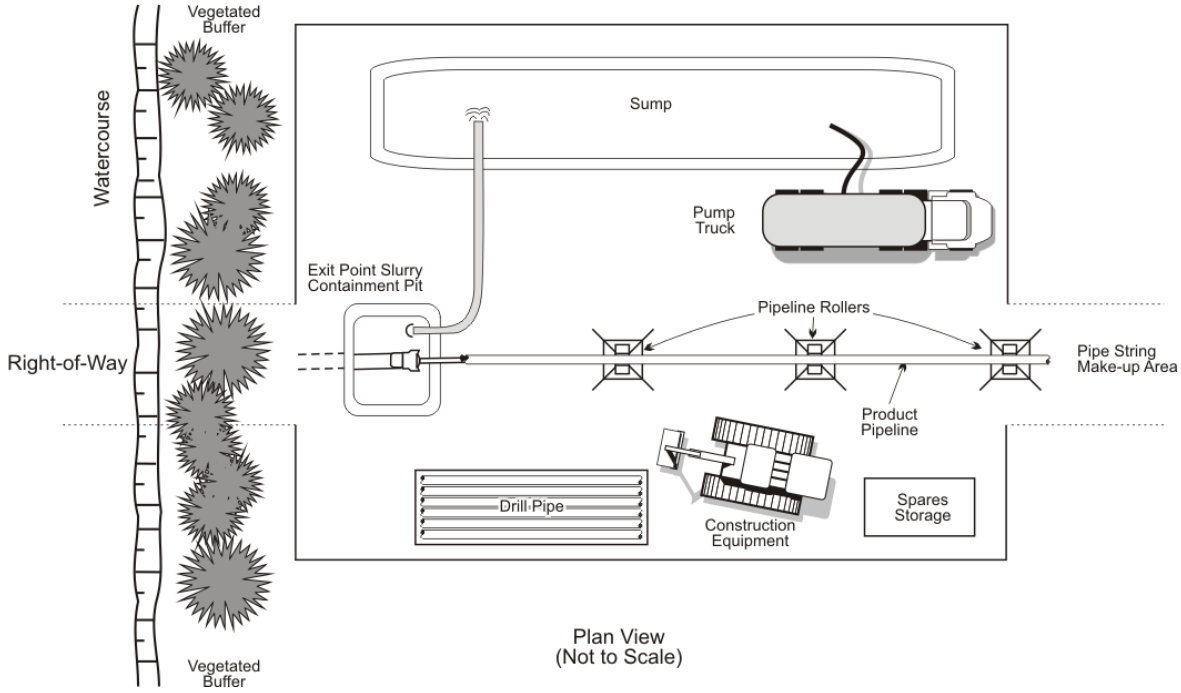
1. Obtain geotechnical data, if warranted prior to initiating drilling. Drilling may not be feasible in some materials such as unconsolidated gravels.
2. Ensure temporary workspace rights have been obtained to conduct monitoring and that access is available for monitoring activities.
3. Set up drilling equipment back from the edge of the watercourse; do not clear or grade within the vegetated buffer zone, except along the work side, if temporary vehicle crossing is utilized.
4. Employ full time inspectors to observe for an inadvertent mud release into the watercourse.
5. Ensure that only bentonite based drilling mud is used. Do not allow the use of any additives to the drilling mud without the approval of appropriate regulatory authorities.
6. Install suitable drilling mud tanks or sumps to prevent contamination of watercourse.
7. Install sumps downslope from the drill entry and anticipated exit points to contain any release of drilling mud.
8. Dispose of drilling mud in accordance with the appropriate regulatory authority requirements.
9. Prepare a drilling mud release contingency plan.

Adapted from CAPP *et al.* (2005)

(A) Typical Rig Side Workspace

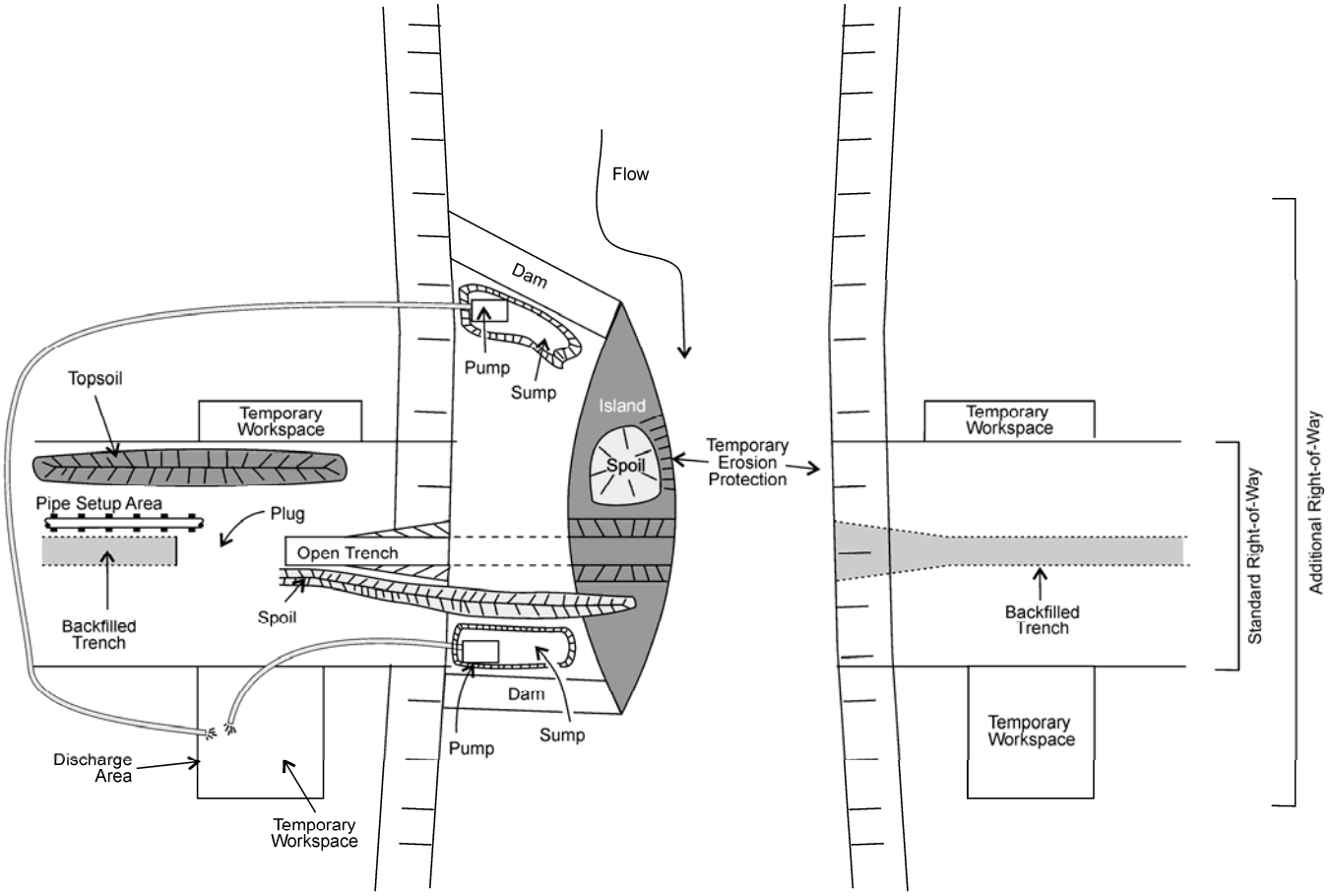


(B) Typical Pipe Side Layout



Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE **ALBERTA CLIPPER PROJECT**		
	WATERCOURSE CROSSING – LARGE DIRECTIONAL DRILL		
	4462	April 2007	Detail 6A-35b



Plan View
(Not to Scale)

Notes:

1. If there is a high velocity streamflow, install deflection barrier (*e.g.,* median barriers) to permit construction of dam outside full streamflow.
2. Construct dam from local materials, sandbags, 1 m^3 sandbags, water-filled dams, sheet piling, median barriers, gravel or other appropriate material to extend over halfway across the watercourse.
3. Install impermeable barrier within dam.
4. Install riprap on upstream side to protect the dam from erosion if dam is constructed of loose material.
5. Spoil storage shall be above the high water mark or protected by erosion control measures to ensure that, when the water level rises after all flow has been channelized into one channel, spoil is not washed away.
6. Install sumps to collect seepage and then pump to dewatering area.
7. Ensure discharge area can handle the volume of water and silt pumped to shore.
8. Complete trenching, lowering in and backfilling.
9. Remove dam, reconstruct bank.
10. Repeat process for other channel.
11. Temporary diversion also may be made through abandoned channels as long as steps are taken to minimize a flush of sediment once the watercourse is redirected through the "new" channel.
12. Temporary diversion through a channel excavated into a flood plain is possible if lined or passed through a flexible conduit to prevent excessive erosion along the "new" channel.

Adapted from CAPP *et al.* (2005)

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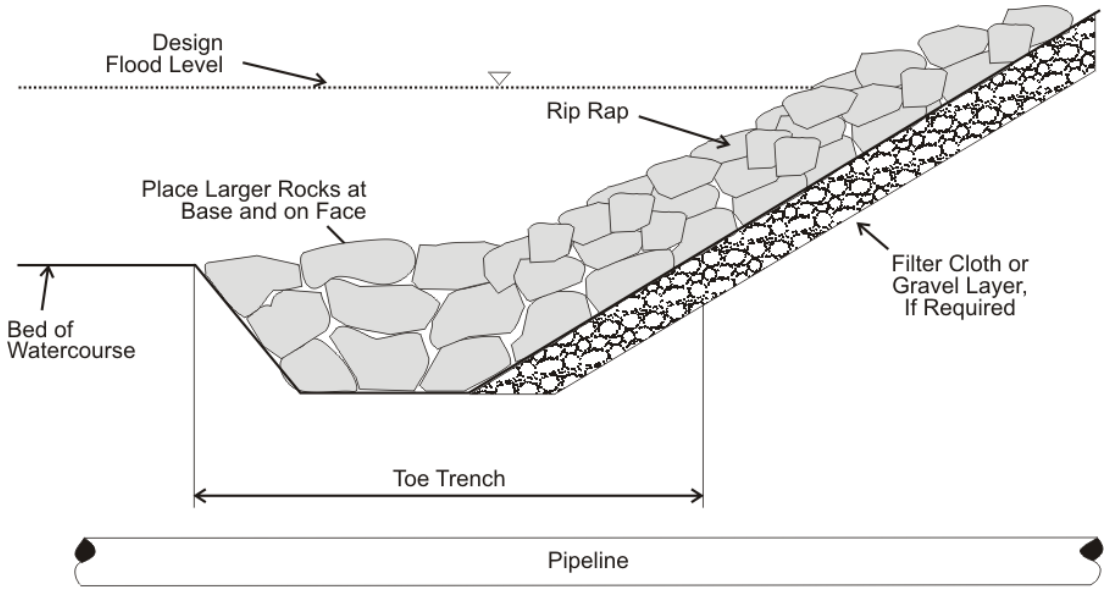
ALBERTA CLIPPER PROJECT

WATERCOURSE CROSSING - CHANNEL DIVERSION

4462	April 2007	Detail 6A-36



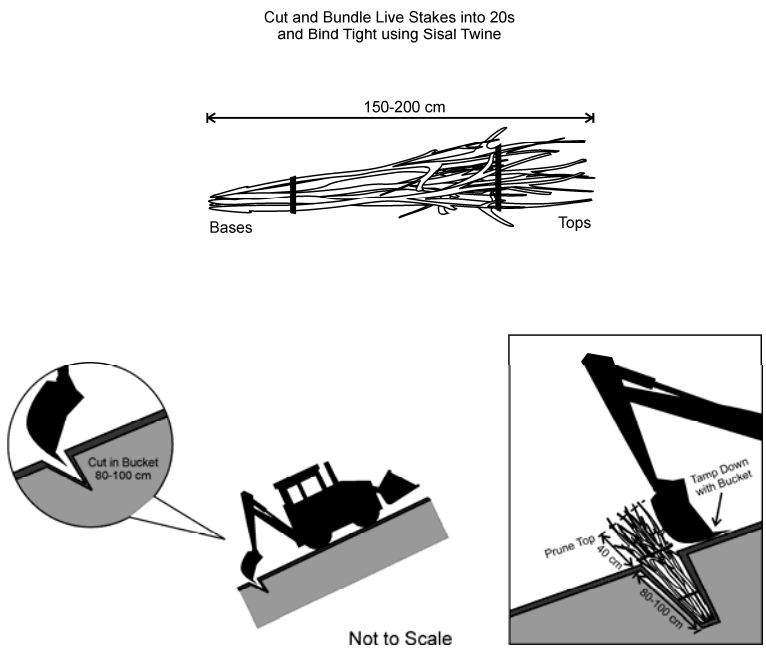
Profile
(Not to Scale)

Notes:

1. Proper placement and design is critical and qualified specialists should be involved.
2. Remove all stumps, organic matter and work material and grade/prepare banks to a maximum slope as directed by a geotechnical engineer.
3. Construct toe trench to key in bottom of armour protection, or adopt thickened toe option.
4. Install filter cloth (geotextile) or gravel filter layer.
5. Place riprap on slope to be protected such that a well-interlocked, smooth layer is produced.
6. Riprap should be dense, durable, roughly equidimensional (not flat and thin), angular and clean.
7. Size of riprap used is dependent upon slope of bank and water velocity.
8. The minimum thickness of a riprap layer shall be 1.5 to 2 times the approximate dimensions of rock being used.
9. Key in up and downstream ends of the armoured bank in a manner such that it will not be outflanked.
10. Riprap should extend 0.5 m (min) above design flood level. If design flood level is above the top of the bank, riprap should be placed to the top of the bank.
11. Riprap should be flush with bank adjacent to the right-of-way.

Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE **ALBERTA CLIPPER PROJECT**		
	STREAMBANK PROTECTION – RIPRAP ARMOUR		
	4462	April 2007	Detail 6A-37



Notes:

Collection

1. Collect cuttings from local shrubs (*e.g.,* willow, poplar, red osier dogwood) from sites with similar conditions and species composition as the proposed receiving site.
2. Collect live stakes during winter dormancy, when feasible. Collect stems that are healthy, young, single stem, 2-3 cm at the base and 150-200 cm in length.
3. Harvest live stakes using a single clean cut at the base using hand loppers or a skilled chainsaw operator using a sharp chain.
4. Make stakes into bundles of 20 with all base cuts orientated to one end. Firmly tie bundles at the base and top, using biodegradable bailing twine.
5. Protect harvested stakes from drying out; store immediately under cover out of the wind and sun in cool moist conditions.

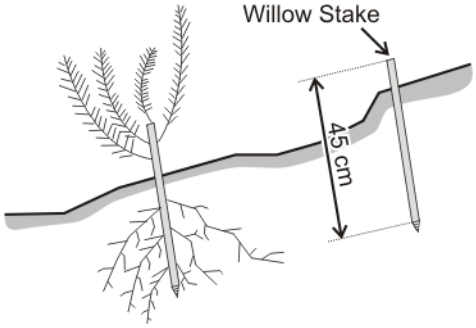
Installation Sites

6. Install live stakes at sites that receive prolonged periods of moisture and have some drainage (*i.e.,* moist slopes and watercourse banks).
7. Use a minimum of one bundle per metre of bank.
8. Place butt ends of live stake bundles in water 1 to 2 days prior to installation, if feasible.

Live Stake Installation

9. Using a hoe sitting on the upside slope, cut the bucket into the bank working it in as deep as possible (100 cm). Create an opening; insert a bundle of live stakes at the base of the cut. Cut the twine and spread the whips apart. Withdraw the hoe bucket and tamp down the upside of the cut. Make installations in continuous lines or individually at specific sites.
10. Prune excess live stake material back to 40 cm above the ground.

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE **ALBERTA CLIPPER PROJECT**		
	TYPICAL LIVE SHRUB STAKING		
	4462	April 2007	Detail 6A-38a



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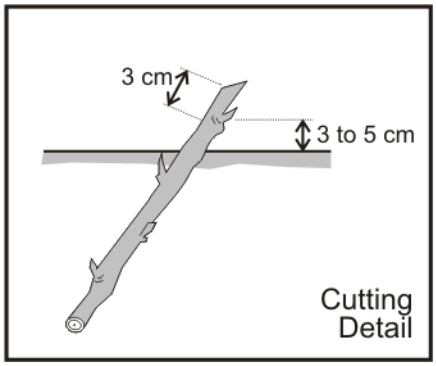
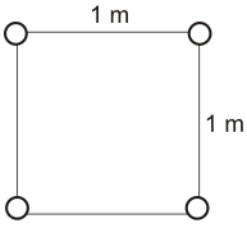


Profile
(Not to Scale)

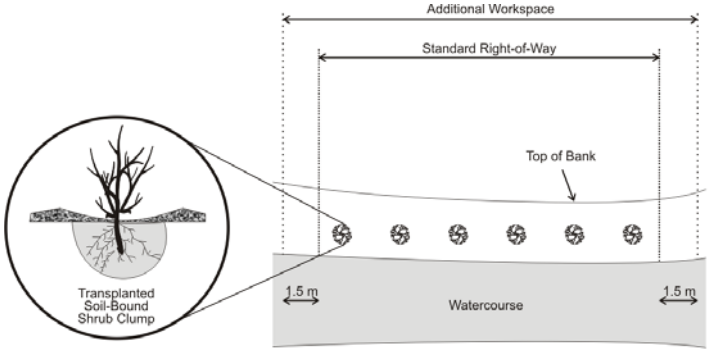
Staking Pattern Detail



Plan View
(Not to Scale)

Notes:

1. Install stakes of suitable species (*e.g.,* willow, dogwood) on watercourse banks.
2. Make clean cuts with unsplit ends using pruning shears, hand saw or chain saw.
3. Select stock from bottom of branches not tips.
4. Mark basal ends to ensure correct installation.
5. Ensure at least one lateral bud above surface and three below. Plant cutting at an angle.
6. Protect material from drying out. Install as quickly as practical.
7. Trim side shoots close to main stock.
8. Use frost pin to make pilot hole. Minimize damage to stake when driving by using a neoprene lined post hole pounder or rubber mallet.
9. Install live stakes on banks and 1.5 m (approximately) back from banks for entire disturbed width of right-of-way.



Notes:

1. Salvage and replace shrubs on all watercourse banks where shrubs are present on the right-of-way.
2. Salvage whole bushes from the right-of-way during grading of banks. Ensure bulk of root mass is surrounded by soil.
3. Store salvaged shrubs on edge of right-of-way, cover with soil and do not let dry out.
4. Transplant as quickly as practical when reconstructing watercourse banks.
5. Soak the ground around the transplant with water.

Adapted from CAPP *et al.*(2005)

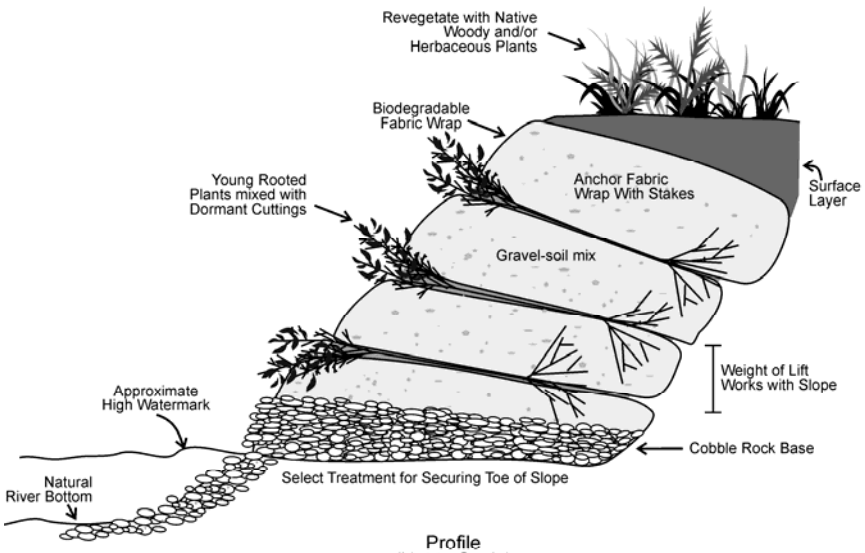
tera environmental consultants
CALGARY, ALBERTA

ENBRIDGE

ALBERTA CLIPPER PROJECT

TYPICAL LIVE SHRUB STAKING

4462	April 2007	Detail 6A-38b



Profile
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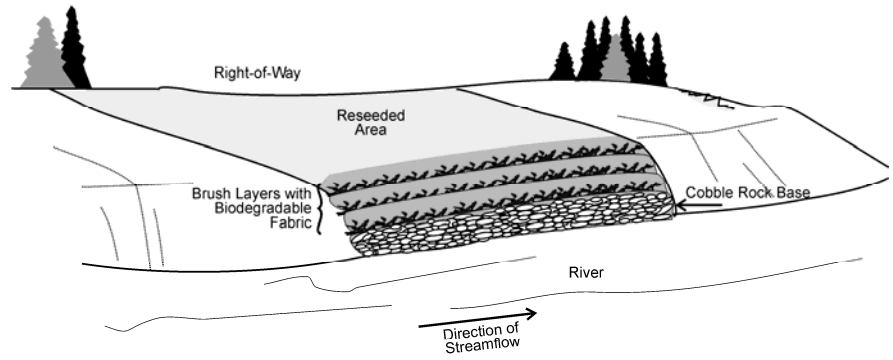


Oblique View
(Not to Scale)

Notes:

1. An Environmental Inspector will be onsite to ensure correct placement and design.
2. At the base of the bank install a base of local cobble or imported rock to above mean water levels or higher. Other stabilization techniques can be incorporated including: log structures, coniferous tree revetments, angular rock armouring, etc.
3. To recreate banks, install layers of soil filled biodegradable fabric (coir or equivalent) wraps. To make each layer, roll out the fabric parallel with the bank with one-third into the bank and two-thirds out (streamside). Form a step of soil 30-40 cm high over the bank side fabric. Fold the stream side fabric over the soil step and firm into place.
4. Over the fabric wrap arrange locally salvaged live shrub with roots (alder, rose ssp., etc.) with live stake material (willow, poplar, red osier dogwood) at 20 stems per metre, incorporate topsoil and firm into place.
5. Continue building layers of fabric soil wraps and live shrubs until original bank height is reached.
6. For best results, collect live shrub material during plant dormancy; store in moist conditions and install as soon as feasible.

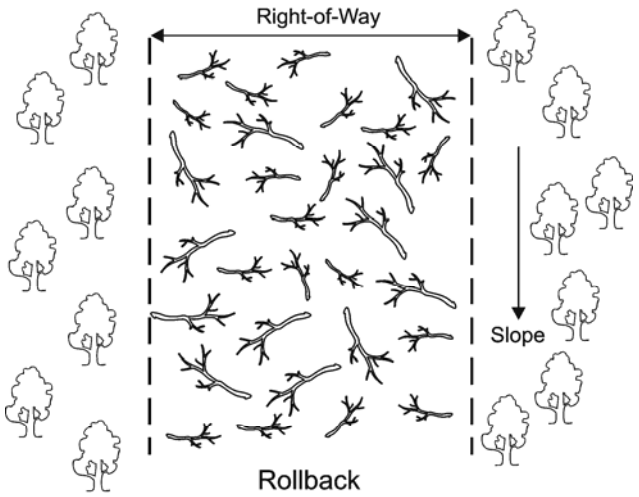
Source: Adapted from CAPP *et al.* (2005)

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE **ALBERTA CLIPPER PROJECT**		
	HEDGE / BRUSH LAYERING		
	4462	April 2007	Detail 6A-39

CRITERIA FOR IMPLEMENTATION

Machine application of tackifier for soil erosion control will be used at sites specified by the Environmental Inspector following approval by the appropriate authorities.

1. All equipment used for tackifier applications must be fully operational to manufacturer's specification, free of any contaminants, including weeds and chemicals, and be operated by an experienced and qualified crew.
2. All applications of tackifier must follow individual site specifications provided by the Environmental Inspector and using methods and dates recommended by manufacturers.
3. All products applied will be biodegradable, nontoxic, of organic origin and preapproved by the appropriate land authority.
4. Seed applications will be made separately and prior to applications of tackifier.
5. Water withdrawal for applications must be made from an approved source. A valid copy of the water withdrawal permit, where applicable, must be available for inspection onsite.
6. All ground preparations are to be completed prior to tackifier applications.
7. Where the tackifier application disturbs soils and erosion control installations (*i.e.*, surface berms) repairs will be made followed by repeat tackifier applications.



Rollback

Plan View
(Not to Scale)

CRITERIA FOR IMPLEMENTATION

Slash and nonsalvageable timber may be used as rollback for erosion control where available and acceptable to the landowner. Specific locations will be determined by the Environmental Inspector at the time of clearing.

Notes:

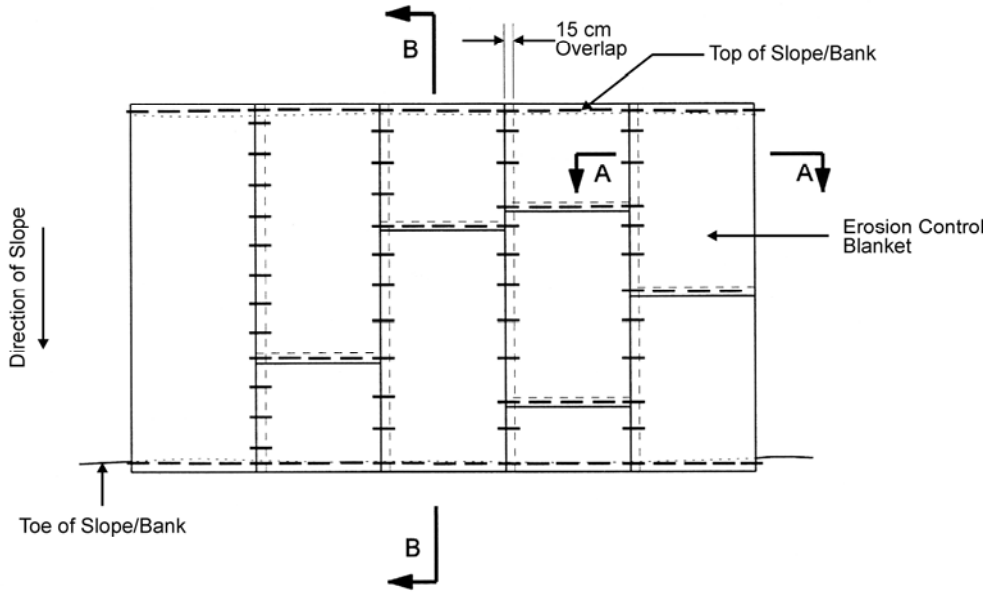
1. Retain slash and nonsalvageable timber, where required, for use as rollback.

2. Smaller slash (*e.g.,* less than 10 cm in diameter) should be used for rollback as an erosion control measure.

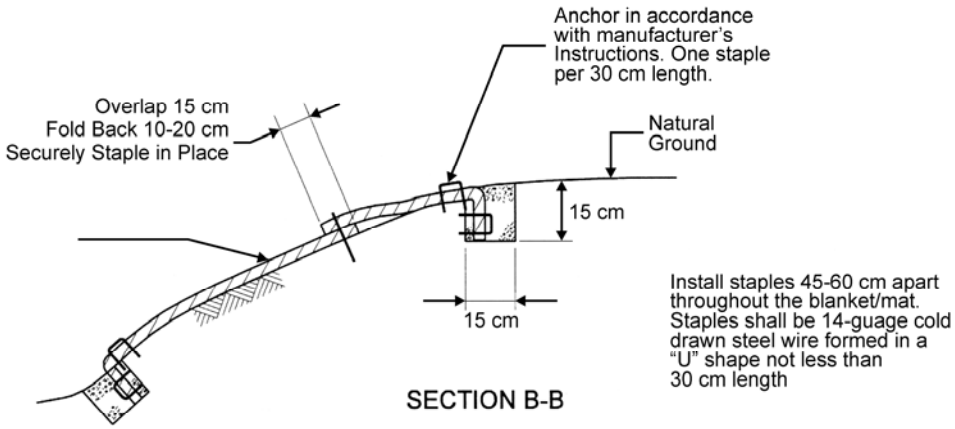
3. The amount of timber retained for use as rollback will be determined by the Chief Inspector in consultation with the Environmental Inspector and the landowner. Store material for rollback along the edges of the right-of-way, or in natural clearings.

4. Walk down rollback with a dozer on steep slopes, if safe to do so.

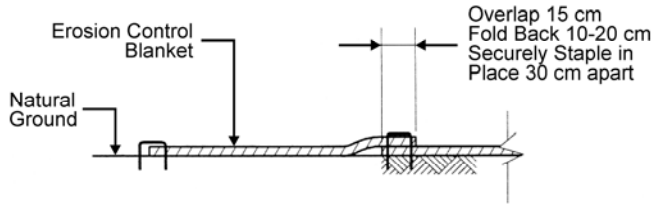
5. Leave gaps in the rollback at obvious livestock/wildlife trails.



PLAN
(Not to Scale)



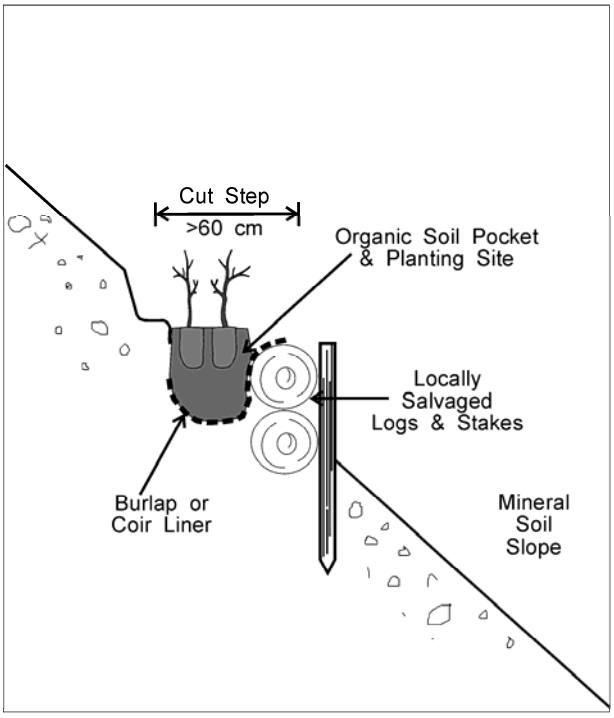
SECTION B-B

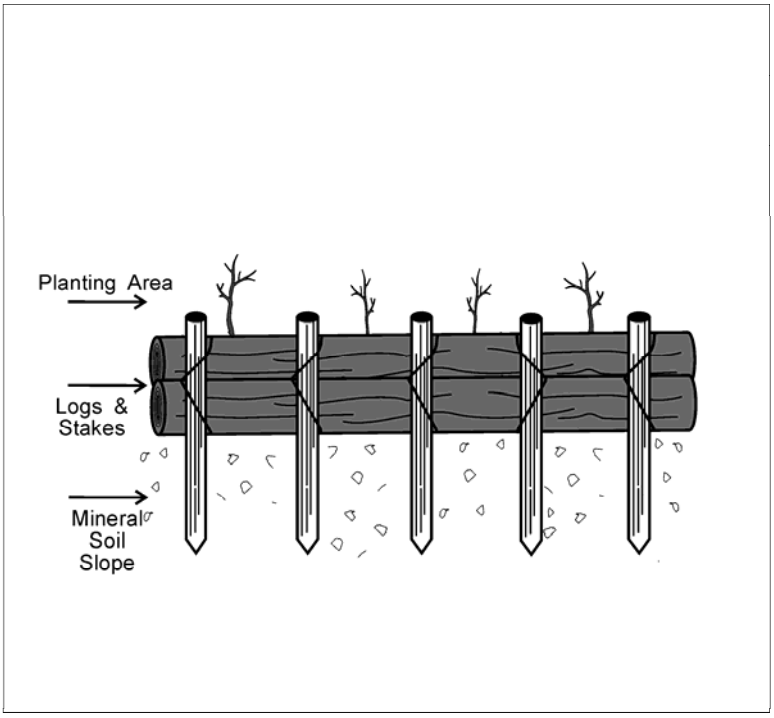


SECTION A-A

Note: When used at streambanks, erosion control matting shall be secured to the bank using willow cuttings rather than staples.

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE ALBERTA CLIPPER PROJECT		
	EROSION CONTROL MATTING - SLOPES		
	4462	April 2007	Detail 6A-42





(Not to Scale)

At sites where erosion is a concern and where shrub plantings are required for restoration on non-agricultural lands, locally salvaged logs will be used to secure slopes and provide planting sites.

1. Sites where staked logs are to be installed will be selected by the Environmental Inspector. When possible, sites will be selected prior to clearing and suitable local logs will be salvaged and stockpiled for later use.
2. Install staked logs during clean-up or reclamation phase. Where possible, use a backhoe to cut a step into the slope and push in a line of wood stakes. Note: take all necessary safety measures when working in proximity to pipeline.
3. A qualified chainsaw operator will select and cut to fit suitable logs for horizontals. If necessary, the logs may be secured to the stakes using biodegradable rope.
4. Create a pocket immediately upslope of the horizontally staked logs. The pocket can be used to install live shrub stakes (see Detail 6A-38) and backfilled with topsoil.
5. Where the planting pocket is required for rooted plugs or salvaged plantings, line the pocket with biodegradable fabric (burlap or coir). Bring the fabric over the top log. Fill the lined pocket with topsoil and tamp down. Install plants in pockets as directed by the Environmental Inspector.

tera ENVIRONMENTAL CONSULTANTS CALGARY, ALBERTA	ENBRIDGE **ALBERTA CLIPPER PROJECT**		
	STAKED LOGS FOR EROSION CONTROL		
	4462	April 2007	Detail 6A-43

CRITERIA FOR IMPLEMENTATION

In conjunction with broadcast seeding and tackifying on steep slopes where straw crimping is not feasible, track mounted equipment may be used to systematically pack and imprint the seed bed with cleat tracks at locations as directed by the Environmental Inspector.

Notes:

1. Track cleat imprinting will be conducted following drill seeding or prior to broadcast seeding to provide a rough surface on steep slopes for trapping water in microsites.

2. In some cases, track cleat imprinting may be done prior to tackifier applications.

3. Track cleat imprints will be perpendicular to the fall line of the slope and spaced sufficiently to provide uniform coverage of the ground surface.

4. Track cleat imprinting will not be done in locations where safety may be compromised.

CRITERIA FOR IMPLEMENTATION

Straw crimping will be conducted on noncultivated, wind erosion prone soils, and on saline soils where vegetation may be difficult to quickly reestablish as identified on the Environmental Alignment Sheets, unless otherwise directed by the Environmental Inspector(s). Straw crimping at additional locations identified by the Environmental Inspector may be necessary.

Notes:

1. Wheat, barley, flax or rye straw will be used, where appropriate, depending upon availability.

2. Wheat, barley flax or rye straw will be spread over disturbed portions of the construction right-of-way at 2,000-2,500 kg/ha. Flax straw, where used, will be spread at 3,000-4,000 kg/ha.

3. Straw will be crimped or anchored into the soil to an approximate depth of 5 cm. Straw should stand vertically 5-20 cm out of the ground in rows spaced approximately 15 cm apart.

4. In highly erodible sandy locations, where directed by the Environmental Inspector, the straw application rate will be doubled and two passes will be made to anchor the straw, one pass perpendicular to the other or criss-crossed.

5. Where excessive stoniness is encountered to the extent that the crimping operation is not feasible, an attempt will be made to anchor the straw by incorporation with an agricultural disc or cultivator.

6. Straw for crimping will be approved by Enbridge as well as the landowners and occupants, or appropriate regulatory authorities where applicable. Criteria for the selection of straw are as follows:

    - for each lot of bales, the field where the bales were obtained will be inspected to the extent feasible, either before it is harvested or the stubble will be inspected immediately after harvest and a sample of grain will be inspected for weed seeds.
    - the straw must have been harvested with a conventional combine, not a rotary combine;
    - the straw must have a minimum fiber length of 30 cm, preferably longer;
    - the straw must be free of Noxious or Restricted weeds and undesirable species which will hamper reclamation efforts; and
    - to the extent feasible, bales obtained from low-lying weedy areas will be identified and avoided.

CRITERIA FOR IMPLEMENTATION

Seed mixes (see table below) will be seeded at locations indicated on the Environmental Alignment Sheets, unless otherwise requested by landowners or land authority.

Notes:

1. Drill native seed mixes (Mixes 1 to 6) at 10 kg/ha and non-native seed mixes (Mixes 7 to 12) at 15 kg/ha (Detail 6A-47). Use double the specified rate for broadcast seeding (Detail 6A-48).

2. Species cultivars, where applicable, will be determined at the time of procurement based on availability and suitability as determined by Enbridge.

3. Native seed species will be obtained from local sources to the extent feasible.

4. All seed mixes must have certificates of analysis for weed and undesirable species content, and germination tests for each lot of each species in the mix.

5. Certificates of analysis for all seed lots will be reviewed by Enbridge prior to purchase. Any lot with unacceptable weed contamination or viability will be rejected.

6. Seed mix species that are unavailable in sufficient quantity or quality at a reasonable cost as determined by Enbridge at the time of procurement will be eliminated from the mix and the proportions of other species in the mix increased.

7. An annual or biennial cover crop will be seeded in addition to the specified seed mix as directed by the Environmental Inspector(s) (Detail 6A-49). Cover crops are to be seeded at a rate of 20-30 kg/ha if drill seeded and 40-60 kg/ha if broadcast seeded. Cover crop species may include annual ryegrass, winter wheat, fall rye, slender/awned wheatgrass, Canada wild rye, hairy wild rye or triticale.

8. Road ditches will be seeded with the seed mix sown on the adjacent lands. In ditches adjacent to cultivated lands, use the appropriate non-native seed mix (see below).

See Detail 6A-47 for procedures related to drill seeding and see Detail 6A-48 for broadcast application procedures.

NATIVE SEED MIXES

Ecoregion	Upland Areas		Sandy, Droughty Areas		Wet or Saline Areas	
	Mix #1	%WT	Mix #2	%WT	Mix #3	%WT
Mixed Grassland Ecoregion Moist Mixed Grassland Ecoregion Lake Manitoba Plain Ecoregion	northern wheatgrass	35	northern wheatgrass	30	western wheatgrass	30
	western wheatgrass	20	blue grama	20	alkali grass	15
	june grass	15	prairie sand-reed	20	tufted hair grass	15
	plains rough fescue	15	june grass	15	june grass	15
	blue grama	10	western wheatgrass	10	slough grass	10
	western porcupine grass	5	needle-and-thread grass	5	spangletop	10
					green needle grass	5
	Mix #4	%WT	Mix #5	%WT	Mix #6	%WT
Aspen Parkland Ecoregion SW Manitoba Upland Ecoregion	northern wheatgrass	25	northern wheatgrass	30	western wheatgrass	30
	slender wheatgrass	20	little bluestem	20	Nuttall's alkali grass	20
	june grass	20	june grass	15	big bluestem	20
	little bluestem	15	slender wheatgrass	15	slender wheatgrass	15
	plains rough fescue	10	plains rough fescue	10	june grass	15
	rough hair grass	10	prairie sand-reed	10		

NON-NATIVE SEED MIXES

Ecoregion	Upland Areas		Sandy, Droughty Areas		Wet or Saline Areas	
	Mix #7	%WT	Mix #8	%WT	Mix #9	%WT
Mixed Grassland Ecoregion Moist Mixed Grassland Ecoregion Lake Manitoba Plain Ecoregion	northern wheatgrass	30	pubescent wheatgrass	25	western wheatgrass	35
	intermediate wheatgrass	20	northern wheatgrass	25	slender wheatgrass	25
	western wheatgrass	20	sheep fescue	25	creeping foxtail	20
	slender wheatgrass	20	slender wheatgrass	15	tall wheatgrass	10
	alfalfa or cicer milk-vetch	10	alfalfa or cicer milk-vetch	10	bird's-foot trefoil	10
	Mix #10	%WT	Mix #11	%WT	Mix #12	%WT
Aspen Parkland Ecoregion Central Parkland Natural Subregion Northern Fescue Natural Subregion SW Manitoba Upland Ecoregion	meadow brome	40	northern wheatgrass	25	creeping foxtail	20
	intermediate wheatgrass	25	Russian wild rye	20	western wheatgrass	20
	creeping red fescue	15	sheep fescue	20	tall wheatgrass	20
	orchard grass	10	meadow brome	15	slender wheatgrass	20
	alfalfa or cicer milk-vetch	10	orchard grass	10	slough grass	10
			alfalfa or cicer milk-vetch	10	bird's-foot trefoil	10

NATIVE SEED MIXES IN ALBERTA

Ecoregion	Upland Areas		Sandy, Droughty Areas		Wet or Saline Areas	
	Mix #13	%WT	Mix #14	%WT	Mix #15	%WT
Central Parkland Natural Subregion Northern Fescue Natural Subregion	northern wheatgrass	40	northern wheatgrass	40	western wheatgrass	50
	slender/awned wheatgrass	20	green needle grass	20	slough grass	15
	plains rough fescue	15	prairie sand reed	15	slender/awned wheatgrass	15
	june grass	15	june grass	15	Nutall's alkali grass	10
	western porcupine grass	10	plains rough fescue	10	june grass	10

NATIVE SEED MIXES IN PFRA LANDS

	Mix #16	%WT		Mix #17	%WT
Central Parkland Natural Subregion Northern Fescue Natural Subregion	northern wheatgrass	30	Elbow PFRA Lands	western wheatgrass	30
	june grass	25		northern wheatgrass	20
	western wheatgrass	20		blue grama	15
	blue grama	10		june grass	15
	prairie sand-reed	10		sand dropseed	10
	needle-and-thread grass	5		needle-and-thread grass	5
				western porcupine grass	5

CRITERIA FOR IMPLEMENTATION

1. Drill seeding will be used on all segments to be seeded with the exception of the following areas:
   - slopes which are too steep to safely operate the tractor and seed drill;
   - areas too wet to access with a tractor and seed drill without causing rutting and poor seed placement;
   - stony areas which could cause damage to the equipment or impede the ability of the drill to properly place the seed; and
   - any areas which cannot be feasibly reached with the seed drill.

Notes:

1. All seed drills will be calibrated for each seed mix using the manufacturer's recommended procedures; alternate calibration procedures may be used if approved by the Environmental Inspector(s).
2. The seeding contractor will develop and have approved by the Environmental Inspector(s), appropriate seeding procedures to ensure even distribution of all species in each seed mix. This may involve, but not be limited to:
   - using seed box agitators to prevent stratification of large and small seeds;
   - seeding large and small seed species from separate seed boxes, or in separate passes with the seeder; or
   - using an inert filler agent with the seed mix.
3. Seeding depth will be 1-2 cm in fine textured soils and 1-3 cm in sandy soils.
4. Only the stripped or cultivated width of the construction right-of-way will be seeded with minimal overlap onto undisturbed areas. Swing-out passes will be made to seed scalped areas adjacent to the stripped portion as needed.
5. Complete coverage of the stripped area will be ensured by using a sufficient number of passes. Damage to the native sod adjacent to the disturbed portion of the right-of-way will be avoided.

Broadcast seeding will be used on noncultivated lands where drill seeding cannot be conducted.

Notes:

1. All broadcast seeders will be calibrated on site using the manufacturer's recommended procedures; alternate calibration procedures may be used if approved by the Environmental Inspector(s).

2. The seeding contractor will develop and have approved by the Environmental Inspector(s), appropriate seeding procedures to ensure even distribution of all species in each seed mix. This may involve, but not be limited to:

    - using seed box agitators to prevent stratification of large and small seeds;
    - seeding large and small seed species from separate seed boxes, or in separate passes with the seeder; or
    - using an inert filler agent with the seed mix.

3. Only the stripped or cultivated width of the construction right-of-way will be seeded unless otherwise directed by the Environmental Inspector(s).

4. Broadcast seeding will be delayed during high wind conditions, as directed by the Environmental Inspector(s).

5. Where site and safety conditions allow, seed will be harrowed into a depth of 1-3 cm, using standard agricultural harrows or other approved equipment.

6. Harrowing will be conducted immediately following broadcasting. Steep slopes that cannot be safely harrowed will be hand raked, if feasible, to incorporate seed if feasible.

CRITERIA FOR IMPLEMENTATION

Cover crop seeding may be used, if warranted, for faster vegetative cover on erosion-prone areas such as moderate to steep slopes, exposed windy areas and areas with coarse textured soils.

A cover crop is a fast-growing annual or biennial species that is seeded to control erosion and limit weed growth while predisturbance vegetation is restored.

Potential cover crop species include annual ryegrass, winter wheat, fall rye, slender/awned wheat grass, Canada wild rye, hairy wild rye and triticale.

Monitoring during subsequent years will be conducted to ensure the cover crop does not become permanently established and provide excessive competition to the desired species.

If the cover crop is found to be persistent, it will be mowed prior to heading and seed set.

The right-of-way segments in the Sounding Dunes within the Sounding-Sunken Environmentally Significant Area (KP 217.5 to KP 230.8), Elbow PFRA Community Pasture (KP 560.4 to KP 566.4), Oak Lake Sand Hills (KP 1008.0 to KP 1012.0), Souris Sand Hills (KP 1021.0 to KP 1025.3), and other areas with Scarth or Dune Sand soil series (see Environmental Alignment Sheets) are especially difficult to reclaim because of the extremely sandy nature of the soils. Extra measures to minimize soils and vegetation disturbance, and prevent soil erosion are warranted. The following construction and reclamation measures will be implemented supplementary to standard measures.

Notes:

CONSTRUCTION

1. Implement the Traffic Control Plan (Appendix 6C) to minimize the impact of rubber tired vehicles. To the extent feasible, inspection and supervisory personnel should use quad access.
2. Restrict construction traffic to the right-of-way and approved access trails and shoo-flies.
3. Clear and salvage merchantable timber as directed on the Line List or by the Environmental Inspector.
4. Delay clearing until just prior to topsoil stripping.
5. Avoid grubbing of tree roots to the extent feasible; use a stump grinder to prepare the right-of-way for construction traffic.
6. Shovel or compressed air clean all topsoil handling equipment prior to entering the Sounding Dunes, Elbow PFRA Community Pasture, Oak Lake Sand Hills and Souris Sand Hills.
7. Minimize the width of topsoil stripping to the extent feasible by stripping one blade width centered over the trench; widen the stripping area if trench sloughing occurs and the risk of topsoil/subsoil mixing exists.
8. Minimize travel on the right-of-way by stringing trucks; confine truck travel to the stripped area to the extent feasible and assign a tow cat to assist trucks through excessively loose sand.
9. Retain all non-salvageable timber along the edge of the right-of-way for use as erosion control.
10. Tackify topsoil windrows if the potential exists for wind erosion during construction (Detail 6A-18).

RECLAMATION

1. Reclamation work will be initiated within two weeks following pipe installation and backfill, if soil and weather conditions permit.
2. The disturbed portion of the slopes will be recontoured to the preconstruction profile.
3. After replacing salvaged topsoil, install erosion control matting (Detail 6A-42) on steep cut banks and slopes, as directed by the Environmental Inspector.
4. Hydro-seeding may be conducted in place of matting, as directed by the Environmental Inspector.
5. Use staked logs for erosion control on slopes as directed by the Environmental Inspector (Detail 6A-43) and approved by the landowner/land authority. Straw-crimp (Detail 6A-45) and seed with a cover crop (Detail 6A-49), where directed by the Environmental Inspector. Seed with seed mixes as identified on the Environmental Alignment Sheets (Detail 6A-46).
6. Spread small diameter slash, woody debris and wood chips (Detail 6A-5) where directed by the Environmental Inspector (Detail 6A-41).
7. Consider fencing the right-of-way to avoid overgrazing during seed establishment on the right-of-way.

CONSTRUCTION OF SECOND PIPELINE WITHIN 6 MONTHS

Should an adjacent pipeline construction project be planned within 6 months of the construction of this project, the following measures shall be implemented.

1. Do not replace the topsoil. Leave the topsoil in windrows with gaps to allow for movement of wildlife, farm equipment and livestock.
2. Seed the topsoil windrow with a cover crop (Detail 6A-49) and tackify (Detail 6A-18).
3. Fence the topsoil windrows to avoid disturbance by livestock and wildlife.
4. Straw crimp (Detail 6A-45) the subsoil to minimize the potential for wind erosion.

Wetland Function

General mitigative measures to be implemented to minimize reduction or loss of wetland functions (hydrologic, water quality and habitat) include the following.

- A construction schedule that avoids high water levels (*i.e.*, spring and wet weather) is preferred. Construction activities that are limited to the late summer, fall and winter will avoid temporary disturbance to ephemeral potholes, thereby minimizing the number of wetland issues. If construction is scheduled for the spring/early summer period, TERA recommends preclearing / premowing (prior to April 1) of trees, shrubs and tall grasses to discourage nesting on the proposed right-of-way.
- No clearing activities are to occur within the migratory bird nesting period between April 1 and July 31. Construction activities may proceed within the nesting period where the area has been precleared or premowed prior to April 1 or if no nests were observed during nest surveys conducted prior to construction.
- Narrow down the proposed area of disturbance and protect the wetland by using fencing, clearly mark the wetland boundaries using flagging and limit traffic in the vicinity of the flagged area [EGC 02-3].
- Ensure activities planned adhere to the following spill prevention measures: prohibit fuel storage, refuelling or servicing of equipment within 100 m of wetlands except where secondary containment is provided; and ensure equipment used for construction within the wetland is well maintained and free of fluid leaks. In the event of a spill, immediately implement measures to stop, control the migration of, and clean up the spilled substance as outlined in the Spill Contingency Plan in Appendix 6B (see also *Accidents and Malfunctions* element 18.1 of Table 6.2) [EGC 02-2].
- Schedule maintenance activities during frozen conditions to the extent feasible.

Mitigative measures to be implemented prior to and during construction to minimize alteration of wetland functions (hydrologic, water quality and habitat) include the following.

- Minimize the removal of vegetation and the disturbance of soil adjacent to wetlands [EGC 02-4, EGC 02-11].
- Maintain low vegetation or vegetative ground mat within a 16 m buffer adjacent to wetlands to the extent practical by walking, storing and constructing over the undisturbed ground [EGC 01-6, EGC 02-4].
- Salvage live trees or shrubs from banks of wetlands if requested by landowners. Store salvaged trees and shrubs on the side of the right-of-way in a manner such that they do not dry out before replanting during restoration (Detail 6A-2) [EGC 02-4].
- Minimize the width of grubbing through wet areas during construction to facilitate the restoration of shrub communities [EGC 02-4, EGC 02-11].
- Cut / mow / walk down shrubs and small diameter trees at ground level and minimize grubbing in temporary workspace.
- Restrict grading as much as practical. Conduct grading adjacent to wetlands away from the wetland to the extent practical to reduce the risk of sediment and other material entering the wetland [EGC 02-7, EGC 02-11]. Keep wetland soils separate from upland soils [EGC 02-5].
- Use wide-track equipment or conventional equipment operated from swamp mats when working on saturated soils during nonfrozen ground conditions to avoid compaction.
- Install a shoo-fly around wetlands or construct a subsoil ramp if approved by appropriate regulatory authorities. Restrict access through wetlands to the shoo-fly or ramp to the extent practical.
- Protect and maintain shallow shoreline areas that contain emergent vegetation (*e.g.*, graminoids).
- Plan trenching, installation and backfilling to minimize periods of open trench. Slope trench walls to maintain stability.
- Where dewatering of the trench with pumps is deemed necessary, ensure all pumped trench water is discharged without causing erosion and is filtered through established vegetation and stable soils. Pumped trench water must be clear of suspended solids before entering natural waterbodies.
- Conduct grading adjacent to wetlands away from the wetland to the extent feasible to reduce the risk of sediment and other material entering the wetland.
- Store excavated material in a manner that does not interfere with natural drainage patterns [EGC 02-7].
- Salvage surface material in unsaturated wetlands, giving extra attention to maintaining root stocks for replacement. Salvage surface material to a maximum depth of 40 cm, or to the depth of colour change where there is less than 40 cm of surface material, using the Environmental Alignment Sheets as a guide.
- Leave an undisturbed organic mat as a buffer zone adjacent to large wetlands to limit the potential for sediment to enter wetlands, if practical [EGC 01-6, EGC 02-4].
- Install berms, cross ditches and/or silt fences between wetlands and disturbed areas to prevent sedimentation of wetlands (Details 6A-23 and 6A-24). Ensure silt fences have been installed properly, are solid and filter fabric is tight.

- Install culverts, if warranted, to prevent grading or spoil from blocking natural drainage and causing ponding that may act as reproductive sinks [EGC 02-2]. Follow measures listed under *Water Quality and Quantity* element 3.1 of Table 6.2. Avoid changing natural hydrological cycles and water levels; maintain streamflow and avoid diverting creeks and streams away from wetland areas.
- Install trench breakers, where warranted, at the edge of perched wetlands to prevent the pipe trench from acting as a drain (Detail 6A-20).
- Construct trench breakers and/or seal the trench bottom as necessary to maintain the original wetland hydrology, where the pipeline trench may drain a wetland.
- Do not dewater any permanent wetland.
- Install swamp mats or geotextiles to allow heavy vehicles/equipment to cross wetlands during nonfrozen ground conditions. Remove swamp mats or geotextiles immediately after construction activity at that location has been completed.
- Install temporary erosion control structures (*e.g.,* silt fences and/or straw bales) within 24 hours of backfilling the wetland crossing (Detail 6A-24) [EGC 02-7, EGC 02-11, EGC 02-14]. Ensure silt fences have been installed properly, are solid and filter fabric is tight.
- Inspect and maintain sediment barriers regularly *(i.e.,* weekly or within 24 hours of substantial rainfall). Remove sediment barriers after the disturbed area is revegetated and the area is stable [EGC 02-14].

Site-specific mitigative measures to be implemented as indicated on the Environmental Alignment Sheets are as follows.

- Maintain water levels in all wetlands encountered within the game bird refuge and Oak Lake/Plum Lakes Important Bird Area (approximately KP 985 to KP 1004). Do not drain wetlands in this area unless otherwise requested / approved by provincial and federal authorities. Restore disturbed areas in wetlands to preconstruction profile during reclamation. Remove any excess backfill to an upland location approved by the appropriate regulatory authorities [EGC 03-2, EGC 03-3].
- Develop site-specific mitigative measures in consultation with the Manitoba Habitat Heritage Corporation and Canadian Wildlife Service to minimize impacts to Ducks Unlimited projects, Conservation Agreements (CA) and North American Waterfowl Management Plan (NAWMP) priority areas along the route.
- For locations with high water table:
  - Use buoyancy controls for the pipe as required.
  - Where dewatering of the trench with pumps is deemed necessary, ensure all pumped trench water is discharged without causing erosion and is filtered through established vegetation and stable soils. Slope trench walls to maintain stability as necessary [EGC 02-17].
  - Remove all mats and ramps used to enable work and travel through wet areas and all bar ditch ramps in order that they do not impede the restoration of natural flow patterns.
  - Maintain adequate culverts if any ramps are left in place with approval from the landowner.

Restoration measures to be implemented to minimize reduction or loss of wetland functions (hydrologic, water quality and habitat) include the following.

- Restore preconstruction profile in wetlands during reclamation. Remove any excess backfill to an upland location approved by the appropriate regulatory authorities [EGC 03-2, EGC 03-3]. Ensure drainage channels are restored.
- Remove all mats and ramps used to enable work and travel through wet areas. Also remove all bar ditch ramps from areas with mineral soils and where requested by the appropriate authority in order that they do not impede the restoration of natural flow patterns.
- Seed wetland with an appropriate wetland mix as indicated on the Environmental Alignment Sheets (Detail 6A-46).
- Where shrubs are present prior to construction, use live plant staking (*e.g.,* willows) along the wetland to stabilize disturbances and reduce sedimentation risk to wetland (Detail 6A-38) [EGC 03-7].
- Maintain silt fences in place at wetland boundaries until revegetation of upland right-of-way is stable.
- Maintain adequate culverts if any ramps are left in place with approval from the appropriate authority.

Post-construction monitoring and maintenance measures to be implemented to confirm that reduction or loss of wetland functions (hydrologic, water quality and habitat) has not occurred and to prevent the loss of wetland function during the operations phase include the following.

- Monitor wetland function during the post-construction monitoring program.
- Qualitative assessment of wetland vegetation growth; wetland vegetation shall be considered successful if the cover of vegetation species appears equivalent to the type, density and distribution of the vegetation in wetland adjacent areas that were not disturbed during construction.
- Schedule maintenance activities during frozen conditions to the extent feasible.
- Follow above measures for work in wetlands during operations.

APPENDIX 6B

CONTINGENCY PLANS

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LIST OF DRAWINGS

CONTINGENCY PLANS

Enbridge has a comprehensive emergency response program which includes procedures, inventory and maintenance of response equipment, and program development. The plan will be activated during construction in the event of an incident involving the Alberta Clipper Project. For construction-related spills, Section 9.0 below provides procedures to contain and clean-up the spill. Additional contingency measures for damage to soils and siltation of watercourses, as well as strategies that may be required in the event of flood or excessive flows, fire, release of instream drilling mud, wildlife encounters or discovery of fish and bivalve species of concern, plant species of concern, wildlife species of concern and heritage resources, are provided in the following subsections.

1.0 FLOOD AND EXCESSIVE FLOW CONTINGENCY PLAN

Notify Enbridge's Environmental Inspector or Chief Inspector that contingency measures have been initiated as a result of flooding or excessive streamflow along the pipeline route, so that a record of the location, timing and reason for implementation of the contingency plan is maintained. Appropriate authorities such as AENV, SENV, Manitoba Conservation, DFO and the NEB will be notified, as soon as practical, by the Environmental Inspector or Chief Inspector, that contingency measures have been implemented (see Tables 6D-1 to 6D-3 in Appendix 6D of this ESA). See also Siltation of Watercourses Contingency Plan (Section 8.0 of Appendix 6B of this ESA).

The weather conditions will be monitored by the Environmental Inspector on a daily basis. If a major storm is predicted or occurs, qualified personnel will inspect all watercourse crossings where construction is in progress or has been completed, to determine whether any corrective actions need to be implemented.

If the potential for siltation of a watercourse due to contractor activity is predicted, the contingency plans for Soil Erosion and for Siltation of Watercourses (Sections 6.0 and 8.0 of Appendix 6B of this ESA) will be implemented.

At watercourses where an isolated crossing method is preferred, the proposed isolation crossing techniques may not be feasible during periods of excessive flow or unusually wet seasons. Excessive flows are flows that are greater than the seasonally expected normal range based on existing and predicted flow data.

The following contingency measures will be implemented progressively or individually, as warranted, if excessive flow or flood conditions are anticipated prior to commencing watercourse crossing construction.

1. Assess the capability to handle the forecasted flow rate with the proposed crossing method. If use of the proposed crossing method is determined by Enbridge to be still feasible, the crossing will proceed.

2. Defer water crossing construction to a later time when flows have subsided, if determined by Enbridge that the proposed crossing method is not feasible.

3. Alternatively, where the forecasted flow rates and window limitations combine to preclude the proposed crossing method, request the appropriate authority (*e.g.,* DFO, AENV, SENV, Manitoba Conservation) for permission to use the approved alternative crossing method.

The following contingency measures will be implemented progressively or individually, as warranted, if excessive flow or flood conditions should occur during watercourse crossing construction.

1. Withdraw all equipment or tanks containing fuel, oil or other hazardous materials from potential flood areas.

2. Relocate all topsoil piles at the direction of the Environmental Inspector.

3. Relocate spoil piles, to the extent feasible, to a position above the anticipated high water level.

4. Remove all stationary and mobile equipment deployed at the crossing site to a safe area above the anticipated high water level.

5. Remove any instream flume or dam equipment that may impede streamflow, as safe work conditions allow.

6. Evaluate vehicle crossing structure to determine whether adequate free-board is present on bridges and adequate capacity is available in culverts. Take corrective measures as appropriate to avoid flooding of adjacent lands.

2.0 FIRE CONTINGENCY PLAN

Appropriate provincial and municipal authorities as well as other applicable provincial government agencies and the NEB will be notified as soon as practical by the Chief Inspector or Environmental Inspector, that contingency measures have been implemented (see Tables 6D-1 to 6D-3 in Appendix 6D of this ESA).

Fire Suppression Measures

The following standard measures will be adhered to during construction of the Alberta Clipper Project, including pipeline, pump additions and tank components.

1. All activity project coordinators and Contractors' vehicles will carry fire-fighting equipment in accordance with provincial regulations. In addition, all motorized equipment must carry a fully charged fire extinguisher.
2. Prior to commencement of construction, the Contractor will designate one of his staff as Fire Boss. The Fire Boss will be familiar with fire-fighting techniques and equipment within the limits of available resources.

In the Event of a Wild Fire

The following mitigative measures will be implemented in the event of a wild fire.

1. Commence fire suppression measures immediately upon detection of fire provided that fire conditions allow personnel to safely proceed.
2. Report location of fire, as well as size of fire and wind direction, to the Fire Boss.
3. The Fire Boss will report wild fires and relevant information to Enbridge's Environment, Health and Safety staff and Chief Inspector. Applicable provincial authorities will be notified.
4. The Fire Boss will deploy fire-fighting equipment and crew to clear or plow fire breaks or extinguish the fire directly if possible. The Fire boss will notify the local fire department or Alberta/Saskatchewan/Manitoba Forest Fire Reporting Centre (1-800-663-5555 / 1-800-667-9660 / 1-800-782-0076) if contractor resources are inadequate. All equipment and personnel adequately fit and trained shall be made available to control the fire.
5. The Fire Boss will inspect the fire site as soon as possible and take charge of directing suppression measures.
6. Movable material, particularly explosive or flammable materials, vehicles etc., will be promptly moved to a safe location whenever there is a possibility of being endangered by fire.
7. The Fire Boss will ensure that all burning embers are extinguished and will monitor burn area for smouldering material.

3.0 WET / THAWED SOILS CONTINGENCY PLAN

Enbridge will assign Environmental Inspectors with sufficient training and soils-related experience to be able to identify soils that are too wet for a particular activity and when the soils are sufficiently dry to allow the activity to resume. The decision to continue or suspend particular pipeline construction activities on lands with excessively wet/thawed soils will be made by the Chief Inspector in consultation with the Environmental Inspector. The Environmental Inspector or Chief Inspector will employ the criteria presented in Tables 6B-1 and 6B-2 of this ESA, as a guide to activities where contingency measures are warranted. A record of the location, timing and reason for implementation of the Wet / Thawed Soils Contingency Plan will be maintained by the Environmental Inspector. In the event that activities are suspended during pipeline or facility construction, the landowner and the NEB will be notified as soon as practical by the Environmental Inspector or the Chief Inspector.

Soils are considered to be excessively wet when the planned activity could cause damage to soils either due to rutting by traffic through the topsoil layer into the subsoil; soil structure damage during soil handling; or compaction and associated pulverization of topsoil structure damage due to heavy traffic.

Contingency measures will be implemented, if warranted, once one of the following indicators occurs:

- rutting of topsoil or root zone material to the extent that admixing may occur;
- excessive wheelslip;
- excessive build-up of mud on tires and cleats;
- formation of puddles; or
- tracking of mud as vehicles leave the right-of-way.

In order to minimize terrain disturbance and soil structure damage through rutting or compaction due to wet soil conditions, construction alternatives will be employed, as necessary, in the event of thawed soils during frozen conditions or an excessively wet surface during nonfrozen conditions. The contingency measures listed below will be implemented individually or in combination, as necessary, based on site-specific conditions.

Wet Soil Contingency Measures

1. Restrict construction traffic, where feasible, to equipment with low-ground pressure tires or wide pad tracks.
2. Work only in nonproblem areas, such as well-drained soil or well-sodded lands, until conditions improve.
3. Install geotextiles, swamp mats or corduroy constructed from nonsalvageable timber in problem areas.
4. Consider stripping an additional width of topsoil in problem areas.
5. Suspend construction until soils dry out.

Thawed Soil Contingency Measures

1. Restrict construction traffic, where feasible, to equipment with low-ground pressure tires or wide pad tracks.
2. Work only in nonproblem areas, such as frozen or well-drained soils, until conditions improve.
3. Postpone construction until evening or early morning when the ground is frozen.
4. Install geotextiles, swamp mats or corduroy constructed from nonsalvageable timber in problem areas.
5. Employ frost inducement measures such as snow packing or plowing to increase the load-bearing capacity of thawed ground.
6. Suspend construction until soils dry out or freeze.

If the indicators of excessively wet/thawed soil conditions previously noted above are not evident, soils will be considered dry enough to resume activity.

TABLE 6B-1

CRITERIA FOR THE SUSPENSION OF ACTIVITIES DUE TO EXCESSIVELY WET SOIL CONDITIONS

Land Use	Topsoil Salvage Status	Construction Activity	Suspend Activity for Environmental Issue?
Cultivated and Poorly-sodded Hay, Pasture, Native Prairie and Bush-Pasture	No salvage conducted	Soils handling (topsoil stripping/ replacement)	Yes
	No salvage conducted	Pipe stringing	Yes
	Trench and spoil area stripped	Pipe stringing	No, if stringing truck traffic is restricted to the stripped area
	Trench and spoil, and work area stripped	Pipe stringing	No
	No salvage conducted	Welding	Yes
	Trench and spoil area stripped	Welding	Yes
	Trench and spoil, and work area stripped	Welding	No
	Trench and spoil area stripped	Trenching	No
	Trench and spoil area stripped	Lowering-in	Yes
	Trench and spoil, and work area stripped	Lowering-in	No
	Trench and spoil area stripped	Backfilling	No if backfilling with back hoes or clean up bucket Yes if dozers are used.
	Trench and spoil, and work area stripped	Backfilling	No
	Trench and spoil area stripped	Testing	Yes (testing would not be initiated but would continue if filling with test water has begun)
	Trench and spoil, and work area stripped	Testing	No
	Topsoil replaced	Testing	Yes (testing would not be initiated but would continue if filling with test water has begun)
	Topsoil replaced	Clean-up	Yes - heavy traffic not permitted; No - quad traffic likely acceptable
Well-sodded Lands; Hay, Pasture, Native Prairie and Bush-Pasture	No salvage conducted	Soils handling (topsoil stripping/ replacement)	Yes
	No salvage conducted	Pipe stringing	Yes
	Blade width stripping conducted	Pipe stringing	No, if stringing truck traffic is restricted to the stripped area
	Blade width and work area stripped	Pipe stringing	No
	No salvage conducted	Welding	No - activity to be closely monitored and suspended if warranted
	Blade width stripping conducted	Welding	No - activity to be closely monitored and suspended if warranted
	Blade width and work area stripped	Welding	No

TABLE 6B-1 Cont'd

Land Use	Topsoil Salvage Status	Construction Activity	Suspend Activity for Environmental Issue?
Well-sodded Lands; Hay, Pasture, Native Prairie and Bush-Pasture (cont'd)	Blade width stripping conducted	Trenching	No
	Blade width stripping conducted	Lowering-in	No - activity to be closely monitored and suspended if warranted
	Blade width and work area stripped	Lowering-in	No
	Blade width stripping conducted	Backfilling	Yes
	Blade width and work area stripped	Backfilling	Yes
	Blade width stripping conducted	Testing	No
	Blade width and work area stripped	Testing	No
	Topsoil replaced	Testing	Yes (testing would not be initiated but would continue if filling with test water has begun)
	Topsoil replaced	Clean-up	Yes - heavy traffic not permitted; No - quad traffic likely acceptable

TABLE 6B-2

CRITERIA FOR THE SUSPENSION OF ACTIVITIES DUE TO THAWED SOIL CONDITIONS

Land Use	Topsoil Salvage Status	Construction Activity	Suspend Activity for Environmental Issue?
Cultivated and Poorly-sodded Hay, Pasture, Native Prairie and Bush-Pasture	No salvage conducted	Soils handling (topsoil stripping/ replacement)	Yes
	No salvage conducted	Pipe stringing	Yes
	Blade width stripped	Pipe stringing	No - if stringing truck traffic is restricted to the stripped area
	No salvage conducted	Welding	Yes
	Blade width stripped	Welding	Yes
	Blade width stripped	Trenching	No
	Blade width stripped	Lowering-in	Yes
	Blade width stripped	Backfilling	Yes
	Blade width stripped	Testing	Yes - testing would not be initiated but would continue if filling with test water has begun
	Topsoil replaced	Testing	Yes - testing would not be initiated but would continue if filling with test water has begun
	Topsoil replaced	Clean-up	Yes - heavy traffic not permitted; No - quad traffic likely acceptable
Well-sodded Lands; Hay, Pasture, Native Prairie and Bush Pasture	No salvage conducted	Soils handling (topsoil stripping/ replacement)	Yes
	No salvage conducted	Pipe stringing	Yes
	Blade width stripping conducted	Pipe stringing	No - if stringing truck traffic is restricted to the stripped area
	No salvage conducted	Welding	No - activity to be closely monitored and suspended if warranted
	Blade width stripping conducted	Welding	No - activity to be closely monitored and suspended if warranted
	Blade width stripping conducted	Trenching	No
	Blade width stripping conducted	Lowering-in	No - activity to be closely monitored and suspended if warranted
	Blade width stripping conducted	Backfilling	Yes
	Blade width stripping conducted	Testing	No
	Topsoil replaced	Testing	Yes - testing would not be initiated but would continue if filling with test water has begun
	Topsoil replaced	Clean-up	Yes - heavy traffic not permitted; No - quad traffic likely acceptable

4.0 SOIL HANDLING CONTINGENCY PLAN

Where warranted, the NEB will be notified as soon as practical that contingency measures have been implemented during the construction of the pipeline component of the Alberta Clipper Project.

While soils handling criteria presented in Section 5.0 of Appendix 6B of this ESA addresses the key soils handling questions that could occur during pipeline construction, the following minor problems may arise during construction which may result in loss of soil capability if not addressed. Mitigative measures are provided to lessen the potential impacts associated with construction.

Condition/Concern	Mitigative Options
Uneven boundary between topsoil and subsoil	1. Utilize equipment capable of fine depth adjustments when salvaging topsoil.
Uneven surface on native prairie, hay or pasture	2. Consider stripping spoil pile area on native prairie, hay and pasture. 3. Use equipment with fine depth control to backfill spoil in contact with sod layer. 4. Consider use of prairie protector on clean-up bucket or grader blade. 5. Minimize scalping of sod layer.

5.0 CRITERIA FOR PROGRESSIVELY INCREASED TOPSOIL STRIPPING WIDTHS

The topsoil salvage procedures shown on the Environmental Alignment Sheets and described in Table 6.2 of the ESA provide the minimum topsoil salvage width requirements based on land use and vegetation criteria. During pipeline construction, it is anticipated that several situations will arise where it will be necessary to increase the minimum stripping width requirements. In many instances, the stripping width will be increased to accommodate grading requirements for construction safety and engineering design reasons. In other cases, environmental effect issues are identified which necessitate increasing the topsoil salvage width as a mitigative measure.

The criteria for selection of alternate soil handling methods, provided in Figure 6A-1 of Appendix 6A of this ESA, will be implemented to increase the stripping width where necessary, based on site-specific conditions at the time of construction of the pipeline.

6.0 SOIL EROSION CONTINGENCY PLAN

Enbridge's Environmental Inspector will recommend to the Chief Inspector that contingency measures be initiated during construction of the pipeline component of the Alberta Clipper Project. A record of the location, timing and reason for implementation of the contingency plan will be maintained by the Environmental Inspector. In the event that soils are impacted to an extent that reclamation may be impeded, the Environmental Inspector or Chief Inspector will notify the appropriate authority (*i.e.,* AENV, SENV, Manitoba Conservation, PFRA pasture manager or landowner) and the NEB as soon as practical (see Tables 6D-1 to 6D-3 in Appendix 6D of this ESA).

Contractor equipment and personnel will be made available to control the erosion. During the construction phase of the pipeline, the Chief Inspector, in consultation with the Environmental Inspector, will determine appropriate procedures to be implemented to control soil erosion and other soil handling problems encountered. One or more of the following contingency measures listed below will be implemented as appropriate. Similar procedures should be followed during the operational phase of the pipeline.

Concern	Mitigative Options
Water Erosion - Cultivated / Hay Land	1. Shut down construction until the risk of erosion has been reduced or the conditions improve. 2. Construct temporary berms of subsoil, sandbags or bales during construction activities. 3. Salvage remaining topsoil and store away from area to be regraded. 4. Construct temporary cross ditches if approved by landowner.
Water Erosion - Hay Land, Pasture, Bush, Bush-Pasture	5. Install temporary berms of subsoil, logs, timbers, sandbags or bales during construction activities. 6. Install silt fences near the base of slopes. 7. Salvage remaining topsoil and store away from area to be regraded. 8. Regrade rills and gullies. 9. Replace salvaged topsoil. 10. Implement one or a combination of the following mitigative techniques: • construct cross ditches and berms decreasing the spacing on steeper slopes or on more erodible soils; • armour the upslope face of berms with geotextile, logs or sandbags; • import small diameter slash then spread and walk down; • apply netting, mulch or tackifier to hold soil; • reseed and hand rake an annual cover crop, hydroseed or apply seed impregnated mats; • transplant native shrubs, plant willow stakes or use other bioengineering techniques; and • install slope indicators at locations where the risk of slope failure, or creep exists; consult a geotechnical engineer.
Wind Erosion - Topsoil	11. Shut down or relocate construction activities until winds dissipate and conditions improve. 12. Consider using the following techniques if wind erosion of the topsoil windrow is of concern: • apply water to the topsoil windrow;

Concern	Mitigative Options
	• windrow snow over the topsoil windrow; • tackify (at rate recommended by the distributor) the topsoil windrow; or • pack the topsoil windrow with a sheepsfoot packer or other suitable equipment. 13. Consider using the following techniques if wind erosion is of concern after topsoil replacement: • seed cereal or sterile hybrid cover crop; • employ straw crimping at 2-2.5 tonnes/ha; • apply hydromulch or tackifier; • use a packing roller (*e.g.,* Accuroller) to lightly compact sandy or pulverized soils on native prairie lands. • import small diameter slash for use as rollback - walk down slash; • add locally available manure and cultivate; and • install wind fences.
Erosion of or Failure of Streambanks	14. Implement one or a combination of the following mitigative techniques: • plant willow stakes in the spring; • transplant willow clumps, install willow wattles, or brush layering; • apply netting or netting with straw mulch complete with seed mix; • install log cribwall bank protection; • armour bank with rock riprap; • install vegetated geogrid; • install rock gabions; or • reconstruct stream profile to remove scour holes or instream obstructions.

7.0 SOIL/SOD PULVERIZATION CONTINGENCY PLAN

Where warranted, the NEB will be notified as soon as practical that contingency measures have been implemented during the construction of the pipeline component of the Alberta Clipper Project.

Criteria for Implementation

Pulverization may occur on unstripped well-sodded lands, particularly on sandy soil and on cultivated lands with clay soils. The Soil/Sod Pulverization Contingency Plan will be implemented where sod integrity or topsoil on cultivated lands has been disturbed to the extent that the sod will not infill naturally in a reasonable time frame, or there is an unacceptably high risk of soil erosion. The following contingency measures will be implemented where there is no compaction in the subsoil and no need to fully strip topsoil from the area. Locations along the pipeline route where these measures apply will be determined by the Environmental Inspector in consultation with the landowner.

1. Lightly cultivate the affected areas in two directions with a spike cultivator or a scarifier mounted on a grader.
2. Ensure that the area of cultivation is approximately 1 m wider than the disturbed area.
3. Harrow the area to prepare a seed bed.
4. Drill or broadcast seed the area as appropriate and lightly harrow the area again to cover all seed and compact the seed bed.
5. Straw crimp, if necessary, on erosion prone soils.

8.0 SILTATION OF WATERCOURSES CONTINGENCY PLAN

Enbridge's Environmental Inspector will notify the Chief Inspector that contingency measures have been initiated and will maintain a record of the location, timing and reason for implementation of the contingency plan. Appropriate authorities such as AENV, SENV, Manitoba Conservation, DFO and the NEB will be notified as soon as practical, by the Environmental Inspector or Chief Inspector, that contingency measures have been implemented during the construction of the pipeline (see Tables 6D-1 to 6D-3 in Appendix 6D of this ESA). See also the Flood and Excessive Flow Contingency Plan (Section 1.0 of Appendix 6B of this ESA).

Should an extreme precipitation/streamflow event threaten, or other circumstances occur which may render the existing sediment control measures inadequate, the procedures outlined below will be implemented progressively or individually as warranted.

1. Prohibit the operation of construction equipment close to the banks of watercourses where there is a risk of bank sloughing, failure of the vehicle crossing or flooding of the work area.
2. Install additional silt fencing to prevent silt-laden water from entering watercourse.
3. Excavate cross ditches to divert runoff away from watercourses.
4. Construct berms of subsoil, sandbags, rock, timber, straw bales or hay bales on approach slopes and/or banks to divert runoff from the right-of-way and onto well-vegetated lands. The location and material of the sediment control structures will be determined by the Environmental Inspector.
5. Import sand bags and place strategically to help stabilize and add height to banks to prevent flooding of nearby areas, especially where vegetation has been removed.

9.0 SPILL CONTINGENCY PLAN

The Chief Inspector and Environmental Inspector will immediately notify the applicable provincial and federal government agencies and the NEB of the spill as required by law when a reportable event occurs during the construction of any component of the Alberta Clipper Project (see Tables 6D-1 to 6D-3 of Appendix 6D of this ESA). If this is not possible, notification will be made as soon as practical.

In Alberta, a reportable spill event is defined by the *Alberta Environmental Protection and Enhancement Act* as:

- The release has caused, is causing or may cause impairment of or damage to the environment, human health or safety, or property;
- The amount exceeds the quantities or emission levels set out for the substance (see Material Safety Data Sheets [MSDS]);
- The release is into a watercourse or into the groundwater or surface water in any quantity; and/or
- The release is 200 L or more (*Transportation of Dangerous Goods Act*, 1992 immediate reporting quantity for flammable liquids (class 3).

In Saskatchewan, a reportable spill event is defined by *The Environmental Management and Protection Act*, 2002 (The Environmental Spill Control Regulations) as:

- Any substance that is discharged into the environment that may cause, is causing or has caused an adverse effect; and
- The release is 100 L or more (Environmental Spill Control Regulations immediate reporting quantity for petroleum and petroleum products)

In Manitoba, a reportable spill event is defined by the *Dangerous Goods Handling and Transportation Act* (Environmental Accident Reporting Regulation), as:

- The release has caused, is causing or may cause an impairment of or damage to the environment, human health or safety, or property;
- The amount exceeds the quantities to emission levels set out for the substance (see MSDS);
- The release is into a watercourse or into the groundwater or surface water in any quantity; and/or
- The release is 100 L or more (*Dangerous Goods Handling and Transportation Act* (Environmental Accident Reporting Regulation), immediate reporting quantity for flammable liquids (class 3).

Contaminated sites will be assessed, remediation designed and disposal sites identified in accordance with documents from the CCME as applicable. These documents will be provided to the Chief Inspector and Environmental Inspectors as part of the Environmental Education Program. Emergency contacts are presented in Tables 6D-1 to 6D-3 of Appendix 6D of this ESA.

9.1 Introduction

Guidelines for the safe handling, storage, use and disposal of potentially hazardous materials as well as spill prevention measures and guidelines for the refuelling and servicing of equipment are provided in Enbridge's Waste Management Plan presently on file with the NEB.

9.2 General Measures

The following are standard measures to be adhered to during construction of the Alberta Clipper Project:

1. Appropriate spill equipment will be maintained at all worksites. The risk potential for site-specific spills will be used to determine the appropriate type of response equipment to be stored onsite and suitable location for storage.
2. Specific instructions regarding applicable contacts and appropriate response actions to be taken in the event of a spill will be posted at the field construction office.

9.3 Initial Response

The following actions will be taken upon detection of a spill.

1. In the event of a spill of hazardous material, the first person on the scene will follow the actions presented in the Spill Scene Checklist.
2. When notified of a spill, the Chief Inspector / Environmental Inspector will immediately ensure that:
   - action is taken to control danger to human life
   - an onsite safety Manager is designated;
   - the appropriate provincial disaster services, local police and/or RCMP have been notified;
   - the necessary equipment and personnel are mobilized, and measures are being implemented to stop the source of the spill, if safe to do so, and commence clean-up; and
   - applicable provincial and federal agencies and the NEB are immediately notified of the spill.
3. The Contractor will make all resources available to contain and clean-up the spill.
4. Once the emergency contacts are made and the initial efforts to contain and clean-up the spill are underway, the Chief Inspector / Environmental Inspector will notify Enbridge's Environment, Health and Safety staff.

9.4 General Spill Containment Procedures

The successful containment of a spill on land or water depends on a variety of factors including: ground cover and topography, hydrogeology, solubility of the material, viscosity of the liquid, water currents, soil permeability and climatic conditions.

The following general guidelines will be followed for containment of most hazardous materials.

1. The first person on the scene will follow the actions listed in the Spill Scene Checklist.
2. Assess the safety hazards of the situation.
3. Remove sources of ignition, if safe to do so.
4. Identify the product, stop source and physically contain spill as soon as safe to do so.
5. Avoid use of water or fire extinguishing chemicals on nonpetroleum product spills since many chemicals react violently with water and chemical extinguishing agents may release toxic fumes. In addition, chemicals may be soluble in water and dispersal makes containment and clean-up more difficult.
6. Minimize traffic on contaminated soils.
7. Use natural depressions or berms constructed with materials and equipment in proximity to the site to physically contain a spill on land. Deployment of booms will be necessary on water.
8. Clean-up will not be attempted without advice from Enbridge's Environment, Health and Safety staff.

9.4.1 Transportation by Truck

The general guidelines listed below will be followed for the containment of materials spilled from a truck.

1. Contain spilled petroleum product.
2. Pump tanker dry (into appropriate containers or another tanker).
3. Remove tanker from site.
4. Pick up spilled product.
5. Clean-up contaminated area.
6. Dispose of sorbent pads, heavily contaminated soil and vegetation at an approved facility. On lightly contaminated soil areas where remediation is feasible, add amendments, repeat as required, sample soil and seed as appropriate. Repeat as required.

9.4.2 Spills Adjacent to or into a Watercourse or Wetland

The general guidelines listed below will be followed for spills adjacent to or into a watercourse or wetland.

1. Construct berms and/or trenches to contain spilled product prior to entry into a watercourse or wetland.
2. Deploy booms, skimmers, sorbents, etc., if feasible, to contain and recover spilled material from a watercourse or wetland.
3. Pick up spilled product.
4. Clean-up contaminated area including downstream shorelines.
5. Dispose of heavily contaminated soil and vegetation at an approved facility. On lightly contaminated soil areas where *in situ* restoration is feasible, fertilize and then cultivate beyond depth of contamination. Repeat as required.

9.4.3 Spot Spills

Impacts from small spot spills can generally be minimized if appropriate actions are implemented. All small spills of fuels or noxious materials must be reported immediately to the Environmental Inspector.

1. Suspend construction activity and travel in the immediate vicinity of a spot spill until permission to resume activity has been granted by the Environmental Inspector.
2. The Environmental Inspector, in consultation with Enbridge's Environment, Health and Safety staff, will determine appropriate methods to remove or restore contaminated soils. Soil and vegetation heavily contaminated with petroleum products will be incinerated or disposed of at an approved facility.
3. Locations where spot spills occur are to be flagged or otherwise marked to ensure that post-construction monitoring of the site can be undertaken.
4. Lightly contaminated soil areas where restoration is feasible will be fertilized and then cultivated to a depth below the depth of contamination, then repeated as required.

SPILL SCENE CHECKLIST

Note: The following activities should be taken by the first person on the scene of a hazardous material spill or release or a spill of other potentially deleterious material into a watercourse or wetland or environmentally sensitive area.

(a) If possible without further assistance, assess the safety hazards of the situation, control danger to human life and identify the composition (see Spill Report Form - next page) of the spilled material. _____

(b) If feasible and safe to do so, remove any sources of ignition, cut off the source of the spill and initiate a release response plan (*i.e.,* control, contain and clean-up). While efforts have been initiated to contain the spill, immediately notify the Chief Inspector and Environmental Inspector. If the Chief Inspector cannot be immediately contacted, notify Enbridge's Environment, Health and Safety staff. These people will, in turn, contact the appropriate authority as well as applicable federal and provincial agencies and the NEB. _____

(c) Once the source has been cut off, attempt to contain the spilled material. _____

(d) Before any reports are filed, take notice of dangers to the environment (*e.g.,* proximity of watercourses) and clean-up actions that might be necessary. _____

(e) If any of the above is beyond the capabilities at hand, do not hesitate to ask for qualified assistance. _____

(f) In Alberta, a written report must be submitted directly to the Monitoring Division of the Alberta Energy and Utilities Board within seven (7) days of verbally reporting an unrefined or refined product release, if the release has caused, is causing, or may cause adverse effect on environment. If the release is fully contained on site, or there are no adverse effects, then a written report is not required. _____

(g) In Saskatchewan, an immediate verbal report is required to Saskatchewan Environment by telephone at (800) 667-7525. A written report is required within seven (7) days of verbal report. _____

(h) In Manitoba, an immediate verbal report is required to the Manitoba Department of Environment and Workplace Safety and Health in Winnipeg at (204) 944-4888 (24 hour emergency line). Where requested to do so by an environment officer, a written report shall also be filed with the department. Federally, Transportation Canada (Dangerous Goods requires a written report be made to the Director General within 30 days, The *Canadian Environmental Protection Act* also requires a written report, to be made to the Regional Director (Prairie and Northern Region). _____

EXAMPLE OF SPILL REPORT FORM

Type of Material Spilled:

Gasoline _____
Diesel _____
Lube Oil _____
Hydraulic Fluid _____
Vehicle Antifreeze _____
Developing Fluids _____
Other (specify) _____

Date and Time of Spill or Discovery: _____
Source of Spill: _____
Area of Spill (m^2): _____
Depth of Spill (cm): _____
Volume of Spill (L): _____
Estimated Release Rate: _____
Duration of Release: _____
Location (land, water, land and water): _____
Soil Type (*e.g.,* sandy, clay, etc.): _____
Legal Location: LSD _____ Sec _____ Twp _____ Rg _____ W_____M; KP_____

Land Use: _____

Environmentally sensitive areas potentially affected: _____
_____

Weather conditions at time of discovery: _____

Procedures taken to minimize, control or stop the release: _____
_____
_____

Remediation plan and schedule of implementation, if required: _____
_____
_____

Current status of the remediation program: _____

(dd/mm/yy) (hr:min): _____

Form Completed by:
Name: _____ (printed) _____ (signed)

10.0 DIRECTIONAL DRILLING PROCEDURES AND INSTREAM DRILLING MUD RELEASE CONTINGENCY PLAN

An accidental release of drilling mud into a watercourse could adversely affect the environment. The following contingency plan has been developed to ensure that appropriate measures are in place to minimize the risk of adverse impacts during directional drilling of the South Saskatchewan, Qu'Appelle and Souris rivers.

Both the Contractor and Enbridge must be diligent during all aspects of directional drilling to ensure that the potential for an instream drilling mud release is minimized; or if it does occur, that environmental impacts are minimized.

Should the Contractor have an instream drilling mud release contingency plan in place, both plans will be reviewed by Enbridge with the Contractor to ensure that the most stringent conditions of both plans apply.

10.1 General Measures

1. Ensure that supervisory personnel are aware of this contingency plan prior to commencement of drilling activity.
2. Arrange for access beyond the boundaries of the pipeline project's surface rights agreement along the drill path to monitor, contain and clean up potential frac-out releases.
3. Install surface casing at the entry point to a depth that extends beyond the coarsest material, if warranted.
4. Ensure that drilling mud composition is limited to bentonite mud drilling systems, fresh water and, if warranted, other inert additives. No toxic additives will be allowed. Provide MSDS to Enbridge upon request.
5. Construct a sump at the entry point and a subsoil berm downslope of the proposed exit point with a capacity adequate to capture anticipated volumes of drilling mud that could be released during pullback and other drilling operations. Construct a sump with the above noted capacity, at the exit point after the pilot hole has been completed.
6. Install surface casing at the exit point if coarse textured near surface deposits could interfere with drilling mud circulation.
7. Develop a clean-up plan, prior to drilling. The plan will be prepared by the drilling contractor in consultation with Enbridge inspection staff, as well as the DFO Fisheries Biologist. Acquire the appropriate approvals to access the release area if off right-of-way and for mud pump-off.
8. Reclaim entry and exit sumps that contained drilling mud immediately after completion of drilling and remediate to meet applicable Alberta EUB Directive 050 *Waste Management Guidelines*.

10.2 Emergency Response Equipment

1. Maintain the following equipment onsite in sufficient quantities during drilling operation to contain any inadvertent drilling mud releases:
    - sandbags;
    - filter cloth (*e.g.,* silt fence);
    - T-bar posts;
    - post pounders;
    - straw bales;
    - light towers;

- shovels;
- 6 mil polyethylene; and
- 2-trash pumps c/w sufficient lengths of leak free hose and suction heads.

2. Maintain vacuum truck(s) onsite during pullback operations.
3. Maintain the appropriate water quality sampling equipment onsite during drilling operation to ensure that accurate water quality samples are taken. Onsite equipment to be provided by Enbridge or their contractor(s) may include:
    - turbidity meter;
    - sampling pole;
    - chest waders;
    - water sample bottles;
    - ice auger;
    - boat; and
    - coolers.
4. Ensure that the water quality sampling program is in place prior to drilling and includes the following information:
    - sample locations (both an upstream control site as well as appropriate downstream sites);
    - frequency of sampling; and
    - sampling procedures.

    The program will be amended if warranted by conditions.
5. Ensure that three (min.) sets of walkie-talkies with spare batteries are onsite and available for use in monitoring operations.

10.3 Monitoring

1. Supervisory personnel will be onsite at all times during drilling, reaming and pullback operations to ensure that emergency response measures will be implemented immediately and effectively. Enbridge will also assign inspection personnel to the site during all phases of drilling of the watercourse.
2. Monitor and record the amount of fluid return to the mud tank/pit and the amount of make up drilling fluid required in the mixing tanks during drilling of the pilot hole and hole opening (reaming). Maintain a detailed log of all drilling activities in order to correlate drilling status with potential frac-out events.
3. Monitor both onshore and instream portions of the drill path and surrounding area (*i.e.,* within 400 m minimum) for signs of drilling mud release. The size of the area to be monitored will be determined by evaluating geotechnical conditions (*i.e.,* amount of fracturing, type and depth of substrate) and drilling conditions (*i.e.,* depth of drill path, distance between watercourse and entry and exit points). Monitoring will be on a continuous basis during drilling operations and will continue for at least 12 hours after shut-down. Personnel equipped with walkie-talkies shall be positioned at the most advantageous locations to observe any sign of a release of drilling mud to the surface or in the watercourse.
4. Ensure that contact is maintained at all times between monitoring and drilling personnel.

5. Establish monitoring stations at the following locations and obtain water samples for visual inspection at the noted intervals if pressurized drilling fluids or water are used.

Up And Downstream Monitoring Sample Sites	Sampling Interval (approx.)
25 m (approx.)	2 hours
100 m (approx.)	2 hours
200 m (approx.)	4 hours
400 m (approx.)	4 hours

   Increase the sampling frequency if monitoring of drilling mud returns indicates that a release may have occurred.

6. On watercourses with ice cover, onsite conditions may allow visual monitoring of water quality by observing open reaches or, if safe, by augering and maintaining an open hole in the ice for sampling. Supply monitors with practical safety gear (*e.g.,* ropes, ladders, inflatable boat, flotation coveralls) for traversing ice. Continue to evaluate ice conditions throughout the monitoring program. If open reaches are not available for monitoring and ice cover is not safe, notify the provincial and DFO fisheries biologists.

7. If the watercourse is frozen to the bottom, onsite conditions will not allow visual monitoring of water quality by observing open reaches or by augering and maintaining an open hole in the ice for sampling. Continue to visually monitor areas where early detection of a frac-out would most likely occur (*e.g.*, at the base of coniferous trees overhanging the watercourse).

10.4 Emergency Response

The loss of drilling mud into seams of coarse material, fissures, etc. routinely occurs during drilling operations. Since drilling fluid does not always flow to the surface, a loss does not necessarily indicate that the drilling mud has been released onto near shore areas or into the watercourse. Nevertheless, a release of drilling mud into a watercourse can adversely affect fish and fish habitat.

1. Suspend drilling operations immediately if excessive loss of drilling mud is noted and conduct a detailed examination of the drill path and surrounding area for evidence of a release to the surface.

2. Immediately notify the Chief Inspector and the Environmental Inspector if a drilling mud release is observed.

3. If the amount of mud released is not great enough to allow practical collection, the mud release will be allowed to dry and dissipate naturally.

4. If the drilling mud release enters a watercourse, the Chief Inspector will immediately notify Enbridge's Engineering staff, the Saskatchewan Environmental Response Centre and the Manitoba Environmental Response Centre. The Environmental Inspector will immediately notify the provincial and DFO fisheries biologists. Enbridge will notify affected landowners, tenants and/or the appropriate land authority. Any drilling mud release that enters waters or that may cause or is causing an adverse effect is reportable to SENV or Manitoba Conservation.

Federal Fisheries Biologist for the South Saskatchewan and Qu'Appelle rivers (Bruce Howard)	(306) 780-8724
Federal Fisheries Biologist for the Souris River (Keith Kristofferson)	(204) 984-8891
Saskatchewan Provincial Fisheries Biologist for the South Saskatchewan River (Jennifer Merkowsky)	(306) 933-7943
Saskatchewan Provincial Fisheries Biologist for the Qu'Appelle River (Al McCutcheon)	(306) 728-7491
Manitoba Provincial Fisheries Biologist (Bruno Brudelin)	(204) 726-6452
Saskatchewan Emergency Response Line	1-800-667-7525
Manitoba Emergency Response Line	(204) 944-4888

5. Contain and further prevent drilling mud from entering the watercourse from near shore areas by installing a berm of subsoil, sandbags or other material approved by the Environmental Inspector.

6. Conduct water quality sampling as directed by the Environmental Inspector. Instream and near-shore containment/cleanup objectives include the following:

Instream:

1) Divert streamflow around the mud release to the extent practical.
2) Install silt fencing around the exit point(s), if feasible.
3) Remove mud from the watercourse by pumping, shovels or with a hoe.
4) Dispose of mud in accordance with provincial requirements.

Onshore:

1) Contain the mud release immediately to limit the area affected and prevent the mud from entering the watercourse.
2) Dispose of mud.

Consider the following options for diverting streamflow from the mud release area.

1) Install aquadams on the upstream side of the release point on larger watercourses.
2) Construct a dam and pump set-up on smaller watercourses.
3) Install a flume to divert water past the release area.
4) Install coffer dams made of sand bags or sheet metal.
5) Attempt to contain the release point within an area isolated with aquadams or sheet metal, etc.

Consider the following options for removal of mud from instream.

1) Use trash pumps or hydrovac truck. If trash pumps are used, ensure that the pump-off area does not drain directly into watercourse or construct a holding area. If a hydrovac truck is used, ensure that all activities comply with the guidelines in the Alberta EUB G-050 *Drilling Waste Management Guidelines* and ID 99-05.
2) In consultation with provincial and DFO fisheries biologists, leave mud in place if current streamflow levels inhibit removal operations or removal will result in unacceptable terrain or instream damage.

For onshore mud release, consider the following options for immediate containment.

1) If accessible by heavy equipment, immediately construct berms or excavate a sump for containment.
2) If not accessible by heavy equipment, construct bale and filter cloth weirs and a containment area where appropriate.

Before allowing filtered water to enter the watercourse, ensure that the TSS level is within 10 mg/L of the background TSS levels.

Enbridge inspection staff will prepare a report summarizing the events leading up to the release as well as measures taken following the release to minimize impacts on the environment.

10.5 Plans for Potential Continuance of Drilling

Drilling will only be allowed to resume if the potential for significant adverse impacts on the environment is low, as determined by the Enbridge project management, inspection staff, the Fisheries Resource Specialist, drilling or geotechnical consultant (if warranted) and the drilling contractor, and as approved by the DFO fisheries biologist.

1. Implement measures to prevent the further release of drilling mud into the watercourse. Appropriate measures will vary depending on the lessons learned during the previous drill attempt.

Progressively implement the following measures to prevent the further release of drilling mud into the watercourse.

a) Ensure that appropriate structures, materials, equipment and personnel are in place and available in the event of a subsequent release of drilling mud.
b) Reduce drilling mud pressures if practical.

c) Plug fissures/fracture with inert sealers or plugging agents pumped into the drill hole and left undisturbed for an appropriate period of time whereupon drilling will be resumed. If the sealing agents are not successful, drilling will be suspended and the plan reviewed and revised.

d) Employ downhole cementing to either seal off the problem zone for redrilling or seal off a large portion of the existing drill hole to a point where a new drill path (generally at a lower elevation) can be attempted. If these measures are unsuccessful, then drilling will be suspended and the plan reviewed and revised.

e) Move the drill and attempt to redrill from a new location employing the same protection measures implemented on the initial drill if conditions indicate that a second drill will be successful. Prior to commencing the redrill, the proposed drill path will be reviewed and revised accordingly.

11.0 FISH AND BIVALVE SPECIES OF CONCERN DISCOVERY CONTINGENCY PLAN

Fish Species of Concern Discovery Prior to Construction

Depending upon the pipeline construction schedule, supplemental fish and aquatic habitat studies in 2007 may be necessary if watercourse construction will occur during the restricted instream activity period or if the recommended water crossing method(s) outside of the restricted activity period is not technically or economically feasible (*e.g.,* due to anticipated high flows during the planned water crossing construction period or subsurface materials are not suitable for a trenchless crossing). In the event that sensitive fish habitats are discovered during the survey, the discovery will be assessed by a qualified aquatic environment specialist based on the following criteria:

- position of the fish habitat feature with respect to the proposed crossing;
- the timing of construction versus the timing constraints for the fish species; and
- the potential for an alteration of construction activities to minimize disturbance.

Once the assessment is completed, DFO and provincial fish biologists will be notified to discuss site-specific mitigative options. The mitigative measures prepared for watercourse crossings as outlined in Section 6.2.6 of this ESA are based on a conservative approach. The mitigative measures available include the following:

- abide by timing constraints for sensitive life history periods;
- alter construction activities to partial bypass or trenchless crossing techniques (*e.g.,* HDD, bore);
- implement temporary and/or permanent erosion control measures (*e.g.,* geotextiles, silt fences, temporary berms) to prevent increased sediment loading;
- restore bank cover by planting shrubs;
- alter vehicle crossing methods to minimize disturbance (*i.e.,* use existing bridges or install temporary bridge); and
- if deemed warranted and, for an authorization for the harmful alteration, disruption or destruction of fish habitat. Compensate loss of habitat and monitor to conform that compensation was effective.

The Fish, Bivalve and Aquatic Surveys report will outline appropriate mitigation to be implemented at each applicable watercourse crossing. If warranted, the Environmental Alignment Sheets will be amended to incorporate these mitigative measures.

Bivalve Species of Concern Discovery Prior to Construction

A study to determine the species of bivalves present in the vicinity of the Souris River, Oak Creek (KP 1109.3) and Deadhorse Creek crossings will be undertaken in spring of 2007. Further studies may also be warranted in the year of construction if the watercourse is to be crossed with a trenched crossing method. In the event that that bivalve species of concern are discovered during the study, the discovery will be assessed by a qualified aquatic environment specialist based on the following criteria:

- position of the bivalve with respect to the proposed crossing; and
- the potential for an alteration of construction activities to minimize disturbance.

Once the assessment is completed, Environment Canada, DFO and provincial fish biologists will be notified to discuss site-specific mitigative options. The mitigative measures available include the following:

- depending on the season, alter construction activities to trenchless crossing techniques (*e.g.,* HDD); and
- collect bivalves of concern within the zone of influence of the crossing and move the bivalves to an upstream location with similar habitat characteristics.

The Fish, Bivalve and Aquatic Habitat Surveys report will outline appropriate mitigation to be implemented at each applicable watercourse crossing. The Environmental Alignment Sheets will be amended, if warranted, to incorporate these mitigative measures.

12.0 PLANT SPECIES OF CONCERN DISCOVERY CONTINGENCY PLAN

In the event that rare vascular plants, or plant communities are discovered during future vegetation studies scheduled for 2007 along the pipeline route, the plant or community will be assessed and appropriate mitigative measures will be determined prior to construction of the pipeline. The appropriate mitigative measures will be determined following an assessment, which will include the following:

- the position of the plant or community on the right-of-way;
- the relative rarity of the plant or community (regionally, nationally etc.);
- the local abundance of the plant or community;
- the growth habit and propagation strategy of the plant or community; and
- the habitat preferences of the plant or community.

The suite of mitigative options (*i.e.,* staged mitigation) that may be implemented is outlined in Detail 6B-1 and includes the following:

- narrow down the proposed area of disturbance and protect the site using fencing or clearly mark the site using flagging;
- inform all users of access restrictions along native vegetation segments and in the vicinity of flagged or fenced sites;
- temporarily cover the site with geotextile pads, flex net, or swamp mats;
- extend road or watercourse bores to avoid or minimize impact on the site;
- realign the route to avoid the site; or
- propagate rare plants or specific portions of sensitive communities, via vegetative or reproductive means (*e.g.,* harvesting of seed from the right-of-way or adjacent area, salvaging and transplanting portions of sod and surrounding vegetation or collecting of cuttings).

The Rare Vascular Plant and Plant Community Survey report will outline appropriate mitigation to be implemented at each site. The Environmental Alignment Sheets will be amended, if warranted, to incorporate these mitigative measures.

CRITERIA FOR IMPLEMENTATION

Protection measures and environmental management techniques for rare plants and sensitive plant communities will be based on site-specific conditions and species sensitivity criteria. Final decisions on mitigative measures will be made by Enbridge in consultation with botanical experts, and where appropriate, the land authority. Mitigative measures generally fall into categories of avoidance, minimizing disturbance and alternative reclamation techniques. The following mitigative measures and options will be considered in the order presented:

1. Preliminary assessment and protection will include the following steps in all cases.
   - Expand field survey of the area to identify whether the species or community is found only within the pipeline construction right-of-way, or extends beyond it.
   - Consult with ANHIC, SK CDC, MB CDC and vegetation experts to verify the status ranking, known distribution, plant species requirements, etc., and to discuss the type of terrain and the construction constraints.
   - Stake and fence off individuals or populations on the right-of-way. This will be done as soon after identification as feasible, to protect rare plants during the pre-construction phase as well as during the construction and reclamation phases.

2. For S1 or S1S2 ranked rare plant species, complete protection is preferred. The mitigation strategy includes the following options in order of preference. One or more options may be used at a site.
   - Consider narrowing down the planned area of disturbance to avoid individuals or populations occurring on the right-of-way or temporary workspace if the species can be fully protected during and after construction, or if a viable, self-sustaining population occurs beyond the right-of-way (Detail 6A-1 in Appendix 6A).
   - Consider a minor realignment of the pipeline or a change in the work side in the immediate area of the vegetation to be protected.
   - Consider boring beneath the site and providing alternative measures for equipment to travel past the area of concern (*e.g.,* protection matting, temporary bridge, drive around).
   - Consider employing appropriate salvage, propagation and transplant techniques (including transplanting the target species surrounded by an island of native vegetation), as directed by Enbridge's Vegetation Consultant (Detail 6A-2, 6A-3, 6A-4 in Appendix 6A).

3. For S2, S2S3, S1S3, S3, SH and SU ranked rare plant species, the mitigation strategy includes the following options in order of preference. One or more options may be used at a site.
   - Consider narrowing down the planned area of disturbance to avoid individuals or populations occurring on the right-of-way or temporary workspace if the species can be fully protected during construction, or if a viable, self-sustaining population occurs beyond the right-of-way (Detail 6A-1 in Appendix 6A).
   - Consider employing appropriate salvage, propagation and transplant techniques, as directed by Enbridge's Vegetation Consultant (Detail 6A-2, 6A-4 in Appendix 6A).
   - Consider traffic restrictions to minimize the amount and type of traffic disturbance.
   - Consider using geotextiles and/or protective matting over the travel lane and spoil pile area to protect populations or habitats from scraping and compacting (Detail 6A-3 in Appendix 6A).

4. For sensitive plant communities the mitigation strategy includes the following options in order of preference. One or more options may be used at a site.
   - Consider narrowing down the planned area of disturbance to avoid individuals or populations occurring on the right-of-way or temporary workspace. Employ the appropriate salvage, propagation and transplant and restoration techniques, as directed by Enbridge's Vegetation Consultant (Detail 6A-1 in Appendix 6A).

13.0 WILDLIFE SPECIES OF CONCERN DISCOVERY CONTINGENCY PLAN

Wildlife Species of Concern Discovery Prior to Construction

In the event that wildlife species of concern or their site-specific habitat is discovered during future wildlife studies in 2007 along the pipeline route and at Hardisty Terminal, the discovery will be assessed and appropriate mitigation measures will be determined. Table 6B-3 of this ESA lists wildlife species of concern and provides examples of associated habitat features that may require special protection or measures if discovered. The wildlife or habitat will be assessed based on the following criteria:

- the position of the wildlife or habitat feature with respect to the proposed area of development;
- the presence of topographic features or vegetation to effectively screen the wildlife or habitat from construction activities;
- the timing of construction versus the critical timing constraints for the species; and
- the potential for an alteration of construction activities to minimize or avoid sensory disturbance.

The mitigative measures available include the following:

- abide by federal timing constraints within the recommended set back distances;
- abide by daily timing restrictions on construction activities;
- narrow down the proposed area of disturbance and protect the site using fencing or clearly mark the site using flagging;
- alter or delay construction activities to avoid sensory disturbance (*e.g.,* no burning);
- extend road or watercourse bores to avoid or minimize effects on the site;
- inform all users of access restrictions in the vicinity of flagged or fenced sites;
- realign the route to avoid the site;
- salvage and transplant vegetation or native seed of critical importance to wildlife species of concern where the habitat could not be avoided;
- install nest boxes or platforms or otherwise replace or enhance habitat during reclamation or restoration; and
- relocate nests or other habitat features or individuals if practical and monitor post-construction response.

The Wildlife and Wildlife Habitat Surveys for Species of Concern report will outline the appropriate mitigation to be implemented at each site. If warranted, the Environmental Alignment Sheets will be amended to incorporate these mitigative measures.

Wildlife Species of Concern Discovery During Pipeline Construction

In the event that wildlife species of concern or their site-specific habitat is discovered during construction of the pipeline, the discovery will be assessed and appropriate mitigation measures from the list above will be determined.

Wildlife species of concern and their habitat characteristics will be identified in the Environmental Education Program for the Environmental Inspectors. The Environmental Inspectors will be provided with detailed information on identifying wildlife species of concern and their site-specific habitat.

In the event that wildlife species of concern or their site-specific habitat are discovered during construction of the pipeline, follow the measures outlined below.

1. Suspend work immediately in the vicinity of any newly discovered wildlife species of concern. Work at that location may not resume until the measures below are undertaken.
2. Notify the Environmental Inspector who will notify the Chief Inspector.
3. The Environmental Inspector will assess the discovery and either allow construction to be resumed or, in the event of a confirmed or potential discovery, proceed by notifying:
   - applicable government agencies (*e.g.,* ASRD, SENV, Manitoba Conservation, Environment Canada) as required (see Tables 6D-1 to 6D-3 in Appendix 6D of this ESA); and
   - Enbridge's Wildlife Consultant.
4. Enbridge's Wildlife Consultant may deem it necessary to visit the site and will, regardless of whether a site visit is warranted, develop an appropriate mitigation plan in consultation with Enbridge's Environment, Health and Safety staff. The mitigative measures available include those listed above.

TABLE 6B-3

WILDLIFE SPECIES OF CONCERN AND EXAMPLES OF ASSOCIATED HABITAT FEATURES THAT MAY REQUIRE SPECIAL PROTECTION OR MEASURES IF DISCOVERED

Taxa	Species or Groups	Examples of Habitat Features
bird	migratory birds	active nests, stick nests, cavity nests, staging areas
	loggerhead shrike, long-billed curlew, burrowing owl, sharp-tailed grouse	active nests, leks, burrows
amphibian	northern leopard frogs	wetlands with signs of active breeding; egg masses

14.0 WILDLIFE ENCOUNTER CONTINGENCY PLAN

In the event of an encounter with wildlife during the construction phase of the pipeline, pump additions and tank components, either at the construction site or on the commute to and from the construction site, follow the measures outlined below.

1. Report any incidents (*e.g.*, aggressive behaviour, nuisance behaviour) with wildlife to the Environmental Inspector who will immediately notify the applicable provincial agency (*i.e.*, ASRD, SENV, Manitoba Conservation) and, if warranted, the local police detachment (see Tables 6D-1 to 6D-3 in Appendix 6D of this ESA).
2. Report any trapped, injured, or dead animals on the site to the Environmental Inspector. The Environmental Inspector will contact the applicable provincial agency to consult on appropriate action.
3. Report location and details of collisions with wildlife to the Environmental Inspector. The Environmental Inspector will notify the applicable provincial authorities and, if warranted, the local police detachment (see Tables 6D-1 to 6D-3 in Appendix 6D of this ESA).
4. Once the preceding contacts have been made, the Environmental Inspector will also contact the Enbridge's Environment, Health and Safety staff.

15.0 HERITAGE RESOURCE DISCOVERY CONTINGENCY PLAN

Heritage Resource Discovery Prior to Construction

In the event that archaeological, historical or palaeontological resources are discovered during the heritage resources work scheduled for 2007 along the pipeline route, the sites will be assessed and appropriate mitigative measures will be determined. The site will be assessed based on the following criteria:

- the significance of the site;
- the location of the site with respect to the route;
- the feasibility of alternate routing or siting to avoid the resource; and
- the decision of the appropriate authority (*i.e.,* ATPRC; Saskatchewan Culture, Youth and Recreation (SCYR); Manitoba Culture, Heritage and Tourism (MCHT).

Prior to construction of the pipeline, the heritage resources report will specify mitigative measures at each site discovered. The proposed mitigation measures will appear on the Environmental Alignment Sheets will be amended, if warranted, to incorporate these mitigative measures.

The mitigative measures that may be implemented include the following:

- have present a qualified archaeologist or palaeontologist to monitor the trenching operations;
- narrow down the proposed area of disturbance and protect the site using fencing or clearly mark the site using flagging;
- install geotextile and swamp mat(s) to protect the site;
- conduct an excavation to salvage and establish an adequate record of the site according to provincial heritage resources guidelines; or
- realign the route or resituate the facility to avoid the site.

Heritage Resource Discovery During Construction

In the event that archaeological, historical or palaeontological resources are discovered during construction of the pipeline, the Rowatt Pump Station or the tanks at the Hardisty Terminal, the sites will be assessed and appropriate mitigative measures will be determined. The site will be assessed based on the criteria mentioned above.

In the event that heritage resources are discovered during construction, follow the measures outlined below.

1. Suspend work immediately in the vicinity of any newly discovered archaeological, palaeontological, historical or traditional land use site. Work at that location may not resume until the measures below are undertaken.
2. Notify the Environmental Inspector who will notify the Chief Inspector.
3. The Environmental Inspector will provide an initial assessment of possible archaeological, palaeontological and historical remains and either allow construction to resume or, in the event of a confirmed or potential discovery, proceed by notifying:
    - Enbridge's Heritage Resource Specialist;
    - applicable government agencies (*e.g.,* ATPRC, SCYR, MCHT) (see Tables 6D-1 to 6D-3 in Appendix 6D of this ESA) as required; and
    - local Aboriginal group representative as required (*i.e.,* Swan Lake Ojibway First Nation).
4. Enbridge's Heritage Resource Specialist may deem it necessary to visit the site and will, regardless of whether a site visit is required, develop an appropriate mitigation plan in consultation with Enbridge's Environment, Health and Safety staff and, if necessary, the appropriate government agency and local Aboriginal group(s). The mitigative measures available include those listed above.

APPENDIX 6C

TRAFFIC CONTROL PLAN

TRAFFIC CONTROL PLAN

The Traffic Control Plan has been prepared to provide guidelines for vehicular use on the pipeline right-of-way and associated access roads. The purpose of the plan is to minimize the effects of equipment and vehicle traffic associated with pipeline development on all lands and particularly on native vegetation, in riparian areas and in areas of high erosion hazard.

1.1 Preconstruction

1. All motorized vehicles, including all-terrain vehicles (ATVs), will be confined to the construction right-of-way and approved access roads, shoo-flies or trails except where specifically authorized by the landowner and occupant. This restriction also applies to all biophysical inventory and land surveying activities.

2. Travel through areas of high sensitivity (*e.g.,* native prairie) will be primarily on foot. However, ATVs may be used for increased efficiency if minimal terrain impact is anticipated. Vehicle travel through native prairie and riparian areas will be restricted to one pass along the right-of-way where practical.

3. In areas where soil testing with a truck mounted auger is required, these activities will only take place under dry or frozen ground conditions so that surface disturbance is minimized.

4. Site-specific features of concern (*e.g.,* rare plant communities or heritage resource sites) identified during biophysical surveys will be flagged sufficiently (if approved by landowner and occupant) so that subsequent traffic can avoid these areas.

5. All preconstruction vehicle traffic will use existing vehicle crossings (*e.g.,* existing bridge) to cross flowing watercourses. Fording of flowing streams by vehicles will not be permitted.

6. Preconstruction vehicle traffic will be limited to ATV traffic and, in severe cases, suspended if excessively wet soil conditions and the potential for topsoil/subsoil mixing due to rutting exists. Traffic will be confined to well sodded, well drained or frozen lands during excessively wet soil conditions.

7. During right-of-way staking prior to commencement of construction activities, features of concern flagged during biophysical surveys and/or indicated on the Environmental Alignment Sheets will be staked or fenced so that areas to be avoided are obvious.

1.2 Construction

1. All project personnel and other visitors to the pipeline right-of-way will receive a pre-job orientation which will include a discussion of the purpose and requirements of the Traffic Control Plan.

2. Access points to the right-of-way will be controlled, where necessary, to prohibit unauthorized public use.

3. All vehicular traffic will be restricted to the approved and staked right-of-way, workspace and access roads. Any newly developed access must be approved by Enbridge.

4. Fences and signs will be erected to protect features of concern as specified on the Environmental Alignment Sheets. The boundaries of shoo-flies will be clearly marked with signs and/or staking and flagging.

5. Enbridge, the Contractor and all subcontractor personnel will avoid areas that are fenced or staked and abide by any restrictions on in/out privileges that are implemented in areas requiring special protection.

6. Enbridge, the Contractor and all subcontractor personnel will limit travel up and down the right-of-way during the course of the work. General touring trips on the right-of-way will be minimized.

7. Two-way travel may be prohibited in areas where special restrictions are in effect (*e.g.,* narrowing of workspace to limit impact on a feature of concern).

8. It may be necessary to designate turn around areas for stringing trucks. These areas will only be used for that purpose and not used for general construction traffic.

9. The speed limit on the right-of-way will be 40 km/h and may be lower under specific conditions such as areas of high erosion hazard, or areas where specific wildlife or vegetation concerns have been identified.

10. All personnel will avoid unnecessary wheel spin.

11. Surface grading will be minimized on native vegetation (*i.e.,* rough microtopography tolerated) unless a safety concern is identified.

12. Equipment travel, particularly that of heavy and/or tracked equipment, will make use of the stripped areas over the trench line and graded areas for travel and passing whenever practical prior to trenching.

1.3 Post-Construction

1. All temporary construction access roads and shoo-flies will be reclaimed to preconstruction conditions. Newly created access points will be blocked unless otherwise directed by Enbridge or the landowner and occupant.

2. Vehicle traffic will be minimized on newly seeded areas until the sod is re-established.

3. Temporary construction gates and any fences removed during construction will be replaced with permanent fences.

4. Routine access to the right-of-way for operations, maintenance and monitoring activities will be by way of pre-existing roads and trails wherever practical. Where travel along the right-of-way in the vicinity of sensitive vegetation is required (*e.g.,* during reclamation monitoring), ATV or foot travel will be used whenever practical.

5. Efforts to control off-road vehicle use will be coordinated with government authorities and landowners and will be conducted until the right-of-way has been satisfactorily reclaimed. Methods to control access may include one or a combination of the following:

    - posting of appropriate signs at all points of access;
    - installation of locking gates and fencing; and
    - installation of slash or rock barriers.

6. Enbridge's emergency response measures will include instructions regarding preferred access routes to the right-of-way in areas of sensitive vegetation or habitats. These instructions will be followed during both emergency response training exercises and real emergencies providing that response times and safety are not compromised.

APPENDIX 6D

EMERGENCY CONTACTS

TABLE 6D-1

ALBERTA EMERGENCY CONTACTS

Contact	Location	Phone Number
RCMP	Hardisty Provost	911 911 or (780) 753-2214
Ambulance	Hardisty Provost	911 911
Hospital	Hardisty Provost	(780) 888-3742 (780) 753-2291
Fire	Hardisty Hughenden Provost	911 or (780) 888-3623 911 or (780) 856-2022 911 or (780) 753-2529
National Energy Board	Calgary	1-800-899-1265
Fisheries and Oceans Canada	Gabrielle Kosmider Edmonton	(780) 495-8494
Environment Canada (Canadian Wildlife Service)	Paul Gregoire Edmonton	(780) 951-8695
Transport Canada (Navigable Waters)	Allan Cadenhead Edmonton	(780) 495-7892
Alberta Sustainable Resource Development (ASRD) (Wildlife Contact)	David Moore Vermilion	(780) 853-8137
ASRD (Fisheries Contact)	Vance Buchwald or Kevin Wingert Red Deer	(403) 340-5356 or (403) 340-7685
ASRD (Public Lands Officer)	Patrick Porter Wainwright	(780) 842-7551
Alberta Tourism, Parks, Recreation and Culture (Heritage Resources Contact)	George Chalut Edmonton	(780) 431-2329
Alberta Disaster Services	Edmonton	(780) 427-2772
Alberta Energy and Utilities Board - Field Centre	Wainwright	(780) 842-7570 (toll free at 310-000)
AENV Compliance Branch	Edmonton	(780) 422-4505
AENV Emergency / Complaint Hotline (24 hours)	Alberta	1-800-222-6514 (24 hr) or 7378 (Telus mobile)
Area "U" Oil Spill Co-operative Chairman	Alberta	(780) 888-8352 (780) 888-2397 (fax)
Forest Fire	Alberta	310-3473
Emergency Link Centre S.T.A.R.S. Air Rescue	Alberta	1-888-888-4567 or *4567 (cell phone)

TABLE 6D-2

SASKATCHEWAN EMERGENCY CONTACTS

Contact	Location	Phone Number
RCMP	Macklin	911 or (306) 228-6300
	Luseland	911 or (306) 372-4844
	Kerrobert	911 or (306) 834-6550
	Kindersley	911 or (306) 463-4642
	Rosetown	911 or (306) 882-5700
	Outlook	911 or (306) 867-5440
	Elbow	911 or (306) 854-1830
	Central Butte	911
	Craik	(306) 734-2288
	Moose Jaw	911 or (306) 691-9670
	Regina	911 or (306) 780-5560
	Montmartre	911 or (306) 424-6400
	Kipling	911 or (306) 736-6400
Ambulance	Macklin	911
	Luseland	911
	Kerrobert	911
	Kindersley	911
	Rosetown	911
	Outlook	911
	Elbow	911
	Central Butte	911
	Craik	(306) 567-2115 (Davidson)
	Moose Jaw	911
	Regina	911 or (306) 525-3999
	Montmartre	911
	Kipling	911
Hospital	Macklin	(306) 753-2366
	Kerrobert	(306) 834-2646
	Kindersley	(306) 463-2611
	Rosetown	(306) 882-2672
	Outlook	911 or (306) 867-8676
	Central Butte	(306) 796-2190
	Craik	(306) 734-2288
	Moose Jaw	(306) 694-0200
	Regina	(306) 766-4444
	Kipling	(306) 736-2553
Fire	Macklin	911
	Kerrobert	911 or (306) 834-5330
	Kindersley	911 or (306) 463-4234
	Rosetown	911 or (306) 882-2513
	Outlook	911
	Central Butte	911 or (306) 796-2288
	Craik	911
	Moose Jaw	911 or (306) 692-2794
	Regina	911 or (306) 777-7846
	Kipling	911
National Energy Board	Calgary	1-800-899-1265
Fisheries and Oceans Canada	Bruce Howard Regina	(306) 780-8724
Environment Canada (Canadian Wildlife Service)	Girma Sahlu Regina	(306) 780-6425
Transport Canada (Navigable Waters)	Allan Cadenhead Edmonton	(780) 495-7892
Mariposa Prairie Farm Rehabilitation Administration (PFRA)	Mark Sayers (KP 347.3 to KP 348.8)	(306) 834-2853

TABLE 6D-2 Cont'd

Contact	Location	Phone Number
Progress PFRA	Joe Coleman (KP 324.5 to KP 331.3)	(306) 834-5161
Elbow PFRA	Ross Sigfusson (KP 560.4 to KP 566.4)	(306) 567-4709
SENV (Oil and Gas Coordinator)	Lorne Sullivan Saskatoon (KP 275.0 to KP 289.8 and KP 388.4 to KP 431.6) Maureen Sigmeth Swift Current (KP 289.8 to KP 388.4 and KP 431.6 to KPR 35.6) Glen Metivier Saskatoon (responsible for Melville) (KPR 35.6 to KP 945.0)	(306) 933-6532 (306) 778-8261 (306) 933-5026
SENV (Wildlife Contact)	John Pogorzelec Swift Current (KP 275.0 to KP 729.8) Adam Schmidt Melville (also responsible for Saskatoon) (KP 729.8 to KP 945.0)	(306) 778-8522 (306) 728-7487
SENV (Fisheries Contact)	Jennifer Merkowsky Saskatoon (also responsible for Swift Current) (KP 275.0 to KP 587.4) Al McCutcheon Melville (KP 587.4 to KP 945.0)	(306) 933-7943 (306) 728-7491
Saskatchewan Culture, Youth and Recreation (Heritage Resources Contact)	Carlos Germann Regina	(306) 787-5772
SWA	Bryan Ireland Moose Jaw	(306) 694-3950
Saskatchewan Emergency Management Organization	Regina	(306) 787-9563
Saskatchewan Environment - Compliance and Field Services Branch - Southern Field Services	Regina	(306) 787-1475
Area "2" Oil Spill Co-operative Chairman	Dallas Morrell	(780) 871-8737 or (306) 821-6879 (Cell)
Area "3" Oil Spill Co-operative Chairman	Gilbert Cadrain Gary Hammer	(306) 778-0234 or (306) 741-8922 (Cell) (306) 773-9381 or (306) 741-7551 (Cell)
Areas "4" and "5" Oil Spill Co-operative Chairman	Laurel Mohl Jon Hutt	(306) 456-4119 (306) 842-3088 or (306) 861-2220 (Cell)
Area "6" Oil Spill Co-operative Chairman	Scott Terlson Richard Thiele	(306) 777-9696 (306) 949-0555
Spill Emergency	Saskatchewan	1-800-667-7525 (24 hours)
Forest Fire	Saskatchewan	1-800-667-9660
Saskatchewan Air Ambulance Service	Saskatchewan	1-888-782-8247

TABLE 6D-3

MANITOBA EMERGENCY CONTACTS

Contact	Location	Phone Number
RCMP	Virden Brandon Souris Wawanesa Glenboro Somerset Morden Winkler Altona Gretna	(204) 748-2046 911 or (204) 729-2345 (204) 483-2854 (204) 483-2854 (204) 834-2131 (Carberry) (204) 822-4900 (204) 822-4900 911 or (204) 325-9990 (204) 324-5217 (204) 324-5217
Ambulance	Virden Brandon Souris Wawanesa Glenboro Somerset Morden Winkler Altona Gretna	(204) 748-3642 911 911 911 911 (204) 836-2132 (Swan Lake) 911 911 (204) 324-7373 (204) 324-7373
Hospital	Virden Brandon Souris Wawanesa Glenboro Somerset Morden Winkler Altona Gretna	(204) 748-1230 (204) 578-4000 (204) 483-2121 (204) 824-2335 (204) 827-2438 (204) 836-2132 (Swan Lake) (204) 331-8808 (204) 331-8808 (204) 324-6411 (204) 324-6411
Fire	Virden Brandon Souris Wawanesa Glenboro Somerset Morden Winkler Altona Gretna	(204) 748-1304 911 or (204) 729-2400 911 911 911 911 911 911 or (204) 325-8151 911 911
National Energy Board	Calgary	1-800-899-1265
Fisheries and Oceans Canada	Keith Kristofferson Winnipeg	(204) 984-8891
Environment Canada (Canadian Wildlife Service)	Mike Norton Edmonton	(780) 951-8687
Transport Canada (Navigable Waters)	Allan Cadenhead Edmonton	(780) 495-7892
Manitoba Conservation (Wildlife contact)	Dan Chranowski (western) Brandon Gene Collins (interlake) Gimli	(204) 726-6450 (204) 642-6077

TABLE 6D-3 Cont'd

Contact	Location	Phone Number
Manitoba Water Stewardship (Fisheries Contact)	Bruno Bruederlin Brandon	(204) 726-6452
Manitoba Culture, Heritage and Tourism (Heritage Resources Contact)	Gord Hill Winnipeg	(204) 945-7730
Manitoba Emergency Measures Organization	Winnipeg	(204) 945-5555 (24 Hour Emergency Line)
Manitoba Science, Technology, Energy and Mines - Petroleum Contacts, Field Operations	Townships North of Twp. 6 - Virden Office (KP 960 to KP 1104) Twp. 1 to 6 - Waskada Office (KP 1104 to KP 1242)	(204) 748-4260 (204) 673-2472
Manitoba Producers Oil Spill Co-operative Chairman	Jim Hay	(204) 748-3095
Manitoba Conservation - Spill Report	Manitoba	(204) 944-4888
Forest Fire		1-800-782-0076
Lifeflight Air Ambulance	Manitoba (Winnipeg)	911