2.0 PROJECT DESCRIPTION

This section describes and identifies the purpose and need for the Project, alternative means, Project location, Project components and Project phases including planning, construction, testing and start-up, reclamation and restoration, operation, decommissioning and abandonment. Figure 1.1 (Section 1.0 of this ESA) provides an overview map of the Project. Additional Project description details are provided in Volume I, Chapter 2 (Project Description).

2.1 Project Purpose

The Project is necessary to accommodate the need for increased crude oil transportation capacity between Enbridge's existing Edmonton and Hardisty terminals. The Project has been developed in conjunction with shippers to address this pipeline transportation capacity constraint. The proposed Project will enable the delivery of crude oil to other existing pipelines and facilities located in the Hardisty area, including delivery onto the Enbridge Mainline system. The proposed pipeline will also contribute to the overall economic development of the area in that increasing delivery capabilities will facilitate further long-term utilization of the Enbridge pipeline network.

2.2 Alternative Means

The proposed Project has been designed to allow increased volumes of oil to flow through the Enbridge system in this area. Only buried pipeline options realistically meet the Project need and purpose, and no existing pipelines can provide enough capacity to provide a feasible alternative for transportation between tie-in points. Additional details are provided in Volume I, Chapter 3 (Economic Feasibility, Alternatives and Justification).

The pipe size has been specifically selected to meet the design needs. Installing a smaller pipeline is not practical since it would require oil to flow at a higher pressure to accommodate the same volumes. This would result in a number of design challenges to tie the pipeline into the existing system. The proposed pipeline will be installed using standard pipeline construction methods and mitigation measures. Due to the size of the pipe, alternative means of pipe installation (*i.e.*, plowing in) are not feasible.

The proposed pipeline route is contiguous to existing linear disturbances for approximately 96.2% of its length. Paralleling the existing rights-of-way allows for a lower Project impact for the following reasons.

1. The existing pipeline rights-of-way can be used to a degree since Enbridge holds the disposition rights to that land and can ensure safe construction around their existing pipes. This will help reduce the potential effects by limiting the amount of new clearing necessary to install the pipeline.

2. Operation crews are able to monitor an additional pipeline located in a common pipeline corridor with little increase in monitoring effort.

Enbridge evaluated whether alternative routes and deviations from the existing pipeline right-of-way could meet the Project's need and purpose. The route selection process for the Project is discussed in Section 4.0 of this ESA.

2.3 Components and Location of the Project

This subsection describes and identifies the proposed location of the components of the Project, including the pipeline, pump stations and associated facilities. The components of the Project are described below.

2.3.1 Pipeline

The proposed pipeline is contiguous to existing linear disturbances for approximately 174 km (approximately 96.2%). The proposed pipe will be installed on the southwest side of the existing pipelines in the corridor for most of its length for efficiencies of construction and equipment operating logistics. The proposed route deviates from the existing rights-of-way at 12 locations, which are discussed further in Section 4.0 of this ESA. None of the deviations will be greater than 1.1 km in length.

Table 2.1 summarizes the technical details for the proposed pipeline.

TABLE 2.1

TECHNICAL DETAILS – EDMONTON TO HARDISTY PIPELINE PROJECT

Total Length:	Approximately 181 km
Length Parallel to Existing Linear Disturbance:	174.1 km (96.2%)
Length Deviating from Existing Disturbance:	6.9 km (3.8%)
Product:	crude oil
Source Point:	Tie-in at the existing Edmonton Terminal at NW 32-52-23 W4M (KPT 0.0)
Delivery Point:	Tie-in at the existing Hardisty Terminal at SE 30-42-9 W4M (KP 175.5)
Pipe Size:	914.4 mm O.D. (NPS 36)
Construction Footprint (typical) (construction right-of-way):	The construction right-of-way will typically be 45 m wide, including an approximately 10-13 m wide permanent easement. The remainder of the construction right-of-way width will be used as temporary workspace.
New Land for Facilities:	1.08 ha of land at the existing Strome Station (expansion to the north) 0.18 ha of land (total) for five sectionalizing valve sites
Extra Temporary Workspace:	Additional temporary workspace will be required at select locations to accommodate construction activities (*e.g.*, road, rail, buried utility line and water crossings; sharp sidebends; tie-ins; and locations where extra depth of cover, deep topsoil, three-lift handling or heavy grading is required). Enbridge will also acquire temporary workspace for Project construction needs such as stockpile sites, shoo-flies, and contractor staging areas.
Minimum Depth of Cover:	0.9 m
Typical Trench Width:	approximately 2 m
Test Medium:	water
Aboveground Facilities:	Remote sectionalizing valves will be installed at the following locations: Mill Creek Isolation Valve (SW 30-51-22 W4M) Amisk Creek Isolation Valve (SW 14-48-19 W4M) Highway 26 Sectionalizing Valve (SW 5-47-16 W4M) Upstream Iron Creek Isolation Valve (SW 35-44-13 W4M) Downstream Iron Creek Isolation Valve (NE 17-44-12 W4M)

Right-of-Way Width

The width of the construction right-of-way is determined based upon pipe dimensions and the space required for a safe and efficient workspace to accommodate construction materials and equipment for pipeline construction right-of-way activities. In addition, there are a number of existing pipelines in the rights-of-way being paralleled that will require extra space to work safely around. The required construction right-of-way will typically be 45 m wide to accommodate the proposed pipeline activities, construction materials, equipment and access along the right-of-way.

Within the construction right-of-way. the permanent easement is typically 10 m wide, but increases to 13 m wide between SW 36-51-23 W4M and NW 11-50-22 W4M for approximately 18.3 km where the Project parallels a Plains Midstream Canada right-of-way. The remainder of the 45 m wide construction right-of-way width will be used as temporary workspace. Temporary workspace is shared with the existing adjacent right-of-way to the extent feasible, up to 8 m wide in shared workspace. When the permanent easement and temporary workspace are taken in the entirety, it is referred to as the construction right-of-way.

Additional temporary workspace will be required at select locations to accommodate construction activities (*e.g.*, road, buried utility line and water crossings; sharp sidebends; tie-ins; and locations where extra depth of cover, deep topsoils, three-lift soils handling or heavy grading is required). Enbridge will also acquire temporary workspace for Project construction needs such as stockpile sites, shoo-flies and contractor staging areas.

Construction Methods

The width of the construction right-of-way and additional temporary workspace has been selected to accommodate storage of soil and equipment, and has taken into consideration the preferred methods of construction and topsoil salvage, discussed below. The topsoil salvage width is selected based on land use considerations, the type of equipment being used, soil types, grading requirements and the conditions at the time of construction (*i.e.*, frozen or nonfrozen, wet or dry). Mechanized welding and large

equipment is anticipated to be used to install the large-diameter pipe for this Project. Consequently, topsoil salvage widths during nonfrozen soil conditions will typically include the trench area, spoil side, travel lane and work side (*i.e.*, full right-of-way) to prevent excessive topsoil pulverization and compaction and to provide a safe working area. As stated in the Soil Survey Report (Appendix 3), full right-of-way salvage also allows construction to be completed with fewer wet weather delays (*i.e.*, reduced duration of inconvenience to landowners) with little or no chance of admixing topsoil with subsoil. However, reduced salvage widths (*e.g.*, blade width, trench area) are recommended where reduced disturbance is recommended to mitigate potential environmental or socio-economic impacts. Selected locations include, but are not limited to, native prairie, rare plant occurrences, wetlands, and where requested on the Line List (*e.g.*, to reduce or avoid impacts to ornamental trees, windbreaks, hedgerows, shelterbelts and yards). Blade width salvage is also recommended on all land uses during frozen soil conditions. Horizontal directional drilling (HDD) or boring of roads, watercourses, wetlands and other selected features is a construction method that will be used where appropriate and economically feasible. These trenchless techniques involve substantial additional temporary workspace requirements on the adjacent lands. The recommended topsoil salvage widths are provided in the Project-specific Environmental Protection Plan (EPP) and on the Environmental Alignment Sheets (Appendices 1A and 2 of the ESA, respectively). The EPP also includes an appendix for Criteria for Alternate Topsoil Salvage Widths. Volume I, Chapter 8 of the Project Application includes drawings that illustrate the proposed right-of-way configurations for the proposed Project.

2.3.2 Permanent Facilities

Three new electrically-driven pump stations and additional facilities and infrastructure will be constructed as part of the Project. A description of the associated facilities to be constructed is provided below and the locations of these activities are shown on Figures 1.2 through 1.5. All facilities will be installed within the boundaries of existing Enbridge terminals/stations, with the exception of the work at Strome Station, which will require new land immediately north of the existing fenced boundary and the road bore connecting the Edmonton terminal.

<u>Edmonton Terminal Initiating Pump Station Scope: NW 32-52-23 W4M</u>

- Four new pump assemblies using approximately 4,519 kW (6,060 Hp) pumps with 4,996 kW (6,700 Hp) motors, including a pump shelter (approximately 34 m x 17.4 m x 7 m).
- Four new 5,220 kW (7,000 Hp) variable frequency drives (VFDs) for each pump assembly (approximately 10.5 m x 4.4 m x 5.1 m).
- New electrical services building (ESB) approximately 19.3 m x 6.1 m x 5.1 m and electrical building (approximately 18 m x 4.4 m x 5.1 m), with power and station controls.
- Install new 914.4 mm O.D. (NPS 36) sending trap.
- Interconnecting piping and valves, manifolds, and pressure control and relief systems, and required electrical power components.
- Permanent access roads within the facility site.

<u>Addition to the Existing Strome Pump Station Scope: SW 2-46-15 W4M</u>

- Four new pump assemblies using approximately 4,519 kW (6,060 Hp) pumps with 4,996 kW (6,700 Hp) motors, including a pump shelter (approximately 34 m x 17.4 m x 7 m).
- Four new 5,220 kW (7,000 Hp) VFDs for each pump assembly (approximately 10.5 m x 4.4 m x 5.1 m).
- New ESB approximately 19.3 m x 6.1 m x 5.1 m and electrical building approximately 18 m x 4.4 m x 5.1 m with power and station controls.

Addition to the Existing Kingman Pump Station Scope: SE 5-49-20 W4M

- Four new pump assemblies using approximately 4,519 kW (6,060 Hp) pumps with 4,996 kW (6,700 Hp) motors, including a pump shelter (approximately 34 m x 17.4 m x 7 m).
- Four new 5,220 kW (7,000 Hp) VFDs for each pump assembly (approximately 10.5 m x 4.4 m x 5.1 m).
- New ESB approximately 19.3 m x 6.1 m x 5.1 m and electrical building approximately 18 m x 4.4 m x 5.1 m with power and station controls.

Associated Facilities and Infrastructure

At the existing Edmonton Terminal (NW 32-52-23 W4M and SE 5-53-23 W4M):

- One new booster pump assembly using approximately 1,119 kW (1,500 Hp) pump and motor.
- One existing booster pump assembly using approximately 1,119 kW (1,500 Hp) pump and motor.
- One new 1,110 kW (1,500 Hp) dedicated VFD.
- One existing 1,110 kW (1,500 Hp) dedicated VFD.
- An approximately 600 m interconnecting transfer line (914.4 mm O.D.) from SE 5-53-23 W4M to NW 32-52-23 W4M.
- Interconnecting piping (including a road bore under Baseline Road), valves, pressure control and relief systems, and required electrical power components.

At the existing Hardisty Terminal (SE 30-42-9 W4M):

- New 914.4 mm O.D. (NPS 36) receiving trap.
- Interconnecting piping, valves, pressure control and relief systems.
- Modifications and additions to existing pipe racks.
- Modifications to existing electrical infrastructure to support all new facilities.

2.3.3 Temporary Facilities

In addition to the pipeline and associated facilities described above, the following temporary facilities will be required during construction of the Project:

- stockpile sites;
- temporary bridges for watercourse crossings;
- road upgrades, new temporary access roads (shoo-flies); and
- contractor staging areas.

All temporary workspace and temporary facility site locations will require the approval of Enbridge's Environmental Inspector or Environment Project Lead. All temporary facility sites will be reviewed from an environmental perspective by Enbridge and their representatives prior to their use. Temporary facilities will be located within existing industrial areas to the extent feasible, and will be reclaimed following construction as part of final clean-up and reclamation activities.

2.4 Construction

2.4.1 Pipeline Construction Activities

Table 2.2 of this ESA describes standard activities and typical equipment requirements for construction of the pipeline. These activities are generally presented in the order of occurrence during construction. All of these activities are considered in the environmental and socio-economic effects assessment (see Section 6.0 of this ESA).

TABLE 2.2

PIPELINE CONSTRUCTION ACTIVITIES

Pipeline Construction Phase	Associated Activities
Engineering	The pipeline and associated appurtenances will be designed and constructed in accordance with all applicable regulations, industry and company standards.
Construction Survey	Activities include line-of-sight clearing with chain saws (where needed), flagging and staking of the boundaries of the proposed construction right-of-way and temporary workspace, as well as marking the trench line and existing utilities. Avoidance areas, such as protected habitats or rare plants, will also be appropriately fenced or flagged.
Clearing	Snow, if present, trees, stumps, brush, crops and other vegetation will be generally cleared or mowed from the proposed construction right-of-way and temporary workspace. Nonsalvageable vegetative debris will be burned or chipped. Equipment used during clearing activities may include chainsaws, rotary grinders, feller-bunchers, hydro-axes or other tree-clearing and brushing equipment, as well as skidders, bulldozers and backhoes.
Topsoil Salvage	Topsoil will be salvaged to ensure that the soil productivity is maintained. The width and depth of topsoil salvage depend on a number of factors including the land use, soil conditions, microtopography, landowner requests and grading requirements. Equipment used during topsoil handling activities may include bulldozers, graders and backhoes.
Grading	Grading of a portion of the right-of-way from NE 32-52-23 W4M to SW 1-50-22 W4M (KP 0.4 to KP 33.8) may commence in August 2013 concurrent with grading activities for the proposed Line 2 Replacement Project, which will parallel the proposed pipeline in this area. If this is not feasible due to landowner concerns or construction feasibility, grading for the Project will commence in August 2014. Following topsoil salvage, grading will be conducted on irregular ground surfaces (including temporary workspace) to provide a safe work surface. Graders, backhoes and bulldozers will be used for this activity. Ripping may be necessary if hard bedrock is encountered.
Stringing and Welding	The pipe will be transported by truck from stockpile sites to the proposed right-of-way. The pipe will be bent, lined-up, welded, joint-coated and inspected, prior to being lowered into the trench. Is it anticipated that mechanized welding will be used. Other equipment used during stringing and welding activities includes pipe trucks, booms, pick-up trucks, excavators and x-ray or ultrasonic inspection equipment mounted on pick-up trucks or skids.
Trenching	The trench will be excavated using tracked excavators or wheel ditchers to a depth sufficient to ensure the depth of cover is in accordance or in excess of applicable codes. The minimum depth of cover for the pipeline will be 0.9 m. Road crossings will generally be bored.
Lowering-In	The pipe will be lowered into the trench using sideboom tractors. Trench dewatering may be necessary at certain locations during lowering-in (*e.g.,* to ensure acceptable bedding for pipe, to prevent the pipe from floating or for performing tie-in welds).
Backfilling	Prior to backfilling, subsurface erosion control structures such as trench breakers will be installed on steep slopes or long continuous slopes, along with subdrains, where warranted, to control subsurface drainage along the trench. The trench will be backfilled using backhoes, graders, bulldozers or specialized backfilling equipment. Backfill material will generally consist of native trench spoil material. Displaced subsoil will be crowned over the trench to compensate for settlement and any excess trench spoil will be feathered-out over adjacent portions of the proposed right-of-way where topsoil salvage has occurred. Padding may be necessary in areas of rock.
Testing	The proposed pipeline will be hydrostatically pressure-tested in accordance with the requirements of Canadian Standards Association (CSA) Z662-11, OPR 99, provincial codes of practice and guidelines. The pipeline will be pressure tested in sequential segments, using water. Source water is likely to be drawn from Joseph Lake and the unnamed wetland at NW 10-43-10 W4M (connected to wetland crossing at KP 168.1). Upon completion, test water will be returned to the appropriate watersheds in accordance with Code of Practice requirements. A detailed hydrostatic test plan will be developed and reviewed prior to the start of the hydrostatic pressure testing program.
Clean-Up and Reclamation	Initial clean-up and reclamation activities along disturbed portions of the proposed pipeline construction right-of-way and temporary access trails (shoo-flies) will be initiated following backfilling, once weather and soil conditions permit, as described in Appendix 1A of this ESA. Garbage or debris remaining following construction will be removed and disposed of in compliance with local regulations. Clean-up and reclamation activities for a portion of the right-of-way from NE 32-52-23 W4M to SW 1-50-22 W4M (KP 0.4 to KP 33.8) may be conducted concurrent with clean-up and reclamation activities for the proposed Line 2 Replacement Project, which will parallel the proposed pipeline in this area. The construction right-of-way will be returned to a stable condition. The topsoil will be replaced, with cross ditches and diversion berms installed, where warranted, on moderate and steep slopes to reduce the risk of erosion. All disturbed, noncultivated, upland areas will be seeded with an appropriate seed mix.

TABLE 2.2 Cont'd

Pipeline Construction Phase	Associated Activities
Watercourse Crossings	Options available for crossing watercourses include trenched (*e.g.*, isolation [dam and pump, flume] and open cut) and trenchless (horizontal directional drill [HDD] and bore) methods. See Table 6 of Appendix 6 of this ESA for more information. The crossing method chosen will be based on the width, streamflow, channel morphology, sensitivity and approach slopes.

2.4.2 Permanent Pipeline-Related Facilities Construction Activities

Permanent pipeline-related facilities associated with the Project include remote sectionalizing valves along the proposed pipeline route. Permanent pipeline-related facilities will be constructed as an integrated part of the pipeline construction.

2.4.3 Pump Station/Terminal Construction Activities

Table 2.3 of this ESA describes standard activities and typical equipment requirements for the proposed pump stations and terminal facilities.

TABLE 2.3

CONSTRUCTION ACTIVITIES FOR PUMP STATION/TERMINAL FACILITIES

Pump Station/Terminal Construction Phase	Associated Activities
Engineering	The proposed pump stations, booster pump and other facilities will be designed and constructed in accordance with all applicable standards.
Site Preparation	Site preparation will involve clearing of vegetation where present, salvaging of topsoil and grading of the site, where warranted, using equipment similar to that described for construction of the pipeline. Site preparation will likely commence in Q1 2014 pending regulatory approval. Topsoil will be stored within the existing stations in areas set aside for long-term storage berms.
Pumps and Facilities	Activities include installing mainline pumps, a booster pump, motor units, VFDs, substations, sending and receiving traps.
Electrical and Piping Connections	Piping between the Edmonton Terminal sites (SE 5-53-23 W4M and NW 32-52-23 W4M) and at Hardisty Terminal (SE 30-42-9 W4M and NE 19-42-9 W4M) will be located adjacent to existing pipeline rights-of-way or on existing facility sites. The electrical and piping connections will be completed once the associated facilities are installed.
Testing	All piping will be pressure tested during fabrication and/or in the field after installation.
Clean-Up and Reclamation	The area around the proposed pump stations and associated facilities will be recontoured and a gravel surface will be placed or restored over high traffic areas.

2.4.4 Temporary Facility Construction Activities

Temporary facilities will be used solely during the construction phase of the Project and are related to the construction of the pipeline. Table 2.4 of this ESA describes the activities associated with the construction, operation and decommissioning of facilities such as stockpile and staging areas, off-load areas and temporary access roads.

TABLE 2.4

CONSTRUCTION ACTIVITIES FOR TEMPORARY FACILITIES

Temporary Facility	Associated Activities
Construction	
Engineering	The temporary facilities will be designed and constructed in accordance with all applicable CSA standards, as well as federal, provincial and municipal requirements and conditions of permits or authorizations.
Site Preparation	Initial site preparation will involve clearing of vegetation where present, salvaging of topsoil and grading of the site, where warranted, using equipment similar to that described for construction of the pipeline.
Facility Construction	Sites may be gravelled and/or fenced, depending on use of the site.

TABLE 2.4 Cont'd

Temporary Facility	Associated Activities
Operation	
Access	Access to the various types of temporary facilities will be controlled during use of the site, if warranted, for public safety and to prevent vandalism of equipment and/or facilities.
Decommissioning	
Facility Dismantle	Any aboveground structures (*e.g.*, fencing, buildings) will subsequently be dismantled and removed from the site. Access roads and associated gravel will also be removed.
Reclamation	Reclamation procedures will be initiated following the dismantling of aboveground structures using bulldozers, backhoes and graders. Garbage or debris remaining at the temporary facility site will be removed and disposed of in compliance with local regulations. The site contours will be returned to a stable and maintenance-free condition. Depending on the intended land use of the site, topsoil will be replaced where salvaged and disturbed areas will be seeded with an appropriate seed mix.

2.4.5 Estimated Workforce Requirements

Construction will be conducted in up to three spreads. The construction spreads will require approximately 500 workers per spread. At the peak of work from September 2014 to October 2014, approximately 1,500 workers are expected. Operation of the Project will be integrated with the existing Enbridge operations.

2.4.6 Environmental Permits/Approvals

The environmental permits and approvals that will be obtained prior to the commencement of construction activities are identified in Table 2.5. In the case that the agencies responsible for issuing certain permits or approvals change prior to the anticipated construction date, Enbridge will abide by the regulations in effect at that time or will consult with the agency in question to determine the appropriate process to follow.

TABLE 2.5

ENVIRONMENTAL PERMITS/APPROVALS

Agency	Permit, Approval, Authorization and/or Notification
FEDERAL	
NEB	Pipeline: CPCN pursuant to Section 52 of the *NEB Act* and Leave to Open pursuant to Section 47 of the *NEB Act* Pump Stations and Associated Facilities: Order pursuant to Section 58 of the *NEB Act*
DFO*	Notification or, if warranted, authorization under Section 35(2) and 32 of the *Fisheries Act*
Transport Canada*	Approval under Section 108 of the *NEB Act* or Section 5(1)(a) of the *NWPA*
	*Regulation requirements of some federal legislation are evolving and actual permitting requirements will be confirmed through continuous consultation with the regulators.
PROVINCIAL	
AESRD	Public Land Agreement (Pipeline Land Agreement [PLA]) on Crown land
	Water Act approval for construction within a water body at the Edmonton Terminal Notification under the *Code of Practice for Watercourse Crossings* Notification under the *Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body* Notification under the *Code of Practice for the Temporary Diversion of Water for Hydrostatic Testing of Pipelines* Registration under the *Code of Practice for the Release of Hydrostatic Test Water from Hydrostatic Testing of Petroleum Liquid and Gas Pipelines*
Alberta Culture	*Historical Resources Act* Clearance

Other environmental permits that may be required during a specific construction activity at a specific location along the proposed pipeline route or at facility sites are presented in Table 2.6.

TABLE 2.6

OTHER POTENTIAL ENVIRONMENTAL PERMITS/APPROVALS

Agency	Permit, Approval, Authorization and/or Notification
FEDERAL	
Canadian Transportation Agency	Approvals and/or exemptions under Section 24 of the *Railway Safety Act* and Section 101 of the *Canada Transportation Act*
Environment Canada	Permit or agreement, if warranted, under Section 73(1) of *SARA*
PROVINCIAL - ALBERTA	
AESRD	Hauling permit Fish Research Licence (FRL) for fish rescue at isolated crossings Temporary Field Authorization (TFA) on Crown land Burning Permits Wildlife Damage Permits for beaver, lodge and beaver dam removal
Alberta Infrastructure	Consent for use of the TUC
Alberta Transportation	Roadside Development Permit at provincial highways
Counties	Local Development and Building Permits, Herbicide Permits, Burning Permits, Excavation Permits, Road Crossing Permits, Utility Crossing Permits

2.4.7 Construction Schedule

The Project schedule has been developed assuming that all of the requisite federal, provincial and municipal regulatory approvals authorizing the overall construction of the pipeline will be received by August 2014. Detailed engineering is underway and it is expected that design activities, including procurement of materials, will continue through to the start of major construction in August 2014.

Construction activities related to the proposed pump stations and associated facilities will also commence upon receipt of NEB approvals. Construction of the pump station and facilities is expected to commence as early as Q1 2014.

Pipeline construction activities are progressive, commencing with survey and right-of-way preparation and continuing through pipe stringing, welding, pipe inspection, trenching, lowering-in, backfilling, clean-up and reclamation (Table 2.7). Construction will be conducted in up to three spreads. Spread 1 will be constructed from west to east from Edmonton Terminal to KP 33.8 (SW 1-50-22 W4M) near Joseph Lake. Spread 2 will also be constructed from west to east from KP 33.8 (SW 1-50-22 W4M) to Strome Station near KP 112 (SE 2-46-15 W4M). Spread 3 will be constructed from east to west from Hardisty Terminal back to Strome Station.

Enbridge is proposing to construct the Edmonton to Hardisty Pipeline Project adjacent to the proposed Line 2 Replacement Project route for approximately 38 km from the Edmonton Terminal at NW 32-52-23 W4M (KPT 0) to a valve site in SW 1-50-22 W4M (KP 33.8). Pending regulatory approval, construction of the Line 2 Replacement Project is scheduled to commence in August 2013, with the construction of the Edmonton to Hardisty Pipeline Project following approximately one year later in August 2014.

Where the Edmonton to Hardisty Pipeline Project parallels the Line 2 Replacement Project, the two pipelines will share a 35 m common construction right-of-way. Enbridge will salvage topsoil and grade the Line 2 Replacement Project 45 m wide construction right-of-way in 2013 and will leave the topsoil windrowed. In 2014, the topsoil piles will be set back to the edge of the Edmonton to Hardisty Pipeline Project right-of-way, and the additional 10 m of topsoil salvage and grading will be completed. Topsoil replacement and reclamation of the combined 55 m Footprint will be completed together upon the completion of the Project.

If the above mentioned soils handling plan is not feasible due to landowner concerns or construction feasibility, topsoil salvage and grading will be conducted for the Project in August 2014.

For any given location on the right-of-way, the average duration crews will be working is approximately two months. Tie-in locations generally take longer to complete construction since they are routinely completed last immediately before and after testing. Certain late stage activities such as testing and final

clean-up may be postponed until suitable weather and soil conditions occur. Construction activities are expected to occur over a four month period. The pipeline is expected to be in-service by early 2015.

TABLE 2.7

EXPECTED DURATION OF MAJOR CONSTRUCTION AND OPERATION ACTIVITIES

Major Activity	Expected Duration of Major Activity
PIPELINE CONSTRUCTION (per spread)	4 months
Preclearing/Premowing	4 weeks
Surveying	Continuous for 4 months
Clearing	2 weeks for the spread where the proposed route parallels the Line 2 Replacement Project 4 weeks for the remainder of the proposed route (*i.e.*, each of the other 2 spreads)
Topsoil Salvage	4 weeks for the spread where the proposed route parallels the Line 2 Replacement Project 4 weeks for the remainder of the proposed route (*i.e.*, each of the other 2 spreads)
Grading	2 weeks where the for the spread where the proposed route parallels the Line 2 Replacement Project 4 weeks for the remainder of the proposed route (*i.e.*, each of the other 2 spreads)
Stringing and Welding	2 months
Trenching	3 months
Lowering-in	3 months
Backfilling	3 months
Testing	Over a period of 2 months
Clean-up and Reclamation	3 months
NEW PUMP STATIONS (per site, Edmonton Terminal, Kingman Station and Strome Station)	15 months
NEW BOOSTER PUMP (Edmonton Terminal)	15 months
PUMP FACILITIES MODIFICATIONS AT EXISTING STATIONS (per station)	15 months
OPERATIONS	30+ years
Line Patrols	Once every two weeks
Facility Inspections	In accordance with the preventative maintenance schedule

2.5 Operation and Ongoing Maintenance

Pipeline and right-of-way operations and maintenance activities that could result in potential environmental effects are described below.

TABLE 2.8

OPERATION AND MAINTENANCE ACTIVITIES

Operation and Maintenance Phase	Associate Activities
Line Patrols	As part of routine operation and maintenance procedures, aerial and ground patrols will be conducted to visually inspect for: environmental monitoring issues; evidence of pipeline damage; erosion and wash-out areas; areas of sparse vegetation; damage to permanent erosion control structures; exposed pipe; and other potential problems that may affect the integrity and safe operation of the pipeline. In addition, pipeline markers and signs will be inspected, and maintained or, if necessary, replaced, as necessary, to ensure the pipeline location is visible.
Vegetation Management	A Weed and Clubroot Management Plan has been prepared for the Project and is provided in the Pipeline EPP (Appendix D2 of Appendix 1A of this ESA). In addition, Enbridge will implement their Vegetation Management Guide (Enbridge 2010) during operation to effectively control the growth of vegetation on the proposed construction right-of-way using the most environmentally appropriate and economical vegetation management methods. The Enbridge Vegetation Management Guide provides information on various control methods and proven vegetation management techniques. The pipeline right-of-way and any other areas not needed for ongoing operation and maintenance will be specifically managed to revert to a natural vegetative state where feasible or in accordance with landowner agreements. Vegetation control (including weeds) will be conducted in accordance with requirements from the appropriate government authority on an as needed basis as well as comply with the *Alberta Weed Act*.

TABLE 2.8 Cont'd

Operation and Maintenance Phase	Associate Activities
Maintenance Digs	In-line inspection tools will periodically inspect the operating pipeline. In the event that an actual or suspected pipeline integrity problem is identified, the pipeline will be exposed and inspected visually. Repairs will be made if needed. Maintenance digs will be conducted in a manner similar to the pipeline construction activities (*i.e.*, topsoil and subsoil will be salvaged and stockpiled separately, subsoil will be backfilled and topsoil will be feathered-out; and the site will be reseeded and reclamation will be conducted).
Cathodic Protection	The pipeline will be cathodically protected to prevent or limit external corrosion of the pipeline. In the event that an actual or suspected pipeline integrity problem is identified, the pipeline will be exposed and inspected visually. Repairs will be made if needed (see *Maintenance Digs* above).

Enbridge's current systems that manage the safe operation and long-term integrity of its existing pipelines and facilities will be expanded to include the proposed Project. Operations and maintenance activities will include regular aerial and ground patrol programs along the right-of-way and at associated facilities. Flow in the new pipeline will be remotely monitored and controlled at the existing Enbridge control centre. No new pipeline maintenance bases will be required. Enbridge is an active participant in oil spill and emergency response exercises, and has detailed emergency response plans in place which will be updated to include this Project (see Section 8.2 of this ESA).

Enbridge conducts periodic patrols of its facilities. All pipeline patrols are conducted by personnel familiar with the location and operation of the facilities.

The new pipeline will have an integrity management plan ensuring the ongoing requirements of this pipeline and facilities are met throughout their respective service lives. Internal inspection is an integral part of Enbridge's current Integrity Management Program (IMP). The proposed in-line inspection tools will regularly inspect the pipeline for internal and external corrosion, dents and cracks that could lead to a failure in the pipeline. In addition, the threat of external corrosion will also be mitigated by means of a cathodic protection system in the event of coating damage or disbondment.

2.5.1 Environmental Permits

Operation and maintenance activities associated with the new pipeline may require permits or approvals depending on the nature and location of the activity. Routine operation and maintenance activities will be evaluated by the NEB as part of the Section 52 Application for Project construction and operation. For those activities listed under Section 4.1 of the *Operations and Maintenance Activities on Pipelines Regulated under the NEB Act: Requirements and Guidance Notes* (NEB 2005), Enbridge will provide notification to the NEB as required. Depending on the scope and location of planned operation and maintenance activity, Enbridge will also seek, where required, approval from other applicable federal, provincial and municipal agencies.

2.5.2 Operation Schedule and Workforce

In-service operation of the pipeline is planned for early 2015. No new permanent positions will be required during operation of the proposed pipeline.

2.6 Decommissioning and Abandonment

It is difficult at this time to predict when or how the pipeline and facilities will be decommissioned and abandoned at the end of the Project's useful life. In May 2011, Enbridge filed with the NEB physical plans for abandonment as part of the NEB's Land Matters Consultation Initiative. The document contains assumptions for the types of facilities that would be abandoned in place, abandoned in place with special treatment or removed. The methods of abandonment that will ultimately be implemented for the Project will be determined at the time the pipeline is removed from operation; however, those determinations will be based on the most current sound scientific studies and accepted industry practice at that time. Any decommissioning or abandonment activities will require prior approval by the NEB and other applicable agencies. Decommissioning and abandonment is discussed further in Section 6.0 of the ESA, and also in Volume I, Chapter 2 (Project Description) and Chapter 10 (Economics).

2.7 References

Enbridge Pipelines Inc. 2010. Enbridge Liquid Pipelines Canada Vegetation Management Guide.

National Energy Board. 2005. Operations and Maintenance Activities on Pipelines Regulated under the National Energy Board Act: Requirements and Guidance Notes. Calgary, Alberta.

Pipeline Abandonment Legal Working Group. 1997. Legal issues relating to pipeline abandonment: a discussion paper. May 1997. Calgary, Alberta. 79 pp.

Pipeline Abandonment Steering Committee. 1996. Environmental and technical issues associated with pipeline abandonment – discussion paper. Calgary, Alberta.

3.0 CONSULTATION AND ENGAGEMENT

The consultation program for the proposed Project was established to provide landowners, government agencies, stakeholders, Aboriginal communities and nongovernment organizations (NGOs) an opportunity to become informed about and engaged with the Project at the earliest possible stage to address or resolve issues and concerns through an open and collaborative process. Section 3.0 of this ESA summarizes the objectives of the consultation and engagement program and key issues identified through the process. The consultation conducted in association with the preparation of this ESA was designed to complement the Enbridge Consultation Program (Volume I, Chapters 4 and 5).

3.1 Consultation Objectives

The objectives of consultation were to:

- seek landowner consent;
- share information about the Project, the proponent and the regulatory process;
- assist in the identification of potential effects of the Project;
- encourage participation in the development of mitigation measures; and
- obtain input from federal and provincial regulatory agencies on the Project design and ESA requirements.

3.2 Government and Nongovernment Consultation

Enbridge's consultation program involves a number of means of identifying public concerns associated with the proposed Project. Contact with government and nongovernment agencies took the form of letters, email, telephone discussions and meetings. Open houses were held in Hardisty on November 6, 2012 in Daysland on November 7, 2012 and in Sherwood Park on November 8, 2012. All concerns identified during open house consultation will be addressed by Enbridge. A summary of Enbridge's consultation with local governments, licensed tenure holders, government agencies, NGOs and Aboriginal communities and organizations is provided in Volume I, Chapters 4 and 5. The Project toll-free line and e-mail address provide an additional avenue for stakeholders to seek information, ask questions and express concerns.

3.3 Consultation with Provincial and Federal Agencies

Consultation with federal and provincial agencies was initiated in June 2012; selected agencies were contacted to review proposed survey methodologies prior to conducting field work. As part of the ESA process, the Project was introduced to all relevant provincial and federal agencies in September 2012 and the opportunity to discuss potential issues and concerns was provided. Information letters related to the ESA were sent to relevant federal and provincial agencies with jurisdiction along the proposed route in September 2012 to ensure that their concerns, if any, were addressed. Government representatives were informed of the location and construction schedule of the proposed Project. Representatives were requested to identify any concerns and to provide information that might influence the routing, construction or operation of the proposed Project. Consultation involved collecting baseline environmental data, discussion of any Project concerns and recommended mitigative measures Follow-up meetings were held with several of the agencies in September and October 2012. Table 3.1 of this ESA provides a summary of communications and consultation activities that have been carried out with provincial and federal government agencies to date. Project updates will be provided on a regular basis to interested agencies and subsequent meetings arranged when warranted.

3.4 Consultation with Municipal and Nongovernment Agencies

TERA, on behalf of Enbridge, contacted municipal agencies and NGOs anticipated to have environmentally or socio-economically-related interests in the Project area in September 2012. Municipal and NGO representatives were informed of the location and construction schedule of the proposed Project. Representatives were requested to identify any concerns and provide information that might

influence the routing, construction or operation of the proposed Project. Table 3.2 of this ESA provides a summary of communications and consultation activities that have been conducted with municipal agencies and NGOs to date. Project updates will be provided on a regular basis to interested agencies and subsequent meetings arranged when warranted.

3.5 Aboriginal Engagement

Enbridge is committed to on-going consultation with Aboriginal groups in the vicinity of the Project. The Aboriginal Engagement Program for the Project was guided by the Enbridge Aboriginal Affairs Group. The primary criteria used by Enbridge to determine which Aboriginal communities to engage with respect to the Project included:

- proximity of Aboriginal communities to the proposed route (*i.e.*, First Nation whose reserve lands are within approximately 75 km of the Project and Métis regional boundaries traversed by the Project); and
- Enbridge's knowledge of the Aboriginal communities in the area, based on its history of project development and operating pipelines and facilities.

The proposed pipeline route traverses the eastern portion of Treaty 6 in central Alberta. Treaty 6 includes most of central Alberta and a substantial portion of central Saskatchewan. There are 17 First Nations in Treaty 6 in Alberta.

The Métis Nation of Alberta is one of the political representative organizations for the Métis people of Alberta. Métis people residing in central Alberta who are members of the Métis Nation of Alberta are represented by Regional Councils in Zones II and IV.

Based on the above criteria, the focus of Enbridge's primary consultation activities has been with the following Aboriginal communities:

- Alexander First Nation;
- Alexis Nakota Sioux Nation;
- Enoch Cree Nation;
- Ermineskin Tribe;
- Louis Bull Tribe;
- Montana First Nation;
- Paul First Nation;
- Samson Cree Nation;
- Métis Nation of Alberta - Zone II Regional Council; and
- Métis Nation of Alberta - Zone IV Regional Council.

The Aboriginal Engagement Program for the Project has and will continue to involve a number of activities including: mail outs of letters and Project information materials; face-to-face meetings; and on-going issues tracking and follow-up activities.

Details of the consultation and engagement program are provided in Volume I, Chapters 4 and 5 of the Project Application.

3.6 Summary of Outcomes of the Consultation Program

The results of consultation and engagement have helped refine the ESA for the Project. With this information, Enbridge identified issues, addressed concerns and responded to questions. Consultation and engagement have also provided communities and government agencies with an understanding of the Project. Results of the consultation and engagement program have been considered and incorporated throughout the ESA where relevant, including the effects assessment and mitigation and enhancement measures. Enbridge will continue to work with government and nongovernment agencies to identify and address environmental issues and concerns with the objective of resolving these issues and concerns in a manner that meets the interests of all parties. Details of the outcomes of the consultation and engagement program are provided in Volume I, Chapters 4 and 5.

3.7 Traditional Ecological Knowledge and Traditional Land Use

The proposed pipeline route traverses approximately 169.9 km (93%) of privately-owned land. The current land tenure and land use precludes, to a large extent, the possibility of traditional activities being practiced on the lands in question. Most of the proposed pipeline route parallels the existing Enbridge pipeline corridor. Enbridge has a history of operating pipelines and facilities in this area for more than 50 years. During this time, Enbridge has not been made aware of any current use of these lands for the purposes of exercising traditional rights or activities. Furthermore, throughout the course of its relationships with stakeholders and Aboriginal communities in the area, Enbridge has not been made aware of any concerns specifically related to its operations in this area.

The areas of Crown land crossed by the proposed route and the Battle River have potential for practicing traditional use activities (*e.g.,* berry picking). Through the consultation process to date, Aboriginal communities have noted that the potential for heritage sites of interest exists in the vicinity of the Hardisty Terminal area. Enbridge will work with Aboriginal communities to identify and address any TLRU issues and concerns with the objective of mitigating these issues and concerns, to the extent possible, in a manner that meets the interests of all parties. Enbridge will review and consider specific community proposals to review areas of Crown land crossed by the proposed pipeline route where proposals are reasonable and appropriate.

TABLE 3.1

CONSULTATION ACTIVITIES WITH FEDERAL AND PROVINCIAL AUTHORITIES

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcome/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
Federal							
Transport Canada	Heather Daymond, Administrative Clerk	Phone Letter	July 5, 2012 Sept. 12, 2012	Called to discuss the field assessment methodologies for the Project. Enbridge provided a brief project description and requested comments and recommendations regarding the Project.	In the field, all waterbodies should be assessed from a navigable waters perspective.	Seek confirmation of navigability on crossings not previously reviewed by Transport Canada.	Section 6.0, Aquatic Assessment
Environment Canada	Paul Gregoire, Senior Wildlife Biologist	Email Letter Meeting	Aug. 15, 2012 Sept. 12, 2012 Sept. 17, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project.	Environment Canada provided information about the regional guidelines related to the migratory bird timing restrictions and setbacks.	Wildlife timing constraints and setbacks were considered during Project planning.	Section 6.0, EPP
DFO	Brian Mackowecki, Jason Shpeley and Brandi Mogge	Meeting	Sept. 6, 2012	Enbridge provided a brief project description and summary of aquatic assessment results and a draft water crossing list. Discussed permitting requirements for the Project.	No concerns with the water crossings as proposed. From a preliminary review of the watercourse crossings it was discussed that a Letter of Advice should suffice for the Project.	DFO requested that Enbridge provide the watercourse mitigation once the EPP was complete.	Section 6.0, Aquatic Assessment
DFO	Habitat Management Department	Letter	Sept. 24, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project.	None	None	N/A
DFO	Jason Shpeley	Email	Oct. 5, 2012	DFO acknowledged receipt of letter.	Mr. Shpeley will be the Project contact.	None	N/A
Provincial							
AESRD	Lonnie Bilyk, Resource Data Biologist	Email Email	June 20, 2012 June 25, 2012	TERA requested Fisheries and Wildlife Management Information System (FWMIS) data.	AESRD provided FWMIS data.	None	N/A
AESRD	Larry Kuchmak, Surface Water Specialist	Phone Letter Meeting	July 3, 2012 Sept. 12, 2012 Sept. 17, 2012	Requested comments on field methodologies. Enbridge provided a brief project description and requested comments and recommendations regarding the Project. Planning and consultation meeting in regards to AESRD expectations, and any permits and/or *Water Act* approval required.	Assessments of waterbodies at multiple times of the year may be warranted as conditions may change over the seasons. *Water Act* approval is required at the Edmonton Terminal.	Prepare Code of Practice notifications for wetlands that are Class II and above, plus mineral wetlands.	Aquatic Assessment, Section 6.0, EPP
AESRD	Lisa Rombough, Water Administration Technologist	Phone Meeting Phone	Aug. 31, 2012 Sept. 17, 2012 Oct. 4, 2012	Planning of face to face meeting with respect to the Project.	See comments regarding meeting with Mr. Kuchmak.	None	N/A

TABLE 3.1 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcome/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
AESRD	Angela Fulton, Water Team Lead	Letter Meeting	Sept. 12, 2012 Oct. 3, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project. Planning and consultation meeting in regards to AESRD expectations, and any permits and/or *Water Act* approvals required.	Concerns were expressed over water withdrawal on the Battle River. Withdrawal limits were sent to Enbridge. No reply to AESRD required – Enbridge agreed to comply with appropriate legislature.		N/A
AESRD	Mary Stewart, Municipal Approvals Engineer	Meeting	Oct. 3, 2012	See comments regarding meeting with Ms. Fulton.	See comments from meeting with Ms. Fulton.	See comments from meeting with Ms. Fulton.	N/A
AESRD	Delaney Anderson, Wildlife Biologist	Letter Phone	Sept. 12, 2012 Sept. 27, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project. Discussed results of wildlife survey, mitigation and the wetland at Edmonton Terminal.	No concerns, but will likely have more comments once more information is received about the detailed construction plans and mitigation regarding the wetland at Edmonton Terminal.	None	N/A
AESRD	Reg Russell, Senior Wildlife Technician	Letter Phone	Sept. 12, 2012 Sept. 20, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project. Discussed pipeline construction scheduling and wildlife timing constraints. Also discussed the Protective Notation (PNT) 030043 (Ungulate Habitat Protection Area) located at NW 11-50-22 W4M.	No additional clearing within this PNT is permitted without the consent of AESRD.	Consultation with AESRD regarding the PNT is ongoing – see Mr. Nahirniak (below).	Section 6.0, Wildlife Report
AESRD	David Moore, Area Wildlife Biologist	Letter Phone Phone	Sept. 12, 2012 Sept. 25, 2012 Oct. 12, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project. Discussed PNT 030043 (NW 11-50-22 W4M).	Discussed wildlife species at risk mitigation and wetlands. AESRD requested a January 1 to March 31 timing restriction within PNT 030043 (NW 11-50-22 W4M).	Wildlife timing constraints and setbacks were considered during Project planning.	Section 6.0, EPP
AESRD	Jason Cooper, Fisheries Biologist	Letter	Sept. 12, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project.	None	None	N/A
AESRD	Daryl Watters, Senior Fisheries Technician	Letter Phone	Sept. 12, 2012 Oct. 1, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project.	No concerns	None	N/A
AESRD	Cody Nahirniak, Lands Management Specialist	Letter	Sept. 12, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project.	Consultation with AESRD is ongoing.	None	N/A

TABLE 3.1 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcome/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
AESRD	Lorne Cole, Lands Division	Letter Phone	Sept. 12, 2012 Sept. 20, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project. Discussed PNT 860268, PNT 870362 and wetland crossings.	Discussed Crown lands and wetland crossings. Mr. Cole would like to see PLA applications to cross Class IV and V wetlands.	Enbridge will submit PLA applications for select locations.	Section 6.0, EPP
Alberta Transportation	Lori McDonald, Aggregates Co-ordinator	Letter Email Letter Phone	Sept. 12, 2012 Sept. 24, 2012 Sept. 28, 2012 Oct. 2, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project. Detailed mapping was provided.	No concerns	None	N/A
Alberta Transportation	Paul Theoret, Aggregates/Reclamation Co-ordinator	Letter Letter Email	Sept. 12, 2012 Sept. 28, 2012 Oct. 9, 2012	Enbridge provided a brief project description and requested comments and recommendations regarding the Project. Detailed mapping was provided.	The proposed pipeline does not have any impact on any active Alberta Transportation sand or gravel pits south and east of 30-49-21 W4M.	None	N/A
Alberta Transportation	Terry Tremblay	Phone	Oct. 29, 2012	TERA requested information on the owners and operators of roads in Alberta for the Socio-Economic Assessment.	Requested information was provided.	None	N/A

TABLE 3.2

CONSULTATION ACTIVITIES WITH MUNICIPAL CONTACTS AND NGOs

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcomes/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
Camrose County	Paul King, Manager, Agricultural and Environmental Services	Email	Feb. 22, 2012	General discussion about clubroot (not Project-specific).	Mr. King confirmed that clubroot has not been found in any quarter-sections in Camrose County.	Mitigation will be considered during planning.	Vegetation Report, ESA Section 6.0, EPP
Camrose County	Steve Gerlitz, County Administrator	Phone	Sept. 5, 2012	Requested data/info from Camrose County relevant to the Socio-Economic Assessment, including land use planning maps.	Requested information was provided. See meeting notes below. The County does not require another meeting after the September 14, 2012 meeting.	None	N/A
		Phone	Sept. 5, 2012				
		Email	Sept. 5, 12012				
		Email	Sept. 10, 2012				
		Email	Sept. 10, 2012				
		Email	Sept. 10, 2012				
		Email	Sept. 10, 2012				
		Email	Sept. 10, 2012				
		Email	Sept. 10, 2012				
		Email	Oct. 23, 2012				
		Email	Oct. 23, 2012				
Camrose County	Mr. Gerlitz, County Administrator; Graham Backus, Manager of Public Works; Mike Kuzio, Manager of Protective Services; Mr. King, Manager of Agricultural and Environmental Services; and Anjah Howard, Manager of Planning and Development	Meeting	Sept. 14, 2012	Met with Camrose County to address issues and concerns relevant to the ESA.	Concerns were expressed with waste disposal at work sites. No capacity issues were expressed with capacity issues for emergency, fire and airport services. A concern was expressed that the county's main August long weekend event, the "Big Valley Jamboree", would cause potential capacity issues for accommodation.	Mitigation measures for waste management during construction and potential decrease in availability of rental accommodations are addressed in the ESA.	Section 6.0, Socio-economic Assessment
Camrose County	Jordan Bassett	Email	Sept. 14, 2012	Requested land use and zoning information, which was provided. Mr. Bassett indicated that Anjah Howard has information about descriptions of land use.	Requested information was provided.	None	N/A
		Phone	Oct. 16, 2012				
		Phone	Oct. 16, 2012				
Camrose County	Anjah Howard, Manager of Planning and Development	Phone	Oct. 19, 2012	Discussed "Wildlife Preserve" in NW 15-49-21 W4M.	No concerns; the zoning shapefiles were incorrect. There is no Wildlife Preserve in NW 15-49-21 W4M, and no concerns with routing within this quarter-section.	None	N/A
Flagstaff County	Laurie Hillaby, Agricultural Fieldman	Email	Feb. 24, 2012	General discussion about clubroot (not Project-specific).	Ms. Hillaby confirmed the sections where clubroot has been found and indicated that precautions against the spread of clubroot should be taken along the whole pipeline.	Mitigation will be considered during planning.	Vegetation Report, Section 6.0, EPP

TABLE 3.2 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcomes/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
Flagstaff County	Mr. Vincett	Phone	Sept. 18, 2012	Discussed land use and county zoning.	Requested information provided.	None	N/A
		Email	Sept. 18, 2012				
		Email	Sept. 19, 2012				
		Email	Sept. 19, 2012				
		Phone	Sept. 19, 2012				
		Phone	Sept. 19, 2012				
Flagstaff County	Shelly Armstrong	Phone	Oct. 16, 2012	TERA called to request information relevant to the Socio-Economic portion of the ESA.	Flagstaff County would like to continue to be notified of any road use agreements/crossing agreements needed. There will likely be a slight increase in traffic with workers in the area and equipment passing through but they've worked with Enbridge to mitigate these issues, and any benefit to Sedgewick, Lougheed or Hardisty is a benefit to the County.	None	N/A
		Phone	Oct. 18, 2012				
		Phone	Oct. 23, 2012				
Beaver County	Krista Kotylak, Acting Agricultural Fieldman	Email	March 29, 2012	General discussion about clubroot (not Project-specific).	Ms. Kotylak provided county-specific information and recommended mitigation regarding the spread of clubroot disease and weeds.	Mitigation will be considered during planning.	Vegetation Report, Section 6.0, EPP
Beaver County	Kim MacMurray	Phone	Sept. 18, 2012	Enquiring about zoning.	County aided in acquiring zoning data.	None	N/A
		Phone	Sept. 18, 2012				
		Email	Sept. 18, 2012				
		Email	Oct. 2, 2012				
		Phone	Oct. 9, 2012				
Beaver County	Bob Beck, Chief Administrative Officer	Phone	Oct. 16, 2012	TERA called to set up a phone meeting to discuss the Project in general on October 29, 2012.	No major concerns. Noted that Beaver County now has an official policy on road use for the spring, which includes weight restrictions.	None	N/A
		Email	Oct. 18, 2012				
		Email	Oct. 19, 2012				
		Email	Oct. 19, 2012				
		Email	Oct. 19, 2012				
		Email	Oct. 22, 2012				
		Phone	Oct. 22, 2012				
Beaver County (Accurate Assessment, contractor)	Monika Tulipan	Phone	Oct. 9, 2012	Discussed land use and county zoning.	Requested information was provided.	None	N/A
		Email	Oct. 9, 2012				
		Email	Oct. 9, 2012				
		Email	Oct. 9, 2012				
Municipal District (MD) of Wainwright	James Schwindt, Agricultural Fieldman	Email	April 25, 2012	General discussion about clubroot (not Project-specific).	Mr. Schwindt indicated that measures to protect against clubroot should be taken; it has not yet been found in the MD of Wainwright. He also indicated some weed species of greater concern and requested that measures be taken against the spread of all weedy species.	Mitigation will be considered during planning.	Vegetation Report, Section 6.0, EPP

TABLE 3.2 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcomes/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
Strathcona County	Alf Kolenosky, Agricultural Services	Email	Feb. 21, 2012	General discussion about clubroot (not Project-specific).	Mr. Kolenosky confirmed the sections where clubroot has been found and indicated that precautions against the spread of clubroot should be taken	Mitigation will be considered during planning.	Vegetation Report, Section 6.0, EPP
Strathcona County	Lori Mills, Energy Exploration Liaison	Phone	Sept. 5, 2012	Requested data/info from the county relevant to the Socio-Economic Assessment, including land use planning maps.	Land use and zoning data was provided. Ms. Mills provided a letter with comments from several Strathcona County departments with recommendations for watercourse crossings, utility crossings, wildlife timing constraints and reclamation.	Enbridge has noted the County comments and recommendations will be considered during Project planning, where appropriate. Consultation with the County is ongoing.	Socio-Economic Assessment, Section 6,0
		Email	Sept. 17, 2012				
		Phone	Sept. 19, 2012				
		Phone	Sept. 20, 2012				
		Email	Sept. 20, 2012				
		Email	Sept. 21, 2012				
		Email	Sept. 25, 2012				
		Phone	Sept. 25, 2012				
		Letter	Oct. 24, 2012				
Strathcona County	Ms. Mills, Energy Exploration Liaison; Rick Wyman, Infrastructure Management Technologist; Paula Laplante, Senior Property Management Technician; Charles Nash, Senior Planner; and Kiley Marchuk, Environmental Analyst	Meeting	Sept. 14, 2012	Met with Strathcona County to address issues and concerns relevant to the ESA.	The county prefers that crossings at Goldbar and Mill creeks be crossed using a trenchless technique. See also Ms. Mills' letter above.	Mitigation is provided in the ESA for potential residual effects to watercourse crossings. See Ms. Mills, above.	Section 6.0, Aquatic Assessment
Strathcona County	Heather Horner, Assistant Agricultural Fieldman	Email	August 7, 2012	Requested county-specific weed or crop disease concerns and any recommended mitigation.	Ms. Horner provided recommended mitigation regarding the spread of clubroot disease and weeds.	Mitigation recommended by Ms. Horner will be incorporated into the ESA.	Vegetation Report, Section 6.0, EPP
		Email	August 7, 2012				
Strathcona County	Mr. Charles Nash, Senior Planner	Phone	Sept. 18, 2012	Discussions to inquire about accessing the data for the county's land use designations.	Requested information was provided.	None	N/A
		Phone	Sept. 19,2012				
		Email	Sept. 25, 2012				
		Email	Oct. 1, 2012				
Strathcona County	Kiley Marchuk, Environmental Analyst	Email	Oct. 2, 2012	Discussed high priority environment management areas, the Beaverhill Initiative area, and the upland and wetland wildlife habitat units.	Requested information about Beaver Hills. Strathcona County requests that all named creeks within Strathcona County (*i.e.*, Mill and Goldbar creeks) be HDD/bored.	Mitigation is provided in the ESA for potential residual effects to watercourse crossings. See Ms. Mills above.	Section 6.0, Aquatic Assessment
		Phone	Oct. 22, 2012				
Leduc County	Aaron Van Beers, Agricultural Foreman	Email	April 20, 2012	Requested county-specific weed or crop disease concerns and any recommended mitigation.	Mr. Van Beers indicated that clubroot and weeds are both very large concerns in Leduc County. Mr. Van Beers provided a potential list of weed species of concern and indicated that precautions against the spread of clubroot should be taken.	Mitigation will be considered during planning.	Vegetation Report, Section 6.0, EPP
		Phone	August 8, 2012				

TABLE 3.2 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcomes/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
Leduc County	Brian Bowles, County Manager; Des Mrygold, Director of Public Works and Engineering; Bob Galloway, Fire Chief; and Steve Lepp, GIS Co-ordinator	Meeting	Sept. 14, 2012	TERA met with Leduc County to gather issues and concerns relevant to the ESA.	Concerns were expressed with potential difficulty with access to Joseph Lake during construction and blocked access during construction to Looking Back Lake Road.	Mitigation for transportation of workers, supplies and equipment is addressed in the ESA.	Section 6.0
Leduc County	Mr. Steve Lepp	Email	Sept. 18, 2012	Discussions to inquire about accessing the county's land use designations.	Requested information was provided.	None	N/A
		Email	Oct. 2, 2012				
		Email	Oct. 3, 2012				
Leduc County	D'Anne O'Keefe, Manager of Current Planning	Phone	Nov. 1, 2012	Discussed whether Leduc County has any policies related to pipeline development in the Beaver Hills Initiative Area.	No Project concerns specific to the Beaver Hills Initiative. The County Municipal Development Plan has policies related to the development of pipelines (*e.g.*, proposed pipelines are encouraged to parallel existing corridors).	The Project routing meets the county request.	Section 4.0
MD of Provost	Oscar Long	Phone	Sept. 18, 2012	Mr. Long provided information regarding land use.	Requested information was provided.	None	N/A
		Email	Sept. 18, 2012				
MD of Provost	Tyler Lawrason	Phone	Oct. 16, 2012	TERA contacted the Town to gather issues and concerns relevant to the ESA.	Mr. Lawrason indicated he hadn't heard of any issues with the current right-of-way and that there are no conflicts with capacity of services during Project timelines.	None	N/A
Town of Viking	Muriel Hansan	Phone	Sept. 18, 2012	Called to enquire about where water is drawn from/treated. Water treatment is the same as Tofield (from Edmonton).	Confirmed that water supply does come from the Edmonton municipal system.	None	N/A
Town of Viking	Rod Krips	Phone	Oct. 18, 2012	TERA contacted the Town to gather issues and concerns relevant to the ESA.	The Town did not have any issues in the past with socio-economic elements of pipeline construction. The Town would like any issues dealt with promptly. The Town has an RV park potentially useful during construction. There are no major events happening during the construction timeline, and they are happy with this early communication with Enbridge over the Project.	None	N/A
		Phone	Oct. 19, 2012				
		Phone	Oct. 19, 2012				
Town of Killam	Aleisha Brody	Phone	Sept. 18, 2012	Called to enquire about where water is drawn from/treated. TERA contacted the Town to gather issues and concerns relevant to the ESA.	Water is obtained from wells and treated locally.	None	Section 5.0
		Phone	Oct. 18, 2012				

TABLE 3.2 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcomes/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
Town of Killam	Kim Borgel, City Manager	Phone	Oct. 23, 2012	TERA contacted the Town to gather issues and concerns relevant to the ESA.	Previous projects have not affected the Town in a positive or negative way. Gas stations will benefit from crews passing by with their vehicles. A rodeo is planned in the third weekend of June but likely will cause no conflict at all. Enbridge has been exemplary in communicating information in the past.	None	N/A
		Phone	Oct. 23, 2012				
Town of Sedgewick	Lorna Polege	Phone	Sept. 18, 2012	Called to enquire about where water is drawn from/treated.	Seven wells are used to supply a local water treatment plant, which is being upgraded with new filtering system.	None	N/A
Town of Sedgewick	Amanda Paris, Town Manager	Phone	Oct. 19, 2012	TERA contacted the Town to gather issues and concerns relevant to the ESA.	The Town welcomes this type of Project as it brings economic and social benefits to the community. The Town Rodeo on Canada Day (July 1, 2013) is a potential factor that will increase traffic and may affect Project construction.	None	N/A
City of Leduc	Ms. Linda Garossino, Executive Assistant to Paul Bennedeto, City Manager	Phone	Oct. 18, 2012	TERA contacted the City to gather issues and concerns relevant to the ESA.	None	None	N/A
		Phone	Oct. 23, 2012				
		Phone	Oct. 26, 2012				
		Phone	Oct. 29, 2012				
		Email	Oct. 29, 2012				
City of Camrose	Ms. Carla Johnson, Administrative Assistant	Phone	Oct. 18, 2012	TERA contacted the City to gather issues and concerns relevant to the ESA.	None	None	N/A
		Phone	Oct. 26, 2012				
City of Edmonton	Teri-Lynn Lefebrie, Administrative Assistant for Simon Farbrother, City Manager	Phone	Oct. 18, 2012	TERA contacted the City to gather issues and concerns relevant to the ESA.	None	None	N/A
		Phone	Oct. 23, 2012				
City of Edmonton	Gord Jackson, Director of Policy for the Sustainable Development Department	Phone	Oct. 22, 2012	TERA contacted the City to gather issues and concerns relevant to the ESA.	The City response was generally positive. There are no Project-related concerns about traffic or accommodation capacity.	None	N/A
Village of Lougheed	Brandy Swiftun	Phone	Oct. 18, 2012	TERA contacted the Village to gather issues and concerns relevant to the ESA.	None	None	N/A
Town of Hardisty, Village of Lougheed	Sandy Otto, Interim CAO	Phone	Oct. 18, 2012	TERA contacted the Village and Town to gather issues and concerns relevant to the ESA.	None	None	N/A
Town of Tofield	Jeff Edwards, Assistant CAO	Phone	Oct. 18, 2012	TERA contacted the Town to gather issues and concerns relevant to the ESA. A list of questions that require answers and a public information package was provided.	The Town does not perceive any concerns with the Project at this time.	None	N/A
		Email	Oct. 22, 2012				
		Email	Oct. 23, 2012				
		Email	Nov. 14, 2012				
		Email	Nov. 21, 2012				

TABLE 3.2 Cont'd

Stakeholder Group/Agency Name	Name and Title of Contact	Method of Contact	Date of Consultation Activity	Reason for Engagement	Consultation Outcomes/Issues/Concerns	Commitments/Follow-up Actions/Comments	Where Issue Addressed in ESA
Alberta Professional Outfitter Society	Fiona Nelson	Email	Sept. 4, 2012	Looking for the best available information in order to narrow down the affected guide outfitters in the Project area.	Ms. Nelson informed TERA that no spatial information is collected for respective Wildlife Management Units (WMUs); that is, TERA has the best available info already.	None	N/A
		Phone	Sept. 4, 2012				
Grey Nuns Hospital	Asyssa Mehlinger, Receptionist	Phone	Sept. 18, 2012	Called to inquire about the number of beds at the hospital and was directed to the website.	Information was confirmed online.	None	N/A
		Phone	Sept. 18, 2012				
Edmonton General Hospital	N/A	Phone	Sept. 18, 2012	Called to inquire about the number of beds at the hospital.	Information was confirmed online.	None	N/A
Edmonton Waste Management Centre	Call Centre Representative	Phone	Sept. 18, 2012	Called to inquire about the types of waste accepted at the waste management centre.	Information was confirmed online.	None	N/A
Ducks Unlimited Canada (DUC)	Robin Hunka	Meeting	Oct. 15, 2012	Meeting to review Project information routing.	DUC requested that Enbridge mulch the trees that are cleared from DUC lands. After the right-of-way is completed; the mulch that is left can be spread over entire right of way. Bore any sloughs or wet spots on DUC lands.	Wetland mitigation is addressed in the ESA. Landowner requests are included in the Line List.	Section 6.0, EPP
DUC	Craig Bishop	Phone	Oct. 26, 2012	Discussed wetland compensation in regards to the Edmonton Terminal site	The wetland compensation process and how DUC works with AESRD was explained to Enbridge. No concerns were raised.	None	N/A

4.0 ROUTE AND FACILITY SITE SELECTION

4.1 Pipeline Routing

The existing Enbridge pipeline system between Edmonton and Hardisty is predominantly located within an agricultural setting. Routing of the proposed pipeline was influenced by Enbridge's commitment to avoid, where feasible, any environmentally sensitive areas. This includes limiting the amount of new land disturbance and maximizing operational efficiency. Installing the proposed pipeline adjacent to the existing pipeline rights-of-way, where feasible, was the preferred strategy to meet these goals.

The existing Enbridge pipeline mainline corridor runs in a generally straight line southeast from the Edmonton Terminal to the Hardisty Terminal. The existing Enbridge Line 4 Extension pipeline right-of-way deviated from the existing Enbridge mainline corridor in three areas (*i.e.*, the Edmonton reroute [KPE], the Lindstrand reroute at SE 20-48-19 W4M [KPD], as well as a reroute to avoid a church near Round Hill, Alberta at NW 12-48-19 W4M [KPC]). The alignment of the Line 4 Extension Edmonton reroute was driven by the requirement of Alberta Infrastructure to use the TUC. The Line 4 Extension Edmonton reroute was preferred for the current Project not only because it used the TUC, but also because it avoids areas of restricted workspace where residential subdivisions had encroached on the existing Enbridge mainline right-of-way over the years and it also avoids the Sherwood Park Natural Area in 11-52-23 W4M. The Lindstrand reroute was necessary to avoid the DUC Lindstrand Project at SE 20-48-19 W4M.

The existing Enbridge pipeline rights-of-way (*i.e.*, the mainline corridor and Line 4 Extension Project route deviations) was generally chosen as the preferred alignment due to the following:

- the existing Enbridge mainline corridor, with the exception of Line 4 Extension Project route deviations, has been in use for over 50 years and is well known to all parties;
- adequate workspace is generally available along the route;
- environmental, socio-economic or land use constraints are generally not encountered along the route that cannot be effectively mitigated or compensated;
- effects associated with widening an existing pipeline corridor would be incremental, while a new route would affect additional lands and increase the amount of land disturbance; and
- pipeline surveillance and maintenance activities can be conducted more efficiently for pipelines located within a common right-of-way than for two rights-of-way that are geographically separated.

Enbridge recognizes that along segments of the route, workspace for the construction of the proposed pipeline is limited, thus narrowing of the construction right-of-way will be necessary to avoid or reduce potential conflicts. Minor deviations from the existing pipeline right-of-way occur at several locations along the proposed route. Minor route refinements may be necessary at additional locations to accommodate landowner concerns or to avoid local features. Any such route refinements will be dealt with as supplemental filings to this Application.

The construction right-of-way will typically be 45 m wide, which includes a 10-13 m wide permanent pipeline easement. The remainder of the construction right-of-way width will be used as temporary workspace.

The following routing factors were considered in the development and evaluation of route alternatives at locations where reroutes were necessary:

- limit the length of the pipeline to the extent feasible to reduce overall disturbance to the environment;
- gather and review environmental information for the proposed corridor from existing public data, company records and field studies;

- contact appropriate regulatory authorities and environmental stakeholders as early as possible to identify general environmental concerns within the corridor and consider the input when selecting the preferred route;
- parallel existing linear developments (*e.g.*, pipelines, roads, trails, powerlines and rail lines), where practical, to reduce the overall area of disturbance and reduce the potential for habitat and landscape fragmentation;
- reduce the amount of steep terrain, sidehill and unstable terrain;
- avoid or reduce, where practical, the length on sensitive landscapes (*e.g.*, native prairie, sand dunes, coulee complexes and steep slopes);
- avoid or reduce, where practical, length in isolated bush or wooded areas to reduce potential project effects on aquatics, native vegetation and wildlife habitat;
- adhere to setback distances from important natural features (*e.g.*, mineral licks and wildlife features such as nest, leks, dens and staging areas);
- adhere to setback distances from rare vegetative species;
- avoid, where practical, known archaeological or historical sites or areas of high archaeological or palaeontological potential to reduce potential project effects on heritage resources;
- maximize, where practical, the length within the TUC, where land has been set aside for utilities such as the current Project;
- avoid, where practical, identified socially and culturally important areas such as parks, natural areas, TLRU sites (*e.g.*, heritage sites, cemeteries, etc.), golf courses, residential subdivisions, churches and other areas with existing infrastructure that could create land use conflicts;
- avoid, where practical, farm buildings, farmsteads, well sites, aquifer recharge areas and shelterbelts;
- where practical, cross windbreaks and shelterbelts at right angles to limit the width of the right-of-way to that necessary for the trench line and vehicle traffic;
- where practical, cross roads, rail lines and pipelines at or near right angles or as per crossing agreements;
- identify watercourse crossing locations that are geotechnically stable and where construction will be feasible by more than one installation method; and
- consider construction costs and difficulty.

As stated in Section 1.0 of this ESA, the system of KPs used in this ESA are Environment KPs. This system of KPs has been used for several NEB-regulated pipelines in the existing right-of-way, including the Enbridge Line 4 Extension Project and the IPL SEP II and CEP Projects. Historically, and in the Environment KP system, KP 0.0 is located at the Enbridge Edmonton Terminal and KP 1,245.2 is located at the United States border near Gretna, Manitoba. Using this Environment KP system, the currently proposed pipeline route begins at KPT 0.0 at the Edmonton Terminal (NW 32-52-23 W4M) and ends at KP 175.5 (SE 30-42-9 W4M), following the Enbridge mainline right-of-way that has been in place since the early 1950s, which is more or less a straight line.

During the Line 4 Extension Project in 2007, the Edmonton reroute was identified at the time of that project as a subset of the KP numbering system, KPE 0.0 to KPE 15.4 (SE 32-52-23 W4M to SW 36-51-23 W4M). This deviation numbering system has also been carried forward to the current Project. The Environment KP numbering system and all deviations greater than 60 m from the mainline right-of-way are shown in detail on Figures 1.6 through 1.17 and are described below.

Route deviations greater than 60 m from the mainline right-of-way are located at:

- KPT 0.0 to KPT 0.3 (11-32-52-23 W4M to 10-32-52-23 W4M) to tie into the Enbridge Edmonton Terminal in NW 32-52-23 W4M;
- KPHA 0.0 to KPHA 1.0 (3-28-52-23 W4M to 12-21-52-23 W4M) to accommodate a powerline;
- KPHB 0.0 to KPHB 0.8 (6-4-52-23 W4M to 14-33-51-23 W4M) to accommodate a powerline;
- KPHC 0.0 to KPHC 0.7 (1-4-51-22 W4M to 16-32-50-22 W4M) to avoid a residence;
- KPHD 0.0 to KPHD 1.1 (14-11-50-22 W4M to 2-11-50-22 W4M) to avoid an industrial development;
- KPHE 0.0 to KPHE 0.5 (1-36-49-22 W4M to 4-31-49-21 W4M) to avoid a well site;
- KPHF 0.0 to KPHF 0.5 (9-30-49-21 W4M to 5-29-49-21 W4M) to avoid a residence;
- KPHG 0.0 to KPHG 1.0 (2-5-49-20 W4M to 13-33-48-20 W4M) to reduce the length of interconnecting pipe at the existing Kingman Station;
- KPHH 0.0 to KPHH 0.3 (9-12-48-19 W4M to 5-7-48-18 W4M) to cross a highway at a right angle;
- KPHI 0.0 to KPHI 0.7 (10-13-46-16 W4M to 12-18-46-15 W4M) to avoid an active well site;
- KPHJ 0.0 to KPHJ 0.8 (10-8-46-15 W4M to 8-8-46-15 W4M) to avoid an active well site; and
- KPHK 0.0 to KPHK 0.7 (8-3-46-15 W4M to 4-2-46-15 W4M) to reduce the length of interconnecting pipe to the new pumps at the existing Strome Station.

Additional deviations have occurred (*i.e.*, moving the proposed route from one side of the existing Enbridge right-of-way to the other) to avoid conflicts with landowners; however, these deviations were not large enough to warrant their own Environment KP label. Using Environment KPs allows for historic consistency on the location of site-specific environmental and socio-economic issues and facilitates cross-referencing of previous Enbridge ESAs, supporting studies, permits, PCEM reports and IRs that use this system. Since the Environmental Alignment Sheets will be used during construction by those using a separate set of Project KPs, both Environment KPs and Project KPs are shown on the Environmental Alignment Sheets (Appendix 2 of this ESA). For additional clarity, legal locations and, where appropriate, GPS co-ordinates of site-specific issues are included in tables and text throughout the ESA.

4.2 Permanent Facility Site Selection

New pump stations and associated facilities will be required for the Project. All facilities will be installed within the boundaries of existing Enbridge terminals/stations, with the exception of the work at Strome Station, for which Enbridge will need to acquire approximately 1.08 ha of new land immediately north of the fenced boundary. Siting of new permanent facilities was influenced by Enbridge's desire to limit the amount of new disturbance, as well as to optimize maintenance activities and the use of existing infrastructure (*e.g.,* access roads, powerlines, fenced site boundaries, etc.) associated with Enbridge's existing facilities. Alternate locations considered for the Strome Station included lands immediately adjacent to the south, west or east of the existing station. The north side was preferred as it was relatively high and dry. No tree clearing and only minimal grading is required for the new lands and no other known environmental or land use conflicts existed. The proposed pump station and interconnecting facilities at Edmonton Terminal will be situated within a wetland complex within existing Enbridge property, in accordance with long-term development plans at the site.

An Intelligent Valve Placement analysis was conducted by Enbridge to identify locations between Edmonton Terminal and Hardisty Terminal where mainline block valves will be installed. Valve locations were then further refined by considering co-location within existing valve sites, the availability of existing power and access, as well as landowner concerns and environmental issues.

4.3 Temporary Facility Siting

4.3.1 Temporary Facilities

The following temporary facilities may be required prior to or during the construction program:

- stockpiles sites;
- temporary bridges for watercourse crossings;
- road upgrades and new temporary access roads (shoo-flies); and
- contractor staging areas.

The need for and the respective general location of these sites are the responsibility of the pipeline construction contractor; however, all temporary workspace and temporary facility site locations will require the approval of the Environmental Inspector or Enbridge Environment staff. Temporary facilities will be located within existing industrial areas to the extent feasible.

4.3.2 Siting Criteria

Once the approximate location of temporary workspace or temporary facility for use during construction has been identified, the sites will be assessed and, where appropriate, approved by the Environmental Inspector or Enbridge's environmental staff. Detailed environmental surveys (*e.g.*, aquatic, vegetation and wildlife) will be conducted, where warranted, to determine any potential environmental issues (see Section 10.0 of this ESA). The surveys conducted during summer 2012 for the proposed pipeline took into account the proposed temporary workspace at road, water and major foreign line crossings. The temporary facility site/workspace selection process will take into consideration any environmental issues (as identified in Section 6.0 of this ESA and on the Environmental Alignment Sheets [Appendix 2 of this ESA]) and ensure adherence to the site selection criteria noted below. It is of note that there is a great deal of flexibility for some temporary facilities (*e.g.*, pipe stockpile sites) while other temporary facilities must be located at or in the immediate vicinity of a particular location (*e.g.*, temporary workspace where heavy grading is necessary).

The following site selection criteria will be used to evaluate and select temporary facility sites and workspace:

- selection of an optimal location for construction needs;
- preference will be given to sites used for the original construction of the Enbridge mainline right-of-way and Line 4 Extension Project;
- avoidance, to the extent practical, of areas of native vegetation by maximizing the use of previously cleared or broken lands, or lands currently under industrial land use;
- preferential selection of grassed areas over bush or treed areas when temporary workspace is necessary on lands supporting native vegetation;
- avoidance, to the extent practical, of known locations that provide site-specific habitat for wildlife species of concern or apply special mitigation (see Section 6.0 of this ESA);
- avoidance, to the extent practical, of known sites that support known rare plant species or apply special mitigation (see Section 6.0 of this ESA);
- avoidance, to the extent practical, of steep slopes, organic soils and poorly-drained areas;
- avoidance, to the extent practical, of known areas with heritage resource or TLRU sites or apply special mitigation (see Section 6.0 of this ESA);

- avoidance of locations adjacent to a conflicting land use where potential noise, dust or visual concerns could not be readily mitigated; and

- locate temporary facilities that require the use of utilities at sites already serviced by roads and utilities.

The evaluation of potential temporary facility sites/workspace will be conducted as far in advance of its intended use as practical to allow adequate time to choose and evaluate alternative 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 and temporary work areas will be as described in Section 6.0 of this ESA. All applicable landowner as well as municipal, provincial and federal approvals for the temporary facility site or workspace will be acquired prior to commencement of work. The level of mitigation applied will ensure that any residual environmental effects are reduced to a level that is not significant.

5.0 ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

The state of the environment in the Project area has changed dramatically since settlers arrived in Alberta in the late 1800s. Agriculture became the dominant economic activity in Alberta until the discovery of oil in the Leduc field in 1947. The Enbridge mainline system was constructed in the early 1950s. Further information on past development of the Project area is provided in the Cumulative Effects Assessment (Section 7.0 of this ESA).

The following subsections present a summary of the environmental and socio-economic setting of the Project. The environmental setting was compiled based on the following sources:

- soil, acoustic, aquatic, wetland, vegetation, wildlife, socio-economic and historical resource studies conducted for the Project;
- existing published literature including topographic maps, aerial photography, scientific papers and reference books, as well as municipal, provincial and federal government maps, reports, interactive websites, guides, information letters, fact sheets and databases; and
- personal communications with local communities, local and regional governments, and federal and provincial government agencies.

Methods of obtaining resource material included searching libraries, internet searches and receiving documents directly from government agencies. References used in the preparation of the environmental and socio-economic setting of this ESA are cited in Section 5.3.

Detailed methodology for the collection of baseline information is provided in the applicable supporting studies in Appendices 3 through 10.

The environmental and socio-economic setting is divided into subsections according to either the environmental or social setting component. In addition, this section is divided into environmental and socio-economic settings for the proposed pipeline (Section 5.1) and the proposed facilities (Section 5.2). The potential Project-related effects and mitigation are presented in Section 6.0.

The spatial boundaries of elements discussed in the environmental setting are described in detail in Section 6.2 and are shown on Figures 6.1 through 6.10. The following provides a summary of the spatial boundaries discussed in the environmental and socio-economic setting:

- the Physical Environment and Soils LSA consists of a 1 km wide band extending 500 m from the proposed Footprint (*i.e.*, the Footprint plus 500 m on both sides);
- the Aquatics LSA is defined as the area from 200 m upstream of the construction right-of-way to 500 m downstream of the proposed construction right-of-way. The Aquatics RSA is defined as a 30 km band extending 15 km from the proposed Footprint (*i.e.*, the Footprint plus 15 km on both sides);
- the Air Quality RSA is defined as a 40 km wide band extending 20 km from the proposed Footprint (*i.e.*, the Footprint plus 20 km on both sides);
- the Acoustic Environment LSA is defined as a 3 km wide band extending 1.5 km from the proposed Footprint (*i.e.*, the Footprint plus 1.5 km on both sides);
- the Wetland LSA is defined as a 60 m wide band extending 30 m from the proposed Footprint (*i.e.*, the Footprint plus 30 m on both sides). The Wetland RSA is defined as a 30 km wide band extending 15 km from the proposed Footprint (*i.e.*, the Footprint plus 15 km on both sides);
- the Vegetation LSA is defined as a 60 m wide band extending 30 m from the proposed Footprint (*i.e.*, the Footprint plus 30 m on both sides). The Vegetation RSA is defined as a 2 km wide band extending 1 km from the proposed Footprint (*i.e.*, the Footprint plus 1 km on both sides);

- the Wildlife LSA is defined as a 2 km wide band extending 1 km from the proposed Footprint (*i.e.*, the Footprint plus 1 km on both sides). The Wildlife RSA is defined as a 30 km wide band extending 15 km from the proposed Footprint (*i.e.*, the Footprint plus 15 km on both sides);

- two Species at Risk LSAs have been established. The first Species at Risk LSA is defined as an 800 m wide band extending 400 m from the proposed Footprint (*i.e.,* the Footprint plus 400 m on both sides) for Sprague's pipits, loggerhead shrike, yellow rail and horned grebe. The second Species at Risk LSA is defined as a 2 km wide band extending 1 km from the proposed Footprint (*i.e.,* the Footprint plus 1 km on both sides) for ferruginous hawk. The Species at Risk RSA is defined as a 30 km wide band extending 15 km from the proposed Footprint (*i.e.,* the Footprint plus 15 km on both sides);

- the Socio-economic LSA is defined as a 3 km wide band extending 1.5 km from the proposed Footprint (*i.e.*, the Footprint plus 1.5 km on both sides). The Socio-economic RSA is defined as an approximately 40 km wide band extending 20 km from the proposed Footprint (*i.e.*, the Footprint plus 20 km on both sides); and

- the Heritage Resources RSA consists of the area extending beyond the Footprint and is defined as an area of intersecting Borden Blocks (Borden and Duff 1952).

5.1 Pipeline

This subsection describes the environmental and socio-economic setting along the proposed pipeline route. The environmental and socio-economic setting for the proposed pump stations is described in Section 5.2 of this ESA.

5.1.1 Physical and Meteorological Environment

This subsection presents a summary of the physical and meteorological environmental setting found in the Physical Environment LSA and, where appropriate, along the proposed route. It describes the physical, geologic and meteorological conditions documented in the Physical Environment LSA and beyond to include the nearest meteorological stations. The potential Project-related effects and mitigation pertaining to physical and meteorological environment are discussed in Section 6.2.1 of this ESA.

5.1.1.1 Physiography

The proposed pipeline route lies within the Eastern Alberta Plains physiographic region (Pettapiece 1986). The Eastern Alberta Plains are characterized by hummocky and undulating topography. Sections and districts of the major physiographic region encountered by the proposed route are listed in Table 5.1 of this ESA.

TABLE 5.1

PHYSIOGRAPHIC DIVISIONS CROSSED BY THE PROPOSED PIPELINE ROUTE

Legal Location (W4M) and Approx. KP	Section	District	Landform
NW 32-52-23 to SW 21-52-23 (KPT 0.0 to KPE 3.5)	Edmonton Plain	Lake Edmonton Plain	Primarily undulating glaciolacustrine material with potential for small areas of glaciofluvial, morainal (till) and rock material.
SW 21-52-23 to NE 6-49-20 (KPE 3.5 to KP 49.0)	Cooking Lake Uplands	Beaver Hills Upland	Hummocky and undulating morainal material with potential for small areas of glaciolacustrine material.
NE 6-49-20 to NE 13-43-11 (KP 49 to KP 161.0)	Sullivan Lake Plain	Daysland Plain	Blanket and veneer morainal material overlying undulating rock and morainal material.
NE 13-43-11 to NE 25-42-10 (KP 161.0 to KP 173.5)	Neutral Hills Uplands	Neutral Upland	Hummocky morainal material with a significant amount of blanket morainal material overlying rolling rock. Glaciofluvial materials may occur.
NE 25-42-10 to SE 30-42-10 (KP 173.5 to KP 175.5)	Lac La Biche Plain	Battle River Valley	Steeply inclined, undifferentiated and dissected.

Source: Pettapiece 1986

The topography along the proposed pipeline route is generally quite subdued with gentle to moderate slopes seldom exceeding 15% (Appendix 3). Strong slopes up to 30% are encountered from approximately KP 44.5 to KP 45.8 (14-49-21 W4M to 11-49-21 W4M) and at several locations within Flagstaff County including slopes in the Battle River valley. A short section with very strong slopes up to 45% is encountered at approximately KP 167.0 (NE 4-43-10 W4M). Elevations along the proposed route range from approximately 600 m above sea level (asl) to 800 m asl.

5.1.1.2 Bedrock Geology

The proposed pipeline route is underlain by bedrock of Upper Cretaceous age (Hamilton *et al.* 1999). The following three geological formations underlie the proposed route: the Horseshoe Canyon Formation; Bearpaw Formation; and Belly River Group (Hamilton *et al.* 1999). The Horseshoe Canyon formation consists of grey, feldspathic, clayey sandstone; grey bentonitic mudstone and carbonaceous shale; concretionary ironstone beds, with scattered coal and bentonite beds of variable thickness; and minor limestone beds. The Bearpaw Formation consists of dark gray blocky shale and silty shale; greenish glauconitic and grey clayey sandstone; and thin concretionary ironstone and bentonitic beds. The Belly River Group consists of grey to greenish grey, thick bedded, feldspathic sandstone; grey clayey siltstone with grey and green mudstone; and concretionary ironstone beds. The Horseshoe Canyon and Belly River Group are considered non-marine in origin, while the Bearpaw Formation is considered marine (Hamilton *et al.* 1999).

Drift thickness in the Physical Environment LSA varies from 15-45 m (Pawlowicz and Fenton 1995). Bedrock within trench depth has been identified along the proposed route near the City of Edmonton and just east of Demay Lake from approximately KP 71.0 to KP 76.5 (SE 7-48-18 W4M to SE 34-47-18 W4M). The bedrock encountered in these locations is anticipated to be rippable (Appendix 3).

Acid-generating bedrock has not been encountered along the proposed route (Appendix 3).

Naturally occurring radioactive materials (NORMs) are long-lived radioactive elements of the Earth's crust normally found in low concentrations, although higher concentrations can result from human activities (Health Canada 2000). In the oil and gas industry, NORMs may be encountered in liquids and gases from hydrocarbon-bearing geological formations, contaminated soils, liberated shale deposits and accumulations of slurry debris (Health Canada 2000, Jaremko 2006). Enbridge considers exposure to NORMs as a very low risk for the current Project.

5.1.1.3 Surficial Geology

The segment of the proposed route from the Edmonton Terminal at NW 32-52-23 W4M (KPT 0) southeast to NE 13-43-11 W4M (approximately KP 161) is primarily underlain by stagnation moraine, which consists of till of uneven thickness (up to 30 m thick) with local water-sorted material. The topography is undulating to hummocky, reflecting the variations in till thickness. The area along the route north of Killam from SE 14-5-14 W4M to SE 19-4-12 W4M (approximately KP 125 to KP 140) is underlain by draped moraine, which consists of till of uneven thickness (up to 10 m) with minor amounts of water-sorted material and local bedrock exposures. The flat to undulating surface reflects the topography of the underlying bedrock and other deposits. The pipeline route in the vicinity of Sedgewick and Hardisty from SE 19-44-12W4M to SE 30-42-9 W4M (approximately KP 140 to KP 175.5) crosses areas underlain by ice contact fluvial deposits, up to 25 m thick, consisting of gravel, sand, silt and clay, and local till. The topography in this area is undulating to hummocky (Shetsen 1990).

5.1.1.4 Ground Stability

The proposed pipeline route does not encounter any areas of permafrost (NRCan 2006) or land susceptible to landslides (NRCan 2007a). The seismic hazard is low on lands crossed by the proposed pipeline (NRCan 2008a, 2011). There are no PNTs for ground instability encountered by the proposed pipeline route (Alberta Energy 2012a).

5.1.1.5 Wind and Water Erosion

Soil erosion risk is a measurement of vulnerability of the soil to erosion combined with the intensity of cultivation (Alberta Agriculture and Rural Development [AARD] 2005a). AARD considers wind erosion

risk, which assesses the risk of soil erosion by wind on bare, unprotected mineral soil, to be low in the Physical Environment LSA, with a small portion of the land crossed near Hardisty Terminal rated as having high wind erosion risk (AARD 2005b). However, since most soils along the proposed pipeline route have a loam or silt loam surface texture they are rated as having a moderate wind erosion hazard when the protective vegetation is disturbed (Appendix 3).

Water erosion risk, which assesses the risk of soil degradation by water on bare, unprotected mineral soil, is considered by AARD to be negligible on most of the lands crossed by the proposed route. However, a portion of the proposed route near Edmonton is rated as having low to high water erosion risk (AARD 2005c). Based on the field studies, most soils along the proposed pipeline route are rated as having a slight to moderate water erosion hazard (Appendix 3).

5.1.1.6 Climate

Regional Climate

The proposed pipeline route lies within the Central Parkland Subregion of the Parkland Natural Region. In 51-22 W4M, the pipeline route crosses a small portion of Dry Mixedwood Subregion of the Boreal Natural Region (Natural Regions Committee 2006). Monthly precipitation patterns in the Central Parkland Subregion are similar to those of the Dry Mixedwood Natural Subregion, with a marked peak in July and substantial rainfalls in June and August. The Dry Mixedwood Natural Subregion has the warmest summers of any of the Boreal Natural Subregions. The number of frost-free days per year in the Central Parkland and Dry Mixedwood Natural Subregions averages 105 and 95 days, respectively (Natural Regions Committee 2006).

Local Climate

The meteorological data summarized below were obtained from Environment Canada's Edmonton City Centre Airport station, located approximately 10 km northwest of KPT 0.0 (NW 32-52-23 W4M). The data were collected from 1971 to 2000 (Environment Canada 2012a).

- The average annual rainfall for Edmonton City Centre is 365.7 mm. Monthly rainfall is the highest in June and July with averages of 87.1 mm and 91.7 mm, respectively. In July 1953, Edmonton City Centre recorded its highest daily rainfall of 114 mm.

- The average annual snowfall for Edmonton City Centre is 123.5 cm. Monthly snowfall averages are highest in December and January, averaging 22.3 cm and 24.5 cm, respectively. In November 1942, 39.9 cm of snowfall was recorded in one day, well above the monthly average of 17.9 cm for November.

- The average yearly temperature for Edmonton is 3.9°C; the warmest month is July with an average of 17.5°C and the coldest month is January with an average of -11.7°C. Edmonton experienced its warmest day in August 1998 when it reached 34.5°C. The coldest temperature Edmonton has recorded is -48.3°C in December 1938.

- Edmonton experiences average annual winds of 12.1 km/h. April to June is the windiest time of year with an average wind speed of 13.6 km/h. The record maximum hourly wind speed in Edmonton was measured at 72 km/h in April 1954 with wind gusts of 117 km/h in June 1960.

- The average number of frost-free days per year (days with the minimum temperature above 0°C) is 187.

The meteorological data summarized below were obtained from Environment Canada's Camrose station, located approximately 15 km southwest of the pipeline route at KP 63.0 (SW 21-48-19 W4M). The data were collected from 1971 to 2000 (Environment Canada 2012b).

- Average annual rainfall for Camrose is 354.4 mm. Monthly rainfall is highest in June and July with averages of 87.3 mm and 87.9 mm, respectively. In June 1973, Camrose recorded its highest daily rainfall of 91.2 mm.

- Average annual snowfall for Camrose is 122.9 cm. Monthly snowfall averages are highest in December and January with averages of 20.6 cm and 25.8 cm, respectively. In March 1988, 40.8 cm of snowfall was recorded in one day, well above the monthly average for March of 22.6 mm.

- Average yearly temperature for Camrose is 2.7°C; the warmest month is July with an average of 16.5°C and the coldest month is January with an average temperature of -13.4°C. Camrose experienced its warmest day in July 1960 when a high of 36.7°C was reached. The coldest temperature Camrose has experienced is -47.8°C in February 1947.

- Camrose wind records are incomplete. Record maximum hourly wind speed in Camrose was measured at 59 km/h in 1998.

- The average number of frost-free days per year (days with the minimum temperature above 0°C) is 168.

5.1.1.7 Natural Hazards

One major tornado was recorded in the Edmonton area on July 31, 1987. It caused 27 deaths, 600 injuries, 1,700 evacuations and $300 million in damage (NRCan 2007b). Two major hailstorms were recorded in close proximity to the Edmonton Terminal: one in 1988 that caused $48 million in damage and one in 1901 that produced 8 cm diameter hailstones (NRCan 2007c).

5.1.2 Soil and Soil Productivity

This subsection presents a summary of the soil landscapes and characteristics found within the Soil and Soil Productivity RSA. It describes the soil characteristics and potential concerns associated with soil landscapes found along the proposed route and within the Soils LSA. Locations of soil types are identified on the Environmental Alignment Sheets (Appendix 2 of this ESA). The potential Project-related effects and mitigation pertaining to soil and soil productivity, and any associated potential for human health effects, are discussed in Sections 6.2.2 and 6.2.16, respectively.

5.1.2.1 Soil Characteristics

Soil assessments along the existing Enbridge pipeline corridor were previously conducted by Pedocan Land Evaluation Ltd. (Pedocan) and Mentiga for the IPL SEP II, CEP, NOVA Chemicals JFP Project and the Line 4 Extension Project (Pedocan 1996a,b, Mentiga 2004, 2007). Historical soils data compiled for this report are considered scientifically sound, since soils do not change at one location from year to year. The studies completed for these previous projects provide substantial soils information; however, additional field investigations were conducted along the entire proposed route in July 2012 to update present land use. In addition, deep soil investigations (1.9 m) at various locations in 46-15 W4M and 46-16 W4M will be conducted in early 2013 (Section 10.0 of this ESA). Detailed information on the known soils encountered by the proposed pipeline route is provided in Appendix 3 of this ESA. Soils have been classified and described according to the criteria established by the Soil Classification Working Group (Agriculture and Agri-Food Canada [AAFC] 1998).

<u>General Soil Characteristics</u>

The proposed pipeline route is located in an agricultural area and primarily encounters previously disturbed soils. The proposed pipeline route is mainly located in the Black Soil Zone. Chernozems and Solonetzs are the dominant soil orders encountered along the proposed pipeline route (Appendix 3). Chernozemic soils are well to imperfectly drained and generally consist of a thick, dark, organic surface (A) horizon. They typically occur in the cool, sub-arid to sub-humid Interior Plains of western Canada. Soils of the Solonetzic order have B horizons that are very hard when dry and swell when wet resulting in very low permeability. They occur on saline parent material in association with Chernozemic soils, and occasionally Luvisolic and Gleysolic soils, in some areas of the semi-arid to sub-humid Interior Plains (AAFC 1998).

Specific Soil Characteristics

The following provides detailed descriptions of dominant and less common soil sub-groups encountered along the proposed pipeline route. In total, 23 soil units were described and mapped along the proposed pipeline route (Appendix 3).

Well to imperfectly drained Black Chernozemic soils with 10-56 cm of topsoil developed on till, glaciofluvial sands and, to a lesser extent, glaciolacustrine clays are the dominant soils occupying approximately 51% of the proposed route. Topsoils are easily distinguished from subsoils by colour in these soils.

Moderately well to imperfectly-drained Black Solodized Solonetz with 10-30 cm of topsoil and developed on till or weathered bedrock occupy approximately 22% of the proposed route. These soils are usually strongly saline and sodic at depth. Topsoils are not always easily distinguished from subsoils by colour because the topsoil and underlying upper subsoil can both be dark coloured.

Well to imperfectly drained Dark Gray Chernozemic soils with 15-30 cm of topsoil developed on till or glaciolacustrine clays are confined to the western portion of the proposed route and occupy approximately 12% of the proposed pipeline route. Topsoils are easily distinguished from subsoils by colour in these soils.

Poorly to very poorly drained Humic Gleysols with 10-60 cm of topsoil developed on loam to clay textured till or glaciolacustrine material as well as glaciofluvial sands occur in level to depressional areas and occupy approximately 7% of the route. These soils can be strongly saline at or near the surface, especially along the central portion of the proposed route. Topsoils are easily distinguished from subsoils by colour in these soils.

The remaining 8% of the route consists of Orthic Gray Luvisols developed on loam to clay loam textured till (3%), Terric or Typic Mesisols developed on poorly drained sedge peat (2%), Orthic Dark Brown Chernozems with 15-50 cm of topsoil developed on glaciofluvial or eolian sands (2%) and Humic Regosols developed on recent fluvial materials on the floodplain of the Battle River (<1%). The Orthic Gray Luvisols usually occur in treed areas and lack a topsoil horizon. Instead there is a thin L-H horizon (duff layer) overlying a relatively thick, light coloured Ae horizon.

Land use along the proposed pipeline route consists of: cultivated land (55.8%); tame pasture (18.8%); hay (11.7%); treed-pasture (10.4%); treed areas (2.4%); disturbed land (0.2%); open water (0.3%); a tree nursery (0.2%); native prairie (0.1%); and campground (0.1%). Present land use is shown on the Environmental Alignment Sheets (Appendix 2 of this ESA).

The topsoil layer of most soils along the proposed route are rated as fair-good quality material for reclamation according to criteria proposed by the Soil Quality Criteria Subcommittee of the Alberta Soils Advisory Committee (Alberta Soils Advisory Committee 1987) (Appendix 3).

There are no Crown dispositions related to soils encountered by the proposed route (Alberta Energy 2012a).

Soil Erosion Hazards

Sandy textured soils, which are rated as having high wind erosion hazard, occupy approximately 17% of the route. These soils include Desjarlais, Irma, gleyed Irma, Kinsella, Peace Hills, gleyed Peace Hills, Redwillow, shallow Redwillow, Rosebank, Rosebank with a saline lower subsoil, Ukalta, gleyed Ukalta and Wainwright soils. Wind erosion along the remainder of the route is expected to be moderate since most soils have a loam or silt loam surface texture. Peaty soils (*i.e.,* Golden Spike 1 and 2 and peaty Haight soils) are rated as have a slight wind erosion hazard.

Soils on slopes greater than 15% are rated as having high water erosion hazard. Only some of the Elnora, Irma, Redwillow, Rosebank and Rolly View soils, as well as the rough broken slope on the west side of the proposed Battle River crossing are rated as having a high water erosion hazard. Most of the soils are rated as having a slight or moderate water erosion hazard. Water erosion of soil particles should not be a great concern during construction.

Approximately 11% of the soils along the proposed pipeline route are susceptible to soil compaction and rutting due to their physical characteristics (texture) and drainage. Certain types of the Haight, Hairy Hill, Desjarlais, Mico, Navarre, Angus Ridge and Golden Spike soil units encountered by the proposed route are susceptible to compaction and rutting, and are identified on the Environmental Alignment Sheets (Appendix 2 of this ESA).

5.1.2.2 Canada Land Inventory Soil Capability

The Canada Land Inventory (CLI) (1967, 1970, 1971) has rated the capability of soils along the proposed pipeline route as ranging from having no significant limitations to agricultural production (Class 2) to having no capability for arable agriculture or permanent pasture (Class 7). Limitations restricting agricultural production are listed in Table 5.2. A complete record of CLI soil capability ratings along the proposed pipeline route is identified on the Environmental Alignment Sheets (Appendix 2).

TABLE 5.2

CANADIAN LAND INVENTORY CLASSIFICATIONS ALONG THE PROPOSED PIPELINE ROUTE

Location (KP)	Location (LSD)	CLI Class	Limitations
KP 0 to KPE 1.37	NW 32-52-23-W4M to NW 28-52-23-W4M	2	Adverse topography
KPE 1.37 to KPE 4.35	NW 28-52-23-W4M to SW 21-52-23-W4M	1,3	Soil limitations
KPE 4.35 to KPE 6.14	SW 21-52-23-W4M to SW 16-52-23-W4M	2,6	Adverse topography
KPE 6.14 to KPHB 0.72	SW 16-52-23-W4M to NW 4-52-23-W4M	4	Adverse topography
KPHB 0.72 to KPE 10.55	NW 4-52-23-W4M to NW 33-52-23-W4M	2,3	Adverse topography
KPE 10.55 to KPE 12.38	NW 33-52-23-W4M to SE 34-51-23-W4M	3,6	Adverse topography and excess water
KPE 12.38 to KPE 13.29	SE 34-51-23-W4M to SW 35-51-23-W4M	4	Adverse topography
KPE 13.29 to KPE 14.26	SW 35-51-23-W4M to SE 35-51-23-W4M	4	Adverse topography and soil limitations
KPE 14.26 to KPE 15.09	SE 35-51-23-W4M to SW 36-51-23-W4M	3	Adverse topography and soil limitations
KPE 15.09 to KP 13.41	SW 36-51-23-W4M to NE 25-51-22-W4M	4	Adverse topography and soil limitations
KP 13.41 to KP 14.51	NE 25-51-23-W4M to SW 30-51-22-W4M	3	Adverse topography and soil limitations
KP 14.51 to KP 15.11	SW 30-51-22-W4M to SW 30-51-22-W4M	4,6	Soil limitations, adverse topography and excess water
KP 15.11 to KP 15.41	SW 30-51-22-W4M to NW 19-51-22-W4M	3,2,5	Adverse topography, soil limitations and excess water
KP 15.41 to KP 18.21	NW 19-51-22-W4M to SW 17-51-22-W4M	4,6	Soil limitations, adverse topography and excess water
KP 18.21 to KP 19.95	SW 17-51-22-W4M to SE 8-51-22-W4M	4,6	Soil limitations, adverse topography and excess water
KP 19.95 to KP 22.45	SE 8-51-22-W4M to SE 4-51-22-W4M	5,6,4	Adverse topography, soil limitations and excess water
KP 22.45 to KPHC 0.10	SE 4-51-22-W4M to SE 4-51-22-W4M	3,6	Adverse topography, soil limitations and excess water
KPHC 0.10 to KP 26.27	SE 4-51-22-W4M to SE 28-50-22-W4M	2,6	Soil limitations and excess water
KP 26.27 to KP 29.06	SE 28-50-22-W4M to NE 15-50-22-W4M	3,6	Adverse topography, soil limitations and excess water
KP 29.06 to KP 30.26	NE 15-50-22-W4M to SW 14-50-22-W4M	3,6	Soil limitations and excess water
KP 30.26 to KPHD 0.23	SW 14-50-22-W4M to NW 13-50-22-W4M	3	Soil limitations and adverse topography
KPHD 0.23 to KP 33.0	NW 13-50-22-W4M to NE 2-50-22-W4M	3,6	Soil limitations and excess water
KP 33.0 to KP 38.87	NE 2-50-22-W4M to SW 29-49-21-W4M	2	Soil limitations
KP 38.87 to KP 41.27	SW 29-49-21-W4M to SE 21-49-21-W4M	2	Adverse topography
KP 41.27 to KP 41.46	SE 21-49-21-W4M to SE 21-49-21-W4M	3,2	Soil limitations
KP 41.46 to KP 42.67	SE 21-49-21-W4M to NW 15-49-21-W4M	2	Adverse topography
KP 42.67 to KP 43.26	NW 15-49-21-W4M to NE 15-49-21-W4M	4	Adverse topography and soil limitations
KP 43.26 to KP 45.27	NE 15-49-21-W4M to SE 14-49-20-W4M	3,2,6	Soil limitations, adverse topography and excess water
KP 45.27 to KP 50.05	SE 14-49-21-W4M to SW 5-49-20-W4M	4,5	Adverse topography and soil limitations
KP 50.05 to KP 53.51	SW 5-49-20-W4M to SW 34-48-20-W4M	2,3	Adverse topography and soil limitations
KP 53.51 to KP 55.61	SW 34-48-20-W4M to NW 26-48-20-W4M	2	Soil limitations
KP 55.61 to KP 57.31	NW 26-48-20-W4M to SW 25-48-20-W4M	2	Adverse topography
KP 57.31 to KP 59.62	SW 25-48-20-W4M to NE 19-48-19-W4M	2,6	Soil limitations, adverse topography and excess water
KP 59.62 to KP 65.20	NE 19-48-19-W4M to SE 15-48-19-W4M	2,4,6	Soil limitations and excess water
KP 65.20 to KPC 0.87	SE 15-48-19-W4M to NW 12-48-19-W4M	2,4	Soil limitations and excess water
KPC 0.87 to KPHH 0.11	NW 12-48-19-W4M to NE 12-48-19-W4M	3	Soil limitations and adverse topography
KPHH 0.11 to KP 72.06	NE 12-48-19-W4M to NW 5-48-18-W4M	2,4	Soil limitations and excess water
KP 72.06 to KP 79.27	NW 5-48-18-W4M to NW 25-47-18-W4M	2,4,6	Soil limitations and excess water
KP 79.27 to KP 80.47	NW 25-47-18-W4M to SE 25-47-18-W4M	4,6	Soil limitations, adverse topography and excess water
KP 80.47 to KP 86.95	SE 25-47-18-W4M to SW 15-47-17-W4M	3,4,6	Soil limitations and excess water

TABLE 5.2 Cont'd

Location (KP)	Location (LSD)	CLI Class	Limitations
KP 86.95 to KP 91.85	SW 15-47-17-W4M to NW 6-47-16-W4M	2,4	Soil limitations and excess water
KP 91.85 to KP 94.16	NW 6-47-16-W4M to NE 31-46-16-W4M	2	Soil limitations
KP 94.16 to KP 95.16	NE 31-46-16-W4M to NW 32-46-16-W4M	3,4,6	Soil limitations and excess water
KP 95.16 to KP 96.05	NW 32-46-16-W4M to SE 32-46-16-W4M	2	Soil limitations
KP 96.05 to KP 99.26	SE 32-46-16-W4M to SW 27-46-16-W4M	3,4,6	Soil limitations and excess water
KP 99.26 to KP 100.16	SW 27-46-16-W4M to SE 27-46-16-W4M	2,6	Soil limitations and excess water
KP 100.16 to KP 100.96	SE 27-46-16-W4M to NW 23-46-15-W4M	3,4,6	Soil limitations and excess water
KP 100.96 to KP 110.48	NW 23-46-16-W4M to NW 3-46-15-W4M	2,6	Soil limitations and excess water
KP 110.48 to KP 115.40	NW 3-46-15-W4M to NE 25-45-15-W4M	3,4,6	Soil limitations and excess water
KP 115.40 to KP 125.49	NE 25-45-15-W4M to SW 13-45-14-W4M	2,6	Soil limitations and excess water
KP 125.49 to KP 126.90	SW 13-45-14-W4M to SW 7-45-13-W4M	2	Soil limitations
KP 126.90 to KP 134.10	SW 7-45-13-W4M to SW 35-44-13-W4M	2,6	Soil limitations and excess water
KP 134.10 to KP 134.80	SW 35-44-13-W4M to NE 26-44-13-W4M	2	Soil limitations
KP 134.80 to KP 136.20	NE 26-44-13-W4M to NW 25-44-13-W4M	3,2	Soil limitations
KP 136.20 to KP 137.10	NW 25-44-13-W4M to SE 25-44-13-W4M	3	Adverse topography
KP 137.20 to KP 141.39	SE 25-44-13-W4M to NE 17-44-12-W4M	6,7	Excess water
KP 141.39 to KP 142.0	NE 17-44-12-W4M to SW 16-44-12-W4M	3	Soil limitations
KP 142.0 to KP 143.60	SW 16-44-12-W4M to NE 9-44-12-W4M	6,7	Excess water
KP 143.60 to KP 150.0	NE 9-44-12-W4M to SW 6-44-11-W4M	3	Soil limitations
KP 150.0 to KP 150.39	SW 6-44-11-W4M to SE 6-44-11-W4M	3,6	Soil limitations and excess water
KP 150.39 to KP 151.80	SE 6-44-11-W4M to NW 32-43-11-W4M	2,6	Adverse climate and excess water
KP 151.80 to KP 153.90	NW 32-43-11-W4M to NW 32-43-11-W4M	2	Adverse climate
KP 153.90 to KP 157.19	NW 28-43-11-W4M to SE 33-43-11-W4M	2,6	Adverse climate and excess water
KP 157.19 to KP 157.79	SE 33-43-11-W4M to NE 22-43-11-W4M	4	Adverse topography
KP 157.79 to KP 159.0	NE 22-43-11-W4M to SE 23-43-11-W4M	6	Adverse topography
KP 159.0 to KP 160.09	SE 23-43-11-W4M to SW 24-43-11-W4M	3,7	Soil limitations and excess water
KP 160.09 to KP 162.09	SW 24-43-11-W4M to SW 18-43-10-W4M	3	Soil limitations
KP 162.09 to KP 163.39	SW 18-43-10-W4M to SE 18-43-10-W4M	6	Excess water and adverse topography
KP 163.39 to KP 164.30	SE 18-43-10-W4M to NW 8-43-10-W4M	3,6	Adverse topography and excess water
KP 164.30 to KP 164.82	NW 8-43-10-W4M to NE 8-43-10-W4M	3	Soil limitations
KP 164.82 to KP 168.61	NE 8-43-10-W4M to NW 3-43-10-W4M	6,4	Adverse topography
KP 168.61 to KP 169.27	NW 3-43-10-W4M to NE 3-43-10-W4M	3	Soil limitations
KP 169.27 to KP 169.59	NE 3-43-10-W4M to SE 3-43-10-W4M	6	Excess water
KP 169.59 to KP 173.09	SE 3-43-10-W4M to SW 36-42-10-W4M	6	Adverse topography and soil limitations
KP 173.09 to KP 173.89	SW 36-42-10-W4M to NE 25-42-10-W4M	5	Soil limitations
KP 173.89 to KP 174.58	NE 25-42-10-W4M to NW 30-42-9-W4M	6	Soil limitations
KP 174.58 to KP 175.5	NW 30-42-9-W4M to SE 30-42-9-W4M	4	Adverse topography

Sources: CLI 1967, 1970, 1971

Notes:
Class 1 = Soils that have no significant limitations in use for crops.
Class 2 = Soils that have moderate limitations that restrict the range of crops or require moderate conservation practices.
Class 3 = Soils that have moderately severe limitations that restrict the range of crops or require special conservation practices.
Class 4 = Soils that have severe limitations that restrict the range of crops or require special conservation practices, or both.
Class 5 = Soils have very severe limitations that restrict their capability to producing forage crops and improvement practices are feasible.
Class 6 = Soils are only capable of producing perennial forage crops and improvement practices are not feasible.
Class 7 = Soils in this class have no capability for arable culture or permanent pasture.

5.1.2.3 Contaminated Soils

The proposed route does not encounter any contaminated sites listed on the Federal Contaminated Sites Inventory (Treasury Board of Canada Secretariat 2011). A rupture of Enbridge's Line 3 pipeline occurred in 2001 in Hardisty Terminal at SE 30-42-9 W4M (NEB 2010). The rupture is publicly listed by the NEB; however, the remediation conducted is not published. There were no spills reported during the construction of the SEP II or JFP Projects. Two areas of historic contaminated soil were encountered during hydrovac activities along the Line 4 Extension Project at KP 34.5 (NW 36-49-22 W4M) and at

Kingman Station at KPHG 0.3 SE 5-49-20 W4M. All contaminated soil was handled in accordance with the Contaminated Soil Management Procedure set out in the EPP for the Line 4 Extension Project (TERA 2009).

The likelihood of encountering contaminated soils is considered to be higher adjacent to previously-disturbed lands (*e.g.*, existing pipelines and roads). Most of the proposed pipeline route encounters cultivated, tame pasture and hay with treed areas, and is adjacent to existing pipeline rights-of-way. Potential contaminants of concern that may be present from previous pipeline construction activities include fusion bond epoxy, liquid epoxy pipe coating, paint and hydrocarbons. Other possible sources of soil contamination are from spot spills and leaks during past farming activities.

5.1.2.4 Clubroot Disease

Clubroot is a soil-borne disease that affects canola and other crops in the mustard family. It is considered a pest under the *Agricultural Pests Act* and was first detected in Alberta in a canola field near Edmonton in 2003. Clubroot disease is spread through resting spores in the soil which can survive for up to 20 years. Symptoms will vary depending on the growth stage of the crop when infection occurs. Infection at the seedling stage can result in wilting, stunting and yellowing of plants. In later stages, infected plants will ripen prematurely and seeds will shrivel, which can be confirmed by checking for gall formation on roots. Canola crops that are infected with clubroot disease will also show a reduction in yield.

All counties have identified potential for clubroot disease to be encountered by the pipeline route (Hillaby, Horner, Kotylak, Van Beers pers. comm.). As of November 2011, clubroot disease was identified in 10 to 45 fields each in Strathcona County, the County of Camrose and Flagstaff County (AARD 2011a). More than 45 fields have been identified as being affected by clubroot disease in Leduc County (AARD 2011a). To date, clubroot disease has not yet been identified in Beaver County (AARD 2011a, Kotylak pers. comm.). There are no known occurrences of clubroot disease in the MD of Provost (Forbes pers. comm.).

5.1.3 Water Quality and Quantity

This subsection presents a summary of the findings related to water quality and quantity, and details the hydrologic resources within the Aquatics RSA. The locations of watercourse crossings along the proposed pipeline route are identified on the Environmental Alignment Sheets (Appendix 2 of this ESA). The potential Project-related effects and mitigation pertaining to water quality and quantity, and any associated potential for human health effects, are discussed in Sections 6.2.3 and 6.2.16, respectively.

An aquatic assessment was conducted by Qualified Aquatic Environment Specialists (QAES) in July 2012 along the proposed pipeline route. The information gathered from this assessment was used to complement and confirm pre-existing information available from aquatic assessments conducted along existing pipeline rights-of-ways that parallel the proposed route. This pre-existing data and the findings from the 2012 field studies have been incorporated into a detailed aquatic assessment (Appendix 6 of this ESA). Two potential watercourse crossings located at NE 12-45-14 W4M (approximately KP 126.5) and NW 8-43-10 W4M (approximately KP 163.7) were not able to be surveyed during the July 2012 aquatic assessment due to lack of land access. Supplemental studies will be completed as described in Section 10.0 of this ESA.

5.1.3.1 Surface Water Quantity

The North Saskatchewan River Basin, where the proposed pipeline route is situated, covers approximately 122,800 km² of Alberta and Saskatchewan (NRCan 2010). The North Saskatchewan River is a glacial fed river that has headwaters situated in Banff and Jasper National Parks within the Rocky Mountains. The river flows northeast to Edmonton and then east towards the Alberta-Saskatchewan border (Canadian Heritage Rivers System 2011). Its major tributaries include the Battle, Clearwater, Brazeau and Vermilion rivers. The Battle River Watershed forms part of the North Saskatchewan River Basin, with the Battle River joining the North Saskatchewan River in Saskatchewan (AESRD 2012a). Surface water quantity is in part affected by local climate. Further details on the climate in the vicinity of the proposed pipeline route are provided in Section 6.1.1.6 of this ESA.

The proposed pipeline route crosses the Beaverhill subwatershed and Vermilion subwatershed within the North Saskatchewan River Watershed (North Saskatchewan Watershed Alliance 2012), as well as the

Bigstone subwatershed and the Iron Creek subwatershed within the Battle River Watershed (Battle River Watershed Alliance 2011).

A section of the North Saskatchewan River is designated a Canadian Heritage River however, this designation only applies to the 48.5 km long headwaters situated in Banff National Park. There are no sections of designated or nominated Canadian Heritage Rivers crossed by the proposed pipeline route (Canadian Heritage Rivers System 2011). The proposed route does not cross any of the 13 designated irrigation districts in Alberta (AARD 2011b).

The proposed pipeline route crosses four named watercourses (*i.e.*, Mill Creek, Goldbar Creek, Irvine Creek and the Battle River), two unnamed tributaries to Iron Creek, one unnamed ditch, two unnamed fish-bearing wetlands and numerous nonfish-bearing wetlands. A summary of the watercourse and fish-bearing wetland crossings along the proposed pipeline route is provided in Table 5.3. A summary of the nonfish-bearing wetlands is provided in Section 5.1.8 of this ESA.

Goldbar and Mill creeks are direct tributaries to the North Saskatchewan River. Irvine Creek drains into Blackmud Creek and then Whitemud Creek, which is a direct tributary to the North Saskatchewan River. All three watercourses drain into the North Saskatchewan River within the city limits of Edmonton.

The Battle River is a direct tributary to the North Saskatchewan River. The Battle River begins at Battle Lake approximately 50 km northwest of the Town of Ponoka, Alberta. The Battle River flows southeast through the Town of Ponoka, and then heads east through several other towns including the Town of Hardisty, Alberta. The Battle River then flows across the Alberta-Saskatchewan border and into the North Saskatchewan River in Saskatchewan. Iron Creek is a direct tributary to the Battle River.

TABLE 5.3

SUMMARY OF PROPOSED WATERCOURSE AND FISH-BEARING WETLAND CROSSINGS ALONG THE PROPOSED PIPELINE ROUTE

Site No.	Legal Location (W4M)	KP	Name
WC1	SW 28-52-23	E 1.8	Goldbar Creek
WC2	SE 35-51-23	E 14.4	Mill Creek
WC3	SE 33-50-22	24.2	Irvine Creek
WC4	NW 31-46-16	94.1	Unnamed ditch
FD1	SW 18-46-15	105.3	Unnamed fish-bearing wetland
WC5	NW 26-44-13	135.6	Unnamed tributary to Iron Creek
WC6	SE 19-44-12	140.6	Unnamed tributary to Iron Creek
FD2	NW 3-43-10	168.1	Unnamed fish-bearing wetland
WC7	NE 25-42-10	173.6	Battle River

Hydrostatic test water for the proposed pipeline is expected to be withdrawn from Joseph Lake and the unnamed wetland at NW 10-43-10 W4M (connected to wetland crossing at KP 168.1). An estimated 30,000 m^3 of water will be needed to conduct hydrostatic testing for each of the three spreads of the proposed pipeline route, for an estimated total of 90,000 m^3. Water used for hydrostatic testing will be released within the same watershed from where it was withdrawn.

The North Saskatchewan River Basin has 20-30% of its natural flow that may be diverted under terms of licensed allocation (Alberta Environment [AENV] 2010). The Battle River Basin has over 100% of its flow available for diversion (AENV 2010). Although seemingly over allocated, the Battle River Basin has a large license that returns most of the water that is initially diverted, allowing for nearly all of the water to be reused or passed downstream. However, 10 year flow averages for the Battle River are documented as being below normal in all seasons near the Saskatchewan border downstream of the proposed pipeline route (AENV 2009).

There are 457 registered water licenses in the Aquatics RSA, mostly concentrated around the northwest end of the proposed pipeline route (Government of Alberta 2012a). A list of the water licenses registered

with AESRD within 10 km downstream of the watercourses crossed by the proposed route is provided in Table A3 of Appendix 10 of this ESA.

The Battle River Watershed Alliance in the process of developing a watershed management plan for the Alberta portions of the Battle River watershed. The purpose of this watershed management plan is to develop recommendations for policy directions and management practices that lead to the long-term sustainability of the watershed (Battle River Watershed Alliance 2011). Phase I of the watershed management planning process focuses on water quantity in the Battle River watershed, and is anticipated to be completed in 2012. Phase II will look more broadly at watershed management and source water protection, integrating land cover, land use, water quality, wetlands, riparian areas and other factors (Battle River Watershed Alliance 2011).

5.1.3.2 Historical Streamflow

The Water Survey of Canada maintains hydrometric stations on the Battle River at Highway No. 872 (Station No. 05CF008) and Iron Creek near the Town of Hardisty, Alberta (Station No. 05FB002) approximately 28 km southwest and 5 km northeast of the proposed pipeline route, respectively (Environment Canada 2012c,d). Streamflow was recorded seasonally from March to October at both stations, however, the periods of record range from 2005 to 2010 in the Battle River and from 1964 to 2010 in Iron Creek. Of the recorded months, mean monthly flows of the Battle River and Iron Creek were highest in April (*i.e.*, 18.7 m^3/s and 2.5 m^3/s, respectively). Mean monthly flows of the Battle River were lowest in October (*i.e.*, 0.9 m^3/s) and in Iron Creek in September (*i.e.*, 0.07 m^3/s). Streamflow in the Battle River is regulated by a weir at Driedmeat Lake located approximately 150 km upstream of the proposed pipeline route.

Streamflow data for the Battle River and Iron Creek stations are presented on Figures 5.1 and 5.2, and in Tables 5.4 and 5.5, respectively, and include maximum, minimum and mean monthly streamflows, maximum and minimum daily streamflows for the recorded period, and drainage area information. Streamflow data for the other watercourses crossed by the proposed route were not available.

Figure 5.1 Historical Mean Monthly Streamflow (m^3/s) Summary for the Battle River Station Near Highway 872 (Station 05FC008)

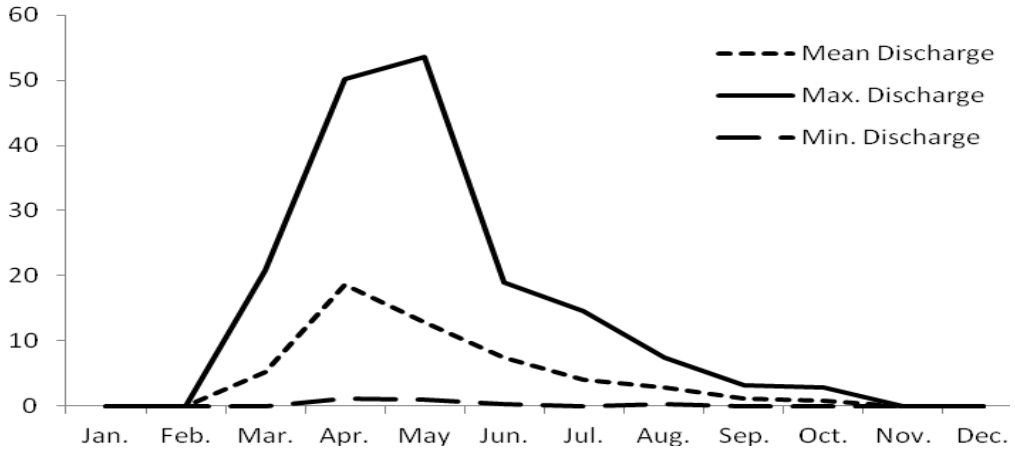

TABLE 5.4

HISTORICAL MEAN MONTHLY STREAMFLOW (m^3/s)
SUMMARY FOR THE BATTLE RIVER (STATION NO. 05FC008)

Discharge	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mean Discharge	--	--	5.25	18.7	12.9	7.46	4.00	2.86	1.22	0.87	--	--
Max. Discharge	--	--	20.9	50.1	53.5	19.0	14.5	7.42	3.19	2.78	--	--
Min. Discharge	--	--	0.04	1.09	1.03	0.295	0.042	0.339	0.012	0.019	--	--

Years of Streamflow Record: 2005 to 2012
Maximum Daily Discharge: 105 m^3/s on May 8, 2007
Minimum Daily Discharge: 0.000 m^3/s from November to February, annually
Effective Drainage Area: 6,010 km^2
Source: Environment Canada 2012c

Figure 5.2 Historical Mean Monthly Streamflow (m^3/s) Summary for the Iron Creek Station Near the Town of Hardisty (Station 05FB002)

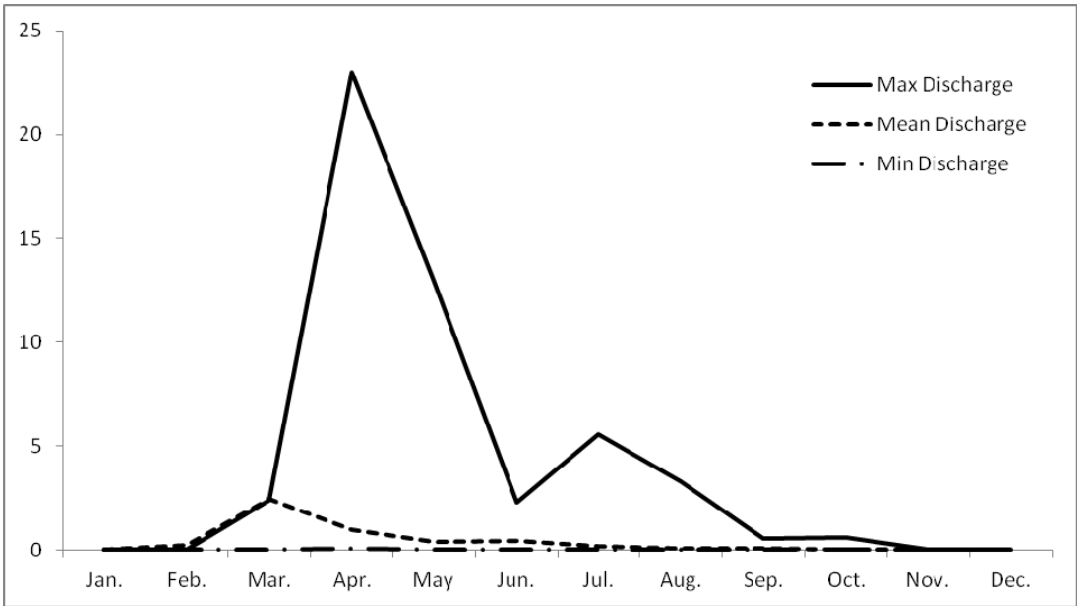

TABLE 5.5

HISTORICAL MEAN MONTHLY STREAMFLOW (m^3/s)
SUMMARY FOR IRON CREEK (STATION NO. 05FB002)

Discharge	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mean Discharge	--	0.253	2.46	0.97	0.420	0.466	0.172	0.067	0.076	--	--	--
Max. Discharge	--	--	2.38	23	12.9	2.29	5.58	3.27	0.56	0.632	--	--
Min. Discharge	--	--	0.000*	0.085	0.008	0	0	0	0.000*	0	--	--

Note: * occurs more than once
Years of Streamflow Record: 2005 to 2012
Maximum Daily Discharge: 68.0 m^3/s on April 23, 1974
Minimum Daily Discharge: 0.000 m^3/s from November to February, annually
Effective Drainage Area: 815 km^2
Source: Environment Canada 2012d

5.1.3.3 Surface Water Quality

Surface water quality risk in most of the Aquatics RSA is rated as 0.76-1.00 (with 1 being the highest risk and 0 being the lowest risk) (AARD 2005d). The dominant land use surrounding the proposed pipeline route is agricultural. This attributes to the high risk rating, since the potential exists for non-point source discharges of sediment and chemicals used in pesticides and fertilizers into surrounding surface water. Potential contributing factors also include a rise in the volume of municipal wastewater effluent, runoff from domestic lawn care products and increased soil erosion.

Water quality at the Battle River approximately 2 km south of Highway 53 has been sampled from 1999 to 2008 at sampling station AB05FA0060. Total phosphorus concentrations ranged from 0.042-1.170 mg/L. Nitrite and total nitrogen concentrations ranged from 0.001-0.50 mg/L and 0.292-4.815 mg/L, respectively. Fecal coliform and *E. coli* levels ranged from 9-880 per 100 mL. The pH in the Battle River ranged from 6.76-9.75 (AENV 2008a).

Surface water quality data for Goldbar Creek were obtained from sampling station AB05EB0230 located approximately 8.5 km downstream of the proposed crossing. This station is located near the confluence of Goldbar Creek with the North Saskatchewan River. Historical inorganic water quality data were collected at this station from 1983 to 1997, while organic water quality data were collected in August 1990 and 1997 (Teichreb pers. comm.). Nutrient concentrations were near and sometimes exceeding Canadian Council of Ministers of the Environment (CCME) *Canadian Water Quality Guidelines*. Total phosphorus ranged from 0.039-20.0 mg/L in summer months (May to August) and 0.025-0.4 mg/L in fall/winter months (September, October and January). Nitrite concentrations ranged from 0.025-0.18 mg/L in summer months, while total nitrogen concentrations ranged from 0.71-4.35 mg/L during this period. In the fall/winter months, nitrite concentrations were from 0.005-0.17 mg/L and total nitrogen concentrations ranged from 1.14-2.9 mg/L. Fecal and total coliforms ranged from 22-4500/100 mL and 270-80,000/100 mL, respectively, in the summer months and 50-850/100 mL and 730-13,000/100 mL in the fall/winter months. Organic water quality data indicated lower than detection level concentrations for most pesticides. However, weed control herbicide, Atrazine, was recorded at 14.3 µg/L in August 1990 (Teichreb pers. comm.).

Surface water quality data were available from sampling station AB05EB0140 at the mouth of Mill Creek prior to its confluence with the North Saskatchewan River. The sampling station is located approximately 23.1 km downstream from the proposed crossing at KPE 14.4. Historical inorganic water quality data from May to August 1983 were available. Historical organic water quality data were available for August 1997 and September 2001 (Teichreb pers. comm.). Total phosphorus concentrations ranged from 0.38-2.6 mg/L and total nitrogen concentrations ranged from 1.49-25.5 mg/L during this period. Fecal coliforms and total coliforms ranged from 4-19,000 No./100 mL and 800-66,000 No./100 mL, respectively (Teichreb pers. comm.). Most organic water quality data were below detection level concentrations, however, some pesticides were measurable. In September 2001, the following herbicide concentrations were recorded: Atrazine at 0.075 µg/L; Dicamba at 0.11 µg/L; Mecoprop at 0.62-0.93 µg/L; and 2,4-D at 0.037-0.36 µg/L (Teichreb pers. comm.).

There is no sediment loading data available for the watercourses crossed by the proposed pipeline route.

Details on water supplies for the towns and cities in the Aquatics RSA are provided in Section 5.1.12 of this ESA.

The North Saskatchewan River Watershed Alliance has proposed water quality objectives for specific reaches of the mainstem of the North Saskatchewan River using indicators such as total suspended solids, total dissolved solids, temperature, total phosphorus, nitrites, ammonia, pH, fecal coliforms, *E. coli*, turbidity and dissolved oxygen (North Saskatchewan Watershed Alliance 2010).

5.1.3.4 Groundwater Quantity and Quality

Most of the proposed route is underlain by Upper Cretaceous non-marine shale, siltstone and sandstone. This non-marine sequence is interrupted by a wedge of the marine Bearspaw Formation near Hardisty that primarily consists of silty shale (Pupp *et al.* 1989). Pupp *et al.* suggest that groundwater in the Aquatics RSA exists in amounts that are suitable to meet the needs of domestic and farm demands (Pupp *et al.* 1989). The quality of the groundwater varies greatly throughout the proposed route, with total

dissolved solids ranging from 500 mg/L to over 2,000 mg/L (Pupp *et al.* 1989). Aquifers in the area generally reside in deep coal seams and sandstone units. Most groundwater flow within the area is by a downward hydraulic gradient from the surficial deposits toward the upper bedrock aquifers (Hydrogeological Consultants Ltd. 1998, 2001).

The Aquifer Vulnerability Index in the Aquatics RSA is rated as Low to Moderately-Low (AARD 2005e). The groundwater quality risk for contaminants from agricultural activities ranges from 0.28-0.45 (with 1 being the highest risk and 0 being the lowest risk) (AARD 2005f).

The northwest portion of the proposed pipeline route has upper surficial deposits that are primarily composed of till with pockets of sand and gravel. Upper Sand and Gravel Aquifers are found in areas of saturated sand and gravel within the upper surficial deposits. The upper surficial deposits are close to 60 m thick near the Edmonton Terminal in the Buried Beverley Valley. However, they are less than 30 m thick along the remainder of the northwest portion of the proposed route. The Upper Sand and Gravel Aquifers are present at no particular depth within the upper surficial deposits (Hydrogeological Consultants Ltd. 2001). This type of aquifer yields approximately 10-100 m^3/day. Where surficial aquifers are not sufficient in this area, most groundwater is used from the Lower Horseshoe Canyon Aquifer with some from the Middle Horseshoe Canyon Aquifer. Depth to the top of these aquifers is a function of surficial deposits and is mainly less than 30 m below ground level within the Aquatics RSA (Hydrogeological Consultants Ltd. 1999, 2001).

Data available for KPHC 0.4 to KP 37.0 (NE 32-50-22 W4M to NE 30-49-21 W4M) along the proposed pipeline route indicate highly permeable sand and gravel at less than 1 m below ground surface north of Looking Back Lake near approximately KP 26.0 to KP 27.0 (SE 28-50-22 W4M to NW 22-50-22 W4M). This area has been designated as having a high level of potential groundwater contamination due to high surface permeability (Hydrogeological Consultants Ltd. 1999).

Data available along the proposed route from approximately KP 93.9 to KP 98.6 (SW 5-47-16 W4M to SE 28-46-16 W4M) indicate 0-25% sand and gravel deposits in surficial deposits that are less than 30 m below ground level. Most of this area does not have aquifers present or, if present, they are not in surficial deposits (Hydrogeological Consultants Ltd. 1999).

Bedrock aquifers along the central portion of the proposed route from approximately KPHG 0.2 to KP 98.6 (SE 5-49-20 W4M to SE 28-46-16 W4M) include: the Lower Horseshoe Canyon Aquifer (depth to the top of aquifer is less than 40 m below ground level); the Bearpaw Aquifer (less than 60 m below ground level); the Oldman Aquifer (less than 20 m below ground as it subcrops in this area); and the Continental Foremost Aquifer (greater than 100 m below ground level). Depth to the top of these aquifers is a function of surficial deposits. The potential for groundwater contamination is rated as high in this area along the central portion of the proposed route due to high surface permeability (Hydrogeological Consultants Ltd. 1999).

An important source for groundwater along the southeast portion of the proposed pipeline route from approximately KPHK 0.2 to KP 175.5 (SW 2-46-15 W4M to SE 30-42-9 W4M) is from aquifers in the upper and lower surficial deposits. The depth of upper surficial deposits is less than 30 m below ground level with the exception of the Buried Wainwright Valley from KP 131.0 to KP 161.6 (SE 5-45-13 W4M to NE 13-43-11 W4M), which is more than 60 m below ground level (Hydrogeological Consultants Ltd. 1998). The amount of sand and gravel within upper surficial deposits of buried bedrock valley is greater than 25%. Some areas along the southeast portion of the proposed pipeline route yield more than 100 m^3/day from water wells completed through upper sand and gravel aquifers. The Lower Sand and Gravel Aquifer may be a continuous aquifer in the Buried Wainwright Valley (Hydrogeological Consultants Ltd. 1998). The Lower Sand and Gravel Aquifer occurs near the base of surficial deposits where bedrock is greater than 60 m below ground level.

Bedrock aquifers from approximately KPHK 0.23 to KP 175.5 (SW 2-46-15 W4M to SE 30-42-9 W4M) include: the Bearpaw Aquifer (less than 60 m below ground level); the Oldman Aquifer (below the Bearpaw and the Lower Horseshoe Canyon formations); and the Continental Foremost Aquifer (greater than 100 m below ground level). Depth to the top of these aquifers is a function of surficial deposits. The Milan Aquifer is also present along the southeast portion of the proposed route within the Continental Foremost Formation and Marine Foremost Formation (Hydrogeological Consultants Ltd. 1998). The

deposits underlying the southeast portion of the proposed route are highly permeable and, therefore, the potential for groundwater contamination is rated as high.

Groundwater Wells

Groundwater is a primary source of water for the population of this region. Water well records within a 1 km radius of the proposed pipeline route were reviewed. A total of 1,286 wells were identified including:

- 780wells for domestic use;
- 166 wells for domestic and stock use;
- 108 wells for stock use;
- 44 wells for industrial use;
- 18 wells for municipal use;
- 106 wells for other uses (*e.g.*, observation, investigation, irrigation); and
- 64 wells for unknown water use (AESRD 2012b).

Twenty-five wells were identified within the Project Footprint (AESRD 2012b). Additional information on the identified wells is provided in Table A4 of Appendix 10 of this ESA.

Springs

A spring is defined by Borneuf as "a place where, without the agency of man, water flows from a rock or soil upon the land or into a body of surface water" (Borneuf 1983).

There are no recorded springs along the proposed pipeline route according to Borneuf (1983) and AENV (1991). However, two springs were crossed along the existing Enbridge right-of-way during construction of the IPL SEP II Project in 1998 (IPL 1998). The springs were recorded at SW 16-44-12 W4M (approximately KP 143.3) and at NW 3-43-10 W4M (approximately KP 167.7). The spring at KP 143.3 was also encountered during construction of the Line 4 Extension Project in 2008 (TERA 2009).

5.1.3.5 Potential Water Quality Contaminants

The potential contaminants of concern associated with the proposed pipeline that may affect water quality if accidentally released include those compounds routinely used in pipeline construction such as fusion bond epoxy, liquid epoxy pipe coating, paint, various hydrocarbons and drilling mud during HDD.

5.1.4 Air Emissions

This subsection presents a summary of the findings related to air quality in the Air Quality RSA. Air quality in this RSA is primarily a function of anthropogenic sources of emissions. The potential receptors to nuisance air emissions from the proposed pipeline route include local residents and communities. There are many residences located within the Air Quality LSA. The potential Project-related effects and mitigation pertaining to air emissions, and any associated potential for human health effects, are discussed in Sections 6.2.4 and 6.2.16, respectively.

5.1.4.1 Existing Air Quality and Emissions

The regional ambient air quality in the vicinity of the northwest end of the proposed pipeline route is monitored at a number of stations administered by the Strathcona Industrial Association (SIA). The SIA operate several monitoring stations in east Edmonton that collect data through continuous, intermittent and passive monitoring methods. Monitoring stations within approximately 5 km of the Edmonton Terminal include Sherwood Park, Elmjay, Goldbar and Beverly (SIA 2011). A summary of the annual averages of ambient air quality results for 2011 at these stations are provided in Table 5.6 of this ESA. The reported annual air quality values are below the annual objectives, where present for the CAC in question.

TABLE 5.6

2011 AVERAGE ANNUAL AMBIENT AIR QUALITY DATA IN THE AIR QUALITY RSA

Station	H_2S (parts per billion [ppb]	SO_2 (ppb)	NO_2 (ppb)	Total Hydrocarbons (parts per million)	$PM_{2.5}$ (µg per m^3)
Sherwood Park	0.3	1.6	12	2.1	7
Elmjay	0.3	1.1	--	--	--
Goldbar	0.4	1.6	14	--	7.5
Beverly	0.5	0.9	--	2.6	7
Alberta Annual Ambient Air Quality Objective	--	8.0	24	--	10[1]

Source: SIA 2011

Notes: 1 World Health Organization Annual Guideline for $PM_{2.5}$

SO_2 = sulphur dioxide

NO_2 = nitrogen dioxide

Minor increases in anthropogenic emissions in the Air Quality RSA are expected to occur as a result of transportation activities, agricultural activities, oil and gas development, and utility activities. Vehicle traffic and machinery use resulting from these activities are also a source of dust in the Air Quality RSA. Table 5.7 provides details on emissions data from existing facilities located within the Air Quality RSA.

TABLE 5.7

REPORTED EMISSIONS (IN TONNES) FROM FACILITIES IN THE AIR QUALITY RSA OF THE PIPELINE ROUTE (2010)

Name of Facility	Location (W4M)	Facility ID	CO	SO_2	NO_2	TPM	VOC
Alberta Capital Region Commission - Wastewater Treatment Plant	SW 3-54-23	6648	-	-	-	3.885	29.71
Penn West Petroleum Ltd.	11-18-53-21	18777	41.135	-	26.606	-	-
Park Paving Ltd., Asphalt Plant	SE 29-50-22	21682	-	66.534	-	4.201	-
Rife Resources Ltd., Bittern Lake Compressor Station	16-19-49-22	24115	46.134	-	45.311	-	-
Enerplus Corporation, Joarcam Compressor Station	11-31-49-21	18857	30.093	-	-	-	-
Enerplus Corporation, Joarcam Sweet Gas Plant	6-29-49-22	16799	189.086	-	123.141	0.543	-
Plains Midstream Canada, Joarcam Truck Terminal	SE 30-49-21	21763	-	-	-	-	22.111
Rife Resources Ltd., Rife Bittern Lake	11-32-47-22	17836	-	-	76.825	-	-
Shaw Pipe Protection Ltd. (Camrose 39 St.)	1-47-20 (Camrose)	23192	-	-	-	1.958	6.1
Shaw Pipe Protection Ltd. (Camrose 54 St.)	2-47-20 (Camrose)	4008	-	-	-	1.848	21.5
Border Paving Ltd., Camrose Batch Plant	34-46-20	6850	5.276	0.135	1.035	0.687	1.935
Richardson Pioneer Ltd., Legacy Junction	21-46-19	18274	-	-	-	17.468	-
Perpetual Energy Inc., Archer West Holden	SW 35-48-18	16446	-	-	38.993	-	-
AltaGas Ltd., Holden Compressor Station	16-22-47-17	15172	27.129	-	-	-	-
AltaGas Ltd., Holden Gas Battery	9-19-48-16	15170	248.591	-	334.089	0.68	-
AltaGas Ltd., Bruce Compressor Station	10-29-45-17	15169	62.892	-	68.923	-	-
Prairie Mines & Royalty Ltd., Paintearth Mine	NW 12-44-16	21775	-	-	-	422.425	-
Perpetual Energy In., Archer Bruce	SW 6-47-15	22390	25.485	-	315.273	0.693	-
Perpetual Energy In., Archer Bruce	3-6-47-15	16442	24.922	-	55.403	-	-
TransCanada PipeLines Ltd., Dusty Lake	NE 24-46-16	6714	-	-	65.766	0.394	-
AltaGas Ltd., Iron Creek Sweet Gas Plant	13-31-45-13	15120	54.24	-	179.727	-	-
AltaGas Ltd., Iron Creek Compressor Station	11-31-45-13	15121	27.912	-	-	-	-
AltaGas Ltd., Iron Creek Antelope Compressor Station	13-17-45-12	22599	52.145	-	65.554	-	-
AltaGas Ltd., Killam North Sweet Gas Plant	4-5-45-12	15094	132.364	-	379.763	0.342	-
Viterra Inc., Killam	16-44-13	19142	-	-	-	14.421	-
Zargon Oil and Gas Ltd., Jarrow West	8-14-45-14	19234	-	-	69.9	0.8	-

TABLE 5.7 Cont'd

Name of Facility	Location (W4M)	Facility ID	CO	SO_2	NO_2	TPM	VOC
Zargon Oil and Gas Ltd., Jarrow	6-17-45-10	19233	114.3	-	70.3	0.3	-
Canadian Natural Resources Limited, Hawkins	4-5-43-9	15821	-	-	73.089	-	-
Penn West Petroleum Ltd., Penn West Sedgewick	SE 16-42-12	19063	43.226	-	59.243	-	-
Penn West Petroleum Ltd., Signalta Sedgewick	16-4-42-12	21203	27.555	-	-	-	-
Perpetual Energy Inc., Archer Killam	NW 23-43-11	16457	-	-	80.653	-	-
Flint Hills Resources, Hardisty Terminal	SE 1-43-10	6570	-	-	-	-	11.929
Husky Oil Limited, Hardisty Pipeline Terminal	SE 36-42-10	6605	-	-	-	-	33.466
Plains Midstream Canada, Hardisty	NE 30-42-9	21761	-	-	-	-	10.426
Gibson Energy Ltd., Hardisty Terminal	SW 29-42-9	21534	-	-	-	344.618	303.671
Gibson Energy Ltd., Hardisty Fractionation Plant	NE 20-42-9	22320	-	-	-	0.462	70.542
Penn West Petroleum Ltd., Killam	15-11-43-9	22446	71.968	-	68.68	0.512	-
Penn West Petroleum Ltd., Albers Gas Group	NE 28-42-8	17526	22.517	-	-	-	-
West Fraser Mills ltd., ALBERTA PLYWOOD EDMONTON	4-21-52-24	7787	97.239	-	36.593	30.68	11.608
National Oilwell Varco, Dreco	4-23-52-24	21584	-	-	-	-	23.18
ZCL Composites Inc.	9-24-52-24	5262	-	-	-	-	32.39
ZCL Composites Inc., ZCL Corrosion	9-24-52-24	2301	-	-	-	-	16.39
Maple Leaf Metals (A Partnership),	12-24-52-24	5202	-	-	34.078	-	-
Celanese EVA Performance Polymers Inc.	14-36-52-24	126	249.471	-	365.2	8.69	312.7
Lafarge North America, Lafarge Canada, Inc.	1-9-53-24	19246	-	-	-	5.817	-
EPCOR Water Services Inc., Gold Bar Wastewater Treatment Plant	5-12-53-24	5390	-	63.6	-	-	-
Great Western Containers Inc., Edmonton South Plant	8-19-52-23	16950	-	-	-	-	20.4
General Scrap Partnership, GenAlta Recycling Inc.	4-31-52-23	5367	4.052	-	18.817	91.462	1.236
AltaSteel Ltd., AltaSteel	3-31-52-23	1106	654.815	69.552	69.35	138.355	8.321
Alberta Envirofuels Inc.,	5-32-52-23	3974	101.23	21.5	228.4	-	34.35
Shell Canada Products, Sherwood Marketing Terminal	2-32-52-23	6660	-	-	-	-	523.231
Kinder Morgan Canada Inc., Edmonton North 40 Terminal	3-5-53-23	22904	-	-	-	-	17.067
Kinder Morgan Canada Inc., Edmonton Terminal	4-5-53-23	6860	-	-	-	-	65.097
Suncor Energy Inc., Edmonton Refinery	11-5-53-23	3903	928.701	3,605.939	1,410.128	190.696	791.77
Shaw Pipe Protection Ltd.	1-6-53-23	4002	-	-	-	-	3.89
Imperial Oil, Strathcona Refinery	4-6-53-23	3707	922.2	3,978.8	1,675.5	636.8	583.6
Ashland Canada Corp.,	4-7-53-23	1671	0.246	0.002	0.283	-	-
Rio Tinto Alcan, Strathcona Works	4-8-53-23	19289	70.435	5,608.185	224.108	106.351	-
Suncor Energy Inc, Edmonton Terminal	3-8-53-23	6566	-	-	-	-	795.5
Air Products Canada Ltd.	1-8-53-23	19995	177.9	-	252	30.5	28.1
Gibson Energy Ltd., Edmonton South Terminal	13-8-53-23	21533	-	-	-	197.396	375.873
Armor Wood Products Ltd.	6-15-53-23	5305	0.001	-	-	-	-
Great Western Containers Inc., Edmonton North Plant	4-16-53-23	19628	-	-	-	-	5.28
Owens Corning Insulating Systems Canada LP,	1-17-53-23	1251	66.248	-	20.232	121.136	37.235
Keyera Corp, Alberta Diluent Terminal (ADT) Terminal	1-17-53-23	23575	-	-	-	-	46.837
Gilead Alberta ULC, Clover Bar Site	1-18-53-23	5245	-	-	-	-	20.825
Capital Power (Alberta) Limited Partnership, Clover Bar Energy Centre	4-20-53-23	23368	46	-	86.85	-	-
ATCO Gas and Pipelines Ltd., ATCO Pipelines – Cloverbar	11-21-53-23	6567	42.83	-	35.66	-	11.41
City of Edmonton, Edmonton Composting Facility	13-21-53-23	6513	-	-	-	1,189.28	-
Capital Power (Alberta) Limited Partnership	15-21-53-23	21512	163.46	-	61.3	-	19.09

Source: Environment Canada 2010

Notes: CO = carbon monoxide
SO_2 = sulphur dioxide
NO_2 = nitrogen dioxide
TPM = Total Particulate Matter
VOC = Volatile Organic Compounds

5.1.4.2 Local and Regional Meteorological Conditions

Environment Canada has two major meteorological stations (Edmonton City Centre and Camrose) with wind data that are applicable to the Air Quality RSA (Environment Canada 2012a,b). The most frequent wind direction at the Edmonton City Centre is from the west, although during the winter months, the wind is predominantly from the south (Environment Canada 2012a). The most frequent wind direction at Camrose is from the west and northwest (Environment Canada 2012b).

Additional information related to climatic conditions is summarized in Section 5.1.1.6 of this ESA.

5.1.5 Greenhouse Gas Emissions

This subsection presents a summary of the findings related to GHG emissions in the Air Quality RSA. GHG emissions in the Air Quality RSA are primarily a function of anthropogenic sources of emissions. The potential Project-related effects and mitigation pertaining to GHG emissions are discussed in Section 6.2.5 of this ESA.

The largest contributing GHG in Canada is CO_2, which totals 79% of Canada's total emissions. Most of these emissions result from fossil fuel combustion (Environment Canada 2012e). In Alberta, the oil and gas sector contributes substantially to overall increases in provincial GHG emissions (AENV 2008b). However, GHG emissions associated with oil and gas transportation activities are relatively minor, and are primarily associated with stationary combustion devices used to transport the products (*e.g.*, pump stations).

5.1.6 Acoustic Environment

This subsection presents a summary of the findings related to ambient noise and the acoustic environment in the Acoustic Environment LSA. The potential Project-related effects and mitigation pertaining to the acoustic environment, and any associated potential for human health effects, are discussed in Sections 6.2.6 and 6.2.16, respectively.

Ambient noise in the Acoustic Environment LSA is primarily caused by anthropogenic sources such as those identified in Section 5.1.17 of this ESA. The potential receptors to nuisance noise emissions include local residences and communities. There are many residences located within the Acoustic Environment LSA.

Strathcona County's Noise Control Bylaw No. 66-99 states that no person shall cause a "noise" as defined as any sound which, in the opinion of a County Bylaw Enforcement Officer, having regard for all circumstances, including the time of day and the nature of the activity generating the sound, is likely to unreasonably annoy or disturb persons or to injure, endanger or detract from the comfort, repose, health, peace or safety of persons within the boundary of the County. This Bylaw does not apply during the hours of 7:00am to 9:00pm from Monday to Thursday, from 7:00 AM to 10:00 PM from Friday to Saturday, and from 10:00 AM to 9:00 PM on Sunday from September 1 to June 30. In addition, the Bylaw does not apply on land zoned as Heavy Industrial by Strathcona County (*i.e.*, the Edmonton Terminal in NW 32-52-23 W4M) (Strathcona County 1999).

The Camrose County Noise Bylaw No. 1019 and Beaver County Noise Bylaw No. 09-957 do not apply to the construction of the proposed pipeline since the proposed route is not located in a Designated Area, as defined by the bylaws (Camrose County 2002, Beaver County 2009). There are no local bylaws pertaining to noise in Leduc County, Flagstaff County or the MD of Provost.

With the exception of inspection and general maintenance activities, noise generated by the operation of the pipeline is expected to be undetectable and will not contribute to ambient noise levels. Therefore, a quantitative assessment of the construction and operation of the proposed pipeline on the acoustic environment is not warranted for the pipeline as per Table A-2 of the NEB *Filing Manual*.

Noise arising from construction activities and the potential effects on wildlife are discussed under the Wildlife and Wildlife Habitat element.

No concerns related to noise have been raised during public consultation for the Project.

5.1.7 Fish and Fish Habitat

This subsection presents a summary of the findings related to fish and fish habitat and fish species of concern in the Aquatics RSA and watercourse crossings. Documented fish spawning and rearing habitat potential is provided for watercourse crossings identified along the proposed pipeline route on the Environmental Alignment Sheets (Appendix 2 of this ESA). The potential Project-related effects and mitigation pertaining to fish and fish habitat, and any associated potential for human health effects are discussed in Sections 6.2.7 and 6.2.16 of this ESA, respectively.

5.1.7.1 Fish-Bearing Crossings

Nine proposed water crossings were identified along the proposed pipeline route that had fish and fish habitat (Table 5.8). The nine fish-bearing proposed water crossings include all seven watercourses crossed and two fish-bearing wetlands. The seven watercourses include Goldbar Creek, Mill Creek, Irvine Creek, an unnamed channelized ditch at KP 94.1 (NW 31-46-16 W4M), two unnamed tributaries to Iron Creek at KP 135.6 (NW 26-44-13 W4M) and KP 140.6 (SE 19-44-12 W4M) and the Battle River.

Goldbar and Mill creeks are direct tributaries to the North Saskatchewan River. The proposed crossings on Goldbar Creek and Mill Creek are approximately 9 km and 23 km upstream, respectively, from their confluences with the North Saskatchewan River. Irvine Creek flows into Blackmud Creek and then Whitemud Creek. Whitemud Creek is a direct tributary to the North Saskatchewan River.

The proposed crossing on Irvine Creek is approximately 30 km upstream from its confluence with Blackmud Creek. The confluence of Irvine Creek is approximately 15 km upstream from Blackmud Creek's confluence with Whitemud Creek. The confluence of Blackmud Creek is approximately 8 km upstream from Whitemud Creek's confluence with the North Saskatchewan River.

The unnamed channelized ditch at KP 94.1 (NW 31-46-16 W4M) is located in a field and is part of a channelized system for crops that is not connected to downstream fish habitat.

The proposed crossings on the two unnamed tributaries to Iron Creek at KP 135.6 (NW 26-44-13 W4M) and KP 140.6 (SE 19-44-12 W4M) flow for approximately 2 km and 3 km, respectively, to their confluences with Iron Creek. The confluences of the two unnamed tributaries with Iron Creek are approximately 55 km and 50 km, respectively, upstream from Iron Creek's confluence with the Battle River. The confluence of Iron Creek and the Battle River is immediately downstream of the Town of Hardisty.

The proposed crossing on the Battle River is approximately 250 km upstream from the Battle River's confluence with the North Saskatchewan River in Saskatchewan.

The classifications and restricted activity periods (RAPs) for the seven watercourses crossed by this proposed pipeline route were determined according to the Code of Practice St. Paul Management Area Map (AENV 2006a) and the COP Red Deer Management Area Map (AENV 2006b). The Battle River is a mapped Class C watercourse with an instream RAP from April 16 to June 30. Goldbar and Mill creeks are uncoded mapped Class D watercourses. The unnamed tributary to Iron Creek at KP 135.6 (NW 26-44-13 W4M) is a mapped Class D watercourse, while Irvine Creek, the unnamed ditch at KP 94.1 (NW 31-46-16 W4M) and the unnamed tributary to Iron Creek at KP 140.6 (SE 19-44-12 W4M) are unmapped Class D watercourses. These six watercourses have no instream RAP.

The fish-bearing wetlands lack defined bed and banks and, therefore, do not fall under the COPs. Since the two fish-bearing wetlands lack defined bed and banks and the only fish and fish habitat present is for non-sportfish species, they do not have a classification and do not require a RAP (Kuchmak pers. comm.).

TABLE 5.8

SUMMARY OF PROPOSED WATERCOURSE AND FISH-BEARING WETLAND CROSSINGS ALONG THE PROPOSED PIPELINE ROUTE

Site No.	Name, KP [1]	Legal Location (W4M), UTM Co-ordinates (NAD 83, Zone 12)	Latitude/Longitude (DD-MM-SS)	Watercourse Class and Restricted Activity Period [2]	Mean Channel Morphology (m)	Fish Species Captured or Observed During Open Water Assessment (Previously Documented) [3]	Beaver Activity Present	Comments
WC1	Goldbar Creek KP E1.8	SW 28-52-23 E: 344933 N: 5932486	53° 31' 6.147" N / 113° 20' 20.130"W	Uncoded Mapped Class D No RAP	Bankfull: 1.1 Wetted: 1.1 Depth: 0.2	Brook stickleback and fathead minnow (brook stickleback and fathead minnow previously documented approximately 900 m downstream of the proposed crossing; lake chub previously documented approximately 4 km downstream)	None	Low approach slopes with flooded wetland on both sides of the proposed crossing.
WC2	Mill Creek KPE 14.4	SE 35-51-23 E: 349087 N: 5924205	53° 26' 42.752" N / 113° 16' 20.439" W	Uncoded Mapped Class D No RAP	Bankfull: 1.9 Wetted: 6.5 Depth: 0.9	Brook stickleback and fathead minnow (brook stickleback and fathead minnow previously documented 200 m downstream of the proposed crossing)	None	Crossing was flooded over top of the banks at time of assessment. Note there is also an existing culvert vehicle crossing approximately 250 m downstream of the proposed crossing.
WC3	Irvine Creek KP 24.2	SW 33-50-22 E: 356003 N: 5914212	53° 21' 26.591" N / 113° 9' 49.430" W	Unmapped Class D No RAP	Bankfull: 4.9 Wetted: 32.5 Depth: 0.4	No fish captured or observed (no fish previously documented at the proposed crossing or in Irvine Creek. The following fish species have been previously documented in Blackmud Creek: white sucker; longnose sucker; longnose dace; lake chub; fathead minnow; and brook stickleback)	None	Crossing was flooded over top of the banks at time of assessment. There is an existing culvert vehicle crossing at the existing right-of-way approximately 25 m upstream of the proposed crossing.
WC4	Unnamed ditch KP 94.1	NW 31-46-16 E: 411778 N: 5874974	53° 1' 1.305" N / 112° 18' 54.468" W	Unmapped Class D No RAP	Bankfull: 2.8 Wetted: 2.1 Depth: 0.2	Brook stickleback (no fish previously documented at crossing or downstream)	None	Channelized ditch bisecting cultivated canola field. No flow, only residual fish-bearing pools remain. Banks have been shaped and graded. Channel is heavily vegetated with cattails and sedges.
WC5	Unnamed tributary to Iron Creek KP 135.6	NW 26-44-13 E: 447153 N: 5853340	52° 49' 38.033" N / 111° 47' 3.636" W	Mapped Class D No RAP	Bankfull: 1.0 Wetted: 16.3 Depth: 0.4	Brook stickleback (no fish previously documented at crossing. Fathead minnow, white sucker and brook stickleback have been previously documented in Iron Creek approximately 25 km downstream)	None	Crossing was flooded over top of the banks at time of assessment. Multiple marshy/impounded areas with no channel definition.
WC6	Unnamed Tributary to Iron Creek KP 140.6	SE 19-44-12 E: 451297 N: 5850627	52° 48' 11.645" N / 111° 43' 20.784" W	Unmapped Class D No RAP	Bankfull: 0.9 Wetted: 0.9 Depth: 0.3	Brook stickleback (brook stickleback previously documented at crossing. Fathead minnow, white sucker and brook stickleback have been previously documented in Iron Creek approximately 20 km downstream)	Yes	Beaver activity does not influence crossing. This tributary is sourced by water runoff from a wetland complex upstream.
WC7	Battle River KP 173.6	NE 25-42-10 E: 479339 N: 5833485	52° 39' 3.371" N / 111° 18' 19.472" W	Mapped Class C April 16 to June 30	Bankfull: 20.6 Wetted: 19.6 Depth: 0.8	Lake chub, longnose sucker, white sucker, trout-perch (the following fish species have been previously documented in the Battle River within approximately 20 km upstream and downstream of the proposed crossing: northern pike; goldeye; walleye; longnose dace; lake chub; shorthead redhorse; white sucker; and trout-perch)	Yes	Laminar flow throughout reach dominated by fine substrates. Little cover throughout the river, with steep vertical banks. Flood signs apparent at 100 m upstream from the proposed crossing. Recent beaver activity noted with a partially constructed dam 300 m downstream.
FD1	Unnamed fish-bearing wetland KP 105.3	SW 18-46-15 E: 421308 N: 5869022	52° 57' 54.079" N / 112° 10' 17.946" W	n/a No RAP (Class V Wetland)	Bankfull: n/a Wetted: 150 Depth: >1.5	Brook stickleback (no fish previously documented at crossing)	No	Fish-bearing wetland approximately 150 m wide at the proposed crossing. A second (isolated) non-fish bearing pool is located 25 m to the southwest of this waterbody.
FD2	Unnamed fish-bearing wetland KP 168.1	NW 3-43-10 E: 474739 N: 5836448	52° 40' 38.562" N / 111° 22' 25.073" W	n/a No RAP (Class IV Wetland)	Bankfull: n/a Wetted: 95 Depth: >1.0	Brook stickleback and lake chub (no fish previously documented at crossing)	Yes	Fish bearing wetland approximately 95 m in width at the proposed crossing. Multiple beaver dams upstream, downstream and directly parallel to the proposed crossing.

Notes: n/a (not applicable)

1 KPs are based on surveys from September 2012 and may be subject to change.

2 Determined from the COP Management Area Map for St. Paul (AENV 2006a) and the COP Management Area Map for Red Deer (AENV 2006b).

3 Results from AESRD (2012c).

5.1.7.2 Background Species Information

The proposed pipeline route lies within the North Saskatchewan and Battle River basins. The fish communities in the North Saskatchewan River and the Battle River near the proposed pipeline route are a mixed assemblage containing both coldwater (*e.g.,* salmonids) and coolwater (*e.g.,* percids and esocids) species. Tables 5.9 and 5.10 provide lists of fish species that may occur in the North Saskatchewan and Battle rivers, respectively near the proposed pipeline route.

Although the North Saskatchewan and Battle rivers contain both coldwater and coolwater species, they are dominated by coolwater species and their tributaries, except near their mouths into the North Saskatchewan and Battle rivers, would only be expected to provide habitat for coolwater species. Therefore, many of the fish species listed in Table 5.9 that are present within the mainstem of the North Saskatchewan and Battle rivers, would not occur in its smaller tributaries. These fish species are denoted in Tables 5.9 and 5.10 with asterisks.

TABLE 5.9

FISH SPECIES THAT MAY OCCUR IN THE NORTH SASKATCHEWAN RIVER NEAR THE PROPOSED PIPELINE ROUTE

Common Name[1]	Scientific Name	Spawning Season[2]	Provincial Status[3]	Committee on the Status of Endangered Wildlife in Canada (COSEWIC)-Listed Species[4]
SPORTFISH				
rainbow trout (RNTR)*	*Oncorhynchus mykiss*	spring	secure	not listed
lake sturgeon (LKST)*	*Acipenser fulvescens*	summer	undetermined	endangered
lake whitefish (LKWH)*	*Coregonus clupeaformis*	fall-winter	secure	not listed
mountain whitefish (MNWH)*	*Prosopium williamsoni*	fall	secure	not listed
burbot (BURB)*	*Lota lota*	winter	secure	not listed
northern pike (NRPK)	*Esox lucius*	spring	secure	not listed
walleye (WALL) *	*Sander vitreus*	spring	secure	not listed
yellow perch (YLPR)*	*Perca flavescens*	spring	secure	not listed
sauger (SAUG) *	*Sander canadensis*	spring	sensitive	not listed
goldeye (GOLD) *	*Hiodon alosoides*	spring-summer	secure	not listed
mooneye (MOON) *	*Hiodon tergisus*	spring	secure	not listed
NON-SPORTFISH				
longnose sucker (LNSC)	*Catostomus catostomus*	spring	secure	not listed
white sucker (WHSC)	*Catostomus commersoni*	spring	secure	not listed
mountain sucker (MNSC)	*Catostomus platyrhynchus*	summer	secure	not at risk
shorthead redhorse (SHRD) *	*Moxostoma macrolepidotum*	spring-summer	secure	not listed
silver redhorse (SLRD) *	*Moxostoma anisurum*	spring-summer	undetermined	not listed
quillback (QUIL) *	*Carpiodes cyprinus*	spring	undetermined	not listed
lake chub (LKCH)	*Couesius plumbeus*	spring	secure	not listed
flathead chub (FLCH)*	*Platygobio gracilis*	summer	secure	not listed
longnose dace (LNDC)	*Rhinichthys cataractae*	spring-summer	secure	not listed
pearl dace (PRDC)	*Margariscus margarita*	spring-summer	undetermined	not listed
northern redbelly dace (NRDC)	*Phoximus eos*	summer	sensitive	not listed
finescale dace (FNDC)	*Phoximus neogaeus*	summer	undetermined	not listed
spottail shiner (SPSH)	*Notropis hudsonius*	summer	secure	not listed
emerald shiner (EMSH)*	*Notropis atherinoides*	summer	secure	not listed
river shiner (RVSH)*	*Notropis blennius*	summer	undetermined	not listed
fathead minnow (FTMN)	*Pimephales promelas*	summer	secure	not listed
Iowa darter (IWDR)	*Etheostoma exile*	spring	secure	not listed
spoonhead sculpin (SPSC)*	*Cottus ricei*	spring	may be at risk	not at risk
trout-perch (TRPR)	*Percopsis omiscomaycus*	spring-summer	secure	not listed
brook stickleback (BRST)	*Culaea inconstans*	spring-summer	secure	not listed

Note: * Occurs in large river and/or deep lake systems and not expected to occur in the smaller streams crossed by the proposed project.

Sources: 1 AESRD 2012c, Nelson and Paetz 1992

2 Nelson and Paetz 1992

3 Alberta Sustainable Resource Development (ASRD) 2011

4 COSEWIC 2012

TABLE 5.10

FISH SPECIES THAT MAY OCCUR IN THE BATTLE RIVER NEAR THE PROPOSED PIPELINE ROUTE

Common Name[1]	Scientific Name	Spawning Season[2]	Provincial Status[3]	COSEWIC-Listed Species[4]
SPORTFISH				
rainbow trout (RNTR) * (introduced populations)	*Oncorhynchus mykiss*	spring	secure	not listed
lake whitefish (LKWH)*	*Coregonus clupeaformis*	fall-winter	secure	not listed
burbot (BURB)*	*Lota lota*	winter	secure	not listed
northern pike (NRPK)	*Esox lucius*	spring	secure	not listed
walleye (WALL) *	*Sander vitreus*	spring	secure	not listed
yellow perch (YLPR)*	*Perca flavescens*	spring	secure	not listed
goldeye (GOLD) *	*Hiodon alosoides*	spring-summer	secure	not listed
mooneye (MOON) *	*Hiodon tergisus*	spring	secure	not listed
NON-SPORTFISH				
longnose sucker (LNSC)	*Catostomus catostomus*	spring	secure	not listed
white sucker (WHSC)	*Catostomus commersoni*	spring	secure	not listed
lake chub (LKCH)	*Couesius plumbeus*	spring	secure	not listed
longnose dace (LNDC)	*Rhinichthys cataractae*	spring-summer	secure	not listed
pearl dace (PRDC)	*Margariscus margarita*	spring-summer	undetermined	not listed
northern redbelly dace (NRDC)	*Phoximus eos*	summer	sensitive	not listed
finescale dace (FNDC)	*Phoximus neogaeus*	summer	undetermined	not listed
spottail shiner (SPSH)	*Notropis hudsonius*	summer	secure	not listed
emerald shiner (EMSH)*	*Notropis atherinoides*	summer	secure	not listed
fathead minnow (FTMN)	*Pimephales promelas*	summer	secure	not listed
trout-perch (TRPR)	*Percopsis omiscomaycus*	spring-summer	secure	not listed
brook stickleback (BRST)	*Culaea inconstans*	spring-summer	secure	not listed

Note: * Occurs in large river and/or deep lake systems and not expected to occur in smaller tributaries crossed by the proposed pipeline route.

Sources: 1 AESRD 2012c, Nelson and Paetz 1992

2 Nelson and Paetz 1992

3 ASRD 2011

5.1.7.3 Fish Species of Concern

One fish species, lake sturgeon, listed by COSEWIC are known to occur in the North Saskatchewan River in the vicinity of the proposed pipeline route Aquatic RSA (COSEWIC 2012). Two species, sauger and northern redbelly dace, listed as 'sensitive' in Alberta are known to occur in the North Saskatchewan River near the proposed pipeline route (ASRD 2011). In addition, spoonhead sculpin, listed as 'may be at risk' in Alberta, are also known to occur in the North Saskatchewan River (ASRD 2011).

No fish species listed by COSEWIC are known to occur in the Battle River near the proposed pipeline route (COSEWIC 2012). One species, northern redbelly dace, listed as 'sensitive' in Alberta is known to occur in the Battle River near the proposed pipeline route (ASRD 2011).

5.1.7.4 Important Habitat for Fish Species of Concern and Sportfish

Lake sturgeon, sauger, northern redbelly dace and spoonhead sculpin may occur within the Aquatics RSA in the North Saskatchewan River and are considered species of concern. Sportfish which may occur in the North Saskatchewan River and/or Battle River within the Aquatics RSA include rainbow trout, lake whitefish, mountain whitefish, burbot, northern pike, walleye, yellow perch, sauger, goldeye and mooneye (Tables 5.9 and 5.10). As previously noted, many of these fish species listed are present within the mainstem of the North Saskatchewan River and/or the Battle River and would not occur in its smaller tributaries near the proposed crossings. Descriptions of fish species of concern and sportfish which may occur near the proposed crossings are presented below. With the exception of northern redbelly dace and northern pike, these fish species generally occur in deep rivers and/or large lakes and would not occur at

most of the proposed watercourse crossings. Northern redbelly dace and northern pike are known to occur within the Battle River, in the vicinity of the proposed pipeline route.

Species of Concern

Lake sturgeon are bottom-dwelling fish that occur in lakes and large rivers at depths generally between 5-10 m (DFO 2006). Lake sturgeon primarily feed on benthic organisms such as clams, snails, crayfishes, insect larvae, fish or fish eggs, and algae or plant material. They may also feed on zooplankton in the water column or insects at the water surface (Nelson and Paetz 1992, DFO 2006). Lake sturgeon spawn in the spring generally from early May to late June when water temperatures reach 13-18°C. Spawning occurs in areas of fast-flowing water or rapids over clay, sand, gravel and boulders. The sticky eggs are scattered and adhere to rocks and logs. The young feed on their yolk sacs for about two weeks and then start to feed on small benthic food items (Scott and Crossman 1973).

Lake sturgeon are large, slow-growing fish that reach sexual maturity late in life (14-33 years of age) and spawn only every 4-5 years. These biological characteristics make them particularly susceptible to population declines and populations do not recover quickly. Populations are sensitive to overharvest and habitat degradation. Historically, commercial fishing contributed to declines in sturgeon populations to levels from which they have never fully recovered. The construction of dams has resulted in changes to river flow regimes, loss and fragmentation of lake sturgeon habitat, and may increase fish mortality through entrainment in turbines. Lake sturgeon habitat has also been degraded as a result of poor land use and agricultural practices. Other threats to lake sturgeon and their habitat include water use, pollutants, poaching and the introduction of non-native species (Scott and Crossman 1973, DFO 2006, Nelson and Paetz 1992, ASRD 2002).

Alberta implemented a management plan for lake sturgeon in 1996 (Berry 1996, ASRD 2002, 2006). The Saskatchewan River Basin sturgeon population is currently being considered for listing under the federal *SARA*. If listed under the *SARA,* the population will be given additional protection and a recovery strategy must be developed for the species (DFO 2006). In Alberta, ASRD has formed a lake sturgeon recovery team to develop a recovery plan for lake sturgeon populations in Alberta (ASRD 2009).

Northern redbelly dace are listed as ‘sensitive’ in Alberta; however, there is currently no management plan for northern redbelly dace populations in Alberta. They frequently hybridize with finescale dace where the two species occur in sympatry and pure populations are rare (Nelson and Paetz 1992). Adults are typically associated with stained waters associated with bogs, beaver ponds and sluggish streams. Northern redbelly dace typically are found close to cover (*e.g.,* lake margins and vegetation) in water less than 2 m deep and over silt substrates; younger life history stages reportedly share similar habitat preferences (Nelson and Paetz 1992). In Alberta, spawning occurs in mid-June after temperatures begin to exceed 11°C (Nelson and Paetz 1992).

Spoonhead sculpin are most abundant in rivers and streams in the foothills and adjacent plains (Nelson and Paetz 1992). They are bottom feeders and prefer streambeds that are comprised of boulders, cobbles and large gravels. Spawning takes place on rocks usually in April and May. Since spoonhead sculpin are bottom feeders and often occur in large rivers, they are difficult to capture and study. Therefore, basic inventory information on spoonhead sculpin population trends in Alberta is lacking (Clayton pers. comm.).

Sportfish

Rainbow trout occur in both streams and lakes, thriving in cool waters where they prefer temperatures less than 20°C; however, they can withstand temperatures up to 24°C. Rainbow trout feed primarily on insects, leeches, molluscs, crustaceans and occasionally on small fish. They are native to the Athabasca River drainage in Alberta and have been successfully introduced into the North Saskatchewan River drainage as well as other drainages in Alberta. Spawning usually takes place in small tributaries to rivers or in inlet or outlet streams of lakes in fine gravels or in riffles. During spawning, females prepare nests called ‘redds’ by thrashing their tails in gravel to make a depression in which spawning occurs. Males fertilize the eggs deposited by the females and the females generally cover the fertilized eggs with gravel from the upstream margin of the redd. For known introduced populations in Alberta, spawning occurs in late spring and early summer (Nelson and Paetz 1992).

Lake whitefish are primarily found in lakes and occasionally in rivers. The age range of first maturity is highly variable and related to growth (Ford *et al.* 1995). In Alberta, lake whitefish mature at age 6 or 7 (Nelson and Paetz 1992). Lake whitefish spawn in fall when the water temperature is less than 8°C (late September to January in Alberta) (Nelson and Paetz 1992, Joynt and Sullivan 2003). Lake whitefish are broadcast spawners and do not build nests. Spawning takes place over firm lake substrates such as rocky or stony bottom or occasionally sand, in water about 2-4 m deep (Scott and Crossman 1973, Nelson and Paetz 1992). Lake whitefish also spawn in the shallow areas of rivers at depths of 0.1-1 m (McPhail and Lindsey 1970, Ford *et al.* 1995). Eggs incubate on the substrate over the winter with normal development taking place at temperatures between 0.5-6°C (Scott and Crossman 1973) and 7-day mean dissolved oxygen concentrations greater than or equal to 6.5 mg/L (Barton and Taylor 1996). Eggs generally hatch in April or May (Scott and Crossman 1973, Joynt and Sullivan 2003). After hatching, juvenile lake whitefish remain in shallow, current-free areas where they feed on small zooplankton (Ford *et al.* 1995). The optimum temperature for juveniles is about 14°C (Ford *et al.* 1995). As the juveniles grow during their first year, they move away from inshore areas to deeper waters and switch from primarily zooplankton to benthic organisms. The sensitive period for this species extends from November through mid-May, which includes spawning, incubation and emergence.

Burbot are a sportfish that occur in cold lakes, rivers and small streams. Burbot prey and scavenge on fish, insect larvae and fish eggs. Burbot are a broadcast spawner, spawning in the late winter and early spring over a variety of substrates including sand and silt (Nelson and Paetz 1992). Nelson and Paetz (1992) also indicate that although their popularity as a sportfish is increasing, a large portion of the angler harvest often results from incidental catches of burbot by anglers targeting other more highly desired species.

Northern pike are a coolwater species and its habitat is usually warm, slow, heavily vegetated rivers or the weedy bays of lakes. They are known as a voracious predator that feeds on insects as well as fish, amphibians, small mammals and birds (Nelson and Paetz 1992). They spawn in the spring immediately after the ice melts (Berry 1999). The breeding grounds include areas that flood only in the spring and early summer, and may be dry the remainder of the year. During spawning, they swim through the vegetated areas of shallow water and the eggs are scattered at random and attach to the vegetation. The eggs hatch in approximately 12-14 days and the young remain attached to the vegetation for 6-10 days. The young remain in the shallow spawning areas for several weeks after hatching. Young pike feed on larger zooplankton and immature aquatic insects until they reach about 5 cm in length, when fish becomes their main diet. Typically, adult northern pike do not migrate far from their spawning grounds. Angler overharvest and habitat degradation are commonly cited in management plans as key factors that have led to the decline of this species.

Walleye are a coolwater species that prefers turbid waters in either large, shallow lakes or rivers, provided they are deep or turbid enough to give shelter in daylight. Since their eyes are very sensitive to bright light, walleye often use sunken trees, boulders, weed beds or thick layers of ice and snow as a shield from the sun. Walleye spawn in the spring or early summer, depending on the latitude and water temperature. Adults migrate to the rocky areas in white water below impassable falls and dams in rivers, or boulder to coarse-gravel shoals of lakes. Angler overharvest and habitat degradation are commonly cited in management plans as key factors that have led to the decline of this species.

Yellow perch are common in ponds, lakes and slow moving streams, and are found in pools, usually occurring in loose schools. They feed predominantly on plankton in the first year, and then later on aquatic insects, crustaceans, snails and small fish. Yellow perch usually reach sexual maturity in the third year and spawn in the spring (Nelson and Paetz 1992).

Goldeye are usually found in large turbid rivers. Goldeye overwinter in deep turbid rivers such as the Peace and Liard rivers, and migrate to spawning sites in the spring (McPhail 2007). Goldeye may undergo lengthy river migrations. They are spring spawners and, in the North Saskatchewan River, females may be ready for spawning from late April to late June (Nelson and Paetz 1992). After spawning, adult goldeye migrate back into rivers and occupy deep quiet water areas near the inlets of tributary streams (McPhail 2007). They feed primarily on zooplankton, and aquatic and aerial insects (Nelson and Paetz 1992).

Mooneye are not as widely distributed as goldeye. Similar to goldeye, mooneye spawn in spring usually between late April to June. Mooneye primarily feed on invertebrates (Nelson and Paetz 1992).

5.1.7.5 Summary of Field Results

The aquatic assessment in Appendix 6 of this ESA was completed in order to document baseline fish and fish habitat information at each proposed water crossing with fish and fish habitat. Information will be provided to DFO to assist with any case-specific reviews of water crossings they may need to conduct. The aquatic assessment satisfies clause (a) in Part 1 of Schedule 2 of the *AENV Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body* (AENV 2000a) and *Code of Practice for Watercourse Crossings* (AENV 2000b).

An open water aquatic assessment was conducted from July 12-27, 2012 at watercourse crossings along the proposed pipeline route. Where accessible, all watercourses with defined bed and banks (as determined by the QAES) were assessed. Open water assessments were carried out by a two-person crew and involved an aquatic habitat assessment and a fish inventory at each crossing. Any additional sites (*e.g.*, wetlands) that the QAES believed provided fish and fish habitat were also assessed. The proposed pipeline route crosses seven watercourses which are all fish-bearing and two fish-bearing wetlands.

Water was present at all seven watercourses and the two fish-bearing wetlands at the time of the assessments. Three watercourses (Mill and Irvine creeks, and the unnamed tributary to Iron Creek at KP 135.6 [NW 26-44-13 W4M]) were flooded over the top of the banks at the time of the assessments. Six of the seven watercourses had mean bankfull widths within the study reach of less than 5 m. The Battle River had a mean bankfull width of 20.6 m wide.

Flow from Goldbar Creek to the North Saskatchewan River has a stormwater outfall crossing the channel a few metres upstream of the mouth of Goldbar Creek. The structure prevents fish passage upstream of the stormwater outfall (TERA 2007a). The mouth of Mill Creek is also obstructed by a stormwater outfall located immediately upstream of the James MacDonald Bridge. In addition, Mill Creek lacks continuous surface flow throughout the year in sections of the City of Edmonton that are downstream of the proposed pipeline crossing (TERA 2007a).

The CCME (2007) guideline for the protection of aquatic life for pH ranges from 6.5-9.0. At the time of the assessment, all seven watercourses and the fish-bearing wetland at KP 168.1 (NW 3-43-10 W4M) had pH levels within the preferred range for aquatic life (Table 3 of Appendix 6 of this ESA). The fish-bearing wetland at KP 105.3 (SW 18-46-15 W4M) had a pH level above the preferred range for aquatic life (*i.e.*, above 9.0).

The CCME (2007) guideline for dissolved oxygen for coldwater species (*e.g.,* salmonids) is 9.5 mg/L in early life stages and 6.5 mg/L in other life stages, while for coolwater species (*e.g.,* esocids and percids) the guideline is 6.0 mg/L in early life stages and 5.5 mg/L in other life stages (CCME 2007). However, some species (*e.g.,* cyprinid and stickleback species) found in northern climates can tolerate and survive even lower dissolved oxygen levels (Barton and Taylor 1996). The dissolved oxygen was below the CCME (2007) guidelines for coldwater and coolwater species in all life stages (*i.e.*, below 5.5 mg/L) at five of the seven watercourses and the fish-bearing wetland at KP 168.1 (NW 3-43-10 W4M) (Table 3 of Appendix 6 of this ESA). The dissolved oxygen was above the CCME (2007) guideline for coolwater species in all life stages other than early life stages (*i.e.*, above 5.5 mg/L and below 6.0 mg/L) in the Battle River. The unnamed tributary to Iron Creek at KP 140.6 (SE 19-44-12 W4M) and the fish-bearing wetland at KP 105.3 (SW 18-46-15 W4M) had dissolved oxygen levels above the guideline for coldwater species in all life stages other than early life stages (*i.e.*, above 6.5 mg/L and below 9.5 mg/L).

Table 4 of Appendix 6 of this ESA summarizes the fish habitat potential ratings for the seven proposed watercourse crossings and the two fish-bearing wetlands along the proposed pipeline route.

Appendix 6 of this ESA provides a summary of the riparian area and dominant riparian vegetation present at each of the proposed water crossings. The riparian areas at Goldbar Creek, Irvine Creek, the unnamed tributaries to Iron Creek, and the two fish-bearing wetlands were dominated by wetland vegetation species (*i.e.*, grasses and sedges), while deciduous trees and shrubs were identified as the dominant riparian vegetation at Mill Creek and the Battle River, respectively.

Fish inventories were conducted at six of the seven proposed watercourse crossings and at the two fish-bearing wetlands. No sportfish or federally or provincially-listed fish species were captured or observed during fish sampling. Table 5 of Appendix 6 of this ESA provides the sampling efforts and results of the fish inventories. The following fish species were captured or observed during fish sampling on the Battle River: lake chub; longnose sucker; white sucker; trout-perch; and an unidentified large-bodied fish species. Non-sportfish species (*i.e.*, lake chub, brook stickleback and fathead minnow) were captured and observed in Goldbar and Mill creeks, the two unnamed tributaries to Iron Creek at KP 135.6 (NW 26-44-13 W4M) and KP 140.6 (SE 19-44-12 W4M), and the two fish-bearing wetlands, while no fish were captured or observed in Irvine Creek.

In Goldbar Creek, one brook stickleback and seven fathead minnows were captured during electrofishing. Brook stickleback and fathead minnow have been previously documented approximately 900 m downstream of the proposed crossing and lake chub have previously documented approximately 4 km downstream in Goldbar Creek (AESRD 2012c).

Mill Creek was sampled using minnow traps and dipnetting. In total, 19 fathead minnows and 30 brook stickleback were captured. Brook stickleback and fathead minnow have been previously documented 200 m downstream of the proposed crossing in Mill Creek (AESRD 2012c).

Irvine Creek was sampled with a backpack electrofisher and baited gee minnow traps. No fish were captured. Based on AESRD (2012c), no fish species have been previously documented in Irvine Creek. However, the following fish species have been previously documented in Blackmud Creek: white sucker; longnose sucker; longnose dace; lake chub; fathead minnow; and brook stickleback (AESRD 2012c).

The unnamed channelized ditch was sampled with both a backpack electrofisher and baited gee minnow traps. In total, 22 brook stickleback were captured. No fish have been previously documented in the unnamed ditch (AESRD 2012c).

The unnamed tributary to Iron Creek at KP 135.6 (NW 26-44-13 W4M was sampled for fish using backpack electrofisher and baited gee minnow traps. In total, 60 brook stickleback were captured. No fish have been previously documented at the proposed crossing of the unnamed tributary to Iron Creek at KP 135.6 (NW 26-44-13 W4M). The unnamed tributary to Iron Creek at KP 140.6 (SE 19-44-12 W4M) was not sampled for fish since the site was not included on the fish research licence, however, two brook stickleback were observed at the time of the assessment. Brook stickleback have been previously documented at the proposed crossing on the unnamed tributary to Iron Creek at KP 140.6 (SE 19-44-12 W4M) (AESRD 2012c). According to AESRD (2012c), fathead minnow, white sucker and brook stickleback have been previously documented in Iron Creek approximately 25 km and 20 km downstream of the two unnamed tributaries confluences with Iron Creek, respectively. Fish species previously documented at the mouth of Iron Creek includes: walleye; northern pike; shorthead redhorse; white sucker; and trout-perch.

The fish-bearing wetland at KP 105.3 (SW 18-46-15 W4M) was sampled using electrofishing and minnow traps. In total, 17 brook stickleback were captured. Baited gee minnow traps were set at the fish-bearing wetland at KP 168.1 (NW 3-43-10 W4M). In total, 389 brook stickleback were captured and one lake chub. No fish have been previously documented in either of the two fish-bearing wetlands.

The Battle River crossing was sampled using electrofishing and minnow traps. In total, 15 fish were captured including: 7 lake chub; 1 longnose sucker; 3 white sucker; and 4 trout-perch. In addition, three unidentified large-bodied fish were observed during the time of the assessment. The following fish species have been previously documented in the Battle River within approximately 20 km upstream and downstream of the proposed crossing: northern pike; goldeye; walleye; longnose dace; lake chub; shorthead redhorse; white sucker; and trout-perch.

5.1.7.6 Traditional Economic Importance

Consultation to date has not resulted in the identification of any fish of traditional economic value as country foods.

5.1.8 Wetlands

This subsection presents a summary of the findings related to wetlands in the Wetlands RSA. Potential Project-related effects and mitigation pertaining to wetlands are discussed in Section 6.2.8 of this ESA.

Ground-based wetland surveys were conducted from August 1-14, 2012. During the ground-based wetland surveys, wetlands located within 30 m of the proposed pipeline route were classified, delineated and documented for baseline health and function. Details on the wetland survey methodology and results are provided in Appendix 7 of this ESA.

The 2012 wetland field surveys confirmed that 138 wetlands (13.04 km) are crossed by the proposed construction right-of-way, comprising approximately 7.75% of the proposed pipeline route. Wetlands crossed include 5 Class V wetlands, 23 Class IV wetlands, 74 Class III wetlands, 19 Class II wetlands, 3 Class I wetlands and 14 shrubby swamp wetlands. This list will be updated following supplemental wetland surveys planned for 2013 targeting locations where access was not available in 2012.

The Project is located within the Central Parkland Natural Subregion of the Boreal Natural Region. In 51-22 W4M, the pipeline route crosses a small portion of Dry Mixedwood Subregion of the Boreal Natural Region (Natural Regions Committee 2006). Wetlands cover approximately 10% of the Central Parkland Natural Subregion. Wetland types include marshes, willow shrublands and seasonal ponds in the southern part of the Subregion. Wetlands comprise approximately 15% of the Dry Mixedwood Natural Subregion (Natural Regions Committee 2006).

The Project is located within the Continental and Transitional Mid-Boreal Wetland regions (Government of Canada 1986). This area is transitional between the Prairie region to the south and the Boreal region to the north. Common wetlands in this region include treed bogs and fens occurring on broad flats and in confined basins. Floating fens and shore swamps may border lakes and ponds. Lodgepole pine may be present on drier, poorer sites and balsam poplar and black spruce are common on wetter, organic sites. Marshes can be found in agricultural areas and along edges of some streams and lakes. The climate varies from cold winters and warm summers in the west to mild winters and cool summers in the east. Permafrost is absent (Government of Canada 1986).

The key functions for wetlands in the Wetlands RSA are to provide habitat for native plants and wildlife species, including nesting and foraging habitat for bird species as well as provide storage and natural filtering of water.

There are no Ramsar Wetlands of International Importance along the Project (Bureau of the Convention on Wetlands 2012). The Project does not cross any Western Hemisphere Shorebird Reserves (Western Hemisphere Shorebird Reserve Network [WHSRN] 2012), Migratory Bird Sanctuaries (Environment Canada 2012f) or Ducks Unlimited Canada (DUC) Priority Areas (DUC 2010).

For the purposes of this ESA, Wetlands are defined as follows:

"…*areas where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development. Wetlands will have a relative abundance of hydrophytes in the vegetation community and/or soils featuring 'hydric'* characters…" (Mackenzie and Moran 2004);

"…areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh*, brackish or salt…"* (Ramsar 1987); and

"…land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment." (National Wetland Working Group [NWWG] 1997).

The methodology used to classify wetland basins in the Wetlands RSA was based on assessment techniques used by Environment Canada and DUC which follow Stewart and Kantrud (1971) for mineral wetlands. The Canadian Wetland Classification System (NWWG 1988, 1997) serves as a practical guide for classification of treed/shrubby wetlands typical of the parkland areas of central Alberta.

Table 5.11 lists wetland characteristics for the dominant wetland classes of the Stewart and Kantrud Classification System that commonly occur in the wetland region encountered by the proposed pipeline route.

TABLE 5.11

DOMINANT WETLAND CLASSES IN THE PROJECT AREA AS DESCRIBED BY STEWART AND KANTRUD

Wetland Class	Central Zone	Description
Ephemeral Potholes (I)	Low-prairie	Ephemeral potholes occur in small swales that contain prairie vegetation species such as arnicas and white camas, as well as Kentucky bluegrass.
Temporary Potholes (II)	Wet-meadow	The wet meadow zone dominates the deepest part of the wetland area. A peripheral low-prairie zone is usually present. The central zone is usually dominated by vegetation species that can tolerate some salts, such as western wheatgrass, foxtail barley and salt-grass.
Seasonal Potholes (III)	Shallow-marsh	Seasonal potholes are wetlands with a shallow-marsh zone dominating the deepest part of the wetland area. These ponds are frequently surrounded by a ring of willows with a wet centre containing sedges for freshwater wetlands, or bulrushes in more brackish wetlands. Pondweeds and mosses may occur in the open-water. Brackish ponds may have halophytic vegetation in the drawdown area, such as foxtail barley, red goosefoot, oak-leaved goosefoot or summer cypress.
Semi-permanent Potholes (IV)	Deep-marsh	The deep-marsh zone dominates the deepest part of the wetland area. Shallow-marsh, wet meadow and low-prairie zones are usually present. Cattails and rushes are typical emergent species, while aquatic plants such as pondweeds, bladderwort, water-milfoil and water hornwort are found floating in the centre. The edges of brackish semi-permanent potholes typically contain prairie bulrush, alkali grass and red samphire.
Permanent Lakes (V)	Open-water	The permanent open-water zone dominates the deepest part of the wetland area. Peripheral deep-marsh, shallow-marsh, wet meadow and low-prairie zones are often present. The centre portion of a permanent lake or pothole is typically open-water, although submerged vegetation may occur, such as widgeon grass.
Alkali Pond or Lake (VI)	Intermittent Alkali	The intermittent alkali zone dominates the deepest part of the wetland area. This zone is characterized by highly saline shallow water that, in its drawn-down phase, appears as white alkali salt flats. In Alkali Ponds and Lakes peripheral shallow-marsh, wet meadow, and low-prairie zones are usually present and populated with more salt-tolerant vegetation, such as Nuttall's salt-meadow grass, salt grass, samphire, western wheatgrass, arrowgrass and scratch grass.

Sources: Stewart and Kantrud (1971)

Table 5.12 lists wetland characteristics for the dominant wetland classes of the Canadian Wetland Classification System that commonly occur in the wetland region encountered by the proposed pipeline route.

TABLE 5.12

DOMINANT WETLAND CLASSES IN THE PROJECT AREA AS DESCRIBED BY THE CANADIAN WETLAND CLASSIFICATION SYSTEM

Dominant Wetland Class	Wetland Class Characteristics
Swamp	• peatland and mineral wetland; • water table at or below the surface; • minerogenous (nourished by groundwater); • highly decomposed woody peat and organic material; and • coniferous or deciduous trees or tall shrub vegetation cover.
Marsh	• mineral wetland or peatland that is periodically inundated by standing or slow moving waters; • minerogenous (nourished by groundwater); • substratum usually consists of mineral material, although occasionally it consists of peat deposits; and • emergent aquatic macrophytes largely rushes, reeds, grasses, and sedges and some floating aquatic macrophytes.
Shallow Open Water	• distinct wetlands transitional between those wetlands that are saturated or seasonally wet (bog, fen, marsh or swamp) and permanent, deep waterbodies; • standing water less than 2 m deep in mid-summer; • natural impoundments such as beaver ponds or other open water wetland systems are included where water levels are not regulated; and • usually associated with lacustrine (lake) or fluvial (stream) systems.

Sources: NWWG 1988, 1997

Tables 5.13 provides a summary of wetland class, length of disturbance and percentage encountered along the construction right-of-way.

TABLE 5.13

SUMMARY OF WETLANDS ENCOUNTERED ALONG PROPOSED PIPELINE RIGHT-OF-WAY

Wetland Class	Number of Wetlands Encountered	Approximate Length of Disturbance Crossed (km)	Percent of Pipeline Right-of-way Crossed
Class I	3	0.13	0.07
Class II	19	1.08	0.6
Class III	74	7.31	4.04
Class IV	23	3.05	1.69
Class V	5	0.63	0.35
Shrubby Swamp	14	0.84	0.46
Total:	**138**	**13.04**	**7.2**

5.1.9 Vegetation

This subsection provides a summary of the findings related to land use, ecosystem classification, rare plants and rare ecological communities, non-native and invasive species and crop disease in the Vegetation RSA. Further detail is provided in Appendix 8 of this ESA. Occurrences of rare plants, weed infestations and other issues affecting construction and/or operation of the proposed pipeline are identified on the Environmental Alignment Sheets (Appendix 2 of this ESA). The potential Project-related effects and mitigation pertaining to vegetation are discussed in Section 6.2.9 of this ESA. The potential effects on vegetation in the context of human health are discussed in Section 6.2.16 of this ESA.

5.1.9.1 Land Use

Approximately 13.2% of the pipeline route crosses lands supporting native vegetation (treed–pasture 10.4%, treed 2.4%, native prairie 0.1% and open water 0.3%) and 86.8% agricultural or disturbed lands (cultivated, tame pasture, hay, disturbed land, tree nursery and campground). The proposed pipeline route crosses lands within the Strathcona County, Leduc County, Beaver County, Flagstaff County, Camrose County and the MD of Provost in central Alberta.

5.1.9.2 Ecosystem Classification

The proposed pipeline route is located within the Aspen Parkland Ecoregion of the Prairies Ecozone (Environment Canada 2012g) and crosses the Central Parkland Natural Subregion of the Parkland Natural Region and the Dry Mixedwood Natural Subregion of the Boreal Forest Natural Region (Natural Regions Committee 2006).

The Central Parkland Natural Subregion occupies over 50,000 km² of land and most of these lands are under cultivation. Undulating till plains and hummocky uplands dominate the landscape. Lacustrine and fluvial deposits are common with some substantial eolian deposits in the northern and eastern parts of the subregion. Plains rough fescue dominates the vegetation communities in the southern and eastern areas of the subregion with small aspen dominated communities occurring in moister habitats. The northern and western parts of the subregion are composed of aspen forest with grasslands being restricted to the driest areas. Black Chernozem soils normally occur under grasslands while Dark Grey Chernozems and Luvisols generally occur in aspen forests (Natural Regions Committee 2006). The Central Parkland Natural Subregion is crossed by the proposed pipeline route from KPT 0 to KP 19 (NW 32-52-23 W4M to SE 17-51-22 W4M) and from KP 29 to KP 175.5 (NE 15-50-22 W4M to SE 30-42-9 W4M).

The Dry Mixedwood is the most southern and the warmest of the Boreal Forest Subregions in Alberta. It is dominated by level to gently undulating glacial till and lacustrine plains. Hummocky uplands are prevalent in the south with Grey Luvisols being the dominant soil type in this area. Gleysols and Organic soils dominate wetland areas. Aspen forests with understories dominated by prickly rose, low-bush cranberry, beaked hazelnut and Canada buffaloberry are typical of the uplands. Treed, shrubby or sedge-

dominated fens are common in wet areas. Jack pine typically dominates dry, well drained areas (Natural Regions Committee 2006). The Dry Mixedwood Natural Subregion is crossed by the proposed pipeline route from KP 19 to KP 29 (NW 32-52-23 W4M to NE 15-50-22 W4M).

An early-season vegetation survey for the Project was conducted on July 2-14, 2012. A late-season vegetation survey was conducted on August 20-31, 2012. Areas of native vegetation crossed by the proposed pipeline route were characterized by deciduous forests, coniferous forests, mixedwood forests, riparian areas (including wetlands, drainage features and watercourses) and existing pipeline rights-of-way.

Deciduous forests observed during the vegetation survey included both aspen and balsam poplar dominated forests. Aspen forests were distinguished by an aspen canopy with variations of shrub layer species which included wild red raspberry, saskatoon, wild sarsaparilla, beaked hazelnut, red-osier dogwood, prickly rose and bluejoint. Balsam poplar dominated forests were distinguished by moist conditions with willow species dominating the shrub layer. Very moist sites had an understory dominated by common nettle, bluejoint and western Canada violet.

Coniferous forests observed during the vegetation survey were dominated by black spruce. Black spruce canopies with common Labrador tea and Schreber's moss dominant understories are characteristic of this type of forest.

Mixedwood forests were similar in species composition to observed deciduous forests, however, canopies were further characterized by subdominant to codominant densities of white spruce.

Moist to wet habitats observed during the vegetation surveys included wetlands and drainage features, and their associated riparian areas. Several different classes of wetlands were observed during the vegetation survey and the dominant species in each wetland varied by class. Riparian areas surrounding the Battle River were characterized by sandbar willow, rose species and reed canary grass.

Existing pipeline rights-of-way were dominated by agronomic species including timothy, awnless brome, orchard grass and alfalfa.

5.1.9.3 Natural Areas of Concern

The proposed pipeline route crosses lands in Strathcona County identified as Medium and High Priority Environment Management Areas of which there are no limitations or concerns identified regarding pipeline rights-of-way (Strathcona County 2007). Strathcona County does identify several objectives for High Priority Management Areas, of which two of these objectives relate to vegetation resources: protect rare and sensitive flora; and create buffers around unique habitats (Strathcona County 2007).

Where construction and/or operation of a land use or subdivision is located within or adjacent to environmentally sensitive areas, Leduc County requires that: associated activities do not result in adverse environmental effects; that the proposed activity be designed to integrate with the environmentally sensitive area wherever feasible; that natural areas would be retained in a natural state; and that physical features of the environment would be retained where feasible (Leduc County 2010).

In Flagstaff County, the proposed pipeline route crosses and is located in close proximity to environmentally sensitive areas associated with the Battle River and Wavy Lake. However, there are no limitations or concerns identified regarding construction of pipeline rights-of-way (Flagstaff County 2009). There are no defined objectives for the management of environmentally sensitive areas that pertain specifically to vegetation resources (Flagstaff County 2009).

Beaver County encourages that commercial land uses be located to avoid environmentally sensitive areas (Beaver County 2011). Furthermore, Beaver County requires that development shall not occur on "lands containing unique endangered flora". However, there are no limitations or concerns identified regarding the construction of pipeline rights-of-way (Beaver County 2011).

Camrose County requires that subdivision of land in sensitive areas (*e.g.*, steep slopes; riparian areas to streams, creeks, rivers or lakes; or forested lands) be limited in parcel size to prevent loss of natural

vegetation. There are no limitations or concerns identified regarding construction of pipeline rights-of-way (Camrose County 2012).

Alberta Tourism, Parks and Recreation (ATPR) defines Environmentally Significant Areas as being important to the long-term maintenance of biological diversity, soil, water or other natural processes, at multiple spatial scales and/or areas that contain rare or unique elements or that include elements that may require special management consideration due to their conservation needs. However, ATPR also states that Environmentally Significant Areas do not represent government policy and do not necessarily require legal protection. They are intended to be an information tool to help inform land use planning and policy at local, regional and provincial scales. The proposed pipeline route crosses four Environmentally Significant Areas (Table 5.14) (ATPR 2009).

TABLE 5.14

ENVIRONMENTALLY SIGNIFICANT AREAS CROSSED BY THE PROPOSED PIPELINE ROUTE

Environmentally Significant Area No.	Importance	Location Crossed/Distance from proposed route	Vegetation Value	Wildlife Value
717	International	Crossed from KPHD 0.4 to KPHD 0.5 (NW 11-50-22 W4M), KP 33.5 to KP 34.3 (SW 1-50-22 W4M) and KP 34.9 to KP 35.3 (NE 36-49-22 W4M to SE 36-49-22 W4M)	The area contains large natural areas and also contains elements of conservation concern, including one moss and three vascular plants (Campylium moss, Back's sedge, watermeal and widgeon-grass).	Provides several important wildlife habitat for species, including American white pelican, ferruginous hawk, piping plover and northern myotis. It also contains sites of recognized significance, including the Ministik, Joseph and Oliver Lakes Important Bird Area (IBA), and the Miquelon Lake IBA.
380	International	Crossed from KP 114.4 to KP 115.0 (SW 36-45-15 W4M)	Presence of large natural areas.	Contains large natural areas and habitat for species such as ferruginous hawk. It also contains the Wavy Lake IBA, a site of recognized significance. The Wavy Lake IBA AB037 is a critical moulting and staging area for waterfowl including various species of duck, snow goose, greater white-fronted goose and sandhill crane.
117	National	Crossed from KP 138.9 to KP 142.9 (NW 19-44-12 W4M to NW 16-44-12 W4M); 0.5 km southwest of the proposed pipeline route at KP 164.7 (NE 8-43-10 W4M)	Presence of large natural areas.	Contains large natural areas and habitat for species such as ferruginous hawk.
362	National	Crossed by the proposed pipeline route from KP 171.8 to KP 172.1 (SE 35-42-10 W4M) and KP 174.7 to KP 175.5 (SW 30-42-9 W4M)	Contains large natural areas, intact riparian areas and contains elements of conservation concern, including two vascular plants (annual skeletonweed and shrubby evening-primrose).	Contains large natural areas, intact riparian areas, important wildlife habitat and habitat for species including ferruginous hawk and northern grasshopper mouse.

Source: ATPR 2009, Fiera Biological Consulting Ltd. (Fiera) 2009

The proposed pipeline route does not cross any parks or protected areas (ATPR 2011). The closest is Strathcona Science Provincial Park which is located approximately 2 km northwest of KPT 0.0.

Numerous Consultative Notations (CNTs) and PNTs related to alteration of land use are provided for areas under the management of AESRD are located in the Vegetation RSA. The proposed pipeline route encounters PNT 030043, located at NW 11-50-22 W4M (approximately KP 30.5 to KPHD 0.5), that requires consent from AESRD prior to clearing of treed areas within an Ungulate Habitat Protection Area (Alberta Energy 2012a). Further details on this PNT are provided in Section 5.1.10.3 of this ESA.

5.1.9.4 Rare Plants and Rare Ecological Communities

No plant species designated under the Alberta *Wildlife Act* are identified as potentially occurring in the Central Parkland or the Dry Mixedwood Natural Subregions. There are no known occurrences of plant

species designated under the Alberta *Wildlife Act* within 5 km of the proposed pipeline route (Alberta Conservation Information Management System [ACIMS] 2012).

A search of the ACIMS database identified occurrences of 11 rare plant species within 5 km of the pipeline route (ACIMS 2012). The previously observed species include: annual skeletonweed; city dot lichen; clammy hedge-hyssop; few-flowered aster; flat-topped white aster; leafy pondweed; *Rhodobryum* moss; prairie wedge grass; salt-marsh sand spurry; sandhills cinquefoil and widgeon-grass.

There were no known rare ecological communities within 5 km of the pipeline route (ACIMS 2012).

Four ACIMS-listed rare plant species were identified during previous surveys conducted along the Enbridge mainline right-of-way in 1993, 1996, 2007 and 2008 including annual skeletonweed, few-flowered aster, leafy pondweed and salt-marsh sand spurry (TERA 2007b, 2008a,b, Wilkinson 1996, Wilkinson *et al.* 1993). Rare plant species identified in 2007 and 2008 for the Line 4 Extension Project include few-flowered aster, leafy pondweed and salt-marsh sand spurry (TERA 2007b, 2008a,b). Details regarding the location of rare plants observed during preconstruction surveys of existing Enbridge pipeline rights-of-way are provided in Appendix 8 of this ESA.

A rare plant survey component was included as part of the vegetation surveys conducted for the Project in July and August 2012 (Appendix 8 of this ESA). No rare plant species listed by the Alberta *Wildlife Act* were observed during the vegetation surveys. A total of 18 rare plant species designated by ACIMS were observed during the vegetation surveys including: American water horehound; annual skeletonweed; clammy hedge-hyssop; crystalwort; few-flowered aster; fox sedge; lance-leaved loosestrife; leafy pondweed; low cinquefoil; marsh felwort; Parry's sedge; prairie wedge grass; purple-fringed Riccia; *Riccia* liverwort; salt-marsh sand spurry; sand nut-grass; sandhills cinquefoil; and yellow cress.

No rare ecological communities listed by ACIMS were observed during vegetation surveys conducted along the pipeline route. Additional information regarding occurrences of rare plants observed during the vegetation surveys is provided in Appendix 8 of this ESA.

5.1.9.5 Non-native and Invasive Species

In addition to the information and regulations provided under the Alberta *Weed Control Act*, municipalities have provided additional information regarding the status and distribution of weeds and invasive species on lands within their jurisdiction.

Strathcona County conducts regular inspections for weeds and will notify Enbridge if any concerns arise during construction or operation of the Project (Horner pers. comm.).

Noxious weeds of concern for Leduc County, as identified by the Agricultural Feldman, are creeping thistle, common tansy, orange hawkweed, Himalayan balsam, common toadflax, tall buttercup and scentless chamomile (Van Beers pers. comm.).

The Agricultural Committee for the County of Camrose has designated five Noxious weeds as problem weeds, including common toadflax, scentless chamomile, leafy spurge, ox-eye daisy and creeping thistle (Camrose County 2003).

Flagstaff County indicated that leafy spurge and knapweed species may be encountered in the vicinity of the Battle River (Hillaby pers. comm.). Noxious weeds of concern in Flagstaff County include scentless chamomile, white cockle and creeping thistle.

In Beaver County, the main Prohibited Noxious weed of concern is spotted knapweed. Noxious weeds of concern include woolly burdock, tall buttercup, scentless chamomile, white cockle, dame's rocket, perennial sow-thistle, leafy spurge, common tansy, creeping thistle and common toadflax (Kotylak pers. comm.).

Noxious weeds of concern for the MD of Provost include downy brome, leafy spurge, common toadflax, scentless chamomile and common tansy. Absinthe, a non-listed, invasive species, is regarded in the same respect as Noxious weeds; however, the species has not yet been formally uplisted by the MD of Provost (Forbes pers. comm.).

A weed survey component was included as part of the vegetation surveys conducted for the proposed pipeline route in July and August 2012. One Prohibited Noxious weed, nodding thistle, was observed along the pipeline route. A total of 10 Noxious weeds, bladder campion (white cockle), common baby's-breath, common tansy, common toadflax (yellow toadflax), creeping thistle (Canada thistle), leafy spurge, ox-eye daisy, perennial sow-thistle, scentless chamomile and tall buttercup were observed along the route. Several non-listed, non-native species also occur along the route. Characteristics of Prohibited Noxious and Noxious weed species observed during the vegetation survey are provided in Table 5.15.

TABLE 5.15

CHARACTERISTICS OF THE NOXIOUS WEED SPECIES OBSERVED DURING THE VEGETATION SURVEY

Common Name	Scientific Name	Provincial Designation (AB)	Life Cycle	Reproduction By	Undesirable or Problematic Areas
bladder campion	*Silene latifolia*	Noxious	annual, perennial	seed	road sides, waste areas
common baby's-breath	*Gypsophila paniculata*	Noxious	perennial	seed	road sides, waste areas, pasture
common tansy	*Tanacetum vulgare*	Noxious	perennial	shallow rhizomes, seed	pasture
common toadflax	*Linaria vulgaris*	Noxious	perennial	rhizomes, seed	crops, pastures, road sides, waste areas
creeping thistle	*Cirsium arvense*	Noxious	perennial	deep rhizomes, seed	crop, pasture
leafy spurge	*Euphorbia esula*	Noxious	perennial	rhizomes, seed	pasture
nodding thistle	Carduus nutans	Prohibited Noxious	biennial	seed	pasture
ox-eye daisy	*Chrysanthemum leucanthemum*	Noxious	perennial	shallow rhizomes, seed	pasture
perennial sow-thistle	*Sonchus arvensis*	Noxious	perennial	deep rhizomes, seed	crops, pasture, road sides
scentless chamomile	*Matricaria perforata*	Noxious	annual, biennial, short-lived perennial	seed	roadside, waste areas, crops, pastures
tall buttercup	*Ranunculus acris*	Noxious	perennial	seed	pasture

Sources: Mulligan 1989, Royer and Dickinson 1999

Additional information on weeds and other non-listed, invasive species observations is provided in Appendix 8 of this ESA. A weed survey of the construction right-of-way and associated temporary workspaces will be conducted for the Project prior to construction during the growing season in 2013.

5.1.9.6 Crop Disease

Several of the counties crossed have been affected by clubroot disease. Refer to Section 5.1.2 of this ESA for additional information on clubroot disease. In addition to clubroot disease, Flagstaff County identified that the *Fusarium* disease and virulent blackleg of canola are of concern and may be encountered by the pipeline route (Hillaby pers. comm.).

5.1.9.7 Traditional Economic Importance

The Ermineskin Tribe has noted during consultation that blueberries were once present in the area near Hardisty Terminal. Consultation to date has not resulted in the identification of any other vegetation of traditional economic value as country foods.

5.1.10 Wildlife and Wildlife Habitat

This subsection provides information on wildlife species and wildlife habitat along the proposed pipeline route. This information assists in identifying the potential need for special measures to be implemented during construction. Provincially identified wildlife areas that have operating and/or associated timing restrictions are identified on the Environmental Alignment Sheets (Appendix 2 of this ESA).

The potential Project-related effects and mitigation pertaining to wildlife and wildlife habitat, including any effects on consumptive and non-consumptive values, are discussed in Section 6.2.10 of this ESA. The potential effects on wildlife and wildlife habitat in the context of human health are discussed in Section 6.2.16.

5.1.10.1 Land Use

The proposed pipeline route is located in the Central Parkland Subregion of the Parkland Natural Region and the Dry Mixedwood Subregion of the Boreal Forest Natural Region (Natural Regions Committee 2006). Land use along the proposed pipeline route consists of: cultivated land (55.8%); tame pasture (18.8%); hay (11.7%); treed-pasture (10.4%); treed areas (2.4%); disturbed land (0.2%); open water (0.3%); a tree nursery (0.2%); native prairie (0.1%); and campground (0.1%). Most of the lands crossed by the proposed route (86.3%) are agricultural, disturbed by plowing for cultivation, hay and tame pasture. There are small areas of aspen woodlands and mixed aspen forest, treed pasture, and fringes of native vegetation around wetlands and the edges of certain watercourses. The proposed pipeline route crosses four named watercourses (*i.e.*, Mill Creek, Goldbar Creek, Irvine Creek and the Battle River), two unnamed watercourses, one unnamed drainage ditch and two unnamed fish-bearing wetlands. In addition, 25 nonfish-bearing drainages were identified along the proposed pipeline route, including one named nonfish-bearing drainage (Fulton Creek).

5.1.10.2 Existing Habitat Disturbances

The proposed pipeline route is contiguous to existing linear disturbances for approximately 96.2% of its length. Most of the proposed route traverses land which has been continually disturbed by cultivation and grazing. Several oil and gas facilities and well heads are present along the length of the proposed pipeline route. Refer to Section 7.0 of this ESA for further explanation of existing land use in the Wildlife RSA and disturbance related to wildlife habitat.

5.1.10.3 Provincially Identified Wildlife Areas

The proposed pipeline route is located within Sensitive Raptor Range for bald eagle from KPT 0.0 to KP 19.1 (NW 32-52-23 W4M to SE 17-51-22 W4M) and KP 28.9 to KP 90.0 (NE 15-50-22 W4M to SE 11-47-17 W4M) (AESRD 2010-2012). The proposed route is not located within the 1,000 m setback of any provincially identified colonial nesting bird waterbodies or within the 200 m setback of any provincially identified piping plover waterbodies (AESRD 2010-2012). The closest piping plover waterbody is Oliver Lake, approximately 4 km east of the proposed pipeline route. The proposed route is not located within the 800 m setback of any provincially identified trumpeter swan waterbodies (AESRD 2010-2012). The closest trumpeter swan waterbody is Cooking Lake, approximately 5 km northeast of the proposed pipeline route. The proposed pipeline route does not traverse any provincially identified Key Wildlife and Biodiversity Zones (AESRD 2010-2012). The closest Key Wildlife and Biodiversity Zone, associated with the North Saskatchewan River, is approximately 1.9 km northwest of KPT 0.0 (NW 32-52-23 W4M) of the proposed pipeline route.

The proposed pipeline route crosses four Environmentally Significant Areas and is in close proximity to five additional Environmentally Significant Areas (Table 5.14 of this ESA) (ATPR 2009).

The proposed pipeline route does not cross any parks (ATPR 2011). The closest is Strathcona Science Provincial Park which is located approximately 2 km northwest of KPT 0.0 (NW 32-52-23 W4M).

The proposed pipeline route does not traverse any IBAs (BirdLife International *et al.* 2012, IBA Canada 2012). The proposed pipeline route is located directly adjacent to the Ministik, Joseph, and Oliver Lakes IBA (IBA AB070) from KP 33.5 and KP 34.2 (in SW 1-50-22 W4M). The Ministik, Joseph, and Oliver Lakes IBA, listed as Globally Significant, provides excellent habitat for dabbling ducks and has recorded globally significant numbers of waterfowl in late summer. Joseph Lake hosts a number of colonial nesting birds, such as American white pelicans, California gulls, double-crested cormorants, and the entire area is an important spring and fall staging site for waterfowl, including tundra swans (BirdLife International *et al.* 2012, IBA Canada 2012). Additional IBAs occur in the Wildlife RSA, including Miquelon Lake (AB071), Wavy Lake (AB037), Bellshill Lake (AB116) and Shultz Lake (AB117) (BirdLife International *et al.* 2012, IBA Canada 2012).

The proposed pipeline route does not traverse any DUC Priority Areas (DUC 2010). The proposed pipeline route does not cross any National Wildlife Areas, Migratory Bird Sanctuaries, Western Hemisphere Shorebird Reserves, Ramsar wetlands or World Biosphere Reserves (BirdLife International *et al*. 2012, Environment Canada 2012f, WHSRN 2012, Bureau of the Convention on Wetlands 2012, United Nations Educational, Scientific and Cultural Organization [UNESCO] 2012).

The proposed route traverses the Beaver Hills Initiative (BHI) area for approximately 25 km from KPE 10.7 (NE 33-51-23 W4M) to KP 32.5 (NE 2-50-22 W4M) in Strathcona and Leduc counties (Beaver Hills Initiative 2012). The BHI area (also known as the Cooking Lake Moraine) is an extensively treed, upland area consisting of rolling to hummocky terrain rich in native wetlands and aspen dominated boreal mixedwood forest habitat. This ecosystem supports a high diversity of vegetation and wildlife. The BHI was developed in 2002 from a collective recognition among all levels of government agencies, academia, industry and locally-active environmental groups that for this ecosystem to remain sustainable, the sensitivity of the BHI area needs to be considered when planning growth and development (Beaver Hills Initiative 2012).

The proposed pipeline route encounters one PNT (Alberta Energy 2012a). PNT 030043, located at NW 11-50-22 W4M (located from KP 30.5 to KPHD 0.5), is administered by the AESRD Red Deer Fish and Wildlife Office and is an Ungulate Habitat Protection Area. Referral to AESRD is required prior to issuing any dispositions in the treed areas. No additional clearing within this PNT is permitted without AESRD consent (Alberta Energy 2012a). In addition, there is a January 1 to March 31 timing restriction for this PNT, which may be relaxed during mild winters (Moore pers. comm.). Consultation regarding this PNT is on-going.

5.1.10.4 Wildlife Species with Special Conservation Status

Prior to commencing the wildlife field work for the Project, a list of wildlife species with special conservation status that have the potential to occur along the proposed pipeline route was prepared. The list, provided in Appendix 9 of this ESA, is based on wildlife species identified as having the potential to occur in the Central Parkland Subregion of the Parkland Natural Region and Dry Mixedwood Subregion of the Boreal Forest Natural Region (Natural Regions Committee 2006). The list includes federal designations as listed by the *SARA* (Government of Canada 2011) and COSEWIC (2012), as well as provincial status designations. A complete summary of wildlife species with special conservation status whose ranges overlap the Wildlife RSA and have the potential to occur along the proposed pipeline route is provided in Appendix 9 of this ESA.

A search of the AESRD FWMIS database (AESRD 2012d) reported observations of six species listed under Schedule 1 of *SARA* (Government of Canada 2011) and/or by COSEWIC (2012) within 2 km of the proposed pipeline route. In addition, the FWMIS search and a review of the Line 4 Extension Project wildlife report identified 34 provincially-listed wildlife species within 2 km of the proposed pipeline route (ASRD 2010, 2011, AESRD 2012d, TERA 2007c). A summary of these species is provided in Table 5.16.

TABLE 5.16

OCCURRENCES OF SPECIES WITH SPECIAL CONSERVATION STATUS REPORTED WITHIN 2 km OF THE PROPOSED PIPELINE ROUTE

Species Common Name	Scientific Name	Federal Designation[1]	Provincial Designation[2]	Comments
American badger	*Taxidea taxus*	--	Sensitive	One den reported within 2 km of the proposed pipeline route.
American bittern	*Botaurus lentiginosus*	--	Sensitive	American bitterns were observed at five locations along the proposed pipeline route during the wildlife survey of the Line 4 Extension Project in 2007 (TERA 2007c).
American kestrel	*Falco sparverius*	--	Sensitive	No nests reported within 2 km of the proposed pipeline route. Three sightings of individual birds within 2 km of the proposed pipeline route.
American white pelican	*Pelecanus erythrorhynchos*	--	Sensitive	No breeding colonies reported within 1 km of the proposed pipeline route. Several sightings and nests on Joseph lake, approximately 1.5 km from proposed route.

TABLE 5.16 Cont'd

Species Common Name	Scientific Name	Federal Designation[1]	Provincial Designation[2]	Comments
bald eagle	*Haliaeetus leucocephalus*	--	Sensitive	No nests reported within 1 km of the proposed pipeline route. Two recorded sightings within 2 km of the proposed pipeline route.
black tern	*Chlidonias niger*	--	Sensitive	No nesting colonies reported along the proposed pipeline route. Black terns were observed at 14 locations along the proposed pipeline route during the wildlife survey of the Line 4 Extension Project in 2007 (TERA 2007c).
black-crowned night heron	*Nycticorax nycticorax*	--	Sensitive	No nest sites reported on the proposed pipeline route. One sighting of an individual reported within 2 km of the proposed route.
broad-winged hawk	*Buteo platypterus*	--	Sensitive	No nest sites reported along the proposed pipeline route. One sighting of an individual reported within 2 km of the proposed route.
burrowing owl	*Athene cunicularia*	Endangered (COSEWIC, *SARA* Schedule 1)	At Risk	Unconfirmed possible burrow location (1985). The proposed pipeline route occurs outside of currently mapped burrowing owl breeding range (COSEWIC 2006).
Canadian toad	*Anaxyrus hemiophrys*	--	May Be At Risk	One record located along the proposed pipeline route. Four additional records within 2 km of the proposed pipeline route.
chestnut-collared longspur	*Calcarius ornatus*	Threatened (COSEWIC, SARA Schedule 1)	Sensitive	Three sightings of individuals reported within 2 km of the proposed route.
common yellowthroat	*Geothlypis trichas*	--	Sensitive	Two records of individuals within 2 km of the proposed route.
great blue heron	*Ardea herodias*	--	Sensitive	A single great blue heron was observed flying over the proposed route during the wildlife survey of the Line 4 Extension Project in 2007 (TERA 2007c).
great gray owl	*Strix nebulosa*	--	Sensitive	No nest sites reported within 1 km of the proposed pipeline route. Several records of individuals and a probable nest within 2 km of the proposed route.
green-winged teal	*Anas crecca*	--	Sensitive	No nest sites reported along the proposed pipeline route. Three sightings of individuals reported within 1 km of the proposed route.
horned grebe	*Podiceps auritus*	--	Sensitive	No records reported at wetlands crossed by the proposed pipeline route. Two records within 2 km of the proposed pipeline route.
least flycatcher	*Empidonax minimus*	--	Sensitive	One sighting on an individual reported within 2 km of the proposed route.
lesser scaup	*Aythya affinis*	--	Sensitive	No nest sites reported along the proposed pipeline route. Two individuals reported within 2 km of the proposed route.
northern goshawk	*Accipiter gentilis*	--	Sensitive	No nest sites reported along the proposed pipeline route. One sighting on an individual reported within 1km of the proposed route.
northern harrier	*Circus cyaneus*	--	Sensitive	No nest sites reported along the proposed pipeline route. Two sightings of individuals reported within 2 km of the proposed route.
northern hawk owl	*Surnia ulula*	--	Sensitive	No nest sites reported along the proposed pipeline route. Two sightings of individuals reported within 2 km of the proposed route.
northern leopard frog	*Lithobates pipiens*	Special Concern (COSEWIC, *SARA* Schedule 1)	At Risk	One record reported, found dead (1971). Northern leopard frog is not in the Project range based on the recent range map for this species (COSEWIC 2009a)
peregrine falcon	*Falco peregrinus*	--	May Be At Risk Threatened[3]	An artificial nest site reported >1 km from the proposed pipeline route (2010). One record of a juvenile within 1 km of the proposed pipeline route.
plains garter snake	*Thamnophis radix*	--	Sensitive	Two individuals recorded, no hibernacula reported.
purple martin	*Progne subis*	--	Sensitive	One record of this species within 2 km of the proposed pipeline route.
sandhill crane	*Grus canadensis*	--	Sensitive	One recorded individual within 2 km of the proposed pipeline route.
sedge wren	*Cistothorus platensis*	--	Sensitive	Sedge wrens were heard in three locations along the proposed pipeline route during the survey of the Line 4 Extension Project in 2007 (TERA 2007c).
sharp-tailed grouse	*Tympanuchus phasianellus*	--	Sensitive	No lek sites reported within 500 m of the proposed pipeline route. Two records of individuals within 2 km of the proposed pipeline route.

TABLE 5.16 Cont'd

Species Common Name	Scientific Name	Federal Designation[1]	Provincial Designation[2]	Comments
short-eared owl	*Asio flammeus*	Special Concern (COSEWIC, *SARA* Schedule 1)	May Be At Risk	Two individuals found dead of unknown causes (1965, 1977) within 2 km of the proposed pipeline route.
sora	*Porzana carolina*	--	Sensitive	Multiple records recorded within 2 km of the proposed pipeline route (2008, 2009).
Sprague's pipit	*Anthus spragueii*	Threatened (COSEWIC, *SARA* Schedule 1)	Sensitive, Special Concern[3]	Sprague's pipits were heard and observed at six locations along the proposed pipeline route during the wildlife survey of the Line 4 Extension Project in 2007 (TERA 2007c). In addition, three FWMIS records reported Sprague's pipits within 2 km of the proposed pipeline route in 2009 (AESRD 2012d).
Swainson's hawk	*Buteo swainsoni*	--	Sensitive	Multiple records along the proposed pipeline route.
wandering garter snake	*Thamnophis elegans*	--	Sensitive	Museum specimen found dead of unknown causes (1944) approximately 1.5 km from proposed pipeline route.
western grebe	*Aechmophorus occidentalis*	--	Sensitive Special Concern[3]	No breeding colonies reported within 1 km of the proposed pipeline route. Multiple records and nests at Hastings Lake, approximately 1.5 km from the proposed pipeline route.
yellow rail	*Coturnicops noveboracensis*	Special Concern (COSEWIC, *SARA* Schedule 1)	--	Yellow rails were observed at four locations along the proposed pipeline route during the wildlife survey of the Line 4 Extension Project in 2007 (TERA 2007c). In addition, three FWMIS records were reported within 2 km of the proposed pipeline route in 2009 (AESRD 2012d).

Sources: AESRD 2012d, NatureServe 2012a,b, TERA 2007c.

Notes: 1 COSEWIC 2012, Government of Canada 2011
2 ASRD 2011
3 ASRD 2010

General Habitat requirements for *SARA* Schedule 1 and COSEWIC-Listed Wildlife Species

The following provides an overview of the status and general habitat requirements of wildlife species listed under Schedule 1 of *SARA* or by COSEWIC that have the potential to occur along the proposed pipeline route.

Little brown myotis: During summer, reproductive females form colonies, typically in buildings and large tree hollows. Adult males and non-reproductive females roost alone or in small groups in buildings, trees, rock crevices, wood piles and caves (Fenton and Barclay 1980). Foraging often occurs in open fields or over waterbodies and streams that have a high abundance of aquatic insects (Anthony and Kunz 1977). Winter hibernacula are typically caves and abandoned mines where temperatures stay above freezing and humidity is high (Fenton and Barclay 1980).

Baird's sparrow: Originally thought to be a native grassland specialist, the Baird's sparrow has been found to adapt and nest in forage crops, such as hayfields and pasture (Davis and Sealy 1998). Occurrence of Baird's sparrows is more influenced by grazing practices than plant species composition, with a higher density of birds occurring in areas of ungrazed prairie than in grazed areas (Sutter *et al.* 1995).

Barn swallow: Barn swallows prefer various types of open habitats for foraging. Nesting sites are often in and on artificial structures, including barns and other outbuildings, garages, houses, bridges and road culverts (COSEWIC 2011).

Bobolink: Bobolink historically nests in tall-grass prairie, but since recent clearing and expansion of agricultural lands the bobolink nests primarily in forage fields (*e.g.*, hayfields and pasture). The bobolink also nests in grassland habitats, including uncultivated prairie, peatland, and fields dominated by tall grasses (COSEWIC 2010a).

Chestnut-collared longspur: Chestnut-collared longspur typically breeds in grazed or mowed short- and mixed-grass prairie. This species prefers short vegetation (20-30 cm) but will use tall grass if it is mowed or grazed. Conversion of native prairie to cultivated land has fragmented this species' habitat and patches that remain are left idle and, therefore, unsuitable for breeding (COSEWIC 2009b).

Common nighthawk: Open habitats are required for common nighthawk nesting and foraging and can include logged or slash burned areas, woodland clearings, open mixed and coniferous forests, grasslands, pastures and wetlands (COSEWIC 2007).

Ferruginous hawk: Considered a native grassland specialist, preferred nesting sites are located in pasture or native grassland (COSEWIC 2008a). This species often roosts on the ground and a variety of structures are used for nesting, including cliffs, tress, farm buildings and machinery, and hay stacks (COSEWIC 2008a). Preferred foraging habitat of ferruginous hawks may be that of their main prey species, the Richardson's ground squirrel; areas with 30% cultivation and grass less than 30 cm in height (COSEWIC 2008a).

Horned grebe: Horned grebes forage by diving in shallow waters often near emergent vegetation and will also forage on surface prey and snatch insects from the air or overhanging plants (Johnsgard 1987). Their diet mainly consists of small fishes, crustaceans and aquatic insects, and also includes amphibians and leeches (Semenchuk 1992). Horned grebes nest in both open and forested areas, preferring those ponds, sloughs and lakes with extensive marshy vegetation. The emerging vegetation provides nest materials, concealment and anchorage, and protection for young (COSEWIC 2009c). Nests are a floating mass of decayed and fresh aquatic vegetation built up in shallow waters and anchored to reeds (Semenchuk 1992).

Loggerhead shrike: Loggerhead shrikes inhabit a wide variety of habitats with open foraging areas adjacent to nesting and foraging areas, including grasslands, sagebrush stands, pastures, agricultural areas and thinly wooded areas with small trees and shrubs (Government of Canada 2011). They prefer small bushy trees and dense or thorny bushes for foraging perches and nesting sites (COSEWIC 2004). In Alberta, loggerhead shrikes preferably forage in areas with medium (15-35 cm) to tall grasses (more than 35 cm) (COSEWIC 2004).

Long-billed Curlew (Special Concern on Schedule 1 of *SARA* and by COSEWIC). Long-billed curlews nest in fescue grasslands, sandhills and short or mixed grass native prairie (Hill 1998). Although long-billed curlews will nest in agricultural land, preferred sites are in large areas of relatively low, irregular vegetation (Government of Canada 2011). After the young hatch, parents often move the young to areas with denser, taller vegetation (COSEWIC 2002). In the Grassland Natural Region of Alberta, long-billed curlews are twice as numerous in areas containing >50% native grassland (Hill 1998). Only the southern portion of the proposed pipeline route is located within the long-billed curlew range (Federation of Alberta Naturalists 2007).

Piping plover: Piping plovers nest just above the normal high watermark on exposed sandy or gravelly beaches of large lakes and shallow, saline lakes (Government of Canada 2011).

Short-eared owl: Short-eared owls are often associated with open habitat, including grasslands, bogs, marshes, old pastures and occasionally agricultural fields (COSEWIC 2008b). The short-eared owl breeds in open country with short vegetation including rangelands, grasslands, near dry marshes, farmlands, brushy fields and forest clearings (Semenchuk 1992). A combination of areas of suitable resting and nesting cover, with adjacent hunting areas is a dominant factor in selecting breeding habitat (Johnsgard 1988).

Sprague's pipit: Sprague's pipit prefers open native vegetation of intermediate height and density, with moderate amounts of litter and no or low shrub density (COSEWIC 2010b). This species is rarely found in cultivated lands or areas where native grasses have been replaced with introduced forages.

Yellow rail: Yellow rail are found in wetlands (*e.g.*, fens) dominated by sedges, grasses and rushes where there is little or no standing water (generally 0-12 cm water depth), and where the substrate remains saturated throughout the summer (Federation of Alberta Naturalists 2007, Semenchuk 1992). It has been suggested that only wetlands large enough to support a small group of territorial birds will have yellow

rails on a long term basis (Semenchuk 1992). Nests are constructed of grasses and other dead emergent vegetation, and are situated on the ground and well concealed by a canopy of bent over grass in or near a marsh (Semenchuk 1992).

5.1.10.5 Summary of Wildlife Results

Wildlife field work was conducted from July 13-26, 2012 (see Appendix 9 of this ESA) along selected segments of the proposed pipeline route. Survey locations were selected based on the desktop/literature review that identified habitat types with the potential to support species with special conservation status or important wildlife features and where land access was permitted. Field work was conducted on foot and included breeding bird point count surveys, visual scans and ground inspections at all surveyed locations to observe wildlife and wildlife habitats along and immediately adjacent to the proposed pipeline route. All wildlife observations were identified by sight or sound and documented, as well as wildlife sign and important habitat features.

Mammals

Ungulate species and their sign (tracks, pellets, beds) observed during the wildlife field work included mule deer, white-tailed deer and moose. Observations and evidence (tracks, pellets, beds) of both mule deer and white-tailed deer were common along the proposed pipeline route in areas of tame pasture, treed-pasture and treed areas. Evidence of moose (pellets) was observed at one location along the route near KPHD 0.07 (NW 11-50-22 W4M). No mineral licks were observed during the wildlife field work.

Coyote and American badger were recorded during the survey. Coyote tracks and scat were observed at several locations along the proposed pipeline route. Old American badger burrows were observed near KP 81.2 (NW 19-47-17 W4M) and KP 141.1 (SW 20-44-12 W4M). No recent sign of American badger was observed. No other dens were observed during the wildlife field work.

Small mammals observed during the wildlife field work included red squirrel, Richardson's ground squirrel, northern pocket gopher and mouse species. Red squirrels were observed in deciduous forest near KP 16.4 (SE 19-51-22 W4M), KP 17.2 (NE 18-51-22 W4M) and KP 25.2 (NE 28-50-22 W4M). A mouse (species unidentified) was observed in a tame pasture near KP 133.2 (NW 34-44-13 W4M). Richardson's ground squirrels and their sign (burrows) were observed along the length of the proposed pipeline route, primarily in areas of tame pasture. Evidence of northern pocket gopher (dirt mounts) was observed in all upland habitat types encountered by the proposed pipeline route.

Recent beaver activity (chewed trees, runs, tracks) was observed at the wetland crossed by the proposed pipeline route near KP 160.8 (NE 13-43-11 W4M). The proposed construction right-of-way does not appear to cross any beaver dams in this area. No other beaver sign was observed during the wildlife field work. A muskrat was observed in the Battle River near KP 173.6 (NE 25-42-10 W4M).

Birds

Raptors recorded during the survey include northern harrier, red-tailed hawk and Swainson's hawk. Great horned owl and turkey vulture were also observed. Stick nests were observed in the Wildlife LSA during the wildlife field work near KP 30.1 (SW 14-50-22 W4M), KPHD 0.1 (NW 11-50-22 W4M), KP 66.2 (SW 14-48-19 W4M), KP 81.4 (NW 19-47-17 W4M) and KP 172.6 (SW 36-42-10 W4M). All appeared unoccupied. An active stick nest was observed near KP 150.8 (SW 6-44-11 W4M), which was occupied at the time of wildlife fieldwork by an adult Swainson's hawk with two young. A pair of Swainson's hawks was observed behaving defensively south of KP 123.0 (NE 15-45-14 W4M). A nest is suspected to occur in the area, but was unconfirmed during the field visit due to land access. Several stick nests were noted along and adjacent to the proposed pipeline route that were identified as black-billed magpie or American crow nests. None of the nests were occupied at the time of the wildlife field work. American crow and black-billed magpie nests are used for a single year.

A total of 50 passerines were recorded during the wildlife field work and included the following four *SARA* Schedule 1 and COSEWIC listed species: barn swallow; common nighthawk; loggerhead shrike and Sprague's pipit.

- Barn swallows were observed foraging along the route, in open pastures and the vicinity of nearby farmyards near KP 65.4 (SE 15-48-19 W4M), KP 66.2 (SW 14-48-19 W4M), KP 71.8 (NW 5-48-18 W4M), KPHJ 0.15 (NE 8-46-15 W4M), south of KP 123.4 (NE 15-45-14 W4M) and near KP 136.4 (NE 26-44-13 W4M). No suitable nesting sites for this species were noted along the proposed pipeline route in the areas surveyed.

- Two common nighthawks were observed foraging adjacent to the proposed pipeline route from approximately KP 171.8 to KP 172.3 (SE 35-42-10 W4M to SW 36-42-10 W4M).

- Three loggerhead shrikes were observed in a row of willow on the north side of the existing pipeline right-of-way near KP 138.6 (NE 24-44-13 W4M). There was evidence that loggerhead shrikes have been actively hunting in this area (a dead wood frog on barbed wire near the row of willow). A loggerhead shrike was also observed hunting in tame pasture and treed-pasture near KP 150.6 (SW 6-44-11 W4M).

- Sprague's pipit were observed near KP 81.3 (NW 19-47-17 W4M), KP 122.8 (NE 15-45-14 W4M), KP 136.5 (NE 26-44-13 W4M), KP 137.3 (SW 25-44-13 W4M), KP 137.5 (SW 25-44-13 W4M), KP 143.2 (SW 16-44-12 W4M) and KP 172.3 (SW 36-42-10 W4M), typically in tame pastures more than 500 m in length. A Sprague's pipit was also observed in a mix of tame pasture and hay near KP 65.3. The following five provincially-listed passerine species were also observed: Baltimore oriole; common yellowthroat; least flycatcher; purple martin and western wood-pewee.

Woodpecker species observed along the proposed pipeline route included downy woodpecker, hairy woodpecker, northern flicker and yellow-bellied sapsucker. Evidence of pileated woodpecker (old work on trees) was noted near KP 27.1 (NW 22-50-22 W4M), KP 29.5 (NW 14-50-22 W4M), KP 30.1 (SW 14-50-22 W4M) and KP 172.3 (SW 36-42-10 W4M).

Two *SARA* Schedule 1/COSEWIC listed waterbird species, horned grebe and yellow rail, were recorded during the wildlife field work. A pair of horned grebes (listed as "Special Concern" by COSEWIC) with two young were observed at the wetland crossed by the proposed pipeline route near KP 49.4 (NE 6-49-20 W4M). Horned grebes were also observed at a wetland located north of the proposed pipeline route near KP 145.1 (NW 10-44-12 W4M). A yellow rail was heard calling directly north of KP 142.0 (NE 17-44-12 W4M) in a wetland dominated by sedges, rushes and grasses approximately 0.3-0.6 m tall, with some shallow standing water 2-5 cm in depth.

The following eight provincially-listed wildlife species were also observed: American bittern; American white pelican; black tern; great blue heron; green-winged teal; lesser scaup; pied-billed grebe; sandhill crane and sora. American bitterns were observed in wetlands containing cattail and bulrush near KP 140.1 (SE 19-44-12 W4M) and KP 143.9 (SE 16-44-12 W4M). A flock of 31 American white pelicans was observed on the large wetland north of KP 138.6 (NE 24-44-13 W4M) and three were observed flying overhead near KPHD 0.17 (NW 11-50-22 W4M). Green-winged teals were observed near KP 139.0 (NW 19-44-12 W4M) and at a wetland north of the proposed pipeline route near KP 145.1 (NW 10-44-12 W4M). A lesser scaup was also observed at the wetland north of KP 145.1 (NW 10-44-12 W4M). Sandhill cranes were observed west of KP 138.6 (NE 24-44-13 W4M) and great blue herons were observed flying overhead near KP 84.4 (NW 16-47-17 W4M) and KP 138.9 (NW 19-44-12 W4M). Pied-billed grebes observed at the wetland crossed by the proposed pipeline route near KP 159.6 (SE 23-43-11 W4M) as well as at wetlands located east of KP 16.2 (NE 19-51-22 W4M) and north of KP 139.0 (NW 19-44-12 W4M). Soras and black terns were observed at several wetlands along the length of the proposed pipeline route.

Additional observed waterfowl include American wigeon, blue-winged teal, bufflehead, Canada goose, canvasback, common goldeneye, dowitcher (species unidentified), eared grebe, gadwall, mallard, northern shoveler and ruddy duck. A pair of common loons was observed flying overhead during the field work. Additional shorebirds observed include American avocet, American coot, greater yellowlegs, killdeer, lesser yellowlegs, marbled godwit, spotted sandpiper and Wilson's snipe. Several gulls were also observed.

Amphibians and Reptiles

Amphibians identified during the field work include wood frog and boreal chorus frog. Given the wet spring, both wood frogs and boreal chorus frogs were relatively abundant along the proposed pipeline route, primarily along the margins of wetlands, near watercourses and in wet tame pastures. Suitable breeding habitat for amphibians occurs along the length of the proposed pipeline route in wetlands and at slow-moving watercourses. No other amphibian species were observed during the wildlife field work.

No observations or evidence of reptiles were recorded during the survey.

5.1.10.6 Wildlife of Ecological, Human, and Economic Importance

All wildlife species, including those with relatively abundant local and regional populations, can be considered ecologically important since they contribute to the function of the ecosystem. For the purposes of assessment and developing mitigation to reduce potential effects of the Project, ecologically important species and habitats are considered to include those with special conservation status, and are summarized in Table 5.17 and described in Section 5.1.11 and Appendix 9 of this ESA. These wildlife species and their habitats are also considered to be of human importance since society typically places high value on species of conservation concern.

The wildlife species of human and economic importance that are likely to occur in the Wildlife RSA include those that are hunted or trapped. Within Wildlife Management Units (WMUs) 202 (Neutral Hills), 203 (Alliance), 228 (Camrose), 230 (Wavy), 232 (Hardisty), 242 (Beaverhill) and 248 (Edmonton), big game and game bird species harvested include white-tailed deer, mule deer, moose, elk, cougar, sharp-tailed grouse, pheasant, ruffed grouse, spruce grouse, gray partridge, snow goose, Ross' goose, Canada goose, white-fronted goose, ducks, coots and snipe (Government of Alberta 2012b).

The proposed pipeline route is located in Fur Management Zone 7 (Government of Alberta 2012c). There are no registered trapping areas crossed by the pipeline route (Alberta Energy 2012a). Furbearing species trapped in Fur Management Zone 7 include badger, beaver, coyote, red/Arctic fox, mink, muskrat, red squirrel, weasel and wolf (Government of Alberta 2012c).

Consultation did not result in the identification of any wildlife of traditional economic importance used as country foods. The potential effects on wildlife and wildlife habitat in the context of human health are discussed in Section 6.2.16 of this ESA.

5.1.11 Species at Risk

This subsection identifies plant and animal species listed under Schedule 1 of *SARA*, whose range and habitat potentially occur within the Aquatics, Vegetation and Wildlife LSAs. The potential pipeline-related effects and mitigation pertaining to species at risk are discussed in Section 6.2.11 of this ESA.

Aquatic Species at Risk

One fish species, lake sturgeon, listed as endangered by COSEWIC is known to occur in the North Saskatchewan River within the Aquatic RSA (COSEWIC 2012). Although lake sturgeon are known to occur within the mainstem of the North Saskatchewan River, they would not occur in its smaller tributaries near the proposed crossings within the Aquatic LSA.

Plant Species at Risk

No plant species at risk listed by *SARA* or COSEWIC are identified as potentially occurring in the Central Parkland or the Dry Mixedwood Natural Subregions. No previously recorded occurrences of rare plants with a *SARA* or COSEWIC designation are known to occur within 5 km of the proposed pipeline route (ACIMS 2012). No COSEWIC or *SARA*-listed species were found during the vegetation surveys in July and August 2012.

Wildlife Species at Risk

Wildlife species at risk with potential to occur in the Central Parkland Subregion of the Parkland Natural Region or the Dry Mixedwood Subregion of the Boreal Forest Natural Region (Natural Regions

Committee 2006) were evaluated to determine which species may occur along the proposed pipeline route based on species range, habitat requirements and professional knowledge. The complete list of wildlife species with special conservation status is provided in Appendix 9 of this ESA. Based on these lists, 14 wildlife species with special conservation status were identified as having the potential to occur along the proposed pipeline route based on species range, habitat requirements, consultation and field work conducted to date (Table 5.17).

TABLE 5.17

SUMMARY OF POTENTIAL SPECIES WITH SPECIAL CONSERVATION STATUS

Species and Status	FWMIS Records/Observations During July 2012 Field Work
little brown myotis (Endangered by COSEWIC)	• No observations. Suitable foraging habitat is present throughout the route. Suitable roosting habitat is likely limited to a few stands of mature forest in this area.
Baird's sparrow (Special Concern by COSEWIC)	• No observations. Suitable habitat was observed in hayfields and tame pasture along the proposed pipeline route.
barn swallow (Threatened by COSEWIC)	• Barn swallows were observed foraging along the proposed pipeline route in the vicinity of wetlands and in some tame pastures near KP 65.4 (SE 15-48-19 W4M), KP 66.2 (SW 14-48-19 W4M), KP 71.8 (NW 5-48-18W4M), KPHJ 0.15 (NE 8-46-15 W4M), south of KP 123.4 (NE 15-45-14 W4M) and near KP 136.4 (NE 26-44-13 W4M). No suitable nesting sites for this species were noted along the proposed pipeline route in the areas surveyed.
bobolink (Threatened by COSEWIC)	• No observations. Suitable habitat was present along the route in hayfields, tame pasture and areas of native prairie.
chestnut-collared longspur (Threatened on Schedule 1 of *SARA* and by COSEWIC)	• AESRD FWMIS identified records of chestnut-collared longspur within 500 m of the proposed pipeline route (AESRD 2012d). • No observations. Suitable breeding habitat is present along the proposed pipeline route in grazed or mowed native prairie and tame pastures.
common nighthawk (Threatened on Schedule 1 of *SARA* and by COSEWIC)	• Two nighthawks were observed along the proposed pipeline route between KP 171.8 and KP 172.3 (SE 35-42-10 W4M to SW 36-42-10 W4M). Suitable habitat was observed in open mixed and coniferous forests, grasslands and tame pastures with sandy soils, such as those located from KP 169.5 to KP 169.8 (in SW 2-43-10 W4M) and KP 171.0 to KP 172.3 (NW 35-42-10 W4M to SW 36-42-10 W4M).
ferruginous hawk (Threatened on Schedule 1 of *SARA* and by COSEWIC)	• No observations. Suitable habitat occurs along the length of the proposed pipeline in areas containing trees suitable for nesting and in areas of native prairie and tame pastures.
horned grebe (Special Concern by COSEWIC)	• AESRD FWMIS identified records of horned grebe within 2 km of the proposed pipeline route (AESRD 2012d). • A pair of horned grebes with 2 young was observed at the wetland crossed by the proposed pipeline route near KP 49.4 (NE 6-49-20 W4M). Horned grebes were also observed at a wetland located approximately 210 m north of the proposed pipeline route near KP 145.1 (NW 10-44-12 W4M). Suitable nesting habitat occurs at wetlands crossed by the proposed pipeline route that contain open water and sufficient emergent vegetation for nesting and cover.
loggerhead shrike (Threatened on Schedule 1 of SARA and by COSEWIC)	• Three loggerhead shrikes were observed in a row of willow adjacent to the north side of the existing pipeline right-of-way near KP 138.6 (NE 24-44-13 W4M). The row of willow appears to be suitable for nesting habitat. The proposed pipeline route is south of the existing right-of-way in this location, therefore, the row of willows will not be disturbed. A loggerhead shrike was also observed hunting in tame pasture and treed-pasture near KP 150.6 (SW 6-44-11 W4M), but no potential nesting habitat was observed near this location. Suitable habitat for loggerhead shrike occurs along the length of the proposed pipeline route in open areas, including tame pastures, agricultural areas and thinly wooded areas with small bushy trees and dense or thorny bushes for nesting.
long-billed curlew (Special Concern on Schedule 1 of *SARA* and by COSEWIC)	• No observations. Native prairie suitable for nesting habitat is limited along the proposed pipeline route. Only the southern portion of the route is within the long-billed curlew range (Federation of Alberta Naturalists 2007).
piping plover (Endangered on Schedule 1 of *SARA* and by COSEWIC)	• No observations. Suitable water bodies for piping plover were not observed along the proposed pipeline route.
short-eared owl (Special Concern on Schedule 1 of *SARA* and by COSEWIC)	• AESRD FWMIS identified records of short-eared owl within 2 km of the proposed pipeline route (AESRD 2012d). • No observations. Suitable habitat occurs along the length of the proposed pipeline in tame pastures, farmland and occasionally agricultural fields.
Sprague's pipit (Threatened on Schedule 1 of *SARA* and by COSEWIC)	• AESRD FWMIS identified records of Sprague's pipit within 500 m of the proposed pipeline route (AESRD 2012d). • Sprague's pipits were observed at multiple sites during the July 2012 field work: in pastures near KP 81.3 (NW 19-47-17 W4M), KP 122.8 (NE 15-45-14 W4M), KP 136.5 (NE 26-44-13 W4M), KP 137.3 (SW 25-44-13 W4M), KP 137.5 (SW 25-44-13 W4M) and KP 143.2 (SW 16-44-12 W4M); and in a mix of tame pasture and hay near KP 65.3 (SE 15-48-19 W4M). An additional Sprague's pipit was heard at a distance of more than 350 m from the proposed right-of-way near KP 172.3 (SW 36-42-10 W4M) over a segment of treed-pasture. Observations were generally made in suitable habitat: open grasslands greater than 500 m in length containing mixed height grasses and litter cover.
yellow rail (Special Concern on Schedule 1 of *SARA* and by COSEWIC)	• AESRD FWMIS identified records of yellow rail within 500 m of the proposed pipeline route (AESRD 2012d). • One yellow rail was observed at a wetland on the right-of-way near KP 142.0 (NE 17-44-12 W4M). Habitat in this area was dominated by sedges, rushes and grasses 0.3-0.6 m tall, with some shallow standing water 2-5 cm in depth. Additional locations containing suitable habitat for yellow rail were noted near KP 132.7 (NE 33-44-13 W4M), KP 139.7 (SW 19-44-12 W4M), KP 140.4 (SE 19-44-12 W4M), north/northeast of KP 139.3 (NW 19-44-12 W4M) and north of KP 143.8 (SE 16-44-12 W4M).

5.1.12 Human Occupancy and Resource Use

This subsection describes the current human occupancy and resource use in the Socio-economic RSA. Information is provided relating to population, demographics, land use, zoning, natural resource use, parks, protected areas, outdoor recreation, water use and visual attributes.

The potential construction impacts and mitigation pertaining to human occupancy and resource use are discussed in Section 6.2.12 of this ESA. In addition, the potential effects on visual and other aesthetic qualities in the context of human health are discussed in Section 6.2.16 of this ESA.

No new permanent access will be needed since the proposed route will be located adjacent to or in close proximity to existing development. The proposed pipeline route traverses the TUC for 10 km (6%), provincial Crown land for 1.1 km (1%) and the remaining 169.9 km (93%) of its length is privately-owned land. Table 5.18 summarizes the Crown dispositions encountered along the proposed pipeline route.

TABLE 5.18

CROWN DISPOSITIONS CROSSED BY THE PROPOSED PIPELINE ROUTE

Legal Location (W4M)	Approximate KP	Disposition Number	Disposition Type	Disposition Holder Name	Disposition Holder Address	Comments
SE 4-51-22	KP 22.5	080834	Pipeline Right-of-Way	Enbridge Pipelines Inc.	10130 103 St. Suite 1731-07 Edmonton	Partially water covered, includes bed and shore of Lake #3
NW 11-50-22	KPHD 0.0	030043	Protective Notation	Red Deer Office - Fish and Wildlife Resource Development	404, 4911 - 51st Street Red Deer, Alberta T4N 6V4	AESRD Red Deer Fish and Wildlife Office; Ungulate Habitat Protection Area. Referral to AESRD required prior to issuing any dispositions in the treed areas. No additional clearing is permitted without agency consent.
NW 11-50-22	KPHD 0.0	761225	Farm Development Lease	Ronald F. Otto	RR 1 New Sarepta, Alberta T0B 3M0	N/A
NE 34-42-10	KP 170.1	039546	Grazing Lease	Ian MacRae	PO Box 155 Hardisty, Alberta T0B 1V0	N/A

Source: Alberta Energy 2012a

5.1.12.1 Population and Demographics

Table 5.19 presents a list of the communities in the Socio-economic RSA that are considered to be potentially affected by the construction and operation of the proposed pipeline. The communities assessed in more detail in Sections 5.15 and 6.2.15 include Sherwood Park, Edmonton, Leduc, Tofield, Viking, Camrose, Killam, Sedgewick, Lougheed and Hardisty.

TABLE 5.19

COMMUNITIES IN THE SOCIO-ECONOMIC RSA

Community	2011 Population	Approximate Location[1]	Rationale for Inclusion in the Socio-Economic RSA
Sherwood Park	92,490[2]	Crossed	The pipeline crosses Sherwood Park.
Edmonton (City)	812,201	200 m west of KPE 4.0 (SW 21-52-23 W4M)	The City of Edmonton municipal boundary is close to the pipeline route. Edmonton is located in the Socio-economic LSA.
Leduc	16,967	19.8 km southwest of KPE 10.0 (NW 33-51-23 W4M)	The City of Leduc is a moderately-sized community in Leduc County. It is possible that Project personnel could use community facilities and services.

TABLE 5.19 Cont'd

Community	2011 Population	Approximate Location[1]	Rationale for Inclusion in the Socio-Economic RSA
Camrose	15,630	13 km southwest of KPD 0.0 (NW 20-48-19 W4M)	Moderately-sized community in Camrose County close to the pipeline route. It is reasonable to expect that Project personnel would use community facilities and services.
Tofield	1,876	22.2km northeast of KP 50.0 (SW 5-49-20 W4M)	The Town of Tofield is a small community in Beaver County. It is possible that Project personnel could use community facilities and services.
Viking	1,085	25.5 km northeast of KP 121.0 (SE 21-45-14 W4M)	The Town of Viking is a small community in Beaver County. It is possible that Project personnel could use community facilities and services.
Killam	1,019	4 km southwest of KP 133.0 (NW 34-44-13 W4M)	Small community in the Flagstaff County. It is reasonable to expect that Project personnel would use community facilities and services should the Project workforce be located in proximity.
Sedgewick	891	200 m southwest of KP 144.0 (SE 16-44-12 W4M)	The Town of Sedgewick is located in the Socio-economic LSA.
Lougheed	217	100 m northeast of KP 154.0 (SE 32-43-11 W4M)	The Town of Lougheed is located in the Socio-economic LSA.
Hardisty	760	100 m northeast of KP 173.0 (SW 36-42-10 W4M)	The Town of Hardisty is located in the Socio-economic LSA.

Sources: Statistics Canada 2012a,b,d,f,g,i,k,l,m,n

Notes: 1 Distances are approximate

2 Sherwood Park is within the boundaries of Strathcona County.

5.1.12.2 Land Use Plans and Zoning

This subsection provides a summary of the goals and objectives of the municipal land use plans crossed by the proposed pipeline route. Where available, the land use designation crossed by the proposed pipeline route is identified.

Lands adjacent to most of the proposed pipeline route have been used as pipeline rights-of-way since the 1950s. Most of the proposed pipeline route is located on privately-owned lands. Primary land uses in the Socio-economic RSA include agriculture and oil and gas activity. Other land uses include transportation, transmission and recreation, which are addressed in Section 5.1.17 of this ESA. The pipeline route is located within Strathcona County, Leduc County, Beaver County, Camrose County, Flagstaff County and the MD of Provost. These jurisdictions and their land use designations are presented in Table 5.20.

There are no conflicts between the land use designations at the regional and local levels along or adjacent to the proposed pipeline route.

TABLE 5.20

ZONING AND LAND USE DESIGNATIONS ALONG THE PIPELINE ROUTE

Approximate Location[1]	Authority	Zoning and Land Use Designation	
		Zoning Type	Length of Land Use Crossed
KPT 0.0 to KPHC 0.3 (NW 32-52-23 W4M to NE 32-50-22 W4M)	Strathcona County	Agricultural General	20.4 km
		Agricultural Future Development	2.2 km
		Rural Residential and Agriculture	1.5 km
		Medium Industrial	1.3 km
		Country Residential	0.4 km
		Golf Course	0.1 km
		Heavy Industrial	0.05 km
KPHC 0.3 to KPHF 0.3 (NE 32-50-22 W4M to SW 29-49-21 W4M)	Leduc County	Agricultural and Crown Land Transitional	11 km
		Agricultural	4 km
		Lake Watershed	0.7 km
KPHF 0.3 to KP 93.8 (SW 29-49-21 W4M to SE 6-47-15 W4M)	Camrose County	Agricultural General	56.4 km

TABLE 5.20

Approximate Location[1]	Authority	Zoning and Land Use Designation	
		Zoning Type	Length of Land Use Crossed
KPT 0.0 to KPHC 0.3 (NW 32-52-23 W4M to NE 32-50-22 W4M)	Strathcona County	Agricultural General	20.4 km
KP 93.8 to KP 93.9 (SW 5-47-16 W4M)	Beaver County	Agricultural District	0.03 km
KP 93.9 to KP 174.7 (NW 31-46-16 W4M to NW 30-42-9 W4M)	Flagstaff County	Agricultural	55.9 km
		Highway Commercial	25.1 km
		Country Residential	4.4 km
KP 174.7 to KP 175.5 (SW 30-42-9 W4M to SE 30-42-9 W4M)	MD of Provost No. 52	Terminal Area	0.5 km
		Agricultural and Conservation	0.3 km

Sources: Beaver County 2012a, Camrose County 2012, Flagstaff County 2012, Leduc County 2012a, MD of Provost No. 52 2012, Strathcona County 2012a.

5.1.12.3 Natural Resource Use

Land use along the proposed pipeline route consists of: cultivated land (55.8%); tame pasture (18.8%); hay (11.7%); treed-pasture (10.4%); treed areas (2.4%); disturbed land (0.2%); open water (0.3%); a tree nursery (0.2%); native prairie (0.1%); and campground (0.1%). The proposed route is contiguous to existing linear disturbances for approximately 96.2% of its length.

There are no Forest Management Agreements (FMA) in the Socio-economic RSA. The Project is located in the Central Parkland Natural Subregion of the Parkland Natural Region and the Dry Mixedwood Natural Subregion of the Boreal Forest Natural Region (Natural Regions Committee 2006). The Central Parkland Natural Subregion includes over 50,000 km^2 of land under cultivation (Government of Alberta 2009).

Oil and gas activities are prevalent in the Socio-economic RSA. Exploration and development infrastructure along the proposed pipeline route related to the oil and gas sector include pipelines, wells, compressor stations and batteries. A number of companies active in the Socio-economic RSA, include Enbridge Pipelines Inc., Petro Canada, Kinder Morgan, Imperial Oil Resources Limited, Keyera Energy Ltd., Alberta Oil Sands Pipeline Ltd. Praxair Canada Inc., Inter Pipeline (Corridor) Inc., ATCO Gas and Pipelines Ltd. (South), Shell Canada Limited, Alberta Products Pipeline Ltd., NOVA Chemicals Corporation, Pipeline Management Inc., Plains Midstream Canada ULC, Alberta Ethan Development Company Ltd., Tiamat Resources Inc., Jaycor Resources Inc., Canadian Natural Resources Limited, Penn West Petroleum Limited, Enerplus Corporation, NOVA Gas Transmission Ltd., Altagas Ltd., Encana Corporation, Enhance Energy Inc., Perpetual Energy Operation Corporation, Sorthorn Exploration Ltd., Rife Resources Ltd., Conoco Phillips Canada Operations Ltd., Ankerton Gas Co-op Ltd., Crew Energy Inc., Whitecap Resources Inc., Signalta Resources Limited, Zargon Oil and Gas Ltd., the Town of Sedgewick, Enbridge Pipelines (Athabasca) Inc., Hardisty Caverns Ltd. and Gibson Energy ULC (Information Handling Services Inc. [IHS] 2012a).

Enbridge has determined that there are no surface mining activities conflicting with the proposed pipeline route. The proposed route traverses subsurface metallic and industrial leases, operated by Hardisty Caverns Ltd. (owned by Enbridge), as well as active coal leases operated by the Carbon Development Corporation; however, no surface operating or abandoned coal mines, potash licenses, patent claims, quarry leases or withdrawals, mining-restricted lands or land dispositions associated with mining or aggregate developments are crossed (Alberta Energy 2012b).

Outfitting, hunting and fishing

The proposed route traverses several WMUS, including: Edmonton WMU 248, Beaverhill WMU 242 (Beaverhill), WMU 228 (Camrose), WMU 230 (Wavy), WMU 232 (Hardisty), WMU 203 (Alliance) and WMU 202 (Neutral Hills) (Government of Alberta 2012b). Table 5.21 provides the WMUs crossed by the proposed route.

TABLE 5.21

WILDLIFE MANAGEMENT UNITS CROSSED BY THE PROPOSED PIPELINE ROUTE

Location[1]		WMU	No. Of Guides/Outfitters	Overview of Hunting Seasons
Legal Location (W4M)	KP Location			
NW 32-52-23 to SE 4-51-22	KPT 0.0 to KPHC 0.18	Edmonton WMU 248	72	• white-tailed deer (antlered and antlerless) – archery only September 1 to November 30 • mule-deer (antlered and antlerless) – archery only September 1 to November 30 • moose (antlered and antlerless) – archery only September 1 to November 30 • moose (antlerless) – October 25 to December 7[2] (Monday to Friday, Strathcona County portion only) • elk (antlered and antlerless) – archery only September 1 to November 30 • snow or Ross's geese, Canada or white-fronted geese, ducks, coots and snipe – September 1 to December 16 • male pheasant, ruffed grouse, spruce grouse and gray partridge – September 1 to November 30 • sharp-tailed grouse – October 1 to 30
SE 4-51-22 to SW 4-49-20	KPHC 0.2 to KPHG 0.8	Beaverhill WMU 242	48	• white-tailed deer (antlered and antlerless) – November 1 to 30, archery only September 1 to October 31 • mule-deer (antlered and antlerless) – November 1 to 30, archery only September 1 to October 31[2] • moose (antlered and antlerless) – November 1 to 30, archery only September 1 to October 31[2] • cougar (fall) – November 1 to November 30; • black bear (fall 2012, spring 2013 requiring a new licence) – September 1 to November 30 and April 1 to May 31, respectively • snow or Ross's geese, Canada or white-fronted geese, ducks, coots and snipe – September 1 to December 16 • male pheasant, ruffed grouse, spruce grouse, gray partridge – September 1 to November 30 • sharp-tailed grouse – October 1 to 30
SW 4-49-20 to SW 27-46-16	KPHG 0.8 to KP 98.9	Camrose WMU 228	29	
SW 27-46-16 to SW 4-45-13	KP 98.9 to KP 131.0	Wavy WMU 230	27	
SW 4-45-13 to NE 2-44-12	KP 131.0 to KP 147.8	Hardisty WMU 232	48	• white-tailed deer (antlered and antlerless) – November 1 to 30, archery only September 1 to October 31 • mule-deer (antlered and antlerless) - November 1 to 30, archery only September 1 to October 31[2] • moose (antlered and antlerless) - November 1 to 30, archery only September 1 to October 31[2] • elk (antlered and antlerless) – November 1 to December 20 and January 1 to 20, archery only September 1 to October 31[2] • cougar (fall) – November 1 to 30 • black bear (fall 2012, spring 2013 requiring a new licence) – September 1 to November 30 and April 1 to May 31, respectively • snow or Ross's geese, Canada or white-fronted geese, ducks, coots and snipe – September 1 to December 16 • male pheasant, ruffed grouse, spruce grouse, gray partridge – September 1 to November 30 • sharp-tailed grouse – October 1 to 30
NE 2-44-12 to SW 18-43-10	KP 147.8 to KP 162.3	Alliance WMU 203	26	
SW 18-43-10 to SE 3-43-10	KP 162.3 to KP 168.5	Hardisty WMU 232	48	
SE 3-43-10 to SE 30-42-9	KP 168.5 to KP 175.5	Neutral Hills WMU 202	41	

Source: Government of Alberta 2012b, Nelson pers. comm.

Notes: 1 Locations are approximate.

2 Indicates seasons that apply only to hunters with applicable Special Licenses. Refer to the 2012 Alberta Hunting Draws booklet for details.

The WMUs cover extensive areas and, therefore, only a small number, if any of these guide/outfitters are expected to operate in the Socio-economic LSA.

The archery only hunting season in WMU 248 for white-tailed deer, mule deer, moose and elk extends from September 1 to November 30. A general hunting season for moose occurs from October 25 to December 7 only in the Strathcona portion (Government of Alberta 2012b). WMUs 242, 228, 230, 232, 203 and 202 have archery only seasons for white-tailed deer, mule-deer and moose from September 1 to

October 31. General hunting seasons are less extensive, extending from November 1 to November 30 (Government of Alberta 2012b). These WMUs have a cougar hunting season from November 1 to November 30 and a black bear hunting season with separate seasons for fall and spring from September 1 to November 30 and April 1 and May 31 respectively (Government of Alberta 2012b). WMU 232, 203 and 202 have a general hunting season for elk from November 1 to December 20 and January 1 and January 20, with an archery only season from September 1 to October 31 (Government of Alberta 2012b).

In all WMUs, the game bird hunting season for sharp-tailed grouse is from October 1 to October 30. For male pheasant, ruffed grouse, spruce grouse and gray partridge, the season extends from September 1 to November 30. The hunting season extends to September 1 to December 16 for snow or Ross' geese, Canada or white-fronted geese, ducks, coots and snipe (Government of Alberta 2012b).

The proposed pipeline route is located within Zone 2 of the Alberta Sportfishing Regulations, specifically Watershed Unit PP2 (AESRD 2012e).

Trapping

The proposed pipeline route is located in Fur Management Zone 7 (Government of Alberta 2012b). There are no registered trapping areas crossed by the pipeline route. Furbearing species trapped in Fur Management Zone 7 include badger, beaver, coyote, red/Arctic fox, mink, muskrat, red squirrel, weasel and wolf (Government of Alberta 2012c).

Navigable Waters

A request for pre-submission services in order to determine navigability has been submitted to Transport Canada for three of the seven watercourses (*i.e.*, Irvine Creek, unnamed drainage ditch at KP 94.1, and the unnamed tributary to Iron Creek at KP 135.6). Transport Canada has previously determined three of the watercourses to be non-navigable: Mill and Goldbar creeks on September 17, 2007; and the unnamed tributary to Iron Creek at KP 140.6 on December 13, 2007 under Transport Canada File No. 8200-07-10179. These crossings were reviewed for the Enbridge Line 4 Extension Project which is within 30 m of the proposed crossings. The remaining watercourse, the Battle River, is known to be navigable. As a result of the passage of the *Jobs, Growth and Long-term Prosperity Act* (Bill C-38), regulation requirements of some federal legislation are evolving and actual permitting requirements will be confirmed over the next year.

5.1.12.4 Parks, Protected Areas and Recreational Use

The pipeline route does not encounter any parks, protected areas or recreational areas. However, lands under Parks Canada jurisdiction, provincial parks and protected areas are located in the Socio-economic RSA (ATPR 2011).

Parks and protected areas within the Socio-economic RSA include: Riverlot 56 Natural Area, approximately 19.2 km northeast of the pipeline route at KPT 0.0 (NW 32-52-23 W4M); Strathcona Science Provincial Park, approximately 2 km northwest of the pipeline route at KPT 0.0 (NW 32-52-23 W4M); Sherwood Park Natural Area, approximately 2.6 km northeast of the pipeline route at KPE 14 (SE 35-51-23 W4M); Antler Lake Island Natural Area, approximately 18 km northeast of the pipeline route at KP 18 (NW 17-51-22 W4M); Cooking Lake-Blackfoot Provincial Recreation Area, approximately 20 km northwest of the pipeline route at KP 19 (SE 17-51-22 W4M); North Cooking Lake Natural Area, approximately 16 km northeast of the pipeline route at KP 19 (SE 17-51-22 W4M); Hastings Lake Islands Natural Area, approximately 15.0 km northeast of the pipeline route at KP 27 (NW 22-50-22 W4M); Edgar T. Jones Natural Area, approximately 18.8 km northeast of the pipeline route at KP 28 (SE 22-50-22W4M); Parkland Natural Area, approximately 18.7 km northeast of the pipeline route at KP 41 (SE 21-49-21 W4M); and Miquelon Lake Provincial Park, approximately 2.9 km northeast of the pipeline route at KP 47 (SE 12-49-21 W4M) (ATPR 2011).

Bretona Pond, located approximately 600 m southwest of KP 11 (NW 34-51-23 W4M), is an area of interest for birders but is not federally or provincially protected. Also within Strathcona County there were two conservation easements known to be crossed by the Line 4 Extension Project, which are anticipated to be also crossed by the proposed pipeline route. The first area is located near KPE 14

(SE 35-51-23 W4M) at the Mill Creek crossing and the second area is located near KP 13 (SE 36-51-23 W4M). The conservation easements are an agreement between the landowner and Strathcona County regarding management of the land, and conditions vary depending on the terms of the agreement (Strathcona County 2012b). The purpose of these conservation easement areas is to conserve and enhance the environment of the area, without limiting the protection, conservation and enhancement of its biological diversity.

Recreational facilities in Edmonton, Sherwood Park, Leduc, Tofield, Camrose, Viking and Killam include arenas, recreation centres, tennis courts, golf courses, skateboard parks, sport fields and trails (City of Edmonton 2012a, Strathcona County 2012c, City of Leduc 2012a, Town of Tofield 2012a, Town of Viking 2012a, City of Camrose 2009a, Town of Killam 2012a).

Outdoor recreational uses in the Socio-economic RSA include: established boat launches; cross-country skiing and snowmobiling trails; biking, snowshoeing and hiking trails; and picnic sites. No established motorbiking or all-terrain vehicle (ATV) trails, horseback riding locations, paddling or portage sites or wildlife viewing areas were identified (Mussio Ventures Ltd. 2010).

5.1.12.5 Water Use

The proposed pipeline route is located in the North Saskatchewan and Battle River sub-basins (AESRD 2012a). Further information on surface water quantity is provided in Section 5.1.3 of this ESA.

Well uses in the area include domestic and industrial use, others uses (*e.g.,* stock, municipal, irrigation, etc.) as well as several other wells that have unknown uses. There are approximately 1,286 water wells located within a 1 km radius of the proposed pipeline route, and 25 water wells located within the Footprint of the Project (AESRD 2012b).

The City of Edmonton draws its domestic water supply from the North Saskatchewan River. The water is then treated at the EPCOR water treatment plants (City of Edmonton 2012b). The City of Leduc, the Town of Tofield and Town of Viking's domestic water is piped from Edmonton's treated water supply (Capital Region Southwest Water Services Commission 2012, Town of Tofield 2012b, Hanson pers. comm.). The City of Camrose's domestic water supply is drawn from Dried Meat Lake, which is then treated at facilities in the city (City of Camrose 2009b). Water for municipal use in the Village of Killam is treated in the town and is drawn from local water wells (Brodie pers. comm.). The Town of Sedgewick's domestic water supply is drawn from their local water wells and treated in their local water treatment plant (Polege pers. comm.). Water for municipal use in the Village of Lougheed is drawn from local water wells and treated in the village (Village of Lougheed 2012a). The Town of Hardisty treats its own water drawn from local sources (Town of Hardisty 2006a).

Water withdrawals in the Socio-economic RSA will not be required for temporary construction camps since the workforce will be located in established communities. Water used for hydrostatic testing will be released within the same watershed from where it was withdrawn. Additional information related to water withdrawal locations and volumes for hydrostatic testing are provided in Section 5.1.3 of the ESA.

5.1.12.6 Visual Attributes

The pipeline route is located immediately adjacent to existing pipeline rights-of-way; an area readily accessible to communities and crossed by five primary highways, crossed for a total of 8 times, and nine secondary highways, crossed for a total of 12 times. There are four transmission line crossings and five identified railway crossings. The Project is comprised of the construction of a new 914.4 mm (NPS 36) O.D. pipeline located underground as well as aboveground facilities at the Edmonton and Hardisty terminals, and Strome Station.

Residences are located in the Socio-economic LSA, but not on the Footprint. There are yards, shelterbelts, barns and outbuildings located in the Socio-economic LSA. The Colchester School, Lougheed School, Round Hill Church, Sedgewick Lake Cemetery and Hardisty Cemetery are located in the Socio-economic LSA, but not on the Footprint. The Sedgewick Lake Campground and the Belvedere Golf Course are located in the Socio-economic LSA and crossed by the Footprint. Strathcona Science Provincial Park is located in the Socio-economic RSA approximately 2 km northwest of KPT 0.0 (NW 32-52-23 W4M). Miquelon Lake Provincial Park, the Cooking Lake-Blackfoot Provincial Recreation

Area and seven Natural Areas are located outside of the Socio-economic LSA. The proposed pipeline route will be adjacent to other linear features, so few visual issues are expected.

5.1.13 Heritage Resources

This subsection describes the known heritage resources (*i.e.*, archaeological sites, Historic Period sites and palaeontologically sensitive areas) along the pipeline route and in the Heritage Resources RSA. Locations of known archaeological sites are confidential and, therefore, are not included on the Environmental Alignment Sheets. Rather, they will be identified on maps included in the Permit 12-217 Report to be submitted to Alberta Culture. The potential effects related to the construction of the proposed pipeline and mitigation pertaining to heritage resources are discussed in Section 6.2.13 of this ESA.

5.1.13.1 Archaeological Overview

The proposed pipeline route is located in the Central Parkland Subregion of the Parkland Natural Region, spanning most of the subregion. A parcel of Dry Mixedwood Subregion of the Boreal Forest Natural Region is also traversed in the uplands surrounding Cooking Lake, east of Edmonton (Natural Regions Committee 2006). Most of the lands traversed by the proposed route are agricultural, disturbed by plowing for cultivation, hay and tame pasture. Exceptions include smaller areas of aspen woodlands and mixed aspen forest, treed pasture, and fringes of native vegetation around wetlands and the edges of certain watercourses. The most notable watercourse crossed by the proposed pipeline route is the Battle River at NE 25-42-10 W4M (KP 173.6). Three additional named watercourses, three named watercourses, two fish-bearing wetlands, and numerous wetlands and nonfish-bearing drainages are also traversed by the proposed pipeline route.

The proposed pipeline parallels an existing pipeline corridor that has been previously investigated under HRIA and Historical Resources Overviews (HROs). Most of the lands crossed by the proposed pipeline route have no Historical Resource Value (HRV); however, several quarter-sections have been assigned HRVs, including 2h, 3a, 4a and 5a (Alberta Culture 2012). Abundant historic structures (n=124) have been recorded in legal locations crossed by the proposed pipeline route. Many of these previously recorded sites are located more than 100 m from the Project Footprint; however, some structures or structural remains are located close to the proposed pipeline route on some of the lands crossed by the proposed route. A total of 71 archaeological sites have been previously recorded within 100 m of the Project Footprint, several of which have been identified as Precontact campsites. Most of these sites are represented by isolated finds or small scatters of artifacts found on the surface of cultivated fields with no intact subsurface components, and have accordingly been assigned HRVs of 0. Notable archaeological sites with intact components have been previously recorded within or immediately adjacent to the Project Footprint in the gently to moderately rolling terrain surrounding the Battle River.

A Statement of Justification (SoJ) for the Project was submitted to Alberta Culture for review. After reviewing the SoJ, Alberta Culture concluded that a targeted HRIA is required for the Project. Alberta Culture issued a Schedule 'A' requirements letter to Enbridge on August 30, 2012 (Historic Resources Management Branch File No. 4780-12-0051), specifying that an HRIA must be conducted for the Project, including all standing historic structures and all areas of high historic resources potential within the Project Footprint. Qualified archaeologists commenced an HRIA in October 2012 under Archaeological Research Permit 12-217. The HRIA commenced with review of the background data (including video footage of a helicopter overflight of the Project Footprint) to aid identification of potential Historic structures and select target areas of high archaeological potential within the Project Footprint, and consisted of a ground reconnaissance within the target areas involving an intensive visual inspection and, where warranted, shovel testing.

To date, a total of 320 shovel tests have been excavated within 64 test locations under Archaeological Research Permit 12-217. During this assessment, the following were identified within the Project Footprint: three previously recorded Precontact campsites (FdOt-1, FdOt-9 and FdOt-10); seven previously unknown archaeological sites (Precontact artifact scatters FhPg-12, FhPg-13, FdOt-37, FdOt-38, FdOt-39, and historic artifact scatters FiPh-15 and FeOw-8); and four historic sites with standing structures. With the exception of campsites FdOt-1, 9 and 10, for which Stage II assessment (*i.e.*, further testing) is recommended, each of these sites has been mitigated by the recording, mapping and subsurface testing conducted to date. No additional mitigative measures are recommended for sites

FhPg-12, FhPg-13, FdOt-37, FdOt-38, FdOt-39, FiPh-15 or FeOw-8, or for the standing structures in the four historic sites to be impacted by the Project. Three HRV 3 archaeological sites have been previously recorded within or in close proximity to the Project Footprint and may be impacted: campsites FdOt-24 and FdOt-31; and rock art site FeOu-12. Revisits to these sites have not yet been made, owing to land access issues.

Some further ground reconnaissance and visual inspection at the south end of the Project near Hardisty is planned to occur during snow-free conditions (spring 2013) at selected locations where the HRIA was not completed prior to an early October 2012 snowfall, due in part to land access constraints. Deep testing by auger or backhoe is also required within the local environs of the Battle River and is currently planned to occur in November/December 2012. No specific palaeontological HRIA requirements exist for this Project.

Further details on the methodology and results of the HRIA will be provided in the final report submitted to Alberta Culture for Permit 12-217.

5.1.13.2 Traditional Knowledge

To date, Enbridge has been informed through its Aboriginal engagement program for the Project of the potential for archaeological sites in the vicinity of the Hardisty Terminal. An HRIA commenced for the Project in October 2012, however, further studies are necessary to meet Alberta Culture requirements (Section 10.0 of this ESA). Enbridge will continue to work with the communities that have brought this concern forward and make appropriate planning decisions based on any additional information gathered.

5.1.13.3 Potential Palaeontological Areas

The proposed pipeline route does not traverse any previously designated palaeontological sites or recognized palaeontologically sensitive areas and is located on lands listed as having no HRV for palaeontological resources (Alberta Culture 2012).

5.1.14 Traditional Land and Resource Use

In planning development projects, Enbridge engages with Aboriginal communities that may be affected by a proposed development or that may have an interest in the development based on the proximity of their community to the Project. Details of the Aboriginal engagement program for the Project are provided in Volume 1, Chapter 5 (Aboriginal Engagement). Since August 2012, Enbridge has engaged with the following Aboriginal communities regarding the Project:

- Alexander First Nation;
- Alexis Nakota Sioux Nation;
- Paul First Nation;
- Enoch Cree Nation;
- Ermineskin Tribe;
- Louis Bull Tribe;
- Montana First Nation;
- Samson Cree Nation;
- Métis Nation of Alberta – Zone II Regional Council; and
- Métis Nation of Alberta – Zone IV Regional Council.

The proposed pipeline route traverses the TUC for 10 km (6%), provincial Crown land for 1.1 km (1%) and the remaining 169.9 km (93%) of its length is privately-owned land. Approximately 86.3% of the route supports agriculture land uses (Table 5.22).

TABLE 5.22

CROWN LAND USE ALONG THE PROPOSED PIPELINE ROUTE

KP Range	Legal Location (W4M)	Land Use	Crown Dispositions	Access
22.4-22.6	SE 4-51-22	Dry lake	080834	none
30.5-HD 0.5	NW 11-50-22	Treed	PNT 030043 Farm Development Lease 761225	county roads
170.1	NE 34-42-10	Treed-pasture	Grazing Lease 039546	Highway 13 and county roads
173.5-173.7	NE 25-42-10	Battle River	None	Highway 13

Source: Alberta Energy 2012

Crown lands at NE 25-42-10 W4M (Battle River), NW 11-50-22 W4M (PNT 030043) and NE 34-42-10 W4M (Grazing Lease 039546) are accessible by road, however, to date, Enbridge has not been made aware of any use of these lands for traditional activities. Nevertheless, Enbridge assumes that TLRU activities including fishing, hunting and plant gathering are potentially practiced at these locations. Enbridge will review and consider specific community proposals to review areas of Crown land crossed by the proposed pipeline route where proposals are reasonable and appropriate. Information collected will be considered and incorporated into Project planning and mitigation. Enbridge does not believe that formal TLRU studies are necessary for most of the proposed right-of-way since the current land tenure and land use precludes, to a large extent, the practice of traditional activities on the lands in question.

5.1.15 Social and Cultural Well-Being

This subsection presents baseline information on the social and cultural well-being of communities. Information related to social and cultural well-being is found throughout Section 5.0 as well as in the socio-economic supporting study (Appendix 10 of this ESA). Specifically, information on predominant cultural groups is provided in Sections 5.1.12 and 5.1.15, while demographic features of the local population and workforce are provided in Sections 5.1.17 and 5.1.18 of this ESA.

The potential Project-related effects and mitigation pertaining to social and cultural well-being are discussed in Section 6.2.15 of this ESA and those pertaining to human health (such as stresses on community, family and household cohesion, alcohol and substance abuse, or illegal or other potentially disruptive activities) are discussed in Section 6.2.16 of this ESA.

The City of Edmonton municipal boundary is located approximately 200 m west of the proposed pipeline route at KPE 4 (SW 21-52-23 W4M). The population of Edmonton in 2011 was 812,201. The median age was 36 years and approximately 31% of the population was between the ages of 25 and 44 years (Statistics Canada 2012a). In 2006, 38,170 individuals identified themselves as Aboriginal (Statistics Canada 2007a). The workforce population was 427,155. The main industries include business services, retail trade, and health care and social services. The main occupations include: sales and service occupations; business, finance and administration occupations; and trades, transport and equipment operators and related occupations (Statistics Canada 2007a).

The north-western segment of the proposed pipeline route is located within Strathcona County, from KPT 0.0 to KPHC 0.3 (NW 32-52-23 W4M to NE 32-50-22 W4M), which includes Sherwood Park. The population of Strathcona County in 2011 was 92,490. The median age was 39.1 years and approximately 26% of the population was between the ages of 25 and 44 years (Statistics Canada 2012b). In 2006, 2,270 individuals identified themselves as Aboriginal (Statistics Canada 2007b). The workforce population was 49,040. The main industries include business services, retail trade and construction. The main occupations include: sales and service occupations; business, finance and administration; and trades, transport and equipment operators and related occupations (Statistics Canada 2007b).

A portion of the proposed pipeline route is within the boundaries of Leduc County from KPHC 0.3 to KPHF 0.3 (NE 32-50-22 W4M to SW 29-49-21 W4M). The population of Leduc County in 2011 was 13,541. The median age was 41.9 years and approximately 23% of the population was between the ages of 25 and 44 years (Statistics Canada 2012c). In 2006, 390 individuals identified themselves as Aboriginal (Statistics Canada 2007c). The workforce population was 7,915. The main industries include agriculture and other resource-based industries, business services and construction. The main occupations include: trades, transport and equipment operators and related occupations; occupations unique to a primary industry, and business, finance and administration occupations (Statistics Canada 2007c).

The City of Leduc is located approximately 19.8 km southwest of the proposed pipeline route at KPE 10 (NW 33-51-23 W4M). In 2011, the population of Leduc was 24,279. The median age was 34 years and approximately 32% of the population was between the ages of 25 and 44 years (Statistics Canada 2012d). In 2005, 500 individuals identified themselves as Aboriginal (Statistics Canada 2007d). The workforce population was 10,080. The main industries include business services, retail trade, and agriculture and other resource-based industries. The main occupations include: sales and service occupations; trades, transport and equipment operators and related occupations; and business, finance and administration occupations (Statistics Canada 2007d).

The proposed pipeline route crosses Camrose County from KPHF 0.3 to KP 93.8 (SW 29-49-21 W4M to SE 6-47-15 W4M). The population of Camrose County in 2011 was 7,721. The median age was 43.2 years and approximately 22% of the population was between the ages of 25 and 44 years (Statistics Canada 2012e). In 2006, 105 individuals identified themselves as Aboriginal (Statistics Canada 2007e). The workforce population was 4,545. The main industries include agriculture and other resource-based industries, business services and construction. The main occupations include: occupations unique to primary industry; trades, transport and equipment operators and related occupations; and sales and service occupations (Statistics Canada 2007e).

The City of Camrose is located approximately 13 km southwest of the pipeline route at KPD 0 (NW 20-48-19 W4M). The population of Camrose in 2011 was 17,286. The median age was 41.2 years and approximately 24% of the population was between the ages of 25 and 44 years (Statistics Canada 2012f). In 2006, 530 individuals identified themselves as Aboriginal (Statistics Canada 2007f). The workforce population was 8,375. The main industries include retail trade, health care and social services, and business services. The main occupations include: sales and service occupations; trades, transport and equipment operators and related occupations; and business, finance and administration occupations (Statistics Canada 2007f).

The proposed pipeline route is located within Beaver County from KP 93.8 to KP 93.9 (SW 5-47-16 W4M). In 2011, the population of Beaver County was 5,689. The median age was 42.2 years and approximately 22% of the population was between the ages of 25 and 44 years (Statistics Canada 2012g). In 2006, 105 individuals identified themselves as Aboriginal (Statistics Canada 2007g). The workforce population was 3,465. The main industries include agriculture and other resource-based industries, business services and construction. The main occupations include: occupations unique to primary industry; trades, transport and equipment operators and related occupations; and sales and service occupations (Statistics Canada 2007g).

The Town of Tofield is located approximately 22.2 km northeast of the pipeline route at KP 50.0 (SW 5-49-20 W4M). The population of Tofield was 2,182 in 2011. The median age was 42.3 years and approximately 24% of the population was between the ages of 25 and 44 years (Statistics Canada 2012h). In 2006, 75 individuals identified themselves as Aboriginal (Statistics Canada 2007h). The workforce population was 765. The main industries include business services, construction and retail trade. The main occupations include: trades, transport and equipment operators and related occupations; sales and service occupations; and business, finance and administration occupations (Statistics Canada 2007h).

The Town of Viking is located approximately 25.5 km northeast of the pipeline route at KP 121.0 (SE 21-45-14 W4M). The population of Viking was 1,041 in 2011. The median age was 49.4 years and approximately 19% of the population was between the ages of 25 and 44 years (Statistics Canada 2012i). In 2006, 25 individuals identified themselves as Aboriginal (Statistics Canada 2007i). The workforce population was 555. The main industries include health care and social services, agriculture and other

resource-based industries, and retail trade. The main occupations include: trades, transport and equipment operators and related occupations; sales and service occupations; and business, finance and administration occupations (Statistics Canada 2007i).

A portion of the proposed pipeline route is within the boundaries of Flagstaff County from KP 93.9 to KP 174.7 (NW 31-46-16 W4M to NW 30-42-9 W4M). The population of Flagstaff County in 2011 was 3,244. The median age was 45 years and approximately 19% of the population was between the ages of 25 and 44 years, which represents the largest age demographic (Statistics Canada 2012j). In 2006, 85 individuals identified themselves as Aboriginal (Statistics Canada 2007j). The workforce population was 2,320. The main industries include agriculture and other resource-based industries, health care and social services, and business services. The main occupations include: occupations unique to primary industry; sales and service occupations; and trades, transport and equipment operators and related occupations (Statistics Canada 2007j).

The Town of Killam is located approximately 4 km southwest of the pipeline route at KP 133.0 (NW 34-44-13 W4M). The population of Killam was 981 in 2011. The median age was 39.9 years and approximately 26% of the population was between the ages of 25 and 44 years (Statistics Canada 2012k). In 2006, no individuals identified themselves as Aboriginal (Statistics Canada 2007k). The workforce population was 560. The main industries include agriculture and other resource-based industries, health care and social services, and retail trade. The main occupations include: sales and service occupations; trades, transport and equipment operators and related occupations; and business, finance and administration occupations (Statistics Canada 2007k).

The Town of Sedgewick is located approximately 200 m southwest of the pipeline route at KP 144.0 (SE 16-44-12 W4M). In 2011, the population of Sedgewick was 857. The median age was 43.7 years and approximately 23% of the population was between the ages of 25 and 44 years (Statistics Canada 2012l). In 2006, 15 individuals identified themselves as Aboriginal (Statistics Canada 2007l). The workforce population was 505. The main industries include agriculture and other resource-based industries, construction, and health care and social services. The main occupations include: trades, transport and equipment operators and related occupations; sales and service occupations; and occupations unique to a primary industry (Statistics Canada 2007l).

The Village of Lougheed is located immediately northeast of the pipeline route at KP 154.0 (SE 32-43-11 W4M). The population of Lougheed was 233 in 2011. The median age was 42.9 years and approximately 24% of the population was between the ages of 25 and 44 years (Statistics Canada 2012m). In 2006, 10 individuals identified themselves as Aboriginal (Statistics Canada 2007m). The workforce population was 90. The main industries include business services, health care and social services, and retail trade. The main occupations include: trades, transport and equipment operators and related occupations; sales and service occupations; and occupations unique to a primary industry (Statistics Canada 2007m).

The Town of Hardisty is located immediately northeast of the pipeline route at KP 173.0 (SW 36-42-10 W4M). In 2011, the population of Hardisty was 639. The median age was 41.6 years and approximately 23% of the population was between the ages of 25 and 44 years (Statistics Canada 2012n). In 2006, no individuals identified themselves as Aboriginal (Statistics Canada 2007n). The workforce population was 380. The main industries include agriculture and other resource-based industries, business services and retail trade. The main occupations include: trades, transport and equipment operators and related occupations; sales and service occupations; and business, finance and administration occupations (Statistics Canada 2007n).

The south-eastern portion of the proposed pipeline is located within the MD of Provost from KP 174.7 to KP 175.5 (SW 30-42-9 W4M to SE 30-42-9 W4M). In 2011, the population of the MD of Provost was 2,288. The median age was 42 years and approximately 22% of the population was between the ages of 25 and 44 years (Statistics Canada 2012o). In 2006, 10 individuals identified themselves as Aboriginal (Statistics Canada 2007o). The workforce population was 1,635. The main industries include agriculture and other resource-based industries, business services and construction. The main occupations include occupations unique to primary industry; trades, transport and equipment operators and related occupations; and business, finance and administration occupations (Statistics Canada 2007o).

5.1.16 Human Health

Human health is defined as “a state of complete physical, mental and social well-being, and the ability to adapt to the stresses of daily life; it is not merely the absence of disease or infirmity” (NEB 2004, World Health Organization 1946). This widely accepted interpretation of health recognizes the interrelationships between social, economic, political and cultural health determinants and the biophysical environment (Health Canada 2004).

The environmental elements associated with the proposed pipeline that may be related to human health include physical and meteorological environment, soil and soil productivity, water quality, air emissions, acoustic environment, fish and fish habitat, and wildlife and wildlife habitat. Information pertaining to these environmental elements is presented in Sections 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.6, 5.1.7 and 5.1.10 of this ESA. Socio-economic elements that may be related to human health include human occupancy and resource use, traditional land and resource use, social and cultural well-being, and infrastructure and services. Information pertaining to these socio-economic elements is presented in Sections 5.1.12, 5.1.14, 5.1.15 and 5.1.17; information related to health services is presented under infrastructure and services in Section 5.1.17 of this ESA. The Project-related activities, nuisance emissions and environmental changes that could potentially be sources of adverse human health effects, potential human receptors of these effects and mitigation pertaining to human health, are discussed in Section 6.2.16 of this ESA.

5.1.17 Infrastructure and Services

This subsection identifies infrastructure and services in the Socio-economic RSA. The potential effects on infrastructure and services arising from the construction of the proposed pipeline are discussed in Section 6.2.17 of this ESA. In addition, the potential effects on transportation in the context of human health are discussed in Section 6.2.16 of this ESA.

Roads

Along the pipeline route, there are 5 different primary highways, crossed for a total of 8 times and 9 different secondary highways, crossed for a total of 12 times, as well as various access roads. A summary of road infrastructure crossed by the proposed pipeline route is provided in Table 5.23 of this ESA. Figure 6.9 of this ESA provides an overview map of the pipeline route and highways crossed by the Project. Highways 216 and Highway 14 will provide initial access for the western portion of the proposed route and Highway 13 will provide access to the eastern portion of the proposed route.

Due to increasing economic activity in the area, traffic levels have been on the rise. There are several Automated Traffic Recorders (ATRs) within the Socio-economic RSA that provide data on traffic levels. In 2002, an ATR located 1.6 km south of Highway 216 and Baseline Road recorded Average Annual Daily Traffic (AADT) of 29,200 vehicles, which increased gradually to 57,180 vehicles in 2011 (Alberta Transportation 2012).

Along Highway 13, there are three ATRs near the pipeline route. The first ATR, located 1.6 km west of Highway 13 and Highway 36, recorded an AADT volume of 4,630 vehicles in 2002 and 4,950 in 2011. The second ATR, located 2.7 km west of Highway 13 and Highway 16, recorded an AADT volume of 1,930 in 2002 and in 2011 the volume of vehicles had slightly increased to 2,150. The third nearest ATR, located 1.7 km east of Highway 13 and Highway 36, recorded a slight increase in 2011 with an AADT volume of 2,200 vehicles compared to 1,960 vehicles in 2002 (Alberta Transportation 2012).

By comparing the 2002 data with the 2011 data, it is evident that Highway 216 has experienced a substantial increase in traffic levels, indicative of the growing economic activity in the area.

TABLE 5.23

ROAD INFRASTRUCTURE CROSSED BY THE PROPOSED PIPELINE ROUTE

Type	Operator	Total
Primary	Alberta Transportation	8
Secondary	Alberta Transportation	12
Tertiary	Various Municipal Jurisdictions	97
Other	Canadian Natural Resources Limited	4
Other	Conocophillips Canada Operations Ltd.	4
Other	Enermark Inc.	1
Other	Enerplus Corporation	2
Other	Penn West Petroleum Ltd.	1
Other	Perpetual Energy Operating Corporation	2
Other	Public	6
Other	Seagull Resources Limited	1
Other	Unknown	3
Other	Zargon Oil and Gas	1
Other	Voyager Petroleums Ltd.	1

Source: IHS Inc. 2012b

Airports

The Edmonton International Airport is the largest airport in the Socio-economic RSA. It is owned and operated by Edmonton Airports and is located approximately 22 km southwest of the proposed pipeline route at KPE 10 (NW 33-51-23 W4M). It has 24-hour service to accommodate any aircraft at any time and has had no capacity issues (Edmonton Airports 2010a). The Edmonton City Centre Airport is the closest airport to Edmonton at approximately 12 km west of the pipeline route at KPT 0.0 (NW 32-52-23 W4M). It operates 24-hours daily and is home to private and corporate aircraft, industrial and Medevac flights, and small charters (Edmonton Airports 2010b). There are several other airports along the proposed pipeline route including the Cooking Lake Airport, located approximately 7 km east of the pipeline route at KP 15.0 (SW 36-51-23 W4M); the Camrose Airport, located approximately 14 km southwest of the pipeline route at KPD 2.0 (SW 21-48-19 W4M); the Killam Sedgewick Airport, located approximately 2 km southwest of the pipeline route at KP 139.0 (NW 19-44-12 W4M); and the Hardisty Airport, located approximately 3 km southwest of the pipeline route at KP 169.0 (SE 3-43-10 W4M) (Edmonton Airports 2010c, City of Camrose 2009c, Town of Killam 2012b).

The pipeline route is also near five turf runways including the Edmonton Twin Island Airpark located approximately 7.5 km northeast of the pipeline route at KP 14.0 (NE 25-51-23 W4M); Bjorgum Farm Airport, located approximately 8.8 km southwest of the pipeline route at KPD 0.0 (SW 21-48-19 W4M); Marek Farms Airport, located approximately 13.5 km southwest of the pipeline route at KP 64.0 (NE 16-48-19 W4M); and Bawlf Blackwells Airport, approximately 19 km southwest of the pipeline route at KP 86.0 (SE 16-47-17 W4M). Finally, the Viking Airport is located approximately 24 km northeast from the pipeline route at KP 113.0 (NW 35-45-15 W4M).

Local helicopter pads in the Socio-economic RSA can also be accessed. There is one helipad located in the Socio-economic LSA and eight in the Socio-economic RSA. Most helipads are stationed at hospitals or health centers.

Water Crossings

The proposed pipeline route is expected to cross four named watercourses, including Goldbar Creek, Mill Creek, Irvine Creek and the Battle River (see Table 5.3 of this ESA). In addition, the proposed route crosses three unnamed watercourses, two large fish-bearing wetlands, and numerous nonfish-bearing drainages.

Rail

The Canadian National Railway Company (CN) rail system operates a railway terminal in Edmonton. Known as the Canadian line, this CN railway links the cities of Toronto in Ontario to Vancouver in British Columbia. It runs southwest to Vancouver, and southeast to Tofield and Viking (NRCan 2008b). There are five railway crossings along the proposed pipeline route near KP 58.3 (SE 25-48-20 W4M), KP 64.0 (NE 16-48-19 W4M), KP 141.5 (NE 17-44-12 W4M), KP 161.63 (NE 13-43-11 W4M) and KP 163.0 (SE 18-43-10 W4M). The company using this route is the Canadian Pacific Railway (CPR) and the rail systems are mainlines. The pipe materials will be shipped by rail from Regina and equipment will be transported on accessible highways and municipal roads. Materials will be offloaded in Edmonton, Camrose and Hardisty. Rail service is available in each of the communities identified in the Socio-economic RSA.

5.1.17.1 Emergency and Health Care Services

This subsection identifies emergency services and health care in the Socio-economic RSA. The proposed pipeline route crosses two Alberta Health Services Zones, including the Edmonton Zone and Central Zone.

Edmonton Zone

The Edmonton Zone includes the cities of Edmonton and Leduc. The closest emergency services are in Edmonton. There is 911 service throughout the Edmonton Zone (Alberta Health 2012).

Edmonton has five hospitals with capacity to offer a range of emergency to extended care services (Alberta Health Services 2012a). One of the largest facilities is the Grey Nuns hospital, which is a 352 bed, fully accredited hospital with emergency, critical and extended care services (Covenant Health 2012). Other hospitals in Edmonton include the Misericordia Community Hospital, the Northeast Community Health Centre, the Royal Alexandra Hospital and the University of Alberta Hospital (Alberta Health Services 2012a). The Leduc Community Hospital is a 50-bed facility providing emergency services to the city and areas that surround Leduc (Capital Health 2012).

Emergency services in Edmonton include full-time Community Fire Rescue stations and Emergency Medical Services (EMS). A current Municipal Emergency Plan and Legislation is in place for Edmonton (City of Edmonton 2012c). Responses to emergency events occurring in the City of Edmonton are directed and controlled by the Emergency Operations Centre (EOC). The EOC is composed of over 300 staff responsible for providing the essential services necessary to reduce the effects of an emergency on the city, such as the Royal Canadian Mounted Police (RCMP) staff sergeant, fire chief, director of public works and a hospital designate. Emergency situations handled by the EOC may include, but are not limited to major incidents or disasters. Actions of the EOC are co-ordinated through an Incident Command System (City of Edmonton 2012c).

The City of Leduc has a fire service and EMS response in the event of an emergency (City of Leduc 2012b).

The Edmonton Fire Rescue Services is a combination of professional and volunteer fire-fighters (City of Edmonton 2012d). There are 27 fire stations with 46 trucks servicing the Edmonton Area (City of Edmonton 2012e). In 2011, 1,115 full-time employees responded to 36,356 dispatched events (City of Edmonton 2012e). The department operates hazardous material teams, fire investigations, river rescue and technical rescue, and provides protection to a large industrial area as well as both urban and rural residential areas (City of Edmonton 2012d). The Leduc City fire department provides service to the city and surrounding rural zones (City of Leduc 2012b).

Alberta Health Services provides service to the Edmonton Zone. Emergency services include both ground and air ambulance, and fire rescue with 911 access (Alberta Health 2012). Alberta Health Services operates more than 550 ambulances, with 4,000 employees and conducted 5,500 air evacuations in 2010 (Alberta Health Services 2011). In Edmonton in 2011, ambulance services responded to an average of 4,000 emergency calls per month (Alberta Health Services 2012b).

Policing services in Edmonton are provided by the Edmonton Police Commission, which employs more than 1,500 sworn officers, and the RCMP (Edmonton Police Service 2011, RCMP 2012). The closest RCMP detachment is at the Edmonton International Airport, with other nearby detachments in Strathcona County, St. Albert and Fort Saskatchewan (RCMP 2012).

Policing in Leduc is provided by the City of Leduc Enforcement Services as well as a local RCMP detachment (City of Leduc 2012c, RCMP 2012).

Central Zone

The Central Zone includes Sherwood Park, Tofield, Viking, Camrose, Killam, Sedgewick, Lougheed and Hardisty. The closest emergency services are in Camrose, approximately 13 km southwest of the pipeline route at KPD 0 (NW 20-48-19 W4M). Camrose is also the largest service centre in the Central Zone for emergency and health care services. There is 911 service in the Central Zone that is provided by Alberta Health Services (Alberta Health 2012).

Camrose has one hospital, Saint Mary's Hospital, that offers a range of emergency and extended care services (Saint Mary's Hospital 2012). St. Mary's Hospital is a 76-bed, fully accredited hospital with emergency and extended care services (Saint Mary's Hospital 2012). Sherwood Park is in the process of constructing a new hospital, with an expected completion date of 2013 (Alberta Health Services 2012c). The Towns of Tofield, Viking, Killam and Hardisty have health centres providing emergency and acute care services (Town of Tofield 2012c, Town of Viking 2012b, Town of Killam 2012c, Alberta Health Services 2012d). Neither Sedgewick nor Lougheed have a hospital (Town of Sedgewick 2012a, Village of Lougheed 2012b).

Emergency services in all of the service centres in the Socio-economic RSA in the Central Zone include fire rescue, EMS response and policing services.

The Camrose Fire Rescue Service is a combination of 47 professional and volunteer fire-fighters with 1 station and 3 pump trucks servicing Camrose and parts of the county around the city (City of Camrose 2009d). Sherwood Park, Tofield, Viking, Killam, Lougheed and Hardisty all have volunteer fire departments (Strathcona County 2012d, Tofield Fire Department 2012, Town of Viking 2012b, Town of Killam 2012d, Town of Sedgewick 2012b, Village of Lougheed 2012b, Town of Hardisty 2006b).

Alberta Health Services provides emergency medical services to the Central Zone. Emergency medical services include both ground and air ambulance, and fire rescue with 911 access (Alberta Health 2012). Alberta Health Services operates more than 550 ambulances, with 4,000 employees and conducted 5,500 air evacuations in 2010 (Alberta Health Services 2011). All service centres in the Socio-economic RSA in the Central Zone have 911 access for emergency medical service (Alberta Health 2012).

In the City of Camrose, policing services are provided by the Camrose Police Service and the RCMP (Camrose Police Service 2012, RCMP 2012). There are RCMP detachments in Sherwood Park, Camrose, Tofield, Viking and Killam (RCMP 2012). Sedgewick, Lougheed and Hardisty do not have RCMP detachments, and are policed by forces in neighbouring communities (RCMP 2012).

5.1.17.2 Waste Management

There are a number of transfer stations and landfills located in the Socio-economic RSA that accept solid non-hazardous wastes, as well as options for hazardous waste disposal.

The nearest solid waste facility in the Socio-economic RSA is the Waste Management Centre in the City of Edmonton, which accepts solid non-hazardous waste for direct landfill disposal as well as material suitable for recycling and composting (City of Edmonton 2012f). The Waste Management Centre in the City of Edmonton also provides disposal services for commercial and hazardous solid waste (Strathcona County 2012e). There are three drop-off facilities for hazardous and general domestic waste in Edmonton, which also accept solid non-hazardous commercial waste (City of Edmonton 2012g). Waste collection for Sherwood Park is provided by Strathcona County, which includes recyclables and organics (Strathcona County 2012f).

The Leduc and District Regional Waste Management Facility accepts commercial waste for direct landfill disposal as well as material suitable for recycling and composting (Leduc and District Regional Waste Management Facility 2012).

The Town of Tofield has a landfill that accepts solid non-hazardous waste for direct disposal as well as recycling and composting (Town of Tofield. 2012d). There are two transfer stations that accept hazardous waste in the town (Town of Tofield 2012d).

The Town of Viking has one transfer station in the town that accepts scrap wood and is operated by Beaver Municipal Solutions (Beaver Municipal Solutions 2012).

The City of Camrose is serviced by the Camrose Regional Sanitary Landfill, which accepts commercial and non-commercial non-hazardous and special wastes (City of Camrose 2009e).

Waste services in the Town of Killam are provided by the Flagstaff Regional Solid Waste Management Association with one transfer station that accepts solid non-hazardous waste (Town of Killam 2012e).

The Town of Sedgewick has one transfer station and landfill that accepts non-hazardous solid waste and is operated by the Flagstaff Regional Solid Waste Management Association (Town of Sedgewick 2012c).

The Village of Lougheed has one transfer station and is serviced by the Sedgewick Regional Landfill operated by the Flagstaff Regional Solid Waste Management Association (Village of Lougheed 2012a, Town of Hardisty 2006c).

The Town of Hardisty has one transfer station and is serviced by the Sedgewick Regional Landfill operated by the Flagstaff Regional Solid Waste Management Association (Town of Hardisty 2006c).

5.1.17.3 Commercial Accommodation and Recreational Campsites

Accommodation available in the Socio-economic RSA includes hotels, motels, bed and breakfasts, and campgrounds. Commercial accommodation likely to be utilized by construction crews is located in Edmonton, Camrose and Hardisty. This subsection describes the accommodations available for those communities and others along the proposed route with the potential to be used during Project development.

The City of Edmonton has over 13,270 units of temporary accommodation, including hotels/motels, recreational vehicle (RV) parks and campgrounds (City of Edmonton 2012h, World Web Technologies Inc. 2012a). Currently, there are 96 hotels/motels with more than 13,000 rooms (City of Edmonton 2012h). In and near Edmonton there are at least 6 campgrounds with approximately 270 outdoor camping spots and at least 45 full hook-up sites (World Web Technologies Inc. 2012b). There are also 12 bed and breakfasts, 1 resort, 6 vacation rental properties, 10 extended stay hotels and 5 hostels (World Web Technologies Inc. 2012a).

In Sherwood Park, there are over 450 units of temporary accommodation, including hotels/motels, RV parks and campgrounds (World Web Technologies Inc. 2012c, Coast Hotels Limited 2012, Franklin's 2012). There are over 390 rooms in approximately 9 hotels/motels (World Web Technologies Inc. 2012c, Coast Hotels Limited 2012, Franklin's 2012). In and near Sherwood Park, there is 1 RV park/campground with approximately 58 outdoor camping spots with full hook-up sites (World Web Technologies Inc. 2012d, Kawtikh RV Retreat 2012).

In the City of Leduc, there are more than 1,540 units of temporary accommodation, including hotels/motels, RV parks and campgrounds (World Web Technologies Inc. 2012e). There are over 1,500 rooms in approximately 19 hotels/ motels (City of Leduc 2012d, World Web Technologies Inc. 2012f). In and near Leduc, there are 2 campgrounds with approximately 40 outdoor camping spots and at least 20 full hook-up sites (World Web Technologies Inc. 2012g). There is also one vacation rental property (World Web Technologies Inc. 2012e).

The Town of Tofield has approximately 140 units of temporary accommodation, including hotels/motels, RV parks and campgrounds (Town of Tofield 2012e). There are approximately 40 rooms in

2 hotels/motels and 1 inn (Town of Tofield 2012e). In and near Tofield, there are 4 campgrounds with approximately 100 outdoor camping spots and 40 full hook-up sites (Town of Tofield 2012e).

The City of Camrose offers more than 870 units of temporary accommodation, including hotels/motels and RV parks (City of Camrose 2009f,g). There are over 720 rooms in 12 hotels/motels (City of Camrose 2009f). In and near Camrose, there are 2 RV parks with over 150 full hook-up sites (City of Camrose 2009g). There is also one bed and breakfast (City of Camrose 2009f). Accommodations can reach full capacity quickly; especially during city events such as the Camrose County Big Valley Jamboree (Gerlitz pers. comm.).

The Town of Viking has more than 38 units of temporary accommodation, including motels, RV parks and campgrounds (Kalyna Country 2012, World Web Technologies Inc. 2012h). These include 30 rooms in 2 motels, 2 campgrounds with at least 18 outdoor camping spots and 1 RV park with 10 full hook-ups (Kalyna Country 2012, World Web Technologies Inc. 2012h,i).

The Town of Killam has approximately 80 units of temporary accommodation, including hotels/motels, RV parks and campgrounds (World Web Technologies Inc. 2012j, Camp Scout 2012a,b). There are more than 30 rooms in 1 hotel and 1 motel (World Web Technologies Inc. 2012k). In and near Killam, there are 2 campgrounds with approximately 50 outdoor camping spots and approximately 27 full hook-up sites (Camp Scout 2012a,b).

The Town of Hardisty has at least 72 units of temporary accommodation, including hotels/motels, RV parks and campgrounds (World Web Technologies Inc. 2012l). There are more than 14 rooms in 2 hotels/motels (World Web Technologies Inc. 2012m). In and near Hardisty, there are 2 campgrounds and 1 RV park with 6 campsites and at least 52 full hook-up sites (World Web Technologies Inc. 2012n).

5.1.17.4 Educational Services

The Edmonton Public Schools Division operates over 200 schools including kindergarten, elementary, middle, secondary and continuing education schools in the Edmonton area (Edmonton Public Schools 2012). There are a number of post-secondary education institutions offering career and college preparation, university arts and sciences, applied business and trades training (City of Edmonton 2012i). The Northern Alberta Institute of Technology offers a large number of courses that allow students to obtain safety and other training required to work in the oil and gas or other industries (Northern Alberta Institute of Technology 2012). The University of Alberta campus services include Aboriginal education services and financial aid (University of Alberta 2012).

In Strathcona County, the Elk Island Public and Catholic Schools Division provides educational services for Strathcona County, which includes Sherwood Park, and operates seven schools in the county, including elementary and junior and senior high schools (Elk Islands Public Schools 2012). There are no post-secondary institutions within the county (Strathcona County 2012g). Leduc County has 14 elementary, junior and senior high schools operated by 3 school divisions (Leduc County 2012b). Edmonton is the nearest major service centre that can provide post-secondary education and career and trades training required to work in the oil and gas industry (Leduc County 2012b).

The Battle River Regional School Division Number 31 operates 9 schools in Beaver County, 18 schools in Camrose County and 8 schools in Flagstaff County including elementary, middle and high schools (Beaver County 2012b).

The Buffalo Trails Public Schools Division operates six schools including elementary and middle and high schools in the MD of Provost (Buffalo Trail Public Schools 2010).

The Battle River Training Foundation, servicing Beaver County, Camrose County, Flagstaff County and the MD of Provost, offers post-secondary training in a number of business and trades fields applicable to work in the oil and gas industry (Battle River Training Foundation 2012).

5.1.18 Employment and Economy

This subsection describes local and regional economy and employment in the Socio-economic RSA. Potential effects on employment and economy arising from the construction and operation of the

proposed pipeline, and mitigation pertaining to employment and economy are discussed in Section 6.2.18 of this ESA.

5.1.18.1 Existing Local and Regional Employment

The City of Edmonton had a workforce of 427,155 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 52.3%. Most employed individuals in the city worked in sales and service occupations (24.2%), while 18.8% worked in business, finance and administration occupations, and 17.7% were employed in trades, transport and equipment operators and related occupations. The employment and unemployment rates were 68.4% and 4.9% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the city was reported to be $27,734 and the median household income was reported to be $57,085 (Statistics Canada 2007a).

Strathcona County, which includes Sherwood Park, had a workforce of 49,040 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 55.3%. Most employed individuals in the county worked in sales and service occupations (20.4%), while 19.9% worked in business, finance and administration occupations, and 17.3% were employed in trades, transport and equipment operators and related occupations. The employment and unemployment rates for the county were 73.5% and 3.5% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the county was reported to be $36,792 and the median household income was reported to be $90,746 (Statistics Canada 2007b).

Leduc County had a workforce of 7,915 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 43.2%. Most employed individuals in the county worked in trades, transport and equipment operators and related occupations (23.6%), while 19.6% worked in occupations unique to a primary industry and 17% were employed in business, finance and administration occupations. The employment and unemployment rates for the county were 75.4% and 2.3% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the county was reported to be $27,690 and the median household income was reported to be $66,036 (Statistics Canada 2007c).

In 2006, the City of Leduc had a workforce of 10,080. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 45.7%. Most employed individuals in the city worked in sales and service occupations (24%), while 23.3% worked in trades, transport and equipment operators and related occupations, and 20.3% were employed in business, finance and administration occupations. The employment and unemployment rates for the city were 71.1% and 4.7% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the city was reported to be $29,516 and the median household income was reported to be $66,963 (Statistics Canada 2007d).

In 2006, Camrose County had a workforce of 4,545. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 39.9%. Most employed individuals in the county worked in occupations related to a primary industry (29%), while 21.6% worked in trades, transport and equipment operators and related occupations, and 14.5% were employed in sales and service occupations. The employment and unemployment rates for the county were 78% and 1.9% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the county was reported to be $26,921 and the median household income was reported to be $60,145 (Statistics Canada 2007e).

The City of Camrose had a workforce of 8,375 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 45.3%. Most employed individuals in the town worked in sales and service occupations (29.3%), while 17.3% worked in trades, transport and equipment operators and related occupations, and 14.1 worked in business, finance and administration occupations. The employment and unemployment rates for the city were 63.2% and 4.8% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the city was reported to be $25,025 and the median household income was reported to be $47,972 (Statistics Canada 2007f).

Beaver County had a workforce of 3,465 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 41.8%. Most employed individuals in the county worked in occupations unique to a primary industry (28.9%), while 23.1% worked in trades, transport and equipment operators and related occupations, and 14.1% were employed in sales and service occupations. The employment and unemployment rates for the county were 77.2% and 1.6% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the county was reported to be $24,258 and the median household income was reported to be $52,111 (Statistics Canada 2007g).

The Town of Tofield had a workforce of 765 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 41.2%. Most employed individuals in the town worked in trades, transport and equipment operators and related occupations (32%), while 23.5% worked in sales and service operations, and 14.4% were employed in business, finance and administration occupations. The employment and unemployment rates for the town were 53.9% and 4.6% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the town was reported to be $23,579 and the median household income was reported to be $47,534 (Statistics Canada 2007h).

The Town of Viking had a workforce of 555 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 45.8%. Most employed individuals in the town worked in trades, transport and equipment operators and related occupations (21.5%), while 18% worked in sales and service occupations and 14.4% worked in business, finance and administration occupations. The employment and unemployment rates for the town were 59.3% and 4.5% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the town was reported to be $25,735 and the median household income was reported to be $39,387 (Statistics Canada 2007i).

In 2006, Flagstaff County had a workforce of 2,320. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 35.7%. Most employed individuals in the county worked in occupations unique to primary industry (36.9%), while 17.2% worked sales and service occupations, and 17% were employed in trades, transport and equipment operators and related occupations. The employment and unemployment rates for the county were 82% and 3.2% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the county was reported to be $24,912 and the median household income was reported to be $62,508 (Statistics Canada 2007j).

The Town of Killam had a workforce of 560 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 42.3%. Most employed individuals in the town worked in sales and service occupations (25%), while 17.9% worked in the trades, transport and equipment operators and related occupations, and 14.3% were employed in business, finance and administration occupations. The employment and unemployment rates for the town were 69.9% and 1.8% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the town was reported to be $26,812 and the median household income was reported to be $63,906 (Statistics Canada 2007k).

The Town of Sedgewick had a workforce of 505 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 30.3%. Most employed individuals in the town worked in the trades, transport and equipment operators and related occupations (28.7%), while 24.8% worked in sales and service occupations, and 13.9% were employed in occupations unique to a primary industry. The employment and unemployment rates for the town were 63.2% and 4% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the town was reported to be $25,707 and the median household income was reported to be $57,869 (Statistics Canada 2007l).

The Village of Lougheed had a workforce of 90 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 40.6%. Most employed individuals in the village worked in the trades, transport and equipment operators and related occupations (50%), while 27.8% worked in sales and service occupations, and 11.1% were employed in health occupations. The employment and unemployment rates for the village were 54.5%

and 0% respectively, compared to 70.9% and 4.3% for Alberta as a whole. The median total annual income and median household income data were suppressed due to low population size (Statistics Canada 2007m).

The Town of Hardisty had a workforce of 380 in 2006. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 41.2%. Most employed individuals in the town worked in trades, transport and equipment operators and related occupations (30.3%), while 27.6% work in the sales and service occupations, and 7.9% in business, finance and administration occupations. The employment and unemployment rates for the town were 65.8% and 3.9% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the town was reported to be $27,405 and the median household income was reported to be $56,925 (Statistics Canada 2007n).

In 2006, the MD of Provost had a workforce of 1,635. The percentage of individuals 15 years and over with a trade, post-secondary certificate, diploma or university degree during the 2006 census was 35.9%. Most employed individuals in the MD worked in occupations unique to a primary industry (41.9%), while 20.5% worked in trades, transport and equipment operators and related occupations, and 14.6% were employed business, finance and administration occupations. The employment and unemployment rates for the MD were 80.8% and 1.8% respectively, compared to 70.9% and 4.3% for Alberta as a whole. In 2005, the median total annual income of individuals over the age of 15 in the MD was reported to be $26,424 and the median household income was reported to be $68,397 (Statistics Canada 2007o).

5.1.18.2 Local Employment Development Plans

No formal local employment development plans were identified for municipalities, counties or the MD considered in the socio-economic assessment.

Enbridge is not aware of any formal local employment development plans in place for the Aboriginal communities engaged for the Project. Enbridge, with the cooperation of its selected contractor(s) will be seeking to maximize participation from local Aboriginal communities in employment opportunities.

5.1.18.3 Aboriginal Participation

Enbridge is committed to providing work opportunities for Aboriginal communities in proximity to the Project. Where possible, these communities will be given an opportunity to provide labor, material, equipment and services to the Project. Enbridge will work with and expect that the successful contractor(s) support Enbridge's commitment that Aboriginal communities and businesses are provided full and fair opportunity to participate in the Project through contract opportunities. Further, Enbridge will offer sole-sourced contracts opportunities to qualified Aboriginal suppliers and contractors where appropriate, and will encourage joint venture opportunities between Aboriginal businesses and non-Aboriginal businesses when it builds capacity and supports mutual business interests.

In addition, Enbridge has an Aboriginal and Native American Policy which focuses on recognizing the history, uniqueness and diversity of Aboriginal and Native American peoples. Enbridge has invested in building positive relationships with Aboriginal communities, based on mutual respect and trust to help them realize their aspirations, and to help Enbridge reach their strategic business objectives (Enbridge 2009).

5.1.18.4 Anticipated Levels of Local and Regional Economic Participation

Enbridge works diligently when developing projects to ensure that participation of Aboriginal businesses and Aboriginal employment capacity is maximized.

The City of Edmonton and the Town of Hardisty are recognized as a hub of pipeline activity in central Alberta. As a result, local businesses are anticipated to participate in the construction of the proposed pipeline by providing various goods and services required for the construction of the pipeline. While communities such as Sherwood Park, Edmonton, Leduc, Tofield, Camrose, Viking, Killam, Sedgewick, Lougheed and Hardisty are expected to provide the highly-specialized skills required for pipeline construction, skilled workers will also be needed from various areas of Alberta and potentially other provinces.

Construction will be conducted in three spreads. The construction spreads will require approximately 500 workers per spread. At the peak of work from September 2014 to October 2014, approximately 1,500 workers are expected. One to two new permanent positions will be required during operation of the proposed pipeline.

Information on the cost of the Project and economic benefits are provided in the Economic Effects Analysis in Appendix 10 of this ESA.

5.2 Facilities

New pump stations will be located at the Edmonton Terminal at NW 32-52-23 W4M, Kingman Station at SE 5-49-20 W4M and Strome Station at SE 2-46-15 W4M. In addition, a new booster pump is planned to be installed at the Edmonton Terminal at SE 5-52-23 W4M and piping will connect it to the terminal at NW 32-52-23 W4M via a road bore under Baseline Road. Additional associated facilities and infrastructure to be installed include interconnecting piping, receiving and sending traps, new booster pump, electrical infrastructure, instrumentation controls, communication and Supervisory Control and Data Acquisition (SCADA) system equipment at the existing Edmonton and Hardisty terminals.

5.2.1 Edmonton Terminal

The proposed Project activities at the Edmonton Terminal include construction of a new pump station and associated facilities at NW 32-52-23 W4M and construction of a booster pump and associated facilities at SE 5-53-23 W4M (Figure 1.2 in Section 1.0 of this ESA). Table 5.24 provides a summary of the environmental and socio-economic elements and considerations for the Edmonton Terminal pursuant to Guide A.2.4 as well as Tables A-2 and A-3 of the NEB *Filing Manual*.

TABLE 5.24

SUMMARY OF ENVIRONMENTAL AND SOCIO-ECONOMIC ELEMENTS AND CONSIDERATIONS FOR THE EDMONTON TERMINAL

Environmental and Socio-Economic Elements	Summary of Considerations
Physical and Meteorological Environment	• The terminal lies within the Lake Edmonton Plain Physiographic District of the Eastern Alberta Plains Physiographic Region, which is primarily composed of glaciolacustrine materials (Pettapiece 1986). • The terminal is located within the Central Parkland Subregion of the Parkland Natural Region (Natural Regions Committee 2006). • The topography surrounding the Edmonton Terminal is level and the elevation is approximately 685 m asl. • The Horseshoe Canyon formation of the Upper Cretaceous formation underlies the Edmonton Terminal, which is characterized by grey, feldspathic, clayey sandstone; grey bentonitic mudstone and carbonaceous shale; concretionary ironstone beds, scattered coal and bentonite beds of variable thickness; minor limestone beds; and is of mainly nonmarine origin (Hamilton *et al.* 1999). • The terminal does not encounter any areas of permafrost (NRCan 2006) or ground instability (NRCan 2007a). • The site is located in a zone of low seismic activity with no recorded activity or substantial earthquakes in the area (NRCan 2008a, 2011). • During a previous soil assessment for the Edmonton Terminal in 2006, surficial deposits in NW 32-52-23 W4M consisted mainly of slightly to moderately stony loam to clay loam textured till on gently undulating to moderately rolling landscapes. A small area of gently undulating to undulating glaciolacustrine clays occur in the extreme north corner of the terminal near Baseline Road. There is a poorly-drained depressional area in the central portion of the property and a number of poorly-drained depressional areas occur in the southern portion. Poorly-drained depressional areas consist of till or glaciolacustrine materials. All surficial materials on the property are non-saline and non-sodic but can be weakly to moderately calcareous at depth (Mentiga 2006). • Soils at the Edmonton Terminal within SE 5-53-23 W4M have been disturbed for industrial use. • NRCan considers unprotected soils in the vicinity of the Edmonton Terminal to have low wind erosion risk with high climatic sensitivity (NRCan 2003). • The Edmonton Terminal is located in an agricultural area considered to have low to moderate soil erosion risk (AARD 2005a). Wind erosion risk, which assesses the risk of soil degradation by wind on bare, unprotected mineral soil, is considered low at the terminal (AARD 2005b). Water erosion risk, which assesses the risk of soil degradation by water on bare, unprotected mineral soil, is considered negligible in the vicinity of the site (AARD 2005c). • Meteorological data from Environment Canada's Edmonton City Centre Airport station, located approximately 10 km northwest of the Edmonton Terminal, is provided in Section 5.1.1 of this ESA. • One major tornado was recorded in the Edmonton area on July 31, 1987. It caused 27 deaths, 600 injuries, 1,700 evacuations and $300 million in damage (NRCan 2007b). Two major hailstorms were recorded in close proximity to the terminal: one in 1988 that caused $48 million in damage, and one in 1901 that produced 8 cm diameter hailstones (NRCan 2007c).

TABLE 5.24 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Soil and Soil Productivity	• A soil survey was conducted by Mentiga at the Edmonton Terminal within NW 32-52-23 W4M in 2006. Soils at the terminal predominantly consist of Angus Ridge soils, which are well to moderately drained Orthic Black Chernozems with 10-60 cm of topsoil and developed on slightly to moderately stony, loam to clay loam textured till. Gleyed Angus Ridge soils occur in some of the low-lying areas. Topsoil thickness in gleyed Angus Ridge soils varies from 24-46 cm. Moderately well-drained Orthic Black Chernozems developed on stone-free to slightly stony, clay textured glaciolacustrine material (Malmo soils) occur in the northern portion of the terminal. Topsoil thickness in Malmo soils varies from 27-30 cm deep. Poorly-drained depressional areas are characterized by Orthic or Rego Humic Gleysols developed on loam to clay textured till or glaciolacustrine material (Haight soils). Topsoil thickness in Haight soils ranges from 30-50 cm deep. Malmo and Haight soils are susceptible to soil compaction and rutting. Colour differentiation between topsoils and subsoils is excellent in soils encountered within the terminal (Mentiga 2006). • The CLI (1967) has rated the soils at the terminal as having moderate limitations (Class 2) to crop production. • Two existing tanks are located in the north portion of the Edmonton Terminal in NW 32-52-23 W4M. The remainder of the property is primarily cultivated with several isolated wetlands, a wetland complex and treed areas. Possible sources of soil contamination include spot spill and leaks that may have occurred onsite during operation activities or during past farming activities; potential contaminants of concern may include fusion bond epoxy, liquid epoxy pipe coating, paint and hydrocarbons. • The proposed facilities to be installed at SE 5-53-23 W4M will be located within the existing fenced industrial area of Edmonton Terminal lacking topsoil and, therefore, detailed soil information is not deemed warranted as per Table A-1 of the NEB *Filing Manual*. • No contamination sites have been recorded at Edmonton Terminal according to the Federal Contamination Sites and Solid Waste Landfills Inventory (Treasury Board of Canada Secretariat 2011). • Clubroot is a soil-borne disease that affects canola and other crops in the mustard family. It is considered a pest under the *Agricultural Pests Act.* Clubroot was found in 10 to 45 fields in Strathcona County (AARD 2011a).
Water Quality and Quantity	• The Edmonton Terminal is located in the North Saskatchewan River Basin, which covers approximately 122,800 km² of Alberta and Saskatchewan (NRCan 2010). • An aquatic assessment was conducted by a QAES on July 12, 2012. There is an unnamed wetland complex in NW 32-52-23 W4M. Additional details of the aquatic assessment are provided in Appendix 6 of this ESA. • An unnamed tributary to the North Saskatchewan River (Class C watercourse) crosses the Edmonton North Terminal in 7-5 and 8-5-53-23 W4M, and is over 30 m north of the Project activities. The watercourse is confined in a buried culvert through most of the terminal in SE 5-53-23 W4M and will not be impacted by the Project. • Hydrostatic testing is planned for the piping to be installed within the Edmonton Terminal. Water may be withdrawn and released back to the fire pond at the Edmonton Terminal in SE 5-53-23 W4M. Alternatively, rental fluids will be used for hydrostatic testing. • There are no springs in the vicinity of the Edmonton Terminal (Borneuf 1983, AENV 1991). • The surface water quality risk in the vicinity of the Edmonton Terminal is rated as 0.76-1.0 (with 1 being the highest risk and 0 being the lowest risk) according to AARD (2005d). • No water wells will be impacted by activities at the Edmonton Terminal; however, there are several water wells within 1 km of the terminal (AESRD 2012b). Proposed activities at the terminal are not anticipated to have any effects on groundwater quantity or quality. • The groundwater quality risk in the vicinity of the Edmonton Terminal is rated as 0.46-0.53 (with 1 being the highest risk and 0 being the lowest risk) according to AARD (2005f). • The Aquifer Vulnerability Index in the vicinity of the Edmonton Terminal is rated as moderate, indicating that contaminated water would take a long time (in the range of thousands of years) to reach the aquifer (AARD 2005e). • Contaminants of concern associated with activities at the Edmonton Terminal that may affect water quality, if spilled or leaked, include crude oil, lubricants, fuel, anti-freeze and hydraulic fluids.
Air Emissions	• The nearest residences are located in Sherwood Park, approximately 1.35 km east of the Edmonton Terminal fence line. • An increase in dust and particulate emissions during installation of the proposed facilities is expected. • Air quality in the area surrounding the Edmonton Terminal is primarily a function of anthropogenic sources of emissions such as those arising from vehicle and rail traffic on adjacent roads and railways, agricultural activity and the surrounding industrial facilities (*i.e.*, the two existing tanks in NW 32-52-23 W4M, facilities at the Edmonton Terminal in SE 5-53-23 W4M, several manufacturing plants, two refineries and a wastewater treatment plant). • The primary sources of air emissions (CACs) during construction will be from fuel combustion and dust related to the use of transportation vehicles and heavy equipment. • The proposed pump station and booster pump to be installed at Edmonton Terminal will not result in an increase in measurable airborne emissions during operations or maintenance since the pumps will be electrically driven.
Greenhouse Gas Emissions	• The primary sources of GHG emissions will be from construction-related activities associated with fuel combustion such as transporting crews to and from the work site, and from the operation of heavy equipment. • The proposed pump station and booster pump to be installed at the Edmonton Terminal will be electrically driven and, therefore, there will be no direct GHG emissions attributable to the proposed pumps at the terminal. • The consumption of electric power generated from fossil fuels is an indirect source of GHG emissions. Indirect GHG emissions are expected to be produced due to electric power consumption by the proposed pump station during operation. Overall, operation of the proposed pumps at the Edmonton Terminal, Kingman Station and Strome Station combined is expected to increase indirect GHG emissions by 434,486 tonnes $C0_2E$ per year (Appendix 4 of this ESA). This represents approximately 0.186% of the total 2010 Alberta GHG emissions, and approximately 0.063% of Canada's total GHG emissions in 2010.

TABLE 5.24 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Acoustic Environment	• Current sources of noise emissions in the area surrounding the Edmonton Terminal are from vehicle and rail traffic on adjacent roads, railways and the surrounding industrial facilities. • The nearest residences are located in Sherwood Park, approximately 1.35 km east of the Edmonton Terminal fence line. • Strathcona County's Noise Control Bylaw No. 66-99 does not apply to the Edmonton Terminal since it is located in an area zoned as Heavy Industrial by Strathcona County. • ACI conducted a Noise Impact Assessment at the Edmonton Terminal in October 2012 (Appendix 5 of this ESA). The purpose of the Noise Impact Assessment was to determine the impact of the proposed pumps relative to baseline sound levels. All noise levels were compared to the Alberta Energy Resources Conservation Board (ERCB) Directive 038 (ERCB 2007). • As part of the study, two baseline noise monitorings were conducted at the closest impacted residential areas. The first noise monitor was located adjacent to the Woodridge Farms residential area in Sherwood Park (approximately 1.35 km east of the terminal). The second noise monitor was located in the Rundle Heights residential area (approximately 2.6 km northwest of the terminal). • Noise modeling results for all noise sources, building and tanks included in the baseline case as well as the equipment and buildings proposed as part of the Project are presented in Appendix 5 of this ESA. The results of the noise modeling indicated that noise levels associated with the existing and noise sources and the Project will be below the ERCB Directive 038 permissible sound levels for all surrounding residential and theoretical 1.5 km receptors. • The noise levels associated with traffic on the surrounding roadways as well as the other industrial and energy facilities closer to both residential areas will contribute significantly more to the local residential noise climate than the proposed pump station and booster pump at the Edmonton Terminal.
Fish and Fish Habitat	• An aquatic assessment was conducted at the Edmonton Terminal on July 12, 2012 (Appendix 6 of this ESA). A wetland complex is located in NW 32-52-23 W4M. Based on the aquatic assessment and relevant literature reviewed, the aquatic habitat throughout the site is not accessible or suitable to sportfish or any listed species found in the North Saskatchewan River. Review by DFO of the proposed facility will not be required. • An unnamed tributary to the North Saskatchewan River (Class C watercourse) crosses the Edmonton North Terminal in 7-5 and 8-5-53-23 W4M. The watercourse is confined in a buried culvert through most of the Edmonton Terminal and will not be impacted by the Project. The proposed booster pump will be located over 30 m from the watercourse and, therefore, detailed information on fish and fish habitat is not warranted as per Table A-1 of the NEB *Filing Manual.* • The aquatics assessment did not result in the identification of any fish of traditional economic importance being harvested from the site for use as country foods; moreover the Edmonton Terminal is located in an industrial area on privately-owned land.
Wetlands	• A wetland evaluation was conducted at the Edmonton Terminal on July 10, 2012. The undeveloped portion of Edmonton Terminal in NW 32-52-23 W4M is primarily cultivated with several isolated wetlands, a wetland complex and treed areas. The proposed pump station to be located at the Edmonton Terminal at NW 32-52-23 W4M is anticipated to permanently disturb a portion of a deep marsh (Class IV) wetland complex (1.4 ha). In addition, a portion of deep marsh (Class IV) in NE 32-52-23 W4M will be traversed by the proposed transfer lines (*i.e.*, temporarily disturbed). Further details of the extent of the wetland areas are provided in Appendix 7 of this ESA. • There are no wetlands at the Edmonton Terminal within SE 5-53-23 W4M. • The Edmonton Terminal is not located within or near any Ramsar wetlands (Bureau of the Convention on Wetlands 2012).
Vegetation	• The Edmonton Terminal is located within the Aspen Parkland Ecoregion of the Prairie Ecozone; characteristic natural vegetation of this ecoregion includes aspen, mixed tall shrubs and intermittent fescue grassland (Environment Canada 2012g). • The undeveloped portion of Edmonton Terminal in NW 32-52-23 W4M is primarily cultivated with several isolated wetlands, a wetland complex and treed areas. • A vegetation survey was conducted at the Edmonton Terminal on July 10, 2012 (Appendix 8 of this ESA). • Strathcona County conducts regular inspections for weeds and will notify Enbridge if any concerns arise during construction or operation of the Project (Horner pers. comm.). • Five Noxious weeds, common tansy, common toadflax, creeping thistle, scentless chamomile and white cockle were observed within the proposed disturbance. A number of non-listed, non-native species were also observed at the site. • A search of the ACIMS database indicated that there are three known provincially-listed rare plant occurrences within 5 km of the Edmonton Terminal (ACIMS 2012). There are two occurrences of flat-topped white aster and one occurrence of *Rhodobryum* moss (ACIMS 2012). No previously recorded occurrences of rare plants with an Alberta *Wildlife Act* designation or rare ecological communities are known from within 5 km of the Edmonton Terminal (ACIMS 2012). • No species designated under the Alberta *Wildlife Act,* ACIMS-listed rare plant species or rare ecological communities were observed during the survey. Due to the industrial land use and the largely modified vegetation in the vicinity of Edmonton Terminal, the potential habitat for rare species is generally very limited except in remnant wetland areas where rare plant potential is low to moderate. • The survey did not result in the identification of any vegetation of traditional economic importance being harvested from the site for use as country food; moreover, the Edmonton Terminal is located in an industrial area on privately-owned land. • The proposed booster pump will be located within the existing disturbed and fenced industrial area of Edmonton Terminal in SE 5-53-23 W4M which lacks a vegetative cover and, therefore, detailed vegetation information is not deemed warranted as per Table A-1 of the NEB *Filing Manual*.

TABLE 5.24 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Wildlife and Wildlife Habitat	• The Edmonton Terminal is located within a highly developed petrochemical corridor. Two existing tanks are located in the north portion of the Edmonton Terminal in NW 32-52-23 W4M. The remainder of the property in NW 32-52-23 W4M is primarily cultivated with several isolated wetlands, a wetland complex and treed areas. There are extensive reed beds, some areas of wet grasses and thick poplar/willow woodland bordering a large deep marsh (Class IV) wetland complex and associated open water ponds. The proposed pump station to be located at the Edmonton Terminal at NW 32-52-23 W4M are anticipated to permanently disturb a portion of a deep marsh (Class IV) wetland complex (1.4 ha). In addition, a portion of deep marsh (Class IV) in NE 32-52-23 W4M will be traversed by the proposed transfer lines (*i.e.*, temporarily disturbed). • Existing industrial development occurs immediately to the south, west, north and northeast of the terminal. The terminal in NW 32-52-23 W4M is bounded by Baseline Road to the north and 17th Street to the west. • The terminal is located within a Sensitive Raptor Range for bald eagle (AESRD 2010-2012). • The Edmonton Terminal is not located within or adjacent to any Environmentally Significant Areas, Parks or Protected Areas, IBAs, Migratory Bird Sanctuaries, National Wildlife Areas, Western Hemisphere Shorebird Reserves, Ramsar wetlands or World Biosphere Reserves (ATPR 2009, 2011, BirdLife International *et al.* 2012, Environment Canada 2012f, WHSRN 2012, Bureau of the Convention on Wetlands 2012, UNESCO 2012). • Strathcona Science Provincial Park (101.2 ha), the nearest park or protected area, is located approximately 2 km northwest of the terminal. • A search of the AESRD FWMIS database (AESRD 2012c) reported the following species listed under Schedule 1 of *SARA* (Government of Canada 2011) or by COSEWIC (COSEWIC 2012) within 2 km of the Edmonton Terminal: - peregrine falcon (Special Concern); and - short-eared owl (Special Concern). • Provincially-listed wildlife species (ASRD 2010, 2011) identified by the FWMIS search (AESRD 2012c) within 2 km of the Edmonton Terminal included: - American kestrel (Sensitive); - American wigeon (Sensitive); - black-crowned night heron (Sensitive); - common yellowthroat (Sensitive); - green-winged teal (Sensitive); and - Swainson's hawk (Sensitive). • A wildlife survey of the Edmonton Terminal was conducted on July 12 and 13, 2012 (Appendix 9 of this ESA). Most of NW 32-52-23 W4M has been converted to cultivated fields in the south portion and oil and gas facilities in the north. During the wildlife field work, the cultivated areas were seeded with barley. Treed areas and wetlands occur between current terminal development and the cultivated area. No stick nests or dens were observed during the wildlife field work. The survey did not result in the identification of any wildlife of traditional economic importance being harvested from the site for use as country foods; moreover, the Edmonton Terminal is located in an industrial area on privately-owned land. Further details on the results of the wildlife survey are provided in Appendix 9 of this ESA. • The proposed booster pump will be located within the existing disturbed and fenced industrial area of Edmonton Terminal in SE 5-53-23 W4M, which is not considered to be suitable wildlife habitat.
Species at Risk or Species of Special Status	• No plant species at risk listed by *SARA* or COSEWIC are identified as potentially occurring in the Central Parkland Natural Subregion. No previously recorded occurrences of rare plants with a *SARA* or COSEWIC designation are known to occur within 5 km of the Edmonton Terminal (ACIMS 2012). No COSEWIC or *SARA*-listed species were found during the vegetation survey conducted on July 10, 2012 (Appendix 8 of this ESA). • No COSEWIC or *SARA*-listed fish species were captured or observed during the July 12, 2012 aquatic assessment (Appendix 6 of this ESA). • The Edmonton Terminal is in a highly developed area, dominated by land previously disturbed by cultivation and oil and gas activities, which is not considered suitable habitat for wildlife species at risk. Nevertheless, the construction activities at the terminal could disturb *SARA*-listed wildlife species in the remaining native vegetation and wetlands on the site. • A search of the AESRD FWMIS database (AESRD 2012c) reported the following species listed under Schedule 1 of *SARA* (Government of Canada 2011) or by COSEWIC (COSEWIC 2012) within 2 km of the Edmonton Terminal: - peregrine falcon (*Falco peregrinus*, Special Concern); and - short-eared owl (*Asio flammeus*, Special Concern). • Two wildlife species listed under *SARA* Schedule 1 and COSEWIC have been identified as having the potential to occur in the vicinity of Edmonton Terminal, based on species range and habitat requirements: barn swallow (Threatened by COSEWIC) and horned grebe (Special Concern by COSEWIC). • TERA conducted a wildlife survey of the Edmonton Terminal (specifically, NW 32-52-23 W4M) on July 12 and 13, 2012 (Appendix 9 of this ESA), and in June 2010 (TERA 2010). No species listed under Schedule 1 of *SARA* or listed by COSEWIC were observed during the wildlife surveys. • The proposed booster pump will be located within the existing previously disturbed and fenced industrial area of Edmonton Terminal in SE 5-53-23 W4M, which is not considered to be suitable habitat for wildlife or plant species at risk.

TABLE 5.24 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Human Occupancy and Resource Use	• The proposed permanent facilities will be located within the boundaries of the existing Edmonton Terminal in NW 32-52-23 W4M and SE 5-53-23 W4M, owned by Enbridge. Adjacent lands are privately-owned by various industrial companies. The area is zoned as a Heavy Industrial Area (Strathcona County 2012a). The proposed developments at Edmonton Terminal are compatible with zoning at this site. • The Edmonton Terminal is fully developed in SE 5-53-23 W4M with Enbridge facilities, including multiple tanks. Two existing tanks are located in the north portion of the Edmonton Terminal in NW 32-52-23 W4M. The remainder of the property in NW 32-52-23 W4M is primarily cultivated with several isolated wetlands, a wetland complex and treed areas. • The nearest residences are located in Sherwood Park, approximately 1.35 km east of the Edmonton Terminal fence line. • Edmonton Terminal is located next to several roads and other industrial facilities and, as such, it is unlikely that any fishing, hunting, trapping and guiding occurs next to the pump station. • The Edmonton Terminal does not encounter: rural or residential areas; Indian Reserves or Aboriginal communities; lands under Parks Canada jurisdiction or conservation areas; water wells, reserves, licenses or water intakes; or land and water-based transportation (ATPR 2011, Government of Alberta 2012a, AESRD 2012b). Some cultivated areas will be impacted in NW 32-52-23 W4M. • The Edmonton Terminal does not encounter any Environmentally Significant Areas, proposed or existing provincial parks, Ecological Reserves, provincial Recreation Areas, designated Wilderness Areas or Natural Areas (ATPR 2009, 2011). • Sherwood Park Natural Area is located approximately 8 km southeast of the Edmonton Terminal, and Strathcona Science Provincial Park is located approximately 2 km northwest of the terminal (ATPR 2009). • Due to the large proportion of land in private ownership and under industrial use surrounding the terminal, recreational use of the lands around this location is limited. • The proposed activities at the Edmonton Terminal will entail the installation of aboveground facilities within an industrial park. As such, the addition of these structures may be considered an aesthetic effect.
Heritage Resources	• There is no heritage resources potential in SE 5-53-23 W4M, since the land is previously disturbed for industry. • According to Alberta Culture (2012) there are no known historical resources located within NW 32-52-23 W4M. • The potential for undiscovered heritage resources is low because of the high level of existing disturbance. The Edmonton Terminal is located in an existing industrial area with some undeveloped (mostly cultivated) lands. • *Historical Resources Act* clearance has been obtained for the entire quarter-section of NW 32-52-23 W4M. A copy of the clearance is provided in Appendix 11 of this ESA.
Traditional Land and Resource Use	• The Edmonton Terminal is located in an industrial area on privately-owned land. Therefore, traditional use of the lands in the vicinity of the terminal is not anticipated to be affected. • Stony Plain Indian Reserve No. 135, the nearest reserve to the terminal, is located approximately 25 km to the west.
Social and Cultural Well-Being	• The Edmonton Terminal is located within Strathcona County and adjacent to the City of Edmonton. In 2011, the total population of the Edmonton Metropolitan Area, which includes Sherwood Park, was reported as 1,159,869. Approximately 30% of the population was between the ages of 25 and 44 years old, which represents the largest age demographic. The median age of the population was 36.5 (Statistics Canada 2012p). The workforce population was 606,535 in 2006. The main industries include business services, retail trade and construction (Statistics Canada 2007p). • The proposed activities at the Edmonton Terminal will entail a small workforce using the services of the surrounding communities over a short period. Consequently, no social and cultural well-being impacts on the local communities (*i.e.,* Edmonton, Sherwood Park) arising from the proposed activities are anticipated.
Human Health	• The environmental elements associated with the Project that may be related to human health include *Physical and Meteorological Environment, Soil and Soil Productivity, Water Quality, Air Emissions, Acoustic Environment, Fish and Fish Habitat,* and *Wildlife and Wildlife Habitat*. Information pertaining to these environmental elements is presented in this table. • Socio-economic elements that may be related to human health include *Human Occupancy and Resource Use, Traditional Land and Resource Use, Social and Cultural Well-being,* and *Infrastructure and Services*. Information pertaining to these socio-economic elements is presented in this table; information related to health services is presented under *Infrastructure and Services.* • Nuisance air and noise emissions will be associated with the construction of the permanent facilities at Edmonton Terminal. The effects of these nuisance emissions are discussed under the *Air Emissions, GHG Emissions and Acoustic Environment* elements of this table. • Air emissions and GHG emissions are not expected to increase at Edmonton Terminal during operations since the proposed pump station and booster pump will be electrically driven. • Although noise levels at the Edmonton Terminal may increase slightly during operations due to the proposed pump station and booster pump, as discussed in Appendix 5 of this ESA, Enbridge will conduct post-construction noise monitoring at the terminal to ensure compliance with ERCB Directive 038 (ERCB 2007).

TABLE 5.24 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Infrastructure and Services	• Access to the Edmonton Terminal is via Baseline Road and 17th Street. • Major highways near the terminal include Highways 14/216 and 16. The CPR railway line is located approximately 250 m northwest of the terminal. • Power facilities currently service the Edmonton Terminal. Waste management facilities are available within both Sherwood Park and Edmonton. • Various services are provided in Sherwood Park and Edmonton including accommodation, restaurants, recreational facilities and emergency services (*i.e.*, police, ambulance, fire and hospitals). Hospitals are located in Edmonton and Sherwood Park (Alberta Health Services 2012a). • Given the small anticipated workforce for the proposed developments at Edmonton Terminal, the short duration of construction activities at the site and proximity to Sherwood Park and Edmonton, this component of the Project will generally have a negligible impact on local infrastructure (*i.e.*, roads, power utilities, water), services (*i.e.*, accommodation, recreation, emergency and health care services) and traffic.
Employment and Economy	• In 2006, the Edmonton Metropolitan Area had a 73% participation rate in the labour force with an employment rate of 69.6% and an unemployment rate of 4.6% (Statistics Canada 2007p). • Employment and economy was considered in the Economic Effects Analysis, the details of which are discussed in Appendix 10 of this ESA.

5.2.2 Kingman Station

The proposed Project activities at Kingman Station in SE 5-49-20 W4M include construction of a new pump station and associated facilities (Figure 1.3 in Section 1.0 of this ESA). Table 5.25 provides a summary of the environmental and socio-economic elements and considerations for Kingman Station pursuant to Guide A.2.4 as well as Tables A-2 and A-3 of the NEB *Filing Manual*.

TABLE 5.25

SUMMARY OF ENVIRONMENTAL AND SOCIO-ECONOMIC ELEMENTS AND CONSIDERATIONS FOR KINGMAN STATION

Environmental and Socio-Economic Elements	Summary of Considerations
Physical and Meteorological Environment	• Kingman Station lies within the Sullivan Lake Plain Section of the Eastern Alberta Plains Physiographic Region (Pettapiece 1986). • The station is located within the Central Parkland Subregion of the Parkland Natural Region (Natural Regions Committee 2006). • The topography in the area of Kingman Station is flat to slightly undulating and the elevation is approximately 750 m asl. • The upper Cretaceous Horseshoe Canyon Formation underlies Kingman Station. This formation is nonmarine in origin and is characterized by grey, feldspathic, clayey sandstone; grey bentonitic mudstone and carbonaceous shale; concretionary ironstone beds, scattered coal and bentonite beds of variable thickness; and minor limestone beds (Hamilton *et al*. 1999). • The station does not encounter any areas of permafrost (NRCan 2006) or ground instability (NRCan 2007a). • The site is located in a zone of low seismic activity with no recorded activity or substantial earthquakes in the area (NRCan 2008a, 2011). • Soils at Kingman Station within SE 5-49-20 W4M have been disturbed for industrial use and construction of the new pump station will be conducted within the boundaries of the existing station. NRCan considers unprotected soils in the vicinity of the Kingman Station to have low wind erosion risk with high climatic sensitivity (NRCan 2003). • The Kingman Station is located in an agricultural area considered to have low to moderate soil erosion risk (AARD 2005a). Wind erosion risk, which assesses the risk of soil degradation by wind on bare, unprotected mineral soil, is considered low at the station (AARD 2005b). Water erosion risk, which assesses the risk of soil degradation by water on bare, unprotected mineral soil, is considered low to moderate in the vicinity of the site (AARD 2005c). • Meteorological data from Environment Canada's Camrose station, located approximately 20 km south of the Kingman Station, is provided in Section 5.1.1 of this ESA. • No major tornadoes or hailstorms have been recorded in the vicinity of Kingman Station (NRCan 2007b,c).

TABLE 5.25 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Soil and Soil Productivity	• Soils at the Kingman Station within SE 5-49-20 W4M have been disturbed for industrial use. Construction of the new pump station will be conducted within the boundaries of the existing station. • The CLI (1967) has rated the soils at Kingman Station as having moderate limitations (Class 2) to crop production. • The current Kingman Station has been previously disturbed and contains pumps, buildings and other equipment. Possible sources of soil contamination include spot spill and leaks that may have occurred onsite during operation activities. The potential contaminants of concern may include fusion bond epoxy, liquid epoxy pipe coating, paint and hydrocarbons. • No contamination sites have been recorded at Kingman Station according to the Federal Contamination Sites and Solid Waste Landfills Inventory (Treasury Board of Canada Secretariat 2011). • Clubroot is a soil-borne disease that affects canola and other crops in the mustard family. It is considered a pest under the *Agricultural Pests Act.* As of 2011, Camrose County had between 10 to 45 fields with confirmed clubroot (AARD 2011a).
Water Quality and Quantity	• The Kingman Station is located in the North Saskatchewan River Basin, which covers approximately 122,800 km² of Alberta and Saskatchewan (NRCan 2010). • The nearest water feature to Kingman Station is a Class III wetland located approximately 50 m north of the existing station. • Hydrostatic testing is planned for the piping to be installed within the Kingman Station. Rental fluids will be used for hydrostatic testing. • There are no springs in the vicinity of Kingman Station (Borneuf 1983, AENV 1991). • The surface water quality risk in the vicinity of Kingman Station is rated as 0.76-1.0 (with 1 being the highest risk and 0 being the lowest risk) according to AARD (2005d). • No water wells will be impacted by activities at Kingman Station; however, there are several water wells within 1 km of the station (AESRD 2012b). Proposed activities at the station are not anticipated to have any effects on groundwater quantity or quality. • The groundwater quality risk in the vicinity of Kingman Station is rated as 0.28-0.35 (with 1 being the highest risk and 0 being the lowest risk) according to AARD (2005f). • The Aquifer Vulnerability Index in the vicinity of Kingman Station is rated as moderate, indicating that contaminated water would take a long time (in the range of thousands of years) to reach the aquifer (AARD 2005e). • Contaminants of concern associated with activities at Kingman Station that may affect water quality, if spilled or leaked, include crude oil, lubricants, fuel, anti-freeze and hydraulic fluids.
Air Emissions	• The community of Kingman is located approximately 11 km to the east of Kingman Station. A permanent residence is located approximately 250 m east of the station. • An increase in dust and particulate emissions during construction is expected. • Air quality in the area surrounding Kingman Station is primarily a function of anthropogenic sources of emissions such as those arising from vehicle traffic on adjacent roads and railways and surrounding agricultural activity. • The primary sources of air emissions (CACs) during construction will be from fuel combustion and dust related to the use of transportation vehicles and heavy equipment. During operation, emissions will b limited to transportation and equipment use during maintenance activities. CACs expected to be emitted from activities at Kingman Station include SO_x, NO_x, VOCs, CO and PM. • The proposed pump station to be installed at Kingman Station will not result in an increase in measurable airborne emissions during operations or maintenance since the pumps will be electrically driven.
Greenhouse Gas Emissions	• The primary sources of GHG emissions will be from construction-related activities associated with fuel combustion such as transporting crews to and from the work site, and from the operation of heavy equipment. • The proposed pump station to be installed at the Kingman Station will be electrically driven and, therefore, there will be no direct GHG emissions attributable to the proposed pumps at the station. • The consumption of electric power generated from fossil fuels is an indirect source of GHG emissions. Indirect GHG emissions are expected to be produced due to electric power consumption by the proposed pump station during operation. Overall, operation of the proposed pumps at the Edmonton Terminal, Kingman Station and Strome Station combined is expected to increase indirect GHG emissions by 434,486 tonnes $C0_2E$ per year (Appendix 4 of this ESA). This represents approximately 0.186% of the total 2010 Alberta GHG emissions, and approximately 0.063% of Canada's total GHG emissions in 2010.

TABLE 5.25 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Acoustic Environment	• Current sources of noise emissions in the area surrounding Kingman Station are from intermittent sources such as vehicle traffic, farm equipment and the existing facilities at Kingman Station. • A permanent residence is located approximately 350 m to the east of Kingman Station. • Camrose County Noise Bylaw No. 1019 does not apply to the construction at Kingman Station since the station is not located in a Designated Area, as defined by the bylaw (Camrose County 2002). • ACI conducted a Noise Impact Assessment at Kingman Station in October 2012 (Appendix 5 of this ESA). The purpose of the Noise Impact Assessment was to determine the impact of the proposed pumps relative to baseline sound levels. All noise levels were compared to the ERCB Directive 038 (ERCB 2007). • There are 10 residences within 1,500 m of the Kingman Station, with the closest being approximately 350 m to the east and the next closest approximately 450 m to the south. There are also 11 additional residences within 2 km of the Kingman Station which have been included in the Noise Impact Assessment. • Noise modeling results for all noise sources, building and tanks included in the baseline case as well as the equipment and buildings proposed as part of the Project are presented in Appendix 5 of this ESA. The noise levels associated with the existing noise sources at Kingman Station and the Project noise sources operating at their operational capacity will be below the ERCB Directive 038 permissible sound levels for most of the surrounding residential receptors and all theoretical 1.5 km receptors. At the nearest residential receptor, however, the noise levels are projected to exceed the permissible sound level. Enbridge will conduct post-construction noise monitoring at the station and apply mitigative measures as necessary to ensure compliance with ERCB Directive 038 (ERCB 2007). • Although noise levels at Kingman Station are expected to increase during operations, Enbridge will conduct post-construction noise monitoring and mitigation at the station to ensure compliance with ERCB Directive 038 levels or, where compliance with Directive 038 is not reasonably practical due to pre-existing noise conditions at the site, to achieve a zero net increase in sound levels from the site.
Fish and Fish Habitat	• The proposed activities at Kingman Station will not impact fish or fish habitat. • The nearest potential fish-bearing watercourse is an unnamed nonfish-bearing drainage located approximately 500 m southeast of the pump station.
Wetlands	• There are no wetlands within 30 m of the pump station. The nearest water feature to the site is a Class III wetland located approximately 50 m north of the existing station. • Kingman Station is not located within or near any Ramsar wetlands (Bureau of the Convention on Wetlands 2012).
Vegetation	• Kingman Station is located within the Aspen Parkland Ecoregion of the Prairie Ecozone; characteristic natural vegetation of this ecoregion includes aspen, mixed tall shrubs and intermittent fescue grassland (Environment Canada 2012g). • The fenced area of Kingman Station is devoid of vegetation. • The Agricultural Committee for the County of Camrose has designated five Noxious weeds as problem weeds, including common toadflax, scentless chamomile, leafy spurge, ox-eye daisy and creeping thistle (Camrose County 2003).
Wildlife and Wildlife Habitat	• Kingman Station is not located within any provincially identified wildlife areas (AESRD 2010-2012). • Kingman Station is not located within or adjacent to any Environmentally Significant Areas, Parks or Protected Areas, IBAs, Migratory Bird Sanctuaries, National Wildlife Areas, Western Hemisphere Shorebird Reserves, Ramsar wetlands or World Biosphere Reserves (ATPR 2009, 2011, BirdLife International *et al.* 2012, Environment Canada 2012f, WHSRN 2012, Bureau of the Convention on Wetlands 2012, UNESCO 2012). • A search of the AESRD FWMIS reported observations of black tern, horned grebe, lesser scaup and Swainson's hawk within 2 km of Kingman Station (AESRD 2012c). Activities at Kingman Station will be entirely contained within the existing station boundaries and, therefore, will not impact potential habitat for these species. • The modifications to Kingman Station will occur within an existing large, previously disturbed industrial site, which is not considered to be suitable wildlife habitat. No impacts to wildlife or wildlife habitat are expected to occur as a result of the pump station modifications.
Species at Risk or Species of Special Status	• The proposed permanent facilities will be installed on an existing large, previously disturbed industrial site (Kingman Station), which is not considered suitable habitat for wildlife or plant species at risk. • Barn swallows (Threatened by COSEWIC) use buildings as nesting sites (COSEWIC 2011) and may nest at Kingman Station; however, there are no records of barn swallows nesting at this facility site (AESRD 2012c). • Considering adjacent agricultural land use and the existing facility site, the potential for COSEWIC and *SARA*-listed wildlife species to be disturbed by construction activities is low.

TABLE 5.25 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Human Occupancy and Resource Use	• The proposed permanent facilities will be located within the boundaries of the existing Kingman Station at SE 5-49-20 W4M, owned by Enbridge. Adjacent lands are privately-owned. • A permanent residence is located approximately 250 m to the east of Kingman Station. • Kingman Station is situated within an existing industrial site on private lands next to several roads and, therefore, it is unlikely that any hunting and guiding occurs next to the pump station. All hunters require permission from the landowner. • The Kingman Station does not encounter: rural or residential areas; Indian Reserves or Aboriginal communities; lands under Parks Canada jurisdiction or conservation areas; water wells, reserves, licenses or water intakes; or land and water-based transportation (ATPR 2011, Government of Alberta 2012a, AESRD 2012b). • The Kingman Station does not encounter any Environmentally Significant Areas, proposed or existing provincial parks, Ecological Reserves, provincial Recreation Areas, designated Wilderness Areas or Natural Areas (ATPR 2009, 2011). • Due to the large proportion of land in private ownership and under industrial use surrounding the station, recreational use of the lands around this location is limited. • The proposed activities at the Kingman Station will entail the installation of aboveground facilities. As such, the addition of these structures may be considered an aesthetic effect.
Heritage Resources	• There is no heritage resources potential in SE 5-49-20 W4M, as the land is previously disturbed for industry and cultivation. • According to Alberta Culture (2012) there are no known historical resources located within SE 5-49-20 W4M. • The potential for undiscovered heritage resources is low because of the high level of existing disturbance. The Kingman Station is located in within a highly disturbed area stripped of topsoil. • *Historical Resources Act* clearance has previously been obtained for the existing station at SE 5-49-20 W4M.
Traditional Land and Resource Use	• The Kingman Station is located in an industrial area on privately-owned land. Therefore, traditional use of the lands in the vicinity of the station is not anticipated to be affected.
Social and Cultural Well-Being	• The nearest community to the station is Kingman, located approximately 5 km to the east. • The City of Camrose is located approximately 20 km to the southwest of Kingman Station. The population of Camrose in 2011 was 17,286. The median age was 41.2 years and approximately 24% of the population was between the ages of 25 and 44 years. The workforce population was 8,375. The main industries include retail trade, health care and social services, and business services. The main occupations include: sales and service occupations; trades, transport and equipment operators and related occupations; and business, finance and administration occupations (Statistics Canada 2007f). • The proposed activities at Kingman Station will entail a small workforce using the services of the surrounding communities over a short period. Consequently, no social and cultural well-being impacts on the local communities (*i.e.,* Kingman, Camrose) arising from the proposed activities are anticipated.
Human Health	• The environmental elements associated with the Project that may be related to human health include *Physical and Meteorological Environment, Soil and Soil Productivity, Water Quality, Air Emissions, Acoustic Environment, Fish and Fish Habitat,* and *Wildlife and Wildlife Habitat*. Information pertaining to these environmental elements is presented in this table. • Socio-economic elements that may be related to human health include *Human Occupancy and Resource Use, Traditional Land and Resource Use, Social and Cultural Well-being,* and *Infrastructure and Services*. Information pertaining to these socio-economic elements is presented in this table; information related to health services is presented under *Infrastructure and Services.* • Nuisance air and noise emissions will be associated with the construction of the permanent facilities at Kingman Station. The effects of these nuisance emissions are discussed under the *Air Emissions, GHG Emissions and Acoustic Environment* elements of this table. • Air emissions and GHG emissions are not expected to increase at Kingman Station during operations since the proposed pumps will be electrically driven. • Although noise levels at Kingman Station are expected to increase during operations, Enbridge will conduct post-construction noise monitoring and mitigation at the station to ensure compliance with ERCB Directive 038 levels (ERCB 2007) or, where compliance with Directive 038 is not reasonably practical due to pre-existing noise conditions at the site, to achieve a zero net increase in sound levels from the site.
Infrastructure and Services	• Access to Kingman Station is provided by Highways 21 and 617. • Power facilities currently service Kingman Station. • Various services are provided in Camrose including accommodation, restaurants, recreational facilities and emergency services (*i.e.*, police, ambulance, fire and hospitals). • Given the small anticipated workforce for the proposed developments at Kingman Station and the short duration of construction activities at the site, this component of the Project will generally have a negligible impact on local infrastructure (*i.e.*, roads, power utilities, water), services (*i.e.*, accommodation, recreation, emergency and health care services) and traffic.
Employment and Economy	• In 2006, the City of Camrose had a 66% participation rate in the labour force with an employment rate of 63% and an unemployment rate of 4.8% (Statistics Canada 2007f). • Employment and economy was considered in the Economic Effects Analysis, the details of which are discussed in Appendix 10 of this ESA.

5.2.3 Strome Station

The proposed Project activities at Strome Station in SW 2-46-15 W4M include construction of a new pump station and associated facilities (Figure 1.4 in Section 1.0 of this ESA). Table 5.26 provides a summary of the environmental and socio-economic elements and considerations for Strome Station pursuant to Guide A.2.4 as well as Tables A-2 and A-3 of the NEB *Filing Manual*.

TABLE 5.26

SUMMARY OF ENVIRONMENTAL AND SOCIO-ECONOMIC ELEMENTS AND CONSIDERATIONS FOR STROME STATION

Environmental and Socio-Economic Elements	Summary of Considerations
Physical and Meteorological Environment	• The Strome Station lies within the Sullivan Lake Plain Section of the Eastern Alberta Plains Physiographic Region (Pettapiece 1986). • The upper Cretaceous Bearpaw Formation underlies Strome Station. This formation is of marine origin and is characterized by dark grey blocky shale and silty shale; greenish glauconitic and grey clayey sandstone; thin concretionary ironstone and bentonitic beds (Hamilton *et al*. 1999). Surficial geology encountered includes lacustrine deposits consisting of fine sand and clay (Shetsen 1990). • The station is located within the Central Parkland Subregion of the Parkland Natural Region (Natural Regions Committee 2006). • The topography surrounding Strome Station is relatively flat and the elevation is approximately 705 m asl. • There are no areas of permafrost or ground instability in the vicinity of Strome Station (NRCan 2006, 2007a). • Strome Station is located in a zone of low seismic activity with no recorded activity or substantial earthquakes in the area (NRCan 2008a, 2011). • NRCan considers unprotected soils in the area to have low wind erosion risk with high climatic sensitivity (NRCan 2003). • Strome Station is located in an agricultural area considered to have moderate soil erosion risk (AARD 2005a). Wind erosion and water erosion risk are considered low and negligible, respectively, in the vicinity of the station (AARD 2005b,c). • Meteorological data from Environment Canada's "Camrose" station, located approximately 50 km northwest of Strome Station, is provided in Section 5.1.1 of this ESA. • No major tornadoes or hailstorms have been recorded in the vicinity of Strome Station (NRCan 2007b,c).
Soil and Soil Productivity	• Strome Station is an existing fenced industrial site lacking topsoil. However, the proposed permanent facilities will be installed immediately north of the fenced boundaries of Strome Station on cultivated land. • Well-drained Solonetzic Black Chernozems on medium textured loam and clay-loam till (Heisler Series) are the dominant soils in the vicinity of Strome Station. Orthic Black Chernozems and Orthic Humic Gleysols are also present but less common (AARD 2011c). • The CLI (1971) has rated the soils in the vicinity of Strome Station as having moderately severe to severe limitations to crop production. • Possible sources of soil contamination include spot spills and leaks that may have occurred during past onsite activities or during past farming activities; potential contaminants of concern may include fusion bond epoxy, liquid epoxy pipe coating, paint and hydrocarbons. • No contaminated sites have been recorded at Strome Station according to the Federal Contamination Sites and Solid Waste Landfills Inventory (Treasury Board of Canada Secretariat 2011). However, contamination at Strome Station, including the area immediately to the north where the proposed pump station will be installed, has occurred in the past. Excavations were conducted to remove all contamination • Clubroot is a soil-borne disease that affects canola and other crops in the mustard family. It is considered a pest under the *Agricultural Pests Act*. As of 2011, Flagstaff County had between 10 and 45 fields with confirmed clubroot (AARD 2011a). One of the confirmed clubroot fields is at the Strome Station location in 2-46-15 W4M (Hillaby pers. comm.).
Water Quality and Quantity	• Strome Station is located in the North Saskatchewan River Basin, which covers approximately 122,800 km² of Alberta and Saskatchewan (NRCan 2010). • The nearest water feature to Strome Station is a Class III wetland located approximately 45 m east of the station boundaries. • Hydrostatic testing is planned for the piping to be installed at Strome Station. Rental fluids will be used for hydrostatic testing. • There are no springs in the vicinity of Strome Station (Borneuf 1983, AENV 1991). • Surface water quality risk in the vicinity of Strome Station is rated as 0.76-1.0 (with 1 being the highest and 0 being the lowest risk) according to AARD (2005d). • No water wells will be impacted by activities at Strome Station, however, there are four water wells (one industrial, two domestic and one domestic and/or stock) within 1 km of the station (AESRD 2012b). Activities associated with the station are not anticipated to have any effects on groundwater quantity or quality. • The groundwater quality risk in the vicinity of Strome Station is rated as 0.28-0.35 (with 1 being the highest risk and 0 being the lowest risk) according to AARD (2005f). • The Aquifer Vulnerability Index in the vicinity of Strome Station is rated as low, indicating that contaminated water would take a long time (in the range of thousands of years) to reach the aquifer (AARD 2005e). • Contaminants of concern associated with the modifications that may affect water quality, if spilled or leaked, include crude oil, diesel fuel, lubricants and hydraulic fluids.

TABLE 5.26 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Air Emissions	• The nearest residence to Strome Station is located approximately 520 m southeast of the existing fence line. • An increase in dust and particulate emissions during construction is expected. • Air quality in the area surrounding Strome Station is primarily a function of anthropogenic sources of emissions such as those arising from vehicle and rail traffic on adjacent roads and railways, agricultural activity, and the existing industrial facilities at Strome Station. • The primary sources of air emissions (CACs) during construction will be from fuel combustion and dust related to the use of transportation vehicles and heavy equipment. During operation, emissions will be limited to transportation and equipment use during maintenance activities. CACs expected to be emitted from activities at Strome Station include SO_x, NO_x, VOCs, CO and PM. • The proposed pump station to be installed at Strome Station will not result in an increase in measurable airborne emissions during operations or maintenance since the pumps will be electrically driven.
GHG Emissions	• The primary sources of GHG emissions will be from construction-related activities associated with fuel combustion such as transporting crews to and from the work site, and from the operation of heavy equipment. • The proposed pump station to be installed at Strome Station will be electrically driven and, therefore, there will be no direct GHG emissions attributable to the proposed pumps at Strome Station. • The consumption of electric power generated from fossil fuels is an indirect source of GHG emissions. Indirect GHG emissions are expected to be produced due to electric power consumption by the proposed pump station during operation. Overall, operation of the proposed pumps at the Edmonton Terminal, Kingman Station and Strome Station combined is expected to increase indirect GHG emissions by 434,486 tonnes $C0_2E$ per year (Appendix 4 of this ESA). This represents approximately 0.186% of the total 2010 Alberta GHG emissions, and approximately 0.063% of Canada's total GHG emissions in 2010.
Acoustic Environment	• Current sources of noise emissions in the area surrounding Strome Station are from intermittent sources such as vehicle traffic, farm equipment and from the existing facilities at Strome Station. • The nearest residence to Strome Station is located approximately 520 m to the southeast of the existing fence line. • There are no local bylaws pertaining to noise in Flagstaff County. • ACI conducted a Noise Impact Assessment at Strome Station in October 2012 (Appendix 5 of this ESA). The purpose of the Noise Impact Assessment was to determine the impact of the proposed pumps relative to baseline sound levels. All noise levels were compared to the ERCB Directive 038 (ERCB 2007). • There are two residential receptors within 1.5 km of the station and four additional residential receptors within approximately 2.5 km of the station. All six nearby residential receptors have been included in the noise impact assessment. • Noise modeling results for all noise sources, building and tanks included in the baseline case as well as the equipment and buildings proposed as part of the Project are presented in Appendix 5 of this ESA. The noise levels associated with the existing noise sources at Strome Station operating at their average annual capacity and the Project noise sources operating at their operational capacity will be below the ERCB Directive 038 permissible sound levels for most of the surrounding residential receptors and all theoretical 1.5 km receptors. At the nearest residential receptor, however, the noise levels are projected to exceed the permissible sound level. • Although noise levels at Strome Station are expected to increase during operations, Enbridge will conduct post-construction noise monitoring and mitigation at the station to ensure compliance with ERCB Directive 038 levels or, where compliance with Directive 038 is not reasonably practical due to pre-existing noise conditions at the site, to achieve a zero net increase in sound levels from the site.
Fish and Fish Habitat	• The proposed activities at Strome Station will not impact fish or fish habitat. • The nearest potential fish-bearing watercourse along the proposed pipeline route is the unnamed fish-bearing wetland (FD1) at KP 105.3 (SW 18-46-15 W4M) located approximately 12 km northwest of the station.
Wetlands	• The proposed activities at Strome Station will not cause disturbance to wetlands. • The nearest wetland is a Class III wetland located approximately 45 m east of the station boundaries.
Vegetation	• Strome Station is located within the Aspen Parkland Ecoregion of the Prairie Ecozone; characteristic natural vegetation of this ecoregion includes aspen, mixed tall shrubs and intermittent fescue grassland (Environment Canada 2012g). • The fenced area of Strome Station is devoid of vegetation. The area immediately north of Strome Station to be acquired for the proposed permanent facilities is cultivated and, consequently, a vegetation survey was not conducted at this site. • Noxious weeds of concern in Flagstaff County include scentless chamomile, white cockle and creeping thistle (Hillaby pers. comm.).

TABLE 5.26 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Wildlife and Wildlife Habitat	• Strome Station is not located within any provincially identified wildlife areas (AESRD 2010-2012). • Strome Station is not located within or adjacent to any Environmentally Significant Areas, Parks or Protected Areas, IBAs, Migratory Bird Sanctuaries, National Wildlife Areas, Western Hemisphere Shorebird Reserves, Ramsar wetlands or World Biosphere Reserves (ATPR 2009, 2011, BirdLife International *et al.* 2012, Environment Canada 2012f, WHSRN 2012, Bureau of the Convention on Wetlands 2012, UNESCO 2012). • Strome Station is located 1 km north of Environmentally Significant Area No. 380. This 5,422 ha ESA provides large natural areas and habitat for species such as ferruginous hawk (Fiera 2009). • A search of the AESRD FWMIS reported an observation of a wandering garter snake within 2 km of Strome Station (AESRD 2012c). Wandering garter snakes are Sensitive according to the 2010 General Status of Alberta Wild Species (ASRD 2011). Activities at Strome Station will not impact any wetlands and, therefore, will not impact potential habitat for wandering garter snake. • The proposed permanent facilities will be installed on new land immediately north of an existing industrial facility (Strome Station), on cultivated land which is not considered to be suitable wildlife habitat. No impacts to wildlife or wildlife habitat are expected to occur as a result of the proposed permanent facilities. • Given that the proposed expansion site is located on cultivated land, a wildlife survey was not conducted at this site.
Species at Risk or Species of Special Status	• The proposed permanent facilities will be installed adjacent to an existing large, previously disturbed industrial site (Strome Station), which is not considered suitable habitat for wildlife or plant species at risk. • Barn swallows (Threatened by COSEWIC) use buildings as nesting sites (COSEWIC 2011) and may nest at Strome Station; however, there are no records of barn swallows nesting at this facility site (AESRD 2012c). • Considering lands within 500 m of the site are cultivated, the potential for COSEWIC and *SARA*-listed wildlife species to be disturbed by construction activities is low.
Human Occupancy and Resource Use	• The proposed permanent facilities will be located on privately-owned land, adjacent to the north side of Strome Station in SW 2-46-15 W4M. Adjacent lands are privately-owned and zoned as Agricultural. • Strome Station is an existing fenced industrial site lacking topsoil. However, the proposed permanent facilities will be installed immediately north of the fenced boundaries of Strome Station on acquired cultivated land. • The nearest residence to Strome Station is located approximately 520 m to the southeast of the existing fence line. • Strome Station does not encounter: rural or residential areas; Indian Reserves or Aboriginal communities; lands under Parks Canada jurisdiction or conservation areas; water wells, reserves, licenses or water intakes; or land and water-based transportation (ATPR 2011, Government of Alberta 2012a, AESRD 2012b). • Strome Station does not encounter any Environmentally Significant Areas, proposed or existing provincial parks, Ecological Reserves, provincial Recreation Areas, designated Wilderness Areas or Natural Areas (ATPR 2009, 2011). • Due to the large proportion of land in private ownership and under industrial use or cultivation surrounding the station, recreational use of the lands around this location is limited. • No water wells will be impacted by activities at Strome Station, however, there are four water wells (one industrial, two domestic and one domestic and/or stock) within 1 km of the station (AESRD 2012b). Activities associated with the station are not anticipated to have any effects on groundwater quantity or quality. • The proposed development at Strome Station will entail the installation of aboveground facilities adjacent to an existing industrial facility. As such, the addition of these structures may be considered an aesthetic effect.
Heritage Resources	• According to Alberta Culture (2012) there are no known historical resources located at SW 2-46-15 W4M. • The potential for undiscovered heritage resources is low because of the high level of existing disturbance. The proposed permanent facilities at Strome Station will be placed on cultivated lands adjacent to an existing industrial facility. • *Historical Resources Act* clearance will be obtained as part of the Project HRIA.
Traditional Land and Resource Use	• The proposed permanent facilities at Strome Station will be installed on cultivated lands adjacent to an existing industrial facility. Therefore, traditional use of the lands in the vicinity of Strome Station is not anticipated to be affected. • There are no Indian Reserves in close proximity to Strome Station.
Social and Cultural Well-Being	• The proposed permanent facilities at Strome Station will be placed on cultivated lands adjacent to an existing industrial area in SW 2-46-15 W4M, which is owned by Enbridge. • The Town of Daysland is located approximately 14 km southwest of Strome Station. In 2011, the population of Daysland was reported as 807. Approximately 19.3% of the population was between the ages of 25 and 44 years old, which represents the largest age demographic. The median age of the population was 47.5 years (Statistics Canada 2012q). In 2006, the town had a workforce of 365 people. The main industries include health care and social services, retail trade, and agriculture and other resource-based industries (Statistics Canada 2007q).

TABLE 5.26 Cont'd

Environmental and Socio-Economic Elements	Summary of Considerations
Human Health	• The environmental elements associated with the Project that may be related to human health include *Physical and Meteorological Environment, Soil and Soil Productivity, Water Quality, Air Emissions, Acoustic Environment, Fish and Fish Habitat,* and *Wildlife and Wildlife Habitat*. Information pertaining to these environmental elements is presented in this table. • Socio-economic elements that may be related to human health include *Human Occupancy and Resource Use, Traditional Land and Resource Use, Social and Cultural Well-being,* and *Infrastructure and Services*. Information pertaining to these socio-economic elements is presented in this table; information related to health services is presented under *Infrastructure and Services*. • Nuisance air and noise emissions will be associated with the construction of the permanent facilities at Strome Station. The effects of these nuisance emissions are discussed under the *Air Emissions, GHG Emissions and Acoustic Environment* elements of this table. • Air emissions and GHG emissions are not expected to increase at Strome Station during operations since the proposed pumps will be electrically driven. • Although noise levels at Strome Station are expected to increase during operations, Enbridge will conduct post-construction noise monitoring and mitigation at the station to ensure compliance with ERCB Directive 038 levels (ERCB 2007) or, where compliance with Directive 038 is not reasonably practical due to pre-existing noise conditions at the site, to achieve a zero net increase in sound levels from the site.
Infrastructure and Services	• Access to Strome Station is Highways 13 and 855 and local roads. • Limited services are available in the Town of Daysland, located approximately 14 km southwest of Strome Station. • Services are also provided in Camrose, approximately 50 km northwest of Strome Station, including accommodation, restaurants, recreational facilities and emergency services (*i.e.*, police, ambulance, fire and hospitals). • Given the small anticipated workforce for the proposed developments at Strome Station and the short duration of construction activities, this component of the Project will generally have a negligible impact on local infrastructure (*i.e.*, roads, power utilities, water), services (*i.e.*, accommodation, recreation, emergency and health care services) and traffic.
Employment and Economy	• In 2006, the Town of Daysland had a 58.9% participation rate in the labour force with an employment rate of 54.8% and an unemployment rate of 6.8% (Statistics Canada 2007q). • Employment and economy was considered in the Economic Effects Analysis, the details of which are discussed in Appendix 10 of this ESA.

5.2.4 Hardisty Terminal

The proposed Project activities at Hardisty Terminal in SE 30-42-9 W4M and NE 19-42-09 W4M include the installation of a new 914 mm O.D. (NPS 36) receiving trap and interconnecting piping, valves, pressure control and relief systems (Figure 1.5 in Section 1.0 of this ESA). Table 5.27 provides a summary of the environmental and socio-economic elements and considerations for Hardisty Terminal pursuant to Guide A.2.4 as well as Tables A-2 and A-3 of the NEB *Filing Manual*.

TABLE 5.27

SUMMARY OF ENVIRONMENTAL AND SOCIO-ECONOMIC ELEMENTS AND CONSIDERATIONS FOR HARDISTY TERMINAL

Environmental and Socio-economic Elements	Summary of Considerations
Physical and Meteorological Environment	• Hardisty Terminal lies at the border of the Battle River district of the Lac La Biche Plain Section and the Neutral Upland district of the Neutral Hills Uplands section of the Eastern Alberta Plains Physiographic Region (Pettapiece 1986). • The upper Cretaceous-Belly River Group Formation underlies Hardisty Terminal. This formation is characterized by grey to greenish grey, thick-bedded feldspathic sandstone, grey clayey siltstone, grey and green mudstone and concretionary ironstone beds at a depth of 10 m (Hamilton *et al.* 1999). • There are no areas of permafrost (NRCan 2006) or ground instability (NRCan 2007a, 2008a) within the area of Hardisty Terminal (NRCan 2006). • The site is located in a zone of low seismic activity with no recorded activity in the area (NRCan 2011). • Hardisty Terminal is located east of the Battle River valley. The topography in the area of Hardisty Terminal is relatively flat and the elevation is approximately 675 m asl. • Surficial deposits at Hardisty Terminal are fluvial deposits consisting of fine sand, silt and clay sediments up to 25 m thick (Shetsen 1990). • Where activities are planned within Hardisty Terminal, soils have been disturbed for industrial use and construction of the new infrastructure will be conducted within the boundaries of the existing station. NRCan considers unprotected soils in the vicinity of Hardisty Terminal to have severe wind erosion risk with high climatic sensitivity (NRCan 2003). • Hardisty Terminal is located in an agricultural area considered to have low to moderate soil erosion risk (AARD 2005a). Wind erosion risk, which assesses the risk of soil degradation by wind on bare, unprotected mineral soil, is considered low at the terminal (AARD 2005b). Water erosion risk, which assesses the risk of soil degradation by water on bare, unprotected mineral soil, is considered moderate in the vicinity of the site (AARD 2005c). • Hardisty Terminal is located within the Prairie Ecozone in which the climate is marked by short, warm summers and long, cold winters with continuous snow cover (Environment Canada 2010). • Meteorological data from Environment Canada's Camrose station, located approximately 110 km northwest of Hardisty Terminal, is provided in Section 5.1.1 of this ESA. • No major tornadoes or hailstorms have been recorded in the vicinity of Hardisty Terminal (NRCan 2007b,c).
Soil and Soil Productivity	• Activities at Hardisty Terminal will be conducted within the existing fenced industrial site lacking topsoil and, therefore, detailed soil information is not deemed warranted as per Table A-1 of the *Filing Manual*. • The CLI (1970) has rated the soils at the terminal as having severe limitations (Class 4) to crop production. • Possible sources of soil contamination include spot spills and leaks that may have occurred during past onsite activities. • A search of the Federal Contaminated Sites Inventory revealed no listed contamination in the vicinity of the site (Treasury Board of Canada Secretariat [TBS] 2011). • Clubroot is a soil-borne disease that affects canola and other crops in the mustard family. It is considered a pest under the *Agricultural Pests Act.* Clubroot has not been found in the MD of Provost (AARD 2011a).
Water Quality and Quantity	• The surface waters in the vicinity of the Hardisty Terminal form part of the North Saskatchewan River basin, which covers approximately 122,800 km² of Alberta and Saskatchewan (NRCan 2010). • The nearest watercourse is the Battle River, a tributary to the North Saskatchewan River, located approximately 1.4 km west of the proposed activities. The nearest natural water feature to Hardisty Terminal is a slough located approximately 500 m southeast of the terminal. • Hydrostatic testing is planned for the piping to be installed at Hardisty Terminal. Rental fluids will be used for hydrostatic testing. • There are no springs in the vicinity of Hardisty Terminal (Borneuf 1983, AENV 1991). • The surface water quality risk in the vicinity of HardistyTerminal is rated as 0.68-0.75 (with 1 being the highest risk and 0 being the lowest risk) according to AARD (2005d). • No water wells will be impacted by activities at Hardisty Terminal; however, there are several water wells within 1 km of the terminal (AESRD 2012b). Proposed activities at the terminal are not anticipated to have any effects on groundwater quantity or quality. • The Aquifer Vulnerability Index in the vicinity of Hardisty Terminal is rated as moderate, indicating that contaminated water would take a long time (in the range of thousands of years) to reach the aquifer (AARD 2005e). • The groundwater quality risk in the vicinity of Hardisty Terminal is rated as 0.20-0.27 (with 1 being the highest risk and 0 being the lowest risk) according to AARD (2005f). • Contaminants of concern associated with Project activities that may affect water quality, if spilled or leaked, include crude oil, fuel, lubricants, hydraulic fluids, antifreeze and glycol.

TABLE 5.27 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Air Emissions	• Air quality in the area of Hardisty Terminal is primarily a function of anthropogenic sources of emissions such as those arising from vehicle and rail traffic on adjacent rural roads and railways, and the surrounding agricultural and oil and gas activities (e.g., tank farms). • Hardisty Terminal is located approximately 4 km southeast of the Town of Hardisty, Alberta. The nearest residences are located approximately 450 m and 980 m northwest of the existing Hardisty Terminal fence line. The terminal is partially screened by trees from the nearest residence. • An increase in nuisance dust and particulate emissions during construction is expected. • The primary sources of air emissions (CACs) during construction will be from fuel combustion and dust related to the use of transportation vehicles and heavy equipment. • The proposed infrastructure to be installed at Hardisty Terminal will not result in an increase in measurable airborne emissions during operations or maintenance.
Greenhouse Gas Emissions	• The primary sources of GHG emissions will be from construction-related activities associated with fuel combustion such as transporting crews to and from the work site, and from the operation of heavy equipment. • There will be no direct GHG emissions attributable to the proposed activities at the terminal.
Acoustic Environment	• Current sources of noise emissions in the area surrounding Hardisty Terminal are from vehicle and rail traffic on adjacent roads and railways, farm equipment as well as the existing facilities at Hardisty Terminal and adjacent tank farms. • The nearest residents are located approximately 450 m and 980 m northwest of the existing Hardisty Terminal fence line. • The MD of Provost Noise Bylaw No. 1906 does not apply to the proposed activities at Hardisty Terminal since the terminal is located in an area zoned as Industrial by the MD of Provost. • Construction, operations and maintenance of the proposed facilities at Hardisty Terminal will adhere to ERCB Directive 038 levels or, where compliance with Directive 038 is not reasonably practical due to pre-existing noise conditions at the site, Enbridge will achieve a zero net increase in sound levels from the site.
Fish and Fish Habitat	• The activities associated with the modifications to Hardisty Terminal will not impact fish or fish habitat. • No fish-bearing watercourses are located within 30 m of the Hardisty Terminal. The nearest fish-bearing watercourse is the Battle River, a tributary to the North Saskatchewan River, located approximately 1.4 km west of the proposed activities.
Wetlands	• There are no wetlands within 30 m of the activities proposed at Hardisty Terminal. • The nearest natural water feature to Hardisty Terminal is a slough located approximately 500 m southeast of the edge of the terminal.
Vegetation	• Hardisty Terminal is located within the Aspen Parkland Ecoregion of the Prairie Ecozone; characteristic natural vegetation of this ecoregion includes trembling aspen, mixed tall shrubs and intermittent fescue grassland (Environment Canada 2010). The Hardisty Terminal is included in the Central Parkland Natural Subregion which is mostly cultivated with a mosaic of aspen and prairie vegetation on remnant native parkland areas (Natural Regions Committee 2006). • Weeds of concern in the MD of Provost include downy chess (downy brome), leafy spurge, toadflax species, scentless chamomile, common tansy and absinthe wormwood. Absinthe wormwood has not been officially re-designated but is treated as a Noxious weed. • Project activities will be conducted within the existing Hardisty Terminal which lacks a vegetative cover and, therefore, detailed vegetation information is not deemed warranted as per Table A-1 of the NEB Filing Manual.
Wildlife and Wildlife Habitat	• Hardisty Terminal is located within the Central Parkland Natural Subregion of the Parkland Natural Region of Alberta (Natural Regions Committee 2006). • Hardisty Terminal is not located within or adjacent to any Parks or Protected Areas, IBAs, Migratory Bird Sanctuaries, National Wildlife Areas, Western Hemisphere Shorebird Reserves, Ramsar wetlands or World Biosphere Reserves (BirdLife International *et al.* 2012, Environment Canada 2012f, WHSRN 2012, Bureau of the Convention on Wetlands 2012, UNESCO 2012). • The terminal is approximately 120 m northwest of the Environmentally Significant Area No. 362, which is of national importance and contains large natural areas and habitat for northern grasshopper mouse, burrowing owl and ferruginous hawk (ATPR 2009, Fiera 2009). • A search of the AESRD FWMIS database indicated the presence of bald eagle (Sensitive according to ASRD 2011), horned grebe (Special Concern by COSEWIC), least flycatcher (Sensitive according to ASRD 2011), sandhill crane (Sensitive according to ASRD 2011), Canadian toad (May be at Risk according to according to ASRD 2011) and plains garter snake (Sensitive according to ASRD 2011) within 2 km of Hardisty Terminal (AESRD 2012c, Government of Canada 2011). • Project activities will be confined to the existing previously disturbed industrial terminal, which is not considered to be suitable wildlife habitat.

TABLE 5.27 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Species at Risk or Species of Special Status	• Project activities will be confined to an existing previously disturbed industrial site that is devoid of vegetation and is not considered suitable habitat for wildlife or plant species at risk. • A search of the AESRD FWMIS database indicated the presence of horned grebe (Special Concern by COSEWIC) within 2 km of Hardisty Terminal (AESRD 2012c). There is no potential horned grebe nesting habitat in the vicinity of Hardisty Terminal. • Barn swallows (Threatened by COSEWIC) use buildings as nesting sites (COSEWIC 2011) and may nest at Hardisty Terminal; however, there are no records of barn swallows nesting at this facility site. No other wildlife species listed under Schedule 1 of the *SARA* and by COSEWIC (Government of Canada 2011, COSEWIC 2012) have the potential to nest at the facility site. • Given that the surrounding land use is tame pasture, Project activities at the terminal could disturb the following two additional wildlife *SARA* Schedule 1 and COSEWIC listed species that have the potential of occurring in the vicinity of Hardisty Terminal: common nighthawk (Threatened on *SARA* Schedule 1 and by COSEWIC); and short-eared owl (Special Concern on *SARA* Schedule 1 and by COSEWIC). • No previously recorded occurrences of rare plants with a *SARA* or COSEWIC designation are known from within 1.5 km of the terminal (ACIMS 2012).
Human Occupancy and Resource Use	• Since the early 1970s, lands at this site have been used as a pipeline facility. • Hardisty Terminal is situated on lands owned by Enbridge. Adjacent privately-owned lands are used for farming and contain facility sites owned by Gibson Energy and Husky Energy. Hardisty Terminal is located on lands administrated by the MD of Provost that have been zoned as Industrial. Surrounding lands are zoned as Agricultural (MD of Provost 2004). The Project activities are compatible with industrial zoning at this site. • Hardisty Terminal does not encounter: rural or urban residential areas; agricultural areas; Indian Reserves or Aboriginal communities; recreation and park areas; Environmentally Significant Areas, lands under Parks Canada jurisdiction or conservation areas; controlled or managed forest areas; water reserves and licenses or water intakes; or land and water-based transportation. Hardisty Terminal is not adjacent to any proposed or existing provincial parks, Ecological Reserves, Provincial Recreation Areas, designated Wilderness Areas or Natural Areas (ATPR 2009, 2011, Government of Alberta 2012a, AESRD 2012b). • Hardisty Terminal is situated within an existing industrial site on privately-owned lands. As such, no hunting, trapping, guiding, recreation or other public use is permitted within the terminal. • Due to the large proportion of land in private ownership and under industrial use and cultivation surrounding Hardisty Terminal, recreational use of the lands around this location is limited. • Project activities at Hardisty Terminal will entail the construction of aboveground components (*e.g.,* valves) which may be considered to have an aesthetic effect.
Heritage Resources	• Hardisty Terminal is located within a highly disturbed area where all available topsoil has been salvaged and, therefore, the potential for encountering historical resources is considered low. • *Historical Resources Act* clearance has previously been obtained for the existing developments in Hardisty Terminal at SE 30-42-9 W4M and NE 19-42-9 W4M.
Traditional Land and Resource Use	• Given that Project activities will be conducted within a disturbed area on privately-owned lands, traditional use of the lands in the vicinity of Hardisty Terminal is not anticipated to be affected by the Project. • The nearest Aboriginal communities to Hardisty Terminal are the Montana First Nation approximately 150 km to the west and Little Pine First Nation approximately 150 km to the east of Hardisty Terminal.
Social and Cultural Well-Being	• The Town of Hardisty is located approximately 4 km northwest of the existing Hardisty Terminal. In 2006, the total population of Hardisty was reported as 760. Approximately 27% of the Hardisty population was between 25 and 44 years old, which represented the largest age demographic. The median age of the population was 35 years. The town had a workforce of 380 people in 2006. The main industries include agriculture and other resource-based industries, business services and other services (Statistics Canada 2007n). • In the 2011 census, the total population of Hardisty was 639, a decrease of 15.9% since 2006. Approximately 41% of the Hardisty population was between 35 and 64 years old. The median age of the population was 41.6 years (Statistics Canada 2012n). • The proposed activities at Hardisty Terminal will entail a small workforce using the services of the surrounding communities over a short period. Consequently, no social and cultural well-being impacts on the local communities (*i.e.,* Hardisty) arising from the proposed activities are anticipated.
Human Health	• The environmental elements associated with the Project that may be related to human health include *Physical and Meteorological* Environment*, Soil and Soil Productivity, Water Quality, Air Emissions, Acoustic Environment, Fish and Fish Habitat,* and *Wildlife and Wildlife Habitat*. Information pertaining to these environmental elements is presented in this table. • Socio-economic elements that may be related to human health include *Human Occupancy and Resource Use, Traditional Land and Resource Use, Social and Cultural Well-being,* and *Infrastructure and Services*. Information pertaining to these socio-economic elements is presented in this table; information related to health services is presented under *Infrastructure and Services.* • Nuisance air and noise emissions will be associated with the construction of the permanent facilities at Hardisty Terminal. The effects of these nuisance emissions are discussed under the *Air Emissions, GHG Emissions and Acoustic Environment* elements of this table. • Air emissions and GHG emissions are not expected to increase at Hardisty Terminal during operations.

TABLE 5.27 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Infrastructure and Services	• It is expected that contract employees will be requiring temporary accommodation within the local area during the Project. The communities of Hardisty, Amisk, Hughenden and Provost provide accommodation services within 50 km of Hardisty Terminal, including a combined total of more than 250 hotel rooms and more than 150 campsites. • Access to Hardisty Terminal will be via provincial Highways 13 and 41, Secondary Highway 881 as well as municipal grid roads. Access to the immediate Project site is only possible through existing Hardisty Terminal access roads. • The Town of Hardisty offers police and fire emergency response services, as well as medical care services. A waste transfer site is also available in Hardisty (Town of Hardisty 2006b,c, Alberta Health Services 2012d). • Given the small anticipated workforce for the proposed developments at Hardisty Terminal and the short duration of construction activities at the site, this component of the Project will generally have a negligible impact on local infrastructure (*i.e.*, roads, power utilities, water), services (*i.e.*, accommodation, recreation, emergency and health care services) and traffic.
Employment and Economy	• In 2006, the Town of Hardisty had a 68.5% participation rate in the labour force with an employment rate of 65.8% and an unemployment rate of 3.9% (Statistics Canada 2007n). • Employment and economy was considered in the Economic Effects Analysis, the details of which are discussed in Appendix 10 of this ESA.

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TERA wishes to acknowledge those people identified in the Personal Communications for their assistance in supplying information and comments incorporated into this report.

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5.3.3 GIS Data

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PHOTOPLATES

Plate 1 View east of the Edmonton Terminal in NW 32-52-23 W4M (July 2012).

Plate 2 View southeast across the proposed right-of-way within the TUC in NW 28-52-23 W4M at approximately KPE 1 (September 2012).

Plate 3 View northwest along a portion of the right-of-way in the vicinity of Looking Back Lake in NE 15-50-22 W4M at approximately KP 29.5 (September 2012).

Plate 4 View northwest along a portion of the right-of-way that crosses a wetland in SE 23-43-11 W4M at approximately KP 159.8 (September 2012).

Plate 5 View east along the right-of-way in NW 28-43-11 W4M at approximately KP 154.1, showing relation to Village of Lougheed (September 2012).

Plate 6 View west across the right-of-way at the Battle River valley in NE 25-42-10 W4M at approximately KP 173.6 (September 2012). Photo taken from Highway 13.