



TransCanada Keystone, L.P.  
Keystone XL Project

Preliminary Environmental Report

## List of Abbreviations and Acronyms

BLM	Bureau of Land Management
bpd	barrels per day
CAA	Clean Air Act
CFR	Code of Federal Regulations
CRP	Conservation Reserve Program
CWA	Clean Water Act
dBA	decibels on the A-weighted scale
EO	Executive Order
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
GLO	General Land Office
L <sub>dn</sub>	day-night sound level
LULC	Land Use and Land Cover
Keystone	TransCanada Keystone Pipeline, LP
mg/l	milligrams per cubic liter
MP	milepost
MUID	Map Unit Identification
NAAQS	National Ambient Air Quality Standards
NHP	Natural Heritage Program
NHPA	National Historic Preservation Act
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service

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NRHP	National Register of Historic Places
NSA	noise sensitive areas
NVCS	National Vegetation Classification System
NWI	National Wetland Inventory
NWP	Nationwide permits
OPS	Office of Pipeline Safety
Project	Keystone XL Project
TCP	traditional cultural properties
U.S.	United States
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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## 1.0 Environmental Report

### 1.1 Introduction

TransCanada Keystone Pipeline, L.P. (Keystone) is proposing to construct and operate a crude oil pipeline and related facilities from Hardisty, Alberta, Canada, to the Gulf Coast area of Texas in the United States (U.S.). The project, known as the Keystone XL Project (Project), will have the nominal capacity to deliver 900,000 barrels per day (bpd) of crude oil from an oil supply hub near Hardisty to existing terminals in Nederland near Port Arthur, Texas, and the Houston Ship Channel near Houston. The Steele City segment of the Project extends from Hardisty, Alberta, southeast to Steele City, Nebraska. The Gulf Coast segment extends from Cushing, Oklahoma, south to Nederland, Texas. The Houston Lateral extends from Liberty County, Texas, southwest to Moore Junction, Harris County, Texas (please refer to **Figure 1**). In total, the Project will consist of approximately 1,704 miles of new, 36-inch-diameter pipeline, consisting of about 329 miles in Canada and 1,375 miles within the U.S. It will interconnect with the northern and southern termini of the previously approved 298-mile-long, 36-inch-diameter Cushing Extension segment of the Keystone Pipeline Project (Cushing Extension). The Project is planned to be placed into service in phases. The Gulf Coast segment is planned to be in-service by the second Quarter of 2011 and the Steele City segment is planned to be in-service by the first Quarter of 2012.

Keystone is committed to completing all necessary environmental permit applications and identifying and addressing environmental impacts pertaining to the Project. This report provides an overview of the known environmental effects of the Project and discusses the additional information that is currently being compiled and assessed. More comprehensive environmental and cultural studies, data, and analyses will be submitted in a supplemental Environmental Report to be filed on or about November 19, 2008. A further supplemental Environmental Report will be submitted in June 2009.

In the U.S., the Keystone XL Project will be constructed as follows:

- The 36-inch-diameter Steele City segment, approximately 850 miles in length, from the U.S./Canadian Border at Morgan, Montana, to Steele City, Nebraska, will be constructed with seven mainline spreads, approximately 120 miles each, from the second Quarter, 2011 to the fourth Quarter, 2011.
- The 36-inch-diameter Gulf Coast segment, approximately 478 miles in length, from Lincoln County, Oklahoma, to Nederland, Texas, will be constructed with five mainline spreads, varying in length from 72 to 122 miles each, and one mini-spread, 12 miles in length, from the third Quarter, 2010 to the fourth Quarter, 2010.
- The 36-inch-diameter Houston Lateral, approximately 47 miles in length, from Liberty County, Texas, to Harris County, Texas, will be constructed with one mini-spread, 47 miles in length, from the third Quarter, 2010 to the fourth Quarter, 2010.

### 1.2 Air Quality

Operational emissions will be limited to the proposed new pump stations to be located along the proposed pipeline and the tank farm to be located near Steele City, Nebraska. Also, as part of the Project, there will be additional pump stations and / or modifications to pump stations along the Cushing Extension segment of the Keystone Pipeline. The proposed pump stations will use electrically driven motors, with electricity to be provided from local electric utilities. The pump stations will not include a source of backup power supply; therefore, operational emissions from each of the pump stations will consist only of negligible levels of fugitive emissions.

The Steele City tank farm will release air pollutants as a result of fugitive emissions from crude oil storage tanks and will be subject to federal and state air quality regulations pursuant to the federal Clean Air Act (CAA) of 1970 and its amendments. Strict adherence to applicable regulations will minimize the potential air quality impacts associated with the Project.

Construction vehicle-related emissions will occur during the construction period of the proposed pipeline and related facilities. The majority of pipeline construction activities will pass by a specific location within a 30-day period, resulting in temporary increases in hydrocarbon combustion emissions (nitrogen oxides, carbon monoxide) and local airborne particulate matter concentrations. All construction equipment will be fitted with the appropriate air emission reduction devices. The Project will limit dust impacts in residential and commercial areas adjacent to pipeline construction by utilizing standard dust minimization techniques.

### **1.3 Geology**

The proposed route crosses the following physiographic subdivisions: the Glaciated Missouri Plateau (Montana, South Dakota), Unglaciated Missouri Plateau (Montana, South Dakota), the Middle Western Upland Plain (Nebraska), High plains (Nebraska), West Central Rolling Hills (Nebraska, Kansas), Mid-continent Plains (Kansas, Oklahoma), Escarpments (Kansas, Oklahoma), and the Gulf Coastal Plains (Texas) physiographic regions. All subdivisions are classified as having low to moderate relief.

Major mineral resources within the vicinity of the pipeline include sand, gravel, crushed stone, oil, natural gas, coal, and bentonite. Paleontological resource surveys are being conducted on lands managed by the Bureau of Land Management (BLM) that are crossed by the Project. Geologic hazards such as seismic activity, landslides, subsidence, flooding, and swelling clays will be addressed in the supplemental Environmental Report to be filed on or about November 19, 2008.

### **1.4 Soils**

The Steele City segment of the Project through Montana, South Dakota, and Nebraska will be located almost entirely within the northern part of the Central Lowlands physiographic province (Thornbury 1965). Within this region of the Project, the geologic surface has been formed by repeated episodes of continental glaciations. As a result, glacial deposits and re-worked alluvium form the parent materials for the majority of soils along the route. Isolated bedrock exposures may occur along stream valleys and associated hill slopes. Extensive sandy soils occur in the sandhills region of South Dakota and Nebraska.

Most soils in the northern part of the Project area have formed in clays, silts, and sands from weathered glacial till and lacustrine deposits or from sands and gravels deposited as glacial outwash. Soil textures reflect the nature of the parent deposits, varying widely from clays to sands and gravels depending on location. Along major streams and river valleys, soils exhibit the stratified textures of alluvial deposits. The depth to bedrock is typically greater than 60 inches throughout the region.

The Gulf Coast segment in Oklahoma extends from of the southern terminus of the Keystone Pipeline Cushing Extension at Cushing, Oklahoma, to the Oklahoma / Texas border. This portion includes the Mid-continent Plains and Escarpments physiographic subdivision (Hammond 1965). The Oklahoma soils range from light sandy loams to heavier silt loams and clays.

The Gulf Coast segment route will terminate near Port Arthur, Texas, and the Houston Lateral will terminate near the refineries along the Houston Ship Channel area. The route in Texas will be located entirely within the Gulf Coastal Plains physiographic region. Within the Gulf Coastal Plains, three subprovinces will be crossed: the Coastal Prairies, the Interior Coastal Plains, and the Blackland Prairies. The Houston Lateral will be located entirely in the Coastal Prairie subprovince of the Coastal Plains physiographic region. The Texas soils range from the sandy piney woods to the Gulf Coast Prairie.

## 1.5 Water Resources

### 1.5.1 Surface Water

Water resources that occur along the Project route are located in three water resource regions, as identified by their major river systems (Seaber et al. 1994):

- The Missouri River Region (in Montana, South Dakota, Nebraska, and Northern Kansas);
- The Arkansas-White-Red Rivers region (in Southern Kansas, Oklahoma, and Northern Texas); and
- The Texas-Gulf rivers region (in Texas).

A detailed tabulation of perennial stream crossings can be found in **Table 1**.

**Table 1 Perennial Streams Crossed by the Keystone XL Project**

County	Approx. MP	Waterbody Name
<b>Montana</b>		
Valley	25.92	Frenchman Creek
Valley	39.24	Rock Creek
Valley	40.42	Willow Creek
Valley	66.89	Cherry Creek
Valley	82.69	Milk River
McCone	88.89	Missouri River
McCone	93.67	West Fork Lost Creek
McCone	94.52	Unnamed Stream
McCone	127.49	East Fork Prairie Elk Creek
McCone	146.50	Redwater River
McCone	153.22	Buffalo Springs Creek
Dawson	159.17	Berry Creek
Dawson	175.12	Clear Creek
Dawson	195.78	Yellowstone River
Prairie	201.32	Cabin Creek
Prairie	201.88	Cabin Creek
Prairie	201.94	Spring Creek
Fallon	226.71	Dry Fork Creek
Fallon	234.22	Pennel Creek
Fallon	235.53	Trib. Pennel Creek
Fallon	262.17	Little Beaver Creek
Fallon	281.20	Boxelder Creek

**Table 1 Perennial Streams Crossed by the Keystone XL Project**

<b>County</b>	<b>Approx. MP</b>	<b>Waterbody Name</b>
<b>South Dakota</b>		
Harding	291.82	Little Missouri River
Harding	317.85	South Fork Grand River
Harding	323.19	Clark's Fork Creek
Butte	356.24	North Fork Moreau River
Perkins	364.15	South Fork Moreau River
Meade	382.92	Pine Creek
Meade	399.23	Sulfur Creek
Pennington	425.58	Cheyenne River
Haakon	443.33	West Plum Creek
Haakon	478.65	Mitchell Creek
Haakon	480.90	Bad River
Tripp	535.43	White River
<b>Nebraska</b>		
Keya Paha	598.27	Keya Paha River
Keya Paha	602.46	Spring Creek
Rock	613.72	Niobrara River
Holt	628.63	South Fork Elkhorn River
Holt	645.49	Holt Creek
Holt	658.39	South Fork Elkhorn River
Wheeler	695.28	Cedar River
Nance	726.40	South Branch Timber Creek
Nance	727.61	Unnamed
Nance	736.50	Unnamed
Nance	738.59	Loup River
Merrick	745.03	Prairie Creek
Merrick	753.67	Warm Slough
Merrick	754.34	Platte River
York	763.29	Big Blue River
York	763.52	Big Blue River
York	773.04	Lincoln Creek
York	787.86	West Fork Big Blue

**Table 1 Perennial Streams Crossed by the Keystone XL Project**

<b>County</b>	<b>Approx. MP</b>	<b>Waterbody Name</b>
Filmore	805.99	Unnamed
Filmore	806.99	Turkey Creek
<b>Oklahoma</b>		
Okfuskee	38.94	North Canadian River
Seminole	48.38	Wewoka Creek
Hughes	74.92	Canadian River
Hughes	73.00	Little River
Coal	87.18	Muddy Boggy Creek
Coal	111.00	Clear Boggy Creek
Bryan	154.62	Red River
<b>Texas</b>		
Fannin	150.00	Red River
Fannin	160.37	Bois D’Arc Creek
Lamar	189.88	North Sulphur Creek
Delta	200.51	South Sulphur Creek
Smith	262.31	Sabine River
Rusk	311.35	Angelina River
Polk	366.08	Neches River
Liberty	412.39	Menard Creek
Liberty	457.51	Lower Neches Valley Canal
<b>Texas - Houston Lateral</b>		
Chambers	29.39	Devers Canal - West
Chambers	35.00	Trinity River

**1.5.2 Groundwater**

Groundwater resources within the Project area were reviewed with particular emphasis on the location of shallow aquifers less than 200 feet deep and shallow groundwater aquifers within 10 miles of the Project. Municipal water supplies are largely withdrawn from groundwater sources within the Project area, starting from the U.S border to approximately Jefferson County, Texas. Along the proposed route in Texas, a mixture of surface water reservoirs and groundwater wells serve municipal supply requirements. In addition, locations of private water wells along the proposed route will be determined.

**1.5.3 Floodplains**

Environmental effects to floodplains also were examined in the Project area. The Federal Emergency Management Agency (FEMA) defines a floodplain as being any land area susceptible to being inundated by

waters from any source (FEMA 2005). Within the Project area, low terraces that are susceptible to being inundated occur at nearly every stream crossing. Smaller intermittent and ephemeral drainages are typically narrow and flood infrequently. At crossings of rivers and larger perennial streams, floodplains are wider, and may flood more frequently depending on elevation and magnitude of the flood. Significant floodplain zones within the Project area are being determined.

#### **1.5.4 Wetland and Riparian Areas**

Wetland and riparian areas were identified along the Project by completing field surveys where possible, and by reviewing aerial photography and other publicly available data sources for inaccessible areas. Wetlands and waters of the U.S. along the proposed route were delineated in accordance with instruction provided by the U.S. Army Corps of Engineers (USACE) – Omaha, Kansas City, Tulsa, Fort Worth, and Galveston Districts. Approximately 802 miles, or 58 percent, of the Project has been surveyed to date, and associated wetlands mapped. National Wetland Inventory (NWI) maps, aerial photography, soils surveys, and other information were used to map wetlands where access was not obtained.

### **1.6 Vegetation**

Vegetation types crossed by the Project were characterized using national geographic information system (GIS) data layers, aerial photograph interpretation, observations made during field reconnaissance, and detailed information collected during field surveys. Twenty-six vegetation types or general land use categories are crossed by the proposed route. Dominant species commonly associated with these vegetation types and general land use categories will be described in the supplemental Environmental Report to be filed on or about November 19, 2008.

#### **1.6.1 Sensitive Plant Species**

Information pertaining to sensitive plant species within the Project area reflects responses received from the USFWS, Natural Heritage Programs (NHPs), and state wildlife agencies. This information will continue to be updated throughout the pre-construction process based on continued consultations.

Occurrence potential along the ROW was evaluated for each plant species based on its habitat requirements and/or known distribution. Based on these evaluations some sensitive plant species were eliminated from detailed analysis due to lack of habitat and species presence encountered during detailed analysis. The remaining species will be analyzed in greater detail including those for which field surveys are required by the USFWS and state wildlife agencies. A preliminary listing of those plants regarded as threatened or endangered potentially found within the Project area is provided in **Table 2**.

**Table 2 Special Status Species Potentially Occurring Along the Keystone XL Project**

Species	Scientific Name	Status	Montana	South Dakota	Nebraska	Kansas	Oklahoma	Texas
<b>Mammals</b>								
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	MT-SC; BLM-S	X					
Long-legged Myotis	<i>Myotis volans</i>	MT-SC; BLM-S	X					
Meadow Jumping Mouse	<i>Zapus hudsonius</i>	MT-SC	X					
Preble's Shrew	<i>Sorex preblei</i>	MT-SC	X					
Black-footed Ferret	<i>Mustela nigripes</i>	FE; BLM-SS; MT-SC; SD-E; NE-E	X	X	X			
Black-tailed Prairie Dog	<i>Cynomys ludovicianus</i>	MT-SC; BLM-S	X					
Swift Fox	<i>Vulpes velox</i>	MT-SC; BLM-S; SD-T	X	X				
River otter	<i>Lontra Canadensis</i>	SD-T; NE-T		X	X			
Black bear	<i>Ursus americanus</i>	FT/SA; TX-T						X
Louisiana black bear	<i>Ursus americanus luteolus</i>	FT; TX-T						X
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>	TX-T						X
Red wolf	<i>Canis rufus</i>	FE; TX-E						X
West Indian manatee	<i>Trichechus manatus</i>	FE; TX-E						X
<b>Birds</b>								
Bald eagle	<i>Haliaeetus leucocephalus</i>	BLM-SS; MT-SC; SD-T; NE-T	X	X	X		X	X
Peregrine falcon	<i>Falco peregrinus</i>	MT-SC; BLM-S; SD-E	X	X				X
Whooping crane	<i>Grus americana</i>	FE; SD-E; NE-E	X	X	X			
Piping plover	<i>Charadrius melodus</i>	FT; BLM-SS; MT-SC; SD-T; NE-T	X	X	X		X	X
Long-billed Curlew	<i>Numenius americanus</i>	MT-SC; BLM-S	X					
Interior least tern	<i>Sterna antillarum athalassos</i>	FE; MT-SC ;BLM-SS; SD-E; NE-E	X	X	X		X	X
Loggerhead shrike	<i>Lanius ludovicianus</i>	MT-SC; BLM-S	X					

**Table 2 Special Status Species Potentially Occurring Along the Keystone XL Project**

Species	Scientific Name	Status	Montana	South Dakota	Nebraska	Kansas	Oklahoma	Texas
Chestnut-collared Longspur	<i>Calcarius ornatus</i>	MT-SC; BLM-S	X					
Mountain Plover	<i>Charadrius montanus</i>	MT-SC; BLM-S	X					
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	MT-SC; BLM-S	X					
Boblink	<i>Dolichonyx oryzivorus</i>	MT-SC	X					
White-faced Ibis	<i>Plegadis chihi</i>	MT-SC; BLM-S	X					
American White Pelican	<i>Pelecanus erythrorhynchos</i>	MT-SC	X					
Eastern Bluebird	<i>Sialia sialis</i>	MT-SC	X					
Common Tern	<i>Sterna hirundo</i>	MT-SC	X					
Caspian Tern	<i>Hydroprogne caspia</i>	MT-SC	X					
McCown's Longspur	<i>Calcarius mccownii</i>	MT-SC; BLM-S	X					
Greater Sage Grouse	<i>Centrocercus urophasianus</i>	MT-SC; BLM-S	X					
Lark Bunting	<i>Calamospiza melanocorys</i>	MT-SC	X					
Swainson's Hawk	<i>Buteo swainsoni</i>	MT-SC; BLM-S	X					
Ferruginous Hawk	<i>Buteo regalis</i>	MT-SC; BLM-S	X					
Burrowing Owl	<i>Athene cunicularia</i>	MT-SC; BLM-S	X					
Sprague's pipit	<i>Anthus spragueii</i>	MT-SC; BLM-S	X					
Brewer's Sparrow	<i>Spizella breweri</i>	MT-SC; BLM-S	X				X	X
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	MT-SC	X					
Baird's Sparrow	<i>Ammodramus bairdii</i>	MT-SC; BLM-S	X					
Common Loon	<i>Gavia immer</i>	MT-SC; BLM-S	X					
Dickcissel	<i>Spiza americana</i>	MT-SC; BLM-S	X					
Franklin's Gull	<i>Larus pipixcan</i>	MT-SC; BLM-S	X					

**Table 2 Special Status Species Potentially Occurring Along the Keystone XL Project**

Species	Scientific Name	Status	Montana	South Dakota	Nebraska	Kansas	Oklahoma	Texas
Golden Eagle	<i>Aquila chrysaetos</i>	MT-SC; BLM-S	X					
Harlequin Duck	<i>Histrionicus histrionicus</i>	MT-SC; BLM-S	X					
Marbled Godwit	<i>Limosa fedoa</i>	MT-SC; BLM-S	X					
Northern Goshawk	<i>Accipiter gentilis</i>	MT-SC; BLM-S	X					
Willet	<i>Tringa semipalmata</i>	MT-SC; BLM-S	X					
Wilson's Phalarope	<i>Phalaropus tricolor</i>	MT-SC; BLM-S	X					
Yellow Rail	<i>Coturnicops noveboracensis</i>	MT-SC; BLM-S	X					
Attwater's greater prairie-chicken	<i>Tympanuchus cupido</i>	FE; TX-E						X
Brown Pelican	<i>Pelecanus occidentalis</i>	FE; TX-E						X
Eskimo Curlew	<i>Numenius borealis</i>	FE; TX-E						X
Reddish egret	<i>Egretta rufescens</i>	TX-T						X
Red-cockaded woodpecker	<i>Picoides borealis</i>	FE, TX-E						X
Swallow-tailed kite	<i>Elanoides forficatus</i>	TX-T						X
White-faced ibis	<i>Plegadis chihi</i>	TX-T						X
White-tailed hawk	<i>Buteo albicaudatus</i>	TX-T						X
Whooping crane	<i>Grus Americana</i>	FE; OK-E, TX-E					X	X
Wood stork	<i>Mycteria Americana</i>	TX-T						X
<b>Fish</b>								
Longnose Sucker	<i>Catostomus catostomus</i>	SD-T		X				
Northern Redbelly X Finescale Dace	<i>Phoxinus eos x Phoxinus neogaeus</i>	MT-SC; BLM-S	X					

**Table 2 Special Status Species Potentially Occurring Along the Keystone XL Project**

Species	Scientific Name	Status	Montana	South Dakota	Nebraska	Kansas	Oklahoma	Texas
Sauger	<i>Sander canadensis</i>	MT-SC; BLM-S	X					
Paddlefish	<i>Polyodon spathula</i>	MT-SC; BLM-S	X					X
Shortnose Gar	<i>Lepisosteus platostomus</i>	MT-SC; BLM-S	X					
Blue Sucker	<i>Cycleptus elongatus</i>	MT-SC; BLM-S	X					
Pallid sturgeon	<i>Scaphirhynchus albus</i>	FE; MT-SC; BLM-SS	X					
Sturgeon chub	<i>Macrhybopsis gelida</i>	MT-SC; BLM-S; SD-T	X	X				
Sicklefin chub	<i>Macrhybopsis meeki</i>	MT-SC; BLM-S	X					
Blacknose shiner	<i>Notropis heterolepsis</i>	SD-E; NE-E		X	X			
Northern redbelly dace	<i>Phoxinus eos</i>	SD-T; NE-T		X	X			
Pearl dace	<i>Margariscus margarita</i>	MT-SC; BLM-S; SD-T	X	X				
Finescale dace	<i>Phoxinus neogaeus</i>	NE-T			X			
Arkansas river shiner	<i>Notropis girardi</i>	FT; OK-T					X	
Blackside darter	<i>Percina maculata</i>	TX-T						X
Bluehead shiner	<i>Pteronotropis hubbsi</i>	TX-T						X
Blue sucker	<i>Cycleptus elongates</i>	TX-T						X
Creek chubsucker	<i>Erimyzon oblongus</i>	TX-T						X
Shovelnose sturgeon	<i>Scaphirhynchus platyrhynchus</i>	OK-SC, TX-T					X	X
Smalleye shiner	<i>Notropis buccula</i>	FC						X
<b>Reptiles/ Amphibians</b>								
Western Hog-nosed Snake	<i>Heterodon nasicus</i>	MT-SC; BLM-S	X					
Milksnake	<i>Lampropeltis triangulum</i>	MT-SC; BLM-S	X					
Massasauga	<i>Sistrurus catenatus</i>	NE-T			X			

**Table 2 Special Status Species Potentially Occurring Along the Keystone XL Project**

Species	Scientific Name	Status	Montana	South Dakota	Nebraska	Kansas	Oklahoma	Texas
Snapping Turtle	<i>Chelydra serpentina</i>	MT-SC	X					
Spiny Softshell	<i>Apalone spinifera</i>	MT-SC; BLM-S	X					
Common Sagebrush Lizard	<i>Sceloporus graciosus</i>	MT-SC	X					
Greater Short-horned Lizard	<i>Phrynosoma hernandesi</i>	MT-SC	X					
Great Plains Toad	<i>Bufo cognatus</i>	MT-SC; BLM-S	X					
Plains Spadefoot	<i>Spea bombifrons</i>	MT-SC; BLM-S	X					
Northern Leopard Frog	<i>Rana pipiens</i>	MT-SC; BLM-S	X					
Alligator snapping turtle	<i>Macrochelys temminckii</i>	OK-SC, TX-T					X	X
Atlantic Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	FE						X
Green sea turtle	<i>Chelonia mydas</i>	FT						X
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	FE						X
Leatherback sea turtle	<i>Dermochelys coriacea</i>	FE						X
Loggerhead sea turtle	<i>Caretta caretta</i>	FT						X
Louisiana pine snake	<i>Pituophis ruthveni</i>	FC; TX-T						X
Northern scarlet snake	<i>Cemophora coccinea copei</i>	TX-T						X
Smooth green snake	<i>Liochlorophis vernalis</i>	TX-T						X
Texas horned lizard	<i>Phrynosoma cornutum</i>	OK-SC, TX-T					X	X
Timber/Canebrake rattlesnake	<i>Crotalus horridus</i>	TX-T						X
<b>Invertebrates</b>								
American burying beetle	<i>Nicrophorus americanus</i>	FE; SD-SC; NE-E		X	X	X	X	
Ouachita rock pocketbook	<i>Arkansia wheeleri</i>							

**Table 2 Special Status Species Potentially Occurring Along the Keystone XL Project**

Species	Scientific Name	Status	Montana	South Dakota	Nebraska	Kansas	Oklahoma	Texas
<b>Plants</b>								
Raceme Milkvetch	<i>Astragalus racemosus</i>	MT-SC	X					
Nine-anther Dalea	<i>Dalea enneandra</i>	MT-SC	X					
Crawe's Sedge	<i>Carex crawei</i>	MT-SC; BLM-S	X					
Narrowleaf Penstemon	<i>Penstemon angustifolius</i>	MT-SC; BLM-S	X					
Blue Toadflax	<i>Nuttallanthus texanus</i>	MT-SC	X					
Bittersweet	<i>Celastrus scandens</i>	MT-SC	X					
Geyer's Milkvetch	<i>Astragalus geyeri</i>	MT-SC; BLM-S	X					
Persistent-sepal Yellow-cress	<i>Rorippa calycina</i>	MT-SC; BLM-S	X					
Sand Cherry	<i>Prunus pumila</i>	MT-SC	X					
Showy Prairie-gentian	<i>Eustoma grandiflorum</i>	MT-SC	X					
Plains Phlox	<i>Phlox andicola</i>	MT-SC; BLM-S	X					
Poison Suckleya	<i>Suckleya suckleyana</i>	MT-SC	X					
Hot Spring Phacelia	<i>Phacelia thermalis</i>	MT-SC	X					
Bractless Mentzelia	<i>Mentzelia nuda</i>	MT-SC; BLM-S	X					
Chaffweed	<i>Centunculus minimus</i>	MT-SC; BLM-S	X					
Small white lady's-slipper	<i>Cypripedium candidum</i>	NE-T			X			
Western prairie fringed orchid	<i>Platanthera praeclara</i>	FT; NE-T			X			
Neches River rose-mallow	<i>Hibiscus dasycalyx</i>	FC						X
Texas golden glade-cress	<i>Leavenworthia texana</i>	FC						X
Texas prairie dawn-flower	<i>Hymenoxys texana</i>	FE; TX-E						X
Texas trailing phlox	<i>Phlox nivalis texensis</i>	FE; TX-E						X

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FE = Federally endangered.

FT = Federally threatened.

FC = Federal candidate.

BLM-S = BLM Sensitive

BLM-SS = BLM Special Status

MT-SC = Montana Species of Conservation Priority.

SD-E = South Dakota endangered.

SD-T = South Dakota threatened.

SD-SC = South Dakota Species of Concern.

NE-SC = Nebraska species of special concern.

KS-E = Kansas endangered.

KS-T = Kansas threatened.

KS-SC = Kansas species in need of conservation.

OK-E = Oklahoma endangered.

OK-T = Oklahoma threatened.

## 1.6.2 Noxious and Invasive Weeds

After disturbance of the soil, vegetation communities may be susceptible to infestations of noxious weed species. The Federal Plant Protection Act contains a list of 137 federally restricted and regulated noxious weeds, including 19 aquatic and wetland weeds, 62 parasitic weeds, and 56 terrestrial weeds (7 Code of Federal Regulations [CFR] Chapter III, Part 360). Each state is required to comply with the rules and regulations set forth by this Act and to manage its lands accordingly. In addition, county weed control boards or districts are present in most counties crossed by the Project. These county weed control boards monitor local weed infestations and provide guidance on weed control. A listing of all known noxious and invasive weeds is being compiled based upon consultation with the Natural Resources Conservation Service (NRCS), weed control boards, and field surveys. Common noxious weeds that occur in the Project area include: Canada thistle (*Cirsium canadensis*), nodding plumeless thistle (*Cirsium nutans*), leafy spurge (*Euphorbia esula*), purple loosestrife (*Lythrum salicaria*), field bindweed (*Convolvulus arvensis*), and Johnson grass (*Sorghum halepense*).

## 1.7 Wildlife

### 1.7.1 Terrestrial Wildlife

Wildlife habitats along the proposed route consist of cropland, native prairie, sagebrush grasslands, range or pasture land, deciduous forest, riparian woodland, wetlands, aquatic, and riverine habitats. The predominance of agricultural areas along the proposed route increases the importance of the remaining undeveloped natural areas because they play an important role in sustaining native wildlife populations. Important undeveloped wildlife habitats that are crossed by the proposed route are being documented. A listing of threatened/endangered wildlife species potentially requiring surveys is provided in **Table 2**. Surveys for some of these species were completed in 2008.

### 1.7.2 Aquatic Resources

Aquatic resources include fish and invertebrate communities that inhabit perennial streams and pond/lake environments. The description of aquatic communities focuses on important species such as species with recreational or commercial value, and special status species (i.e., threatened, endangered or sensitive species). The study area for environmental impacts on important fisheries for the Project include fisheries located immediately downstream of the proposed pipeline crossings and waterbodies located within approximately 0.5 mile of the proposed route that support important fisheries. For the purpose of describing aquatic resources, it is assumed that invertebrates are present in all Project area waterbodies. A listing of the perennial streams crossed by the Project is provided in **Table 1**.

## 1.8 Land Use

A compilation of all residential areas and public assembly locations (e.g. hospitals, churches, assembly halls, government buildings) within 50 feet of the proposed Project workspace, including ownership and known land uses is ongoing. Approximately 42.6 miles of federal lands will be crossed in Montana. A summary of land uses and ownership encountered by the Project is provided in **Tables 3 and 4**.

Recreation and special interest areas crossed by the proposed route also are being documented, such as USFWS Wetland Easements, NRCS conservation easements, and Conservation Reserve Program (CRP) lands. USFWS easements are areas that have permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). A NRCS easement also confers protection to federally listed endangered and threatened species throughout the area. Similar to USFWS easements, NRCS conservation easement areas provide long-term or permanent protection for areas the landowner has restored to natural land cover type with NRCS funding assistance. Precise location information for these

easement areas has been requested from the agencies and, if provided, will be documented in a supplemental Environmental Report.

**Table 3 Land Uses Crossed by the Keystone XL Project (miles)**

Land Use	MT	SD	NE	OK	TX	Total
Developed	0.1	<0.1	<0.1	24.9	38.6	63.6
Agriculture/Cropland	106.2	120.5	181.7	10.7	50.4	469.5
Grassland/Rangeland	172.7	191.4	70.9	77.4	117.9	630.2
Forest Land	0.8	0.9	0.0	40.0	120.7	162.4
Water/Barren	2.0	0.0	0.5	1.2	12.4	16.1
Wetlands	0.5	0.0	2.1	0.7	30.5	33.8
Total	282.3	312.8	255.2	154.9	370.5	1,375.7

Based on National Land Cover information (USGS 2008).

**Table 4 Ownership of Land Crossed by the Keystone XL Project (miles)**

State	Federal	Tribal	State	Private	Water	Total
Montana	42.6	0.0	19.1	220.3	0.3	282.3
South Dakota	0.0	0.0	20.9	291.7	0.2	312.8
Nebraska	0.0	0.0	0.0	255.2	0.0	255.2
Oklahoma	0.0	0.0	1.8	151.9	1.2	154.9
Texas	0.0	0.0	1.4	367.7	1.4	370.5
Keystone XL Project Total	42.6	0.0	51.9	1269.9	3.1	1,375.7

The majority of the proposed route crosses croplands and rangelands. With the exception of proposed facilities within existing industrial sites, pump stations will be located on cropland, pastureland, or grassland/rangeland. Some land impacted by the Project may be terraced and/or have subsurface drainage systems installed.

## 1.9 Noise

Because the primary land uses along the Project route are agricultural and rural, existing ambient noise levels along the pipeline route are low. It is estimated that day-night average levels ( $L_{dn}$ ) on the A weighted scale (dBA) range between 40 dBA (rural residential) and 45 dBA (agricultural cropland) (USEPA 1978). Ambient (background) noise levels occur from roadway traffic, farm machinery on a seasonal basis, pets, and various other household noises. Pipeline areas along major highways and interstates may experience higher ambient noise levels of approximately 68 to 80 dBA (USEPA 1978).

## **1.10 Cultural Resources**

Cultural resources are protected by a series of federal laws enacted to protect these resources from damage or loss resulting from federally-funded or permitted activities. These include the Antiquities Act of 1906, Historic Sites Act of 1935, Executive Order (EO) 13007, the National Historic Preservation Act (NHPA) of 1966, as amended, Archaeological and Historic Preservation Act of 1974, and Archaeological Resources Protection Act of 1979. EO 11593 also provides guidance on protection and enhancement of cultural resources.

In compliance with federal laws enacted to protect cultural resources from damage resulting from federally funded or permitted activities, including the NHPA, cultural resource investigations are being conducted for each state crossed by the proposed Project. These investigations are being conducted in consultation with the State Historic Preservation Offices (SHPOs) for each state as well as the BLM cultural resource specialists. A description of the investigation being conducted for each state is being summarized. Cultural resource field inventories are well underway, pursuant to SHPO-approved plans, to determine whether there are properties in the Project area that are eligible or potentially eligible for inclusion in the National Register of Historic Properties (NRHP). Survey reports describing field efforts to date and a listing of NRHP-eligible or potentially eligible properties is being compiled.

## **1.11 Native American Engagement**

Federal statutes require that the lead federal agency in a federal undertaking consult with Native American tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by federally-approved actions. These federal statutes are interrelated and include Section 106 NHPA of 1966, as amended; EO 13007; the American Indian Religious Freedom Act of 1978; and the Native American Graves Protection and Repatriation Act of 1990. Keystone has initiated informal engagement with a number of Native American tribes in the vicinity of the Project in order to gain an understanding of the tribes' concerns and interests with respect to the proposed Project. Keystone has made clear to the tribes that this engagement does not constitute, nor is it a substitute for, the "government-to-government" consultation to be conducted by the lead federal agency.

## **1.12 Socioeconomics**

A list of communities that may be affected by the proposed Project and their respective year 2000 population statistics is being compiled. This list identifies all communities within 0.5 and 2.0 miles of the Project. In addition, the population size, unemployment rate, and income trends in the counties crossed by the proposed route are being assessed. The proposed route lies in predominantly rural and sparsely populated areas, with population densities generally ranging from approximately three to 50 people per square mile for the majority of the route. Within these communities, infrastructure, fiscal relationships, and issues pertaining to environmental justice are being researched.

## **1.13 Public Health and Safety**

Keystone is preparing a preliminary risk assessment for the accidental release of crude oil from the pipeline. The assessment will include the likelihood of crude oil releases and potential for environmental effects or impacts on public health and safety, based on release volumes and locations.

## **1.14 Public Participation**

### **1.14.1 Stakeholder Relations and Open Houses**

The Project has been engaged in public consultation since March 2008. Project public consultation activities have allowed the Project to reflect input from stakeholders during preliminary planning. Stakeholder relations activities also have produced feedback that will guide the planning and execution of future

consultation activities and project development. Project public consultation activities, which will continue during Execution of the Project, have been focused on the Gulf Coast segment of the Project in Oklahoma and Texas, and the Steele City segment of the Project in Montana, South Dakota, and Nebraska.

Beginning with briefings for officials at the local, county, and state levels and continuing with open houses in communities along the route, the Project is committed to ongoing and regular correspondence, communication, and consultation with all stakeholders. The project has developed a website ([www.transcanada.com/keystone/kxl.com](http://www.transcanada.com/keystone/kxl.com)), an email address ([keystone@transcanada.com](mailto:keystone@transcanada.com)), and a toll-free telephone number (1-866-717-7473), for stakeholders to obtain new information and to enable them to contact us easily.

**1.14.2 Community Leader Meetings**

Community leader meetings were designed to:

- Introduce the Project and stakeholder team members and obtain initial feedback;
- Ensure that community leaders were comfortable with the Project’s approach for Open Houses; and
- Start building relationships with county and local officials, state legislators, and other community leaders in areas on and adjacent to the proposed pipeline route.

**1.14.3 Open Houses**

In June and July 2008, 27 open houses were held along the Project route to inform landowners, stakeholders, and other interested members of the communities along the proposed route about the Project and to gather input and feedback. **Table 5** indicates the locations of the open houses held along the route in the U.S.

**Table 5 U.S. Open House Locations**

State	Town
Montana	Glasgow
	Circle
	Glendive
	Baker
South Dakota	Buffalo
	Faith
	Phillip
	Murdo
	Winner
Nebraska	Atkinson
	Burwell
	Fullerton
	York
	Fairbury

**Table 5 U.S. Open House Locations**

State	Town
Kansas	Clay Center
	El Dorado
Oklahoma	Ada
	Stroud
	Durant
Texas	Paris
	Winnsboro
	Tyler
	Nacogdoches
	Lufkin
	Liberty
	Livingston
	Beaumont

**1.14.4 Issues**

A summary of issues and comments from the Open Houses is provided below under six main topic areas.

- Economic impact: Many of the rural communities through which the Project is proposed are seeking jobs and involvement in other potential economic activity. As a result, these communities had a positive view of the Project’s potential to create local jobs and generate opportunities for local businesses to provide goods and services.
- Tax revenue: The possibility of significant tax revenue was attractive to local and state governments.
- Route location and selection: Stakeholders raised wide ranging issues related to route location and the route refinement process.
- Safety and environment: Many attendees asked general questions related to pipeline safety, including environmental impact of potential leaks, potential water contamination and impact on water sources (existing water lines, aquifers, and irrigation systems), noxious weed impacts, protection of sandhills and wetlands, impact on productivity, and tree cover impacts.
- Easement agreements: Several issues related to easements were discussed, including such matters as liability and cleanup responsibility, as well as the benefit of compensation to affected landowners.
- Construction: There was interest in such issues as depth of cover, impact on roads, construction methods, and time of year when construction will occur.

**1.14.5 Agency Concerns and Permit Requirements**

A preliminary list of concerns expressed to date by agency personnel is provided in **Table 6**. An initial list of permits, licenses, approvals, and consultations required for the Project is shown in **Table 7**.

**Table 6 Agency Concerns Related to the Keystone XL Project**

Agency Contacts	Concerns	Concerns Addressed
MFWP	Land Use, Sage Grouse	Potential issues with sage grouse leks on the Cornwell easement in Valley County – land currently being purchased by the MFWP. May require offsite mitigation.
MFWP	Raptors, Swift Fox	Aerial raptor surveys for April are too early. ROW goes right through the heart of Swift Fox occupied habitat. Many Burrowing Owls in northern Phillips & Valley Counties.
MFWP	Sage and Sharp-tail Grouse	Pre-development surveys recommended along proposed corridor between mid-March-mid-May for sage & sharp-tail grouse.
USFWS , MFWP	General	Concerns include short- & long-term impacts, oil spills, pump stations, pipe construction, & environmental.
MFWP	Water	Milk River Cooperative agreement may require specific mitigation.
USACE MT	Power line	We propose a reroute from ~MP 96 - ~MP104 due to a Power Line and the aforementioned Find.
USFWS MT	Cheyenne & White Rivers Crossing	Recommend HDD.
NGPC, SDGFP, MFWP, USFWS	Special Status Species	Analysis of Special Status Species habitats should include specific habitats for specific species, as indicated through consultation.
NGPC, SDGFP, MFWP, USFWS	Special Status Species	Analysis of Special Status Species habitats should include specific habitats for specific species, as indicated through consultation.
USFWS - SD	Land Use	Locations of some wetland easements close to the proposed pipeline.
Standing Rock Sioux THPO, SD	Cultural Resources	Prefer lead agency to be BLM.
SDGFP	Sage and Prairie Grouse	Incorporate Prairie & Sage grouse survey protocols from SD Wildlife Survey Manual 2003-2009.
SDGFP	Swift Fox	See article by Sovada and Sargeant for Swift Fox protocol.
South Dakota State Univ.	Reptile/Amphibian habitat	Contact Ms. Milda Vaitkus in CALMIT at the University of Nebraska-Lincoln for potential amphibian and reptile habitat in Nebraska.
South Dakota State Univ.	Fish distribution	Contact Dr. Scott Sowa of MoRAP for habitat distribution of fishes.

**Table 6 Agency Concerns Related to the Keystone XL Project**

Agency Contacts	Concerns	Concerns Addressed
NRCS-NE	Mitigation	Pipeline construction concerns and Pipeline mitigation recommendations.
FSA, NE	Land Use	May require a FOIA request to release FSA information
FSA, NE	Land Use	CRP lands may need to be removed from contract for the addition of a pipeline.
Burying Beetle expert, University of Nebraska at Kearney	Burying Beetle	Use current NE ABB guidelines from FWS. Highest population densities are in Tripp & SW Gregory Counties.
Lower Loup Natural Resource District, NE	Water	Want Storm Water Pollution Prevention Plan.
NPS NE	Land Use	Potential NPS issues that may arise: crossing Nationwide Rivers Inventory (candidate species) or any National Historic Trails such as the Oregon Trail, Pony Express Trail, California Trail (2 branches), and Missouri River (Lewis & Clark Trail).
NGPC	Land Use	Holt Creek Wildlife Management Area potential crossing.
USFWS Tulsa	Burying Beetle	Mitigation to the USFWS.
	Arkansas River Shiner	HDD Waterbodies in known areas.
USFWS Arlington	Red-Cockaded Wood Pecker	Avoiding nesting areas.
	Bald Eagle	Helicopter flyover has been conducted 2008 and planned 2009.
USFWS Lufkin	Red-Cockaded Wood Pecker	Avoiding nesting areas.
USFWS Galveston	Bald Eagle	Helicopter flyover has been conducted 2008 and planned 2009.
USACE Tulsa	Wetlands	Conduct a wetland survey. Avoid if possible or HDD, if not, mitigate loss.
USACE Fort Worth	Wetlands	Conduct a wetland survey. Avoid if possible or HDD, if not, mitigate loss.

**Table 7 Permits, Licenses, Approval, and Consultation Requirements for the Keystone XL Project**

Jurisdiction	Agency	Regulatory Approval, Authorization, Review
Federal	Department of the Interior, Bureau of Land Management	Right-of-way Grant and Temporary Use License (Final Standard Form 299)
	Department of State	Presidential Permit
	Lead Federal Agency	Historical Resources Review in compliance with section 106 of National Historic Preservation Act
		Listed Species Review and compliance with Section 7 of the Endangered Species Act
		Archaeological Survey Permits for BLM lands.
	Department of the Interior, Fish and Wildlife Service	Review under Section 7 of the ESA Potential wetland easements
	Department of Transportation, Office of Pipeline Safety	Review of High Consequence Areas
		Emergency Response Plan Review
		Special Permit for Pipe Design Factor
	Department of Transportation, Federal Highway Administration	Federal Highway Crossing Permits and Easements
	Department of Treasury, Bureau of Alcohol, Tobacco and Firearms	Explosives Permits
	U.S. Army Corps of Engineers	Section 404 permits or Nationwide permits for wetland and stream crossings
Section 10 Navigable Waters Crossing Permits		
Montana	Department of Environmental Quality	Major Facility Siting Act Certificate
		Coordination of State Environmental Review Process under Montana Environmental Policy Act
		401 Water Quality Certificate for Stream and Wetland Crossings issued with the USACE Permits
		Water Quality Permit for Exceeding Suspended Solid Thresholds
		Permits for Underground Fuel Storage Tanks or Fuel Lines to Aboveground Tanks
		Water use and water well drilling permits
		Permits for discharging hydrostatic test water, trench dewatering and diverting stormwater

**Table 7 Permits, Licenses, Approval, and Consultation Requirements for the Keystone XL Project**

<b>Jurisdiction</b>	<b>Agency</b>	<b>Regulatory Approval, Authorization, Review</b>
Montana (Cont)	Department of Natural Resources and Conservation	Approval to Work In or Near Perennial Streams
		Right-of-way Grant Across State Lands and the Beds of Navigable Waterways
		Floodplain Permits
		National Pollutant Discharge Elimination System Permits for construction
	Department of Fish, Wildlife and Parks	Review of Projects Affecting the Beds and Banks of Waterways
		Review of Effects on Natural Resources and Threatened or Endangered Species
	Department of Transportation	State Highway Encroachment Permits and Occupancy Agreement
	State Historic Preservation Office	Historical Resources Review
	County and Local Authorities	Pump Station Zoning Approvals, where required
		Special or Conditional Use Permits, where required
		County and Township Road Crossing Permits
	South Dakota	Department of Environment and Natural Resources
National Pollutant Discharge Elimination System Permits for construction		
Hydrostatic Testing Permit		
Department of Game, Fish and Parks		Threatened and Endangered Species Review
State Historic Preservation Office		Historical Resources Review
Public Utilities Commission		Pipeline Siting Act Certificate
County and Local Authorities		Pump Station Zoning Approvals, where required
		Special or Conditional Use Permits, where required
		County and Township Road Crossing Permits

**Table 7 Permits, Licenses, Approval, and Consultation Requirements for the Keystone XL Project**

<b>Jurisdiction</b>	<b>Agency</b>	<b>Regulatory Approval, Authorization, Review</b>
Nebraska	Department of Environmental Quality	401 Water Quality Certificate for Stream and Wetland Crossings issued with USACE permits
		National Pollutant Discharge Elimination System Permits for construction
		Construction Permit for Tank Farm
	Games and Parks Commission	Threatened and Endangered Species Review
	State Historic Preservation Office	Historical Resources Review
	County and Local Authorities	Pump Station Zoning Approvals, where required
		Special or Conditional Use Permits, where required
County and Township Road Crossing Permits		
Kansas	Department of Agriculture	Pipeline Stream Crossing or Buried Cable General Permit (if applicable)
	Department of Health and Environment, Bureau of Water	401 Water Quality Certificate for Stream and Wetland Crossings issued with the USACE Permits
	Department of Health and Environment, Bureau of Water	Hydrostatic Testing Permit (if applicable)
		Water Withdrawal Permit (if applicable)
	Department of Wildlife and Parks	Non-game and Endangered Species Action Permit (if applicable)
	Department of Transportation	State Highway Crossing Permits (if applicable)
	State Historic Preservation Office	Historical Resources Review (if applicable)
	County and Local Authorities	Pump Station Zoning Approvals, where required
		Special or Conditional Use Permits, where required
County and Township Road Crossing Permits (if applicable)		
Oklahoma	Oklahoma Water Resources Board	401 Water Quality Certificate for Stream and Wetland Crossings issued with USACE permits
		Water Use, Appropriate and Stream Access Permits
		Hydrostatic Test Water Discharge Notice

**Table 7 Permits, Licenses, Approval, and Consultation Requirements for the Keystone XL Project**

<b>Jurisdiction</b>	<b>Agency</b>	<b>Regulatory Approval, Authorization, Review</b>
Oklahoma (Cont)	Department of Environmental Quality	National Pollutant Discharge Elimination System Permits for construction
	Department of Wildlife Conservation	Threatened and Endangered Species Review
	State Historic Preservation Office	Historical Resources Review
	County and Local Authorities	Pump Station Zoning Approvals, where required
		Special or Conditional Use Permits, where required
County and Township Road Crossing Permits		
Texas	Commission on Environmental Quality, Water Quality Division	401 Water Quality Certificate to cross Streams and Wetlands (issued with USACE permits)
	Commission on Environmental Quality	National Pollutant Discharge Elimination System Permits for construction
		Construction Permit for Tank Farm
	Coastal Coordination Council	Evaluation for Compliance with the Coastal Zone Management Act (if applicable)
	Department of Parks and Wildlife	Approval to Disturb More than 1,000 Cubic Yards of Excavated Material (if applicable)
		Threatened and Endangered Species Review
	State Historic Preservation Office	Historical Resources Review
	Texas General Land Office	Right-of-Way Grant Over State-Owned Lands or submerged lands
	Texas Railroad Commission	Various Forms Related to Pipeline Location, Operation, and Financial Security
		Hydrostatic Test Water Discharge Notice
		Water Use Permit
	County and Local Authorities	Pump Station Zoning Approvals, where required
		Special or Conditional Use Permits, where required
		County and Township Road Crossing Permits

## **1.15 Environmental Justice**

To facilitate meeting the Department of State's obligations under EO 12898, environmental justice considerations, including information on minority and low-income populations likely to be affected by construction of the proposed pipeline, are being assessed.

## **1.16 Alternatives**

### **1.16.1 System Alternatives**

The following pipeline system alternatives could potentially provide incremental crude transportation service from Canada to the U.S. Gulf Coast (USGC) market.

#### **1.16.1.1 Altex Proposal**

Altex is a proposed direct 2,350 mile greenfield pipeline system between Fort McMurray, Alberta, and the USGC. The proposed initial capacity is 425,000 bpd of heavy crude, with a stated in service date of 2011.

#### **1.16.1.2 KinderMorgan/TEPPCO Chinook Proposal**

Chinook is a proposed direct 2,050 mile greenfield pipeline system between Hardisty, Alberta, and the USGC. KinderMorgan proposes to construct the portion between Hardisty and Cushing, while TEPPCO would construct the portion between Cushing and the USGC. The proposed initial capacity would be 300,000 bpd of heavy crude with a stated in service date of 2012.

#### **1.16.1.3 ExxonMobil/Enbridge Texas Access Proposal**

Texas Access is a proposed 856 mile greenfield pipeline between Patoka, Illinois, and the USGC with a stated in service date of 2014. The proposed initial capacity is 445,000 bpd. The Project proponents have recently announced a delay in development of the Project.

#### **1.16.1.4 Enbridge's Trailbreaker**

Enbridge's Trailbreaker refers to a proposal to ship crude to the northeast U.S., then transfer crude by ship from the northeast U.S. to the USGC by 2010. The proposal includes a number of interrelated projects including an Enbridge Lakehead pipeline expansion between Chicago, Illinois, and Sarnia, Ontario, the reversal of Enbridge's Canadian mainline between Sarnia to Montreal, Quebec, a reversal of the Portland Pipeline from Montreal to Portland, Maine, and transport by ship between Portland, Maine, and the USGC market. The stated potential capacity of the Trailbreaker proposal is up to 200,000 bpd of heavy crude.

#### **1.16.1.5 Enbridge/BP Proposal**

Enbridge and BP recently announced plans to develop a new delivery system to transport Canadian heavy crude oil from Flanagan, Illinois, to Houston and Texas City, Texas, with an initial total system capacity of 250,000 bpd by late 2012. The proposed delivery system would connect to Enbridge's Lakehead pipeline system at Flanagan, utilize an existing BP pipeline system between Flanagan and Cushing, Oklahoma, and new pipeline construction south of Cushing to connect to markets in Houston and possibly Nederland, Texas.

#### **1.16.1.6 ExxonMobil Pegasus Pipeline**

Pegasus is an ExxonMobil crude oil pipeline currently providing crude oil transportation service between Patoka, Illinois, and Nederland, Texas. The capacity of the pipeline is 66,000 bpd in heavy crude service, of which 50,000 bpd is committed capacity. Pegasus is contemplating a potential incremental expansion of 30,000 bpd.

### **1.16.1.7 System Alternatives Comparison**

In comparison to the greenfield Altex and Chinook pipeline proposals, the total length of the Project at 1,704 miles is more direct, providing shippers advantages in both inventory and transit time from an established crude oil supply hub. Compared to these proposals the Project has advanced field studies supporting a regulatory process and advanced procurement processes that would allow the Gulf Coast segment to be available for in-service by the second Quarter of 2011.

In comparison to the remaining alternatives, the Gulf Coast segment of the Project is proposed to be in-service by the second Quarter of 2011, with the Steele City segment in-service by the first Quarter of 2012, well before 2014 as proposed by Texas Access and in advance of the end of 2012 as proposed in the Enbridge/BP alternative. While only the Trailbreaker proposal has a more near-term proposed in-service timeline of 2010, close to that of the Gulf Coast segment, Trailbreaker is not capable of providing the significant incremental capacity to the USGC as requested by shippers. Notably, the Project already has market support for 300,000 bpd of commitments, a demand level which significantly exceeds the proposed capacity of both the Trailbreaker and Pegasus expansion alternatives.

The Project is the only identified alternative that has obtained definitive market support in the form of contractual commitments totaling 300,000 bpd, which enables the Project to proceed with regulatory applications and, pending successful regulatory and environmental approvals, with construction of the pipeline. The Project also concluded a binding Open Season on September 4, 2008 to provide other shippers an opportunity to further participate in the Project. Keystone is currently evaluating the bids submitted during the Open Season, which may provide additional support in excess of the 300,000 bpd of commitments received to date.

Shippers – producers, marketers or refiners – evaluate the merits of various pipeline proposals and ultimately decide which projects to support. Shippers have expressed material interest in the Project and in securing additional crude oil pipeline capacity through binding contract commitments. These binding commitments demonstrate a material endorsement of support for the Project, its economics, proposed route, and target market, as well as the need for incremental pipeline capacity and access to Canadian crude supplies.

### **1.16.2 Route Alternatives**

The proposed route for the Project was developed through an iterative, multidisciplinary route selection process. This process involved the systematic identification of objectives, control points, collection of data, review of alternatives, and continual reassessment of these factors as refinement occurred. Additionally, the process unfolded in two distinct phases, given modifications to basic Project objectives which had significant impacts on suitable routing alternatives.

#### **1.16.2.1 Definition of Control Points**

The following control points served to define the route:

- U.S./Canada border crossing near Morgan, Montana;
- Construction limitations at Fort Peck Reservoir, Montana;
- Crossing the Niobrara River at locations not designated as Wild and/or Scenic;
- Opportunity to connect with the Cushing Extension, a portion of the Keystone Pipeline Project;
- Delivery point at Cushing, Oklahoma;

- Delivery point at Nederland, Texas; and
- Delivery point at the Houston Ship Channel, Texas.

#### **1.16.2.2 Steele City Segment**

The Steele City segment of the project takes a more obviously direct route from Hardisty, Alberta to Steele City, Nebraska than that of the Keystone Pipeline project. The development of the Keystone Pipeline project included the conversion to crude oil service of a significant underutilized segment of TransCanada's Canadian Mainline assets from the Alberta border running east through Saskatchewan to Manitoba. No other existing assets are available for this kind of conversion and use on the Project, therefore a direct route was chosen.

Four route alternatives were analyzed for the Steele City segment of the Project to deliver oil to Cushing, Oklahoma. One alternative was construction of a new pipeline directly from the U.S./Canada border to the delivery point at Cushing. This alternative did not take advantage of the opportunity to connect to a previously permitted pipeline, the Cushing Extension, which is being built as a portion of the Keystone Pipeline Project; therefore, it would require construction of several hundred more miles of pipeline than other alternatives, with associated costs and environmental disturbances. For these reasons, this alternative was removed from further consideration.

Other alternatives involved construction of new pipe to a point near Steele City, Nebraska, where the Project could then connect with the Keystone Pipeline Project Cushing Extension to deliver oil to Cushing, Oklahoma (please refer to **Figure 2**). Of the three remaining routes that were considered, the Project team identified Steele City Route Option B as the preferred route. Several factors led to this decision:

- Steele City Route Option B is approximately 100 miles shorter than Steele City Route Option A1A;
- The route traverses mostly open range land rather than the significant amounts of agricultural land found on Steele City Route Option A1A;
- The route is less congested in relation to population; and
- There appear to be no fatal flaws with Steel City Route Option B; however, as biological and cultural resource surveys continue, further refinements of the Project alignment are being considered.

#### **1.16.2.3 Gulf Coast Segment and Houston Lateral**

Based on all the information reviewed to date, especially that gathered during the route reconnaissance, it was determined that the currently preferred Gulf Coast mainline segment and the Houston Lateral (a hybrid of the original route Options A and B) provided the most desirable alternatives to the target areas of Nederland. The Gulf Coast segment is approximately 478 miles in length (please refer to **Figure 3**).

#### **1.16.2.4 Houston Lateral**

Houston Lateral is approximately 47 miles in length (please refer to **Figure 4**).

Several factors led to this recommendation:

- Houston Lateral incorporates many of the advantages of the originally considered routes into a single route. It has less urban construction to the north coupled with less timbered wetlands to the south;
- The currently preferred configuration potentially requires no break out tanks;

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- Houston Lateral has greater co-location than the alternative; and
- The alternative also crosses Galveston Bay, increasing environmental impacts and the number of regulatory issues and permits.

## 2.0 References

Hammond 1965

Seaber, P. R., F. P. Kapinos, and G. L. Knapp. 1994. Hydrologic Unit Maps. U.S. Geological Survey, Water-Supply Paper 2294. Second printing, U.S. Government Printing Office, Washington, D.C.

Thornbury, W.D. 1965. Regional Geomorphology of the United States. John Wiley and Sons, Inc. New York.

U.S. Environmental Protection Agency (USEPA). 1978.

US Environmental Protection Agency (USEPA) 1978. Protective Noise Levels. Condensed Version of USEPA Levels Document. USEPA 550-9-79-100. November 1978.

## Glossary

Term	Definition
access road	A temporary or permanent road that provides access to a facility, campsite, pipeline right-of-way, water source or infrastructure site.
adverse environmental effect	The impairment of, or damage to, the environment.
alluvial	Pertaining to, or consisting of, alluvium, or material deposited by flowing water.
alluvial deposits	Pertaining to, or consisting of, all sediments, past and present, deposited by flowing water, including glaciofluvial deposits. Wave-worked deposits and deposits resulting from sheet erosion and mass wasting are not included.
alluvial fan	A fan-shaped deposit of alluvium that is laid down by a stream at the point where it emerges from upland into less steeply sloping terrain (e.g., Neutral Hills). (TransCanada Keystone Pipeline GP Ltd.)
alluvial horizon	A soil horizon that has been formed by the process of alluviation, which is the downward or lateral removal of material in solution or suspension.
alluvium	Pertaining to, or consisting of, unconsolidated material, usually clay, sand, silt and gravel, deposited by flowing water.
amphibian	Any of the class of cold-blooded vertebrates, including frogs, toads and salamanders intermediate between fishes and reptiles; they have gilled aquatic larva and air-breathing adults. (TransCanada Keystone Pipeline GP Ltd.)
aquatic	Growing in, living in, or frequenting water. Also, occurring, or situated in, or on, water.
aquifer	A saturated geologic unit having relatively higher permeability compared with adjacent units and that can transmit relatively greater quantities of water under normal hydraulic gradients. (TransCanada Keystone Pipeline GP Ltd.)
archaeology	The discipline that investigates past human cultures by recovering, analyzing, describing and interpreting their remains. (TransCanada Keystone Pipeline GP Ltd.)
archaeological site	A location that contains evidence of past human activity, such as artifacts or structural remains.
artifact	Any portable object made, modified or used by humans, including tools, weapons, ceremonial items, art objects, industrial materials and floral and faunal materials. (TransCanada Keystone Pipeline GP Ltd.)
artifact scatters	Any location that contains a collection of artifacts indicative of human activities but lacking evidence of specific habitation. Such a site can be identified in a surface or buried context. (TransCanada Keystone Pipeline GP Ltd.)

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Term	Definition
atmospheric attenuation	The attenuation of sound as it is absorbed by parts of the atmosphere. (TransCanada Keystone Pipeline GP Ltd.)
atmospheric environment	The layer of air near the earth's surface to a height of about 10 km. (TransCanada Keystone Pipeline GP Ltd.)
average channel depth	The total of all depth measurements divided by the number of measures taken.
backfill	The fill material used to cover a completed pipeline. Adequate fill material is provided above and below the pipe to prevent damage caused by loose rock, abrasion, shifting or washouts.
backhoe	An excavating machine, fitted with a hinged arm with a rigidly attached bucket, used for excavating ditches.
badlands	A land type generally devoid of vegetation and broken by an intricate maze of narrow ravines, sharp crest, and pinnacles resulting from serious erosion of soft geologic materials. This type is most common in semi-arid or arid regions. (TransCanada Keystone Pipeline GP Ltd.)
bank	The rising slope or face of ground bordering a watercourse. It is located above the streambed and below the level of rooted vegetation.
bankfull width	The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters this is often the 1:2 year flood flow return level.
barrel	A volume of oil equal to 42 U.S. gallons (0.1589873 m <sup>3</sup> ). The barrel originated in the Pennsylvania oil fields of the 19th Century. Originally there were two types of barrels, 40 and 42 gallons used to transport oil by cart and railway. However, by the early 1870s the industry adopted Standard Oil's 42-gallon "blue" (from its color) barrel as the standard. Though oil has not been transported in barrels for over a century, the barrel continues in international use for measuring and pricing oil.
baseline	A surveyed condition that serves as a reference point to which later surveys or assessments are coordinated and correlated.
batch	Petroleum is shipped by pipeline in batches of uniform quality. When there are adjacent batches of different qualities, there will be some mixing at the interface between the batches. The mixing can be minimized by operating the pipeline in a turbulent flow regime (which reduces the absolute size of the mixing interface compared to laminar flow) and by scheduling large batch sizes (which reduces the relative amount of mixed petroleum in each batch.)
bed and banks - SEE BANKS DEFINITION	The streambed and the rising slope or face of ground bordering a watercourse, up to the level of rooted perennial terrestrial vegetation. (TransCanada Keystone Pipeline GP Ltd.)

Term	Definition
bedrock	Solid rock either exposed at the surface or found underlying soil or any other unconsolidated surficial cover. (TransCanada Keystone Pipeline GP Ltd.)
berm	A containment structure, reaching above ground-level, constructed with materials, such as soil, soil-filled bags, and synthetic materials.
best available technology economically achievable (BATEA)	Selection and employment of technology that is normal (or better) for the specific industry, is energy efficient and economically viable. (TransCanada Keystone Pipeline GP Ltd.)
best management practices (BMPs)	A practice or combination of practices that are determined to be the most technically and economically feasible means of preventing or managing potential effects. (TransCanada Keystone Pipeline GP Ltd.)
blowout	A small area from which soil material has been removed by wind. (TransCanada Keystone Pipeline GP Ltd.)
canopy	The cover of branches and foliage formed by tree crowns or the tallest layer of vegetation in an area.
campsite, archaeological	A location containing artifacts that are more patterned in their distribution, including evidence of a fireplace or hearth and which are indicative of habitation activities. May include other culturally modified materials such as lithics, faunal remains, ceramics and structural remains. Such a site can be identified in a surface or buried context. (TransCanada Keystone Pipeline GP Ltd.)
capability class	A rating that indicates the capability of land for some use such as agriculture, forestry, recreation or wildlife. In the Canadian system, it is the grouping of lands with the same relative degree of limitation or hazard (nil in Class 1 and becomes progressively greater to Class 7). (TransCanada Keystone Pipeline GP Ltd.)
channel	A natural or artificial waterway that periodically or continuously contains moving water, has a defined bed (evidence of alluvial scour), and has banks that confine water at low to moderate streamflow.
clay	As a particle-size or textural term: a size fraction less than 0.002 mm in equivalent diameter. As a rock term: a natural, earthy, fine-grained material that develops plasticity with a small amount of water. As a soil term: a textural class.
coarse fragments	Particles of rock or mineral with a diameter greater than 2 mm. (TransCanada Keystone Pipeline GP Ltd.)
coniferous forest	Typically, evergreen trees or plants that are cone bearing, such as pine trees.
construction phase	The phase of a project preceding operations, during which project facilities are assembled, installed on their foundations, connected and tested to ensure that they will operate as designed.

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Term	Definition
contract	Defined in Keystone's proposed Tariff as a Petroleum Transportation Service Agreement between the Carrier (Keystone) and a Term Shipper.
critical habitat	The habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species, according to the Species at Risk Act. (NED FM)
cumulative effects	The effect on the environment which results from effects of a project when combined with those of other past, existing and imminent projects and activities. These may occur over a certain period of time and distance (CEAA).
deposit	Material left in a new position by a natural transporting agent, such as water, wind, ice or gravity, or by the activity of people.
discharge	The rate of flow at a given moment, expressed as volume per unit of time (usually expressed as m <sup>3</sup> /sec).
dissolved oxygen	A measure of the amount of oxygen dissolved in water. Dissolved oxygen concentration is one indication of the suitability of surface waters for aquatic life.
ditch	A long, narrow excavation dug in the earth in which a pipeline is buried.
ditchline stripping	The process of removing vegetation and topsoil.
ditch plug	A short section of pipeline ditch that is not excavated and that acts to separate the wet, instream section of a watercourse excavation from the dry, onshore ditch.
ditching	The process of excavating ditches.
Ditchline	The centre of the trench
diversity, in ecology	The variety, distribution and abundance of different plant and animal communities and species in an area. (TransCanada Keystone Pipeline GP Ltd.).
downstream	Below a reference point in the direction of the flow of a stream or river.
drainage	The process or means of draining.
easement	An agreement under which a company acquires the right to use the land for the pipeline or power line. It is a written contract that sets out the rights of the company and rights of the land owner for the use of the right-of-way. (NEB FM)
ecology	A branch of science concerned with the interrelationship of organisms and their environments. (TransCanada Keystone Pipeline GP Ltd.)
ecoregion	An ecological area that has broad similarities in soil, relief and dominant vegetation. (TransCanada Keystone Pipeline GP Ltd.)

Term	Definition
ecosection	Clearly recognizable landforms such as river valleys and wetlands at a broad level of generalization. (TransCanada Keystone Pipeline GP Ltd.)
ecosystem	A single functional system that includes all living organisms in a given area and nonliving factors such as sunlight, temperature, moisture, soil, mineral elements, topography linked together through nutrient cycling and energy flow. (TransCanada Keystone Pipeline GP Ltd.)
edge	Where different plant communities meet in space on a landscape, and where plant communities meet a disturbance. An outer band of a patch that usually has an environment significantly different from the interior of the patch. (TransCanada Keystone Pipeline GP Ltd.)
edge effect	An ecological effect associated with patch edges. An outer band of a plant community that usually has an environment significantly different from the interior of the plant community. (TransCanada Keystone Pipeline GP Ltd.)
endangered	A species facing immediate extinction or extirpation. (TransCanada Keystone Pipeline GP Ltd.)
environment	The components of the earth, including land, water and air, all layers of the atmosphere, organic and inorganic matter and living organisms, and the interacting natural systems of all components.
environmental and socioeconomic assessment	A report prepared in accordance with the NEB's Filing Manual and the Canadian Environmental Assessment Act that identifies possible environmental effects from the Project, proposes measures to mitigative potential effects, and predicts whether there will be significant environmental effects, even after mitigations are implemented.
environmental effect	In respect of a project: (a) any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the Species at Risk Act; (b) any effect of any change referred to in paragraph (a) on (i) health and socio-economic conditions, (ii) physical and cultural heritage, (iii) the current use of lands and resources for traditional purposes by aboriginal persons, or (iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; or (c) any change to the project that may be caused by the environment, whether any such change or effect occurs within or outside Canada.
environmental noise	An accumulation of distant noise sources that creates a relatively steady background noise with no identifiable source. (TransCanada Keystone Pipeline GP Ltd.)

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Term	Definition
environmentally sensitive area	An area designated in regional or local land use plans, or by a local, regional, provincial or federal government body as being sensitive to disturbance or identified by an applicant as being sensitive for some reason. (NEB FM)
environmentally significant area	Landscape elements or places which are vital to the long-term maintenance of biological diversity, soil, water, or other natural process, both onsite and in a regional context, as selected by Alberta Environment. (TransCanada Keystone Pipeline GP Ltd.)
ephemeral watercourse	Streamflows in channels that are short-lived or transitory and occur from precipitation, snow melt, or short-term water releases. Watercourse often has no or poorly defined bed and banks.
equivalent sound level ( $L_{eq}$ )	The A-weighted equivalent continuous sound level. This measure is an energy average of the varying sound levels over a specified time. (TransCanada Keystone Pipeline GP Ltd.)
erosion	The wearing away of the land surface by running water, wind, ice or other geological agents, including such processes as gravitational creep.
ESA	The abbreviation for environmental and socioeconomic assessment.
extinct	A species that no longer exists. (TransCanada Keystone Pipeline GP Ltd.)
facilities - TBC with KP	Structures of the pipeline system, including pump stations, block valves, pigging facilities and meter stations.
falls	Free-falling water with vertical or nearly vertical drops as it falls over an obstruction. Falls may or may not be a barrier to fish passage depending on the height and species present.
fine-grained sediment	Sediment comprising silts and clays, consisting of particles less than 62 µm in diameter.
fines	Particulate material, less than 2 mm in diameter, including sand, silt, clay and fine organic material.
fish habitat	Those parts of the environment on which fish depend, directly or indirectly, to live. Fish habitats include spawning grounds and nursery, rearing, food supply and migration areas. (TransCanada Keystone Pipeline GP Ltd.)
Fisheries and Wildlife Management Information System (FWMIS)	A repository of known location information on wildlife species at risk in Alberta, maintained by Alberta Sustainable Resource Development.
catchment	An area of land that drains to a single outlet. Essentially synonymous terms include "drainage area," "watershed," and "basin."
floodplain	The low-lying land adjacent to a watercourse that may be inundated when the stream is at flood stage.

Term	Definition
footprint	The amount and shape of area to be disturbed. For example, the perimeter of a facility site.
forage	Grasses, herbs and small shrubs that are used by wildlife for food.
forage fish	Fish species used as a food source by other fish.
forb	Any herbaceous plant, other than a grass (i.e., a weed or a broad-leaved non-woody plant).
fossil	Any remains, traces or imprints of past life preserved in the earth's crust. Also known as a palaeontological resource.
furbearer	Mammals that have traditionally been trapped or hunted for their fur. (TransCanada Keystone Pipeline GP Ltd.)
gleyed soil	Soil affected by gleysation, caused by periodic to permanent reducing conditions within the soil matrix. Often expressed by the presence of mottles or reduced blueish color.
gleysolic soils	An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas, or prominent mottling, or both, in some horizons. (TransCanada Keystone Pipeline GP Ltd.)
gravel	Rock fragments with diameters of 2 mm to 7.5 cm. (TransCanada Keystone Pipeline GP Ltd.)
ground attenuation	The attenuation of sound as it passes over absorptive or semi-absorptive open terrain. (TransCanada Keystone Pipeline GP Ltd.)
ground truth survey	Measures of various properties, such as temperature vegetation and land use that are done on the ground to calibrate observations made from satellites, maps or aircraft.
groundwater	Subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated. (TransCanada Keystone Pipeline GP Ltd.)
gully	Channel resulting from erosion caused by the concentrated but intermittent flow of water during rainfall and snowmelt events.
ha	The abbreviation for hectare.
habitat	The area where an animal or plant naturally or normally lives and grows (e.g., stream habitat or forest habitat). (TransCanada Keystone Pipeline GP Ltd.)
habitat effectiveness	The physical characteristics associated with the suitability of a habitat and the ability of a habitat to be used by wildlife. The effectiveness of a habitat can be decreased through visual, auditory or olfactory disturbance even though the physical characteristics of the habitat remain unchanged. (TransCanada Keystone Pipeline GP Ltd.)

Term	Definition
habitat fragmentation	Occurs when extensive, continuous tracts of habitat are reduced by habitat loss to dispersed and usually smaller patches of habitat. Generally reduces the total amount of available habitat and reduces remaining habitat into smaller, more isolated patches. (TransCanada Keystone Pipeline GP Ltd.)
habitat patches	Isolated patches of habitat. (TransCanada Keystone Pipeline GP Ltd.)
habitat suitability index (HIS)	A method of evaluating habitat quality based on species-specific habitat parameters that describe food and cover characteristics. (TransCanada Keystone Pipeline GP Ltd.)
non-criteria air pollutants	Consists of a vast number of chemicals that exist as gases, particles and aerosols (particles less than 10 microns in size) and are dispersed in the atmosphere. They pose a health threat to living organisms and are not comprehensively regulated by ambient air quality criteria.
HDD	The abbreviation for horizontal directional drilling.
headwater	The source and upper part of a stream or river.
horizontal directional drilling	A trenchless method of crossing obstacles such as watercourses whereby a pilot hole is first drilled in a guided arc under the obstacle. If this is successful, the pilot hole is reamed to accommodate the pipe which is then pulled through the hole. Since success is not guaranteed, all HDD crossing plans must include a contingency alternative.
horizontal directional drilling	A watercourse crossing technique used in pipeline construction in which the pipe is buried under the riverbed at depths much greater than conventional crossings. An inverted arc-shaped hole is drilled beneath the river and preassembled pipeline is pulled through it. Also known as a trenchless crossing.
horizontal axially-split bearing pump	A type of pumping unit typically used on liquids pipelines.
historic period	The period after time of contact between indigenous peoples and Europeans. A term used to indicate a time for which there are written (documentary) records. In North America, this typically refers to the time period following contact between Europeans and EuroCanadians and Aboriginal peoples. Also called the Postcontact Period. (TransCanada Keystone Pipeline GP Ltd.)
historic site	A site characterized by structures, features, and objects of European influence. (TransCanada Keystone Pipeline GP Ltd.)
historic resource	A legal designation specified in the Historical Resources Act (Alberta Legislature 2000) that is . . . any work of nature or man that is primarily of value for its paleontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest including, but not limited to, a paleontological, archaeological, prehistoric, historic or natural site, structure or object." (TransCanada Keystone Pipeline GP Ltd.)

Term	Definition
historical/heritage resources	Works of nature or of humans, valued for their palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest.
hydrostatic testing	The final quality control check of the structural soundness of a pipeline or facility. In this test, the line is filled with water or a glycol-water mixture and pressurized to a designated point. This pressure is maintained for a specific period of time. Any ruptures or leaks revealed by the test are repaired. The test is repeated until no problems are noted. Also known as pressure testing.
impeded drainage	A condition that hinders the movement of water by gravity through soils. (TransCanada Keystone Pipeline GP Ltd.)
impervious	Resistant to penetration by fluids or roots. (TransCanada Keystone Pipeline GP Ltd.)
incident	A specific unplanned event or sequence of events that has an unwanted and unintended effect on people's safety or health, on property or the environment, or on regulatory compliance.
infrastructure	Basic facilities, such as transportation, communications, power supplies and buildings, which enable an organization, project or community to function.
instream	Within the wetted perimeter of a watercourse channel.
instream cover	Areas with structure, such as boulders, rock and logs, in a stream channel that provide aquatic organisms with shelter or protection from high velocity, predators or competitors.
integrated public awareness	A program used by TransCanada to promote awareness of its pipeline by landowners, communities and emergency organizations.
integrity management program	A quantitative, risk-based system used by TransCanada to identify potential integrity threats to its pipeline system and then initiate appropriate inspection and mitigation activities. From the IMP TransCanada develops its annual PMP.
intermittent watercourse	Watercourse with flows that occur at certain times of the year only when groundwater levels are adequate but may cease entirely in low water years or be reduced to a series of isolated pools. Defined bed and banks will be present.
invasive species	A term describing species that move into a habitat and reproduce so aggressively that indigenous species are displaced or existing community structures are changed. (TransCanada Keystone Pipeline GP Ltd.)
isolated crossing technique	A method of installing a section of pipeline through a watercourse that involves diverting the water upstream of the right-of-way to downstream of the right-of-way. This technique allows a pipeline to be installed without halting the flow of water.

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Term	Definition
isolated (artifact) find	A site type, which consists of one item only. (TransCanada Keystone Pipeline GP Ltd.)
lacustrine	Pertaining to, produced by, or inhabiting a lake or lakes.
lacustrine deposits	Material deposited in lake water and later exposed either by lowering the water level or uplifting the land. (TransCanada Keystone Pipeline GP Ltd.)
land classification	The arrangement of land units into various categories based on the properties of the land or its suitability for some particular purposes. (TransCanada Keystone Pipeline GP Ltd.)
landscape connectivity	A measure of the probability that individuals are capable of moving across a landscape and colonizing suitable habitat patches in their dispersal range. (TransCanada Keystone Pipeline GP Ltd.)
landscape diversity	The size, shape and connectivity of different ecosystems across a large area. (TransCanada Keystone Pipeline GP Ltd.)
Late Precontact Period	Period between about 2000 and 250 years B.P. associated with the development and widespread employment of bow and arrow technology among precontact peoples. (TransCanada Keystone Pipeline GP Ltd.)
lithic	Human altered stone (usually refers to the products of stone tool manufacturing). (TransCanada Keystone Pipeline GP Ltd.)
magnitude	Relating to an effect, the severity or intensity of the effect. It is rated as low, moderate, or high.
mainline ditching	A pipeline crossing technique used for installing pipelines across watercourses that do not have defined beds and banks, and that can be done by the mainline construction spread without the use of typical wet construction methods.
maximum channel depth	The deepest of all measurements taken along a transect.
maximum operating pressure (MOP)	The maximum pressure at which a pipeline or pressure vessel is legally allowed to operate.
mean	The sum of observations, or items, in a sample divided by the number of observations in the sample.
mineral soil	Soil containing primarily mineral materials, the presence of which predominantly determines the properties of the soil. Mineral soil generally evolves from fluvial, lacustrine or glacier-deposited parent materials, and except for an organic surface or litter layer, contains less than 30% organic material by weight.
Middle Precontact Period	Period between about 7500 and 2000 years B.P. associated with the prevalent use of atlatl and dart technology in the subsistence strategies employed by contemporary precontact peoples. (TransCanada Keystone Pipeline GP Ltd.)

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Term	Definition
minnow	The common name for any freshwater fish of the family Cyprinidae.
mitigation	In respect of a project, the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means (CEAA).
mixedwood forest	A forest that includes deciduous and coniferous trees.
moderately well-drained soil	Soil from which water is removed slowly in relation to supply because of imperviousness or lack of gradient.
follow-up monitoring	Periodic inspection to: observe and report on compliance with approved conditions; confirm effectiveness of approved protective measures; verify the accuracy of impact predictions; identify any unpredicted effects.
native prairie vegetation inventory	A database compiled by Alberta Sustainable Resource Development (ASRD) providing information on land-use and vegetation community distribution in the Grassland Natural Region and adjacent non-forested areas in southern Alberta (TransCanada Keystone Pipeline GP Ltd.).
noise	The phenomenon of unwanted sound.
nominal pipe size	Used to designate the outside diameters of pipes. For pipe sizes greater than NPS 12 the number indicates the pipe diameter in inches. For pipe sizes NPS 12 and lower, the actual pipe diameter is greater, e.g., 12.75" for NPS 12.
nominal pipe size	The outside diameter of a pipe, expressed in inches.
non-contiguous	A term used when the project right-of-way does not parallel an existing right-of-way.
open cut crossing technique	A method of installing a section of pipeline through a watercourse that requires excavation of the bed and banks to create a trench to install the pipe. No measures are used to protect the work area from the rest of the river.
operations control center	The room from which the operation of the Keystone XL Project will be monitored and controlled 24 hours a day.
operations phase	The phase of the project during which the pipeline and associated facilities are operated.
organic deposit	A layer of soil that contains plant and animal residue in various stages of decomposition.
organic soil	Any soil comprising at least 30% organic matter. Most are saturated throughout the year and occur in poorly and very poorly drained depressions.
palaeontology	A scientific discipline that studies fossil plant and animal remains (TransCanada Keystone Pipeline GP Ltd.).

Term	Definition
palaeontological site	A type of historical resource site that contains evidence of past plant and animal communities.
parent material	The unconsolidated and more or less chemically unaltered mineral or organic matter from which the solum of a soil has developed by pedogenic processes.
permeability	As relating to geologic deposits, the interconnected pore space that is a function of grain size, sphericity, roundness and packing. Gravel has a high permeability and clay has low permeability. The capacity of a porous rock, soil or sediment for transmitting a fluid without damaging the structure of the medium. Also known as perviousness.
permissible sound level (PSL)	Limit determined by regulatory agencies regarding the maximum allowable noise level for a given area or region. (TransCanada Keystone Pipeline GP Ltd.)
Petroleum Administration for Defense District.	The U.S. Department of Energy divides the country into PADDs. PADD II which Keystone is intended to service comprises the states of Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Ohio, Kentucky, and Tennessee.
pH	A measure of the relative acidity or alkalinity of a liquid or soil. The pH scale ranges from 1 to 14, with 7 being neutral, 1 being the most acidic and 14 being the most alkaline.
pipeline maintenance plan	TransCanada's annual plan for mitigating integrity threats to its pipeline. The PMP results from the IMP.
plain	Any flat area at low relative elevation in the landscape.
pool habitat	Aquatic habitat in a stream with a gradient less than 1% that is normally deeper and wider than aquatic habitats immediately above and below it. Pool habitat is subdivided as Class 1, Class 2 and Class 3 habitat.
pool	A discrete portion of a watercourse channel, produced by channel scour, that has increased depth and reduced velocity relative to adjacent riffle and run habitats.
pool, impoundment	An area within a watercourse that forms behind damming structures such as debris, beaver dams, and landslides. These pools tend to accumulate more sediment and organic debris than scour pools.
poorly drained soils	Soil from which water is removed so slowly in relation to supply that the soil remains wet for most of the time that it is not frozen.
population (in Biology)	A collective word for individuals of the same species that potentially interbreed. (TransCanada Keystone Pipeline GP Ltd.)
postglacial	The period following the last glaciation. In North America, this is approximately the last 10,000 to 12,000 years. (TransCanada Keystone Pipeline GP Ltd.)

Term	Definition
pre-contact period	The period before contact between Europeans and EuroCanadians and Aboriginal peoples. Archaeologically, the term implies a period before the advent of a written (documentary) record and replaces the term prehistoric. (TransCanada Keystone Pipeline GP Ltd.)
pressure testing	A quality control check of the structural soundness of a pipeline or facility. In this test, the line is filled with water, a freeze depressant mixture, or gas (e.g., methane) and pressurized. This pressure is maintained for a specific period of time. Any ruptures or leaks revealed by the test are repaired. The test is repeated until no problems are noted. Pressure testing with a liquid is known as hydrostatic testing.
pressure control valve	A valve that can be remotely controlled (e.g., from the OCC). It requires a source of electric power.
primary disturbance	Effects to contents or contexts of historical resource sites resulting from planned disturbance factors directly associated with a specific development program. (TransCanada Keystone Pipeline GP Ltd.)
productive capacity	The maximum natural capacity of habitats to produce healthy fish safe for human consumption or to support or produce aquatic organisms upon which fish depend. (TransCanada Keystone Pipeline GP Ltd.)
Project, the	The abbreviation for the Canadian portion of the Keystone XL Project. The Project extends from Hardisty, Alberta, to a point near Monchy, Saskatchewan.
projectile points	A term used collectively for spear points, dart points and arrowheads. Projectile points are diagnostic, based on temporally and regionally variable styles, providing an indication of period and archaeological cultural affiliations.
pump station	A group of one or more 3,000 kW pumps that raises the pressure of the oil to a maximum of the MOP of the downstream pipeline.
Quaternary	A geological period ranging from 1.8 million years ago to the present. This is a time of major glaciations and cool climates. (TransCanada Keystone Pipeline GP Ltd.)
rapidly drained soil	Soil from which water is removed rapidly in relation to supply.
rapids	Moderately steep (4-8% gradient), rapid and turbulent water movement, surface with intermittent whitewater. Coarse substrate with exposed boulders at low flows.
range health	The interaction of ecological processes in a rangeland ecosystem, generating specific functions valuable for sustainable management. These functions include productivity, site stability, capture and beneficial release of water, nutrient cycling and plant species diversity. Healthy rangeland occurs when all functions are being performed, allowing optimal livestock stocking rates. (TransCanada Keystone Pipeline GP Ltd.)

Term	Definition
raptor	A carnivorous (meat-eating) bird; includes eagles, hawks, falcons, and owls. (TransCanada Keystone Pipeline GP Ltd.)
recharge areas	The process involved in the absorption and addition of water to the zone of saturation.
reclamation	The process of re-establishing a disturbed site to a former or other productive use, not necessarily to the same condition that existed before disturbance.
regional study area (RSA)	The Regional Study Area includes the area over which the potential cumulative environmental effects of the Project could be measurable.
relative humidity	The ratio of the amount of water vapor actually in the air compared with the maximum amount of water vapor required for saturation at a particular temperature, usually expressed as percent. (TransCanada Keystone Pipeline GP Ltd.)
residual effects	Effects that are present after mitigation is applied. (TransCanada Keystone Pipeline GP Ltd.)
residual material	Unconsolidated and partly weathered mineral materials formed by the disintegration of consolidated rock in place. (TransCanada Keystone Pipeline GP Ltd.)
Responsible Authority	In relation to a project, a federal authority that is required pursuant to subsection 11(1) of the Canadian Environmental Assessment Act to ensure that an environmental assessment of the project is conducted. (TransCanada Keystone Pipeline GP Ltd.)
restricted activity period (RAP)	The period during which fish migration, fish spawning, egg incubation, fry emergence and early fry development are likely to occur in a waterbody. (TransCanada Keystone Pipeline GP Ltd.)
revegetation	Re-establishment of vegetation in disturbed areas. (TransCanada Keystone Pipeline GP Ltd.)
right-of-way, pipeline	The easement in which the pipeline will be installed and operated. The width of the permanent pipeline right-of-way for the Project will be 50 feet.
right-of-way, construction	The pipeline easement and temporary workspace required to construct the pipeline. The width of the construction right-of-way for the Project will be 110 feet.
right-of-way, new pipeline	Pipeline right-of-way not contiguous with existing rights-of-way.
right-of-way, RoW	The strip of land acquired for which a company has obtained the rights for the construction and operation of a pipeline or powerline.
riparian area	The land next to the normal high-water mark in a stream, river or lake. Riparian areas typically exemplify a rich and diverse vegetation mosaic, reflecting the influence of available surface water.
riparian	Situated or dwelling on the margin of a river or other water body.

Term	Definition
riprap	Large boulders or angular rocks used as an armor layer (TransCanada Keystone Pipeline GP Ltd.).
river	A large, natural or human-modified freshwater watercourse that flows in a defined course or channel. It has considerable flow volume compared to its smaller tributaries.
run habitat	Swiftly flowing stream reach with a gradient greater than 4%, little to know surface agitation or turbulence, no major flow obstructions, approximately uniform flow from bank to bank. It is generally deeper than riffle and rapid habitats, and is subdivided as Class 1, Class 2, and Class 3 habitat.
runoff	The water from rain and snow that flows over land to streams, ponds or other surface waterbodies. Also, the water from precipitation that does not infiltrate into the ground or evaporate.
sand	A soil particle between 0.05 and 2.0 mm in diameter. Any one of five soil separates: very coarse sand, coarse sand, medium sand, fine sand or very fine sand. A soil textural class. (TransCanada Keystone Pipeline GP Ltd.)
saturate	The act of filling all voids between soil particles with a liquid. The act of forming the most concentrated solution possible under a given set of physical conditions in the presence of an excess of the solute. The act of filling to capacity, as the adsorption complex with a cation species. (TransCanada Keystone Pipeline GP Ltd.)
saturation percentage	Moisture content of a soil when all soil porosity is water filled. (TransCanada Keystone Pipeline GP Ltd.)
secondary disturbance	Effects to contents or contexts of historical resource sites resulting from unplanned or indirect disturbance factors associated with a specific development program. (TransCanada Keystone Pipeline GP Ltd.)
sediment	Fragmented material from weathered rocks and organic material that is suspended in, transported by, and eventually deposited by, air, water, or ice.
sediment quality	The physical, chemical or biological properties of sediments relative to their use or value as an environment for aquatic life.
sedimentary rock	Rock formed by the lithification of sediments.
sensitive	Any species that is not at risk of extinction or extirpation but might require special attention or protection to prevent it from becoming at risk. Also used to describe species at risk in general. (TransCanada Keystone Pipeline GP Ltd.)
shale	A fine-grained laminated or fissile sedimentary rock made up of silt or clay-sized particles. It usually comprises about one-third quartz, one third clay materials and one-third minerals, such as carbonates, iron oxides, feldspars and organic matter.

Term	Definition
side channel	An elongated extension off a main channel that can become separated from the main channel under flow conditions, and dry up.
silt	A soil separate consisting of particles between diameters of 0.002 and 0.05 mm; a soil textural class.
system control and data acquisition	A group of sensors, computers and telecommunications systems that enable a distributed network, like a pipeline, to be monitored and controlled from a central point, such as an OCC.
site content	All artifacts, fossils, features, structures and cultural or natural residues that comprise a historical resource site.
site context	The unmodified natural or cultural setting in which a historical resource site occurs immediately following deposition of site contents and the unmodified spatial and temporal relationships among the contents of the site under such conditions.
slope	The percentage of vertical rise to the horizontal run.
soil	The top few meters of regolith, generally including some organic matter derived from plants.
soil admixing	The mixing of organic soil horizons with subsurface mineral soil horizons.
soil association	A natural grouping of soil associates based on similarities in climatic or physiographic factors and soil parent materials. It might include a number of soil associates, provided they are all present in significant proportions.
soil complex	A mapping unit used in detailed soil surveys where two or more defined soil units are so intimately intermixed geographically that it is impractical (because of the scale used) to separate them.
soil horizon	A layer of soil or soil material approximately parallel to the land surface; it differs from adjacent genetically related layers in properties such as color, structure, texture, consistence and chemical, biological and mineralogical composition.
soil order	A category in the Canadian System of Soil Classification. All the soils in an order have one or more characteristics in common.
soil phase	A subdivision of a soil type or order unit of classification having characteristics that affect the use and management of the soil, but that do not vary sufficiently to differentiate it as a separate type.
soil permeability	The ease with which gases and liquids penetrate or pass through a bulk mass of soil or a layer of soil. The property of a porous medium that relates to the ease with which gases and liquids can pass through.
soil profile	A vertical section of the soil through all its horizons and extending into the parent material.

Term	Definition
soil series	A category in the in the Canadian System of Soil Classification. This is the basic unit of soil classification and consists of soils that are essentially alike in all major profile characteristics except the texture of the surface.
soil subgroup	A category in the in the Canadian System of Soil Classification. These soils are subdivisions of the great groups.
song birds	Perching birds (e.g., warblers, sparrows, swallows, chickadees, thrushes and kinglets).
sound	Any pressure variation the human ear can detect. These variations in pressure travel between source and receptor as atmospheric waves.
spawning	A fish reproduction process, characterized by females and males depositing eggs and sperm into the water simultaneously or in succession, to fertilize the eggs.
spawning habitat	Habitat selected by fish for spawning.
special concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
species	A group of organisms that actually or potentially interbreed and are reproductively isolated from all other such groups or a taxonomic grouping of genetically and morphologically similar individuals. Also the classification below genus. (TransCanada Keystone Pipeline GP Ltd.)
species distribution	A location where species in an ecosystem are found. Species distribution varies with season. (TransCanada Keystone Pipeline GP Ltd.)
species diversity	A description of a biological community that includes the number of species and their relative abundance. Provides a measure of the variation in the number of species in a region, depending on the variety of habitats and resources in habitats and, in part, on the degree of specialization of species to particular habitats and resources. (TransCanada Keystone Pipeline GP Ltd.)
species richness	The number of different species occupying a given area. (TransCanada Keystone Pipeline GP Ltd.)
spread, construction	A designated length of pipeline construction that is intended to be constructed by a single pipeline contractor over a single construction season.
spring breakup	The time of year when the temperature rises sufficiently to thaw ice, causing it to break up in rivers and lakes.
spring freshet	The annual spring increase of flow in streams and rivers in cold climates as a result of melting snow.

Term	Definition
Staging birds/areas	Key locations, often wetlands, along their migratory routes where birds concentrate in huge numbers to replenish the body fat and energy reserves needed for their migration. (TransCanada Keystone Pipeline GP Ltd.)
staging site	A location where equipment is stored, maintained, or readied for work.
stakeholders	People or organizations with an interest in, or who are affected by, or share in an undertaking, such as the Keystone XL Project.
stockpile	A supply of materials, such as line pipe or borrow materials, to be used later.
stream	Natural water course containing flowing water, at least part of the year, together with dissolved or suspended materials, that normally supports communities of plants and animals.
stress cracking and corrosion	A type of corrosion where “colonies” of extremely fine cracks develop on a pipe surface and their growth is aggravated by the expansion stress (caused by internal pressure) on the pipe wall.
submergent vegetation	Aquatic vegetation that grows with its roots under water and with leaves and stems that do not emerge above the surface of the water.
temporary workspace	Space adjacent to a permanent right-of-way, which is required during the construction period only, and is not required for operation of the pipeline.
terrace	A single or assemblage of step-like forms, each of which consists of a scarp face and a horizontal or gently inclined surface above.
Threatened	The term used to describe any indigenous classification (species) of fauna or flora likely to become endangered if the factors affecting its vulnerability are not reversed. (TransCanada Keystone Pipeline GP Ltd.)
topography	The physical feature of a district or region, such as those represented on a map, taken collectively; especially, the relief and contours of the land. The configuration of a surface, including its relief and natural and artificial features.
TOPs	The abbreviation for TransCanada Operating Procedures.
topsoil	The layer of soil moved in cultivation; (ii) the A horizon; (iii) the Ah horizon; (iv) presumably, fertile soil material used to topdress road banks, gardens, and lawns.
total dissolved solids (TDS)	A measure of the total concentration of chemicals that are dissolved in water or that are in particulate form smaller than a standard-size filter (i.e., 0.45 microns) in water. These chemicals are usually salts, such as calcium, sodium, chloride, and sulphate ions.

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Term	Definition
total hydrocarbons	A term used to describe compounds containing hydrogen and carbon atoms, such as methane, propane and butane. At high concentrations, THCs can be toxic to humans, animals, and vegetation.
TransCanada Operating Procedures	A series of documents kept in an electronic library that constitutes TransCanada's operating and maintenance manual.
total organic carbon	A measure of the dissolved and particulate organic carbon, most of which is in the form of carbon dioxide (CO <sub>2</sub> ), carbonate (CO <sub>3</sub> ), and bicarbonate (HCO <sub>3</sub> ) compounds.
total suspended solids (TSS)	A measure of the total concentration (in mg/L) of suspended solids in water.
TransCanada	The abbreviation for TransCanada Pipelines Limited.
transect	A line or strip across the earth's surface, or through any object, along which a survey or observations are made.
travel lane	The portion of the right-of-way used for travel by vehicles and equipment.
trench	A long, narrow excavation dug in the earth in which a pipeline is buried. Also known as a ditch.
trenching	The act of constructing a trench.
trenchless crossing	A water crossing technique used in pipeline construction in which the pipe is buried under the riverbed without disturbing the bed of the river. The most common technique is Horizontal Directional Drilling, but punch and bore techniques may also be used.
turbidity	The relative clarity of a waterbody. A measure of the extent to which light penetration in water is reduced by the presence of suspended particles, such as silt, clay, organic matter and plankton.
turbulent flow	When the flow of petroleum in a pipeline becomes sufficiently large it changes from laminar (or smooth) flow as eddies of turbulence appear. Typically the transition from laminar to turbulent flow occurs at Reynolds numbers >2,500.
unconfined	As relating to an aquifer, this is an aquifer that is not bounded above by an adjacent aquitard. A water level in a well installed in an unconfined aquifer directly represents the surrounding water table elevation.
understorey	A foliage layer occurring beneath, and shaded by, the main canopy of a forest.
undifferentiated soil map unit	Soil mapping unit in which two or more soils units occur, but not in a regular geographic association.

Term	Definition
upland	Terrain with sufficient topographical relief that the communities and processes of the site are not influenced by a surface or near-surface water table, and in which riparian vegetation or aquatic processes do not persist.
upstream	The direction from which a watercourse flows.
UTM	The abbreviation for Universal Transverse Mercator.
valley bottom width	The distance from the base of the slope on one side of a valley to the base of the slope on the other side. Also known as floodplain width.
valued ecosystem component (VEC)	Any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process, based on cultural values or scientific concern.
vegetated channel	A watercourse with ephemeral flow, no discernible banks or defined bed, and a drainage area less than 15 km <sup>2</sup> . It is primarily a shallow flow through shrubs and trees during spring runoff or rainfall and is dry most of the year.
very poorly drained soil	Soil from which water is removed from so slowly that the water table remains at or near the surface for most of the time when the soil is not frozen.
vulnerable	Any indigenous classification (species) of flora or fauna that is particularly at risk (e.g., because of low or declining numbers, occurrence at the fringe of its range or in restricted areas). Not a threatened species. (TransCanada Keystone Pipeline GP Ltd.)
viscosity, dynamic	A measure of the resistance of a fluid to deform under shear stress (shear force per unit area). It is commonly perceived as the fluid's "thickness" or resistance to pouring. In a liquid viscosity is independent of pressure (except at very high pressures) but falls as temperature increases. Petroleum viscosity is normally expressed in centistokes (cSt), where 1 cSt = 1 mm <sup>2</sup> /s. This is the kinematic viscosity.
viscosity, kinematic	The dynamic viscosity, in centipoise (cP), where 1 cP = 0.001 Pa•s, is calculated by multiplying the kinematic viscosity by the density of the liquid, in kg/m <sup>3</sup> .
waste management plan	The system developed to track and control emissions and waste, and evaluate pollution-prevention steps.
water, color	The measure of the amount of humic material (i.e., dark-colored organic material) contained in water.
watertable	Elevation at which the pressure in the water is zero with respect to the atmospheric pressure.
waterbody	A body of water up to the high-water mark. Including canals, reservoirs, oceans and wetlands, but not including sewage or waste treatment lagoons.

Term	Definition
watercourse	A natural or artificial channel with perennial or intermittent flow and definable bed and banks.
watercourse crossing	A location where a pipeline or access road crosses a stream, river, or lake.
watercourse gradient	The slope of a stream defined as the vertical drop per unit of horizontal distance travelled.
waterfowl	Aquatic birds, especially swimming game birds, such as ducks and geese.
waterfowl staging area	Waterbodies used by waterfowl to gather, rest and feed before or during migration.
watershed	An area of land that drains to a single outlet and is separated from other watersheds by a divide.
water velocity	The speed of water flow, usually presented in meters per second (m/s).
well-drained soil	Soil from which water is removed readily, but not rapidly.
wetland	A wetland is land where the water table is at, near or above the surface or which is saturated for a long enough period to promote such features as wet-altered soils and water tolerant vegetation. Wetlands include organic wetlands or “peatlands,” and mineral wetlands or mineral soil areas that are influenced by excess water but produce little or no peat (Federal Policy on Wetland Conservation – Implementation Guide for Federal Land Managers, Wildlife Conservation Branch, Canadian Wildlife Service, Environment Canada. 1996).